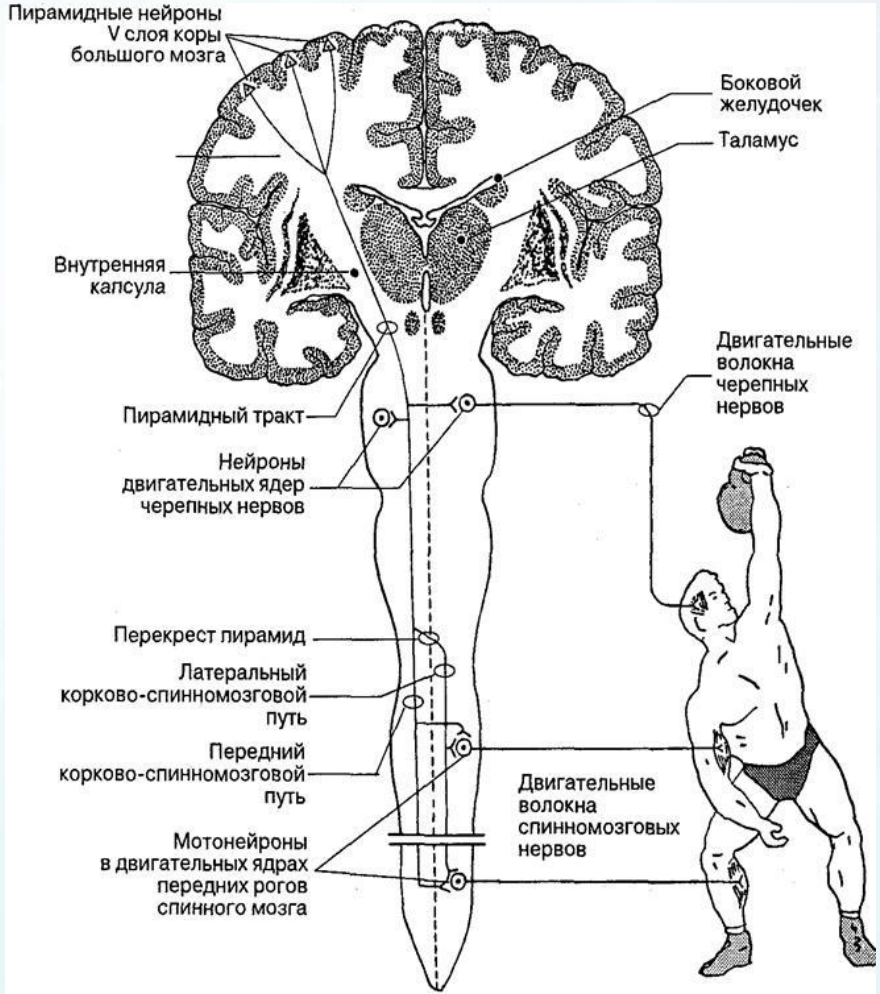
Testing the motor system

The motor system is a set of neurons involved in the regulation of muscle activity

The examination of the motor functions starts with a general evaluation of the muscles of the limbs and trunk to identify muscle atrophy, hypertrophy, pseudohypertrophy, fibrillary and fascicular twitching. If the above changes are present, their localization and severity are noted. To determine the degree of muscle atrophy, the circumference of the limb segments is measured with a centimeter tape on both sides in symmetrical areas.

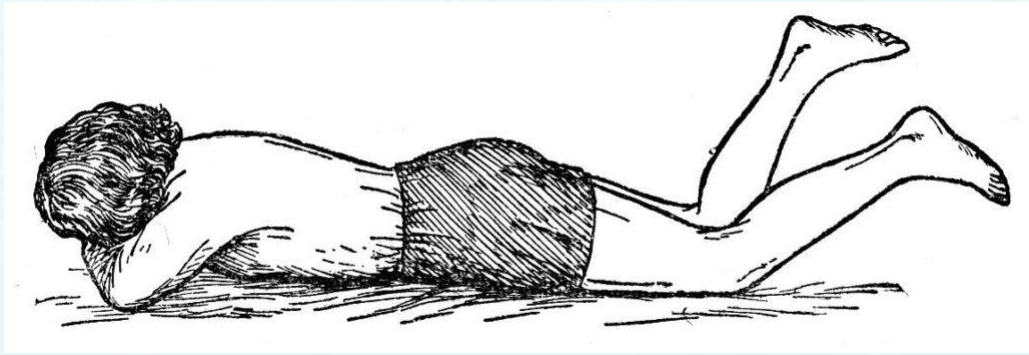


Stages of the motor system research

- General examination
- Evaluating the active and passive movements
- Muscle tone test
- Reflexes examination

