ДОНСКОЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

ЦЕНТР ДИСТАНЦИОННОГО ОБУЧЕНИЯ И ПОВЫШЕНИЯ КВАЛИФИКАЦИИ

Кафедра «Иностранные языки»

УЧЕБНОЕ ПОСОБИЕ
по английскому языку

«Медицинские приборы»

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Аннотация

Настоящее учебное пособие предназначено для студентов и магистрантов специальности «Медицинские приборы». Цель пособия: развитие навыков чтения, перевода, говорения, обучение аннотированию текста. Пособие способствует развитию языковых знаний обучаемых в сфере профессиональной коммуникации.

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Оглавление

UNIT I. EEG: HISTORY, BRAIN WAVES, APPLICATIONS

Brain waves classification

For obtaining basic brain patterns of individuals, subjects are instructed to close their eyes and relax. Brain patterns form wave shapes that are commonly sinusoidal. Usually, they are measured from peak to peak and normally range from 0.5 to 100 V in amplitude, which is about 100 times lower than ECG signals. By means of Fourier transform power spectrum from the raw EEG signal is derived. In power spectrum contribution of sine waves with different frequencies are visible. Although the spectrum is continuous, ranging from 0 Hz up to one half of sampling frequency, the brain state of the individual may make certain frequencies more dominant. Brain waves have been categorized into four basic groups:

- beta (>13 Hz), - alpha (8-13 Hz), - theta (4-8 Hz), - delta (0.5-4 Hz).

The best-known and most extensively studied rhythm of the human brain is the normal alpha rhythm. Alpha can be usually observed better in the posterior and occipital regions with typical amplitude about 50 V (peak-peak). According to our experiences alpha was also significant between posterior and central regions in comparison to other regions. Alpha activity is induced by closing the eyes and by relaxation, and abolished by eye opening or alerting by any mechanism (thinking, calculating). Most of the people are remarkably sensitive to the phenomenon of "eye closing", i.e. when they close their eyes their wave pattern significantly changes from beta into alpha waves. The precise origin of the alpha rhythm is still not known. Alpha waves are usually attributed to summated dendrite potentials. Evoked potentials (e.g. generated in brain stem) often consist of fibre potentials (axonal) and synaptic components. EEG is sensitive to a continuum of states ranging from stress state, alertness to resting state, hypnosis, and sleep. During normal state of wakefulness with open eyes beta waves are dominant. In relaxation or drowsiness alpha activity rises and if sleep appears power of lower frequency bands increase. Sleep is generally divided into two broad types: non-rapid eye movement sleep (NREM) and REM sleep. NREM and REM occur in alternating cycles. NREM is further divided into stage I, stage II, stage III, stage IV.

The last two stages corresponds to deeper sleep, where slow delta waves show higher proportions. With slower dominant frequencies responsiveness to stimuli decreases. Various regions of the brain do not emit the same brain wave frequency simultaneously. An EEG signal between electrodes placed on the scalp consists of many waves with different characteristics. A large amount of data received from even one single EEG recording presents a difficulty for interpretation. Individual's brain wave patterns are unique. In some cases, it is possible to distinguish persons only according to their typical brain activity. For example, subjects who regard themselves as rational types or as holistic/intuitive types may demonstrate certain higher activity in their frontal left and frontal right hemisphere respectively.

I. Phrases for an annotation:

it is claimed that	утверждается, что... л
a method of...is proposed	предполагается метод...
the results of... are presented	предоставлены результаты
a particular interest is ...	особый интерес представляет
the effect of...on...is discussed	обсуждается влияние на
an attempt to ...is made	делается попытка

II. Match the words and word combinations:

1. brain patterns	a) затылочная и центральные час-
2. sine waves	b)восприимчивый
3. posterior and central regions	c) синусоидальная волна
4. evoked potentials	d) отнести к
5. sensitive	e) синоптические компоненты
6. brain stem	f) бодрствование
7. attribute to	д) дремота <
8. wakeful ness	^вызванные потенциалы
9. drowsiness	i) энцефалограмма
lO.synaptic components	j) низкочастотные ритмы
11. lower frequency bands	к)сгвол головного мозга
12. holistic types	1) побном левом и лобном правом
13.frontal left and frontal right	т) целостные типы
14. hemisphere	п) пациент
15. subject	о) полушарие

III. Divide the text into the parts and name each of them.

IV. What information is in each of the parts?

V. Choose the right sentence:

1. Brain patterns form wave shapes that are commonly sinusoidal.	a) Большое количество данных, полученных от одного сигнала ЭЭГ, при интерпретации вызывают затруднение.
2. EEG is sensitive to continuum of states ranging from stress state, alertness to resting state, hypnosis and sleep.	Ь) Альфа активность вызвана закрытием глаз и расслаблением и исчезает при открытии глаз или при активности головного мозга.
3. A large amount of data received from even one single EEG recording presents a difficulty for interpretation.	c) Активность головного мозга формирует волновые формы, которые являются синусоидальными
4. Alpha activity is induced by closing the eyes and by relaxation and abolished by eye opening or alerting by any mechanism (thinking, calculating).	d) ЭЭГ регистрируется в специальной обстановке, в напряженном состоянии, активном и расслабленном состоянии, гипнотическом и во время сна

VI. Agree or disagree:

1. Power spectrum from the raw EEG signal is not derived.
2. The best known rhythm of the human brain is the normal alpha rhythm.
3. The precise origin of alpha rhythm is already well known.
4. Sleep is generally divided into three broad types.
5. Individual's brain wave patterns are quite the same.

VII. Answer the questions.

1. How are brain waves measured?
2. How many groups do brain waves have?
3. What is the best known rhythm of human brain?
4. Where can alpha rhythm be better observed?
5. When is alpha activity abolished?
6. What waves are dominant during the state of wakefulness with open eyes?
7. How many types of sleep can you name?
8. How many stages is NRem divided into?
9. How can you characterize the last two stages?
10. How can the persons be distinguished in some cases?

VIII. Write the annotation.

UNIT II. AIR-DISPLACEMENT PLETHYSMOGRAPHY

Thus, human body volume is measured when a subject sits inside the chamber and displaces a volume of air equal to his or her body volume. Body volume is calculated indirectly by subtracting the volume of air remaining inside the chamber when the subject is inside from the volume of air in the chamber when it is empty. The air inside the chamber is measured by applying relevant physical gas laws. Boyle's Law states that at a constant temperature, volume (V) and pressure (P) are inversely related: P1/P2 = V2/V1.

Therefore, when a constant temperature (isothermal condition) is maintained, Boyle's Law can be applied. Consequently, most early plethysmography required temperature-controlled surroundings and isothermal conditions within the test chamber. This presented burdensome requirements for testing conditions, which restricted practical implementation of air-displacement plethysmography. This problem was not fully "resolved until systems were developed that do not require isothermal testing conditions. •

The principles of plethysmography were first applied to the measurement of the body volume and composition of infants in the early 1900s, but it was not until the 1960s that relatively stable measurements were achieved. However, these systems required that ambient conditions be maintained constant. Therefore, to deal with rapid fluctuations in temperature, humidity, and pressure generated by humans inside the enclosed chamber, the measurement process by necessity included procedures that were difficult and laborious and by modern standards would be considered impractical and unacceptable. Because of inconveniences such as these and various technological difficulties, none of the early APGs were ever developed for common, everyday use. Later experimental APGs developed in the 1980 were more technologically advanced. APG adds quantitative and objective data to the anatomical assessment of non- invasive image methods in the study of chronic venous insufficiency. It is also useful to detect himodynamic alterations in the venous system, whether they are due to obstruction, primary or secondary valve insufficiency, or calf pump alteration. APG has also been applied toward identifying and following up patients that are good candidates for deep venous reconstruction. Furthermore, APG testing can be carried out over compression garments thus enhancing its applicability to a wide range of patients with peripheral disorders. Arterial inflow can be measured to identify patients that are the best candidates for drug therapy and for follow- up to vascular interventions. APG technology has been used on various space missions to quantify the effects of prolonged micro-gravity on vascular tone.

