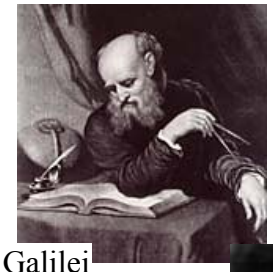
Владимирский государственный университет

Г.Н.Замараева

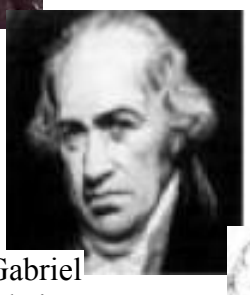
# МЕДИЦИНСКАЯ ТЕХНИКА

Практикум

по английскому языку

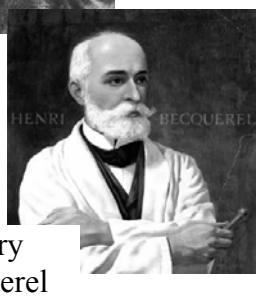


Galileo Galilei



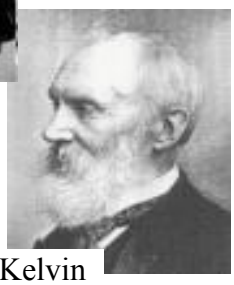
Daniel Gabriel Fahrenheit

Wilhelm C. Roentgen




Henry Becquerel

Anders Celsius



Lord Kelvin

Владимир 2006

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# МЕДИЦИНСКАЯ ТЕХНИКА

Практикум

по английскому языку

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Практикум включает тексты (взятые из оригинальных книг, журналов, газет, а также из Интернета) по специальности, тематически объединенные лексические, грамматические, текстовые и коммуникативные упражнения.

Практикум предназначен для студентов специальностей «Биотехнические и медицинские аппараты и системы» и «Инженерное дело в медико-биологической практике».

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*The harder the struggle*
*the sweeter the victory.*

## Предисловие

Практикум содержит тексты, взятые из современных английских и американских книг, журналов, газет, учебников, проспектов Британских университетов, а также из Интернета. Пояснения к ним и упражнения дают возможность развивать навыки чтения с извлечением информации и полным пониманием, закреплять лексику, необходимую для самостоятельного чтения оригинальной специальной литературы, и приобретать коммуникативные навыки профессионального общения. Перед каждым текстом даны слова, значение которых нельзя понять из контекста, и так называемые "ложные друзья" переводчика (faux amis).

В практикум включены грамматические упражнения, тематически связанные с текстами, лексическими и коммуникативными заданиями. Эти грамматические упражнения предназначены для повторения и закрепления навыков употребления видовременных форм английского глагола в действительном и страдательном залогах, изучения неличных форм глагола, модальных глаголов и др.

Практикум также содержит тексты для дополнительного чтения к каждому разделу с заданиями для контроля понимания прочитанного и развития навыков устной речи и реферирования.

**Условные обозначения**


Тексты для чтения


Грамматические упражнения


Забавные факты


Задания по прочитанному тексту


Особенности грамматические или лексические


Головоломки, загадки, кроссворды

# UNIT I

# INVENTORS AND THEIR INVENTIONS

***(Grammar: Perfect Tenses)***

## LESSON 1

*Genius is a combination*
*Of knowledge, mind and inspiration.*

***I. Do you know these inventors and researchers, their inventions and discoveries? Match the parts of the sentences.***

| | |
|---|---|
| ➢ Alexander ['xllg'zRndq] Popov | ➢ patented their cinematography and opened the world's first cinema in Paris in 1895. |
| ➢ Galileo Galilei ["gxll'li:qu "gxll'leIJ] | ➢ invented telephone in 1876. |
| ➢ Henry Ford ["henrI 'fLd] | ➢ discovered X-rays in 1895. |
| ➢ Alexander Graham Bell ["xllg'zRndq 'greIqm 'bel] | ➢ developed Microsoft ['maIkrqu"sOft] - DOS (Disk Operating System) in 1981. |
| ➢ Wilbur ['wIlbq] and Orville ['LvIl] Wright [raIt] | ➢ discovered electromagnetic induction and built the first generator in 1823. |
| ➢ Lumiere ['lHmIFq] brothers | ➢ developed the electro-magnetic telegraph. |
| ➢ D. Mendeleyev | ➢ invented the thermometer in 1593. |
| ➢ Michel Faraday ['maIkl 'fxrqdeI] | ➢ created the world's first car assembly line in 1913. |
| ➢ Morse [mLs] | ➢ created his famous "Table of chemical elements". |
| ➢ W. K. Roentgen ['rOntjqn] | ➢ designed the first artificial satellite in 1957. |
| ➢ Sergey Korolyev | ➢ built the first airplane in 1903. |
| ➢ Bill Gates [bIl 'geIts] | ➢ was a creator of radio. |

***II. Are these inventions and discoveries important (useful) for you (for people)? Why? Why not? Which event was the most important one in your opinion? Use following words and phrases:***

- *I (don't) think that …*
- *I can't (couldn't) live without…*
- *I'm sure…*
- *I can't (couldn't) imagine my life without…*

To send and receive messages; to write programs, play games, find and use information, etc.; to entertain and learn news; to save time; to get to some place rather quickly; to make more different things; to communicate with people in any part of the world; to measure temperature of a body or water, etc.; to detect foreign (*зд.* инородный) objects in the body and diseased conditions and to treat; to send back to the earth telephone messages, radio and TV signals, etc.

*Example.* I think a computer is very important. I couldn't live without it as a computer allows me to send and receive messages, write programs, play games and get useful information.

***III. Remember some new words and phrases.***

1. cause [kLz] — вызывать, быть причиной
2. discharge [dIs'CRG] — разряжать, разрядный(ая)
3. equip [I'kwIp] — оборудовать, оснащать
4. escape [Is'keip] — утечка, вытекать, просачиваться
5. expose [Iks'pquz] — подвергать действию
6. faint [feint] — слабый, тусклый, неотчетливый
7. forerunner ['fL"rAnq] — предшественник, предвестник
8. image ['ImIG] — изображение
9. inanimate [In'xnImIt] — неодушевленный, неживой
10. initiate [I'nISIeit] — начинать
11. internal [In'tWnql] — внутренний
12. investigation [In"vestI'geISqn] — исследование, изучение

13. matter ['mxtq] ➢ вещество
14. observer [qb'zWvq] ➢ наблюдатель
15. outline ['autlaIn] ➢ контур, очертание
16. particular [pq'tlkjulq] ➢ особый, особенный
17. ray – rays [reI -reIz] ➢ луч – лучи, излучение
18. seal [sJl] ➢ плотно закрыть, запаять
19. sealed [sJld] ➢ герметичный, запаянный
20. skilled [skIld] ➢ опытный, квалифицированный
21. vessel ['vesl] ➢ сосуд

***IV. Pay attention to the words given below. They are faux amis[1]. Try to remember them.***

1. film [fIlm] ➢ *пленка (фотопленка)*, а не только фильм
2. solid ['sOlId] ➢ *твердый, плотный*, а не только солидный
3. conductor [kqn'dAktq] ➢ *проводник - вещество, проводящее тепло, электричество*, а не только проводник - кондуктор
4. curious ['kjuqrIqs] ➢ *любознательный, пытливый*, а не только курьезный
5. machine [mq'SJn] ➢ *механизм, аппарат,* а не автомобиль

***V. Translate the following word combinations.***

1) sealed glass tubes; 2) cathode rays; 3) photographic film; 4) faint *greenish* light; 5) a less skilled observer, 6) solid matter, 7) a thick-walled glass discharge tube.

***Notes****:* Суффикс *–ish* означает небольшую степень качества.

*greenish* – зеленоватый (соответственно, bluish - , blackish - , greyish - , pinkish - , reddish - , whitish – белесый, бел(ес)оватый, yellowish -)

***VI. Match the English words and phrases in A with their Russian***

[1] *Faux amis* [fOzA'mI] – ложные друзья; французское выражение, используемое в английском языке для обозначения так называемых псевдоинтернациональных слов, или «ложных друзей» переводчика.

***equivalents in B.***

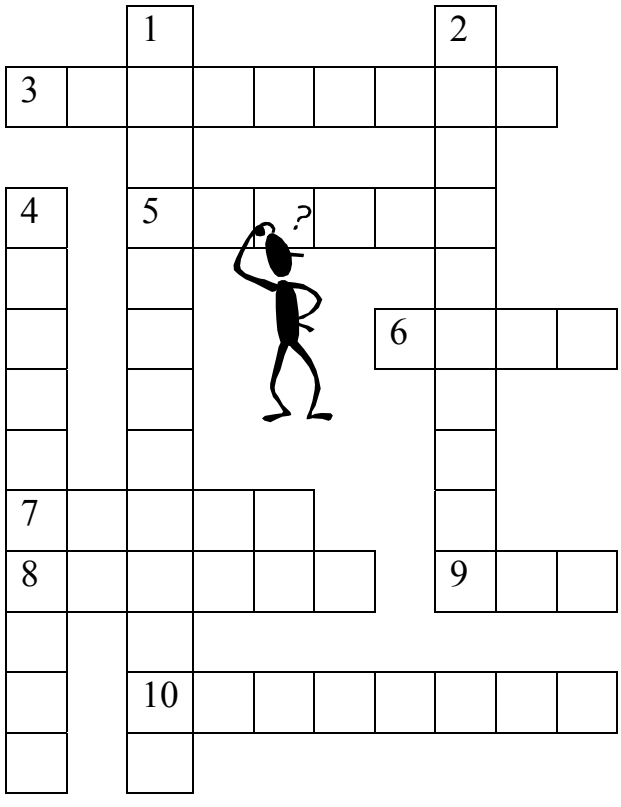
A. 1) to look back into history, 2) to trace the beginnings, 3) late in the year 1895, 4) to turn one's attention to, 5) to take place, 6) pear-shaped, 7) dozens of scientists, 8) to try experiment, 9) fast-moving electrons, 10) completely dark, 11) blackness, 12) high-voltage machine, 13) three feet away from, 14) to apply high voltage to, 15) source of the light, 16) far away from, 17) glass wall of the tube, 18) a series of systematic experiments.

B. a) установить истоки, b) ряд систематических (систематичных) экспериментов, c) обратить внимание на, d) высоковольтное устройство, e) грушевидный, f) в трех футах от, g) источник света, h) далеко от, i) в конце 1895 года, j) иметь место, происходить, k) проводить эксперимент, l) множество ученых, m) быстрые электроны, n) подавать высокое напряжение на, o) совершенно темный, p) мрак, темнота, q) обращаться к истории, r) стеклянная стенка трубки.

***VII. Complete the crossword.***

*Across*

3. substance that conducts heat or electric current, e.g. Water, like metals, is an electric …;
5. a) getting free, getting away, finding a way out ***or***
   b) a button in the top left corner of the computer keyboard;
6. a long hollow cylinder made of metal, glass or rubber; a vessel for gas;
7. a picture;



8. substance;
9. line, beam of light, heat, energy, e.g. the … of sun, X-…;
10. a person who observes or watches;

*Down*

1. a process of examining or researching;
2. something that runs before something else;
4. test which helps to study some process and get knowledge.

## *VIII. Translate the sentences with the words and phrases from the previous exercises.*

1. If we look back into history to trace the beginnings of the Atomic Age, we may start the story with an experiment performed by a tall, bearded[2] professor of physics in the Bavarian town of Würzburg late in the year 1895. 2. Some problems puzzled[3] Dr. Roentgen and he turned his attention to them. 3. He was curious about what took place when electricity was sent through a sealed glass tube. 4. He used a pear-shaped, rather large glass vessel, called a Lenard tube and attached wires from a high-voltage machine to electrodes. 5. Dozens of scientists experimented with such tubes. 6. One day after dinner Roentgen hurried back to the laboratory to try another experiment. 7. The fast-moving electrons, or cathode rays, could pass through an aluminum window of Lenard tube into the air. 8. He took a thick-walled glass discharge tube through which the cathode rays could not pass. 9. He drew the shades[4] on the windows, making sure[5] that the room was completely dark. 10. When his eyes became accustomed[6] to the blackness, Roentgen switched on his high-voltage machine. 11. Suddenly his eye was caught by a faint greenish light about three feet away from the tube.

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[2] *Bearded* ['bIqdId] – бородатый.
[3] *Puzzle* ['pAzl] – озадачивать, ставить в тупик.
[4] *Draw the shades* [drL Dq 'SeIdz] – задернуть шторы
[5] *Make sure* [meIk 'Suq] – удостовериться.
[6] *Became accustomed* [bI'keIm q'kAstqmd] – привык(ли).

12. It glowed[7] when he applied the high voltage to the tube. 13. Roentgen struck a match[8] and looked for the source of the light. 14. He performed a series of systematic experiments and learned a great deal about X-rays.

***IX. Translate the sentences. Pay attention to the verbs in the Perfect Tenses. Explain their usage.***

1. Dr. W. K. Roentgen turned his attention to problems that had puzzled him for some time. 2. Electricity is sent through a sealed glass tube from which most of the air has been pumped. 3. He used a glass vessel, called a Lenard tube, into which he had sealed two metal electrodes. 4. Dozens of scientists had done it before him. 5. It was the study of these rays that had intrigued him. 6. It was coming from a piece of cardboard that he had covered with crystals of a chemical. 7. By the end of the year he will have learned a great deal about them. 8. When he developed the film, he found the key had left its image there. 9. Where the key had been, the film was untouched by the rays. 10. Her wedding ring stood out clearly where the heavy gold had completely absorbed the X-rays. 11. He will have dined with his wife by the beginning of his experiment. 12. He has already sealed the edges of a thick-walled glass discharge tube.

***X. Read the text and say if the discovery of X-rays was occasional.***


**DR. ROENTGEN[9] DISCOVERS X-RAYS**

**Part I**

If we look back into history to trace the beginnings of the Atomic Age, we may start the story with an experiment performed by a tall, bearded professor of physics in the Bavarian town of Würzburg ['vHrtsburg] late in the year 1895.

---

[7] *Glow* [glqu] – светиться, сверкать.
[8] *Struck a match* [strAk q 'mxC] – зажег спичку, чиркнул спичкой.
[9] *Roentgen (or Röntgen)* ['rOntjqn] (1845—1923), German Professor of physics, Nobel ['nqubel] Prize laureate ['lLrIlt] of 1901.

Dr. W. K. Roentgen was fifty years old when he turned his attention to problems that had puzzled him for some time. He had become curious about what took place when electricity was sent through a sealed glass tube from which most of the air had been pumped. For this purpose he used a pear-shaped, rather large glass vessel, called a Lenard tube, into which he had sealed two metal electrodes or conductors of electricity. To these electrodes (one, the cathode, is negative; the other, the anode, positive) he attached wires from a high-voltage machine. Roentgen was not the first to experiment with such tubes; in fact, dozens of scientists had done it before him.

One day, now famous in history, November 8, 1895 - Friday afternoon, to be precise[10], Roentgen, having dined with his wife, hurried back to the laboratory to try another experiment. He had been experimenting with a Lenard tube which was equipped with an aluminum window so thin that the fast-moving electrons, or cathode rays, could pass through it into the air. It was the study of these rays that had intrigued him. This particular evening, however, he took a thick-walled glass discharge tube through which the cathode rays could not pass. He wrapped it in a piece of cardboard, sealing the edges so that no light from the tube would leak out[11].

Then he drew the shades on the windows, making sure that the room was completely dark. When his eyes became accustomed to the blackness, Roentgen switched on his high-voltage machine. No light escaped from the covered discharge tube. Suddenly his eye was caught by a faint greenish light about three feet away from the tube. It was strange. Almost instinctively he switched

[10] *To be precise* [tq bJ prI'saIz] – если быть точным.
[11] *Leak out* [lJk aut] – просачиваться, вытекать, пропускать.

off his apparatus. The light disappeared. But it glowed again when he once more applied the high voltage to the tube. Whatever the glow was, clearly it was caused by the apparatus. Roentgen struck a match and looked for the source of the light. It was coming from a piece of cardboard that he had covered with crystals of a chemical called barium platinocyanide[12]. How strange that it should glow so far away from the discharge tube!

Holding the piece of cardboard closer to his apparatus, the scientist observed that it now glowed brilliantly. Obviously[13] something - some rays - must be coming from the tube and causing the crystals to glow. A less skilled observer might have passed over[14] the *effect*, but Roentgen realised that the rays, whatever they might be, were most peculiar[15]. For they penetrated not only the glass walls of the tube and the cardboard in which it was wrapped, but even through the thickness of a book which he placed in their way. They could penetrate solid matter and cause barium crystals to fluorescence [fluq'resns]. He called these unknown rays «X-rays».

***Notes***. *effect* – производить, выполнять; эффект

*affect* – воздействовать, влиять

***XI. Choose the questions you like best and let your partner answer them. If the question is dull or silly in your opinion don't ask it. Then answer the questions of your partner.***

1. What is the text about?
2. How old was Dr. W. K. Roentgen in 1895?
3. Where did Dr. W. K. Roentgen live?
4. Was Dr. W. K. Roentgen a professor of physics or chemistry?

[12] *Barium platinocyanide* ['be(q)rIqm 'plxtInqu'saIqnaId] – платиноцианид бария.
[13] *Obviously* ['ObvIqslI] – явно, очевидно, безусловно, конечно.
[14] *Pass over* [pRs 'quvq] – пропускать, оставлять без внимания.
[15] *Peculiar* [pI'kjHIjq] – специфический, особенный, своеобразный.

5. What problem had puzzled Dr. W. K. Roentgen for some time?
6. Did he use a sealed glass tube with any gas in it?
7. What is a Lenard tube?
8. What are electrodes?
9. Can electrodes conduct electricity?
10. What is the difference between the cathode and the anode?
11. Where did Dr. W. K. Roentgen attach wires from a high-voltage machine?
12. Was Roentgen the first to experiment with a Lenard tube?
13. What day of the week was November 8, 1895?
14. Was it morning or afternoon when Roentgen hurried back to the laboratory to try another experiment?
15. Did Roentgen take a Lenard tube with an aluminum window that evening?
16. What did he do with the tube that evening?
17. Why did Dr. Roentgen wrap the tube in a piece of cardboard?
18. What did Dr. Roentgen do to make the room completely dark?
19. When did Roentgen switch on his high-voltage machine?
20. Did any light escape from the covered discharge tube?
21. Was there any light some feet away from the tube?
22. By what was Roentgen's eye suddenly caught?
23. When did the light disappear and glow again?
24. What did Roentgen do to look for the source of the light?
25. What was the source of the light?
26. What was strange about this experiment?
27. When did the piece of cardboard glow brilliantly?
28. What caused the crystals glow?
29. Why did Roentgen think that the some rays were most peculiar?
30. How did Roentgen call these unknown rays?

***XII. Put the statements of the summary in the right order according to the text.***

1. It was caused by the apparatus and coming from a piece of cardboard that he had covered with crystals of barium platinocyanide.
2. An experiment performed by Dr. Roentgen, a tall, bearded professor of physics in the Bavarian town of Würzburg late in the year 1895 was the beginning of the Atomic Age.
3. He called these unknown rays “X-rays”.
4. On November, 8, 1895, Roentgen wrapped a thick-walled glass discharge tube in a piece of cardboard and switched on his high-voltage machine.
5. Dr. W. K. Roentgen was 50 when he began to experiment with a Lenard tube.
6. No light escaped from the tube.
7. They could penetrate glass walls of the tube, the cardboard, the thickness of a book and cause barium crystals to fluorescence.
8. But there was a faint greenish light about three feet away from the tube.
9. Some peculiar rays must be coming from the tube and causing crystals to glow.

***XIII. Fill in the gaps with the appropriate forms of the verbs in the brackets (Past Simple, Past Perfect, Present Perfect, Future Perfect).***

1. Unfortunately before we … (make) the experiment they … (publish) their report. 2. By the end of March they … (realize) their new project. 3. He … (be) his father’s assistant for 12 years. 4. He … (become) famous all over the world because he … (make) a great contribution to the development of new technologies. 5. We … (agree) to take part in this investigation before we … (realize) its importance. 6. By the time I … (be) born colour TV … (be) discovered. 7. The first world’s cinema … (be) opened in Paris in 1895 after the Lumiere brothers … (patent) their cinematography. 8. I

… (learn) some facts from the history of medical equipment this year. 9. After W. K. Roentgen … (discover) new rays he … (call) them X-rays.

***XIV. It's interesting to know.***

**It shines in the dark**

Do you know that tea actually shines in the dark? Scientists have discovered that tea, when it's brewed[16], is faintly luminous ['lHmInqs], although it needs very delicate instruments[17] to see this.

[16] *Brew* [brH] – заваривать (чай).
[17] *Delicate instrument* ['delIkIt 'Instrumqnt] – высокочувствительный прибор

LESSON 2

*Everything is impossible for the person*
*Who doesn't try anything.*

***I. You are going to read the second part of the text about Dr. Roentgen's discovery. Three sentences have been removed from the text. Choose from the sentences A – D the one which best fits each gap. There is one extra sentence which you do not need to use.***


## DR. ROENTGEN DISCOVERS X-RAYS

### Part II

He now became completely engrossed[18] in his investigation of X-rays. He performed a series of systematic experiments and by the end of the year he had learned a great deal about them. He found that they *affected* photographic film, causing it to turn black when it was developed. He wrapped a piece of photographic film in black paper, to protect it from light, placed a metal key on it and then exposed it to X-rays. 1. _____ The X-rays had blackened the film all around it, but where the key had been, the film was untouched by the rays. The heavy metal of the key had stopped or absorbed them.

Then Roentgen took his favorite hunting gun and made an X-ray picture of that. 2. _____ This experiment was the forerunner of industrial radiography, in which X-rays are used to examine structures and machinery for internal flaws[19].

Not content[20] with photographing inanimate objects, Roentgen asked his wife to help him in an experiment. He placed a paperwrapped photographic film under her hand and exposed it for fifteen minutes to X-rays from his tube. When

[18] *Become (became) engrossed* [In'grqust] *in* – увлечься чем-либо, уйти с головой в.
[19] *Flaw* [flL] – трещина, дефект.
[20] *Content* [kqn'tent] – довольный, удовлетворенный.

the film was developed the bones of her fingers showed up clearly in the faint outline of her hand, the bones having stopped more of the rays than had the fleshy[21] part of the hand. 3. _____ This experiment initiated a whole new era in medical diagnosis - the science of roentgenology or radiology.

