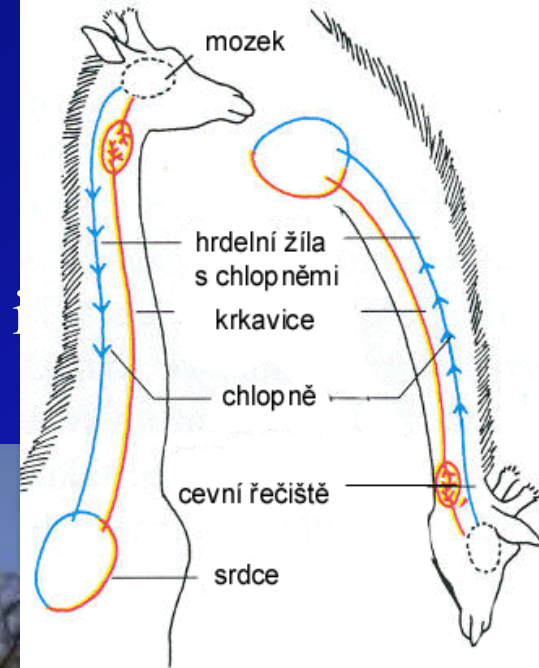
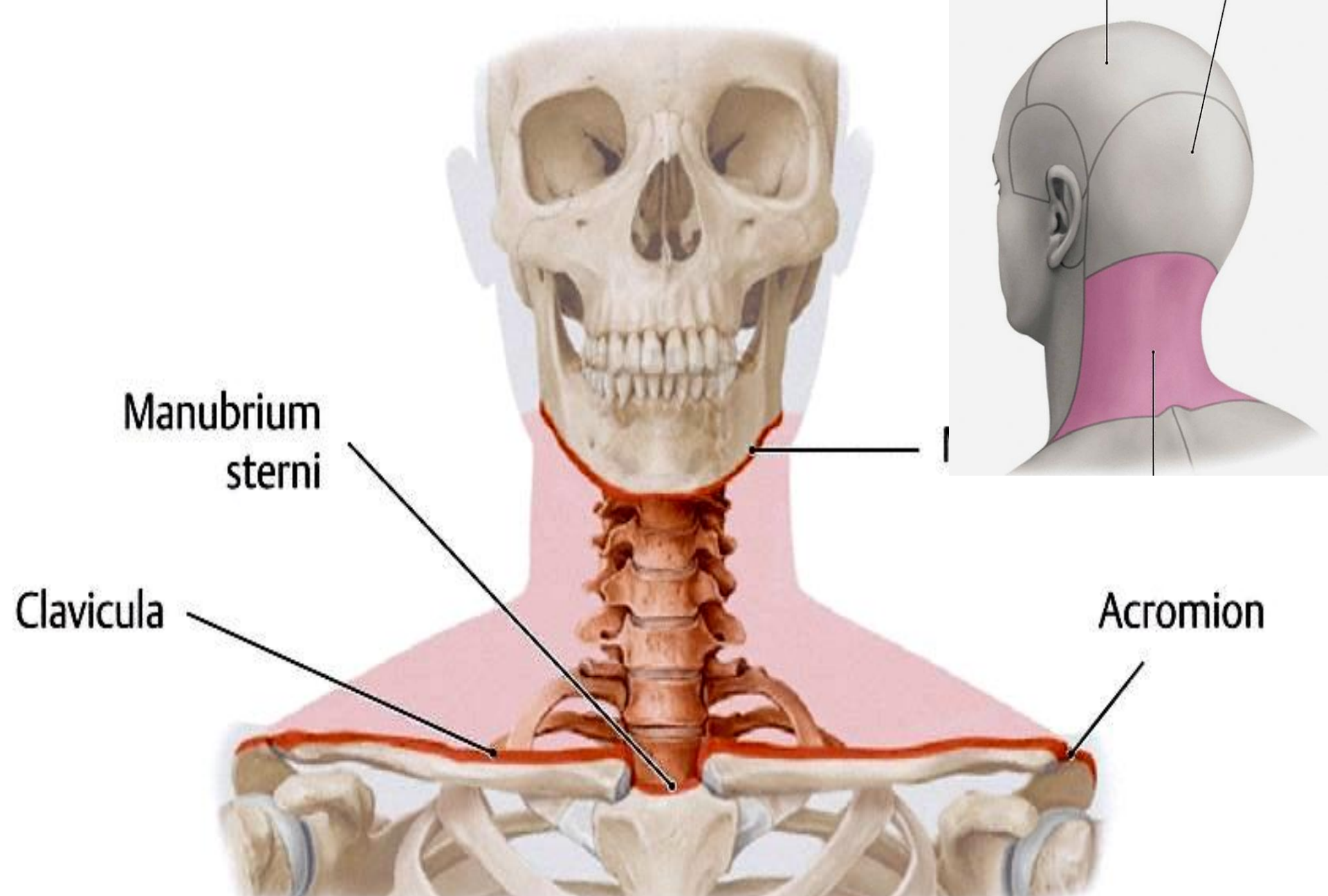


NECK MUSCLES, THEIR INNERVATION,  
OSTEOFASCIAL COMPARTMENTS; MAIN  
TOPOGRAPHIC REGIONS IN THE NECK.  
VASCULAR and NERVOUS STEMS  
the NECK.



Ivo Klepáček

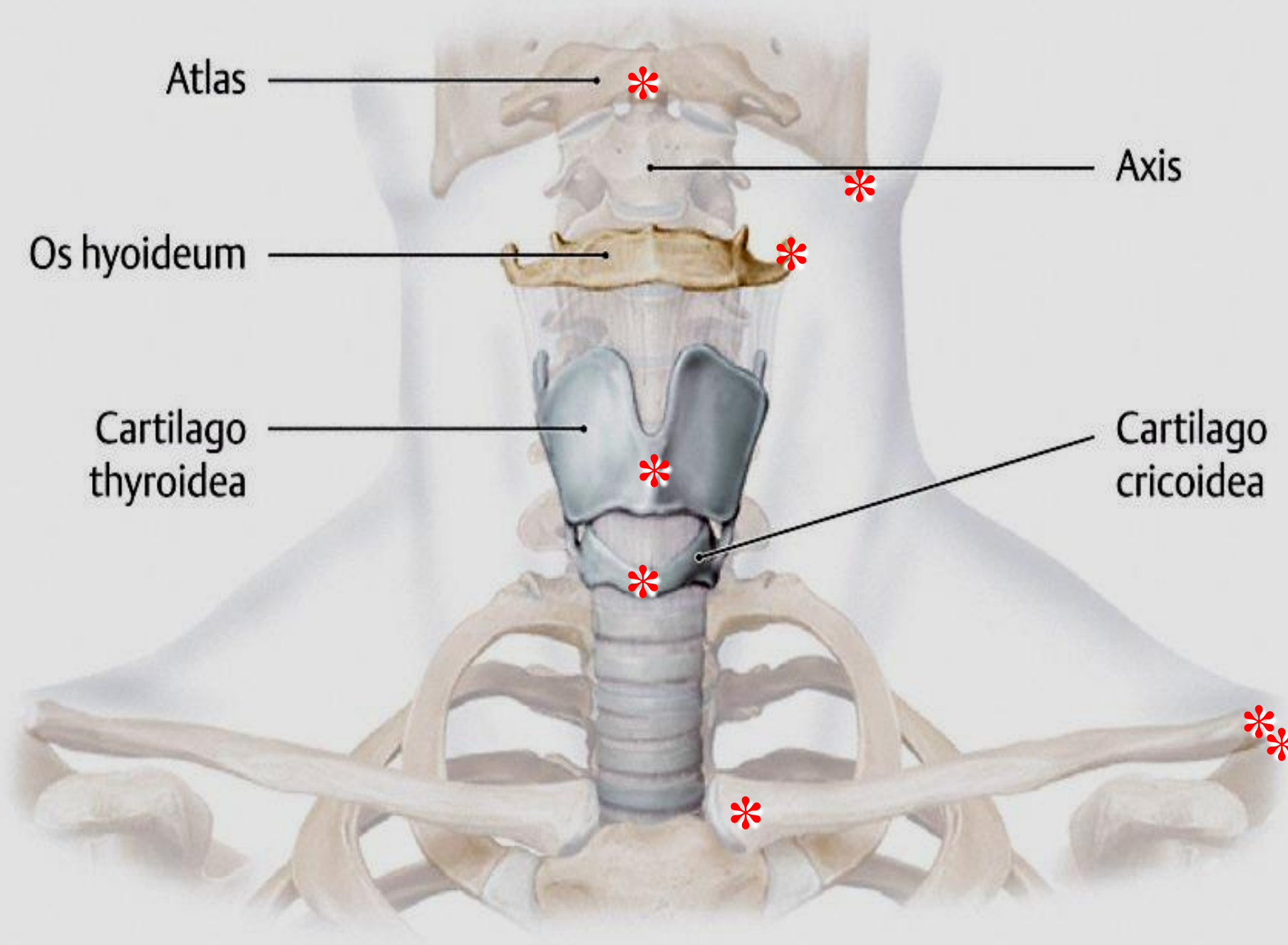


Manubrium  
sterni

Clavicula

Acromion

Vymezení oblasti krku Extent of the neck region



Atlas

Axis

Os hyoideum

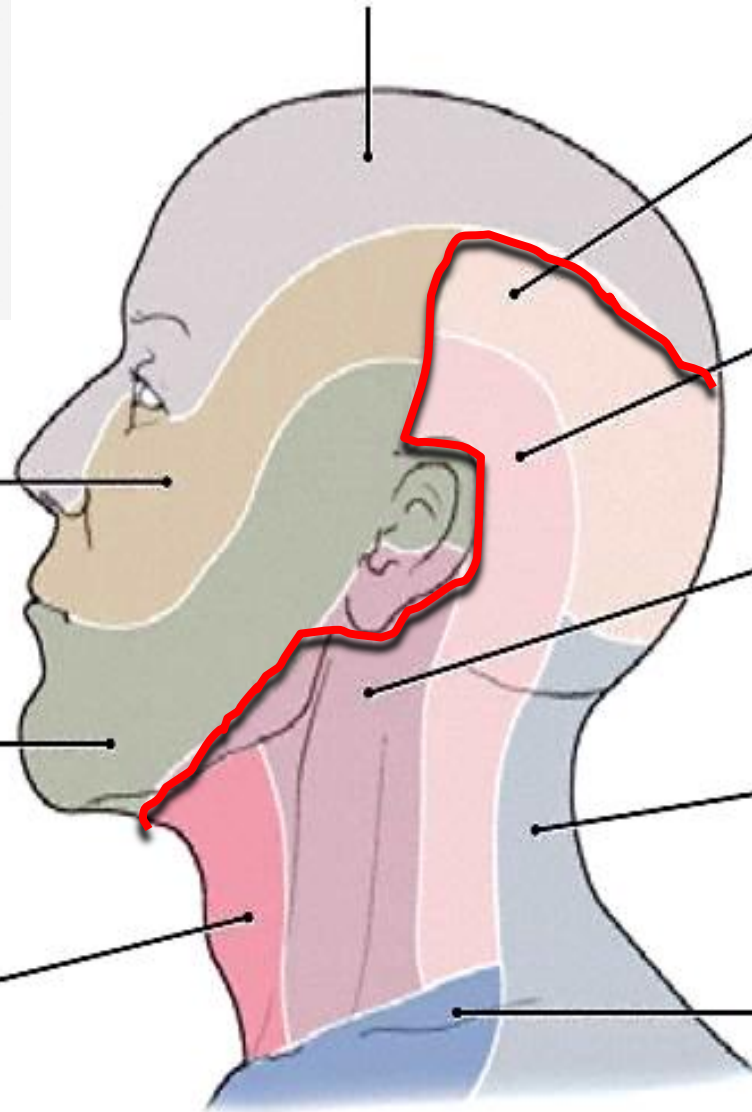
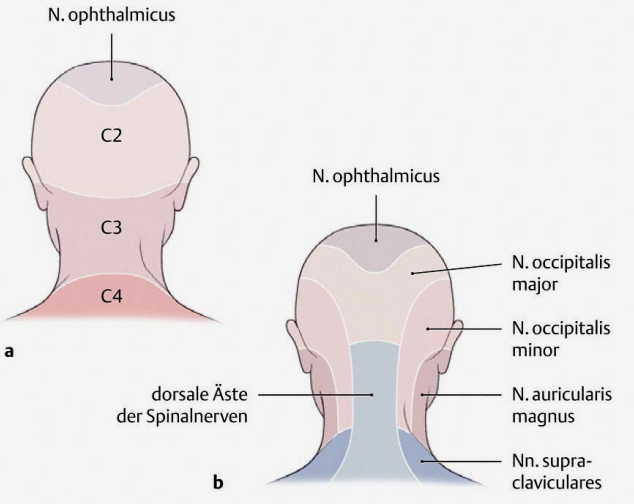
Cartilago thyroidea

Cartilago cricoidea



# N. trigeminus, Sensitive areas V3., plexus cervicalis

## N. ophthalmicus (V<sub>1</sub>)



N. trigeminus,  
N. maxillaris (V<sub>2</sub>)

N. occipitalis  
major (C2)

N. occipitalis  
minor (C3)

N. auricularis  
magnus (C3)

Rr. dorsales  
nn. spinalium

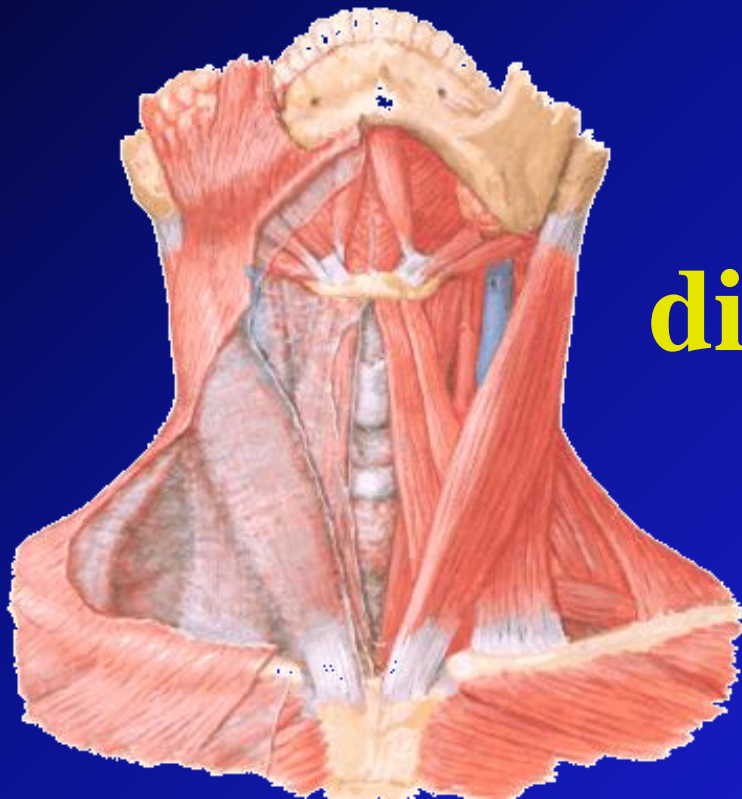
Nn. supra-  
claviculares

N. trigeminus,  
N. mandibularis (V<sub>3</sub>)

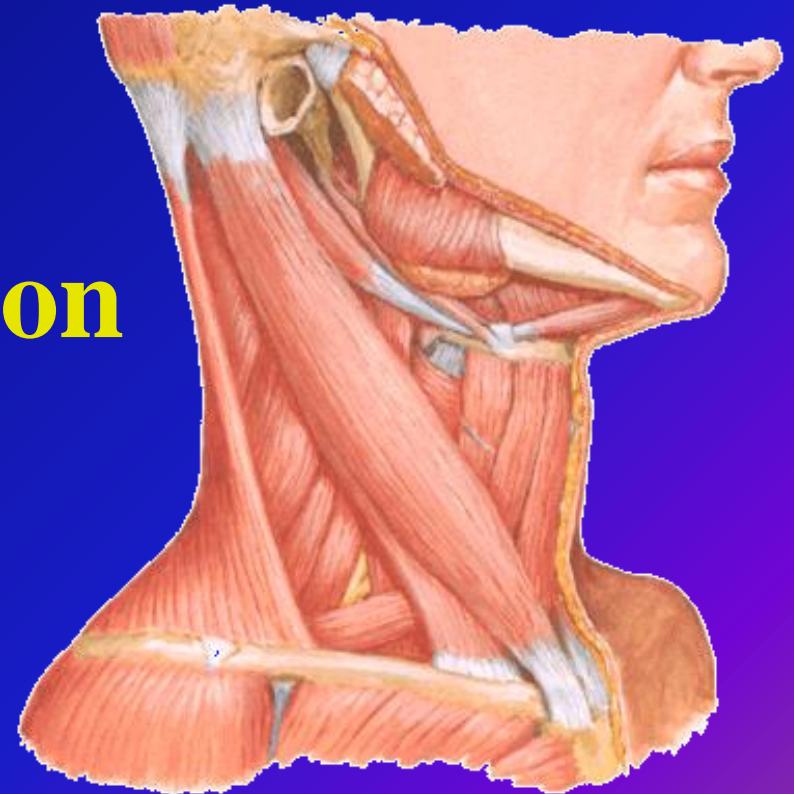
N. transversus  
colli (C3)

# Svaly krku musculi colli neck muscles

1. platysma
2. Sternocleidomastoid m. STCLM
3. Suprahyoid muscles
4. Infrahyoid muscles
5. Scaleni muscles
6. Deep neck muscles



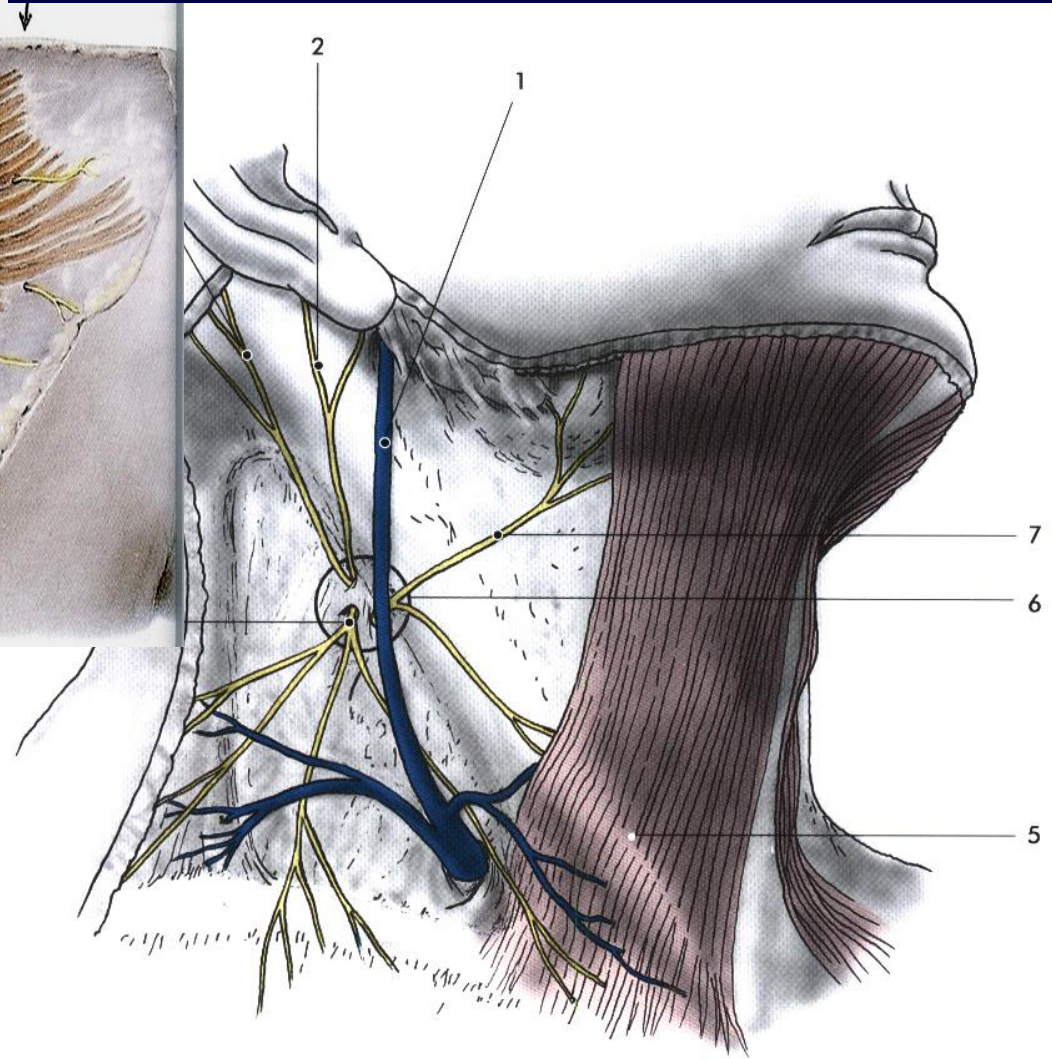
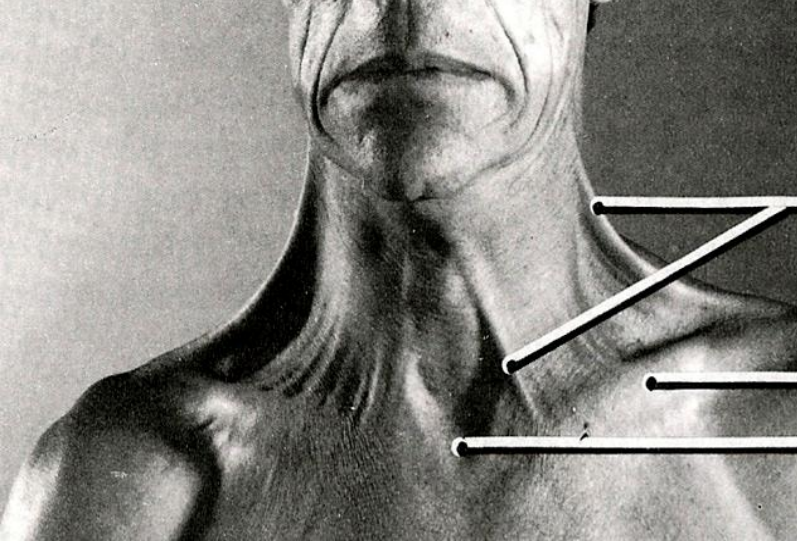
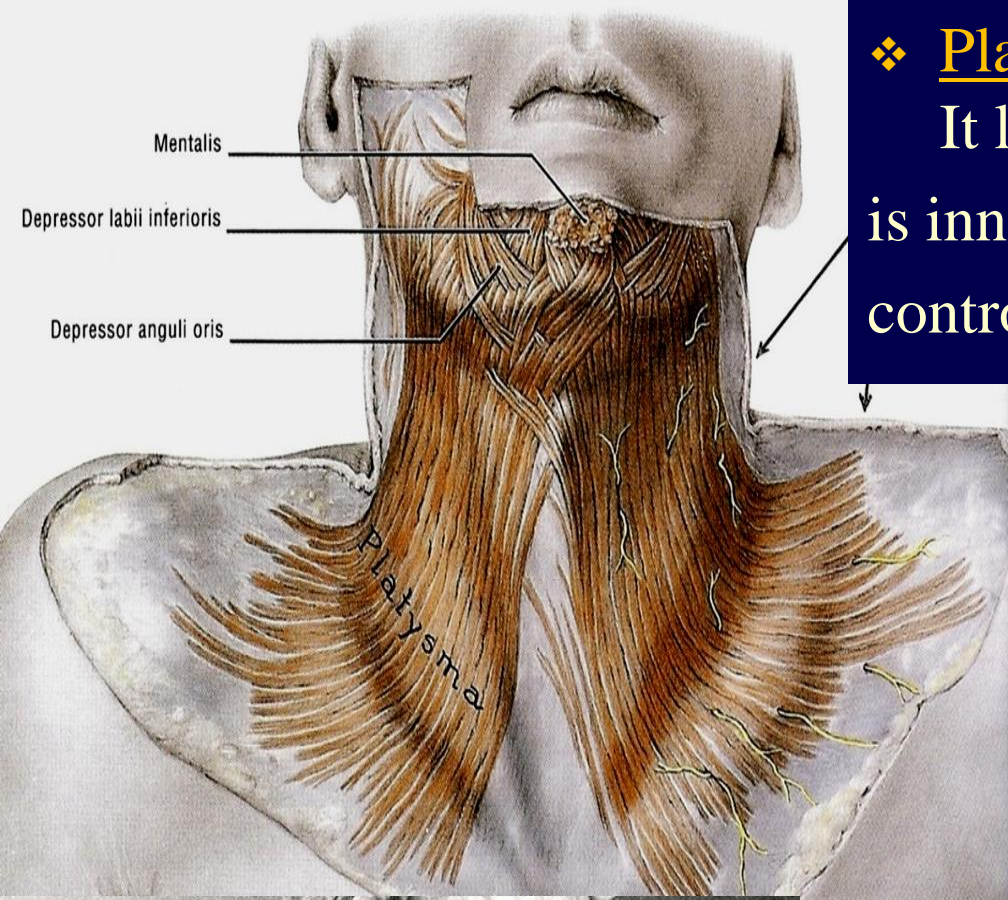
**division**





❖ Platysma - subcutaneous m.

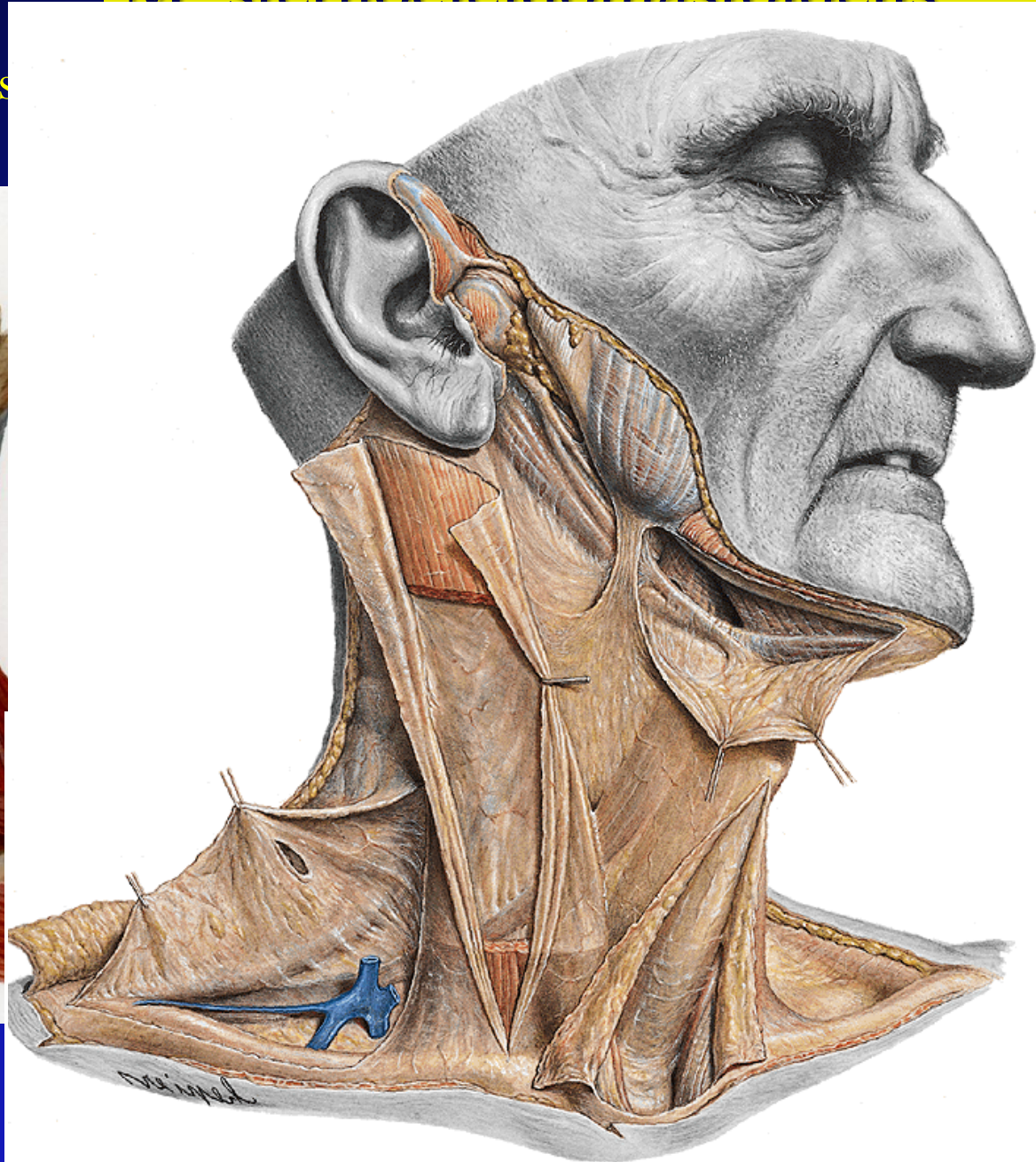
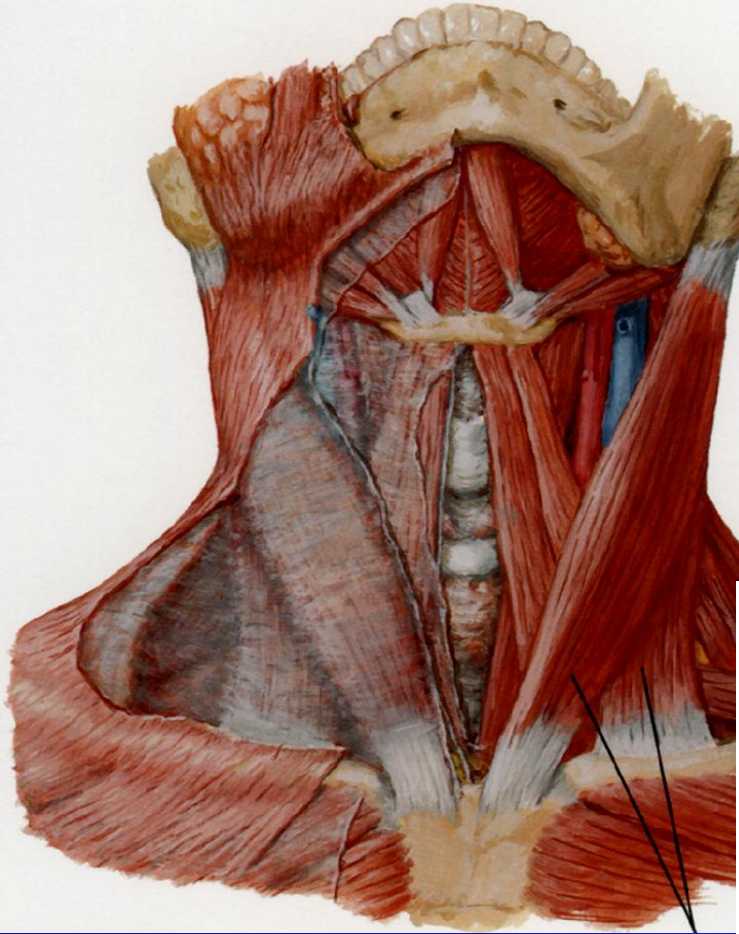
It lies on investing neck fascia  
is innervated from r. colli nervi facialis  
controls tension of neck skin



