General myology

Anastasiia D. Koniaeva, a teaching assistant of anatomy department

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

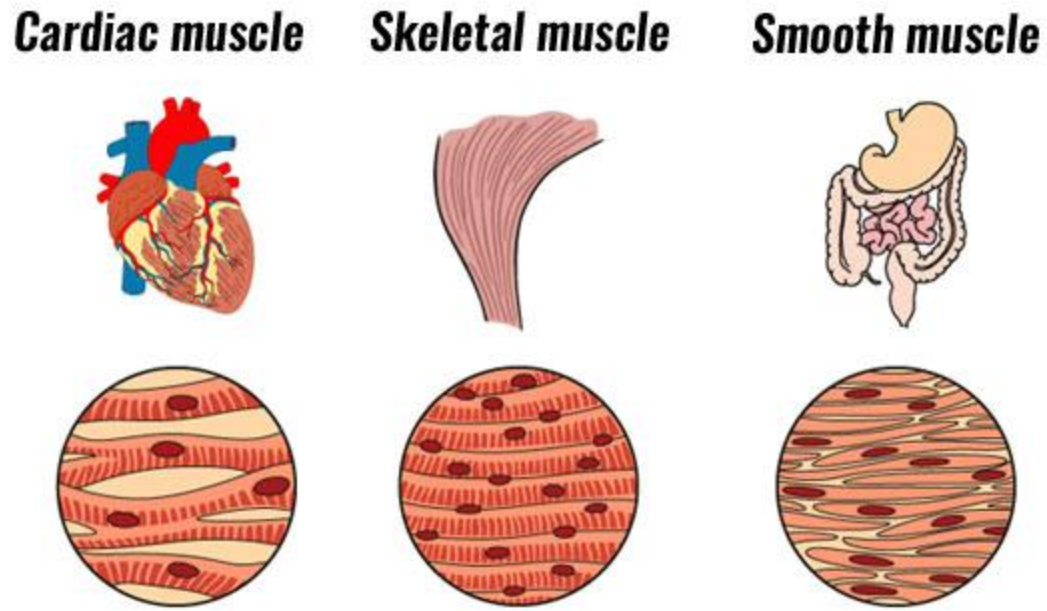
The Functions of Muscles

- 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

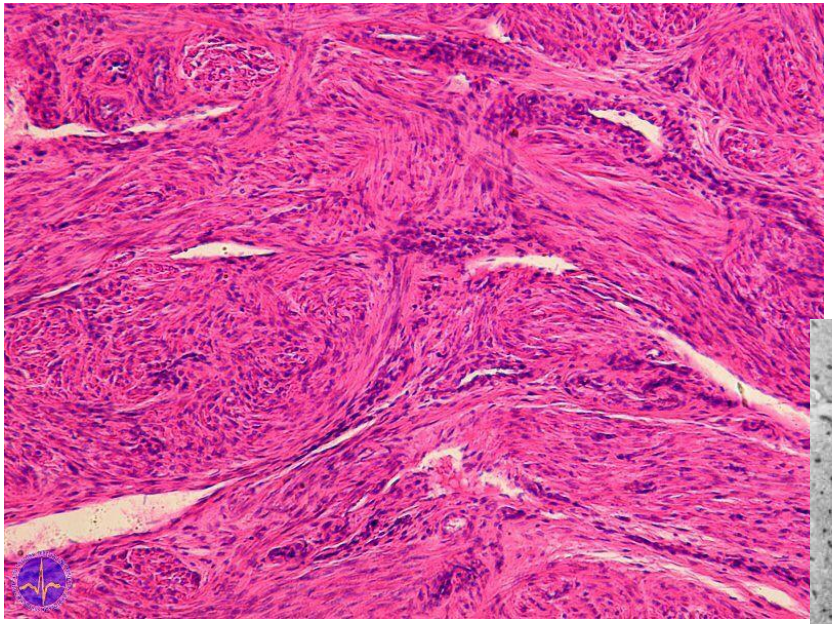
3 types of muscle tissue

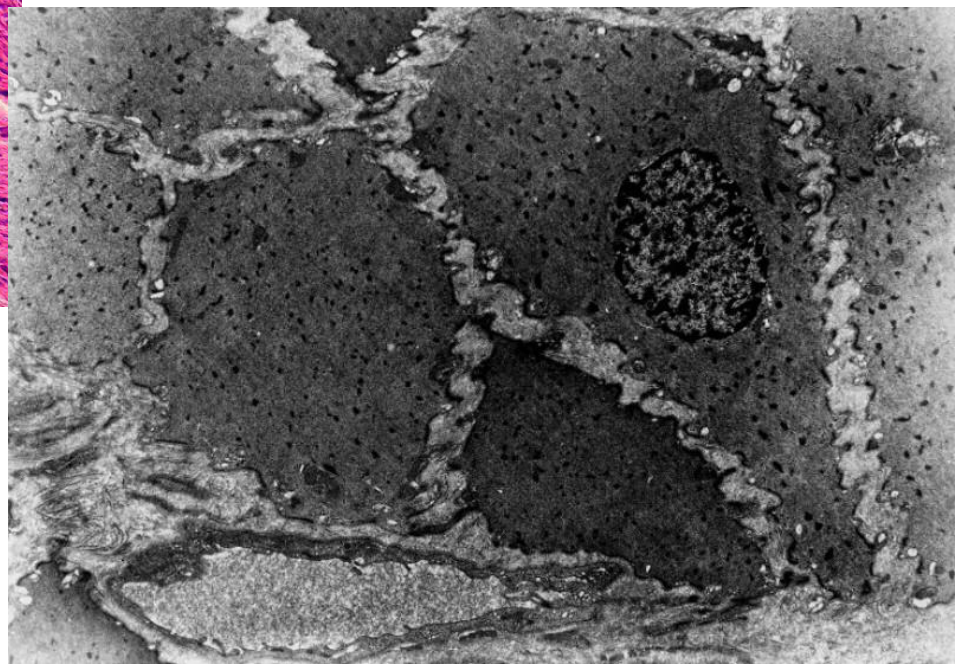
- **Smooth muscle tissue** (textus muscularis levis)
- **Striated muscle tissue** (textus muscularis striatus)
- **Cardiac striated mucle tissue** (textus muscularis striatus cardiacus)

