

# GENERAL MYOLOGY

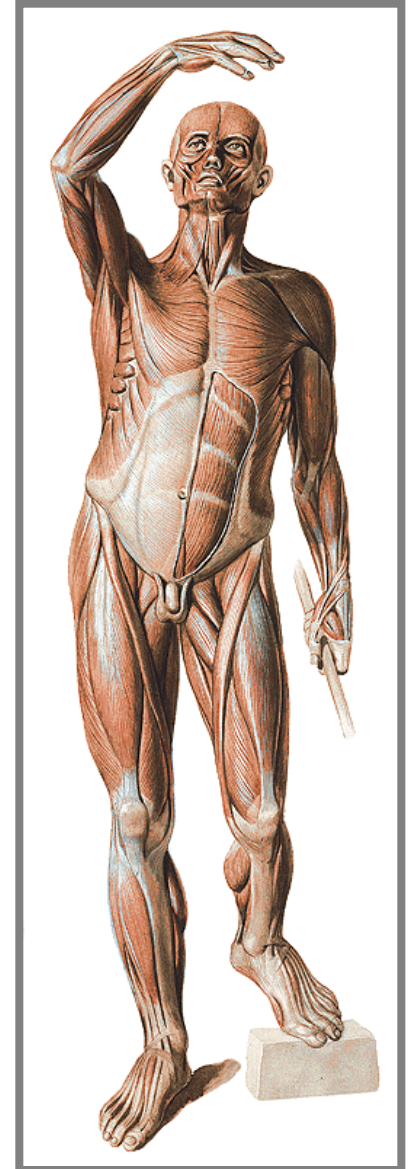
(Muscles - an active part of the locomotor system)



# General function of muscles

- Produce **movement** in sites of skeletal junctions
- **Change shapes** of body cavities and openings
- Give information about the **body position** in 3D space
- Important role during **thermoregulation**
- Help to **blood and lymph circulation**
- **Verbal and non verbal communication**
- **Logistic system** (supports respiration, digestion...)

About 600 muscles (♂ 35%, ♀ 32% of weight)

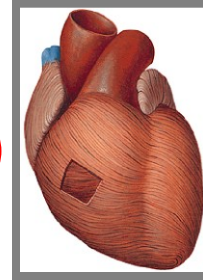


On the basis of **structure** and **physiological** characteristics we distinguish:

**1) Striated (skeleton) muscles – muscoli sceleti** (*skeletal muscles*)

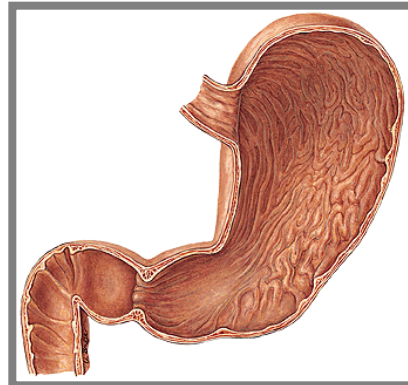
+ **skin muscles** (*musculi cutanei*)

(form muscles of limbs, work under control of our will, easy fatigued, spend a lot of energy, produce a heat)



**2) Cardiac muscles (myocardium)**

**3) Non-striated visceral (smooth) muscles** – form an integral part of some hollow organs and cavities, work without our will, without fatigue.

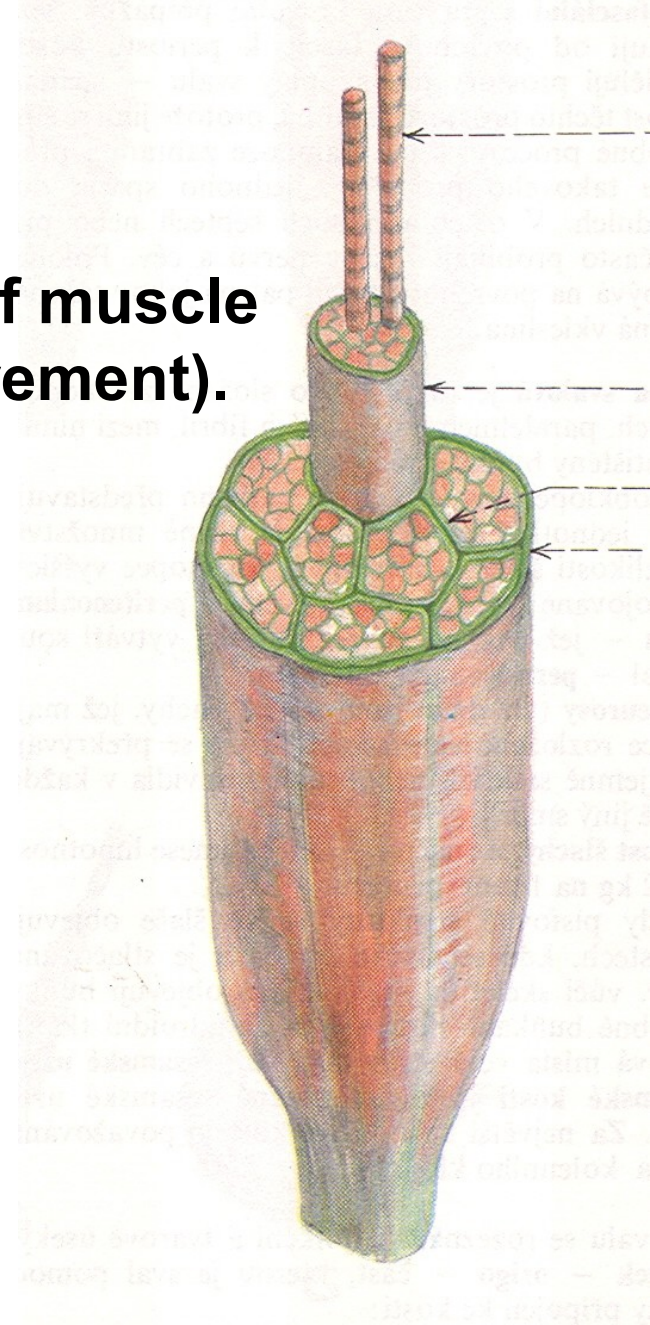


The main of the mechanical function of muscle fibers is **shortening - contraction** (movement).

myocytes

myofibrils

contractile proteins myosin and actin

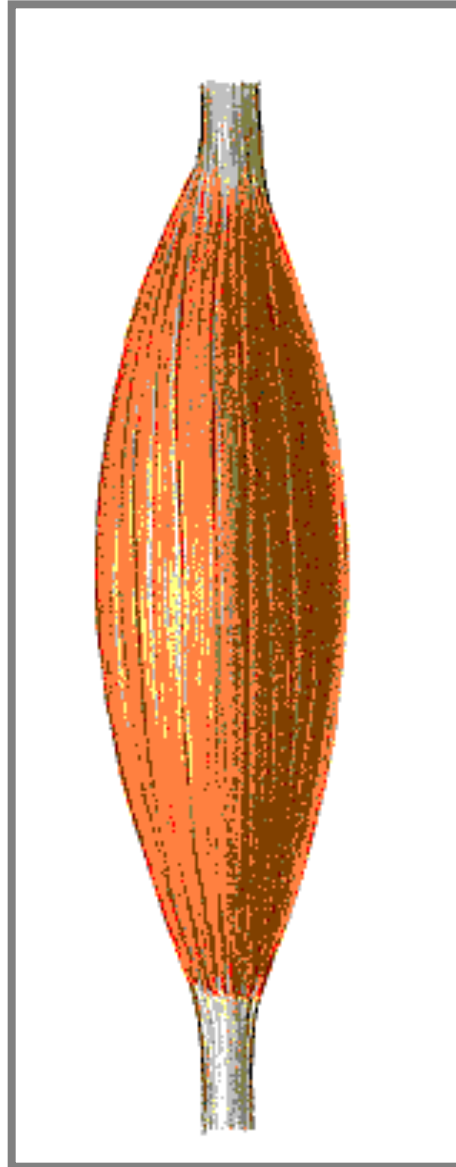


# Common structure of muscle

**Origo (*origin*)**

**Fascia (*cover*)**

**Tendo, aponeurosis  
Insertio (*insertion*)**

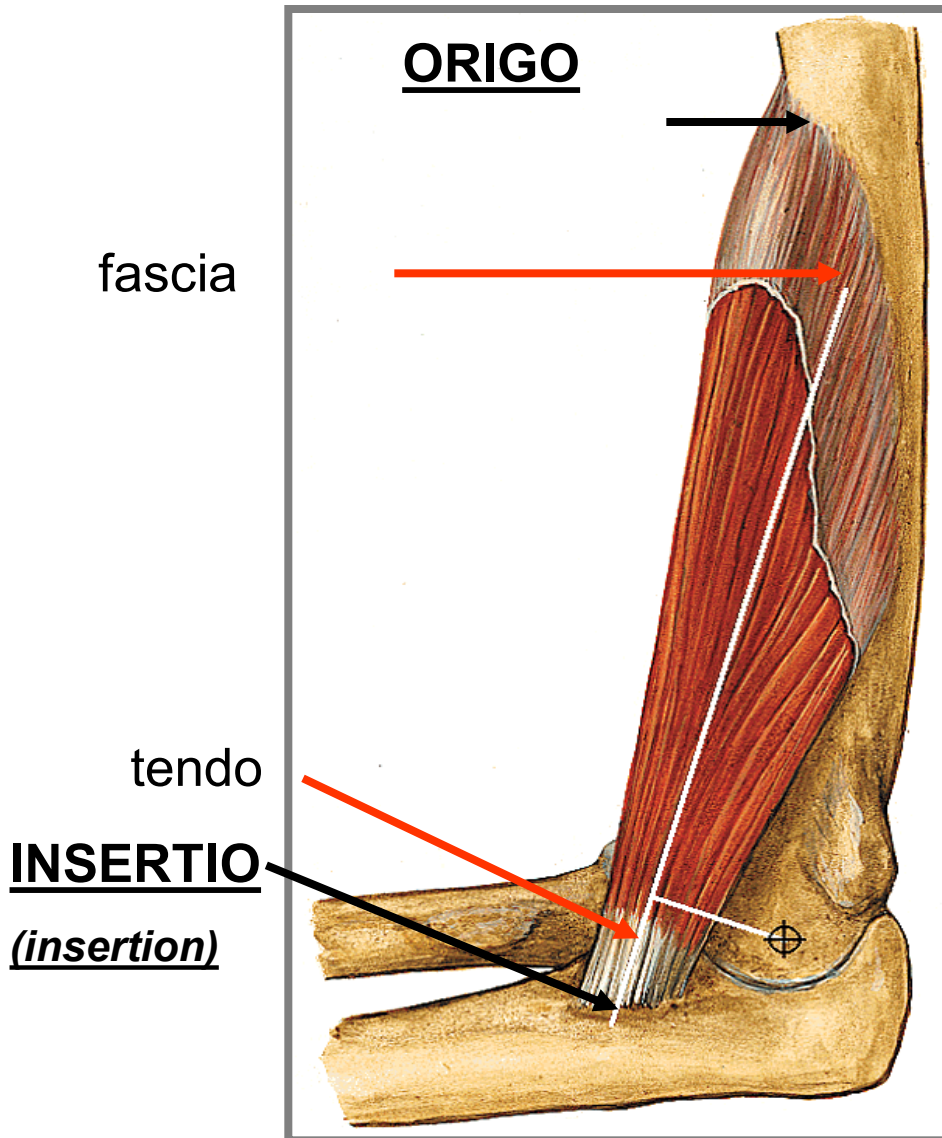


**Caput (*head*)**

**Venter (*belly*)**

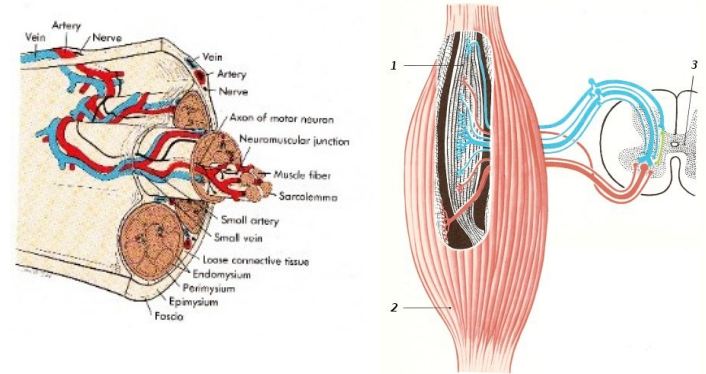
**Cauda (*tail*)**

# Structure of muscle



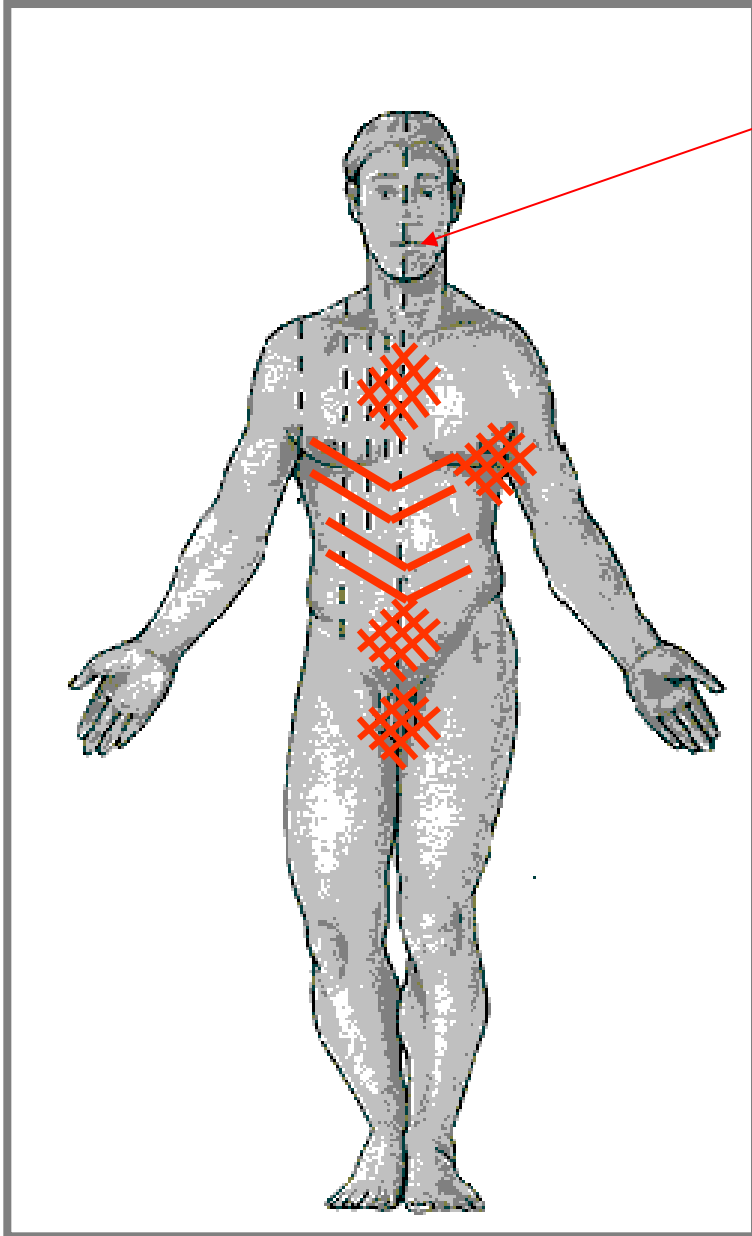
**Fascia** – a fibrous membrane – separates the muscles (or groups) from adjacent structures.

**Vessels and nerves** enter into muscle by its **hilus** (rich ramification)



**Tendons are attached to the bones by Sharpey's fibres.**

# Innervation of muscles



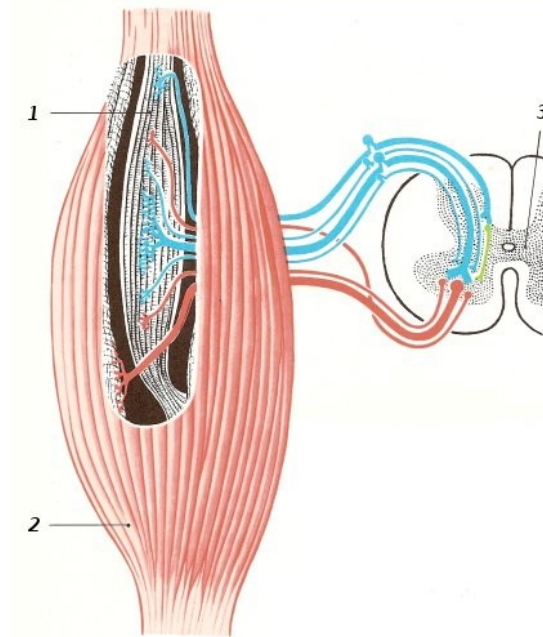
**Cranial nerves** (III. – XII.)