A. Her wedding ring stood out clearly where the heavy gold had completely absorbed the X-rays.
B. When he developed the film, he found the key had left its image there.
C. They could penetrate solid matter and cause barium crystals to fluorescence.
D. The details of the metal parts were showed up clearly.

### *II. Match the synonyms.*

| | |
|---|---|
| 1. image | A. apparatus |
| 2. roentgenology ["rOntjq'nOlqGI] | B. picture |
| 3. leak out | C. escape |
| 4. machine | D. radiography |
| | E. radiology |

### *III. Translate the following phrases from Russian into English.*

Пятидесятилетний профессор физики; заинтересоваться тем, что происходило; запаянная вакуумная (evacuated) стеклянная трубка с двумя металлическими электродами; множество ученых; экспериментировать с; однажды; толстостенная стеклянная разрядная трубка; завернуть в кусок картона; задернуть шторы на окнах; совершенно темный; включить

[21] *Fleshy* ['fleSI] – мясистый.

высоковольтное устройство; слабый зеленоватый свет; примерно в трех футах от трубки; зажечь спичку и искать; источник света; кусок картона, покрытый кристаллами химического препарата; какие-то лучи, исходящие из трубки; заставлять кристаллы светиться; проходить сквозь твердую материю; неизвестное излучение; обнаружить; воздействовать на фотопленку; экспериментировать с ключом, ружьем и живыми (animate) объектами; помещать на пленку; оставлять изображение; предшественник промышленной радиографии; начинать новую эру в медицинской диагностике.

**IV. *Write an interview. Work with a partner. Imagine that you are on a television programme called "Dark Side of the Moon ". Prepare some questions and answers. One of you can be Dr. W. K. Roentgen and another can be the interviewer.***

*Example. - When did you turn your attention to the processes taking place when electricity was sent through a sealed glass tube from which most of the air had been pumped?*

*- It was late in the year 1895.*

**V. *Imagine you work as a journalist for a local English language newspaper. Write a report about Dr. Roentgen and his discovery. Get ready to tell your story to group mates and answer any questions they have.***

**VI. *Choose the appropriate time indicators and put them into the sentence.***

1. Scientists have discovered that tea is faintly luminous. (recently / last year) 2. They will have attached this device to a high-voltage machine

(by 10 a. m. tomorrow / next week). 3. They experimented with such tubes (by the end of last week / last month). 4. These rays have intrigued him (just / yesterday). 5. He will take a thick-walled glass discharge tube for his experiment (by tomorrow morning / tomorrow). 6. He has drawn the shades (already / ten minutes ago). 7. This outstanding scientist has become famous (recently / in 2004). 8. This less skilled observer didn't get any results (this year / last year). 9. They have learned a great deal about X-rays (this year / last year). 10. We'll make an X-ray picture (by 11 p. m. next Monday / next Monday).

### *VII. It's interesting to know.*

❖ Believe it or not, but you are born with 300 bones, but by the time you become an adult, you only have 206.

❖ Sixteen-year-old Natasha Demkina from Saransk has a special gift. She can see into people's bodies! At first, doctors didn't believe Natasha. They tested her and each time she correctly described internal organs. Natasha can diagnose people with illnesses. She hopes to go to medical college, where she can learn more about the human body and use her gift to help people.

*From "Speak Out"*

### *VIII. Have some fun. Can you unscramble the following words?*

1. a e i g m - *image*
2. a e m r t t -
3. o o u c c d n r t -
4. i f l m -
5. a i o o y d g l r -
6. e e o o o y g g l n r t -

# UNIT II

# COMPUTED TOMOGRAPHY

***(Grammar: Passive Voice)***

## LESSON I

*If you want to be on top, don't let education stop.*

### *I. Remember some new words and phrases:*

1. abdomen ['xbdqmen] ➢ брюшная полость
2. attenuation [q''tenju'eiSn] ➢ ослабление
3. chest [Cest] ➢ грудная клетка
4. conventional [kqn'venSqnl] ➢ обычный, традиционный
5. cross-sectional radiograph ['krO'sekSqnl 'reidIqugrRf] ➢ снимок поперечного сечения
6. exposure [Iks'pquZq] ➢ облучение, воздействие
7. impact on ['Impqkt] ➢ влияние, воздействие на
8. in essence [In'esns] ➢ по существу
9. media ['mJdjq] ➢ *здесь* вещества
10. read [rJd] ➢ *здесь* снимать показания, измерять
11. relevant to ['relIvqnt] ➢ уместный, относящийся к делу
12. scanner ['skxnq] ➢ многоточечный измерительный прибор
13. scope [skqup] ➢ границы, рамки, пределы
14. starve [stRv] ➢ лишать пищи
15. stem [stem] ➢ происходить
16. superimposition ['sjHpqrImpq'zISqn] ➢ накладывание одного на другое
17. supine [sjH'pain] ➢ лежащий навзничь
18. suspended [sqs'pendId] ➢ приостановленный
19. tissue ['tISH] ➢ ткань

### *II. Pay attention to the faux amis given below. Try to remember them.*

1. accurate ['xkjurIt] ➢ *точный*, а не аккуратный
2. arc [Rk] ➢ *дуга*, а не только арка
3. decade ['dekeid] ➢ *десятилетие*, а не декада
4. department [dI'pRtmqnt] ➢ *отделение, управление,* а не только департамент
5. examination [Ig''zxmI'neiSqn] ➢ *осмотр, исследование*, а не только экзамен
6. principal ['prInsqpql] ➢ *основной*, а не принципиальный
7. record ['rekLd] ➢ *запись, отчет*, а не только рекорд
8. specific [spI'sIfIk] ➢ *особый, определенный*, а не только специфический
9. technique [tek'nJk] ➢ *методика, аппаратура, оборудование*, а не только техника

***III. Match the English words / phrases in A with their Russian equivalents in B.***

A. 1) is relevant to, 2) in an arc, 3) brunches of surgery, 4) point of view , 5) outside the scope of smth, 6) digital, 7) radiography, 8) contrast media, 9) intravenous ["Intrq'vJnqs], 10) to make the readings, 11) sensitive technique, 12) suspended respiration, 13) patient, 14) powerful diagnostic ["daIqg'nOstIk] tool, 15) tube.

B. a) цифровой, b) точка зрения, c) чувствительная техника, d) приостановленное дыхание, e) уместный, относящийся к делу, f) по дуге, g) рентгенография, рентгеносъемка, h) внутривенный, i) проводить измерения, j) отрасли хирургии, k) за пределами чего-либо, l) контрастные вещества, m) мощный диагностический инструмент, n) пациент, o) трубка.

***IV. Can you find seventeen words on the topic "Medical Equipment" in the grid below? They are written horizontally and vertically.***

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

***V. A. Find and translate the sentences where the Passive Voice is used.***

***B. Transform the sentences with the Active Voice using the Passive Voice.***

*Example: They use CT appropriately. – CT is used appropriately.*

1. Sir Godfrey Hounsfield introduced computed tomography.
2. The interested reader is referred to Hounsfield or to Pullan.
3. Photoelectric detectors will measure the emergent radiation beam.
4. A computer is used to display the measurements as an image.
5. Researchers usually carry out their experiments with great excitement.
6. Some departments prefer to starve their patients if intravenous contrast media are to be given.
7. Examination is usually carried out with the patient supine.
8. Doctors require suspended respiration during examinations or exposures.
9. Students examine a chest to get information about lungs.
10. They plan the examination accurately.
11. They use computed tomography appropriately.

***VI. Word formation.***

***a) What parts of speech (nouns, adjectives, or adverbs) do the italicized suffixes indicate? Translate all the words given.***

***1.*** Power***ful***, intraven***ous***, *success****ful,*** *cross-section****al***

***2.*** Appropriate***ly***, typical***ly***, accurate***ly***

***3.*** Manage***ment***, read***er***, scann***er***, radiat***ion***, detect***or***, measure***ment***, comput***er***, examin***ation***, prepar***ation***, indicat***ion***, posi***tion***, respir***ation***, attenuat***ion,*** *success****fulness***

***b) Make as many words as you can by combining different parts of the box and translate them.***

| | |
|---|---|
| effective | ion |
| demonstrate | tion |
| help | ation |
| rare | ment |
| vena | ful |
| calculate | ous |
| investigate | ly |
| treat | ness |
| manage | or |
| examine | er |
| indicate | al |
| detect | |
| principal | |
| convention | |

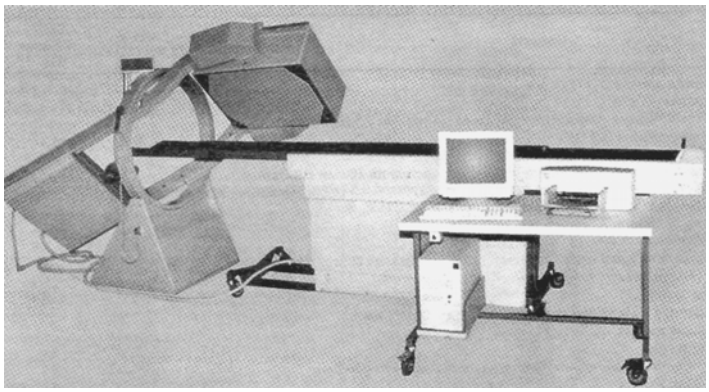

***VII. Read the following text and say if computed tomography is a simple examination.***

**COMPUTED TOMOGRAPHY. INTRODUCTION.**

In the two decades since computed tomography (CT) was introduced by Sir Godfrey Hounsfield it has become established as a powerful diagnostic tool

and one that is relevant to many branches of surgery. Used appropriately, CT is capable of making a major impact on management decisions.

The technology of CT is outside the scope of this chapter and the interested reader is referred to Hounsfield (1973) or to Pullan (1979). In essence,



the scanner rotates an X-ray tube around the patient in an arc and the emergent radiation beam is measured by photo-electric detectors. A computer is used to display the measure-ments as an image representing a cross-sectional radiograph of the patient, based on the density of tissues to X-rays and their attenuation value. The image looks like a cross-sectional radiograph but unlike radiography there is no superimposition of structures and the detector/computer system makes the technique very sensitive. The principal advantages of CT over conventional techniques stem from this fact.

From the patient's point of view CT examination is simple. In the majority of examinations all the patient has to do is to lie on the couch while the machine makes the readings. Preparation is minimal; some departments prefer to starve their patients for a few hours beforehand if intravenous contrast media are to be given.

Examination is usually carried out with the patient supine, although specialized indications may require specific positions. Exposures typically last a few seconds, and suspended respiration is required when the chest or abdomen are being examined. Most CT machines can produce a digital radiograph of the

examination area at the start of the examination. This allows the examination to be planned accurately and also provides a computerized record of the sections.

***VIII. Find in the text words or phrases with the following meanings:***

1) плотность тканей, 2) в отличие от, 3) основанный на, 4) упрочилась как; стала авторитетной в качестве, 5) соответствующим образом, 6) цифровой снимок, 7) преимущество чего-либо над чем-либо, 8) оказывать основное влияние, 9) способный на что-либо, 10) степень ослабления, 11) с точки зрения пациента, 12) заранее, заблаговременно.

***IX. Now read the text again and choose the correct alternative for each of the following sentences.***

1. The technology of computed tomography was introduced by

a) Hounsfield; b) Pullan.

2. The emergent radiation beam is measured by

a) the scanner; b) photoelectric detectors; c) a computer.

3. A computer is used

a) to make a major impact on management decision; b) to measure the emergent radiation beam; c) to display measurements.

4. There is no superimposition of structures

a) on a cross-sectional radiograph made by computed tomography; b) on a conventional radiograph.

5. In the majority of examinations the patient has

a) to lie on the couch and suspend respiration; b) to lie on the couch in the specific position; c) to lie on the couch supine.

6. Some departments prefer

a) to starve their patients for a few hours beforehand; b) to make a digital radiograph of the examination area at the start of it; c) to plan the examination accurately.

***X. Can you answer the questions?***

1. Who introduced computed tomography?
2. It has become established as a powerful diagnostic tool, hasn't it?
3. Is it relevant to many branches of surgery?
4. What is computed tomography capable of?
5. Can you name any devices they need for computed tomography?
6. What does the scanner rotate?
7. What is emergent radiation beam measured by?
8. What is used to display the measurements? How are they displayed?
9. What fact can explain the principal advantages of CT over conventional techniques?
10. Why does the patient think of a CT as a simple examination?
11. Does CT require specific position of the patient?
12. How long do exposures typically last?
13. What allows CT examination to be planned accurately?

***XI. Have some fun. Do you know the words from the Latin which describe the following periods of time?***

1. ten years – a .....
2. a hundred years – a .....
3. a thousand years – a .....

LESSON 2

*Good – better – the best.*
*Never have a rest*
*Till good is better*
*And better is the best.*

## *I. Remember some new words and phrases:*

1. abdominal [xb'dOmInl] ➢ брюшной
2. auditory ossicles ['LdItqrI 'OsIklz] ➢ слуховые косточки
3. console ['kOnsqul] ➢ пульт
4. contiguous [kqn'tIgjuqs] ➢ соприкасающийся, смежный, близкий
5. cortical ['kLtIkql] ➢ корковый[22], кортикальный
6. dense [dens] ➢ плотный, непрозрачный
7. enhancement [In'hRnsmqnt] ➢ усиление, повышение качества изображения
8. fine [faIn] ➢ тонкий, мелкий
9. hence [hens] ➢ отсюда
10. kidney ['kIdnI] ➢ почка
11. lesion ['lJZqn] ➢ повреждение
12. lung [lAN] ➢ легкое
13. precise [prI'saIz] ➢ точный
14. reprocess ['rJ'prquses] ➢ подвергнуть переработке
15. resolution ["rezq'lHSqn] ➢ разрешающая способность, разрешение,

## *II. Pay attention to the faux amis which follow. Try to remember them:*

1. discrimination [dIs"krImI'neISqn] ➢ *различение, распознавание, разрешение, выделение,* а не только дискриминация
2. data ['deItq] ➢ *данные*, а не дата
3. liver ['lIvq] ➢ *печень*, а не ливер

[22] *Cortex* ['kLteks] - кора головного мозга

4. section ['sekSqn] ➢ *поперечное сечение, срез,* а не только секция

5. routine [rH'tJn] ➢ *обычный,* а не только рутина

***III. Match the English words and phrases in A with their Russian equivalents in B.***

A. 1) normal and abnormal tissues, 2) attenuation value, 3) cortical bone, 4) the display console, 5) manipulate, 6) area, 7) data, 8) brain, 9) iodine-containing contrast medium, 10) routine technique, 11) treatment, 12) circulation, 13) intravenous administration, 14) basic.

B. a) мозг, b) обычная методика, c) кровообращение, d) нормальные и аномальные ткани, e) умело обращаться, управлять, f) внутривенное введение (лекарств), g) корковая кость, h) йодсодержащие контрастные вещества, i) область, j) лечение, k) степень проницаемости, l) основной, m) данные, n) пульт управления изображением.

***IV. Complete the crossword.***

*Across*

2. grey substance used by the players of the TV game "What? Where? When?";

4. the movement of the blood from and to the heart;

5. dense structure in a human body;

7. harmful change in the tissues, caused by injury or disease;

8. protective shell of the brain;

11. a device one can use to control some kind of electrical equipment.

*Down*

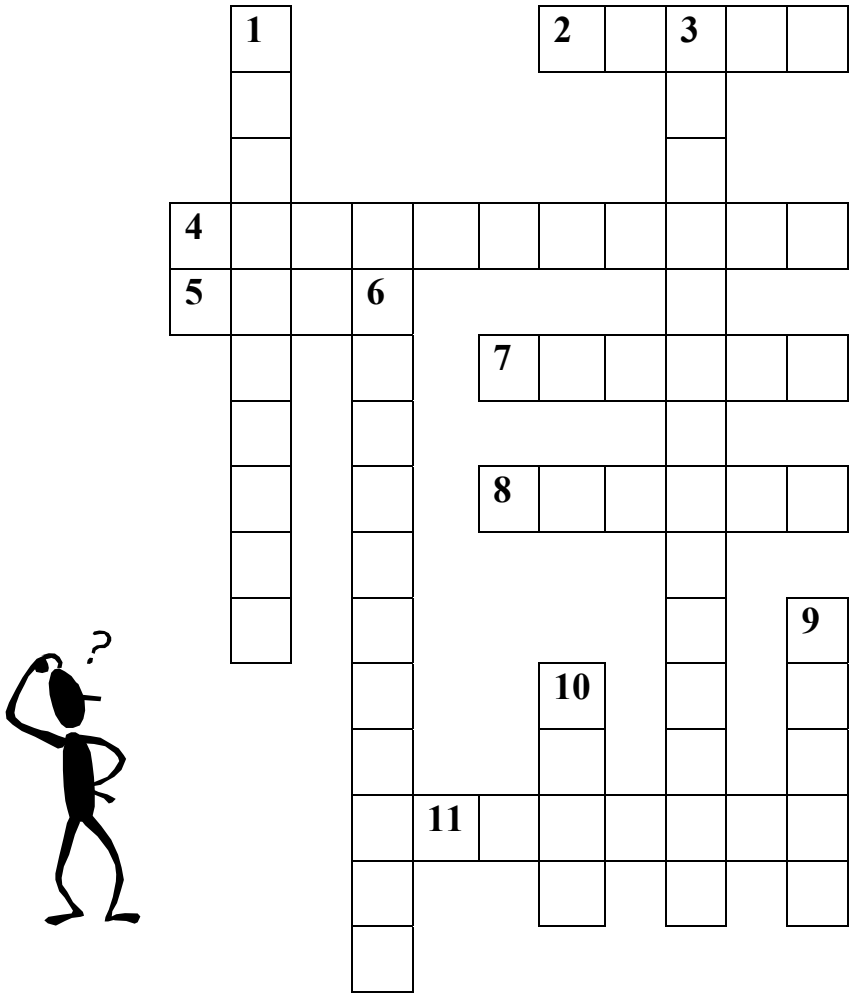
1. an image made with the help of CT or radiology;

3. process of putting substance into some tissue;

6. improvement of the quality of an image;

9. large, reddish-brown organ in the body which produces bile[23] and cleans the blood;

10. organ in the chest of man or animal used for breathing.




***V. Choose the appropriate degree of comparison (positive, comparative or superlative) of the adjectives. Translate the completed sentences.***

**Watch out!**

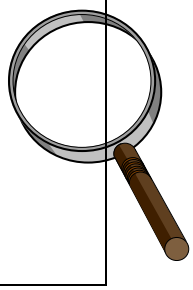
*far - farther/further - the farthest/the furthest*

*good – better – the best*

*bad – worse – the worst*

*little – less – the least*

*old – older/elder – the oldest/the eldest*



[23] *Bile* [ball] - желчь.

*Example:* Bones are (*lighter/the lightest*) than other tissues in the cross-sectional radiograph. - *Bones are* ***lighter*** *than other tissues in the cross-sectional radiograph.*

1. Bones are (*lighter/the lightest*) than other tissues in the cross-sectional radiograph. 2. Tissues with (*lower/the lowest*) density are (*darker/the darkest*) in the radiograph. 3. CT gives an opportunity to examine (*finer/the finest*) details of the lungs. 4. They need (*farther/further/the farthest/the furthest*) diagnostic information. 5. CT is one of (*simpler/the simplest*) examinations. 6. This technique is (*more sensitive/the most sensitive*) and (*more useful/the most useful*) than conventional radiology. 7. CT can give (*higher/the highest*) resolution to demonstrate (*smaller/the smallest*) structures. 8. These images are not much (*more helpful/the most helpful*) than others. 9. CT images have (*wider/the widest*) scale than other techniques. 10. (*Thinner/the thinnest*) sections can't be examined without CT.

***VI. Translate the following sentences. Pay attention to the adjectives italicized.***

1. Conventional radiology is not *so/as sensitive as* CT. 2. Conventional radiology is *less sensitive than* CT. 3. These images are *as helpful as* others. 4. *The lower* the density of tissues is *the darker* the image.

***VII. Make up your own sentences with the adjectives given in the previous exercises.***

*Example:* This cross-sectional radiograph is *lighter* than others. What tissues are *the lightest* in the cross-sectional radiograph?

***VIII. Translate the following word combinations from the text "Computed Tomography. The Image".***

Attenuation value, low density area, display console, attenuation scale, basic image data, high resolution image, precise tissue map.


***IX. Read the text and say if computed tomography gives us only the image of tissues or it is also a basis for planning any kind of therapy.***

## COMPUTED TOMOGRAPHY. THE IMAGE

The CT section is a cross-sectional radiograph in which the tissues are displayed on a grey scale according to their attenuation value. Dense structures such as cortical bone appear light, whereas low density areas like air appear dark, as is the case with conventional radiographs. The attenuation of tissues on CT is displayed on a wider scale than can be shown effectively on one image, however. The display console therefore allows the image to be manipulated so that areas at different points on the attenuation scale can be examined. This allows discrimination of, for example, the fine detail of the lungs, at the lower end of the attenuation scale.

The basic image data can also be manipulated in other ways. Measurements from a small area can be reprocessed to give a high resolution image; this is useful for demonstrating small structures such as the auditory ossicles. Information from contiguous thin sections may be reformatted in different planes, or in three-dimensional perspective views, to provide a more anatomical display. But such images rarely add further diagnostic information.

Enhancement refers to the commonly used technique of scanning following the intravenous administration of iodine-containing contrast medium. This increases the attenuation of areas which have a circulation. It is commonly used to aid diagnosis by increasing the contrast between normal and abnormal

tissues, hence the term enhancement. This technique is routine in the examination of the liver, kidney and brain, and in the investigation of abdominal sepsis or trauma.

The precise tissue map of CT images has been used successfully to direct treatment beams in radiotherapy and it is now common for radiotherapy to be planned on the basis of CT images, using specially constructed computer hardware.