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



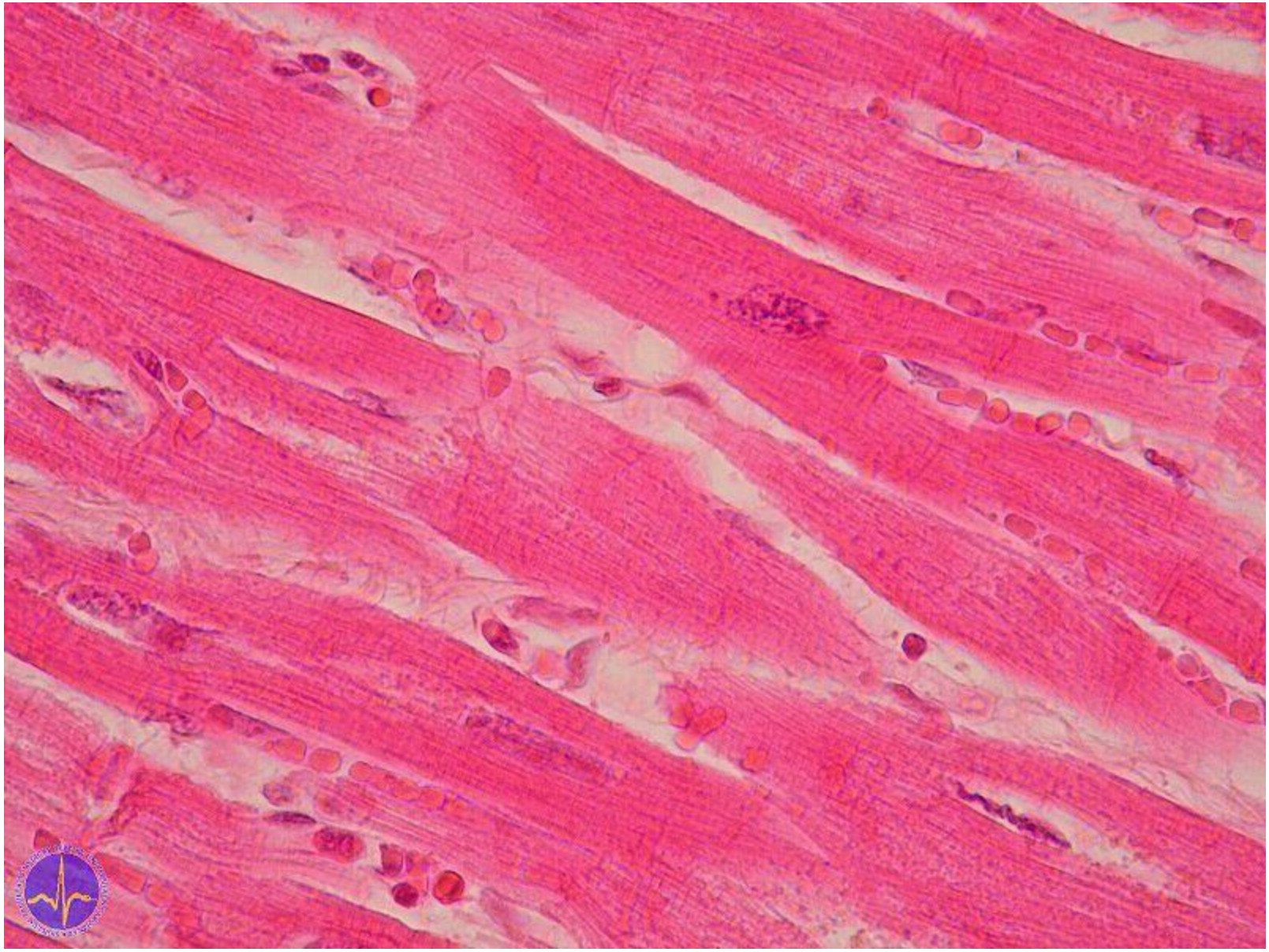
Smooth muscle





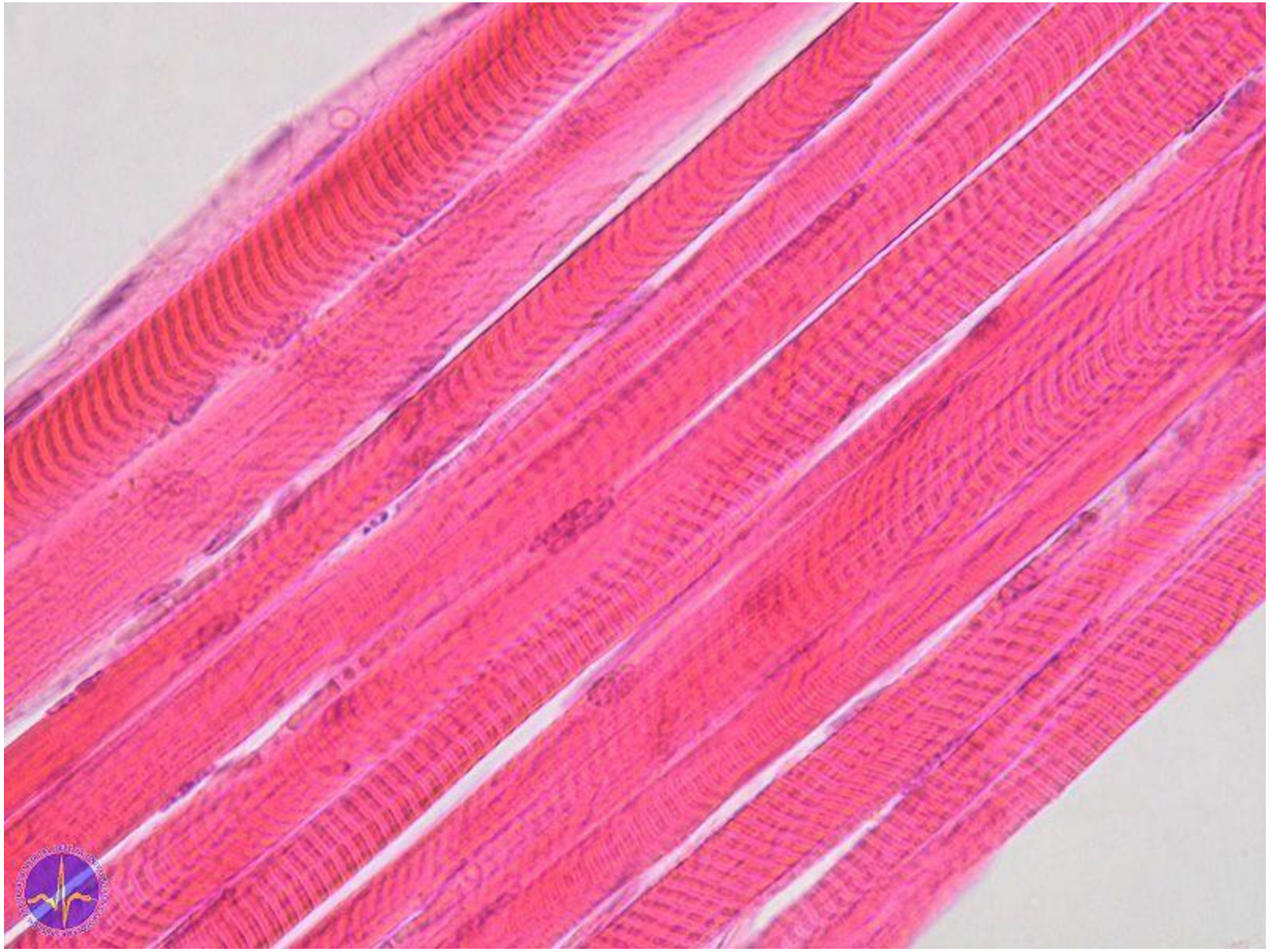
Eis, Jelínek, Špaček, Histopatologický atlas, Praha 2006

Cardiac muscle tissue



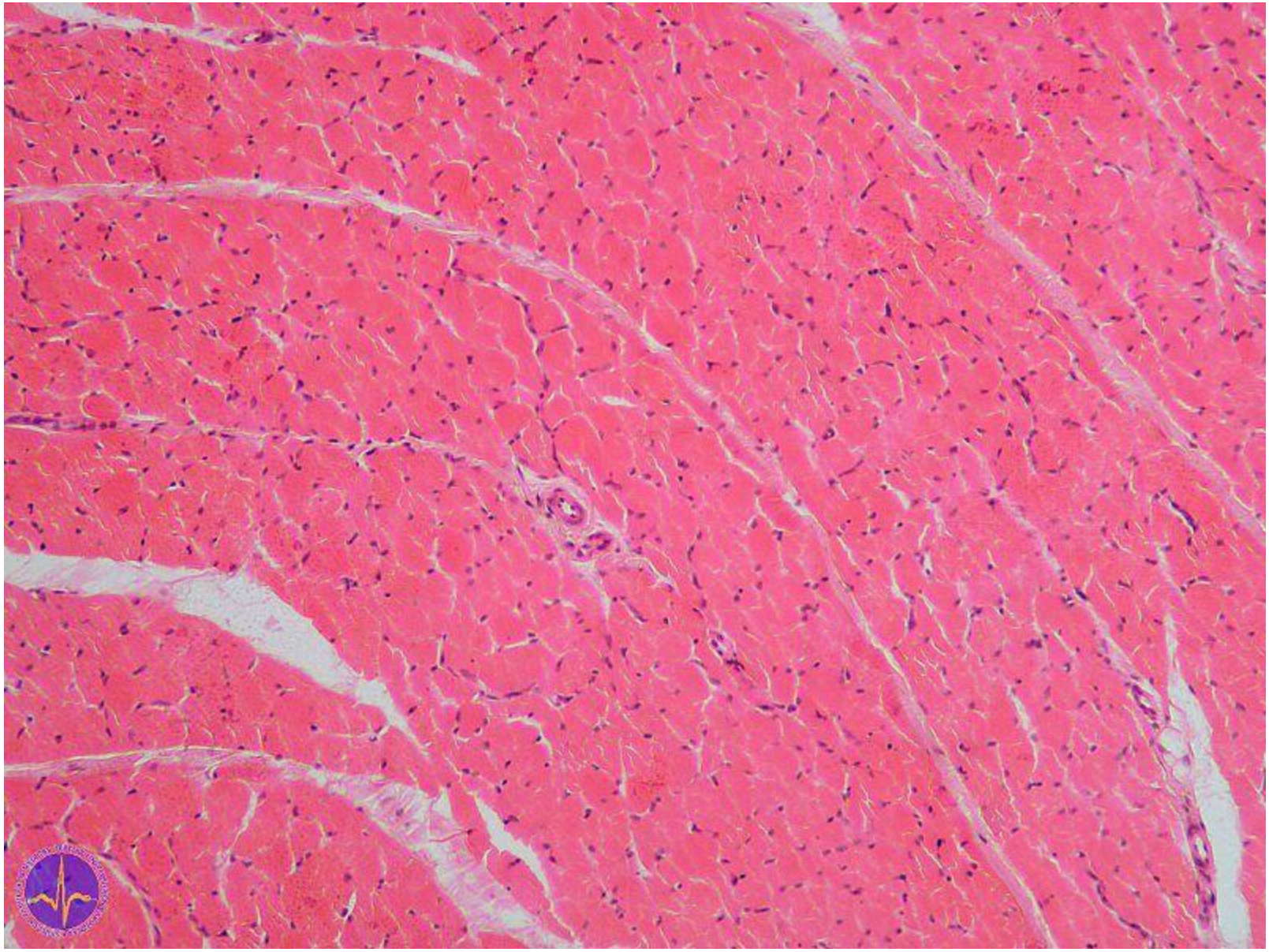
Eis, Jelínek, Špaček, Histopatologický atlas, Praha 2006

Skeletal striated muscle – longitudinal section



Eis, Jelínek, Špaček, Histopatologický atlas, Praha 2006

Skeletal striated muscle – transverse section



Eis, Jelínek, Špaček, Histopatologický atlas, Praha 2006

Skeletal striated muscle

Myoglobin (pigment causing red colouring)

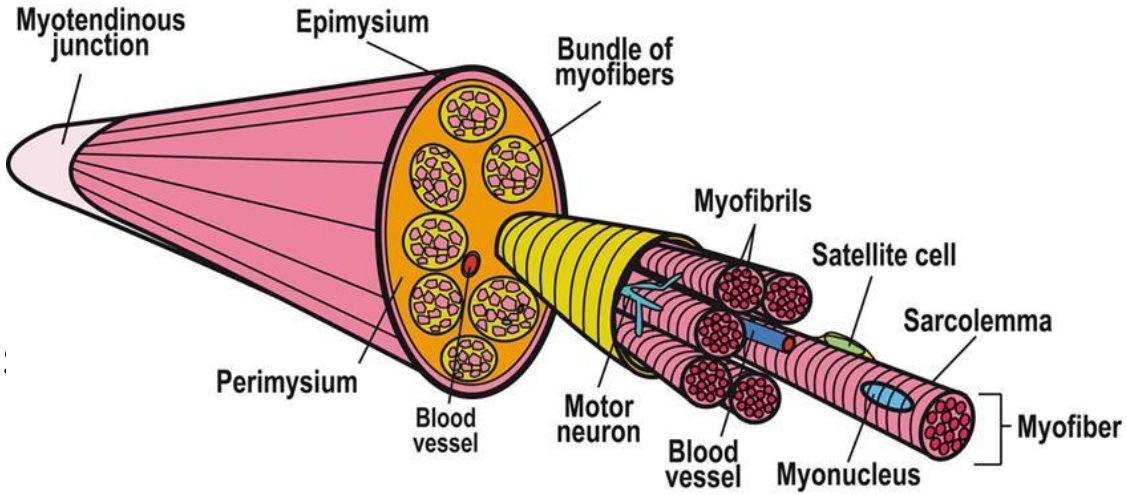
Fibres

- Quick

quickly fatigued
light (white)
in superficial layers

- Slow

more resistant to tiredness
dark (red)
in deeper layer



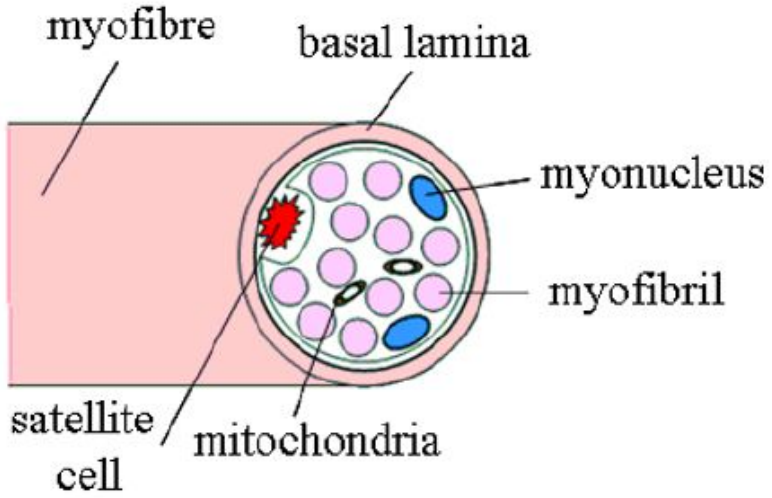
Inervated by cranial and spinal nerves

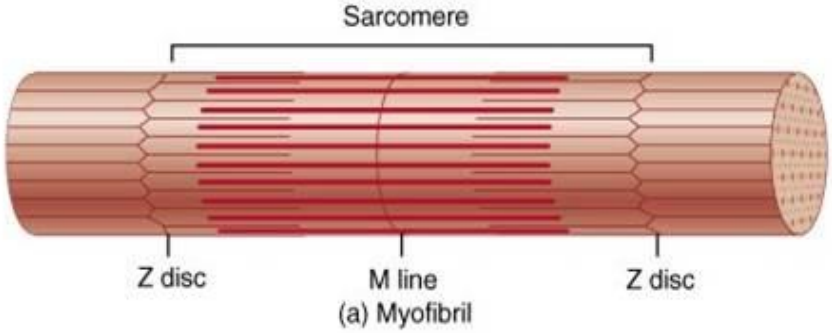
without inervation non-functional and atrophies