**Spinal nerves**

(31 pairs)

→ Dorsal branches

→ Ventral branches  
(form plexus)



Cervical plexus

Brachial plexus

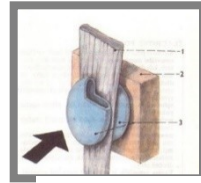
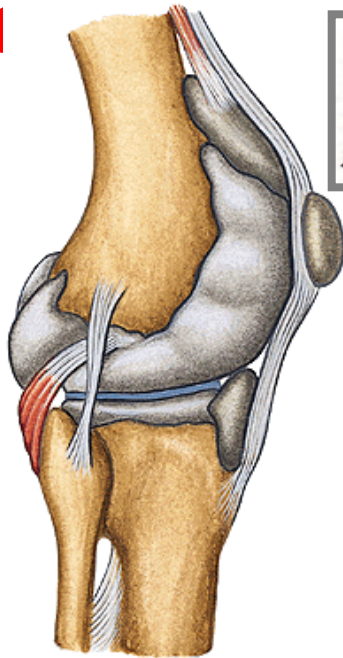
Intercostal nerves

Lumbal plexus

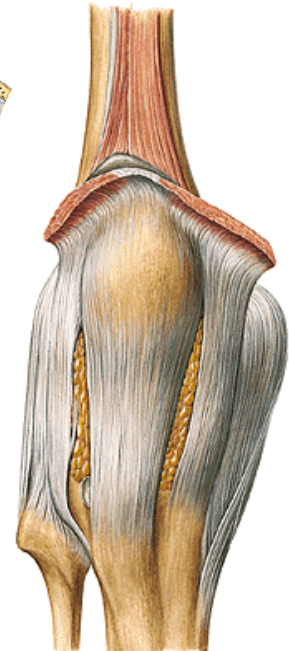
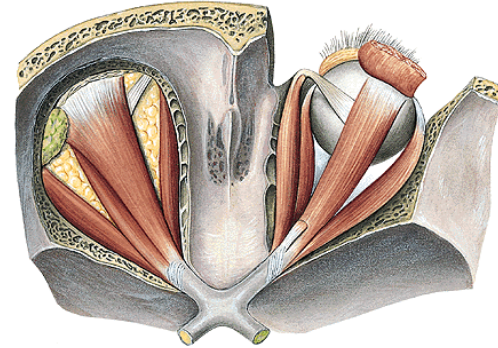
Sacral plexus

# Auxiliary facilities

- 1. Fasciae** – allow to move one muscle (or functional group) against the other; septa
- 2. Bursae synoviales** (*synovial bursae*) – protect tendons against friction
- 3. Tendo aponeurosis**=tendon of flat muscles
- 4. Trochleae musculares** (*muscular trochleae*) – fibrous loops keeping tendon to a bone, permit change of direction of muscle pulling
- 5. Ossa sesamoidea** (*sesamoid bones*) – at the places of pressure



(trochleae)





# Vaginae tendinum and vaginae synoviales

(tendon's and synovial sheaths)

A space along tendons, closed, increasing sliding capacity of tendons

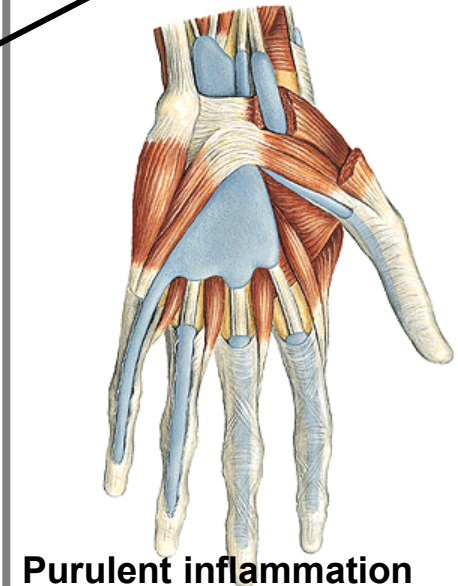
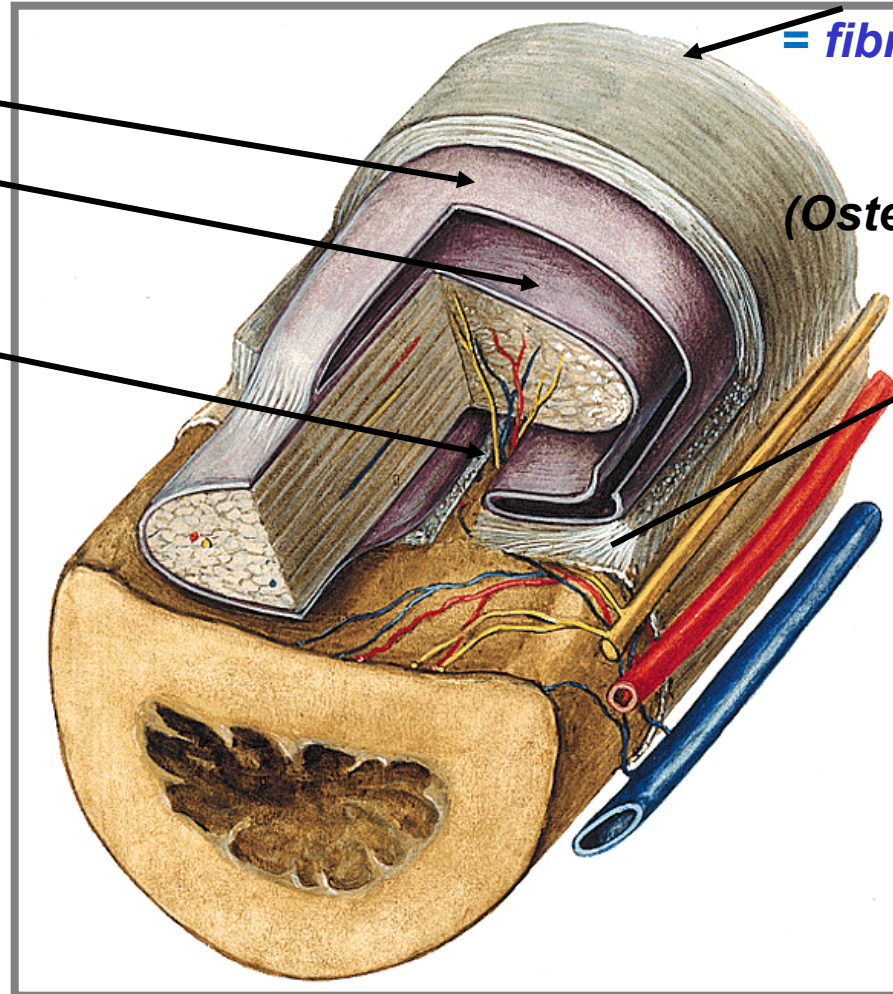
stratum fibrosum  
= fibrous layer

stratum synoviale=  
(synovial layer)

ext. and int. layer with  
mesotenonium for  
penetration of vessels  
into tendon)

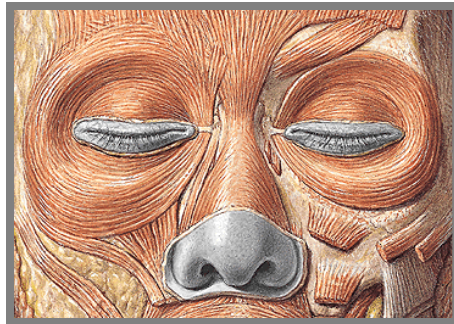
(Osteofibrous canal)

Sharpey s fibers



Purulent inflammation  
can spread here

# Division of muscles according to their shape



- **long type** (predominantly limb muscles)
- **short type** (circumarticular muscles, short muscles of the hand.....)
- **flat type** (for eg. abdominal wall muscles)
- **Composed:**
- **muscles with two or more heads:** biceps, triceps, quadriceps
- **multi-bellied muscles:** musculus digastricus (*digastric muscle*)
- **various types of sphincters or dilatators:** mm. orbiculares (*orbicular muscles*), m. dilatator pupillae
- **unipennate muscles or multipennate muscles:**

# Division of muscles according to the function

**synergists x antagonists**

**flexors x extensors**

Example: biceps of brachium x triceps of brachium

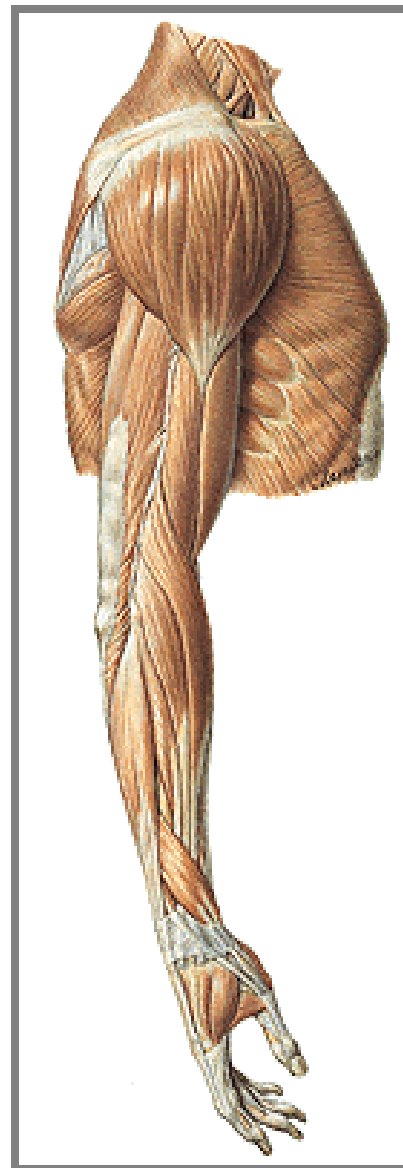
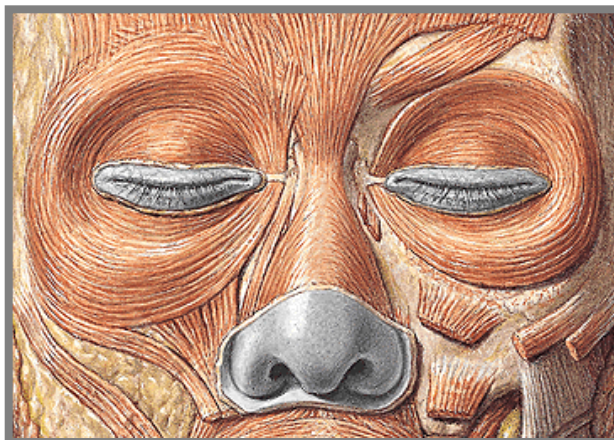
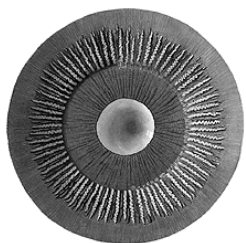
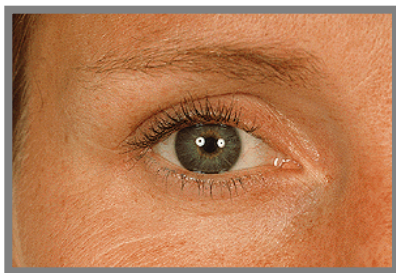


**abductors x adductors**

Example: abductor pollicis brevis x adductor pollicis

**dilatators x sphincters**

Example: dilatator pupillae x sphincter pupillae



# SPECIAL MYOLOGY

**Description** of the muscle:

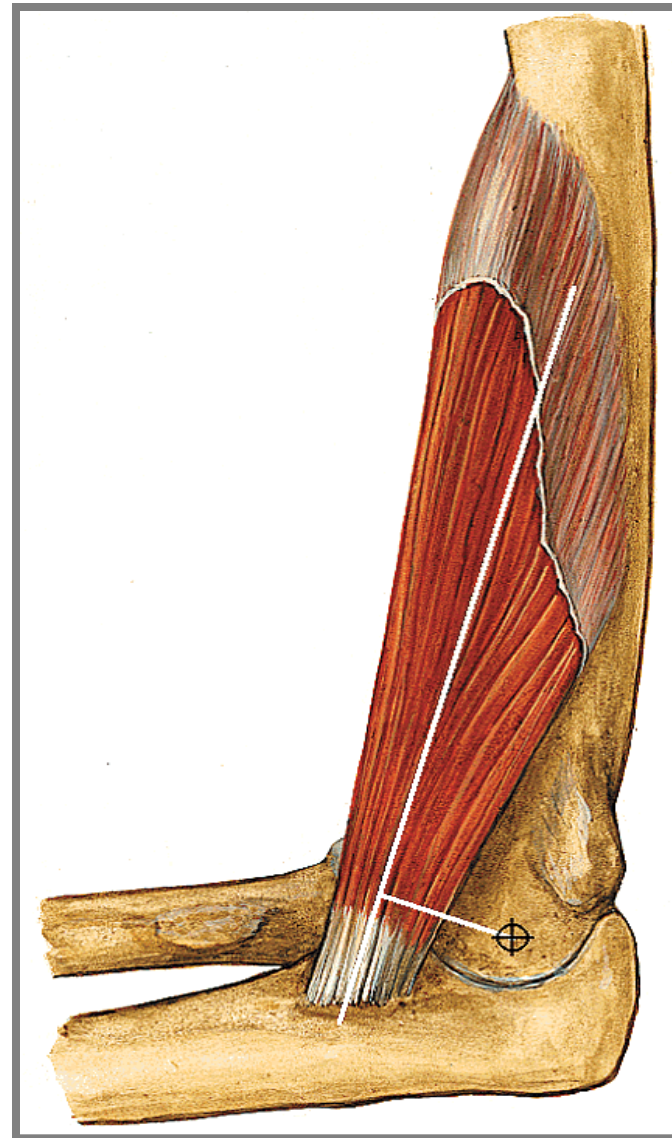
1. **Name of muscle**
2. **Group (a part of body)**

**Origo** - *origin*

**Insertio** - *insertion*

**Functio** – *function/action*

**Innervatio** - *innervation*



# Division of muscles according to regions of the body

**Muscles of the head**

**Muscles of the neck**

**Muscles of the thorax**

**Muscles of the abdomen**

**Muscles of the diaphragm  
pelvis**

**Muscles of the back**

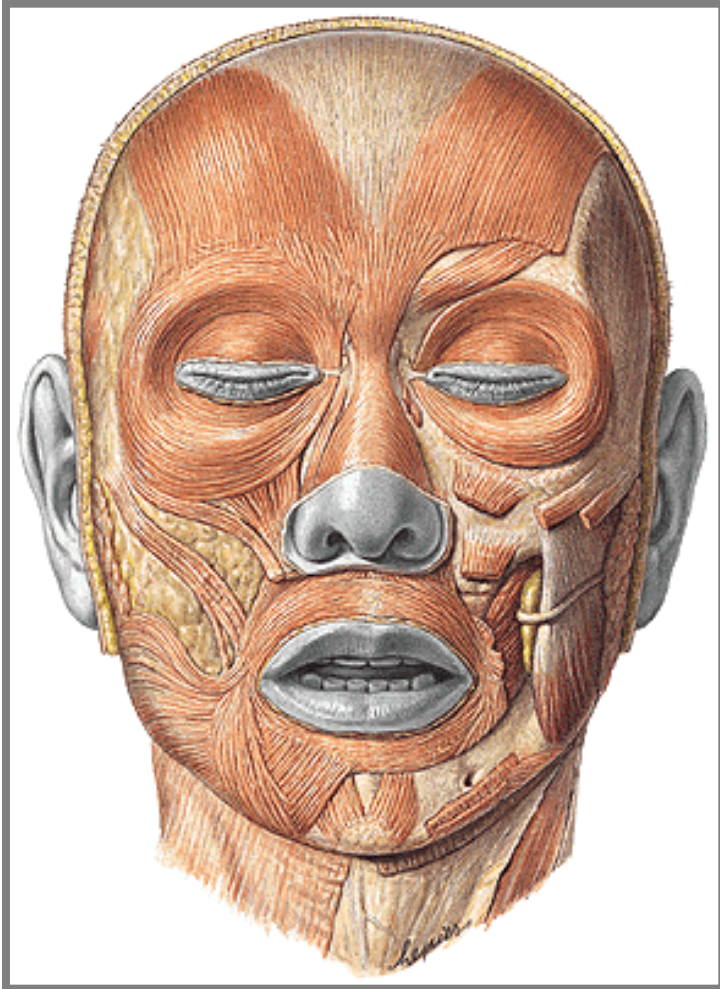
**Muscles of the upper limb**

**Muscles of the lower limb**



# SPECIAL MYOLOGY

## Mm. capitis (Muscles of the head)



### 1) MUSCULI MASTICATORII

(MASTICATORY MUSCLES)

Innervation - **n. trigeminus** = V. cranial nerve

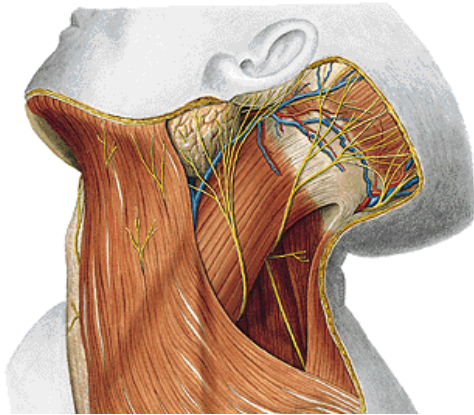
### 2) MUSCULI FACIALES

(MUSCLES of FACIAL EXPRESSION)

Innervation - **n. facialis** = VII. cranial nerve

**NO FASCIA!** – skin muscles

# Musculi colli – *muscles of the neck*



## Superficial layer

m. platysma

m. sternocleidomastoideus

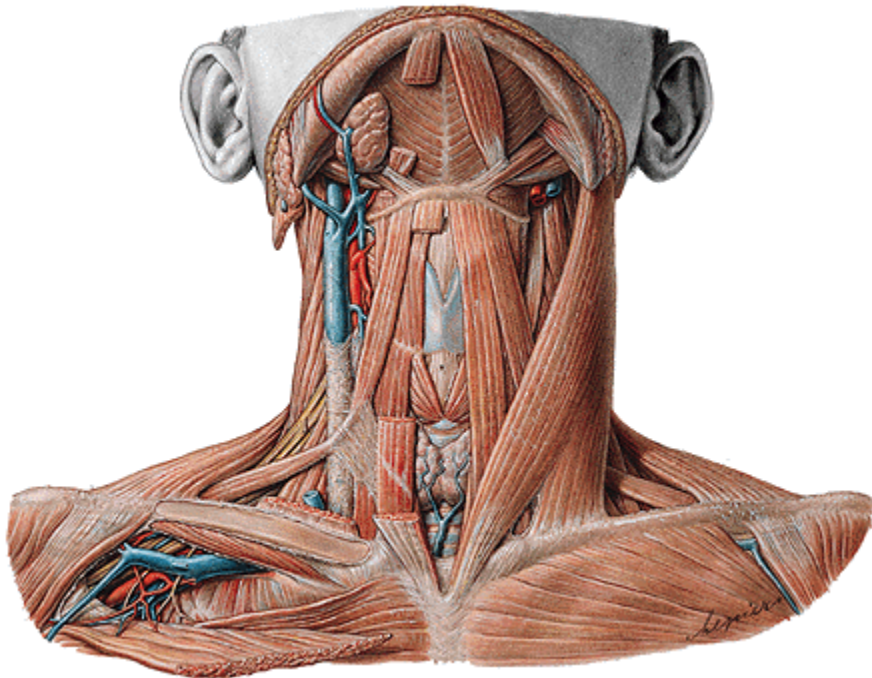
mm. suprahyoidei (depression of mandible)

mm. infrahyoidei - mainly fixation of os hyoideum (*hyoid bone*)

