

General myology

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Myology is the study of the **muscular system**, including the study of the structure, function and diseases of muscle

Muscles are the active part of the locomotor system



The Functions of Muscles

- generation of movements
- stabilization of the position of the body
- control of the volume of the organs
- smooth muscle – sphincters
- motion of the substances in the body-blood, lymph, urine, air, food and fluids, sperm
- generation of body heat
- voluntary and involuntary contractions of skeletal striated muscle

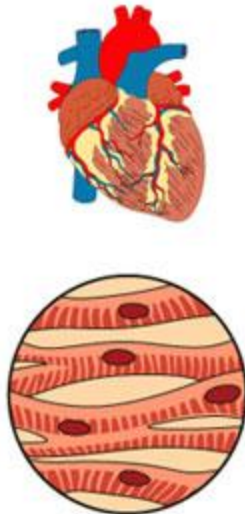


3 types of muscle tissue

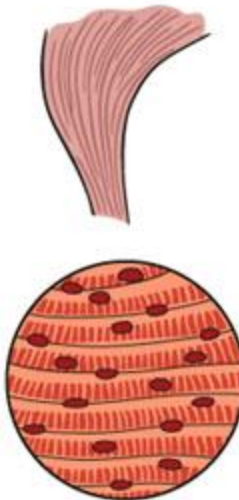
- **Smooth muscle tissue** (textus muscularis levis)
- **Striated muscle tissue** (textus muscularis striatus)
- **Cardiac striated muscle tissue** (textus muscularis striatus cardiacus)

All types of muscle tissue convert the chemical energy of ATP into the mechanical energy of motion.

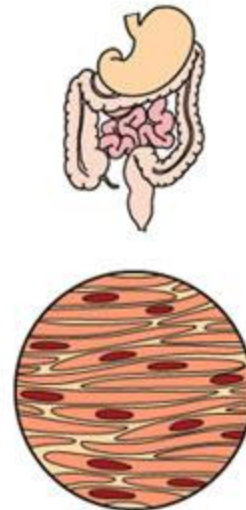
Cardiac muscle



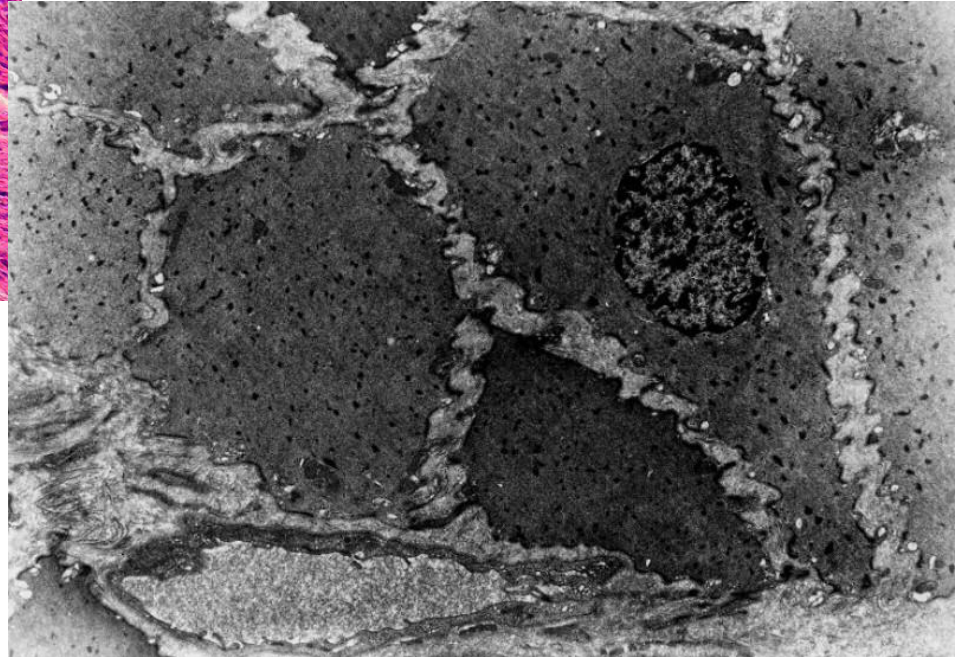
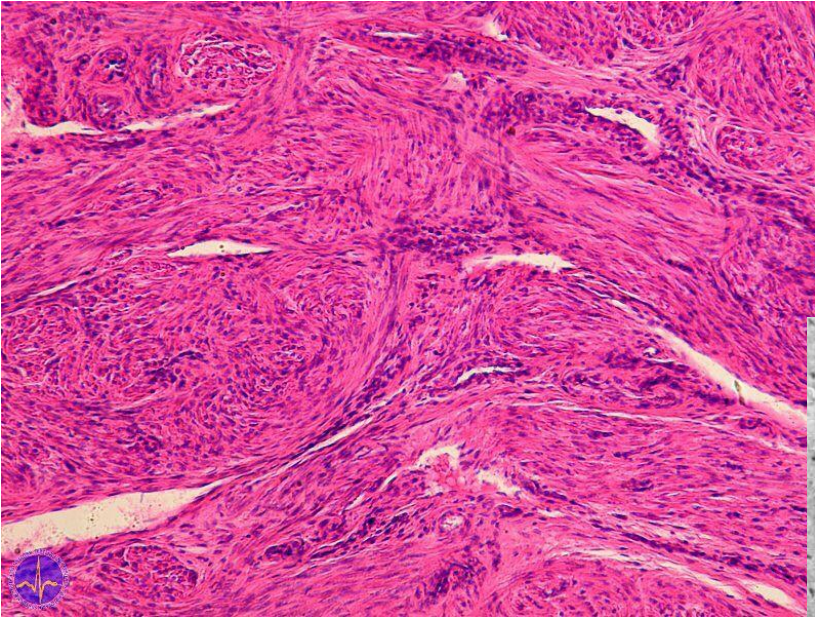
Skeletal muscle