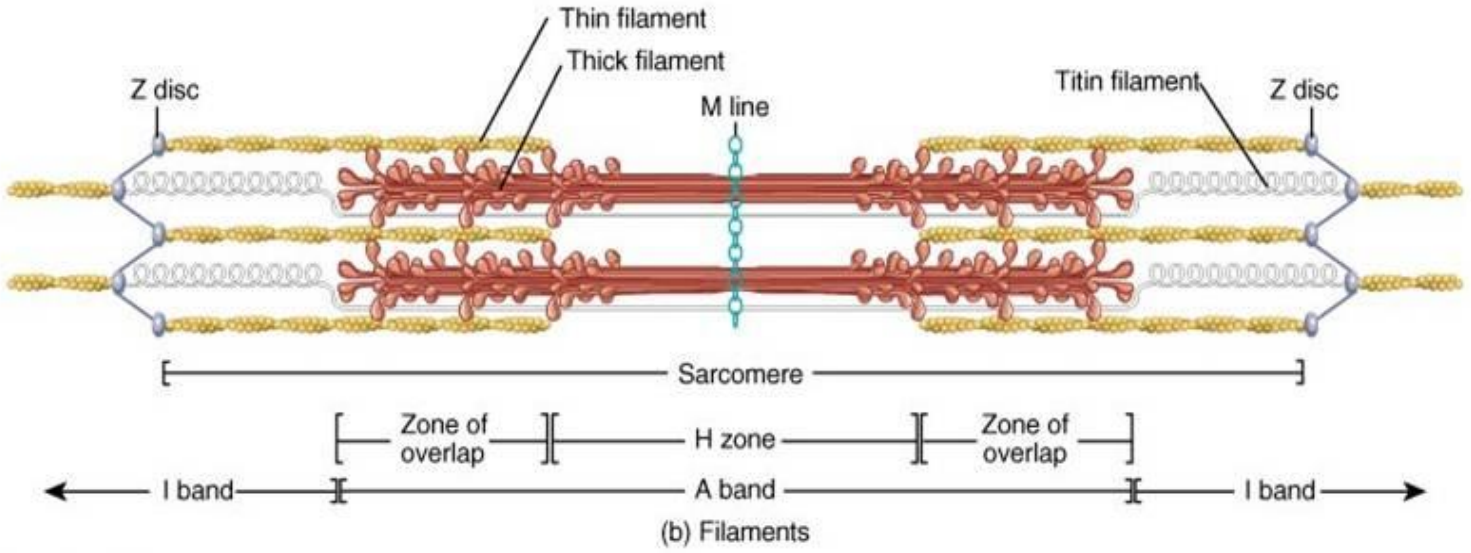
Skeletal striated muscle

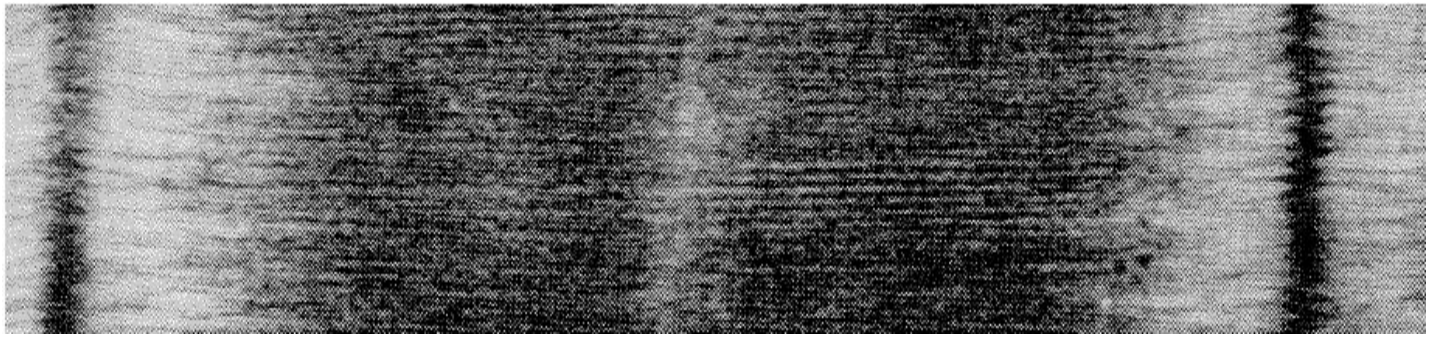
myofibre (myofibra)

- 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









http://www.baileybio.com/plogger/?level=picture&id=264

http://www.bms.ed.ac.uk/research/others/smaciver/Myosin%20II.htm

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

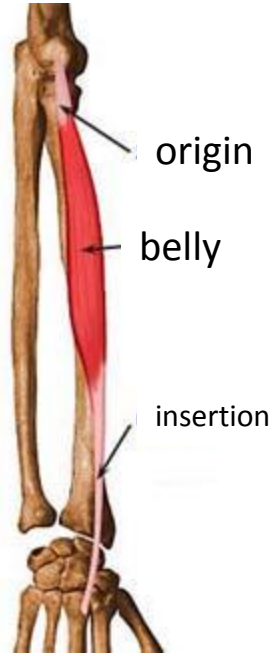
- striated muscle fibres
- special muscle structures
- primary muscle bundle
  - 10-100 fibres connected and covered by fibrous tissue
- secondary bundles
  - connection of primary bundles and covering by fibrous tissue
- bundles of higher orders

Basic muscle structure

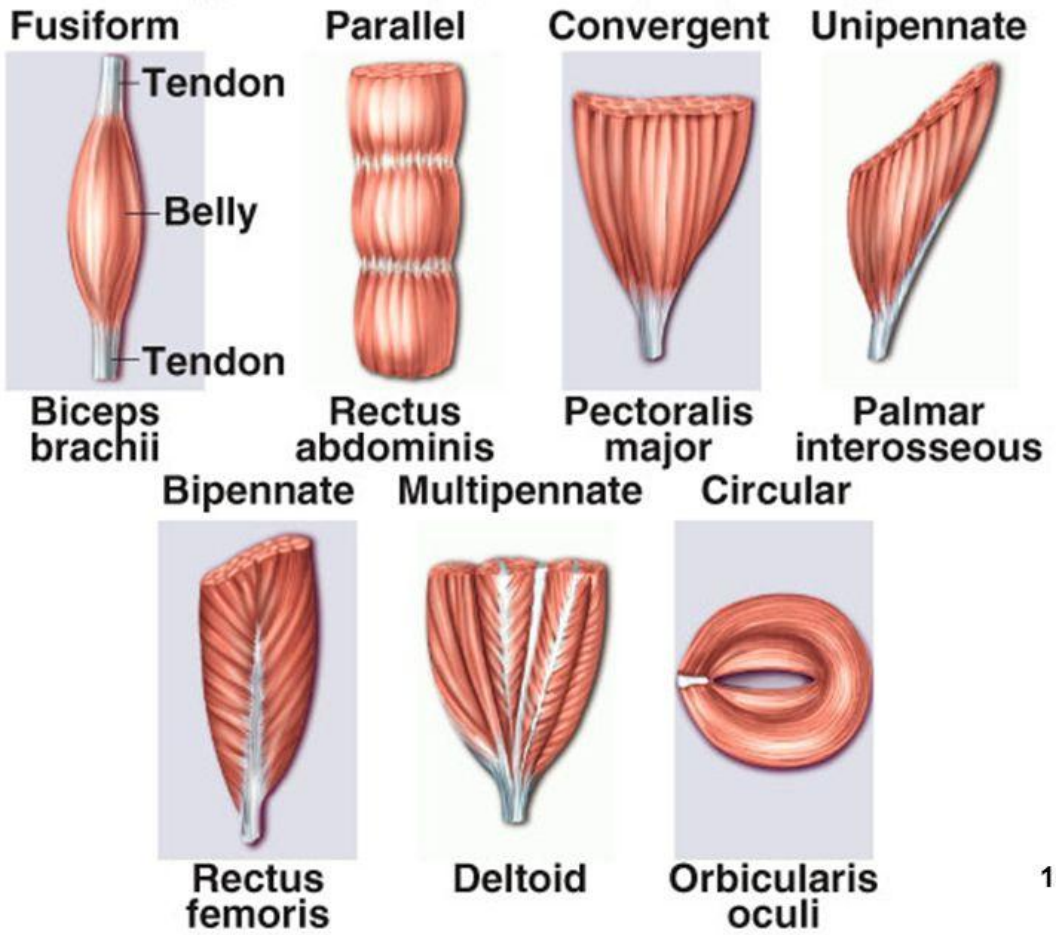
- fibrous tissue
  - endomysium (*perimysium internum*)
    - covers myofibres and bundles
  - epimysium (*perimysium externum*) = *fascia*
    - covers the whole muscle
- tendon (*tendo*) is a tough band of fibrous connective tissue that usually connects muscle to bone and is capable of withstanding 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*)