I. Phrases for an annotation:

1. The paper puts forward the idea	в статье выдвигается идея
2. Data on.... are discussed	обсуждаются данные по
3. The paper is highly recommended to	статья особенно рекомендуется
4. A comparison of... with... is made	проводится сравнение
5. An attempt to...is made	делается попытка

II. Match the words and the word combinations:

1. air-displacement	a) следовательно
2. chamber	b) выполнение
3. consequently	c) изменение
4. burdensome requirements	d)камера
5. implementation	e) недопустимый
6. fluctuation	f) недостаток
7. humidity	g) увеличивать
8. unacceptable	h) перемещение воздуха
9. insufficiency	i) влажность
10. enhancing	j) обременительные требования

III. Divide the text into parts and name each of them.

IV. What information is in each of the parts.

V. Choose the right sentence.

1. Boyle's Law states that at a constant temperature, volume and pressure are inversely related.	a) Кроме того, тестирование APG может быть выполнено на предмет сжатия, таким образом увеличилось его применение для широкого диапазона пациентов с расстройствами периферийного кровеобеспечения.
2. This presented burdensome requirements for testing conditions, which restricted practical **implementation** of air- displacement plethysmography.	Ь)Однако эти биотехнические системы требовали, чтобы условия окружающей среды были постоянно поддержаны. .
3. However, these systems required that ambient conditions be maintained constant.	c) Это представило обременительные требования для проверки условий, которые ограничили практическое применение плетизмографии, основанной на воздушном смещении.
4. Furthermore, APG testing can be carried out over compression garments thus enhancing its applicability to a wide range of patients with peripheral disorders.	d) Закон Бойля- Мриотта утверждает, что при постоянной температуре отношения объемов воздуха или газа и его давления обратно пропорциональны.

VI. Agree or disagree.

1. The air inside the chamber is measured by applying Pascal's law.
2. The problem of isothermal condition wasn't resolved.
3. The principles.of plethysmography were first applied in 1960
4. None of the APGs were ever developed for common, everyday use.
5. APG adds quantitative and objective data to the anatomical assessment of noninvasive image methods in the study of chronic venous insufficiency.

VII. Answer the questions.

1. How is human body volume measured by means of air- displacement plethysmography?
2. How is body volume calculated?
3. In what case can Boyle's law be applied?
4. When was the problem of isothermal condition resolved?
5. What were the principles of plethysmography applied to?
6. Why was none of the early APG ever developed for everyday use?
7. What is a new APG method useful to?

VIII. Write the annotation.

UNIT III. ELECTROENCEPHALOGRAPHY (EEG)

The EEG is the most informative laboratory test in individuals with epileptic seizures. It may play an important role in the diagnosis of epilepsy, classification of the type of epileptic seizure and epileptic syndrome, determining the area in the brain where seizures begin and in certain instances may influence the choice of anti-epileptic medication.

The diagnosis of epilepsy is usually based on the history. Due to the random and often unpredictable nature of epileptic seizures, the EEG is typically recorded between seizures and conclusions are based on the EEG findings in between seizures. If the area triggering seizures lies deep within the brain, such as in the frontal or temporal lobes, the EEG recording may be normal. Indeed, even repeated EEGs may be normal in some patients with epilepsy. In contrast epileptiform EEG patterns occur in about one to two percent of patients without any history of epileptic seizures. Relatives of individuals who have epilepsy may have inherited genetic EEG patterns and not have any epileptic seizures. Thus it is important the EEG findings are interpreted correctly and correlated with the patient's clinical history.

Technical Aspects of EEG

The EEG measures the difference in electrical potential between two points on the surface of the head. It is a tracing of the voltage fluctuations over time recorded from electrodes placed over the scalp in a specific manner. This represents fluctuating electrical potentials in membranes of neurons (brain cells) in superficial layers of the brain cortex. The skull, scalp, and cerebrospinal fluid reduce the EEG activity that is detected on the surface of the scalp.

Typically, 19 EEG electrodes are placed over the scalp as well as electrodes that are reference electrodes placed over the ears, cheek, and to pick up the electrocardiogram (ECG). In selective situations the neurologist may suggest that additional electrodes be applied in order to record the EEG activity that may be missed by a routine EEG.

Video-EEG Monitoring and Ambulatory EEG Recordings

Video-EEG monitoring allows simultaneous recording of the EEG and video data and is of particular value in assessing patients for epilepsy surgery and determining whether clinical events the patient is experiencing are epileptic or not epileptic In nature.

In some EEG laboratories such as BC Children's Hospital video recordings have been performed as part of routine EEG recordings over the past 10 years. This is not standard practice in all laboratories. Ambulatory EEG allows continuous EEG monitoring during normal activities and can be helpful in assessment of seizure frequency and determination of the nature of clinical behaviours. Patients are able to walk around and leave the hospital with the EEG recordings on and typically the battery allows continuous EEG recording for 18 to 24 hours.

Invasive Video-EEG Monitoring

This involves placement of electrodes directly on (subdural grid or strip electrodes) or within (depth electrodes) the brain surface and is performed in patients undergoing brain epilepsy surgery in select situations.

I. Phrases for an annotation.

the paper explores common problems	в статье исследуются общие проблемы
a detailed description is given to	подробно описываются
the object of this study was	целью исследования явилось
the subject (object, purpose) of the paper is	цель статьи
it is assumed that	предполагается, что
it is found that	найден, что

II. Match the words and word combinations;

1) the epileptic seizures	a) вызывающий
2) medication	b) согласовывать
3) random	c) история болезни
4) triggering	d) кора головного мозга
5) the frontal or temporal lobes	e) эпилептические припадки
6) correlate	f) спинно-мозговая жидкость
7) the clinical history	д) одновременный
8) the brain cortex	h)лечение
9) a skull	i) обычный
10) a cerebrospinal fluid	j) передвижной
11) simultaneous	к) клетка
12) an assess	l) лобная и височные доли
13) a routine	т)случайный
14) an ambulatory	п) череп
15) undergoing	о)оценивать
16) cell	р) подвергающийся

III. Divide the text into parts and call them.

IV. What information is in each of the parts.

V. Choose the right sentence.

1	2
1. In contrast epileptic form EEG patterns occur in about one or two percent of patients without any history of epileptic seizures.	a) Передвижная ЭЭГ позволяет непрерывную регистрацию ЭЭГ, контролирующую во время нормальных действий, и может быть полезной в анализе частоты и определения природы и симптомов заболевания.
2. In selective situation the neurologist may suggest that additional electrodes are applied in order to record the EEG activity that may be missed by a routine EEG.	Ь) Для сравнения. ЭЭГ с эпилептиформными участками встречается даже у одного-двух пациентов, у которых в истории болезни не указаны признаки
3. Ambulatory EEG allows continuous EEG monitoring during normal activities and can be helpful in assessment of seizure frequency and determination of the	c) Диагноз эпилепсии обычно основан на истории болезни.
4. The diagnosis of epilepsy is usually based on the history.	d) В особых выборочных состояниях неврологи могут предложить дополнительные электроды, обеспечивающие дополнительную запись ЭЭГ 1

VI. Agree or disagree.

1. The EEG may play an important role in the classification of the type of epileptic seizure.
2. If the area triggering seizures lies deep within the brain, the EEG may not be normal.
3. Relatives of individuals who have epilepsy may have inherited genetic EEG patterns.
4. The EEG measures the difference in electrical potential between four points on the surface of the head.
5. Patients aren't be able to walk around and leave the hospital with the EEGrecordings on.