***X. Match the English words and phrases in the left-hand column with their Russian equivalents in the right-hand one.***

| | |
|---|---|
| 1. on a grey scale | A. изображение в трехмерном виде |
| 2. so that | B. в разных плоскостях |
| 3. in different planes | C. область с низкой плотностью |
| 4. in three-dimensional perspective view | D. так, чтобы |
| 5. dense structures | E. такой (такие) как |
| 6. whereas | F. поэтому, следовательно |
| 7. low density area | G. тогда как |
| 8. therefore | H. плотные структуры |
| 9. such as | I. в сером диапазоне |

***XI. Match up the two halves of the following sentences.***

| | |
|---|---|
| 1. The CT section is a cross-sectional radiograph | A. that areas at different points on the attenuation scale can be examined. |
| 2. The attenuation of tissues on CT is displayed on a wider scale | B. in different planes, or in three-dimensional perspective views. |
| 3. The display console therefore allows the image to be manipulated so | C. in which the tissues are displayed on a grey scale according to their attenuation value. |
| 4. Measurements from a small area can be reprocessed | D. which have a circulation. |

5. Information from contiguous thin sections may be reformatted
6. Administration of iodine-containing contrast medium increases the attenuation of areas
7. The precise tissue map of CT images has been used successfully

E. to give a high resolution image.
F. to direct treatment beams in radiotherapy and to plan radiotherapy on the basis of CT images.
G. than can be shown effectively on one image.

***XII. Read the text again and decide if the following statements are True or False.***

1. Tissues in a cross-sectional radiograph are displayed on a coloured scale.
2. The more is the tissue's density the darker is its image.
3. The display console allows examining areas at different points on the attenuation scale.
4. CT can't give images of small structures such as auditory ossicles.
5. CT is very useful for examining contiguous thin sections.
6. Intravenous administration of iodine-containing contrast medium and enhancement are helpful in examining normal tissues of the liver, kidney and brain.
7. CT is useful for radiotherapy.

***XIII. Find in the text the verbs in the Passive Voice. Make up your own sentences with them (refer the verbs into different tenses).***

***XIV. Have some fun.***

***a) Read and translate the limerick[24].***

[24] *Limerick* ['lɪmqrɪk] - короткий стишок из пяти строк про что-нибудь смешное; первая, вторая и пятая строчки рифмуются между собой, а третья рифмуется с четвертой. Некоторые исследователи утверждают, что название стишков происходит от городка Лимерик в Ирландии.

***As** Small **as** a Button*

There was an old person of Dutton
Whose head was **as** small **as** a button.
So to make it look big
He bought a big wig
And ran to the people of Dutton.

***b) Read and translate the rhymes.***

**The** more we learn –
**The** more we know.
**The** more we know –
**The** more we forget.
**The** more we forget –
**The** less we know.
So why must we study?

*A Wise Old Bird*

A wise old bird
Sat in an oak.
**The** more it heard –
**The** less it spoke.
**The** less it spoke –
**The** more it heard.
Why can't we be
Like that wise old bird?

## LESSON 3

*The smallest deed is greater than the biggest intention.*

***I. Remember some new words and phrases:***

1. assess [q'ses] ➢ определять
2. cerebral ['serIbrql] ➢ мозговой
3. imaging ['ImIdZIN] ➢ визуализация
4. invasive [In'veIsIv] ➢ инвазивный[25]
5. overriding ["quvq'raIdIN] ➢ основной, первостепенный
6. pregnant ['pregnqnt] ➢ беременная

***II. Match the English words and phrases in A with their Russian equivalents in B.***

A. 1) overriding indications, 2) neurosurgery ["nju(q)rq'sWGqrI], 3) disease sites, 4) cerebral anatomy [q'nxtqmI] and pathology [pq'TOlqGI], 5) invasive and indirect tests, 6) largely replaced, 7) arteriography [R"tI(q)rI'OgrqfI] and encephalography [In"sefq'lOgrqfI], 8) biopsy ['baIOpsI], 9) detection and localization, 10) cost of the equipment, 11) ionizing radiation, 12) absorbed radiation.

B. a) стоимость оборудования, b) поглощенное излучение, c) пораженные места, d) первостепенные показания, e) артериография и энцефалография, f) нейрохирургия, g) в значительной степени заменены, h) ионизирующее излучение, i) черепно-мозговая анатомия и патология, j) обнаружение и определение местонахождения, k) биопсия, l) инвазивные и косвенные исследования.

[25] *Инвазивный* – включающий в себя такие методы, как прокол, разрез или проникновение внутрь организма

***III. Try to find fourteen words on the topic "Medical Equipment" in the grid below. They are written horizontally and vertically.***

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

***IV. Read the following text and choose the most appropriate title for it.***

*1) Advantages of CT in neurosurgery.*

*2) Why can't we use CT for testing children and pregnant women?*


*3) Advantages and disadvantages of CT.*

The principal advantage of CT is that it provides a clear, accurate display of tissues without superimposition of structures. Disease processes may be detected at an earlier stage than is possible with other techniques, and lesions may be detected in areas which are difficult to assess with conventional imaging. The technique is not limited to specific organs: since all of the tissues in a body section are displayed it can be used to search for disease sites.

The clinical advantages of CT are well illustrated by its role in neurosurgery, one of its first areas of application. The technique offered for the first time the ability to image cerebral anatomy and pathology directly. Invasive and indirect tests such as arteriography and encephalography were largely replaced, and more accurate diagnosis became possible.

Although CT is effective in disease detection and localization, characterization of lesions is more difficult, since many have similar attenuation characteristics. Biopsy is therefore usually required for definitive diagnosis.

The other main disadvantages of CT are the high capital cost[26] of the equipment and the fact that it employs ionizing radiation. The absorbed radiation dose from CT varies according to examination technique. CT is therefore used with care around radiosensitive structures such as the eye, or in children and young people, and only for overriding indications in pregnant women.

***V. What are the arguments for and against CT?***

***VI. Find in the text the sentences with the Passive Voice. Refer them into the Past, Present and Future.***

*Example:* The technique **is** not **limited** to specific organs. - *The technique* ***was*** *not* ***limited*** *to specific organs (Past Indefinite Passive).*

*The technique* ***will*** *not* ***(won't) be limited*** *to specific organs (Future Indefinite Passive).*

***VII. Complete the proverbs with the appropriate degree of comparison of the given adjectives.***

1. It's (*easy*) to forgive an enemy than a friend. 2. Honesty is (*good*) policy. 3. Actions speak (*loud*) than words. 4. (*good*) late than never. 5. The (*little*) people think – the (*much*) they say. 6. Hope for (*good*), prepare for (*bad*).

[26] *Capital cost* - капитальные вложения

LESSON 4

*If a task is once begun, never leave it till it's done.*
*Be the labour great or small, do it well or not at all.*

**I. *Before reading the following text about CT try to remember some new words and phrases.***

1. artefact/artifact ['RtIfxkt] ➢ артефакт, что-либо случайное
2. as yet [xz 'jet] ➢ все еще, пока, до сих пор
3. bowel ['bauql] ➢ кишка
4. call for [kLl fL] ➢ требовать, предусматривать
5. drainage ['dreInIdZ] ➢ дренирование (раны)
6. employ [Im'plOI] ➢ применять, употреблять, использовать
7. heavily ['hevIlI] ➢ сильно
8. in-patient ['In"peISqnt] ➢ стационарный (больной)
9. liaison [lI(:)'eIzOn] ➢ связь
10. mainstay ['meInsteI] ➢ главная поддержка, опора, оплот
11. moderate ['mOdqrIt] ➢ средний, умеренный
12. otherwise ['ADqwaIz] ➢ иначе, в противном случае
13. out-patient ['aut"peISqnt] ➢ амбулаторный (больной)
14. pelvis ['pelvIs] ➢ таз
15. resemble [rI'zembl] ➢ походить, иметь сходство
16. site [saIt] ➢ располагать
17. tumor ['tjHmq] ➢ опухоль

**II. *The following words are all taken from the text. Match each one with its correct definition in the right-hand column.***

| | |
|---|---|
| 1. technique | a. detailed study of a subject to find out something new |
| 2. chest | b. the treatment of illness without operations |
| 3. abdomen | c. to place something in any area |

| | |
|---|---|
| 4. medium | d. a patient getting treatment while living in a hospital |
| 5. to site | e. method of doing something, e.g. testing or treating |
| 6. therapy | f. the part of the body containing stomach and bowels |
| 7. investigation | g. a person visiting a hospital for treatment but not living there |
| 8. out-patient | h. substance |
| 9. in-patient | i. to make something weaker |
| 10. to attenuate | j. upper part of the body containing lungs and the heart |

***III. Pay attention to the** faux amis **given below. Try to remember them.***

1. medium ['mJdjqm] ➢ *среда,* а не только медиум (у спиритов – лицо, являющееся посредником между людьми и миром «духов»)
2. operator ➢ *врач, делающий операцию*, а не только оператор
3. selection ➢ *выбор, подбор, набор,* а не только селекция

***IV. Read the text and find out if CT can replace other techniques in making diagnosis or treating.***


**COMPUTED TOMOGRAPHY**

**Relationship to Other Techniques**

In the abdomen, pelvis, and musculoskeletal soft tissues, ultrasound offers an alternative to CT as a sectional imaging technique. If a good quality image is obtained by ultrasound, the two techniques are usually comparable in application. However, the results of ultrasound, unlike CT, are limited by the presence of bowel gas and bone, and if these prevent good images being obtained, CT is more reliable. Ultrasound is also attenuated by fat, making the technique more suitable for slim patients, whereas a moderate amount of body fat improves image quality in CT. Ultrasound is of limited use in the chest.

The technique which most resembles CT is magnetic resonance imaging (MRI). Like CT, MRI is a cross-sectional technique, but unlike CT, examination in any plane is possible. MRI has the advantage of not employing radiation, and it discriminates between soft tissues to a degree unequalled by any other technique. However MRI is expensive and of limited availability. Movement artefact is a problem in studying the abdomen, because scan times are long and there is, as yet, no generally available contrast medium to label the bowel, as there is in CT. Little signal is obtained from lung and MRI does not compare with CT in this area.

## CT-Guided Interventional Techniques

A wide range of percutaneous[27] therapeutic procedures are now performed under CT control. The principal advantage of the technique is that it permits the operator to site an instrument with confidence and safety, even in relatively inaccessible areas of the body. The most common technique is CT-guided biopsy. CT-guided drainage can also be used in the treatment of most deep-seated abscesses and other pathological fluid collections. Guided neurolysis[28], tumour lysis[29] by alcohol injection, and laser therapy are also possible.

## Computed tomography. Conclusion.

Although the capital and running costs[30] of CT are high, the technique is undoubtedly cost effective[31]. It can be used to achieve an early diagnosis in patients who would otherwise need to undergo a large number of alternative investigations, and it can be performed on an out-patient basis, reducing costs for in-patient investigation. Moreover, the diagnostic and therapeutic applications of CT frequently replace exploratory laparotomy[32], or other major surgical

[27] *Percutaneous* ["pWkju'teInjqs] – подкожный.
[28] *Neurolysis* [nju'rOlIsIs] – невролиз – разрушение нервной ткани, хирургическая операция освобождения нервов от спаек.
[29] *Lysis* ['laIsIs] – лизис, растворение, разрушение.
[30] *Running costs* – текущие вложения
[31] *Cost effective* – рентабельный, оправдывающий затраты.
[32] *Exploratory laparotomy* [eks'plLrqtqrI "lxpq'rOtqmI] – диагностическая лапоротомия.

procedures. Maximization of these cost benefits[33] is heavily dependent on good patient selection, and calls for close liaison between the surgeon and the radiologist.

In the future the clinical role of CT will need to be reassessed as MRI develops. For the present, CT is the mainstay of cross-sectional imaging.

***V. Read the text again and write down appropriate questions for the following answers.***

1. Ultrasound does.
2. They are limited by the presence of bowel gas and bone.
3. By fat.
4. Magnetic resonance imaging most resembles CT.
5. They are cross-sectional techniques.
6. It has advantages of perfect discrimination between soft tissues and not employing radiation.
7. Its high cost and limited availability are.
8. Percutaneous therapeutic procedures, biopsy, drainage and others are now performed under CT control.
9. An early diagnosis in patients.

***VI. Match adjectives in A with nouns in B and translate the phrases.***

A. slim, therapeutic, common, soft, moderate, contrast, available, wide, good, little, inaccessible, early;

B. diagnosis, medium, signal, tissues, technique, areas, amount, quality, image, patient, procedures, application, range.

***VII. Which word does not belong to each of the following groups?***

1. computed tomography, magnetic resonance imaging, surgery, ultrasound
2. abdomen, chest, bowel, pelvis

[33] *Cost benefits* – окупаемость затрат

3. X-ray tube, photoelectric detectors, cross-sectional radiograph

4. examination, investigation, therapy, reading, exploration

***VIII. Discuss the information from the texts you've read about CT. Try to use some of the following expressions giving your opinion.***

| | |
|---|---|
| 1. From my point of view | ➢ С моей точки зрения |
| 2. In my opinion | ➢ По моему мнению |
| 3. In my view | ➢ На мой взгляд |
| 4. To my mind | ➢ По-моему... |
| 5. It should be said that | ➢ Следует сказать, что |
| 6. It is interesting to note that | ➢ Интересно заметить, что |
| 7. I (don't) think | ➢ Я (не) думаю |
| 8. I (don't) believe | ➢ Я (не) считаю |
| 9. I dare say | ➢ Осмелюсь утверждать, что |
| 10. I am far from thinking that | ➢ Я далек от того, чтобы утверждать, что |
| 11. I'm sorry to say that | ➢ К сожалению, я должен сказать |
| 12. On the one hand | ➢ С одной стороны |
| 13. On the other hand | ➢ С другой стороны |
| 14. They say that /It's said that | ➢ Говорят, что |
| 15. It goes without saying that | ➢ Само собой разумеется, что |
| 16. As far as I know (remember) | ➢ Насколько мне известно (я помню) |
| 17. If I am not mistaken | ➢ Если я не ошибаюсь |
| 18. In other words | ➢ Другими словами |
| 19. I see | ➢ Понятно |
| 20. I think so too. | ➢ Я тоже так думаю |
| 21. Furthermore | ➢ К тому же, кроме того, более того |
| 22. However | ➢ Однако, тем не менее |
| 23. In addition (to this) | ➢ Вдобавок, кроме того |

| | |
|---|---|
| 24. So | ➢ Так, итак |
| 25. Nevertheless | ➢ Тем не менее |
| 26. Moreover | ➢ Более того |
| 27. On the contrary, it is | ➢ Напротив, это |
| 28. I think you're rather optimistic/ unrealistic saying that | ➢ Я думаю, ты слишком оптимистичен, говоря, что |

***IX. Make two or more groups. One group will be inventors of computed tomography. The other group (groups) will be doctors, technical experts, or some interested persons.***

*Imagine you are an inventor of the computed tomography.*

1. Draw a picture or a plan.
2. Be ready to present your invention to the experts. How can people use your invention? What do people need it for?
3. Advertise your invention. Make a poster and advertisement for a TV or radio programme.

*Imagine you are an expert, a doctor or just an interested person.*

1. Be ready to ask inventors about their device. How does it work? What is it for? And so on.

***You may use the phrases from the previous exercise while discussing.***

***IX. Have some fun. Can you solve this problem?***

After a woman was blindfolded[34], a man hung up her hat. She walked 50 feet, turned around, and shot a bullet[35] through her hat. How did she manage to do this?

[34] *Blindfolded* ['blaIndfquldId] – с завязанными глазами.
[35] *Bullet* ['bullt] – пуля.

# UNIT III

# HEART PROBLEMS

***(Grammar: Modal Verbs)***

LESSON I

*Whatever you cannot understand,*
*you cannot possess.*
***Goethe***

***I. Before reading the following text try to remember some new words and phrases.***

1. alarm [q'lRm] ➢смятение, страх, волнение, тревога
2. alleviate [q'lJvIeIt] ➢облегчать (боль, страдания), смягчать
3. apart [q'pRt] from that ➢не говоря уже о том, кроме того
4. completion [kqm'plJSqn] ➢завершение, окончание, заключение
5. deliver a report ➢представлять отчет
6. desktop ['desktOp] ➢настольный
7. downloaded ['daun''lqudId] ➢заложен(ный), загружен(ный)
8. get on ➢продолжать, ладить
9. heartbeat ['hRtbJt] ➢сердечный удар
10. identify the cause [aI'dentfaI Dq kLz] ➢распознавать, идентифицировать причину
11. instant ['Instqnt] ➢немедленный, мгновенный
12. misery ['mIzqrI] ➢страдание
13. reassurance [''rJq'Suqrqns] ➢успокаивание
14. referral [rI'fWrql] ➢направление (к врачу)
15. remainder [rI'meIndq] ➢остальные
16. routinely [rH't JnlI] ➢в плановом порядке, регулярно
17. urgently ['WGqntlI] ➢срочно
18. worsen ['wWsqn] ➢ухудшаться

***II. Pay attention to the*** *faux amis* ***given below. Try to remember them.***

1. director [dI'rektq],[dai' rektq] ➢ *руководитель*, а не только директор
2. general ['Genqrql] ➢ *общий, неспециализированный*, а не только генерал
3. officer ['OfIsq] ➢ *служащий, чиновник, сотрудник*, а не только офицер

e.g. executive officer ➢ управляющий делами

***III. Match the English words and phrases in A with their Russian equivalents in B.***

A. 1) irregular heartbeats, 2) normal life, 3) the UK-made monitor, 4) sixty to seventy per cent, 5) abnormal heartbeats, 6) possible diagnosis, 7) general practitioner, 8) general requirements 9) until the arrival.

B. a) от 60 до 70 процентов, b) датчик, произведенный в Великобритании (Объединенном Королевстве), c) возможный диагноз, d) неровное сердцебиение, e) до появления, f) аномальное сердцебиение, g) обычная жизнь, h) общие требования, i) обычный практикующий врач, совмещающий обязанности терапевта и хирурга.

***IV. Translate the sentences. Pay attention to the Modal Verbs and their equivalents.***

1. A Cardionetics machine can be fitted by a general practitioner (GP) to patients. 2. The doctor will be able to decide whether to refer the patient to a hospital or simply to give reassurance. 3. All those patients had to go for tests at a hospital to identify the cause of their symptoms. 4. 24-hour ECG recordings have to be downloaded to a computer and analysed by a skilled technician. 5. Results can be given to a patient. 6. For those who had a heart disease, a wait could worsen their condition. 7. The monitor is able to classify nine rhythm disorders. 8. If we look back into history to trace the beginnings of the Atomic

Age, we may start the story with the experiment performed by Roentgen. 9. Some rays must be coming from the tube. 10. Any person might realize the importance of this discovery. 11. This technique should be used to examine structures and machinery. 12. All the patient has to do is to lie on the couch. 13. Sometimes contrast media are to be given. 14. He is allowed to use new technique during his experiments. 15. To become a good specialist in medical equipment one should know the rules of electrical safety in medicine.

***V. You are to read the text about new ECG (electrocardiogram). Before reading discuss some questions connected with heart problems. Use the words and phrases from the box.***

1. Should every person go for tests at a hospital? Why?
2. How much time do they need to get a possible diagnosis with conventional technique?
3. Is it dangerous to use conventional devices for examinations? Why? What could happen to a patient?

*to have heart (or any other) disease; to need treatment; to wait several weeks for an appointment (results); special equipment; to need further tests; ECG recordings; to be analysed by a skilled specialist; stress*


***VI. Read the text and answer the following questions to find out the importance of using the device described in the text:***

1. Can a Cardionetics machine be used for in-patient or out-patient investigation?
2. Should patients follow special rules wearing this device?
3. Are the patients to return to the surgery or use a computer to deliver a report to the doctor?

4. How much time does it take to find out what is wrong with the help of the C.Net2000+ device?
5. Who is able to fit a Cardionetics machine and decide if a patient needs further tests and treatments?
6. Where was the C.Net2000+ device designed and produced? (By the way, you will get this information in details, reading part II).

**Monitor Gets to the Heart of the Problem**

**Part I**

*(A revolutionary wallet-sized heart monitor is saving lives, money and misery)*

A Cardionetics machine can be fitted by a general practitioner (GP) to patients visiting the surgery with symptoms such as irregular heartbeats, palpitations[36] and dizziness[37]. The patients are sent home wearing the C.Net2000+ device and advised to get on with their normal lives.

After 24 hours they return to the surgery where the UK-made monitor delivers a report to the doctor, either through a desktop printer or a computer. A possible diagnosis is offered and the doctor is able to decide whether to refer the patient to a hospital (urgently or routinely) or simply to give reassurance.

The UK's 29,000 GPs see at least three patients with palpitations or abnormal heartbeats in their surgeries every day. Sixty to seventy per cent of those will not have heart disease but the remainder will need further tests and treatment.

Until the arrival of this new ambulatory ['xmbjulqtqrl] ECG (electrocardiogram) heart monitor, designed and produced in the UK, all those patients would have had to go for tests at a hospital to identify the cause of their symptoms, and sometimes wait several weeks for an appointment. Apart from that, traditional, hospital-based, 24-hour ECG recordings have to be

[36] *Palpitation* ["pxlpI'teISqn] – сердцебиение – заметная выраженная пульсация сердца, обычно с увеличенной частотой или силой, с нарушением ритма или без него
[37] *Dizziness* ['dIzInIs] - головокружение

downloaded to a computer and analysed by a skilled technician and which again means delay before results can be given to a patient.

Waiting to find out what is wrong can cause a great deal of stress to patients, whether there is a need for alarm or not. For those who do have a heart disease, a wait could worsen their condition, or even be fatal.

Because the new monitor provides GPs with an instant report at the completion of a test, hospital referrals and waiting lists can be reduced because patients who do not have heart disease can have their fears alleviated, and those who do have potential problems can be referred to the appropriate specialist. If necessary the results from the machine can be emailed to a cardiologist at a hospital for advice.

***VII. Fill in the gaps with the appropriate modal verbs or their equivalents.***

1. Those who lose today … win tomorrow. 2. Books and friends … be few but good. 3. A man … do no more than he … 4. Liars … to have good memory. 5. Life … only be understood backwards; but it … be lived forwards. 6. A fool … ask more questions than a wise man … answer. 7. What we … to learn to do, we learn by doing. (Aristotle) 8. My people and I have come to an agreement which satisfies us both. They … to say what they please, and I … to do what I please. (Frederich the Great) 9. He has made his bed, and he … to lie on it. 10. A man without a smiling face … not open a shop.

