Fundamentals of Anesthesia

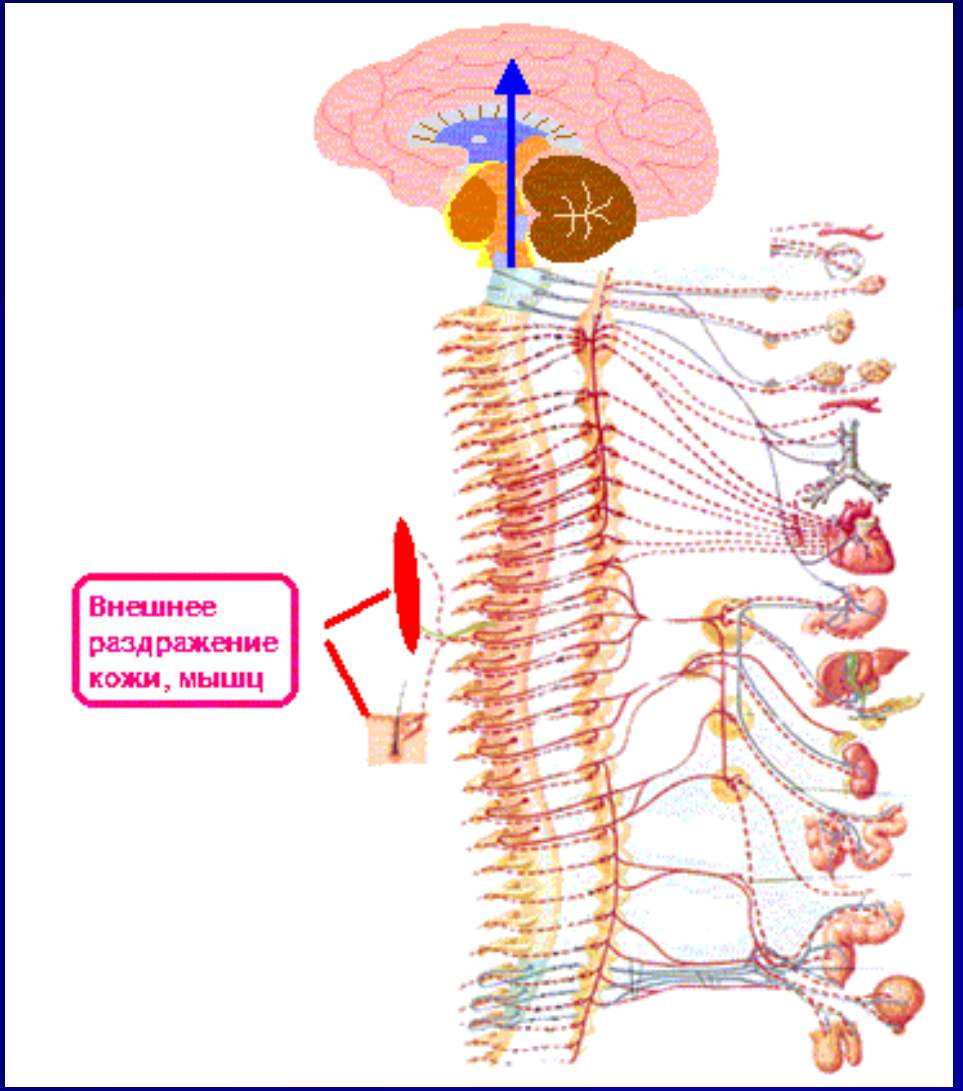
Pain is a physiological phenomenon that informs about harmful effects of a damaging or potentially dangerous nature.

Nociception (**Nocere** - to harm and **Cepcio** - to perceive) - the process of perception of damage.

Nociceptors (**Nocere** - to harm and **Cepcio** - to perceive) - Free nerve endings of the afferent fibers (nerve fibers that go to the spinal cord).

Are located in the skin, muscles, articular capsules, periosteum, internal organs.

Irritation of pain receptors - nociceptors, is the initial link in the system of perception of pain.



NOCICEPTION

TRANSDUCTION

- The damaging effect is transformed in the form of electrical activity at the endings of the sensory nerves.

TRANSMISSION

- Carrying out the impulses generated by the system of sensory nerves.

MODULATION

- Nociceptive transmission is modified under the influence of neural effects.

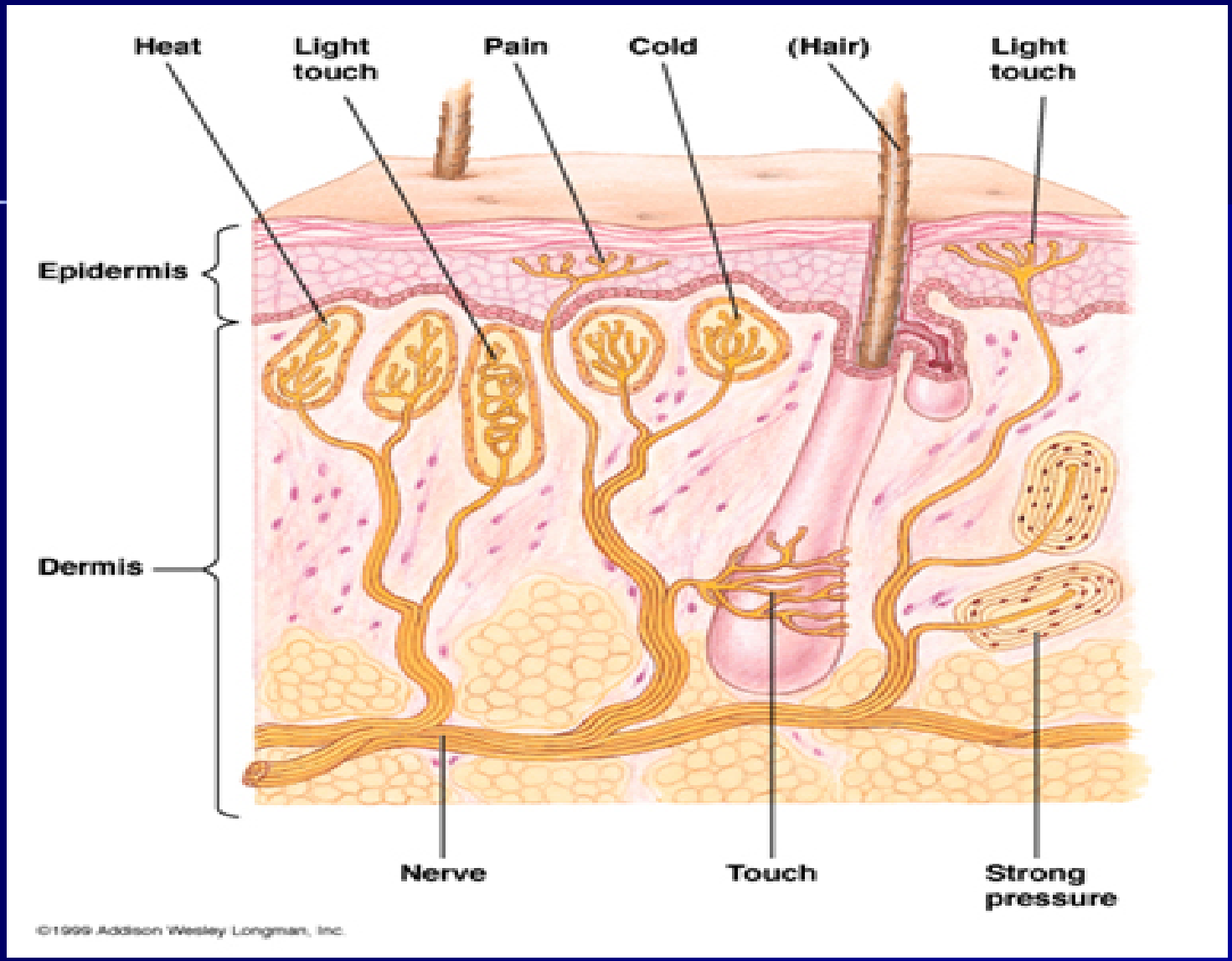
PERCEPTION

- The final process in which transduction, transmission and modulation, interacting with individual physiological characteristics of the personality, create a final subjective emotional sensation, perceived by us as pain.

Types of nociceptors

- Monomodal A-δ-nociceptors (mechanical and chemical irritations)
- Polimodal C-nociceptors (mechanical, chemical, temperature irritations)
- "Sleeping" nociceptors (inflammatory receptors)