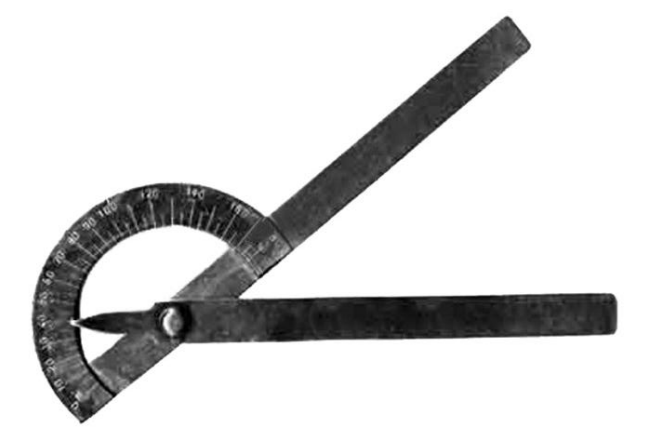
Active movements are examined in all joints. The patient is asked to raise his arms up and spread them to the sides. Extend them forward, bend and straighten them at the elbow and wrist joints, clench and unclench the fingers into a fist, spread and bring the fingers together, oppose the thumb to all the others; perform flexion and extension, abduction and adduction of the hip, flexion and extension of the knee joint, dorsal and plantar flexion of the foot, supination and pronation of the foot, flexion and extension of the toes. Standing and walking on the heels and toes are checked. When assessing active movements, their volume (full, limited, movements impossible) and speed are determined.

The Barre test is used to detect mild paresis: the patient is lying face down, his legs are bent at the knee joints at a right angle and asked to hold them in this position for one minute *(the lower Barre test)*. If there is paresis, the leg quickly gets tired and drops. A similar test reveals paresis of the upper limbs *(the upper Barre test)*: the patient holds his arms outstretched forward with his eyes closed, the paretic arm drops.



Passive movements are examined in all joint limbs. Attention is paid to the range of motion, the presence of contractures and ankylosis. A goniometer is used to accurately determine the degree of limitation of joint motion.

Muscle tone is assessed during passive movements, as well as by palpating the muscles at rest. It is advisable to examine muscle tone with the patient lying on his back. Having achieved complete relaxation of the muscles, a series of repeated passive movements are alternately performed in the joints of the arms (elbows, wrists) and legs (knees, ankles). Normally, during passive movements, even with maximum muscle relaxation, a slight, uniform resistance is felt on both sides.

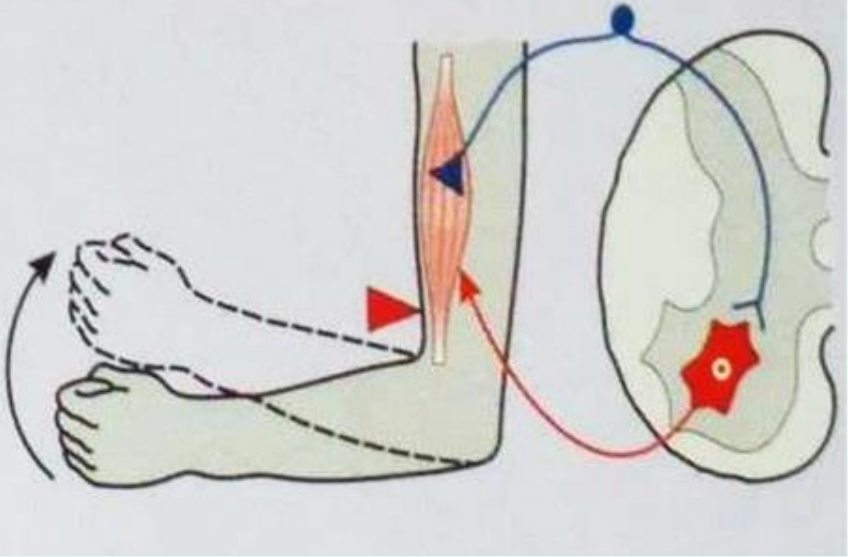


Deep reflexes

- Biceps tendon reflex
- Metacarpophalangeal reflex
- Knee reflex
- Achilles reflex