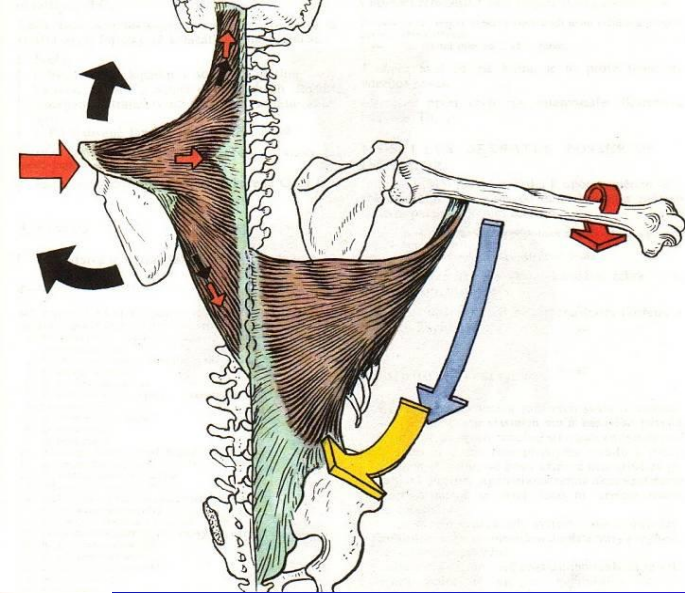
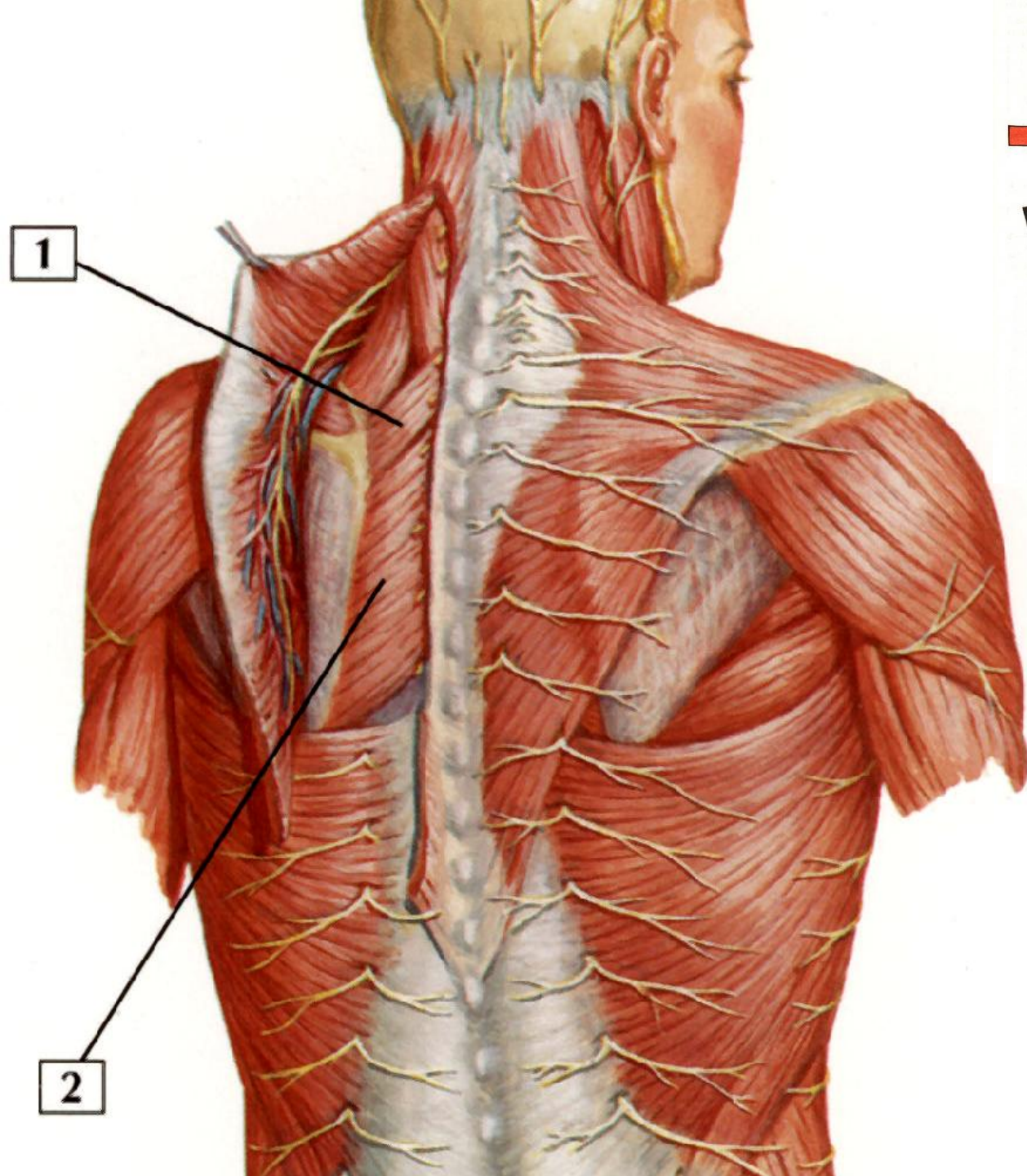


proc. mastoideus  
manubrium sterni, clavicula  
n.accessorius (XI) + branches  
from cervical plexus

## M sternocleidomastoideus



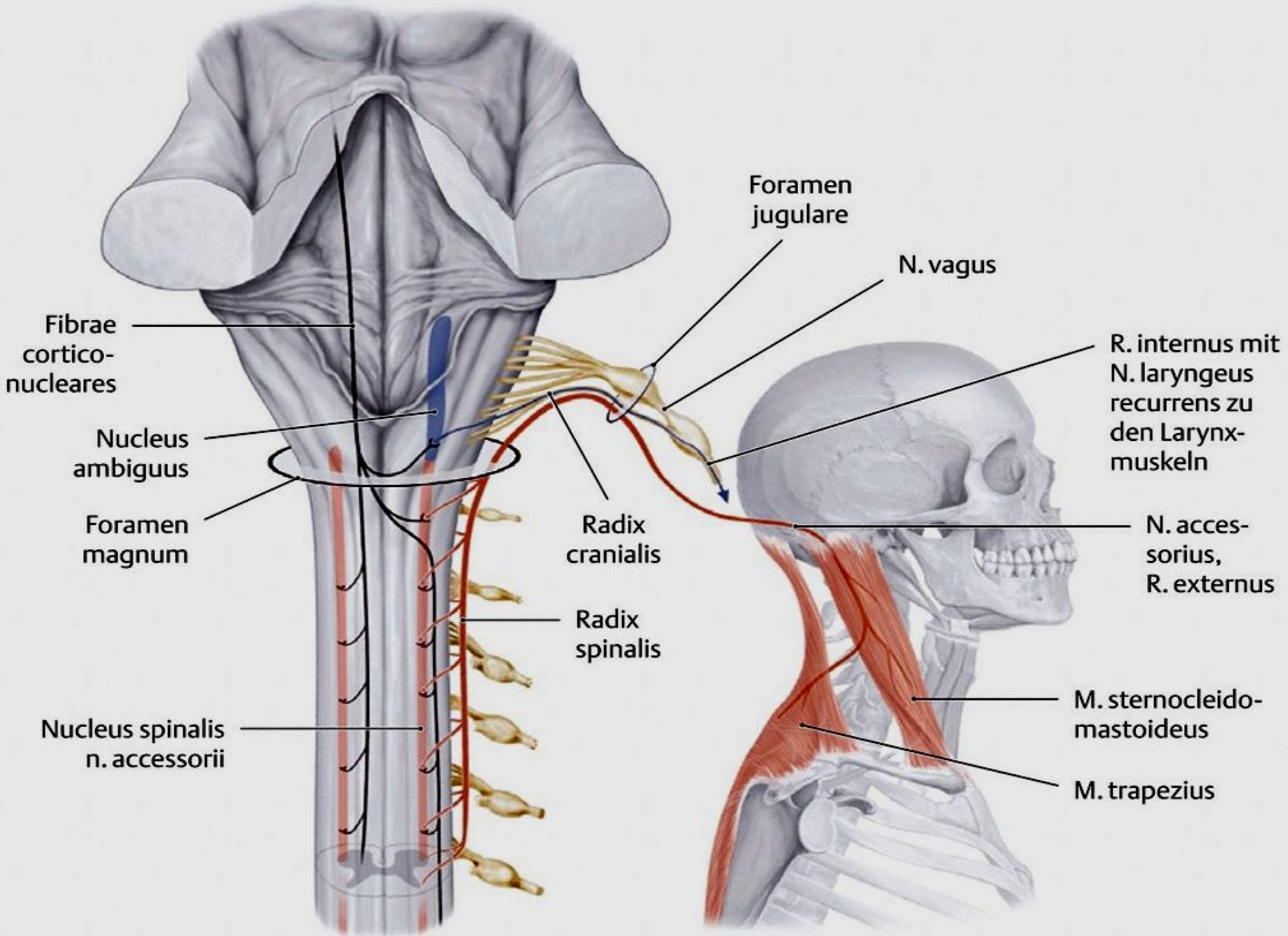




## **m. trapezius**

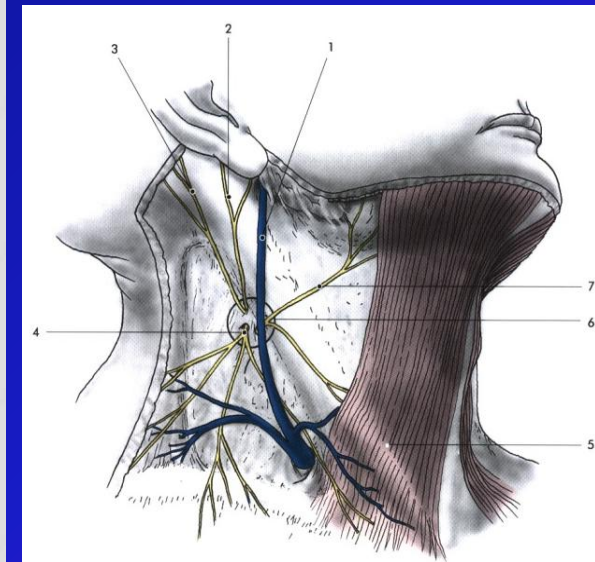
- ❖ protuberantia occipitalis externa až Th 12
- ❖ clavicle, akromion, spina scapulae
- ❖ n. accessorius



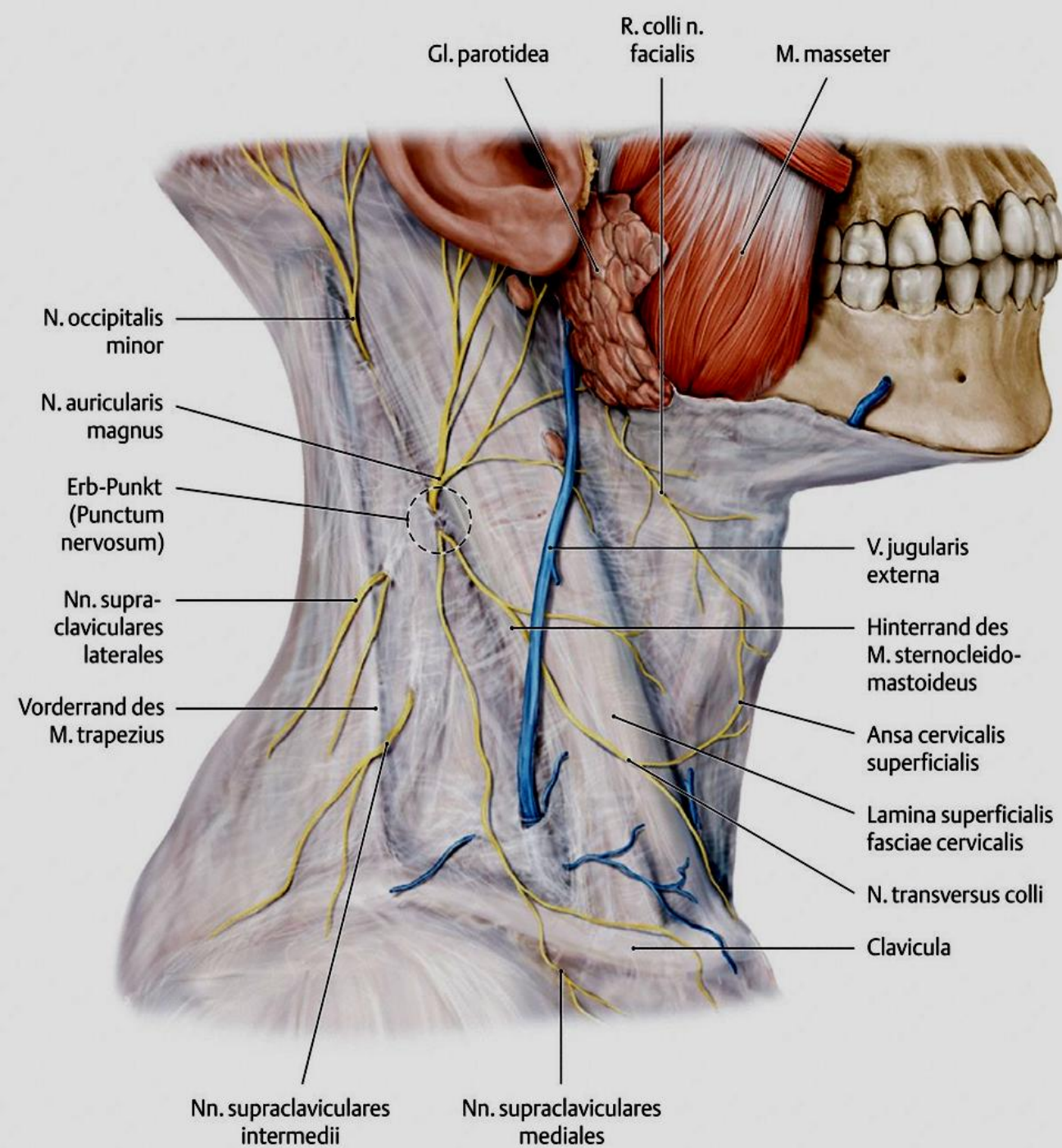


# Punctum nervosum

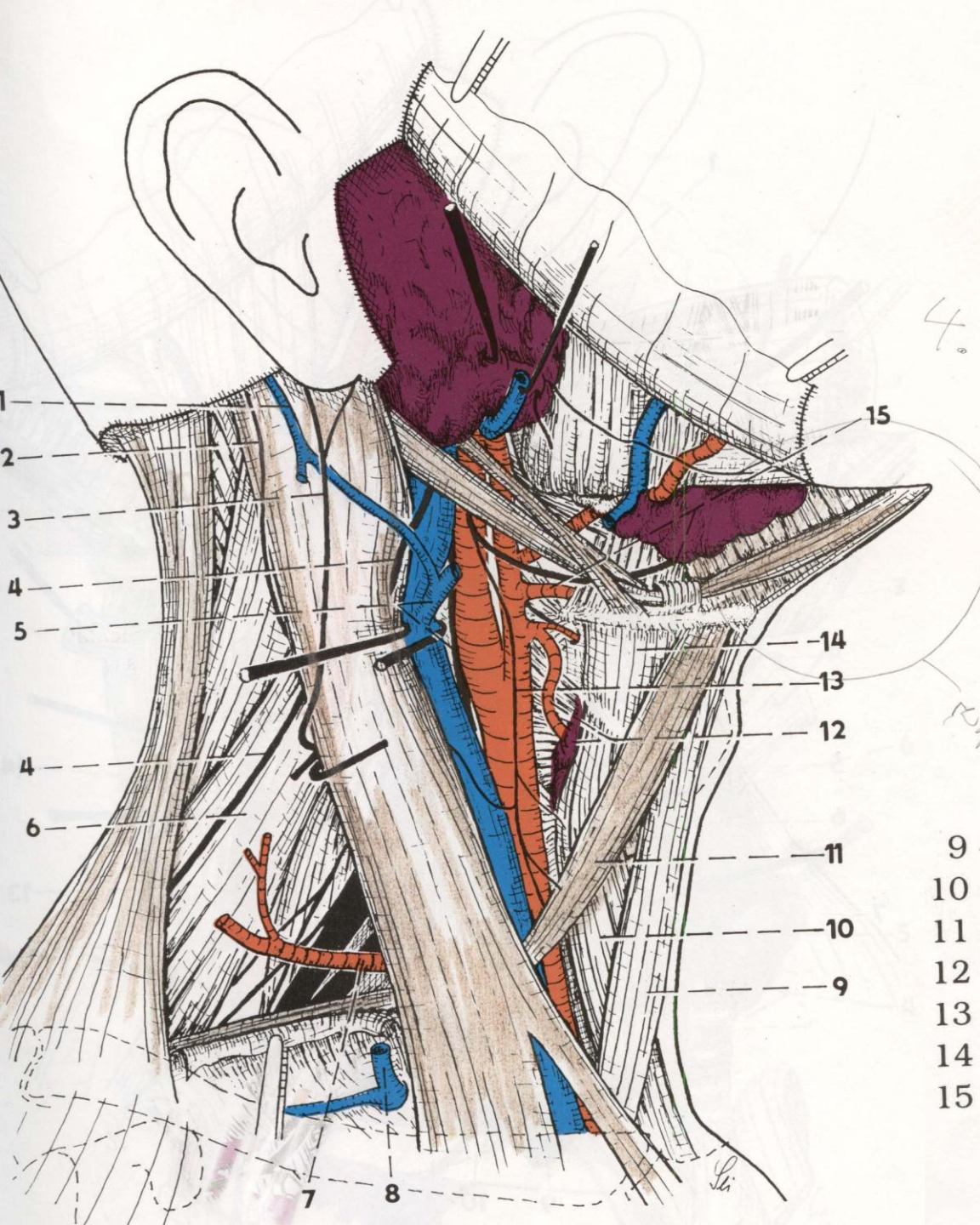
(Erb's point) is formed by the union of the C5 and C6 nerve roots, which later converge, also with branches of **suprascapular nerves** and the **nerve to the subclavius**



**Wilhelm Heinrich Erb** (1840 - 1921), a German neurologist





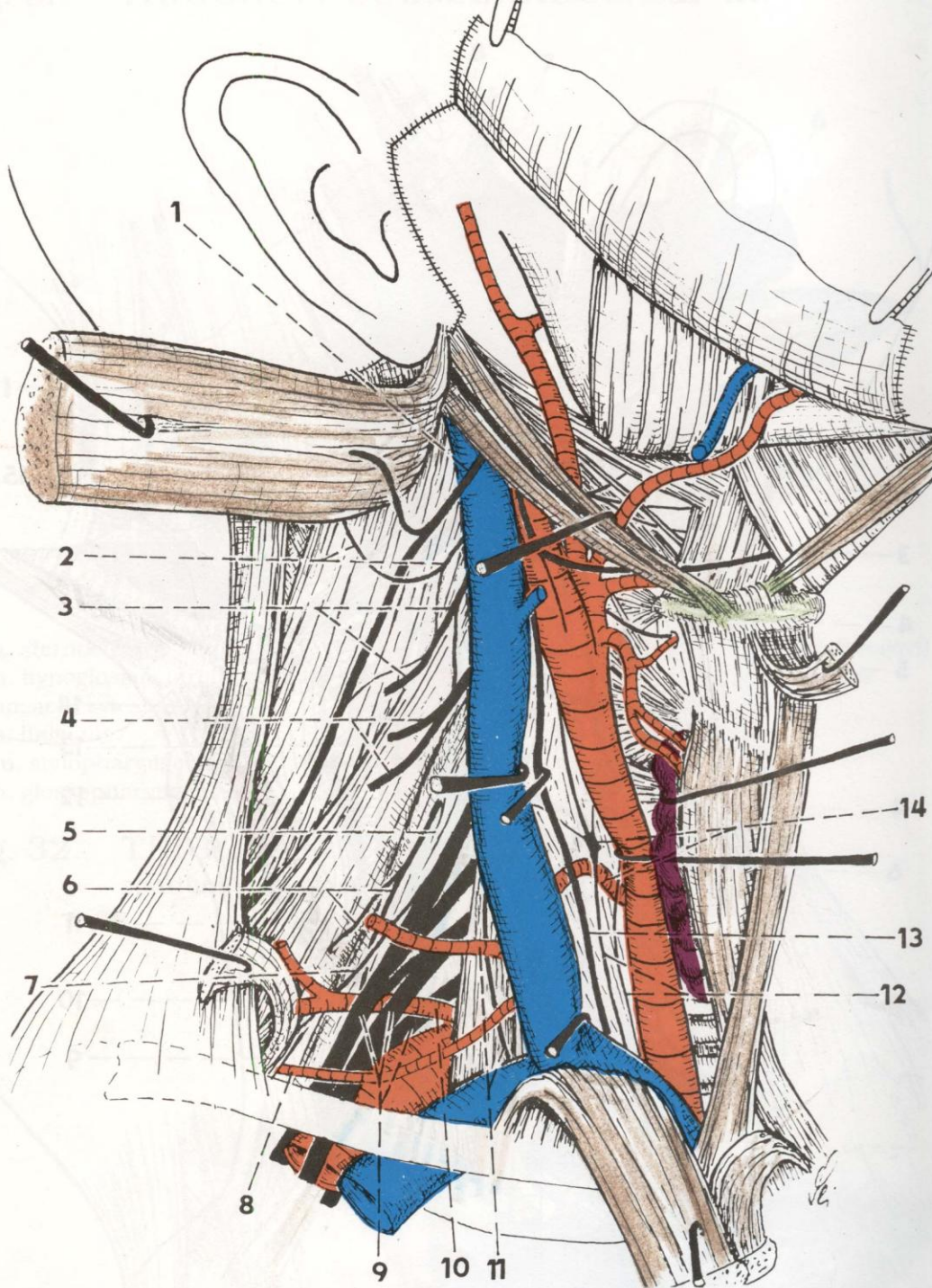


- 1 - v. auricularis post.
- 2 - n. occipitalis minor
- 3 - n. auricularis magnus
- 4 - n. accessorius
- 5 - v. retromandibularis et n. vagus
- 6 - m. levator scapulae
- 7 - a. cervicalis superfic.
- 8 - v. jugularis ext.

Ventrally: it is possible  
palpate nervous  
and vascular neck bundles  
+ deep cervical nodes

- 9 - m. sternohyoideus
- 10 - m. sternothyroideus
- 11 - m. omohyoideus (venter sup.)
- 12 - gl. thyroidea et a. thyroidea sup.
- 13 - ansa cervicalis
- 14 - m. thyrohyoideus
- 15 - a. lingualis (in the angle of Beclard)  
and the triangle of Pirogov





- 1 - n. accessorius
- 2 - n. occipitalis minor et C2
- 3 - n. auricularis magnus et C3
- 4 - n. transversus colli,  
nn. supraclaviculares et C4
- 5 - m. scalenus med.
- 6 - n. dorsalis scapulae,  
n. thoracicus longus et C5
- 7 - n. suprascapularis
- 8 - a. suprascapularis

## Structures medially from muscular belly

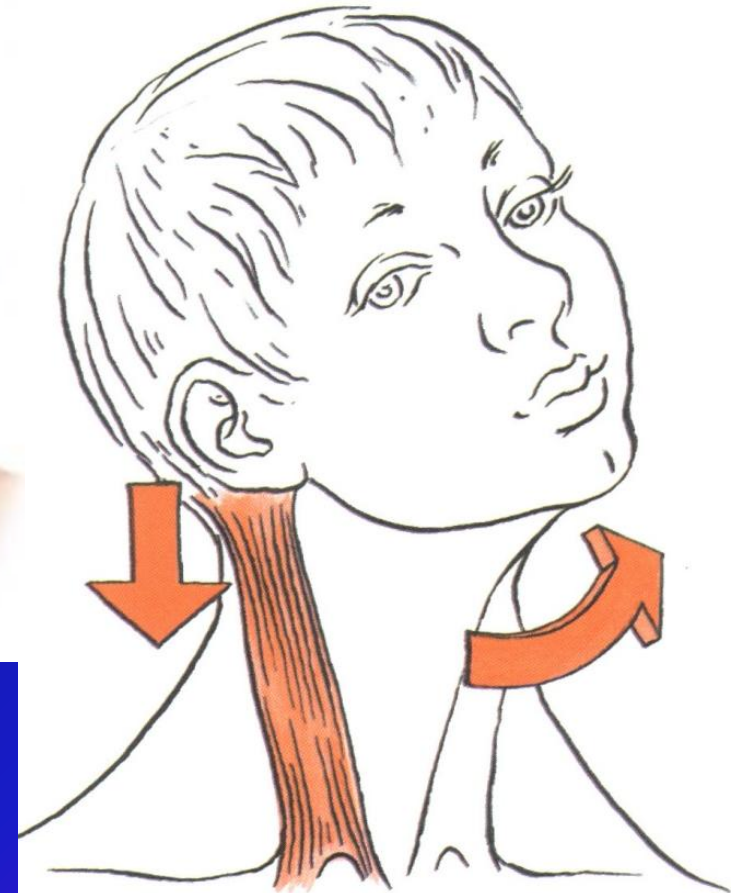
- 9 - trunci plexus brachialis  
(primary trunks) sup. (C5 - C6),  
med. (C7) and inf. (C8 - Th1)
- 10 - a. transversa colli
- 11 - n. phrenicus et a. cervicalis superficialis
- 12 - tr. sympathicus et n. cardiacus
- 13 - n. vagus
- 14 - ganglion cervicale med. et  
a. thyroidea inf.
- C1 - C7 et Th1 - rr. ventrales nn. spinalium