TRANSDUCTION



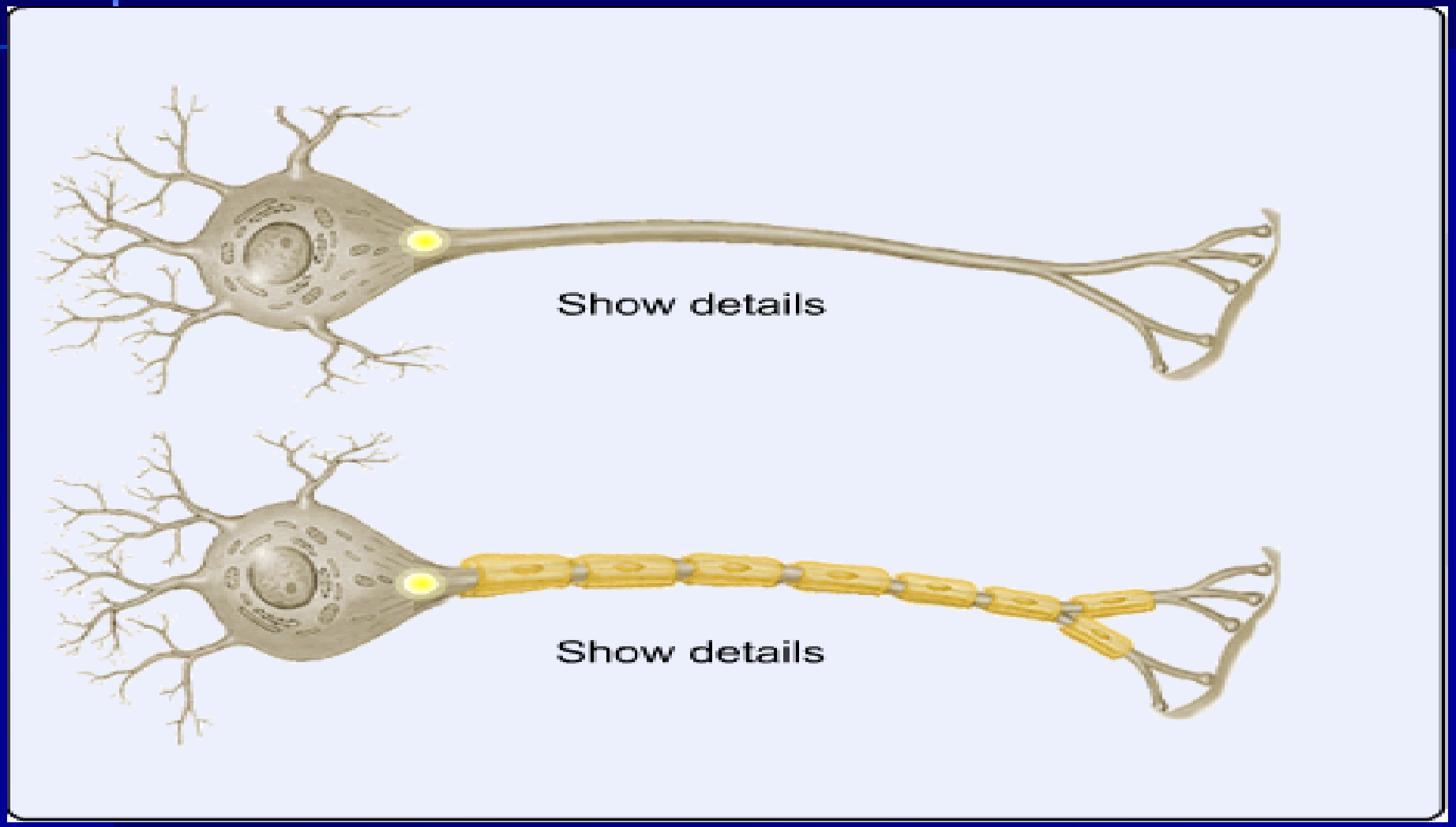
TRANSFORMATION OF IRRITATING STIMULUS IN ELECTRICAL POTENTIALS

PAIN MEDIATORS

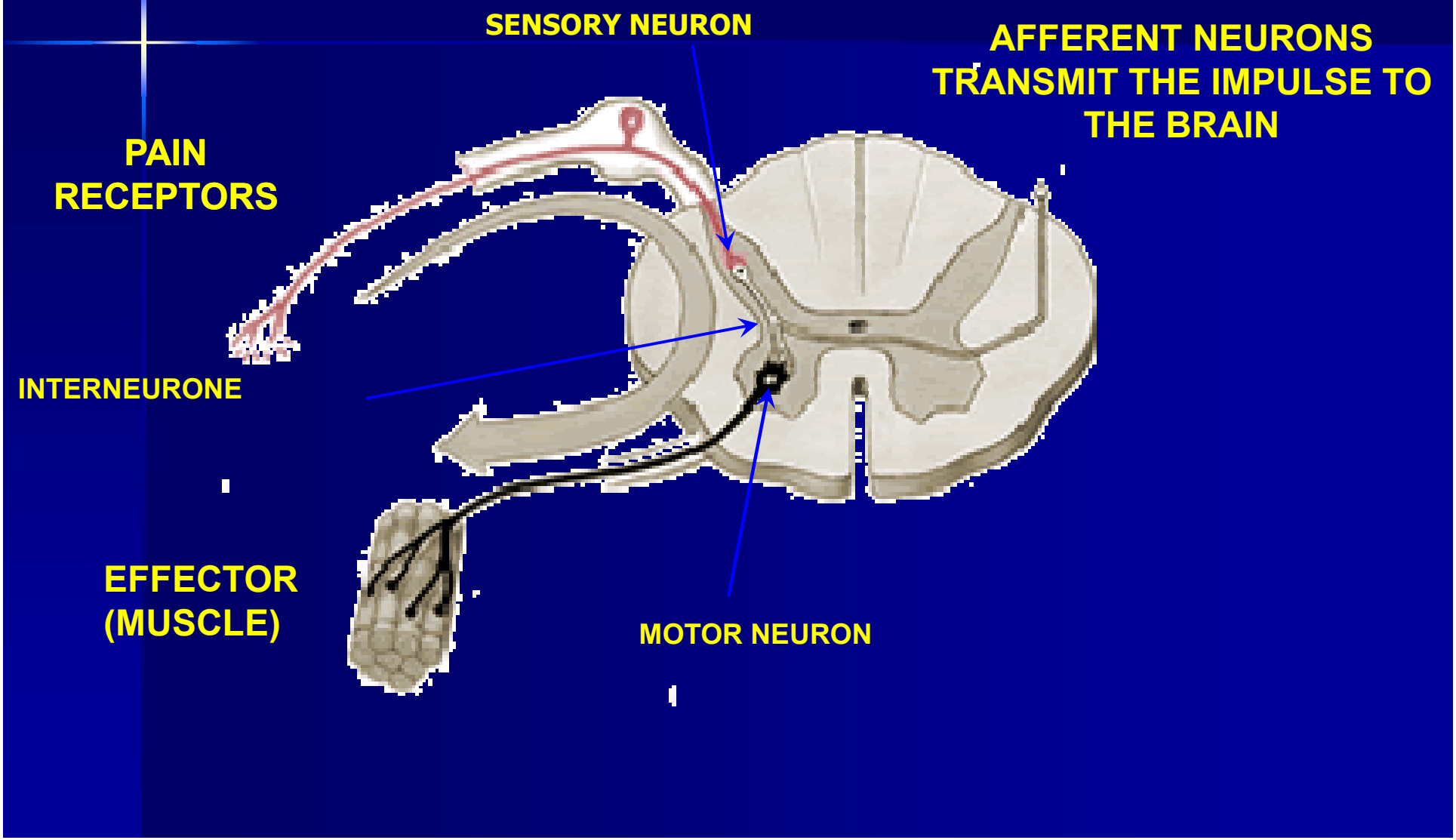
- Released from damaged cells
- Reduce the stimulation threshold

- Prostaglandins
- Substance P
- Serotonin
- Bradykinin
- Histamine
- Hydrogen ions
- Potassium ions

TRANSMISSION



PAIN REFLEX AT LEVEL OF THE SPINAL CORD



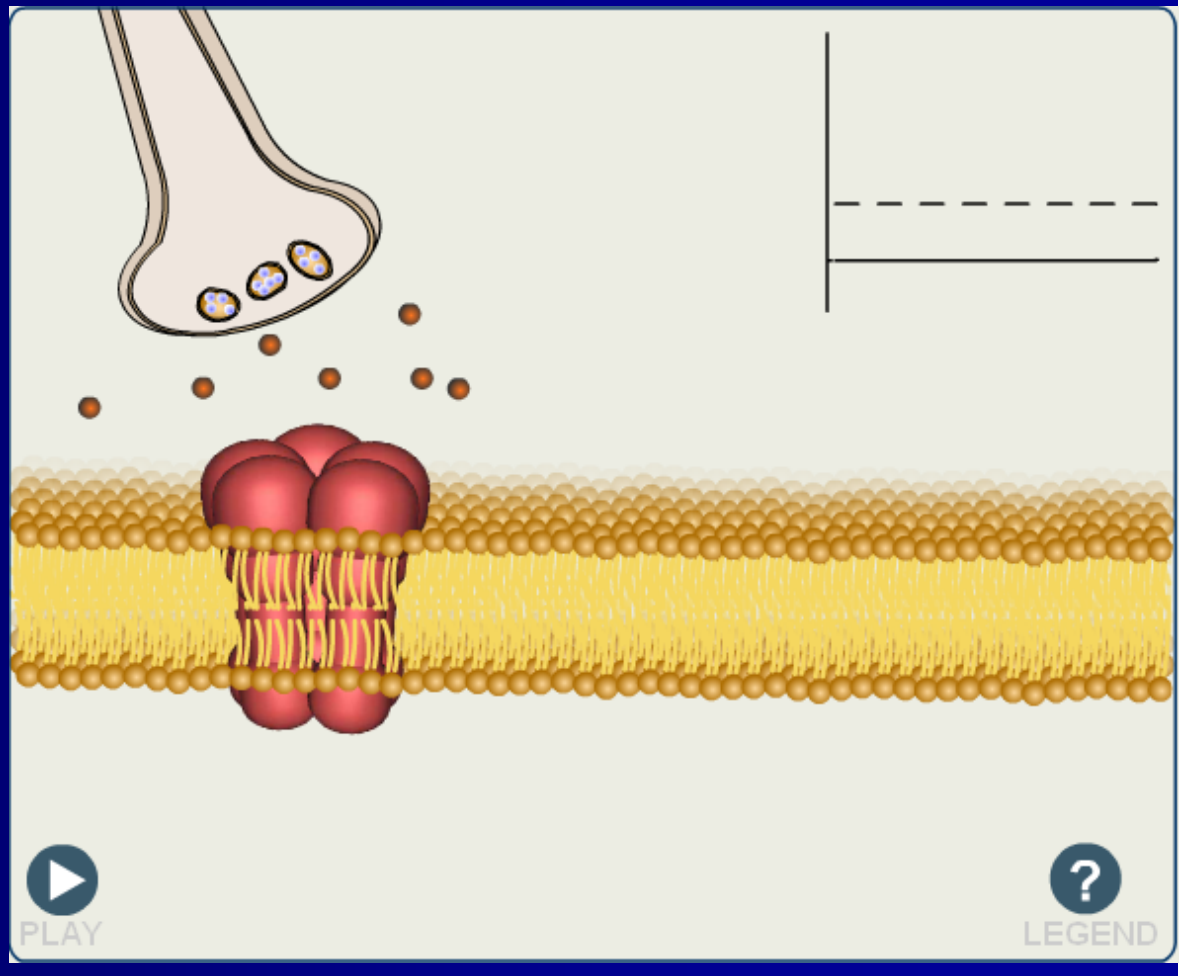
MUSCLE SPASM

- The basic pathogenetic mechanism of the pain syndrome, which causes its maintenance and enhancement.
- Appears as a manifestation of neurological complications according to the principle of a "closed vicious circle".
- Spasmodic muscles are a secondary source of pain, which triggers a vicious circle of "pain - muscle spasm - pain."

