

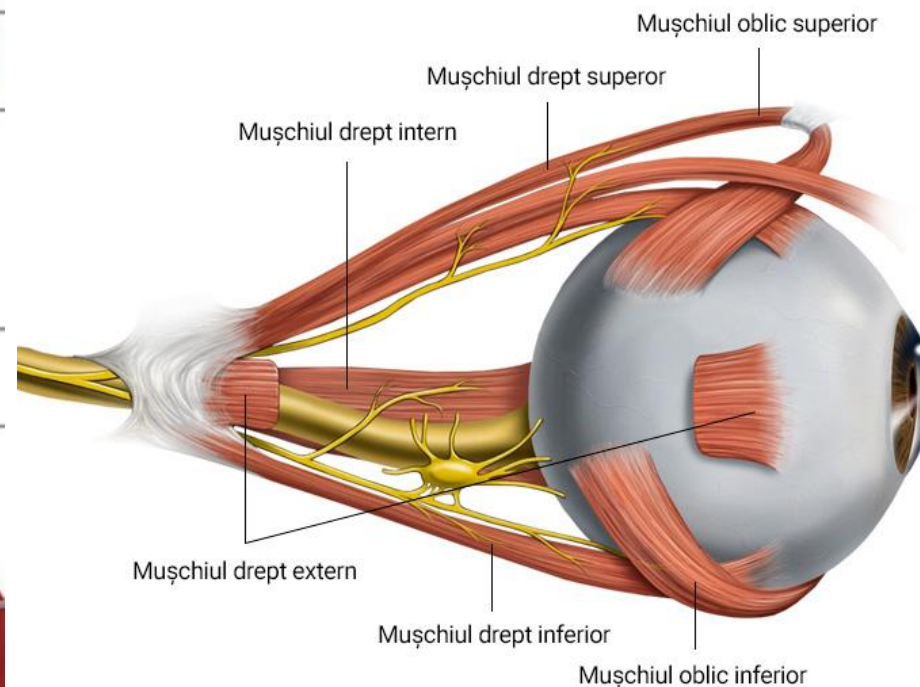
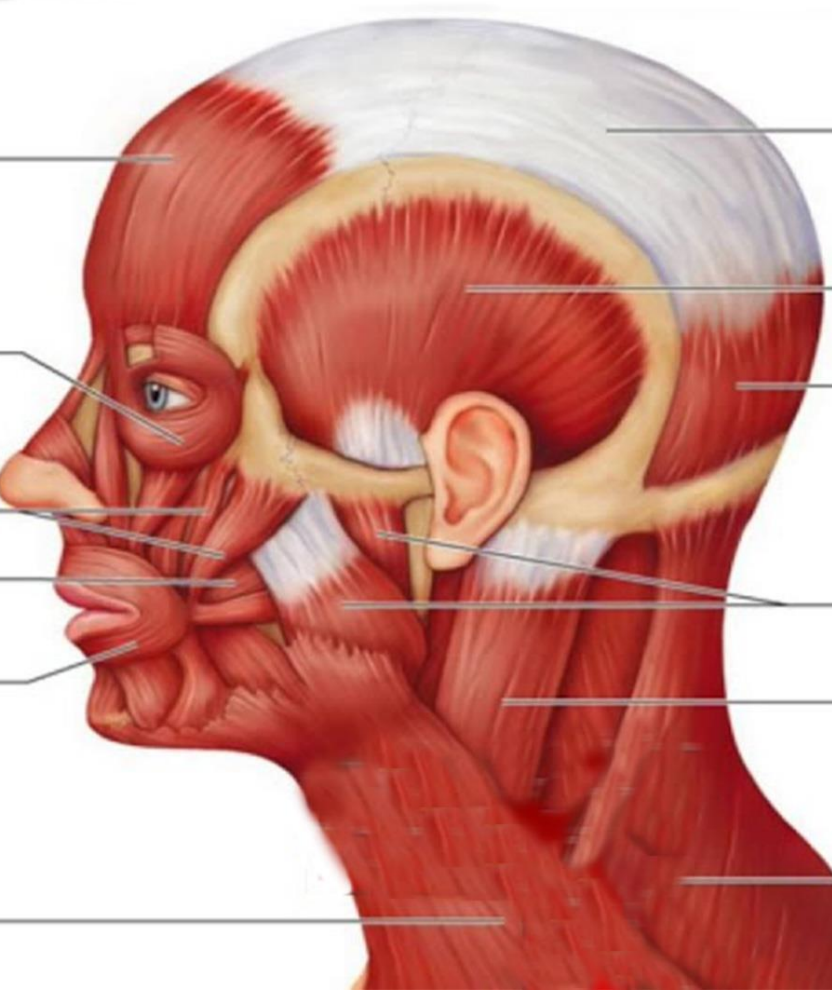
# **Muscles, fasciae and topography of the head and neck**

- 1. Muscles of the head**
- 2. Fasciae and topography of the head. Clinical relevance.**
- 3. Muscles of the neck**
- 4. Fasciae of the neck. Clinical relevance.**
- 5. Topography of the neck. Clinical relevance.**
- 6. Biomechanics of the temporomandibular joint.**

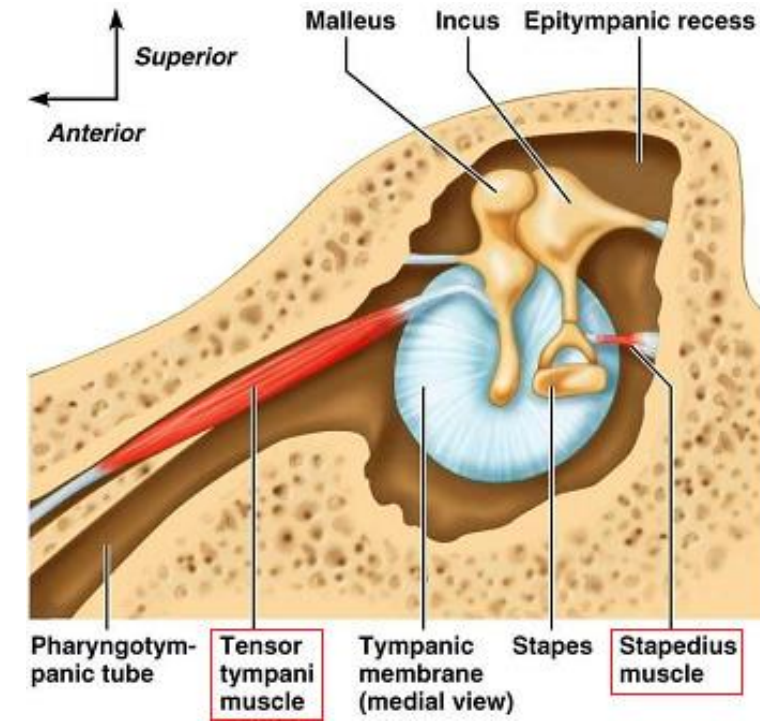
*Lecturer: PhD, Professor Tamara Hacina*

# Muscles of the head

1. *Muscles of mastication*
2. *Muscles of facial expression*
3. *Muscles of eyeball*
4. *Muscles of auditory ossicles*
5. *Muscles of the tongue*
6. *Muscles of soft palate*



## Derivatives of the 1st visceral arch





# MUSCLES OF MASTICATION

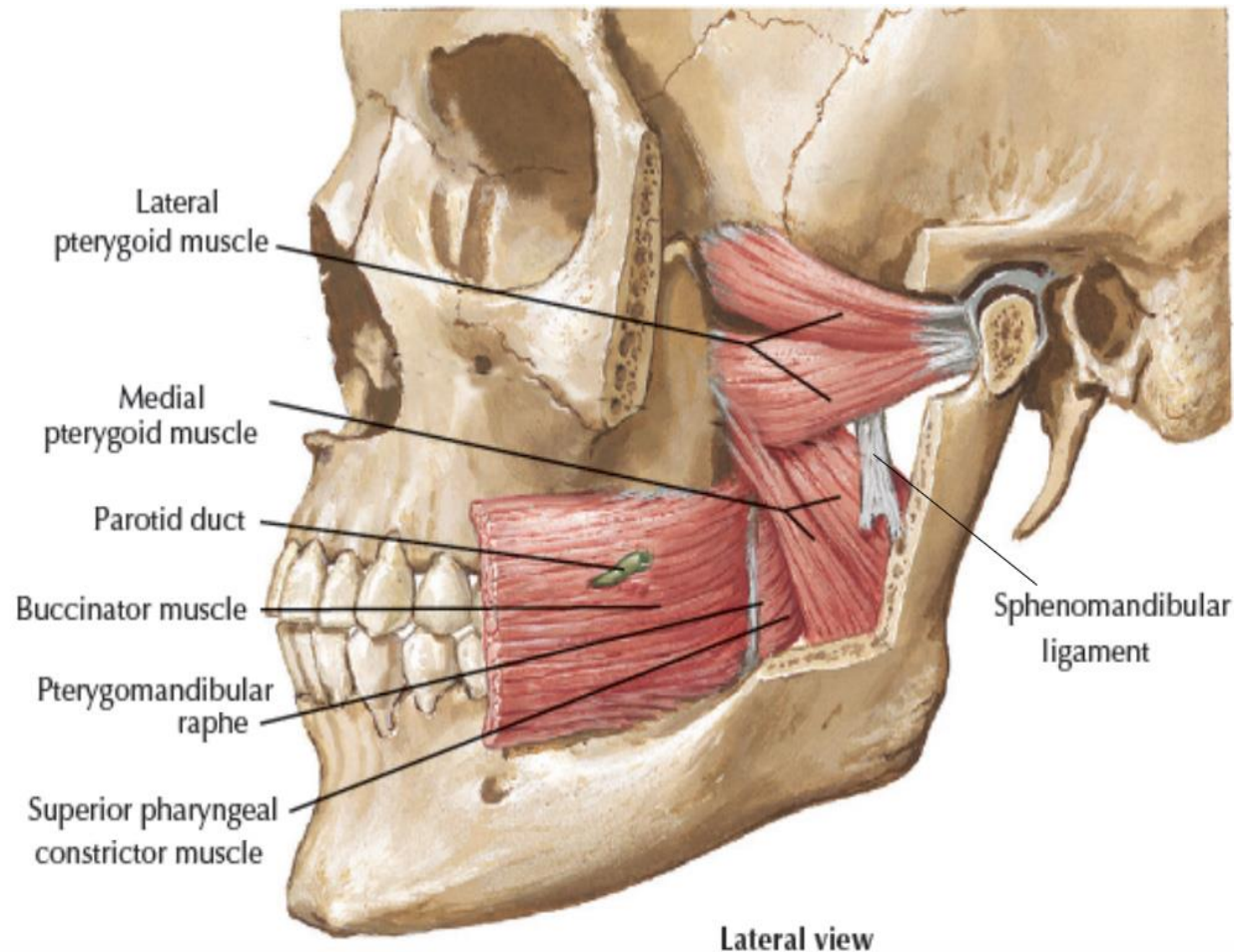
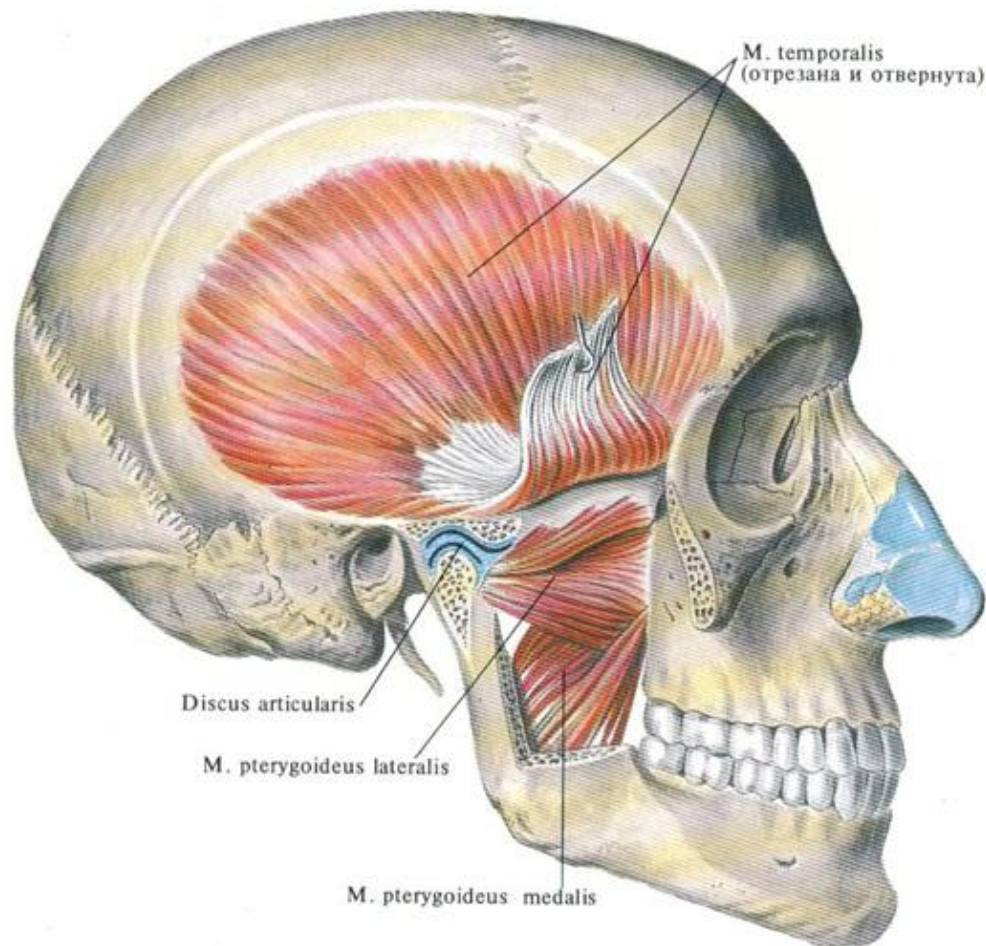
*M. Temporal*

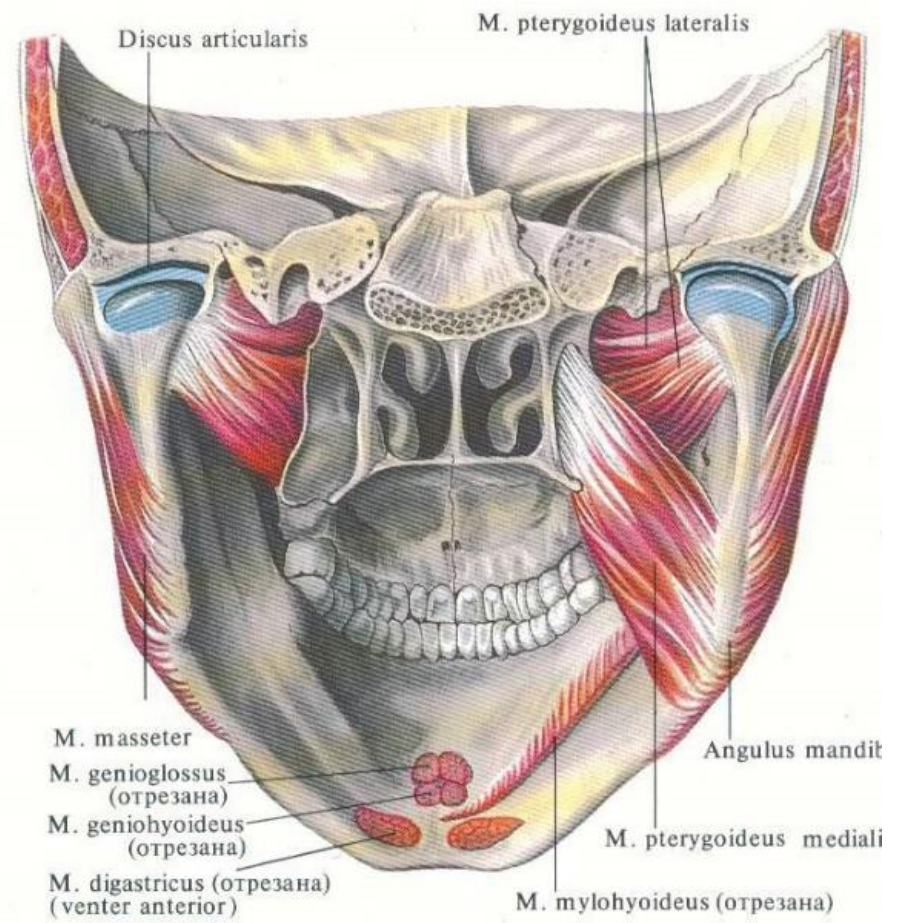
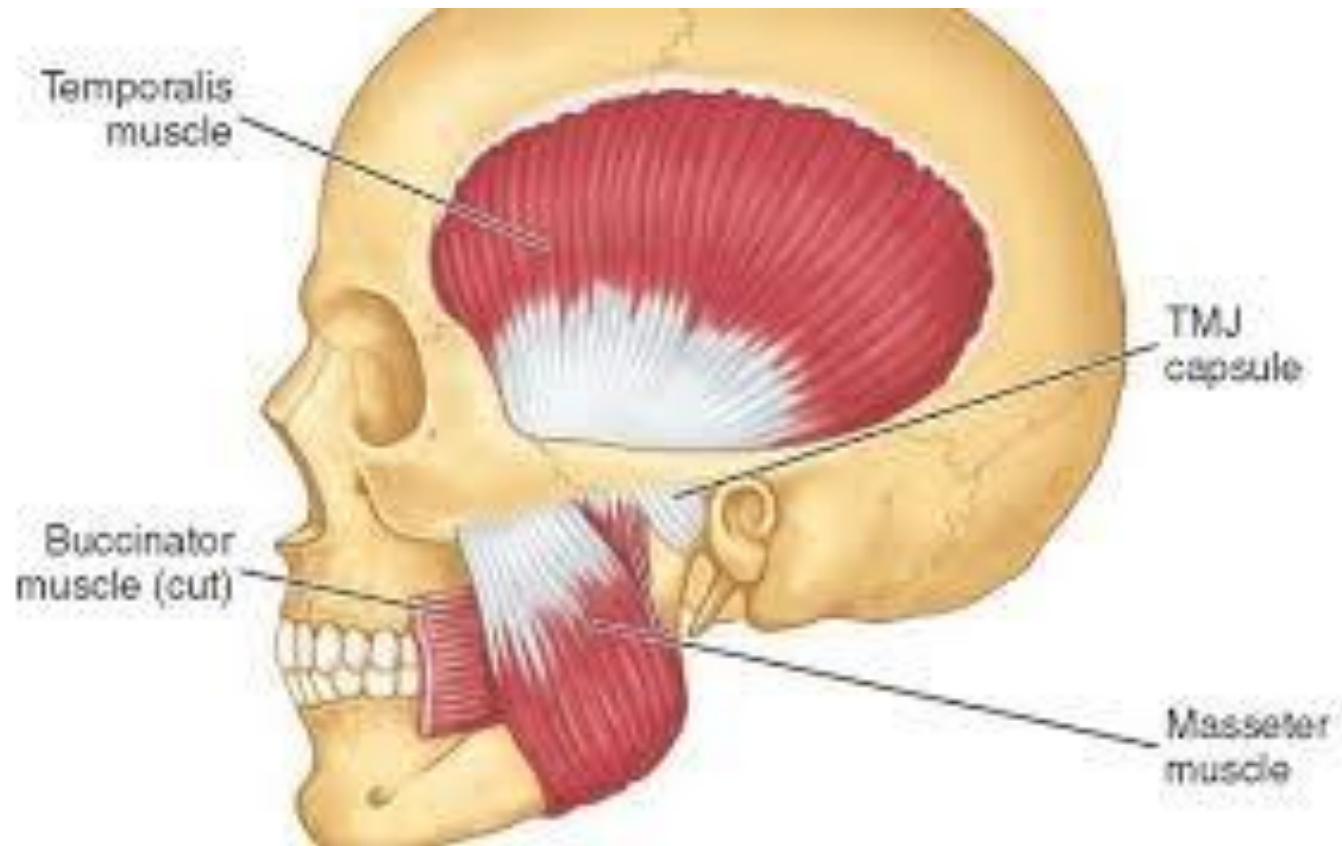
*M. Maseter*

*M. Pterigoidian medial*

*M. Pterigoidian lateral*

- Insertion – mandible
- Causing the movement of the mandible, it participates in the act of chewing (mechanical process of crushing and fragmentation of food)

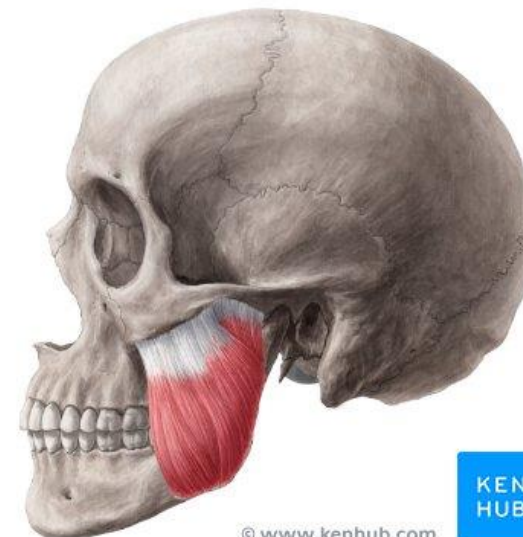
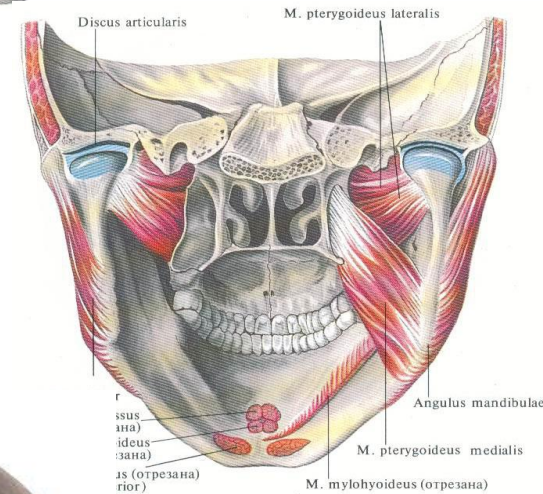
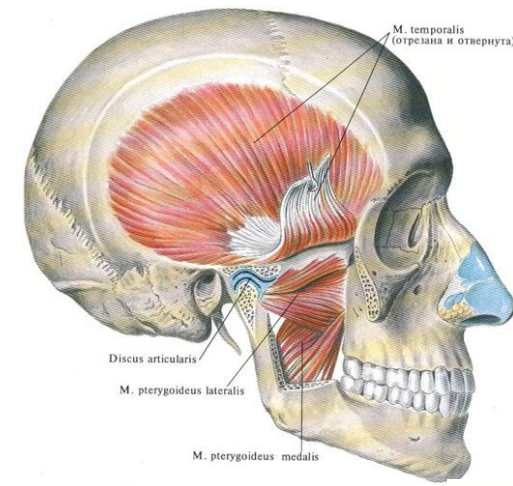




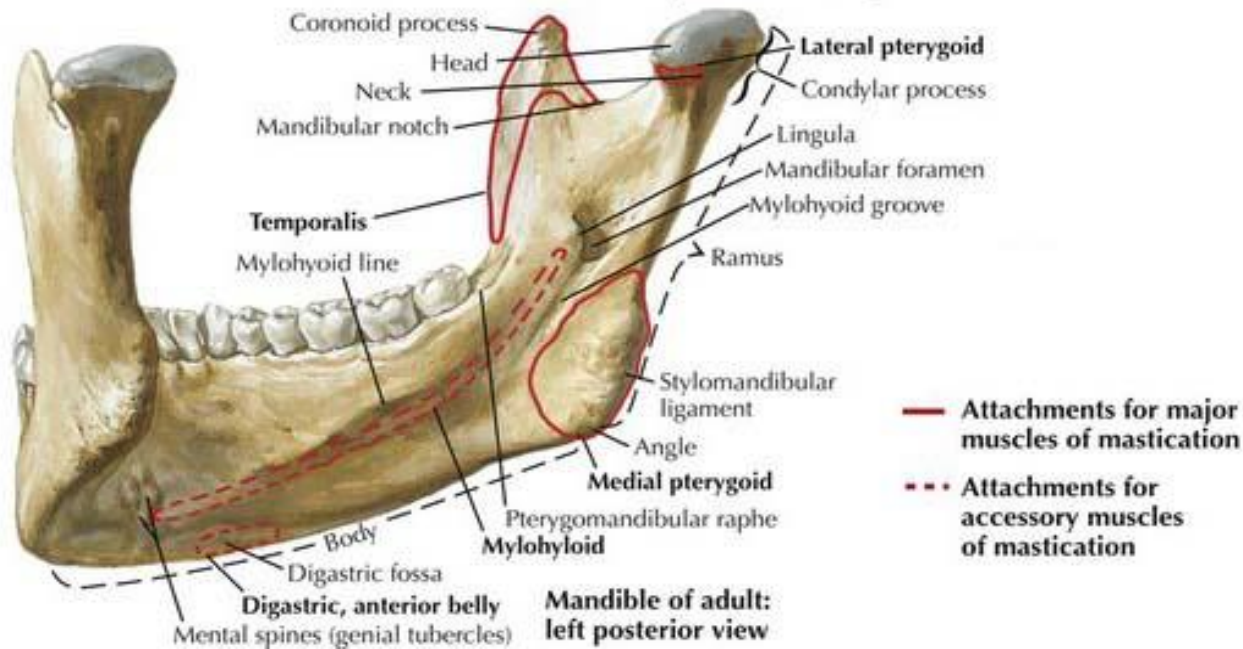
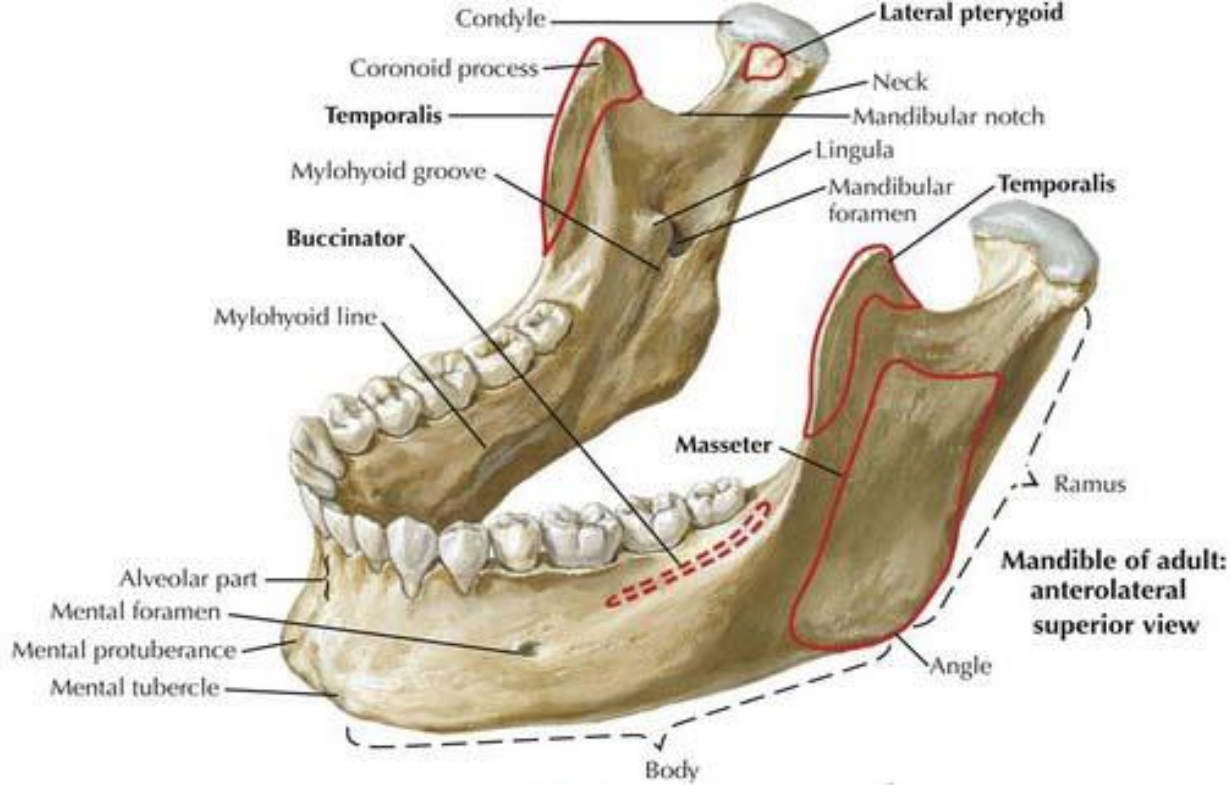