# Torticollis

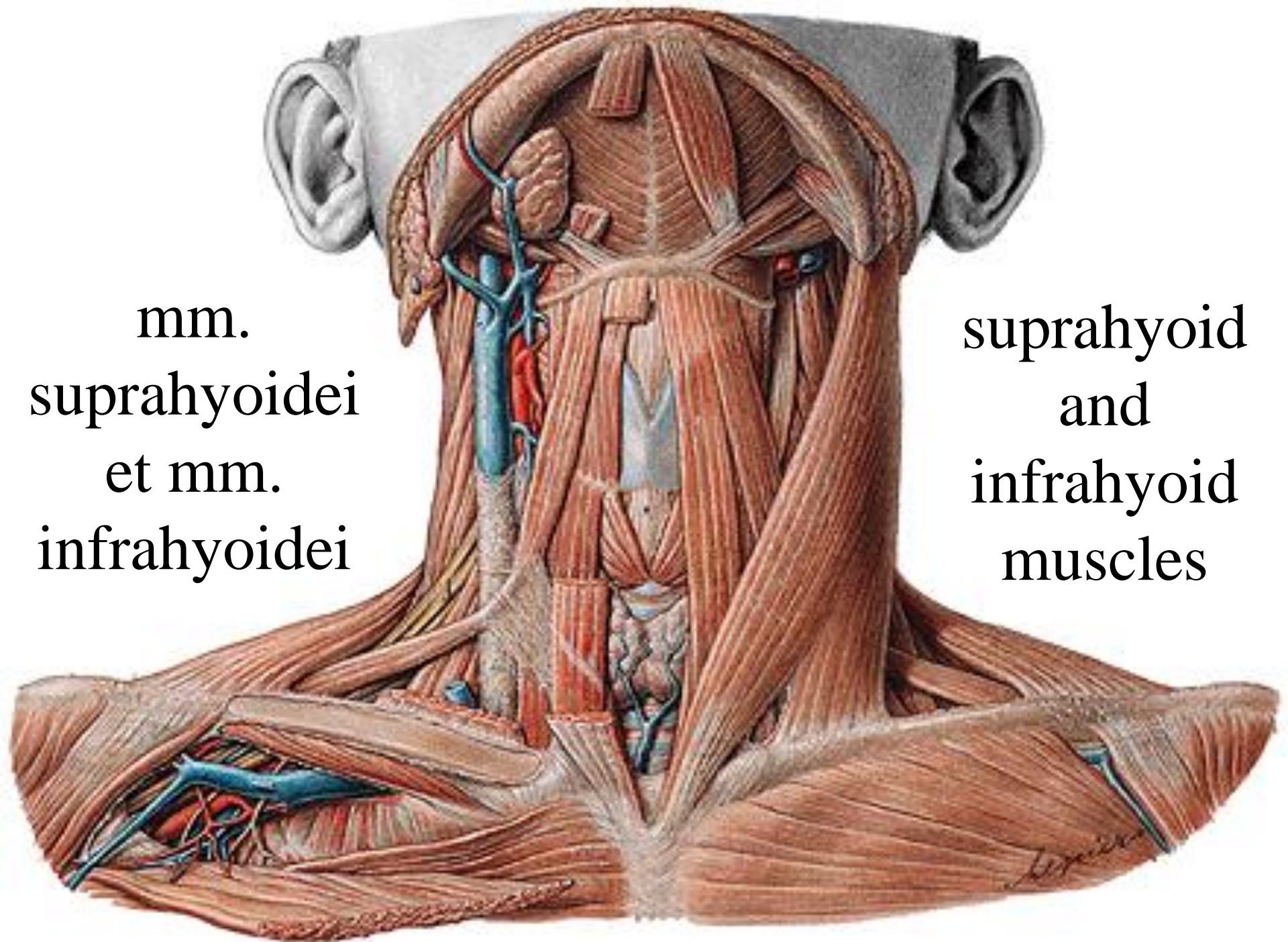


# Wryneck



mm.  
suprahyoidei  
et mm.  
infrahyoidei

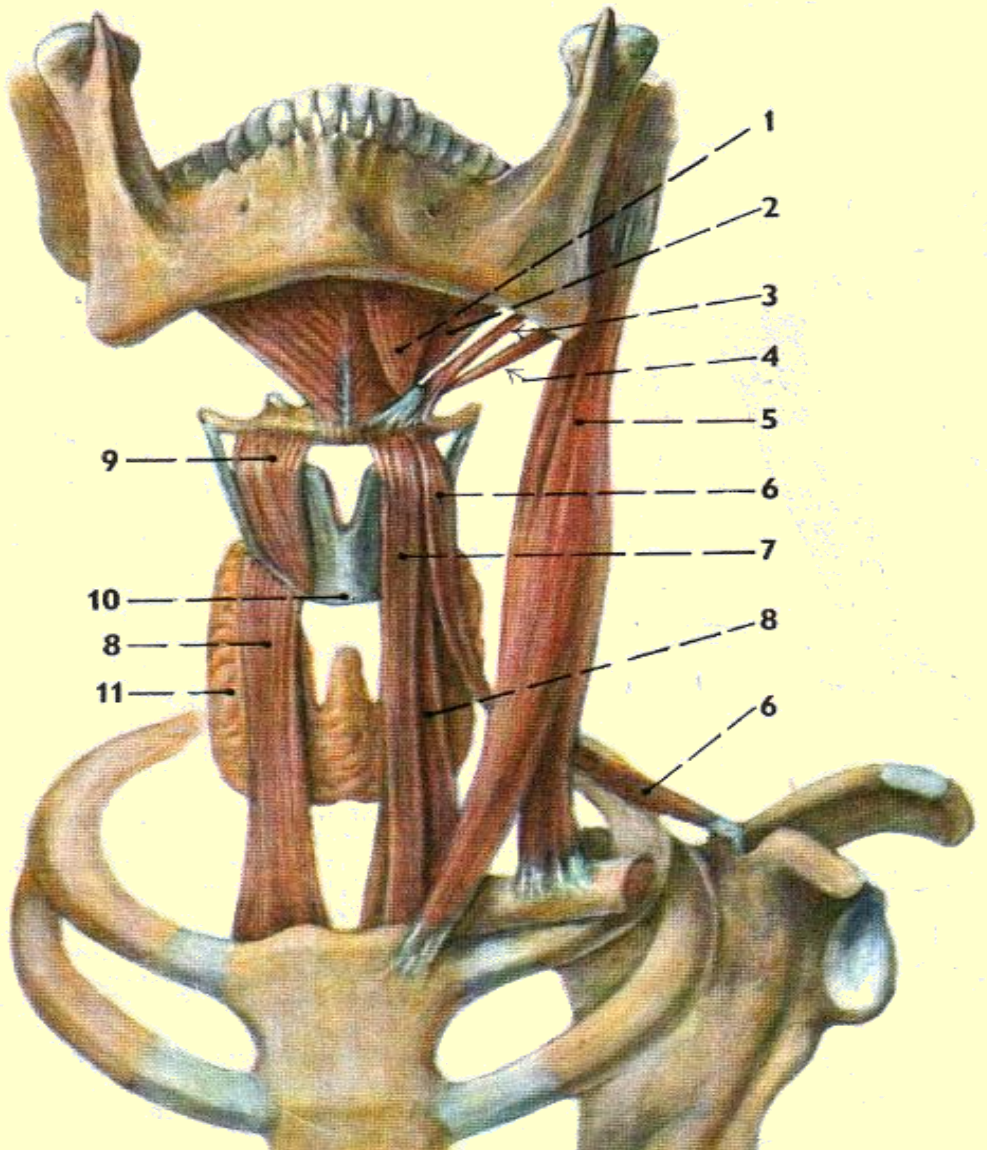
suprahyoid  
and  
infrahyoid  
muscles





# Suprahyoid muscles

## mm. suprahyoidei - overview



### ❖ m. mylohyoideus (2)

Mylohyoid nerve from third branch of V (V3.)

### ❖ m. digastricus (1, 4)

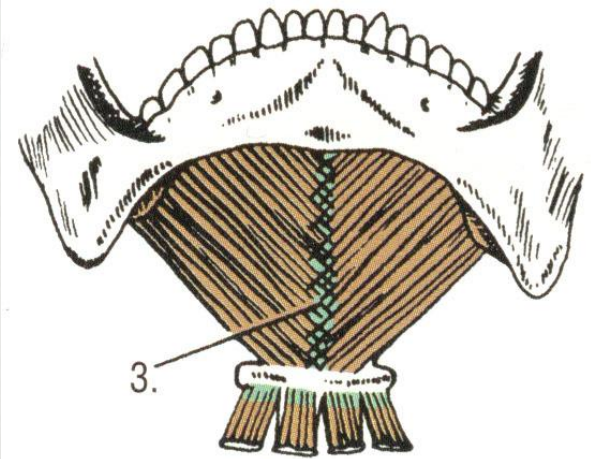
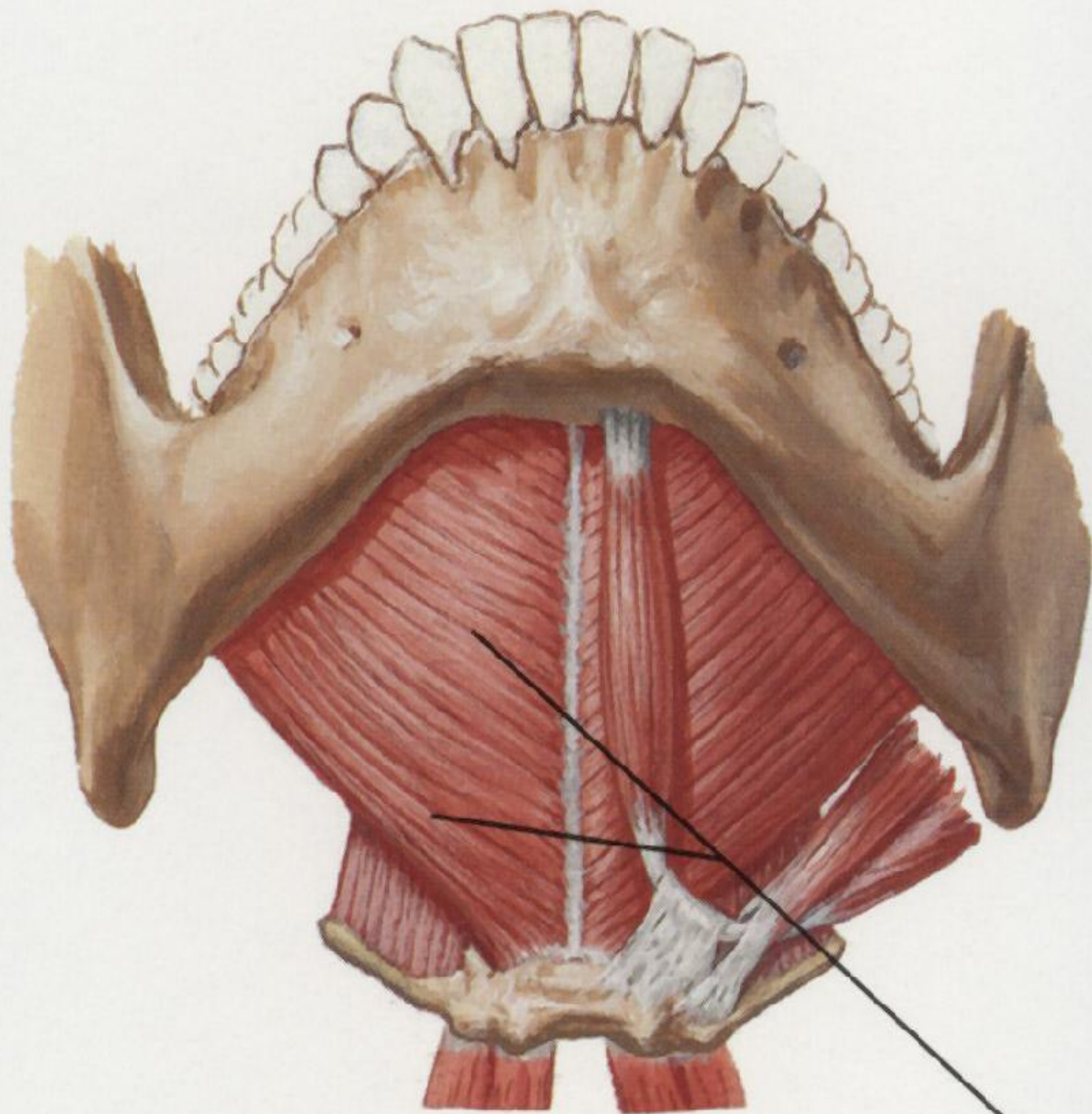
- Mylohyoid nerve from third branch of V (V3)
- n. facialis

### ❖ m. geniohyoideus

- C1, C2, hypoglossal nerve

### ❖ m. stylohyoideus (3)

- Facial nerve



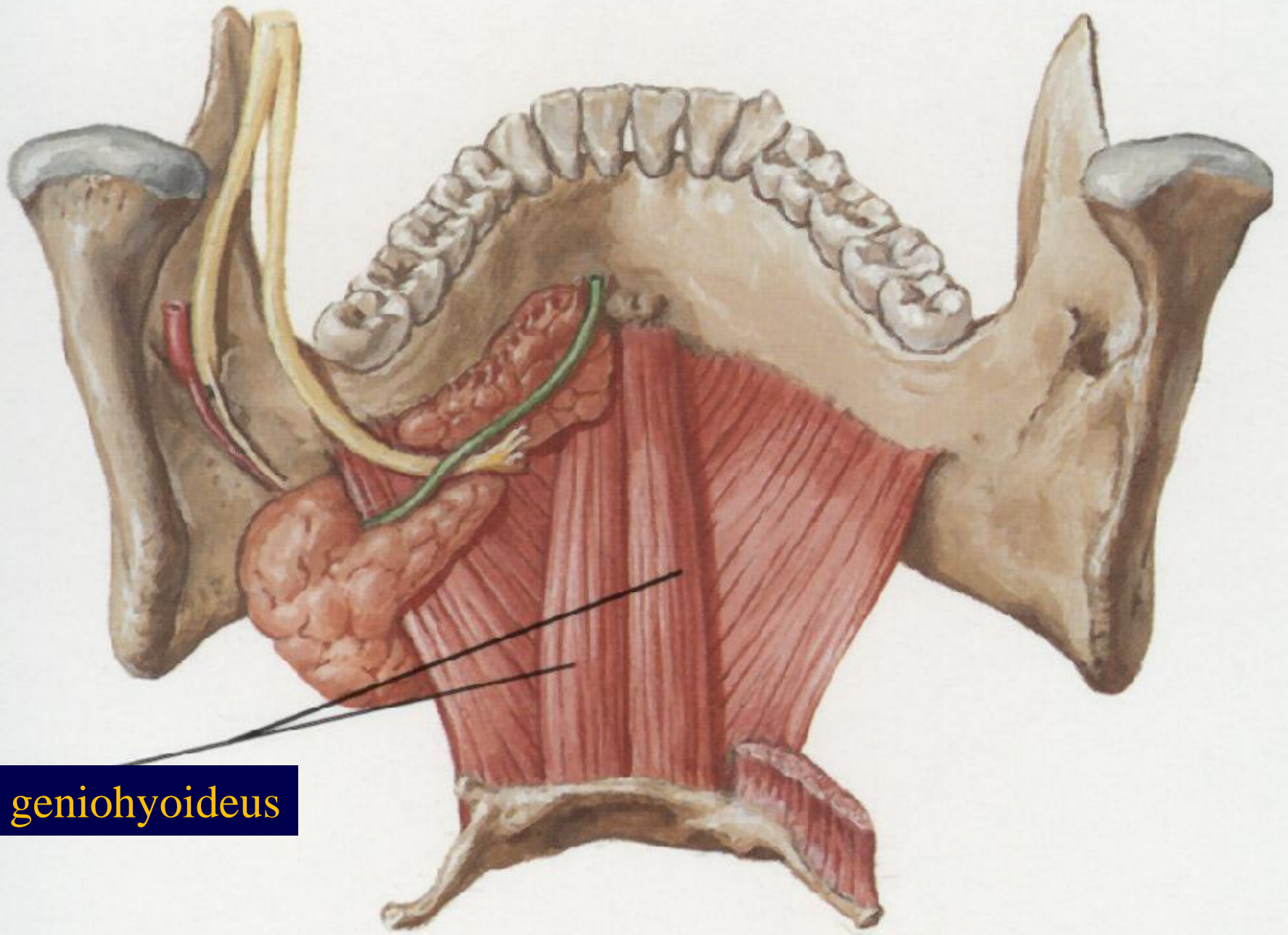
raphe of mylohyoid muscles

## m. mylohyoideus

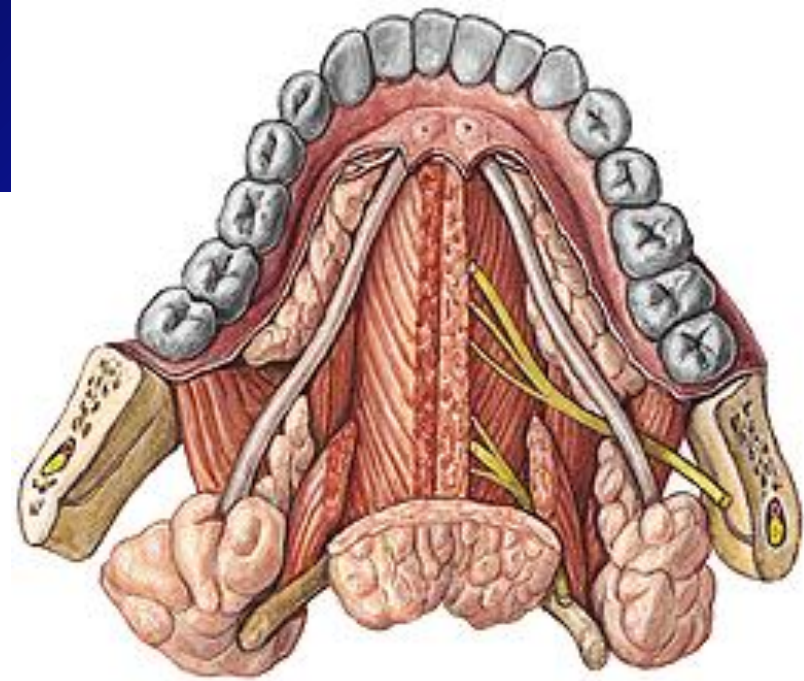
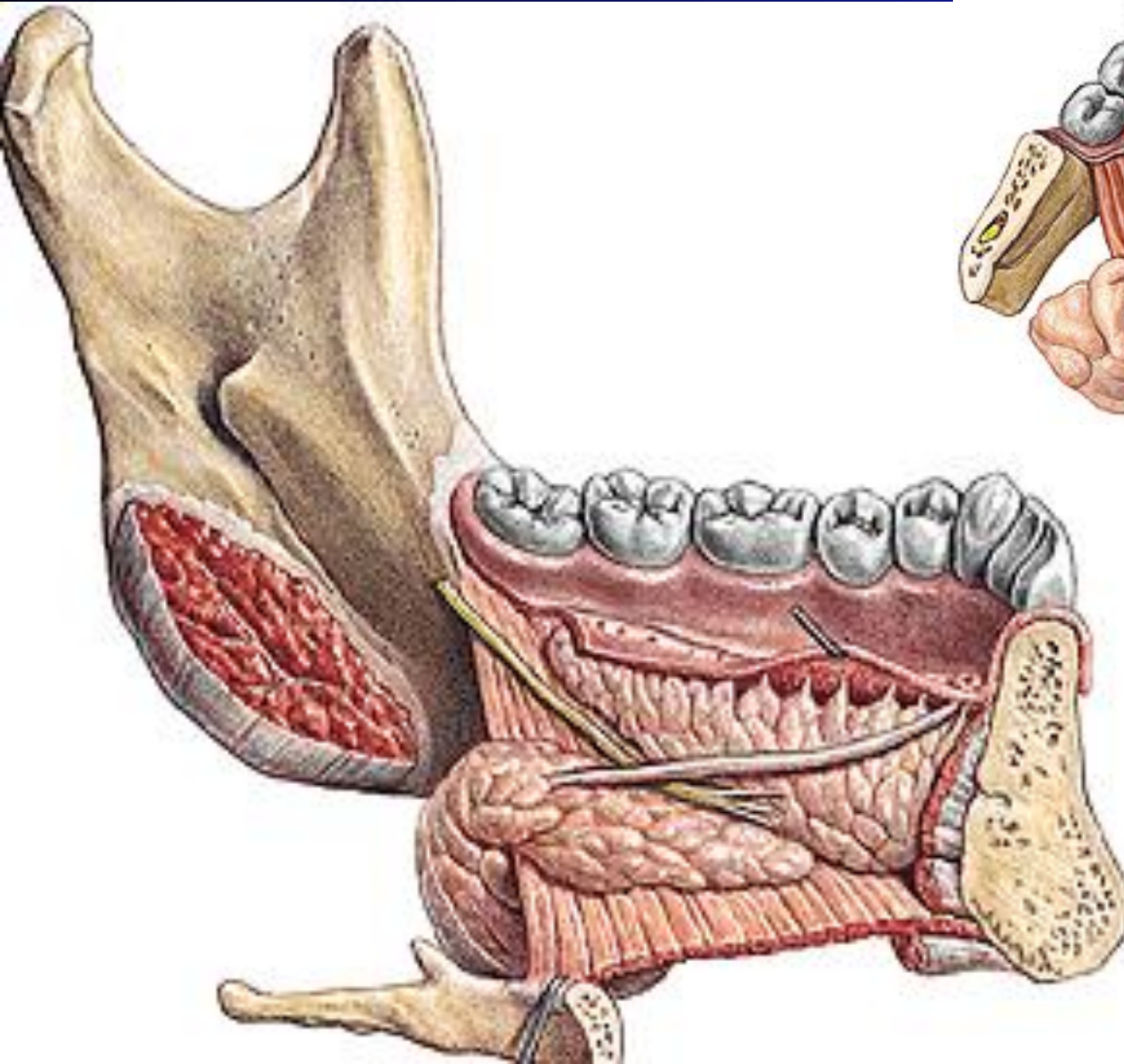
Mylohyoid line and  
mylohyoid raphe  
Hyoid body  
Mylohyoid nerve  
(from mandibular n.  
from CN V.)

1





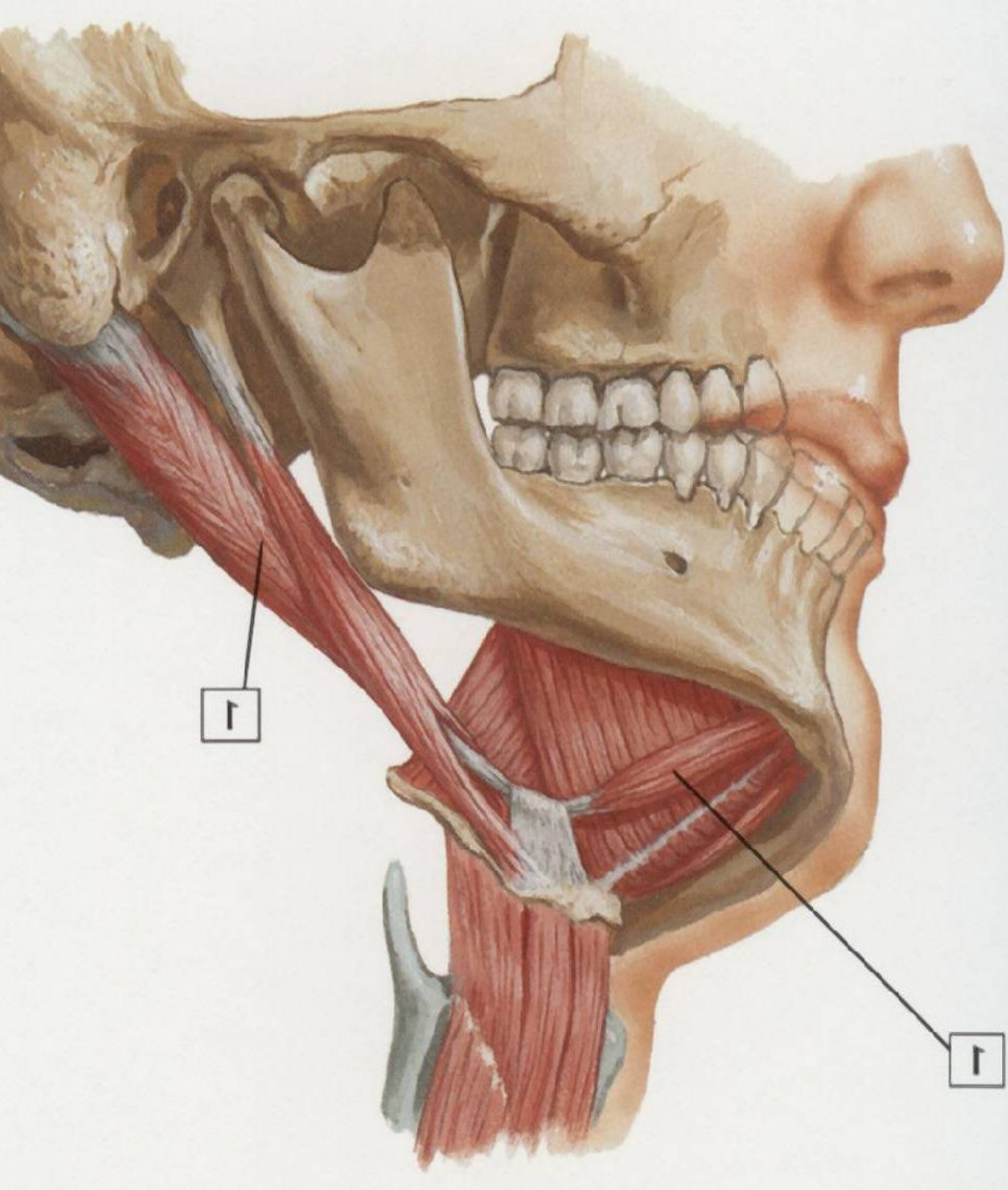
**m. geniohyoideus**



Lingual nerve and submandibular duct are crossed above dorsal margin of this muscle

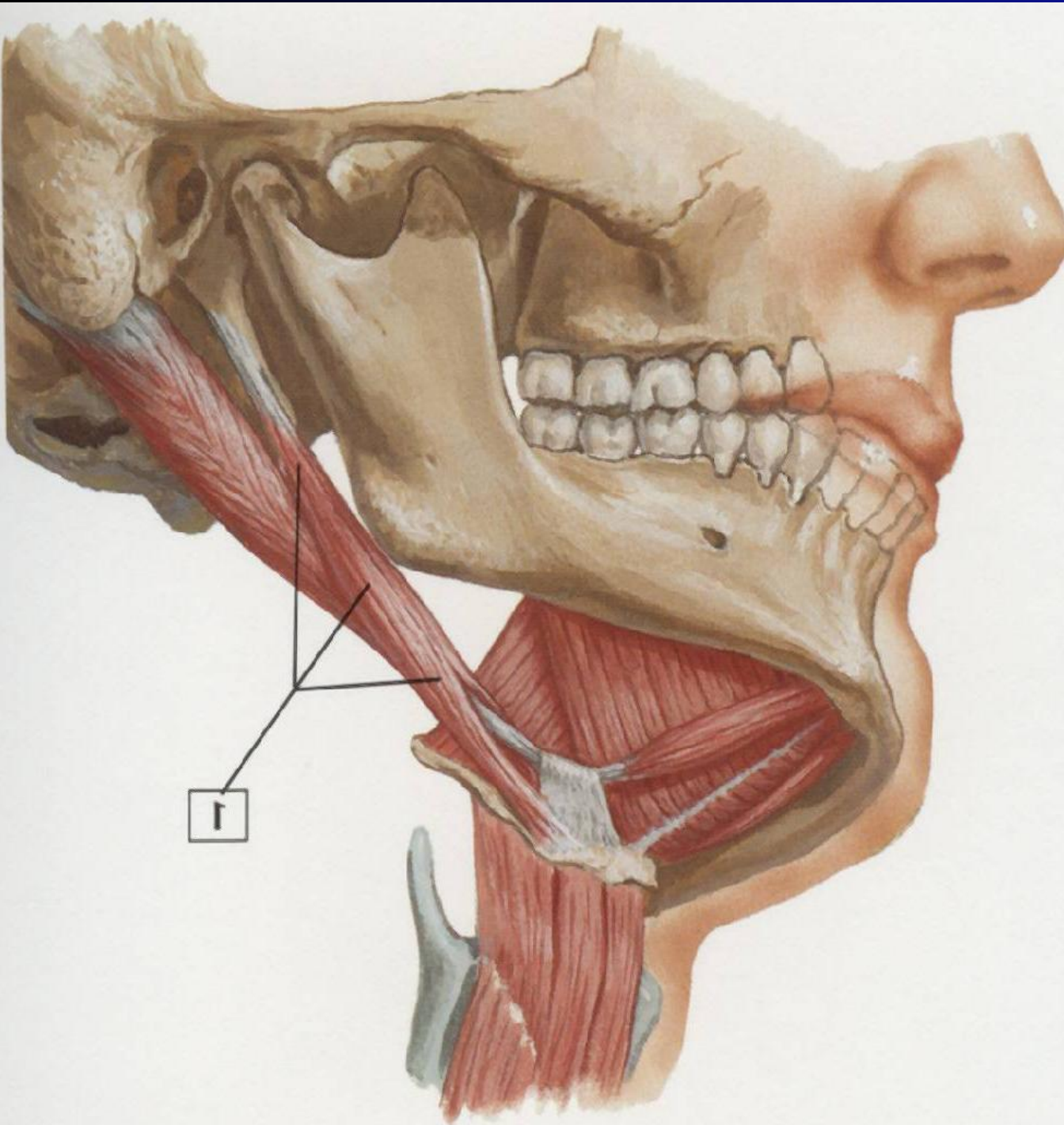
Lingual process of the submandibular gland arms its dorsal margin.





