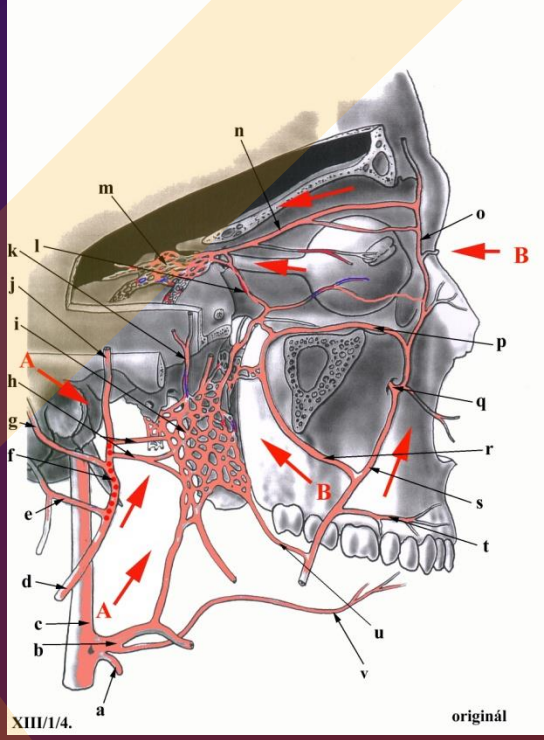
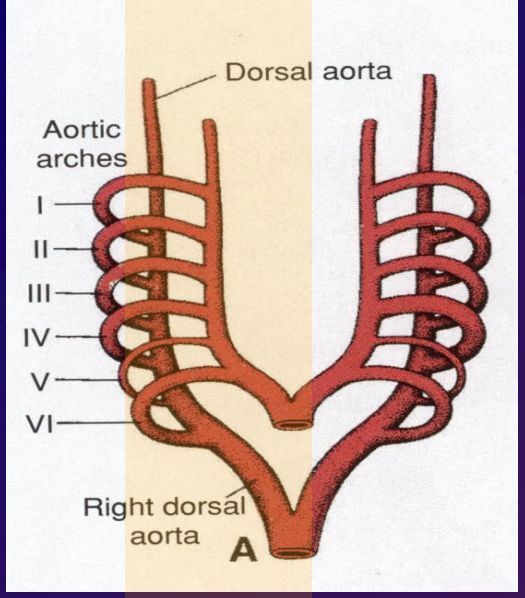
Arteria carotis externa, arteria subclavia, vena jugularis interna and its tributaries, thyroid gland, parathyroid glands



By

Ivo Klepáček

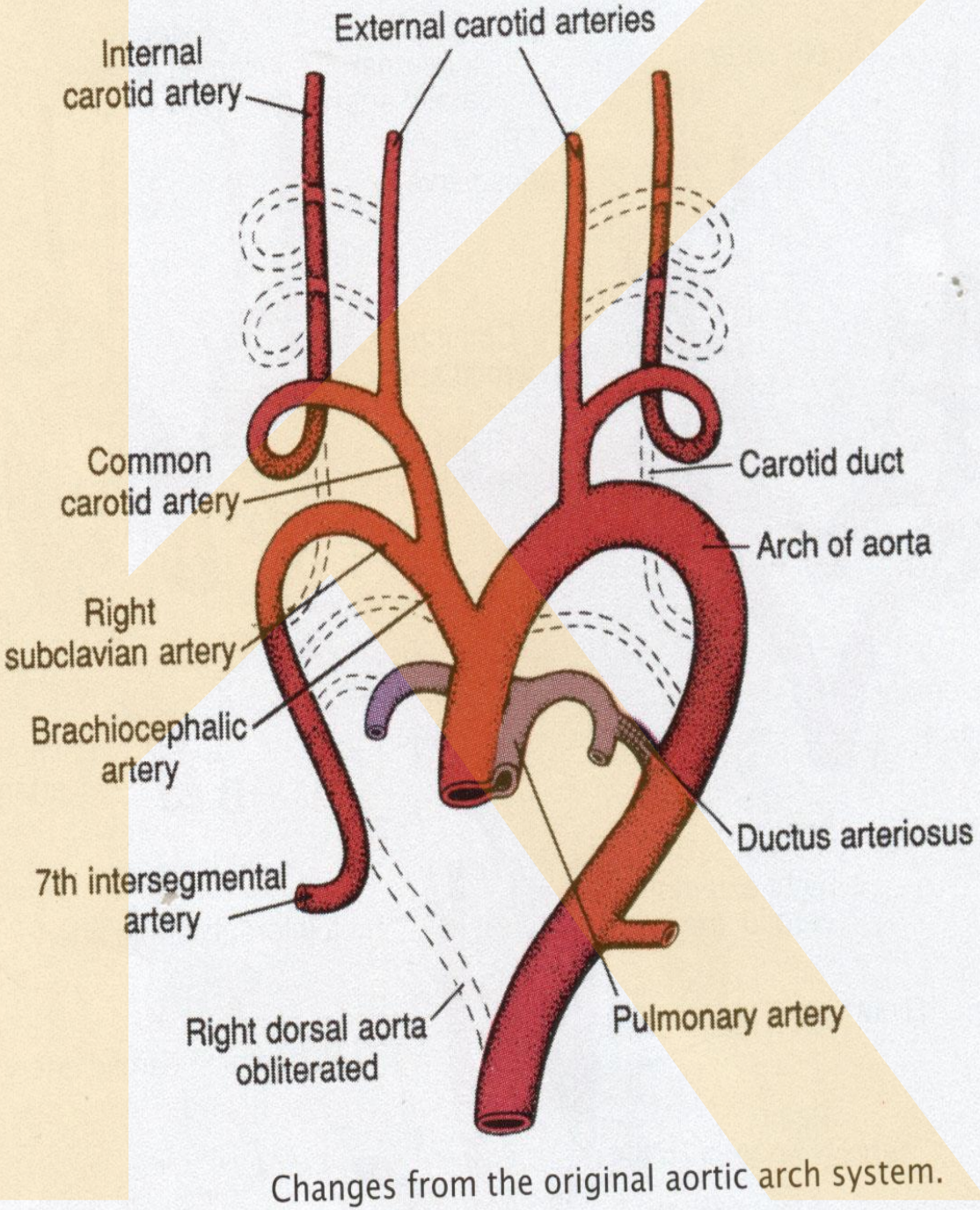


1st – maxillary artery

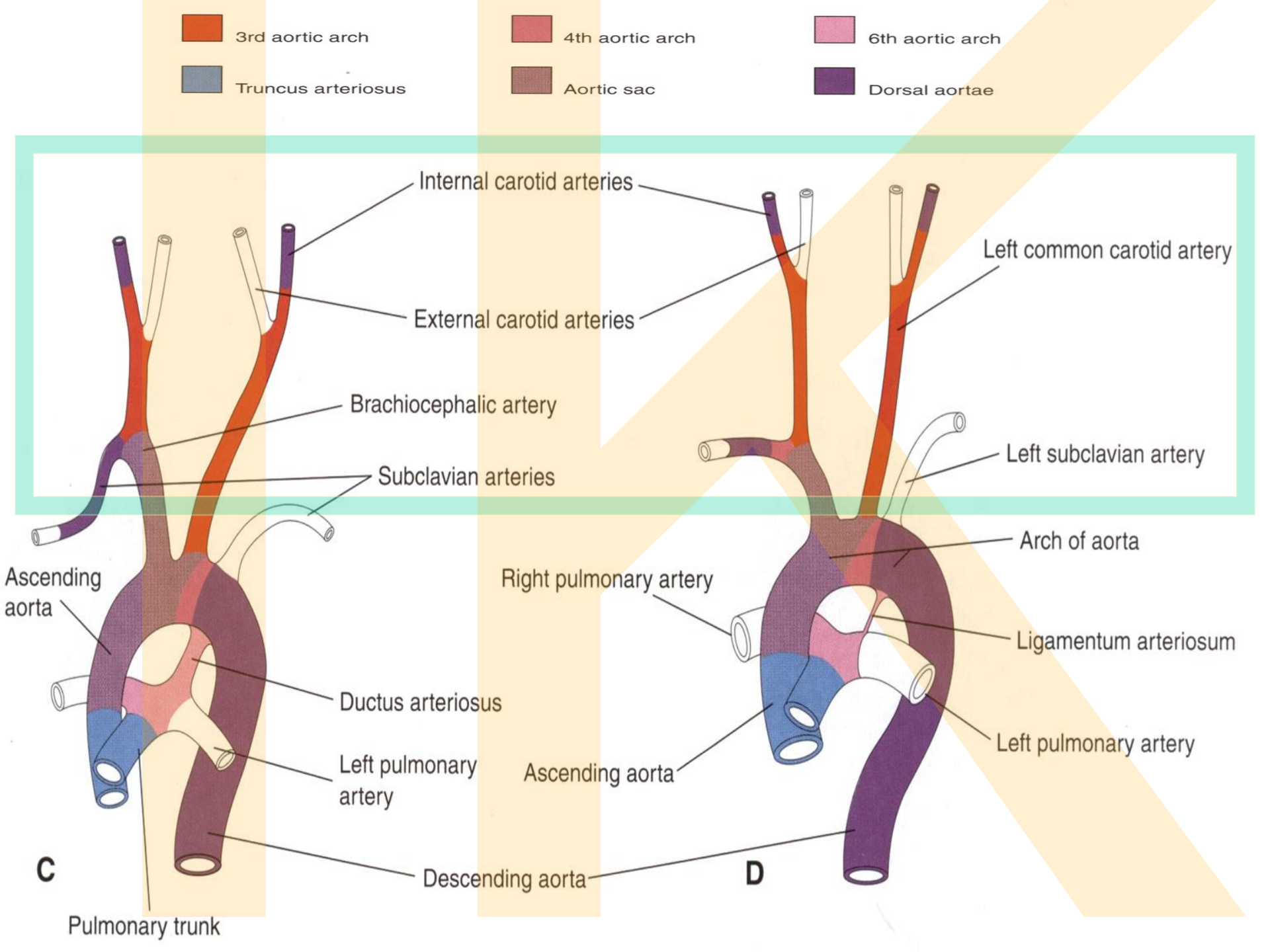
2nd – hyoid, stapedial aa.

3rd – common carotid a. and first part of the internal carotid a., external carotid a.

4th – part of the subclavian aa. some of intersegmental arteries



Changes from the original aortic arch system.


3rd aortic arch
4th aortic arch
6th aortic arch
Truncus arteriosus
Aortic sac
Dorsal aortae
Internal carotid arteries
External carotid arteries
Brachiocephalic artery
Subclavian arteries
Ascending aorta
Ductus arteriosus
Left pulmonary artery
Descending aorta
Pulmonary trunk
C
Left common carotid artery
Left subclavian artery
Arch of aorta
Right pulmonary artery
Ligamentum arteriosum
Left pulmonary artery
Ascending aorta
D

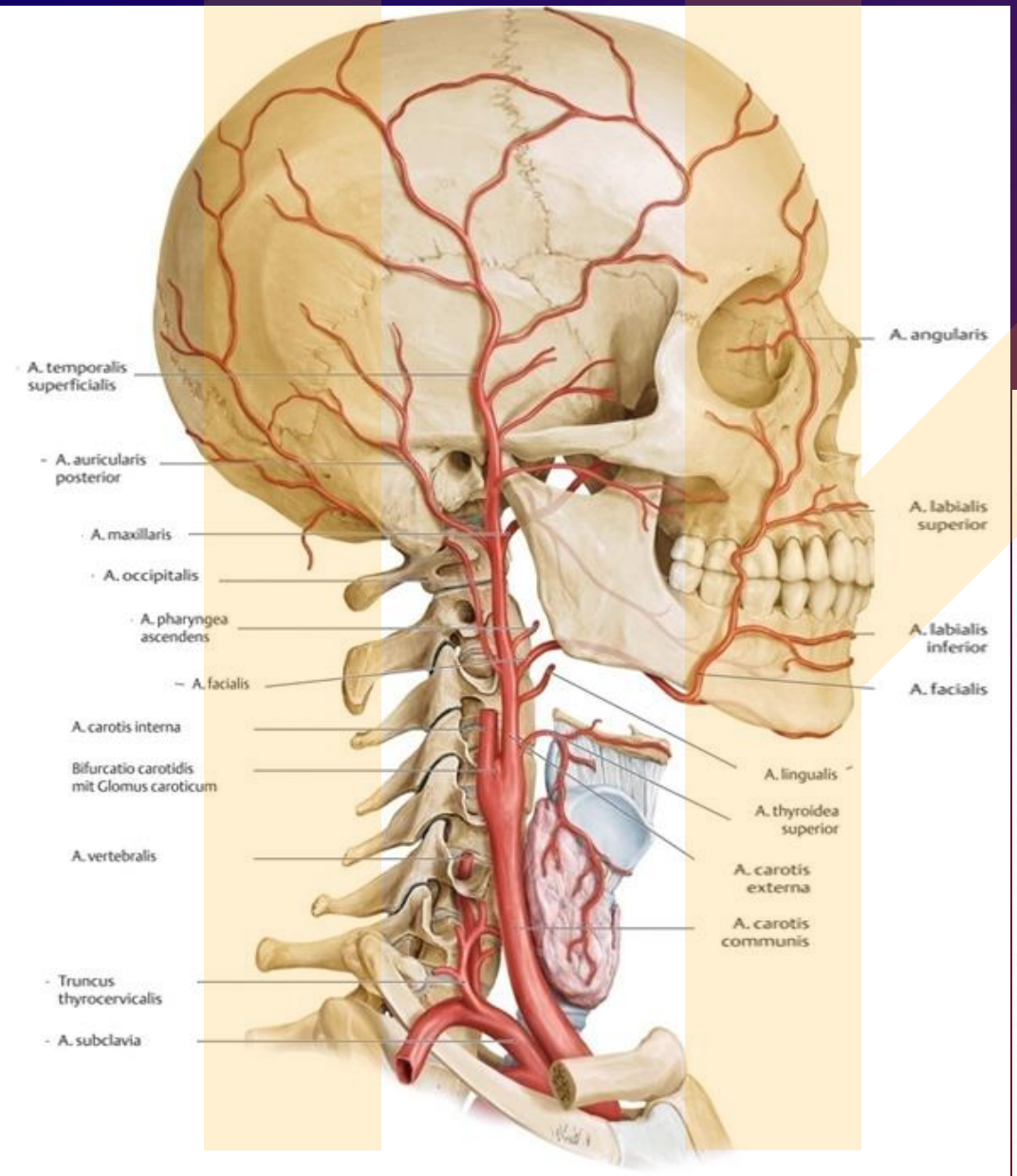
Main arteries

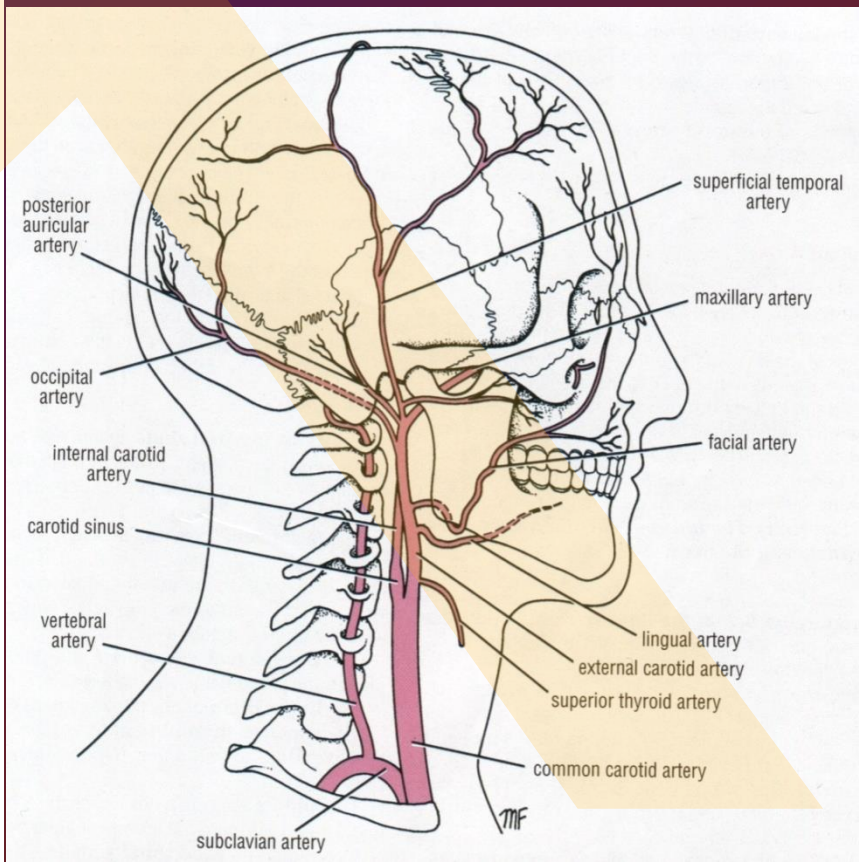
Common carotid artery (left)

Brachiocephalic trunk (right)