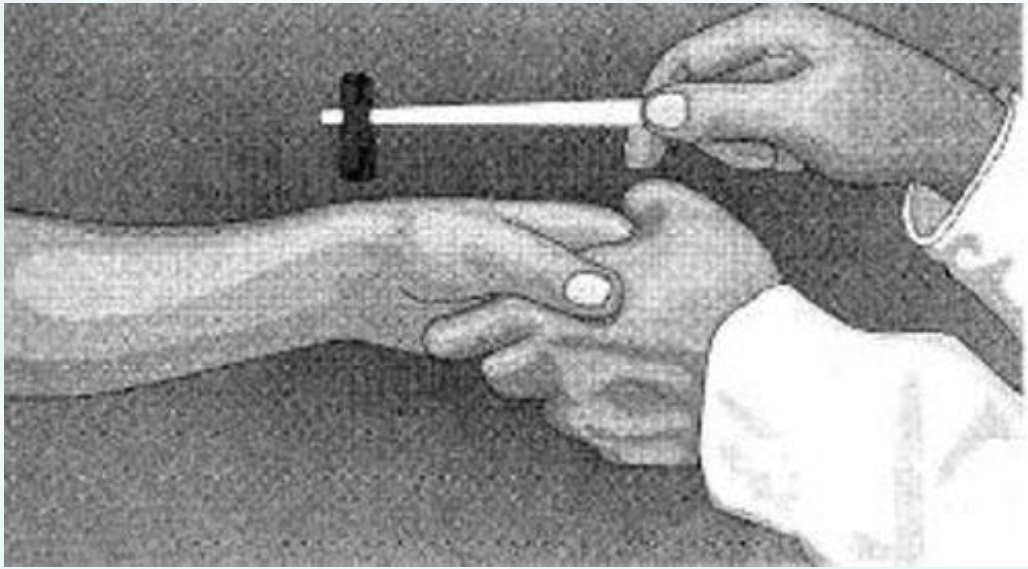
Biceps tendon reflex – flexion and slight pronation of the forearm when striking the biceps tendon with a hammer.

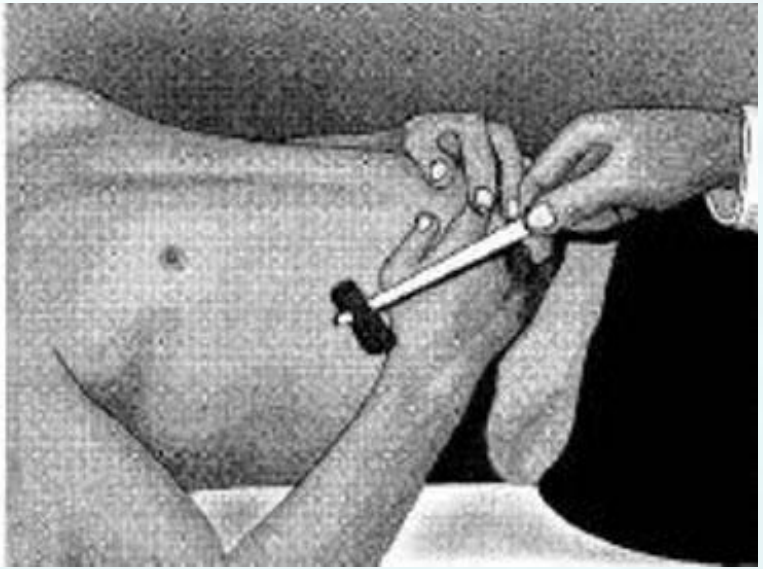
Reflex elicitation technique: the doctor grasps the left hand, the arm, bent at the elbow, slightly at an obtuse angle, the hand fixes the support behind the shoulder above the elbow, while the forearm and hand hang freely; The hammer strike is applied to the biceps tendon.
Reflex arc: segments C_V-C_{VI}.



The metacarpophalangeal reflex is a slight flexion of the arm at the elbow joint and pronation of the hand when striking the styloid process of the radius.

When examining the reflex, the subject's arms are bent at the elbow joints at an obtuse angle and are freely positioned on his thighs (or the doctor holds the subject's hand with his left hand, and strikes with a hammer with the other). Reflex arc: segments C_V-C_{VIII}.