LESSON 2

*Never stop believing*
*You can touch the sky.*

**I. *Before reading the second part of the text try to remember some new words and phrases.***

| | |
|---|---|
| 1. before long | ➢ скоро, вскоре |
| 2. draw on | ➢ черпать, заимствовать |
| 3. highlight ['haIlaIt] | ➢ выдвигать на первый план |
| 4. hook [huk] | ➢ зацеплять, прицеплять |
| 5. medication ["medI'keISqn] | ➢ лекарственная терапия, лечение |
| 6. pacemaker ['peIs"meIkq] | ➢ пейсмейкер, водитель ритма |
| 7. pick up | ➢ *здесь* найти, обнаружить |
| 8. set up | ➢ учреждать, основывать, открывать |

**II. *Read the following part of the text and put down all the advantages of the C.Net2000+ you are to find out (both in the first and second parts).***

**Monitor Gets to the Heart of the Problem**

**Part II**


The C.Net2000+, by Cardionetics, in Hampshire, southern England, drawing on previously programmed information, monitors the heart's electrical activity, looking for changes in rhythm. With every beat of the heart, the device examines the signal and identifies any abnormal conditions. The monitor is able to classify nine rhythm disorders. Also, if patients feel any symptoms, they can press a button and the machine will record this.

Lightweight and comfortable to wear, the device sits in a carrying case hooked onto a belt. Three electrodes are attached to the patient's chest with electrode pads.

Doctors using the mini monitor are reporting that they have been able to

identify people needing treatment to prevent strokes[38], and others requiring pacemakers or medication for various conditions picked up by the device.

One GP in Yorkshire, northern England, even discovered his own heart problem when demonstrating the C.Net. The monitor highlighted an abnormality and, before long, he had had a mitral valve[39] replaced with a mechanical one.

Cardionetics was set up in 1995 by technical director Philip Needham and chief executive officer Chris Francis with support from colleagues at Brunel University Industrial Design Department, based near London, and research scientist Tom Harris.

Development of the C.Net2000+ was partly funded by grants from the UK's Department of Trade & Industry. Hundreds of GPs are now using the device, as are doctors in other countries, such as India, South Africa and South America. *Liz Clark, London Press Service*

***III. Get ready with a summary of the text. Include the information of origin and advantages of the device introduced, prove its effectiveness (add the fact). Don't forget to give your own opinion.***

***IV. Have some fun.***

**Clever Sofa**

An amazing new sofa has been invented by a group of scientists in Northern Ireland. As soon as you sit down on it, it will know it's you. Then it'll be able to set lots of electrical appliances just how you like them, like the lights or the TV without you having to move a finger. The sofa is connected to a computer and weighs you when you sit on it, then it checks its memory and decides who you are. The inventors hope that their idea will also help sick people.

[38] *Stroke* [strquk] – удар – внезапный мозговой удар; точнее тромбоз, кровоизлияние.
[39] *Mitral valve* ['maltrql vxlv] - митральный клапан

# UNIT IV

# ELECTRICAL SAFETY IN HEALTH-CARE FACILITIES

***(Grammar: Non-Finite Forms of the Verb. The Infinitive)***

## LESSON I

*Learn to walk before you run.*

### *I. Try to learn some new words.*

1. deliberate [dl'llbqrlt] ➢ намеренный
2. facility [fq'sllltl] ➢ оборудование
3. ohmic ['qumlk] ➢ омический, активный
4. susceptible [sq'septqbl] ➢ чувствительный, восприимчивый
5. ubiquitous [ju(:)'blkwltqs] ➢ вездесущий, повсеместный
6. utmost ['Atmqust] ➢ крайний, предельный

### *II. Answer the question. The words in the box can help you.*

Why do you think electrical safety in health-care facilities is very important (more important than anywhere)?

| | |
|---|---|
| ➢ ubiquitous electronic equipment | ➢ healthy person |
| ➢ connect(ion) to | ➢ to be more susceptible to |
| ➢ living tissue | ➢ unwanted (harmful) effects of electricity |
| ➢ sick patient | |

### *III. Read the following passage to check if you are right.*

**Electrical Safety in Anaesthesia** ["xnqs'TJzlq] **and Surgery**

The subject of electrical safety in the operating theatre and elsewhere in health-care facilities is of the utmost importance for the following reasons:

1) electronic equipment is now ubiquitous in health care;

2) there is no deliberate ohmic connection of electronic equipment to living tissue in any other sphere; and

3) the sick patient is more susceptible to the unwanted effects of electrical energy than is the healthy person.

***IV. Mind the pronunciation and translation of the following words.***

1. asphyxia [xs'fIksIq] ➢ отсутствие дыхания, асфиксия
2. assume [q'sjHm] ➢ предполагать
3. char [CR] ➢ обжигать, обугливать
4. common sense ['kOmqn sens] ➢ здравый смысл
5. dramatically [drq'mxtIkqlI] ➢ впечатляюще, разительно
6. electrocution [I''lektrq'kjHSqn] ➢ смерть от электрического тока
7. ensue [In'sjH] ➢ следовать, являться результатом
8. excessive [Ik'sesIv] ➢ чрезмерный
9. impedance [Im'pJdqns] ➢ полное сопротивление
10. magnitude ['mxgnItjHd] ➢ величина
11. make use of [meIk jHs Ov] ➢ использовать
12. morbidity [mL'bIdItI] ➢ болезненность
13. mortality [mL'txlItI] ➢ смертность, смертельность
14. perspiration ["pWspq'reISqn] ➢ потоотделение
15. realm [relm] ➢ область, сфера
16. to a certain extent [tH q 'sWtn Iks'tent] ➢ до определенной степени
17. trunk [trANk] ➢ туловище, ствол (нерва, сосуда)

***V. Match the following words and phrases in A with their Russian equivalents in B.***

A. 1) understanding, 2) electrical damage, 3) applied current, 4) alternating current, 5) excessive current, 6) chemical burn, 7) respiratory [rIs'paIqrqtqrI] muscle ['mAs(q)l] spasm ['spxzm], 8) temporary cardiac arrhythmia [q'rIDmIq], 9) permanent cardiac damage, 10) direct current, 11) charring, 12) respiratory arrest.

B. a) временная сердечная аритмия, b) переменный ток, c) чрезмерный ток, d) приложенный ток, e) понимание, f) поражение электрическим током, g) постоянный ток, h) химический ожог, i) спазм дыхательной мышцы, j) необратимое поражение сердца, к) ожог, l) остановка дыхания.

***VI. Can you find eight words on the topic "Electrical Safety in Health-Care Facilities" in the grid below? They are written horizontally/vertically.***

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

***VII. Fill in the gaps with the appropriate words from the box.***

| Charring, healthy, ubiquitous, sick, dramatically, asphyxia |
|---|

1. He's never been ill. He is a … person. 2. You can see computers everywhere nowadays. They are … 3. If a person isn't healthy and is at the doctor's we can say he or she is a … patient. 4. Everybody must be careful with electricity or fire to prevent …. 5. Water and, especially, perspiration reduce the resistance … 6. Sometimes he has …, i. e. there is no air in his lungs.

***VIII. Translate the sentences given below. Pay attention to the forms and functions of the Infinitive.***

1. An electric current may cause damage. 2. Electrical energy converted into heat will cause damage proportional to the product of time and current. 3. To trace the beginning of the Atomic Age we may start with an experiment of Dr. Roentgen. 4. He was advised to get on with his normal life. 5. The cause of this symptom will be identified in short time. 6. To find out what is wrong can take much time. 7. This device was first to be worn with comfort. 8. Measurements from a small area can be reprocessed to give a high resolution image. 9. Everybody wants to be the first. 10. To put it briefly, electricity is both useful and harmful at the same time.

***IX. Read the text and name harmful effects of current electricity and factors on which they depend.***


**HARMFUL EFFECTS OF CURRENT ELECTRICITY**

There are a number of ways by which an electric current passing through living tissue may cause damage. With an understanding of these mechanisms, electrical safety enters the realm of common sense.

Risk of electrical damage may occur whenever the body, or part of it, becomes part of an electrical circuit. The amount and variety of morbidity and mortality depend upon the magnitude of the current, the time for which it passes through the body, and, to a certain extent, the frequency of the applied current.

From Ohm's [qumz] law, I equals E/Z (I divided by Z) where I is the current in amperes ['xmpFqz], E equals the potential difference in volts across Z, which is the resistance (or impedance with alternating current (a.c.)). The current passing through the body therefore depends not only upon the magnitude of the applied voltage but also upon the electrical resistance of the body; the lower the resistance, the higher the current. If the skin was perfectly dry, the skin resistance alone would be between 100 000 ohm and 300 000 ohm. However, water and, especially, perspiration reduce this resistance dramatically, such that the average resistance may be assumed to be between 50 ohms and 10 000 ohm when assessing electrical risk.

The morbidity of excessive currents passing through the living body may be due to one or more of the following:

(1) electrical energy being converted into heat which will cause damage proportional to the product of time and current; this may even progress to charring (a process made use of in radio frequency surgical diathermy[40]);

(2) hypoxemic[41] damage due to respiratory muscle spasm, or temporary cardiac arrhythmia; permanent cardiac damage may also ensue;

(3) chemical burns at contact points due to electrolysis; this type of morbidity only occurs when there is a direct current (d.c.) component to the electric current.

Death from electrocution may occur due to asphyxia caused by the respiratory muscle spasm, respiratory arrest due to CNS[42] dysfunction, or because of cardiac asystole [q'sIstqII] or arrhythmia.

Damage to any particular part of the body is dependent upon current density or current per unit cross-sectional area of the current pathway.

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[40] *Diathermy* ['daIqTWmI] - диатермия – локальное повышение температуры в тканях, вызываемое электрическим током высокой частоты, ультразвуком или коротковолновым излучением.
[41] *Hypoxemia* ["haIpq'ksJmIq] - гипоксемия – сниженное насыщение кислородом артериальной крови.
[42] *CNS* – central nervous system ['sentrql 'nWvqs 'sIstIm] – центральная нервная система.

What about the effects of increasing current at 50 or 60 Hz through the human trunk? These values vary greatly under different conditions, the most obvious of which is the route that the current takes through the body; the most dangerous of which is that which passes through the axis of the heart. Other factors causing variation include sex, body weight, and state of health of the area of contact, and the frequency, the waveform, and the duration of the electric shock.. *John T. B. Moyle*

***X. Are the following statements true or false?***

1. There is electricity almost everywhere in health-care facilities. 2. Electronic equipment is connected to living tissue in health care as often as in any other sphere. 3. Unwanted effects are more dangerous for sick patient than for healthy person. 4. When electronic equipment is connected to living tissue the body or part of it becomes a part of an electrical circuit. 5. The more is the magnitude or frequency of the current the more damage may occur. 6. The electrical resistance of the skin doesn't depend on dryness or perspiration of it. 7. Electrical energy can cause charring. 8. Electrical energy can cause death because of asphyxia, respiratory arrest or arrhythmia. 9. Damage to any particular part of the body isn't dependent upon sex, body weight, state of health or the duration of the electric shock.

***XI. Answer the questions to make up a summary of the text.***

1. What problem does the text deal with? 2. Why is this problem of great importance? 3. When may the risk of electrical damage occur? 4. What do the examples given in the text illustrate (well enough)? What factors do morbidity and mortality depend upon? 5. Give any examples of harmful effects of current electricity and their dependence upon certain factors. 6. What does the author conclude with?

LESSON 2

*To make your dreams come true, wake up!*

***I. Read the following passages about importance of electrical safety in health care facilities. Choose the statements you agree to or express your own opinion.***

I think electronic equipment can cause a lot of harmful effects in living tissue. That is why we should know as much as possible about the factors which may cause any damage in human body.

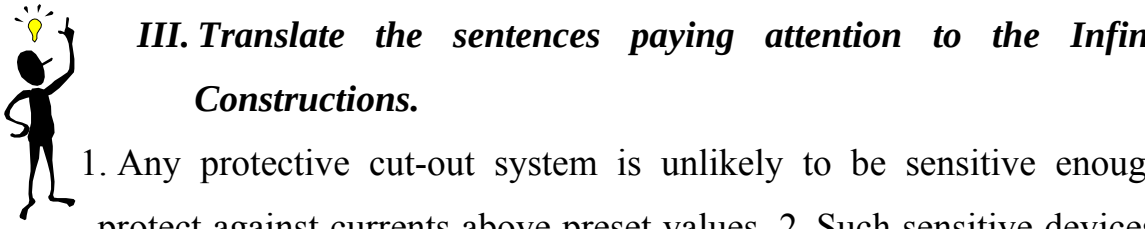
In my opinion to become a good specialist in medical equipment one should know the rules of electrical safety in medicine.

To my mind everybody must learn the rules of electrical safety as electronic equipment is now ubiquitous in domestic and industrial environment.

It is not necessary for specialists in medical equipment to learn the rules of electrical safety or harmful effects of electricity as they are well-known.

***II. Mind the pronunciation and translation of the following words.***

| | | |
|---|---|---|
| 1. | bias ['baIqs] | ➢ уклон |
| 2. | cut-out ['kAtaut] | ➢ предохранитель |
| 3. | fault [fLlt] | ➢ авария, повреждение, неисправность |
| 4. | ferrite ['ferIt] | ➢ ферритовый |
| 5. | fine [faIn] | ➢ тонкий |
| 6. | item ['aItqm] | ➢ каждый отдельный предмет |
| 7. | live [laIv] | ➢ под напряжением |
| 8. | neutral ['njHtrql] | ➢ нейтральный |
| 9. | preset ["prJ'set] | ➢ заранее установленный, заданный |
| 10. | primary ['praImqrI] | ➢ первичная обмотка |
| 11. | single turn ['sINgl tWn] | ➢ один виток |
| 12. | transformer [trxns'fLmq] | ➢ трансформатор |
| 13. | trip-out [trIp 'aut] | ➢ отключать |
| 14. | winding ['waIndIN] | ➢ обмотка |
| 15. | wire ['waIq] | ➢ провод |





***III. Translate the sentences paying attention to the Infinitive Constructions.***

1. Any protective cut-out system is unlikely to be sensitive enough to protect against currents above preset values. 2. Such sensitive devices are very likely to trip-out in non-fault conditions. 3. Specialists would like protective cut-outs to be built into each piece of electronic apparatus. 4. A fault condition occurring in one piece of equipment did not cause the power supply of other life-supporting equipment to be tripped-out. 5. The chief engineer thinks the ELCB (earth leakage circuit breaker) have to be manually reset after the fault condition has been rectified. 6. This new cut-out is reported to be effective.


***IV. Read the text and say if the approach to electrical safety in medicine differs from that in the domestic or industrial situation. Why?***

## PROTECTION AGAINST ELECTRICAL INJURIES AND ELECTROCUTION

The philosophy of electrical safety in medicine has a different bias from that in the domestic or industrial situation. The reasons for this are:

1. Only in the medical environment is direct electrical connection with the body necessary (surgical diathermy, electrocardiogram, electromyogram, electroencephalogram, etc.);

2. Any protective cut-out system must be sensitive enough to protect against currents above preset, but very low, values due to fault conditions, passing through the body. Such sensitive devices are very likely to trip-out in non-fault conditions; this would also be dangerous to life, in the case of ventilators, dialysis machines, and **extracorporeal circulation pumps**[43].

3. Protective cut-outs would have to be built into each piece of electronic apparatus and designed in such a way that a fault condition occurring in one piece of equipment did not cause the power supply of other life-supporting equipment to be tripped-out.

Electrical safety in the domestic and industrial environment and for the doctor's surgery (office), where single items of diagnostic apparatus which are not life supporting and conventional office equipment are used, is nowadays provided by a device called an **earth leakage circuit breaker** (**ELCB**). The live and neutral conductors are passed through a ferrite ring, thus forming the single turn primary of a transformer. The secondary winding consists of many turns of fine wire, which are connected to a solenoid. Under normal conditions, with no

[43] *Extracorporeal circulation pump* ["ekstrqkL'pLrIql "sWkju'leISqn pAmp] – аппарат искусственного кровообращения.

fault in the apparatus supplied through the ELCB, the current in the neutral conductor is equal and opposite in polarity to that in the live conductor, and therefore there is no change in the magnetic field and no current is induced to energize the solenoid.

If a fault occurs such that electrical leakage current passes out of the system, say, through a human body, then there will be an imbalance of current between the live and neutral conductors and a voltage will be induced to energize the solenoid. Energization of the solenoid mechanically disconnects the live and neutral conductors from the apparatus. The ELCB has to be manually reset after the fault condition has been rectified. ELCBs are normally arranged to supply more than one socket outlet, which means that a single fault may disconnect the supply from a number of pieces of equipment.

***V. Choose the correct alternative for each sentence.***

1. Principles of electrical safety in medicine differs from these
   a) in the domestic situation
   b) in the industrial situation
   c) in the domestic and industrial situation.
2. One of the reasons is that
   a) there is direct electrical connection to living tissue in any situation
   b) there is deliberate ohmic connection to living tissue in health-care facilities
   c) there is no deliberate ohmic connection to living tissue in health-care facilities.
3. The other reason and difficulty is that a protective cut-out system must be sensitive enough to protect against
   a) excessive applied current
   b) very low current

c) very low current which is above preset values and not to trip-out in non-fault conditions.

4. Moreover each piece of electronic apparatus should have separate protective cut-out
   a) to prevent the power supply of other life-supporting equipment to be tripped-out
   b) to cause the power supply of other life-supporting equipment to be tripped-out when a fault condition occurs in any piece of equipment
   c) to prevent a fault condition in any piece of equipment.
5. An earth leakage circuit breaker can provide electrical safety
   a) in electronic equipment in any sphere
   b) in the domestic and industrial environment
   c) in the domestic and industrial environment and in diagnostic apparatus which are not life supporting.

***VI. Fill in the gaps and act out the dialogue.***

- Do you think it's necessary to study the rules of electrical safety?
- Certainly. Don't you know that electronic equipment is now … especially in health care.
- What do you mean saying "especially in health care"?
- I mean there is no … ohmic connection of electronic equipment to … … in any other sphere. And the body may become a part of an electrical …
- I see. Is the … patient more … to the unwanted effects of electrical energy than is the … person?
- No doubt the … patient is more … What is more the amount and variety of … and mortality depend upon … and body ….
- Do they depend on the … or the … of the applied current and the duration of the electric shock?

- I think they do. Have you ever heard of any … effects of current electricity in health care?
- They say … burns may occur at … points due to electrolysis.
- And as far as I know electrical energy converted into … may cause ….
- The worst of it is that … may cause death due to asphyxia. Can't we prevent these … effects of current electricity?
- … safety is nowadays provided by a … called an earth leakage circuit breaker (ELCB). To tell the truth I think it is not very reliable.
- All in all we must know the rules of … and as specialists in medical equipment we should design more reliable devices.

***VII. Have some fun.***

*There are so called Sick Jokes in English. Here is one of them.*

- My husband wants me to get him something electrical for his birthday.
- How about an electric chair?

LESSON 3

*It is better to have done something*
*Than not to have done anything at all.*

## *I. Mind the pronunciation and translation of the following words.*

1. apart [q'pRt] ➢отдельно
2. ceiling-mounted ['sJlIN 'mauntId] ➢прикрепленный к потолку
3. comply [kqm'plaI] ➢подчиняться (правилам)
4. criterion (pl criteria) [kraI'tIqrIqn] ➢критерий
5. distribution ["dIstrI'bjHSqn] ➢распределение, структура
6. erroneous [I'rqunjqs] ➢ложный, ошибочный
7. fit [fIt] ➢сильный, здоровый
8. gross [grqus] ➢большой
9. housing ['hauzIN] ➢кожух, футляр
10. inadequate [In'xdIkwIt] ➢не отвечающий требованиям
11. insulation ["Insju'leISqn] ➢изоляция
12. intensive care unit [In'tensIv kFq 'jHnIt] ➢реанимация
13. intentionally [In'tenS(q)nqlI] ➢намеренно
14. knot [nOt] ➢спутывать(ся), запутывать(ся)
15. mains [meInz] ➢главный, основной
16. maintenance ['meIntqnqns] ➢эксплуатация(-ционный)
17. metalwork ['metlwE:k] ➢металлизированные части
18. notify ['nqutIfaI] ➢извещать, уведомлять
19. oximeter [Ok'sImItq] ➢оксигемометр[44]
20. pendant ['pendqnt] ➢ висячий, подвесной
21. permissible [pq'mIsqbl] ➢ допустимый
22. portable ['pLtqbl] ➢ переносной, передвижной

[44] *Оксигемометр* - прибор для измерения степени насыщения крови кислородом.

23. prone [prqun] ➢ склонный
24. rigorous ['rIgqrqs] ➢ точный, тщательный
25. transducer [trxnz'djHsq] ➢ датчик, приемник
26. via ['valq] ➢ через

***II. Match the English words and phrases in A with their Russian equivalents in B.***

A. 1) permissible level; 2) erroneous cut-out; 3) equipment in use; 4) safety criteria; 5) rigorous criteria; 6) design criteria; 7) patient-circuit isolation; 8) relevant standards; 9) protecting housing of equipment; 10) inadequate earth connection; 11) mains supply outlet; 12) on a regular basis; 13) qualified engineering staff; 14) ceiling-mounted pendant supplies; 15) regular maintenance records.

***B.*** a) на постоянной основе; b) подвешенные к потолку кабели; c) критерии безопасности d) квалифицированный технический персонал; e) ложное отключение; f) изоляция пациента от цепи; g) защитный кожух оборудования; h) соответствующие стандарты; i) допустимый уровень; j) критерии проектирования; k) регулярные эксплуатационные записи; l) розетка основного кабеля питания; m) точные критерии; n) заземление, не отвечающее требованиям; o) использующееся оборудование.


***III. Read the text and say if it is possible to prevent electrocution and what the ways of prevention are.***

**PREVENTION OF GROSS ELECTROCUTION**
**IN THE OPERATING THEATRE**

The ELCB is unsuitable for use in the operating theatre and intensive care unit for the following reasons.

1. Permissible levels of electric current that may be allowed to pass through the sick, and so electrically susceptible, patient are much lower than those permissible in the fit and healthy person.

2. If an ELCB is designed to be extra-sensitive, it is always more prone to erroneous cut-outs.

3. An electrical current may be deliberately allowed to pass through the patient and may not all return to the equipment in use, but may find an alternative pathway.

Because of these problems, the idea in medical electronics is to use ever more rigorous design safety criteria, and by patient-circuit isolation rather than the use of ELCBs.

All equipment that may come into contact with a patient should have been designed and manufactured to comply with the relevant national and international standards. International agreement about safe design is published by the International Electrotechnical Commission (IEC) in the Standard IEC 601, which contains all the general requirements for all equipment and particular requirements for each type of equipment.