VII. Answer the questions.

1. What is EEG and where can it be used?
2. What does the EEG measure?
3. What can additional electrodes be applied for?
4. What does video EEG monitoring allow?
5. What does ambulatory EEG allow?

VIII. Write the annotation-

UNIT IV. PHOTOELECTRIC PLETHYSMOGRAPHY

Photo-plethysmography (PPG) provides a qualitative assessment of changes in cutaneous blood volume. It is based on the determination of the optical properties of a selected skin area. The PPG electrode is composed of an infrared light emitting diode and a photosensor. Light transmitted into the skin is scattered and absorbed by tissue in the illuminated field. Blood, being more opaque than surrounding tissue, attenuates the reflected light in greater proportion. The intensity of reflected light changes with tissue blood density. The measurement is localized to the microvasc.ulature of the cutaneous layer underlying the electrode. The instrument may be used to measure arterial pulsations or transient venous volumes. To measure changes in venous volume, the voltage signal generated in the photo sensor is amplified through a DC coupled circuit, which dampens higher frequency arterial pulsations, leaving a low frequency response with a longer time constant. This produces a relatively stable tracing, which corresponds to blood density in the underlying tissue. The PPG is able to monitor alterations in tissue venous filling as the patient is asked to perform certain maneuvers. There are two different types of probes that can be used for PPG measurements:

1. Reflection probe: This type of probe can also be used for the venous test. The light emitting and sensitive parts are located side by side in one probe. The photosensors detect the light, which is backscattered from the tissue of the skin. Due to the body's anatomy, the PPG sensors can only detect the pulse waves in areas that contain many arteriovenous anastomoses such as the fingers, toes, earlobes, or some regions of the face.
2. Transmission probe: In these probes, the photosensors are located on the opposite side of the light emitting parts. The tissue is located between them. This limits the field of application to locations where the light can penetrate all the way through the tissue (e.g., fingers, toes, or earlobes). In contrast to the reflection probe, the main sources of pulsation also contain the large vessels making these sensors especially useful for peripheral blood pressure measurements.
3. PPG testing should be performed in temperature controlled environments and skin temperature should be maintained near thermoneutral temperatures in the range of 28-32°C. Thermoregulatory adjustments in cutaneous blood flow may otherwise affect test results. The results of PPG testing are most often used to evaluate venous hemodynamics of the entire limb. However, it provides localized superficial assessment. Extrapolating the results of testing to the whole limb is of questionable value. The potential use of either instrument for evaluating local derangements in venous hemodynamics has not been adequately explored. Some of the prominent applications of PPG are in the diagnosis of arterial diseases in fingers and toes, functional disturbances of blood flow (e.g., Raynaud's syndrome), thoracic outlet syndrome and measurement of peripheral blood pressure.

I. Phrases for an annotation:

1. the paper is about	статья о...
2. the paper provides ciTevigw	статья представляет сббойобзор
3. the paper discusses, considers examines, analyses, reports on, touches upon	статья обсуждает, рассматривает, исследует, анализирует, сообщает, затрагивает
4. much attention is given to	много внимания уделено

II. Read the text and match the words with the translation:

1) cutaneous	a) кожный
2) photo-sensor	b) фотодатчик
3) tissue	c) темный, непрозрачный
4) scatter	d) ослаблять, смягчать, уменьшать
5)opaque	e)капилляр
6) attenuate	0 венозное кровенаполнение
7) microvasculature	д) рассеиваться
8) venous volumes	h)увеличивать
9) dampen	I) часть
10) amplify	j) ткань
11) probe	к) мочка уха
12) emitting	I) сосуд
13) earlobe	т) конечность
14) light emitting parts	п) исследование
15) vessel	о) испускаемый
16) limb	р) светодиод

III. Divide the text into the parts and give the titles of each of them.

IV. What is the information in each of the parts.

V. Choose the right translation:

1. Photo-plethysmography provides a qualitative assessment of chances in cutaneous blood volume.	a) некоторые из выделенных применений ФПГ относятся к диагностике артериальных болезней в пальцах рук и пальцах ног, функциональных нарушениях кровотока (например,, синдром Раундана), грудной синдром выхода и измерение давления периферической крови.
2. Blood, being more opaque than serrounding tissue, attenuates the reflected light in greater proportion.	Ь) фотодатчики реагируют на свет, который отражается от ткани кожи.
3. The photosensor detect the light which is backscattered from the tissue of the skin	c) кровь менее прозрачная, чем окружающая ее ткань, поэтому интенсивность отраженного от него света больше
4. Some of the prominent applications of PPG are in the diagnosis of arterial diseases in fingers and toes, functional disturbances of blood flow (e.g. Rayriauld's syndrome, thoracic outlet syndrome and measurement of peripheral blood pressure.	d) фотоплетизмография обеспечивает качественную оценку анализа изменений кровенаполнения кожи

VI. Agree or disagree:

1. Photo-plethysmography doesn't provide a qualitative assessment of changes in cutaneous blood volume.
2. The measurement is localized to the microvasculature of the cutaneous layer underlying the electrode.
3. Reflection probe can't be used for venous test.
4. PPG can only detect the pulse wave in some regions of the face,
5. The results of PPG testing are most often used to evaluate venous hemodynamics of the entire limb.

VII. Answer the questions:

1. What does photo-plethysmography provide?
2. What is it based on?
3. What is instrument used to?
4. What is PPG able to monitor?
5. What is the difference between a reflection and a transmission probe?
6. What are the results of PPG testing used to?

VIII. Write the annotation to the text.

UNIT V. FUNDAMENTALS OF EEG MEASUREMENT

Electroencephalography is eT medical imaging technique that reads scalp electrical activity generated by brain structures. The electroencephalogram (EEG) is defined as electrical activity of an alternating type recorded from the scalp surface after being picked up by metal electrodes and conductive media. The EEG measured directly from the cortical surface is called electrocortiogram while when using depth probes it is called electrogram. In this article, we will refer only to EEG measured from the head surface. Thus electroencephalographic reading is a completely non-invasive procedure that can be applied repeatedly to patients, normal adults, and children with virtually no risk or limitation.

When brain cells (neurons) are activated, local current flows are produced. EEG measures mostly the currents that flow during synaptic excitations of the dendrites of many pyramidal neurons in the cerebral cortex. Differences of electrical potentials are caused by summed postsy- naptic graded potentials from pyramidal cells that create electrical dipoles between soma (body of neuron) and apical dendrites (neural branches). Brain electrical current consists mostly of Na+, K+, Ca++, and Cl- ions that are pumped through channels in neuron membranes in the direction governed by membrane potential. The detailed microscopic picture is more sophisticated, including different types of synapses involving variety of neurotransmitters. Only large populations of active neurons can generate electrical activity recordable on the head surface. Between electrode and neuronal layers current penetrates through skin, skull and several other layers. Weak electrical signals detected by the scalp electrodes are
massively amplified, and then displayed on paper or stored to computer memory. Due to capability to reflect both the normal and abnormal electrical activity of the brain, EEG has been found to be a very powerful tool in the field of neurology and clinical neurophysiology. The human brain electric activity starts around the 17-23 week of prenatal development.