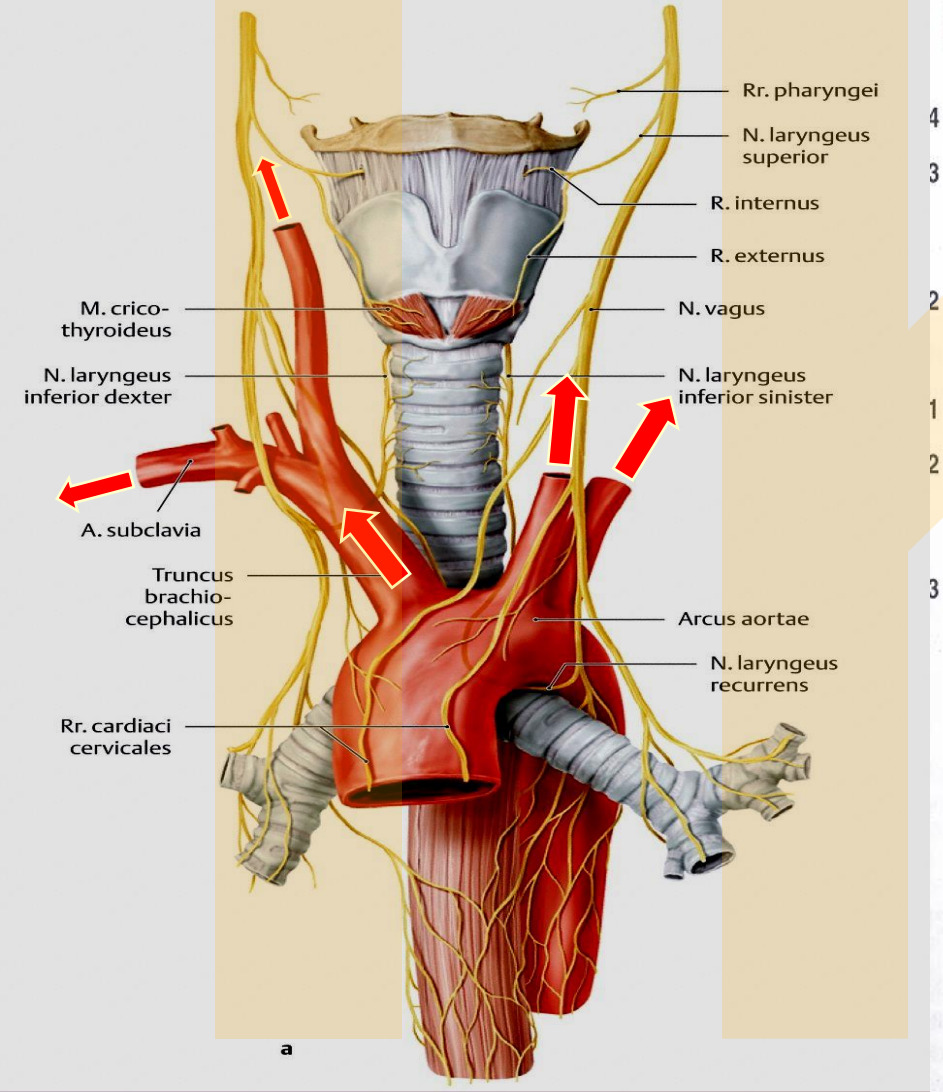
Internal Carotid Artery **ICA**

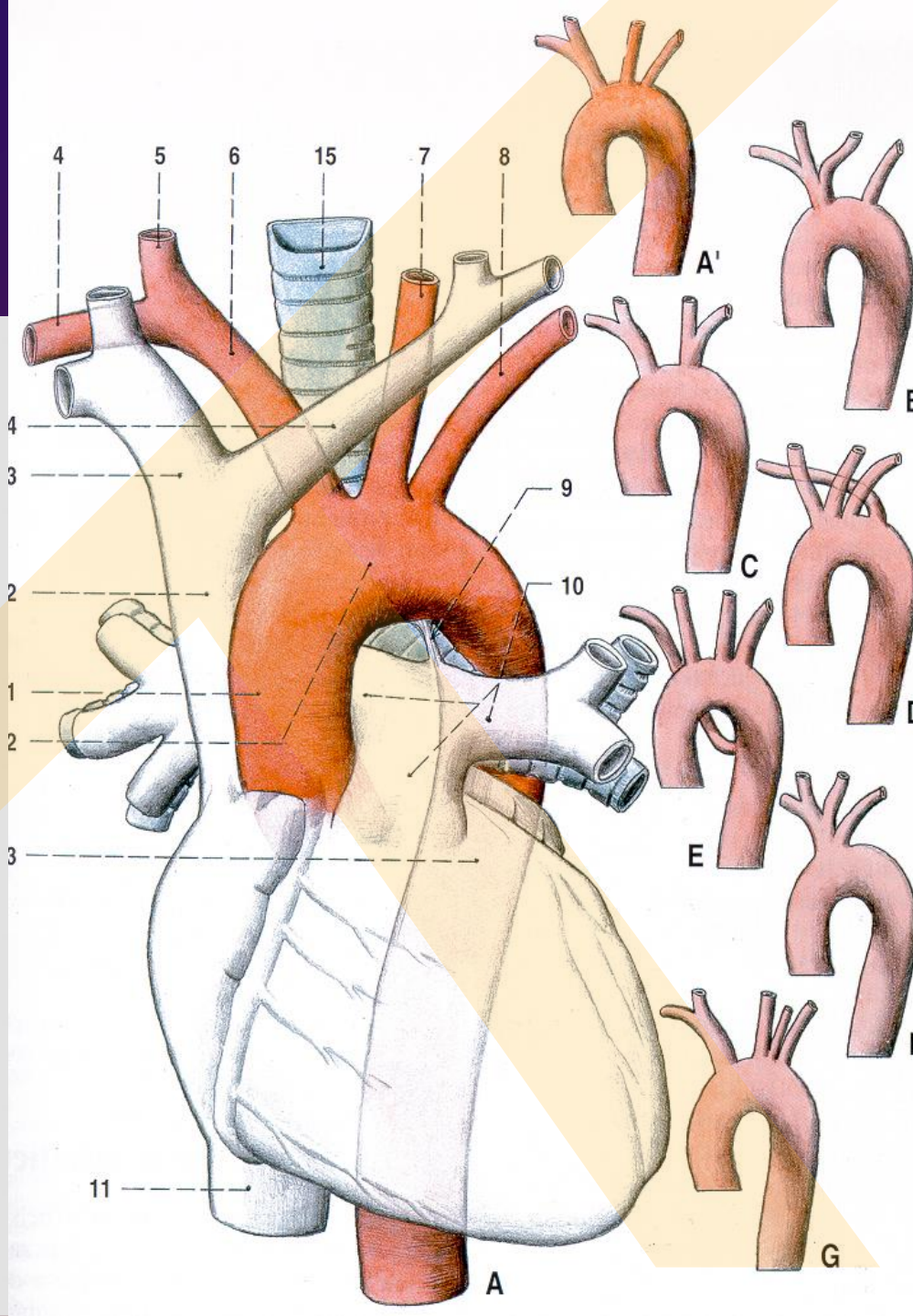
External Carotid Artery **ECA**



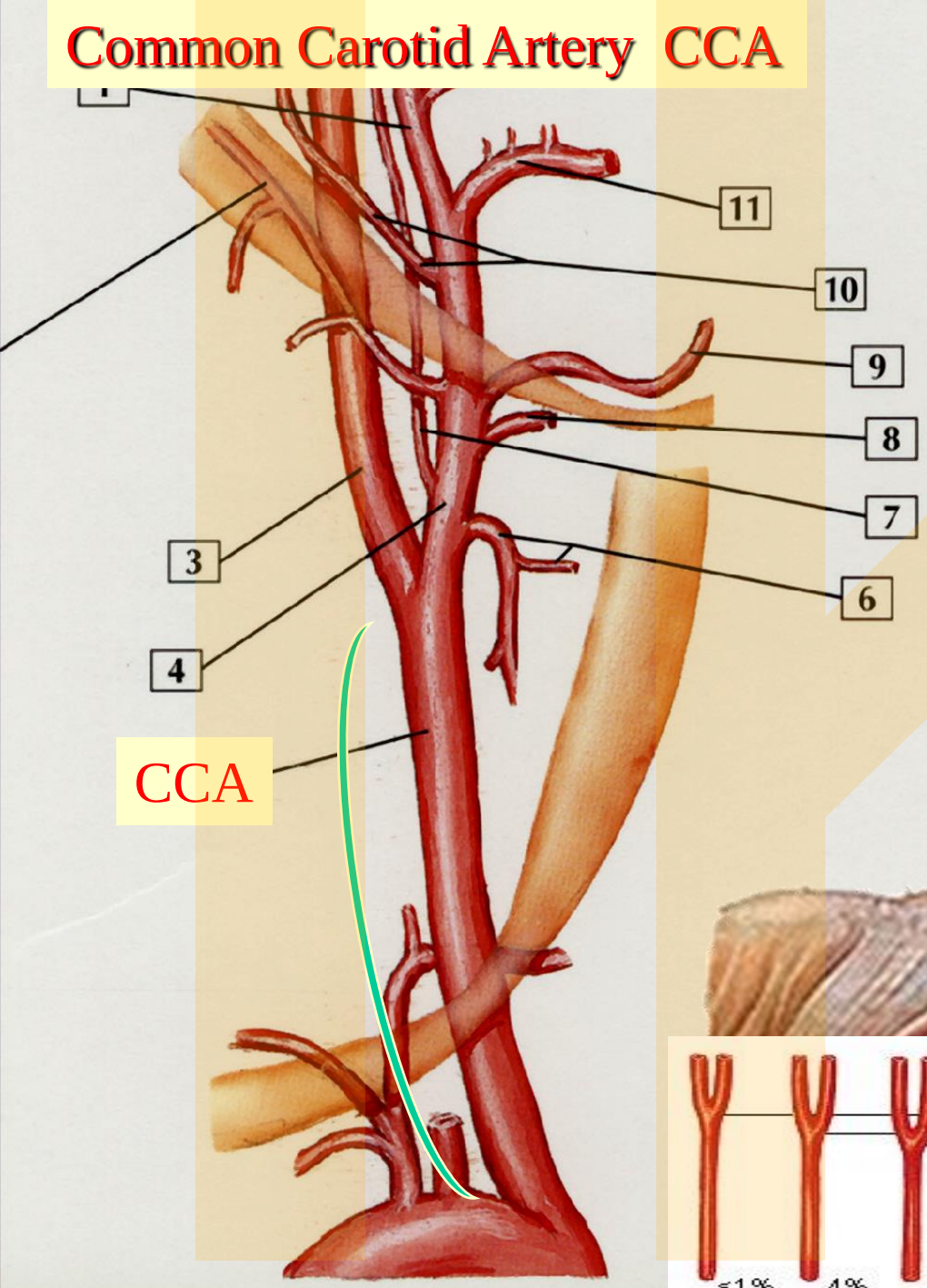


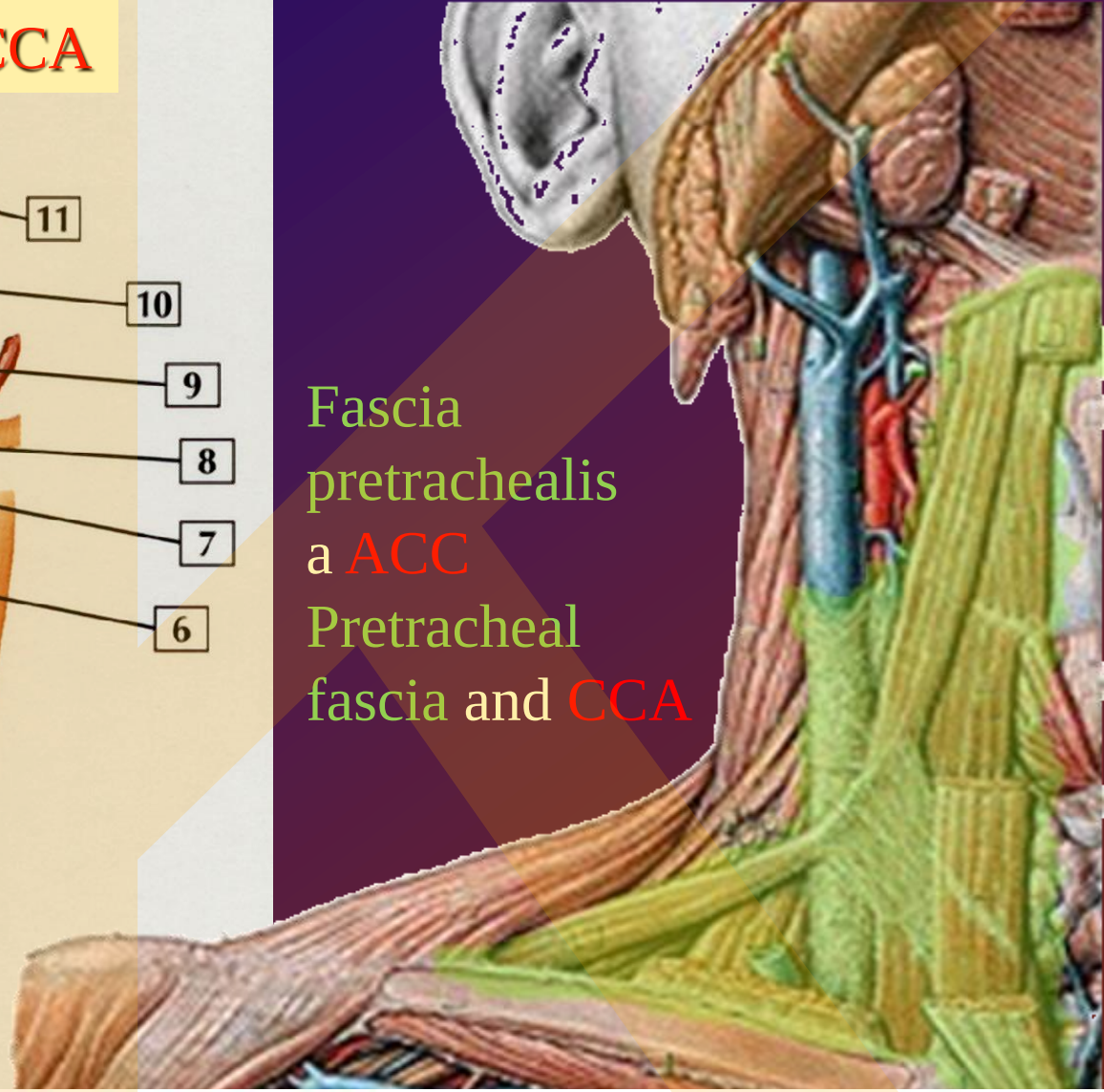
Variations of the aortic arch; its branches