# Muscles of mastication

<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b>Temporal m.</b> <i>Musculus temporalis</i>	*temporal fossa	coronoid process	*pulls the mandible to the maxilla *is associated with speech articulation
<b>Masseter m.</b> <i>Musculus masseter</i>	*zygomatic bone *zygomatic arch	masseteric tuberosity	*pulls the mandible to the maxilla
<b>Lateral pterygoid m.</b> <i>Musculus pterygoideus lateralis</i>	*inferior surface of the greater wing of the sphenoid bone *pterygoid process	pterygoid fovea	*moves the mandible to the contralateral side /unilateral contraction/ *protrudes the mandible forward /bilateral contraction/
<b>Medial pterygoid m.</b> <i>Musculus pterygoideus medialis</i>	pterygoid fossa	pterygoid tuberosity of the mandible	*pulls the mandible to the maxilla *protrudes the mandible forward /bilateral contraction/



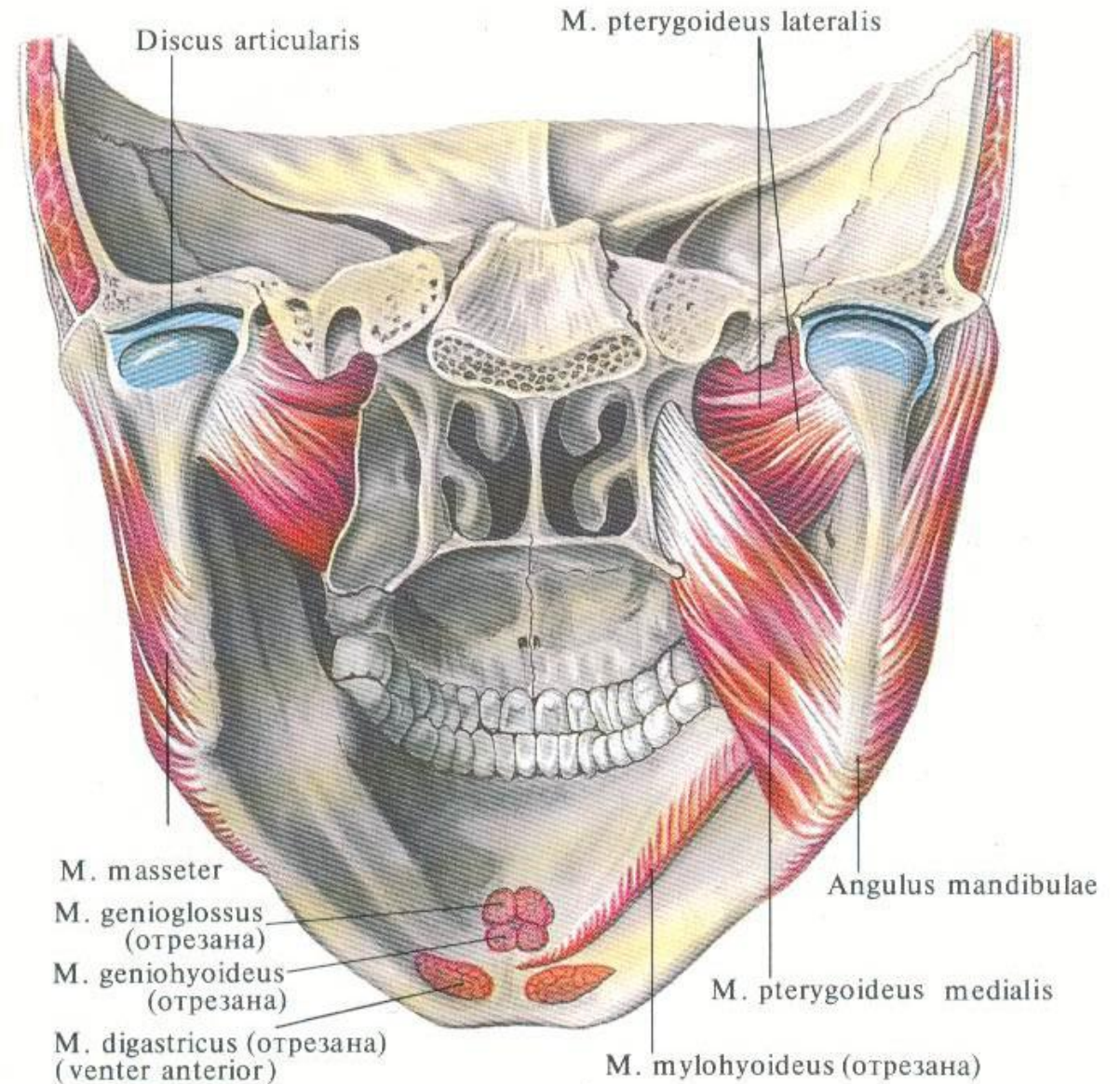
# Insertion of muscles of mastication



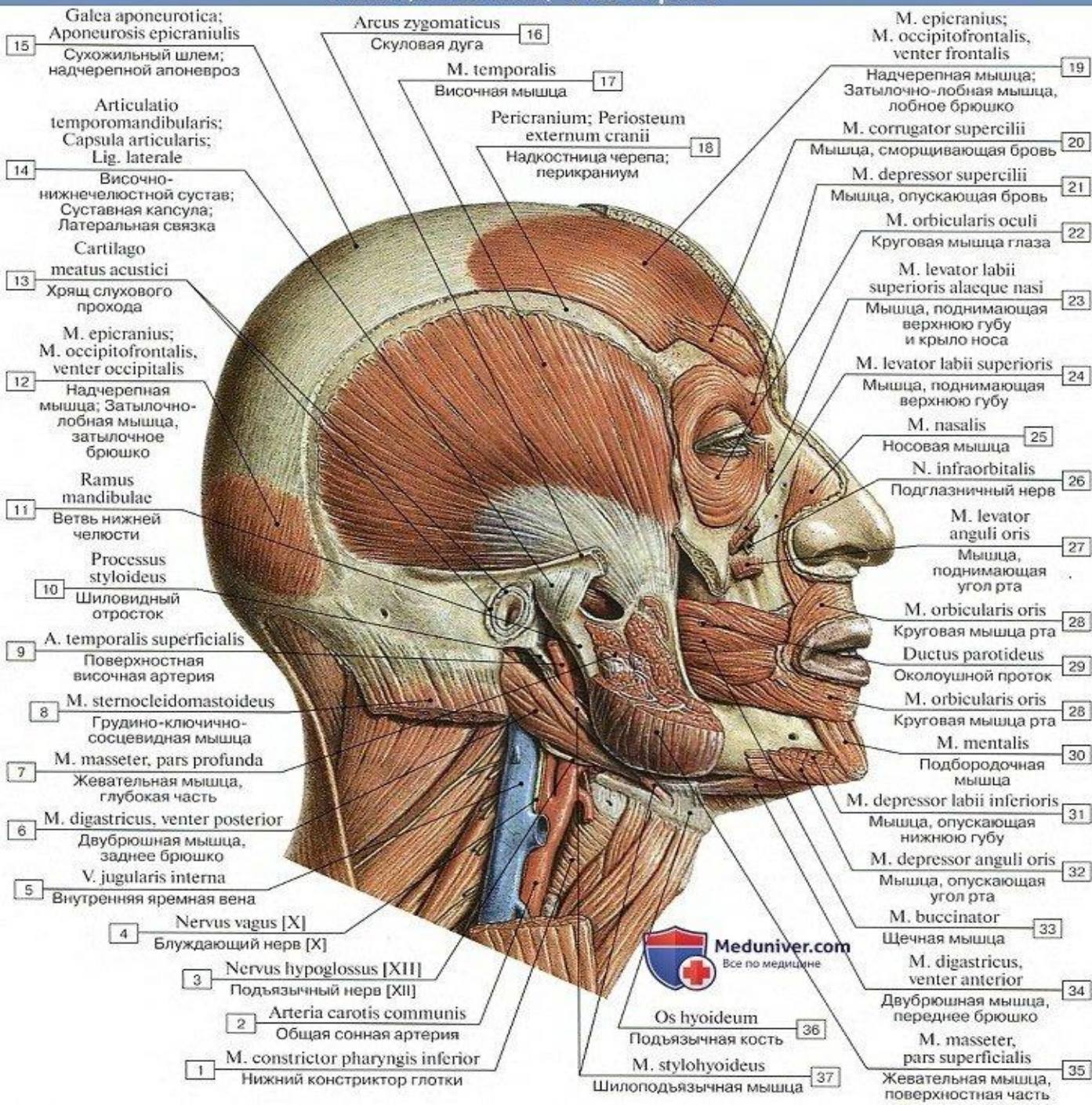


# Function of the muscles of mastication

Movements of mandible	Muscles
Raising of mandible	<i>Temporal, Masseter, Medial pterygoid</i>
Protraction	<i>(superficial fibers)</i> <i>Lateral pterigoid</i>
Retraction	<i>Temporal (posterior part),</i> <i>Masseter (deep fibers)</i>
Lateropulsion	<i>Pterygoid muscle (unilateral contraction)</i>





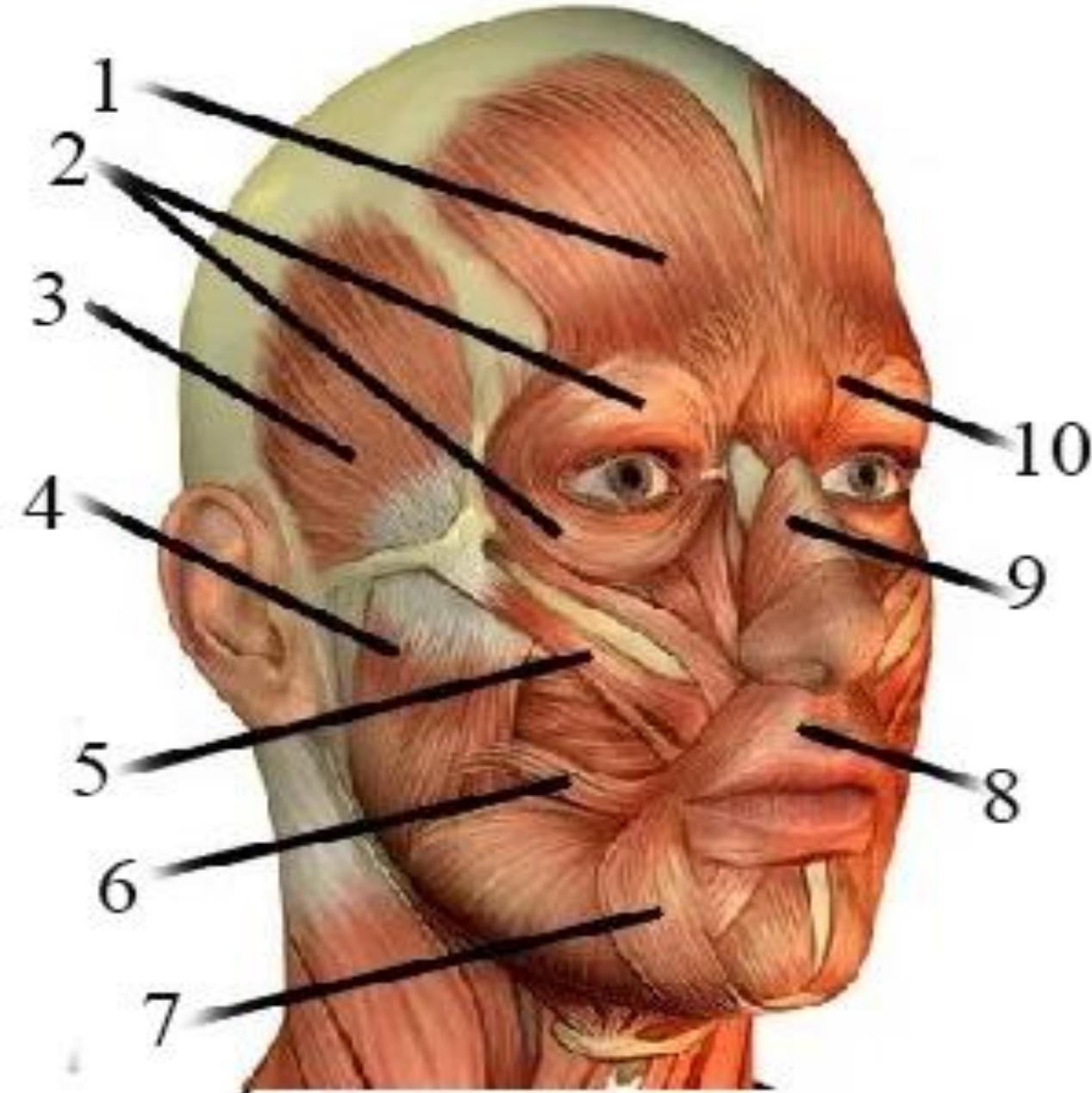


## Muscles of the face are different from other muscles

- They *do not have a double attachment to the bone*, they start from the bone, they stick to the skin
- They *have no fascia* (except the buccinator muscle)
- They are *grouped around natural holes*, changing their lumen
- Through facial expressions, they *reflect a person's mental state*
- *Participates in articulate speech* and *mastication*

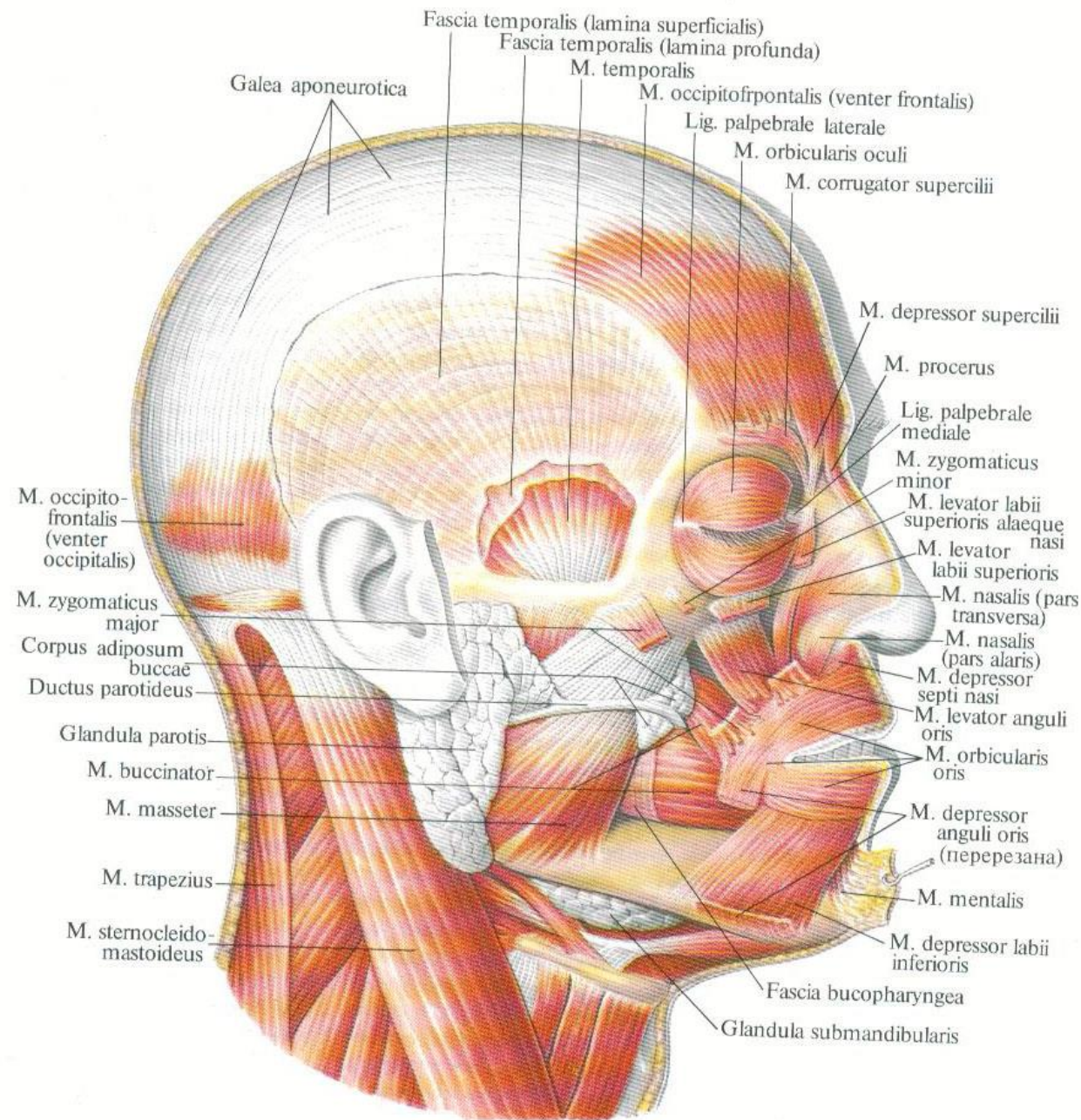
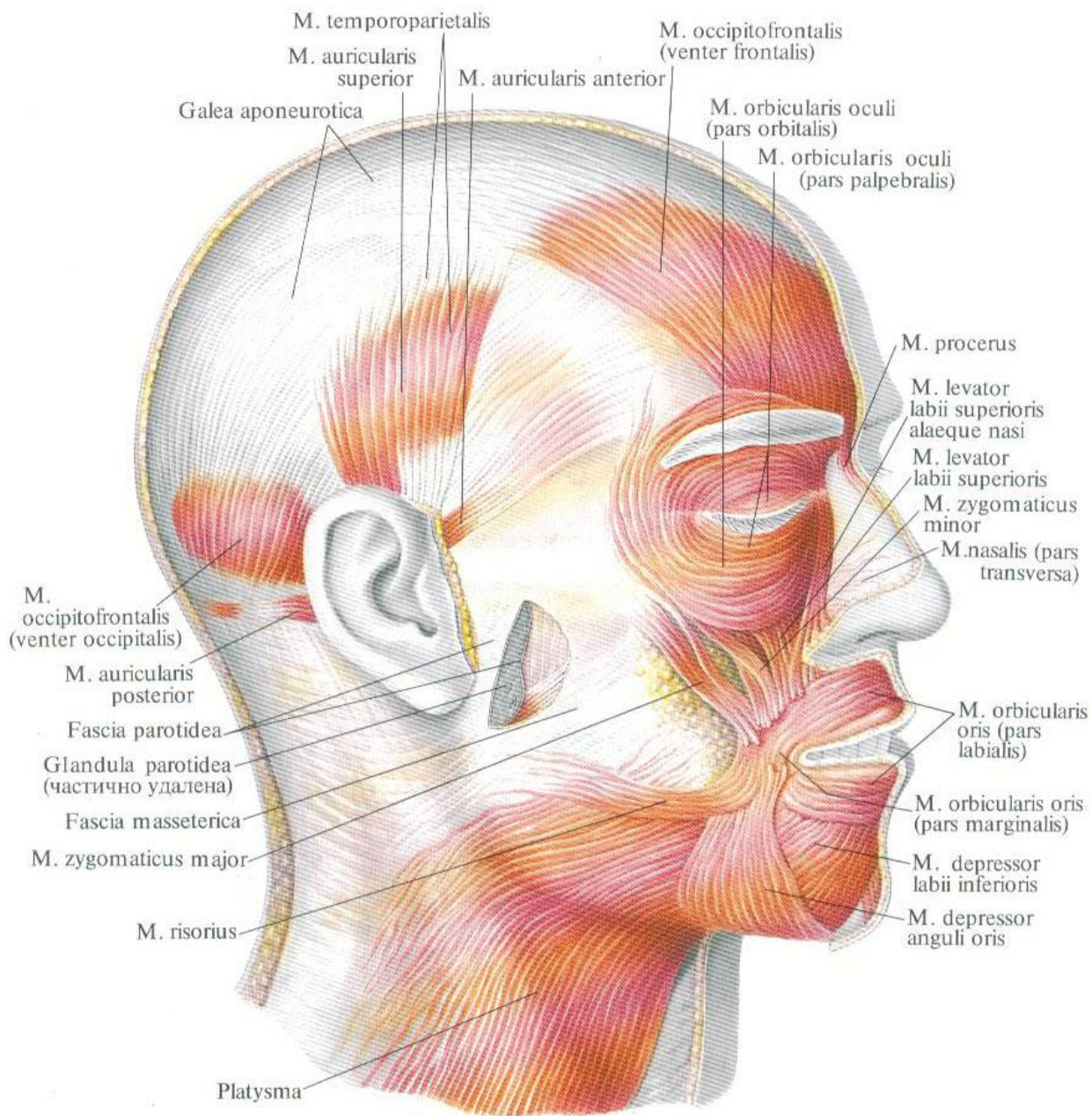


# Muscles of facial expression



- *Cranial vault muscles*
  - *The muscles around the ear*
  - *The muscles around the orbit*
  - *The muscles around the nostrils*
  - *The muscles around the mouth*
- *They are skin muscles originating on the bones of the skull and the insertion on the deep layer of the skin.*
  - *Functionally they are classified into:*
    - *Sphincters and dilators*
    - *Depressants and lifters*



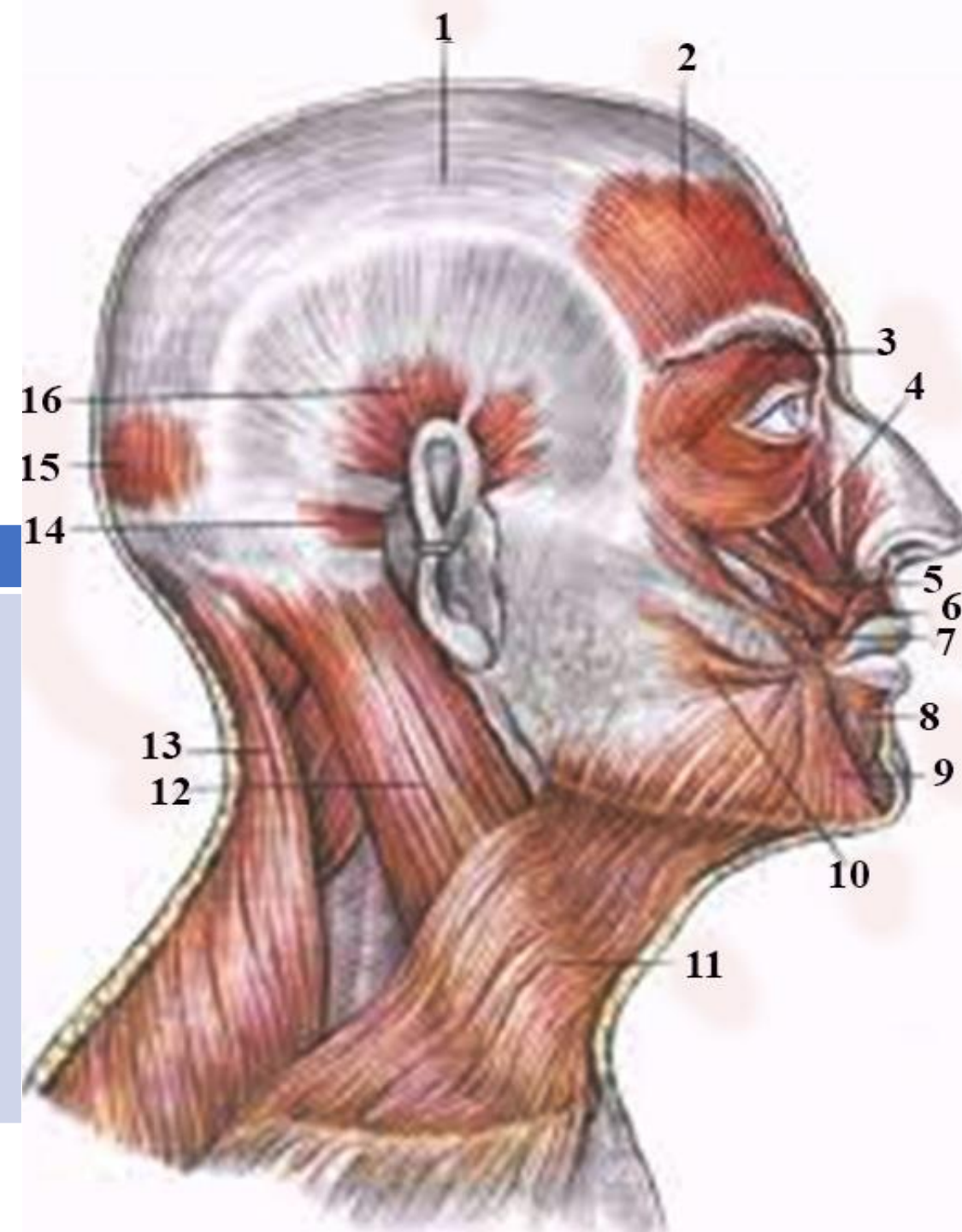




# Muscles of facial expression

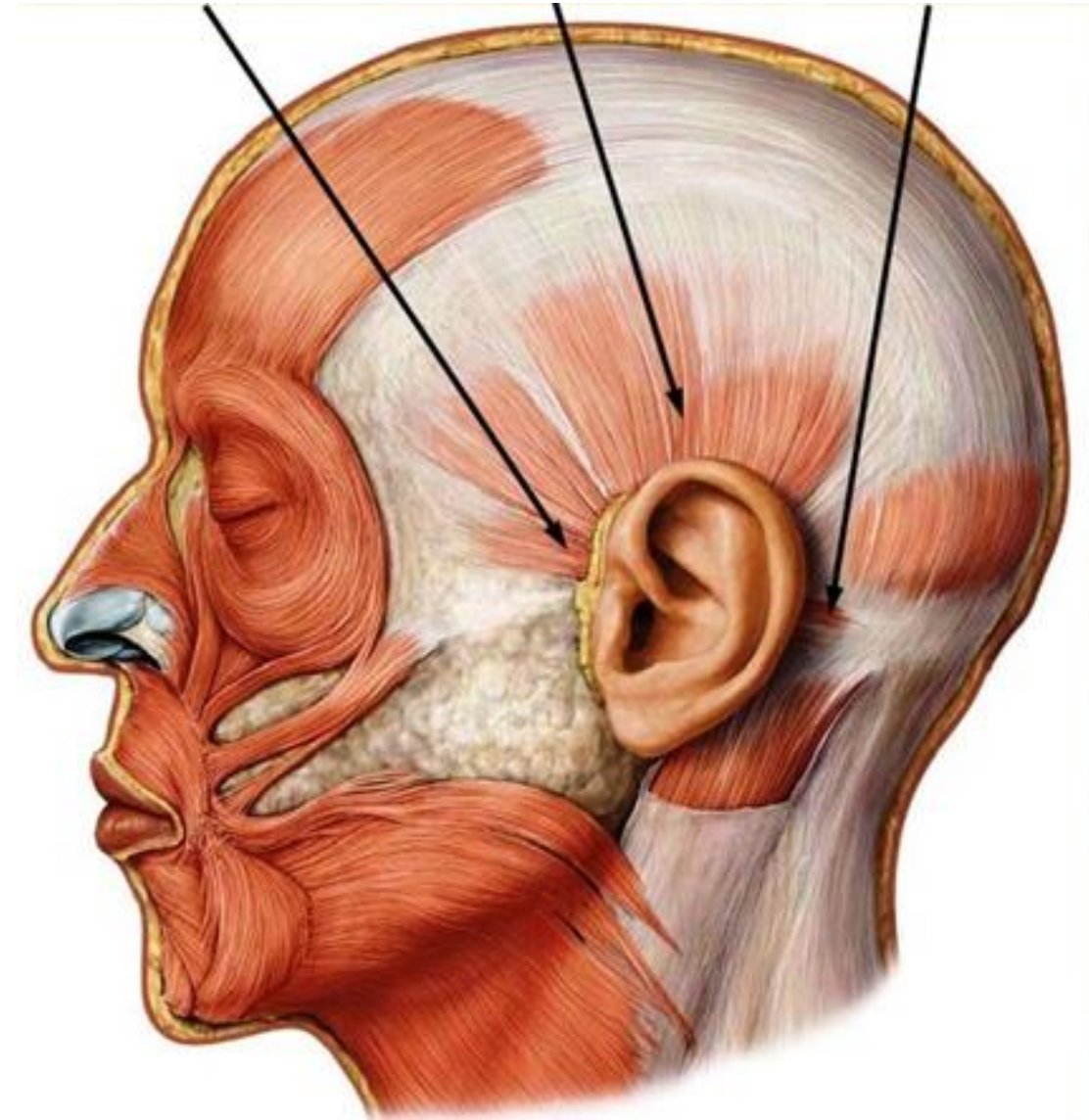
## Muscles of the vault

Muscle	Origin	Insertion	Action
<b><i>Epicranial muscle:</i></b>			
<i>*frontal belly</i>	*frontal bone		*move the skin of the scalp
<i>*occipital belly</i>	*occipital bone		
<b><i>Muscles around the ear</i></b>	*auricle	*epicranial aponeurosis	
-auricularis anterior m.			
-auricularis posterior m.			
-auricularis superior m.			