From the anatomical point of view, the brain can be divided into three sections: cerebrum, cerebellum, and brain stem. The cerebrum consists of left and right hemisphere with highly convoluted surface layer called cerebral cortex. The cortex is a dominant part of the central nervous system. The cerebrum obtains centres for movement initiation, conscious awareness of sensation, complex analysis, and expression of emotions and behaviour. The cerebellum coordinates voluntary movements of muscles and balance maintaining. The brain stem controls respiration, heart regulation, biorythms, neuro-hormone and hormone secretion, etc. The highest influence to EEG comes from electric activity of cerebral cortex due to its surface position. There are some theoretical and practical differences between EEG and MEG. Although the MEG is produced by the same electrical currents, it can provide complementary information to EEG.

I. Phrases for an annotation:

much attention is given to	много внимания уделено
the paper presents a review of	статья представляет обзор
the purpose of the paper is	цель статьи
the author introduces the concept of	автор вводит концепцию

II. Match the words and the word combinations.

1) imaging technique	a) исследование
2) cortical surface	Ь)синоптическиё возбуждения
3) reading	c) вызвана
4) synaptic excitation	d) отображаться на бумаге
5) are caused by	e) мозжечок
6) display on paper	f) сложный
7) cerebellum	д) дополнительный
8) convoluted	h) техническое отображение
9) complementary	i) дыхание
10) respiration	j) поверхность коры головного мозга

III. Divide the text into the parts and name them.

IV. What information is in each of the parts.

V. Choose the right sentence.

1. Thus encephalographic reading is a completely non-invasive procedure that can be applied repeatedly to patients normal adults and children with virtually no risk or limitation	a) мозжечок координирует добровольные движения, поддержание баланса и мышечную деятельность.
2. Differences of electrical potentials are caused by summed postsynaptic graded potentials from pyramidal cells that create electrical rtipolfis hptwpsn мня and apical dendrites	Ь) таким образом, электроэнцефалографическое исследование - это полностью неразрушающая процедура, которая там неоднократно, как взрослым так и детям, без риска и ограничения.
3. The human brain electric activity starts around the 17-23 week of prenatal development.	c) разность электрических потенциалов вызвана суммированием постсинаптических градуируемых нейронов, которые создают диполи между сомом и апикальными дендритами.
4. The cerebellum coordinates voluntary movements of muscles and balance maintaining.	d) человеческая мозговая электрическая активность начинается примерно на 17-23-й неделе плода.

V. Agree or disagree.

1. Electroencephalography is a risk for children.
2. The detailed microscopic picture is less sophisticated.
3. Weak electrical signals detected by scalp can't be displayed on paper.
4. The cerebrum coordinates voluntary movements of muscles.
5. The brain stem controls respiration, heart regulation, biorythms. neurohormone and hormone secretion.

VI. Answer the questions:

1. What is an electroencephalography?
2. What is it recorded from?
3. How is it called when using depth probes?
4. What currents does EEG mostly measure?
5. When does the human brain electric activity start?
6. What sections can the brain be divided?
7. What is a cortex?
8. What does the cerebrum obtain?
9. What does the cerebellum coordinate?
10. What is the difference between EEG and MEG?

VII. Write the annotation.

UNIT VI. MEDICAL DEVICES

This is an ***extremely broad category*** - essentially covering all healthcare products that do not achieve their intended results through predominantly chemical (e.g. pharmaceuticals) or biological (e.g., vaccines) means, and do not involve metabolism.

A medical device is intended for use in: the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease.

Some examples include pacemakers, infusion pumps, the heart- lung machine, dialysis machines, artificial organs, implants, artificial limbs, corrective lenses, cochlear implants, ocular prosthetics, facial prosthetics and dental implants.

Stereo-lithography is a practical example of ***medical modeling*** being used to create physical objects. Beyond modeling organs and the human body, emerging engineering techniques are also currently used in the research and development of new devices for innovative therapies, treatments, patient monitoring, and early diagnosis of complex diseases

Medical devices are regulated and classified (in the US) as follows:

1. Class I devices present minimal potential for harm to the user and are often simpler in design than Ciass II or Class III devices. Devices in this category include tongue depressors, bedpans, elastic bandages, examination gloves, and hand-held surgical instruments and other similar types of common equipment.
2. Class II devices are subject to special controls in addition to the general controls of Class I devices. Special controls may include special labeling requirements, mandatory performance standards. Devices in this class are typically non-invasive and include x-ray machines, PACS, powered wheelchairs, infusion pumps, and surgical drapes.
3. Class III devices generally require pre-market approval, a scientific review to ensure the device's safety and effectiveness, in addition the general controls of Class I. Examples include replacement ~~heart valves, silicone~~ filled breast i~~mplants~~, implants ~~cerebella~~ stimulators, unpalatable pacemaker pulse generators and end osseous (infra-bone); implants.

I. Match the words and the word combinations.

1)to cure	a) продукты здравоохранения
2) mitigation	b) искусственный
3) an infusion pump	c) уменьшение
4) surgical instruments	d) кохлеарный имплант
5) healthcare product	e) глазной протез
6) artificial	f) лечение
7) tongue depressions	д) депрессоры языка
8) cochlear implant	h) насос вливания
9) ocular prosthetics	I) приводные инвалидные кресла
10) powered wheelchair	j) хирургические инструменты
11) surgical drapes	к) внутрикостные импланты
12) an endosseous implant	1) хирургические простыни

II. Divide the text into parts and give the title to each of them.

III. What is the information In each of them?

IV. Choose the right translation:

1. Divices in this category include tongue depressors, elastic bandages, examination gloves, hand-held surgical instruments and other similar types of common equipment.	a) это чрезвычайно широкая категория, по существу, покрывающая все продукты здравоохранения, которые не достигают их намеченных результатов через преобладающие химические или биологические средства, и не вовлекают метаболизм.
2. Stereo-lithography is a practical example of medical modeling being used to create physical objects.	Ь) устройства в этом классе являются типично неразрушающимися и включают рентгеновские аппараты, насосы вливания и хирургические простыни.
3. Devices in this class are typically non-invasive and include X-ray machines, infusion pumps and surgical drapes.	c) стереолитография - практический пример медицинского моделирования, используемого, чтобы создать физические объекты.
4. This is an extremely broad category essentially covering all healthcare products that don't achieve their intended results through predominantly chemical or biological means, and don't involve metabolism.	d) устройства этой категории включают депрессоры языка, эластичные бандажи, перчатки обследования и переносные хирургические инструменты.

V. Agree or disagree.

1. A medical device is only intended for use in the diagnoses of diseases.
2. Stereo-lithography is a practical example of medical modeling for creating physical objects.
3. Class I devices include X-ray machines,
4. Class II devices include bedpans, examination gloves.

, 5. Class III devices include replacement heart valves, silicone gel- filled breast implant.

VI. Answer the questions:

1. What are medical devices used for?
2. What do some medical devices include?
3. What is stereo-lithography used to?
4. How are medical devices regulated?
5. What devices are included in the first category?

6.. What are the second- class devices?

7. What do the third-class devices include?

VIII. Write the annotation.

UNIT VII. VENTR ASSIST LVAS

Ventr Assist is a new third generation cardiac assist system primarily designedas a permanent alternative to heart transplant for patients suffering heart failure. It is a blood pump that connects to the left ventricle of the diseased heart to help ailing heart's pumping function and assists in restoring a better quality of life.

It can also be used as a bridge to heart transplant and possibly a bridge to recovery, where it may allow a deteriorating heart an opportunity to recuperate. Ventr Assist has only one moving part - a hydro dynamically suspended impeller. It has been designed to have no wearing parts or cause blood damage. It weighs just 298 grams (10 oz) and measures 60 mm (2.5 inches) in diameter, making it suitable for both children and adults. The implanted parts of the Ventr Assist system use materials which are fully biocompatible including titanium alloys.