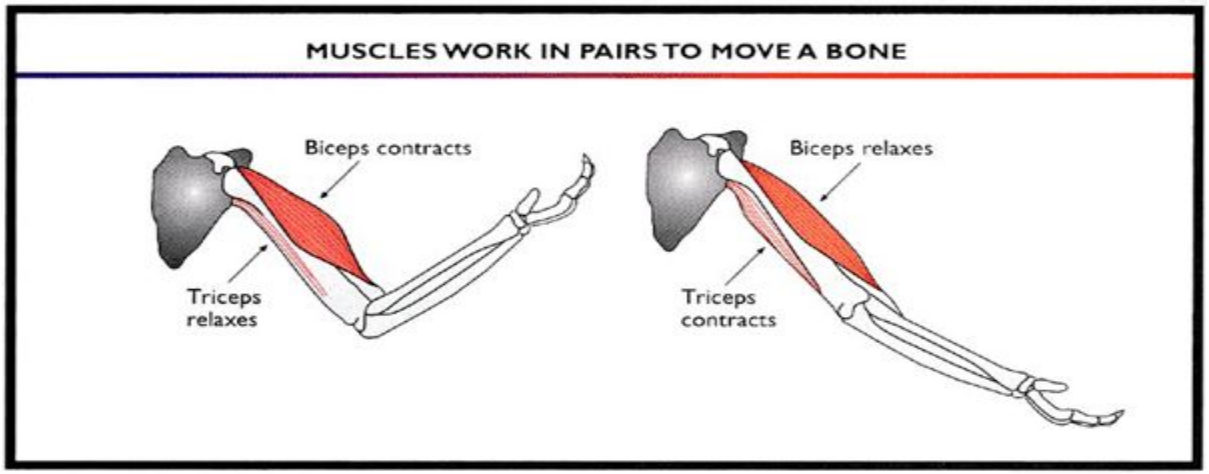


Classification of skeletal muscles by form



Classification of skeletal muscles by movement

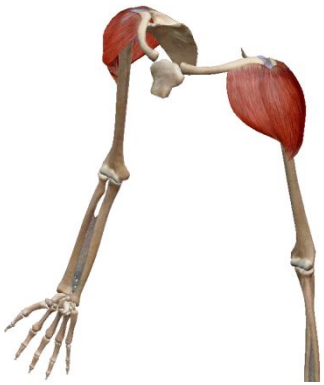
- agonists
  - in the same direction acting muscles
- antagonists
  - counteracting muscles
- synergists
  - muscles participating in one movement (working together)
- main (principal) muscle
  - one out of the group of synergists
- auxiliary (accesory) muscles
  - they act together with the principal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

    -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*)

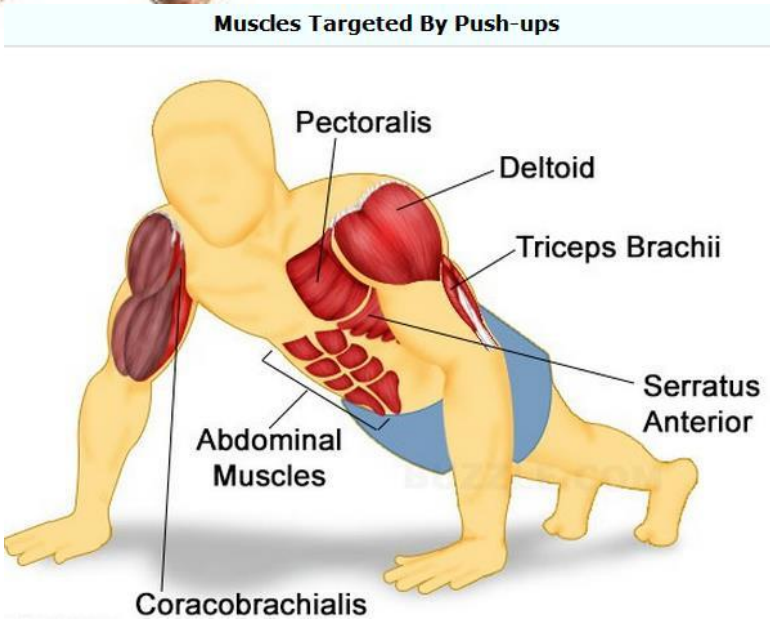
The work of muscles

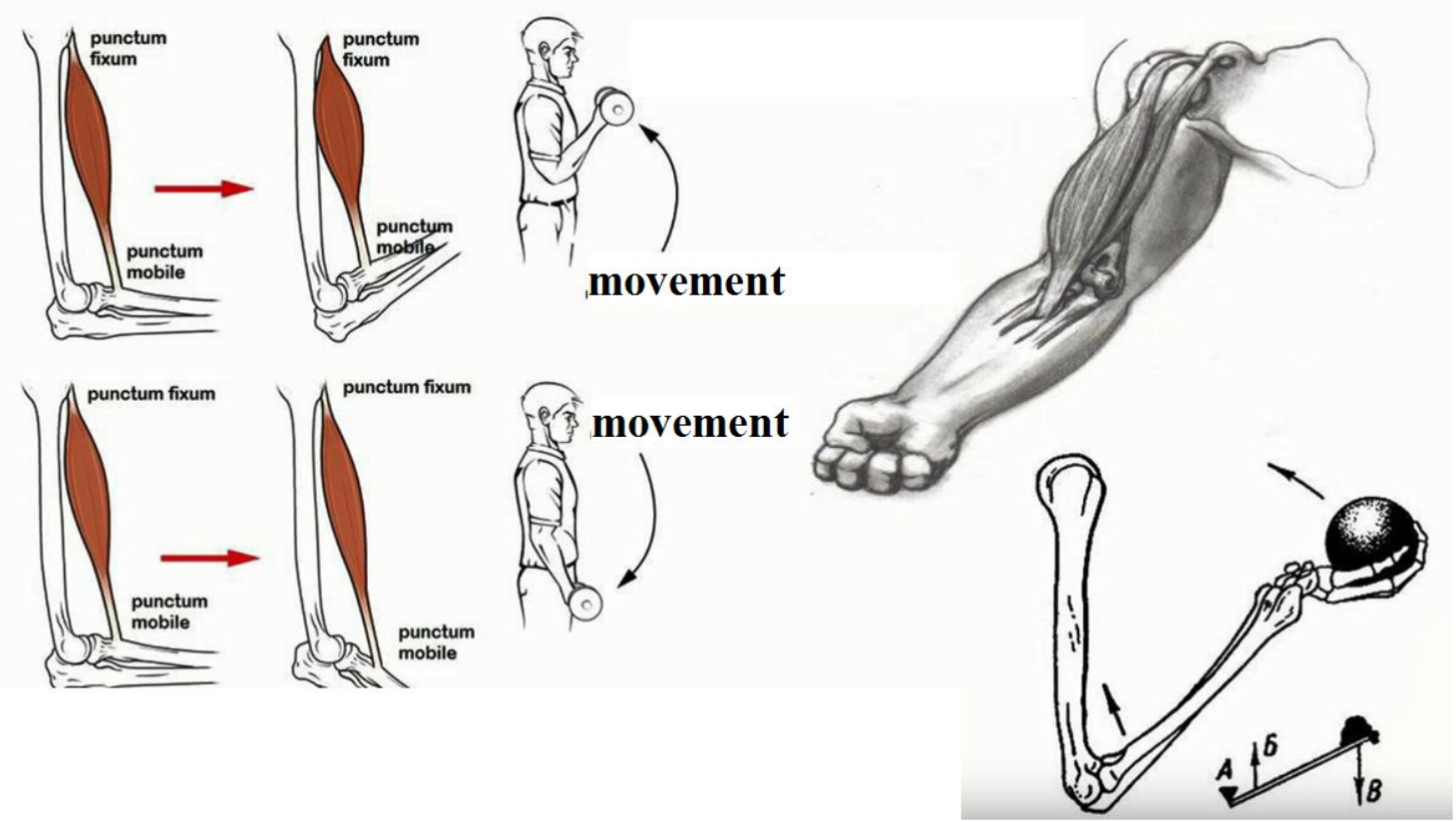
Dynamic-work in which muscles move parts of a person's body, and the body moves in relation to a support, earth or water surface.

- 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



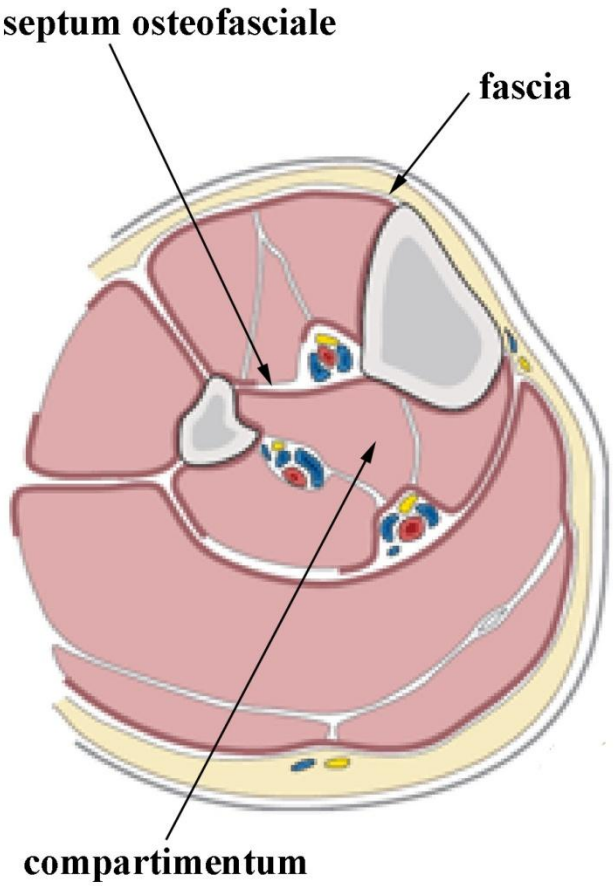


- **Punctum fixum** is a point, which is not moving during a contraction of a muscle, ie it is fixed. If it is an origin of the muscle or an insertion of the muscle depends on the kind of movement.
- **Punctum mobile** is a point, which is <u>not</u> moving during a contraction of a muscle, ie it is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