# Muscles around the ear

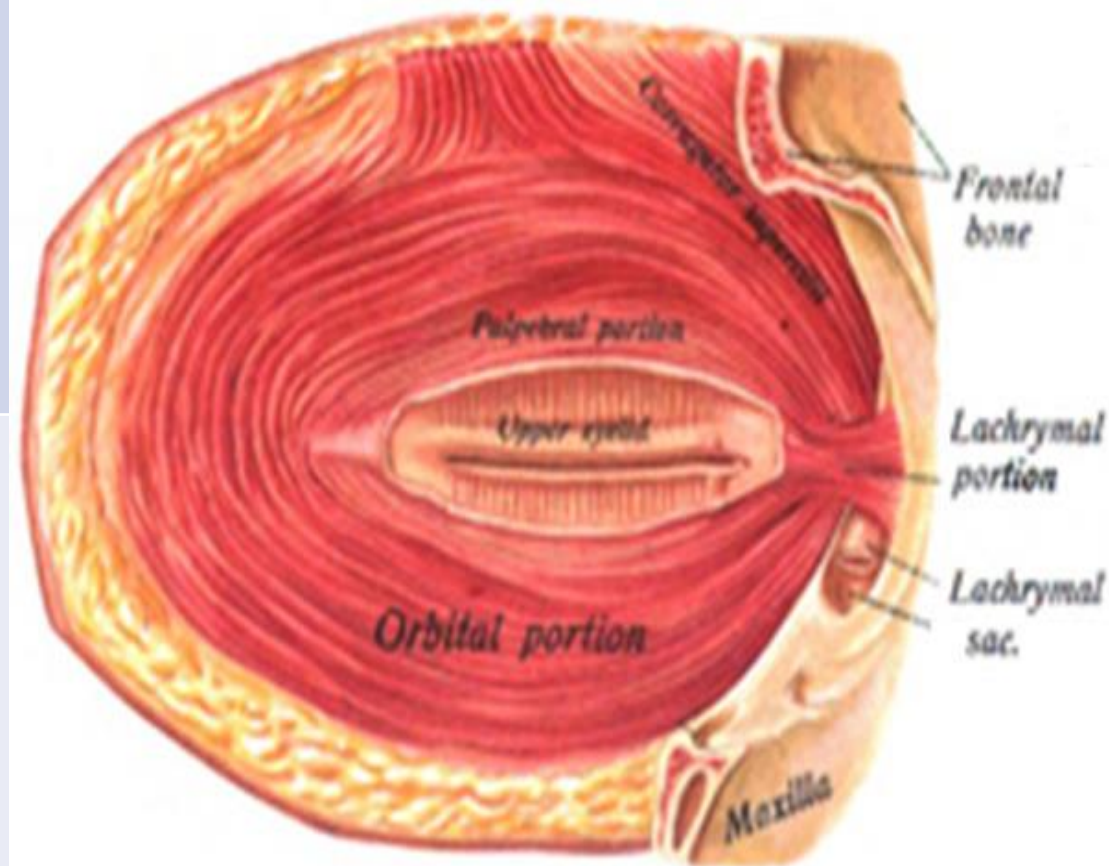
1. **Auricular anterior m.** – pulls ear antero-superiorly
2. **Auricular posterior m.-** pulls ear posteriorly, tense the scalp
3. **Auricular superior m. -** pulls ear postero-superiorly





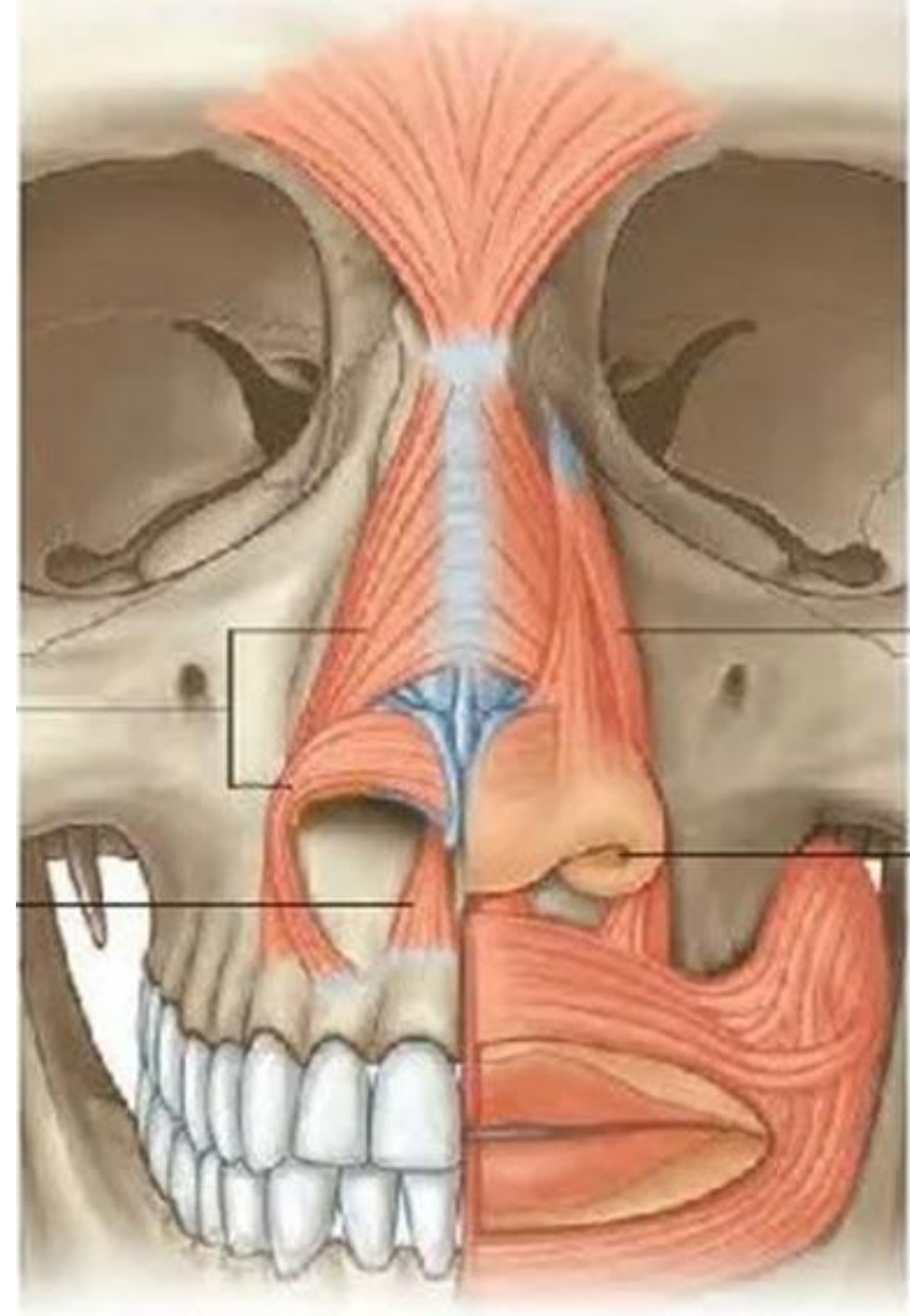
## ***Muscles around the eye***

<i><b>Muscle</b></i>	<i><b>Origin</b></i>	<i><b>Insertion</b></i>	<i><b>Action</b></i>
<i><b>Corrugator m. of the eyebrow</b></i>	*lodges under the orbital part of the orbicular m.	-----	*draws the eyebrows toward each other
<i><b>Orbicularis oculi m.:</b></i> <i>-palpebral part</i> <i>-orbital part</i> <i>-lacrima part</i>	*surrounds the eyelids	- - - -	*closes the lids gently * closes the lids tightly *contributes to the absorption of the tears through the lacrimal canal
<i><b>Procerus m.</b></i>	*nasal bone	*skin of the glabella	*transverse wrinkling of the skin of the bridge of the nose



# Nasal group of muscles

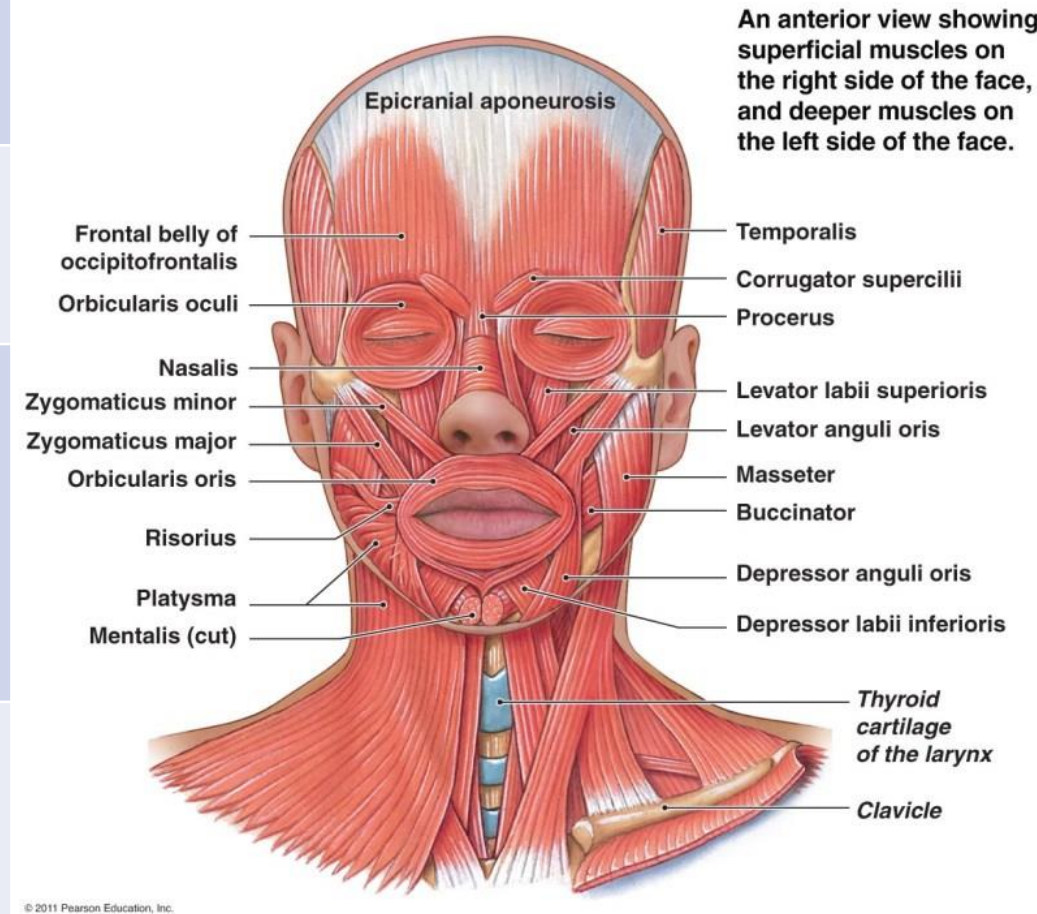
<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b><i>M. Nasal</i></b> /underdeve- loped/ - <i>Transverse</i> <i>part</i> - <i>Alar part</i>	*alveolar wall of the lateral maxillar incizive	*contralateral surface	Pulls the nasal wing down It narrows the nostrils Pulls the nasal wing down and sideways dilating the nostrils Pulls the nasal septum down dilating the nostrils
<b><i>Depressor septi nasi</i></b>	* Nasal septum	* Wing of nose	





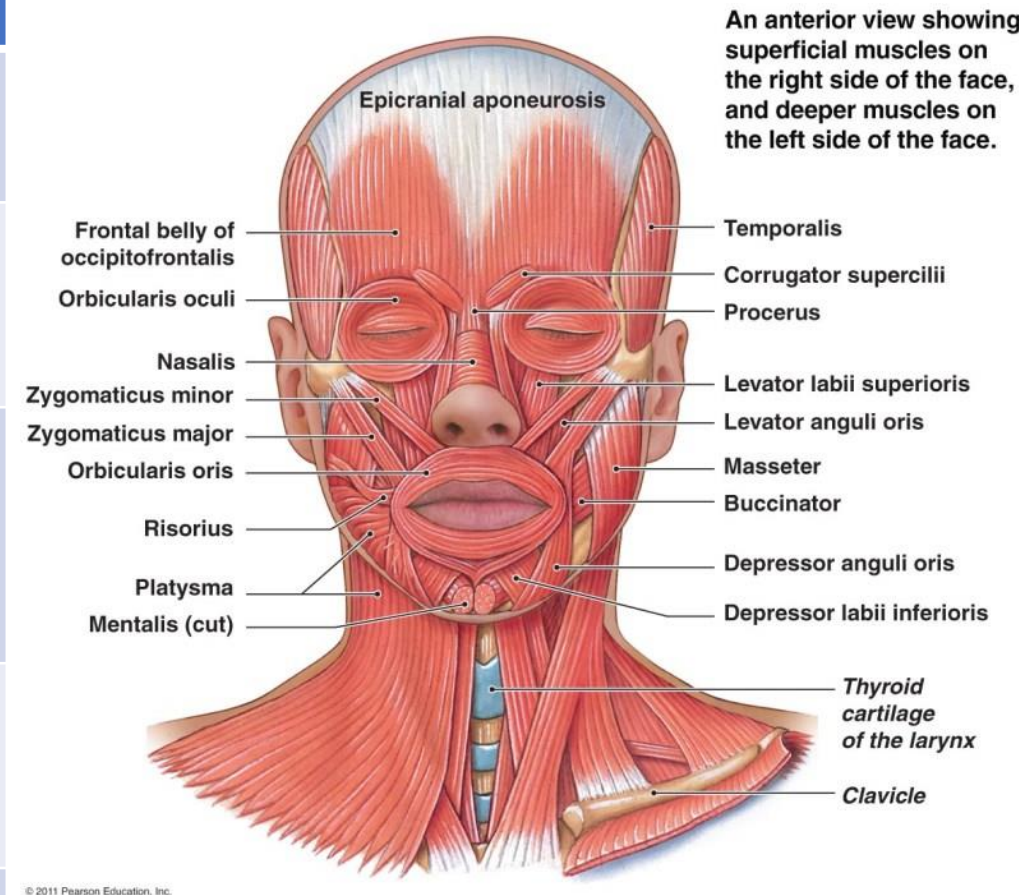
## D. Muscles around the mouth

<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b><i>Levator labii superioris</i></b>	*infraorbital border of the maxilla	*skin of the nasolabial fold	*raises the upper lip
<b><i>Zygomatic minor</i></b>	*zygomatic bone	*nasolabial fold	*deepens the nasolabial fold
<b><i>Zygomatic major</i></b>	*lateral surface of the zygomatic bone	*angle of the mouth	*pulls the angle of the mouth upward and laterally
<b><i>Risorius</i></b> <i>/inconstant/</i>	*parotid + masseteric fascia	*angle of the mouth	*expression of the laughter
<b><i>Depressor anguli oris</i></b>	*inferior border of the	*angle of the mouth	*expression of grief

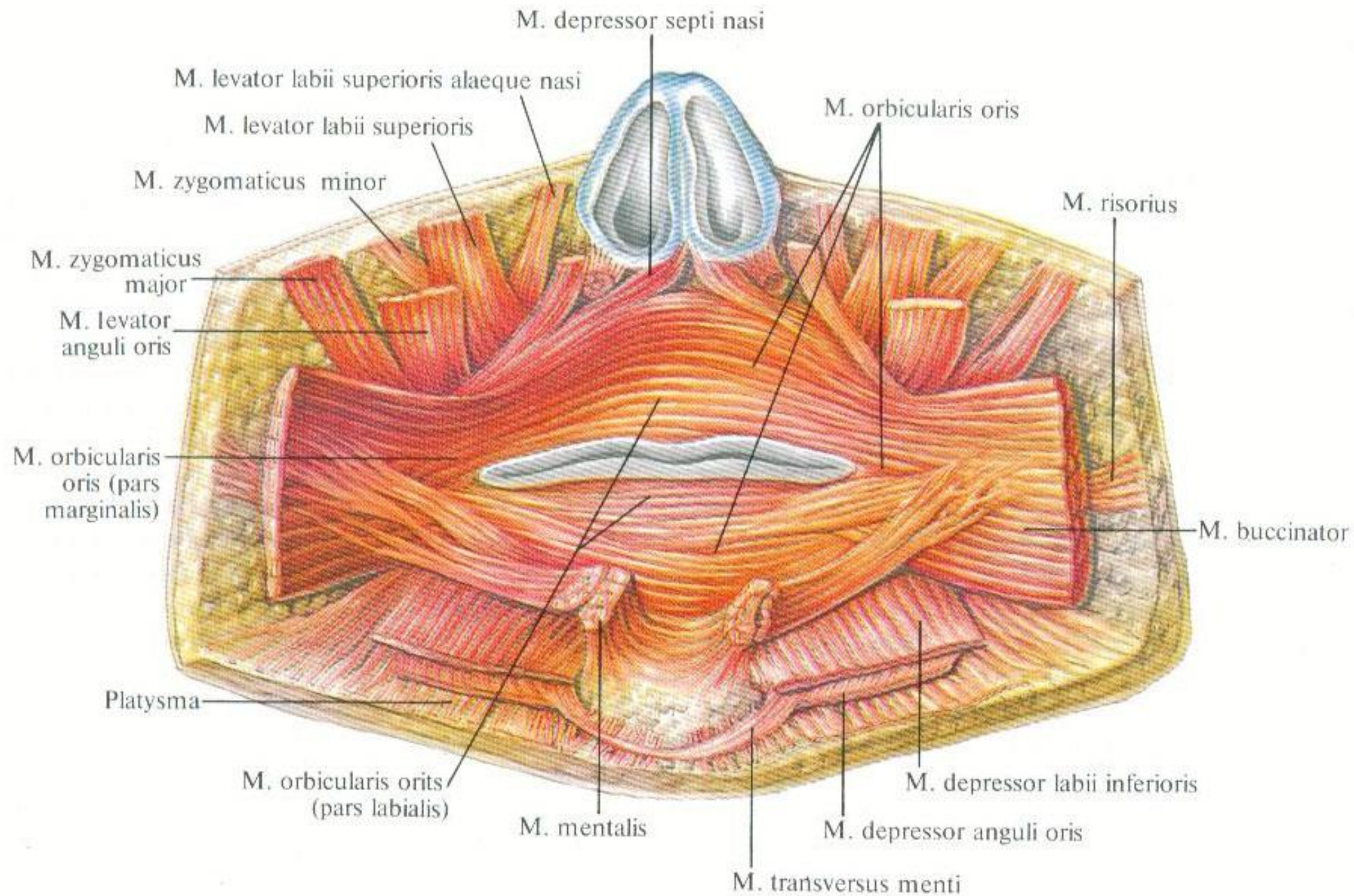


# D. Muscles around the mouth

<b><i>Levator anguli oris</i></b>	*under the levator labii superior and zygomatic - canine fossa	*angle of the mouth	*raises the angle of the mouth
<b><i>Depressor labii inferioris</i></b>	*border of the mandible	*the skin of the lower lip	*expression of the disgust
<b><i>Mentalis</i></b>	*juga alveolaria of the lower incisors and canine tooth	*skin of the chin	*raises the skin of the chin
<b><i>Buccinator</i></b> /forms lateral wall of the oral cavity/	*maxillary alveolar process	*skin of the cheek	*expels contents of the vestibule of the mouth
<b><i>Orbicularis oris</i></b>	*lies in the thickness of the lips	* skin of the lips	*draws the lips tightly together, inverts them /as in kissing/
<b><i>Levator labii superioris</i></b>	*infraorbital border of the maxilla	*skin of the nasolabial fold	*raises the upper lip









# Muscles of the neck

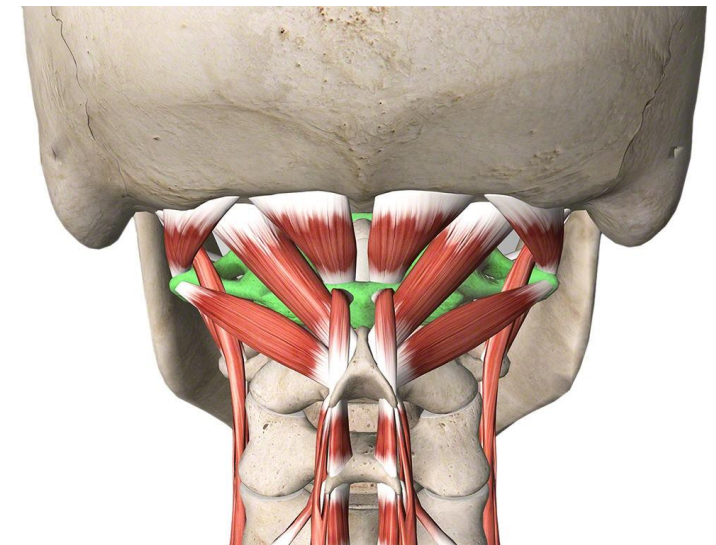
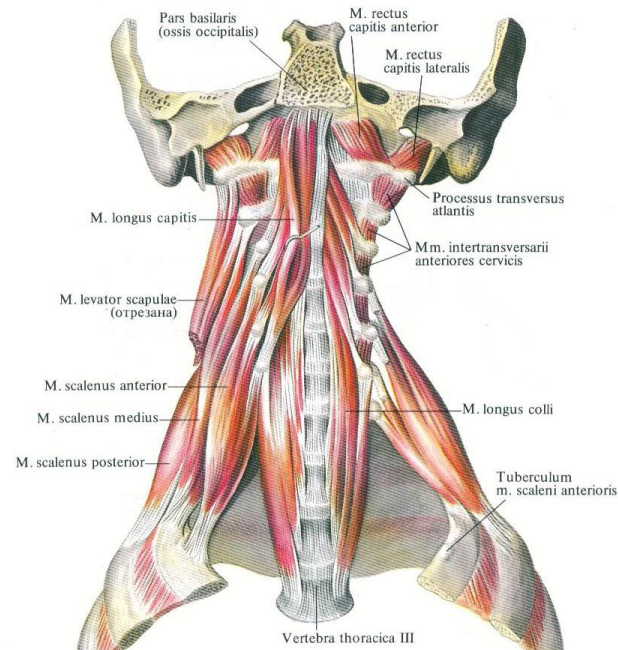
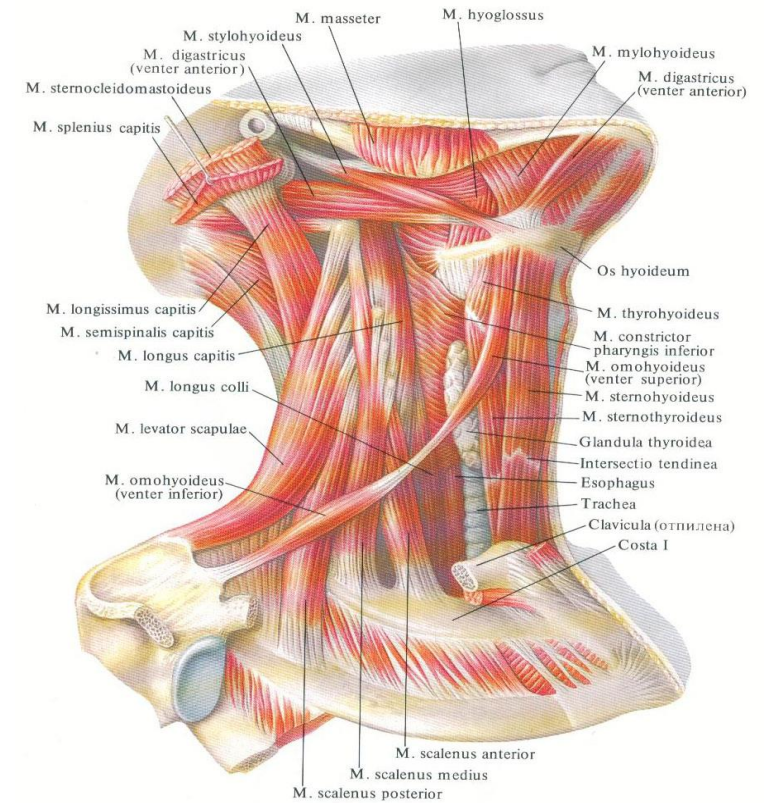
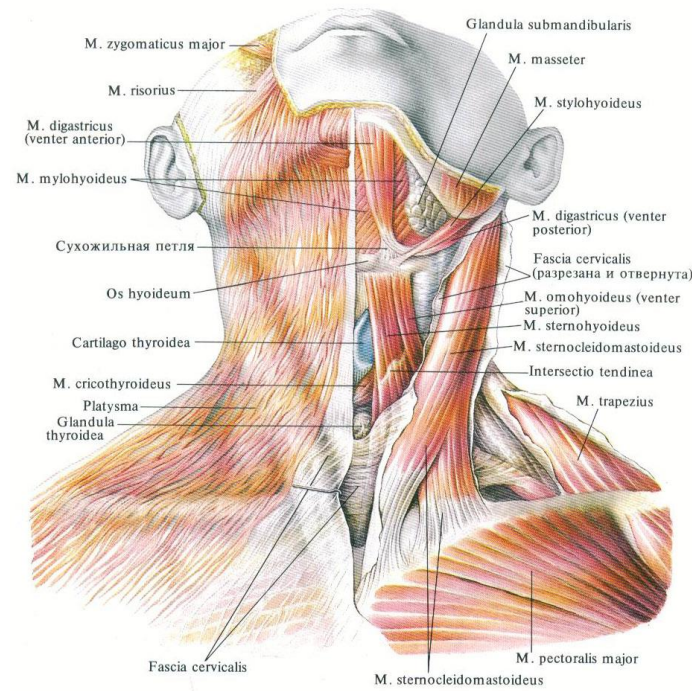
## I. Superficial muscles