The main protection against electrocution in the operating theatre and elsewhere in the health-care facility is insulation, which minimizes the leakage current that may pass through the human body. Insulation, which also refers to the protective housing of equipment, must be designed so that possible leakage currents do not exceed levels set out in Standard IEC 601 even if the earth connection is inadequate. Earth conductors at mains supply outlets should be tested regularly, and the external cables of equipment should also be inspected carefully on a regular basis. These tests should be carried out by qualified engineering staff. However, electrical safety is also the responsibility of the users of the equipment.

1. Avoid portable distribution boards whenever possible.

2. Use ceiling-mounted pendant supplies whenever possible, as they are less likely to be damaged than those on the floor and are unlikely to become wet. Keep water and electricity apart.

3. Avoid the use of long mains supply cables, and avoid damage to cables by knotting, equipment wheels, etc.

4. Notify engineering staff of any visible damage to equipment or cables.

5. Make sure that regular maintenance records are kept and are available for inspection by the user.

At high frequencies, high currents may pass along unexpected routes, causing electrocution or burns. Burns may even occur between the body and metalwork that is not intentionally a conductor but is earthed. Burns due to this mechanism have occurred via the metalwork of operating tables and through the transducers of pulse oximeters (modern pulse oximeter transducers are isolated so that an earth pathway at high frequency cannot occur).

### *IV. Fill in the gaps and act out the dialogue.*

- I wonder, are there any national or international standards containing requirements for health care equipment?
- As far as I know you can find them in … … … …
- Do they contain any general or particular …?
- If I am not mistaken there are both … … for … … and … … for each … of …
- Do you think this Standard IEC 601 set out levels of possible leakage currents?
- I've no idea. But I believe that as … safety is very important in … equipment they should have such standards.
- So medical … should have been designed to comply with these …, shouldn't it?

- I think you are right. By the way what is the main protection against electrocution in the operating …?
- I dare say it is … as it minimizes the … current that may pass through the … …
- I wonder, is electrical safety the responsibility of engineering staff or of the users of the equipment?
- I'm quite sure … safety is the responsibility of both … … and the … of the …

***V.It's interesting to know.***

**The First among the Equals, the First among the Firsts**

Everybody wants to be the first to do something. Somebody always becomes the first. But there are few people lucky enough to be the first among the firsts. How did they do it? Oh, it's very simple. They just wanted it.

The first American President to receive a transcontinental telegram was Abraham Lincoln, in 1861.

The first President to live in the White House was John Adams, who moved in on November 1, 1800. The first President to broadcast from the White House over the television was Harry Truman, in 1947.

*From "English"*

# UNIT V

# LASER THERAPY

***(Grammar: Non-Finite Forms of the Verb. The Participle, the Gerund)***

## LESSON 1

*People known as being too proud*
*to ask the way often go astray.*

### *I. Mind the pronunciation and translation of the following words.*

1. ablation [xb'leISqn] ➢ удаление, иссечение, отсечение
2. adjunct ['xdZANkt] ➢ дополнение
3. angioplasty ['xndZIqplRstI] ➢ ангиопластика[45]
4. exaggerated [Ig'zxdZqreItId] ➢ (пре) увеличенный, излишний
5. hardware ['hRdwFq] ➢ аппаратура
6. lasing ['leizJN] ➢ генерирующий излучение
7. luminal ['lHmInql] ➢ люминальный[46]
8. plaque [plRk] ➢ бляшка, тромбоцит
9. preclude [prI'klHd] ➢ предотвращать, устранять, мешать
10. recanalization [rI''kxnqlai'zeiSqn] ➢ реканализация (например, тромба)
11. resonator cavity ['rezqneItq 'kxvItI] ➢ объемный резонатор
12. result from [rI'zAlt frOm] ➢ следовать, происходить в результате
13. result in [rI'zAlt In] ➢ кончаться, иметь результатом
14. threshold ['TreShquld] ➢ порог, пороговая величина
15. translucent [trxnz'lHsnt] ➢ просвечивающий, полупрозрачный
16. vascular ['vxskjulq] ➢ кровеносный

[45] *Ангиопластика* – пластическая операция на сосудах.
[46] *Люминальный* – относящийся к просвету кровеносного сосуда.

***II. Match the following words and phrases in A and their Russian equivalents in B.***

A. 1) amplification, 2) stimulated, 3) wavelength, 4) pulse duration, 5) energy output, 6) partial and totally, 7) reflecting mirror, 8) corresponding energy level, 9) specific molecules, 10) electric current, 11) entire electromagnetic spectrum, 12) the amount of time, 13) capability, 14) photothermal reaction, 15) luminescence ["lHml'nes(q)ns], 16) conversion, 17) application, 18) occlusive vascular disease, 19) irradiate, 20) identification, 21) discrimination, 22) shock wave.

B. a) фототепловая реакция, b) частично и полностью, c) отражающее зеркало, d) длина волны, e) усиление, f) преобразование, g) ударная волна, h) электрический ток, i) продолжительность пульсации, j) применение, k) соответственный энергетический уровень, l) возбужденный, m) люминесценция, n) избирательность, выделение, o) выходная мощность, p) полный электромагнитный спектр, q) определенные молекулы, r) способность, мощность, s) закупорка сосудов, t) количество времени, u) опознание, выяснение, v) облучать, испускать лучи.

***III. Pay attention to the faux amis given below. Try to remember them.***

number ['nAmbq] ➢ *число, количество, цифра*, а не только номер

specific [spl'slflk] ➢ *отличительный, особый, определенный,* а не только специфический

***IV. Copy the sentences given below and underline participles. Pay attention to the forms and functions of participle. Translate the sentences into Russian.***

1. Cavitation occurs, resulting in shock waves that disrupt tissue through a mechanical mechanism. 2. The lasing medium is activated by an energy source.

3. The specific molecules in the lasing medium are excited to their characteristic higher energy levels and, reaching a threshold, they produce a series of laser light emissions at specific wavelengths. 4. The energy output at each wavelength is determined by the number of molecules at the corresponding energy level. 5. The wavelength emitted is theoretically possible throughout the entire electromagnetic spectrum, ranging from X-rays through to microwaves. 6. The high concentration of coherent light energy produced provides lasers with many of their capabilities. 7. Luminescence can be described as the emission of light energy from a molecule at specific longer wavelength(s), than the wavelength absorbed. 8. The luminescence wavelength profile is usually a characteristic of the particular substance irradiated. 9. The effect on tissue depends on the method by which the energy is delivered, the amount delivered, the duration of the exposure, and the wavelength used. 10. It is the mechanism employed for the ablation and recanalization of non-calcified atherosclerotic plaque. 11. Plasma is a high-energy state resulting from a high-intensity, short-pulse duration of laser light.

### *V. Choose the proper form of the participle in brackets.*

1. A computer is used to display the measurements as an image (representing/being represented) a cross-sectional radiograph of the patient. 2. A computer is used to display measurements (representing/ represented) by an image of a cross-sectional radiograph of the patient. 3. (Used/Using) appropriately, CT is capable of making a major impact on management decisions. 4. (Used/Using) CT we can make decisions. 5. (Having examined/examining) patient's body doctors took him to the operating theatre. 6. (Having examined/examining) his new discovery he learnt all the possible harmful effects. 7. (Being examined/examining) the patient answered a lot of questions. 8. The basic image (manipulating/being manipulated) can be

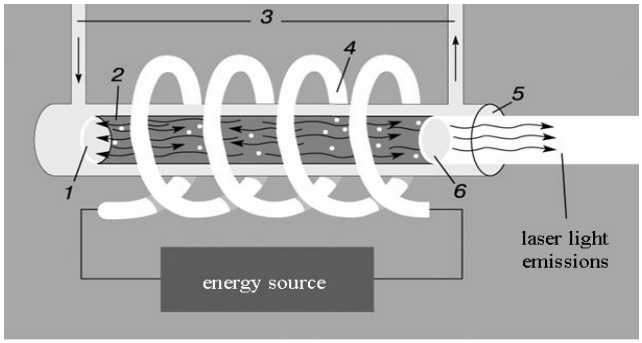
reprocessed to give a high resolution image. 9. Nowadays (used/using) specially constructed computer hardware doctors can plan radiotherapy on the basis of CT images.


***VI. Read the text and say if laser systems are able to examine tissues or treat them.***

**LASER FUNDAMENTALS**

It is important to understand some fundamentals of laser energy delivery before summarizing clinical experiences.

The word LASER is an acronym[47] for *light amplification by stimulated emission of radiation*[48]. Although several different laser systems have been used, major differences between them preclude their being compared to each other. Three fundamental characteristics make each laser system unique; these are wavelength, pulse duration, and energy output.




1) Totally reflecting mirror; 2) ruby rod; 3) cooling liquid; 4) discharge tube; 5) cooling tube; 6) partial reflecting mirror.

The laser hardware consists of a resonator cavity that contains a translucent medium between a partial and totally reflecting mirror. The lasing medium, which gives the laser its name, is activated by an energy source, such as an electric current or a flashlamp. The specific molecules in the lasing medium are excited to their characteristic higher energy levels and, reaching a threshold, they produce a series of laser light emissions at specific wavelengths. The energy output at each wavelength is determined by the number of molecules at the

[47] *Acronym* ['xkrqnIm] – сокращение.
[48] *LASER* ['leizq] =*Light Amplification by Stimulated Emission of Radiation* - усиление света в результате вынужденного излучения

corresponding energy level. The wavelength emitted is theoretically possible throughout the entire electromagnetic spectrum, ranging from X-rays through to microwaves.

Another laser parameter is the pulse duration or the amount of time that the laser emits light energy - from picoseconds to continuous wave. The third important laser characteristic is energy, and the high concentration of coherent light energy produced provides lasers with many of their capabilities.

The laser radiation can interact in several different ways with the tissue by conversion of the light energy into other forms, which may or may not be desirable. There are essentially four different mechanisms of light energy conversion; they include luminescence, photothermal reaction, plasma formation, and photochemical reaction. The first three mechanisms have had applications in the therapy of atherosclerotic occlusive vascular disease.

Luminescence can be described as the emission of light energy from a molecule at specific longer wavelength(s), than the wavelength absorbed. The luminescence wavelength profile is usually a characteristic of the particular substance irradiated. It can be used for the identification of a particular tissue.

A photothermal reaction is the conversion of the light energy into heat energy. The effect on tissue depends on the method by which the energy is delivered, the amount delivered, the duration of the exposure, and the wavelength used. It is the mechanism employed for the ablation and recanalization of non-calcified atherosclerotic plaque, and the welding of blood vessels.

Plasma is a high-energy state resulting from a high-intensity, short-pulse duration of laser light. Cavitation occurs, resulting in shock waves that disrupt

tissue through a mechanical mechanism. It is through this mechanism that specific high-intensity laser systems can ablate calcified atheroma[49].

Although the ablation of atherosclerotic plaque by a laser was first described in 1962, the use of a laser for arterial recanalization is still experimental. The introduction of laser systems initially generated intense enthusiasm on the part of investigators and manufacturers, but clinical experience with these devices has not met the exaggerated expectations. In the peripheral vascular system, laser recanalization is most frequently followed by balloon angioplasty, because the luminal diameter created is insufficient to maintain flow. Lasers are, therefore, an adjunct to balloon angioplasty.

***VII. Read the following sentences. Replace the italicized words with their synonyms:*** *acronym, hardware, fundamental, fundamentals, threshold, specific, entire, activating, several, capabilities, use, conversion, mechanism, ablation, particular, investigators, manufacturers, devices, initially.*

1. First of all you should understand some *principles* of laser energy delivery. 2. The word LASER is an *abbreviation* for light amplification by stimulated emission of radiation. 3. Three *main* characteristics of a laser system are wavelength, pulse duration, and energy output. 4. The laser *device* consists of a resonator cavity with a translucent medium between a partial and totally reflecting mirror. 5. An electric current or a flashlamp are energy sources for *stimulating* the lasing medium. 6. The specific excited molecules in the lasing medium reach a *cut-off* and produce a series of laser light emissions at *particular* wavelengths. 7. The wavelength emitted is theoretically possible throughout the *complete* electromagnetic spectrum, ranging from X-rays through to microwaves. 8. The high concentration of

[49] *Atheroma* ["xTq'rqumq] – жировое перерождение (крупной артерии).

coherent light energy produced provides lasers with many of their *potentials*. 9. The laser radiation can interact in *some* different ways with the tissue by *transformation* of the light energy into other forms such as luminescence, photothermal reaction, plasma formation, and photochemical reaction. 10. Luminescence can be used for the identification of a *certain* tissue. 11. A photothermal reaction is the *technique* employed for the ablation and recanalization of non-calcified atherosclerotic plaque, and the welding of blood vessels. 12. Although the *removal* of atherosclerotic plaque by a laser was first described in 1962, the *utilization* of a laser for arterial recanalization is still experimental. 13. The introduction of laser systems *first* generated intense enthusiasm on the part of *researchers* and *producers*, but clinical experience with these *gadgets* has not met the exaggerated expectations.


***VIII. Fill in the gaps with the appropriate words and phrases from the list below:***

*irradiation, wavelengths, plaque, adjoining*[50]*, thresholds, duration, tissue, irradiate, expanded.*

**LASER TARGETING OF TISSUE**

Specific tissues can absorb different (1)... of light because of their different biochemical composition. With the choice of a specific wavelength that is preferentially[51] absorbed by the target[52] (2)..., selective tissue ablation can be performed. The energy of exposure and the (3)... of exposure are also important to avoid overriding[53] this process or to permit diffusion of heat from the selected target to the (4)... non-targeted tissues. Two cardiovascular applications for this selective use of laser (5)... include the selective ablation of (6)... and thrombus,

[50] *Adjoining* [q'dZOInIN]– прилегающий, примыкающий, соседний.
[51] *Preferentially* ["prefq'renSqll] – предпочтительно.
[52] *Target* ['tRglt] – мишень, заданная координата.
[53] *Overriding* ["quvq'raIdIN] – нарушение.

the ablation of plaque having undergone clinical investigation. In this fashion, one can (7)... the selected tissues at energies that ablate them, but which are below the (8)... of ablation of the surrounding normal or non-targeted tissues. This process can be (9)... by the administration of exogenous[54] chromophores that preferentially localize in the target tissue.

***IX. Try to find twelve words on the topic "Medical Equipment" in the grid below. They are written horizontally and vertically.***

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

***X. Translate the sentences paying attention to the Absolute Participle Construction.***

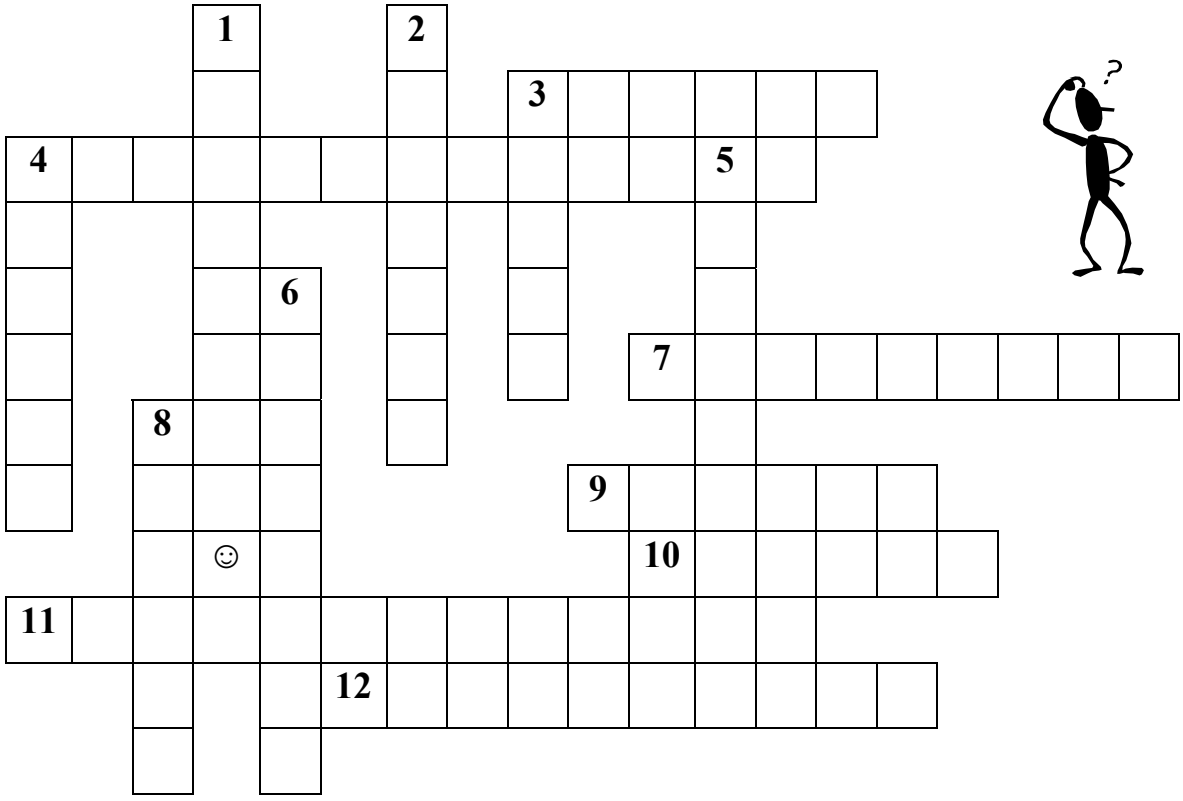
1. The ablation of atherosclerotic plaque by a laser being described in 1962, the use of laser for arterial recanalization is still experimental. 2. Clinical experiences having been summarized, we could start our experiment. 3. The laser hardware consists of a resonator cavity, a translucent medium being between a partial and totally reflecting mirror. 4. Several different laser systems having been used, scientists can't compare them. 5. A photothermal reaction is the conversion of the light energy into heat energy, the effect on tissue depending on the method by which the energy is delivered. 6. The introduction

[54] *Exogenous* [ek'sOdZInqs] – экзогенный.

of laser systems having generated intense scientific enthusiasm, clinical experience with these devices has not met the exaggerated expectations. 7. Quartz fibres having improved the applicability of laser systems, the elevated thermal effects limited the application of these systems.

### *XI. Complete the crossword.*

*Across 3.* generating of a coherent optical radiation; 4. reproduction by rapid multiplication of cells, new parts, etc.; 7. bulb giving sudden burst of light; 9. a hollow receptacle for blood flow along the body; 10. polished surface that reflects images; 11. increasing of the strength of a sound, radiation, etc.; 12. distance between the highest points of two neighbouring points.






*Down: 1.* removal, cutting off; 2. treatment; 3. device for generating, amplifying and concentrating light waves into an intense, highly directional beam, used to cut metal, to aim weapons, to treat; 5. thrombosis; 6. time during which smth lasts or exists; 8. power, energy, etc. produced.

## LESSON 2

*Learn by doing.*

***I. Try to remember some new words:***

1. adiabatic [q"daiq'bxtlk] ➢ адиабатный[55]
2. char [CR] ➢ чистить, убирать, обжигать
3. chop [COp] ➢ колебаться, меняться
4. concomitant [kqn'kOmItqnt] ➢ сопутствующий
5. debris ['deIbrJ] ➢ *фр.* осколки, обломки
6. discrete [dIs'krJt] ➢ состоящий из разрозненных частей, дискретный
7. drawback ['drLbxk] ➢ недостаток
8. encase [In'keIs] ➢ полностью закрывать, заключать,
9. ineffectual ["InI'fektjuql] ➢ безрезультатный, неудачный, слабый
10. jacket ['dZxkIt] ➢ оболочка, обшивка
11. mode [mqud] ➢ тип, вид, способ, метод, режим
12. obstructive [qb'strAktIv] ➢ препятствующий
13. patency ['peItqnsI] ➢ раскрытое состояние (о полом органе, инструменте)
14. quanta ['kwOntq] ➢ *лат.* доли, части
15. subsequent ['sAbsIkwqnt] ➢ последующий
16. superficial ["sjHpq'fISql] ➢ поверхностный, неглубокий, внешний
17. to-and-fro ["tu qn(d)'frqu] ➢ возвратно-поступательное (движение), колебательный, колеблющийся
18. trial ['traIql] ➢ испытание

***II. Match the following English words and phrases in A with their Russian equivalents in B.***

[55] *Адиабатный* – без обмена системы теплотой с окружающей средой

A. 1) Accumulative thermal effect, 2) indistinguishable, 3) to maintain activation, 4) atherosclerotic, 5) utilize, 6) quartz fibres, 7) applicability, 8) loss of energy, 9) application, 10) thermal injury, 11) cause, 12) initial, 13) to engineer the requisite power supply, 14) set time intervals, 15) despite, 16) for this reason

B. a) неразличимый, неотличимый, b) атеросклеротический, c) кварцевые волокна, d) несмотря на, e) накапливающийся тепловой эффект, f) потеря энергии, g) по этой причине, h) поддерживать активацию, i) использовать, k) термическое повреждение, l) пригодность, m) применение, n) причинять, вызывать, o) установленный, p) (перво)начальный, q) проектировать требуемую подачу энергии.

***III. Copy the sentences given below and underline the gerund. Pay attention to the forms and functions of the Gerund. Translate the sentences into Russian.***

1. The elevated thermal effects, including tissue charring, unwanted coagulation, spasm, perforation, thrombosis, and subsequent development of aneurysms, limited the application of these systems. 2. The development of the hot tip was the first attempt at controlling the energy delivery of continuous-wave radiation by encasing the tip of the fibres with a metal jacket that was heated by the latter. 3. It is important to understand some fundamentals of laser energy delivery before summarizing clinical experiences. 4. Major differences between them preclude their being compared to each other. 5. If we look back into history to trace the beginning of the Atomic Age, we may start the story with an experiment performed late in the year 1895. 6. This is useful for demonstrating small structures. 7. Such images are helpful in communicating the orientation of lesions. 8. Enhancement refers to the commonly used technique of scanning following the intravenous administration of iodine-containing contrast medium.

9. It is commonly used to aid diagnosis by increasing the contrast between normal and abnormal tissues. 10. Movement artefact is a problem in studying the abdomen. 11. Although the capital and running costs of CT are high, the technique is undoubtedly cost effective.