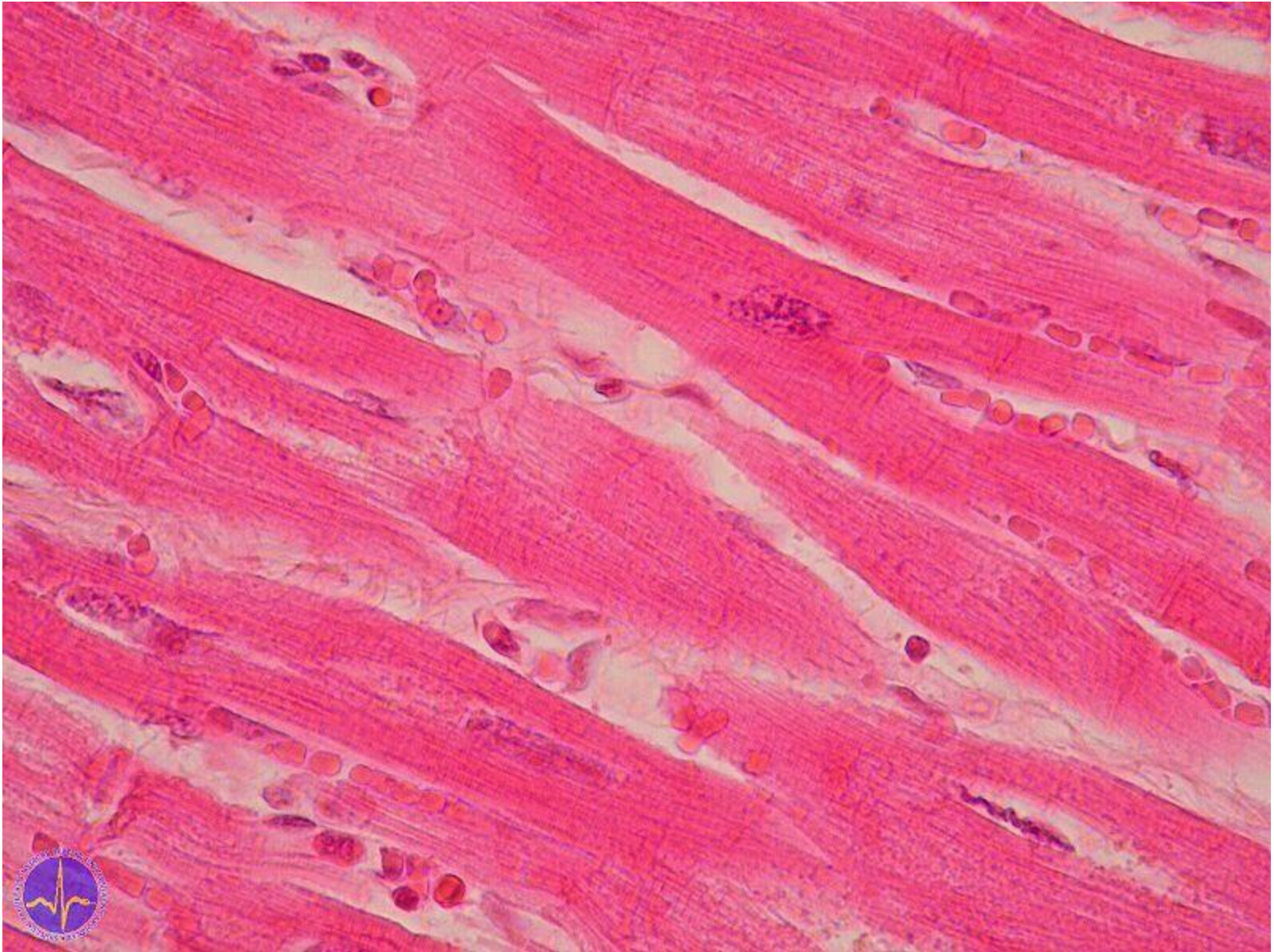
Smooth muscle



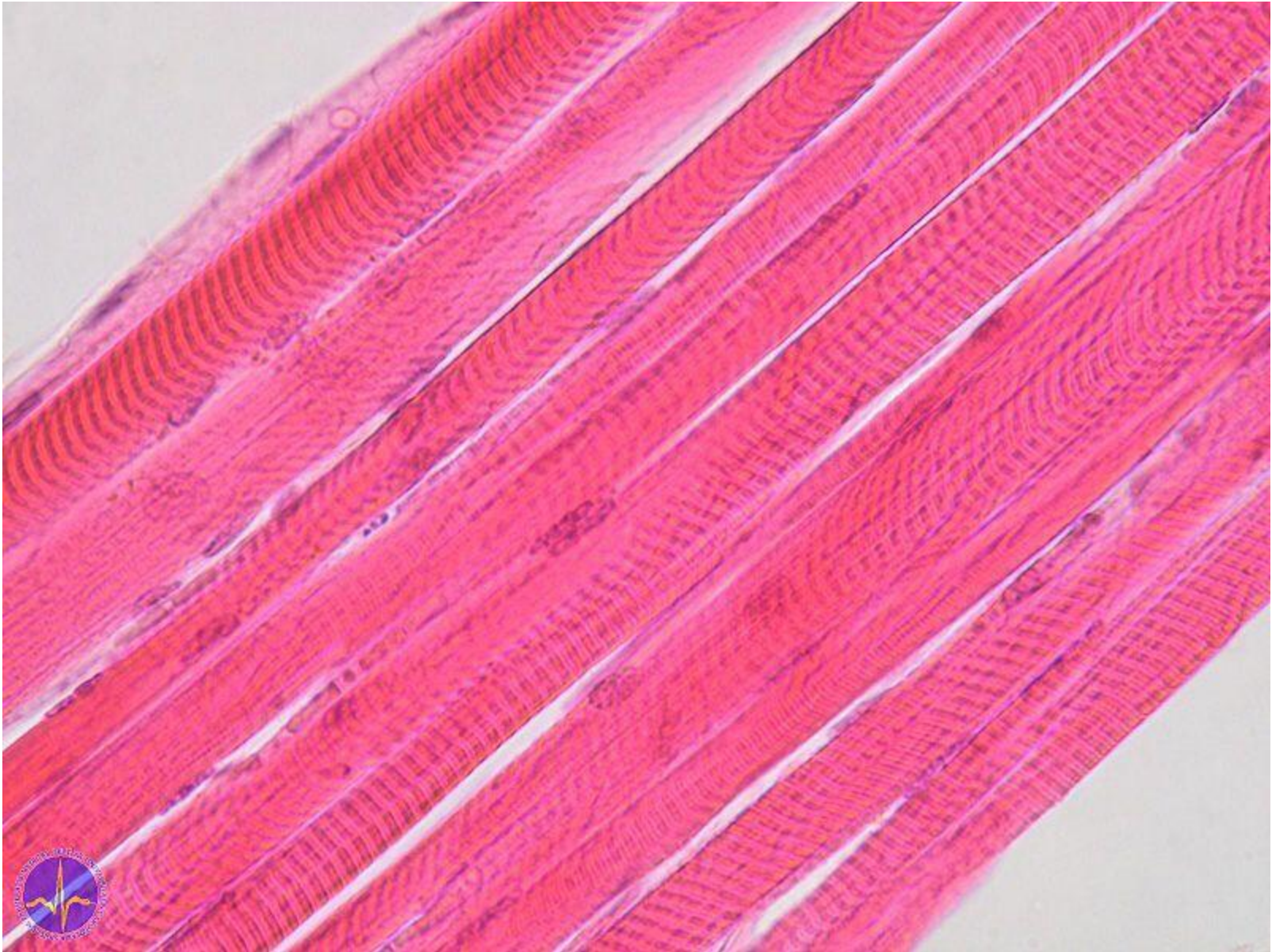
Smooth muscle



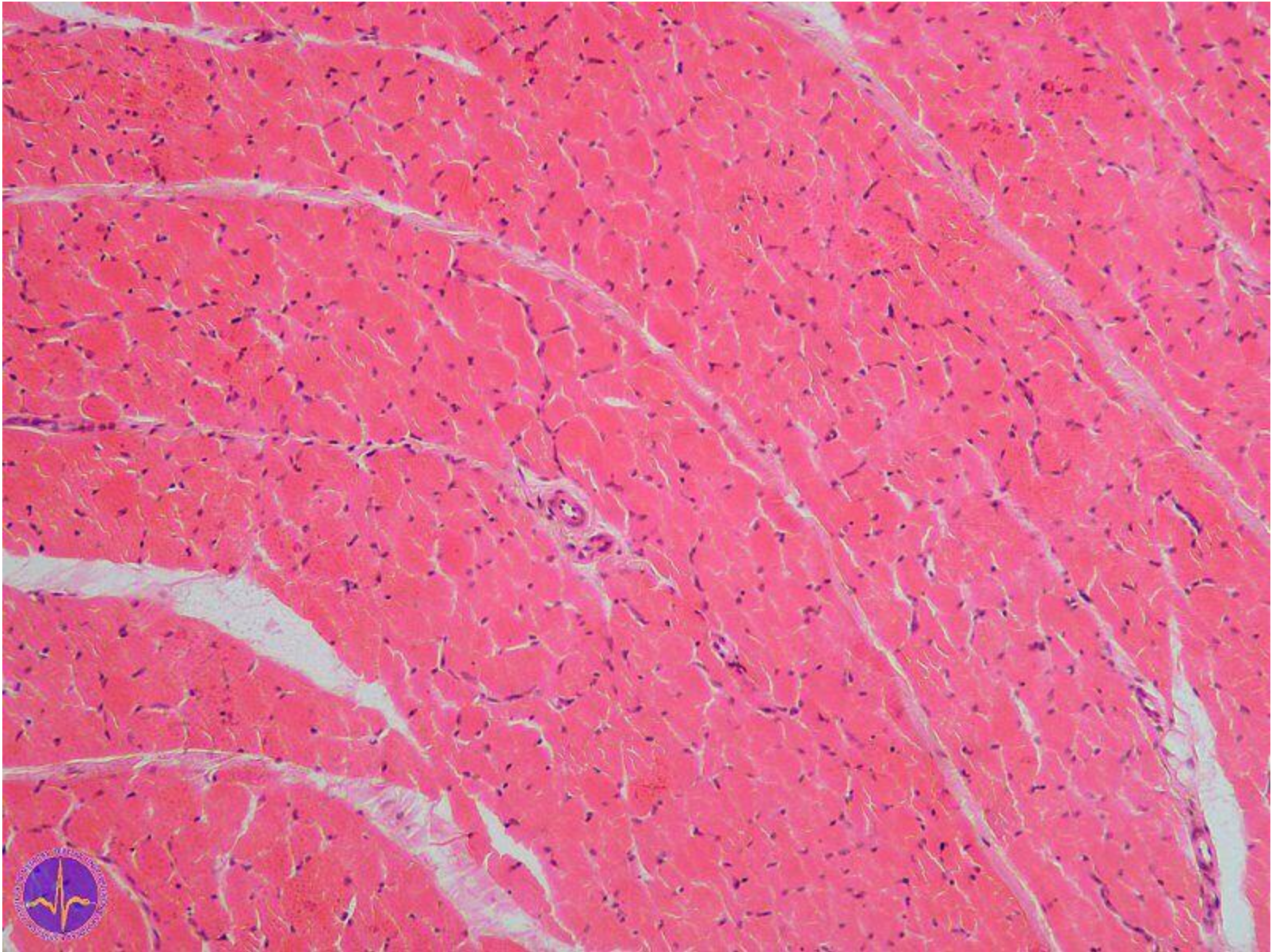
Cardiac muscle tissue



Skeletal striated muscle – longitudinal section



Skeletal striated muscle – transverse section



Skeletal striated muscle

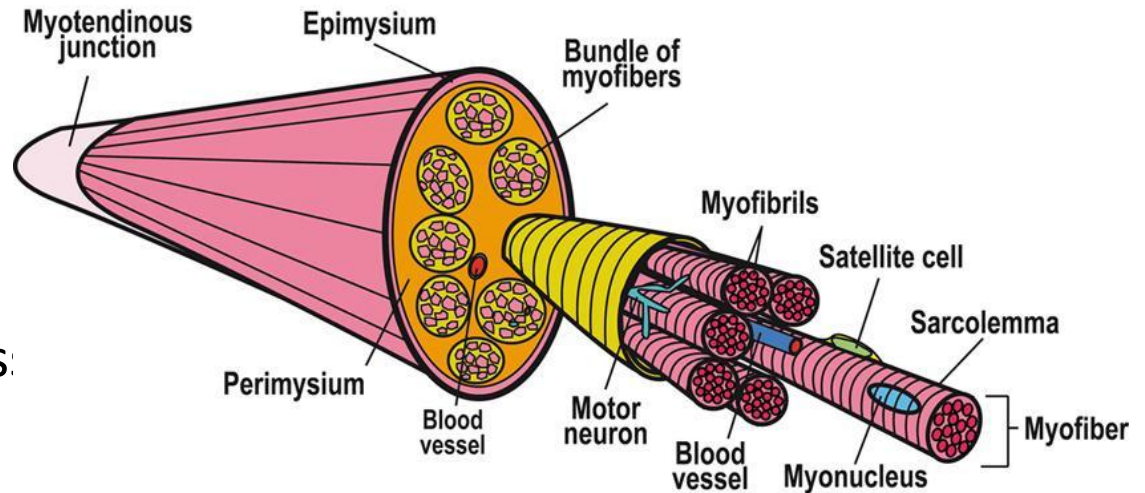
Myoglobin (pigment causing red colouring)

Fibres

- Quick
quickly fatigued
light (white)
in superficial layers
- Slow
more resistant to tiredness
dark (red)
in deeper layer