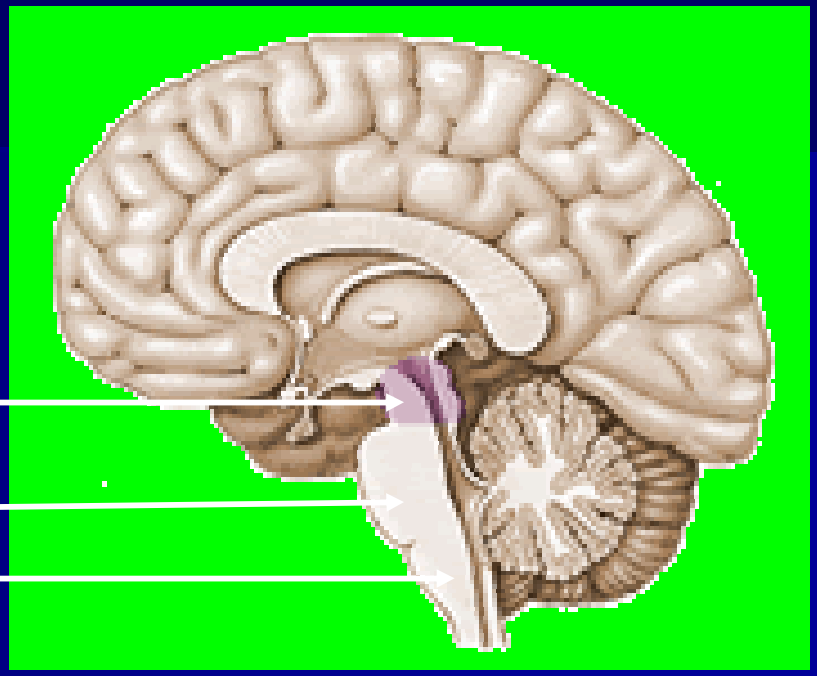
MODULATION

Stimulation (nociceptive and central)

- Substance P



PERCEPTION



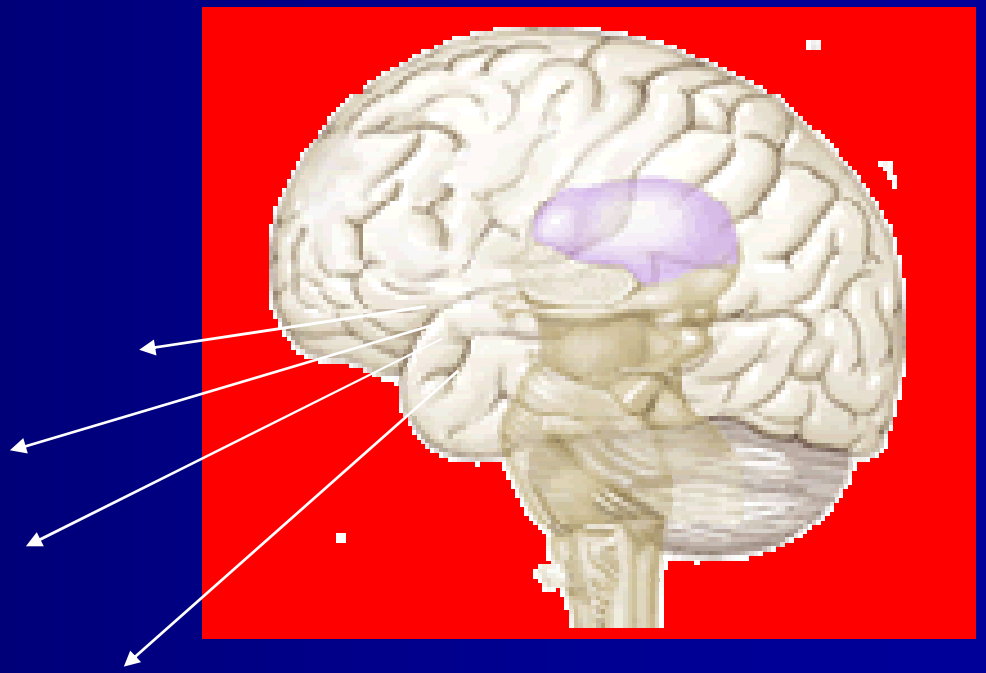
- Midbrain
- Pons
- Medulla oblangata

- Preparedness
- Cardiovascular and inspiratory centre

THALAMUS

- "Communication station"

Limbic system
Hypothalamus
Pituitary
Cortex

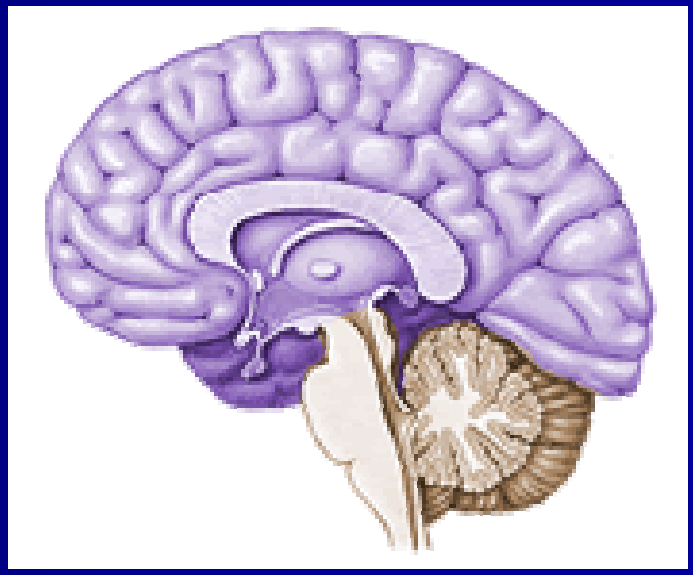


Hypothalamus

- Activation of the sympathetic nervous system (SNS):
- Releasing of neurohormones
  - Tachycardia
  - Tachypnoe
  - Hypertony

PERCEPTION

- The cerebral cortex of the cerebral hemispheres



Anaesthesiology is a section of medicine that studies methods of protecting the body from an operating injury.

Anesthesiology solves two main problems :

- providing analgesia and psychological comfort to the patient during surgical operations and any traumatic and painful manipulations;

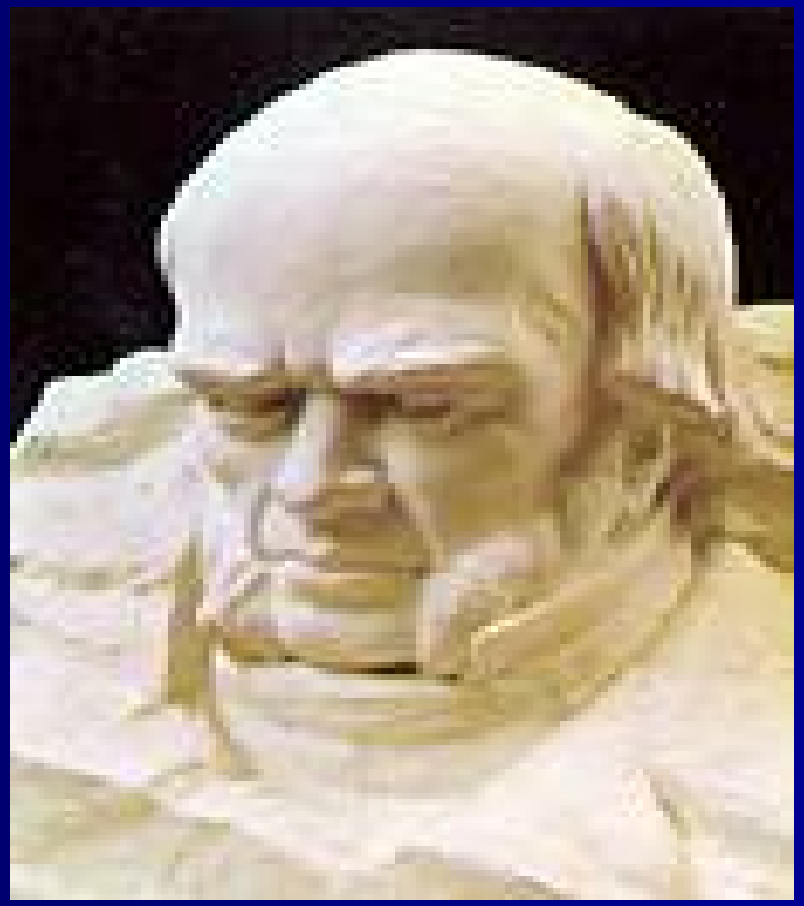
- ensuring human security on the operating table.

MICHAEL FARADAY (1791-1867)

- **MICHAEL FARADAY (1791-1867)**
- **In 1818, discovered the stupefying and overwhelming sensitivity of the action of diethyl ether suggested the possibility of using these gases for anesthesia during surgical operations.**

V.Morton and ED.Warren
16.10.1846

Nikolai Ivanovich Pirogov (1847)



DEFINITIONS

- General anaesthesia- interruption of reflex arcs associated with pain impulses at the level of the brain
  - **Narcosis** – the same + complete disconnection of consciousness

- Local anesthesia– artificially induced reversible elimination of pain sensitivity in a certain part of the human body with preservation of consciousness.

Premedication

- the introduction of medications before the operation in order to reduce intra- and postoperative complications.

Required for:

- Decreased emotional excitement;
- Neurovegetative stabilization;
- Reduction of reactions to external stimuli;
- Creation of optimal conditions for the action of anesthetics;
- Prevention of allergic reactions to anesthetics;
- Reduction of gland secretion

The main drugs for premedication

- **Sleep medication:** (barbiturates: Phenobarbital; benzodiazepines: Nitrazepam, Flunitrazepam)
- **Tranquilizers** (diazepam, bromodihydrochloro-phenylbenzodiazepine, oxazepam)
- **Neuroleptics** (haloperidol, droperidol)
- **Antihistamines** (diphenhydramine, chloropyramine, clemastine)
- **Narcotic analgesics** (trimeperidine, morphine)
- **Cholinolytic agents** (atropine, metocinigium iodide)

Theories of anesthesia (historical interest)

- Coagulation
- Lipoid
- Surface tension
- Hypoxic anesthesia
- Water microcrystals

Theory of anesthesia (modern concept)

- Anesthetics in the central nervous system block the action of cation channels of cell membranes, interrupting excitation
- The greatest sensitivity to the action of anesthetics in the cerebral cortex and the reticular formation

Currently, there are 2 types of anesthesia:

- General (anesthesia)
  - simple (one-component)
  - combined (multicomponent)
- Local

Components of modern general anesthesia:

- inhibition of mental perception (sleep),
- blockade of painful (afferent) impulses (analgesia),
- inhibition of vegetative reactions (hyporeflexia),
- disabling motor activity (muscle relaxation),
- gas exchange control,
- management of blood circulation,
- metabolism management.