Its components are light, strong, non-toxic and highly resistant to degradation within a body. The Ventr Assist is an outstanding advance over the older heart- assist devices. Its unique combination of features and benefits include;

features:

- a small size
- a patented hydro dynamically suspended impeller
- a fully redundant back-up motor drive, controller and processor
- a diamond-like carbon coating on blood contacting surface

benefits:

- assists the natural heart which is not removed
- no wearing parts
- advanced information management allows remote monitoring and logging of critical data.
-

I. Match the words and word combinations with Russian.

1) cardiac assist system	a) полное резервирование электроприборов
2) heart transplants	b) сердечная недостаточность
3) a heart failure	c) левый желудочек
4) a blood pump	d) переход
5) a left ventricle	e) система поддержки сердечной деятельности
6) an ailing heart's pumping system	f) вылечить сердечную недостаточность
7) a bridge	д) сердечные трансплланты
8) deteriorating heart recuperate	h) кровяной насос
9) a suspended impeller	i) биосовместимый
10) bioqompatible	j) ухудшение свойств внутри тела [c]
11) titanium alloys	к) алмазоподобное углеродистое соединение
12) a degradation within body	1) лопастное колесо
13) diamond-like carbon coating	т) титановые сплавы
14) a fully redundant back-up motor drive	п) нарушение сердечной насосной функции

II. Divide the text into the parts and give the title to each of them.

III. What information is in each of them?

IV. Choose the right translation:

1	2
1. It is a blood pump that connects to the left ventricle of the diseased heart to help the ailing heart's pumping function and assist in restoring a better quality of life.	a) имплантируемые части системы Ventr Assist состоят из материалов, которые полностью биосовместимы.
2. It can also be used as a bridge to a heart transplant.	b) **он также может быть использован в качестве перехода к сердечному трасплантанту.**
3. It has been designed to have no wearing parts or cause blood damage.	**c) именно кровяной насос подключается к левому желудочку больного, чтобы ПОМОЧЬ нарушенной насосной сердечной функции и способствовать восстановлению**
4. The implanted parts of Ventr Assist system use materials which	d) **он был создан без деталей, подверженных износу или покрови.**

V. Agree or disagree.

1. Ventr Assist is a new first generation cardiac assist system.
2. It is a blood pump that connects to the left ventricle of diseased heart.
3. 1t weighs just 398 grams.
4. The components aren't light or strong.
5. Ventr Assist system has two moving parts.

VI. Answer the questions.

1. What is the subject of the text?
2. Who is Ventr Assist designed for?
3. How does the blood pump work?
4. How many parts does Ventr Assist have?
5. What can you say about its size?
6. What kind of materials are used for this device?
7. What can you say about its features and benefits?

VII. Write the annotation.

An implant is a kind of medical device made to replace and act as a missing biological structure. The surface of implants that contact the body might be made of a biomedical material such as titanium, silicone or apatite depending on what is the most functional. In some cases implants contain electronics e.g. artificial pacemaker and cochlear implants. Some implants are bioactive, such as subcutaneous drug delivery devices in the form of implantable pills.

Nanotechnology and nanoscience will be in leading development of completely new drugs with more useful behavior and less side effects.

Cancer.

The small size of nanopartieles endows them with properties that can be very useful in oncology, particularly in imagine. Quantum dots, when used in conjunction with MRI (magnetic resonance imaging), can produce exceptional images of tumor sites. These nanoparticles are much brighter than organic dyes and only need one light source for excitation. This means that the use of fluorescent quantum dots could produce a higher contrast image arid of a lower cost than today's organic dyes used as contrast media. The downside, however, is that quantum dots are usually made of quite toxic elements. Nanoparticles of cadmium selenide (quantum dots) glow when exposed to ultraviolet light. When injected, they seep into cancer tumors. The' surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal.

I. Match the words and word combinations with Russian equivalents.

1) to replace	a) раковая опухоль
2) artificial pacemaker	b) квантовые точки
3) cochlear implant	c)заменять
4) quantum dots	d)кохлеарный имплантант
5)cancer tumor	e) искусственный водитель

II. Divide the text into parts and give the title to each of them.

III. What information is in each of the parts.

IV Choose the right translation:

1. An implant is a kind of medical de vice made to replace and act as a missing biological structure.	a) однако отрицательной стороной является то, что квантовые точки делаются из ядовитых элементов.
2. Some implants are bioactive, such as subcutaneous drug delivery device in the form of implantible pills.	Ь) небольшой размер наночастиц обеспечивает их свойствами, которые могут быть полезны в онкологии.
3. The small size of nanoparticles endows them with properties that can that can be very useful in oncology.	c) некоторые имплантанты являются биологически активными, такие как подкожные устройства впрыска препарата в форме
4. The downside, however, is that quan- turn dots are usually made of quite toxic elements. V	d) имплантант - это своего рода медицинское устройство, сделанное для замены, и действует как недостающая биологическая структура.

V. Agree or disagree.

1. The surface of implants is made of silver.
3. In some cases implants contain electronics.Some implants are bioactive.
4. The nanoparticles can't be used in oncology.
5. The quantum dots are not toxic.

VI. Answer the questions.

1. What is an implant?
2. What is the surface of implant made of?
3. What do some implants contain?
4. Why can nanoparticles be used in oncology?
5. Why do nanopartdes glow?

VII. Write the annotation.

UNIT VIII IMPLANTS

An implant is a kind of medical device made to replace and act as a missing biological structure. The surface of implants that contact the body might be made of a biomedical material such as titanium, silicone or apatite depending on what is the most functional. In some cases implants contain electronics e.g. artificial pacemaker and cochlear implants. Some implants are bioactive, such as subcutaneous drug delivery devices in the forrn of implantable pills.

Nanotechnology and nanoscience will be in leading development of completely new drugs with more useful behavior and less side effects.

Cancer.

The small size of nanopartieles endows them with properties that can be very useful in oncology, particularly m imagine. Quantum dots, when used in conjunction with MRI (magnetic resonance imaging), can produce exceptional images of tumor sites. These nanoparticles are much brighter than organic dyes and only need one light source for excitation. This means that the use of fluorescent quantum dots could produce a higher contrast image and of a lower cost than today's organic dyes used as contrast media. The downside, however, is that quantum dots are usually made of quite toxic elements. Nanoparticles of cadmium selenide (quantum dots) glow when exposed to ultraviolet light. When injected, they seep into cancer tumors. The' surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal.

I. Match the words and word combinations with Russian equivalents.

1) to replace	a) раковая опухоль
2) artificial pacemaker	b) квантовые точки
3) cochlear implant	c) заменять
4) quantum dots	d)кохлеарный имплантант
5)cancer tumor	e) искусственный водитель

II. Divide the text into parts and give the title to each of them.

III. What information is in each of the parts.

1. An implant is a kind of medical de vice made to replace and act as a missing biological structure.	a) однако отрицательной стороной является то, что квантовые точки делаются из ядовитых элементов.
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4. The downside, however, is that quan- turn dots are usually made of quite toxic elements. V	d) имплантант - это своего рода медицинское устройство, сделанное для замены, и действует как недостающая биологическая структура.

IV. Agree or disagree.

1. The surface of implants is made of silver.
2. In some cases implants contain electronics.
3. Some implants are bioactive.
4. The nanoparticles can't be used in oncology.
5. The quantum dots are not toxic.

V. Answer the questions.

1. What is an implant?
2. What is the surface of implant made of?
3. What do some implants contain?
4. Why can nanoparticles be used in oncology?
5. Why do nanopartdes glow?

VI. Write the annotation.

UNIT IX. ELECTROCARDIOGRAPHY

I. Read and translate words.

Electrocardiographic device, electrical activity, root, sinoatrial node,systole, weaknesses, myocardial infarction, transthoracic interpretation, nuclear medicine.