Inervated by cranial and spinal nerves

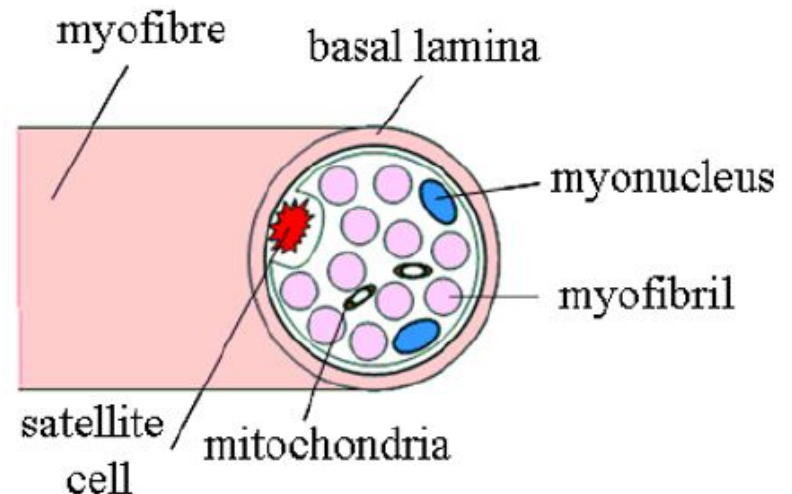
without innervation non-functional and atrophies

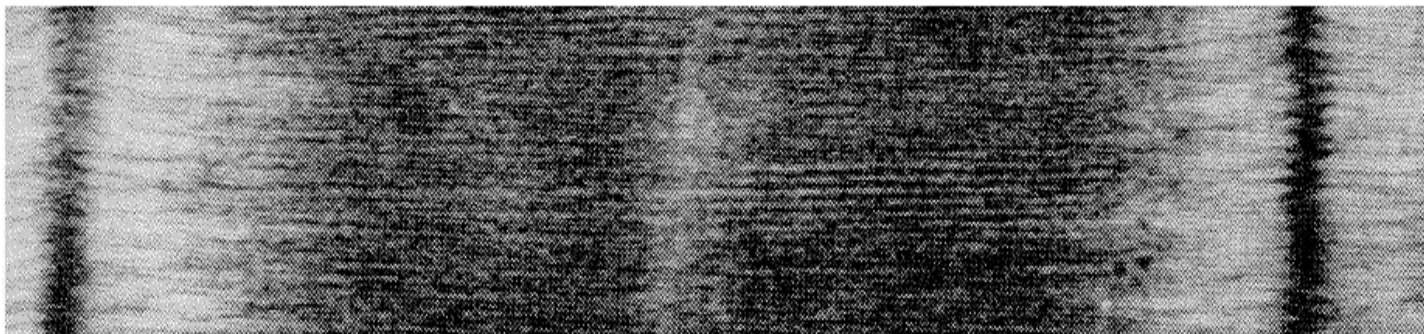
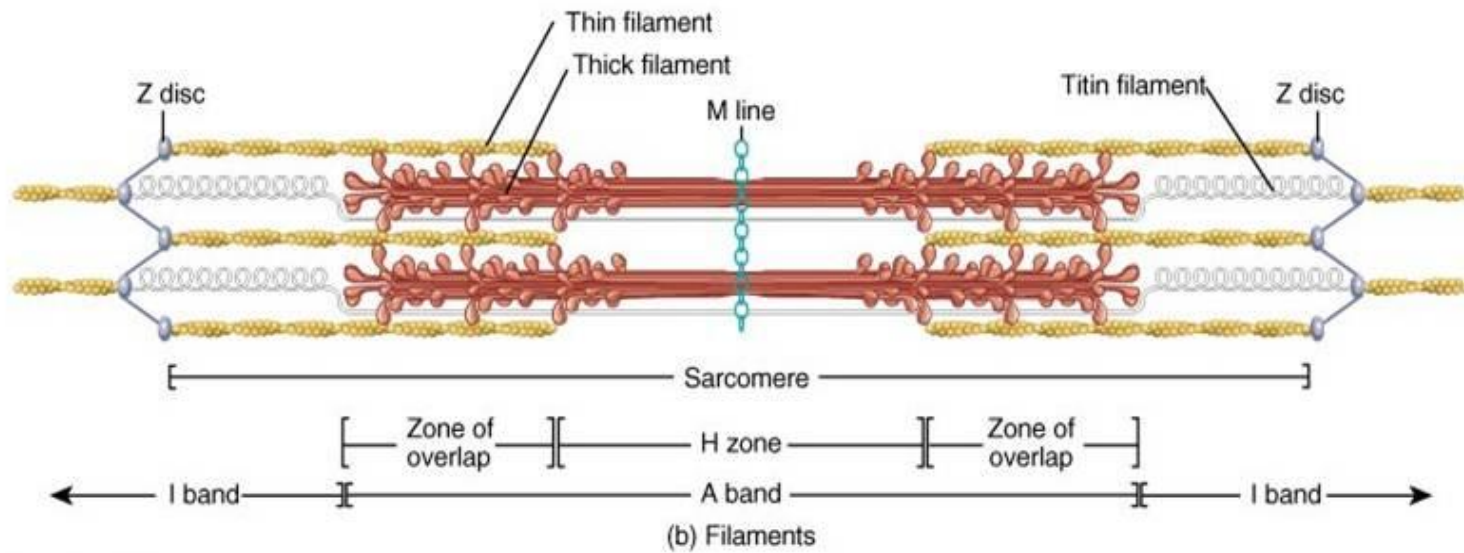
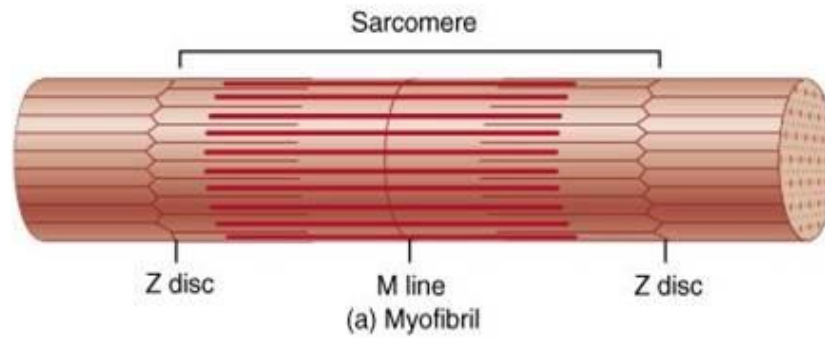


Skeletal striated muscle

myofibre (myofibra)

- Elementary structural unit
- Multinucleated
- thickness: 10–100 μm
- length: mm – cm
- origin: merging of elongated mononuclear cells (myoblasts) → myotubes (nuclei inside, myofibrils at the surface) → conversion to myofibres (nuclei at the surface, myofibrils inside)
- sarcolemma on the surface
- striated in the microscope
- lighter and darker sections





Functions of skeletal muscle

1. Movement of animal body
2. Control of body openings and passages
"maintain continence"
3. Generate heat by shivering
4. Body support and maintenance of posture

Basic muscle structure

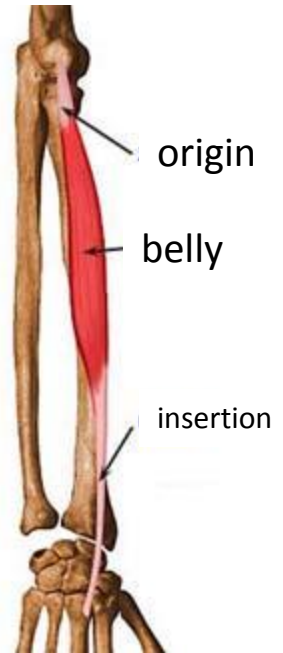
- striated muscle fibres
- special muscle structures
- primary muscle bundle
 - 10-100 fibres connected and covered by fibrous tissue
- secondary bundles
 - connection of primary bundles and covering by fibrous tissue
- bundles of higher orders

Basic muscle structure

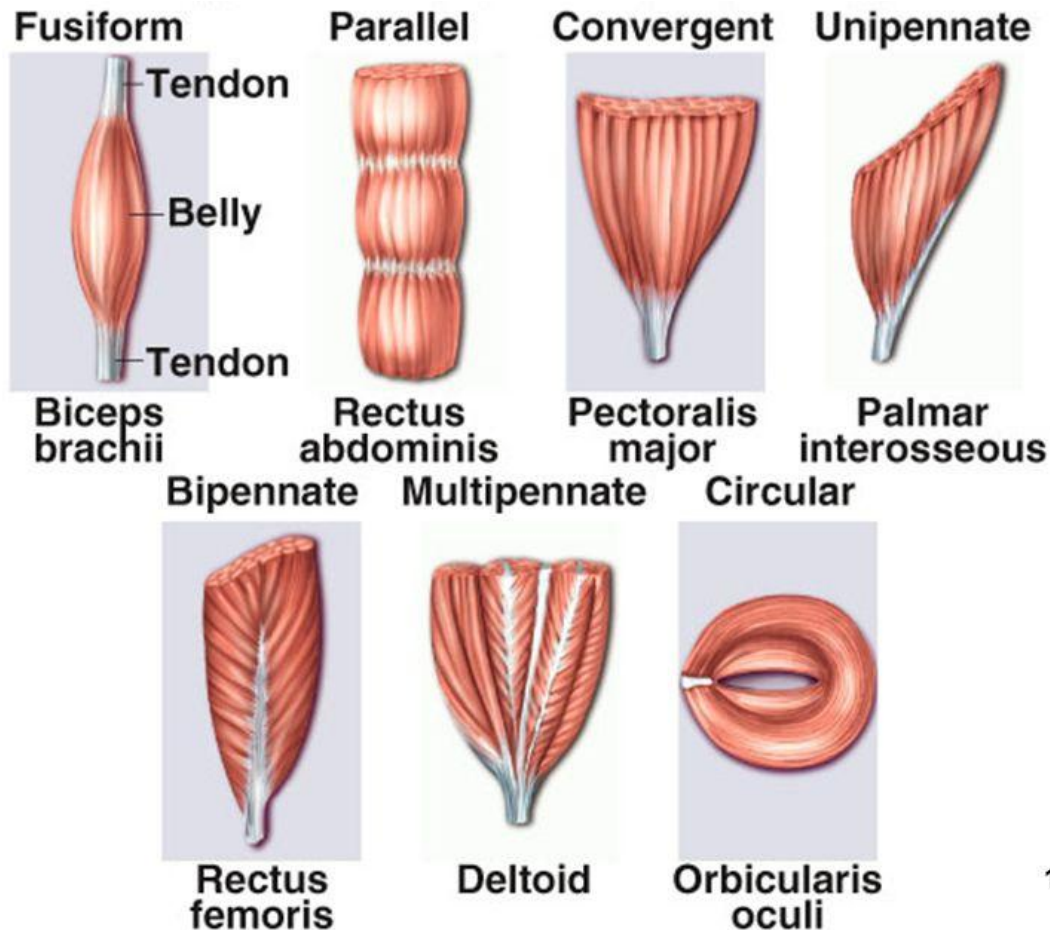
- fibrous tissue
 - endomysium (*perimysium internum*)
 - covers myofibres and bundles
 - epimysium (*perimysium externum*) = *fascia*
 - covers the whole muscle
- tendon (*tendo*) is a tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension.
- aponeurosis (*aponeurosis*)
- myotendinous junction (*junctio myotendinea*)
 - connection of myofibres with first (originating) and inserting tendon