These common components of anesthesia constitute the so-called anesthesia allowance or anesthesia for exogenous intervention and serve as its constituents in all operations.

General Anesthesia

Narcosis

– it is artificially induced deep sleep with the switching off of consciousness, analgesia, oppression of reflexes and muscle relaxation.

- Modern anesthetic maintenance of surgical intervention, or anesthesia - is a complex multicomponent procedure.

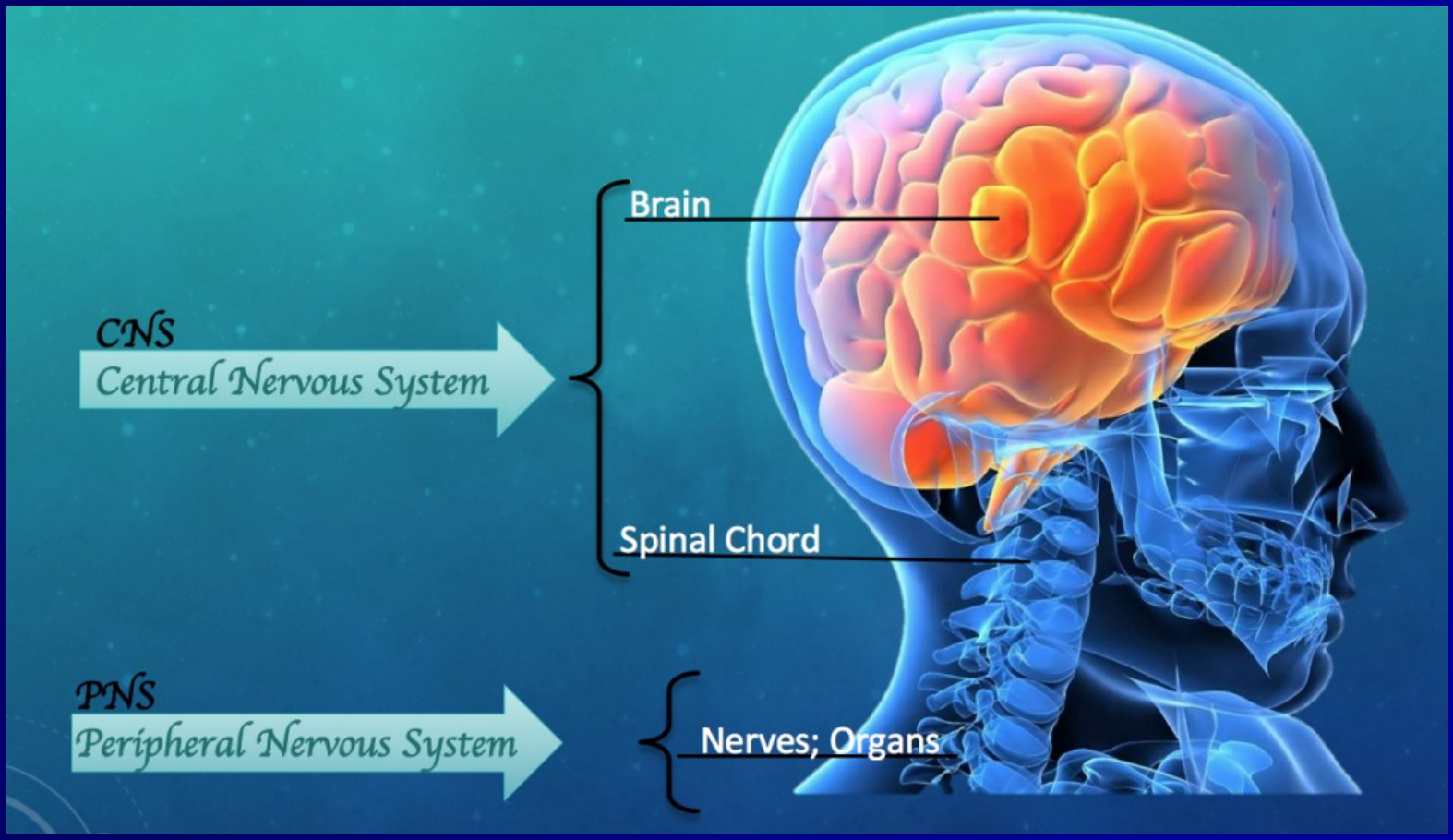
General Anesthesia

The era of modern surgery began in 1846, when chemist C.T. Jackson and dentist W.T.G. Morton discovered the anesthetic properties of ether vapor and for the first time extracted a tooth under general anesthesia.

Somewhat later, surgeon M. Warren performed the world's first operation (removal of a neck tumor) under inhalation anesthesia using ether.

In Russia, the introduction of anesthesia technique was facilitated by the works of F. I. Inozemtsev and N. I. Pirogov. The proceedings of Pirogov (made about 10 000 Narcosis during the Crimean War) played an exceptionally large role.

General Anesthesia



General Anesthesia

Anesthesia Classification

I. Depending on the way of administering the narcotic substance to the body:
   1. Inhalation (narcotic substance in vapor form is fed into the patient's respiratory system and diffuses through the alveoli into the blood):
      - mask
      - endotracheal
   2. Intravenous
   3. Combined (as a rule, introductory anesthesia of an intravenous drug, followed by inhalation anesthesia).

General Anesthesia

Anesthesia Classification

Factors affecting the central nervous system

1. Pharmacodynamic
2. Electro-anesthesia
3. Hypno-anesthesia

Depending on the way of administering the narcotic substance to the body

1. Inhalation - the introduction of drugs through the respiratory tract:
   - mask;
   - endotracheal;
   - endobrochial.

2. Non-inhalation - administration of drugs is not carried out through the respiratory tract:
   - intravenously;
   - intramuscularly;
   - rectally, etc.

By the number of drugs used

1. Mononarcosis –use of a single drug
2. Mixed anesthesia - the simultaneous use of two or more drugs.
3. Combined anesthesia (multicomponent) - the use of various drugs at the stages of the operation.

On application at various stages

1. Introductory - short-term, rapidly advancing without anesthesia phase
2. Supporting (main) - which is used throughout the operation.
3. Baseline (anesthesia basis) is a superficial anesthesia in which an anesthetic agent is administered before or simultaneously with the main anesthetic agent to reduce the dose of the main narcotic drug

General Anesthesia

Anestetics for inhalation anesthesia

I. Liquid (vapor) inhalation anesthetics

- Ether (diethyl ether) is a derivative of the aliphatic series.
- Ftorotan (halothane, fluotan, narcotics) is a potent halogen-containing anesthetic that is 4-5 times stronger than ether.
- Methoxyflurane (pentran, Inglan) is a halogen-containing anesthetic.
- Etran (enflurane) - fluorinated ether.
- Isoflurane, desflurane, sevoflurane - enflurane isomers.

II. Gaseous inhalation anesthetics

- Nitrous oxide is the least toxic and therefore the most common general anesthetic.
- Cyclopropane (trimethylene) - gives a powerful narcotic effect (7-10 times stronger than nitrous oxide).

General Anesthesia

Anesthesia And Respiratory Devices

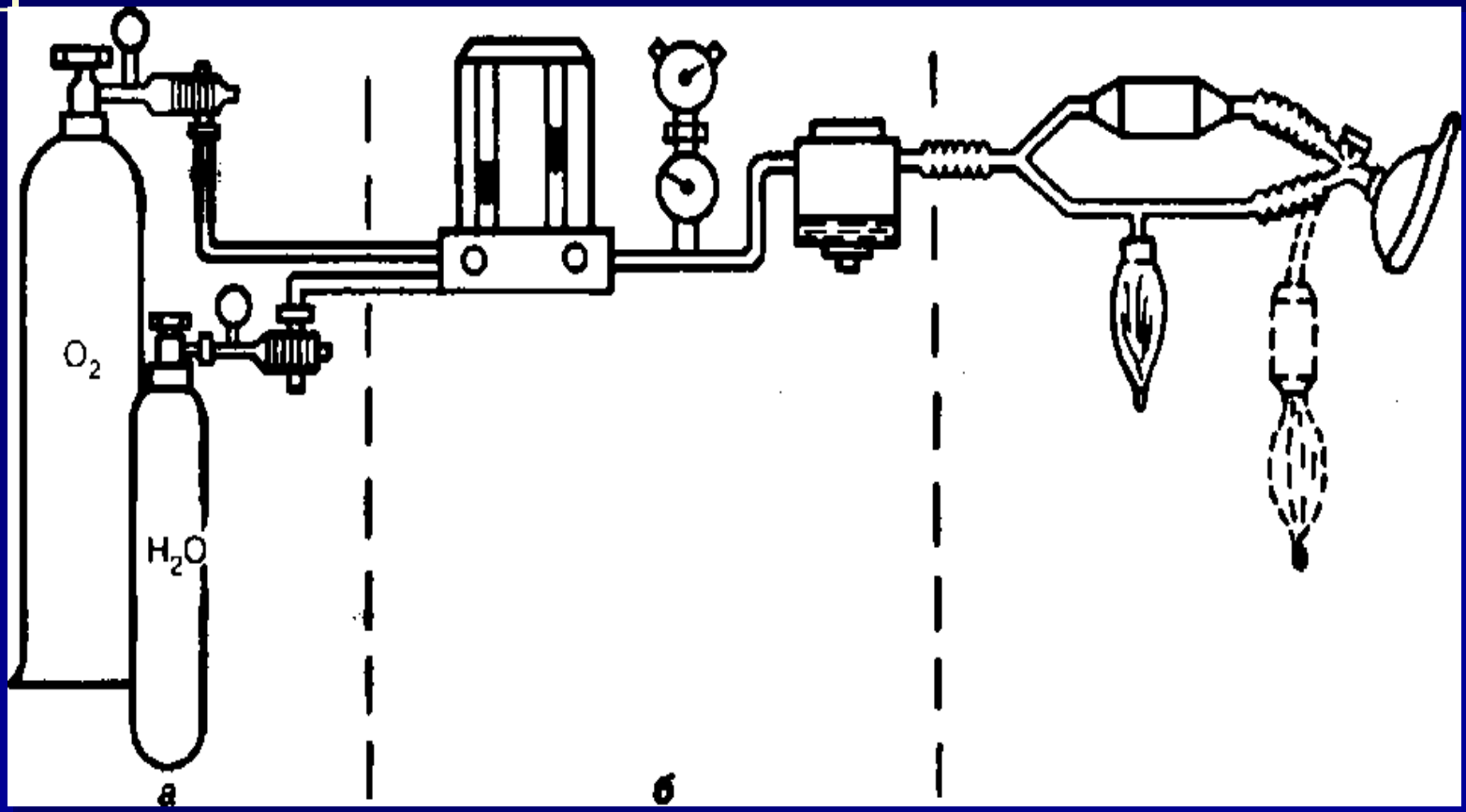
When providing anesthesia, special medical equipment is important (anesthetic devices, ventilators).