***IV. Read the text and say what the difference between pulsed laser radiation and continuous-wave radiation is.***


**CLINICAL LASER ANGIOPLASTY**

**Continuous Wave**

The initial clinical use and trials of laser therapy for the treatment of obliterative[56] atherosclerotic disease utilized available commercial lasers. Quartz fibres, commercially developed for the communications industry, improved the applicability of laser systems with wavelengths between 280 nm ['nxnq(u)"mltq] and 2.5 mkm [mal'krOmltq], because of their ability to transmit high-intensity radiation along their length without significant loss of energy. In these initial laser systems the energy was delivered in a continuous wave through the end of a cleaved[57] fibre; it was difficult to control the irradiated energy during the ablation process. The elevated thermal effects, including tissue charring, unwanted coagulation, spasm, perforation, thrombosis, and subsequent development of aneurysms, limited the application of these systems. The development of the hot tip was the first attempt at controlling the energy delivery of continuous-wave radiation by encasing the tip of the fibres with a metal jacket that was heated by the latter. Although it improved the safety of laser recanalization of arteries, it has suffered several drawbacks. It is very user-dependent because it requires constant, rapid, to-and-fro motion, using a primarily mechanical means of recanalization; it

[56] *Obliterative* [q'blltqrelflv] – поддающийся лечению (уничтожению).
[57] *Cleaved* [klJvd] – расколотый, расщепленный.

causes vessel spasm and a large adjacent area of thermal injury; it is ineffectual against calcified plaque; and the devices advance along the mechanical path of least resistance - a problem with very eccentric plaques. Indeed, the primary mode of action of this device is probably mechanical and not related to any property of the laser energy. Clinical results have not been very promising in patients with clinically important atherosclerotic obstructive disease.

**Pulsed Laser**

Although all clinical laser systems use thermal mechanisms of ablation, short-pulse laser ablation is much more efficient than is pure thermal vaporization because the former uses a micro explosive mechanism for the removal of tissue with the concomitant formation of micro debris. Pulsed laser radiation is different from continuous-wave radiation because it delivers discrete quanta of irradiation at set time intervals of the order of picoseconds to seconds. Although a chopped beam of continuous irradiation is technically considered a pulse, ablative pulsed laser irradiation has come to signify high-intensity light delivery; that is, a laser pulse that carries a significant amount of energy to ablate the irradiated tissue while being delivered in a short enough amount of time to cause minimal thermal effects to adjacent tissues. For most tissue this is adiabatic time-frame microseconds to milliseconds. The type of tissue irradiated is therefore quite important, since mechanically weaker tissue will be more easily ablated at the same energy flounce than mechanically strong tissue. When pulses are of much shorter duration, one of the major problems that arises is that the intensity is too high to be able safely to couple the laser energy into a quartz fibre.

These considerations suggest that, depending on the application, the laser used, and the delivery system employed, there is optimal laser pulse duration. However, it may be difficult to engineer the requisite power supply or to

maintain activation of the lasing media for production of adequate laser output for specific pulse durations.

One other important factor in pulsed irradiation is the frequency of the pulses. If the laser pulse output is at a very high frequency, there may be accumulative thermal effect on the adjacent tissue that could make the system almost indistinguishable from continuous-wave laser irradiation. There are many variables that determine the optimal frequency. Despite the desire to obtain high efficiency by high pulse frequencies, power supply limitations usually keep the laser from a high delivery rate.

Pulsed lasers have not yet been used to a great extent in the treatment of atherosclerotic obstructive disease. It is still early to come to any conclusions about the effectiveness of these techniques.

There are many theoretical and experimental advantages of pulsed systems over continuous-wave lasers, and most emerging new clinical laser systems for the treatment of obstructive atherosclerosis are of this type. However, there are several shortcomings. At present most of these systems are limited to providing access for balloon angioplasty in total occlusions, and cannot provide the definitive therapy if used alone. Because they are relatively inefficient for tissue ablation, the inexperienced operator used them, mostly for mechanical advancement of the devices and not for ablation and removal of tissue. For this reason one may predict that the results of their use would be similar to those of balloon angioplasty.

***V. Say if the following sentences are True or False. Correct the statements if they are wrong.***

1. There were lasers designed for special clinical use and trials.
2. Quartz fibres can transmit high-intensity radiation along their length without significant loss of energy. That is why they improved the applicability of laser systems used.
3. Initially it was difficult to control the irradiated energy during the ablation process.
4. The development of the hot tip limited the application of laser systems because it elevated thermal effects, including tissue charring, unwanted coagulation, spasm, perforation, thrombosis, and subsequent development of aneurysms.
5. The development of the hot tip didn't improve the safety of laser recanalization of arteries. That is why it has suffered several drawbacks.
6. Short-pulse laser ablation and pure thermal vaporization have the same effect.
7. Pulsed laser radiation and continuous-wave radiation have no any differences.
8. Ablative pulsed laser irradiation causes minimal thermal effects to adjacent tissues.
9. The type of tissue irradiated is not very important, since mechanically weaker tissue and mechanically strong tissue will be ablated at the same energy flounce.
10. Important factors in pulsed irradiation are the frequency of the pulses, an optimal laser pulse duration, the type of tissue irradiated.
11. At present most of laser systems are limited to providing access for balloon angioplasty in total occlusions, and cannot provide the definitive therapy if used alone.

LESSON 3

*Research is searching*
*without knowing*
*what you are going to find.*

### *I. Try to remember some new words:*

1. beneficiary ["benI'fIS(q)rI] ➢ лицо, оказавшееся в выигрыше
2. bore [bL] ➢ сверлить, бурить
3. incision [In'sIZqn] ➢ разрез, насечка
4. respond [rIs'pOnd] ➢ отвечать, реагировать
5. restoring [rIs'tLrIN] ➢ восстановление, возмещение
6. revascularization [rJ"vxskjulqraI'zeIS(q)n] ➢ замена кровеносных сосудов
7. shot [SOt] ➢ выстрел
8. to fire a shot ➢ произвести выстрел
9. tiny ['taInI] ➢ крошечный
10. tolerate ['tOlqreIt] ➢ терпеть, дозволять


### *II. Skim the text and complete the following statements:*

*a) This text considers the …*

*b) It tells us how…*

*c) To my mind …*

**NEW HOPE FOR SICK HEARTS**

Using a high-powered laser to bore tiny holes into a beating heart, surgeons have succeeded in restoring the flow of oxygen-rich blood in at least a dozen patients with blocked arteries. The experimental technique, developed by Dr. Mahmood Mirhoseini at Milwaukee's [mIl'wLkI(:)z] St. Luke's Hospital Medical Center, is called transmyocardial laser revascularization, and requires a four-inch cut on the left side of the chest. After making the incision, doctors

insert a laser in the chest cavity and fire computer-controlled laser shots between heartbeats. Ten to 25 bloodsupplying channels ['Cxnlz] – or canals [kq'nxlz] – are created in the left ventricle[58].

Clinical trials for the experimental procedure have begun at four heart centers: Dr. Mirhoseini's at Milwaukee, the San Francisco ["sxnfrqn'sIskqu] Heart Institute at Seton Medical Center in Daly City, California ["kxll'fLnjq], the Texas ['teksqs] Heart Institute at St. Luke's ["seint'lHks] Episcopal [l'pIskqpql] Hospital in Houston ['hjHstqn], and Brigham and Women's Hospital in Boston. Potential beneficiaries are those with coronary artery disease who can't tolerate or don't respond to surgery or medications to control angina.

*(From Medical Tribune)*

***III. Read the sentences, translate them and analyze all the –ing forms in them (the Gerund, the Participle).***

1. Using a high-powered laser, surgeons have succeeded in restoring the flow of oxygen-rich blood. 2. Using a high-powered laser to bore tiny holes into a beating heart is the experimental technique. 3. Having developed the experimental technique, Dr. Mahmood Mirhoseini from Milwaukee's [mll'wLkl(:)z] St. Luke's Hospital Medical Center called it transmyocardial laser revascularization. 4. After making the incision, doctors insert a laser in the chest cavity. 5. Making the incision is the first step in this technique. 6. Having made the incision, doctors insert a laser in the chest cavity. 7. Creating bloodsupplying channels in the left ventricle is the aim of the procedure.

[58] *Ventricle* ['ventrlkl]– желудочек (сердца, мозга)

## UNIT VI

## FUTURE CAREER

*Your life is what you make of it.*

***I. Discuss with your groupmates advantages and disadvantages of your future career. Try to prove your opinion.***

1. Do you think that profession of engineer is prestigious nowadays?
2. Is this profession much wanted?
3. Is it difficult to find a good job in the field of medical equipment?
4. Is there a shortage of good quality graduate engineers in our town ?
5. Are engineers well paid?
6. Is this career more suitable for men or women?
7. Does this profession require much time or efforts for education?
8. Does it require any special traits of character?
9. Does the career of engineer in the field of medical equipment require permanent self-education?

***II. Mind the pronunciation and translation of the following words.***

1. aspiration ["xspq'reiSqn] ➢ стремление, сильное желание
2. assessment [q'sesmqnt] ➢ оценка
3. assimilate [q'sImIleit] ➢ поглощать, усваивать
4. assistive [q'sIstIv] ➢ вспомогательный
5. breakthrough ['breik'TrH] ➢ крупное достижение, открытие
6. collaboration [kq"lxbq'reiSqn] ➢ сотрудничество, совместная работа
7. confidence ['kOnfidqns] ➢ уверенность
8. emergency [I'mWG(q)nsI] ➢ экстренный, срочный
9. frontiers ['frAntIqz] ➢ передний край (науки/ техники)
10. gain [gein] ➢ приобретать
11. incorporate [In'kLpqrIt] ➢ объединять, включать

12. issue ['IsjH] ➢ проблема
13. neo-natal ["nJq'neitl] ➢ относящийся к новорожденному
14. obvious ['ObvIqs] ➢ явный, очевидный
15. overlapping ['quvq"lxpIN] ➢ параллельный, частично дублирующий
16. rehabilitation ['rJq"bIll'teiSqn] ➢ реабилитация, восстановление
17. resuscitation [rI"sAsI'teiS(q)n] ➢ оживление, реанимация
18. supervised ['sjHpqvaizd] ➢ под наблюдением, под руководством
19. sympathetic ["sImpq'TetIk] ➢ сочувственный, полный сочувствия
20. undertake ["Andq'teik] ➢ предпринимать, гарантировать
21. unparalleled [An'pxrqleld] ➢ беспримерный

***III. Can you find eight words on the topic "My Future Career" in the grid below? They are written horizontally and vertically.***

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


***IV. Read the text and make a leaflet for prospective students to provide as much information as possible.***

| | |
|---|---|
| Why study at the Department of Medical Engineering? | |
| Foundation | |
| Current Dean | |
| The staff | |
| General educational subjects | |
| Special subjects | |
| Types of learning activities and their purposes | |
| Methods of the assessment | |
| Final year | |
| Career opportunities | |

Every day we read of new unparalleled breakthroughs in medicine treatments, CAT scanners, pacemakers, neo-natal care, intensive care and emergency resuscitation. All these breakthroughs contribute daily to thousands of lives saved – but in reality they are not medical advances, but breakthroughs in medical engineering. As medicine becomes more technical, it becomes more dependent upon engineering for both the development of new techniques and treatments and the maintenance of the increasingly complex systems found in today's modern hospitals. It is therefore important that there is a Department of Biomedical Apparatus established at the Faculty of Radiophysics and electronics in 2000. It provides students with a broad engineering education which is also combined with a level of subject specialization and gives them the chance to play a role in this exciting world.

The course is designed specifically for those students who wish to enter electronics industries that deal with the development of medical and assistive/rehabilitation systems.

As everybody knows, the first and second years are common to all students and provide a foundation in mathematics, computing, electrical, electronics and scientific principles. Subjects taken in the third and fourth years include analogue and digital electronics, software engineering, microprocessor systems, mathematics, analogue and digital communications, control, electrical systems, and electronic computer aided design, anatomy and healthcare studies.

The course is designed to give students the opportunity to acquire a broad understanding of the effect of the environment and physical phenomena on human health. This course offers a solid grounding in electronic systems with a key focus on engineering issues faced in the medical and rehabilitation world.

The staff who teach students are themselves professional engineers and scientists, each actively engaged in research work as well as teaching.

Courses involve different types of learning activity to help students assimilate the material effectively, developing their understanding and skills, moving towards professional independence. These are lectures, seminars, practicals and laboratories, coursework and projects. Lectures are a significant component of most courses. They are used for providing information, explanation, illustration and application; encouraging students to ask questions and undertake further reading. Seminars tend to involve large groups and offer intensive discussions so that students gain the confidence to explain technical issues to others. Practicals and laboratories are a key component in Science and Engineering courses which illustrate the application of theory and allow students to develop the skills associated with their subject, and acquire the habits needed for self-education. Lectures and practical classes establish a good understanding of the foundation subjects upon which the later years depend.

The assessment of academic progress is by means of the most appropriate method – so in some cases students have to submit coursework and laboratory reports, in others they take examinations. During their final year, all students

have the opportunity to do project work on a topic of their own choice, supervised by members of staff. The topics are usually related to the research work taking place in the department, and students gain practical experience of the problems that exist close to the frontiers of their discipline.

The course can lead to employment in Health Service, research institutes, medical laboratories and industrial plants. People working in this area must often work directly with the user and be sympathetic and sensitive to the needs and aspirations of the user. So engineers in the field of medical equipment work in collaboration with other healthcare professionals. The necessity of coope-ration between physicists and engineers on the one part and physicians and biologists on the other part in the field of the development and use of medical and other instrumentation in contemporary medico-biological investigations is obvious.

***V. Every year our University holds Open Days in order that prospective students can find out more about the range of study opportunities at the University. Being current students you can answer the following questions to provide a realistic picture of studying at your department.***

1. When was the Department of Medical Equipment established? 2. Why is this department important? 3. What general educational subjects do students of this Department study? 4. What special subjects are provided at the Department? 5. Who teaches students? 6. What types of learning activity is there at the University? 7. What kinds of the assessment are there? 8. What do the undergraduates do during their final year? 9. Where can graduates work after getting their diploma?

***VI. Get ready to speak on the topic "My future career" using the information and vocabulary of the lesson.***

## SUPPLEMENTARY READING

## Unit I

## INVENTORS AND THEIR INVENTIONS

***I. Here are some words you need to understand the following text:***

1. bulb [bAlb] ➢ колба
2. exclude [Iks'klHd] ➢ исключать
3. mercury ['mWkjurI] ➢ ртуть
4. physicist ['fIzIsIst] ➢ физик
5. solution [sq'lHSqn] ➢ раствор
6. stick [stIk] ➢ липнуть, приклеиваться
7. substitute ['sAbstItjHt] ➢ заменять, замещать

***II. Read the text and fill in the table:***

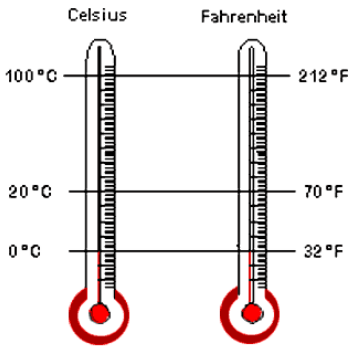
| *Invention of the Thermometer and its improvements* | *Inventor* | *Date* |
|---|---|---|
| A thermometer as a glass bulb with water | | |
| | Grand Duke Ferdinand II | |
| | | 1714 |
| | | 1724 |
| | | |
| Kelvin scale | | |

THERMOMETER

The Thermometer was invented by Galileo Galilei in 1593. His thermometer consisted of water in a glass bulb; the water moved up and down the bulb as the temperature changed.

The sealed thermometer was invented in 1641 by the Grand Duke Ferdinand ['fWd(I)nxnd] II. He used a glass tube containing alcohol, which freezes well below the freezing point of water (alcohol freezes at -175°F = -115°C). He sealed the tube to exclude the

influence of air pressure.




Mercury was later substituted for the alcohol, and then Daniel Gabriel Fahrenheit ['fxrqnhaIt] (1686-1736), a German physicist, used mercury plus a chemical solution that kept the mercury from sticking to the tube of the thermometer (in 1714). Fahrenheit also expanded the thermometer's scale (in 1724); on his scale, the temperature of boiling water is 212°F and the freezing point of water is 32 °F.

Anders Celsius ['selsjqs], a Swedish astronomer, invented the Celsius (or Centigrade ['sentIgreId]) scale in 1742, putting the freezing point of water at 0° and the boiling point at 100°.

Lord Kelvin (William Thompson, 1824 - 1907) designed the Kelvin scale, in which 0 K is defined as absolute zero and the size of one degree is the same as the size of one degree Celsius. Water freezes at 273.16 K; water boils at 373.16 K.

***Notes***: 7°C – seven degrees Celsius / Centigrade
8°F – eight degrees Fahrenheit

***III. Here are some words you need to understand the following text:***

1. by accident [bai 'xksIdqnt] ➢ случайно
2. fogged [fOgd] ➢ затуманенный, затемненный
3. Pitchblende from Bohemia ['pICblend frqm bqu'hJmIq] ➢ уранинит, урановая смолка
4. plate [pleIt] ➢ пластина
5. similar ['sImIlq] ➢ похожий, подобный

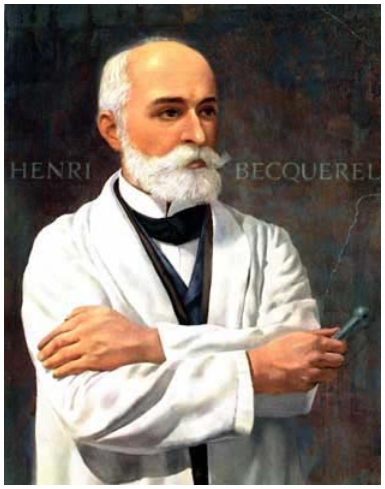
***IV. Pay attention to the** faux amis **given below. Try to remember them.***

natural ['nxC(q)rql] ➢ *естественный, природный*, а не только натуральный

V. ***Read the text and answer the questions:** When was radioactivity discovered? By whom? Did he try any experiments or discover radiation by accident? What is the difference between X-rays and radiation?*

DISCOVERY OF RADIOACTIVITY

Radioactivity was discovered in a way similar to the discovery of X-rays. It happened by accident in 1898.




Henry Becquerel [bq'krel] (1852—1908), a French scientist, kept a collection of curious minerals in his desk. It so happened that in this desk there were several boxes of unopened photographic plates. One day he opened one of the boxes and discovered that the plates were not only fogged, but intensely exposed. He found the others much in the same condition, and quite useless. After studying these happenings, he found that they had been caused by rays given off from a mineral called «Pitchblende from Bohemia». Further investigation showed that the rays could pass through solid substances, such as thick dark paper, and that they could make gases good conductors of electricity, just like X-rays which were discovered only a year before.

These new rays, unlike X-rays, needed no special equipment to produce them. It was found that the elements - uranium, thorium, actinium, give out these radiations even when they were heated or cooled. In fact, the radiations went on naturally and were quite unaffected by any chemical or physical action. This strange discovery was called «natural radioactivity». Scientists soon came to believe that the reasons for these happenings were (должны) to be found deep inside each atom of the substance.

***VI. Here are some words you need to understand the following text:***

| | |
|---|---|
| 1. appreciate [q'prJSIeIt] | ➢ ценить |
| 2. assessment [q'sesmqnt] | ➢ оценка |
| 3. challenge ['tSxlInG] | ➢ вызов |
| 4. evaluate [I'vxljueIt] | ➢ оценивать |
| 5. feature ['fJCq] | ➢ показать на экране |
| 6. filmless ['fIlmlqs] | ➢ беспленочный |
| 7. impact ['Impxkt] | ➢ влияние |
| 8. interoperability ["IntqrOp(q)rq'bIlItI] | ➢ взаимодействие |
| 9. irrespective ["IrIs'pektIv] | ➢ независимый, независимо от |
| 10. live [laIv] | ➢ живой, реальный, действующий |
| 11. pose [pquz] | ➢ ставить |
| 12. relay [rI'lei] | ➢ трансляция, передача |
| 13. remote [rI'mqut] | ➢ отдаленный, уединенный |
| 14. rural ['ruqrql] | ➢ сельскохозяйственный |
| 15. web server [web 'sWvq] | ➢ сетевой узел обслуживания/ обслуживающий процессор |

***VII. Read the text and answer the following questions:***

1. *What advantages has teleradiology?*
2. *Where can it be successfully used?*

TELERADIOLOGY: X-RAY DIAGNOSIS AT A DISTANCE

Latest advances in the field of teleradiology were recently demonstrated successfully to a group of leading radiologists from the Royal College of Radiologists and the Scottish Radiological Society in the United Kingdom.

Teleradiology uses computer networks to relay an X-ray image of a patient to another hospital for further assessment by a specialist or doctor.

The demonstration, held at the Royal College of Physicians, Edinburgh,

Scotland, featured a live link to Hammersmith Hospital, London, from where real-time ultrasound images of patients were generated.

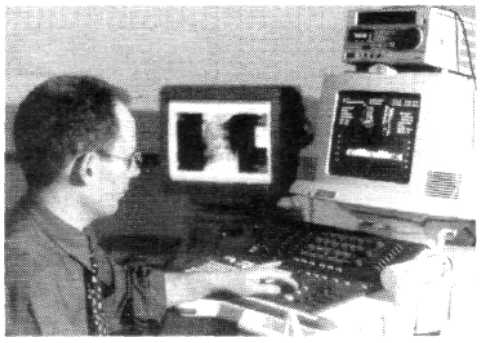
The venture was made possible with the cooperation of ATL UK Limited, which supplied the necessary ultrasound equipment, and Philips Medical Systems which supplied the web server and browser system.

Dr Nicola Strickland, Consultant Radiologist at Hammersmith Hospital, said of the demonstration: "It shows how modern technology enables rapid transmission of complex radiological images over hundreds of miles for live, distant interpretation and case discussion.

Telemedicine is already in use in areas such as teledermatology, telepsychiatry and teleretinoscopy[59]. Teleradiology has great potential but poses more of a technical challenge than other areas of telemedicine, due to the huge amount of data in the radiological images."

Dr Strickland continued: "The speed of transmission has been increased by technological advances in the use of advanced compression algorithms which can markedly reduce the data content of radiological images while completely preserving their diagnostic content.

The introduction of Dicom (digital image communication in medicine) allows complete interoperability of equipment, irrespective of the manufacturer."



During the demonstration, images acquired with different manufacturers' equipment were stored in Hammersmith Hospital's General Electric Picture Archiving Communication System - a hospital-wide filmless radiology network - as well as being

[59] Retinoscopy ['retɪnskqpɪ] – ретиноскопия – метод определения нарушений рефракции путем освещения сетчатки и слежением за направлением движения света во время вращения зеркала.

transmitted to the Philips web server system.