The parts of muscles

- origin (*origo*)
 - mobile end (*punctum fixum*)
- head (*caput musculi*)
- belly (*venter musculi*)
- attachment (*insertio*)
 - fixed point (*punctum mobile*)

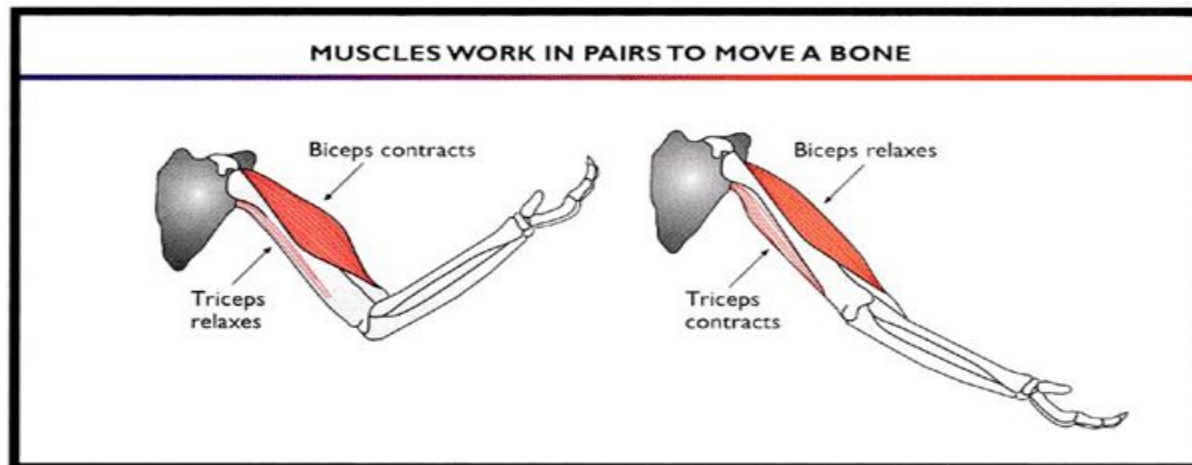


Classification of skeletal muscles by form



Classification of skeletal muscles by movement

- agonists
 - in the same direction acting muscles
- antagonists
 - counteracting muscles
- synergists
 - muscles participating in one movement (working together)
- main (principal) muscle
 - one out of the group of synergists
- auxiliary (accessory) muscles
 - they act together with the principal muscle



Classification of skeletal muscles by number of joints

- one-jointed muscles
 - they're causing the movement only in 1 joint
- double-jointed muscles
 - multiple-jointed muscles
 - they act mainly in the joint closest to the insertion



Classification of skeletal muscles by the direction of movement

- flexor (*m. flexor*)
 - makes the angle in the joint more acute
- extensor (*m. extensor*)
 - makes the angle in the joint more obtuse
- adductor (*m. adductor*)
 - moves the bone medially
- abductor (*m. abductor*)
 - moves the bone laterally
- rotator (*m. rotator*)
 - turns the bone around its long axis
- levator (*m. levator*)
 - lifts up a part of the body
- depressor (*m. depressor*)
 - drops down a part of the body
- pronator (*m. pronator*)
 - helps with pronation
- supinator (*m. supinator*)
 - helps with supination
- opponens (*m. opponens*)
 - places the thumb against other fingers
- sphincter (*m. sphincter*)
- dilator (*m. dilatator*)

The work of muscles

Dynamic-work in which muscles move parts of a person's body, and the body moves in relation to a support, earth or water surface.

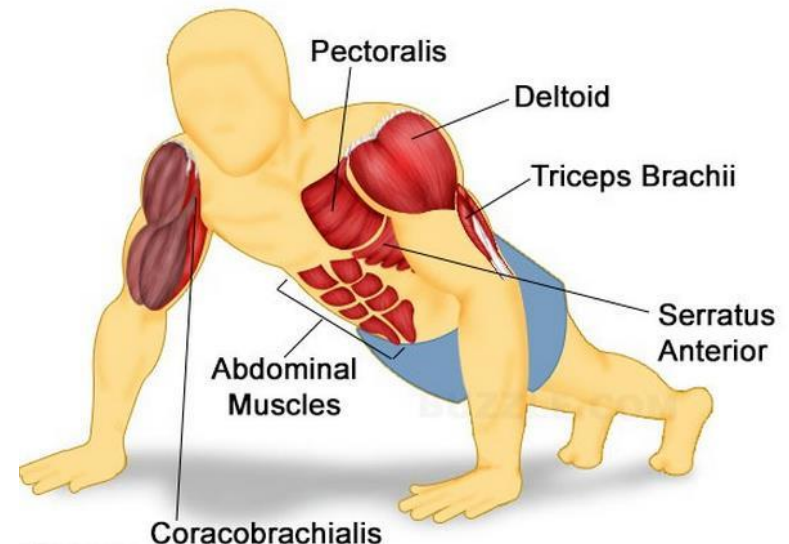
- Holding;
- Overcoming;
- Yield.

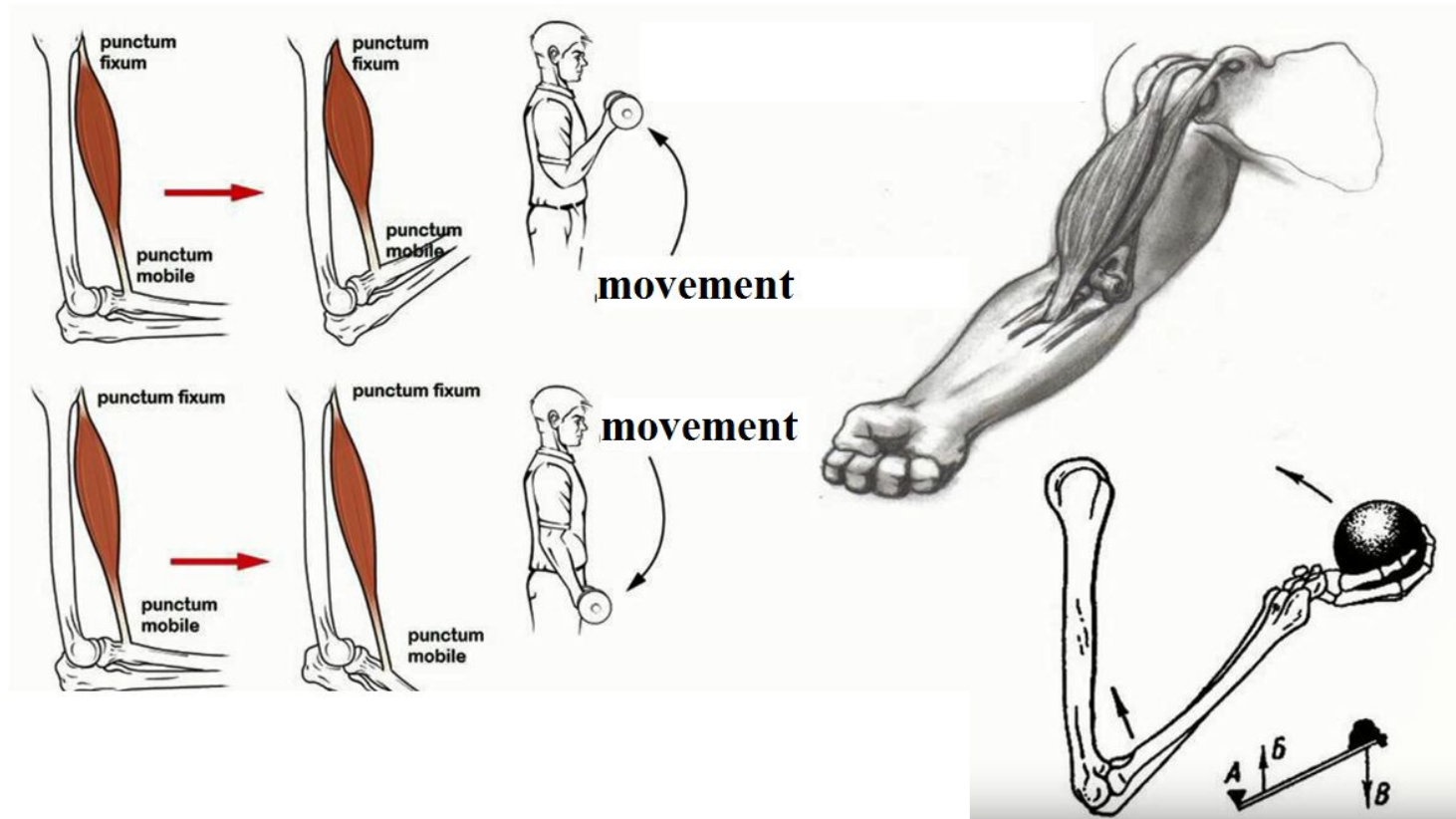
Static work is observed while maintaining the positions of parts of the body. At the same time, there are no noticeable movements in the joints, there is no external mechanical effect.