Purpose of anesthesia machines:

1. Creating a gas mixture;
2. Accurate dosing of anesthetics;
3. Maintain O2 and CO2 levels for introduction into the patient's airway.

General Anesthesia

Anesthesia Machine



Anesthesia Device
а - cylinders with gaseous substances; в - respiratory system
б - unit of dosimeters and evaporators;

General Anesthesia

Anesthesia machine - Patient's Lungs During General Anesthesia

General Anesthesia

Anesthesia Machine (Main components):

1. Tanks (cylinders) with gaseous substances.
2. Dosimeters - are used to measure and regulate the flow of gases entering the machine through hoses from sources
3. Evaporators - designed to convert liquid anesthetics into steam and dosed it into the respiratory system.
4. Breathing unit - consists of an adsorber (serves to absorb CO2), breathing valves (providing gas flow direction), a breathing bag (necessary for injecting breathing mix into the respiratory tract), hoses for connecting the components of the breathing unit.

General Anesthesia

Breathing circuit

Open method (contour). The patient inhales a mixture of atmospheric air that has passed through the vaporizer of the anesthetic apparatus, and the exhalation occurs into the ambient atmosphere of the operating room. With this method, there is a high consumption of narcotic substances and their pollution of the air of the operating room, which all medical personnel involved in the operation breathes.

Half open method (contour). The patient inhales a mixture of oxygen with a narcotic substance from the machine and exhales it into the atmosphere of the operating room. This is the safest breathing circuit for the patient.

Semi-closed method (contour). The inhale is made from the apparatus, as with the half-open method, and the exhalation is partially into the machine, and partially into the atmosphere of the operating room. The mixture exhaled into the apparatus passes through an adsorber, where it is released from carbon dioxide, enters the respiratory system of the apparatus and, mixing with the resulting narcotic mixture, enters the patient again.

The closed method (circuit) provides for inhaling and exhaling, respectively, from the machine to the machine. Inhaled and exhaled gas mixtures are completely isolated from the environment. Exhaled gas-narcotic mixture after release from carbon dioxide in the adsorber again comes to the patient, combining with the newly formed narcotic mixture.

General Anesthesia

Laryngeal masks

General Anesthesia

General Anesthesia
Onset of anesthesia

General Anesthesia

Disadvantages of masked anesthesia

- Difficult handling.
- Significant consumption of narcotic drugs.
- The risk of developing aspiration complications.
- Toxicity due to the depth of anesthesia.

General Anesthesia

Anesthesia includes:

(modern anesthesia is a complex multicomponent procedure)

1) **Narcotic sleep** (caused by drugs for anesthesia). Includes:
   a) deactivation - complete retrograde amnesia;
   b) desensitization (paresthesia, hypesthesia, anesthesia);
   c) analgesia proper;
2) **Autonomic blockade.** It is necessary to stabilize the reactions of the autonomic nervous system to surgery, since the vegetatics are not in many ways controlled by the central nervous system and are not regulated by anesthetics. Therefore, this component of anesthesia is carried out through the use of peripheral effectors of the autonomic nervous system - anticholinergics, adrenergic blockers, ganglioblokatorov;
3) **Muscle relaxation.** Its use is applicable only for endotracheal anesthesia with controlled breathing, but is necessary for operations on the gastrointestinal tract and large traumatic interventions;
4) **Maintaining an adequate state of vital functions:** gas exchange (achieved by accurate calculation of the ratio of the gas mixture inhaled by the patient), blood circulation, normal systemic and organ blood flow. You can monitor the state of the blood flow by the amount of blood pressure, and also (indirectly) by the amount of urine released per hour (urine flow-hour). It should not be lower than 50 ml / h. Maintaining blood flow at an adequate level is achieved by dilution of the blood — hemodilution — by continuous intravenous infusion of saline solutions under the control of central venous pressure (normal 60 mm wg);
5) **Maintenance of metabolic processes at the proper level.** It is necessary to take into account how much heat the patient loses during the operation, and to conduct adequate warming or, conversely, cooling the patient.

General Anesthesia

Benefits of combined endotracheal anesthesia

- A quick introduction to anesthesia, the absence of arousal stage.
- The ability to operate in the stage of analgesia or stage III.
- Reducing the consumption of narcotic drugs, reducing the toxicity of anesthesia.
- Easy control of anesthesia.
- Prevention of aspiration and the possibility of rehabilitation of the trachea and bronchi.

General Anesthesia

Criteria for the adequacy of anesthesia

- Lack of tachycardia and stable blood pressure.
- Normal color and natural dryness of the skin.
- Urination - 30-50 ml / h.
- The normal level of blood oxygen saturation and C02 content.
- Normal ECG readings.

- It is considered permissible to deviate the listed indicators within 20% of the initial level.

General Anesthesia

Stages of anesthesia

First stage

Analgesia (hypnotic phase, raush anesthesia).

Clinically, this stage is manifested by the gradual suppression of the patient's consciousness, which, however, does not completely disappear in this phase. The speech of the patient gradually becomes incoherent. The skin of the patient reddens. Pulse and respiration are slightly increased. Pupils in size are the same as before the operation, react to light. The most important change in this stage concerns pain sensitivity, which almost disappears. Other types of sensitivity saved. In this stage, surgical interventions, as a rule, are not performed, but small surface incisions and reduction of dislocations can be performed.

General Anesthesia

Stages of anesthesia

Second stage

Stage of arousal. The patient loses consciousness, increased motor and autonomic activity. The patient does not give an account of his actions. His behavior can be compared with the behavior of a person who is in a state of severe intoxication. The patient's face turns red, all the muscles tighten, the neck veins swell. On the part of the respiratory system there is a sharp increase in respiration, it can be observed for a short time due to hyperventilation. The secretion of salivary and bronchial glands is enhanced. Blood pressure and pulse rate increase. Due to increased vomiting reflex, vomiting may occur.

Often, patients have involuntary urination. Pupils in this stage expand, their reaction to the light is saved. The duration of this stage when conducting ether anesthesia can reach 12 minutes, with the most pronounced excitement in patients who have long abused alcohol and drug addicts. These categories of patients need fixation. In children and women, this stage is practically not expressed. With the deepening of anesthesia, the patient gradually calms down, the next stage of anesthesia begins.

General Anesthesia

Stages of anesthesia

Third stage

Stage of anesthetic sleep (surgical).

It is at this stage that all surgical interventions are carried out. Depending on the depth of anesthesia, there are several levels of anesthetic sleep. Consciousness is completely absent in all of them, but the systemic reactions of the organism are different. Due to the special importance of this stage of anesthesia for surgery, it is advisable to know all its levels.

General Anesthesia

Stages of anesthesia

Third stage

(first level)

Signs or stages of intact reflexes:

1. Only superficial reflexes are absent, laryngeal and corneal reflexes are preserved.
2. Breathing is calm.
3. Pulse and blood pressure at the same level as before the anesthesia.
4. Pupils are somewhat narrowed, the reaction to the light is alive.
5. Eyeballs move smoothly.
6. Skeletal muscles are in good shape, therefore, in the absence of muscle relaxants, abdominal surgery is not performed at this level.

General Anesthesia

Stages of anesthesia

Third stage

(second level)

1. Reflexes weaken and then completely disappear (laryngopharyngeal and corneal).
2. Breathing is calm.
3. Pulse and blood pressure at the same level as before the anesthesia.
4. Pupils gradually expand, in parallel with this, there is a weakening of their reaction to light.
5. There are no movements of the eyeballs, the pupils are set centrally.
6. Skeletal muscle relaxation begins.

General Anesthesia

Stages of anesthesia

Third stage

(third level)

1. Reflexes are absent.
2. Breathing is carried out only by movements of the diaphragm, therefore shallow and rapid.
3. Blood pressure decreases, heart rate rises.
4. The pupils dilate, and their reaction to the usual light stimulus is practically absent.
5. Skeletal muscles (including intercostal muscles) are completely relaxed. As a result of this, jaw dropping often occurs, the tongue may be retracted and respiratory arrest, therefore, the anesthesiologist in this period always brings the jaw forward.
6. The transition of the patient to this level of anesthesia is dangerous for his life, therefore, if a similar situation arises, it is necessary to adjust the dose of the narcotic drug.

General Anesthesia

Stages of anesthesia

Third stage

(fourth level)

Previously called agonal, because the state of the body at this level is, in fact, critical. At any time, death can occur due to respiratory paralysis or cessation of blood circulation.

The patient needs a complex resuscitation. Anesthesia deepening at this stage is an indicator of anesthesiologist's low qualification.

1. All reflexes are missing, there is no pupil reaction to light.
2. Pupils maximally dilated.
3. Breath superficial, sharply speeded up.
4. Tachycardia, pulse filiform, blood pressure is significantly reduced, can not be determined.
5. Muscle tone is absent.