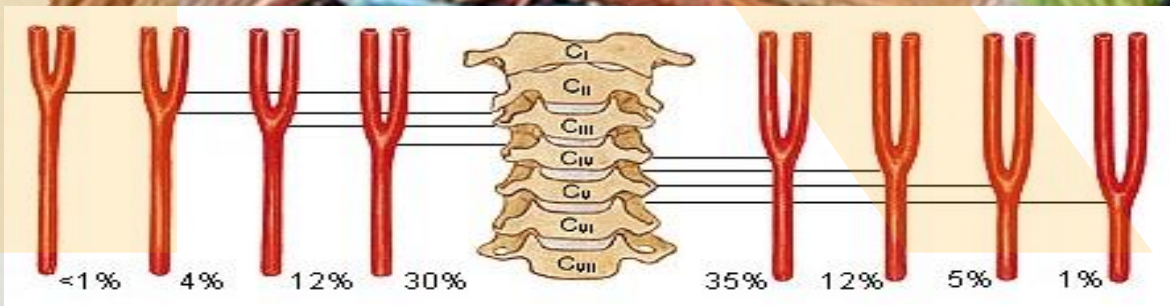


Common Carotid Artery CCA

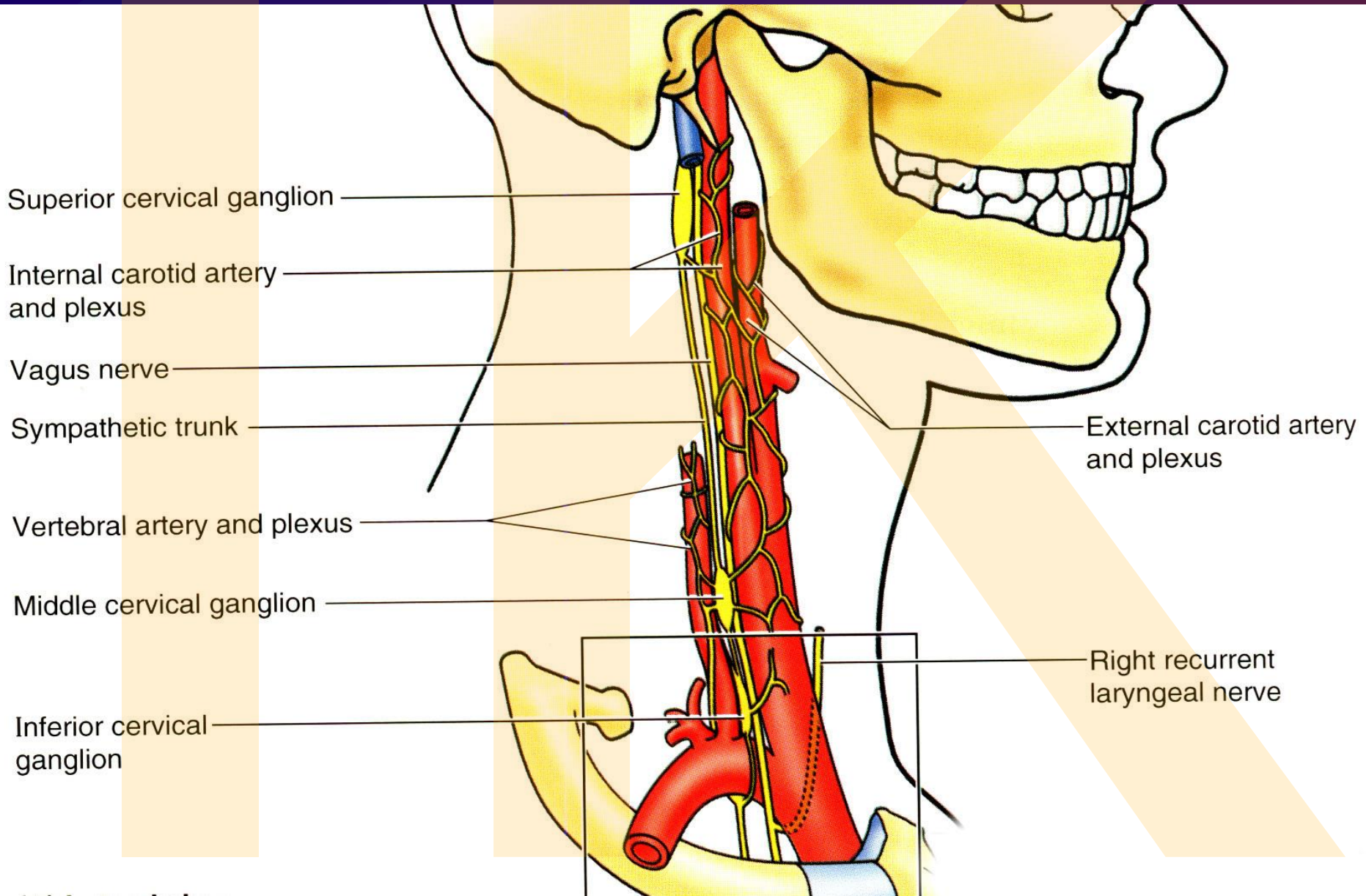




Fascia pretrachealis a ACC Pretracheal fascia and CCA



Accompanying structures: Sympathetic nerve trunks



Common Carotid Artery

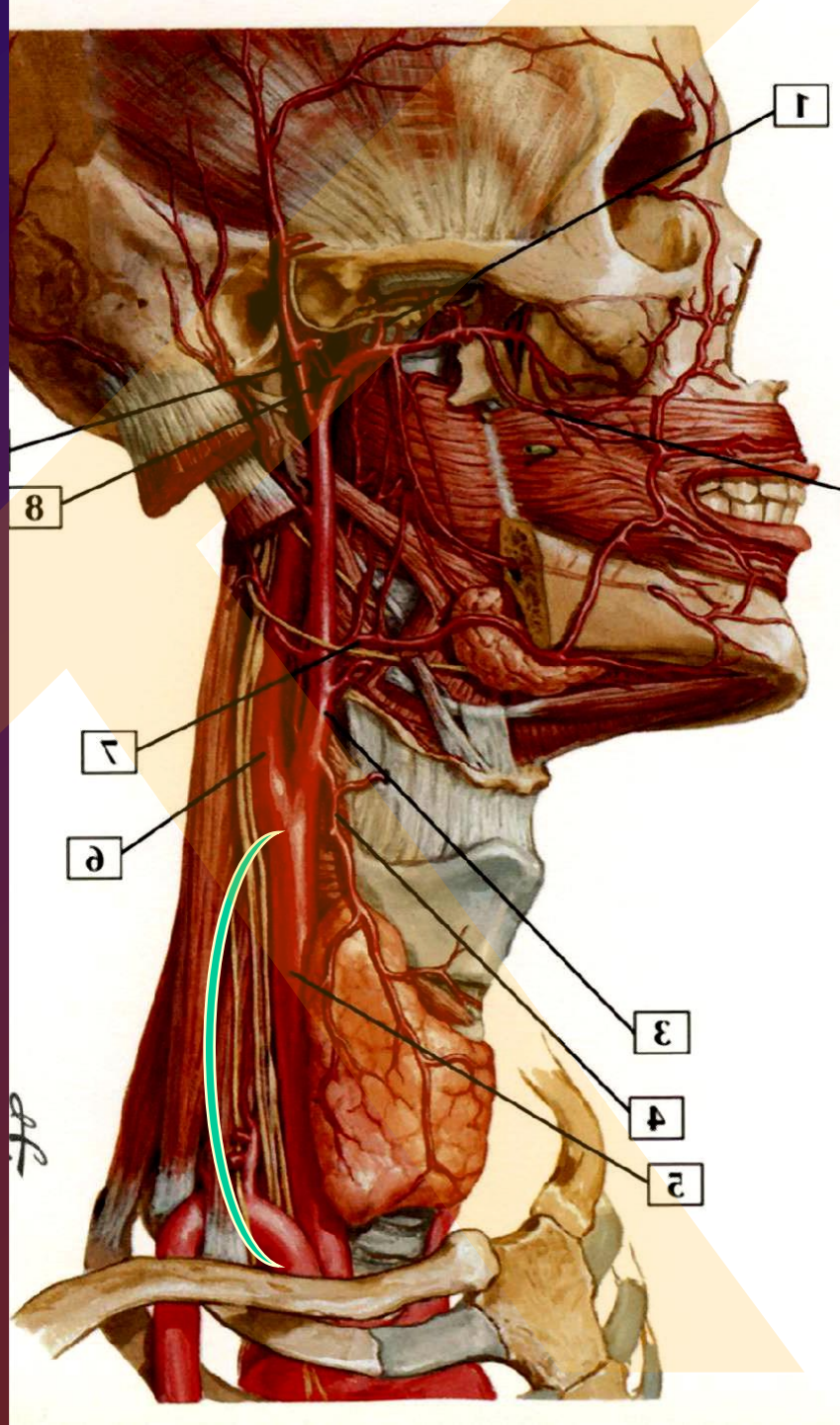
CCA *Relations:*

Anterolaterally – skin, fascia, sternocleidomastoid muscle, sternohyoid, sternothyroid, superior belly of the omohyoid

Posteriorly – transverse process of the C4 vertebrae, prevertebral muscles, sympathetic trunk

Medially – wall of the pharynx and larynx, trachea, esophagus, the lobe of the thyroid gland

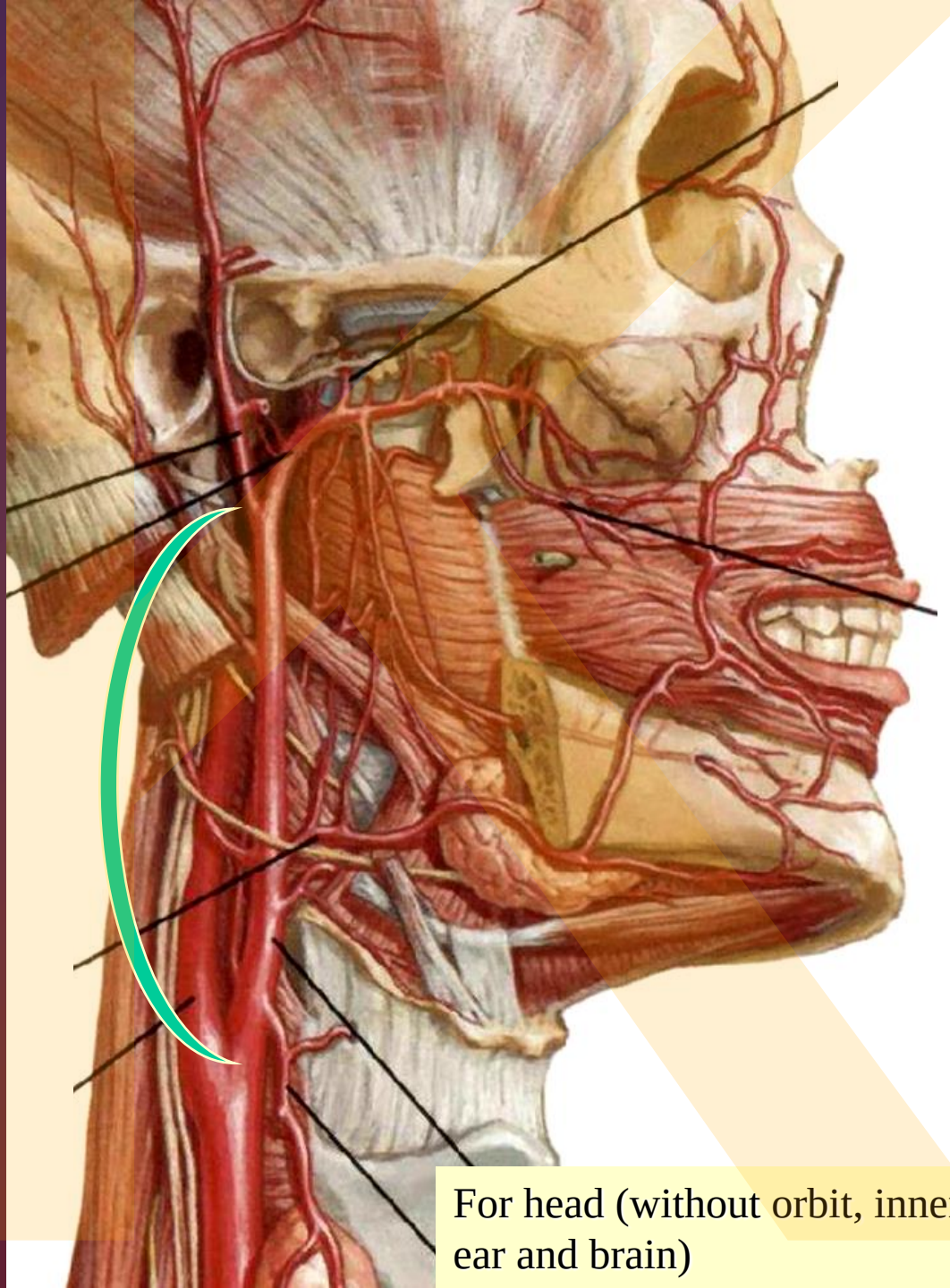
Laterally – the internal jugular vein, vagus nerve (posterolaterally)



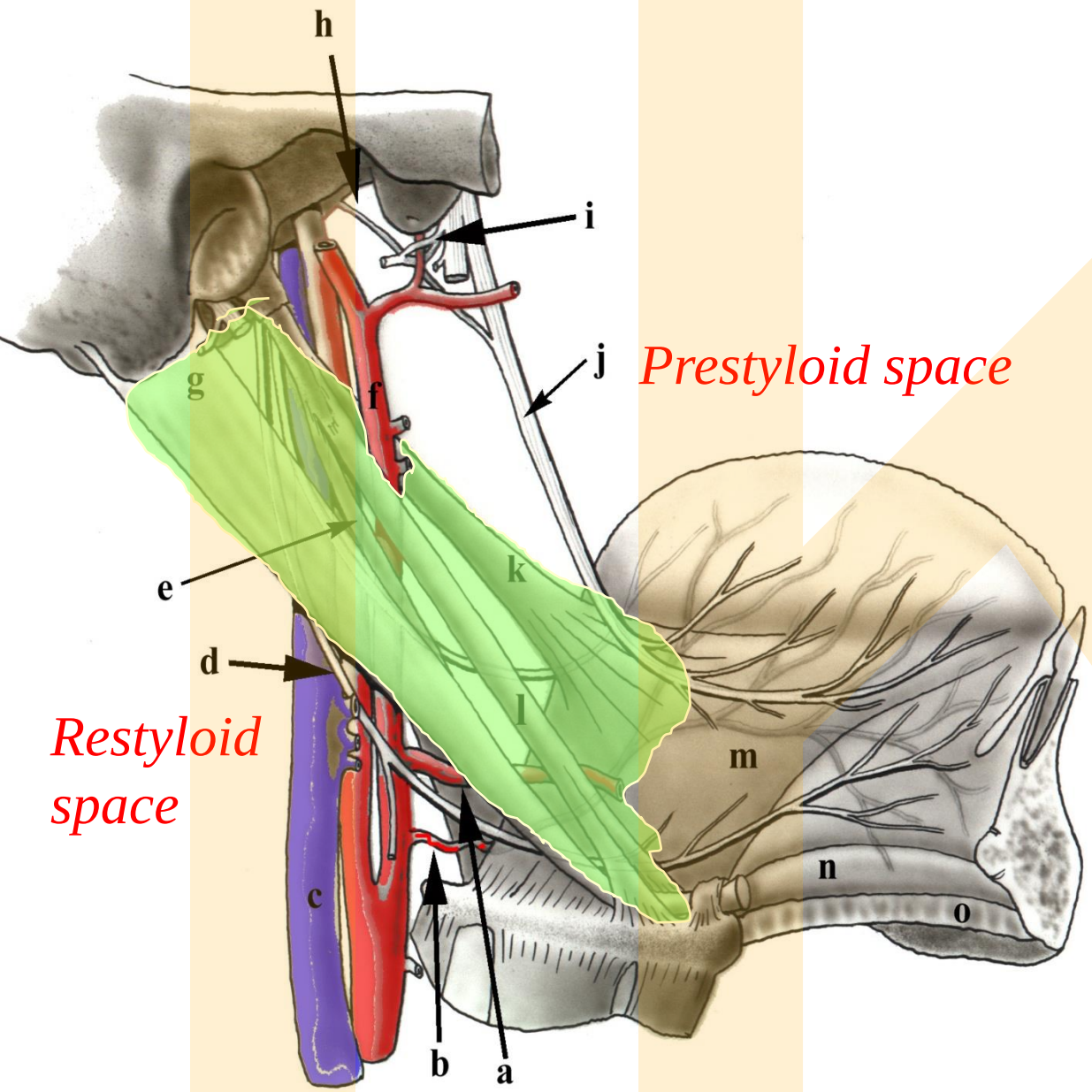
External Carotid Artery ECA

Anterolaterally – sternocleidomastoid muscle, XII. nerve, within parotid gland is crossed by VII. nerve, fascia, skin

Medially – wall of the pharynx, internal carotid artery, stylopharyngeus, pharyngeal branch of the vagus



For head (without orbit, inner ear and brain)



Prestyloid space

Restyloid space

Styloid septum

Internal Jugular Vein

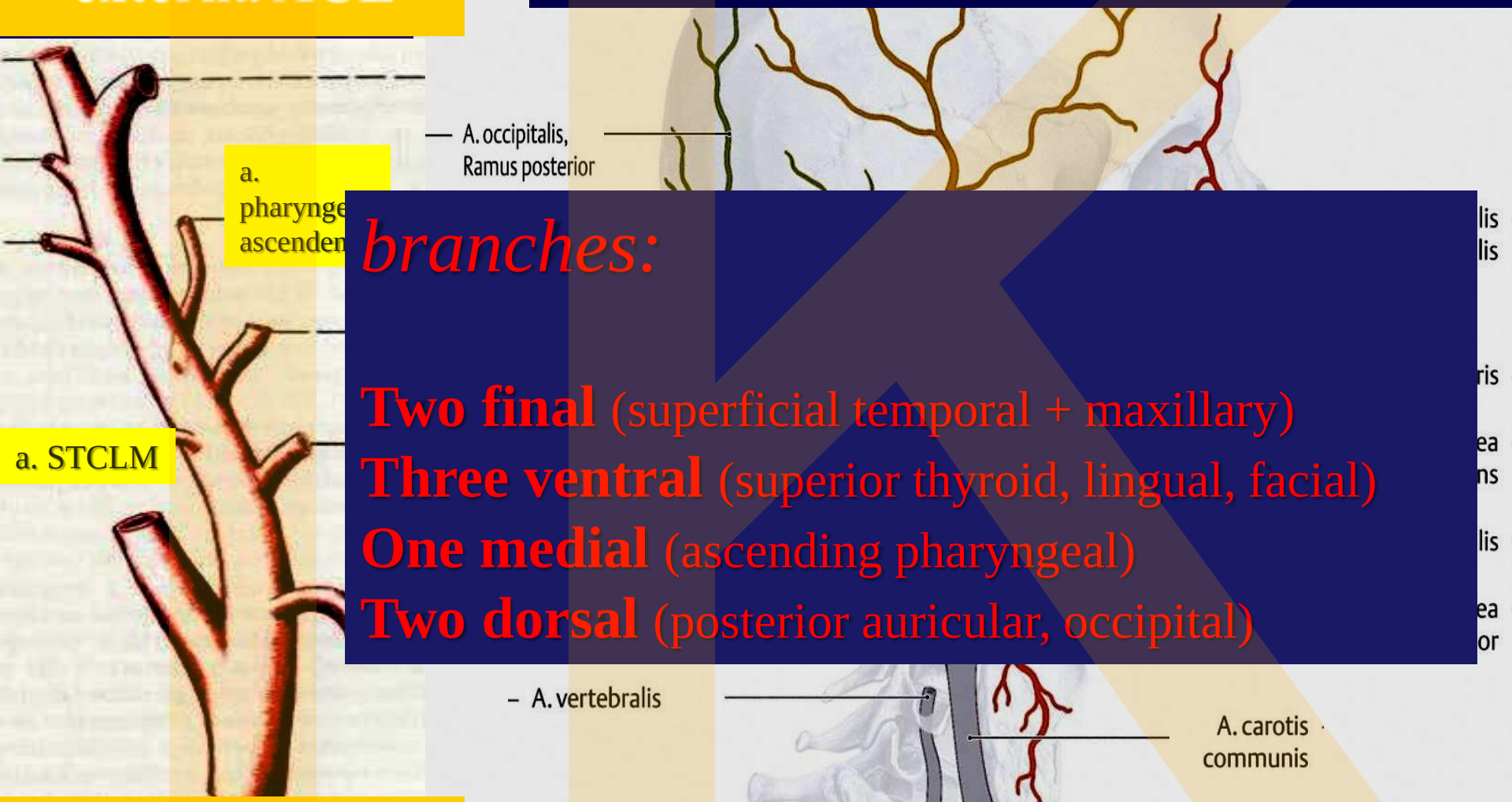
lies dorsally and laterally from ICA behind m. m. stylohyoideus and styloglossus

External Carotid Artery

lies ventrally and laterally from IJV between m.stylohyoideus and styloglossus

Arteria carotis externa ACE

MAIN DIVISION branches:
Temporalis superficialis, maxillaris, thyroidea sup., lingualis, pharyngea ascendens, auricularis posterior, occipitalis