**Deep layer** - mainly flexion of the neck (and head)

mm. scaleni

mm. prae- and intervertebrales



# Musculi thoracis, abdominis et dorsi

*(Muscles of the chest, abdomen and back)*





# Musculi thoracis (*thoracic muscles*)

## I. Thoracohumeral muscles

(mainly ventral flexion and abduction of the upper limb)

**Musculus pectoralis major**

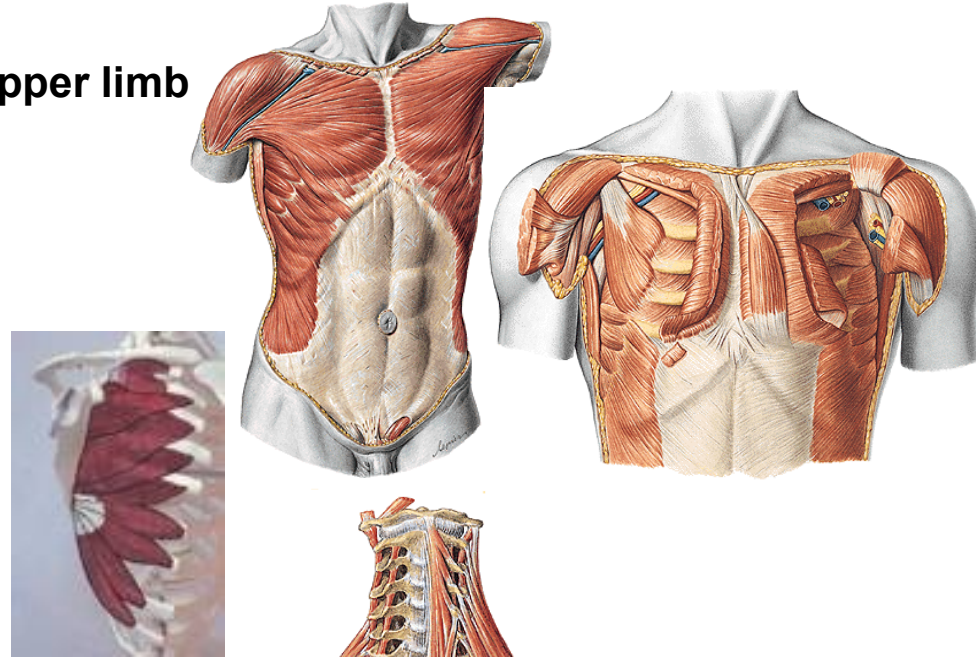
(*greater pectoral muscle*)

**Musculus pectoralis minor**

(*lesser pectoral muscle*)

**Musculus subclavius**

**Musculus serratus anterior**

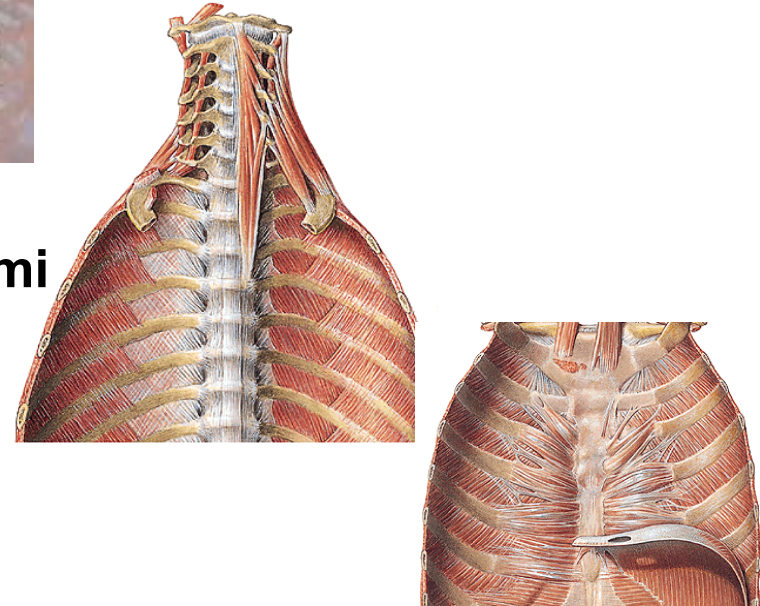


## II. True (intrinsic) thoracic muscles

muscles for respiratory movements

**Musculi intercostales externi, interni et intimi**

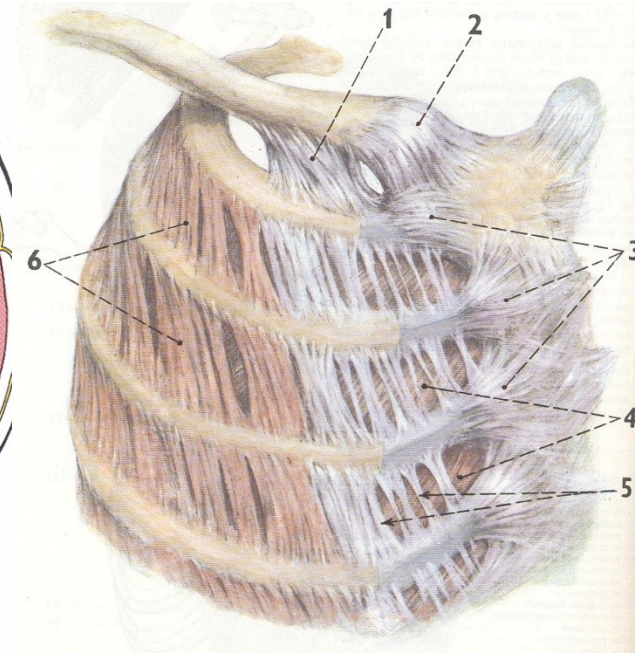
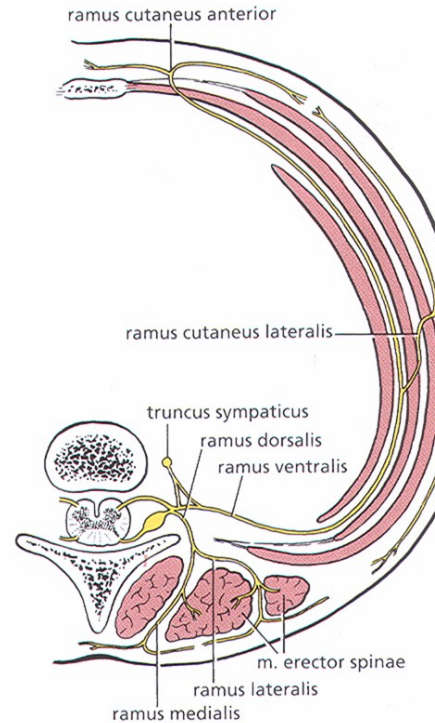
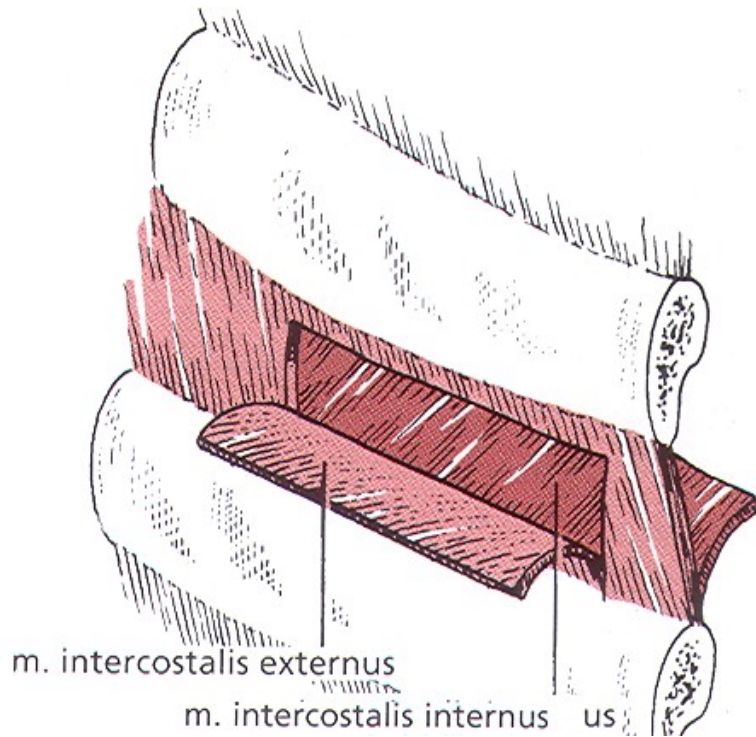
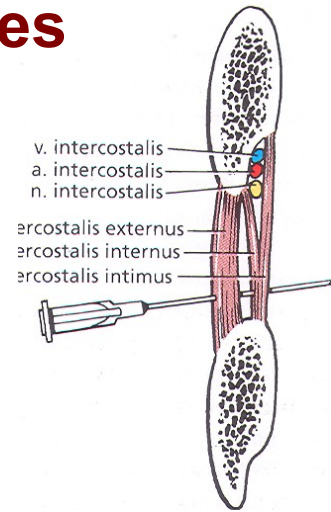
**Musculus transversus thoracis**



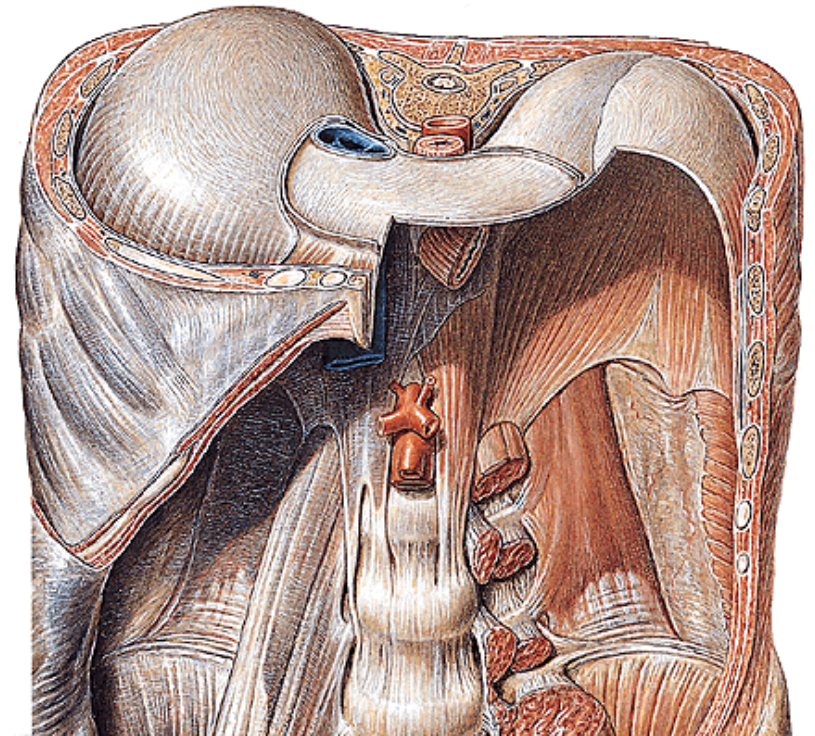
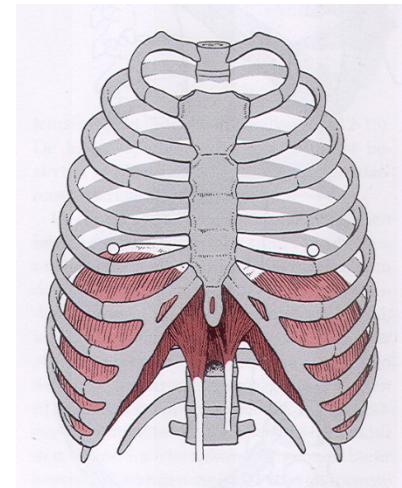
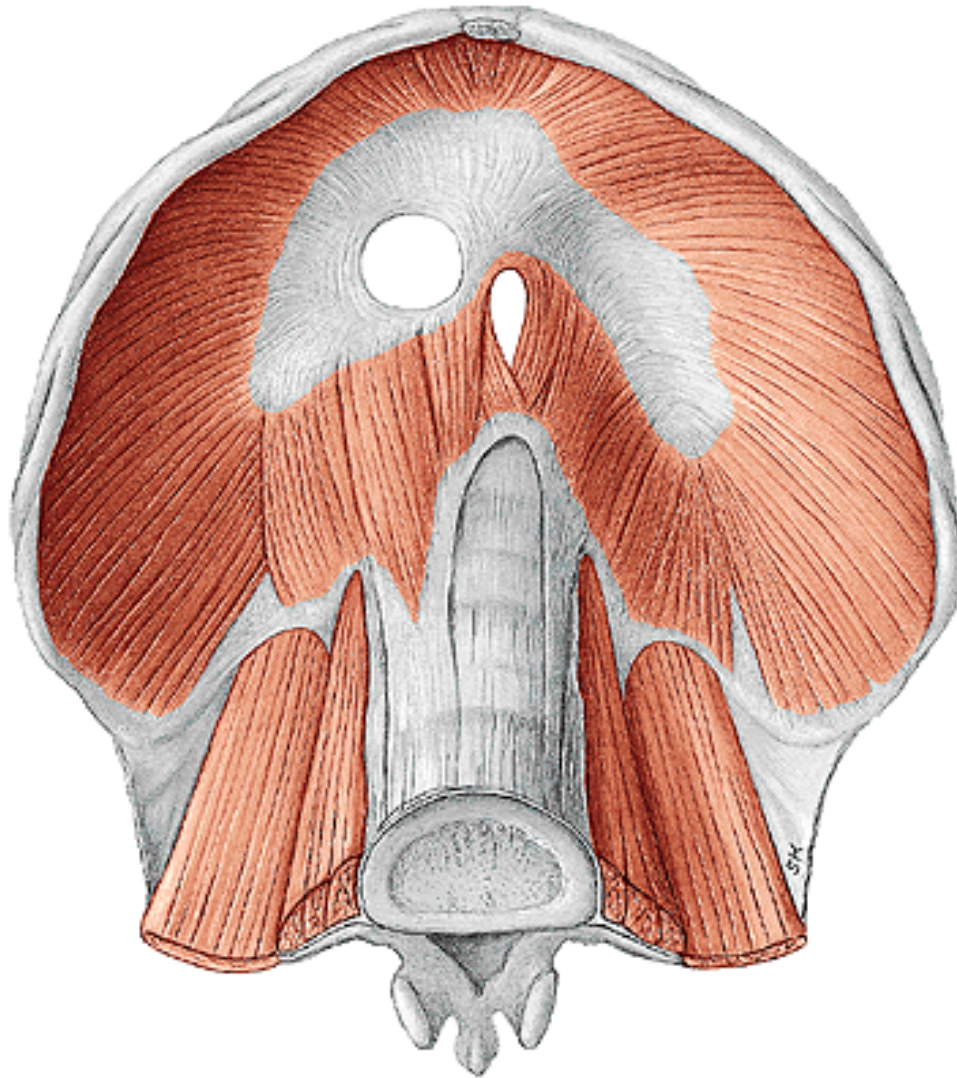
## III. Diaphragma main muscle for inspiration

## II. True (original=intrinsic) thoracic muscles muscles for respiratory movements

1. Mm. intercostales externi
2. Mm. intercostales interni
3. Mm. intercostales intimi
4. M. transversus thoracis



# III. Diaphragm



# **Musculi abdominis (abdominal muscles)**

antagonists of the dorsal muscles, regulate the volume of the abdominal cavity



# **Musculi abdominis** (*muscles of the abdomen*)

antagonists of the dorsal muscles, regulate the volume of the abdominal cavity

## **Ventral group**

**musculus rectus abdominis** (+ its sheath=vagina mm. recti abdominis)

**musculus pyramidalis**

## **Lateral group**

**musculus obliquus externus abdominis**

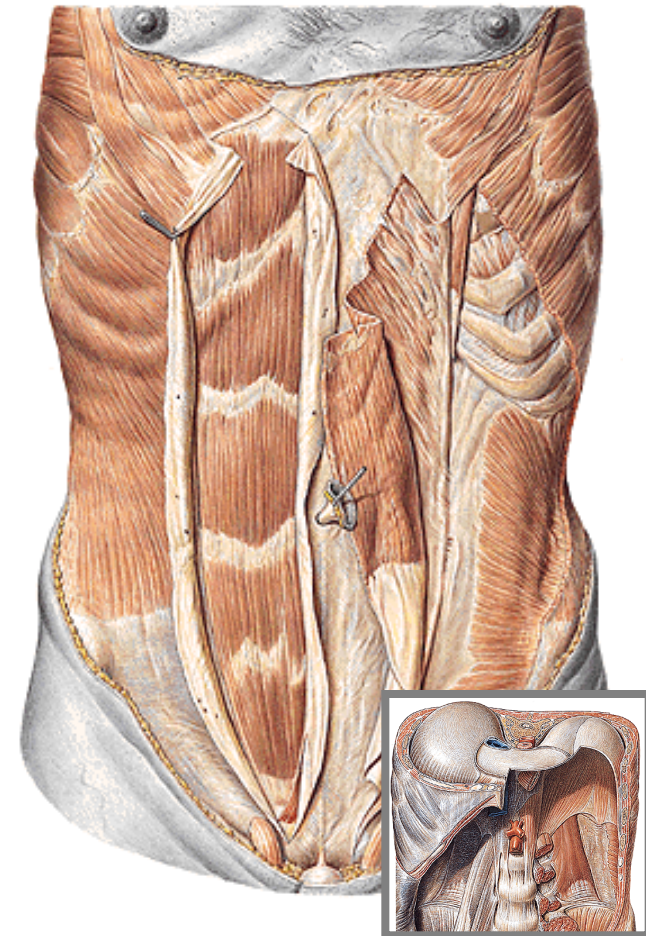
**musculus obliquus internus abdominis**