General Anesthesia

Stages of anesthesia

Fourth stage

It comes after stopping the supply of the drug.

Clinical manifestations of this stage correspond to the reverse development of those when immersed in anesthesia. But they, as a rule, proceed more quickly and are not so sharply expressed.

General Anesthesia

Modern combined intubation anesthesia (a combination of the action of various general anesthetics, muscle relaxants and neuroleptic algesia is carried out). Sequence of use:

- Premedication;
- Introductory anesthesia is performed with the help of barbiturates, (intravenously), in the end comes respiratory depression, which requires the start of mechanical ventilation with a mask;
- Intubation of the trachea injects short-acting muscle relaxants (ditelin). The ventilator through the mask stops at the beginning of the intubation procedure itself (30-40 sec.).
- Basic anesthesia. It is carried out by inhalation anesthetics (a mixture of nitrous oxide and oxygen, halothane, etc.)
- The combination of drugs. To reduce the toxicity of general anesthetic use drugs from other groups:
  - muscle relaxants;
  - neuroleptics.

General Anesthesia

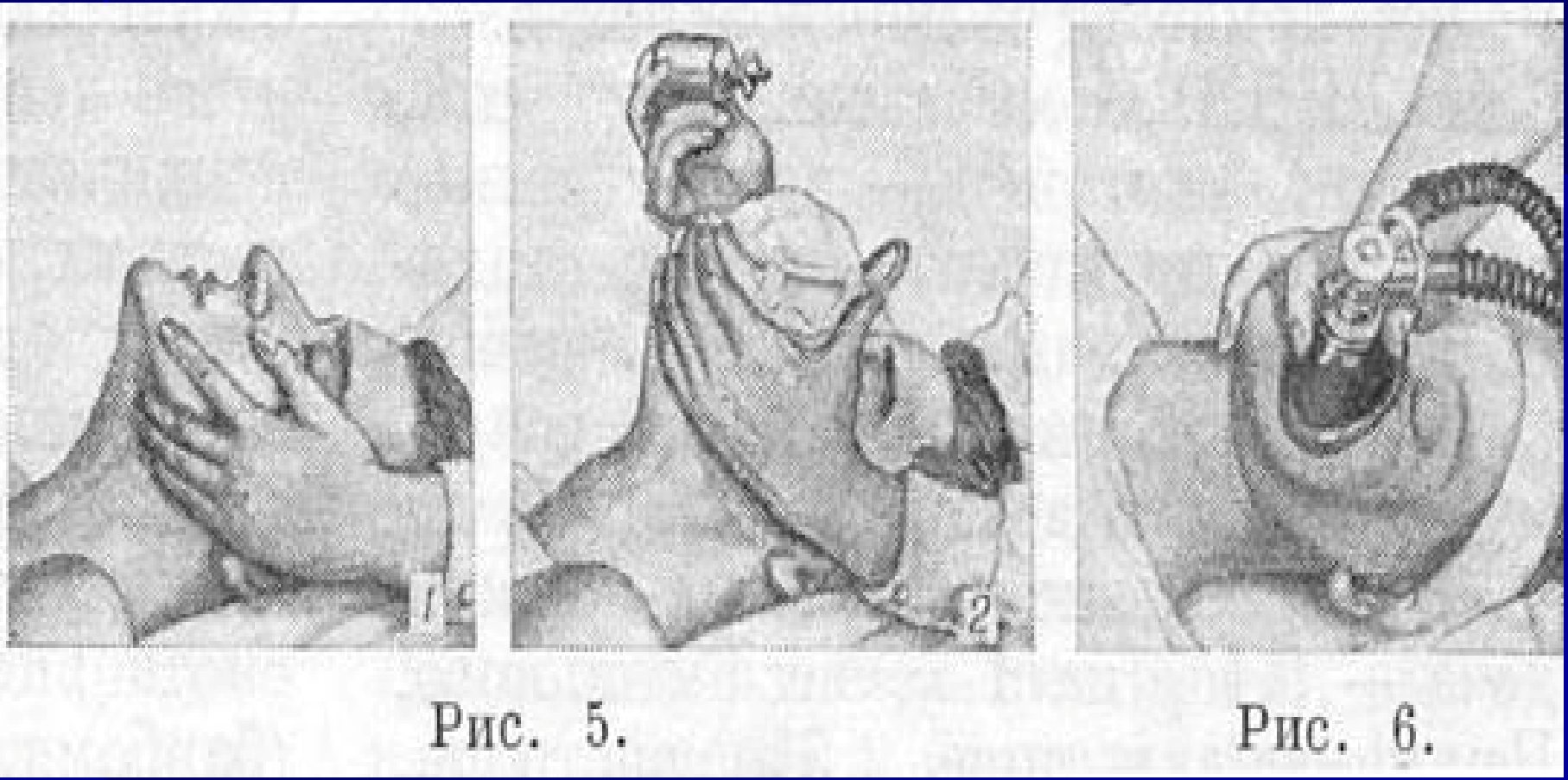
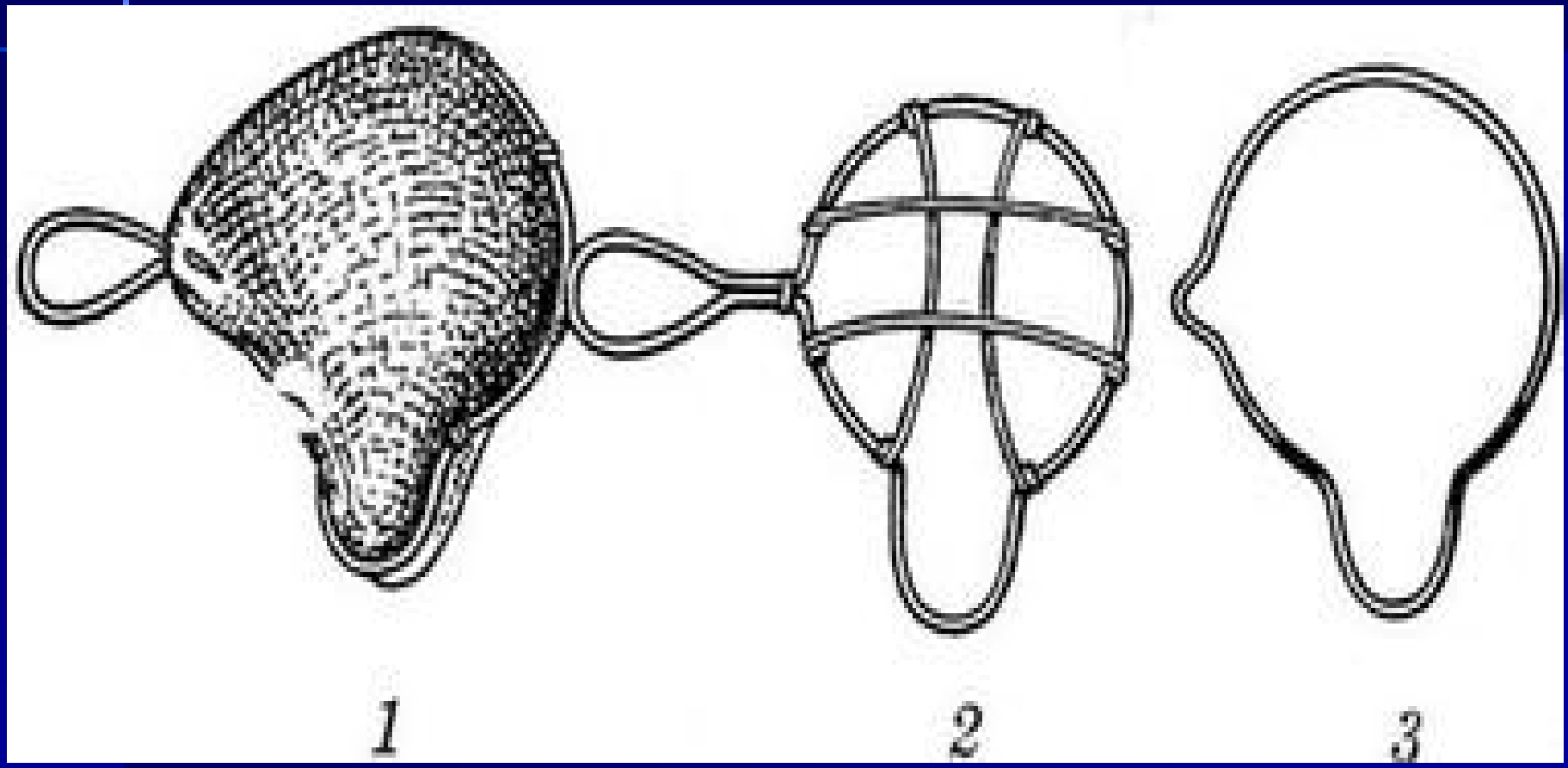


Рис. 5.

Рис. 6.

Рис. 5. Conducting drip ether anesthesia:
1 - maintaining the lower jaw; 2 - mask fixing.
Рис. 6. Fixation of the mask to the anesthesia machine

General Anesthesia



Mask Schimmelbush: 1 - assembled; 2 - frame; 3 - spring ring

General Anesthesia

Beginning of the anesthesia

General Anesthesia

Tracheal intubation is an important stage of anesthesia

General Anesthesia

Laryngoscope - an important attribute of the anesthesiologist

General Anesthesia

Intubation tube - the reliability of breathing during anesthesia

General Anesthesia

Laryngeal masks

General Anesthesia

Anesthesiologist performs tracheal intubation

General Anesthesia

Complications of anesthesia

- Vomiting, regurgitation;
- Airway obstruction (retraction of the tongue);
- Complications of intubation and trachea (damage to the teeth, ligaments, insertion of the tube into the right bronchus, loss of the trachea or its bend);
- Hypotension;
- Heart rhythm disorder;
- Heart failure;
- Swelling of the brain;
- Peripheral nerve damage.

General Anesthesia

Non-inhalational anesthesia:

- intravenous,
- intramuscular,
- subcutaneous,
- rectal
- intracavitary.

It is used as an introduction to the main anesthesia. As the main anesthesia it is not used because of its poor handling.

Intravenous anesthesia

Hexenal, thiopintal sodium, etc. are used. With intravenous anesthesia, the patient falls asleep quickly, the surgical stage begins quickly, without a period of excitation.