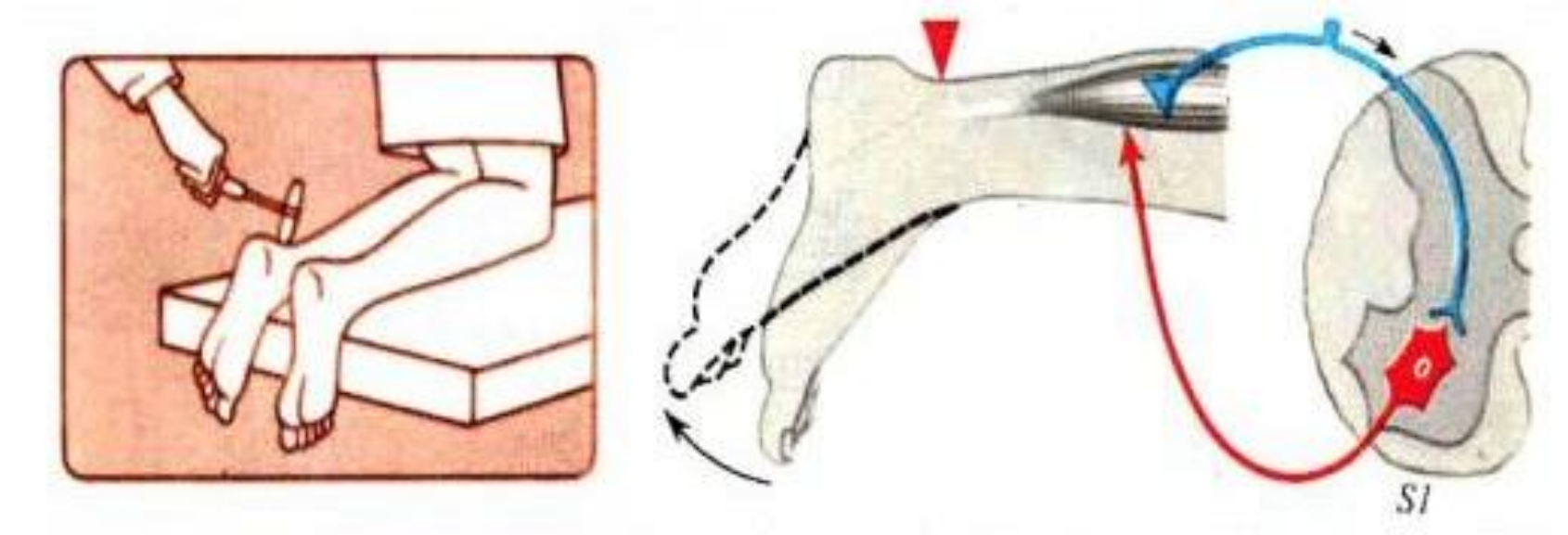


The knee reflex is the extension of the lower leg when the tendon of the quadriceps femoris muscle below the patella is struck. Reflex arc: L_{II}-L_{IV} segments.

Reflex elicitation technique: with the patient lying on his back, the doctor places his left hand under the knee joint of one or both legs and positions the legs so that the shins are bent at an obtuse angle, and the heels rest on the bed, and with the right hand strikes the tendon with a hammer. You can also throw one leg over the other or place a rolled-up pillow under the knee joints.

The Achilles reflex is a contraction of the calf muscles and plantar flexion of the foot in response to a hammer blow to the Achilles tendon. Reflex arc: segments S_I-S_{II}.

Reflex elicitation technique: the patient kneels on a couch so that his feet hang down, while his hands are supported by the wall; the hammer blow is applied alternately to the right and left tendons.