## II. Middle group

- *Suprahyoid*
- *Infrahyoid*

## III. Deep muscles

- *Lateral*
- *Prevertebral*
- *Suboccipital*

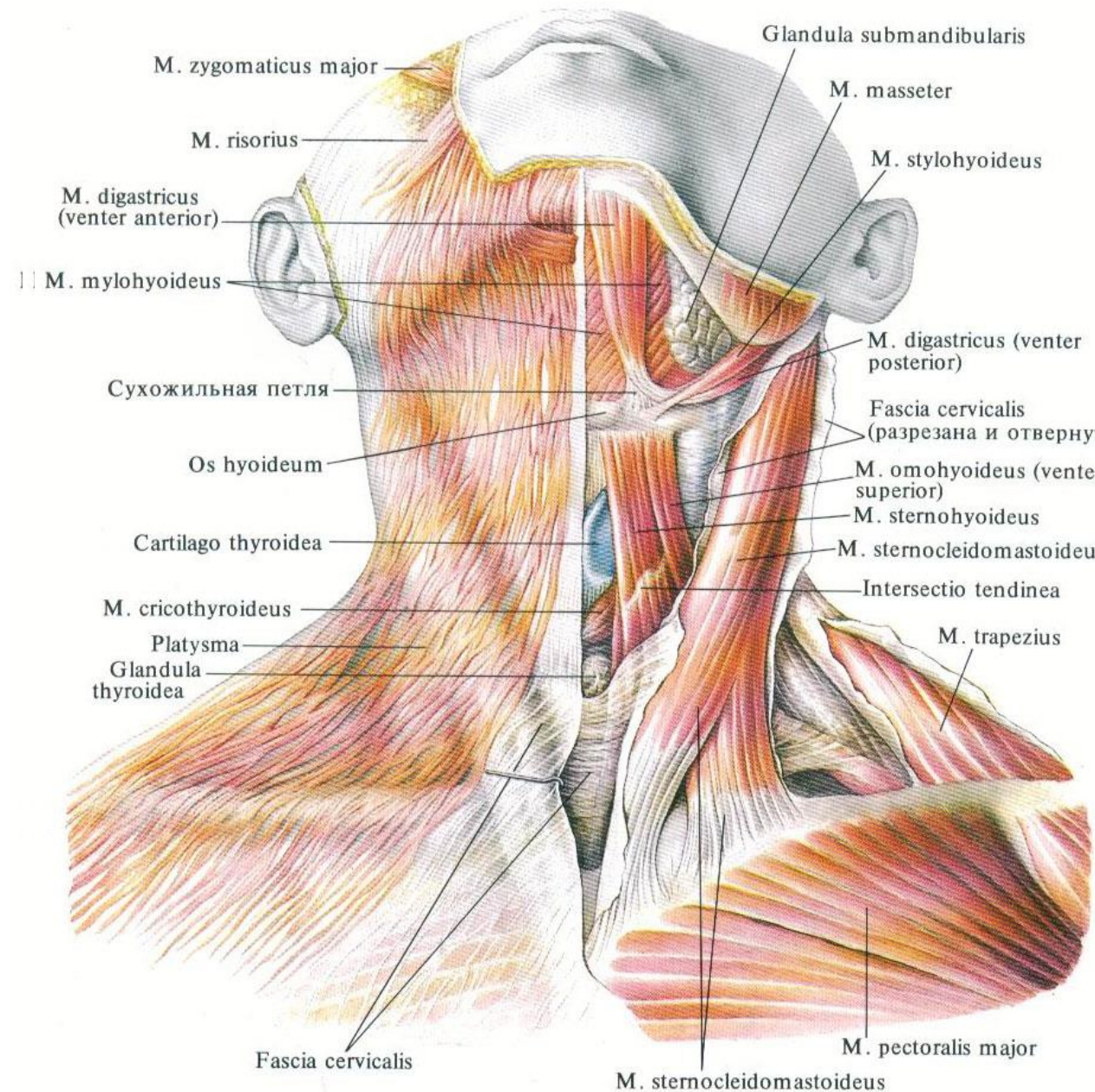




# Muscles of the neck

## I. Superficial group

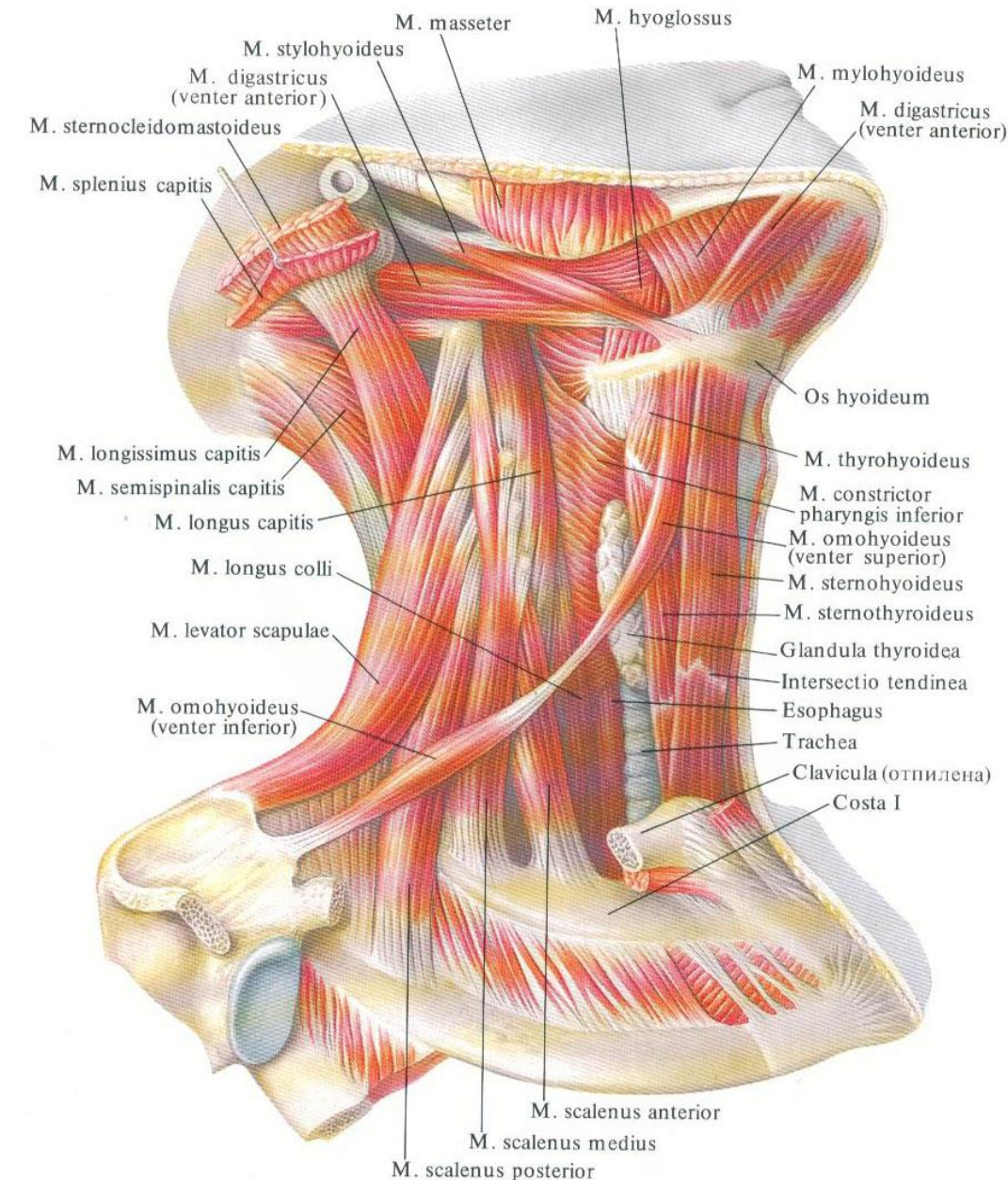
<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b><i>Platysma</i></b>	*the 2-nd rib  *deltoid fascia	*edge of the mandible  *masseter fascia	*pulls the skin of the neck  *protects the subcutaneous veins from compression
<b><i>Sternocleidomastoid</i></b>  ( <i>M. sternocleidomastoides</i> )	*sternal manubrium  *clavicle	*mastoid process	*turns the face to the opposite side /unilateral contraction/  * holds the head in a vertical position





## Ila. Suprahyoid muscles

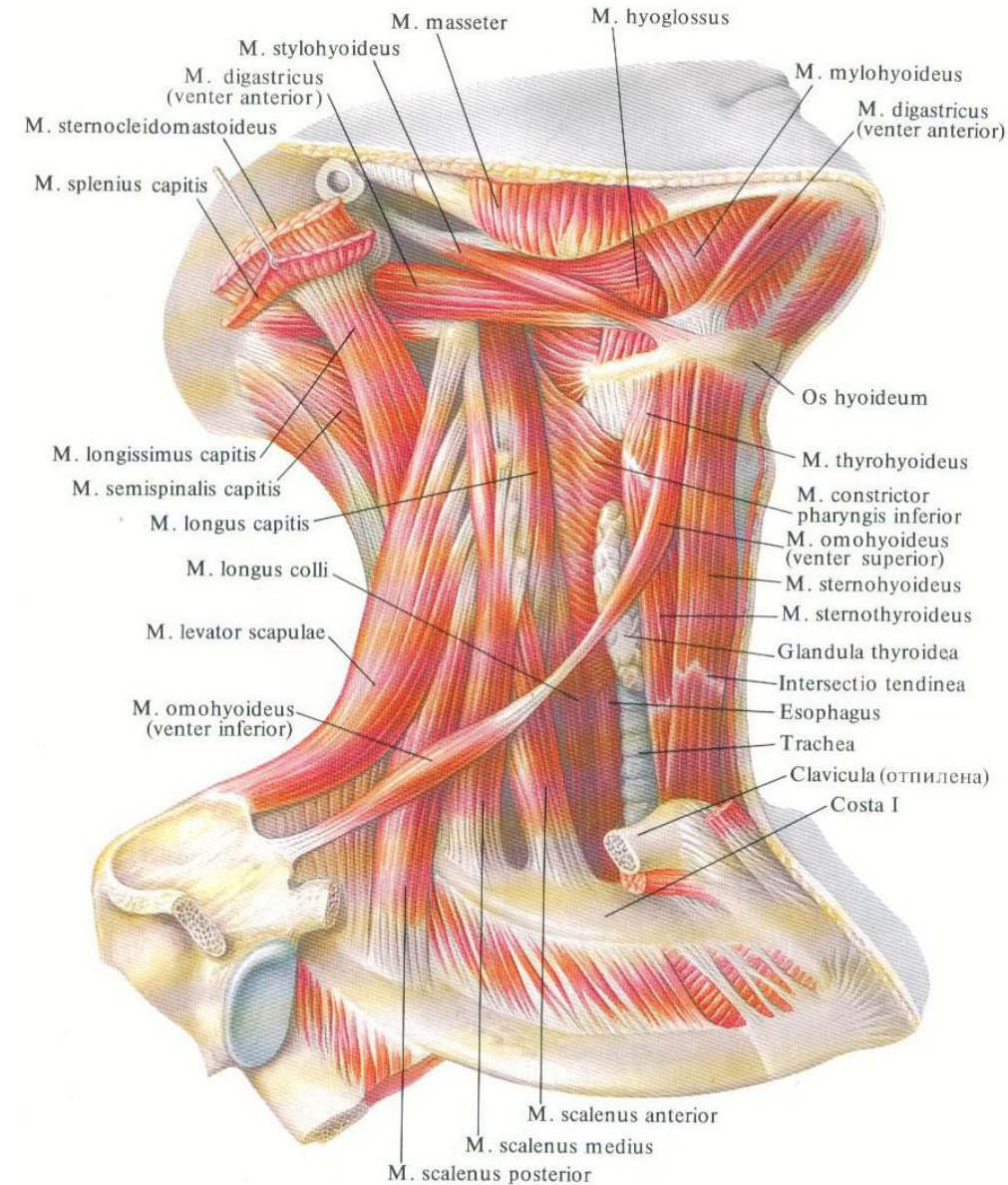
<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b>Digastric m.</b> ( <i>M. digastricus</i> )	*digastric fossa /anterior belly/ *mastoid notch /posterior belly/	*horn of the hyoid bone	*raises the hyoid bone *lowers the mandible *assists in the act of the articulate speech
<b>Mylohyoid m.</b> ( <i>M. mylohyoideus</i> )	*mylohyoid bone of the mandible	*body of the hyoid bone	
<b>Geniohyoid m.</b> ( <i>M. geniohyoideus</i> )	*mental spine	* body of the hyoid bone	
<b>Stylohyoid m.</b> ( <i>M. stylohyoideus</i> )	*styloid process	* body of the hyoid bone	





## I Ib. Infrahyoid muscles

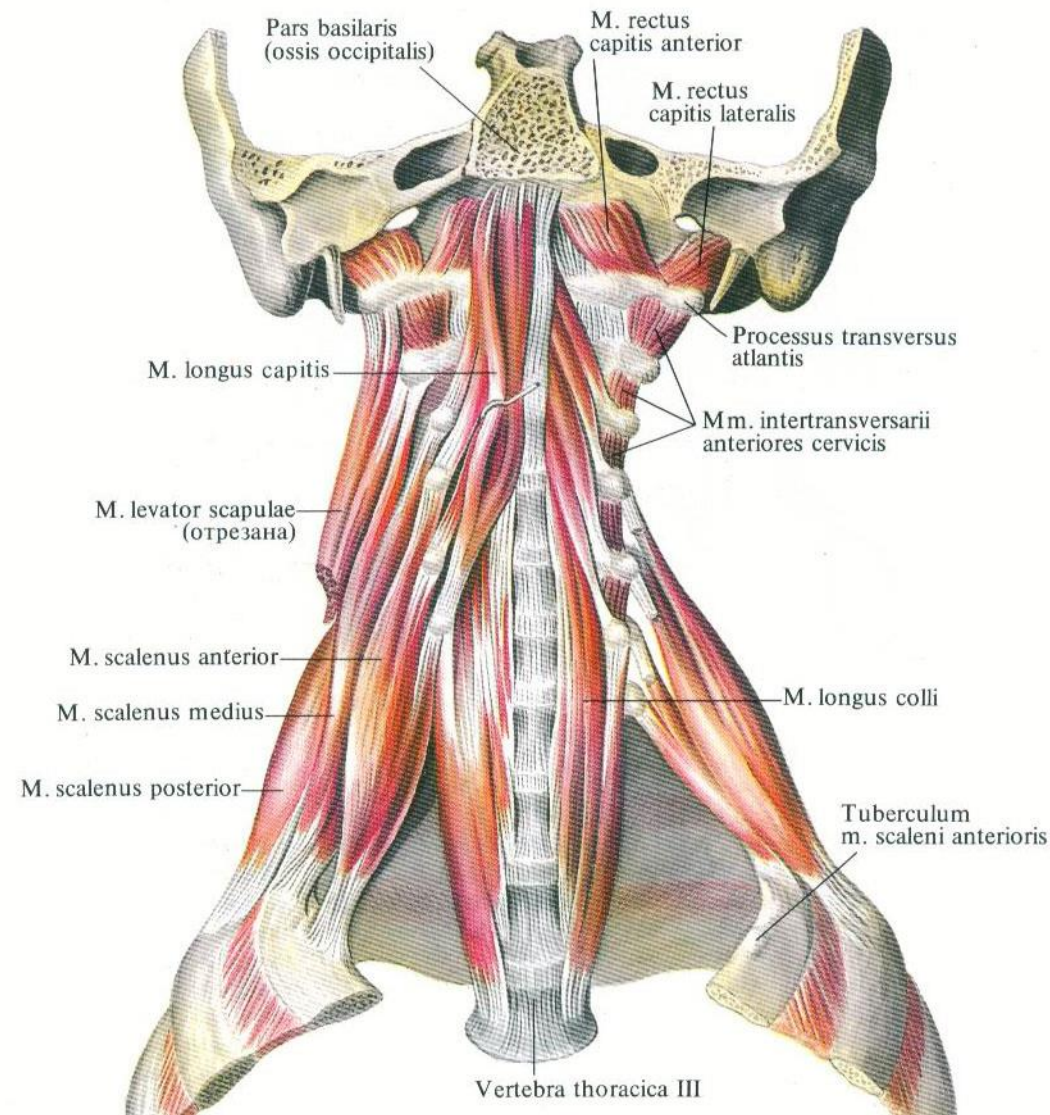
<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b><i>Sternohyoid</i></b>	<ul style="list-style-type: none"> <li>•manubrium of the sternum</li> <li>•sternal end of the clavicle</li> </ul>	<ul style="list-style-type: none"> <li>• inferior edge of the hyoid bone</li> </ul>	<ul style="list-style-type: none"> <li>• pulls the hyoid bone downward</li> </ul>
<b><i>Sternothyroid</i></b>	<ul style="list-style-type: none"> <li>•sternal manubrium</li> <li>•cartilage of the 1<sup>st</sup> rib</li> </ul>	<ul style="list-style-type: none"> <li>• hyoid bone</li> </ul>	<ul style="list-style-type: none"> <li>• lowers the larynx</li> </ul>
<b><i>Thyrohyoid</i></b>	<ul style="list-style-type: none"> <li>• thyroid cartilage</li> </ul>	<ul style="list-style-type: none"> <li>• hyoid bone</li> </ul>	<ul style="list-style-type: none"> <li>• pulls the larynx upward when the hyoid bone is steadied</li> </ul>
<b><i>Omohyoid</i></b>	<ul style="list-style-type: none"> <li>•scapular notch /inferior belly/</li> <li>•intermediate tendon /superior belly/</li> </ul>	<ul style="list-style-type: none"> <li>• hyoid bone</li> </ul>	<ul style="list-style-type: none"> <li>• pulls the hyoid bone downward</li> </ul>



# Deep muscles of the neck

## a) Lateral group

Muscle	Origin	Insertion	Action
<b>Anterior scalene m.</b> ( <i>M. scalenius anterior</i> )	*transverse processes of the C3-6	*the 1-st rib	*rises the upper ribs *flexes the cervical part of vertebral column forward /bilateral contraction/
<b>Middle scalene m.</b> ( <i>M. scalenius medius</i> )	*transverse processes of all cervical vertebrae	*the 1-st rib	
<b>Posterior scalene m.</b> ( <i>M. scalenius posterior</i> )	*transverse processes of cervical vertebrae C5-7	*the 2-nd rib	*rotates the cervical vertebral column to their side/ unilateral side/

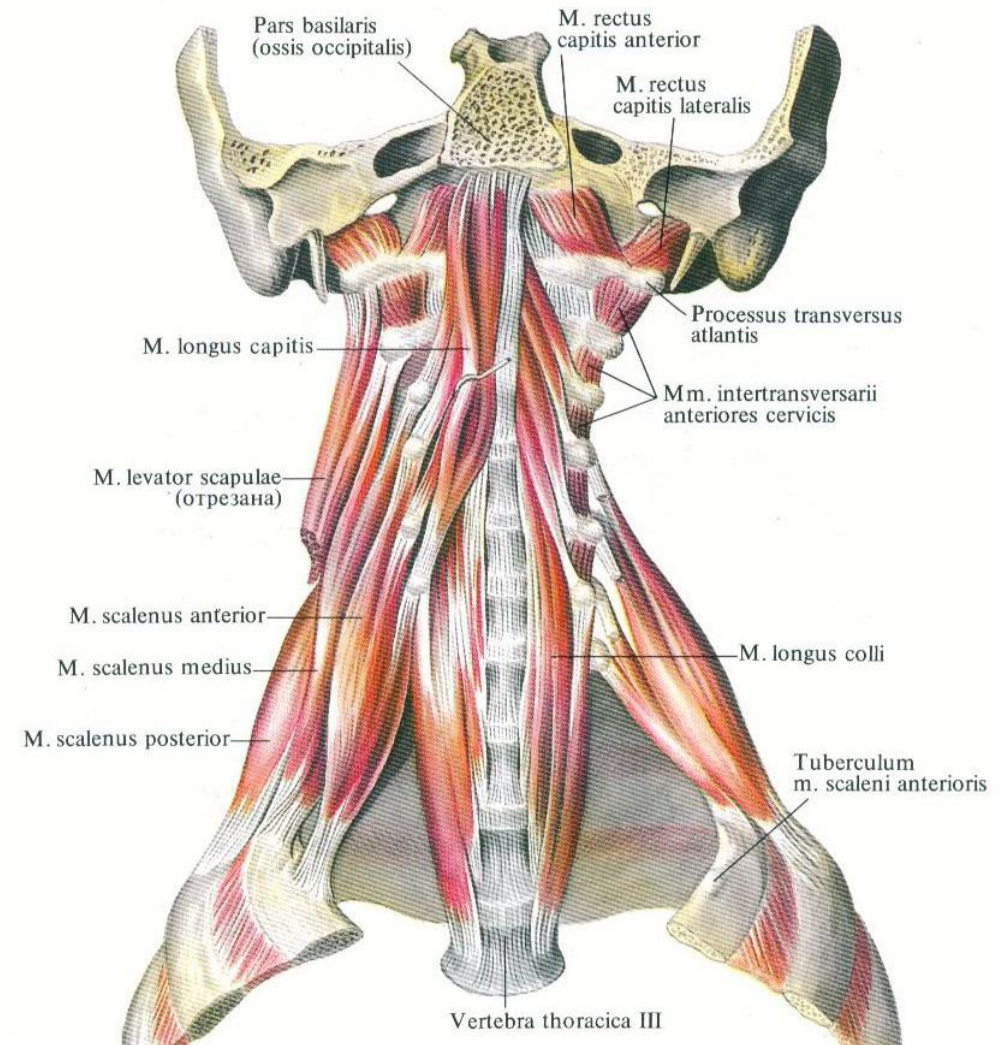




<i>Muscle</i>	<i>Origin</i>	<i>Insertion</i>	<i>Action</i>
<b><i>Longus cervicis :</i></b> -vertical part -inferior oblique part  -superior oblique part	*bodies of the Th3-C5 *bodies of the Th3-1  *transverse processes C5-3	*bodies of the C4-2 *transverse processes C6-5 *anterior tubercle of the atlas	*flexes the vertebral column *flexes the cervical spine /bilateral contraction/ *flexes laterally the cervical spine /unilateral contraction/
<b><i>Longus capitis</i></b>	*transverse processes C6-3	*base of the Occipital bone	*flexes the head forward
<b><i>Rectus capitis anterior</i></b>	*lateral mass of the atlas	*occipital bone	*flexes the head forward /bilateral contraction/ *flexes the head laterally /unilateral contraction/
<b><i>Rectus capitis lateralis</i></b>	*transverse process of the C1	*occipital bone	*flexes the head forward /bilateral contraction/ *flexes the head laterally /unilateral contraction/