## m. digastricus

- ❖ **Anterior belly**  
from inner  
mandibular surface  
(fossa digastrica)
  - ❖ N. mylohyoideus  
(from mandibular  
nerve V3)
- ❖ **Posterior belly**  
to the mastoid notch  
(incisura mastoidea)
  - ❖ N. facialis
- ❖ to hyoid bone (os  
hyoideum)

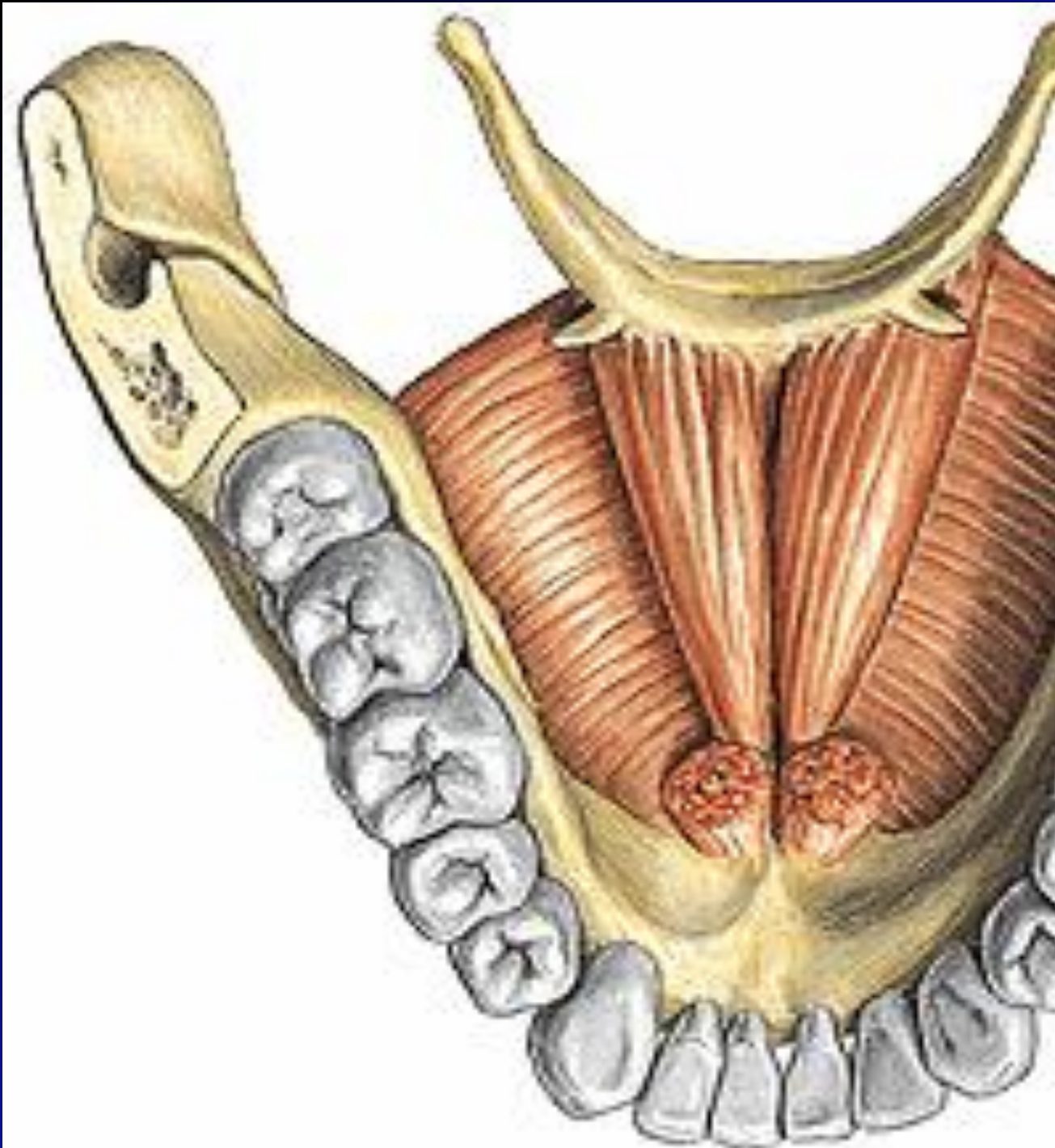


## M. stylohyoideus

- Styloid process
- Splitted into two parts; to the body of the hyoid bone

n. facialis





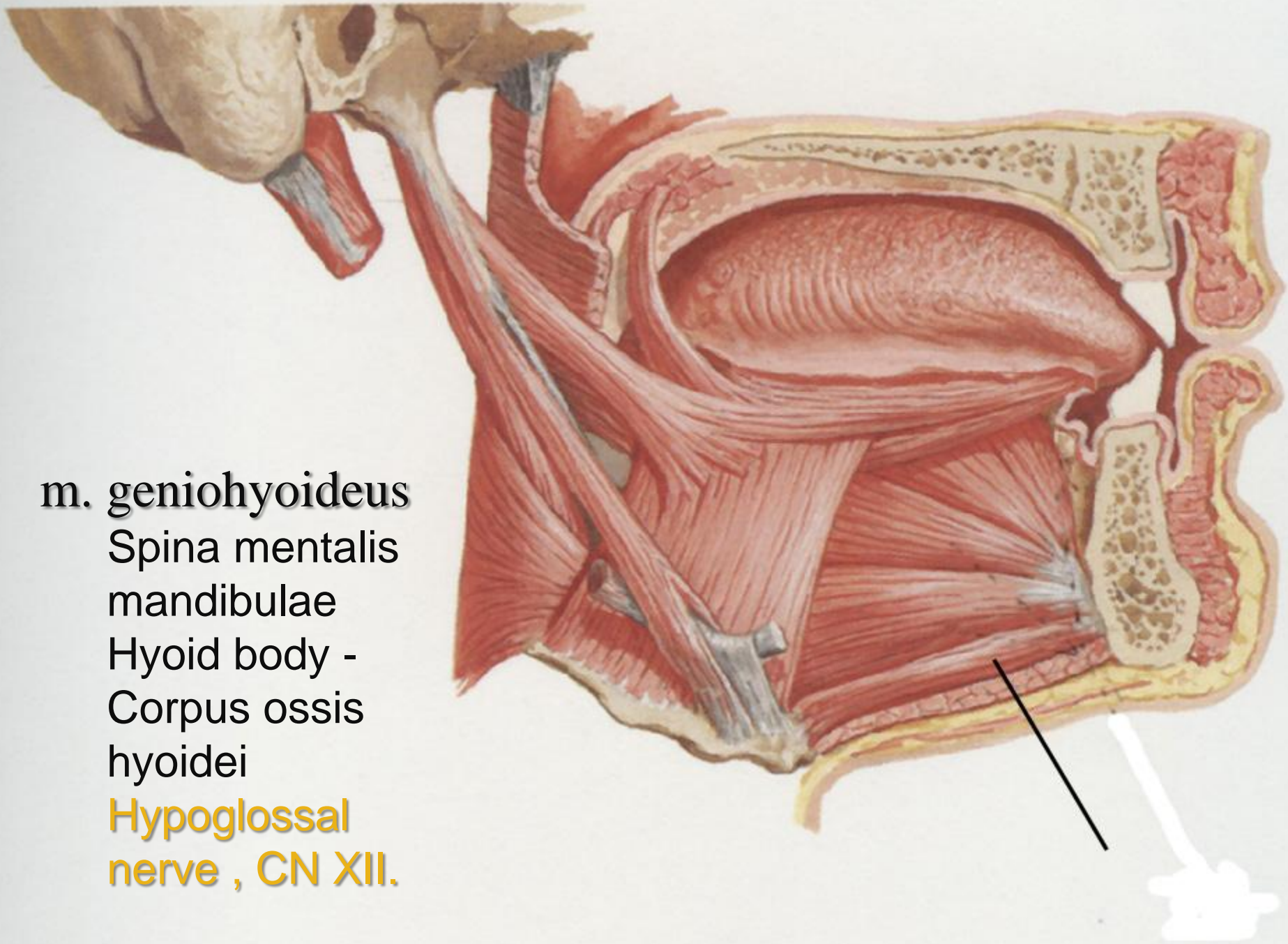
## m. geniohyoideus

- Spina mentalis mandibulae

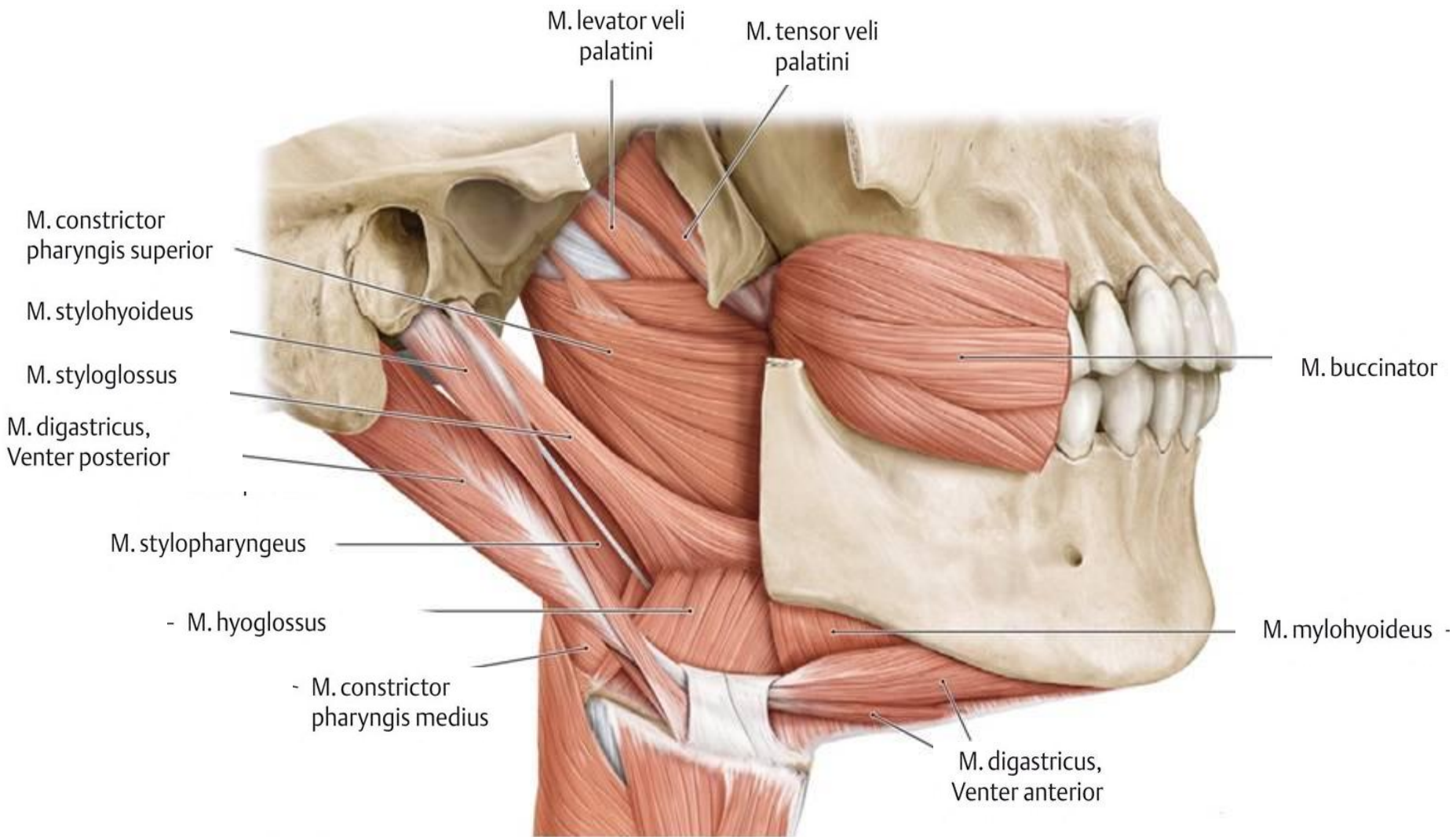
- corpus ossis hyoidei, hyoid body

Hypoglossal nerve (**fibers from C1**)

m. geniohyoideus  
Spina mentalis  
mandibulae  
Hyoid body -  
Corpus ossis  
hyoidei  
Hypoglossal  
nerve , CN XII.



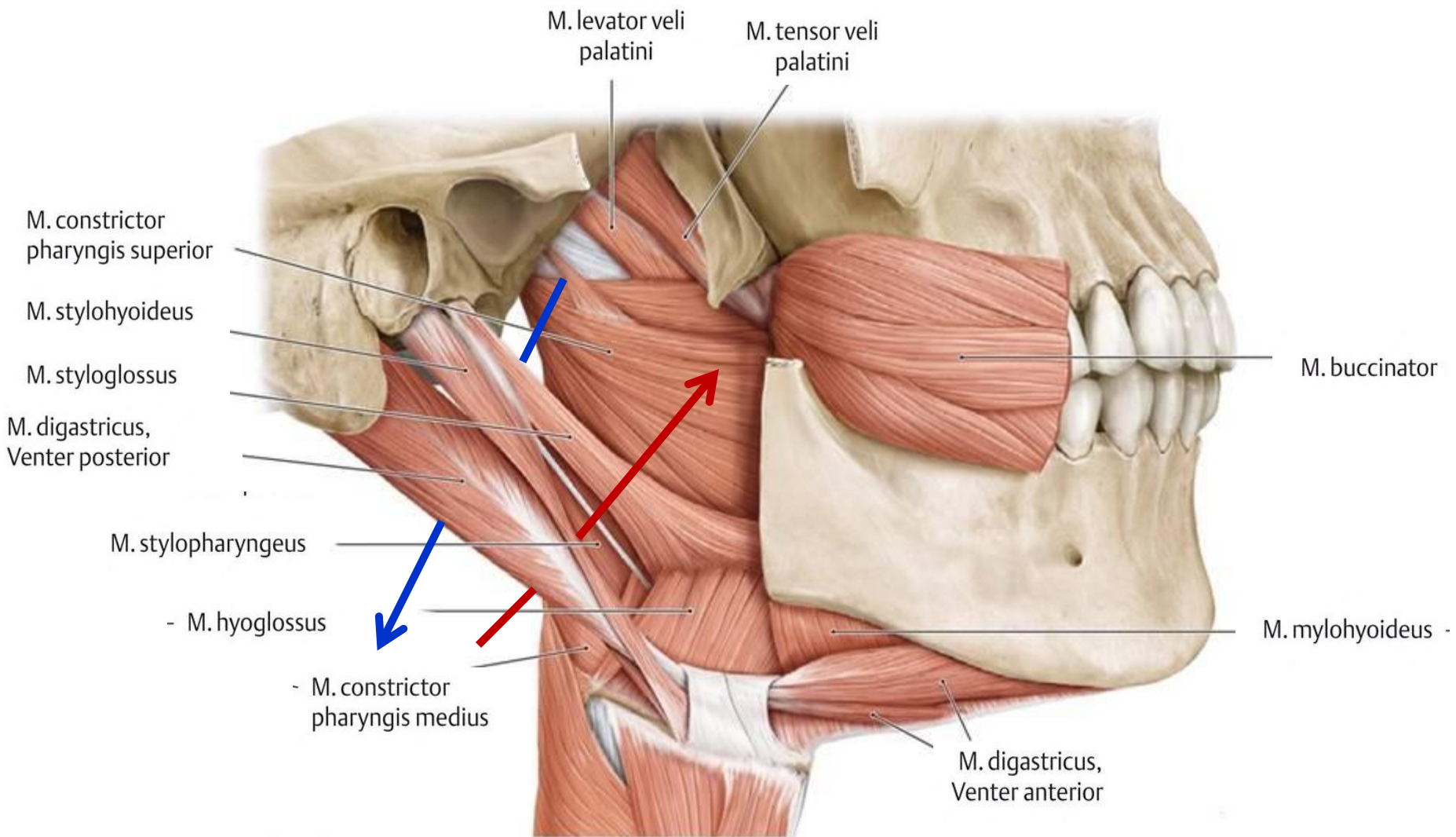




Septum styloideum  
 Styloid septum



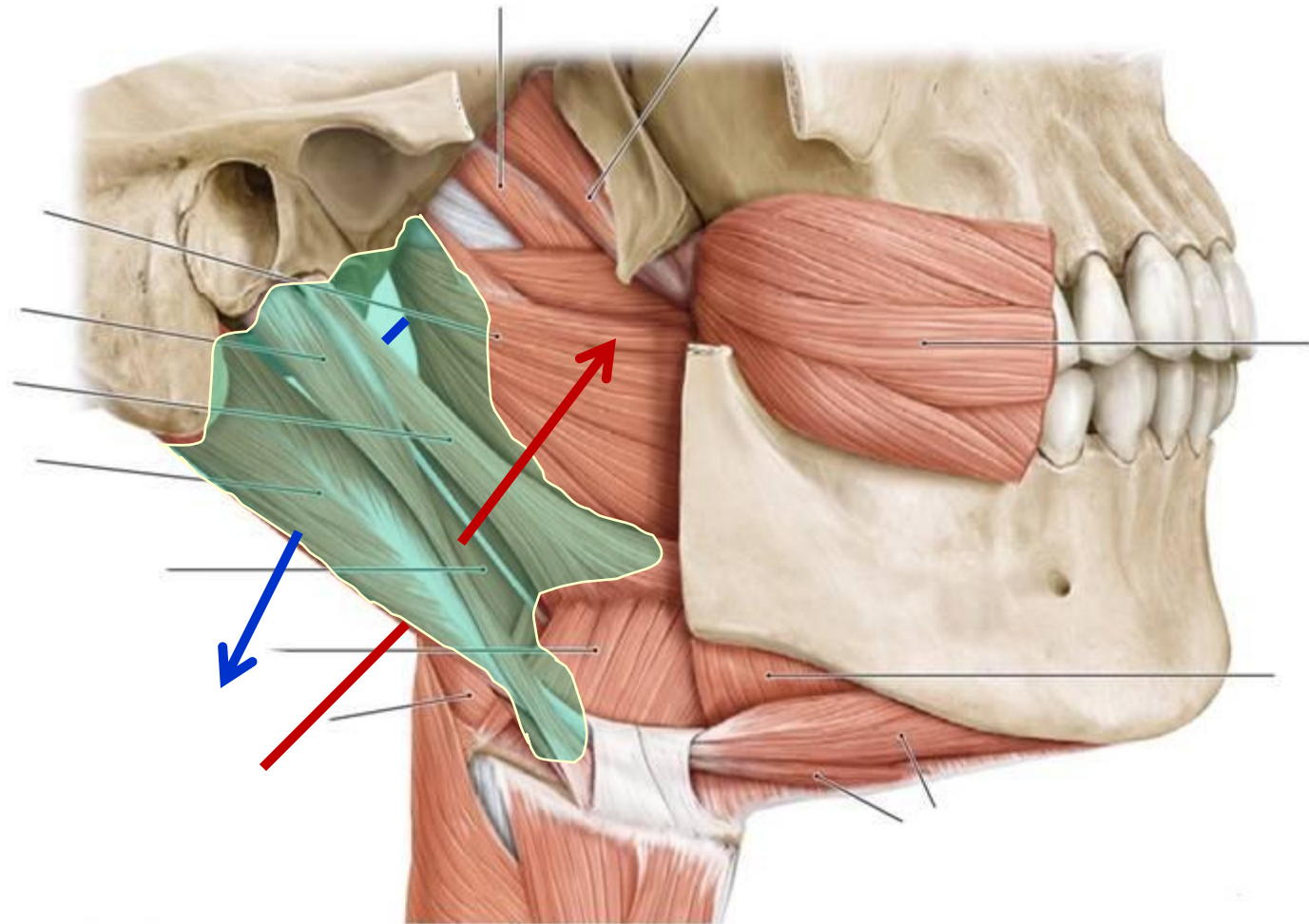
arteria carotis externa  
 external carotid artery



Septum styloideum  
 Styloid septum

arteria carotis externa  
 external carotid artery





Septum styloideum  
Styloid septum



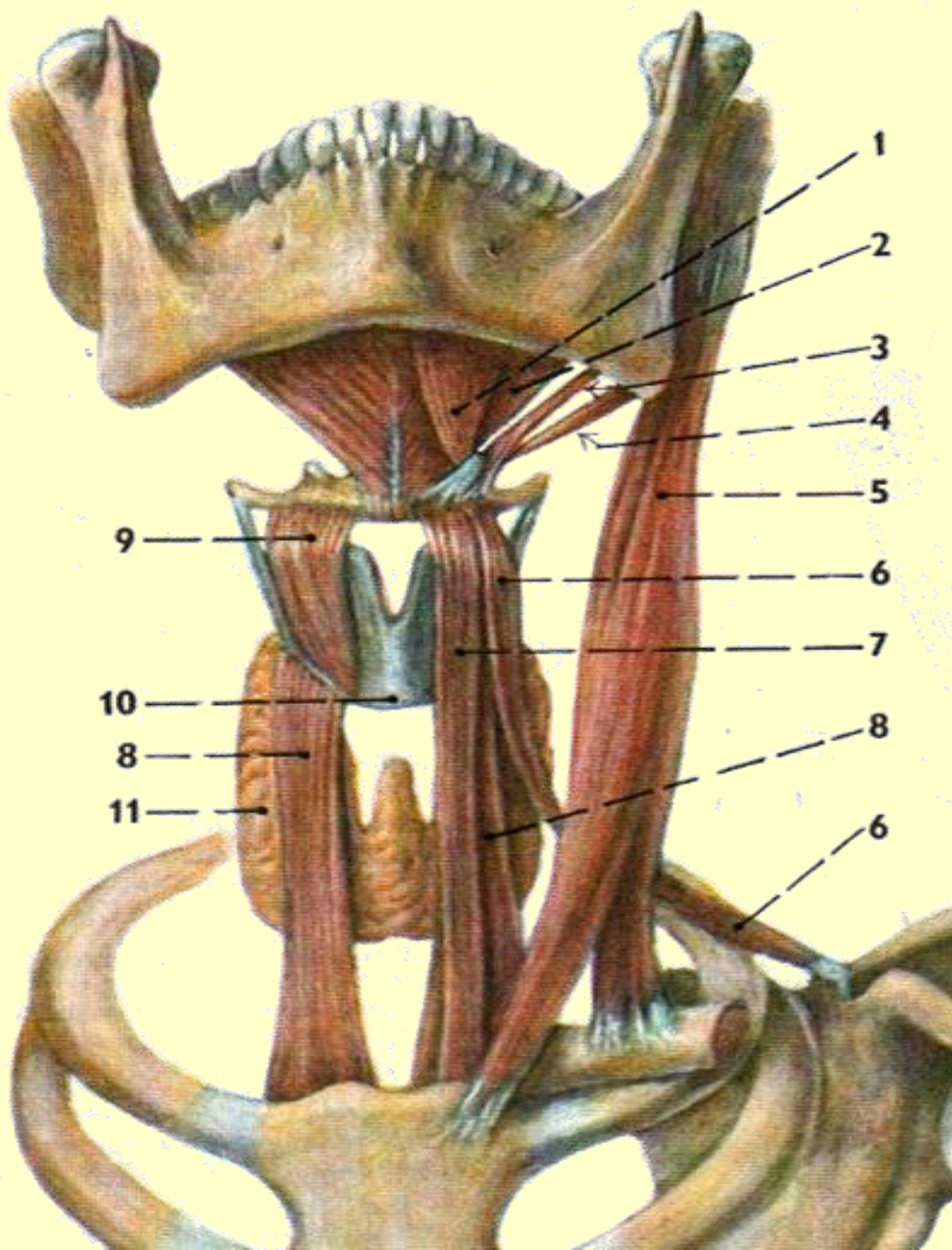
arteria carotis externa  
external carotid artery

Dorsal view on

Septum  
styloideum  
Styloid septum



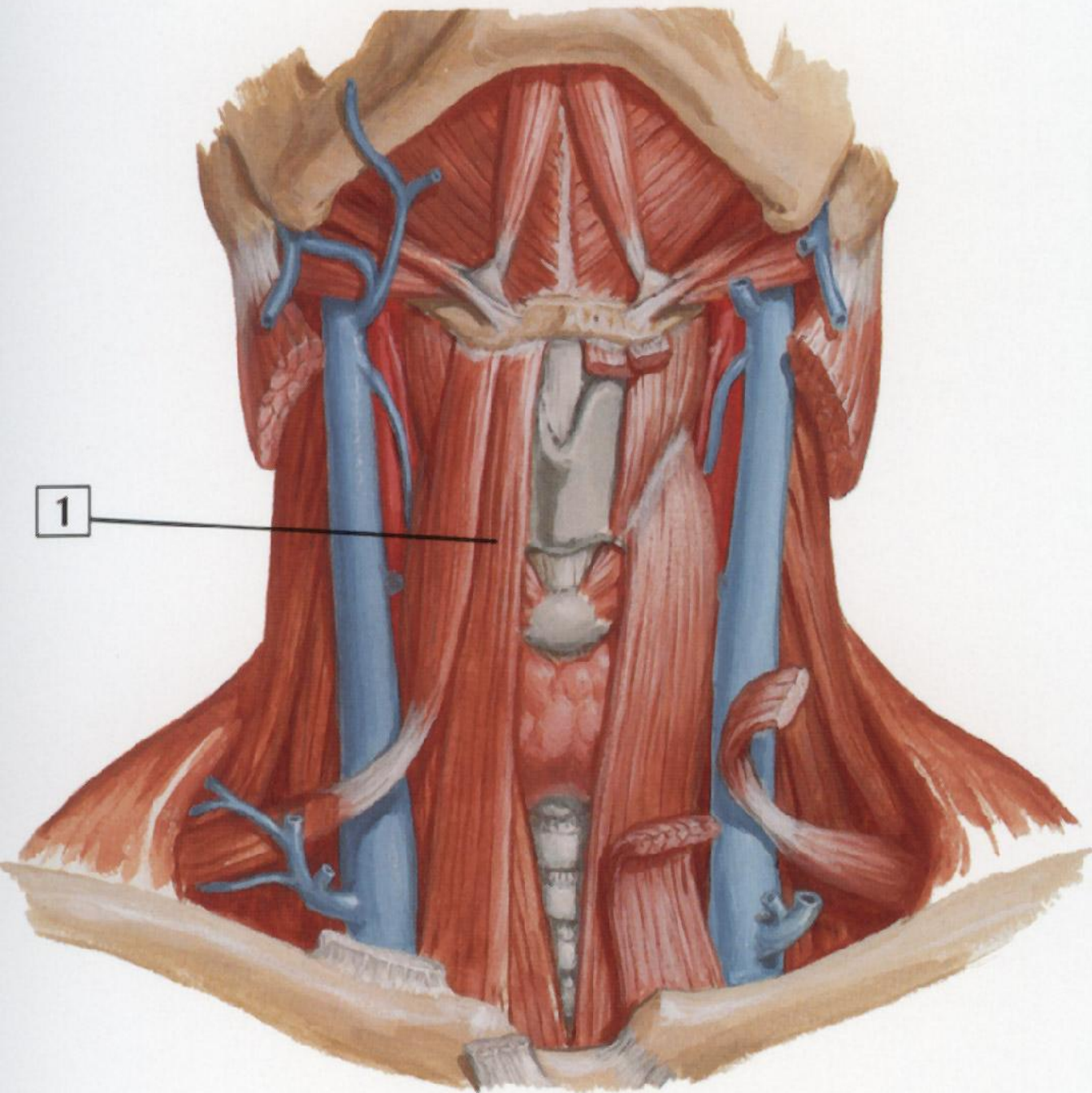




# Infrahyoid muscles

## mm. infrahyoidei - overview

- ❖ m. sternohyoideus (7)
- ❖ m. sternothyroideus (8)
- ❖ m. thyrohyoideus (9)
- ❖ m. omohyoideus (6)
  