Images were then transmitted to Edinburgh via an ISDN (high speed telephone link) line and viewed on a web browser. Teleradiology will undoubtedly have a great impact on radiology, particularly in the areas of distant and remote diagnosis.

Professor Jamie Weir, the chairman of the Royal College of Radiologists' Standing Scottish Committee[60], said: "Scotland, with its remote rural population is ideal for the development of teleradiology which will allow expertise to be delivered locally where patients most need it.

"This demonstration provides an opportunity to appreciate the full potential of teleradiology which is set to greatly improve the standard of radiology delivered locally throughout Scotland."

The technology is also being evaluated by the UK's Ministry of Defence where it is being used for remote diagnostic radiology on members of the armed forces injured on the battlefield. Advances in teleradiology will also broaden the options available for training, making distance learning an interactive experience.

But for many radiologists the greatest benefit will be the ability to refer images for review either to an on-call doctor or for a consultant's opinion.

[60] *Standing committee* – постоянная комиссия.

## UNIT II

## COMPUTED TOMOGRAPHY

### *I. Here are some words you need to understand the following text:*

1. amphibian [xm'fIbIqn] ➢ земноводный
2. artistry ['RtIstrI] ➢ мастерство, искусство, художественность
3. by means of [baI 'mJnz qv] ➢ посредством
4. chambered nautilus ['CeImbqd 'nLtIlqs] ➢ наутилус (моллюск)
5. come about [kAm q'baut] ➢ происходить, случаться
6. dissect [dI'sekt] ➢ рассекать, вскрывать, анатомировать
7. exciting [Ik'saItIN] ➢ волнующий, захватывающий
8. forgery ['fLGqrI] ➢ подлог, подделка
9. genuine ['GenjuIn] ➢ подлинный, настоящий
10. have an eye for beauty [hxv qn 'aI fq 'bjHtI] ➢ обладать наблюдательностью, быть знатоком красоты, уметь разбираться в красоте
11. moth [mOT] ➢ мотылек
12. pelvic arrangement ['pelvIk q'reInGmqnt] ➢ строение таза
13. ranging from ... to ... ['reInGIN frOm ... tH ...] ➢ начиная с ... и до (заканчивая) ...
14. reveal [rI'vJl] ➢ открывать, показывать, обнаруживать
15. specimen ['spesImIn] ➢ образец, экземпляр
16. take pictures [teIk 'pIkCqz] ➢ фотографировать
17. verify ['verIfaI] ➢ проверять, подтверждать

***II. Can you guess what the article will be about (judging by the title)? Now read the text to check if you are right.***

**ARTISTRY IN NATURE**

Charles Bridgman is a scientist who specializes in verifying by means of X-rays that objects of art are genuine and not forgeries. Recently, however, his interest has been awakened in the artistry in nature that human eyes normally do not see. This exciting addition to his regular work with art objects came about because Bridgman has an eye for beauty and enjoys experimenting with X-ray photography.

"I've got a question mark where I should have a mind," he jokes. "Right now I'm trying to learn everything I can about X-ray techniques and how they apply to the -art world."

Radiography permits one to see the insides of a plant or animal without dissecting the specimen or having to destroy it to examine it. In his examination of small fauna through radiography, Bridgman was attracted by the symmetrical designs of skeletal structure. Using his radiography camera, Bridgman took pictures of some examples of nature's artwork.

Under the revealing eye of Bridgman's camera, the skeleton of a frog shows surprising similarity to that of a human. The X-ray also gives a clear view of the pelvic arrangement that gives the amphibian his ability to jump.

One of the most impressive photographs in Bridgman's collection is the symphony in spirals which the radiograph reveals in the chambered nautilus.

Although Bridgman's main interest in making these pictures was for their esthetic value, the pictures also have practical uses in fields ranging from medicine to space travel.

*From "Science and Technology in Everyday Life"*

### *III. Can you match each word in the left column with the related or associated one in the right?*

| | | | |
|---|---|---|---|
| 1. | amphibian | A. | technique |
| 2. | animals | B. | specimen |
| 3. | night insect | C. | cold-blooded animal |
| 4. | spiral shell | D. | radiography |
| 5. | example | E. | dragon |
| 6. | X-ray | F. | fauna |
| 7. | crime | G. | moth |
| 8. | monster | H. | nautilus |
| 9. | skill | I. | forgery |

### *IV. Can you choose the correct alternative to complete the sentences?*

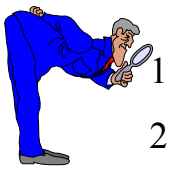
1. Charles Bridgman is a specialist in the field of
   a) medicine; b) art; c) biology.
2. He uses radiography to find out
   a) what human eyes normally can't see; b) if objects of art are genuine.
3. Charles Bridgman is interested in artistry in nature as he
   a) has an eye for beauty and enjoys experimenting; b) wants to show everybody what human eyes normally do not see.
4. The scientist uses radiography to see the insides of a plant or animal
   a) before dissecting it to examine it; b) instead dissecting it to examine it.
5. In his examination Bridgman was attracted by
   a) possibilities of X-ray technique and its application to the art world;
   b) by the symmetrical designs of skeletal structure.
6. Bridgman's pictures have

a) esthetic value; b) practical uses in the fields of medicine and space travel; c) both esthetic value and practical uses in the fields of medicine and space travel.

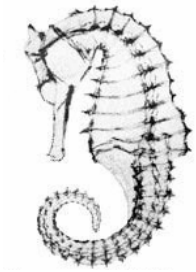
7. The phrase to have an eye for beauty means

a) to have beautiful eyes; b) to like beauty; c) to have a good understanding of beauty.

## *V. Can you answer the following questions?*



1. What does the article touch upon?
2. Who is the main character of the article? What is his occupation?
3. What interest has he got recently?
4. Are there any reasons for his interest?
5. Does the author make it clear what advantages radiography has?
6. What was Bridgman attracted by in his examination?
7. Does the author give any examples to illustrate Bridgman's experimenting?
8. What does the author point out in conclusion?
9. What is your attitude to Bridgman's experiments?



## *VI. Here are some words you need to understand the following text:*

1. admission [qd'mISqn] ➢ доступ, принятие, допущение, признание
2. baseline ['beIsleIn] ➢ база, базис
3. command [kq'mRnd] ➢ *зд.* занимать
4. in spite of ➢ несмотря на, вопреки
5. lateral ['lxtqrql] ➢ боковой, горизонтальный
6. mainstay ['meInsteI] ➢ главная поддержка, оплот, опора
7. oedema [i(:)'dJmq] ➢ отек
8. posteroanterior ["pqustqrxn'tI(q)rIq] ➢ задне-передний
9. supervene ["sjHpq'vJn] ➢ происходить

### *VII. Match the English words and phrases in A with their Russian equivalents in B.*

A. 1) over a century; 2) major advances; 3) imaging techniques; 4) plain radiograph; 5) surgical practice; 6) chest radiograph; 7) hospital practice; 8) a routine film on admission; 9) a baseline for later comparison; 10) following surgery; 11) lateral projection; 12) posteroanterior view.

B. a) снимок грудной клетки; b) хирургическая практика; c) более столетия; d) больничная практика; e) основа для более позднего сравнения; f) крупные, значительные успехи; g) боковая проекция; h) вид сзади и спереди; i) методики получения изображения (снимка); j) простой снимок; k) доступная стандартная пленка; l) последующее оперативное вмешательство.

### *VIII. Read the text and say if conventional radiology is used nowadays.*

CONVENTIONAL RADIOLOGY

Even though it is over a century since the discovery of X-rays by Wilhelm Roentgen on 8 November 1885 and in spite of the major advances in imaging techniques, plain radiographs still command an important place in surgical practice. This section will concentrate mainly on the chest radiograph.

The posteroanterior chest radiograph is still the mainstay of the standard medical examination. In hospital practice a routine film on admission will provide a baseline for later comparison, following surgery, when infection, oedema, or collapse might supervene. The lateral projection is no longer carried out routinely, but may be necessary to localize a lesion anatomically (for interventional purposes) or to obtain a view of a structure not seen on the posteroanterior view.

The key to successful diagnosis of the chest radiograph is its systematic examination, which must include the soft-tissue shadows, the diaphragmatic and

subdiaphragmatic areas, the bony cage, the lung fields, the heart, and mediastinum. Whenever possible, bilateral and symmetrical structures must be carefully compared.

***IX. Give the summary of the text "Conventional Radiology" (4-5 sentences).***

***X. Here are some words for you to understand the following text:***

1. bodily ['bOdIlI] ➢ телесный, физический
2. by contrast [baI 'kOntrRst] ➢ напротив
3. cine-angiogram ['sInI'xnGIqgrqm] ➢ киноангиограмма
4. clarity ['klxrItI] ➢ ясность, чистота
5. constricted [kqn'strIktId] ➢ суженный
6. figure out ['fIgqr''aut] ➢ вычислять, понимать
7. frame [freIm] ➢ *здесь* кадр
8. line up [laIn'Ap] ➢ строить(ся), выстраивать(ся)
9. movie ['mHvI] ➢ киносъемка
10. narrow ['nxrqu] ➢ суживать(ся), уменьшать(ся)
11. perturb [pq'tWb] ➢ возмущать, беспокоить

***XI. Read the text and find out advantages of MRI over conventional X-ray angiograms.***

AN AFFAIR OF THE HEART

**Magnetic-resonance imaging could become even more useful**

Every year, more than a million X-ray angiograms are performed in the United States alone. These are done in order to look inside people's arteries and figure out whether they are narrowing in a life-threatening manner. The difficulty with this technique is that it requires either the use of contrast agents -

which can cause kidney damage - or significant quantities of radiation.

It would be better if such images could be taken with something less damaging, such as magnetic-resonance imaging (MRI). And that is exactly what Robert Judd and his colleagues at Duke University, in North Carolina, think they have done. In the May issue of the journal Nature Medicine, they explain that they have found a way of using MRI to make movies of blood travelling through vessels in the human body.

MRI employs magnetic fields and radio signals to generate its pictures. Atomic nuclei, particularly the single-proton nuclei of hydrogen atoms, are made to line up in the same direction by a strong magnetic field. A pulse of radio waves is then used to perturb this alignment, causing the nuclei to give off radio waves of their own. The radio signal sent back by a tissue thus depends on the chemical composition of that tissue, and since different tissues have different compositions, the application of sufficient computing power can turn the signal into a picture.

Normally, MRI is applied to static tissues. The imager takes pictures of thin slices of body, and these slices are "glued" together electronically. In Dr Judd's technique, by contrast, the imager stays still and the tissue (blood, even though liquid, counts as a bodily tissue) does the moving. By using a series of radio pulses sent out at intervals of a few milliseconds, a moving picture known as a cine-angiogram can be built up frame by frame.

With this technique, says Dr Judd, it is possible to see the anatomy of vessels, and to work out the rate of blood flow. That is useful information for doctors attempting to predict whether a constricted vessel is likely to present a problem.

The team is still developing the technique. In particular, it is trying to improve the clarity of the images. But things look promising - and if it can be made to work routinely, it could be applied easily to existing MRI machines. All

that would be required is a change of software.

*From The Economist, April 24th, 2004*

***XII. Put the sentences in the proper order according to the text..***

1. Due to this new technique we can get a cine-angiogram, see the anatomy of vessels, and work out the rate of blood flow. 2. Usually specialists apply MRI to static tissues. 3. As for magnetic-resonance imaging it is less damaging. 4. In new technique developed by Dr. Judd the imager stays still and the tissue does the moving. 5. In essence, MRI employs magnetic fields and radio signals to generate its pictures. 6. But X-ray angiograms are harmful for health because they require use of contrast agents or significant quantities of radiation. 7. Moreover it can be used to make movies of blood traveling through vessels in the human body. 8. Conventional X-ray angiograms are used very often to figure out if people's arteries are narrowing and threatening people's lives. 9. This research is not over and the team is still developing the technique.

## UNIT III

## HEART PROBLEMS

### *I. Here are some words you need to understand the following text:*

1. cautious ['kLSqs] ➢ осторожный, осмотрительный
2. digital cellular telephone ['dIGIt(q)l 'seljulq] ➢ цифровой сотовый телефон
3. intermittent ["Intq'mItqnt] ➢ прерывистый
4. warrant ['wOrqnt] ➢ служить основанием

### *II. Read the text to find out if phones are harmless for heart.*

### PHONES AND PACEMAKERS

A growing number of doctors are warning patients with pacemakers to be careful around digital cellular telephones because they might affect the heart-regulating devices. Dr. David Hayes, director of pacemaker services at the Mayo Clinic, and Dr. Roger Carrillo, cardiovascular surgeon at Miami's Mount Sinai Medical Center, conducted separate studies with patients who weren't dependent on their pacemakers. (Some people have the devices to treat intermittent slow beats, while others need them to control a permanently slow heartbeat.) The findings: there were no irregularities when analog cellular phones were used. But when newer digital cellular phones were tried - especially when placed close to the pacemaker - the patients' electrocardiograms showed interference, "a rare slowing or speeding up the pacemaker," says Hayes.

While the interference hasn’t yet proved harmful, the researchers say that the studies are enough to warrant further research. "If a patient asked me if it was okay to use a digital cellular phone," adds Hayes, "I'd have to say 'I don't know.' Because we can't answer the question, I'd be particularly cautious with patients who are completely pacemaker-dependent."

*(Robert W. Troll, AP)*

## UNIT IV
## ELECTRICAL SAFETY IN SURGERY AND ANASTHESIA

***I. Here are some words you need to understand the following texts:***

1. artificial ["RtI'fIS(q)l] ➢ искусственный
2. exploratory [Ik'splLrqt(q)rI] ➢ пробный, испытательный
3. heal [hJl] ➢ выздоравливать
4. incision [In'sIZqn] ➢ разрезание, разрез
5. mimic ['mImIk] ➢ подражать
6. outperform ["autpq'fLm] ➢ превосходить, превзойти
7. precision [prI'sIZ(q)n] ➢ точность, четкость, аккуратность
8. restricted [rI'strIktId] ➢ ограниченный
9. surgeon in charge ➢ дежурный хирург

***II. Read both texts and find sentences taken from another text (one odd sentence in each text). Replace them.***

### TRUST ME, I'M A ROBOT

A robot named Da Vinci recently started operating on patients in Maastricht's teaching hospital. Although three-armed robots are in use elsewhere, this is the first four-armed robot to operate in Europe. From a console, the surgeon in charge controls each movement made by Da Vinci, whose hands not only mimic human ones perfectly - they outperform them by never shaking. The scanner is mobile, moving on rails, and can be used in either shock room.

Robotic surgery has two major advantages: it lets surgeons operate with more precision, since robots make smaller incisions than a human would, and it reduces the risk of infection. The benefit to patients is that they heal faster.

For the time being, Da Vinci will be restricted to exploratory operations. But the long-term goal is to use it for complex procedures such as kidney transplants or stomach removals.

### TIME TO SAVE LIVES

**The Academic Medical Centre (AMC) in Amsterdam recently unveiled its new high-tech shock rooms. It is the first hospital in the world to have such life-saving facilities.**

Every minute counts when a patient's life is in danger. The sooner the hospital diagnoses the exact cause of the problem, the more successful treatment will probably be. In the critical first few minutes, however, patients often have to be moved from one part of the hospital to another because the equipment needed to examine them is not all in one place.

Working with Siemens, the AMC has installed two shock rooms, with everything needed to examine critically ill patients quickly and with minimum stress. Apart from X-ray equipment and artificial respirators, for instance, these rooms are equipped with a multislice CT scanner, which takes less than 30 seconds to determine whether a patient has internal injuries. Through a viewfinder, the surgeon gets a close-up 3-D view of the part of the patient being operated on.

The AMC is the first hospital in the world to have facilities like these. They will undoubtedly be appearing elsewhere soon. *From Holland Horizon*

***III. Here are some words you need to understand the following text:***

1. acknowledge [qk'nOllG] ➢ признавать
2. adjust [q'GAst] ➢ приспосабливать, регулировать
3. breakthrough ['breIkTrH] ➢ прорыв
4. caterpillar ['kxtq"pIlq] ➢ гусеница
5. cerebral palsy ['serIbrql 'pLlzI] ➢ церебральный паралич
6. clamp [klxmp] ➢ скреплять
7. commit [kq'mIt] ➢ предаваться
8. crawl [krLl] ➢ ползти
9. disability ["dIsq'bIlItI] ➢ неспособность, инвалидность
10. disabled [dIs'eIbld] ➢ потерявший трудоспособность

11. eventually [I'venCu(q)lI] ➢ со временем
12. file [faIl] ➢ регистрировать
13. flip [flIp] ➢ щелкать, ударять слегка
14. four-pronged ['fLprONd] ➢ четырехзубый
15. gripper ['grIpq] ➢ захватное устройство; схват (робота)
16. incorporate [In'kLpqreIt] ➢ объединяться, соединять
17. multi-jointed ["mAltI'GOIntId] ➢ многосуставный
18. plug [plAg] ➢ штепсель, штекер, вилка
19. plug in ['plAgIn] ➢ вставлять штепсель
20. primarily ['praIm(q)rqlI] ➢ сначала, главным образом
21. socket ['sOkIt] ➢ розетка
22. spin-off ['spInOf] ➢ новый, дочерний
23. tend [tend] ➢ заботиться
24. trundle ['trAndl] ➢ катить (ся)
25. vehicle ['vJIkl] ➢ транспортное средство

***IV. Match the English words and phrases in A with their Russian equivalents in B.***

A. 1) robotic system, 2) arm-like device, 3) development team, 4) multi-jointed arm, 5) caterpillar-like, 6) four-pronged gripper, 7) power supply, 8) wall socket, 9) robotic design, 10) Rehabilitation Robotics, 11) space-age technology, 12) spin-off company.

B. a) разработка роботов, b) космическая технология, c) реабилитационная робототехника, d) источник электропитания, e) роботизированная система, f) настенная розетка, g) похожий на гусеницу, h) команда/группа разработчиков, i) устройство, похожее на руку, j) новая компания, k) многосуставная рука, l) четырехзубый схват.

***V. Answer the questions.***

1. Can disabled people do everything by themselves? 2. What kind of physical work do you think is difficult for them? Why? 3. Who/What can help them?

***VI. Read the text and say***

a) if there is a device developed to help disabled; b) by whom it was designed; c) what tasks it can perform; d) how it looks like and in what way it moves.

**ROBOT THAT LENDS A HELPING HAND**

A type of robot, primarily designed to give people with disabilities much more independence in their daily lives, could become a reality in the near future.

Developed by United Kingdom experts, the prototype robotic system Flexibot (the arm-like device plugged to the wall) has been designed to perform tasks such as preparing and cooking food, washing and drying dishes, and vacuuming floors. It can even shave its owner's face which was demonstrated by Professor Mike Topping, the leader of the Flexibot development team. Unlike other robots, this one does not have a body that trundles around taking up floor space but instead – looking like a long, multi-jointed arm – it moves, caterpillar-like, around the walls or ceilings, clamping itself to series of prearranged, interconnected portals. Each Flexibot arm has a four-pronged gripper at each end that acts both as manipulators and as an electric plug. Either end of the arm can plug into the power supply via a wall socket. The arm, which is uniquely able to adjust its length automatically, can move by stretching a free end to the next socket and plugging itself in before pulling its other end out of the wall. The free end flips around to the next socket, and the arm crawls its way along the wall, socket by socket.

Professor Topping is a realized international figure in robotic design and is based at the Centre for Rehabilitation Robotics at Staffordshire University, English Midlands. He is also director of the spin-off company Rehab Robotics.

He has been committed to this field of research for the past 15 years, during which time he and his team developed another machine called Handy 1, an acknowledged world-leader which has changed the lives of some of its users. One of them is Stephanie O'Connell who has cerebral palsy. She said: "I would be lost without it. It allows me to feed myself and it also helps me with such things as make-up, drawing and playing games."

Flexibot takes the ideas incorporated in Handy 1 much further and uses space-age technology to help the disabled. Professor Topping came up with the idea for Flexibot when he was trying to extend the capabilities of Handy 1.

He was searching for a new type of arm that could move about the house doing jobs that would not normally be within easy reach of someone in a wheelchair, such as washing dishes or changing a light bulb. Professor Topping has filed a patent on the system and hopes to have a working prototype by the end of 2001. He does not believe that scientists have realized the full potential of robotic technology but considers the Flexibot system will provide a breakthrough. It could eventually be applied to a great range of tasks and be of benefit to society in general, both domestically and in industry. For example, with appropriate attachments and under instructions from a central control unit, the robot could be programmed to wash vehicles, clean windows, tend gardens or, in a wider context, work underwater, in laboratories or in space.

### *VII. Get ready to speak on the following topics:*

1. Devices which help people live.
2. Devices which help doctors save people's lives.
3. Electricity – both helpful and harmful.

## UNIT V

## LASER THERAPY

***I. There are some new words below. Try to remember them.***

1. administer [qd'mInIstq] ➢ управлять, оказывать помощь; назначать
2. ageing ['eIGIN] ➢ старение
3. apparent [q'pxrqnt] ➢ видимый, явный, очевидный
4. blast [blRst] ➢ взрывать, разрушать
5. cell [sel] ➢ клетка
6. cervical [sq(:)'vaIkql] ➢ затылочный, шейный
7. clearance ['klIqrqns] ➢ очистка
8. clinician [klI'nIS(q)n] ➢ клиницист[61]
9. compound ['kOmpaund] ➢ соединение, компаунд
10. cumulative ['kjHmjulqtIv] ➢ накопленный, кумулятивный
11. excise [ek'saIz] ➢ иссекать, удалять с помощью скальпеля
    excision [ek'sIZqn] ➢ иссечение, хирургическое удаление ткани
12. existing [Ig'zIstIN] ➢ существующий, находящийся
13. exploit [Iks'plOIt] ➢ эксплуатировать
14. flexible ['fleksqbl] ➢ гибкий, эластичный, податливый
15. furthermore ['fWDq'mL] ➢ к тому же, кроме того, более того
16. intact [In'txkt] ➢ нетронутый, неповрежденный, целый
17. involve [In'vOlv] ➢ вызывать, влечь за собой
18. joint [GOInt] ➢ объединенный, совместный
19. launch [lLnC] ➢ пускать в ход
20. lengthy ['leNTI] ➢ очень длинный
21. manage ['mxnIG] ➢ руководить, управлять, уметь обращаться
22. nurse [nWs] ➢ сиделка, медицинская сестра

[61] *Клиницист* – врач, занимающийся клинической практикой.