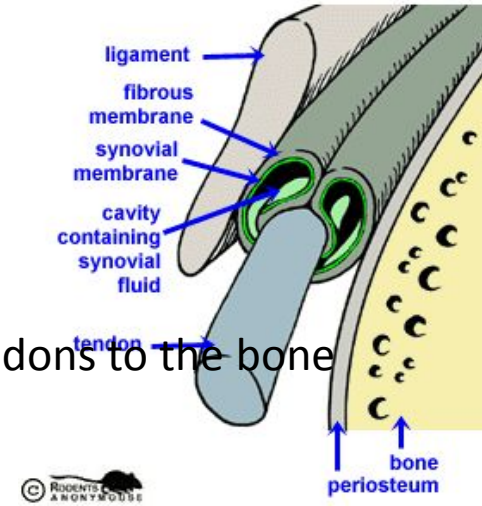


Fasciotomy

http://lifeinthefastlane.com/ortho-library/compartment-syndrome/

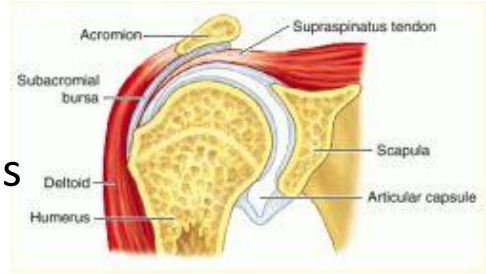
Special muscle structures

- 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



http://www.zoology.ubc.ca/~biomania/tutorial/bonejt/jt01ac03.h

Special muscle structures



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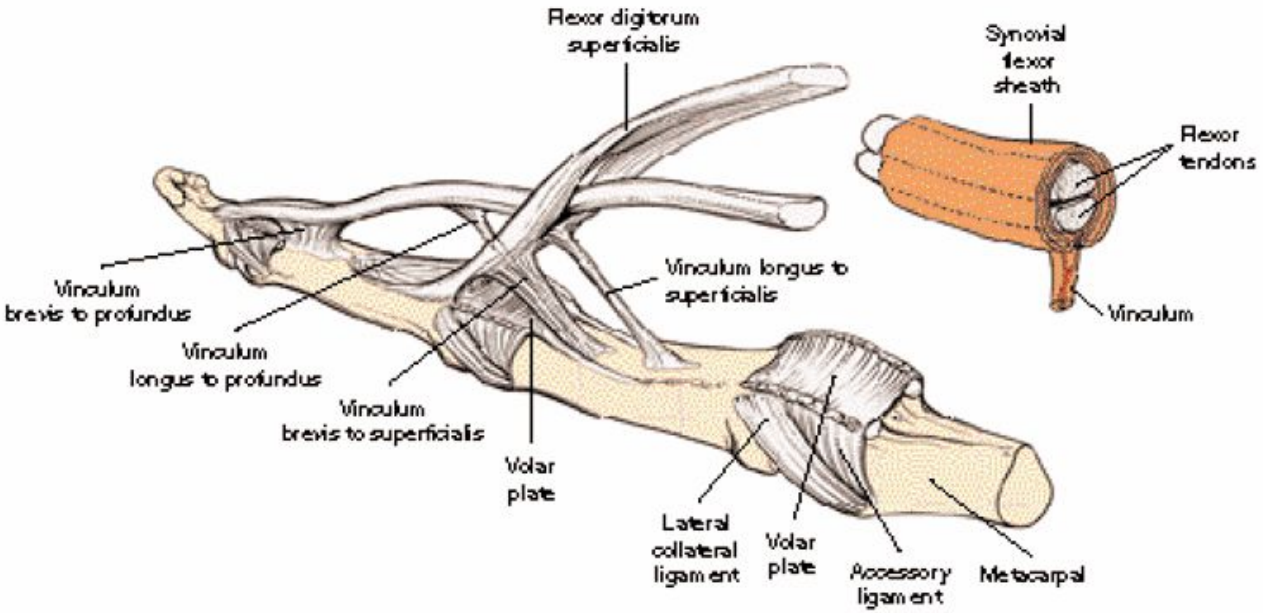
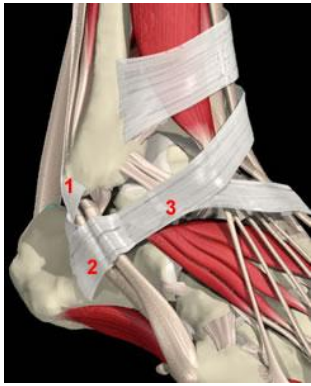


canal

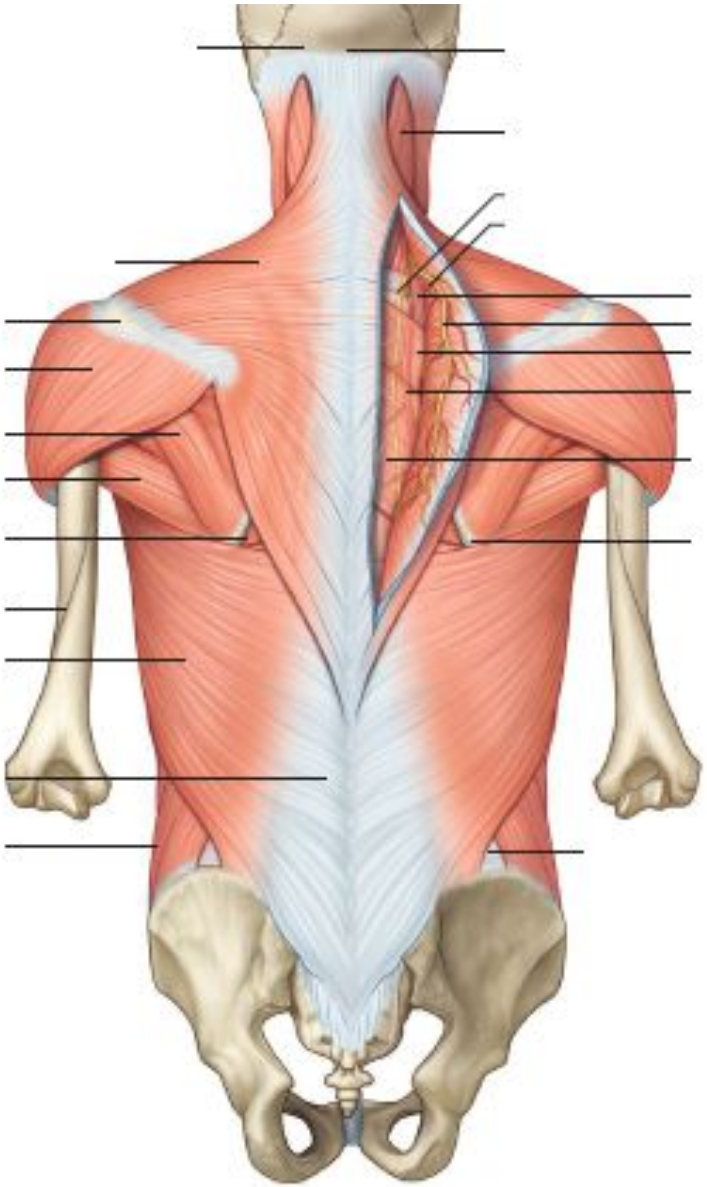


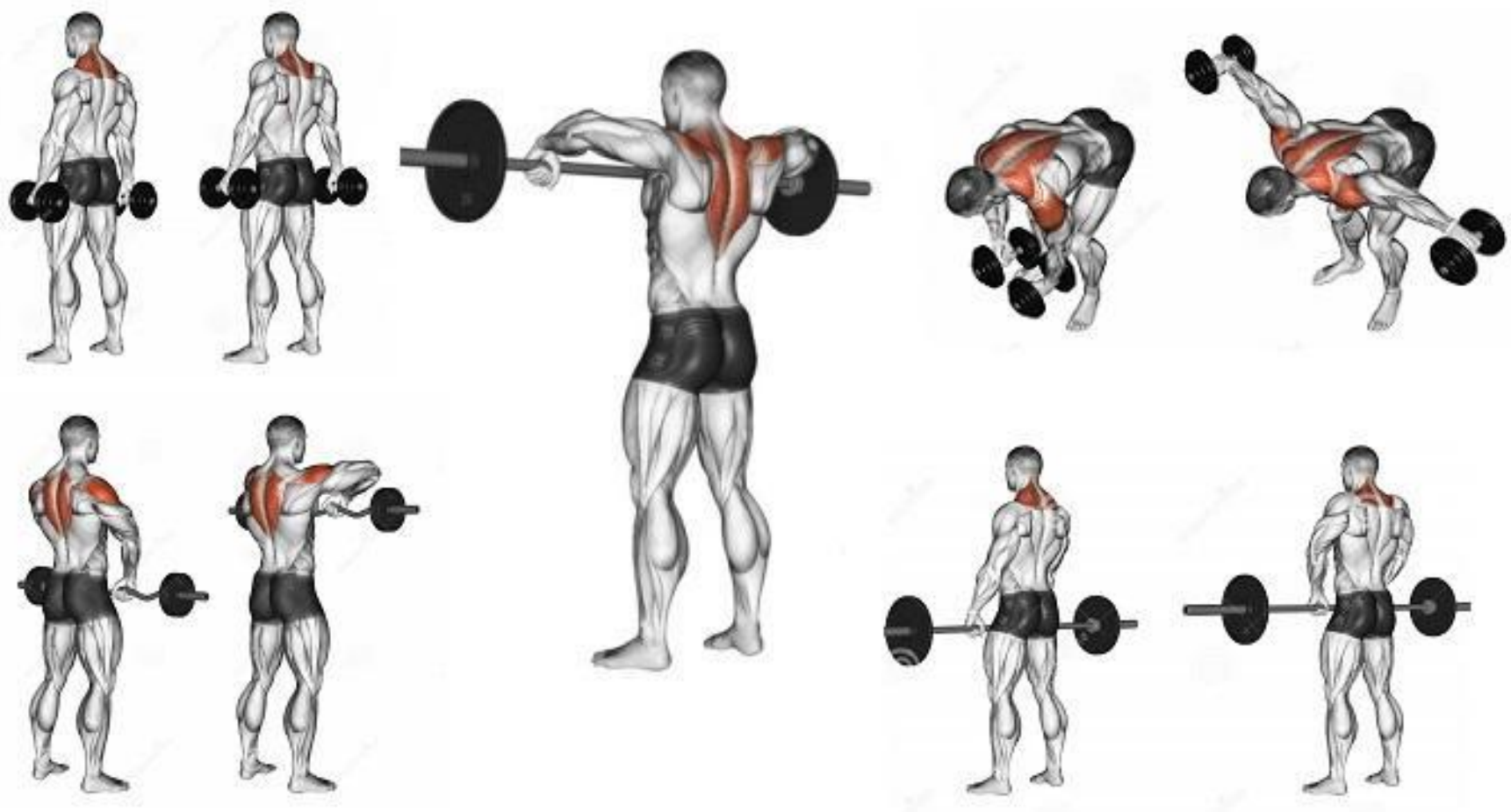
- vincula
  - mesotenonium of tendinous sheaths of the flexors of the hand
  - vascular supply for corresponding tendons run through them
  - *vincula brevia et longa*