Skin reflexes

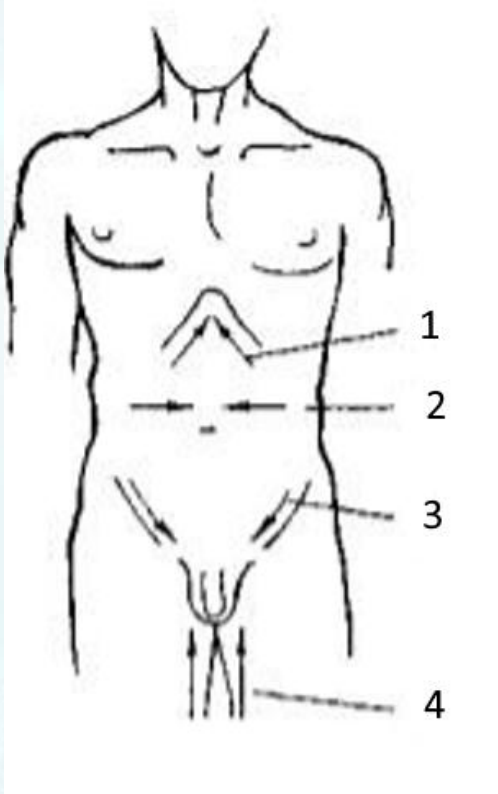
- Abdominal reflexes
- Cremasteric reflex
- Plantar reflex

Abdominal reflexes – contraction of the abdominal wall muscles in response to stroke irritations of the abdominal skin in the direction from the periphery to the midline alternately on the left and right.

- ***upper abdominal reflex*** (Th_{VII}-Th_{VIII}) is caused by stroking irritation along the edge of the costal arch;
- ***middle abdominal reflex*** (Th_{IX}-Th_{X}) – at the level of the navel;
- ***lower abdominal reflex*** (Th_{XI}-Th_{XII}) – along the inguinal ligament.

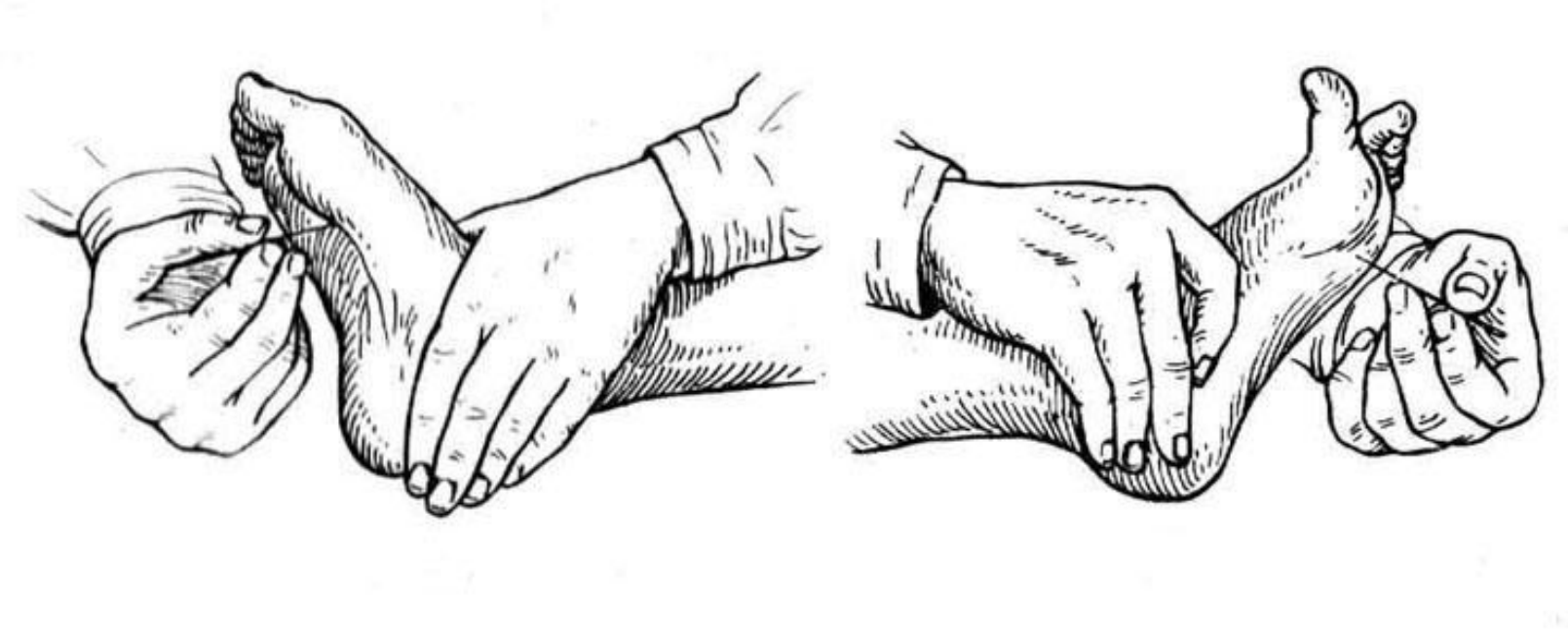
Cremasteric reflex (L_{I}-L_{II}) – when the handle of the malleus is stroked on the inner surface of the thigh, the cremaster muscle contracts and the testicle rises.