- Holding items
- Holding the posture



Muscles Targeted By Push-ups

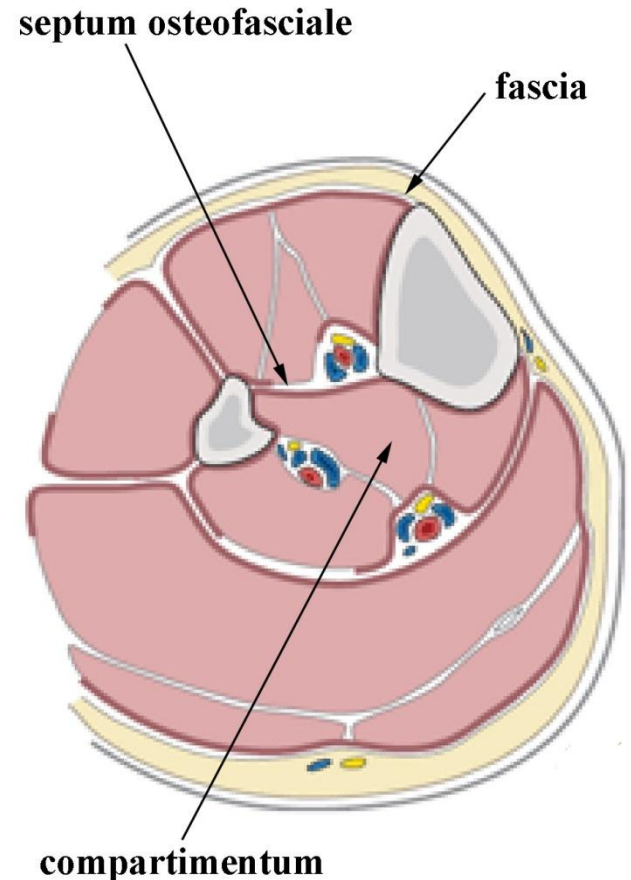




- **Punctum fixum** is a point, which is not moving during a contraction of a muscle, ie it is fixed. If it is an origin of the muscle or an insertion of the muscle depends on the kind of movement.
- **Punctum mobile** is a point, which is not moving during a contraction of a muscle, ie it is fixed.

Special muscle structures

- **fascia** (= *perimysium externum*)
 - fibrous envelope of muscle or muscle group
 - barrier for spreading of inflammation in that specific area
- **osteofascial septum** (= *septum osteofasciale*)
 - fascial divider from the superficial fascia to the periosteum
 - separates the space for muscle groups – **compartment** (*compartmentum*)

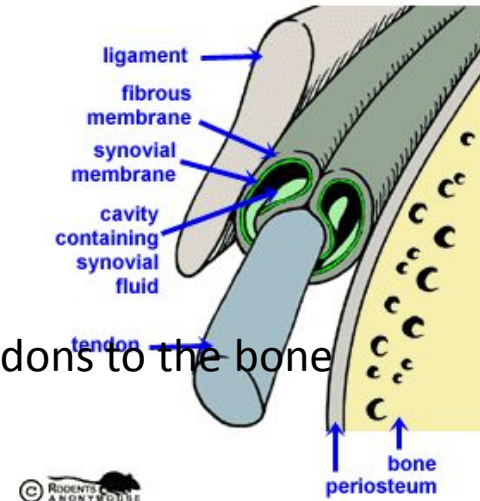


Fasciotomy

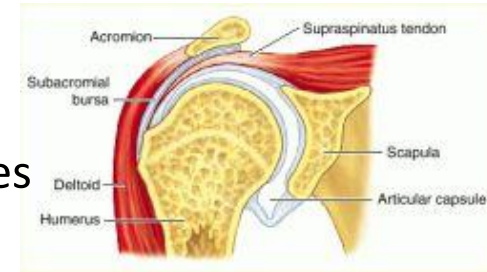
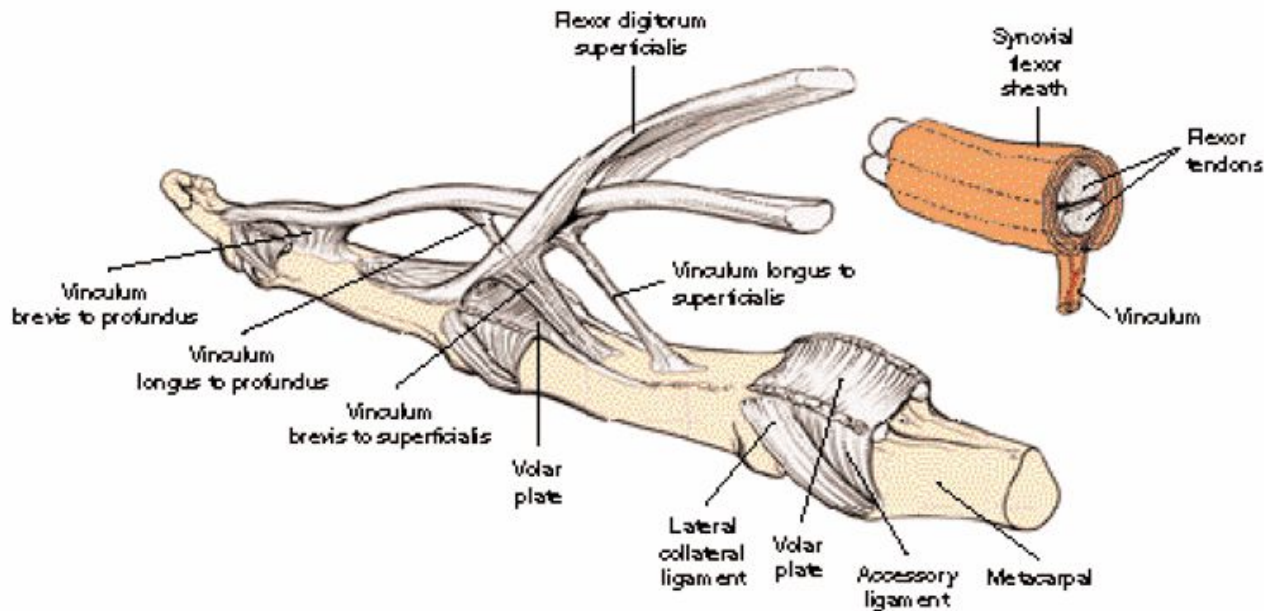


Special muscle structures

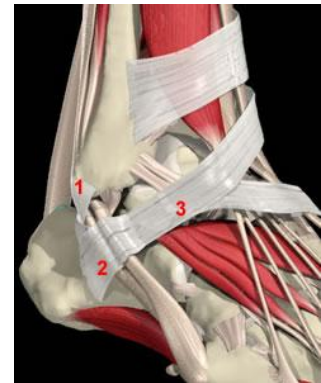
- tendon (*tendo*)
 - strip of tough fibrous connective tissue composed of bundles of collagenous fibrils
 - connects the muscle to the bone
 - *peritenonium internum* (covers the bundles)
 - *peritenonium externum* (consistent envelope on the surface of the tendon)
- aponeurosis (*aponeurosis*)
 - flat tendon
 - mutually crossing bundles in layers
- tendinous sheath (*vagina tendinum*)
 - space along the tendon lined by synovial membrane
 - *vagina fibrosa*: surrounds the vagina synovialis, holds the tendons to the bone
 - *vagina synovialis*
 - *epitenonium*: inner layer (covers the tendon)
 - *peritenonium*: outer layer
 - *mesotenonium*: mutual switching of both previous things