II. Read and translete the text, learn the italicized word combinations:

Electrocardiography

Electrocardiography (ECG or EKG) is a ***transthoracic interpretation*** of the ***electrical activity of*** the heart over time captured and externally recorded by ***skin electrodes.*** It is a noninvasive recording produced by an ***electrocardiographic device.*** The etymology of the word is derived from ***electro,*** because it is related to electrical activity, ***cardio,*** Greek for heart, and ***graph,*** a Greek root meaning "to write".

Electrical impulses in the heart originate in the ***sinoatrial node*** and travel through the intimate conducting system to the ***heart muscle.*** The impulses stimulate the myocardial muscle fibres to contract and thus induce ***systole.*** The electrical waves can be measured at electrodes placed at specific points on the skin. Electrodes on ***different sides*** of the heart measure the activity of different parts of the heart muscle. An ECG displays the ***voltage*** between pairs of these electrodes, and the muscle activitythat they measure, fromdifferent directions, can also be understood as vectors. This display indicates the overall rhythm of the heart and weaknesses in different parts of the heart muscle. It is the best way to measure and diagnose abnormal rhythms of the heart, particularly abnormal rhythms caused by damage to the conductive tissue that carries electrical signals, or. ***abnormal rhythms*** caused by electrolyte imbalances. In a ***myocardial infarction*** (MI), the ECG can identify if the heart muscle has been damaged in specific areas, though not all areas of the heart are covered.The ECG cannot reliably measure the pumping ability of the heart, for which ***ultrasound-based (echocardiography)*** or nuclear medicine tests are used.

Alexander Muirhead is reported to have attached wires to a feverish patient's wrist to obtain a record of the ***patient's heartbeat*** while studying for his Doctor of Science (in electricity) in 1872 at St Bartholomew's Hospital. This activity was directly recorded and visualized using a Lippmann capillary electrometer by the British physiologist John Burdon Sanderson.The first to systematically approach the heart from an electrical point-of-view was Augustus Waller, working in St Mary's Hospital in Paddington, London.His electrocardiograph machine consisted of a Lippmann capillary electrometer fixed to a projector. The trace from the heartbeat was projected onto a photographic plate which was itself fixed to a toy train. This allowed a heartbeat to be recorded in real time.
In 1911 he still saw little clinical application for his work.

An initial breakthrough came when Willem Einthoven, working in Leiden, The Netherlands, used the string galvanometer that he invented in 1903. This device was much more sensitive than both the capillary electrometer that Waller used and the string galvanometer that had been invented separately in 1897 by the French engineer Clement Ader.

: _Einthoven assigned the letters P. O. R, S and T to the various _____ jj deflections, and described the electrocardiographic features of a number of cardiovascular disorders. In 1924, he was awarded the Nobel Prize in Medicine for his discovery,

Though the basic principles of that era are still in use today, there have been many advances in ***electrocardiography*** over the years.
The instrumentation, for example, has evolved from a ***cumbersome*** » ***laboratory*** apparatus to compact electronic systems that often include computerized ***interpretation*** of the electrocardiogram.

III. Match the words to make sentences.

1. Electrodes on different sides of the heart measure
2. The first to systematically approach the heart from an electrical point-of-view
3- In a myocardial infarction, the ECG can identify if
4. Electrical impulses in the heart
5. The ECG cannot
6. The impulses stimulate the myocardial muscle fibres
7. Alexander Muirhead is reported to have attached wires to

a) originate in the sinoatrial node;
b) a feverish patient’s wrist to obtain a record of the patient's heartbeat;
c) the heart muscle has been damaged in specific areas;
d) was Augustus Waller;
e) reliably measure the pumping ability of the heart;
f) the activity of different parts of the heart muscle;
g) to contract and thus induce systole.

IV. Find a word from the text that means:

1. the original form of a word from which others are developed - _____

2. the movement of the heart ■_____ .
3.one of the bands or bundles of tissue that can be tightened or loosened to produce movement '
4. the joint between the hand and the arm _____
5. the state of being weak _____

V. Reread the passage and answer the questions.

1. Where do electrical impulses originate?
' 2. What does systole mean?
3. How can the electrical waves be measured?
4. Who was the first person to systematically approach the heart from an electrical point-of-view?
5. What device was much more sensitive than the capillary electrometer?
6. In what way can ECG identify that the heart muscle has been damaged in specific area?
7. Who awarded the Nobel Prize in Medicine in 1924 ?

VI. Translate from Russia to English.

1. Электрокардиография - методика регистрации и исследования электрических полей, образующихся при работе сердца.
2. Для измерения разности потенциалов на различные участки тела накладываются электроды.
3. Деятельность мускулатуры сердца измеряют электродами.
4. Данные на дисплее показывают весь ритм биения сердца.
5. Электрокардиография представляет собой относительно недорогой, но ценный метод электрофизиологической инструментальной диагностики в кардиологии.
6. Прямым результатом электрокардиографии является получение электрокардиограммы (ЭКГ) - графического представления разности потенциалов, возникающих в результате работы сердца.
7. На ЭКГ отражается усреднение всех векторов потенциалов действия, возникающих в определённый момент работы сердца.
8. Электрокардиограмма записывается на термобумаге. Полностью электронные приборы позволяют сохранять ЭКГ в компьютере.
9. Применяемые в современных электрокардиографах фильтры сигнала позволяют получать более высокое качество электрокардиограммы, внося при этом некоторые искажения в форму полученного сигнала.
10. В 1924 году Виллему Эйнтховену присудили Нобелевскую премию по медицине.

UNIT X. COMPUTED TOMOGRAPHY (CT)

I. Read and translate words.

Depth of field, medical imaging method, a volume of data, three-dimensional image, a single axis of rotation, nondestructive materials testing, a water-filled Perspex tank, "windowing", research branch, head-cap.

II. Read and translate the text, learn the italicized word combinations:

Computed tomography (СГ) is a ***medical imaging method*** employing tomography created by computer processing ***Digital geometry processing*** is used to generate a three-dimensional image of the ***inside of*** an object from a large series of two-dimensional ***X-ray images*** taken around a single axis of rotation

CT produces a volume of data which can be manipulated, through a process known as ***"windowing", in order to*** demonstrate various bodily structures based on their ability to block the X-ray. Although historically the images generated were in the axial or transverse plane, ***orthogonal*** to the long axis of the body, modern scanners allow this volume of data to be reformatted in various planes or even as volumetric (3D) representations of structures. Although most common in medicine, CT is also used in other fields, such as ***nondestructive materials testing.***

The word "tomography" is derived from the Greek tomos (slice) and graphein (to write). Computed tomography was originally known as the "EMI scan" as it was developed at a ***research branch*** of EMI, a company best known today for its music and recording business. It was later known as computed axial tomography (CAT or CT scan) and body section ***rontgenography.***

In the early 1900s, the Italian radiologist Alessandro Vallebona proposed a method to represent a ***single slice*** of the body on the radiographic film. This method was known as tomography. The idea is based on simple principles of projective geometry: moving ***synchronously*** and in ***opposite*** directions the ***X-ray tube*** and the film, which are connected together by a ***rod*** whose ***pivot point*** is the focus; the image created by the points on ***the focal plane*** appears sharper, while the images of the other points annihilate as noise. This is only marginally effective, as blurring occurs only in the "x" plane. There are also more complex devices which can move in more than one plane and perform more effective It has been claimed that thanks to the success of The Beatles, EMI could fund research and build early models for medical use. The first production X-ray CT machine (in fact called the "EMI-Scanner") was limited to making tomographic sections of the brain, but acquired the image data in about 4 minutes (scanning two adjacent slices), and the computation time (using a Data General Nova minicomputer) was about 7 minutes per picture. This scanner required the use of a ***water-filled Perspex tank with*** a pre-shaped rubber ***"head-cap"*** at the front, which enclosed the patient's head. The water-tank was used to reduce the dynamic range of the radiation reaching the detectors (between scanning outside the head compared with scanning through the bone of the skull). The images were relatively low resolution, being composed of a matrix of, only 80 x 80 pixels. ‘

A form of tomography can be performed by moving the X-ray source and detector during an exposure. Anatomy at the target level remains sharp, while structures at different levels are blurred. By varying the extent and path of motion, a variety of effects can be obtained, with variable ***depth of field and*** different degrees of blurring of ***"out of p/and'*** structures.