**musculus transversus abdominis**

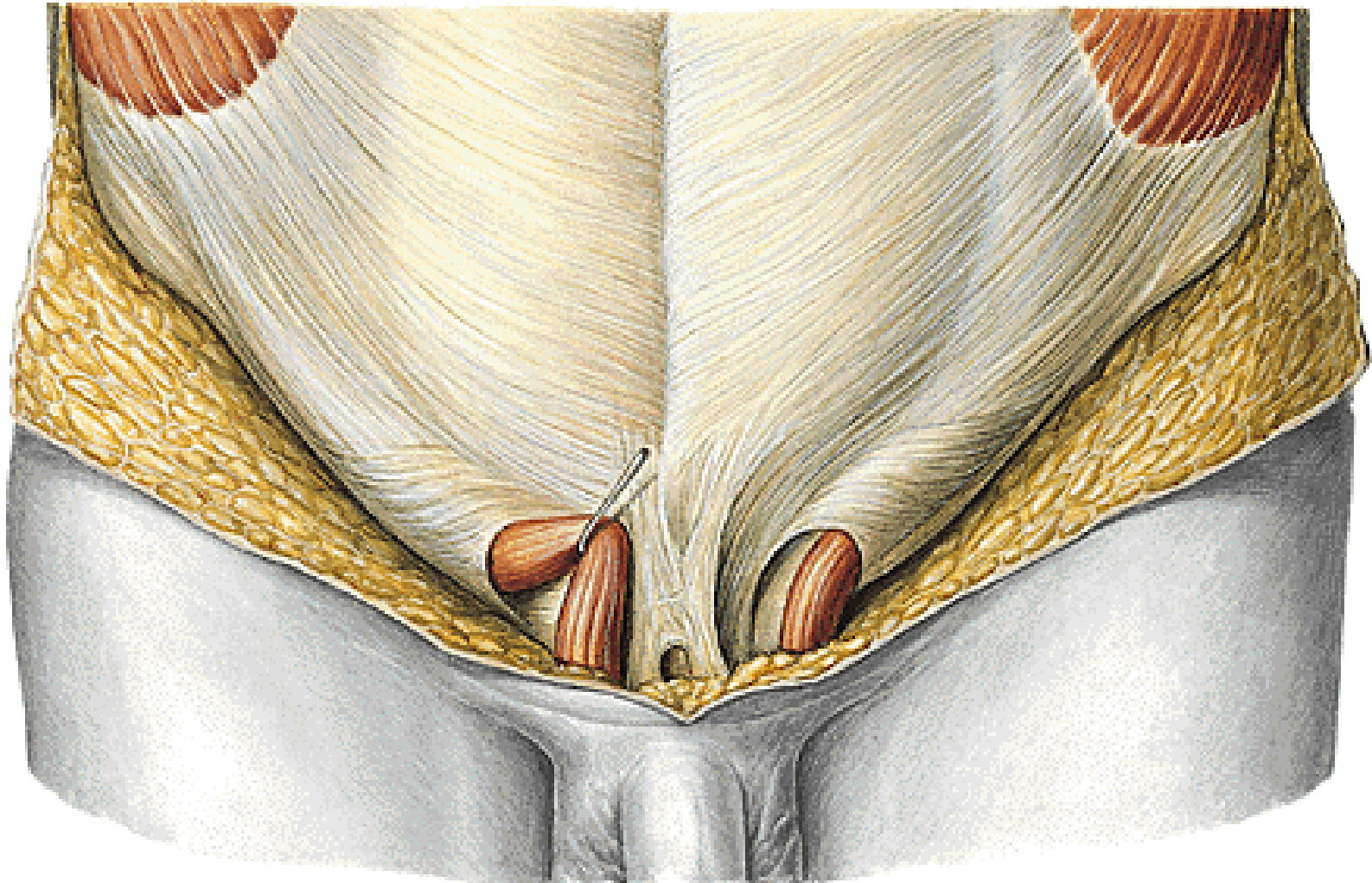
**musculus cremaster**

## **Dorsal group**

**musculus quadratus lumborum**



**Canalis inguinalis (*inguinal canal*) !!!**



# Musculi dorsi (*muscles of the back*)

I. Extrinsic muscles of the back

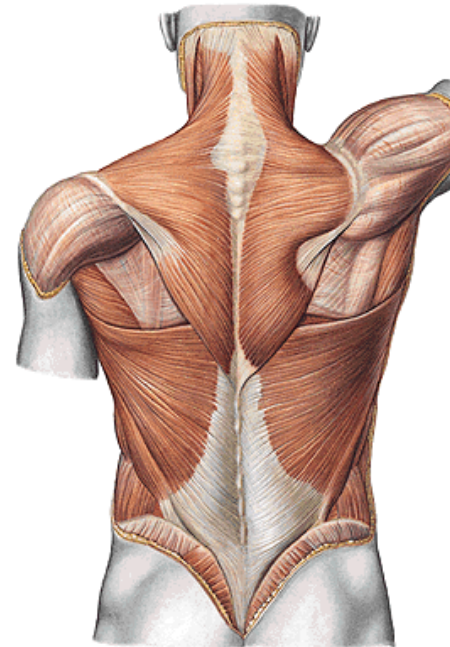
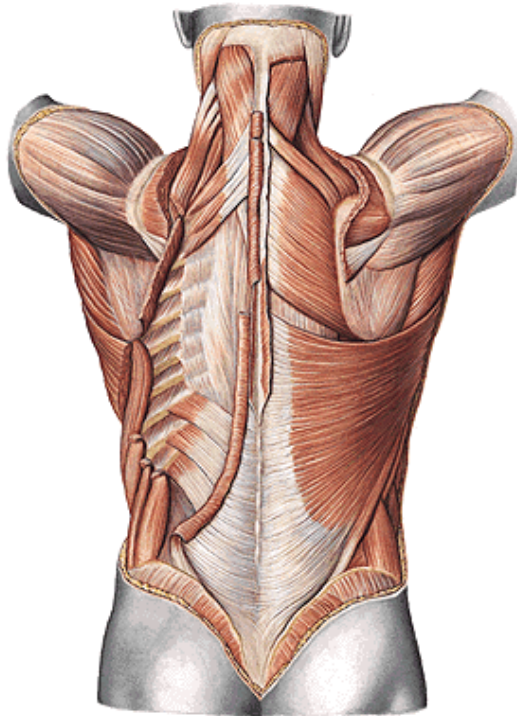
II. Intrinsic muscles of the back (located deeper, innervation by dorsal rami of spinal nerves)

III. Short muscles of the back

**Ad I. Extrinsic muscles of the back**

**A) Mm. spinohumerales (*spinohumeral group*)** movements of the upper limb

**B) Mm. spinocostales (*spinocostal group*)** help respiratory movements

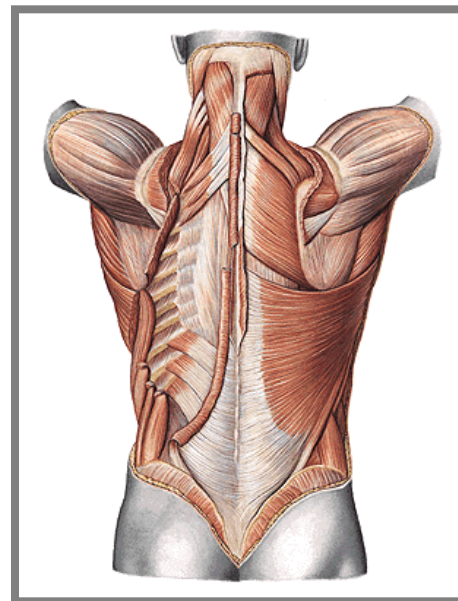
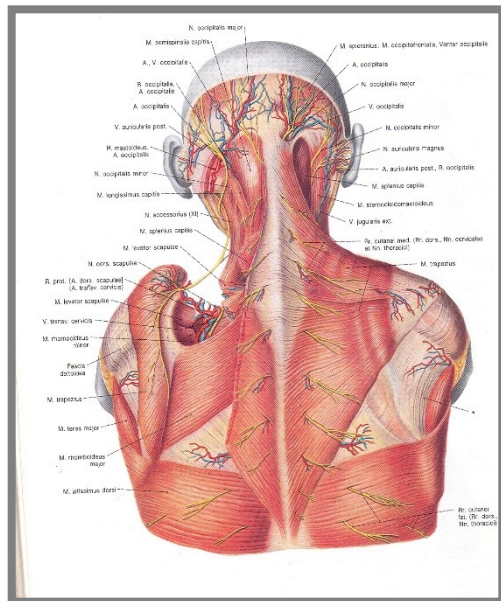
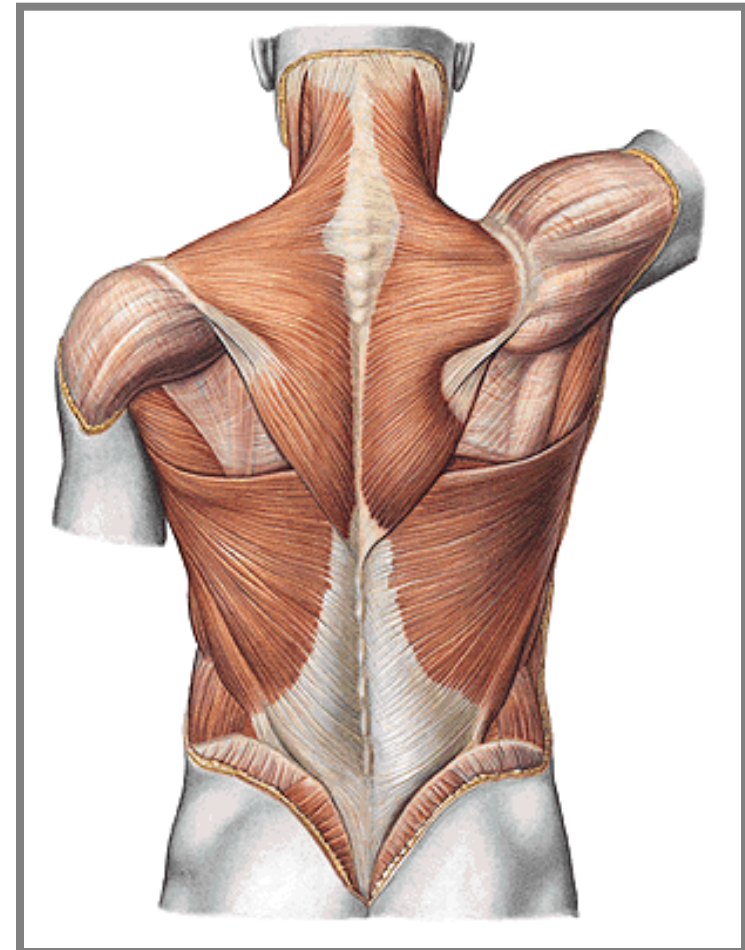
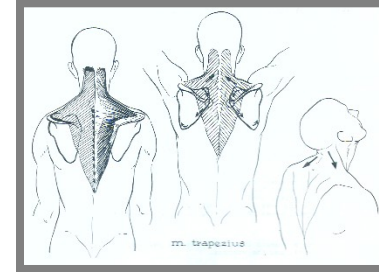


# I. EXTRINSIC BACK MUSCLES

## A. Mm. spinohumerales

(*spinohumeral group*)

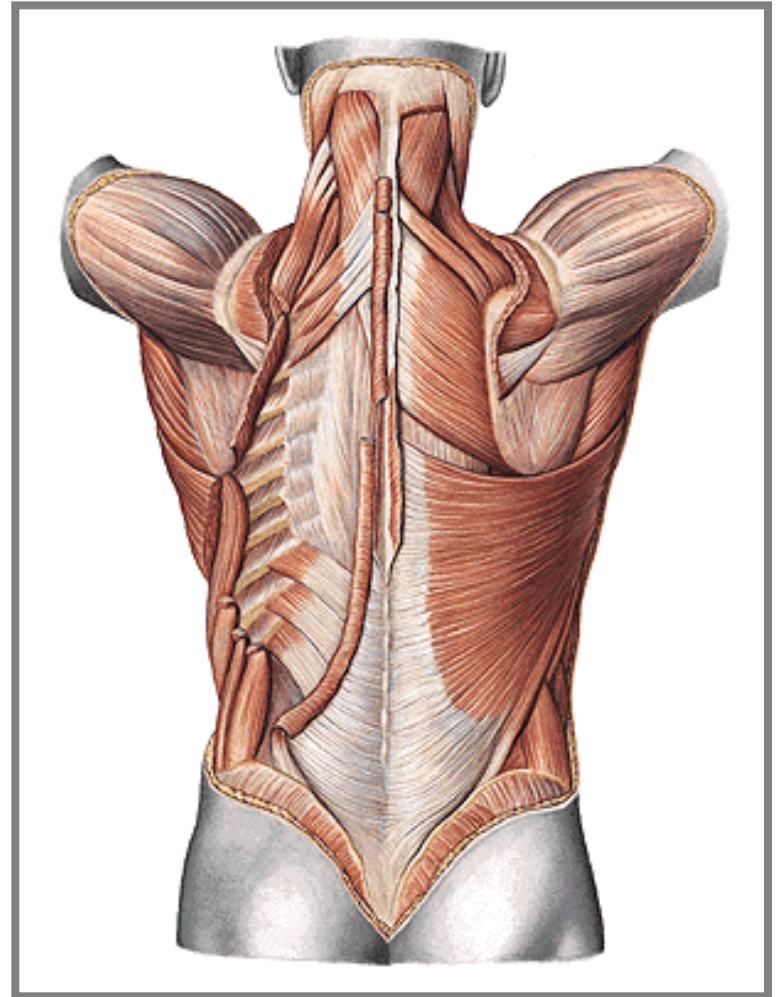
1. m. trapezius
2. m. latissimus dorsi
3. m. levator scapulae
4. m. rhomboideus minor
5. m. rhomboideus major





**B) Spinocostal group of muscles** help respiratory movements

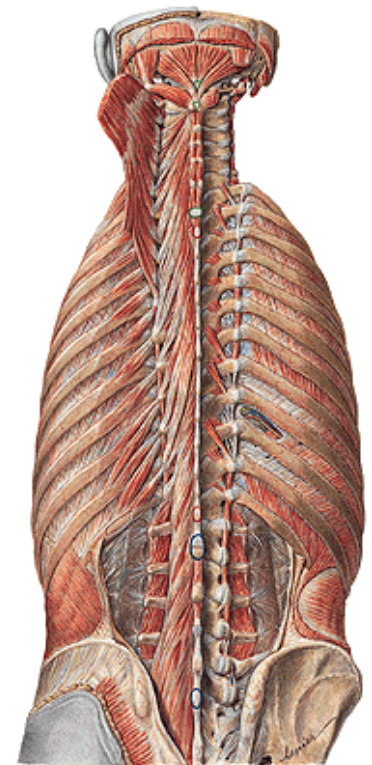
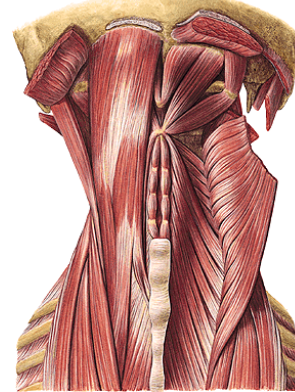
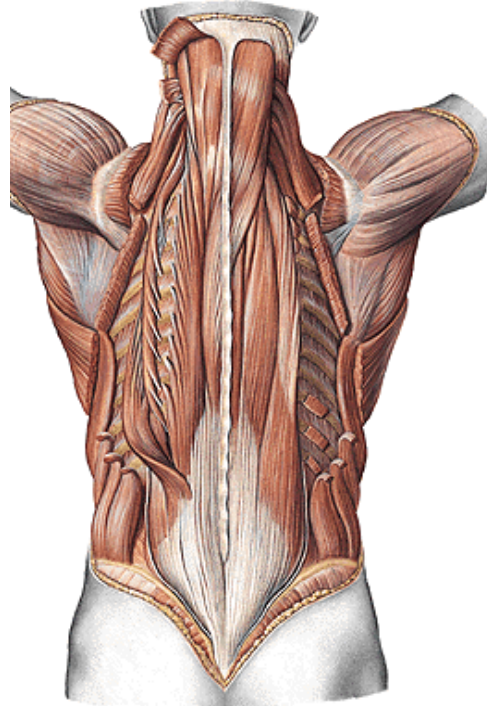
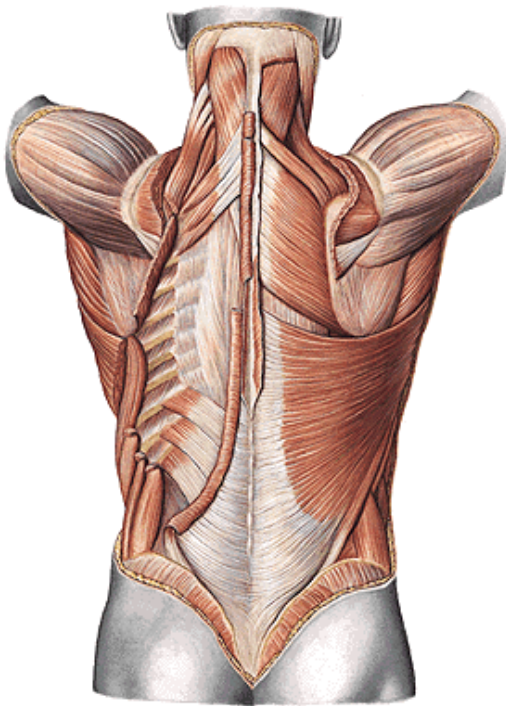
1. **m. serratus posterior superior**
2. **m. serratus posterior inferior**



# Ad II. Intrinsic muscles of the back

mainly extensors of the back and the head, innervation rami dorsales of spinal nerves