Special muscle structures

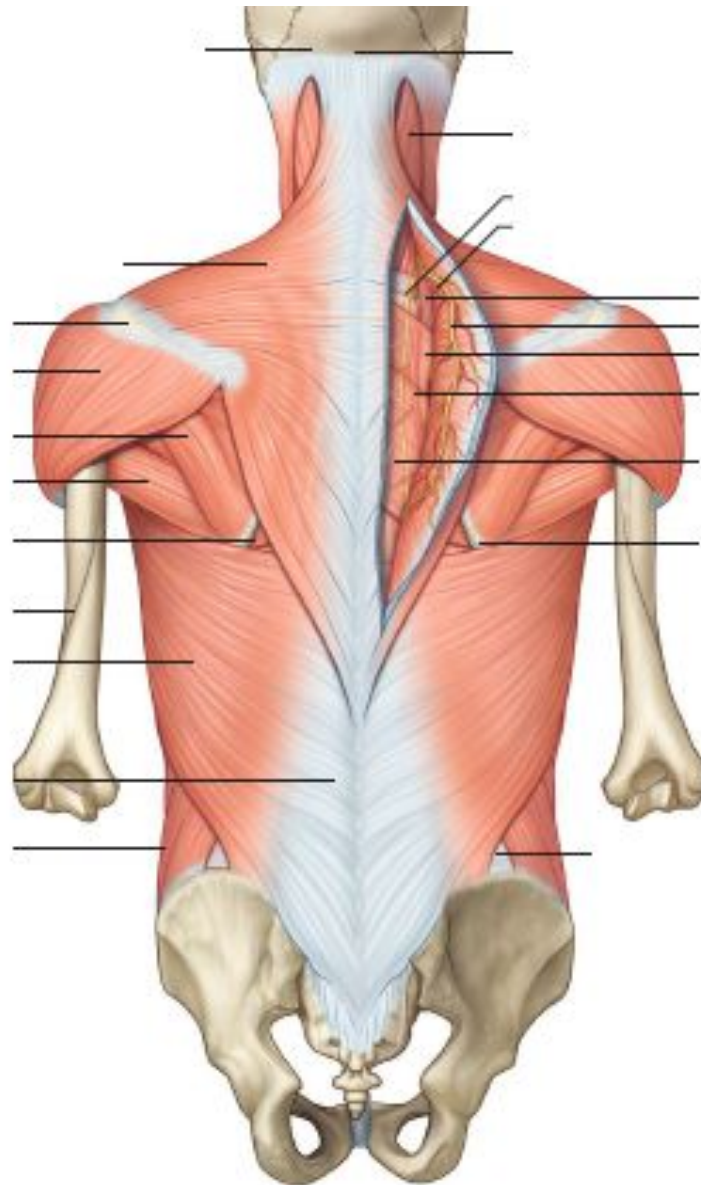


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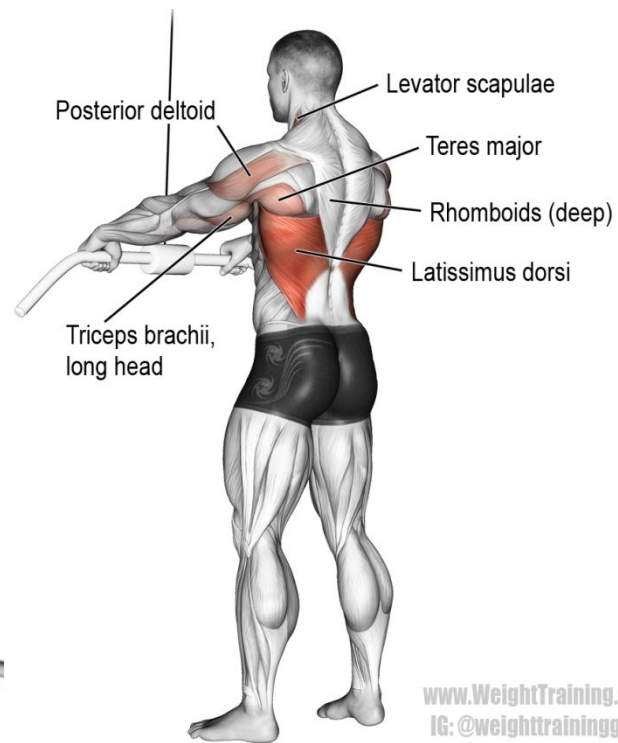
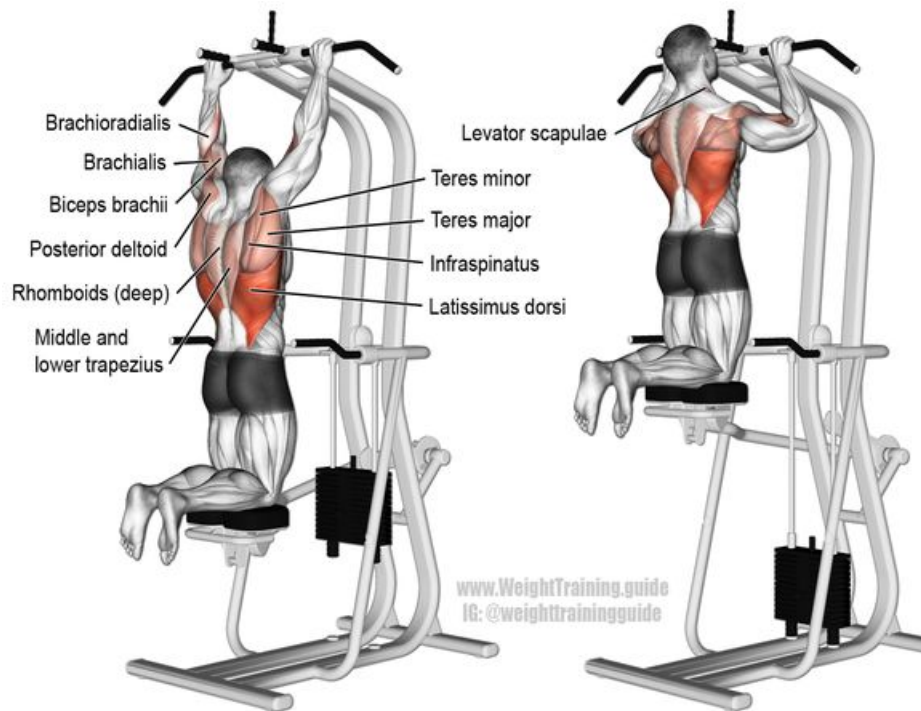


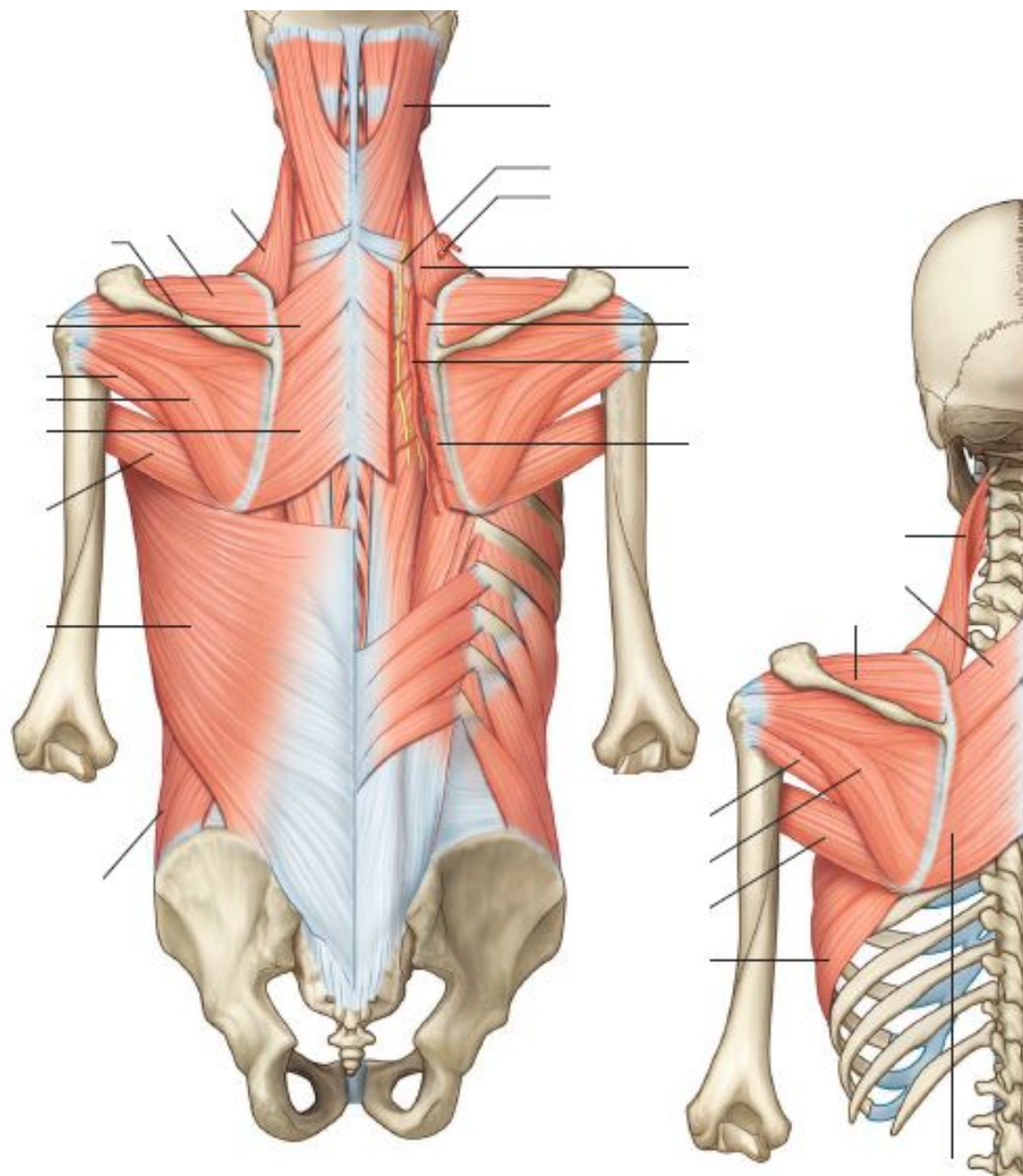
canal

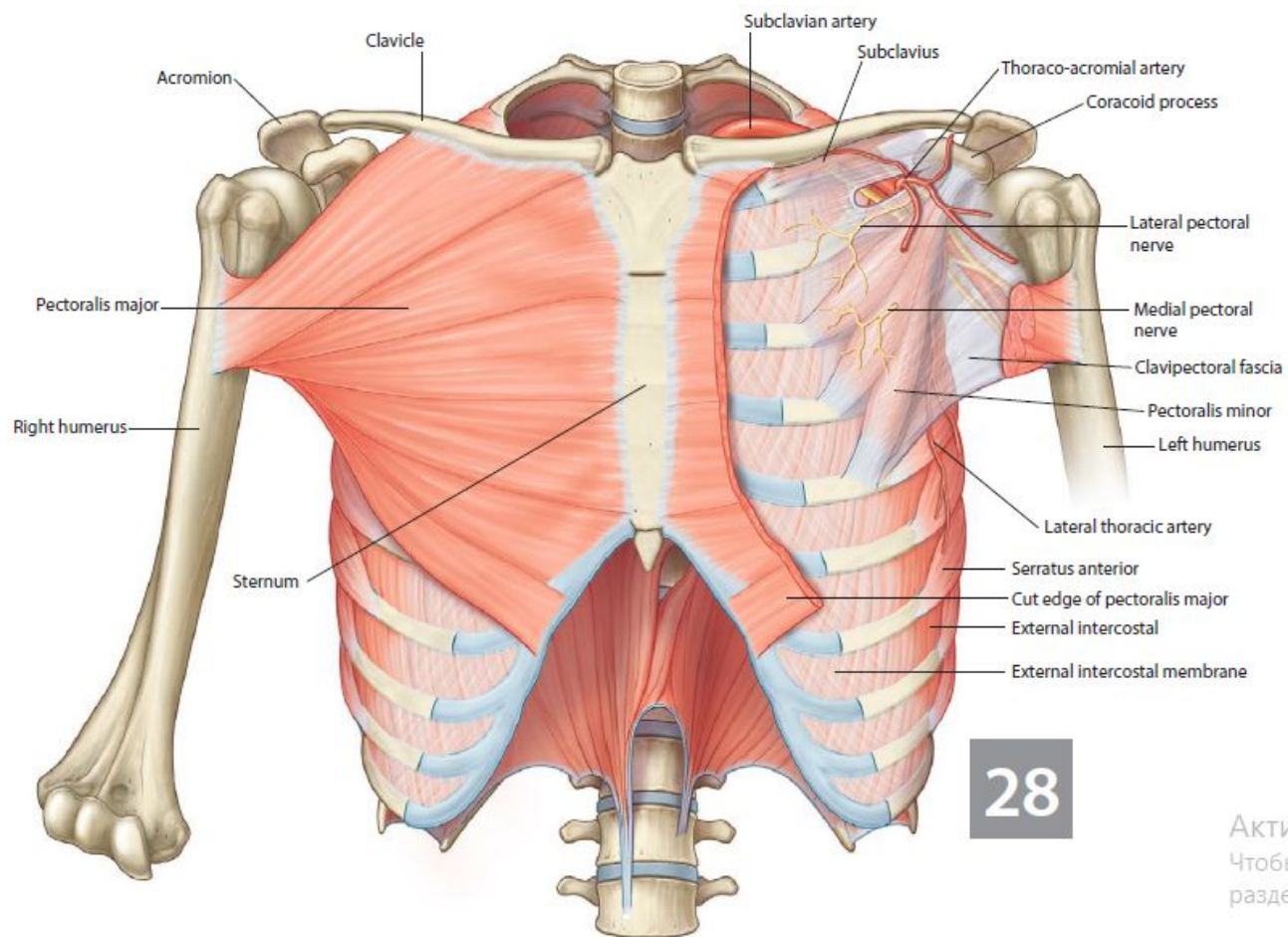
- vincula
 - mesotenonium of tendinous sheaths of the flexors of the hand
 - vascular supply for corresponding tendons run through them
 - *vincula brevia et longa*