III. Fill the gaps, (inside of, through, opposite, at the front, during,opposite)

1. Digital geometry processing is used to generate a three-dimensional image of the _ ____ an object.
2. CT produces a volume of data which can be manipulated, _____ a process known as "windowing"
3. The idea is based on simple principles: moving synchronously and in _____ directions the X-ray tube
4. This scanner required the use of a water-filled Perspex tank with a pre-shaped rubber "head-cap" _____which enclosed the patient's head
5. A form of tomography can be performed by moving the X-ray source and detector _■ an exposure.

IV. Reread the passage and answer the questions:

1. What is computed tomography?
2. What is Digital geometry processing used for?
3. Who proposed a method to represent a single slice of the body?
4. What is the idea of tomography based on?
5. Where is computer tomography used?
6. What did the "EMI-Scanner" require?
7. For what purpose was the water-tank used in the "EMI- Scanner" ?
8. What resolutions did the scanner s images have?
9. How can a form of tomography be performed?
10. How is the imagine created?

V. Match the words to make sentences.

1. Computed tomography was known as the "EMI scan"
2. There are more complex devices which
3. Digital geometry processing is used
4. The idea is based on
5. This scanner required the use of
6. The water-tank was used
7. Modern scanners allow the volume of data
8. The images from scans took 2.5 hours
9. Historically the images generated
10. A form of tomography can be performed

a) to generate a three-dimensional image of the inside of an object;
b) simple principle of projective geometry: moving synchronously;
c) to reduce the dynamic range of the radiation;
d) by moving the X-ray source and detector during an exposure;
e) showing the relationship between the X-ray;
f) were in the axial or transverse plane;
g) as it was developed at a research branch of EMI;
h) to be processed by algebraic reconstruction techniques on a large computer;
i) a water-filled Perspex tank with a pre-shaped rubber "head- cap" at the front;
j) to be reformatted in various planes;
k) can move in more than one plane.

VI. Translate from Russia to English.

1. Методика компьютерной томографии основана на измерении и сложной компьютерной обработке (КТ) разности ослабления рентгеновского излучения различными по плотности тканями.
2. Прогресс КТ напрямую связан с увеличением количества детекторов, то есть с увеличением числа одновременно собираемых проекций.
3. Для улучшения дифференцировки органов друг от друга, а также нормальных и патологических структур используются различные методики контрастного усиления.
4. С математической точки зрения построение изображения сводится к решению системы линейных уравнений.
5. Для визуальной и количественной оценки плотности визуализируемых методом компьютерной томографии структур используется шкала ослабления рентгеновского излучения.
6. «Рентгеновская плотность» - усредненное значение поглощения тканью излучения.
7. Компьютерная томография - метод был предложен в 1972 г Годфри Хаунсфилдом и Алланом Кормаком, удостоенными за эту разработку Нобелевской премии.
8. Современный компьютерный томограф представляет собой сложный программно-технический комплекс.
9. Механические узлы и детали выполнены с высочайшей точностью.
10. Для регистрации прошедшего через среду рентгеновского излучения используются сверхчувствительные детекторы, конструкция и материалы, применяемые при изготовлении которых, постоянно совершенствуются.

UNIT XI. BLOOD PRESSURE METER

I. Read and translate words.

Sphygmomanometer, inflatable cuff, pressure blood flow, stethoscope, inflation bulb, valve, tongue, flipper, artery, brachial artery, pounding sound, whooshing,

II. Read and translate the text, learn the italicized word combinations:

A sphygmomanometer or ***blood pressure meter*** is a device used to measure blood pressure, comprising an ***Inflatable cuff*** to restrict blood flow, and a mercury or mechanical manometer to measure the pressure. It is always used in conjunction with a means to determine at what ***pressure blood flow*** is just starting, and at what pressure it is unimpeded. Manual sphygmomanometers are used in conjunction with a stethoscope.

The word comes from the Greek ***sphygmos*** (pulse), plus the scientific term manometer (pressure meter). The device was invented by Samuel Siegfried Karl Ritter von Basch in 1881.A sphygmomanometer consists of an inflatable cuff, a measuring unit (the mercury manometer, or aneroid gauge), and ***inflation bulb and valve,*** for manual instruments.

In humans, the cuff is normally placed smoothly and snugly around an upper arm, at roughly the same vertical height as the heart while the subject is seated with the arm supported. Other sites of placement depend on species, and may include the ***tongue, flipper, tail or teat.*** It is essential that the correct size of cuff is selected for the patient. Too small a cuff results in too high a pressure, whilst too large a cuff results in too low a pressure. The cuff is inflated until the artery is completely occluded. Listening with a stethoscope to the ***brachial artery*** at the elbow, the examiner slowly releases the pressure in the cuff. As the pressure in the cuffs falls, a ***"whooshing"*** or ***pounding sound*** is heard when blood flow first starts again in the artery. The pressure at which this sound began is noted and recorded as the systolic blood pressure. The cuff pressure is further released until the sound can no longer be heard. This is recorded as the diastolic blood pressure.

There are three types of sphygmomanometers:

- Digital with manual or automatic inflation. These are electronic, easy to operate, and practical in noisy environments. Many have not been validated for ail patient groups, and they can give very inaccurate reading. They measure ***mean arterial pressure*** (MAP) and use oscillometric detection to calculate systolic and diastolic values.
- Digital portable finger blood pressure monitors with automatic inflation. These are more portable and easy to operate, although less accurate. They are the smallest blood pressure monitors.
- Manual. Should be operated by a trained person. Mercury manometers are considered to be the "gold standard" of measurement because their measurement is absolute and does not require recalibration. For this reason they are often required in clinical trials of pharmaceuticals and for clinical evaluations of determining blood pressure for high risk patients including pregnant women.

III. Match the words to make sentences.

1. A sphygmomanometer is a device
2. The cuff is
3. Digital portable finger blood pressure monitors
4. Manual sphygmomanometers are
5. Mercury manometers are
6. Digital sphygmomanometers
7. It is essential that the correct size of cuff is
8. The pressure at which this sound began is
9. The examiner slowly releases

a) used in conjunction with a stethoscope;
b) selected for the patient;
c) the pressure in the cuff;
d) use oscillometric detection to calculate systolic and diastolic values;
e) a device used to measure blood pressure;
f) measure mean arterial pressure (MAP);
g) with automatic inflation;
h) recorded as the diastolic blood pressure;
i) noted and recorded as the systolic blood pressure;
j) normally placed smoothly and snugly around an upper arm; k) considered to be the "gold standard" of measurement.

IV. Find a word from the text that means:

1. the end of a sleeve near the wrist _____
2. an instrument used by doctors for listening to sounds in the heart and lunas
3. an invention, sometimes made for a special purpose _____
4. move or spread along or over ' _____

5. any round thing as the glass tube in a thermometer

6. that part of an organ in the body which allows blood to flow one way only _____

7. that which is smooth _____

8. the weight or force of air, gas, steam, etc., measured on a unit of area _____

9. the red liquid in the body _____.