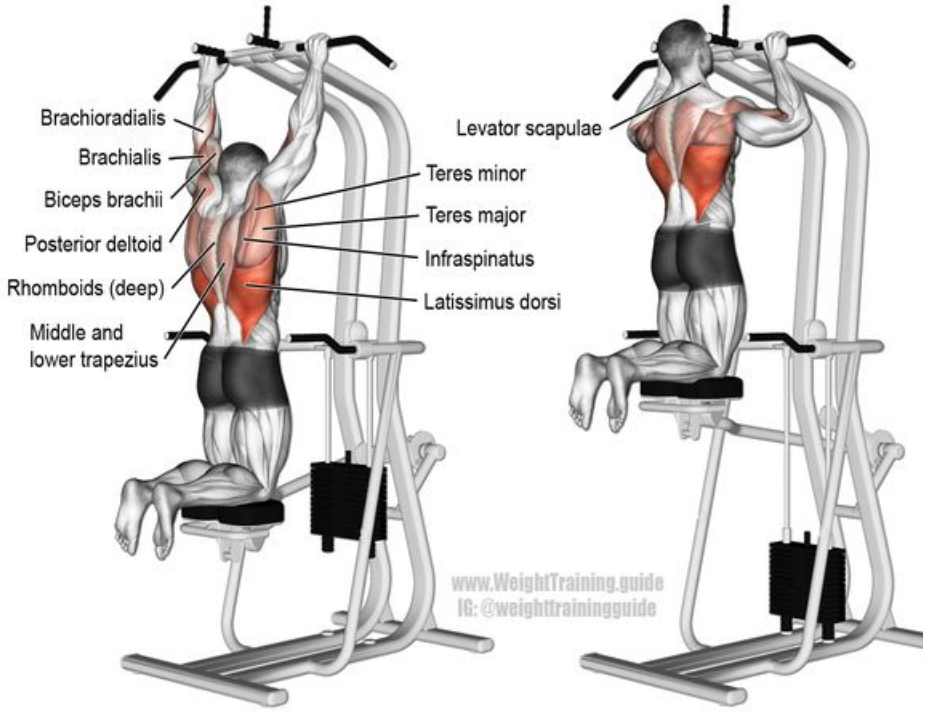
http://medical-dictionary.thefreedictionary.com/bursa

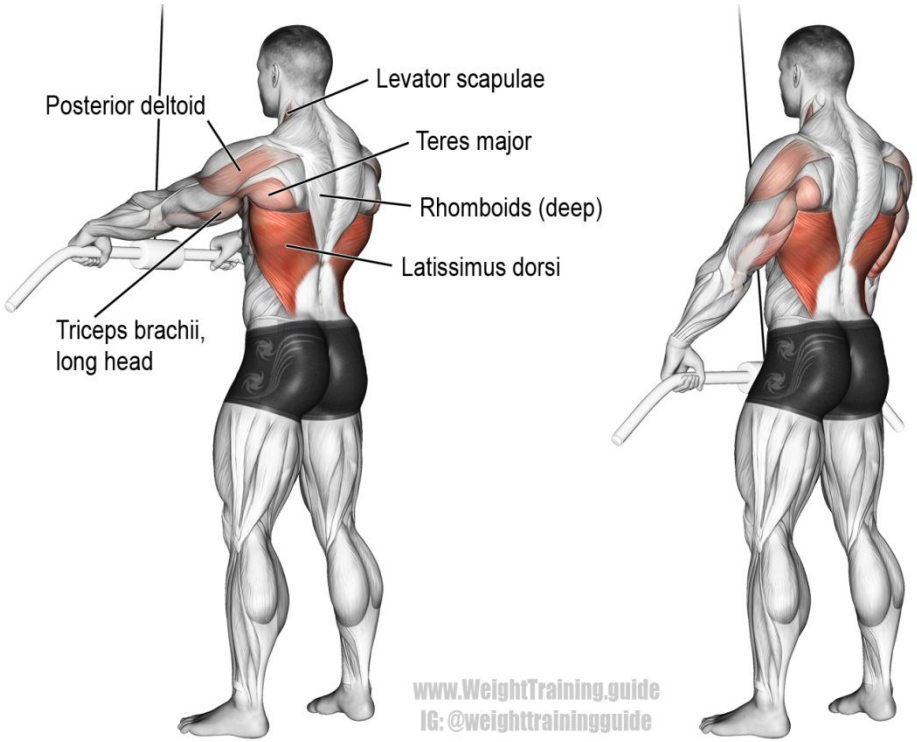
http://www.blackburnfeet.org.uk/hyperbook/trauma/ankleFx/ankleFxBasic1.htm

http://www.msdlatinamerica.com/ebooks/SurgicalExposuresinOrthopaedicsTheAnatomicApproach/sid139333.html