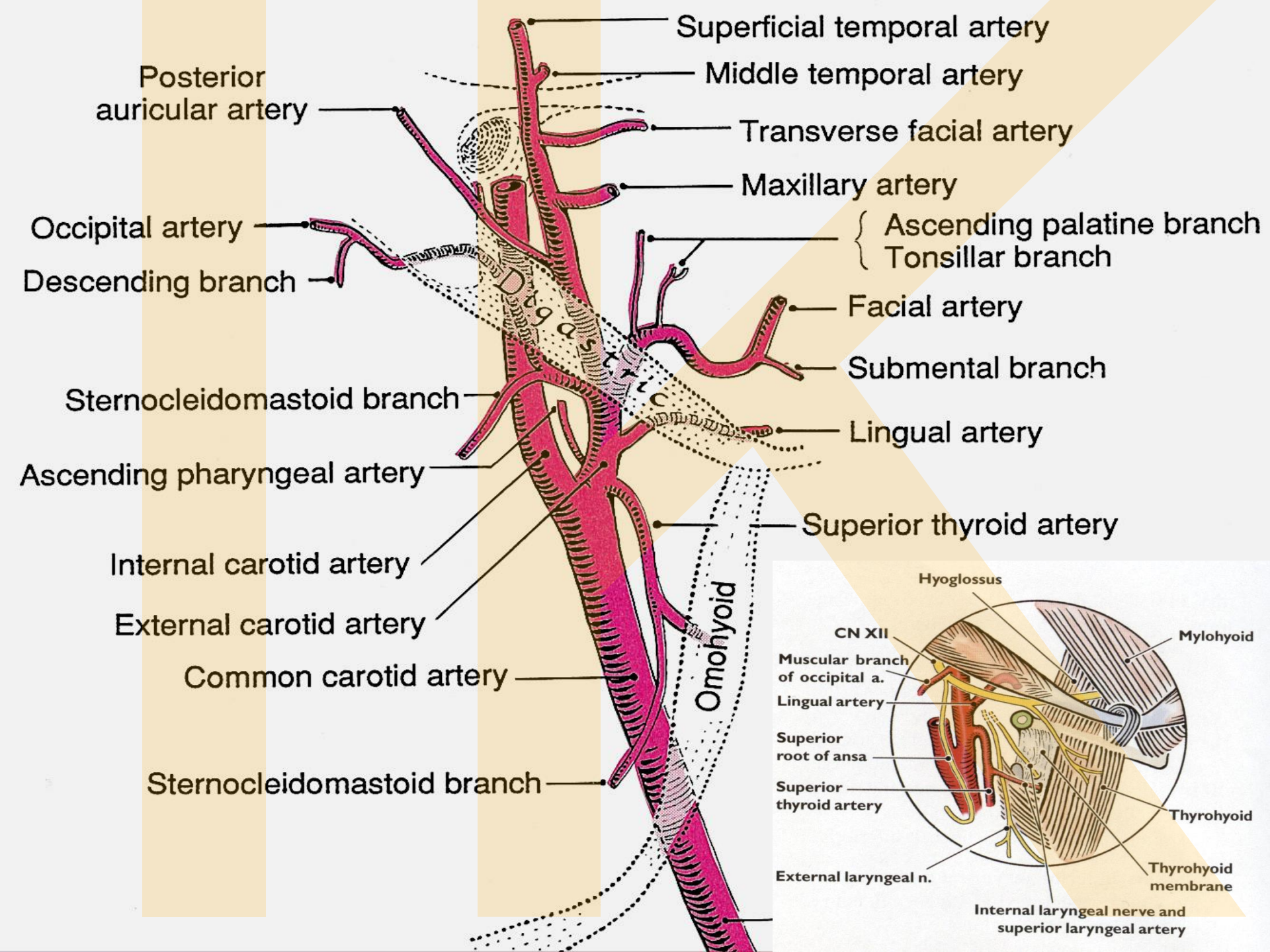


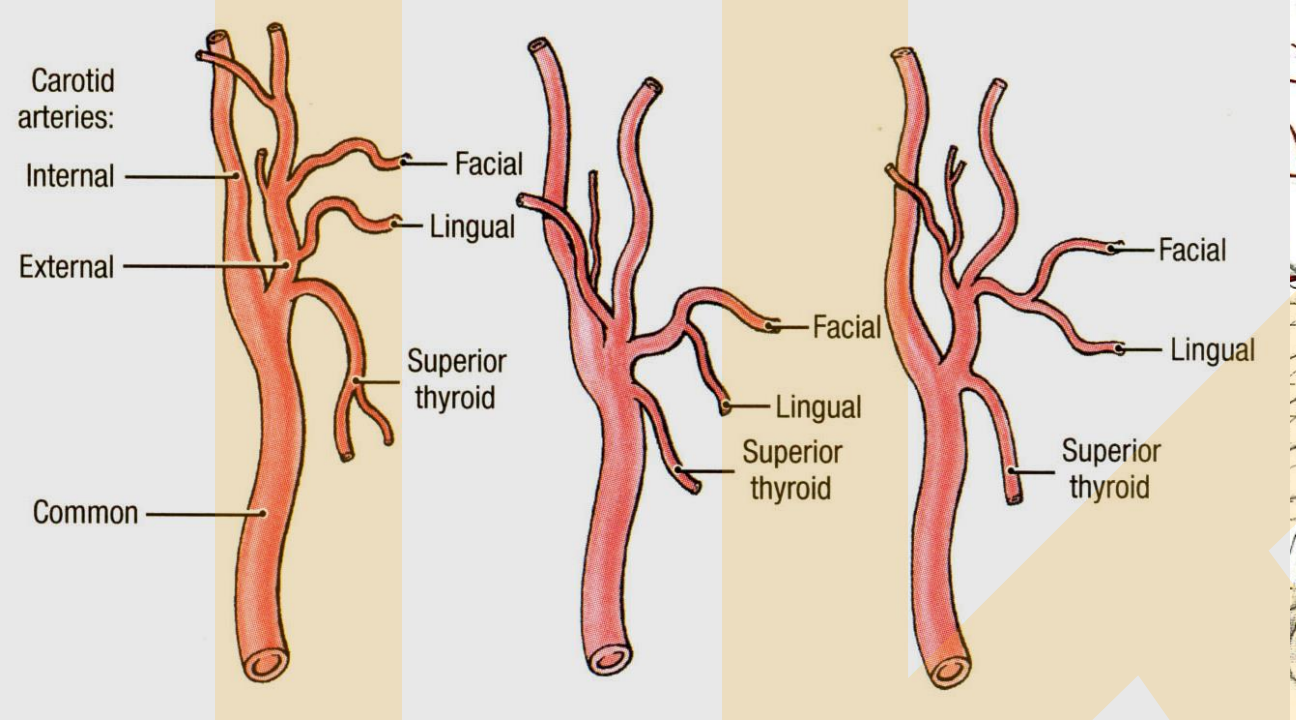
branches:

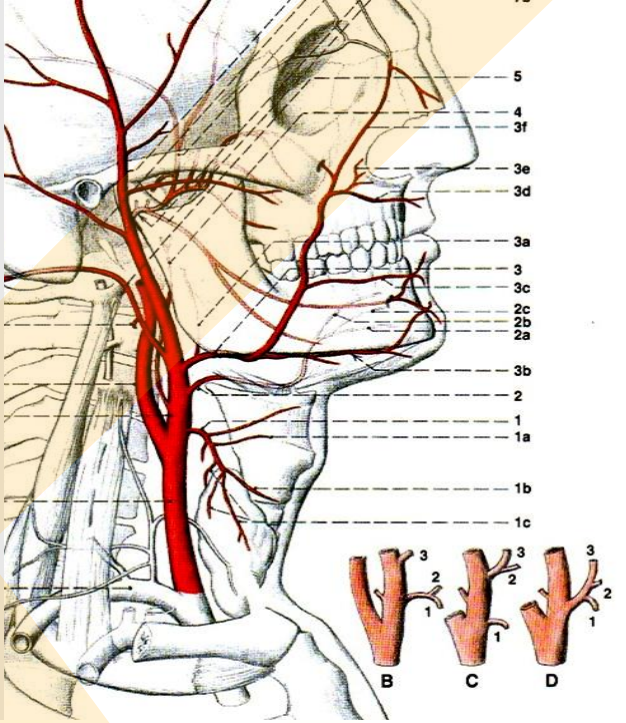
Two final (superficial temporal + maxillary)
Three ventral (superior thyroid, lingual, facial)
One medial (ascending pharyngeal)
Two dorsal (posterior auricular, occipital)

External carotid artery ECA

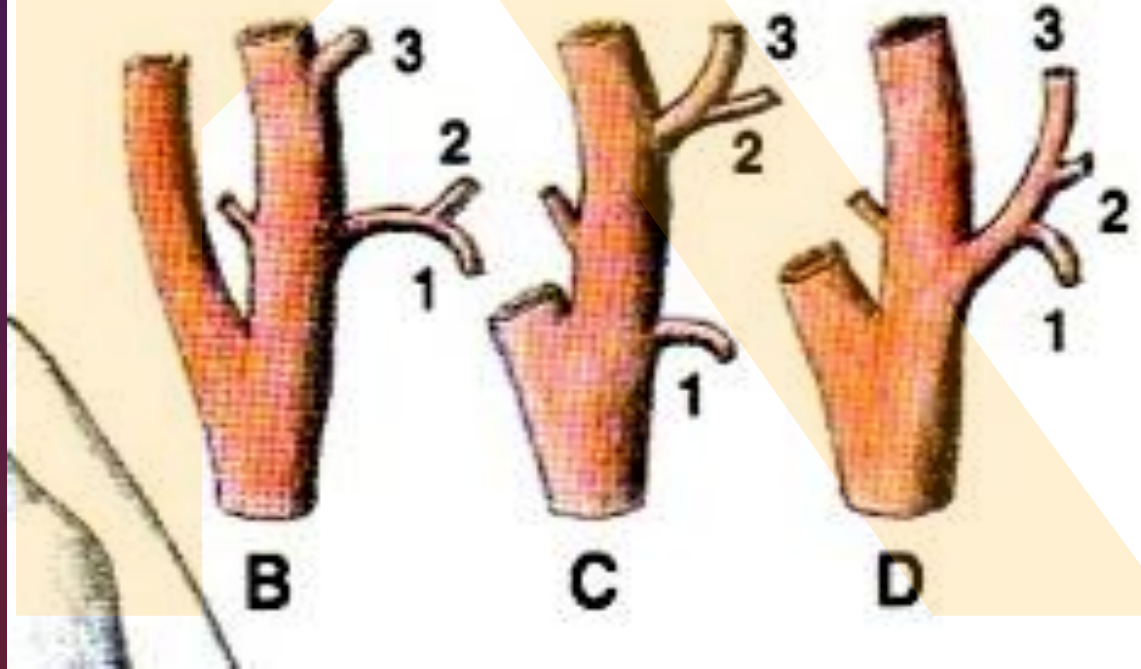
For full head instead of orbit, inner ear and brain


Superficial temporal artery
Middle temporal artery
Posterior auricular artery
Transverse facial artery
Maxillary artery
Occipital artery
Ascending palatine branch
Tonsillar branch
Descending branch
Facial artery
Submental branch
Sternocleidomastoid branch
Lingual artery
Ascending pharyngeal artery
Superior thyroid artery
Internal carotid artery
External carotid artery
Omohyoid
Common carotid artery
Sternocleidomastoid branch
Hyoglossus
CN XII
Mylohyoid
Muscular branch of occipital a.
Lingual artery
Superior root of ansa
Superior thyroid artery
Thyrohyoid
External laryngeal n.
Thyrohyoid membrane
Internal laryngeal nerve and superior laryngeal artery

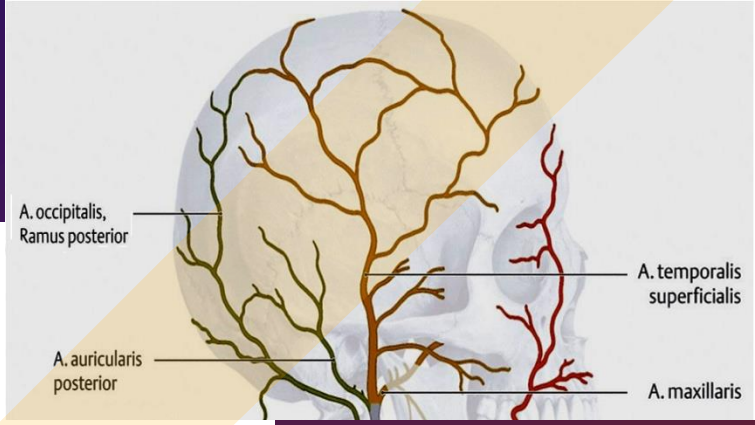


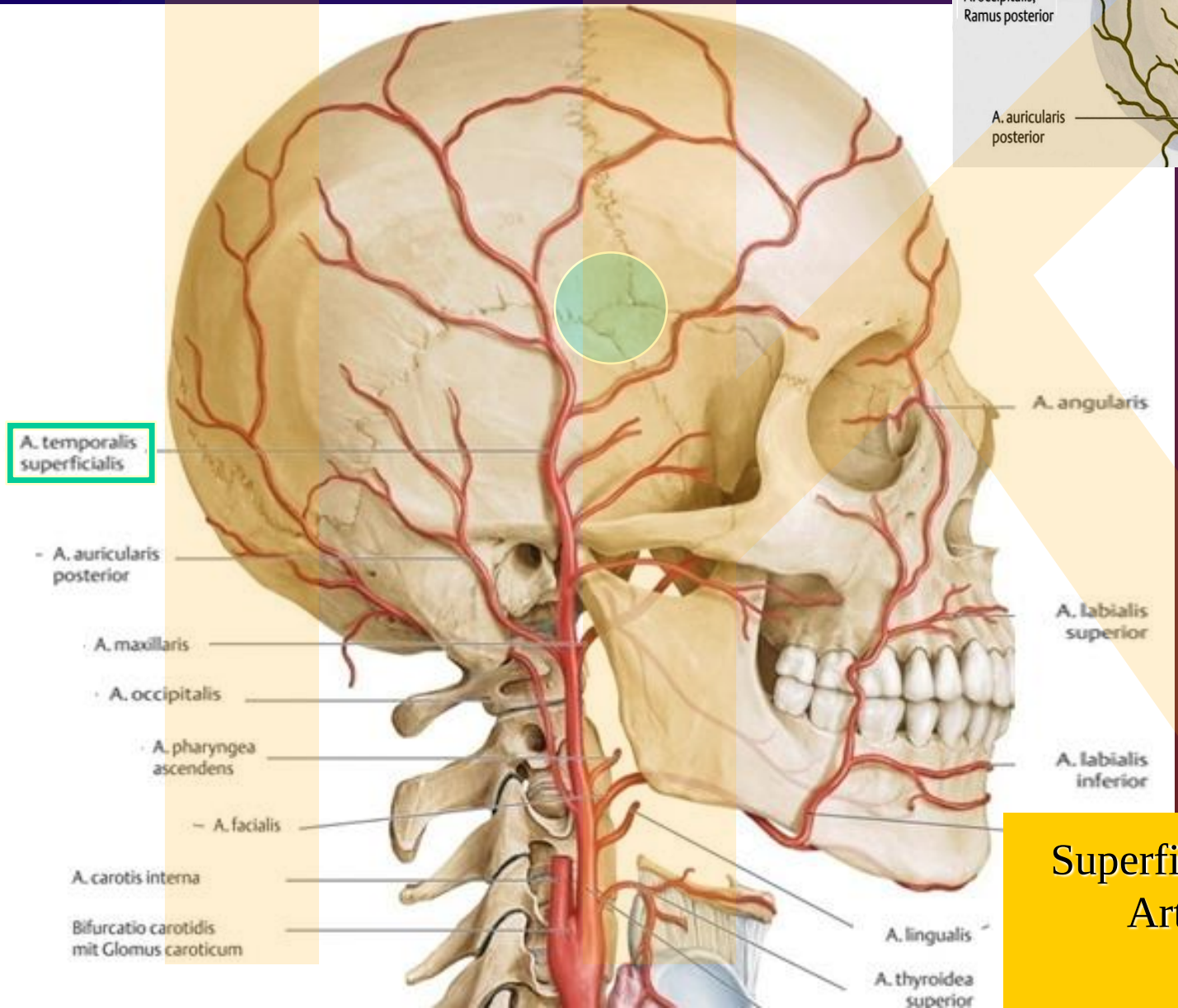


Variety ECA Varieties



pteryon



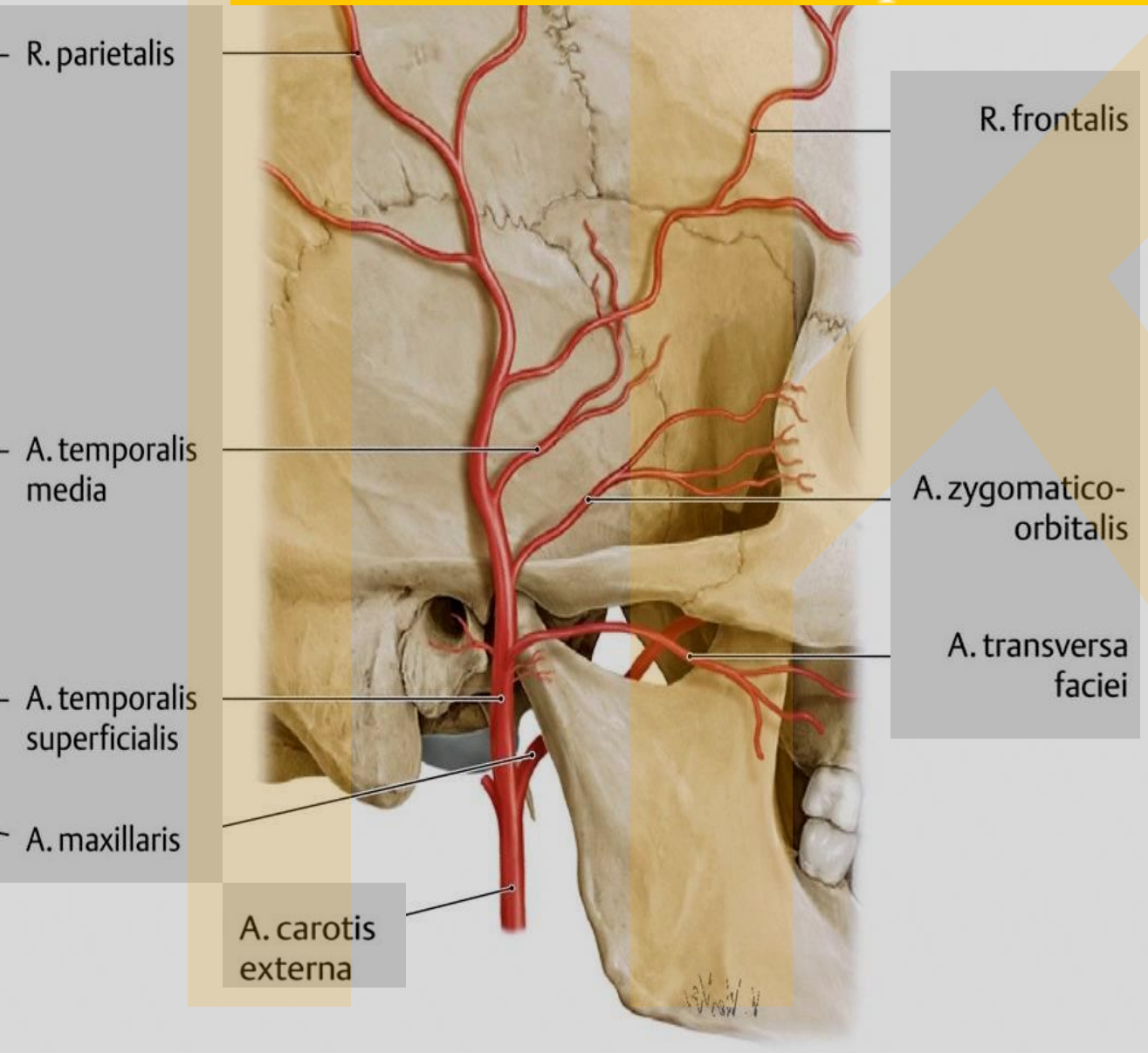


For scalp;