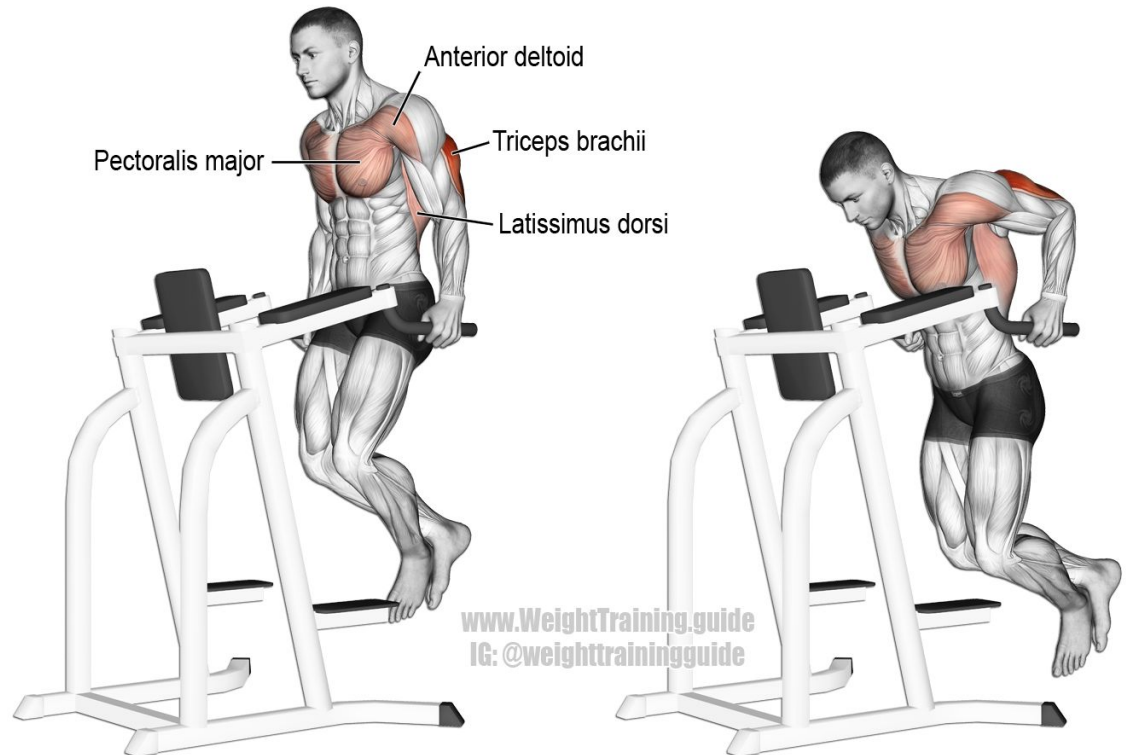
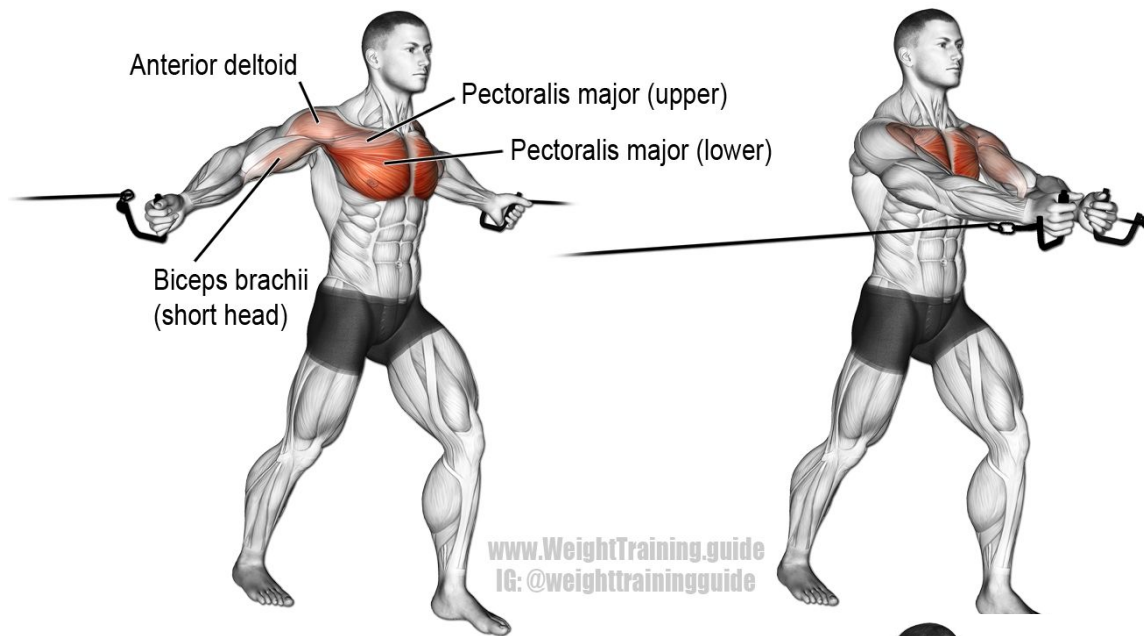


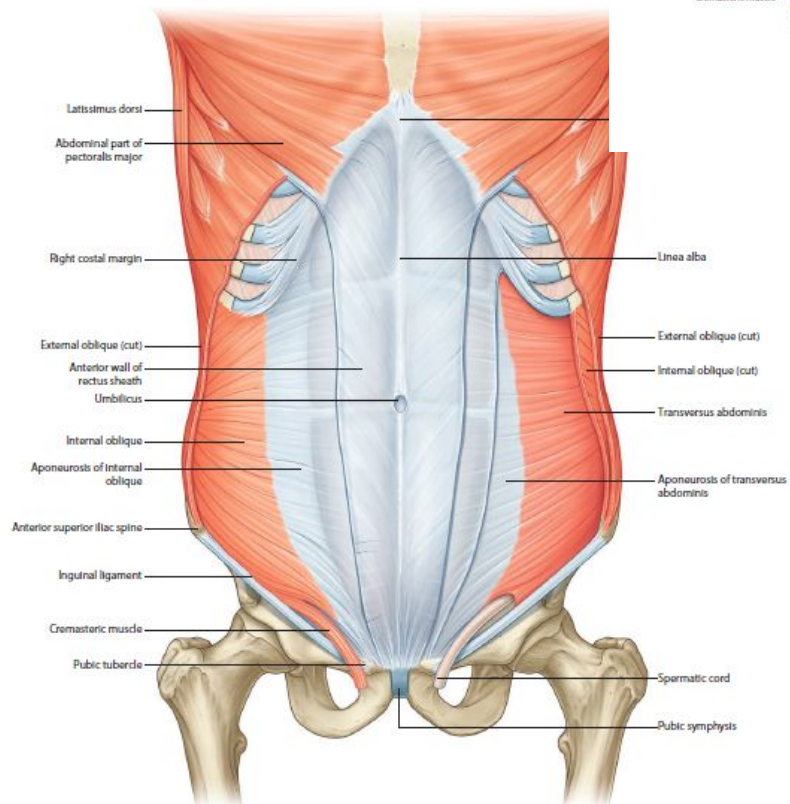
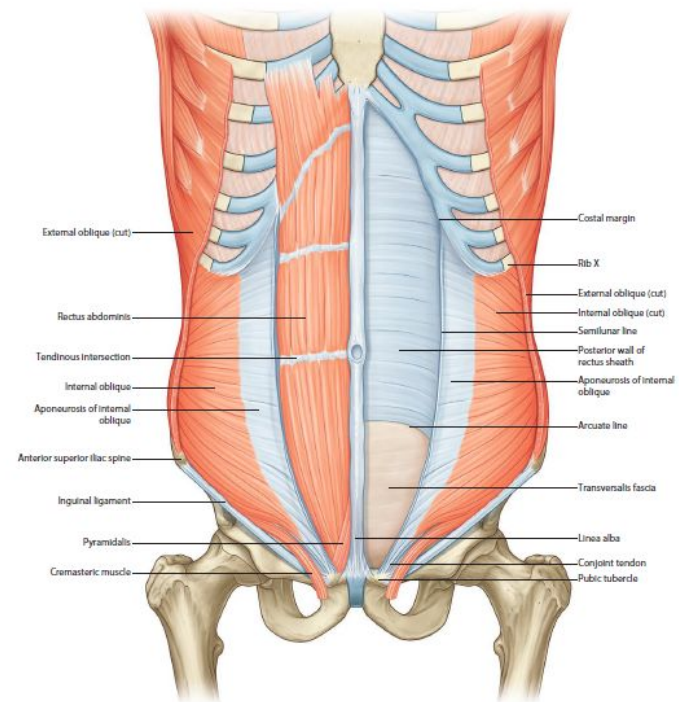
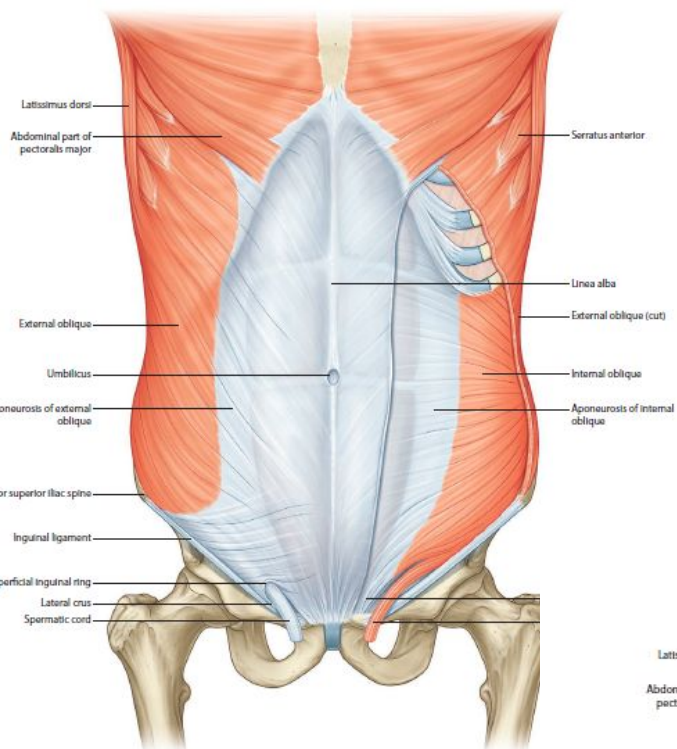