Evaluating the abdominal and cremasteric reflexes



1 – upper abdominal reflex
2 – middle abdominal reflex
3 – lower abdominal reflex
4 – cremasteric reflex

Plantar reflex – plantar flexion of the toes in response to a stroke of the sole.
Reflex arc: segments L_V-S_I.

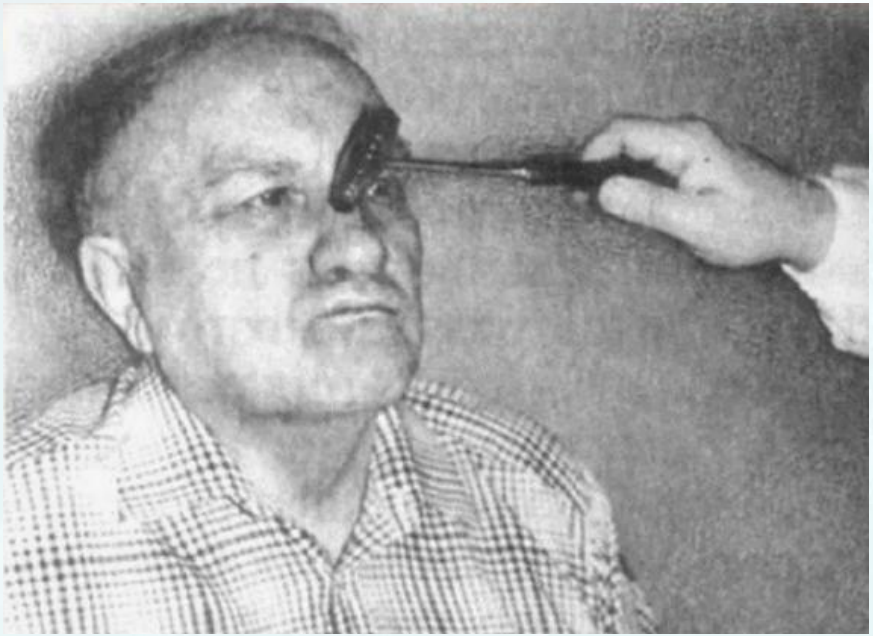


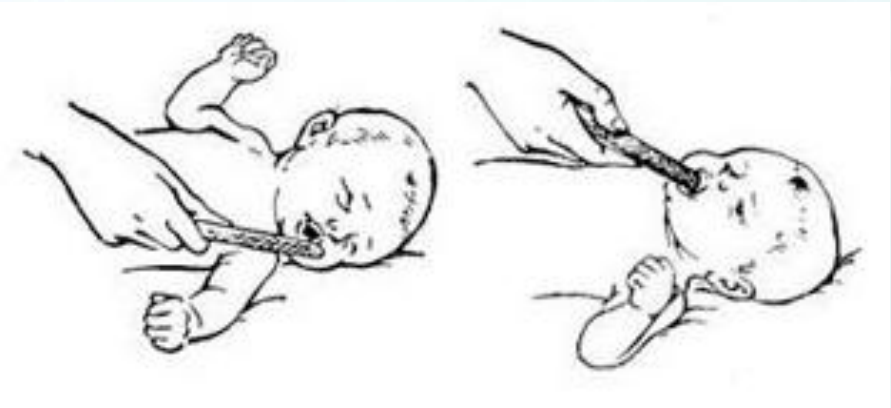
Oral automatism reflexes

- Nasolabial reflex
- Proboscis reflex
- Sucking reflex
- Palmomental reflex

Astvatsaturov's nasolabial reflex is evoked by tapping the root of the nose with the neurological hammer, the response is the protrusion of the lips forward.