- r. frontalis
- r. parietalis

Superficial temporal artery
Arteria temporalis
superficialis

Superficial temporal artery
Arteria temporalis superficialis



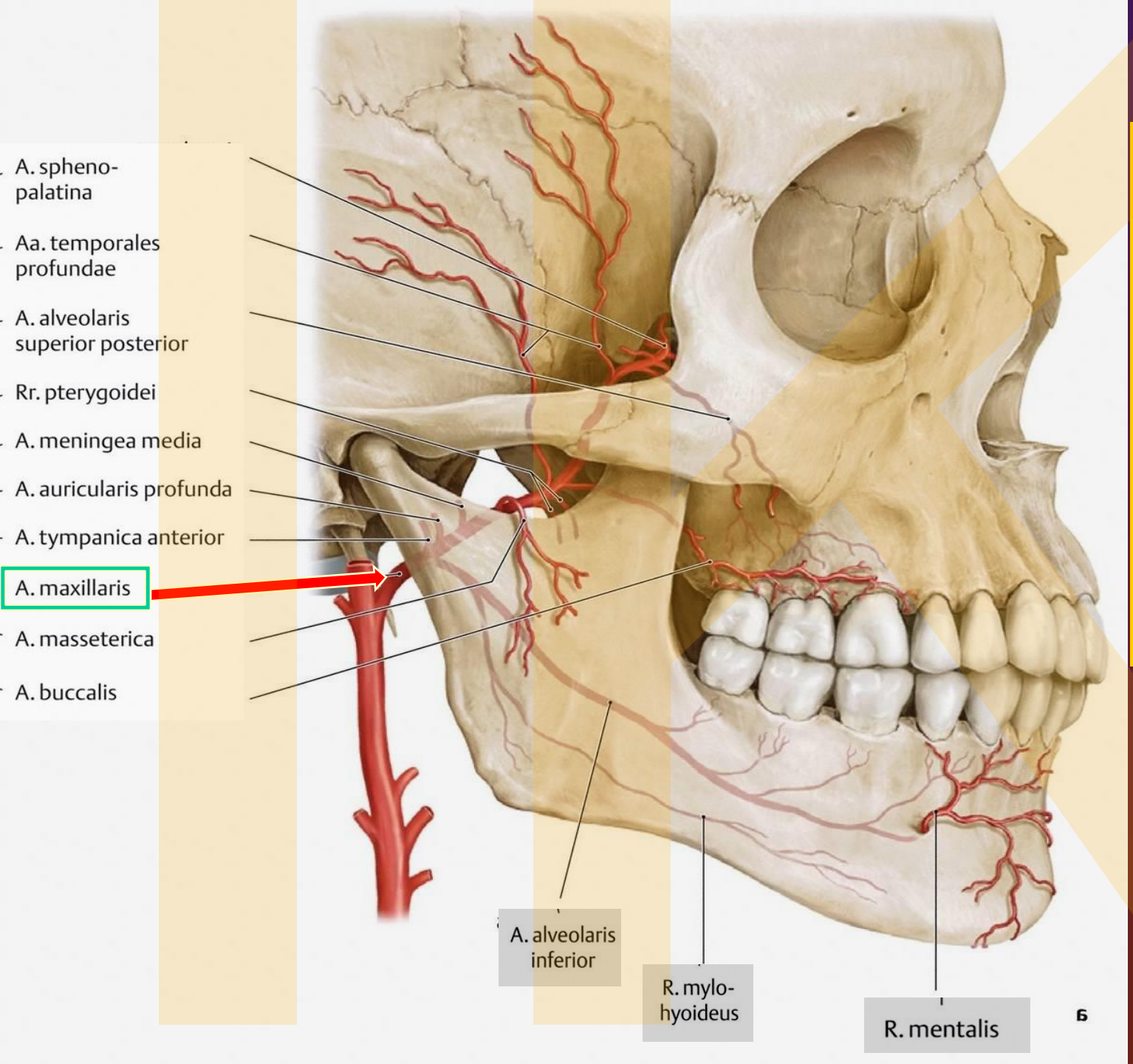
For gl. parotis, TMJ, m. orbicularis oculi, m. temporalis;

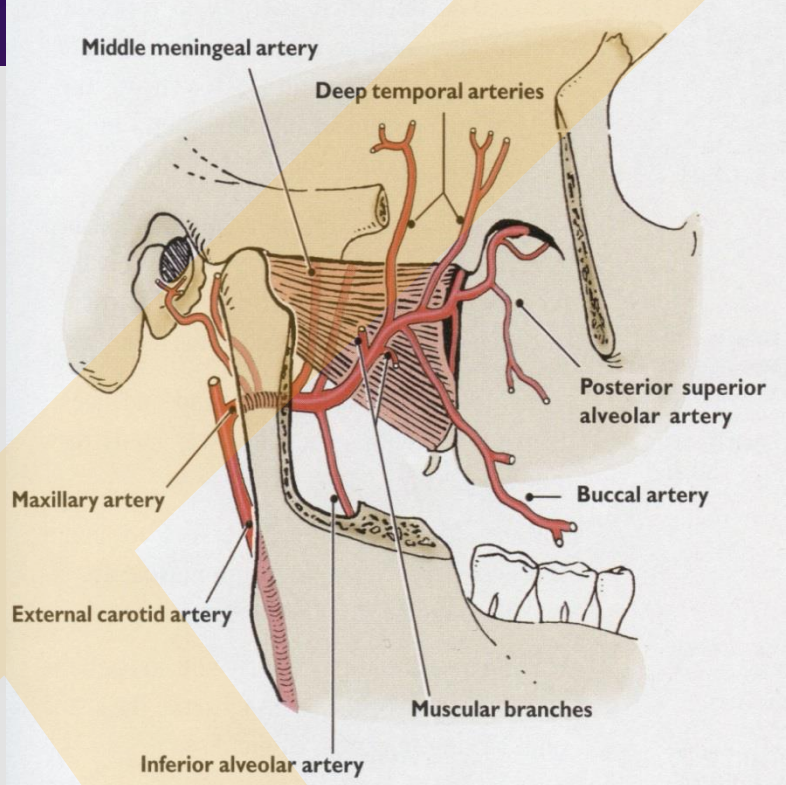
- glandular branches transversa faciei (for mimic muscles)
- rr. auriculares anteriores (capsule of TMJ)
- a. zygomaticoorbitalis
- a. temporalis media
- frontal branches
- parietal branches

Maxillary artery

Arteria maxillaris –

Overview
Lateral aspect





Maxillary artery

Three segments (parts):

Retromandibular

Pterygoid

Pterygopalatine

Arteria maxillaris – retromandibular part

A. spheno-palatina

Aa. temporales profundae

A. alveolaris superior posterior

Rr. pterygoidei

A. meningea media

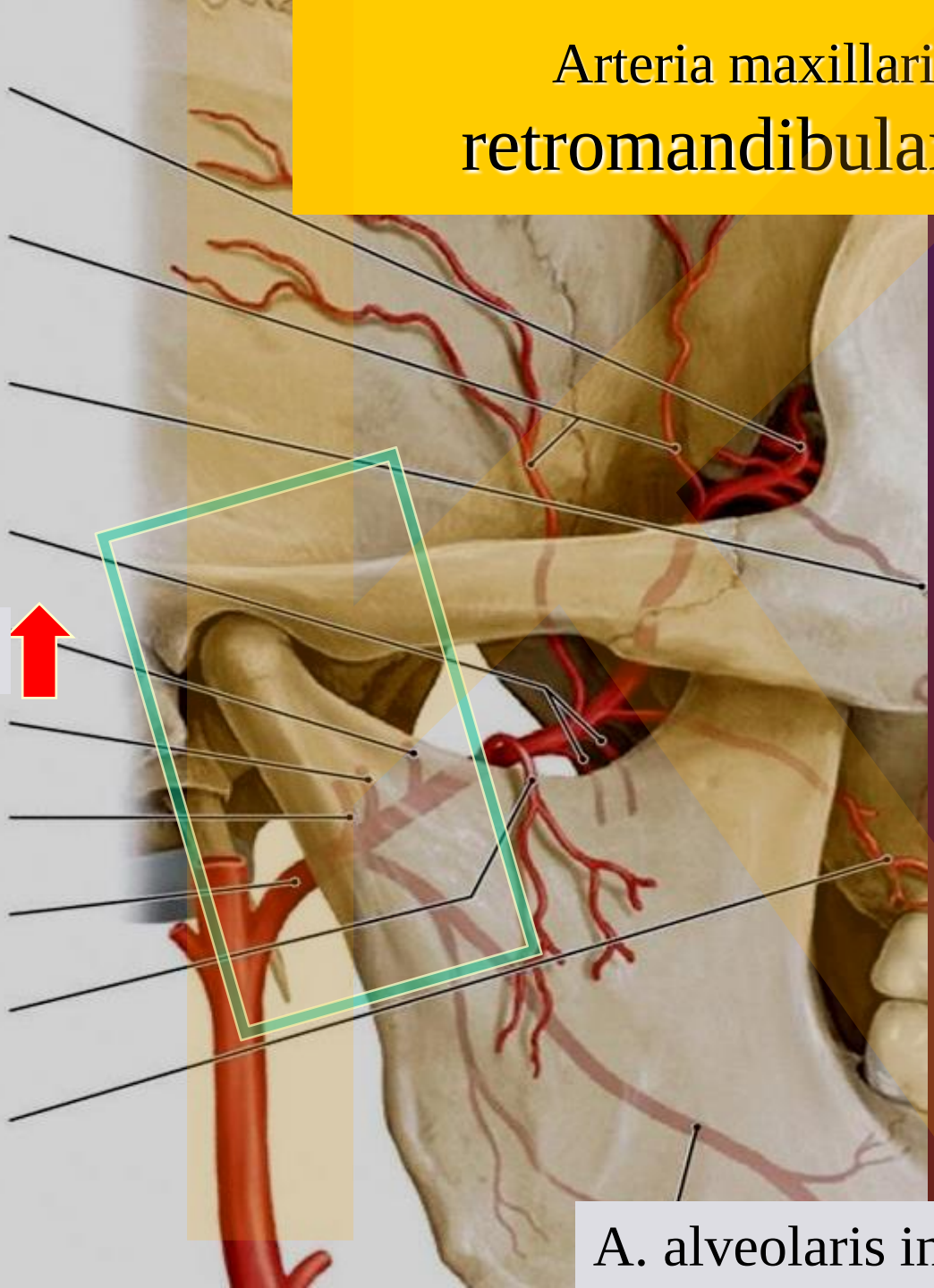
A. auricularis profunda

A. tympanica anterior

A. maxillaris

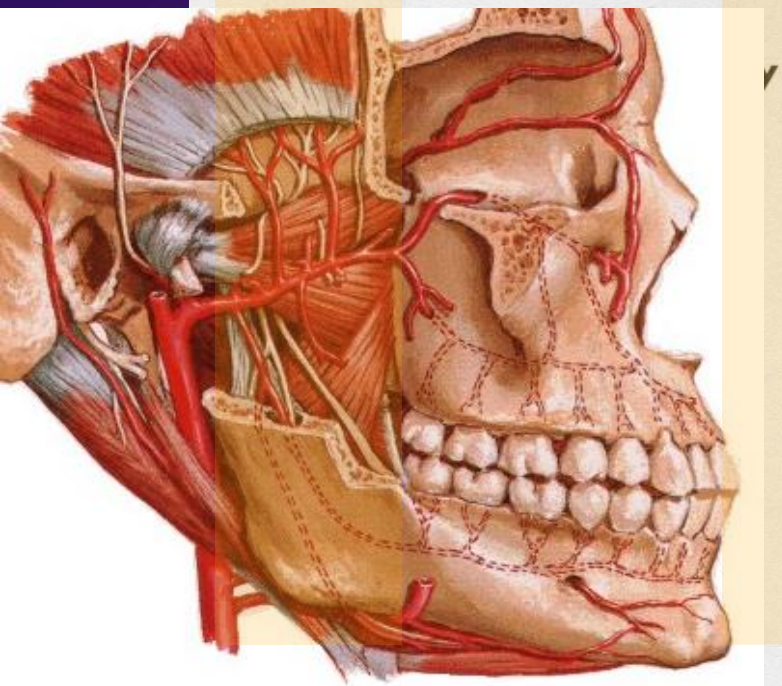
A. masseterica

A. buccalis



- a. auricularis profunda
- a. tympanica anterior
- a. meningea media
- a. alveolaris inferior

A. alveolaris inferior



Nerves to temporalis

Nerve to masseter

Auriculotemporal nerve

Sphenopalatine artery
entering pterygopalatine fossa

Buccal nerve
(branch of V_3)