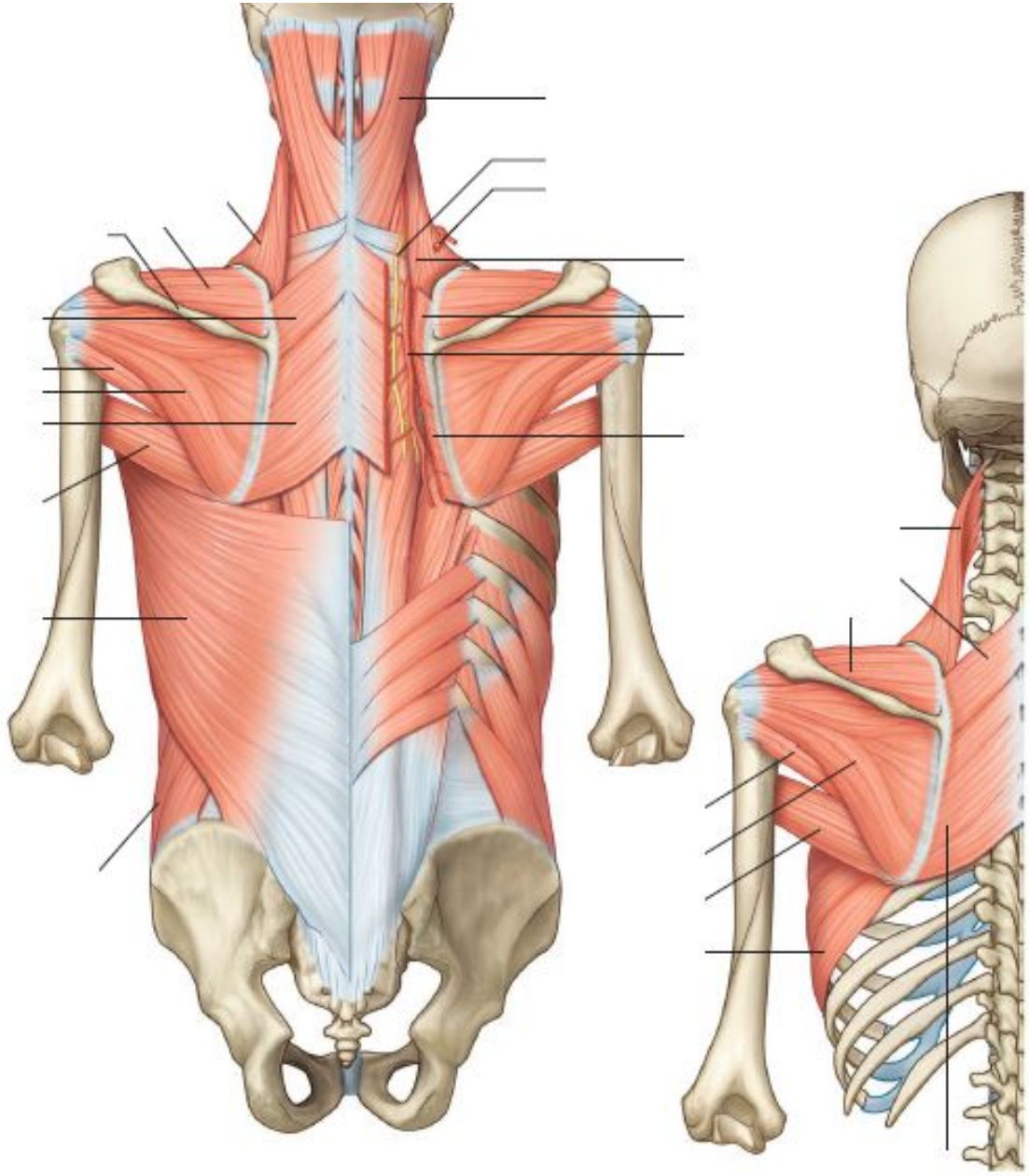


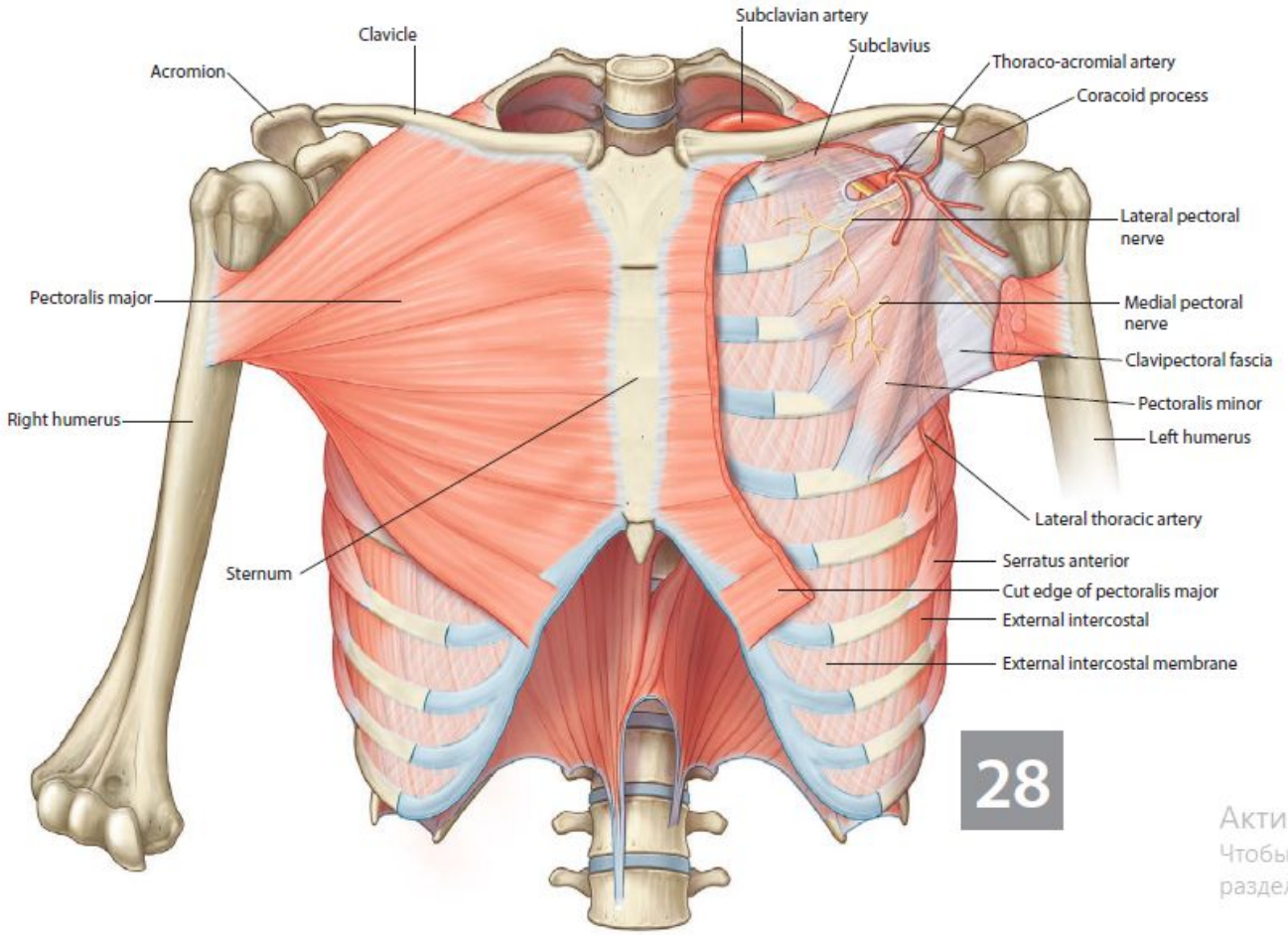



Brachioradialis
Brachialis
Biceps brachii
Posterior deltoid
Rhomboids (deep)
Middle and lower trapezius
Teres minor
Teres major
Infraspinatus
Latissimus dorsi
Levator scapulae
www.WeightTraining.guide
IG: @weighttrainingguide


Posterior deltoid
Levator scapulae
Teres major
Rhomboids (deep)
Latissimus dorsi
Triceps brachii, long head
www.WeightTraining.guide
IG: @weighttrainingguide


Middle and lower trapezius
Infraspinatus
Posterior deltoid
Rhomboids (deep)
Latissimus dorsi
Teres minor
Teres major
Brachialis
Pectoralis major





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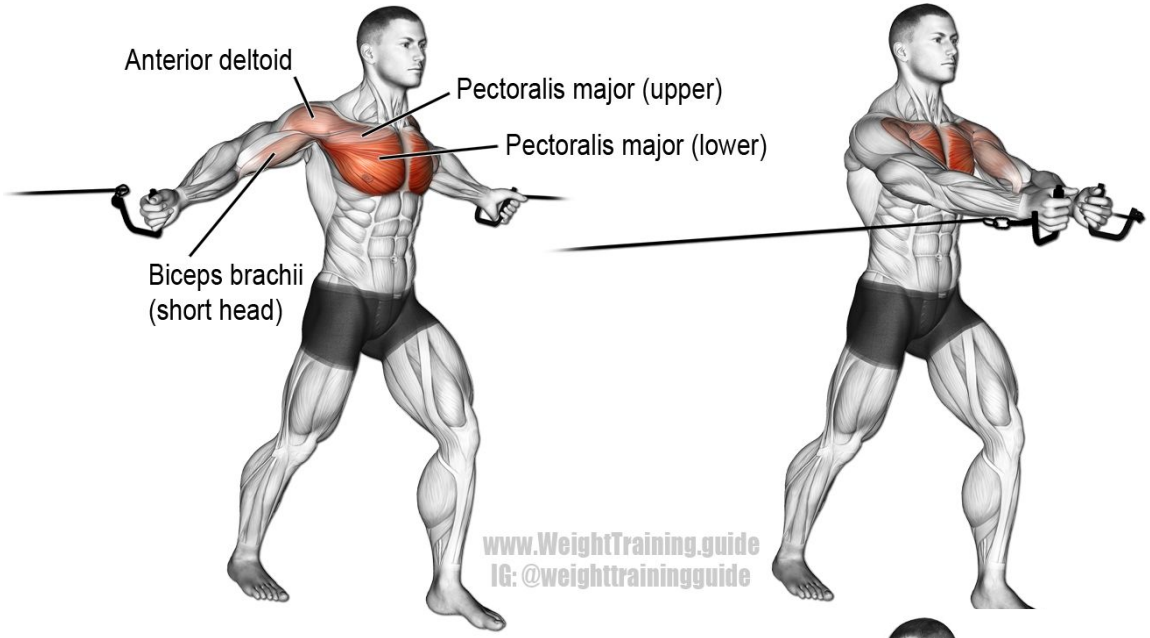
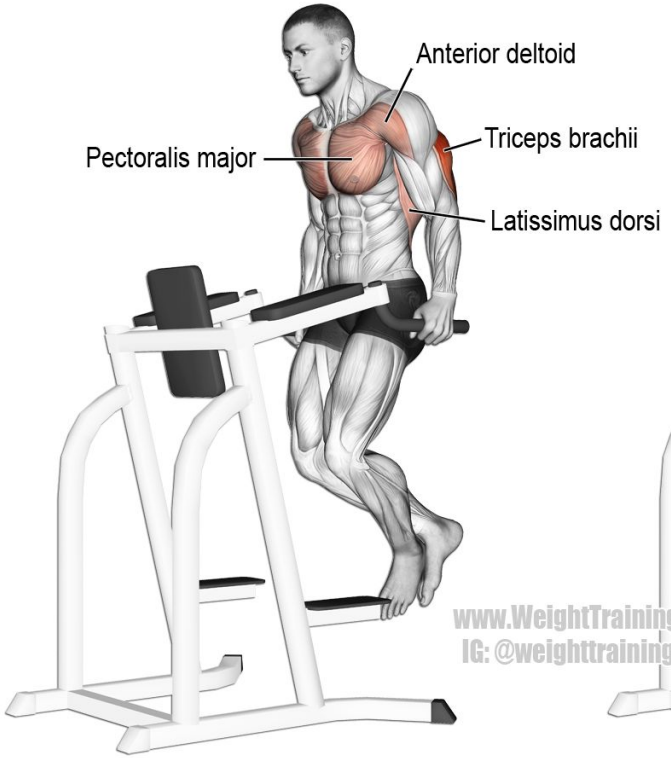
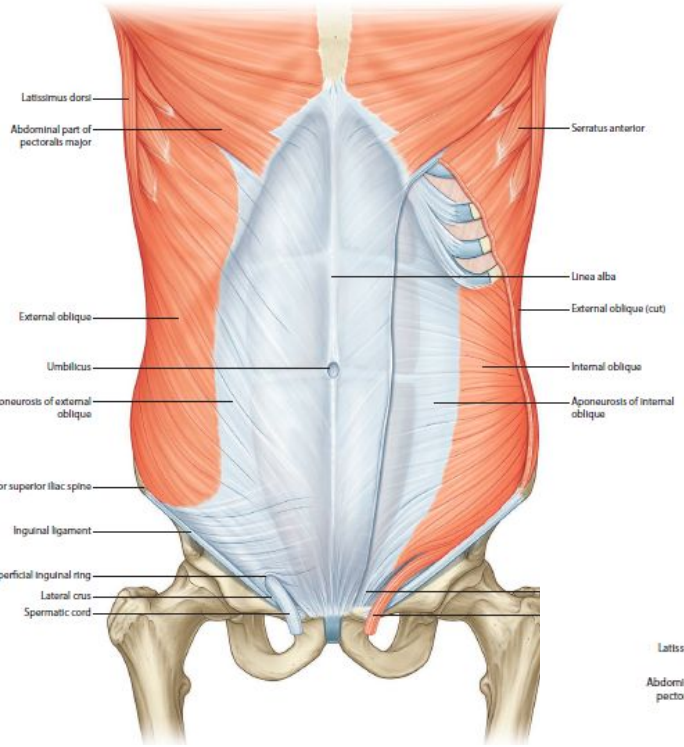
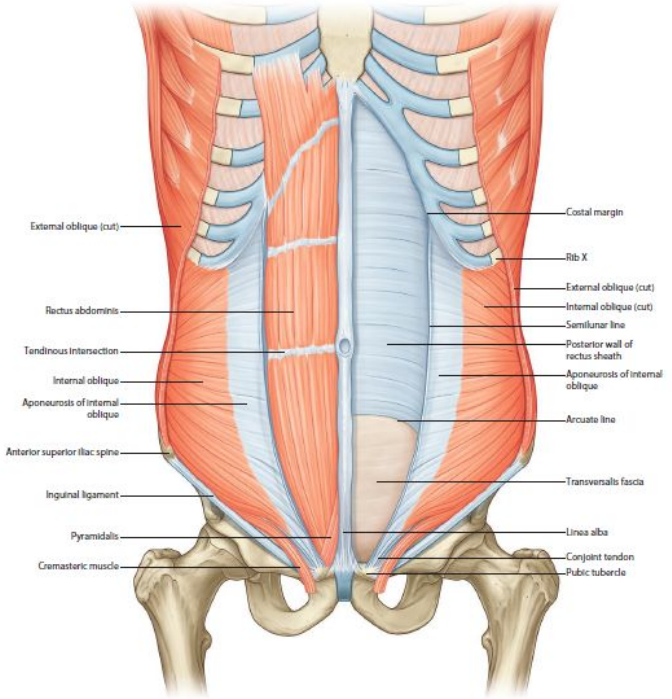
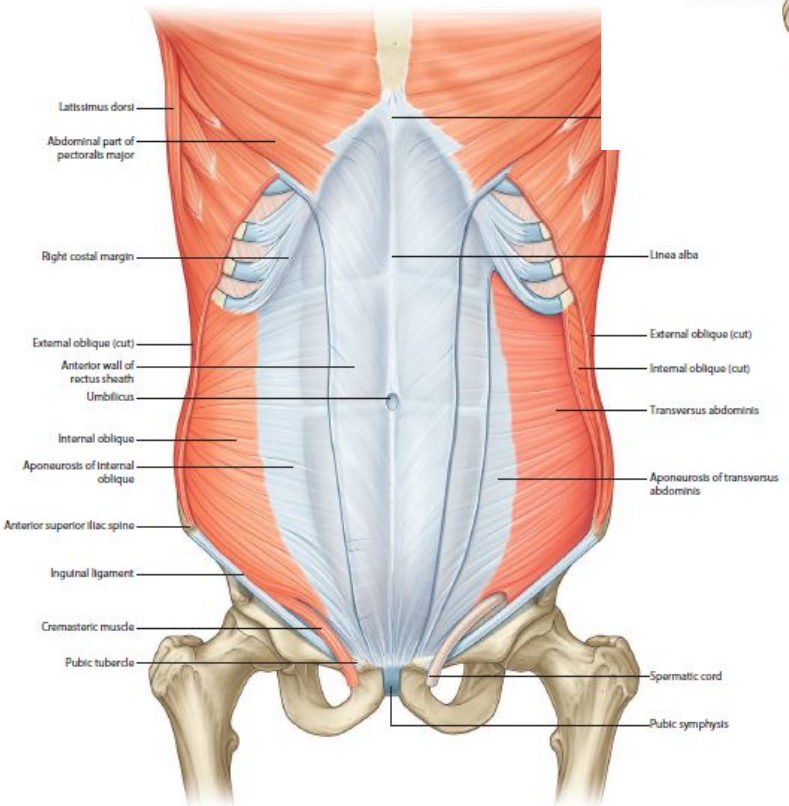