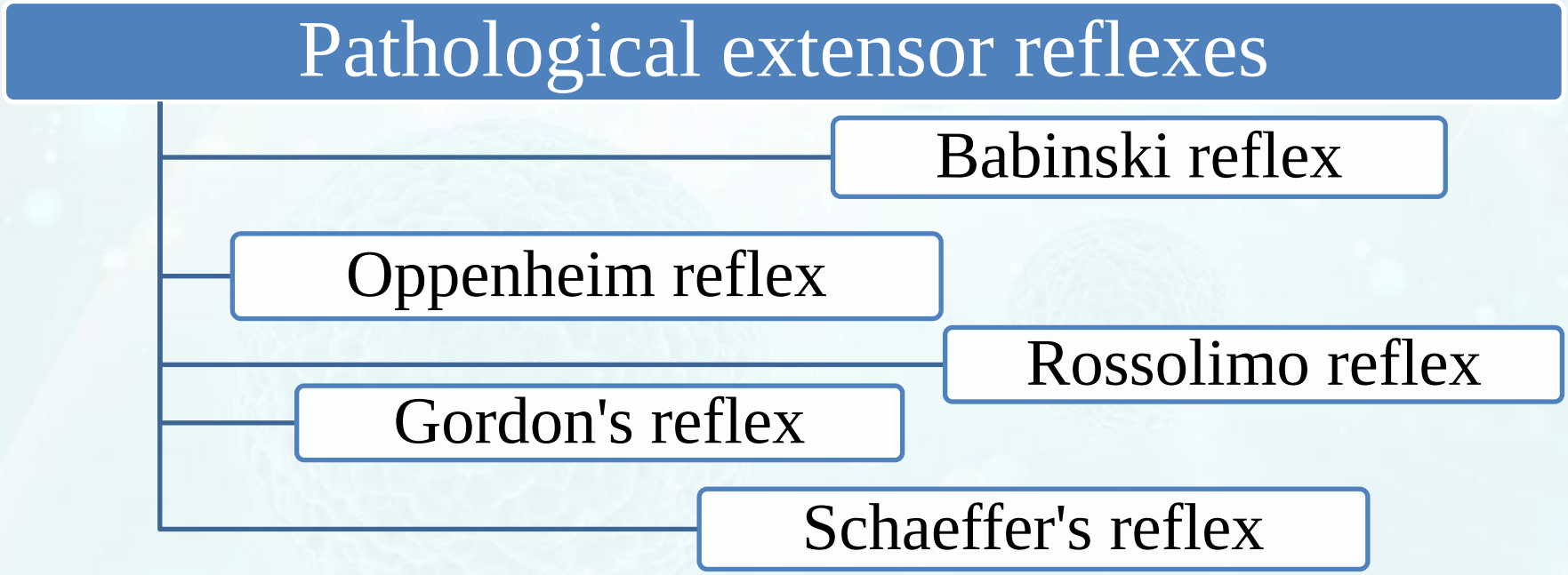
Proboscis reflex – protrusion of the lips when the neurological hammer is struck on the upper or lower lip.