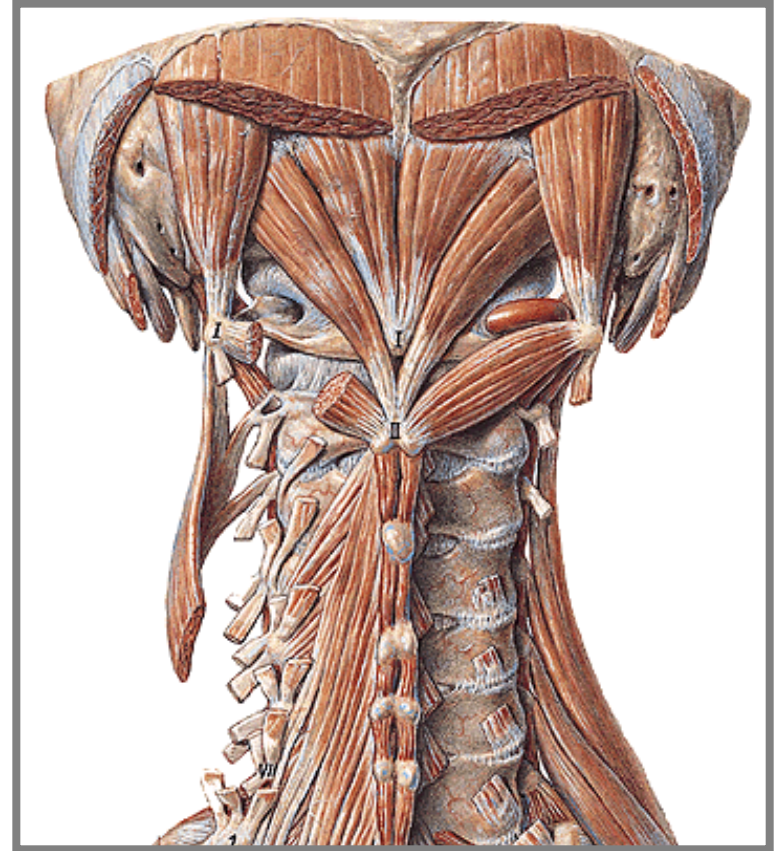
- 1) **Spinotransversal system** (m. splenius capitis and cervicis)
- 2) **Sacrospinal system** (m. erector spinae, longissimus and iliocostalis)
- 3) **Spinospinal system** (m. spinalis thoracis)
- 4) **Transversospinal system** (m. semispinalis capitis and cervicis)



## Ad III. Short muscles of the back

### Mm. nuchae profundi

- a) m. rectus capitis posterior minor (*lesser*)
- b) m. rectus capitis posterior major (*greater*)
- c) m. obliquus capitis superior
- d) m. obliquus capitis inferior

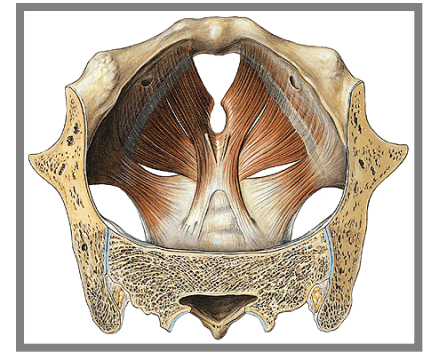


# Diaphragma pelvis

*m. levator ani (m. pubococcygeus, m. iliococcygeus)*

*m. coccygeus*

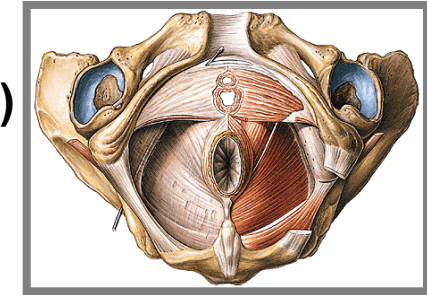
Lifting and closure of rectum



# Diaphragma urogenitale (ventrally + caudally)

*m. transversus perinei profundus (+ m. sphincter urethrae)*

*m. transversus perinei superficialis*

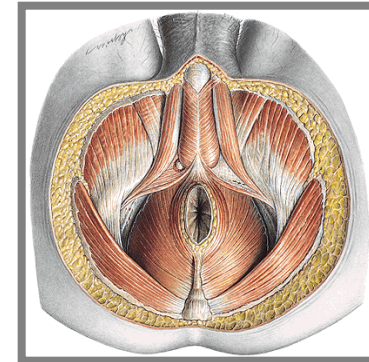
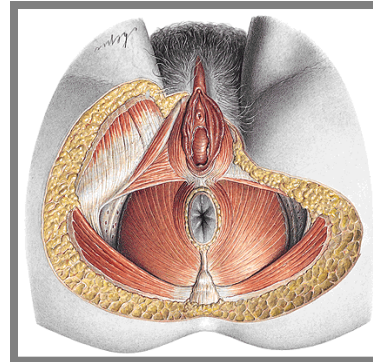


# Muscles of the external sexual organs:

*m. ischiocavernosus*

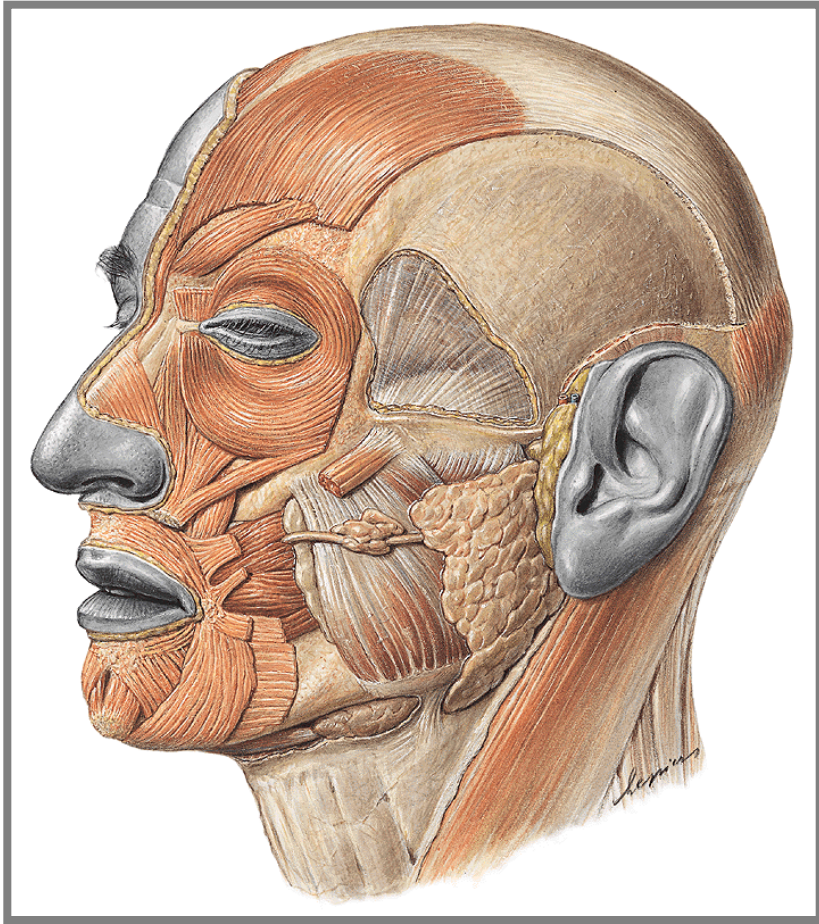
*m. bulbospongiosus*

*m. sphincter ani externus*



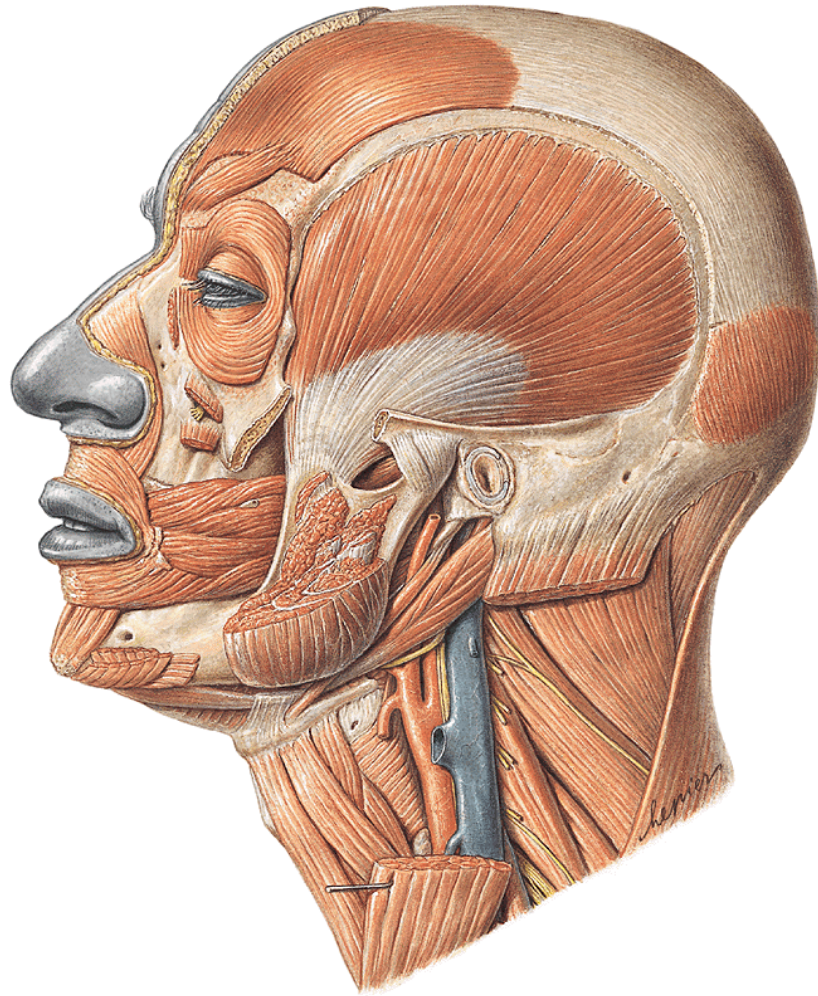
# Musculi masticatorii

(innervation by n. trigeminus = V. cranial nerve)



1. **M. temporalis** (*temporal muscle*)
2. **M. masseter** (*masseter muscle*)
3. **M. pterygoideus medialis**  
(*medial pterygoid muscle*)
4. **M. pterygoideus lateralis**  
(*lateral pterygoid muscle*)

# Musculus temporalis (*temporal muscle*)



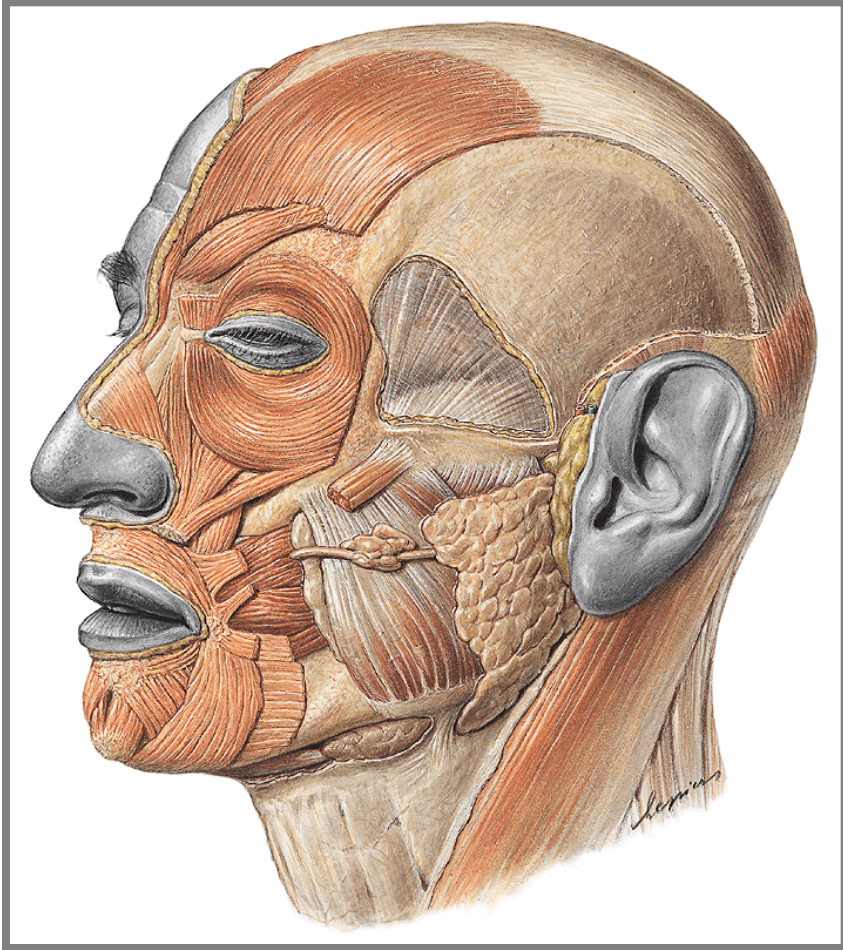
**Origin:** linea temporalis inferior, fossa temporalis, fascia temporalis

**Insertion:** processus coronoideus mandibulae (*coronoid proces of mandible*)

**Function:** elevation of mandible, retraction

**Inervation:** trigeminal nerve (n. V.)

# Musculus masseter (*masseter muscle*)



**Origin:** corpus ossis zygomatici, arcus zygomaticus (*body and zygomatic arch*)

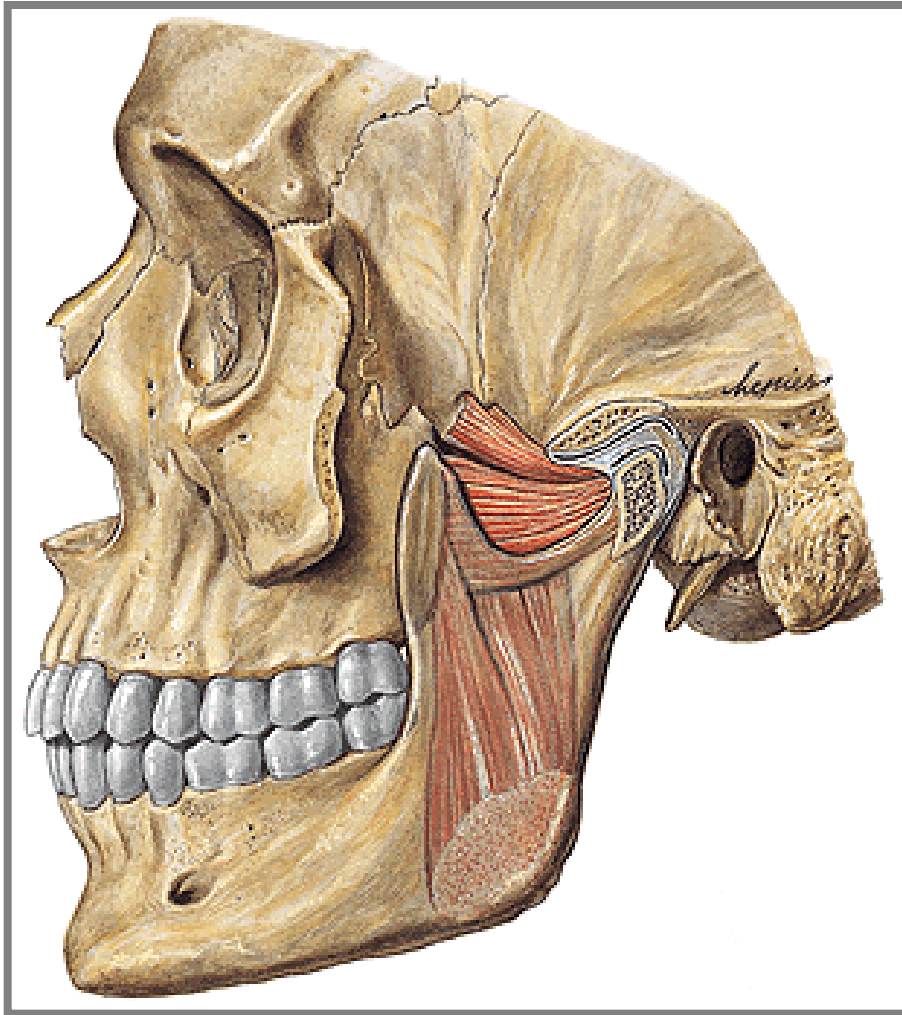
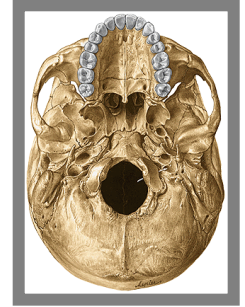
**Insertion:** tuberositas masseterica (*masseteric tuberosity*) of mandible

**Function:** elevation and protraction of mandible

**Innervation:** trigeminal nerve (n. V.)

# Musculus pterygoideus medialis

*(medial pterygoid muscle)*



**Origin:** fossa pterygoidea and tuber maxillae

**Insertion:** tuberositas pterygoidea

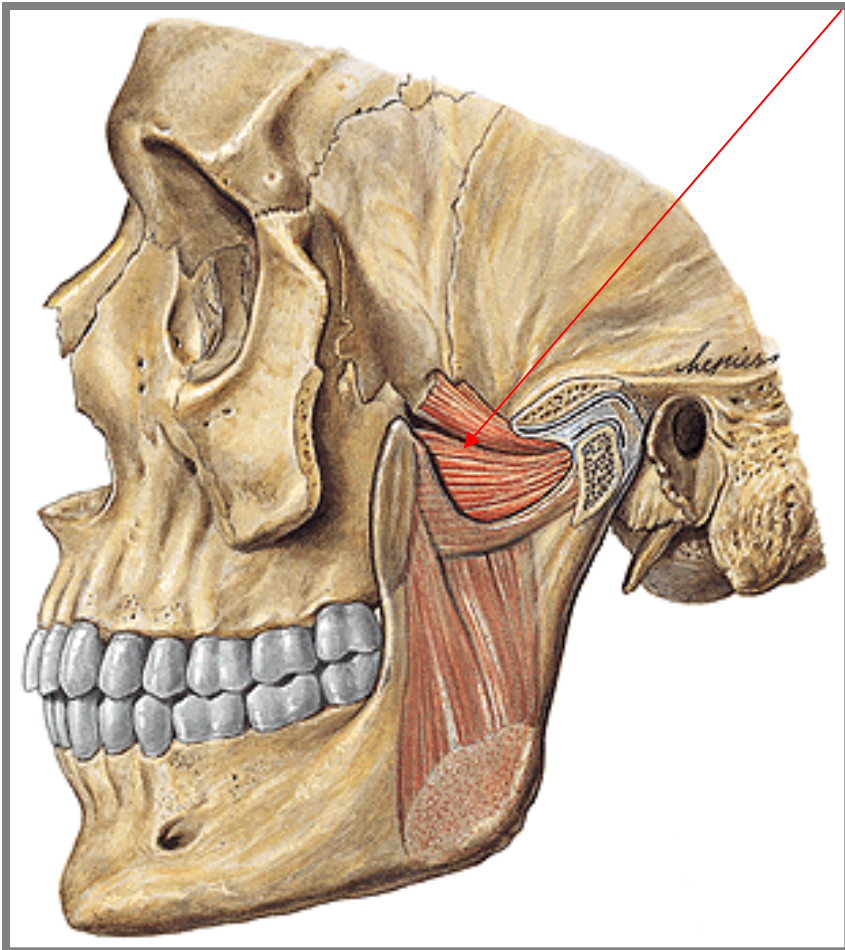
**Function:** elevation of mandible and movements to the sides