Latissimus dorsi
Abdominal part of pectoralis major
Serratus anterior
Linea alba
External oblique
External oblique (cut)
Umbilicus
Internal oblique
oneurosis of external oblique
Aponeurosis of internal oblique
or superior iliac spine
Inguinal ligament
perficial inguinal ring
Lateral crus
Spermatic cord

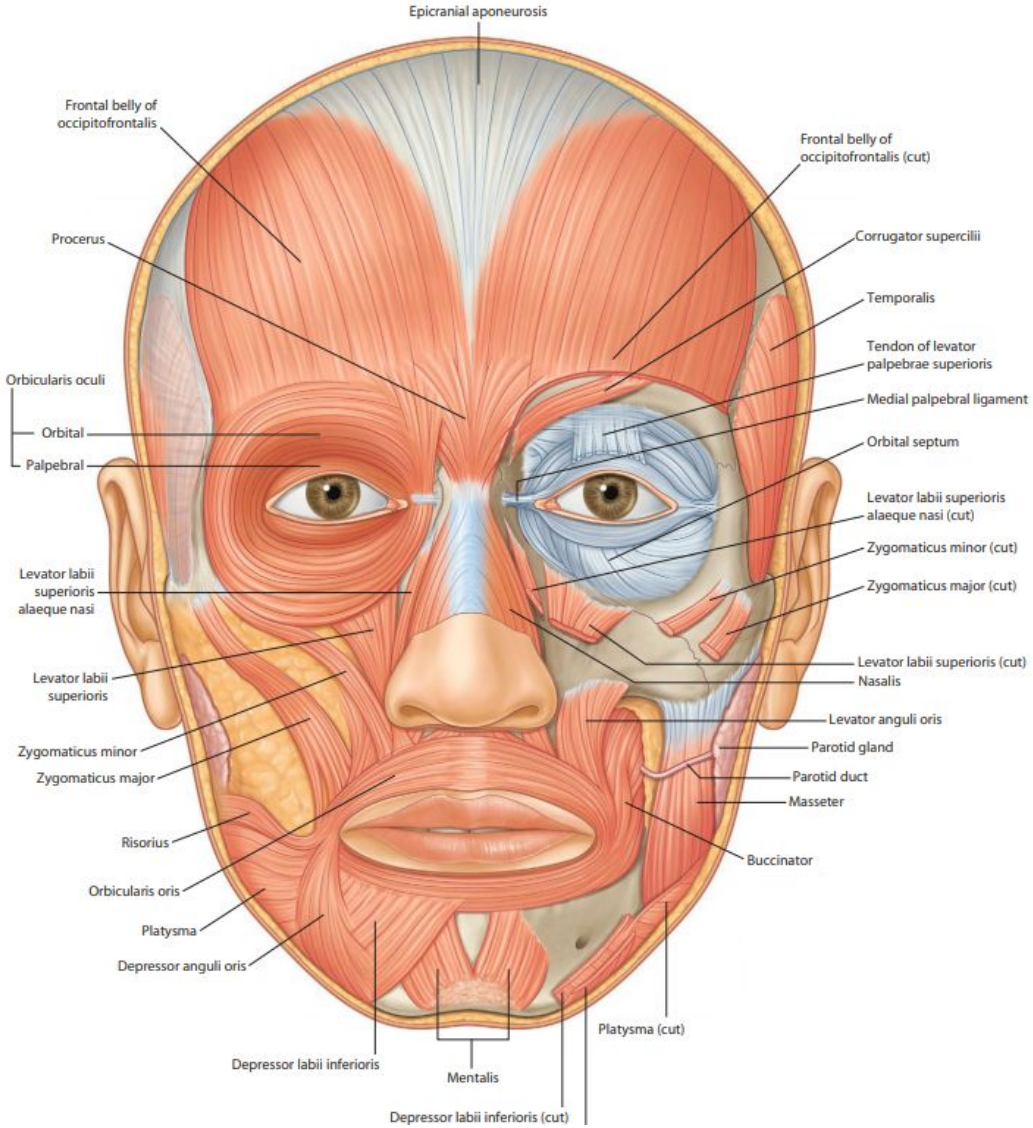

External oblique (cut)
Costal margin
Rib X
External oblique (cut)
Internal oblique (cut)
Semilunar line
Posterior wall of rectus sheath
Aponeurosis of internal oblique
Rectus abdominis
Tendinous intersection
Internal oblique
Aponeurosis of internal oblique
Arcuate line
Anterior superior iliac spine
Transversalis fascia
Inguinal ligament
Linea alba
Pyramidalis
Conjoint tendon
Cremasteric muscle
Pubic tubercle


Latissimus dorsi
Abdominal part of pectoralis major
Right costal margin
Linea alba
External oblique (cut)
External oblique (cut)
Anterior wall of rectus sheath
Internal oblique (cut)
Umbilicus
Transversus abdominis
Internal oblique
Aponeurosis of internal oblique
Aponeurosis of transversus abdominis
Anterior superior iliac spine
Inguinal ligament
Cremasteric muscle
Pubic tubercle
Spermatic cord
Pubic symphysis

Упражнения для ПРЕССА

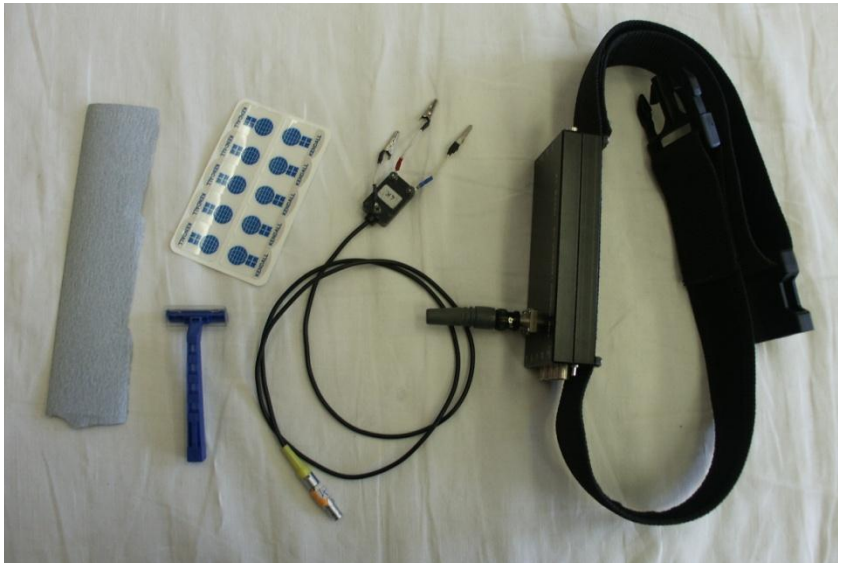
С СОБСТВЕННЫМ ВЕСОМ

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

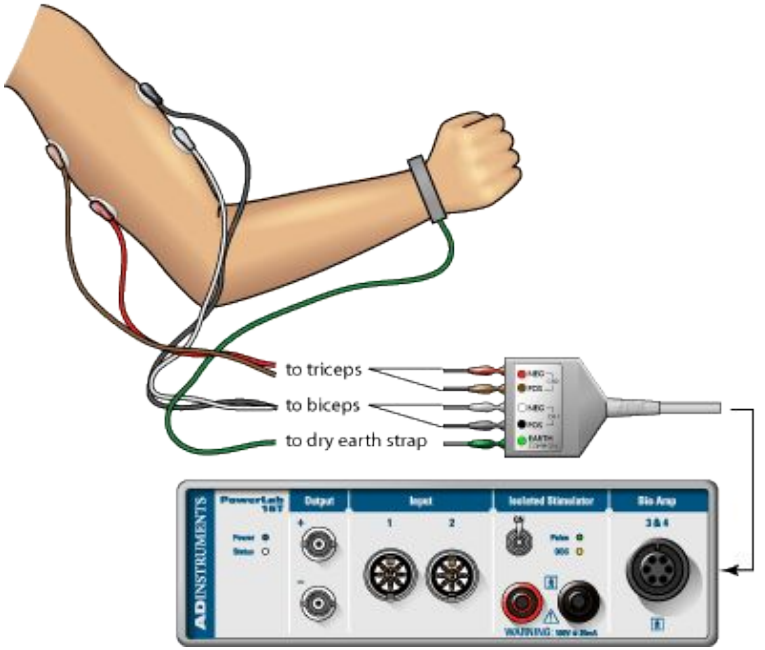

Epicranial aponeurosis
Frontal belly of occipitofrontalis
Frontal belly of occipitofrontalis (cut)
Procerus
Corrugator supercilii
Temporalis
Tendon of levator palpebrae superioris
Orbicularis oculi
Medial palpebral ligament
Orbital
Orbital septum
Palpebral
Levator labii superioris alaeque nasi (cut)
Zygomaticus minor (cut)
Levator labii superioris alaeque nasi
Zygomaticus major (cut)
Levator labii superioris (cut)
Levator labii superioris
Nasalis
Levator anguli oris
Zygomaticus minor
Parotid gland
Zygomaticus major
Parotid duct
Masseter
Risorius
Buccinator
Orbicularis oris
Platysma
Depressor anguli oris
Platysma (cut)
Depressor labii inferioris
Mentalis
Depressor labii inferioris (cut)

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 – twich (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 twiches of muscles, usually under voluntary control
- *tremor* – rhythmical, involuntary contractions of opposite groups of muscles
- *fasciculations* – involuntary, short twiches on motor unit visible under the skin
- *fibrilace* – spontaneous contractions of fibres of one muscle that aren´t visible under the skin

Homework

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