23. particularly [pq'tIkjulqlI] ➢ особенно, в особенности, в отдельности
24. pure [pjuq] ➢ чистый, безупречный, простой
25. scar [skR] ➢ шрам, рубец
26. spokesman ['spquksmqn] ➢ представитель
27. throat [Trqut] ➢ горло, гортань
28. venture ['venCq] ➢ рискованное предприятие, начинание
29. wrinkle ['rINkl] ➢ морщина

***II. Match the English words and phrases in A with their Russian equivalents in B.***

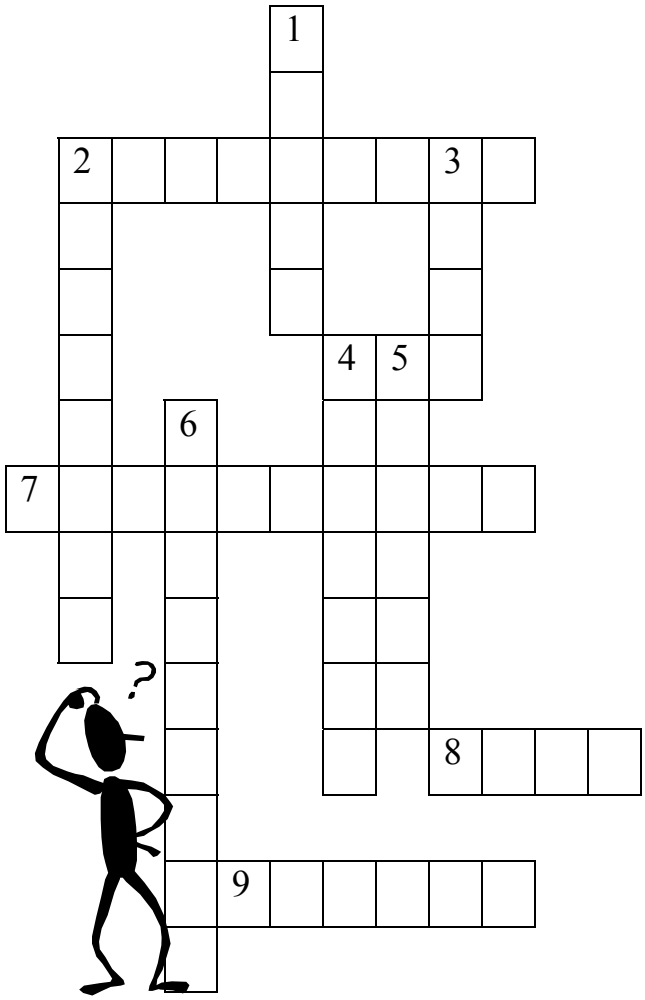
A. 1) photodynamic therapy, 2) spectrally pure, 3) cost-effective, 4) light-sensitive compound, 5) joint venture, 6) diseased cells, 7) significant advantage, 8) pure oxygen, 9) cumulative toxicity, 10) lengthy treatment, 11) beneficial effects, 12) signs of ageing, 13) cryotherapy.

B. a) светочувствительное соединение, b) признаки старения, c) чистый кислород, d) спектрально чистый, e) криотерапия[62], f) фотодинамическая терапия, g) поврежденные, заболевшие клетки, h) совместное начинание, i) благотворное воздействие, j) наилучшее соотношение цены и качества, k) накопленная токсичность, l) значительное преимущество, m) очень длительное лечение.

***III. Solve the crossword puzzle.***

*Across*: **2**. clearing up, removing, making tidy; **7**. person visiting a hospital for treatment but not living there; **8**. mark remaining on the surface (of skin, etc.) as the result of injury or illness; **9**. passage in the neck through which food passes to the stomach/air to the lungs.

[62] *Криотерапия* – общее название методов лечения, основанных на применении низких температур для охлаждения тканей, органов или всего организма.




*Down*: **1**. person who cares for people who are ill or injured (in a hospital, etc.); **2.** thing made up of two or more combined parts; **3**. microscopic unit of living matter; **4**. small fold or line in the skin (especially of the kind produced by age);

**5.** process of growing old; changes that occur as the result of the passing of time; **6**. person speaking, chosen to speak, as the representative of a group.

***IV. Read and translate the sentences paying attention to the non-finite forms of the verb.***

1. This device produces the non-laser beam for treating different medical conditions ranging from skin, throat and cervical cancers. 2. The device is claimed to be more flexible and cost-effective than existing laser treatments. 3. Invented by Dr Colin Whitehurst it was developed and launched in the UK. 4. A light-sensitive compound is applied to the diseased cells. 5. The Paterson lamp activates the compound, producing pure oxygen to destroy the diseased cell. 6. The new lamp offers patients a treatment with the significant advantage of leaving the normal skin surrounding the lesion intact. 7. PDT treatment can easily be managed on an out-patient basis with the treatment administered by the clinician or nurse.

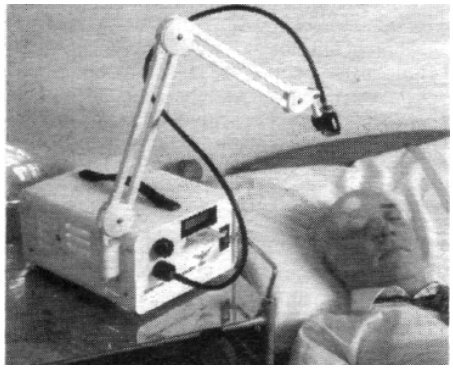
***V. Read the text. A) Say if the Paterson lamp is easier for employment than existing devices. B) Find the things that follow which are not mentioned in the text:*** <u>weapon</u>, <u>device</u>, <u>lamp</u>, <u>disease</u>, <u>harm</u>, <u>illness</u>, <u>cancer</u>, <u>speaker</u>, <u>doctor</u>.

## LAMP THAT BLASTS AWAY SKIN CANCER

Paterson photodynamic therapy (PDT) - the world's most spectrally pure, non-laser beam for treating medical conditions ranging from skin, throat and cervical cancers - is recognised as an important new weapon against the disease.

The device, which has been clinically tested and is widely used in some (около) 40 National Health Service hospitals in the United Kingdom, is claimed to be more flexible and cost-effective than existing laser treatments. Invented by Dr Colin Whitehurst of the Cancer Research Campaign's Paterson Institute Laboratories, it was developed and launched in the UK by Photo Therapeutics Limited in Manchester, north-west England, in a joint venture with the University of Manchester Institute of Science and Technology and the Cancer Research Campaign (CRC).

How does it work? A light-sensitive compound is applied to the diseased cells and the skin area (as shown on this patient) is then illuminated with the Paterson lamp which activates the compound, producing pure oxygen to destroy the diseased cell. Clearance of the lesions often becomes apparent as early as four weeks after treatment. "The new lamp offers patients an alternative treatment to conventional therapies such as cryotherapy, radiotherapy, excisional or laser surgery, with the significant advantage of leaving the normal skin surrounding the lesion intact. It leaves little or no scars at all," said a spokesman for Photo Therapeutics.



Furthermore, unlike radiotherapy and chemotherapy which creates cumulative toxicity and can involve lengthy treatment, PDT treatment can easily be managed on an out-patient basis with the treatment administered by the clinician or nurse. Photo Therapeutics has also launched the lamp as a cosmetic product to exploit its beneficial effects on the signs of ageing, particularly wrinkles.

### *VI. Match up the two parts of the following sentences.*

| | |
|---|---|
| **1.** Paterson photodynamic therapy | **A.** the world's most spectrally pure, non-laser beam for treating skin, throat and cervical cancers. |
| **2.** It is | **B.** is applied to the diseased cells. |
| **3.** This device | **C.** is an important new weapon against the cancer. |
| **4.** Invented by Dr Colin Whitehurst | **D.** it was developed and launched in the UK by Photo Therapeutics Limited in Manchester the University of Manchester Institute of Science and Technology and the Cancer Research Campaign. |
| **5.** A light-sensitive compound | **E.** is then illuminated with the Paterson lamp which activates the compound, producing pure oxygen to destroy the diseased cell. |
| **6.** The skin area | **F.** becomes apparent as early as four weeks after treatment. |
| **7.** Clearance of the lesions | **11.** offers patients an alternative treatment to conventional therapies with the significant advantage of leaving the normal skin surrounding the lesion intact. |
| **8.** The new lamp | **G.** is claimed to be more flexible and cost-effective than existing laser treatments. |
| **9.** PDT treatment | **H.** has also launched as a cosmetic product to exploit its beneficial effects on the signs of ageing, particularly wrinkles. |
| **10.** The lamp | **I.** can easily be managed on an out-patient basis with the treatment administered by the clinician or nurse. |

### *VII. Now read the article again and answer the questions.*

1. What does the article deal with? 2. What kind of therapy is the described one? 3. Is it recognised as an important one? 4. What advantages is this device claimed to have? 5. Who invented this lamp? 6. How does the Paterson lamp work? 7. How long does it take to clear lesions with the help of the Paterson lamp? 8. What advantages of the new device did a spokesman for Photo Therapeutics draw our attention to? 9. What other advantages of the lamp does the author point out? 10. Does the author mention any other ways of using the lamp (except therapy)? 11. What can you say in conclusion?

## UNIT VI

## FUTURE CAREER

### *I. There are some new words below. Try to remember them.*

1. bishop ['bISqp] ➢ епископ
2. chair of Medicine ➢ кафедра медицины
3. chancellor ['CRnsqlq] ➢ старшина присяжных заседателей (шотл.)
4. clergy ['klWGI] ➢ духовенство, священники
5. divinity [dI'vInItI] ➢ богословие

### *II. Read the text and say what the University of Aberdeen is famous for.*

**The Faculty of Medicine and Medical Sciences at the University of Aberdeen**

The University of Aberdeen is Scotland's third oldest university, founded in 1495 as Columbus was opening up the New World and the Renaissance [rq'neIsqns] was spreading throughout Europe. William Elphinstone, Bishop of Aberdeen and Chancellor of Scotland, established King's College to train doctors, teachers and clergy for the communities of northern Scotland, and lawyers and administrators to serve the Scottish Crown. This university boasted, from 1497, the first chair of Medicine in the English-speaking world. In 2002 – 2003

The Institute of Medical Sciences brings together scientists and clinicians in a state-of-the-art research laboratory facility.

- there were over 13,000 students, including 10,352 undergraduates and 3,097 postgraduates;
- the student population was 46% men, 54% women, included 19% mature undergraduates;
- over 117 nationalities were represented.

The University provides training in five fields. They are: Arts & Divinity, Education, Medicine & Medical Sciences, Science & Engineering, Social Sciences & Law.

***III. You should learn some most common abbreviations used in the UK.***

1. CAD = computer-aided design ➢ проектирование с помощью ЭВМ
2. Dept = department ➢ факультет, кафедра
3. ELF = extremely low frequency ➢ ультранизкая частота
4. MPhil = Master of Philosophy ➢ магистр философии
5. MRI = magnetic resonance imaging ➢ ядерно-магнитный резонанс
6. MSc = MS = M. S. = Master of Science ➢ магистр (естественных/точных) наук
7. NHS = National Health Service ➢ Государственная служба здравоохранения
8. NMR = nuclear magnetic resonance ➢ ядерный магнитный резонанс
9. PC = personal computer ➢ персональный компьютер
10. PET = positive emission tomography ➢ томография на позитивном излучении
11. Pg Dip = Postgraduate ➢ аспирант, аспирантка
12. Ph D = Doctor of Philosophy ➢ доктор философии

*IV.* ***Here you can find some articles from the University Prospectus for postgraduates. Look through them to find out a)*** *in what specialities the Faculty of Medicine & Medical Sciences provides training;b) what degrees you can get there.*

**BIOMEDICAL PHYSICS & BIOENGINEERING**

**Research Degrees:** MSc, MPhil. PhD

**Taught Programmes:** MSc/PgDip Medical Physics; MSc/PgDip Information Technology (Medical Physics); MSc/PgDip Bioengineering; MSc/PgDip Medical Imaging

**Head of Department:** Professor P F Sharp

| | |
|---|---|
| Academic Staff: 24<br>Research Fellows: 15<br>Research Assistants: 4<br>Research Students: 20 | *Research Fellows* – действительные члены научного общества; *Research Assistants* – научные сотрудники; *Research Students* – аспиранты |

**Departmental Website:** www.biomed.abdn.ac.uk

***For Further Information Contact***

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**THE DEPARTMENT**

The Department is multi-disciplinary, embracing all branches of physical, engineering and computing sciences applied to medicine. It is situated on the 200 acre ['elkq] campus of the Medical School and four major hospitals of the North-East of Scotland and is unique in that all staff, although actively engaged in University teaching and research, are also concerned with the provision of appropriate scientific services within the hospital. The Department was one of the first to offer postgraduate courses in medical physics, and many hundreds of our graduates have taken up posts in the UK and world-wide. Several of its past and present staff have become Presidents of major professional organisations, and links with the medical physics and bioengineering profession are consequently excellent. The Department has an international reputation for its research, especially in Magnetic Resonance Imaging which it pioneered. In 2000 it was awarded the prestigious Queen's Anniversary Prize for its work in medical imaging. It offers students teaching by world-leaders in their field as well as access to the latest in medical technology, including 5 Magnetic Resonance Imagers, 3 gamma cameras, Positron Emission Tomography, rapid prototyping equipment and the latest biomaterials testing equipment. There is also a comprehensive network of PCs and workstations for the use of students.

## CAREERS

The course is accredited by the Institute of Physics & Engineering in Medicine as fulfilling part of the training requirements for physicists wishing to work in the NHS. Many opportunities exist for research, and graduates also find employment in the many health related industries.

## RESEARCH INTERESTS

### FREE RADICAL IMAGING

Proton electron double resonance imaging is a novel technique developed in the Department which combines magnetic resonance imaging with electron spin resonance, to produce high-resolution images of free radical distribution. We use it routinely to image stable free radical 'contrast agents' in animals, and are working at imaging humans.

### MAGNETIC RESONANCE IMAGING

We are studying the potential of *superconducting quantum interference devices* (*SQUIDs*) as ultra-sensitive detectors for NMR signals and have constructed a small-scale MRI using SQUIDs. The group has a high field, small MR research imager on which research into, for example, inflammatory eye disease and carpal tunnel syndrome, is being carried out. A new 1.51 research MR imager has recently been installed. It supports clinical programmes in cardiac MRI, neuroimaging, the detection of acute stroke and imaging breast cancer, as well as the development of new MR pulse sequences.

### RADIONUCLIDE IMAGING

The Department has a state-of-the-art PET imaging centre. There are research programs on optimising the performance of PET imaging, data-quantitation, developing new imaging technology as well as clinical programmes in cardiology, orthopaedics, oncology and neuroimaging. The nuclear medicine group has 3 gamma cameras, one of which is capable of PET imaging.

## RADIATION PROTECTION

Work is carried out on the radiation doses received by members of the public from artificial and natural sources of radiation and the mechanisms which can control these doses. The group is also involved in the assessment of exposure levels from non-ionising electromagnetic radiation, in particular the magnetic field component of ELF.

## ULTRASOUND

Research concentrates on the technology and clinical applications of cardiac output measurement via (non-imaging) Doppler ultrasound - in particular, the optimisation of probes for suprasternal use and the development of robust algorithms for computing cardiac output. There is also an interest in the computerised analysis of A-scans of the eye for the assessment of a variety of pathological conditions.

## RETINAL IMAGING

The section has a scanning laser ophthalmoscope that it has constructed and which is capable of imaging the retina in 3D and full colour. Research concentrates on developing measures of retinal physiology, rather than analysing anatomy. This is done by the analysis of time sequence images from fluorescein angiography[63], by 3D multispectral imaging of tissue physiology, and by imaging individual blood cells as they pass through the retinal vasculature. Programmes have been developed for automatically quantifying the retinal appearances of diabetes and have been commercialized.

## IMAGE PROCESSING AND ANALYSIS

The image processing group works with images from many different imaging modalities. Example applications include the automated analysis of colour images of the retina to detect natural features (such as the optic disc) and abnormalities (such as microaneurysms, exudates and drusen), creation of three-

[63] Angiography ["xndZI'Ogrqfl] – ангиография - рентгенография сосудов после введения в них рентгеноконтрастного вещества

dimensional CAD models from CT scans, texture analysis, multimodality image registration and fusion (e.g. combining the anatomical information from MR with the functional information from PET), and 3D modelling and rendering.

BIOENGINEERING

Research is carried out on how the composition and structure of tissues influence their mechanical properties and how surgical intervention affects the mechanical behaviour of joints and their tissues. The group is equipped with Instron testing machines and CAD facilities. Work extends from the computer design of new devices, their mechanical testing, to the use of imaging techniques to measure how natural and artificial joints respond to mechanical loading and how they respond to surgical procedures including total joint replacement.

BIOMECHANICS AND ERGONOMICS

The group is researching the prevention, aetiology and rehabilitation of occupational musculoskeletal injuries, particularly low back pain. The new Liberty Safework Centre has facilities for stadiometry, lifting strength, electromyography, kinematic measurement of the trunk and workplace measurements, such as posture and whole body vibration. A positional MR imager for imaging patients while they are standing has recently been installed.

## TAUGHT PROGRAMMES

### *MEDICAL PHYSICS*

MSc 12 months full-time, 24 months part-time;

Pg Dip 9 months full-time

Number of students on course: 13

***For further Information contact: Dr A. Manivannan***

Department of Biomedical Physics & Bioengineering

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AIMS

Students receive a thorough academic grounding in Medical Physics, are

exposed to its practice in a hospital environment, and complete a short research project. Many graduates take up careers in health service medical physics, either in the UK or their home country. The course is accredited by the Institute of Physics & Engineering in Medicine as fulfilling part of the training requirements for physicists wishing to work in the NHS. Numerous opportunities exist for research, and graduates also find employment in the many health related industries.

ENTRANCE REQUIREMENTS

Science-based Honours Degree/equivalent for MSc, Ordinary degree for PgDip.

SYLLABUS

The programme spans 3 terms, each lasting 4 months. In the first, the core course provides a good general grounding in Medical Physics; lectures are designed to update knowledge in topics such as experimental statistics, and others deal with clinical applications of physics such as nuclear medicine, radiotherapy, magnetic resonance imaging and biomechanics. Additionally, lectures on anatomy, physiology and biochemistry provide students with a basic medical knowledge.

Lectures are supported by practicals, demonstrations and attachments to staff members. In the second term, three topics are selected from a list of 12 and studied in detail. Topics include radiotherapy, nuclear medicine, biomechanics, and computing. During a series of tutorial demonstrations clinicians introduce their own specialities; students become familiar with how clinicians work, attend operations, etc. The final term (MSc students only) is spent carrying out a short research project.

## *INFORMATION TECHNOLOGY (MEDICAL PHYSICS)*

MSc 12 months full-time; Pg Dip 9 months full-time

Number of students on course: 3

***For further information contact: Dr A Allen***

Dept of Biomedical Physics & Bioengineering
Tel: 01224 552746; Fax: 01224 685645; E-mail: a.allen@biomed.abdn.ac.uk

## AIMS

To provide training in the techniques used in the acquisition, organisation and manipulation of information obtained by the application of physics, computing and digital electronics to medical problems and patient care. Additionally, to provide a training in Medical Physics with particular emphasis on "hands on' experience of typical computer systems used in research and diagnosis. The course equips students with sufficient skills to apply their training to a wide range of IT disciplines as well as pursuing careers in Medical Physics. The course is accredited by the Institute of Physics & Engineering in Medicine as fulfilling part of the training requirements for physicists wishing to work in the NHS.

## ENTRANCE REQUIREMENTS

Science or Engineering-based Honours Degree (or equivalent) for MSc, Ordinary Degree for PgDip.

## SYLLABUS

The programme spans three terms, each lasting 4 months. In the first students acquire a general introduction to the whole field of Medical Physics; topics include radiation physics, magnetic resonance imaging, computing applications and software development. There are also courses on anatomy, physiology, diseases, and management in the health service. Students carry out practical and attend demonstrations by both physics and medical staff. In the second term students specialise by choosing three subjects for deeper study out of a choice of 12. Students must take either Medical Image Processing and Analysis or Biomedical Computing, but can choose the others from a list including nuclear medicine, radiotherapy, magnetic resonance imaging and medical device development. In the final term (MSc only) students undertake a

short experimental project, which is submitted as a bound project report and examined orally in September.

## *BIOENGINEERING*

MSc 12 months full -time, 24 months part-time

Pg Dip 9 months full-time

Number of students on course: 5

***For further information contact: Dr D Shepherd***

Dept of Biomedical Physics & Bioengineering

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### AIMS

By the end of the course students will have received a thorough academic grounding in Bioengineering, been exposed to the practice of Bioengineering in a hospital environment, and carried out a short research project. Many graduates take up careers in health service bioengineering departments, either in the UK or their home country. The course is accredited by the Institute of Physics & Engineering in Medicine as fulfilling part of the training requirements for physicists wishing to work in the NHS. There are many opportunities for research in Bioengineering and Medical Devices. Graduates also find employment in the many health related industries.

### ENTRANCE REQUIREMENTS

Science or Engineering-based Honours Degree (or equivalent) for MSc, Ordinary Degree for Pg Dip.

### SYLLABUS

The course is divided into 3 terms, each 4 months long. The first, the core course, is designed to give students a good general grounding in Medical Physics and Bioengineering. Some lectures are designed to update the student's knowledge in topics such as radiation physics, electronics and experimental statistics, others deal with the clinical applications of physics and engineering

such as biomechanics, medical electronics, and magnetic resonance imaging. In addition there are lectures on anatomy and physiology to provide students with a basic medical knowledge. These lectures are supported by practicals, demonstrations and attachments to staff members.

In the second term students study selected topics in detail All students must study 3 topics including at least one topic from Medical Electronics and Instrumentation; Human Performance and Rehabilitation Engineering; and Medical Device Development, and up to 2 others from a list including nuclear medicine, medical image processing, diagnostic radiology and radiation protection. In addition there are a series of clinical tutorial demonstrations where clinicians introduce their own specialities. Students become familiar with how clinicians work, attend operations, etc.

The final term (MSc students only) is spent carrying out a short research project.

ASSESSMENT (common for all taught programmes)

Written examination (3 papers), continuous assessment, oral examination and project report. Diploma students do not do a project report.