- ❖ Innervation by cervical  
nerves C1 – C3

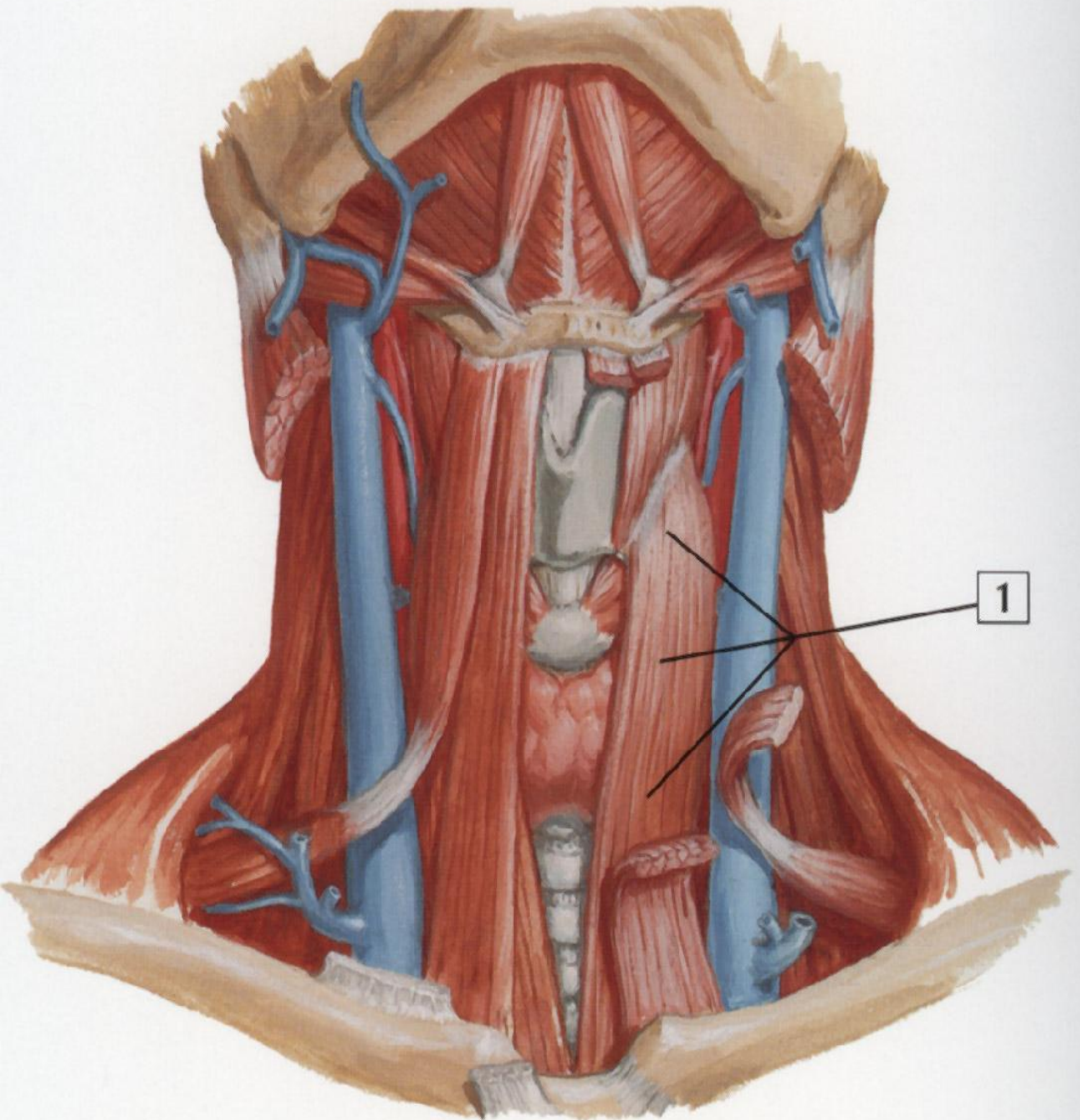


**m.**  
**sternohyoideus**

Dorsal surface of  
the manubrium  
sterni, clavicle

Body of the  
hyoid bone

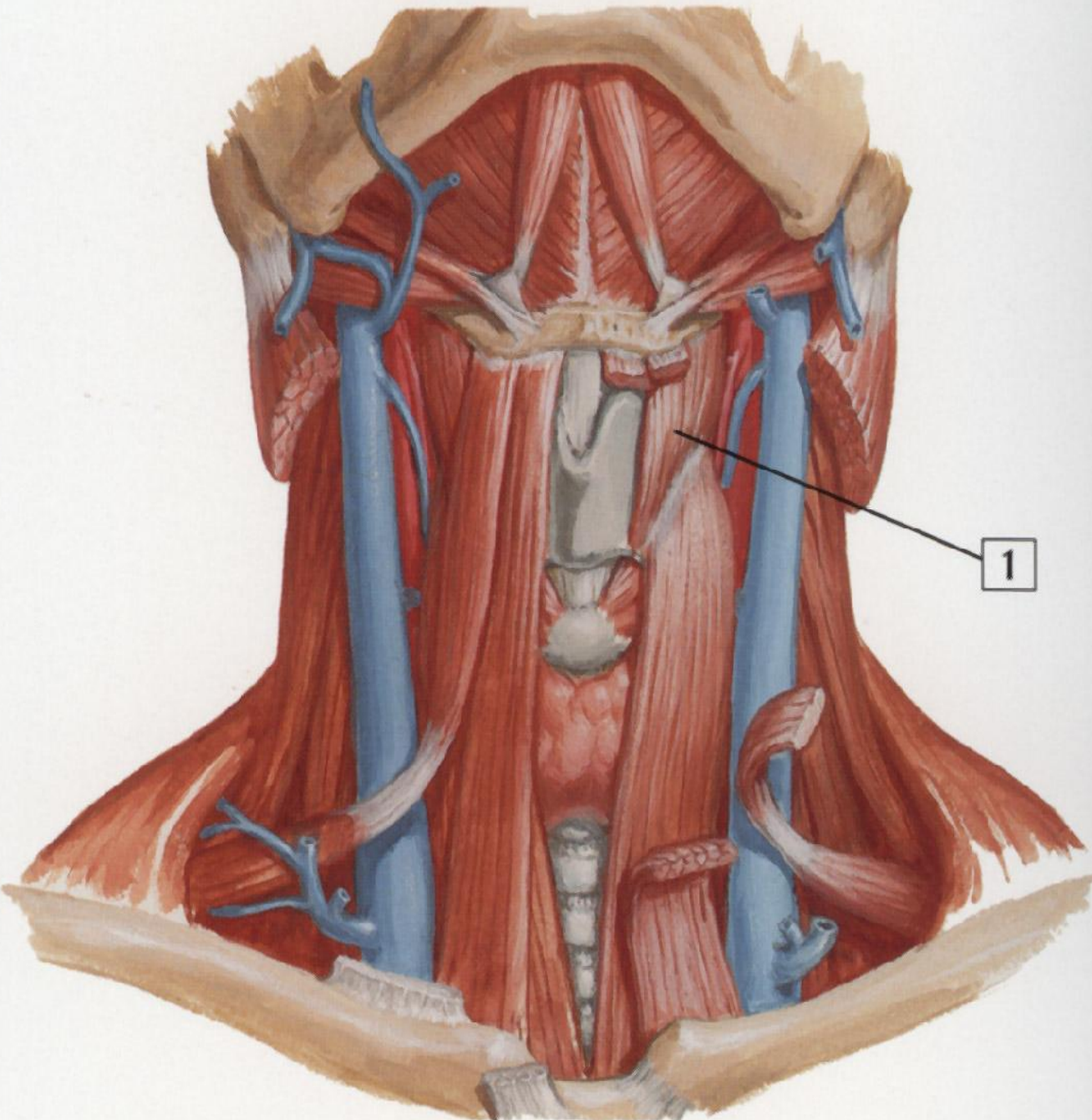




m.  
sternothyroideus

Dorsal surface of  
sternum

cartilago  
thyroidea

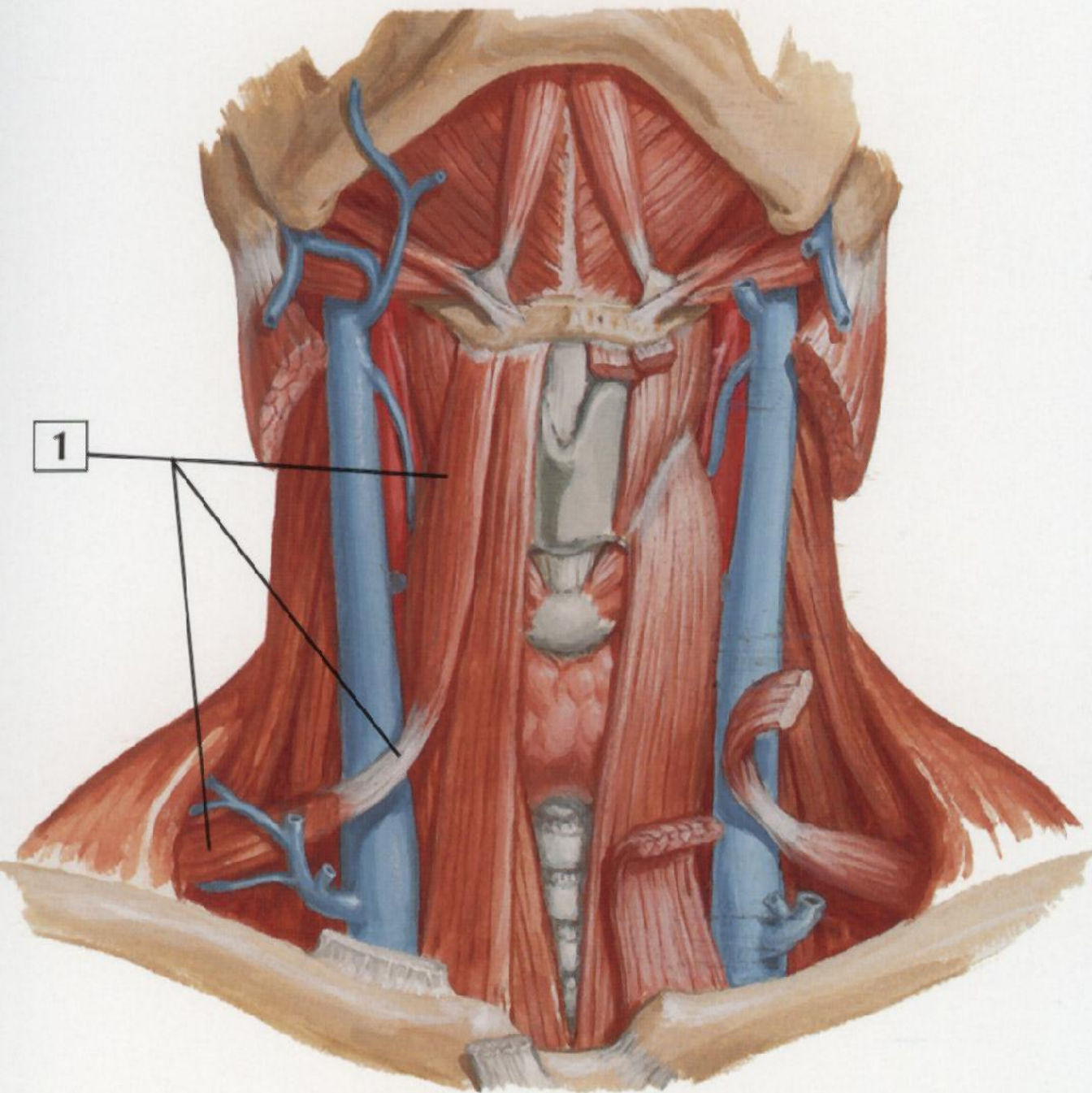


m.  
thyrohyoideus

From thyroid  
cartilage

To greater horns  
of the hyoid bone



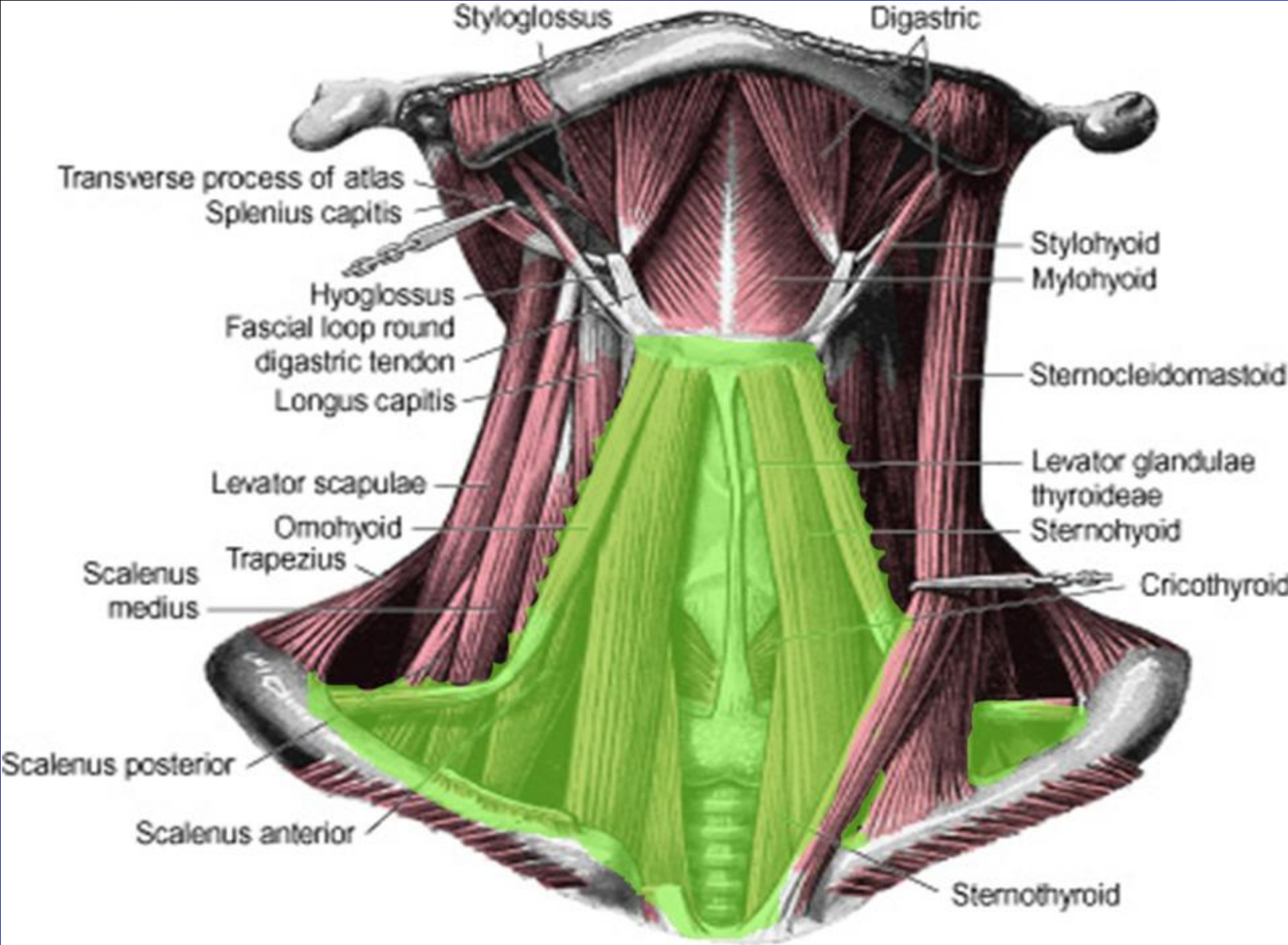


## m. omohyoideus

Superior margine  
of scapula

Body of the  
hyoid bone

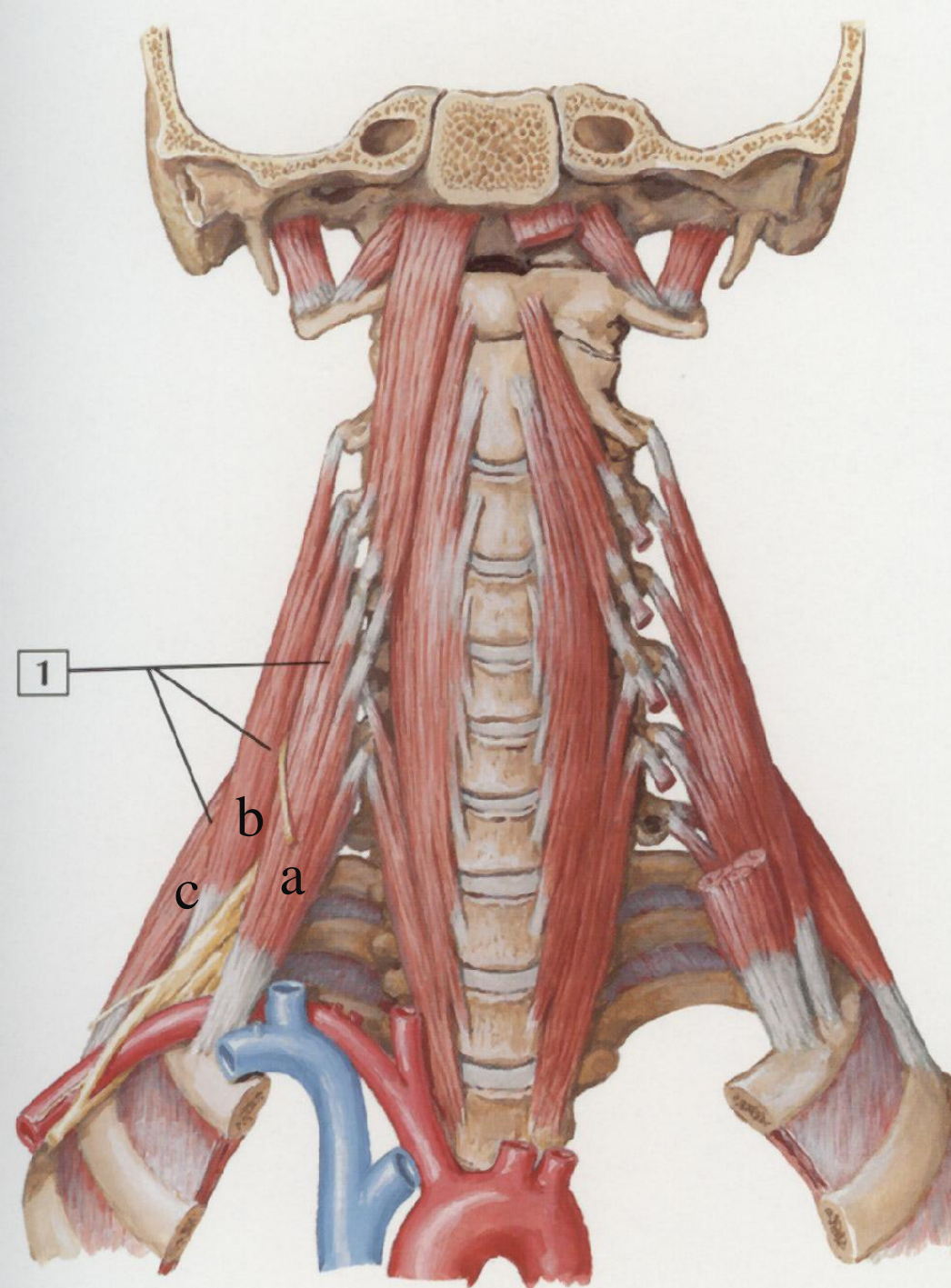
Between bellies  
there is tendinous  
bundle – biventer  
muscle





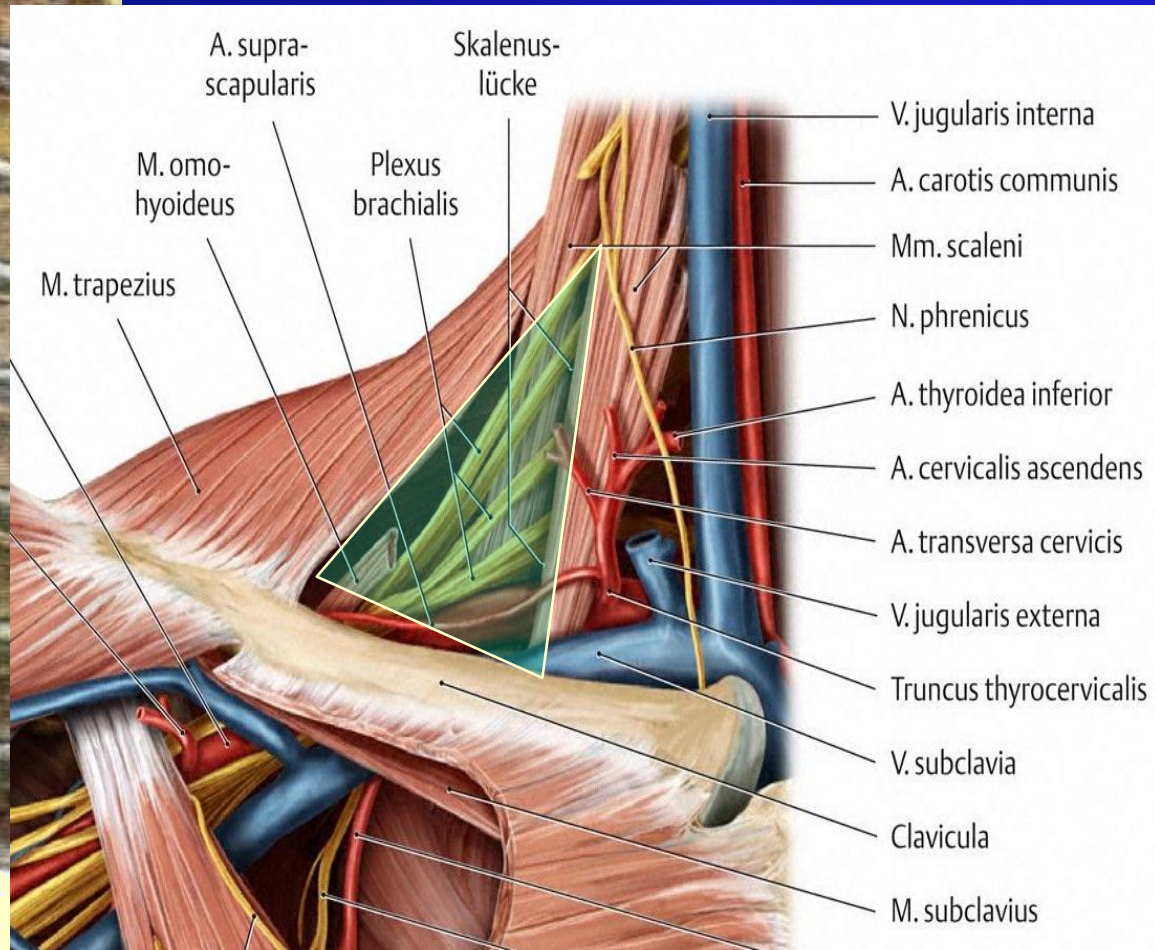
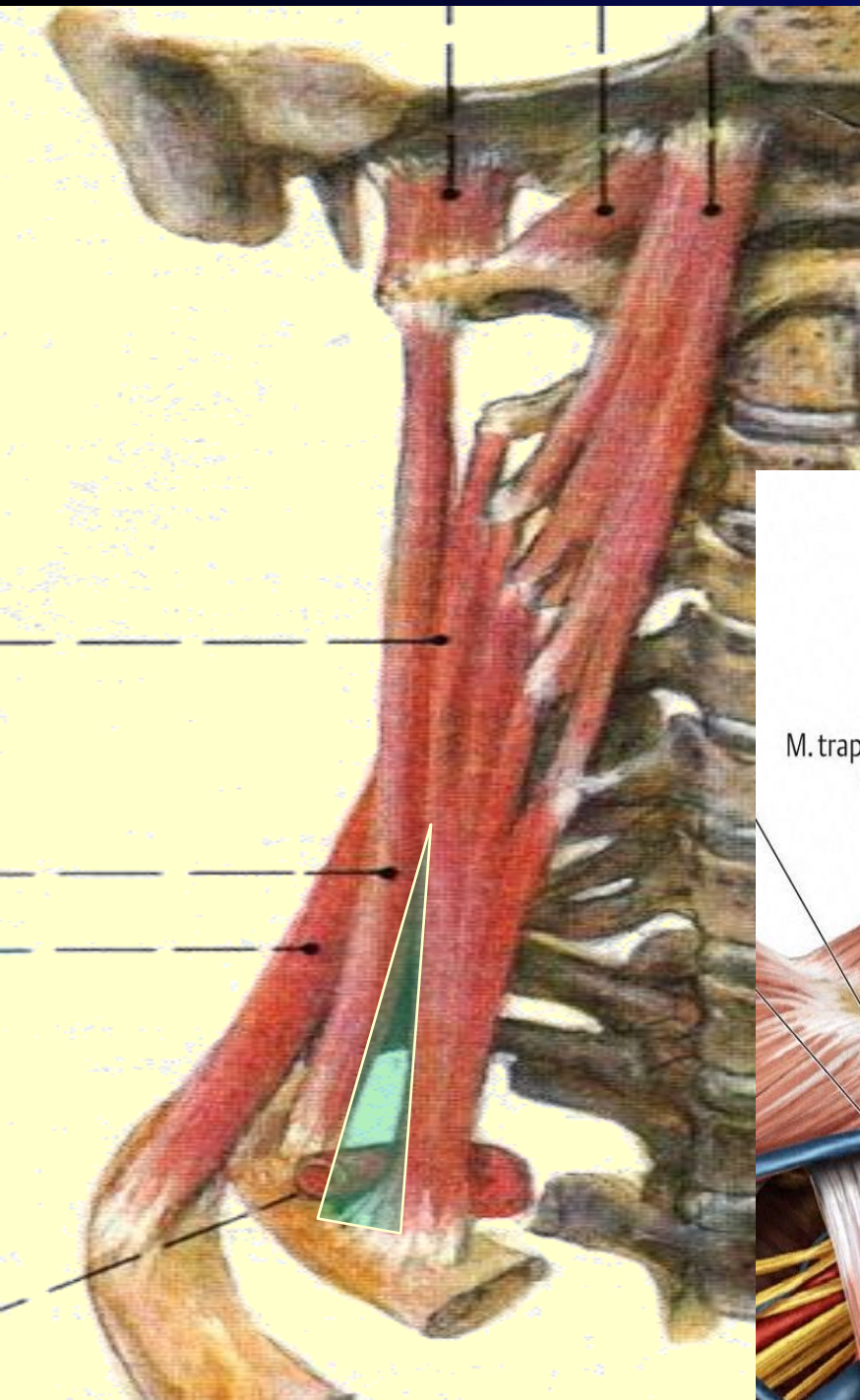
# Scaleni muscles

- ❖ m. scalenus anterior (1a)
- ❖ m. scalenus medius (1b)
- ❖ m. scalenus posterior (1c)
- ❖ innervation C2 – C8
- ❖ **Unilateral action:**
  - ❖ lateroflexion
  - ❖ Rotation to the contralateral side
- ❖ **Bilateral action:**
  - ❖ Ventral flexion in cervical segments
  - ❖ Ribs 1 and 2 are lifted



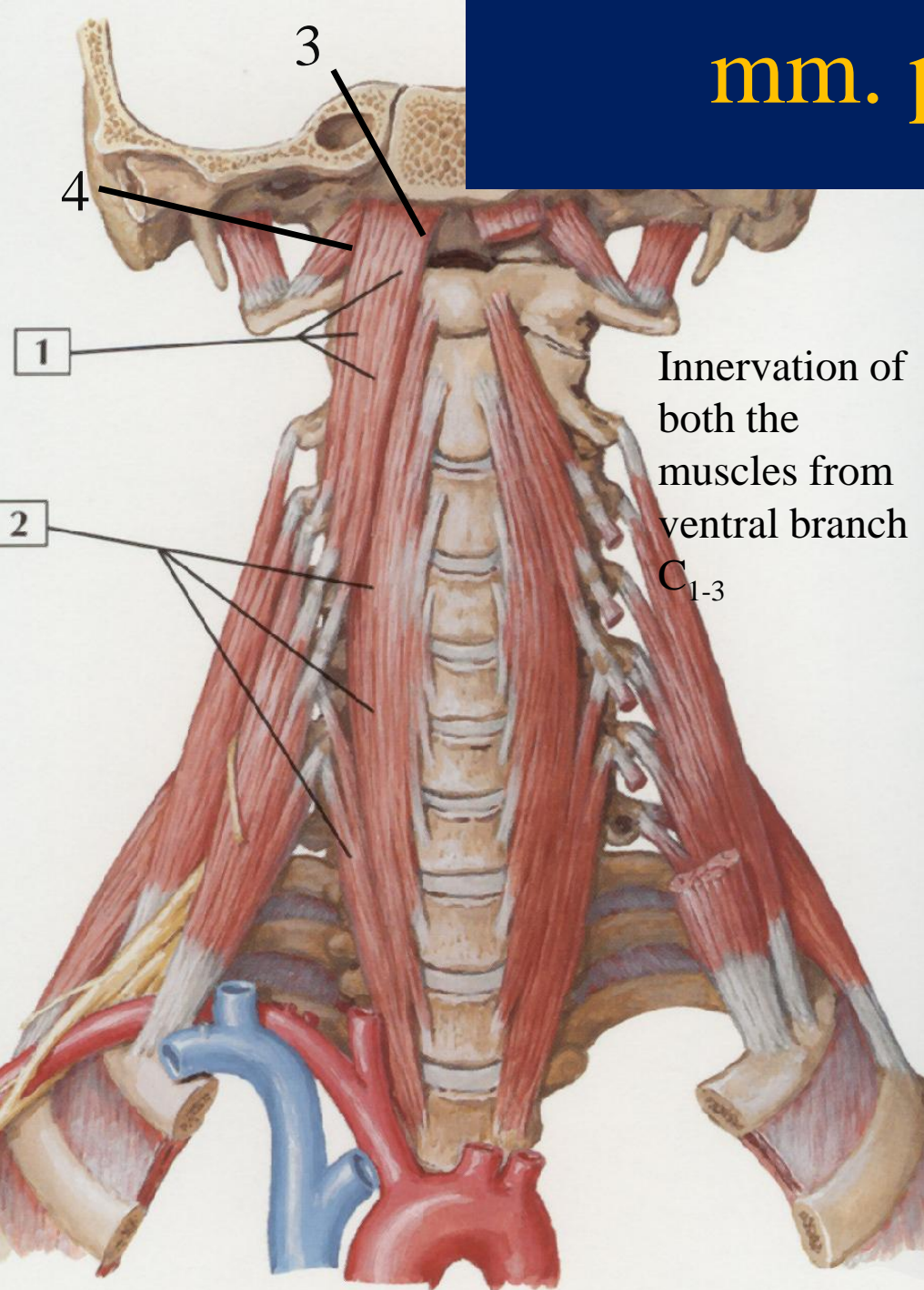


# Fissura scalenorum scalenic fissure





# mm. praevertebrales



**m. longus capitis (1)** Basis ossis occipitalis (ventrálně od for. magnum)  
Procc. transversi C<sub>3-6</sub> (tuber. ventralia)

❖ ventral flexion

❖ **m. longus colli (2)**

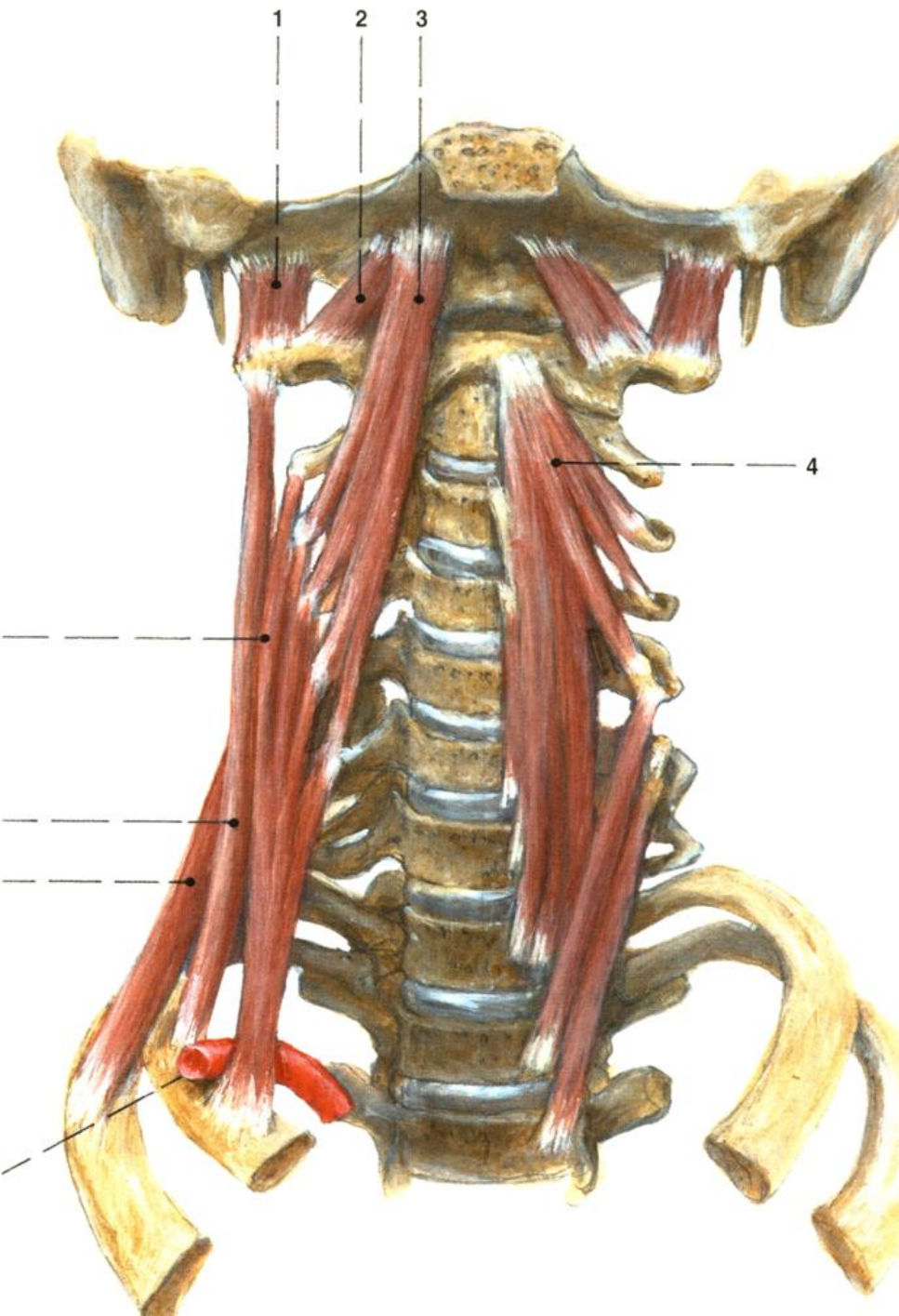
❖ cervical vertebral column is flexed

❖ **m. rectus capitis lateralis (3)**

❖ ventrally curved

❖ **m. rectus capitis anterior (4)**

❖ forward direction



# mm. praevertebrales

## M. longus colli

### ❖ Pars recta

- Ventral part of the body C<sub>2-4</sub>
- Ventral part of the body C<sub>5-7</sub> and T<sub>1-4</sub>