## Deep muscles of the neck

### *b) Prevertebral muscles*



## ***1. Musculus rectus capitis anterior***

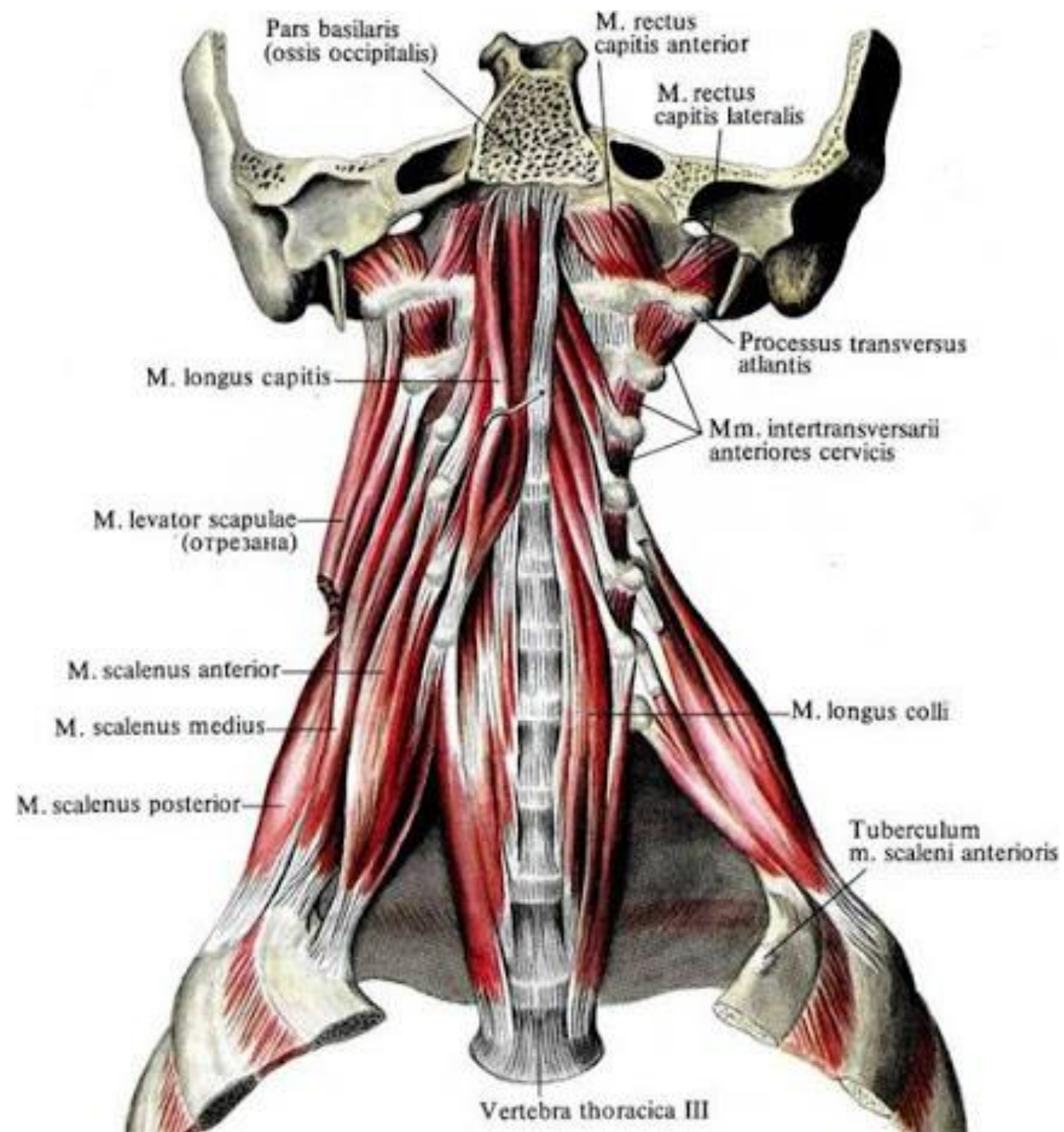
***Origin:*** *processus transversus atlantis*

***Insertion:*** *pars basilaris ossis occipitalis*

## ***2. Musculus rectus capitis lateralis***

***Origin:*** *processus transversus atlantis*

***Insertion:*** *processus paramastoideus processu jugularis ossis occipitalis*





## Suboccipital muscles

### 3. *M. rectus capitis posterior major*

*Origin:* processus spinosus  $C_{II}$

*Insertion:* linea nuchae inferior ossis occipitalis

### 4. *M. rectus capitis posterior minor*

*Origin:* tuberculum posterior atlantis

*Insertion:* linea nuchae inferior ossis occipitalis

(linea nuchae inferior  
ossis occipitalis)

### 5. *M. obliquus capitis superior*

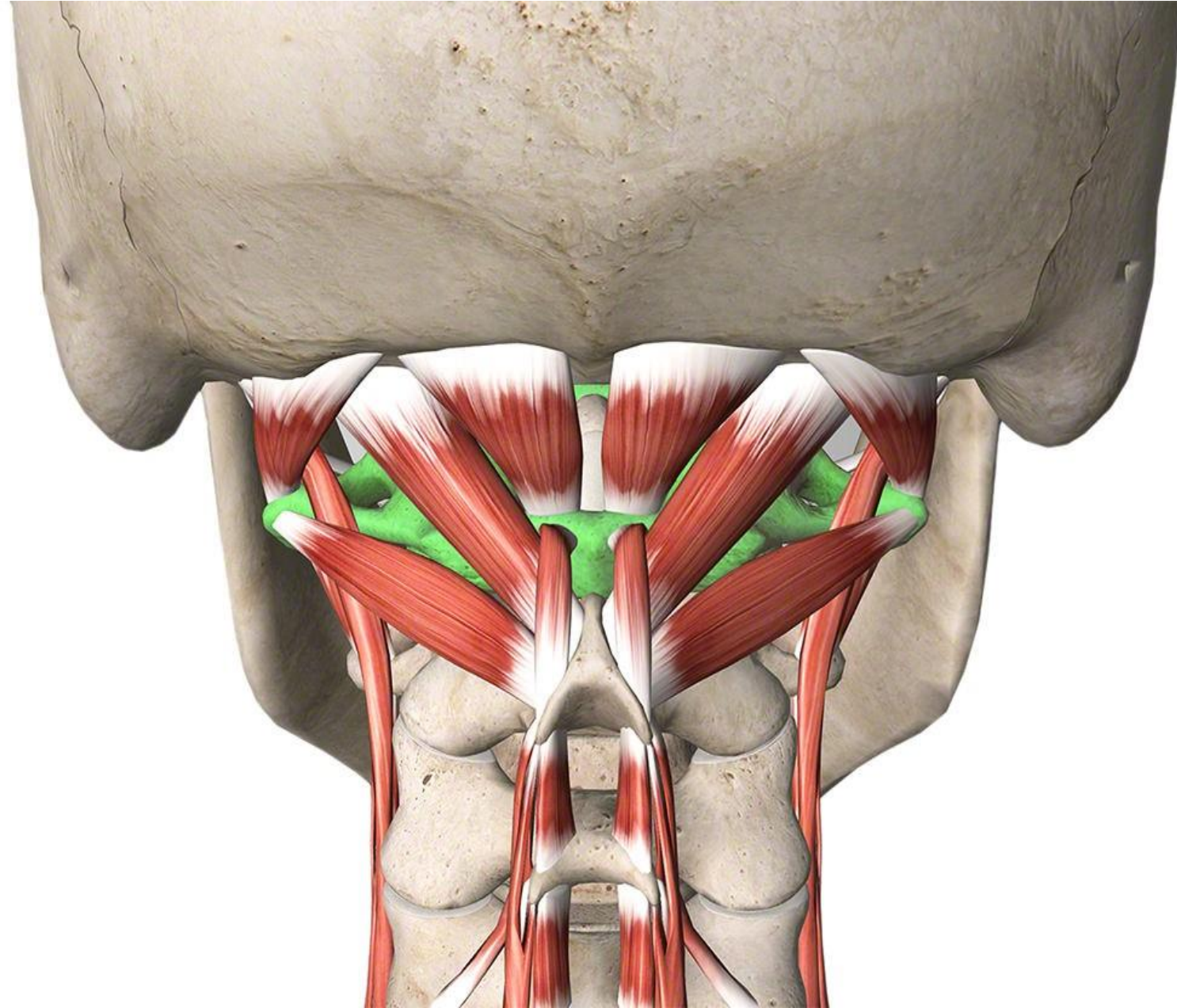
*Origin:* processus transversus atlantis

*Insertion:* betwee the linea nuchae superior and  
inferior

### 6. *M. obliquus capitis inferior*

*Origin:* processus spinosus  $C_{II}$

*Insertion:* processus transversus atlantis



# Fasciae of the head

The muscles of the facial expression *do not have the fascia*, except for the *buccinator muscle* which is covered posteriorly with *the thick buccopharyngeal fascia*:

- it is interspersed with adipose tissue of the cheek (anterior)

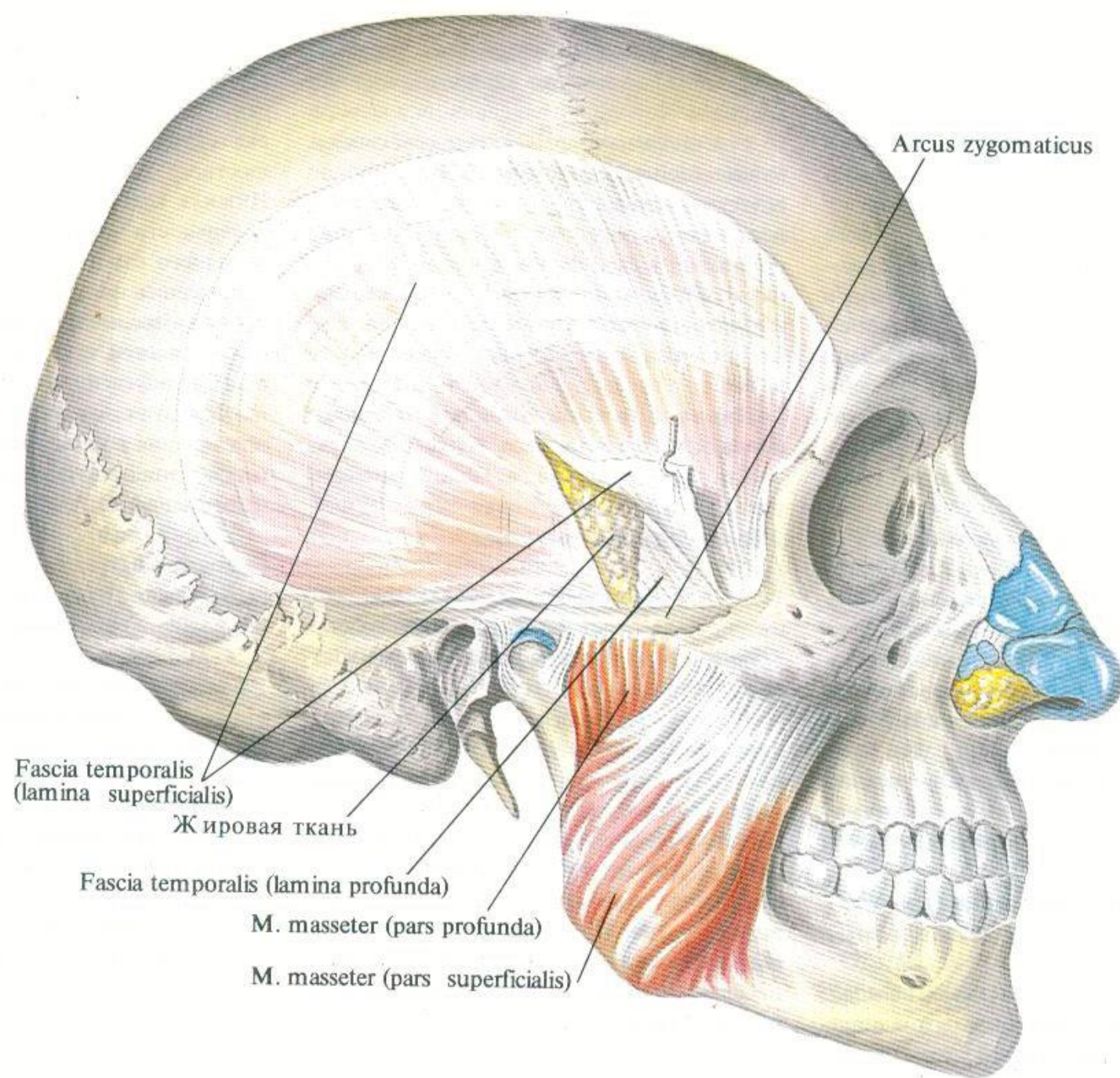
The masticatory muscles *possess the fasciae*:

**1) The temporal fascia** (*temporal fascia*)- covers the temporal muscle

**2) Masseter fascia** (*fascia masseterica*) = *parotideomasseteric fascia*

- It is a strong layer of fascia derived from the deep cervical fascia.
- It covers the Masseter and is firmly connected to it.
- Above, this fascia is attached to the lower edge of the zygomatic arch, and posteriorly, it invests the parotid gland.
- It covers the lateral surface of the masseter muscle
- It is attached to the base of the mandible (bottom), the mandibular branch (anterior + posterior)
- It is connected to the parotid fascia (*fascia parotidea*) which covers the parotid gland (posterior + partially external)



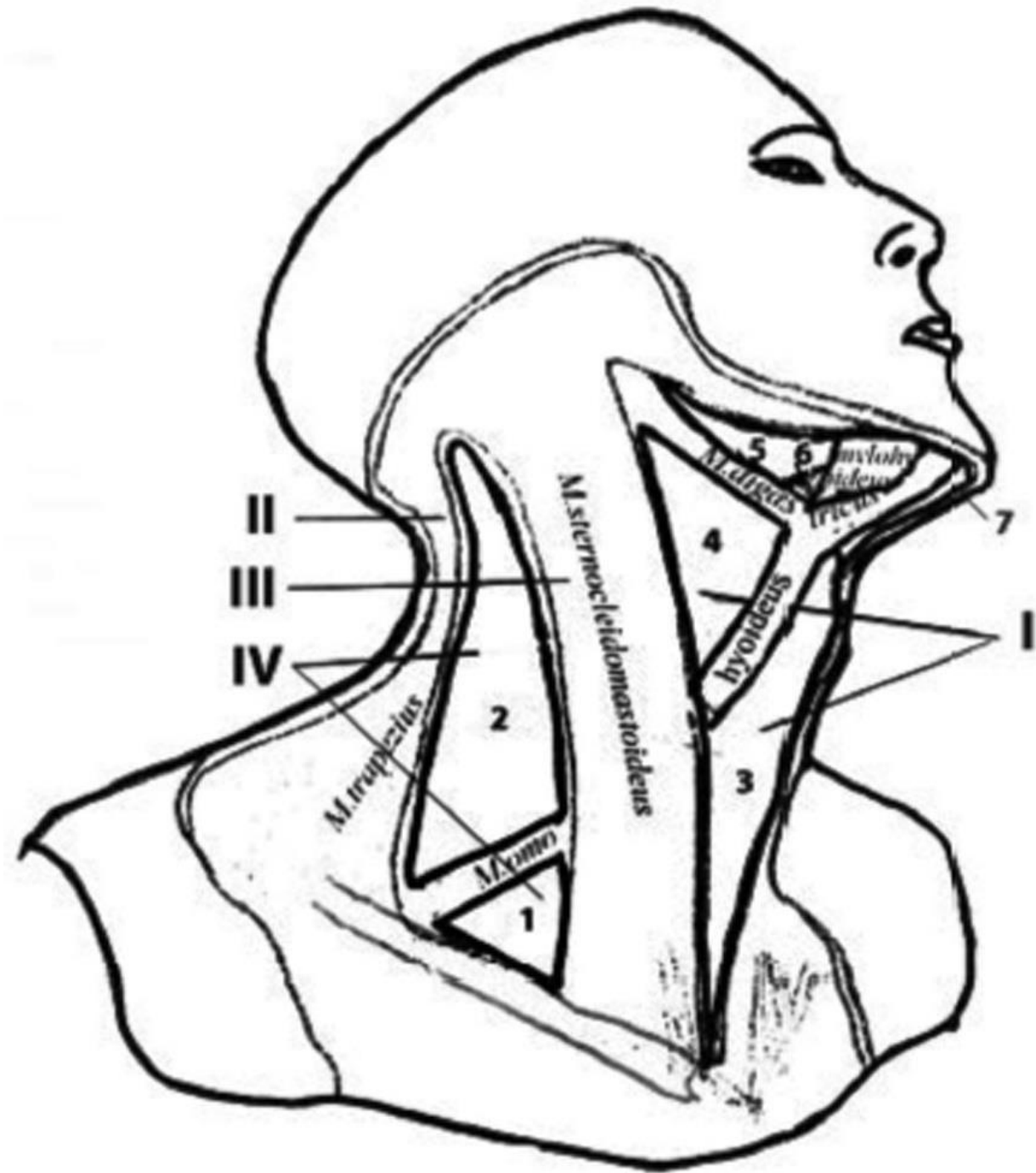


# Topography of the neck

**6 regions, 7 triangles and 2 spaces** are distinguished in the neck:

Regions of the neck:

- I. anterior** – between the right and left sternocleidomastoid muscles,
- II. posterior** – behind the lateral borders of the trapezius muscle,
- III. lateral (2)** – between the sternocleidomastoid and the trapezius muscles,
- IV. sternocleidomastoid (2)** – corresponds to this muscle.





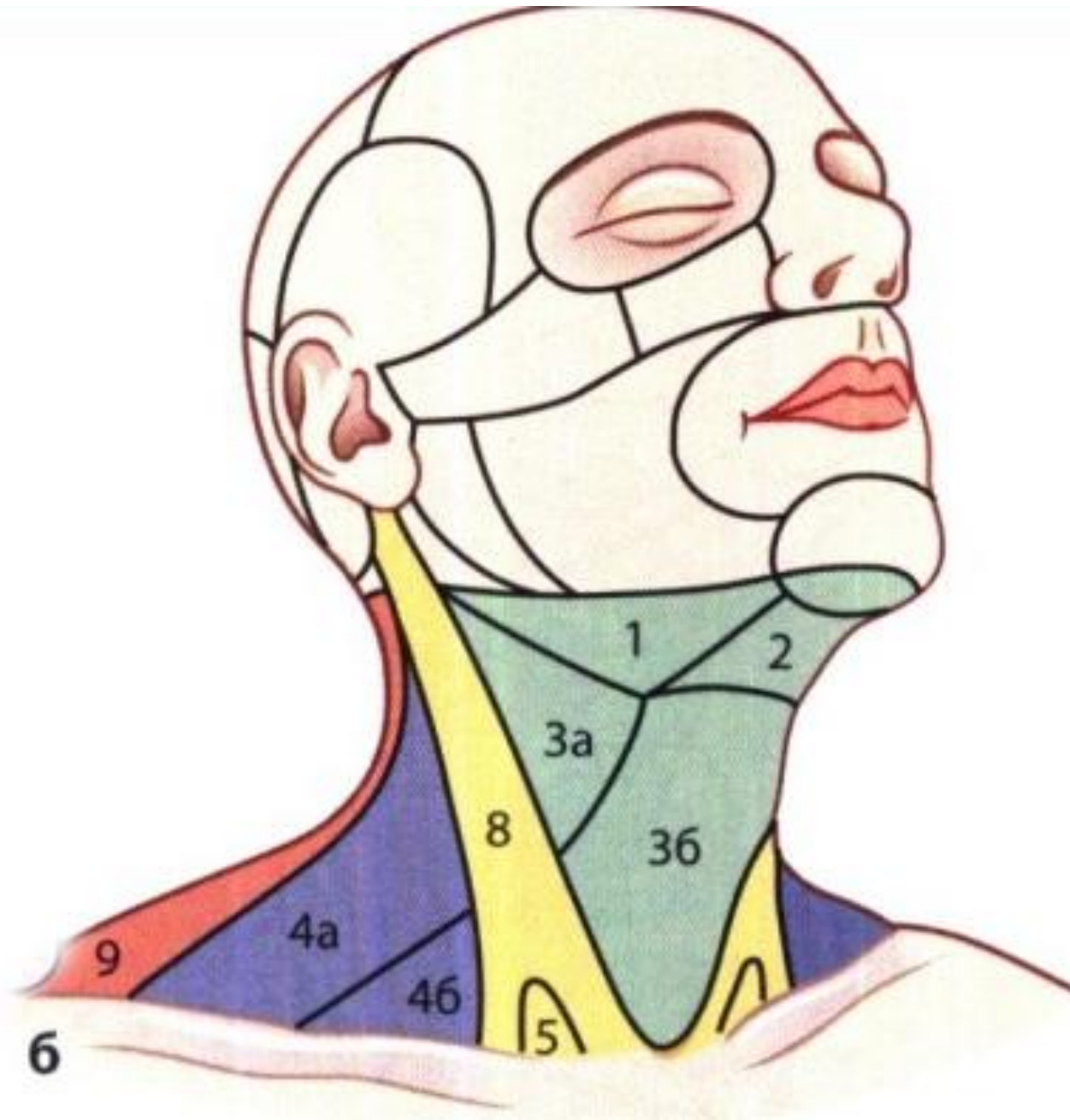
# There are six regions of the neck:

**Anterior,  
Sternocleidomastoid -2,  
Lateral - 2,  
Posterior.**

The boundaries of the regions are drawn along the external landmarks: the lower edge of the mandible, along the anterior and posterior edges of the sternocleidomastoid muscle, the anterior edge of the trapezius muscle, the sternum and the clavicle.

## **Anterior region**

- Bounded *at the base* of the mandible
- *Lower* - jugular notch of sternum,
- *From the sides* - sides of the medial edges of the sternocleidomastoideus



# Triangles of anterior region

## 1. *Trigonum submandibulare*

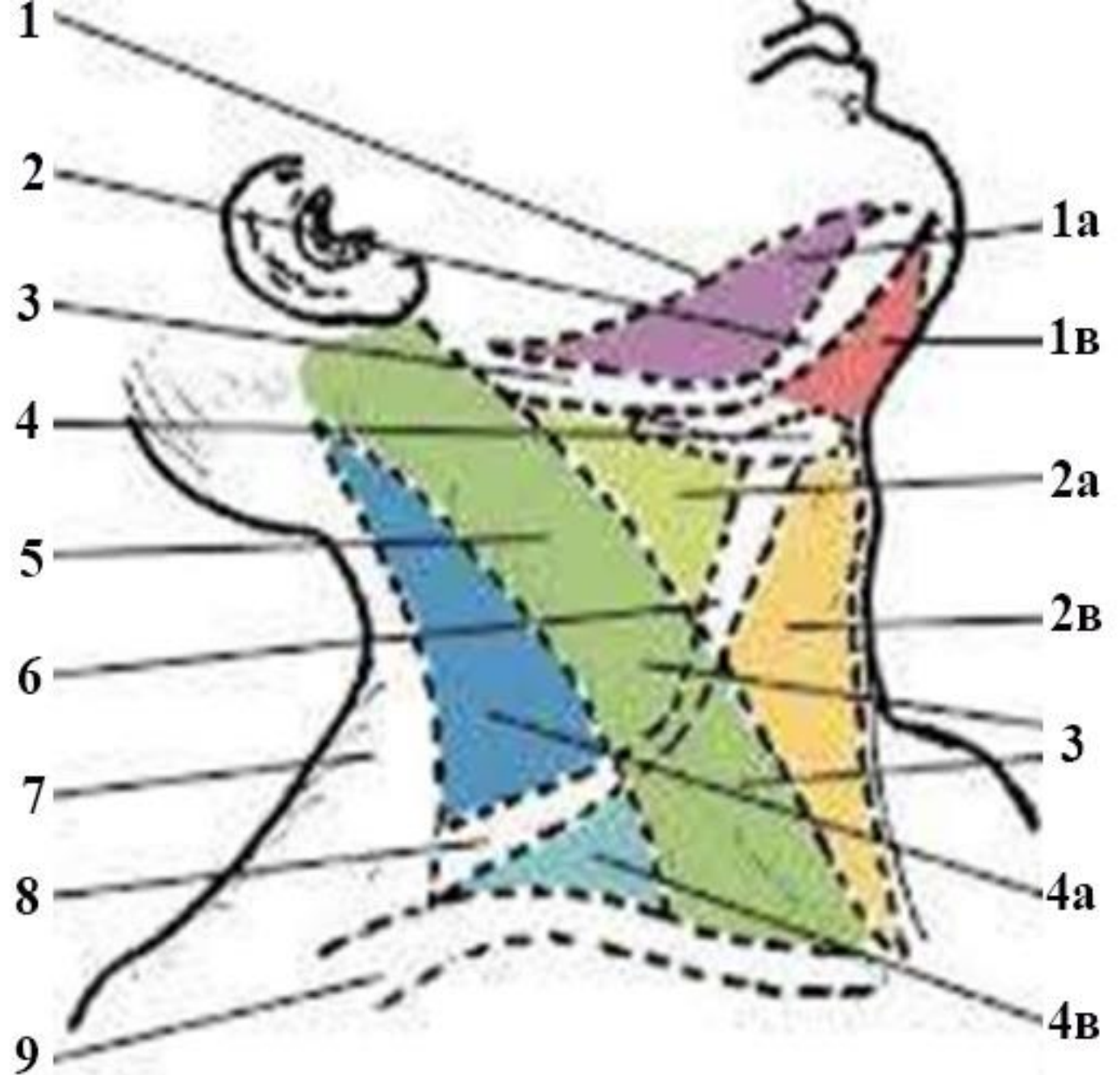
- *Superior* - base mandibulei,
- *Anterior* - anterior belly of *m. digastricus*,
- *Posterior* - posterior belly of *m. Digastricus*.

## 2. *Pirogov's triangle*

- *Superior* – hypoglossal nerve,
- *Anterior* - posterior margin of mylohyoid,
- *Posterior* - posterior belly of *m. digastricus*.

## 3. *Trigonum submentale*

- It is limited: by anterior belly of *m. Digastricus* right and left





## 4. *Trigonum caroticum*

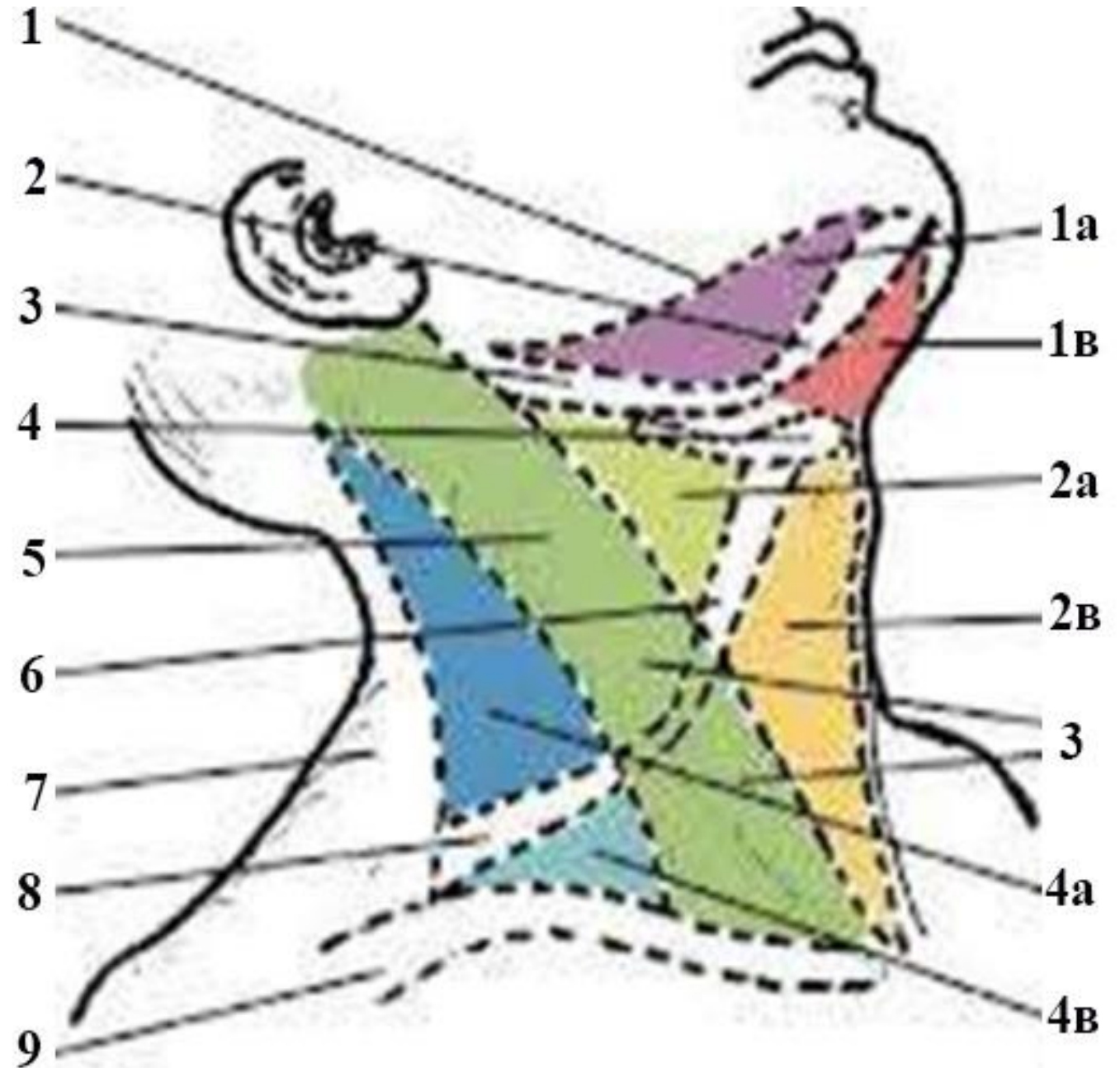
- **superior** - posterior belly of *m. digastricus*,
- **anterior** - superior belly of *m. omohyoideus*,
- **posterior** - anterior margin of *m. sternocleidomastoideus*.