**Innervation:** trigeminal nerve (n.V.)



# Musculus pterygoideus lateralis

*(lateral pterygoid muscle)*

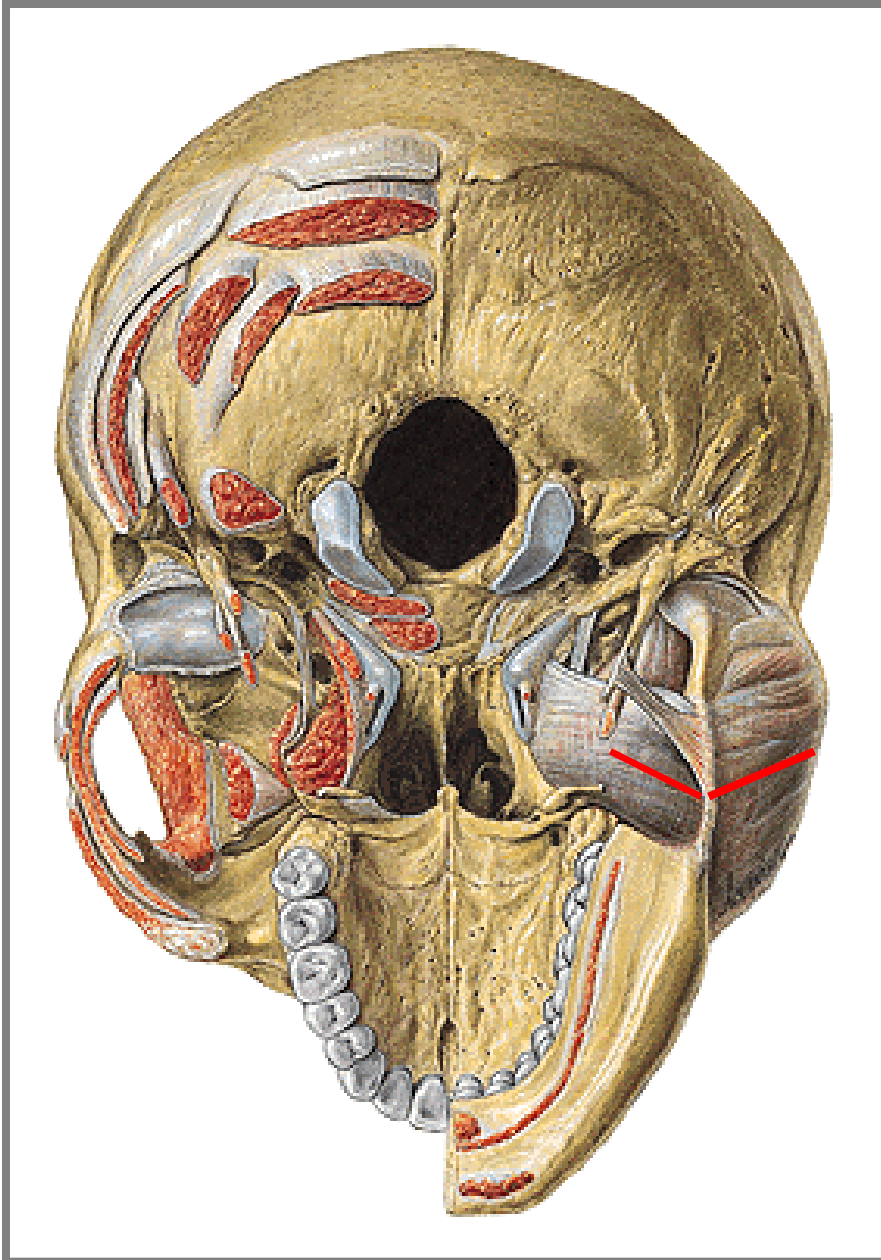


**Origin:** facies infratemporalis of ala major ossis sphenoidalis and lamina lateralis processus pterygoidei

**Insertion:** fovea pterygoidea mandibulae + discus and articular capsule of temporomandibular joint

**Function:** protraction of mandible, chewing movements

**Innervation:** trigeminal nerve (n.V.)

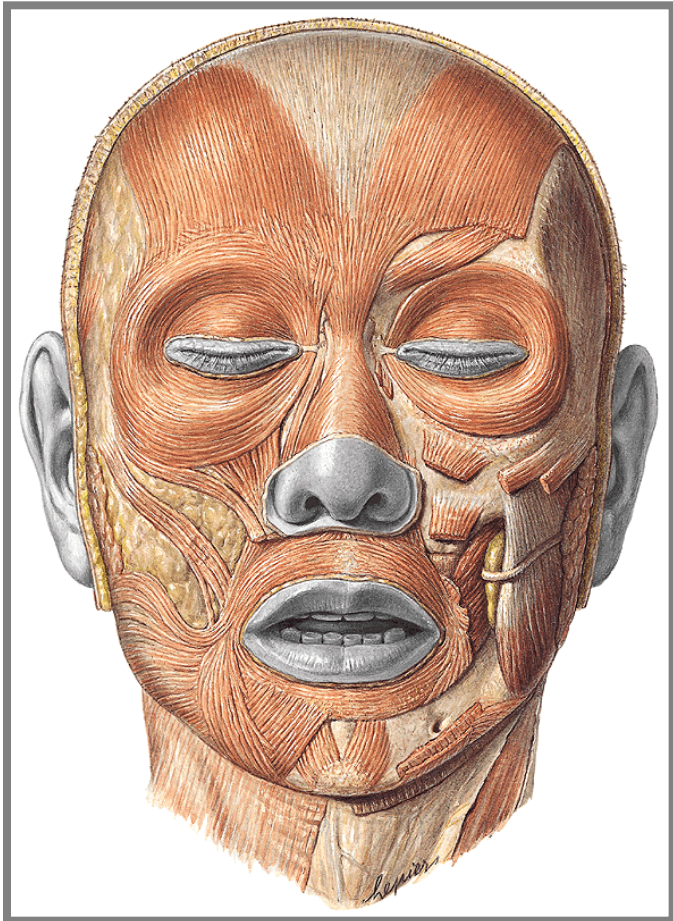


## Muscles of mastication

M. masseter and m. pterygoideus medialis form a „loop“ around mandible

# Mm. faciales (muscles of facial expression)

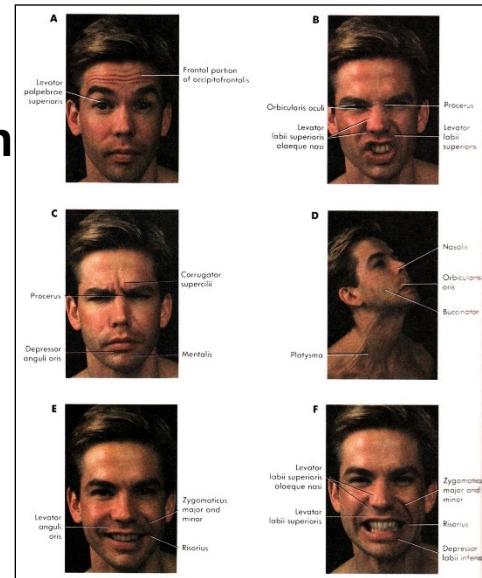
facial nerve – n.VII.



**Muscles of the scalp**  
**Muscles of the orbit region**  
**Muscles of the nasal region**  
**Muscles of the mouth region**

Their contraction causes shift of the skin (folds or wrinkles)  
– it is the basis of the facial expression.

They **have no fascias!**



# Muscles of the scalp

## M. Epicranius

### M. occipitofrontalis with venter frontalis and occipitalis *(frontal and occipital belly)*

**o:** **venter occipitalis** from highest nuchal line  
*(linea nuchae suprema)*

**i:** galea aponeurotica

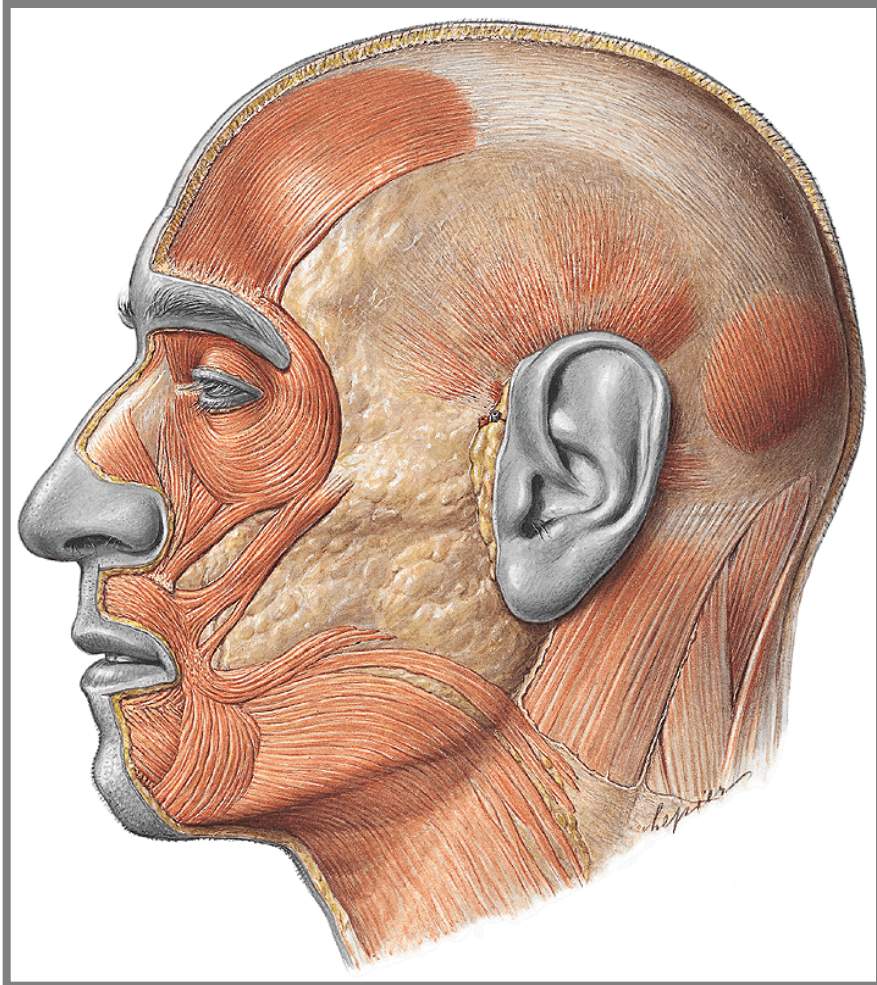
**o:** **venter frontalis** from galea aponeurotica

**i:** skin of eyebrow and glabellar region

**f:** wrinkles in the forehead, lift the eyebrow  
(astonishment)

## M. temporoparietalis

Rudimentary muscle, from galea aponeurotica to  
auricular cartilage



# Muscles of the region of the palpebral fissure



## **M. orbicularis oculi:**

**Palpebral part, orbital part, lacrimal part**

Circularly around the orbit, basis of the eye lids, a sphincter.

**O:** palpebral lig., frontal process of maxilla and lacrimal crests

**F:** firmly closure the eyelid, palpebral part concerned with blink reflex, radial folds in lateral angle (expression of worry and concern)

## **Corrugator supercilii:**

**O:** From the glabellar and supraorbital region

**I:** skin of eyebrows

**F:** produces a vertical wrinkles

## **Procerus**

**O:** dorsum nasi (*dorsum of nose*)

**I:** skin of the forehead

**F:** transverse folds across the root of nose

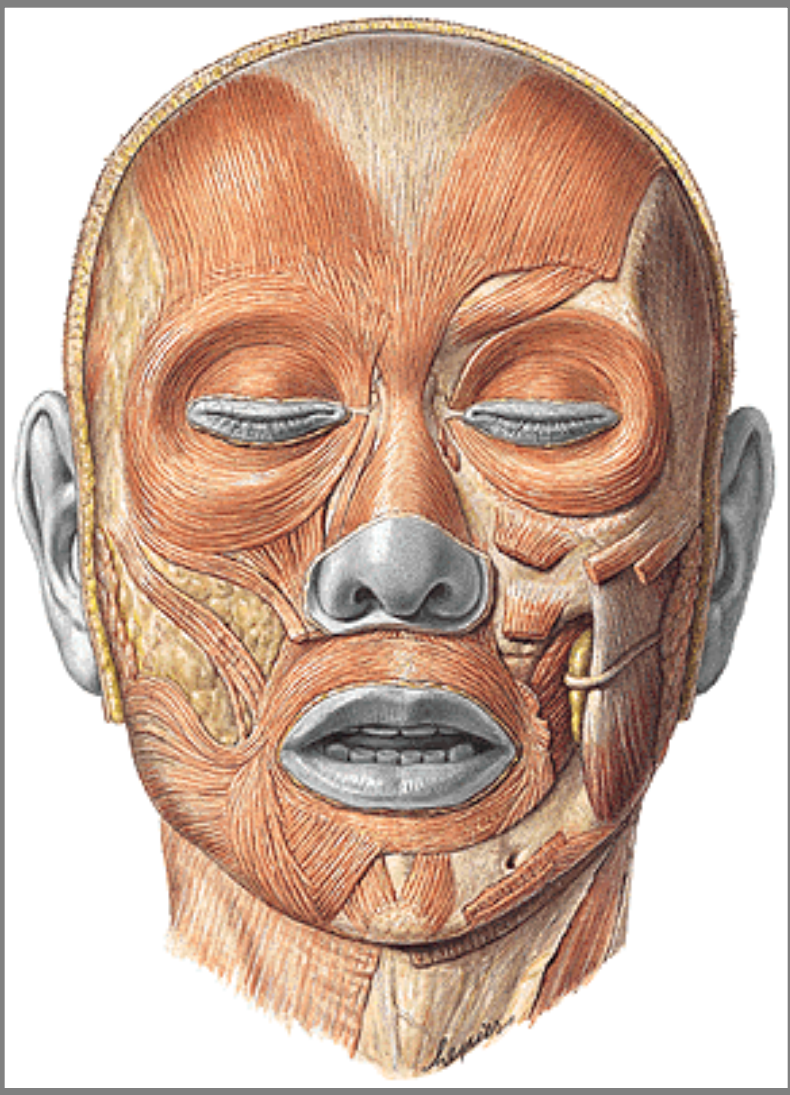
## **Nasalis**

**O:** alveolar juga of the canine tooth and lateral incisor

**I:** skin of the side of the nose

**F:** pulls the nasal wings downward and backward and reduce size of nostrils. Gives impression of desiring, demanding, sensuousness.

## **Musculi oris** (*muscles of the mouth region*)



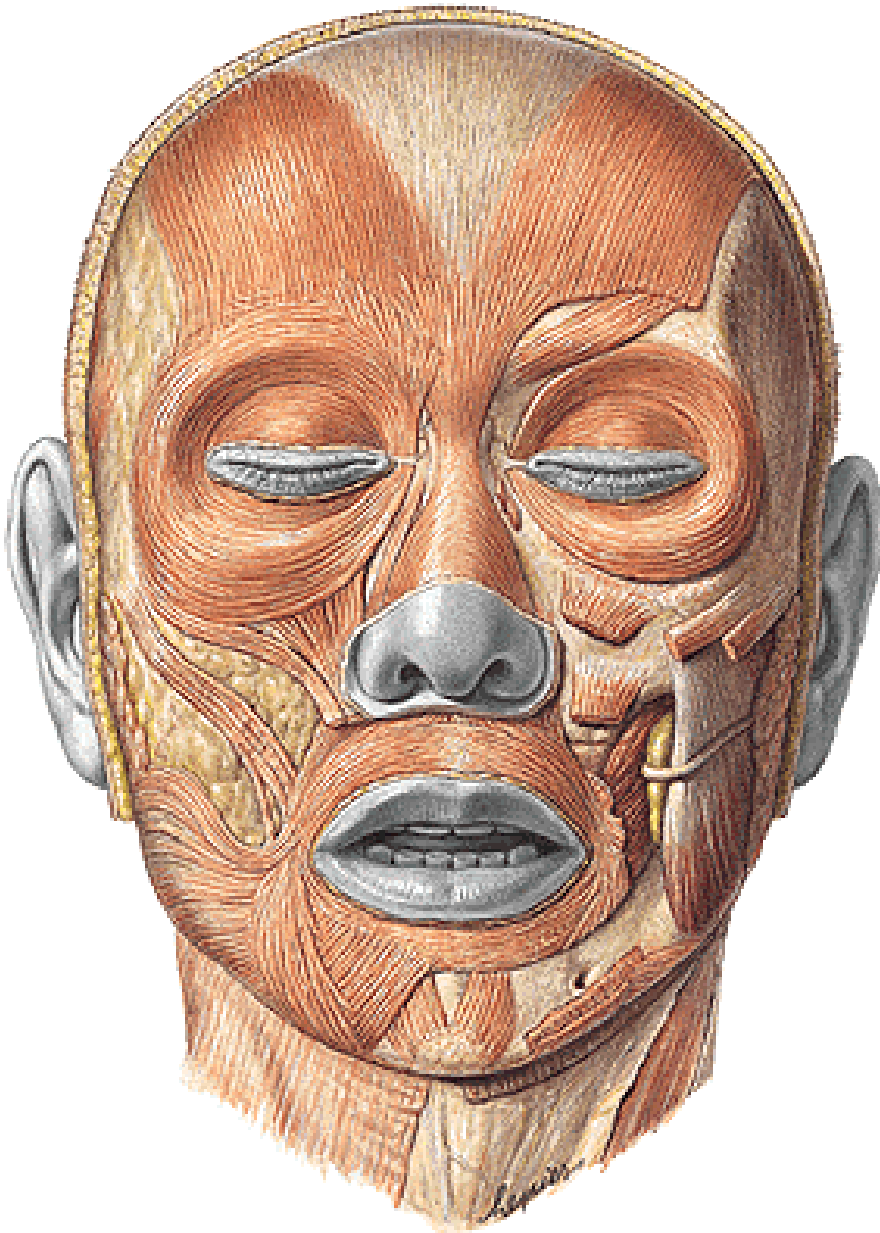
1. Orbicularis oris
2. Buccinator
3. Zygomaticus major
4. Zygomaticus minor
5. Levator labii superioris
6. Levator labii superioris alaeque nasi
7. Levator anguli oris
8. Depressor anguli oris
9. Depressor labii inferioris
10. Risorius
11. Mentalis