### ❖ Pars obliqua superior

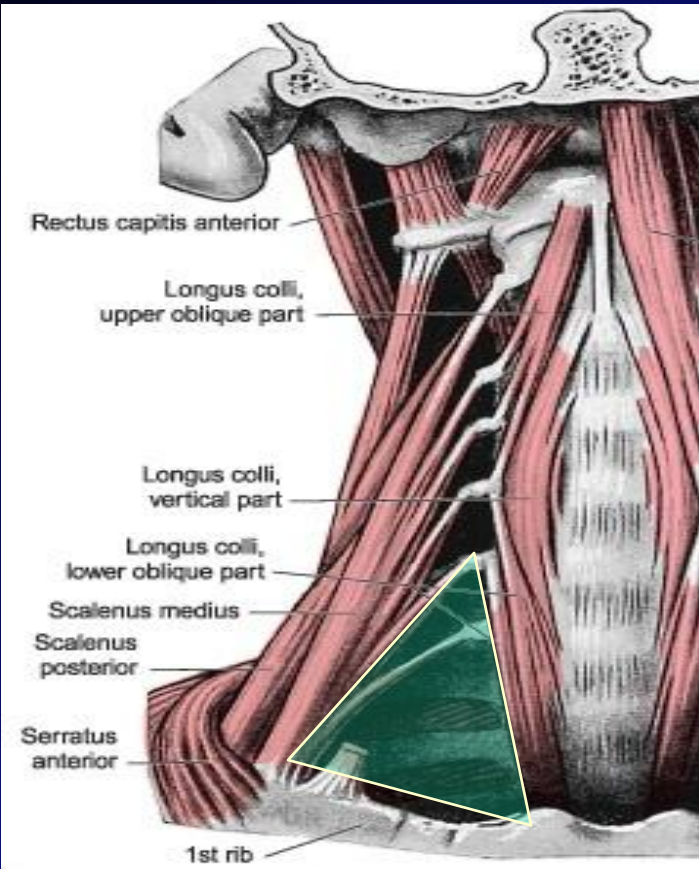
- anterior tubercle C<sub>1</sub>
- Transverse procc. C<sub>3-5</sub>  
(Anterior tubercles)

### ❖ Pars obliqua inferior

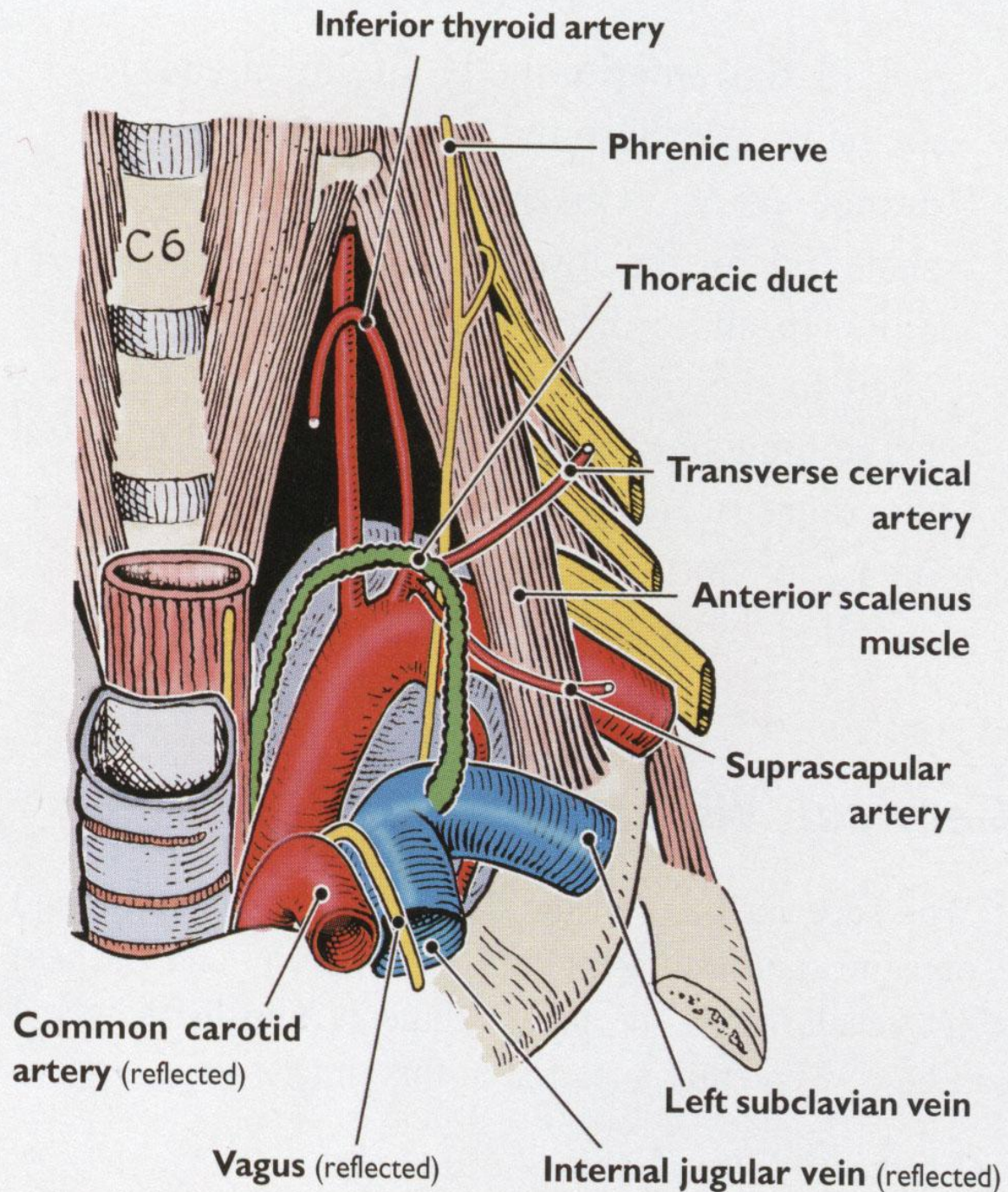
- Transverse procc. C<sub>5-6</sub>  
(anterior tubercles)
- Ventral part of the body T<sub>1-3</sub>



# Trigonum scalenovertebrale

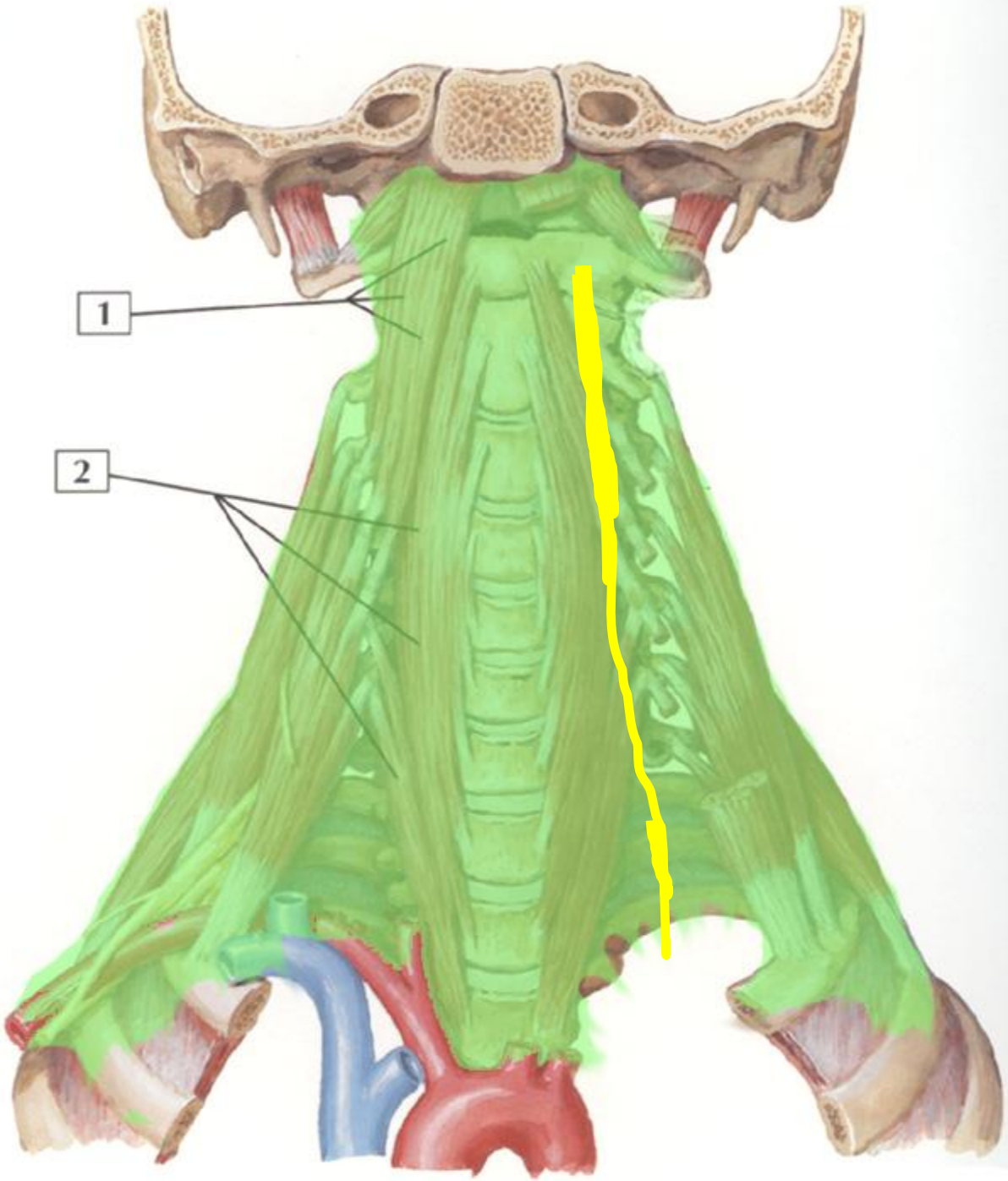


# Scalenovertebral triangle





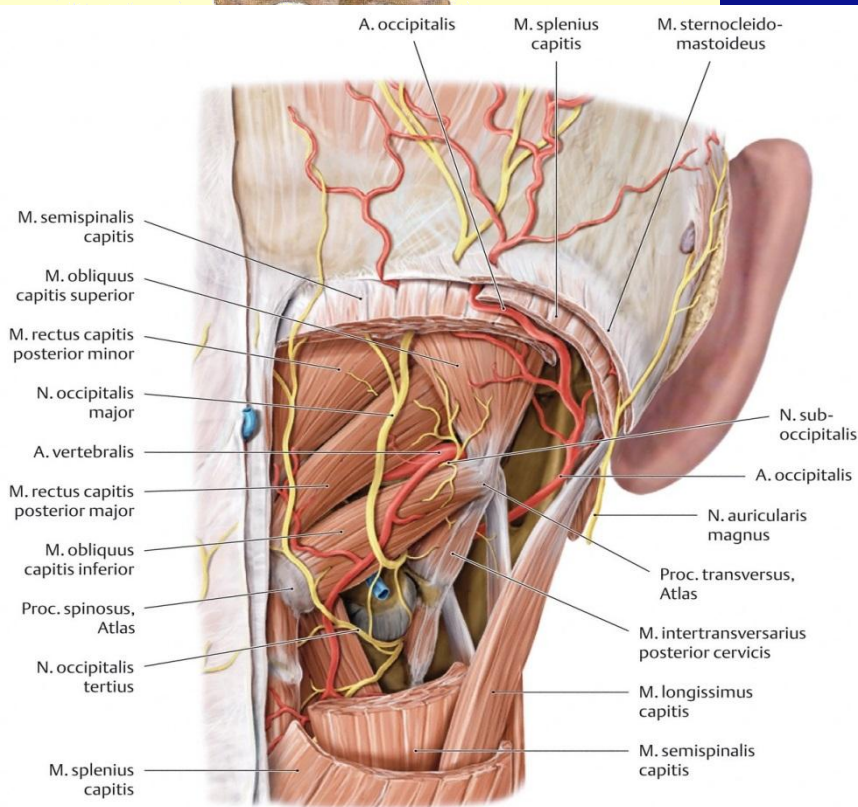
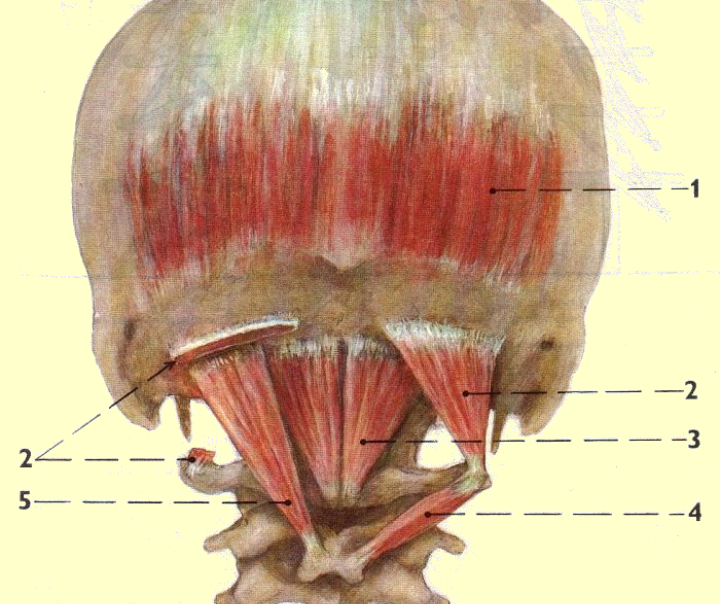
# Prevertebral fascia





# Suboccipital muscles (deep nuchal) and short back muscles

- ❖ between C1, C2 and occipital bones
- ❖ Balance of head and vertebrae
- ❖ suboccipital triangle (vertebral a.)

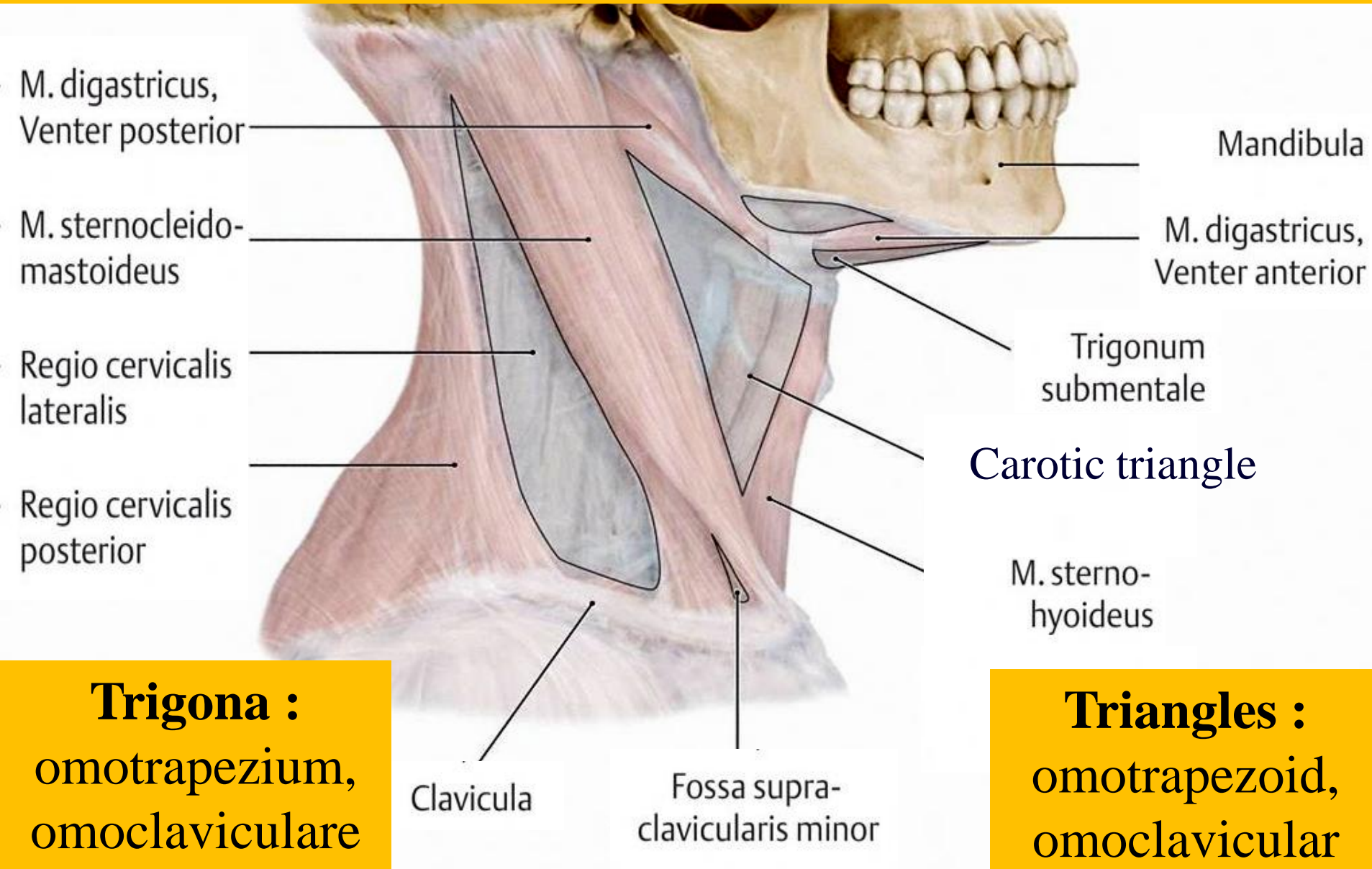


- ~ m. rectus capitis posterior major (5)
- ~ m. rectus capitis posterior minor (3)
- ~ m. obliquus capitis superior (2)
- ~ m. obliquus capitis inferior (4)

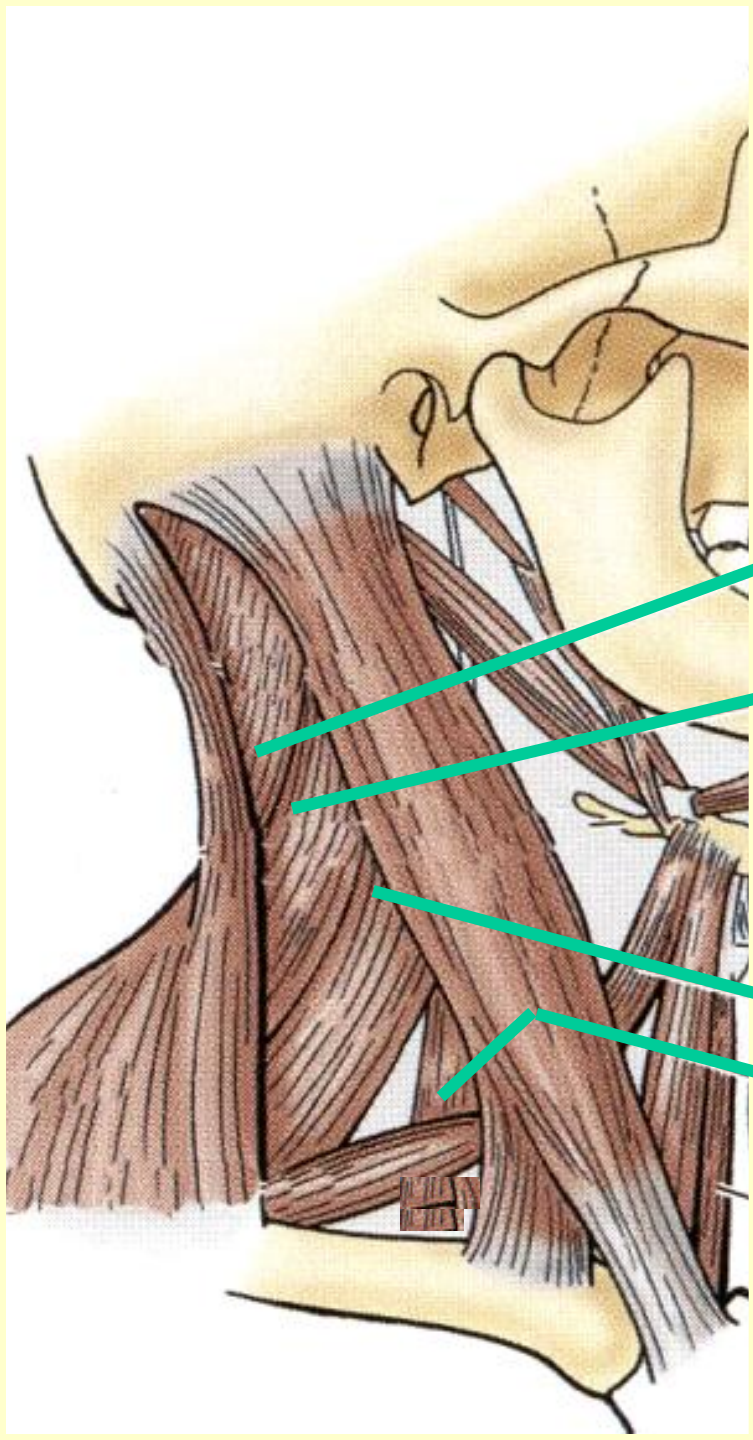
**TOPOGRAPHIC  
REGIONS  
and  
SPACES**



# Regio colli lateralis; Lateral (posterior) neck triangle



# Muscles in the bottom of the lateral neck triangle



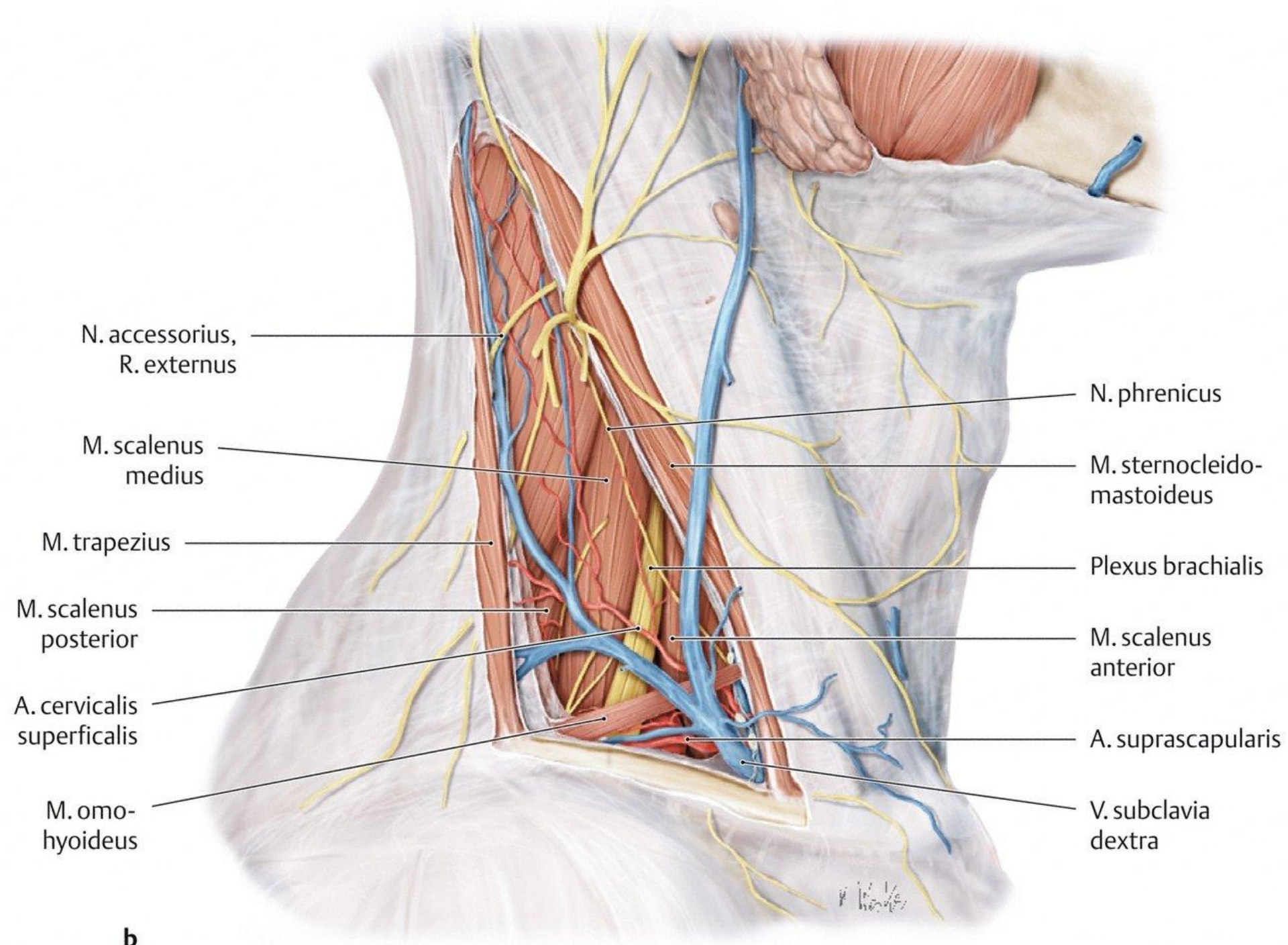
Semispinalis

Splenius

Levator scapulae

Scalenus anterior





**b**

# Lateral (Posterior) triangle of the neck

## Main structures

Cervical plexus part (Erb' point)

XI. nerve

Part of the brachial plexus

External jugular vein

Deep (profundus) lymph nodes

Branches from the subclavian artery



# Regio colli anterior ; Anterior (ventral) neck triangle

Trigonum submandibulare

M. digastricus, Venter anterior

**Trigona :**  
submentale,  
submandibulare,  
caroticum  
(musculare), regio  
suprasternalis

Trigonum submentale

Os hyoideum

Trigonum caroticum

M. sternocleidomastoideus

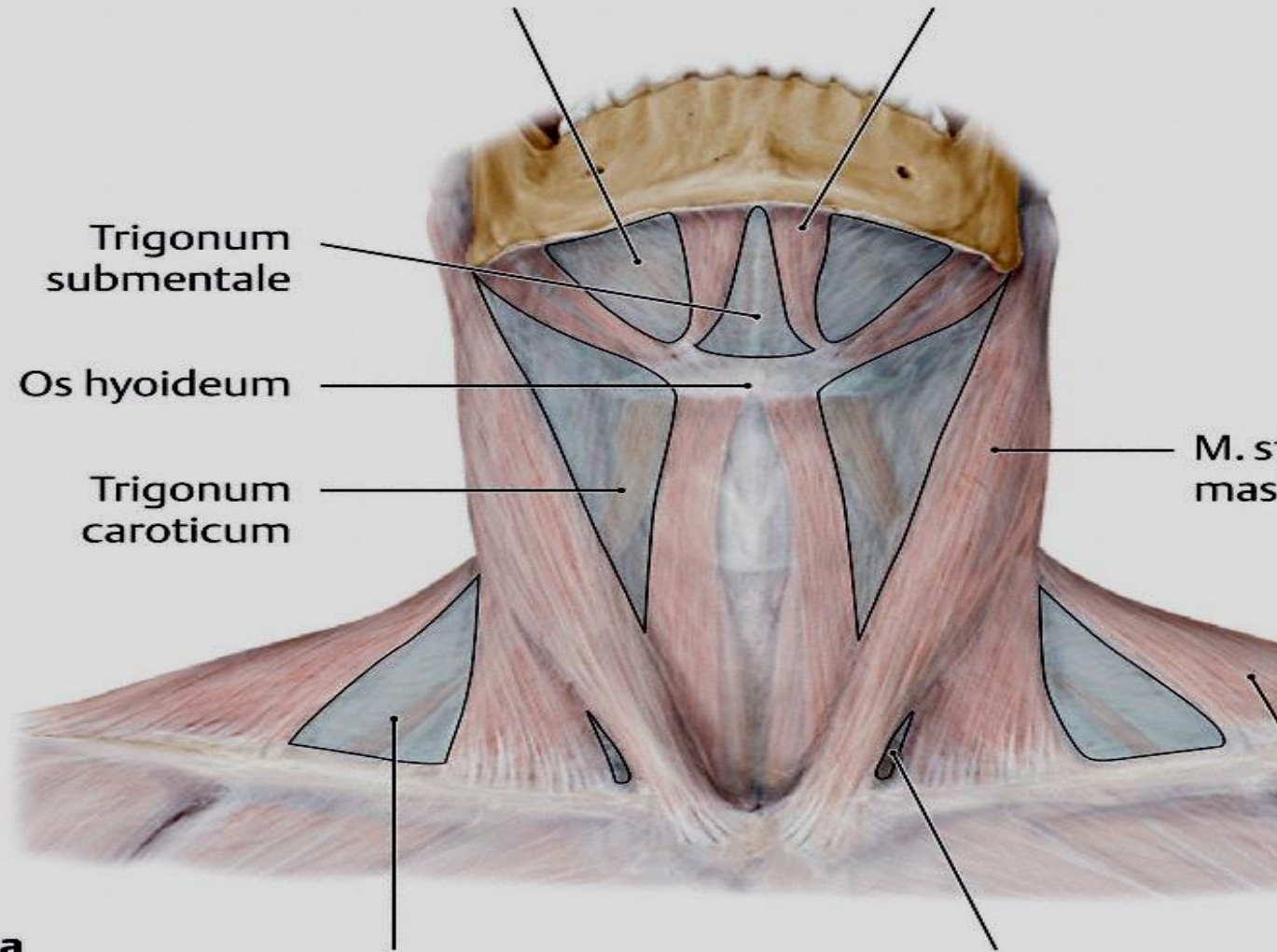
**Trigona :**  
submental,  
submandibular,  
carotic (muscular),  
suprasternal region