## 5. *Trigonum omotracheale*

**Superior** – superior belly of *m. omohyoideus*,

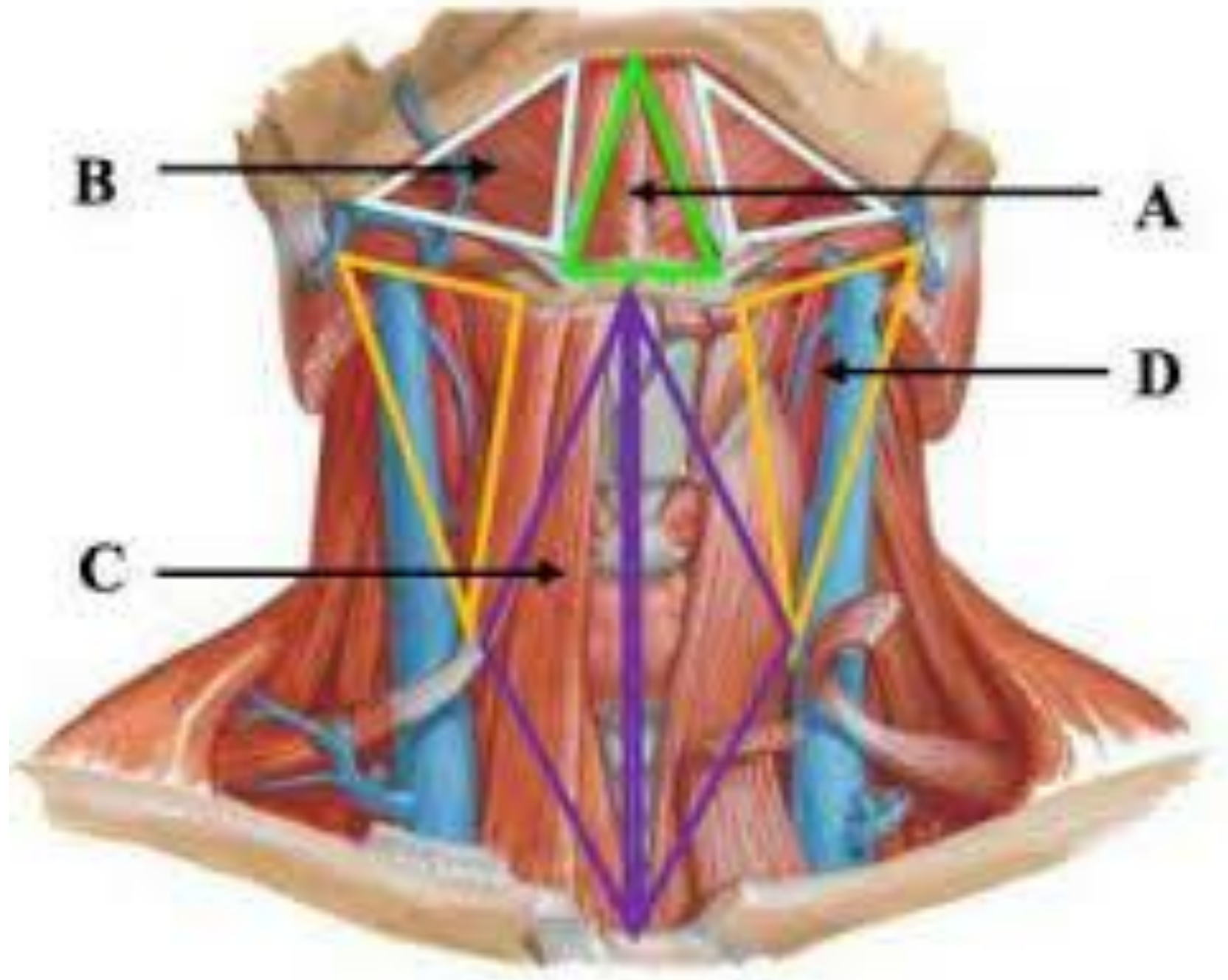
**Medial** - anterior median line,

**Lateral** – anterior margin of *m. sternocleidomastoideus*



## Triangles of anterior region of the neck

1. Submandibular *B*
2. Pirogov's triangle
3. Submental triangle *A*
4. Carotid triangle *D*
5. Omotracheal triangle *C*





# Triangles of lateral region:

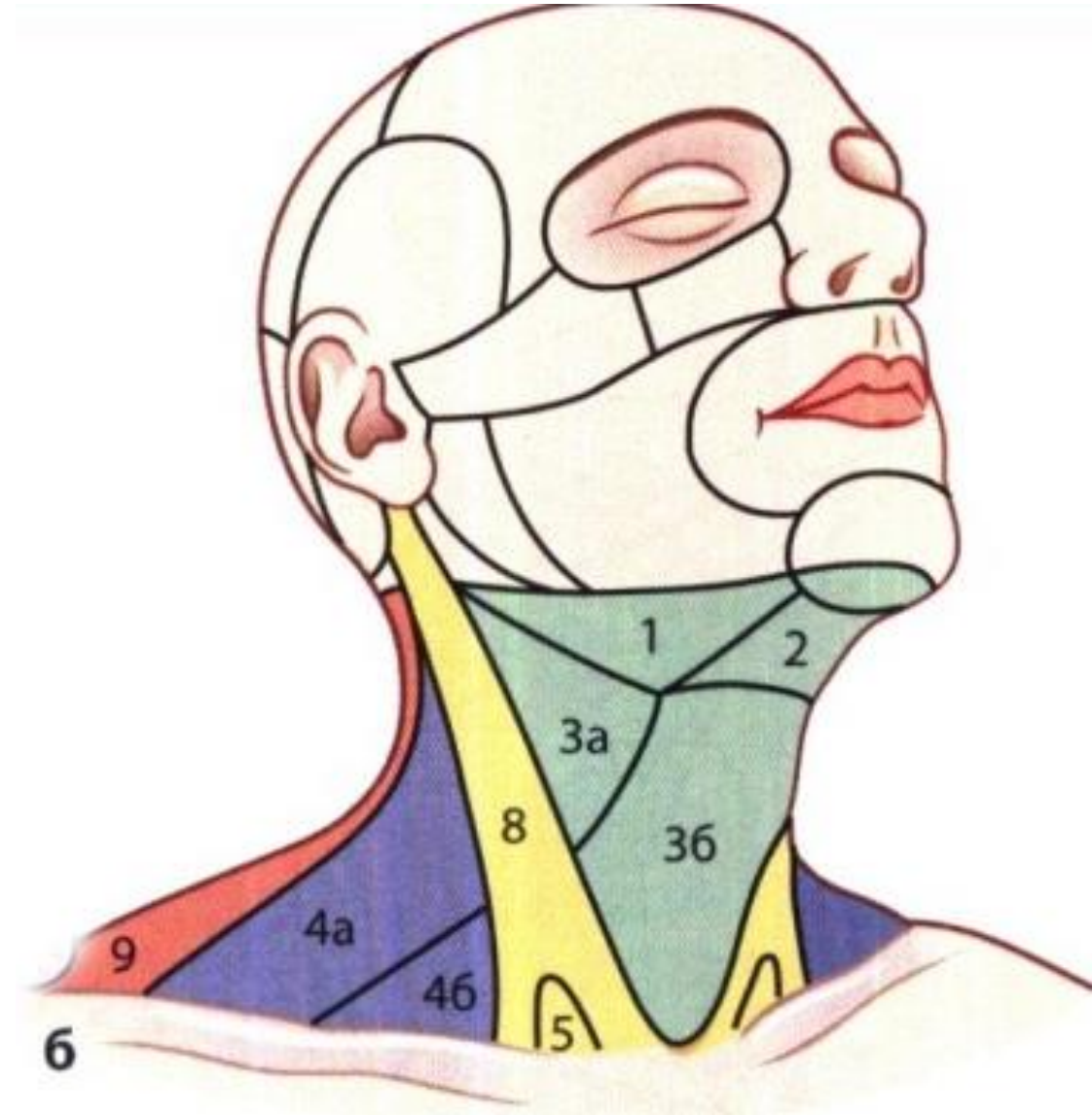
## 1. *Trigonum omo-trapezoideum*

- **Inferior** - *m. omohyoideus*,
- **Anterior** - posterior margin of *sternocleidomastoid*,
- **Posterior** - anterior margin of *m. trapezoid*

## 2. *Trigonum omo-claviculare*

- **Inferior** - clavicle,
- **Anterior** - posterior margin of *sternocleidomastoid*,
- **Superior** –inferior belly of *m. omohyoideus*.

**Posterior region of the neck** is located posterior to the anterior margin of *Trapezoid*.



# Regions of neck

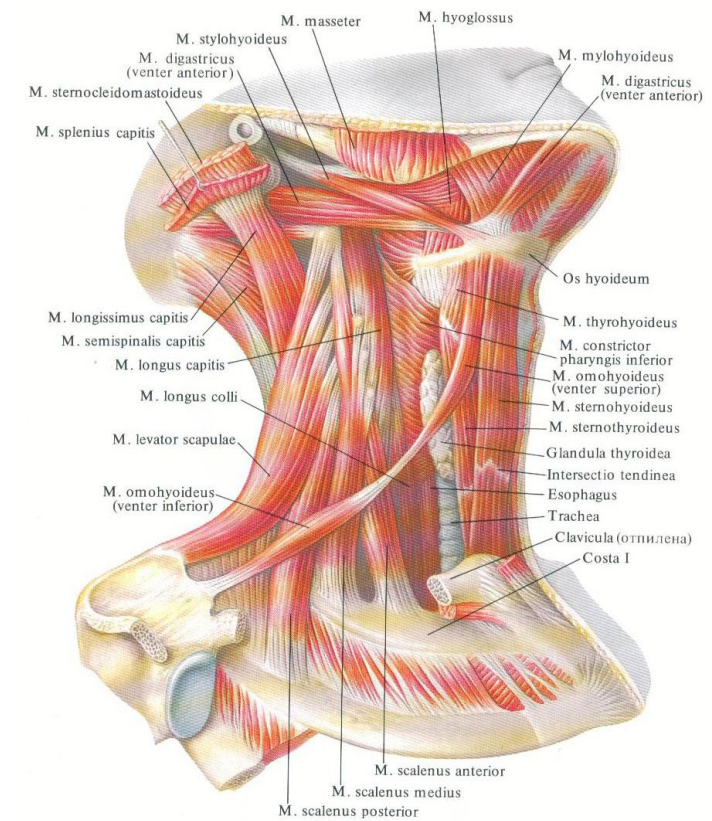
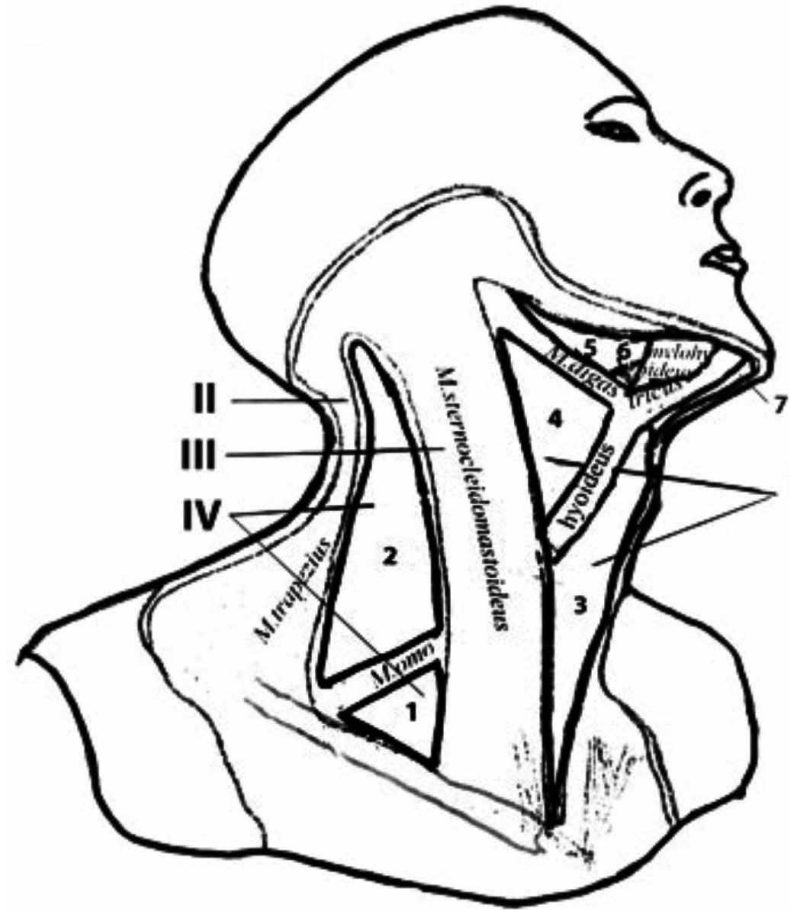
**I- anterior** – between the right and left sternocleidomastoid muscles,  
**II- posterior** – behind the lateral borders of the trapezius muscle,  
**III- sternocleidomastoid** (right and left) – corresponds to this muscle,  
**IV- lateral** (right and left) – between the sternocleidomastoid and the trapezius muscles.

# Triangles of neck

- 1) *omoclavicular*,
- 2) *omotrapezoid*,
- 3) *omotracheal*,
- 4) *omohyoid or carotis*,
- 5) *submandibular*,
- 6) *Pirogov's*, (under the hypoglossal nerve)
- 7) *submental*.

# Triangular spaces of neck

- 1) *spatium antescalenium*  
- in front to anterior scalenic m.
- 2) *spatium interscalenium*  
• between the anterior and middle scalenic mm.





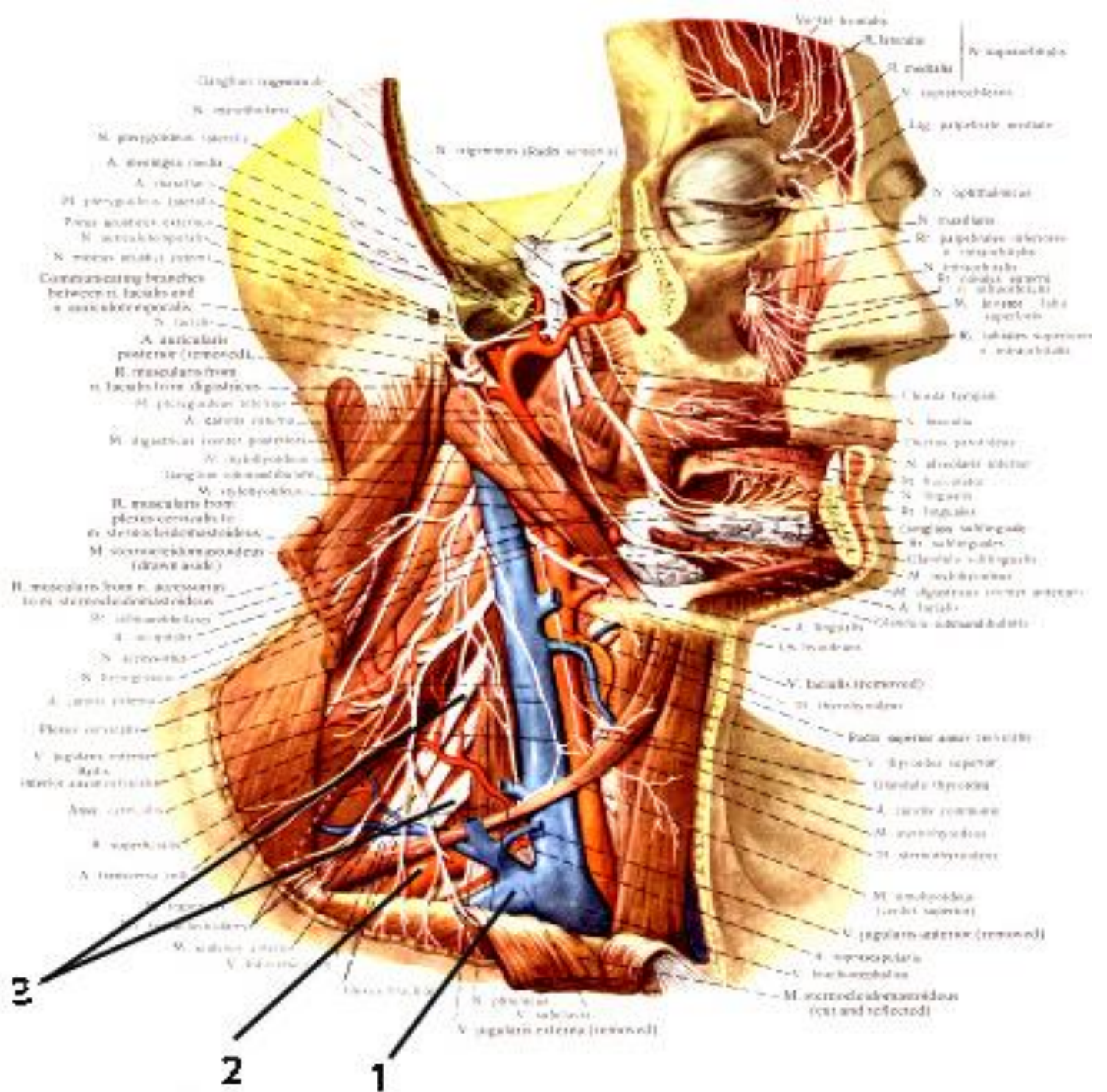
# Intermuscular spaces

1. Prescalenic space:  
Subclavian vein – 1.
2. Interscalenic space:  
Subclavian artery – 2.  
Trunks of brachial plexus – 3.

## Subclavian vein– 1.

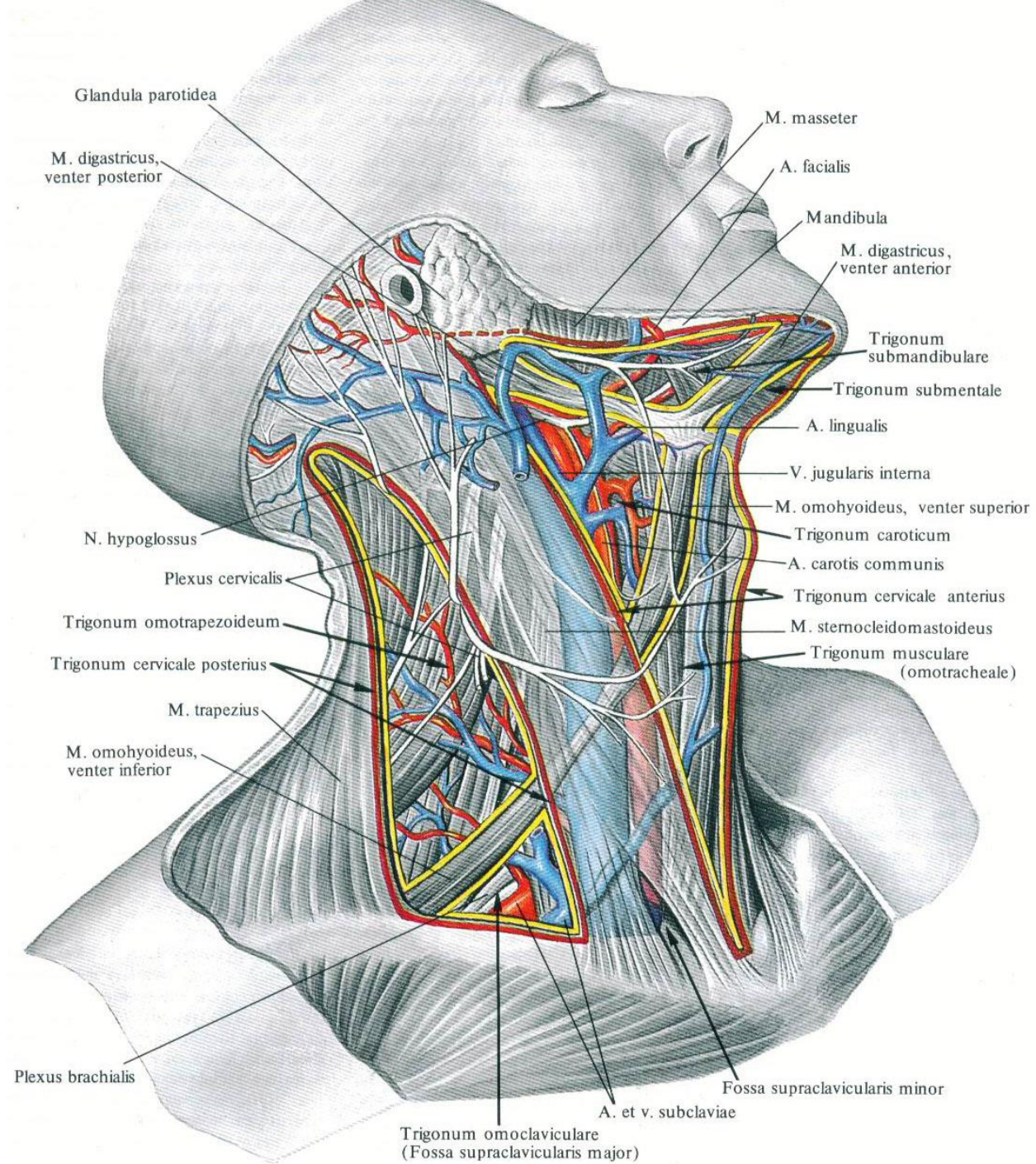
## Subclavian artery– 2.

## Trunks of brahial plexus – 3.





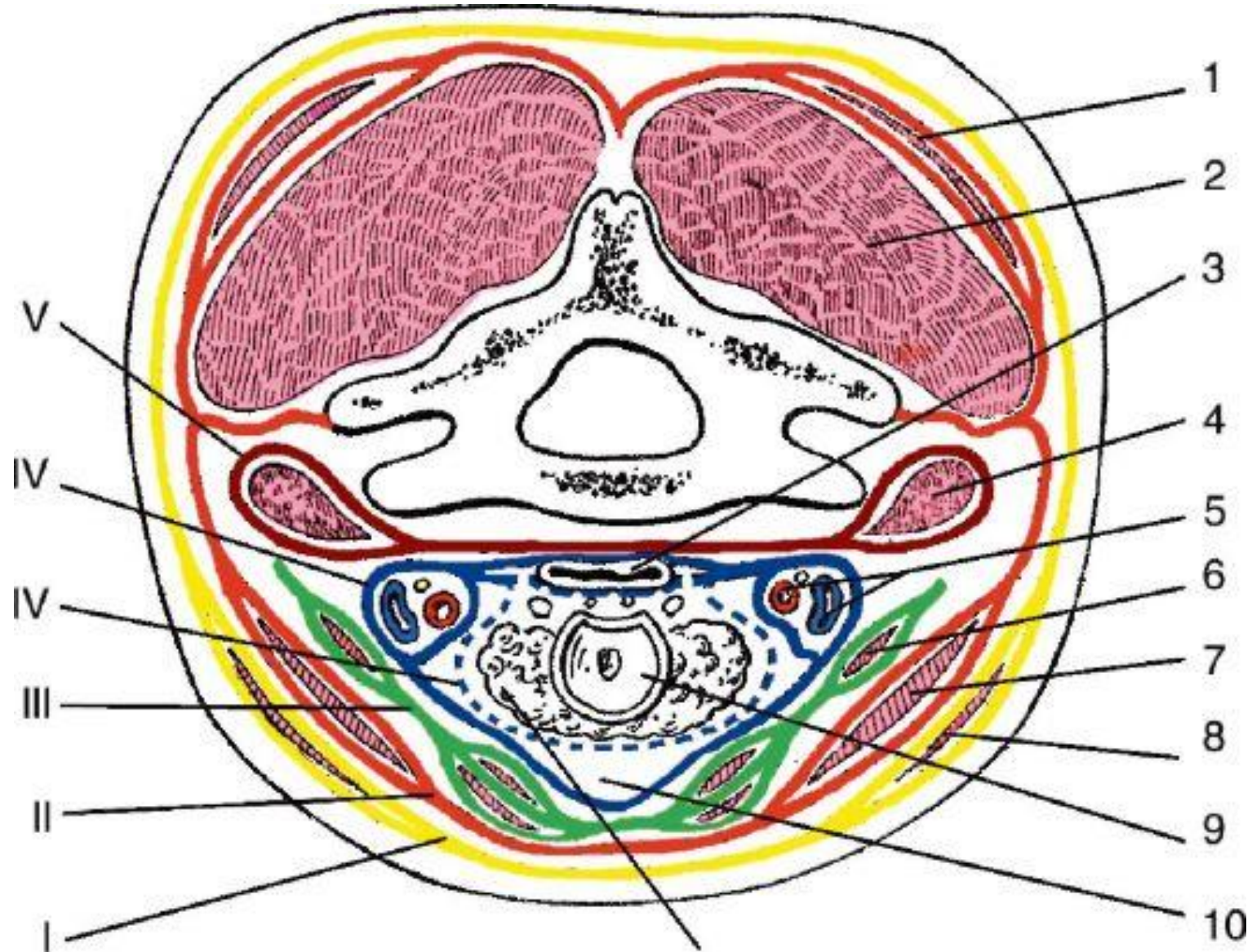
## *Triangles of the neck*





# Fasciae of the neck

- According to the anatomical terminology, there are three fascial lamellae and the carotid vagina (*vagina carotica*).
- In topographic anatomy they are described as **5 fasciae by Ševcunenko V. N.**