Chorda tympani

y artery

Inferior alveolar nerve

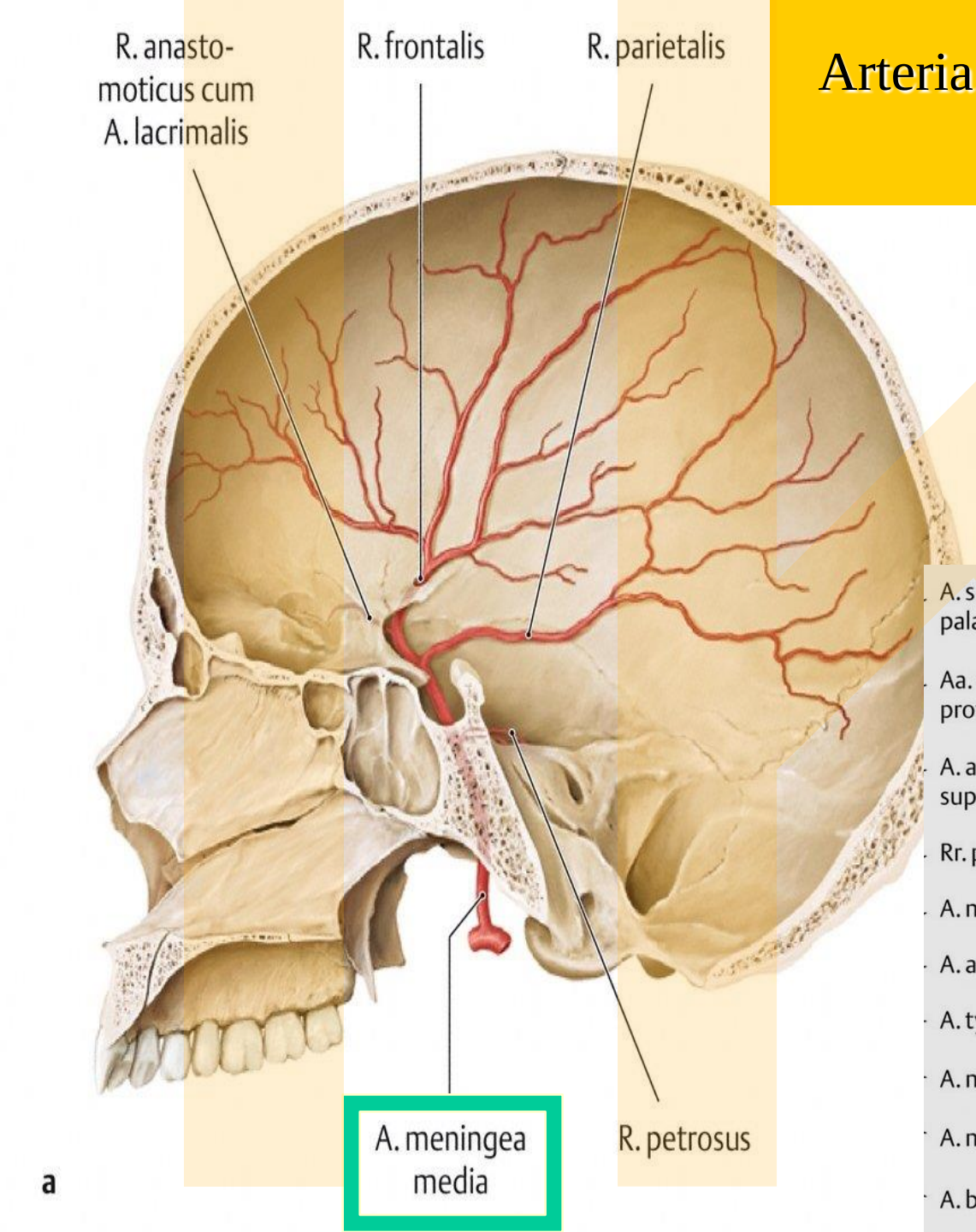
Lingual nerve

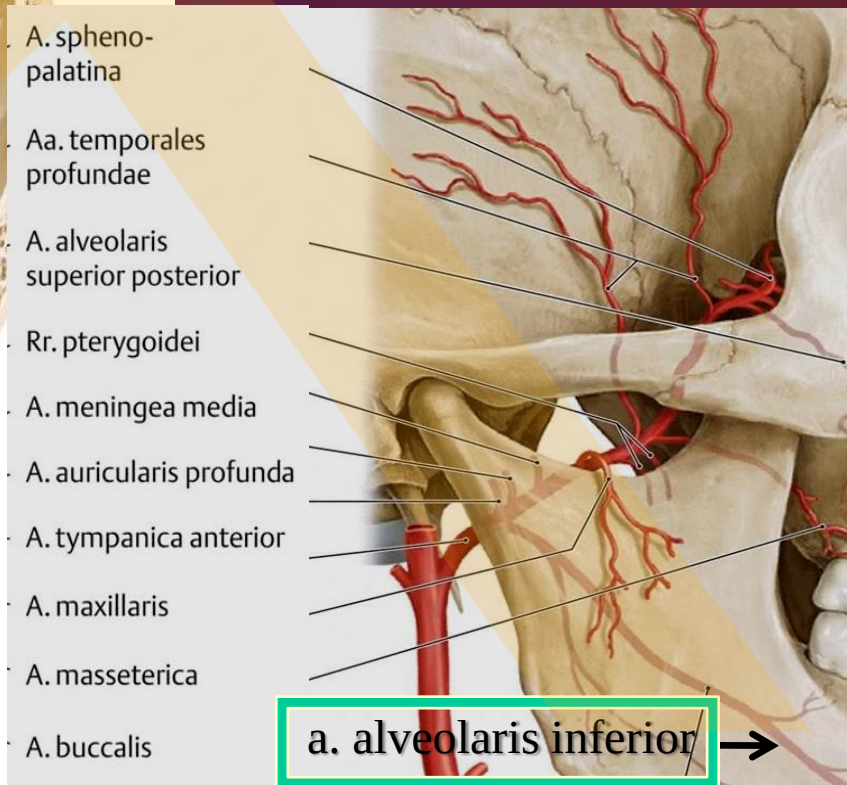
Medial pterygoid muscle

Nerve to mylohyoid and digastric

Arteria maxillaris – branches of the retromandibular part

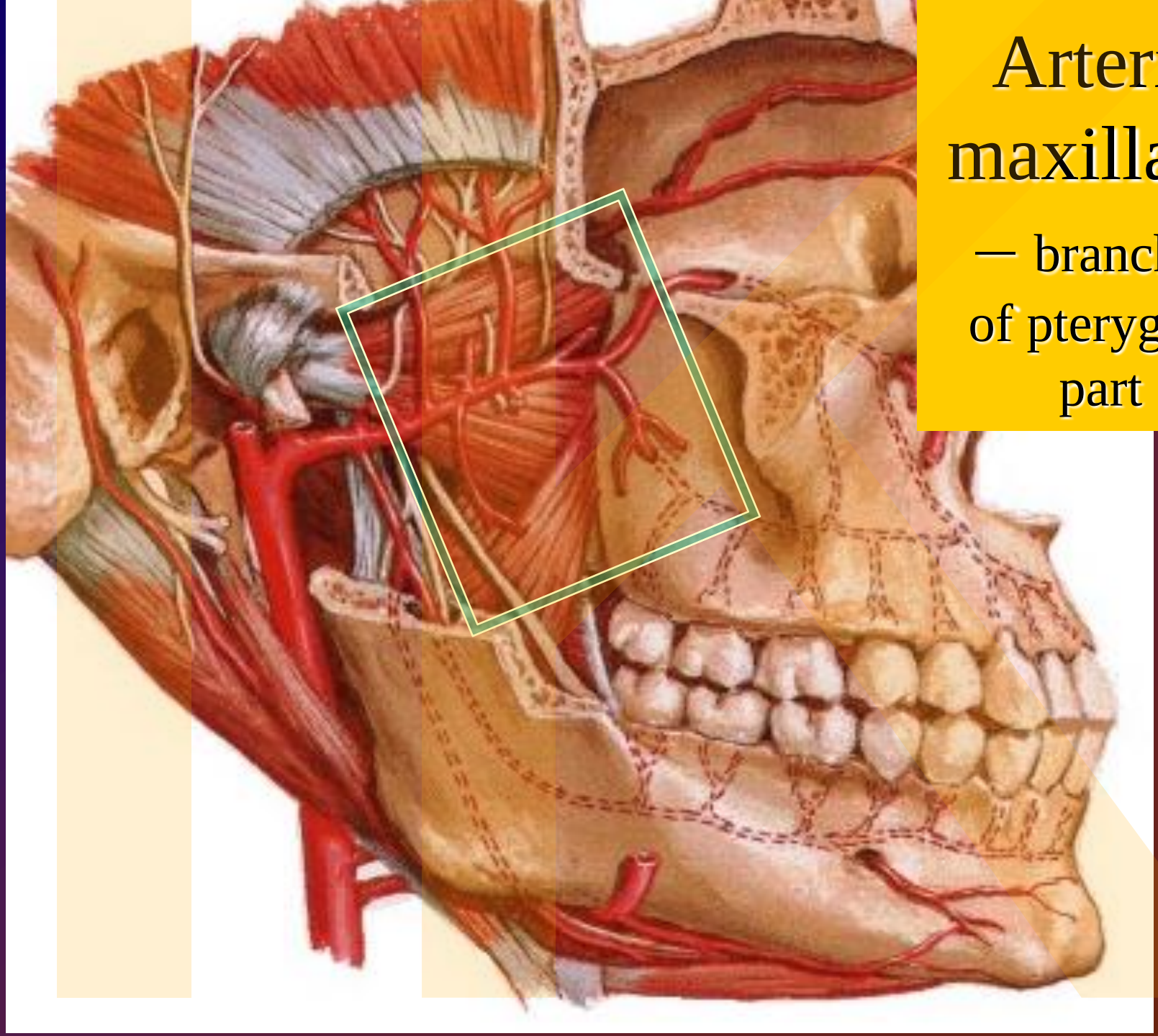
- a. auricularis profunda
- a. tympanica anterior
- **a. meningea media**
- **a. alveolaris inferior**





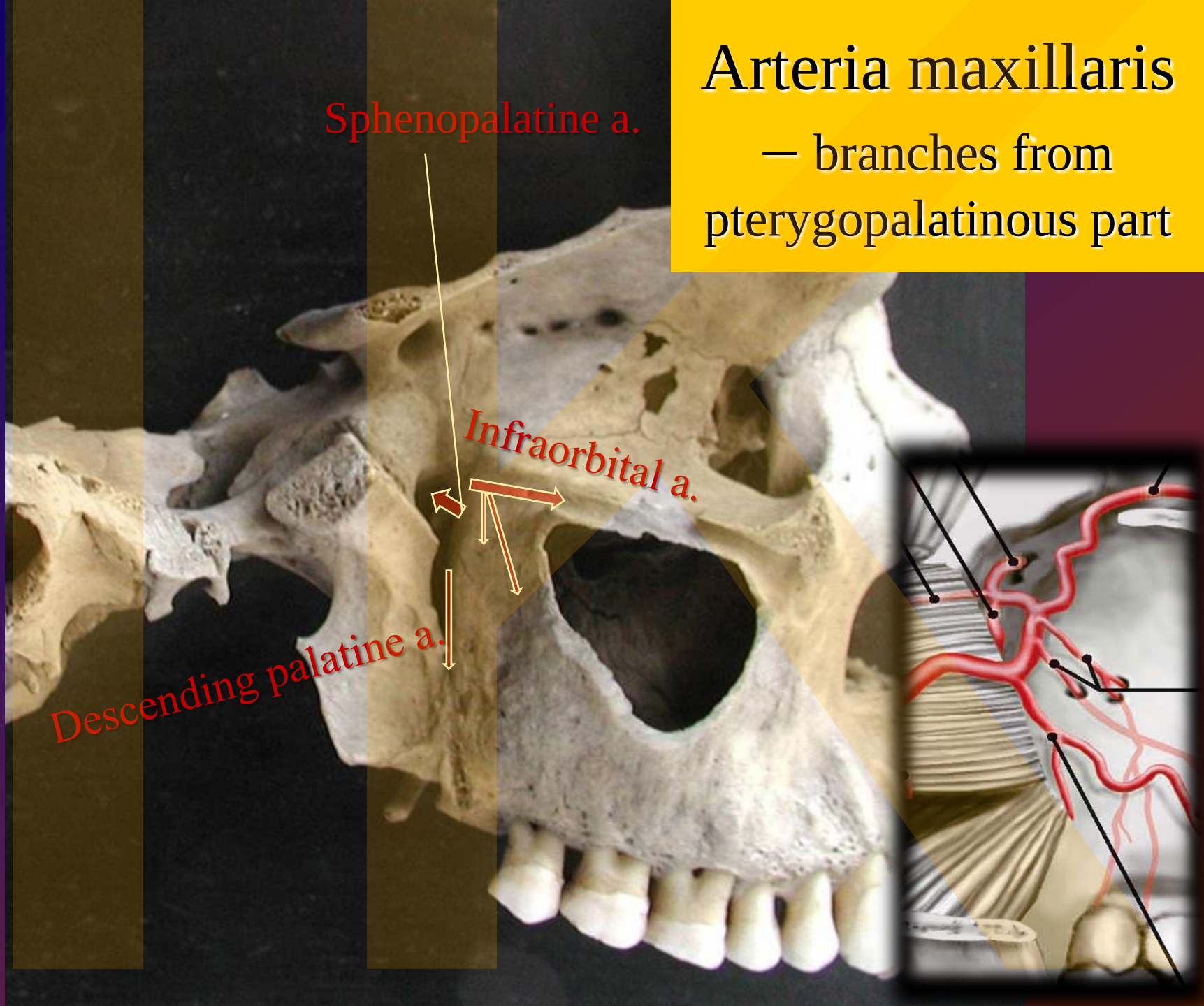
Arteria maxillaris

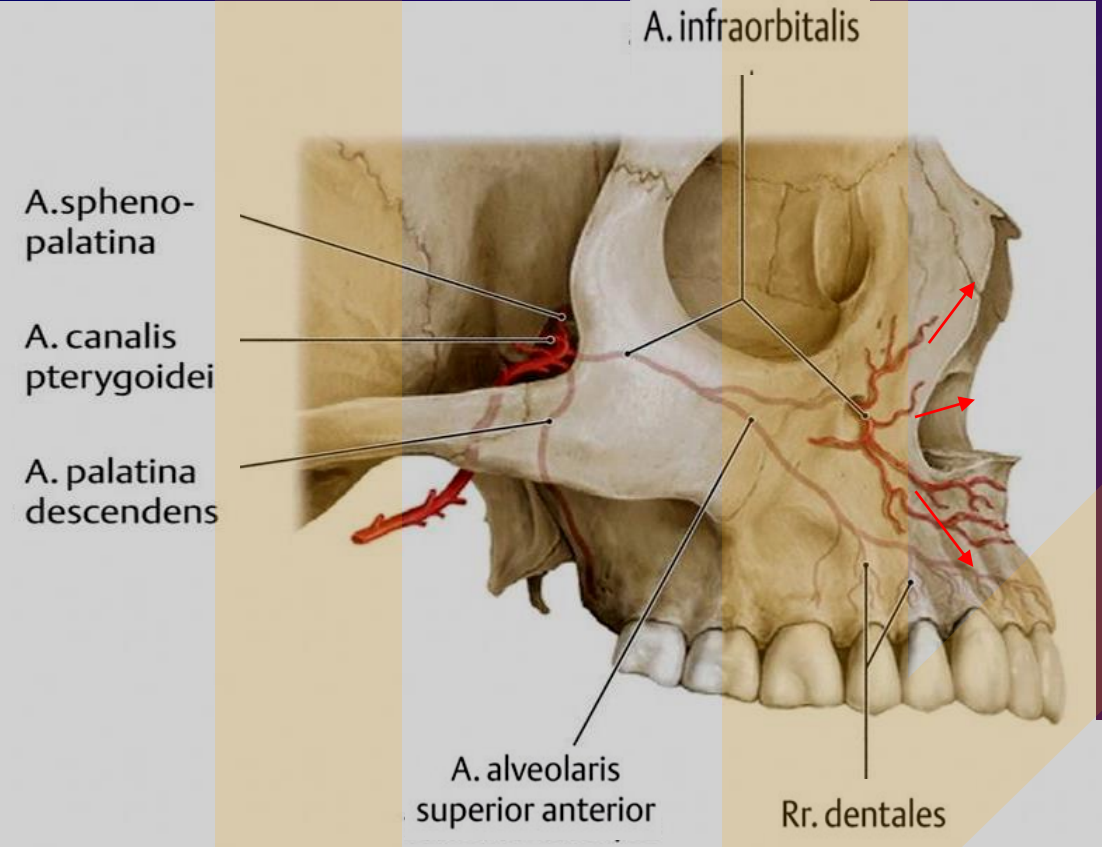
– branches of pterygoid part



Arteria maxillaris

– branches from pterygopalatinous part





- Superior posterior alveolar a.
- Infraorbital a.
- Palatine descendens a.:

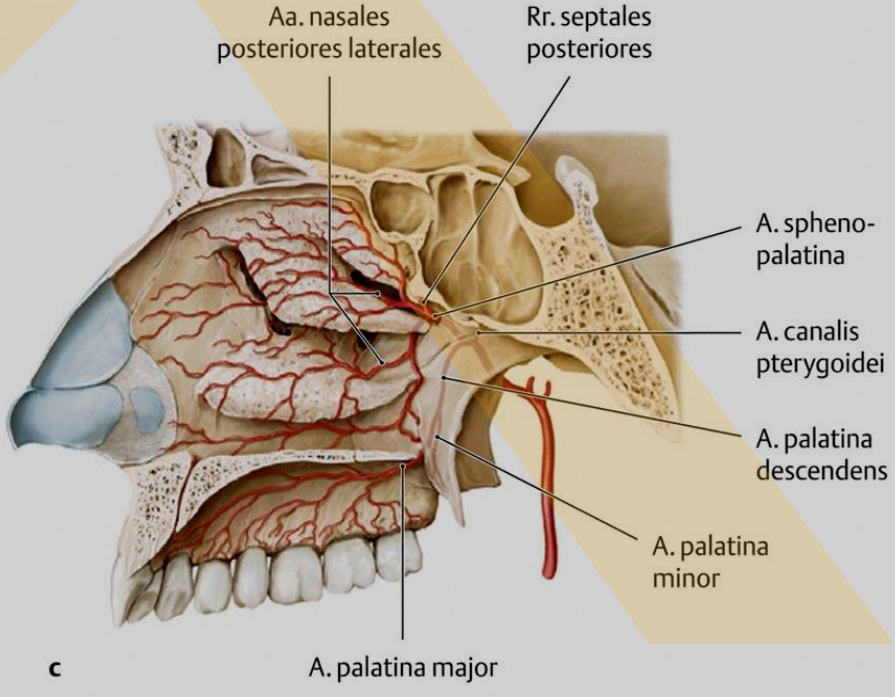
a. palatina major et minores

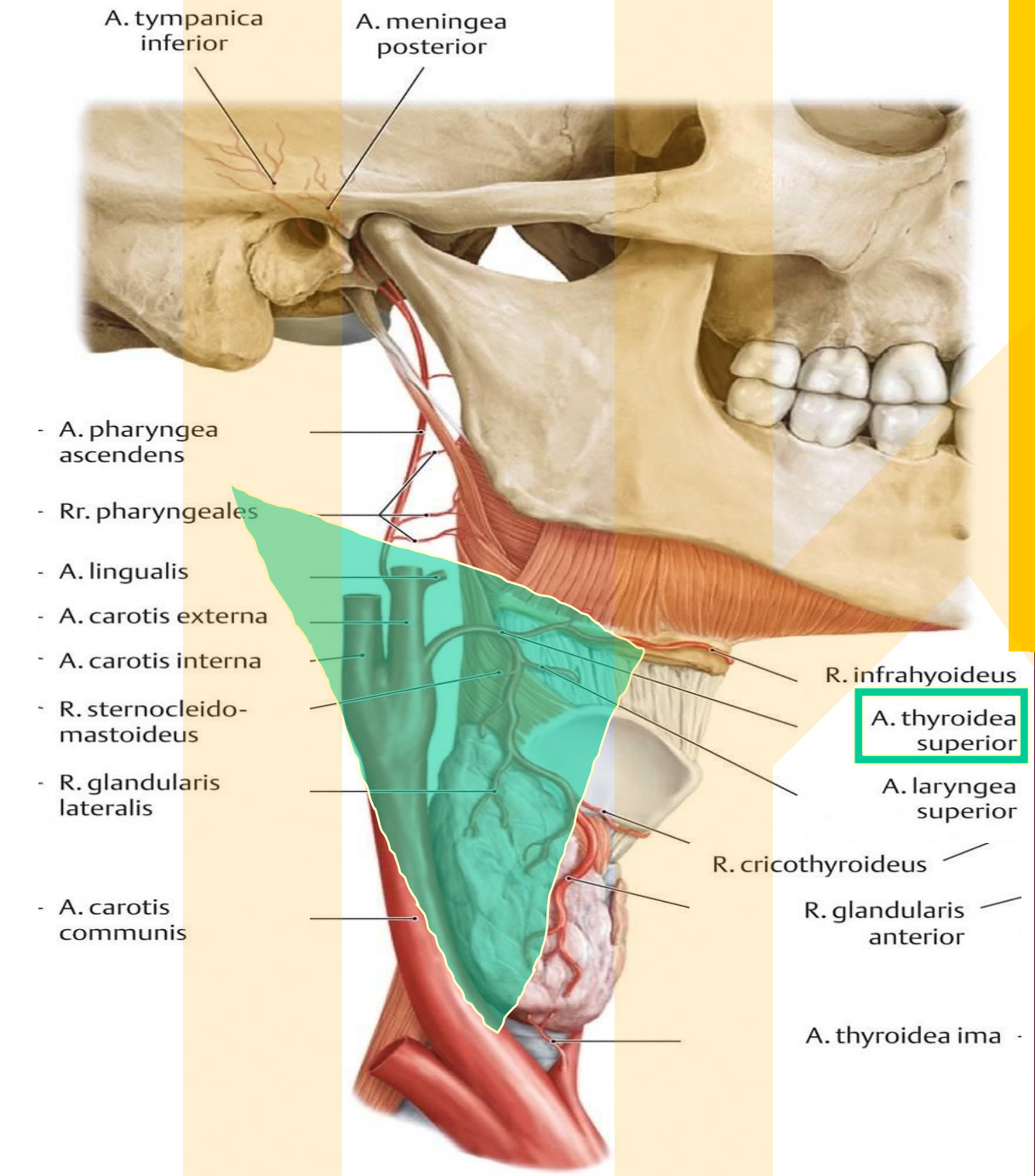
a. canalis pterygoidei

- a. sphenopalatina:

a. nasales posteriores laterales et nasales posteriores septales

Arteria maxillaris – branches from pterygopalatinous part



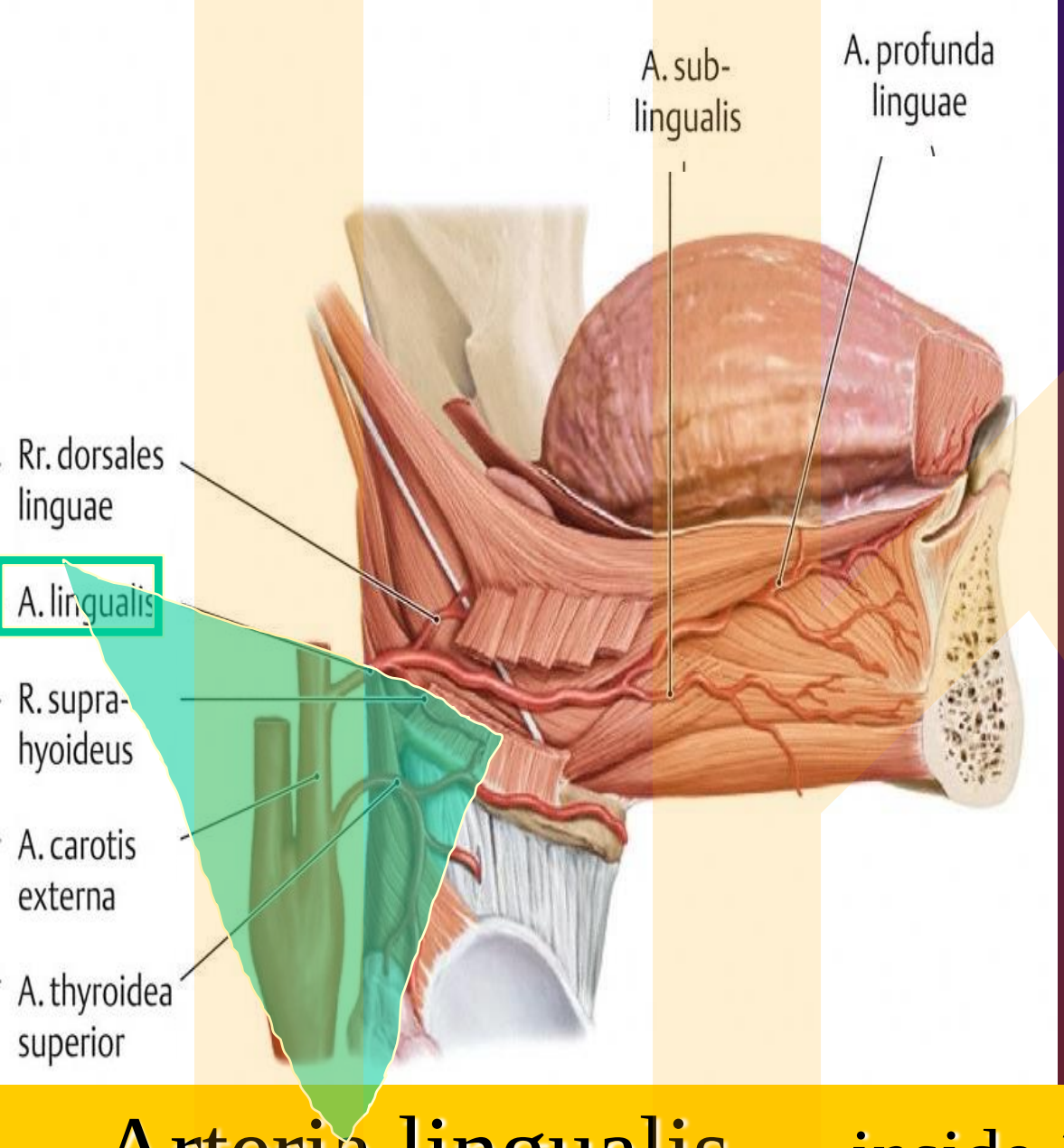


Superior thyroid a.,

Arteria thyroidea superior

For thyroid gland,;
Ventral branch anastomoses with the same contralateral opposite artery ;
Dorsal branch anastomoses with inferior thyroid a.,

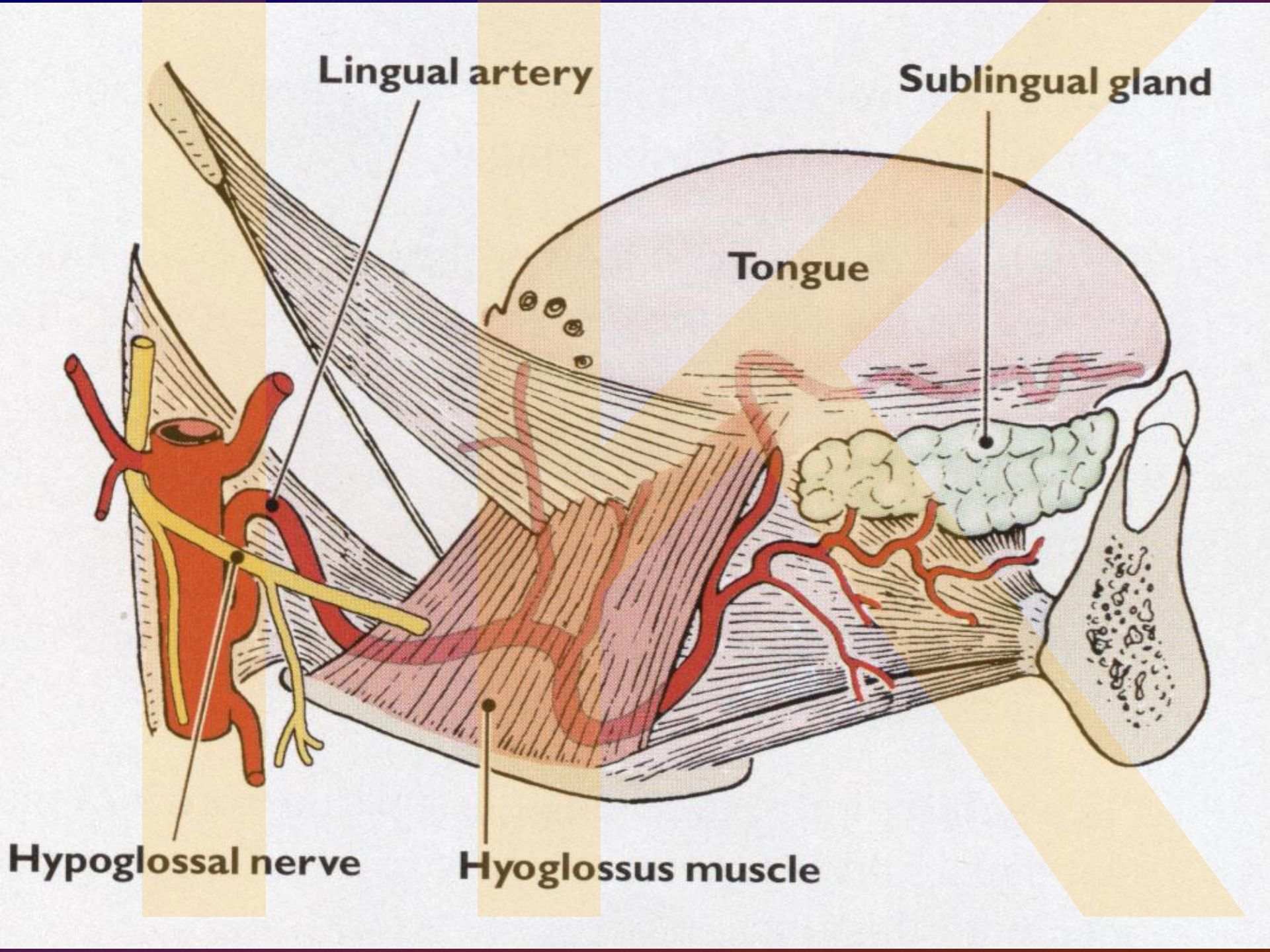
- glandular branches
- superior laryngeal a.,
- muscular branches

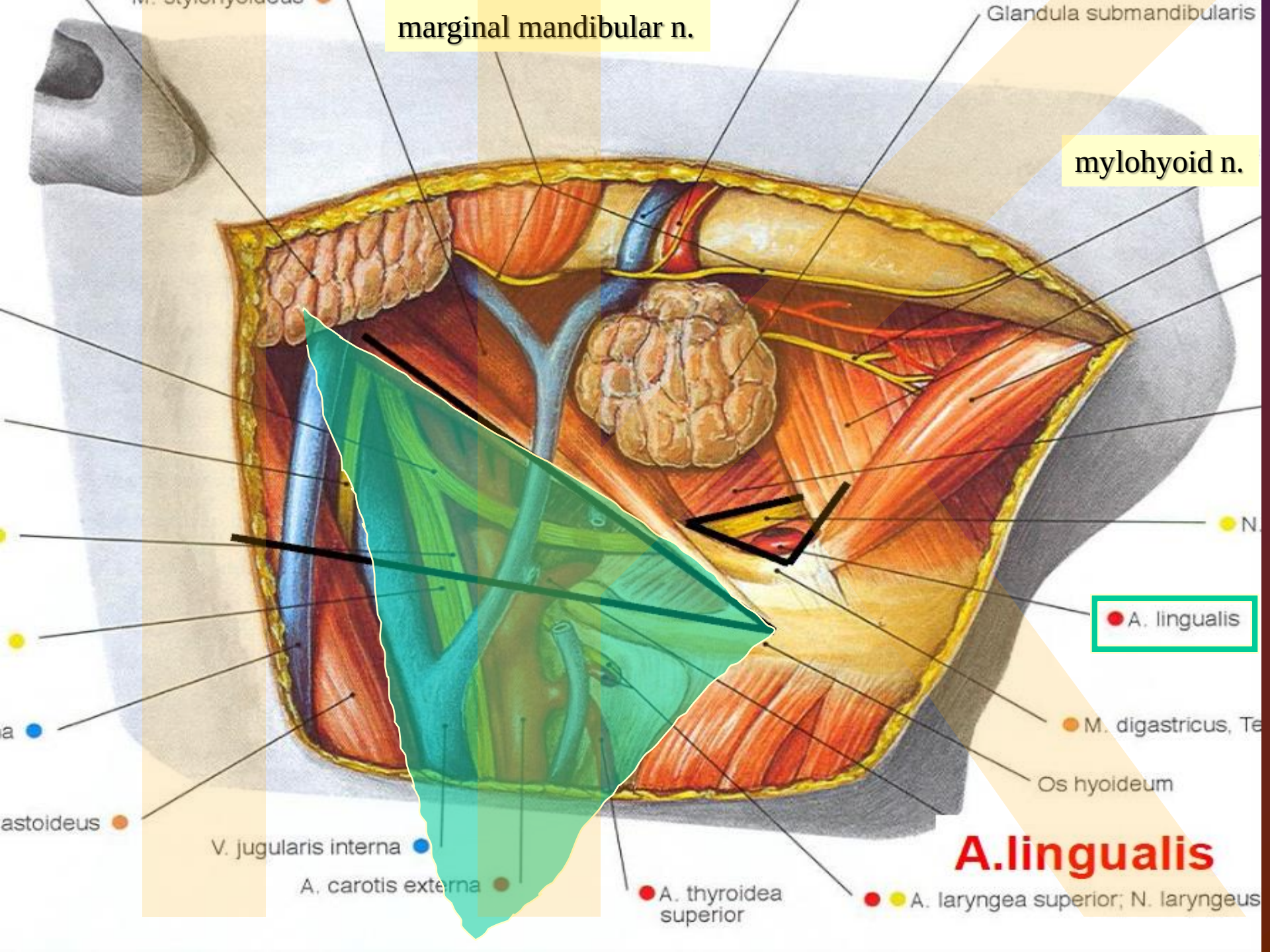


For tongue;

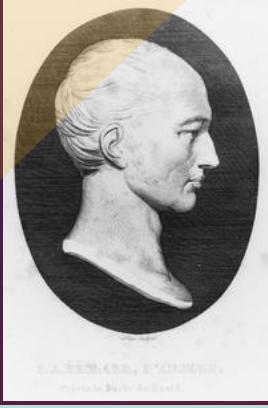
- Suprahyoid branch
- Sublingual a. (for sublingual gland)
- Dorsal lingual branches (from tongue root to epiglottis)
- a. profunda linguae (deep lingual a. – for intraglossal muscles; it proceeds to frenulum linguae)

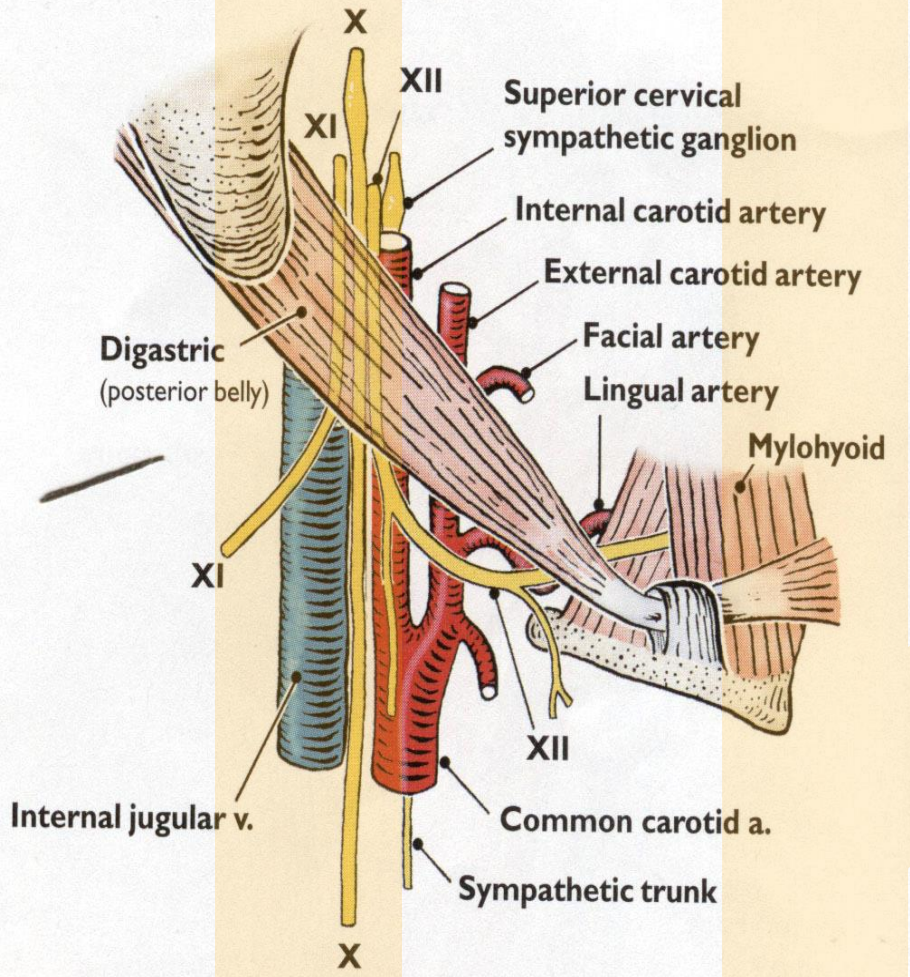
Arteria lingualis - inside ´paralingual´ canal (canalis paralingualis)


Lingual artery
Sublingual gland
Tongue
Hypoglossal nerve
Hyoglossus muscle

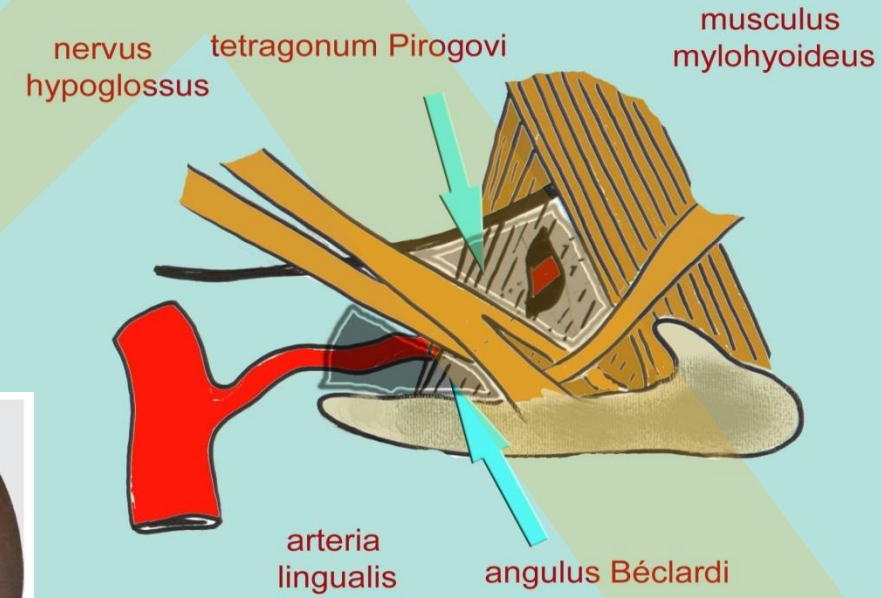

marginal mandibular n.
mylohyoid n.
Glandula submandibularis
A. lingualis
M. digastricus, Te
Os hyoideum
V. jugularis interna
A. carotis externa
A. thyroidea superior
A. laryngea superior; N. laryngeus
A.lingualis

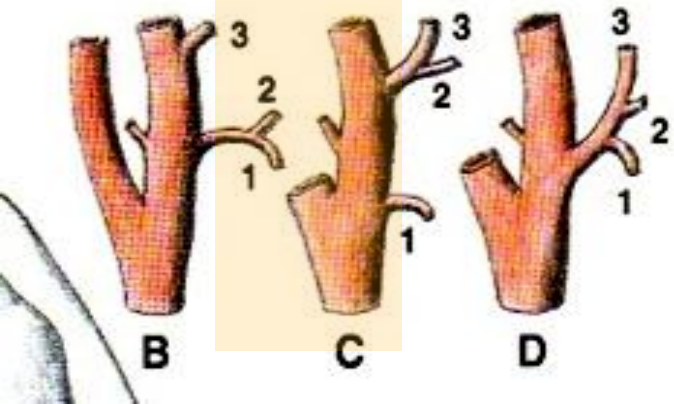
Trigonum Pirogovi
(Pirogoff ´triangle)
Angulus Béclardi
(Béclard´ angle)