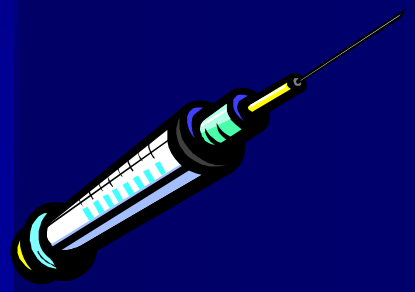
Rectal anesthesia

It is used most often in pediatric surgery. Use 3% solution of chloral hydrate, which is injected into the previously cleaned rectum. Sleep occurs in 15-20 minutes.

Neuroleptanalgesia

A peculiar state in which analgesia develops, a state of drowsiness appears. A combination of analgesics (fentanyl) and neuroleptics (droperidol) is used. A mixture of fintanyl and droperidol is produced under the name "talamonal". It is used in combination with endotrachial anesthesia or local anesthesia.

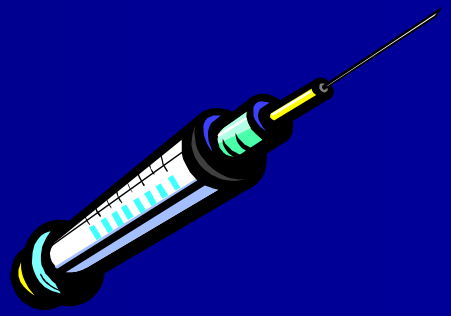
Local anesthesia - a reversible loss of pain sensitivity of tissues in limited areas of the body. It is achieved due to the cessation of generation and conduction of impulses along sensory nerve fibers or blockade of receptors.



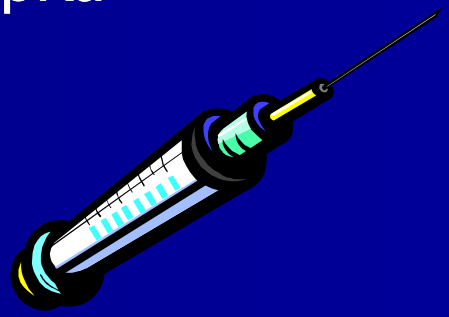
History of developing of local anesthesia

Use of crocodile fat, crocodile skin, marble powder -"Memphis Stone", Indian hemp, opium, henbane, hemlock, mandrake, ammonia, phenol, Erythroxylon Coca
1879 - V.K. Anrep - analgesic effect of cocaine
1884 - K. Koller - description of cocaine for local anesthesia
1896 - A.I. Lukashevich - conduction anesthesia
1885 - L. Corning - action of cocaine on the spinal cord
1885 - W. Halstedt - conduction anesthesia of the inferior alveolar nerve
J. Conway - the introduction of cocaine in the hematoma in fractures
1891- H. Quincke - lumbar spinal puncture
1897- G. Grile - blockade of the brachial plexus and sciatic nerve in an open way
1899- A. Bier - Opening Spinal Anesthesia
1901- A. Sicard F. Cathelin - description of caudal (epidural anesthesia)
1903- H. Braun - Adrenaline Addition to the Solution of Local Anesthetic
1905- A. Eincyorn - the discovery of Novocain
1906- A. Sicard - epidural anesthesia through spinous processes
1909- W. Steckel - caudal block for anesthesia of labor
1911 - D. Kulenkampff - percutaneous blockade of the brachial plexus
1942- H. Hingson - Prolonged Caudal Anesthesia
1946 - N. Lofgren - received xylocaine

- Modern local anesthetics are derived from the coca leaf cocaine plant alkaloid.
- Weak base, poorly soluble in water, a derivative of benzoic acid, obtained by combining it with an ether bond with a tertiary amine
- Typical structure of a local anesthetic molecule: contains hydrophilic and lipophilic moieties linked by an ester or amide



- The local anesthetic solution contains an equilibrium mixture of ionized (cationic) salt and non-ionized base.
- The combination of hydrophilic and lipophilic parts, ionized and non-ionized forms provide the ability to penetrate the membrane of the nerve cell and cause anesthesia
- Ether or amide bonds determine metabolic rate and toxicity.
- Local anesthetics are weak bases with pKa



CLASSIFICATION OF LOCAL ANESTHETICS

Amides

- Amides of heterocyclic and aromatic acids (sovkain, procainamide)
- Amides of aromatic amines-anilides (lidocaine, bupivacaine, mepivacaine)

Ester

- Esters of benzoic acid (cocaine, benkain)
- Esters of para-aminobenzoic acid (Novocain)
- Aminobenzoic and benzoic acid esters (dikain)

Esters are metabolized in plasma by esterases.

Amides are metabolized mainly in the liver, which is determined by the hepatic blood flow.

LOCAL ANESTHETICS

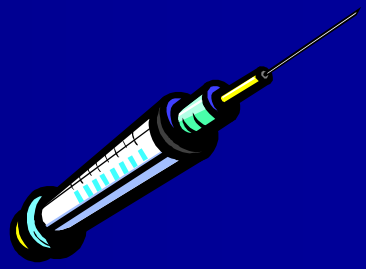
Drug	Efficiency	Toxicity	Applied concentrations, %		
			Anesthesia infiltration	Anesthesia of the nerve trunks and plexuses	Peridual anesthesia
Procaine	1	1	0,25-0,5	2	1,5-3
Lidocaine	3	1,5	0,25-0,5	2	1-2
Mepivacaine	3	2	0,25-0,5	1-1,5	1-2
Bupivacaine	15	10	0,125-0,25	0,375-0,5	0,25-0,75
Tetracaine	15	12	0,1-0,15	0,15-0,3	0,2-0,5
Ropivacaine	15	10	0,2-0,75	0,75	0,2-0,75

The mechanism of action of local anesthetics

- Local anesthetics prevent the generation and conduction of nerve impulses.
- The main area of action - the membrane of nerve cells Local anesthetics cause blockade of membrane depolarization due to blockade of sodium channels, i.e. reduce cell permeability to sodium ions by displacing local anesthetics Ca ++ from receptors located on the inner surface of the membrane
- Changing the action potential leads to a change in resting potential.
- NB! Small nerve fibers are more sensitive to local anesthetics than larger, non-myelin fibers are more easily blocked than myelin.

Effect of the local anesthesia

- The period of introduction of the anesthetic substance
- The effect of anesthetic on the nervous elements of tissues from the moment of introduction to full anesthesia (the period of "waiting")
- Full anesthesia
- Return of sensitivity and its full restoration



Contraindications for local anesthesia

- Drug intolerance
- Mental illness
- Nervous excitement
- Categorical refusal of the patient from local anesthesia
- Early childhood
- If necessary, using controlled breathing
- Hypotension

Classification of local anesthesia

- Terminal (surface)
- Infiltration Regional (conductor):
  - paravertebral
  - intercostal
  - stem
  - sacral
  - anesthesia of the jaw area
- Peridural (epidural)
- Spinal (subarachnoid)
- Intraosseous.
- Intravenous regional
- Cross Section Anesthesia (Sheath)

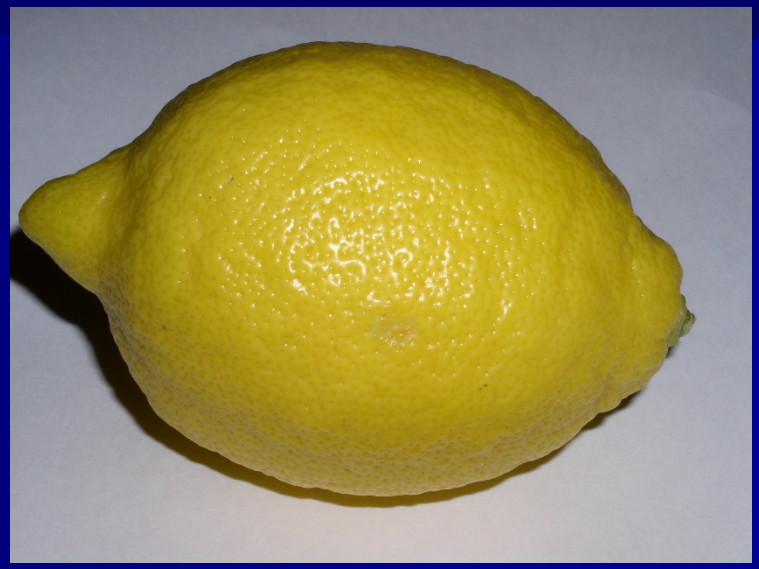
Terminal anesthesia

Terminal anesthesia - “anesthesia of the surface of organs” (Bunyatyan A. A., 1982) is achieved by direct contact of the anesthetic agent with the tissue of the organ. Spraying of chloroethyl on the skin surface causes significant cooling of the treated area of the skin and loss of pain sensitivity, which makes it possible to open small abscesses and hematomas. It is used in ophthalmic, dental, urological practice, cosmetology and aesthetic surgery, pediatrics. Achieved by lubrication of mucosal surfaces, instillation of anesthetic in the conjunctival sac or urethra.

Infiltration anesthesia

Infiltration anesthesia - allows for even large-scale operations. For this purpose, the method of "creeping infiltrate" by AVVishnevsky is used. This method is based on the anatomical features of the structure of the body, due to the "case principle" (N.I. Pirogov). In the most general form, the method consists in layer-by-layer, gradual infiltration of tissues with a solution of a local anesthetic, which is replaced by a slit, after which tissue is infiltrated again with a 0.25% novocaine solution surrounding the organ to be surgery.

Infiltration anesthesia



Surface infiltration of the skin by the type of "lemon peel"

Infiltration anesthesia

Infiltration of the subcutaneous tissue

Cross-section blockade (sheath anesthesia)

Cross-section blockade - used for transport anesthesia for limb fractures, as well as one of the components of anti-shock therapy. The main principle of this blockade is the introduction of anesthetic into the fascial shells of the limbs above the fracture site. The needle is inserted from two points into the anterior and posterior muscle groups.

Regional anesthesia

Regional anesthesia is achieved by the introduction of anesthetics in the region of large nerve trunks, plexuses or spinal cord roots, which allows to reduce pain sensitivity in a topographic region corresponding to the innervation zone of the blocked nerve trunk or plexus.