10. _____ one of the blood-vessels

V. Reread the passage and answer the questions:

1. What is blood pressure meter?
2. Who was the manometer invented by? When?
3. Where is the cuff placed?
4. What does the manometer include?
5. How is the correct size of cluff selected?
6. How many and what types of sphygmomanometers do you know? Describe them.
7. Why is the cluff inflated?
8. How is the systolic blood pressure determined?

VI. Translate from Russia to English.

1. Сфигмоманометр (тонометр) — прибор для измерения артериального давления.
2. Состоит из манжеты, надеваемой на руку пациенту, устройства для нагнетания воздуха в манжету и манометра, измеряющего давление воздуха в манжете.
3. Сфигмоманометр оснащается либо стетоскопом, либо электронным устройством, регистрирующим пульсации воздуха в манжете.
4. Измерение артериального давления должно проводиться в спокойной комфортной обстановке при комнатной температуре.
5. Для измерения артериального давления манжету располагают на плечевой части левой руки на уровне сердца и нагнетают в манжету воздух до тех пор, пока его давление не будет большим предполагаемого систолического (верхнего) давления у пациента
6. Принцип работы прибора прост: когда давление в манжете превышает давление крови, манжета пережимает артерию.
7. Когда давление в артерии превышает давление в манжете, артерия резко распрямляется, это распрямление и слышно как щелчок.
8. Автоматические сфигмоманометры не требуют использования стетоскопа.
9. Появлению полностью автоматических тонометров предшествовала разработка тонометров-полуавтоматов, в которых нагнетание воздуха в манжету осуществляется вручную.
10. Современные модели тонометров способны при измерении артериального давления указать на признаки не только артериальной гипертонии, но и других заболеваний.

UNIT XII. TOMOSYNTHESIS

I. Read and translate words.

Digital tomosynthesis, rotation angle, discrete exposures, yield images, thicknesses, radiation exposure, narrow slice, breast imaging, reconstruction algorithms, preventive medicine, pulmonary embolism, great vessels, coronary artery disease.

II. Read and translate the text, learn the italicized word combinations:

Digital tomosynthesis combines digital image capture and processing with simple tube/detector motion as used in conventional radiographic tomography. Although there are some similarities to CT, it is a separate technique. In CT, the source makes a complete 360-degree rotation about the subject obtaining a complete set of data from which images may be reconstructed. In digital tomosynthesis, only a small
rotation angle (e.g., 40 degrees) with a small number of ***discrete exposures (e.g.,*** 10) are used. This incomplete set of data can be digitally processed to ***yield images*** similar to conventional tomography with a limited depth of field. However, because the image processing is digital, a series of slices at different depths and with different ***thicknesses*** can be reconstructed from the same acquisition, saving both time and ***radiation exposure.***

Because the data acquired is incomplete, tomosynthesis is unable to offer the extremely ***narrow slice*** widths that CT offers. However, higher resolution detectors can be used, allowing very-high in-plane resolution, even if the Z-axis resolution is poor. The primary interest in tomosynthesis is in ***breast imaging,*** as an extension to mammography, where it may offer better detection rates with little extra increase in radiation exposure.

Reconstruction algorithms for tomosynthesis are significantly^ different from conventional CT, because ***the conventional filtered back projection algorithm*** requires a complete set of data. Iterative algorithms based upon ***expectation maximization*** are most commonly used, but are extremely computationally intensive. Sonje manufacturers have produced practical systems using off-the-shelf GPUs to perform the reconstruction.

Since its introduction in the 1970s, CT has become an important tool in medical imaging to supplement X-rays and medical ultrasonography. It has more recently begun to also be used for ***preventive medicine*** or screening for disease, for example CT colonography for patients with a high risk of ***colon cancer,*** A number of institutions offer full-body scans for the general population. However, this is a controversial practice, given its ***lack of*** proven benefit, cost, radiation exposure, and the risk of finding 'incidental' ***abnormalities*** that may trigger additional investigations.

CT can be used for detecting both acute and chronic changes in the lung parenchyma, that is, the internals of the lungs. It is particularly relevant here because normal two dimensional x-rays do not show such defects. A variety of different techniques are used depending on the suspected abnormality. For evaluation of chronic interstitial processes (emphysema, fibrosis, and so forth), thin sections with high spatial frequency reconstructions are used-often scans are performed both in .
inspiration and expiration. This special technique is called High Resolution *
CT (HRCT). HRCT is normally done with thin section with skipped areas between the thin sections. Therefore it produces a sampling of the Sung
and not continuous images. Continuous images are provided in a standard CT of the chest.

For detection of airspace disease (such as pneumonia) or cancer, relatively thick sections and general purpose image reconstruction techniques may be adequate. IV contrast may also be used as it clarifies the anatomy and boundaries of ***the great vessels*** and improves assessment of the ***mediastinum*** and ***hilar regions*** for ***lymphadenopathy;*** this is particularly important for accurate assessment of cancer.

CT angiography of the chest is also becoming the primary method for detecting ***pulmonary embolism*** (PE) and ***aortic dissection,*** and requires accurately timed rapid injections of contrast (Bolus Tracking) and high-speed helical scanners. CT is the standard method of evaluating abnormalities seen on chest X-ray and of following findings of uncertain acute significance. Cardiac CTA is now being used to diagnose ***coronary artery disease.***

III. Match the words to make sentences.

1. Digital tomosynthesis combines
2. A number of institutions
3. ***Reconstruction algorithms*** for tomosynthesis are
4. A variety of different techniques are
5. HRCTis
6. CT has
7. A series of slices at different depths and with different ***thicknesses*** can
8. The primary interest in tomosynthesis is
9. CT can
10. Tomosynthesis is

a) important for accurate assessment of cancer;
b) significantly different from conventional CT;
c) unable to offer the extremely ***narrow slice*** widths that CT offers;
d) used depending on the suspected abnormality;
e) be used for detecting both acute and chronic changes in the lung parenchyma;
f) normally done with thin section with skipped areas between the thin sections;
g) offer full-body scans for the general population;
h) digital image capture;
i) in breast imaging; .
j) become an important tool in medical imaging to supplement X- rays and medical ultrasonography;
k) be reconstructed from the same acquisition.

IV. Reread the passage and answer the questions:

1. What does digital tomosynthesis combine?
2. Why can a series of slices at different depths and with different thicknesses be reconstructed?
3. Why has CT become an important tool in medical imaging?
4. What techniques are used in CT?
5. What does HRCT mean ? How is HRCT done?
6. What is the primary method for detecting pulmonary embolism? ---- - .
7. Is cardiac CTA being used to diagnose aortic dissection?

V. Translate from Russia to English.

1. Томосинтез - рентгенологический метод исследования, представляет собой последовательность томограмм.
2. Метод занимает промежуточное положение по диагностическим возможностям между рентгенографией и компьютерной томографией.
3. Дозовая нагрузка не превышает таковую при линейной томографии.
4. Метод в целом более информативен, но для некоторых локализаций уступает по эффективности методам классической рентгенологии.
5. Преимущество метода в том, что он позволяет, сводя к минимуму проекционные наложения, визуализировать структуры, недоступные при классической рентгеноскопии.
6. Работы над данным методом начались в 1988 году с целью расширения возможностей линейной томографии.
7. В настоящее время ведутся работы по повышению эффективности метода и расширения круга заболеваний доступных для диагностики с помощью томосинтеза.
8. В настоящее время методика постепенно получает распространение как более дешевая альтернатива компьютерной томографии.