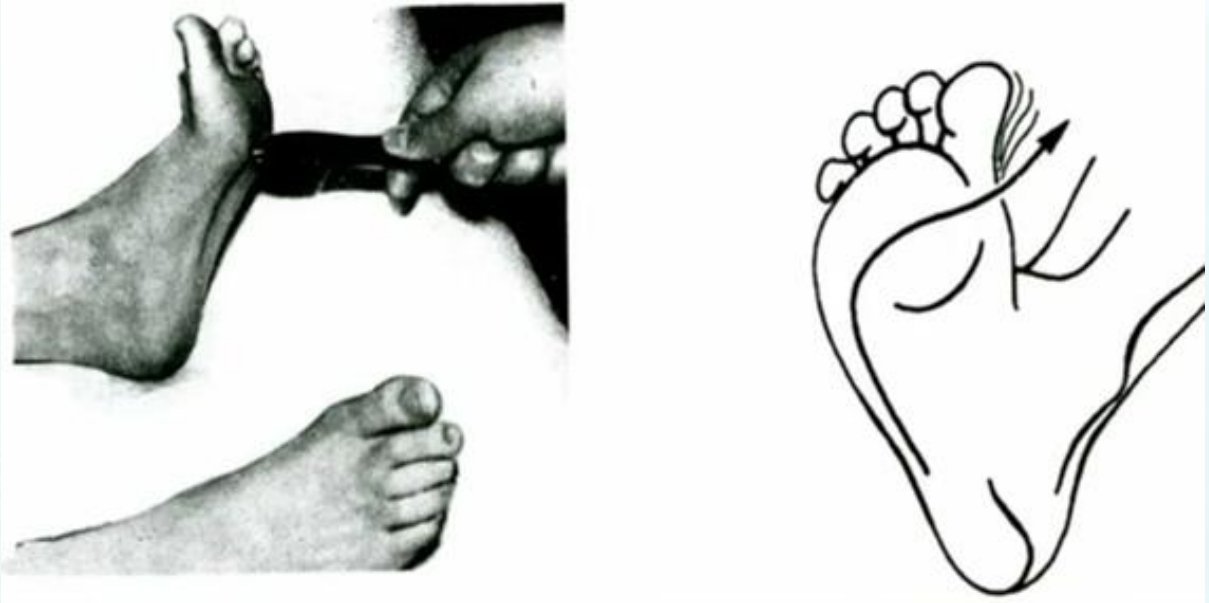


Sucking reflex – stroking irritation of the closed lips causes sucking movements.

Marinesco-Radovici palmomental reflex – contraction of the mental muscle on the same side with stroke irritation of the skin in the area of the elevation of the thumb.

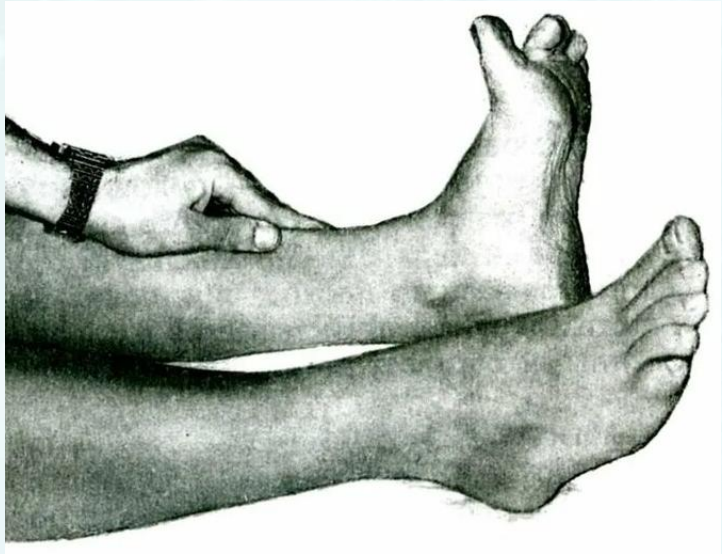

Pathological extensor reflexes
Babinski reflex
Oppenheim reflex
Rossolimo reflex
Gordon's reflex
Schaeffer's reflex

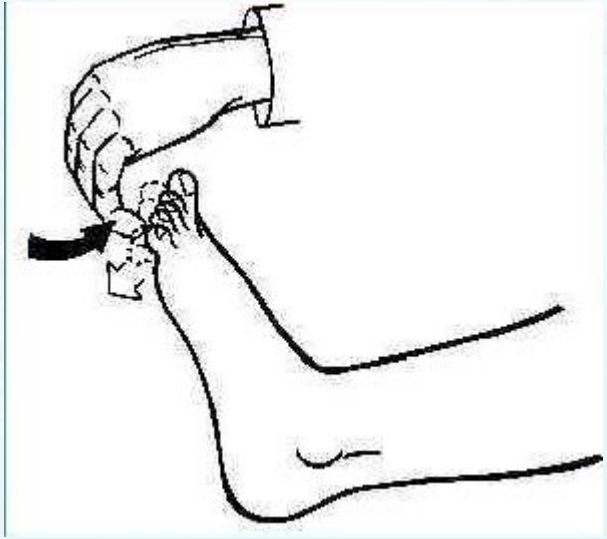
Babinski reflex is a slow extension of the big toe (isolated or combined with fan-shaped divergence of the other toes) in response to a stroke irritation of the outer edge of the sole.
It is observed normally in children under one year of age.



Oppenheim reflex – extension of the big toe when moving the flesh of the big toe along the inner edge of the tibia in the direction from top to bottom.

Rossolimo reflex – rapid flexion of the II-V toes/fingers when the examiner's fingers strike the flesh of these toes with abrupt blows.





Gordon's reflex is the extension of the big toe when the calf muscles are compressed by the hand.

Schaeffer's reflex is the extension of the big toe when the Achilles tendon is compressed or irritated by pinching.