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Активация
 Чтобы активир
 раздел "Парам

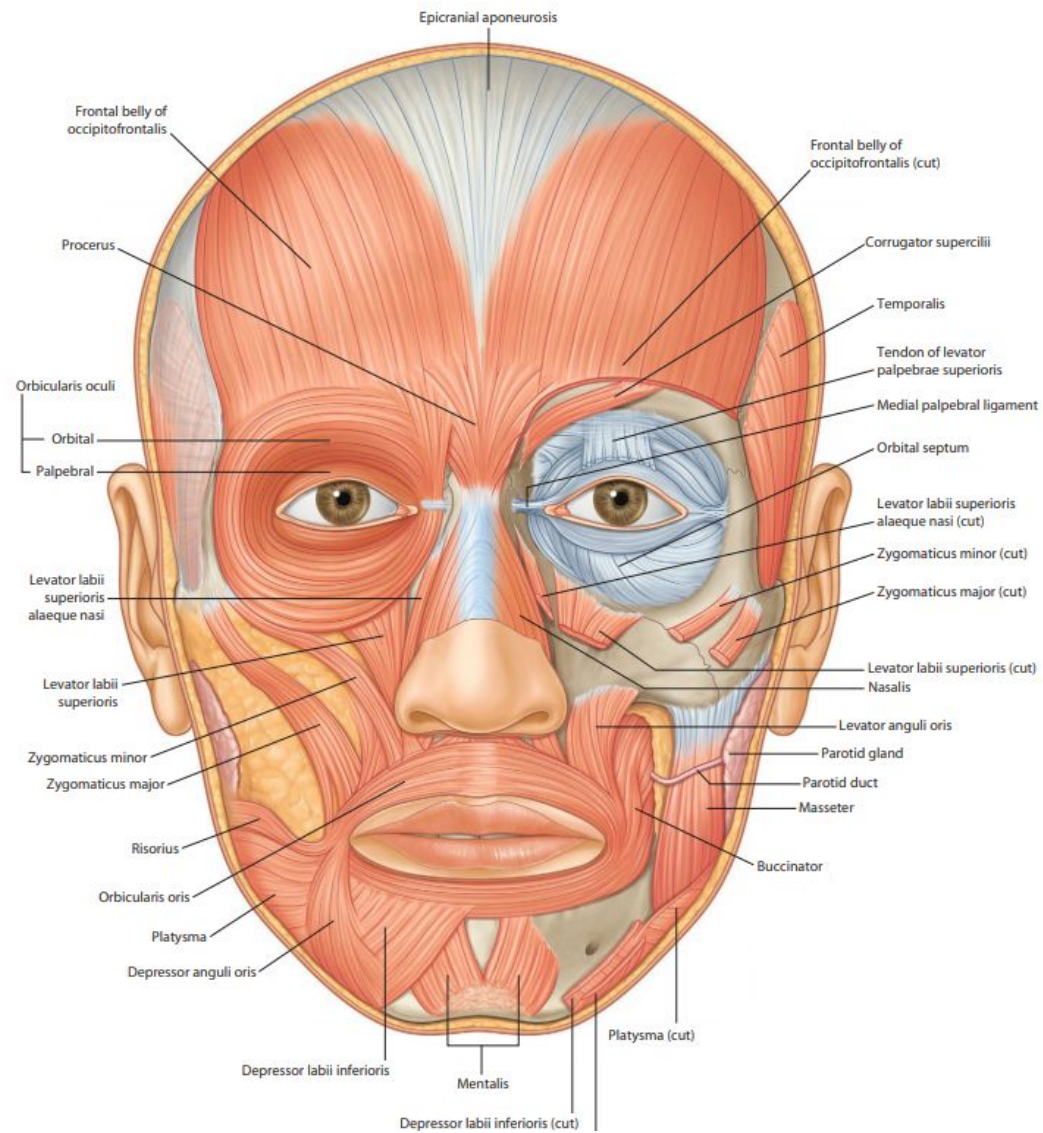




Упражнения для ПРЕССА

С СОБСТВЕННЫМ ВЕСОМ

 верхний сегмент прямой мышцы	 скручивания	 стандартные подъемы корпуса	 скручивания с выпрямленными руками к согнутым ногам
 нижний сегмент прямой мышцы	 обратные скручивания	 ножницы	 подъемы ног
 прямая мышца	 махи ногами в положении лежа на спине	 планка на локтях	 статический подъем прямых рук и ног
 внешние косые мышцы	 скручивания с касанием стоп	 скручивание на боку с подъемом ноги	 косые скручивания

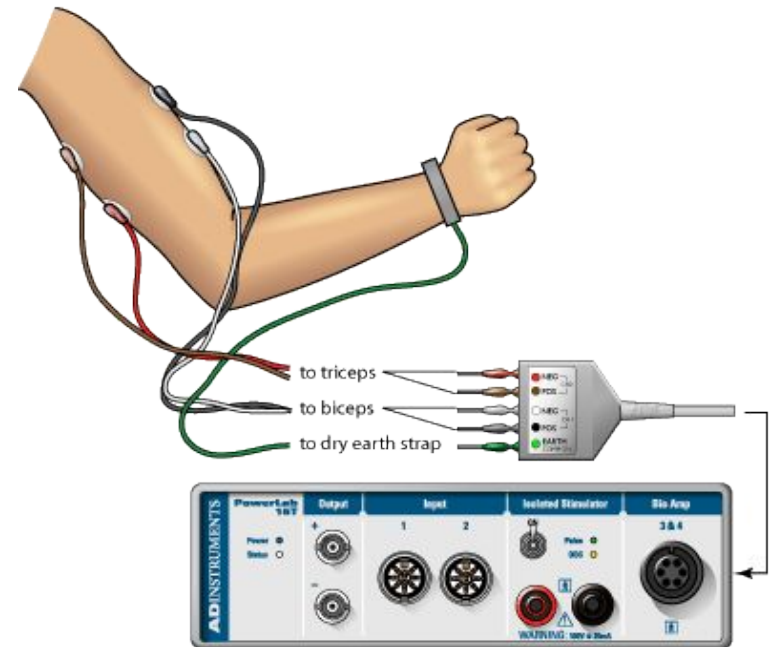


EMG (electromyography)

- detection of the superficial muscle or the intramuscular activity
- detects the change of electrical potential
- diagnostics for various muscle and neural malfunctions



http://biomech.ftvs.cuni.cz/pbpk/kompendium/biomechanika/experiment_metody_emg.php



<http://www.fsps.muni.cz/inovace-SEBS-ASEBS/elearning/biomechanika/vyzkumne-metody-v-biomechanice>

Functional muscle test

- informs us about the muscle strength
- helps to assess the extent and location of the impairment
- analysis and examination of performance for the whole movement
- assessment – 6 grades
 - 0 – no sign of contraction
 - 1 – twitch (not enough to do the move)
 - 2 – very weak (movement in the whole extent, doesn't overcome the resistance of the tested part of the body)
 - 3 – weak (overcomes the gravity)
 - 4 – good (overcomes medium-sized outer resistance)
 - 5 – normal (very good function)

Abnormal contraction

- *spasm* – involuntary contraction of one muscle
 - cramp – painful spasm
 - tetanus – multiple spasms of skeletal muscles
- *tic* – involuntary twitches of muscles, usually under voluntary control
- *tremor* – rhythmical, involuntary contractions of opposite groups of muscles
- *fasciculations* – involuntary, short twitches on motor unit visible under the skin
- *fibrillate* – spontaneous contractions of fibres of one muscle that aren't visible under the skin

Homework

- ***#Brightanatomy***
- ***@ssmutomsk***
- ***@salome_mee***