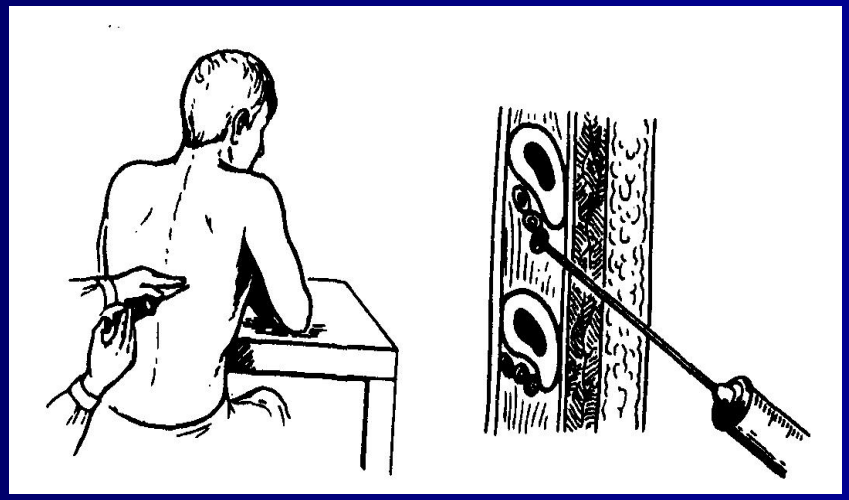
- paravertebral
- intercostal
- stem
- sacral
- anesthesia of the jaw area

Regional anesthesia

Paravertebral blockade - used for lumbago, exacerbation of chronic radiculitis, bruises and spinal fractures. The needle is inserted at a point located 1-1.5 cm lateral of the spinous process, perpendicular to the skin to a depth of the transverse process. Then it is slightly removed and sent to 0.5-1 cm above the upper edge of the transverse process and injected 5-10 ml of 0.5-2% solution of novocaine. As a rule, one manipulation is enough, performed on both sides of the spinous process, but sometimes it takes two to three times the blockade to be repeated at intervals of 1–2 days.

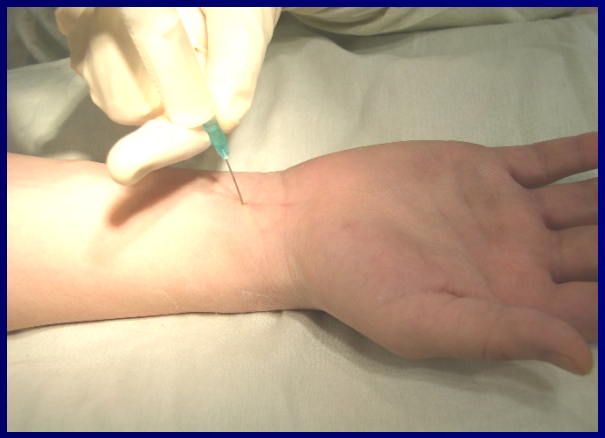
Regional anesthesia

Intercostal blockade - consists in the introduction of an anesthetic substance into the intercostal space. This blockade is carried out with rib fractures, chest contusions, intercostal neuralgia. For rib fractures, anesthetic can be injected directly into the fracture area.



Regional anesthesia

Stem anesthesia - most often used for surgical interventions on the limbs, as well as for transportation and closed reposition of fractures of the limbs. The anesthetic is injected directly into the nerve innervating the corresponding area of interest to the surgeon.



Regional anesthesia

Sacral anesthesia is a type of paravertebral and is used for small-volume operations. Anesthesia of the jaw area.

A regional unit may also be used to relieve dental interventions. Usually used 1-2% solution of novocaine, trimecain, lidocaine, xylocaine.

Spinal anesthesia

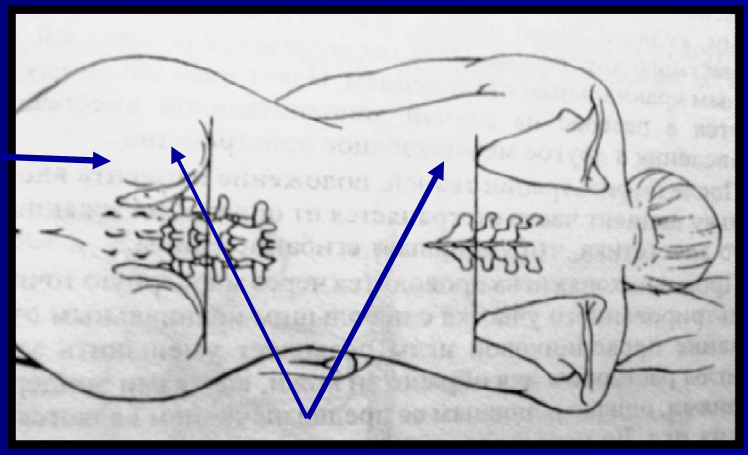
Spinal anesthesia

Spinal anesthesia (subarachnoid) - is achieved by introducing an anesthetic solution into the subarachnoid space after puncture of the dura mater in the caudal part of the lumbar spine. Usually, 2% lidocaine is administered at a dose of 1 mg / kg. To improve and lengthen the time of analgesia, you can enter 1 ml of fentanyl. The level of administration is between 2-3 or 3-4 lumbar vertebrae. Higher puncture can not be, because there is a risk to damage the spinal cord. (it ends at about the level of 1 lumbar vertebra.) Pain relief occurs after 3-5 minutes. The duration of CMA without fentanyl is 40-60 minutes, with fentanyl - 90-120 minutes.

Determination of the needle insertion site during spinal anesthesia

Spinal anesthesia

The line between the posterior iliac ridges crosses the spinal column between L IV –V at the level of the spinous process LIV



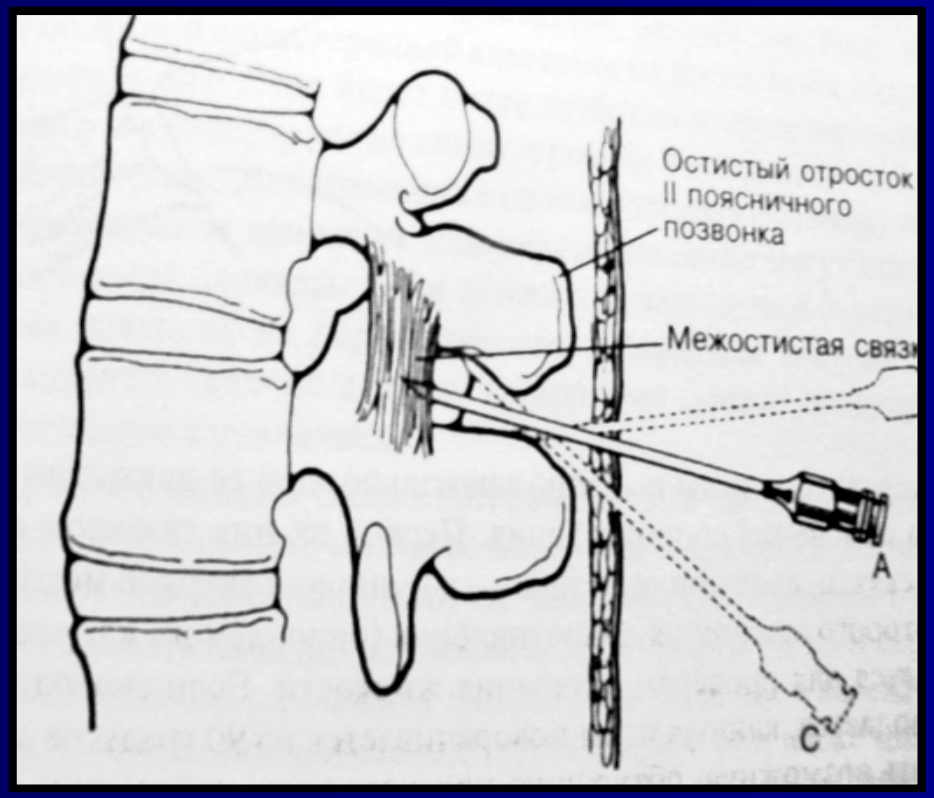
Epidural Anesthesia

For thoracic epidural anesthesia, the line between the angles of the shoulder blades passes through the spinous process of Th IX

Epidural Anesthesia

Epidural anesthesia is a variant of conductive anesthesia, due to the pharmacological blockade of spinal roots. During epidural anesthesia, the anesthetic solution is injected into the space between the outer and inner sheets of the dura mater and blocks the roots

The position of the needle during epidural anesthesia



The needle passes through the interstitial ligament, the yellow ligament and enters the epidural space.

Intraosseous anesthesia

Intraosseous anesthesia - can be used for operations on the limbs. To this end, the limbs give a sublime position, at the base impose a tourniquet until the pulse disappears on the peripheral arteries. After anesthesia of the skin and subcutaneous tissue with a thick needle with mandrin, with rotational movements, the needle is advanced through the cortical substance of the bone to a depth of 1.0-1.5 cm in a spongy substance. Punctures are carried out depending on the area of surgery, but the needle is injected into the epiphyseal part of the bone (the femoral condyles, the ankles, the epiphysis of the radial bone, the ulnar process).

Anesthetic effect occurs in 15-20 minutes. after the introduction of 20-100 ml of 0.5% solution of novocaine and kept until the harness is removed. For the closed reduction of bone fragments, the introduction of a 1-2% solution of novocaine directly into the hematoma formed in the fracture area can be used. Anesthesia occurs in 10-15 minutes.

Intravenous (intraarterial) anesthesia

Intravenous regional anesthesia - used for operations on the limbs up to the upper third of the shoulder or thigh. Based on the penetration of anesthetic through the capillaries and blocking the first endings, and then the trunks of the nerves. The exsanguination of the limb and its isolation of the vascular network from the general circulation must necessarily be achieved. First, an elastic bandage is applied to the limb, above that, at the upper boundary of the field, a tourniquet is removed, a tourniquet is removed, at the lower boundary, a tourniquet is applied, after which the anesthetic is administered intraarterially (analgesia occurs after 2-3 minutes) or intravenously (analgesia occurs after 20— 30 min.). The analgesic effect is observed before the harness is removed.

Intravenous (intraarterial) anesthesia

Thanks for Attention!