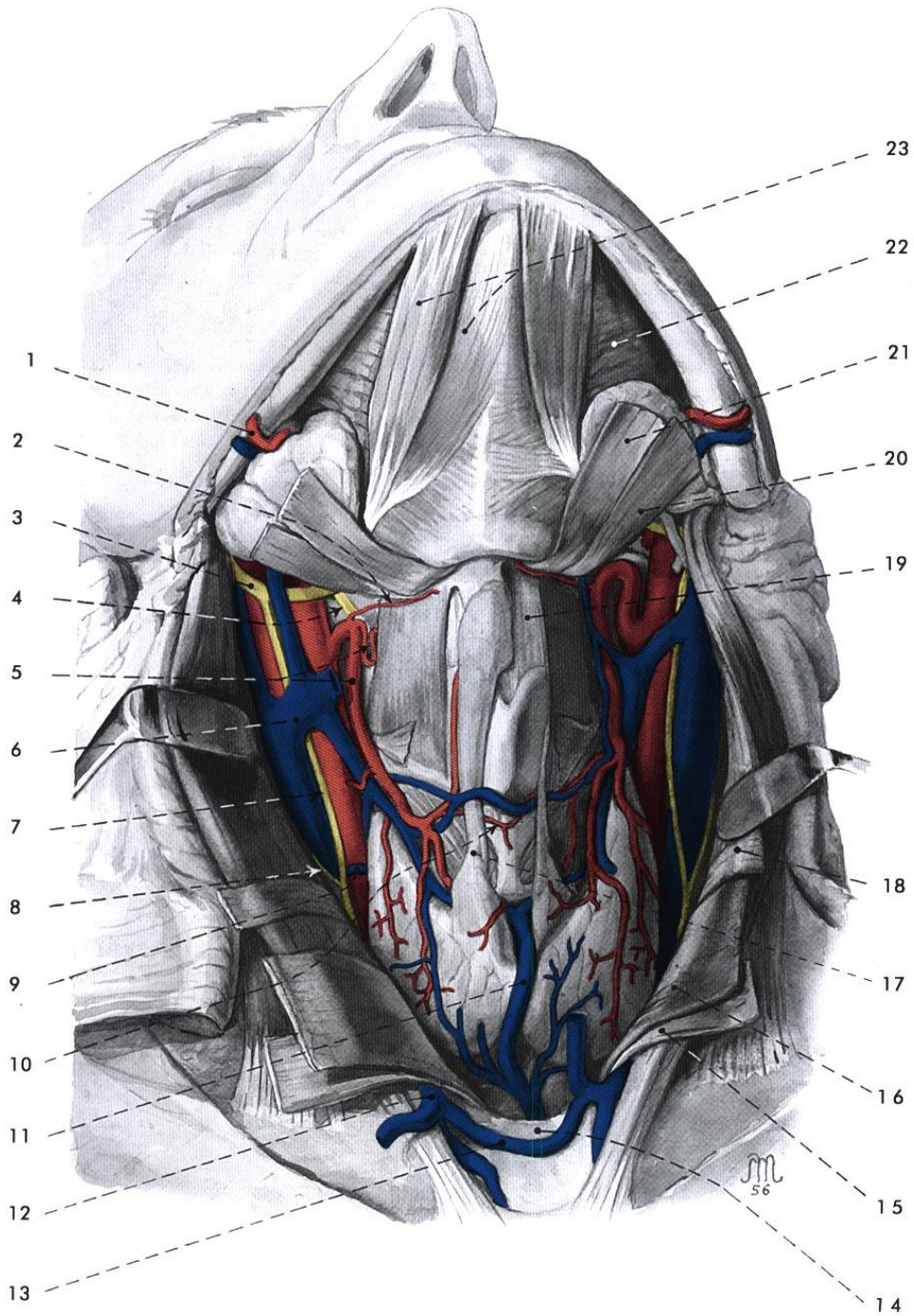
a

Regio cervicalis lateralis;  
Trigonum cervicale posterius;  
Trigonum colli laterale

Fossa supraclavicularis minor

M. trapezius





- 1 – a. et v. facialis,
- 2 – r. infrahyoideus z a. thyroidea superior,
- 3 – n. hypoglossus,
- 4 – n. laryngeus superior,
- 5 – a. thyroidea superior a z ní odstupující a. laryngea superior,
- 6 – truncus thyrolinguofacialis ústící do v. jugularis interna,
- 7 – r. descendens n. hypoglossi,
- 8 – radix inferior ansae cervicalis,
- 9 – v. thyroidea media,
- 10 – r. cricothyroideus z a. thyroidea superior,
- 11 – v. thyroidea inferior,

## Nervous and vascular bundles in the neck

- 12 – v. jugularis anterior,
- 13 – arcus venosus juguli,
- 14 – lamina pretrachealis fasciae colli,
- 15 – m. sternohyoideus,
- 16 – m. sternothyroideus,
- 17 – lobus pyramidalis gl. thyroideae,
- 18 – m. omohyoideus,
- 19 – membrana thyrohyoidea,
- 20 – m. omohyoideus,
- 21 – m. sternohyoideus,
- 22 – m. mylohyoideus,
- 23 – venter anterior m. digastrici s akcesorním bříškem



# Anterior triangle of the neck

## main structures

Internal jugular vein + branches

Common carotid artery, external + internal carotid aa.

Lymph nodes

X. nerve, branches of the V. nerve, XII. nerve

Sympathetic trunk

Thyroid gland, parathyroid gland, submandibular gland, sublingual gland

Trachea, larynx, pharynx, esophagus

# Neck fasciae

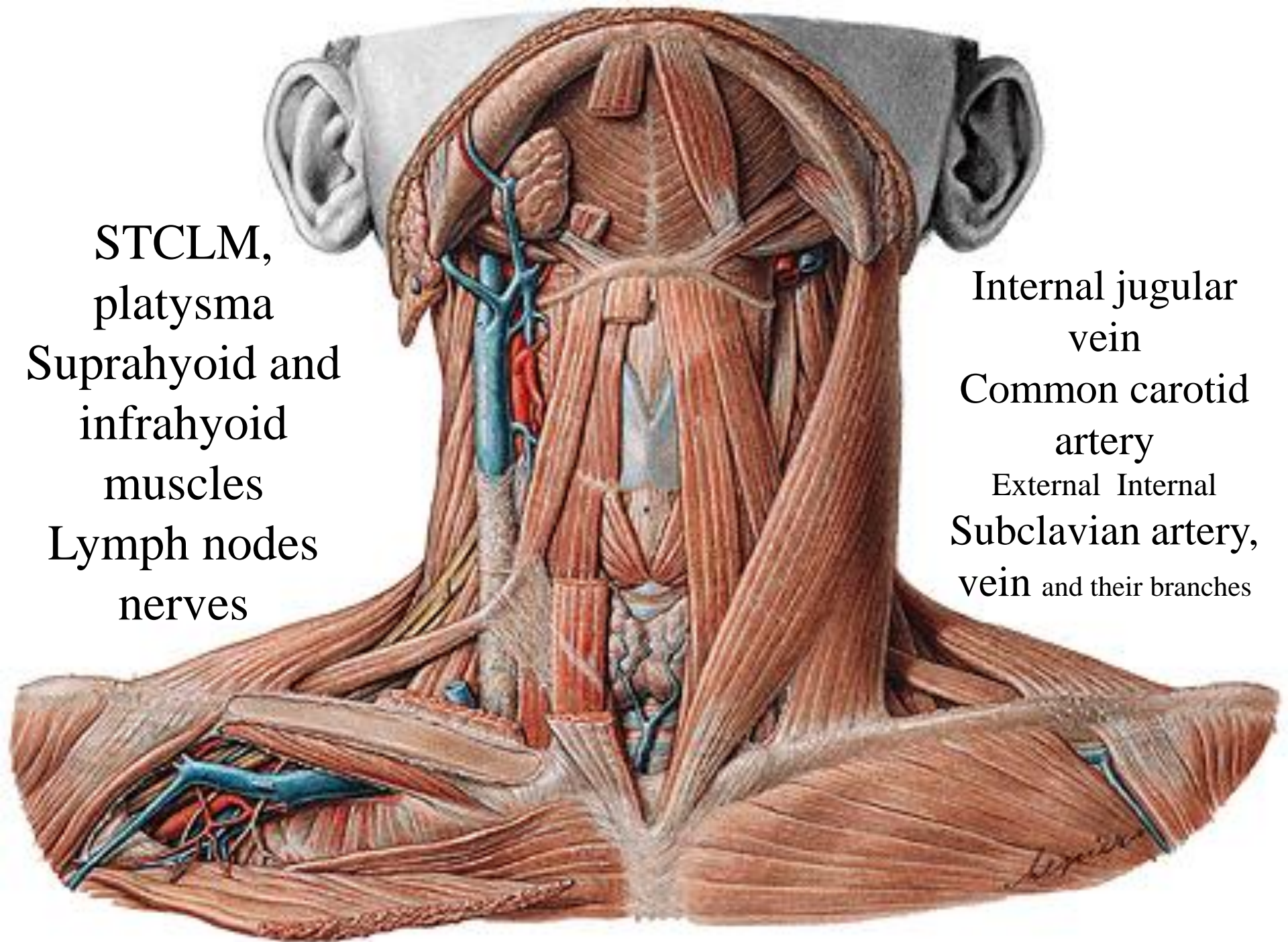
They make borders among muscles and organs:

- ❖ Lamina superficialis - investing fascia (f. colli superf., investing cervical):
  - ❖ → f. nuchae, f. pectoralis, f. deltoidea
  - ❖ obaluje m. sternocleidomastoideus + trapezius
  - ❖ p. supra/infrahyoidea
- ❖ Lamina pretrachealis pretracheal fascia (f. colli media, middle cervical)
  - ❖ Form -  $\Delta$ , invests infrahyoid muscles
  - ❖ vagina carotica
- ❖ Lamina prevertebralis prevertebral fascia (profunda, deep cervical)
  - ❖ covers mm. scaleni
  - ❖ alar fascia

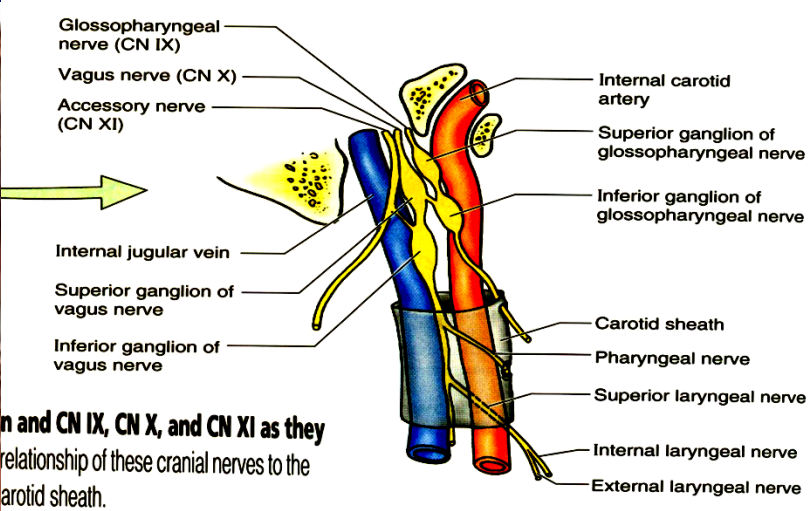
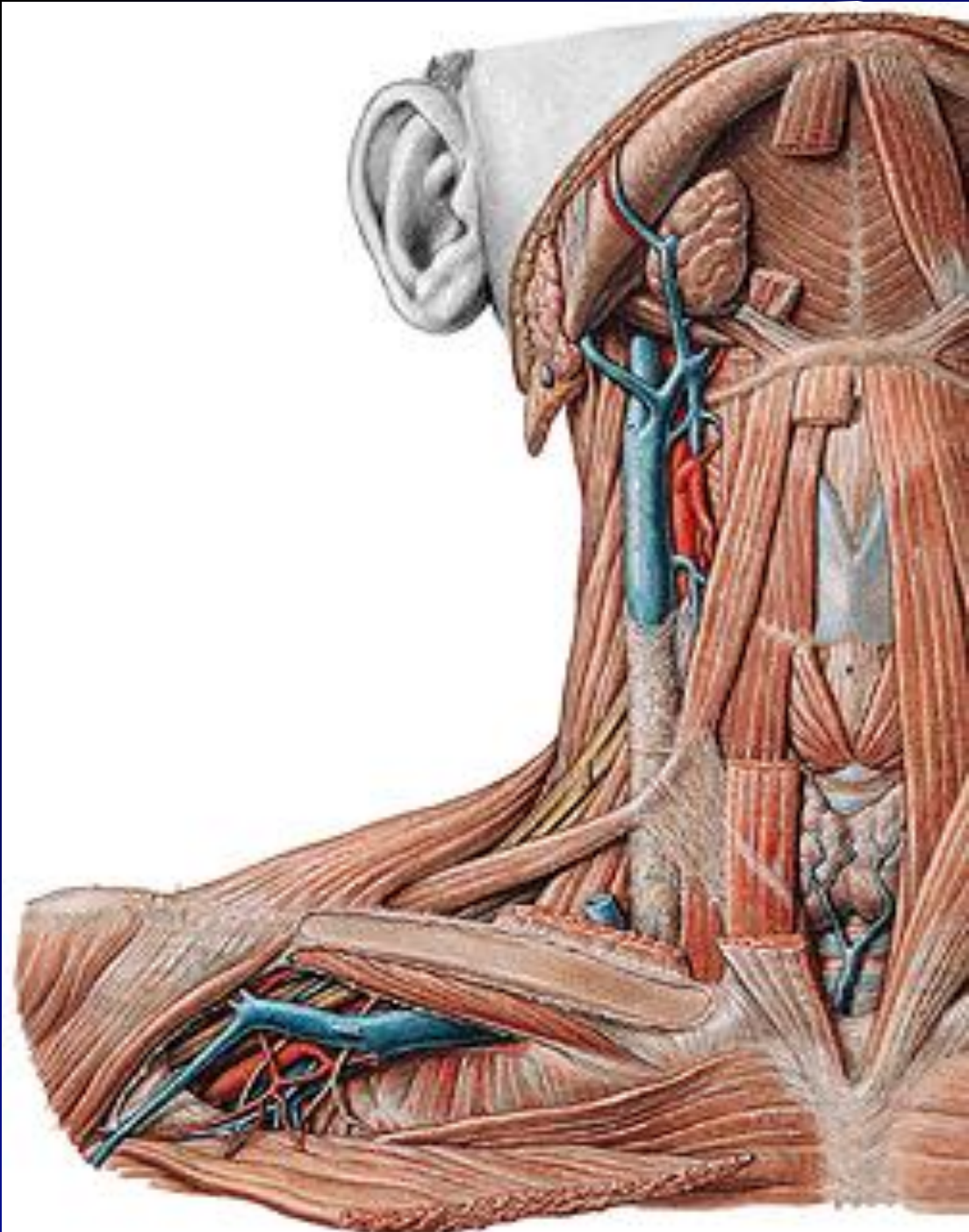


STCLM,  
platysma  
Suprahyoid and  
infrahyoid  
muscles  
Lymph nodes  
nerves

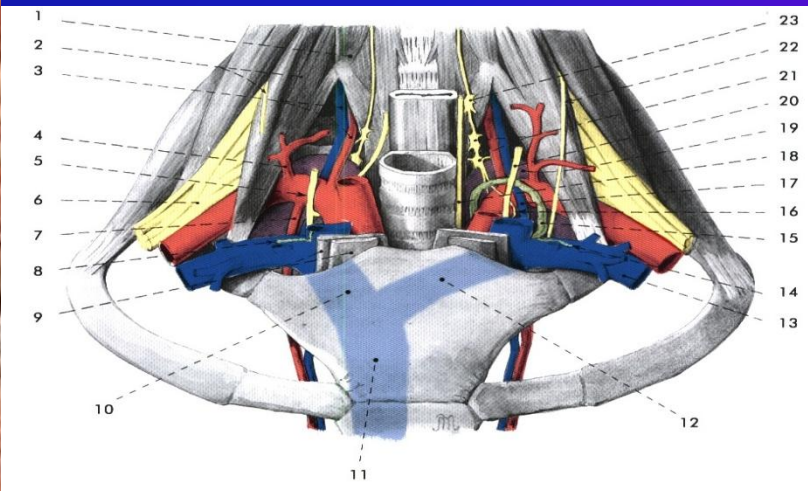
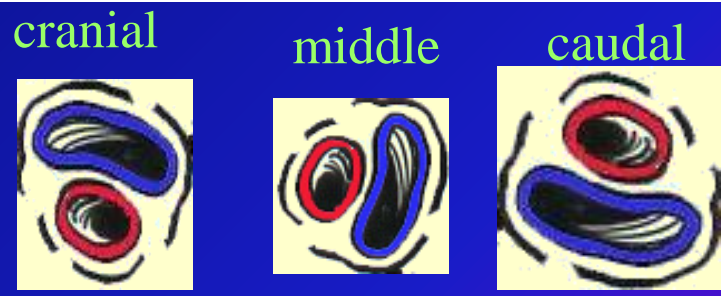
Internal jugular  
vein  
Common carotid  
artery  
External Internal  
Subclavian artery,  
vein and their branches





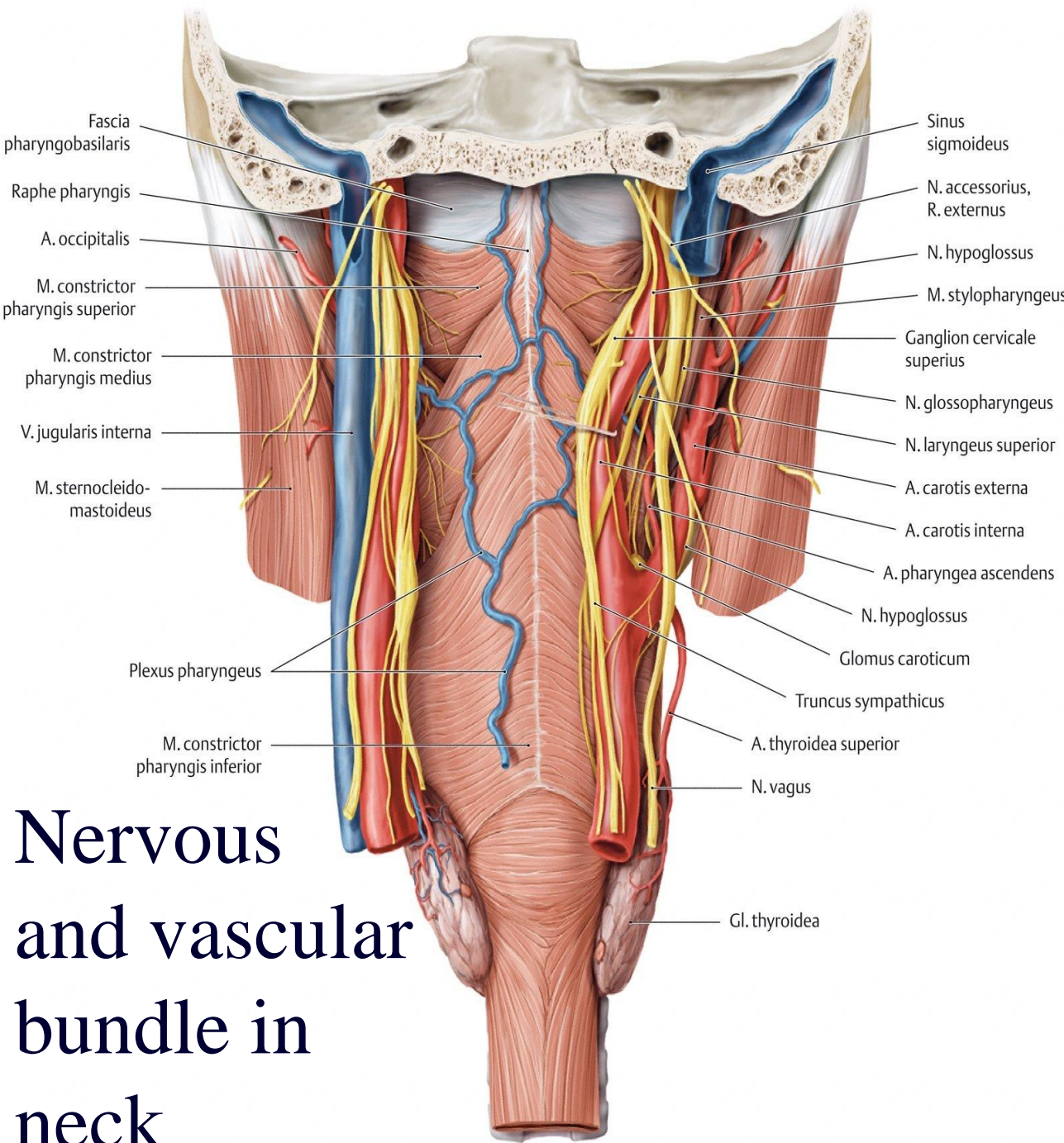


n and CN IX, CN X, and CN XI as they  
 relationship of these cranial nerves to the  
 arotid sheath.

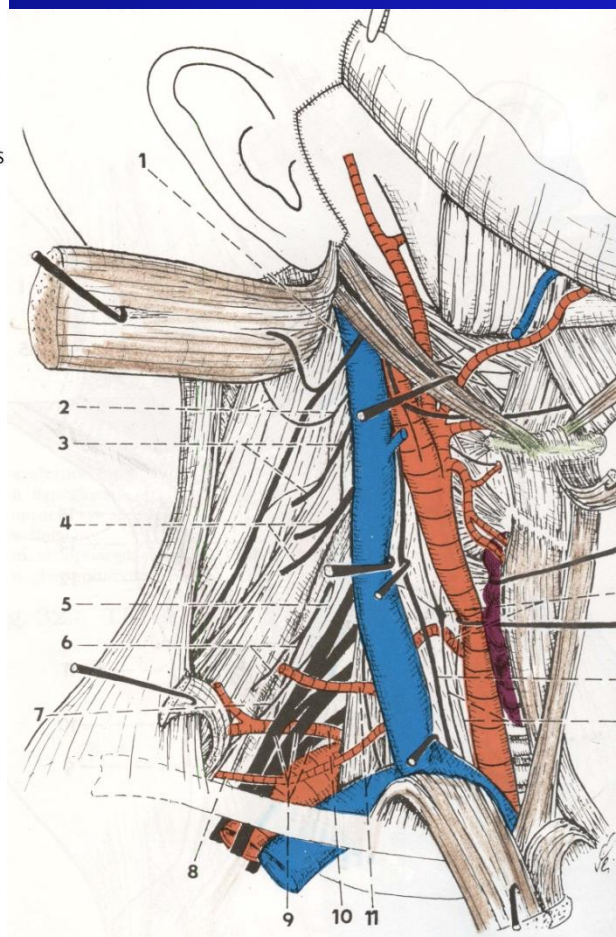


Obr. 14.9. Fissura scalenorum, trigonum scalenovertrebrale a cervikotorakální přechod. 1 – m. longus capitis, 2 – m. scalenus anterior a n. phrenicus, 3 – a. et v. vertebralis, 4 – truncus thyrocervicalis, 5 – n. vagus, 6 – plexus brachialis, 7 – a. thoracica interna, 8 – truncus subclavius dexter, 9 – m. sternohyoideus et m. sternothyroideus, 10 – v. brachiocephalica dextra, 11 – v. cava superior, 12 – v. brachiocephalica sinistra, 13 – v. subclavia sinistra, 14 – truncus subclavius sinister, 15 – ductus thoracicus, 16 – ansa subclavia, 17 – v. vertebralis, 18 – n. laryngeus recurrens, 19 – cupula pleurae, 20 – n. vagus, 21 – ganglion cervicale medium, 22 – n. phrenicus, 23 – ganglion vertrebrale (odštěpení část ggl. cervicale medium)





# Nervous and vascular bundle in neck

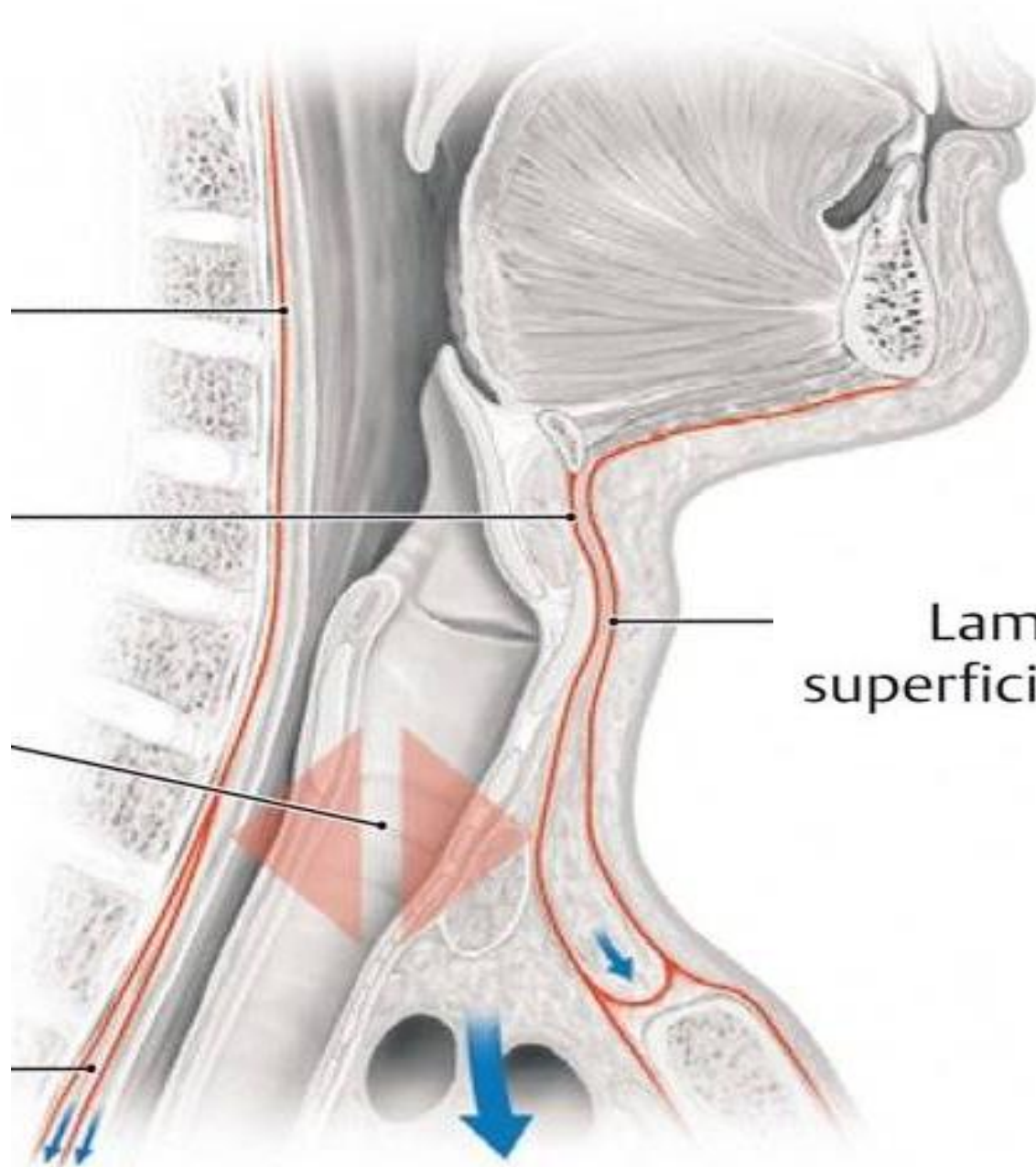


Lamina  
prevertebralis

Lamina  
pretrachealis

zervikaler  
Gleitraum  
(Eingeweide-  
raum)

— „danger  
space“



Lamina  
superficialis

Mediastinum

d



# RECOMMENDED LITERATURE

**M. DYKES** : Anatomy

*2<sup>th</sup> edition, Mosby 2002*

**R. ČIHÁK**: Anatomie 1, 2, 3

*Grada Publishing 2003*

or **S.SNELL**: Clinical anatomy for Medical Students

*6<sup>th</sup> edition, Lippincott, Williams & Wilkins*

**G.J.TORTORA** : Principles of Human Anatomy

*4<sup>th</sup> edition, Williams & Wilkins*

**K.L.MOORE, A.F.DALLEY**: Clinically Oriented Anatomy

*4<sup>th</sup> edition, Williams & Wilkins*

**F.H.NETTER**: anatomický atlas člověka

*Grada Avicenum 2003*

*END*





# Neck important notices

## ❖ laryngoscopy

- ❖ indirect: using laryngoscopic mirror

## ❖ Central venous cathetrization

- ❖ v. subclavia
- ❖ v. jugularis int.