## *Fasciae by Şevcunenko*

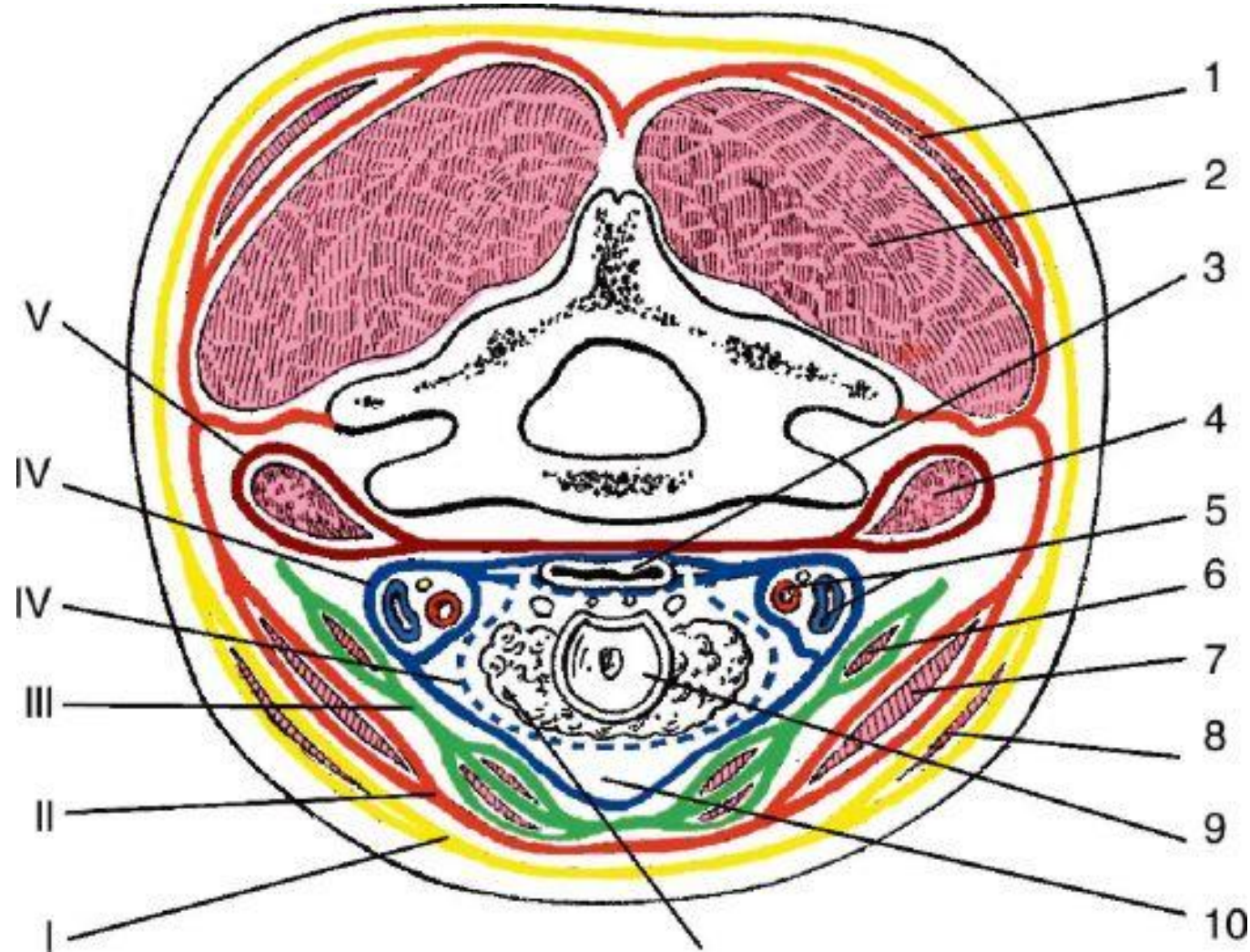
**I** – *fascia colli superficialis*

**II** - *lamina superficialis fasciae colli propriae*

**III** - *lamina profunda fasciae colli propriae*

**IV** - *fascia endocervicalis*

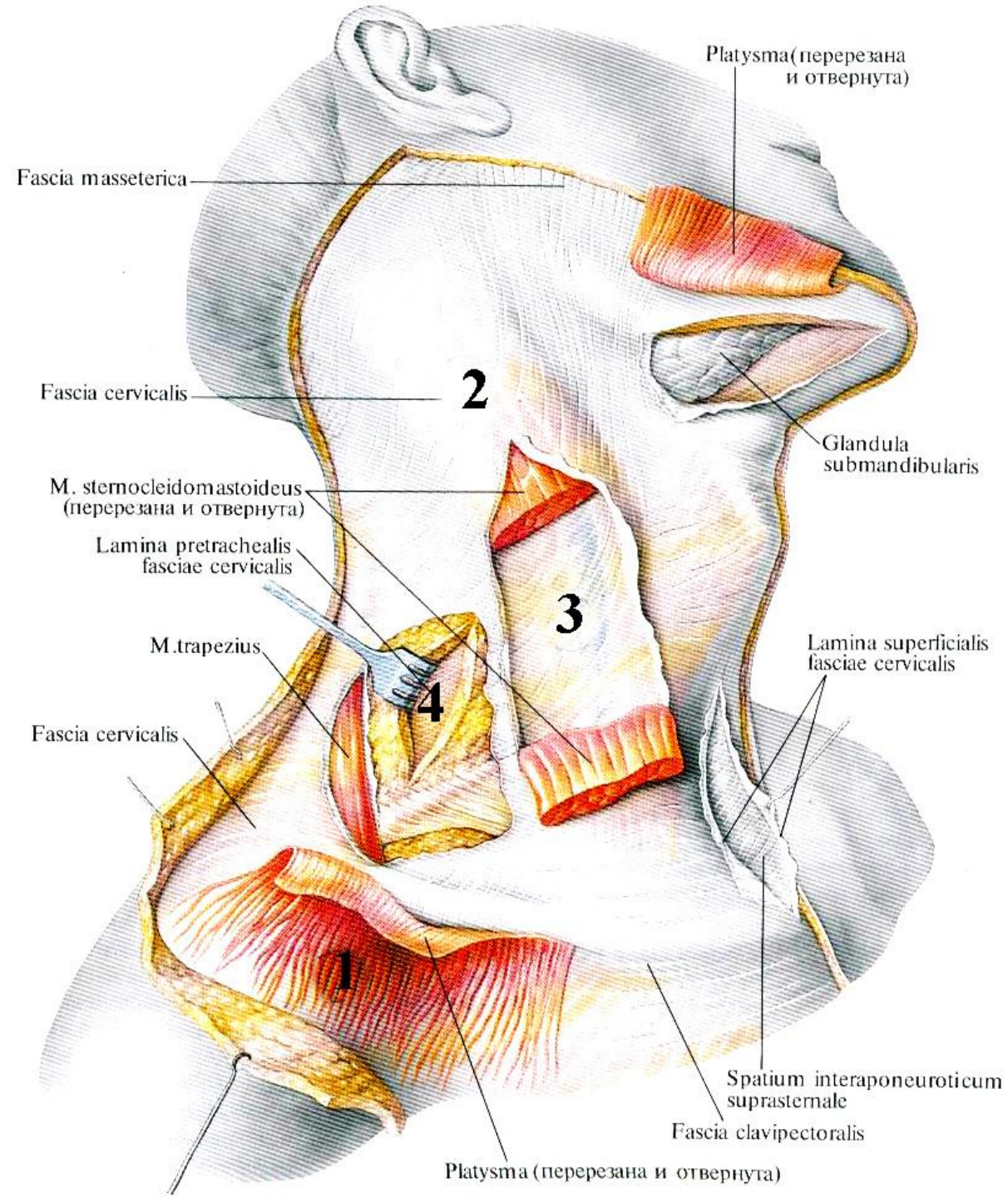
**V** - *fascia prevertebralis*





## Interfascial spaces of the neck

Fascia	Space	Note
<i>Fascia cervicalis superficialis</i>		Covers m. platysma
<i>Fascia coli propria</i>		Covers m. sternocleidomastoideus and m. trapezius Gives septum to transverse processes of the cervical vertebrae
	Spatium supraclaviculare	It is filled with fatty tissue
<i>Aponeurosis omoclavicularis</i>		Covers infrahyoid muscles
	Spatium previscerale	Communicates with anterior mediastinum
<i>Fascia endocervicalis</i>		Surrounds viscera and neurovascular packet of the neck Has two laminae: parietal and visceral
	Spatium retroviscerale	Communicates with posterior mediastinum
<i>Prevertebralis</i>		Covers deep muscles of the neck





***According to the Parisian anatomical nomenclature***, all the fasciae of the neck are united under the name of *fascia cervicalis*, which is divided into 3 lamellae:

1. *lamina superficialis*, corresponds to the superficial cervical fascia (after Shevcunenko).
2. *lamina pretrachealis*, covers the salivary glands, muscles, and other anterior tracheal structures. It corresponds to fascias II and III after Shevchenko.
3. *lamina prevertebralis*, corresponds to fascia V after Shevcunenko.

The fourth fascia, the endocervical fascia, is not described in the NAP.

The cervical fascia is firmly connected to the walls of the veins through the connective tissue that prevents the veins from collapsing in case of their trauma.

**The temporomandibular joint (TMJ)** is a synovial joint that is made up of the articulating surface of the temporal bone - *Mandibular fossa*, and the *head of mandible*.

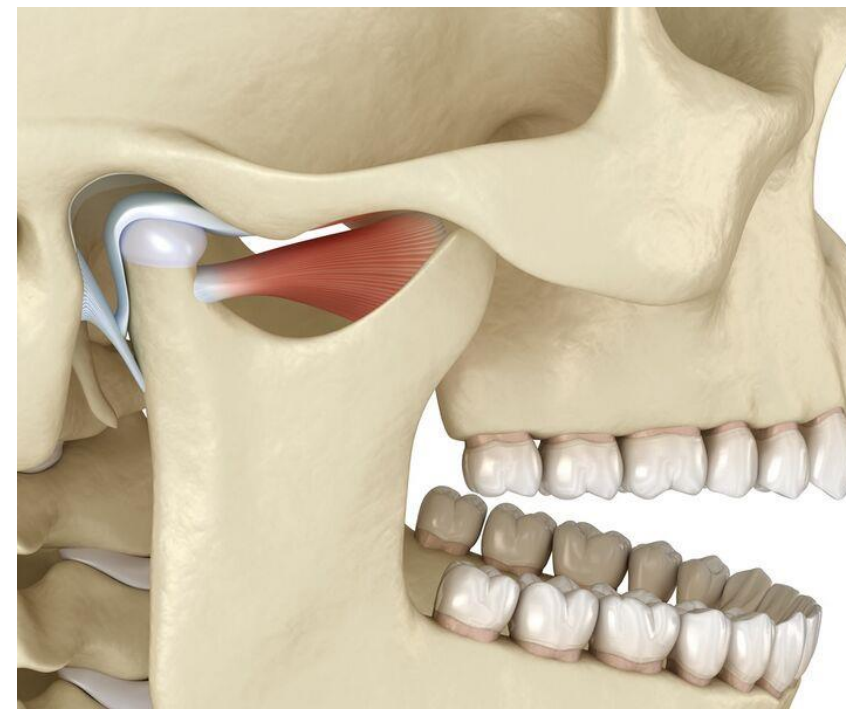
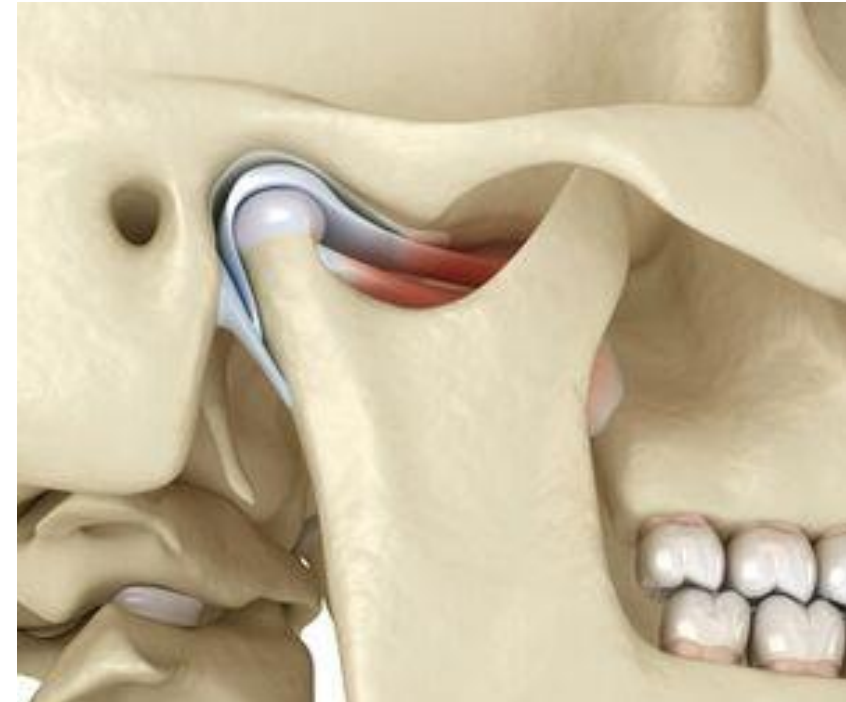
Dysfunction of the TMJ is considered the most common cause of orofacial pain.

The joint itself is also associated with a number of important functions including *mastication, eating, speaking, breathing*.

The right and left TMJ function simultaneously and form the single *combined joint*. It is a condylar joint that allows rotation and translation in the sagittal plane.

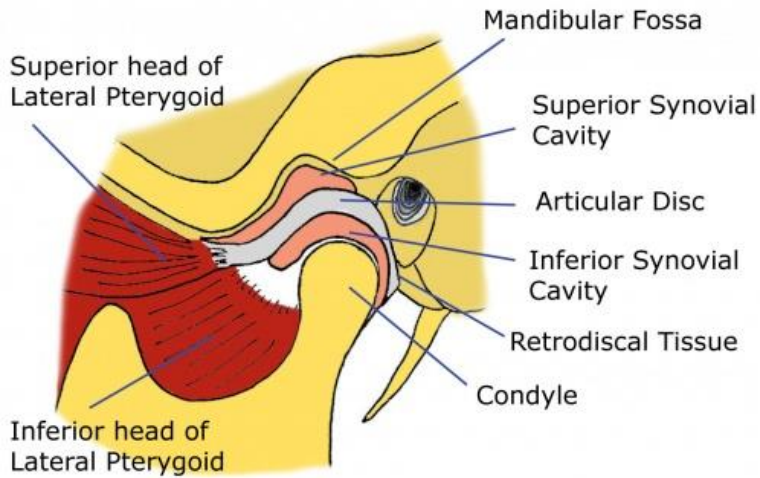
TMJ is a *complex joint*. Its disc has two articular surfaces:  
*Superior surface of the articular disc* - faces the temporal fossa  
*Inferior surface of the articular disc* - is in contact with the mandible condyle.

The mandible is suspended, supported by the muscles, ligaments and the articular capsule.

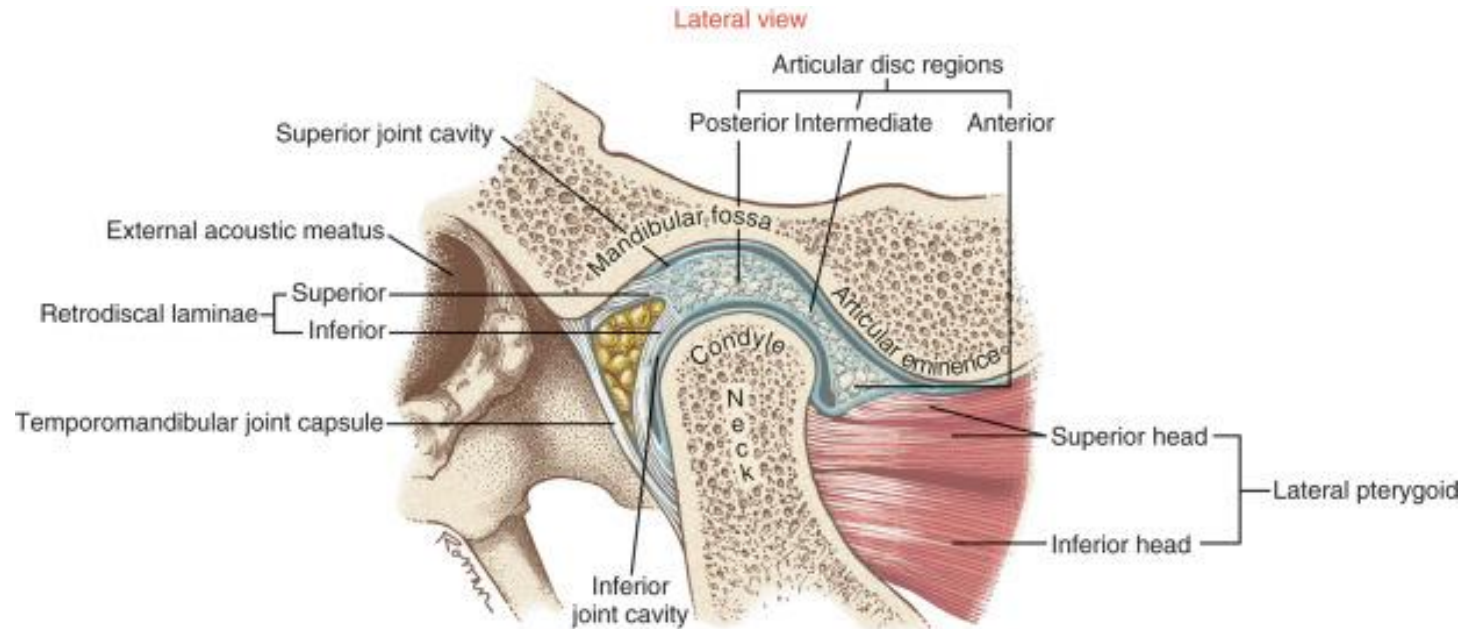
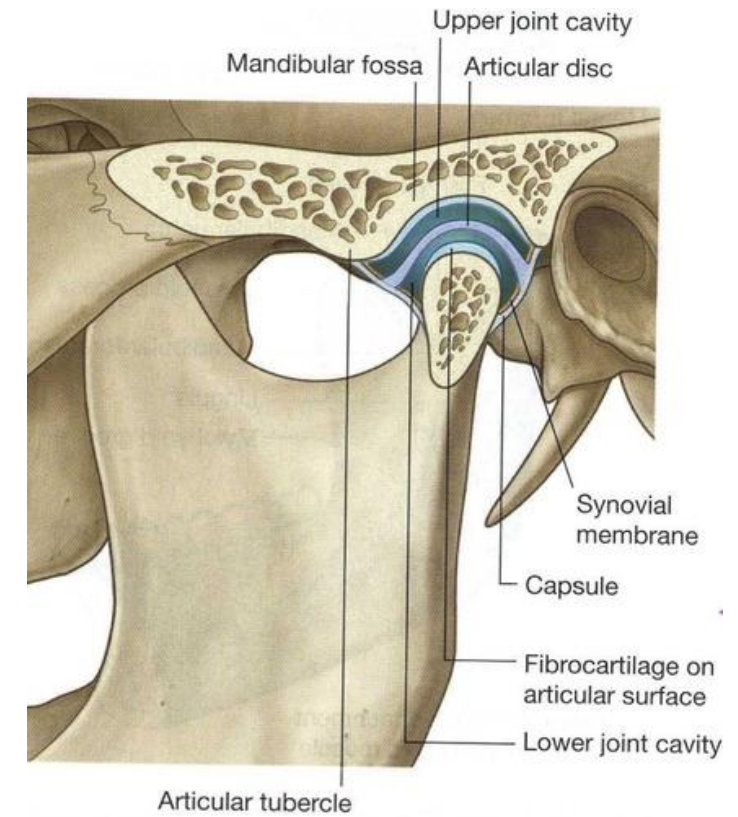
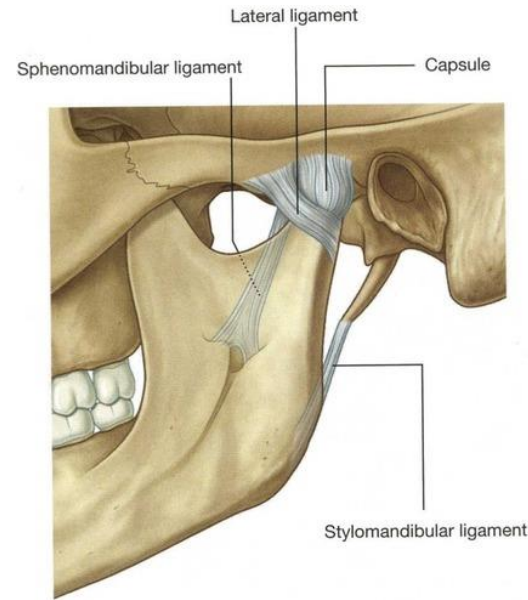




# Structure of the TMJ



**The Temporomandibular Joint**



**The maintenance of mandible position** depends on mandible reflexes and the action of gravity. It is also affected by an individual's position / posture and specific variations which allow functional jaw movements to occur.

When the mandible is at rest, the mouth is slightly open, so that the teeth are not in contact.

This resting position is called *physiological non-occlusion*:

- In this position, the lips close the oral cavity without pressure, - the teeth remain separated by a distance of around 2 mm, - this distance is measured between the superior and inferior incisors

- *The resting position is maintained by various reflexes*, as well as *active* and *passive mechanisms*.

*Passive mechanisms:*

- Passive tension of the *elevators of the mandible* and connective tissue

*Active mechanisms:*

- Peripheral afferents including:
  - Muscle and articular proprioceptors
  - Periodontal mechanoreceptors and mechanoreceptors of the mucosa (i.e. gums, lips, tongue, palatal area)
- Central control from the:
  - Cortico-visual system
  - Limbic system
  - Fusimotor-extrapyramidal system

The limbic and visual systems are not only actively involved in maintaining the position of the jaw, they also have an impact on the tone of the masticatory muscles.



# Mastication

Mastication marks the beginning of the digestive process. It is an essential step in the oral processing of food before deglutition (i.e. swallowing).

The process of mastication is controlled by the central pattern generator in the brainstem and other phases of swallowing. It occurs in the mouth with the help of the mandible and associated muscles.

For mastication to occur, a range of information from sensory receptors (smell, taste and touch) is required, as well as information from the tongue, palate, lips, masseter muscles and salivary glands.

A change in one or more of these elements can cause issues with mastication.

*Huckabee and Daniels divide mastication into four phases:*

***I. Pre-oral (anticipatory) phase:*** This phase “is the interaction of pre-oral motor, cognitive, psychosocial and somataesthetic elements which begin the swallowing process”

- Information about the food, which is obtained via the optic and olfactory nerves, is interpreted in the central nervous system and a swallowing plan is developed
- This information includes smell and specific routines that show the feeding act is about to begin
- The orofacial structures start to prepare to receive food - e.g. the taste buds begin generating saliva.

***II. Oral phase:*** The oral phase starts when food enters the mouth<sup>[8]</sup>

- The lips close and the tongue forms a seal to prevent the food (which is being transformed into a bolus) from falling out of the mouth
- The bolus is formed through the movement of the lips, jaw, cheeks and tongue<sup>[3]</sup> - i.e. the food is cut, split and ground up
  - Saliva changes the viscosity of the bolus<sup>[8]</sup>
- Once the bolus is safe to be swallowed, it is pushed backwards by the tongue to the pharynx

The oral phase can be affected by pathology of the TMJ. For some patients with TMJ dysfunction, it will be difficult for them to open their mouths. This will cause issues with mastication and, therefore, the overall digestive process.