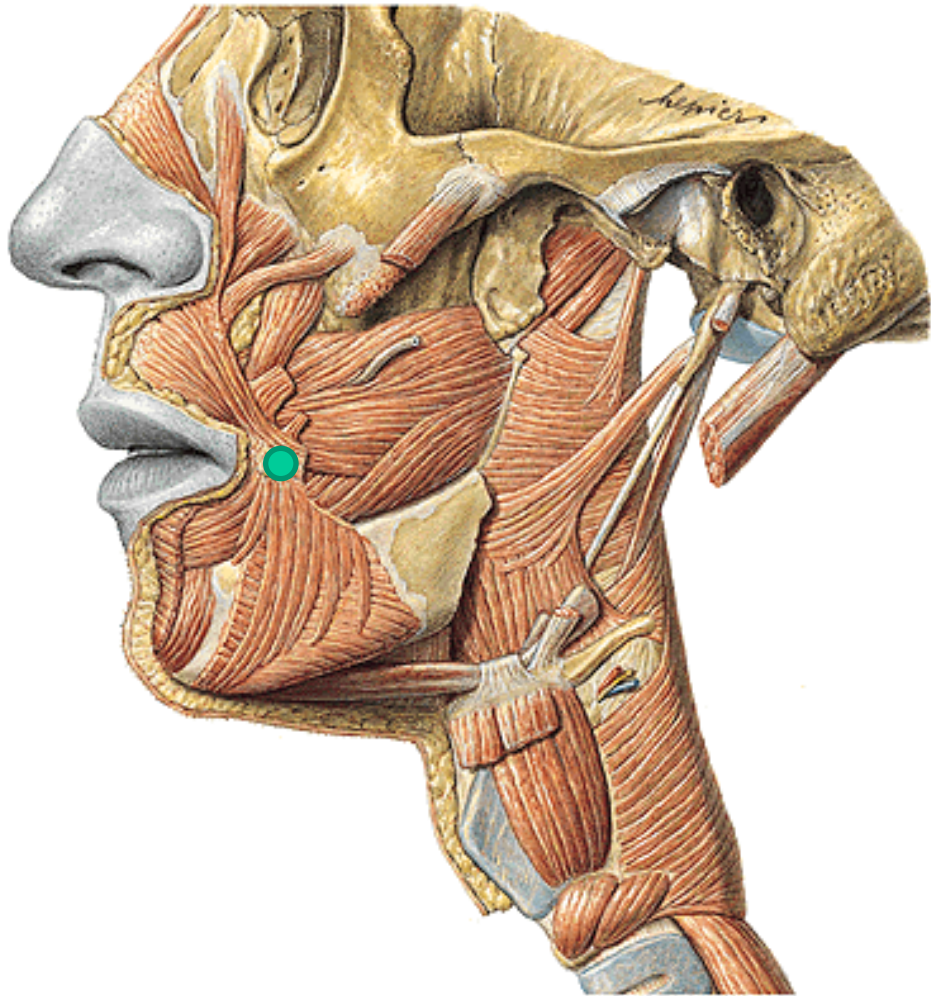
# 1. Orbicularis oris

Labial and marginal parts

**F**: Closes lips, protrudes in the sucking, function during eating and drinking, speaking.

Contraction gives an expression of reserve (distance).





## 2. M. buccinator

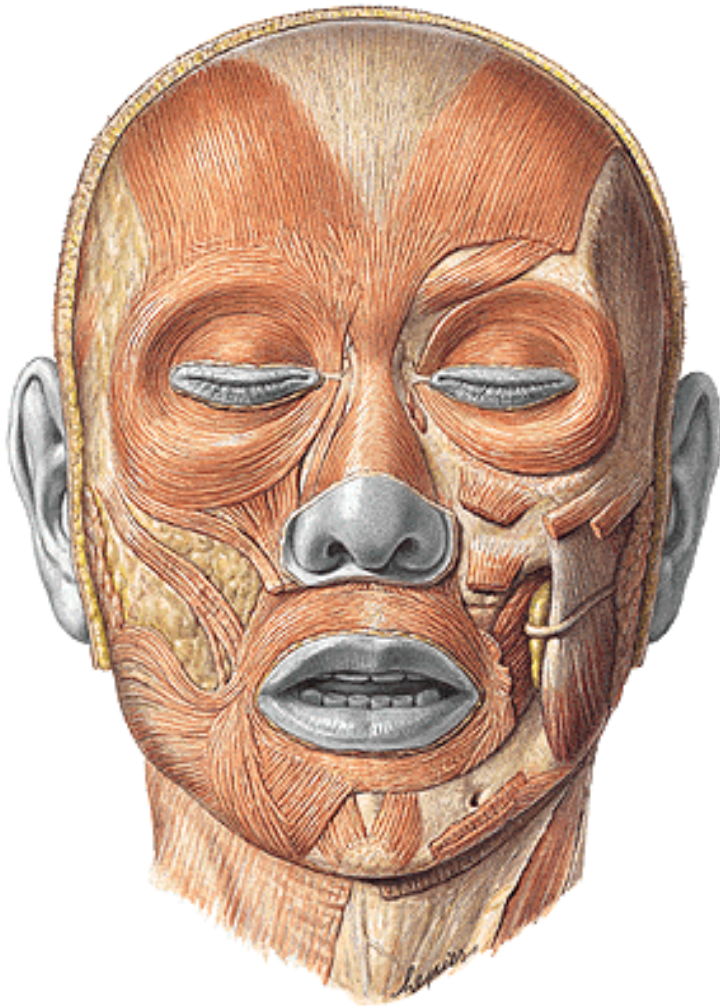
**O**: mandibula and maxilla (alveoli of the 1st and 2nd molars) and raphe pterygomandibularis=buccopharyngea

**I**: angle of the mouth (fibrous nodule) ●

**F**: blows air out of mouth (trumpeter), pulls the angle of mouth laterally and keeps out the mucous membrane of the cheeks free of folds

Expression of satisfaction





### 3. **Zygomaticus major** (*lesser zygomatic*)

**O:** zygomatic bone and zygomatic arch

**I:** the angle of the mouth

**F:** lifts corner of the mouth upward and laterally

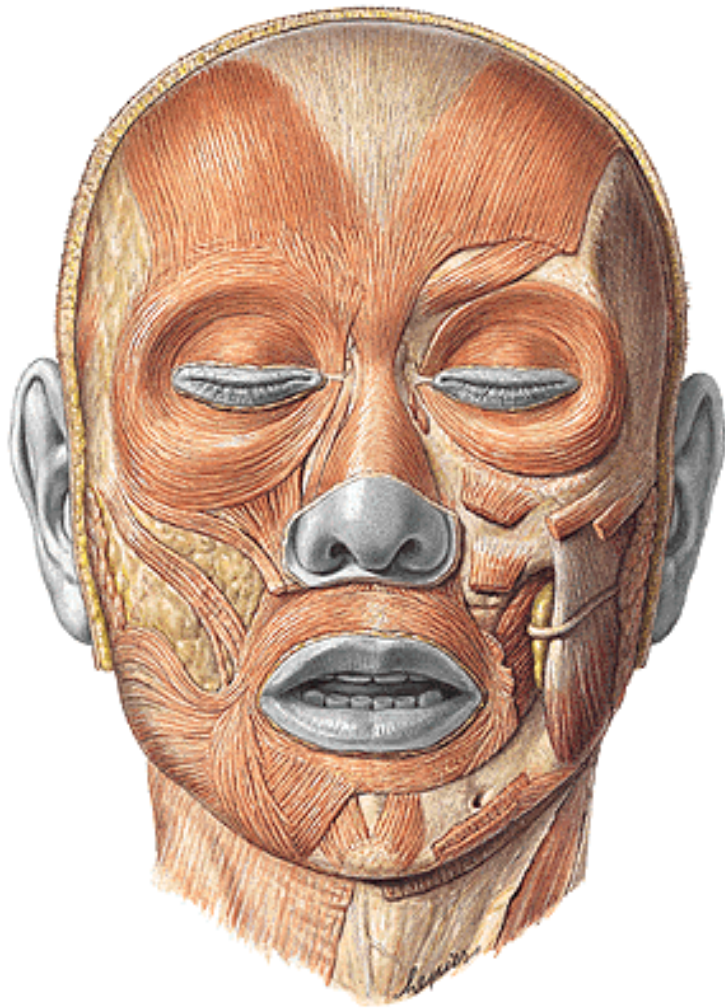
Facial expression of laughter or pleasure

### 4. **Zygomaticus minor** (*lesser zygomatic*)

**O:** zygomatic bone

**I:** nasolabial groove

**F:** as previous



## 5. Levator labii superioris

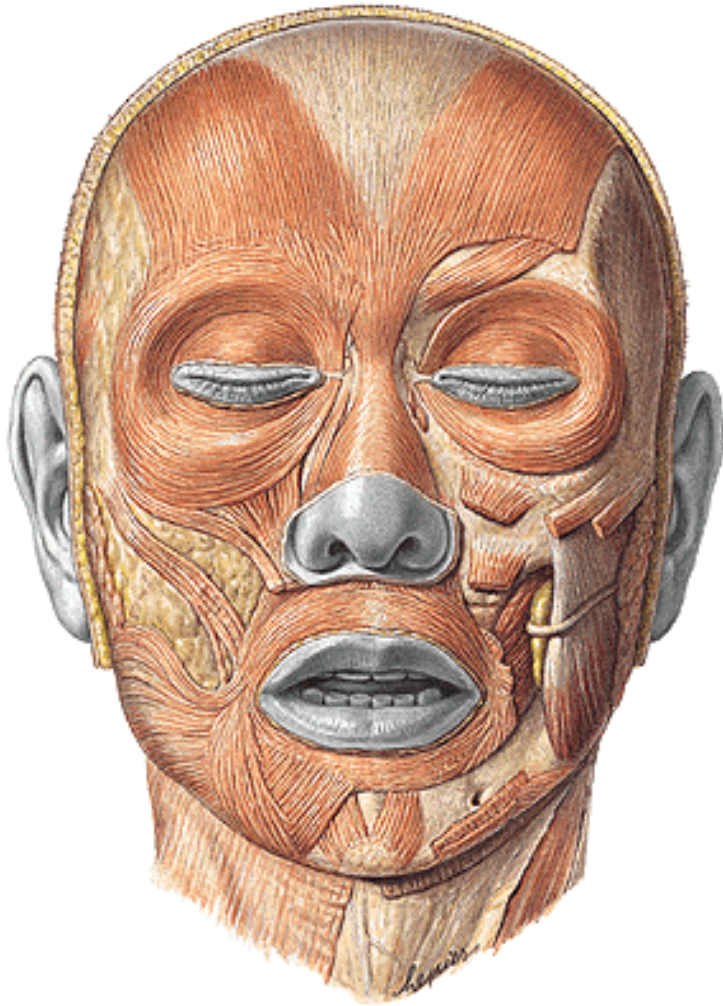
O: infraorbital margin  
I: skin of the upper lip

## 6. Levator labii superioris alaeque nasi

O: frontal process of maxilla  
I: skin of the upper lip and nose

## 7. Levator anguli oris

O: below infraorbital foramen (canine fossa)  
I: angle of the mouth  
Expression of self-confidence



### 8. **Depressor anguli oris**

**O:** lower margin of the mandible

**I:** angle of the mouth

### 9. **Depressor labii inferioris**

**O:** below the mental foramen

**I:** skin of lower lip

**Expression of perseverance**

### 10. **Risorius**

**O:** masseteric fascia

**I:** angle of the mouth

**F:** „laughing muscle“

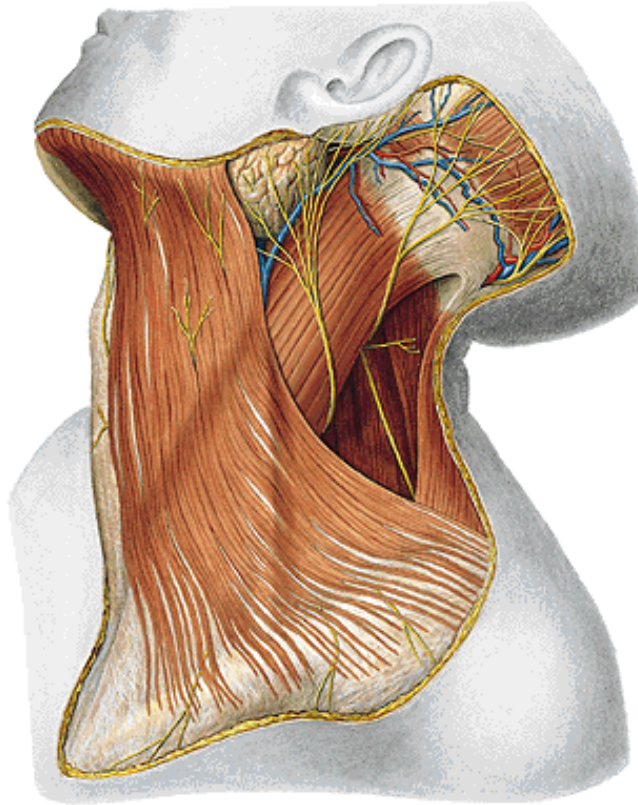
### 11. **Mentalis**

**O:** alveolar jugum of the lateral incisor

**I:** skin of the chin

**Expression of doubt and indecision**

## **Mm. colli** (*muscles of the neck*)



### **I. Superficial layer:**

1. m. platysma
2. m. sternocleidomastoideus
3. Mm. hyoidei:
  - a) mm. suprahyoidei
  - b) mm. infrahyoidei