## ❖ endarterectomy

- ❖ plx. brachialis, skalenic syndrom + costoclavicular syndrom

# What it is necessary to memorize?

## ❖ Nodes:

- ❖ n.l. submandibulares, submentales, cervicales lat., V-T

## ❖ Salivary glands

- ❖ Carotic  $\Delta$  – carotic sinus, pulse

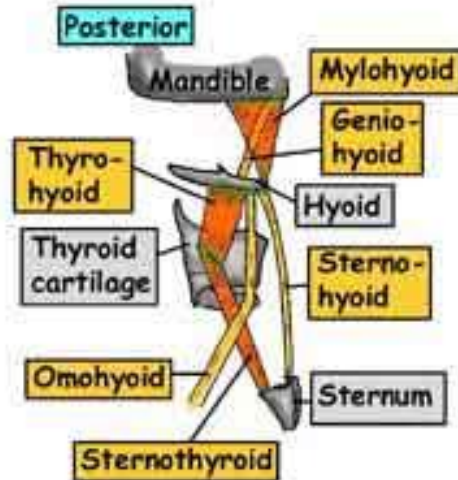
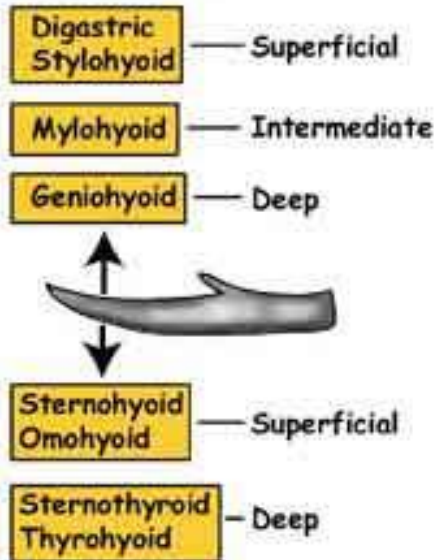
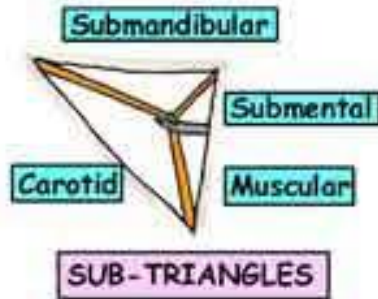
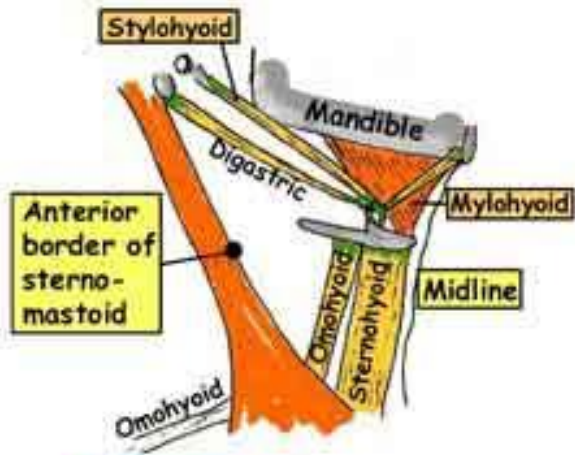
- ❖ Superficial neck veins – content

- ❖ Thyroid gland – isthmus at level 2-4  
cartilaginous ring; attaches pretracheal fascia

- ❖ coniotomy x tracheotomy+tracheostomy



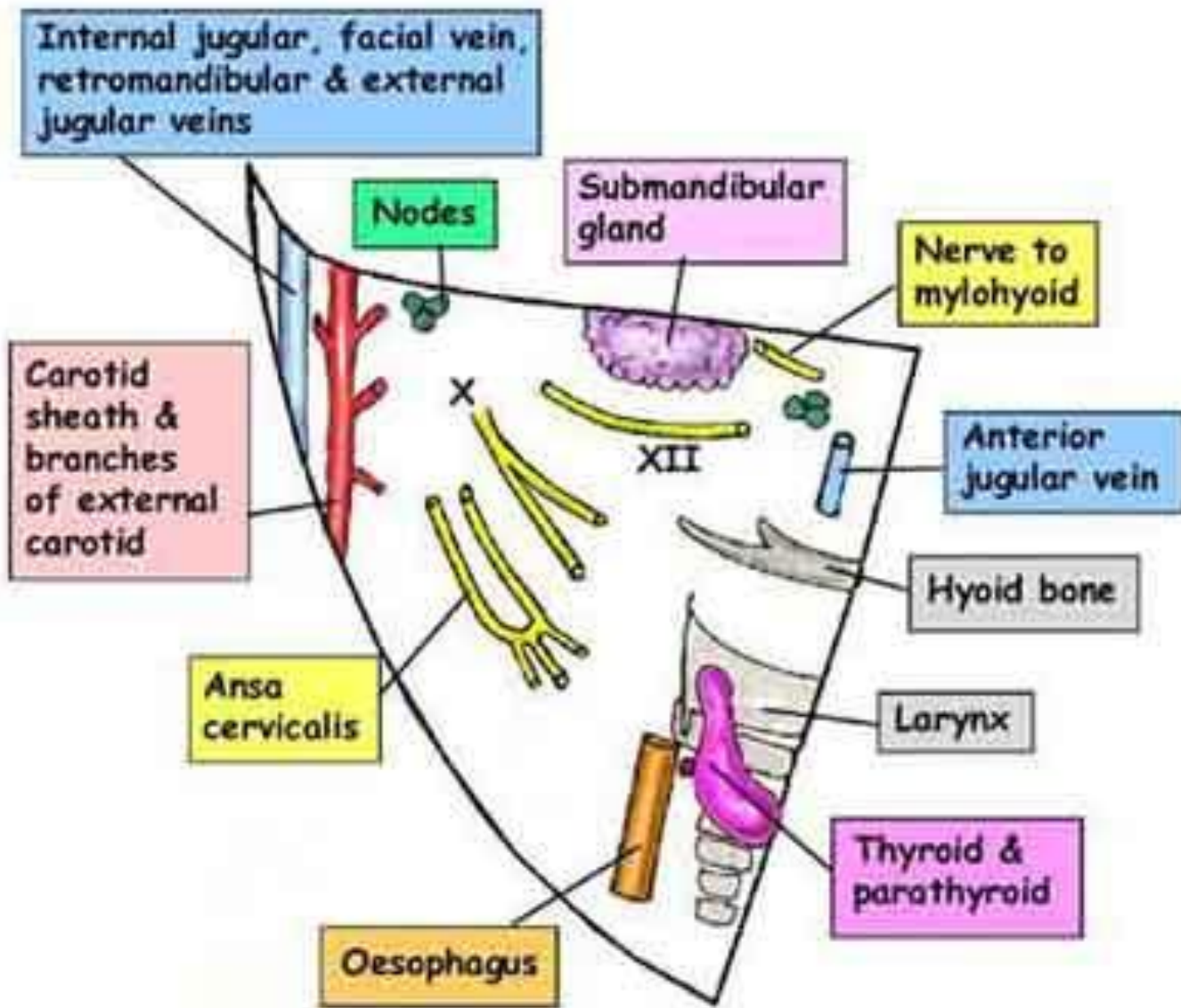
**ANTERIOR TRIANGLE OF NECK  
SUB-TRIANGLES  
SUPRAHYOID AND STRAP MUSCLES**



**MUSCLES**

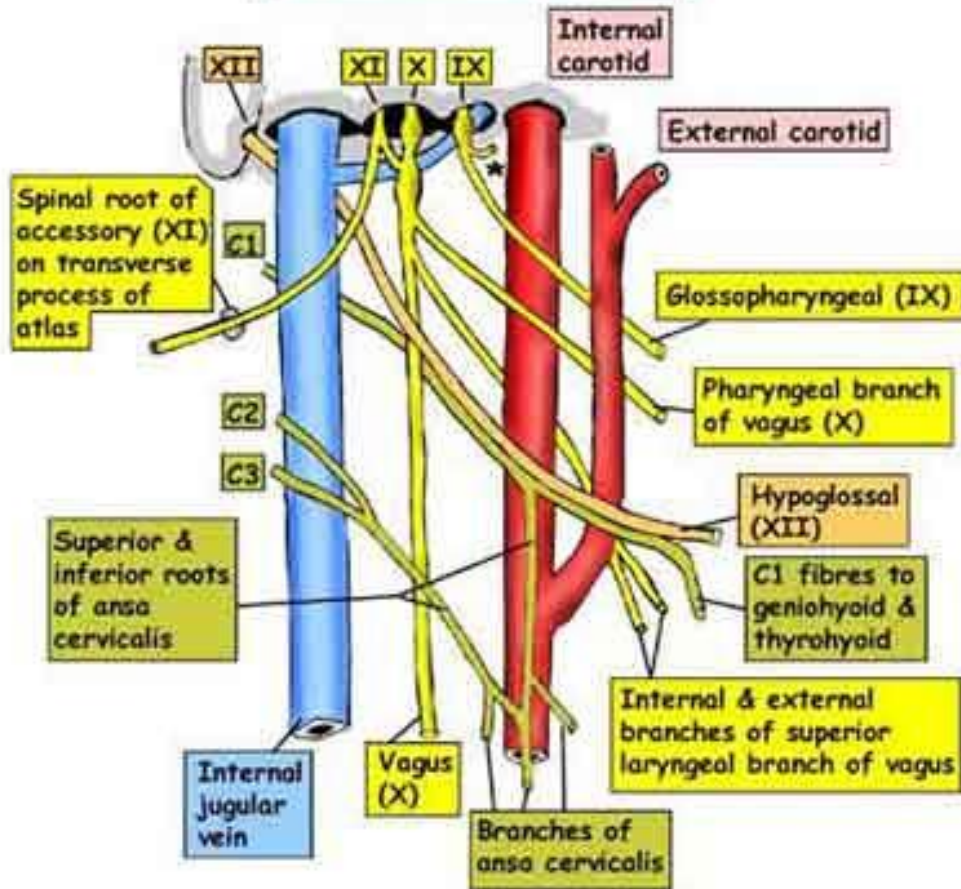
Lie between pretracheal & investing fasciae.  
Supplied by anterior rami of C1-3, ansa cervicalis,  
facial nerve & nerve to mylohyoid (Vc)

# ANTERIOR TRIANGLE OF NECK DIAGRAM OF CONTENTS



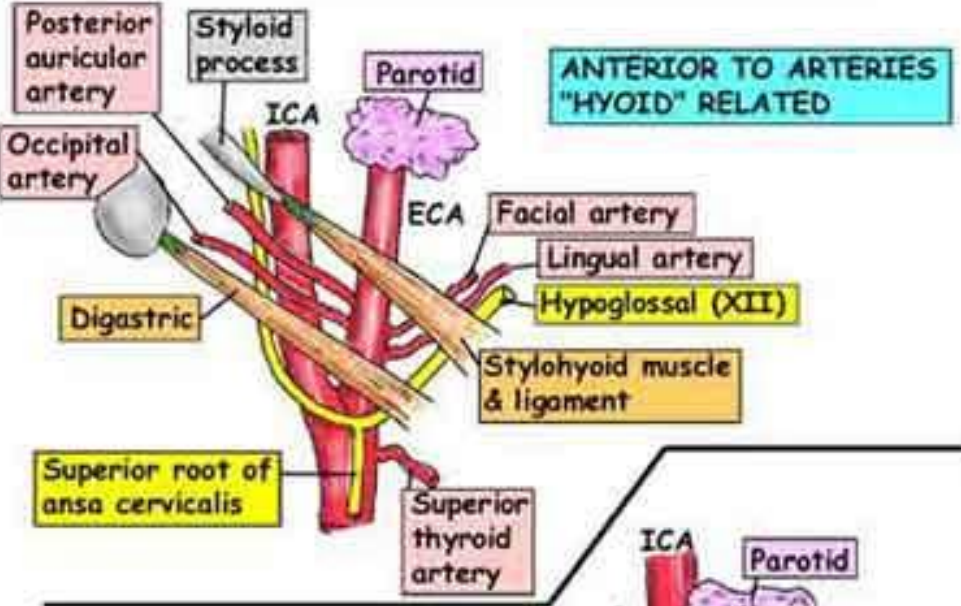


## JUGULAR FORAMEN EXPLODED VIEW



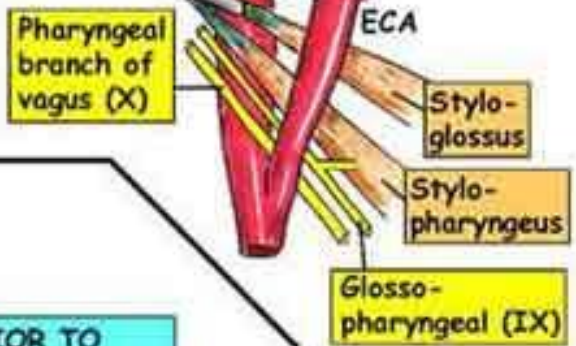
- The vagus lies most medial in the foramen
  - Glossopharyngeal nerve & inferior petrosal sinus exit from the anterior compartment of the foramen
  - Vagus & accessory nerves exit from the middle compartment
  - The sigmoid sinus exits from the posterior compartment, is soon joined by the inferior petrosal sinus to become the internal jugular vein
- \* = Tympanic branch of IX (Jacobson's nerve)

# RELATIONS OF THE BIFURCATION OF THE CAROTID ARTERIES

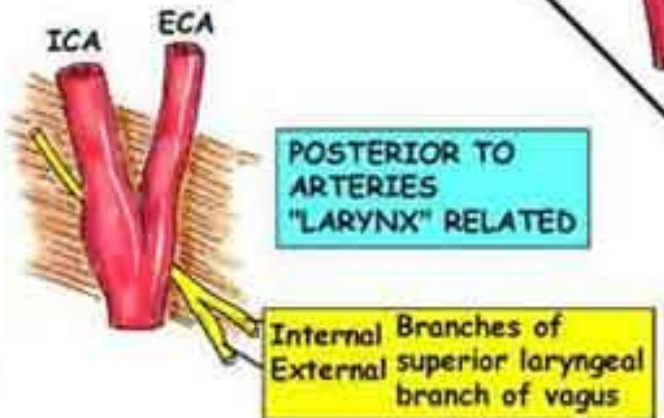


ANTERIOR TO ARTERIES  
"HYOID" RELATED

BETWEEN ARTERIES  
"TONGUE/PHARYNX"  
RELATED



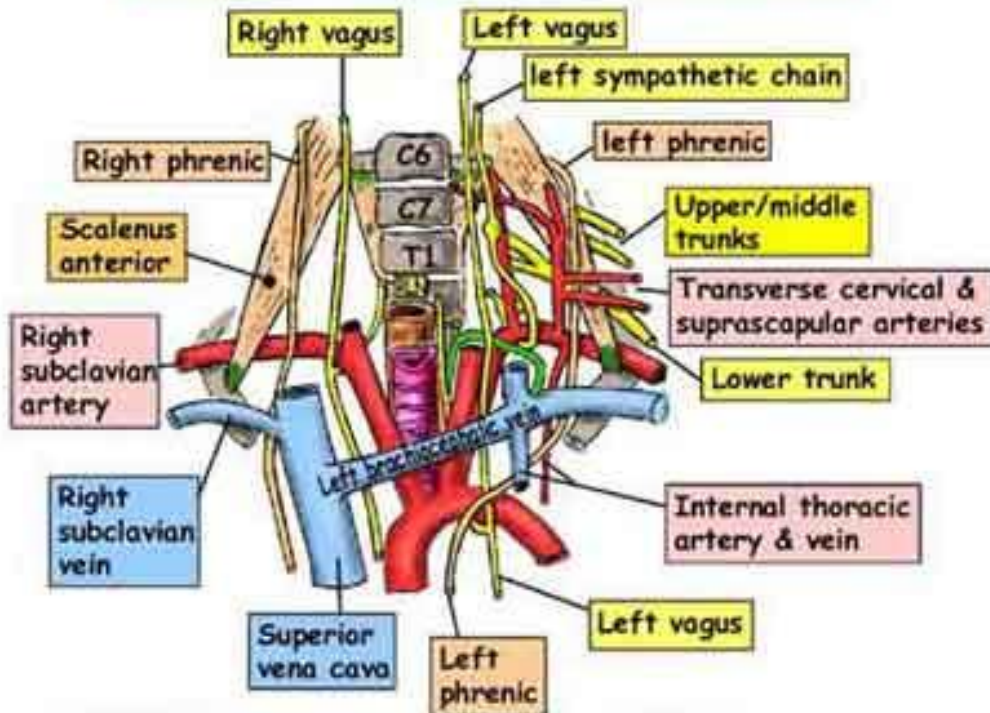
POSTERIOR TO ARTERIES  
"LARYNX" RELATED



ICA  
Internal carotid artery  
ECA  
External carotid artery



## RELATIONS TO SCALENUS ANTERIOR



### ANTERIOR

- Phrenic nerve (Under prevertebral fascia)
- Ascending cervical artery
- Transverse cervical/suprascapular arteries
- Carotid sheath
- Vagus
- Thoracic duct
- Lower belly of omohyoid
- Deep cervical nodes

### POSTERIOR

- 2nd part subclavian artery
- Anterior rami C3-T1
- Costocervical trunk
- Superior intercostal & deep cervical arteries
- Scalenus Medius

### MEDIAL

- longus coli
- Carotid tubercle
- Pyramidal space
- Carotid sheath
- Stellate ganglion
- Vertebral artery
- Middle cervical ganglion
- Inferior thyroid artery
- 1st part subclavian artery
- Ansa subclavia
- Thyrocervical trunk
- Vertebral vein

### LATERAL

- Trunks of brachial plexus
- 3rd part subclavian artery

# PHARYNX - VESSELS & NERVES

## ARTERIAL SUPPLY

Ascending pharyngeal

Internal carotid



Greater palatine (maxillary)

Artery to pterygoid canal (maxillary)

Tonsillar (facial)

Ascending palatine (facial)

Lingual

Superior laryngeal (superior thyroid)

Common carotid

## VENOUS DRAINAGE

Plexus on middle constrictor draining to:  
Pterygoid plexus  
Internal jugular vein  
Lower pharynx to inferior thyroid veins

## NERVE SUPPLY

Levator palati  
Salpingopharyngeus  
Palatopharyngeus  
Palatoglossus  
3 constrictors  
Striated oesophagus

All from PHARYNGEAL PLEXUS on posterior wall of pharynx. It is:  
IX (glossopharyngeal) sensory only  
X (pharyngeal branch of vagus)  
Branchiomotor fibres from nucleus ambiguus via cranial accessory (XI)  
Sympathetic - vasoconstrictor only

Stylopharyngeus

Glossopharyngeal (IX) only

Cricopharyngeus (+/- some oesophagus)

Recurrent laryngeal (X)

Sensation/taste

Nasopharynx: pharyngeal branch of maxillary (Vb) via pterygopalatine ganglion and palatovaginal canal  
Oropharynx/valleculae: IX and X

Sensation only

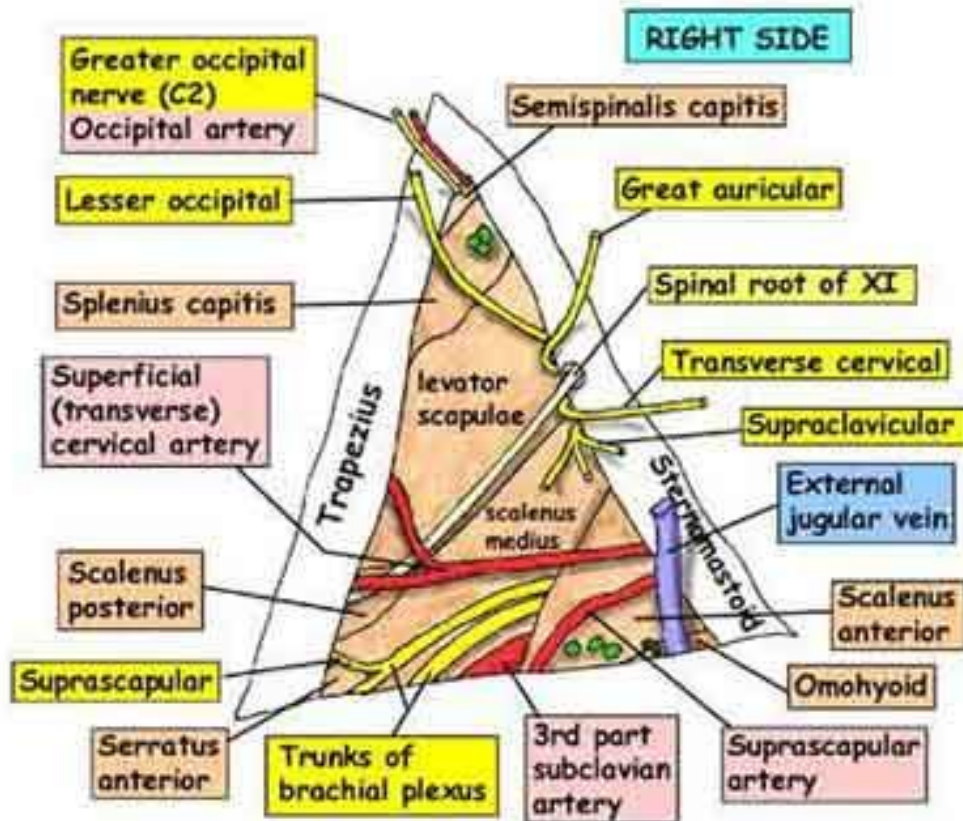
Laryngopharynx: Internal branch of superior laryngeal (X) & recurrent laryngeal (X)

LYMPH - Retropharyngeal to upper/lower deep cervical

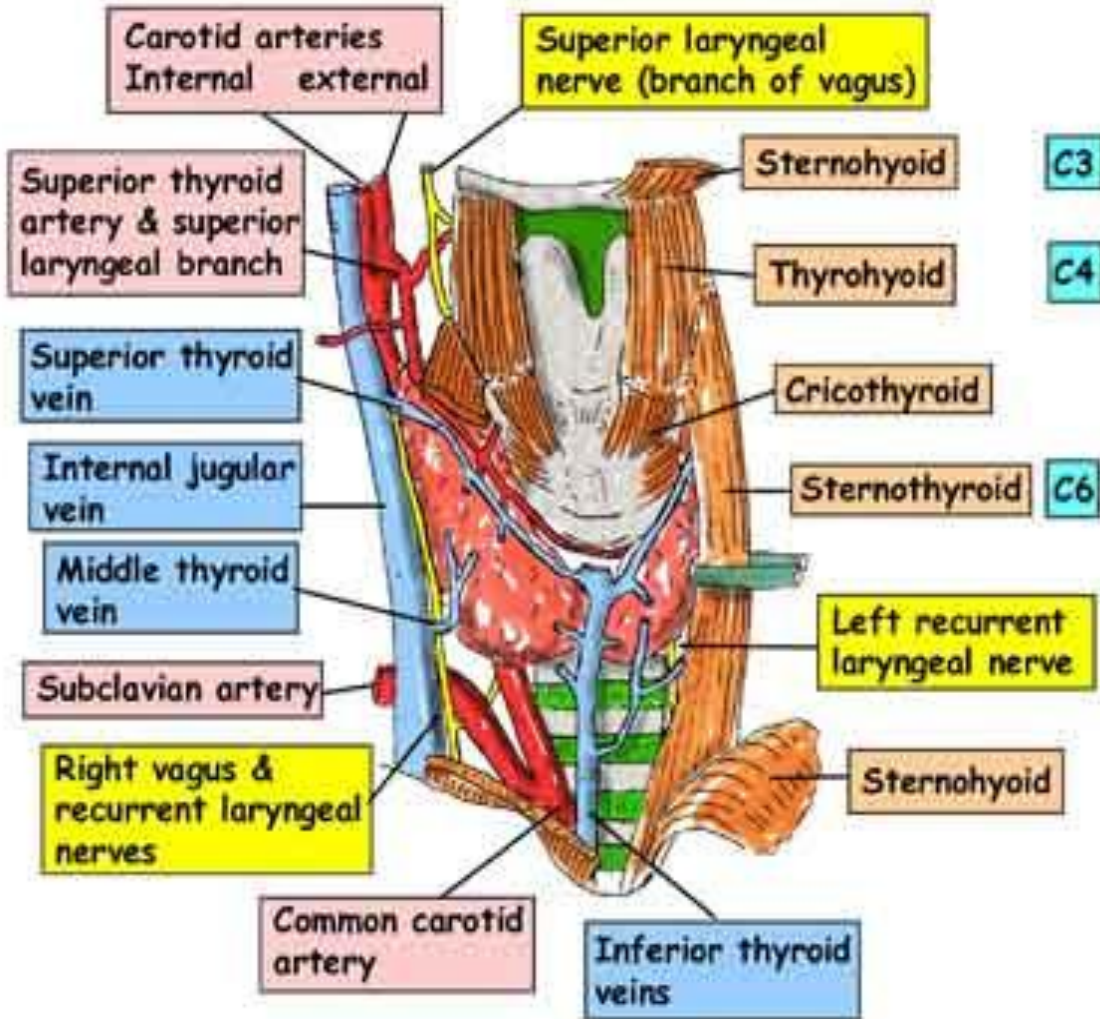


## POSTERIOR TRIANGLE OF NECK

- **Boundaries:** Posterior border of sternocleidomastoid, anterior border of trapezius, mid 1/3 clavicle
- **Shape:** Spiral
- **Roof:** Investing fascia, platysma, external jugular vein
- **Floor:** Prevertebral fascia covering muscles, subclavian artery, trunks of brachial plexus & cervical plexus
- **Contents:**
  - **Arteries:** Occipital, superficial cervical, suprascapular
  - **Veins:** Transverse cervical, suprascapular, external jugular
  - **Nerves:** Branches of cervical plexus, spinal root of accessory
  - **Muscle:** Omohyoid with its sling
  - **Lymph nodes:** Occipital (rubella/scalp infections)  
Supraclavicular (part of the deep chain)



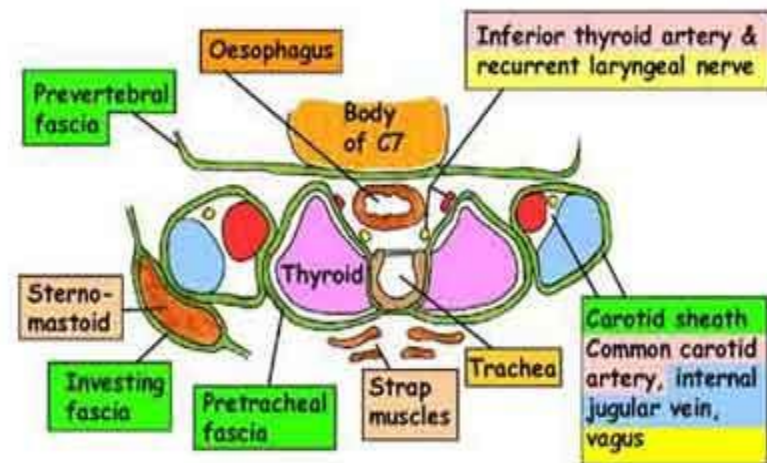
# THYROID GLAND - GENERAL TOPOGRAPHY



# THYROID GLAND - AXIAL SECTION AT C7

## Relations of thyroid gland

- Posterior:** Prevertebral fascia, carotid sheath, parathyroids, trachea
- Medial:** Recurrent laryngeal nerve, trachea, larynx, oesophagus
- Anterior:** Pretracheal fascia, sternohyoid, sternothyroid venous arch

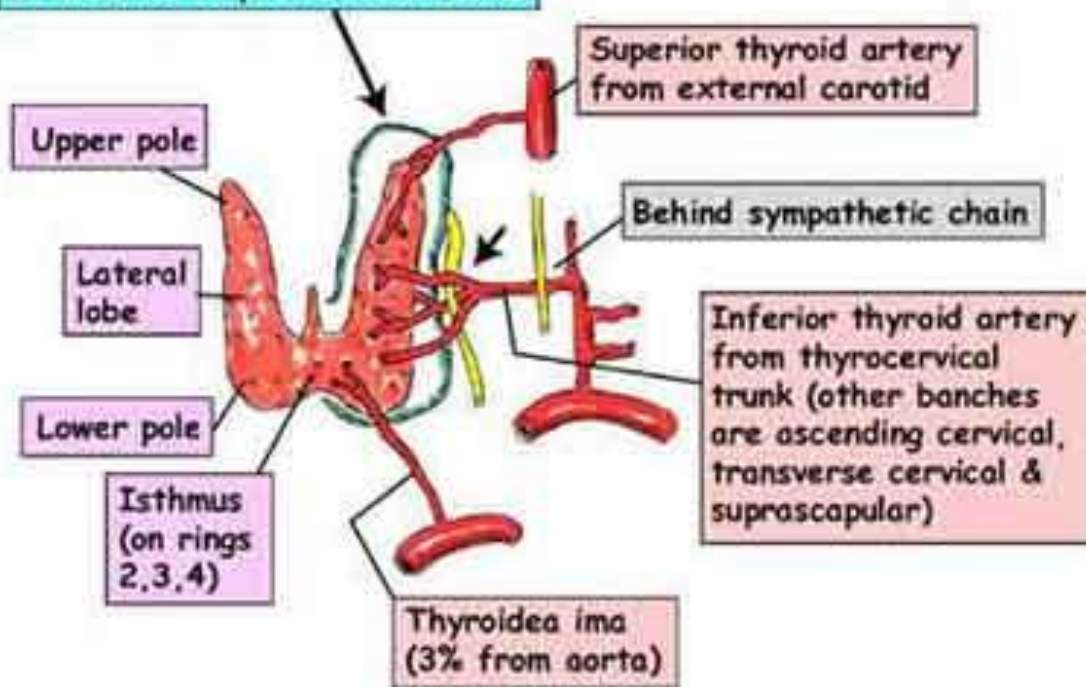




## THYROID GLAND - GENERAL & BLOOD SUPPLY

Bilobed, lobulated & 5cm long, extending to tracheal ring 6  
Shield shaped & lies on carotid sheath  
Limited extension upwards by sternothyroid  
Can pass below into mediastinum

Note relationship of branching of arteries to pretracheal fascia



Note intimate relationship of branches of the inferior thyroid artery to the recurrent laryngeal nerve

## THYROID GLAND - SURGICAL ASPECTS



NORMAL



PARTIAL  
THYROIDECTOMY



SUBTOTAL  
THYROIDECTOMY

### HYPERTHYROIDISM

- 80% Graves' disease (auto-immune)
- 10% Multinodular goitre
- 5% Toxic adenoma

### INDICATIONS FOR SURGERY (subtotal or nodule excision)

- Failed medical treatment
- Poor drug compliance
- Large goitre/nodule
- Compression - trachea, oesophagus, superior vena cava
- Retrosternal extension

### RISKS OF SURGERY

- To parathyroids
- To recurrent laryngeal/superior laryngeal nerves (1%)

Note that right recurrent laryngeal nerve can enter larynx directly from vagus and not pass around subclavian artery