### ***III. Pharyngeal phase*** (see Figure 2):

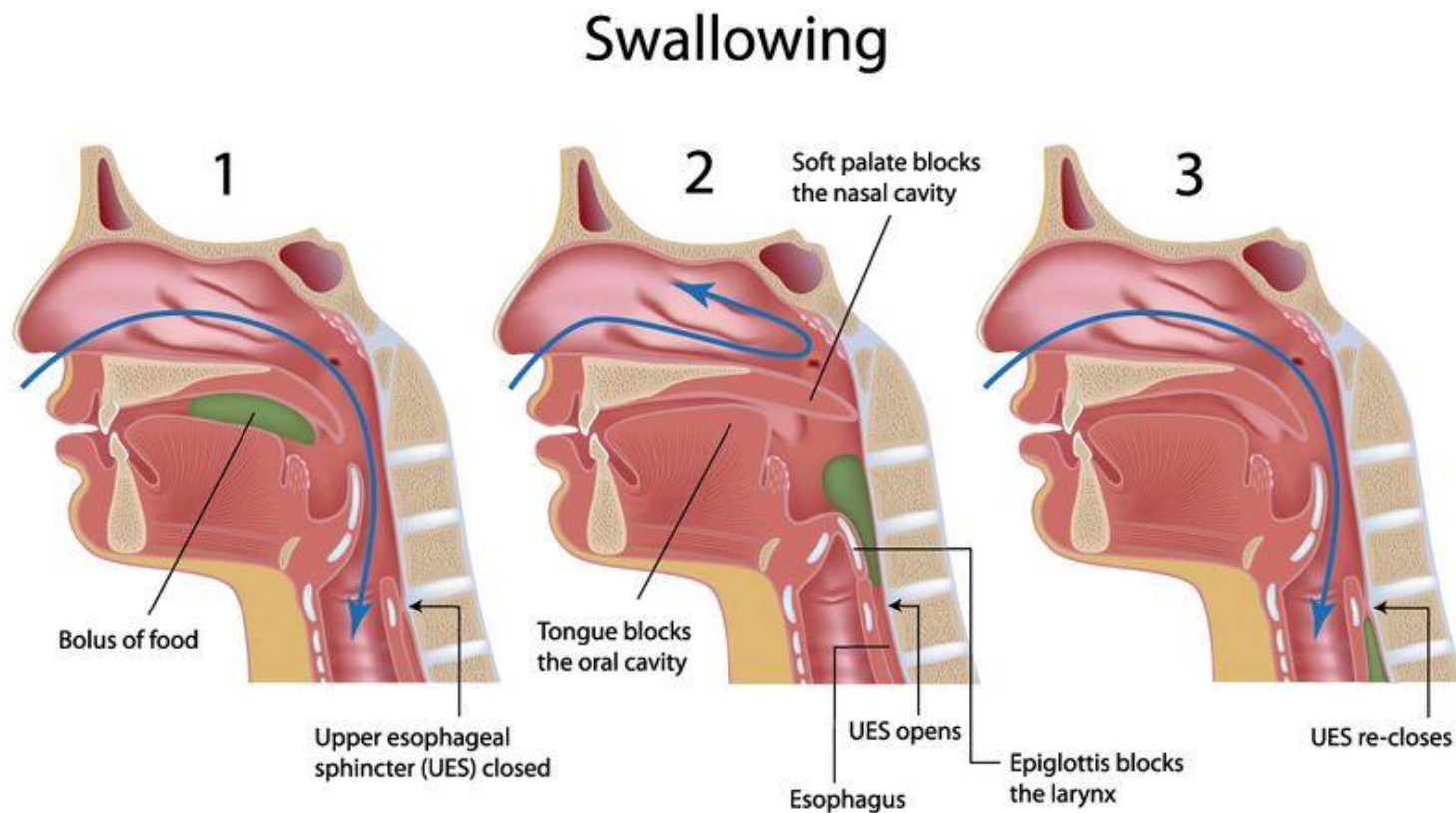
The pharyngeal phase refers to the movement of the bolus through the pharynx  
During this phase, the airway is also protected from the bolus

The bolus moves from the base of the tongue to the wall of the posterior pharynx

### ***IV. Oesophageal phase:***

This phase begins once the bolus passes through the upper oesophageal sphincter

Peristalsis pushes the bolus down to the stomach via the lower oesophageal sphincter





**Jaw opening** is divided into the following phases:

### 1. Pure rotation of the condyles on their axis

1. Most of this **movement happens in the infra-meniscal space of the condylo-discal complex**
2. This is facilitated by the **lateral pterygoid muscle** (inferior part), **mylohyoid**, **geniohyoid** and **digastric muscles**

### 2. Translation of the condylo-disc complex forwards

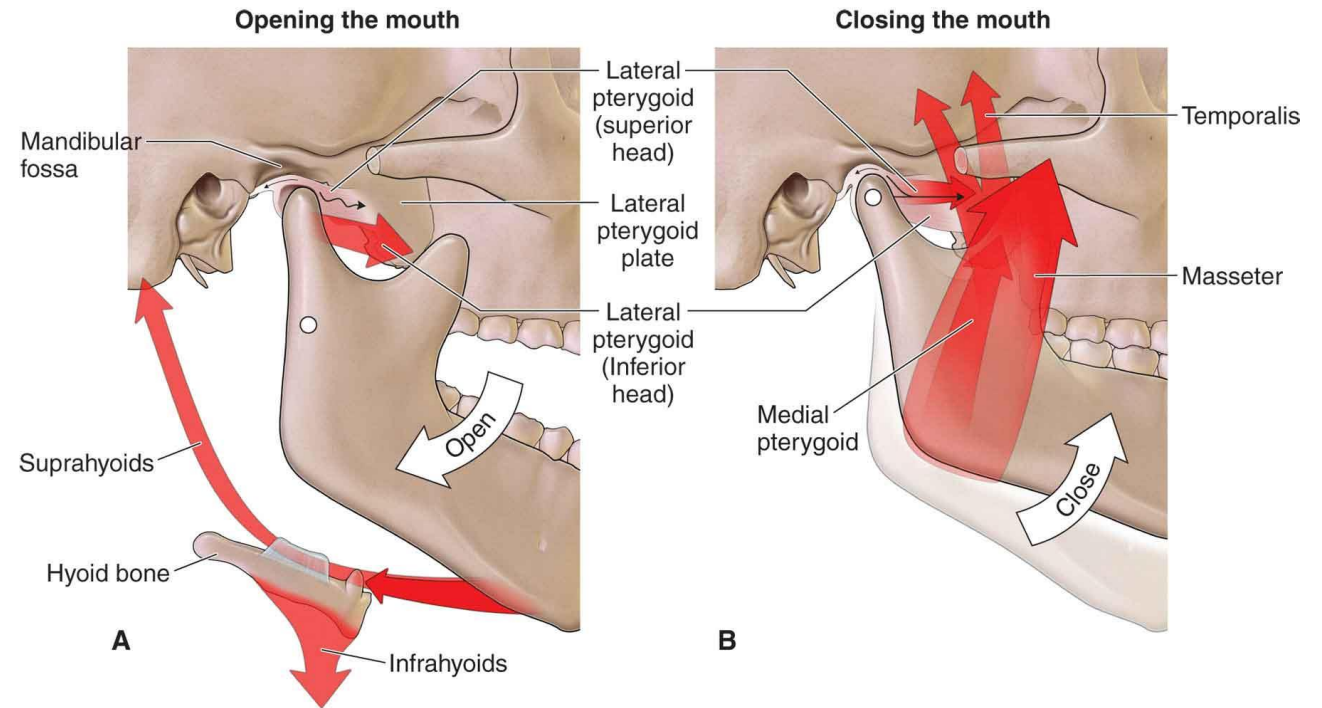
1. This movement happens mainly **in the superior compartment of the disc-temporal complex**
  1. The jaw opens around 40 to 50 mm
  2. **The temporomandibular ligament (lateral)** helps to maintain stability to prevent the jaw dislocating forwards
  3. **The lateral pterygoid muscle** is involved in this action

NB: The lateral pterygoid has opposite functions - while its superior fascicle relaxes during opening, stabilising the anterior displacement of the disc, the inferior fascicle contracts and allows movement of the condyle

### 3. The ligaments create stability at the end of the movement

1. The disc and condyles move medially and the collateral lateral ligaments on each side of the TMJ tighten
2. At a certain point, the condylo-discal complex is unable to move any further due to the tension in the ligaments and the joint capsule - at this point, it rotates on its own axis

## Movements of the TMJ



It takes place **in the lower compartment** of the joint, between the articular disc and articular head:

- 1) **the first phase** – the mandible moves downward, its head first glides together with the disc;
- 2) **the second phase** – the mandibular head rotates on the transverse axis passing through both heads.

To open the mouth wide, the heads glide forward and downward with the disc onto the articular tubercles

**Jaw closure** is associated with cervical extension. The elevator muscles of the jaw work against gravity. Closing of the jaw is divided into three phases:

**1. Condylar rotation in the inferior posterior meniscus area** - this is similar to jaw opening, but in the opposite direction

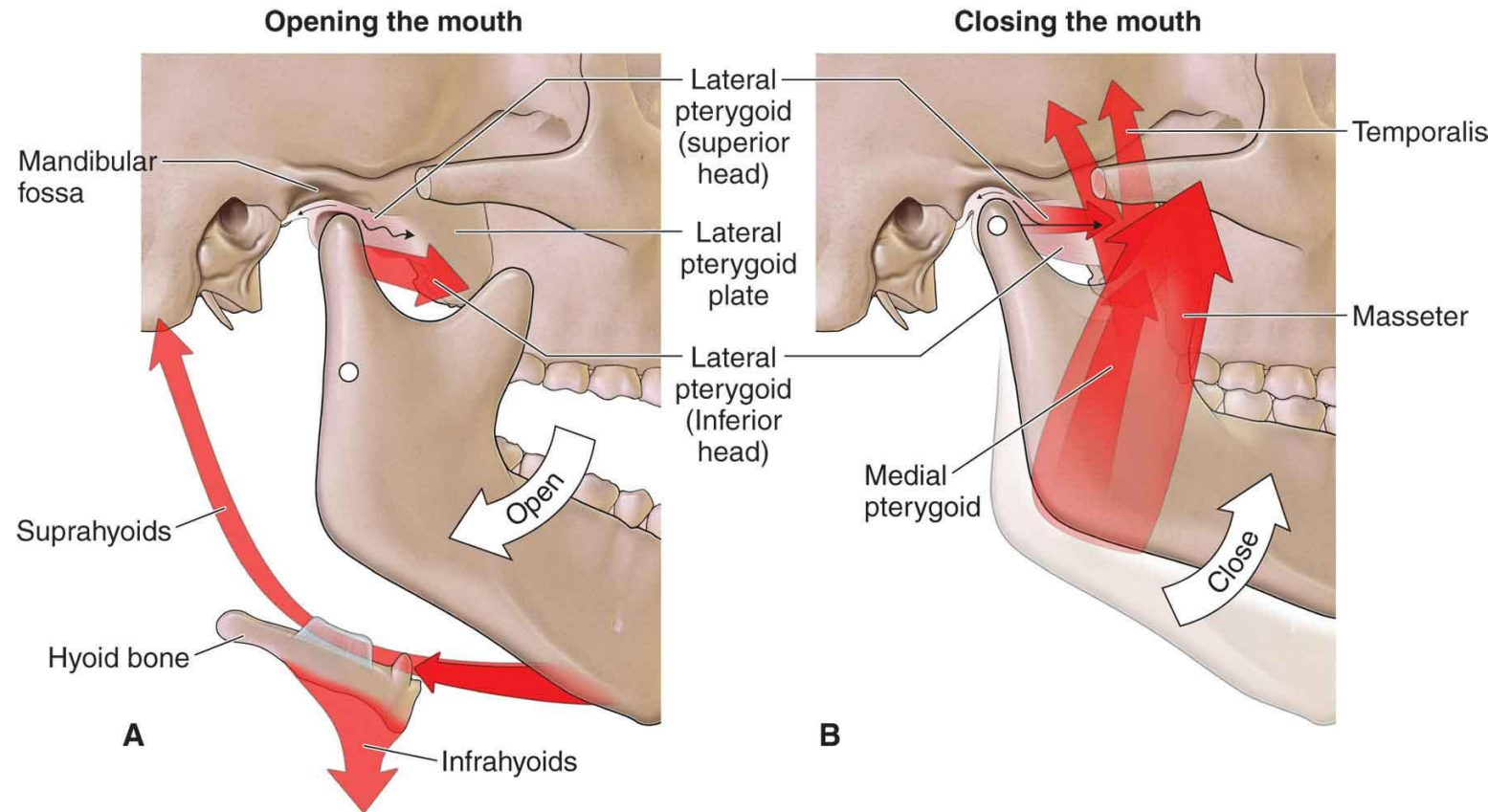
1. This phase starts without any specific muscle action - rather it occurs due to the relaxation of the muscles involved in opening and the release of tension within the ligaments

**2. Translation of the superior condylo-disc meniscal area**

The complex made by the condyle and disc moves to the most posterior and superior part of the mandibular fossa

3. When the condyle has reached this point, there is a rotation in the posterior direction of the condyle in the intra-meniscal space - this ends with occlusal contact (NB occlusion refers to the relationship between the upper and lower teeth when the jaw closes)

In normal conditions, a slight lateral displacement of condyles can be observed in a sagittal view.



<https://musculoskeletalkey.com/the-temporomandibular-joint-3/>

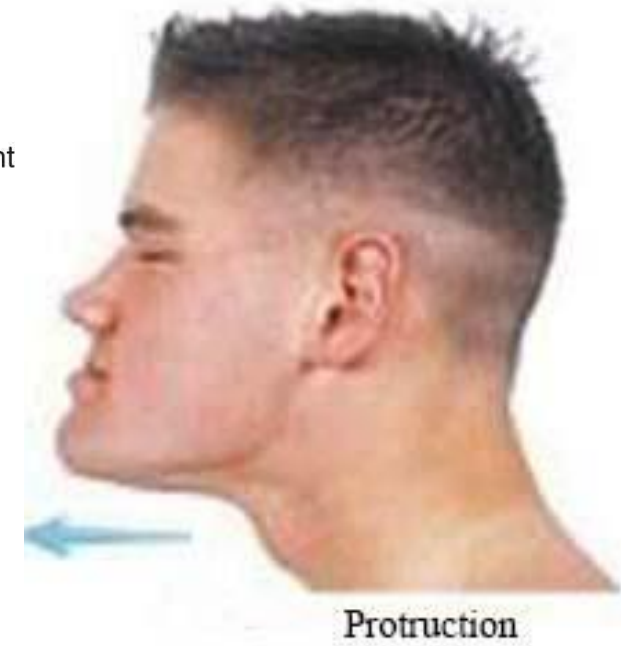
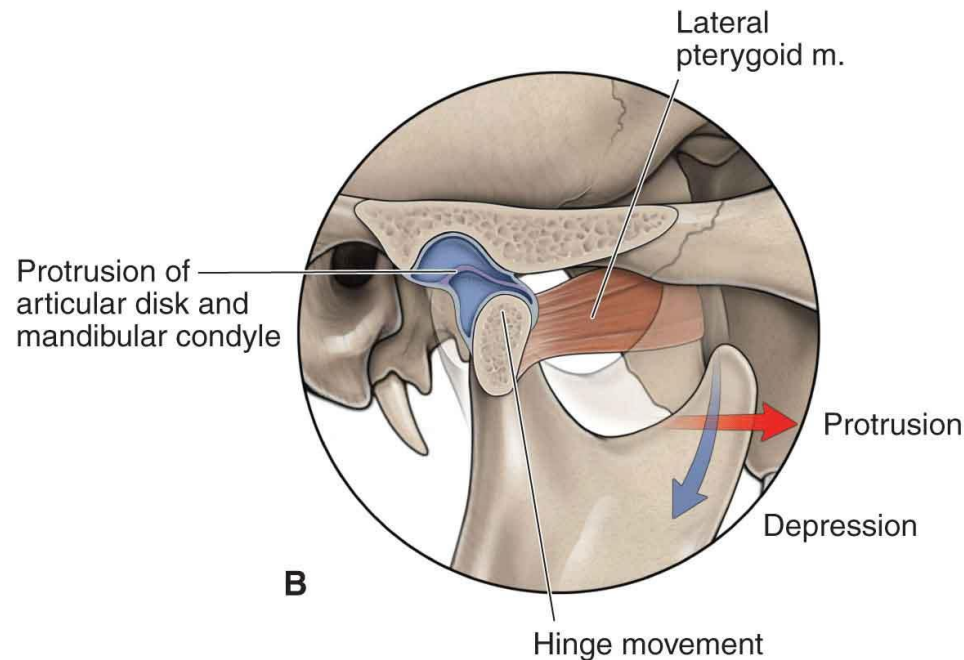
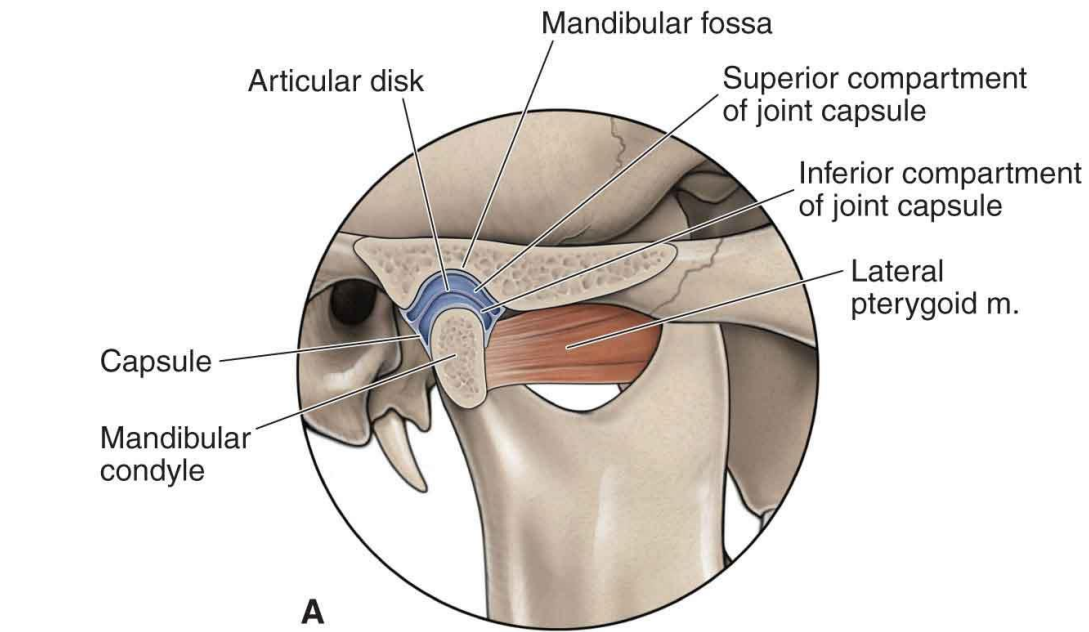


# Forward & backward

It occurs in the upper compartment of the joint:

**The first phase** – the head of mandible glides forward with the disc to the articular tubercle.

**The second phase** – the head of mandible glides on the tubercle and at the same time rotates about the transverse axis.



**Protraction** occurs when the jaw moves forwards:

The jaw is slightly opened to avoid any interference from the teeth (i.e. occlusion) - this opening causes anterior rotation in the sagittal plane

The condyle translates forwards and downwards - this is due to the disposition of the condylar fossa, which makes the condyle move down.

This movement occurs due to the coordinated action of both fascicles of the pterygoid muscles.

As jaw opening does not progress in protraction, the jaw is stabilised by the contraction of the temporalis muscles.

**Retraction** is the reverse of protraction:

The condyle translates backwards and upwards inside the articular fossa - this movement is activated by the temporalis muscle and the posterior belly of the digastric muscle

Finally there is a posterior rotation of the condyle at the intra-meniscal level (i.e. the condylo-disc complex)



Protruccion



Retruccion



# Lateral movements

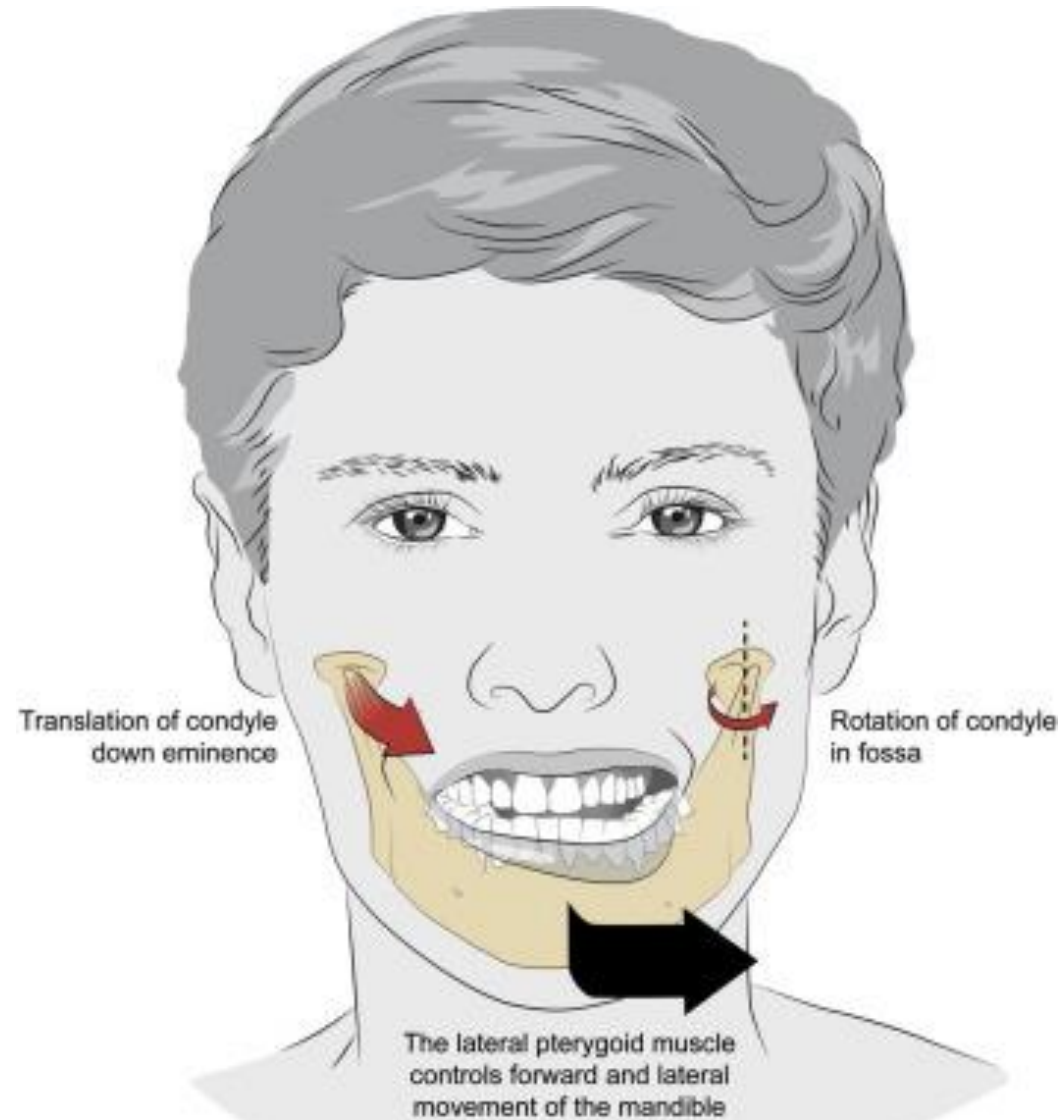
The condyles work together to achieve lateral movements of the jaw.

When assessing lateral movement, it is necessary to differentiate one condyle from the other:

- The "working side" is the side that moves laterally when taking the chin as a reference
- The "non-working side" is the side that moves towards the midline

In the working side, there is a *rotation of the condyle over its own vertical axis*, and a *transversal displacement* of about 0.9 mm. This movement is caused by the *deep masseter muscle* and the *medial and posterior fascicles of the temporalis muscle*.

In the non working side, the *condyle moves to the midline, going forwards and moving closer to the midline*. It also moves *transversally around 0.4 mm*. In this case, the muscles activated are the *lateral pterygoid* (inferior fascicle) and *the medial pterygoid*.



# Muscles around the TMJ

Muscles of **mastication** (innervated by CN V trigeminal nerve)

## **Closers:**

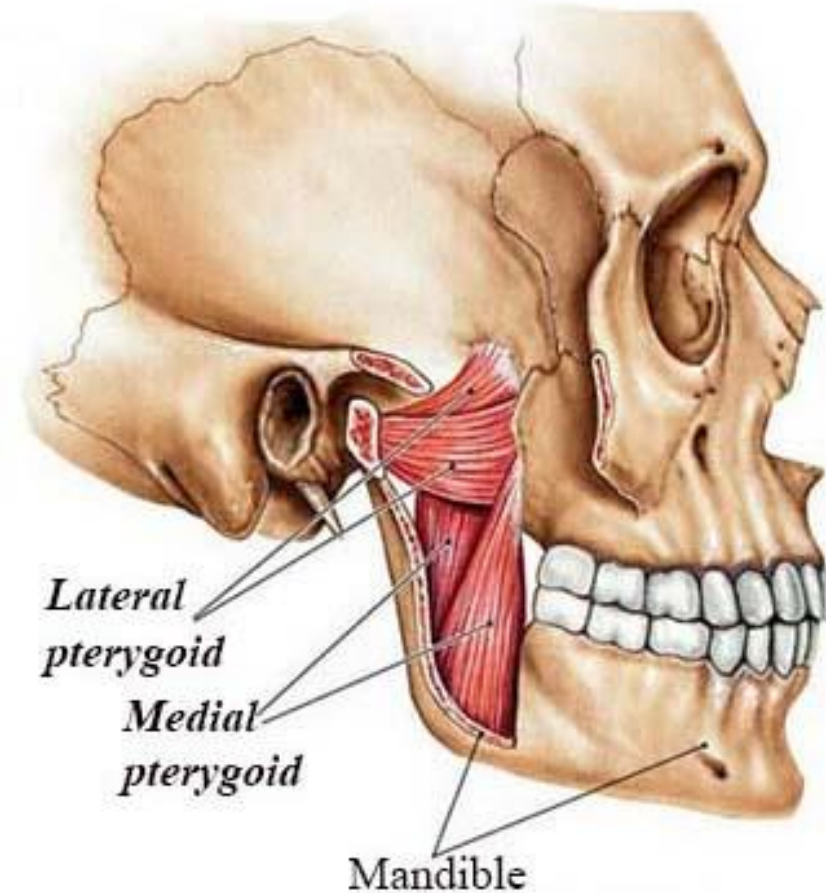
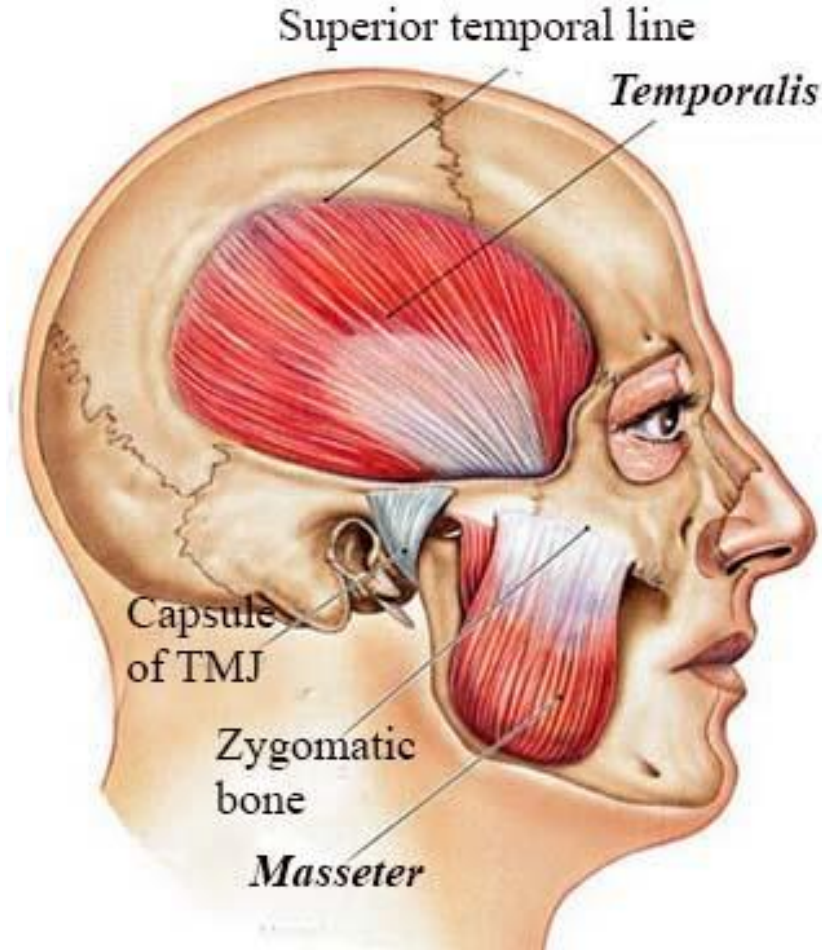
**Temporalis** – elevates mandible  
**Masseter** – elevates and protrudes mandible  
**Medial pterygoid** – elevates and protrudes mandible.

## **Openers:**

**Lateral pterygoid** – acting bilaterally to protrude and depress mandible, acting unilaterally to laterally deviate mandible.

**Accessory muscles** consisting of the suprahyoid and infrahyoid muscles (don't provide much stability around the TMJ).

**Geniohyoid, mylohyoid, and digastric** – assist with depression of the mandible and elevate hyoid bone.





# PHYSICAL EXAMINATION OF TMJ

## Occlusal position

Observation of posture of the jaw, head, neck and thorax. (You will read further in the treatment blog that posture plays a big role in jaw movement retraining.)

## Mandibular range of movement:

Unassisted **opening** without pain - should be **> 5cm** as the mean or **> 3 fingers** width. **Limited opening < 25mm between upper and lower jaws.**

**Lateral excursions** - watch the movement of the bottom molars which should move **~1cm** to each side.

**Protrusion** - if the lower teeth move forward of the top teeth **2-3cm**, or 1-2 fingers, then the movement is considered functional.

**Measuring** of the range of movements can be done in many different ways using tools: **a)** visual observation for lateral deviation and protrusion, and **b)** the number of fingers between top and bottom jaw for opening.

## Palpation

**Internally:** Medial pterygoid, internal TMJ and gums.

**Externally:** Masseter, temporalis, lateral pterygoid, **TMJ, C1 t.p, and SCM** proximal muscle belly.

**Isometric strength tests** of mandibular elevation, depression, lateral deviation and protrusion.