### **II. Deep layer:**

- mm. scaleni
- mm. praevertebrales

# Mm. colli (*muscles of the neck*)

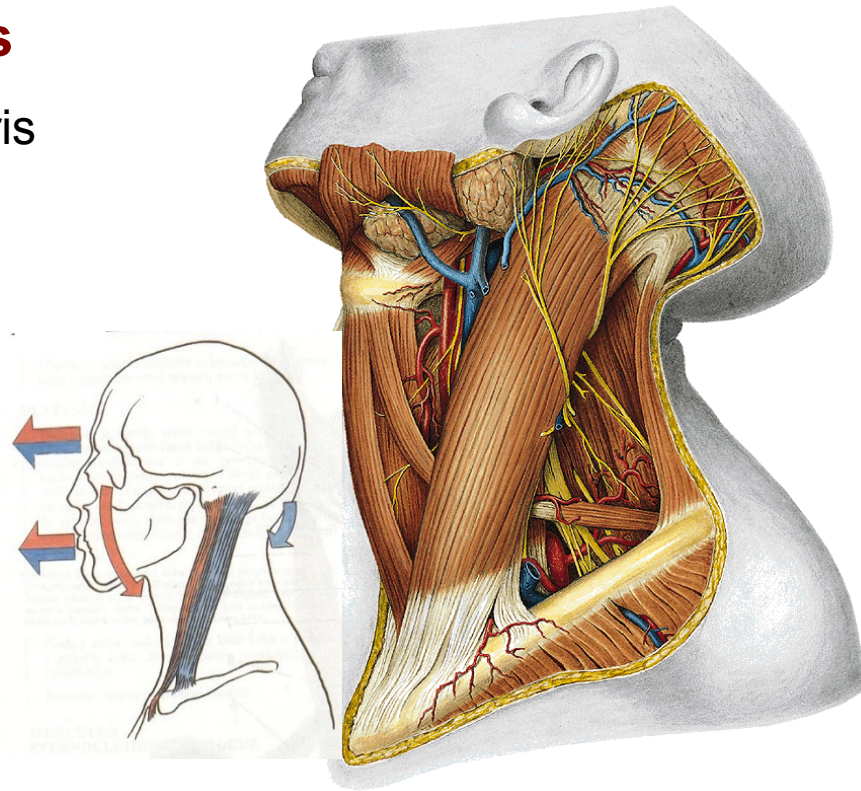
## Superficial layer

### M. sternocleidomastoideus

O: pars sternalis + pars clavicularis

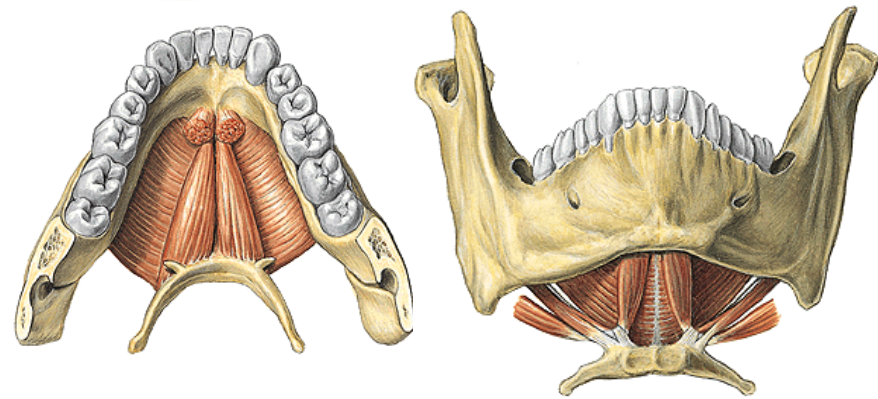
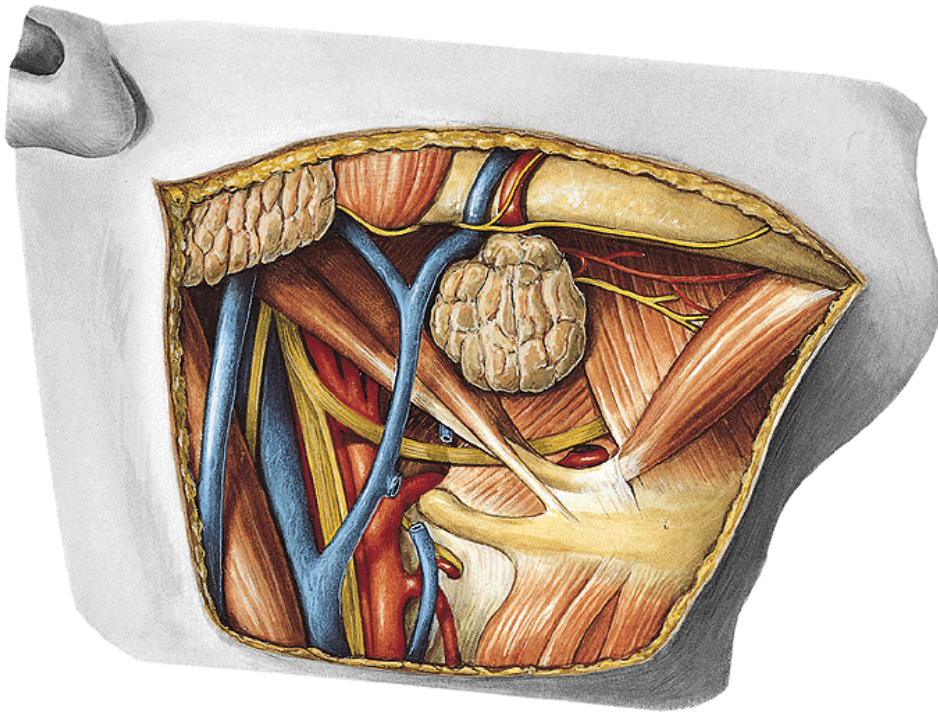
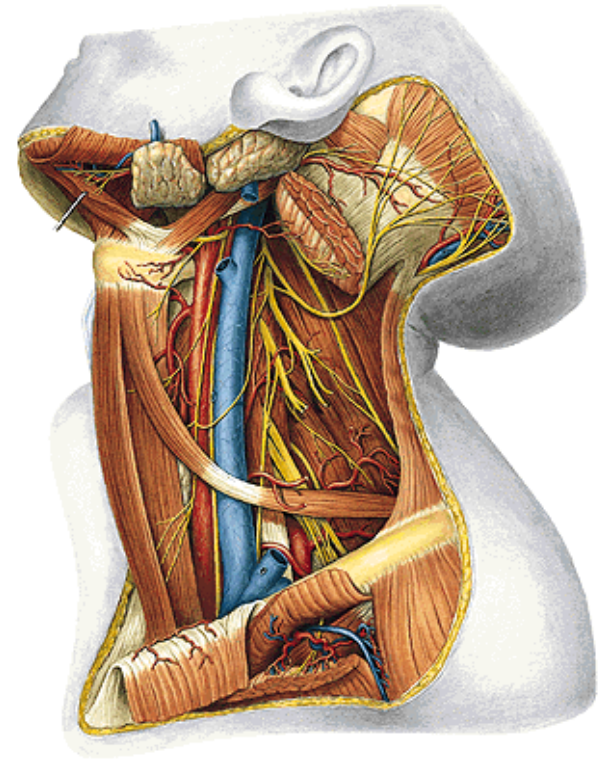
Fossa supraclavicularis minor

Innervation: XI. CN + plexus cervicalis



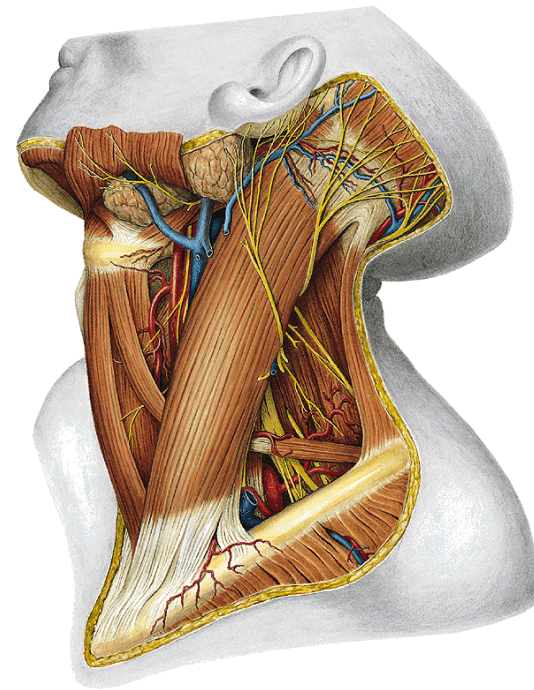
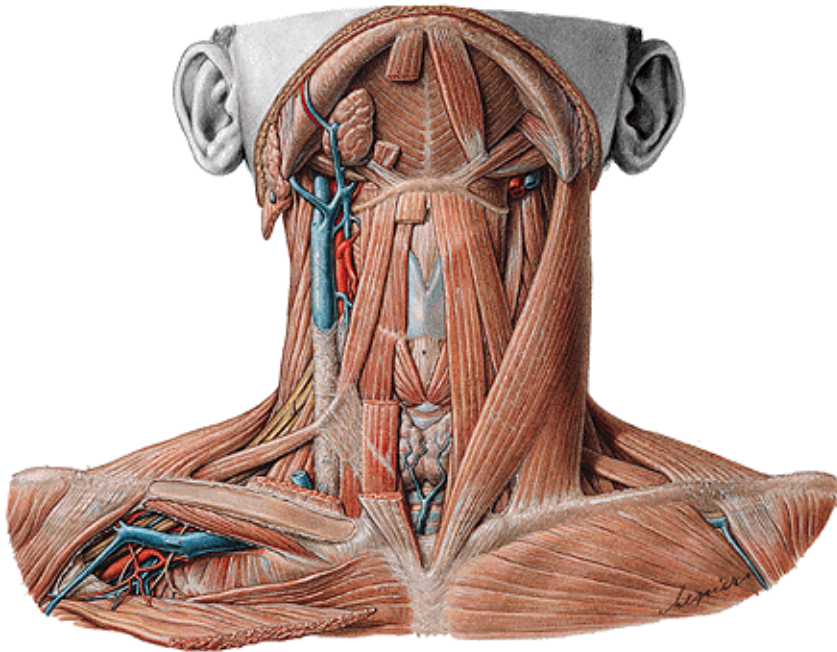
# Mm. suprahyoidei

1. m. digastricus
2. m. stylohyoideus
3. m. geniohyoideus
4. m. mylohyoideus



# Mm. infrahyoidei

1. m. sternohyoideus
2. m. sternothyroideus
3. m. thyrohyoideus
4. m. omohyoideus



## II. Deep layer of mm. colli

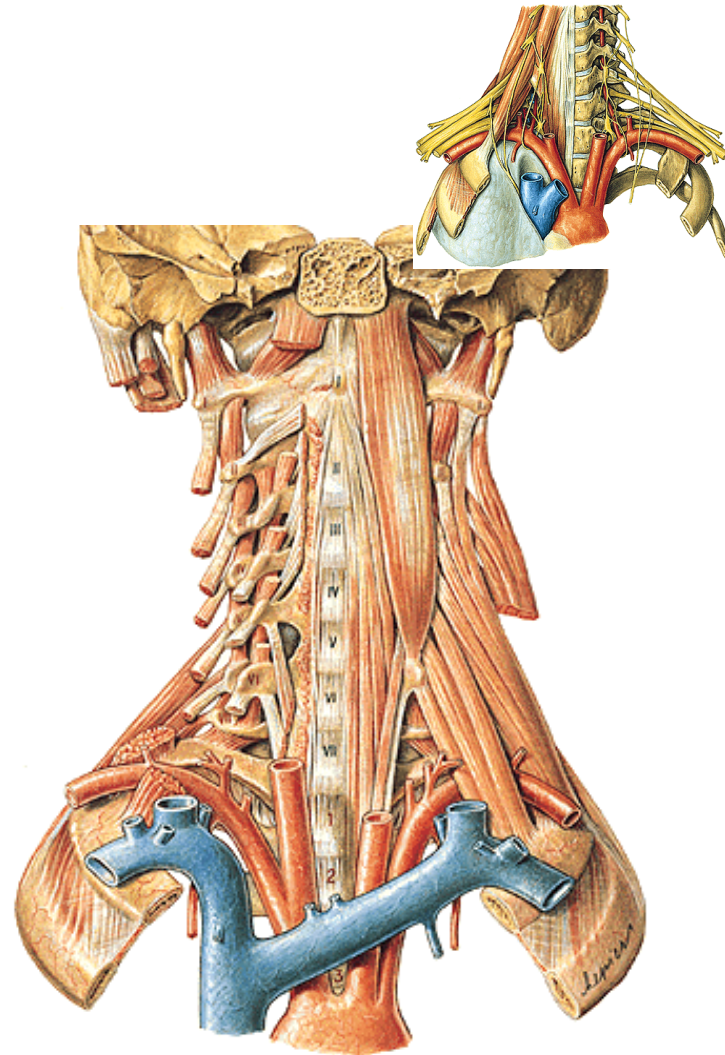
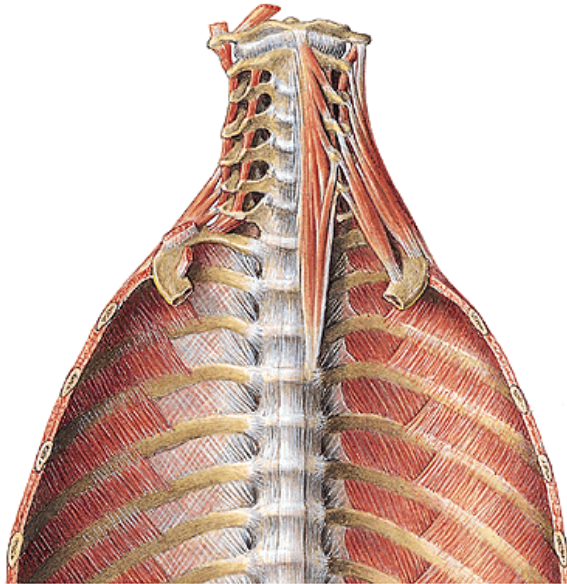
### 1) Mm. scaleni

m. scalenus anterior

m. scalenus medius

m. scalenus posterior

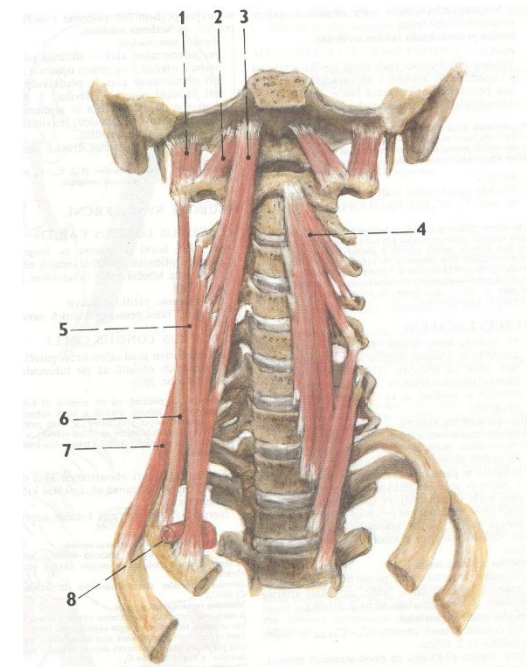
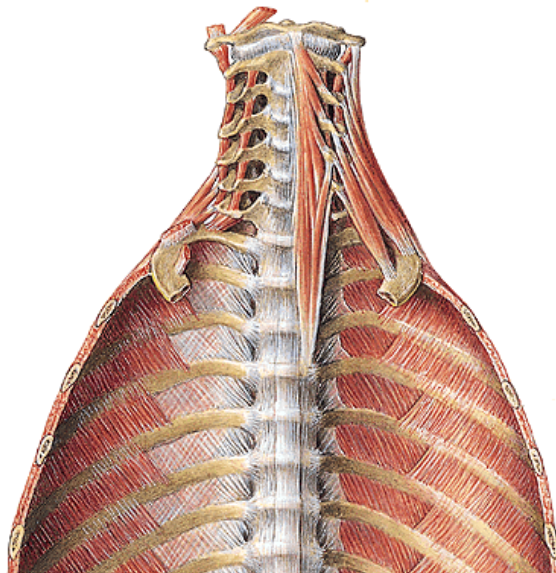
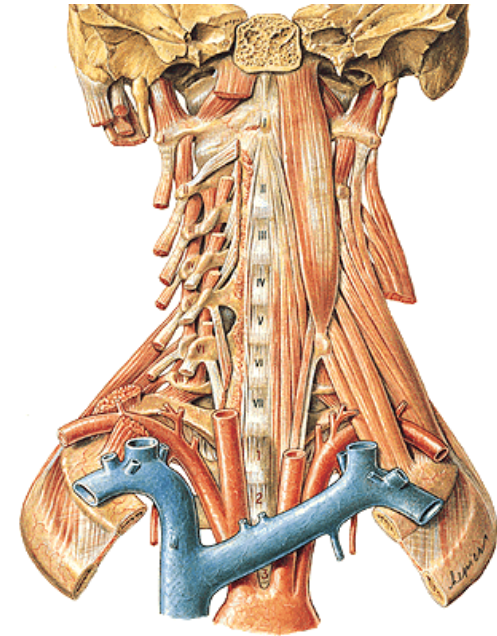
(fissura scalenorum)





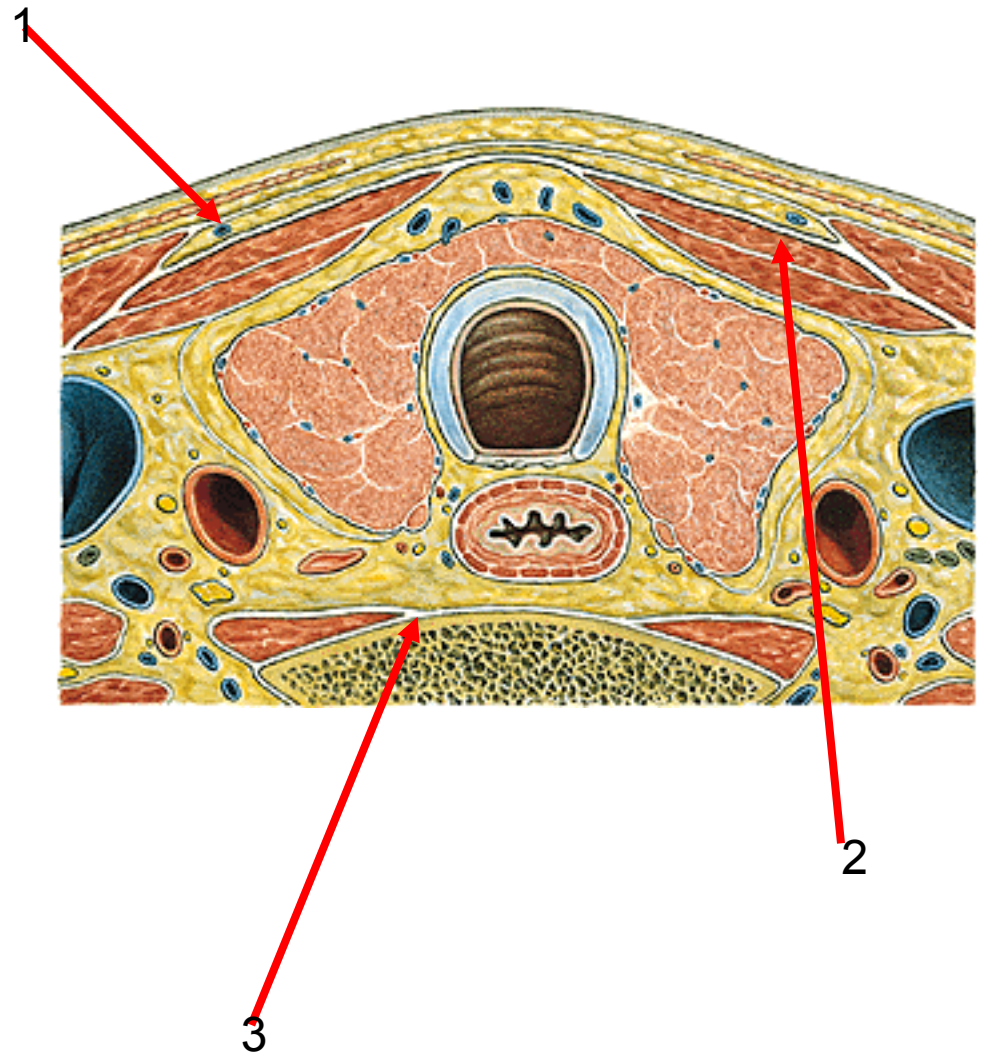
## 2) Mm. praevertebrales

- m. longus colli
- m. longus capitis
- m. rectus capitis anterior
- m. rectus capitis lateralis
- mm. intertransversarii anteriores cervicis (6 páru)



# Fasciae colli

- 1) Lamina superficialis
- 2) Lamina praetrachealis
- 3) Lamina praevertebralis



**Used pictures come from:**

**Moore, K. L. (1992):** Clinical oriented anatomy. Third edition.  
Williams&Wilkins, A Waverly Company.

**Gilroy, A. M. et all. (2009):** Atlas of Anatomy. Thieme New York, Stuttgart.

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**Atlas of Human Anatomy Sobotta. Elsevier Books.**

**Platzer, W., Kahle, W., Leonhardt H. (1992):**  
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New York, 4th edition.**

**Čihák, R. (1987):** Anatomie 1. Avicenum, Zdravotnické nakladatelství.