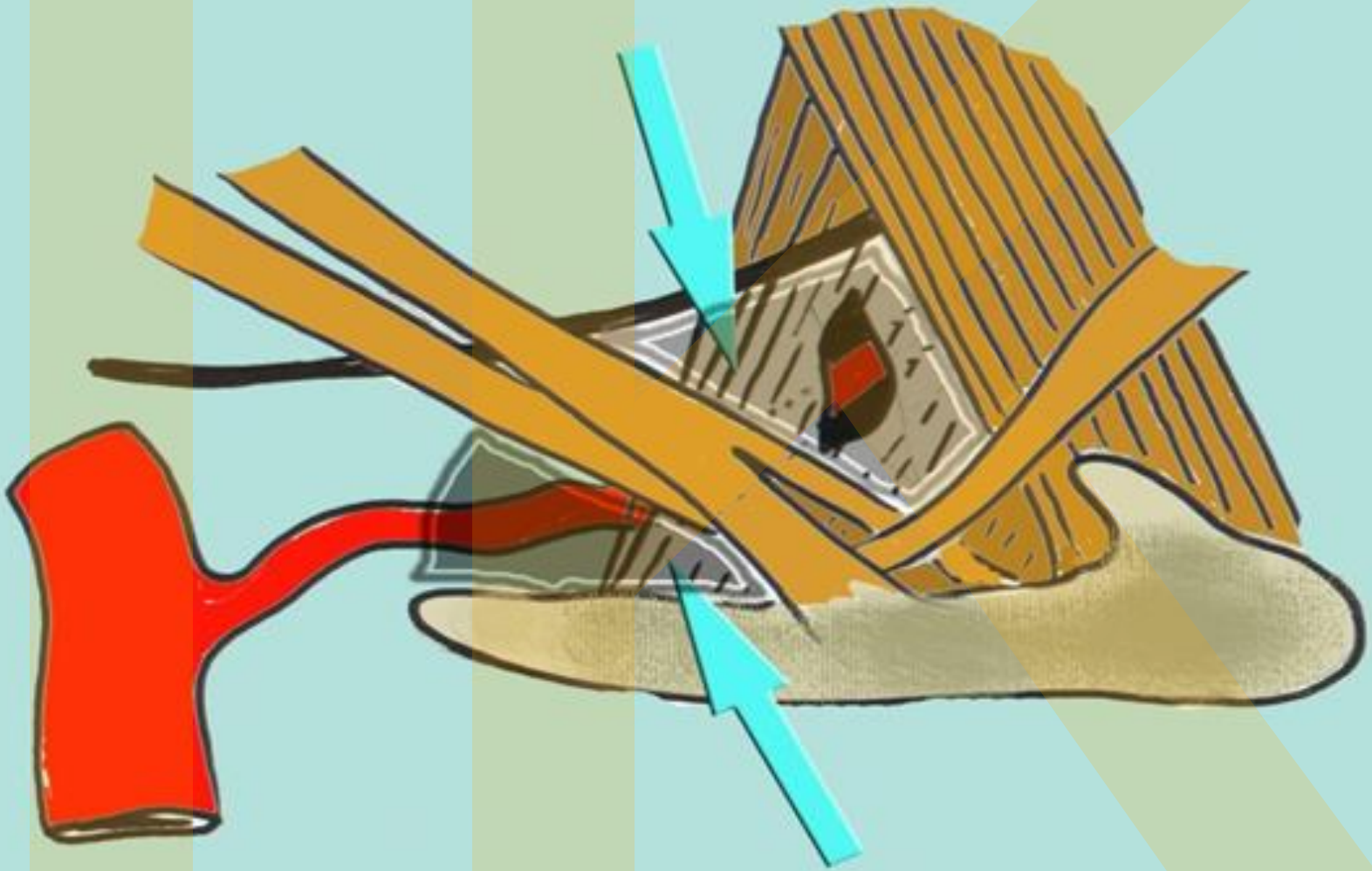
Pierre Augustin Béclard, French anatomist (*1785- †1825)



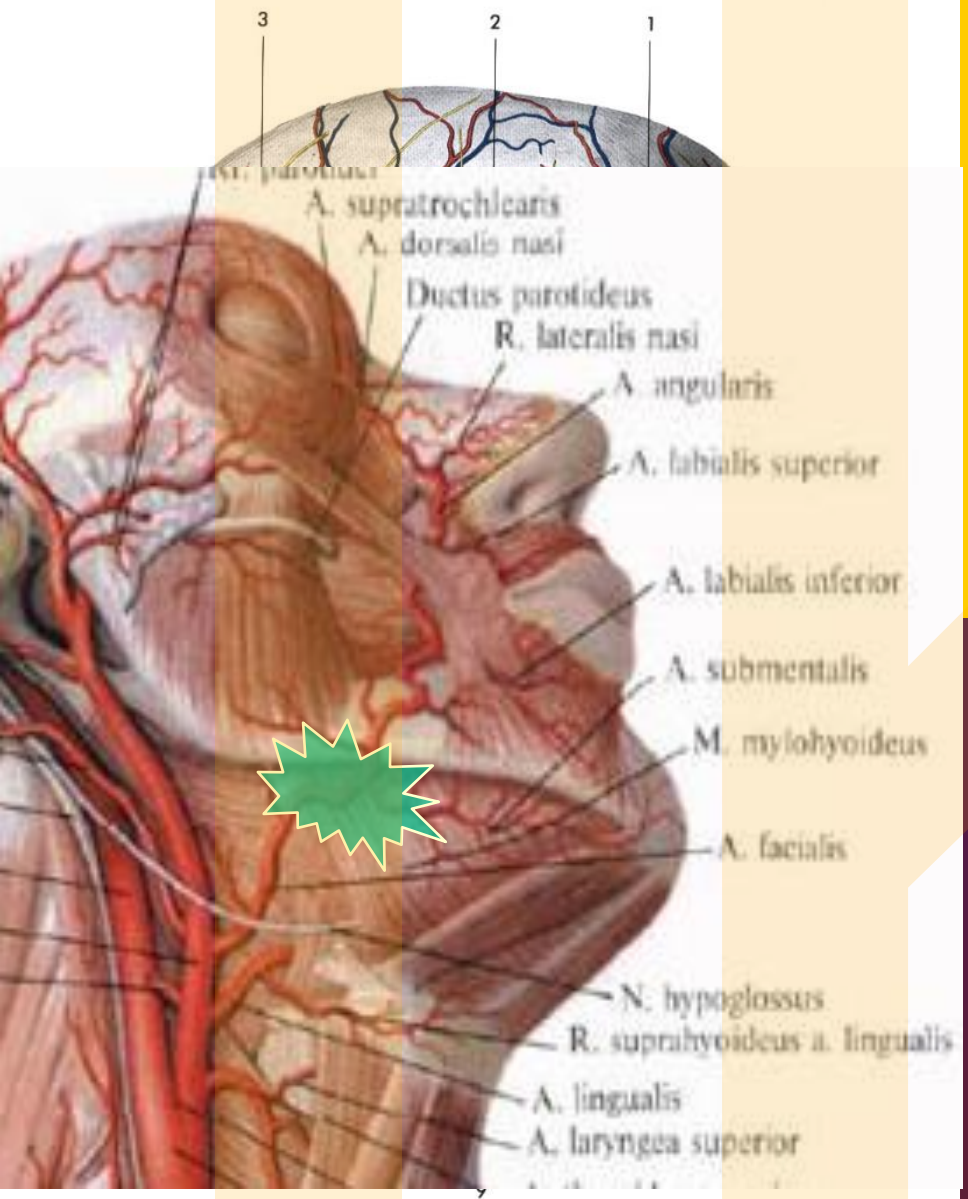


N. Pirogov

Nikolaj Ivanovič, Pirogov Russian surgeon (*1810 - †1881)



Facial artery
Arteria facialis



Obr. 13.7. Povrchové krajiny obličeje, pohled ze strany. 1 – r. frontalis a. temporalis superficialis, 2 – r. parietalis a. temporalis superficialis, 3 – a. et v. occipitalis, 4 – n. occipitalis major, 5 – n. occipitalis minor, 6 – n. auricularis magnus, 7 – v. retromandibularis, 8 – n. transversus colli, 9 – v. jugularis externa, 10 – r. colli n. facialis, 11 – a. et v. facialis, 12 – rr. buccales n. facialis, 13 – ductus parotideus, 14 – rr. temporales n. facialis, 15 – n. auriculotemporalis

For neck and face;

- Ascending palatine a. (for soft palate and palatine tonsil)
- Glandular branches (for submandibular gland)
- Submental a. (for mylohyoid a., anterior belly of digastric m.)

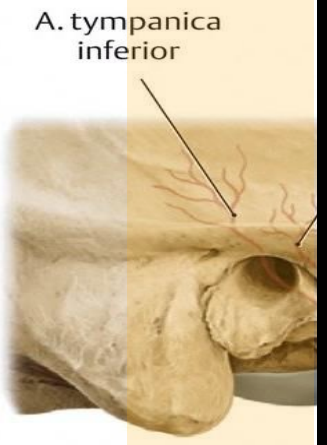
- Superior and inferior labial aa. (they form circle around rima oris)
- alaris nasi m.
- angularis m.

perior
ngeal a.,

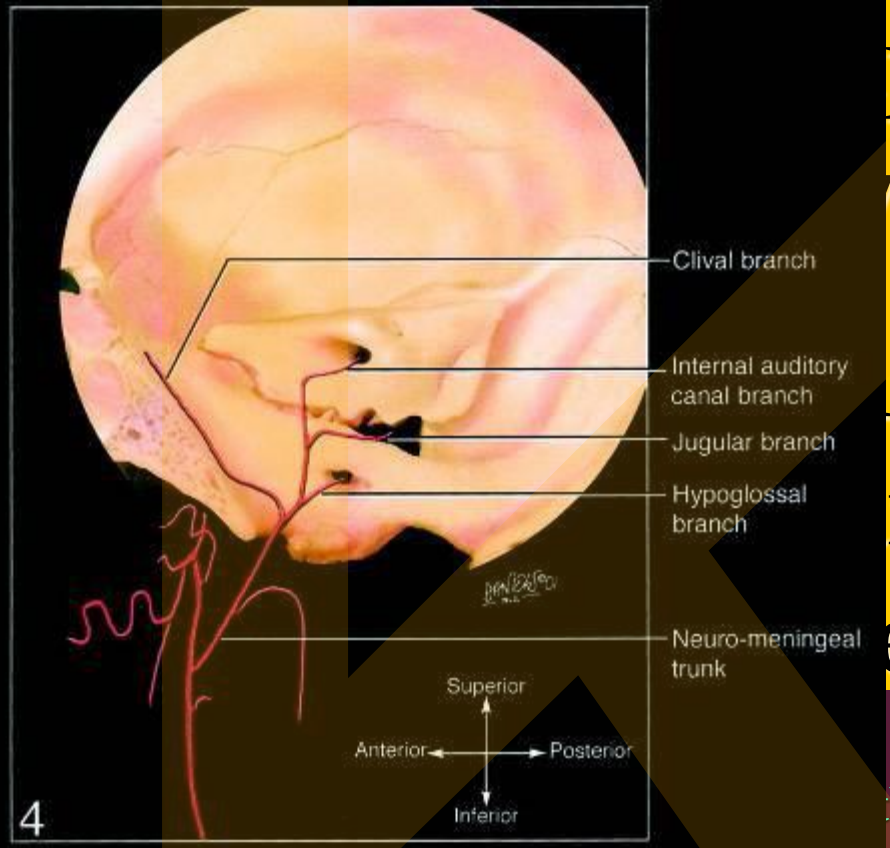
rteria
ryngea
endens

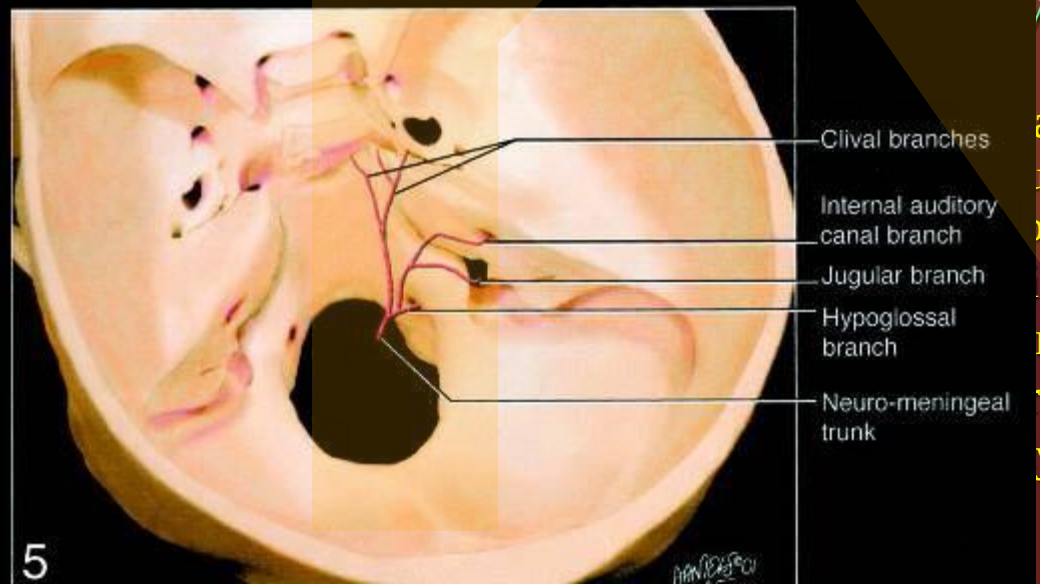
hin artery, supplies
nx

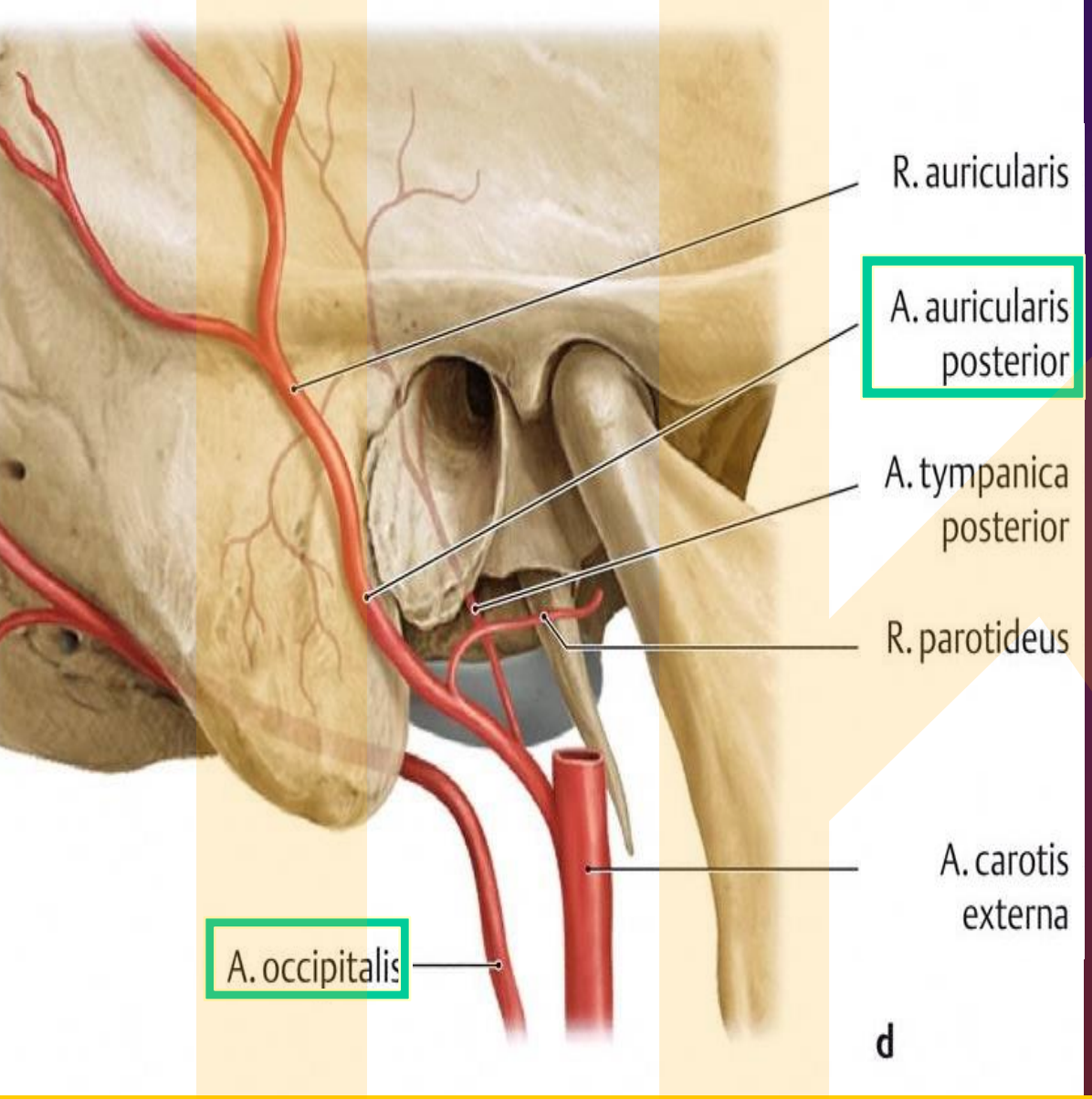
al branches (for
s sympathicus, vagus,
oglossus and pharynx)
ngeal branches (for
mater)
ior tympanic artery
ympanic cavity)



- A. pharyngea ascendens
- Rr. pharyngeales
- A. lingualis
- A. carotis externa
- A. carotis interna
- R. sternocleido-mastoideus
- R. glandularis lateralis
- A. carotis communis







For soft meningeal membranes, external acoustic meatus, mastoid process;

- Occipital branches
- Sternocleidomastoid brr. (sternocleidomastoid a. – crosses arcus nervi hypoglossi)
- Auricular br.
- Mastoid ale br. (for dura mater near mastoid canal)
- Meningeal brr. (for dura mater near for. jugulare)

- Stylomastoid a. (for cavum tympani, canales semicirculares and cellulae mastoideae;
- Posterior tympanic a. supplies cavum tympani)

Occipital artery + posterior auricular a.
Arteriae occipitalis + auricularis posterior

Aa. caroticotympanicae		A. carotis interna
A. stylomastoidea		A. auricularis posterior
A. tympanica inferior	←	A. pharyngea ascendens
A. auricularis profunda		A. maxillaris
A. tympanica posterior	←	A. stylomastoidea
A. tympanica superior	←	A. meningea media
A. tympanica anterior	←	A. maxillaris

Internal carotid artery ICA

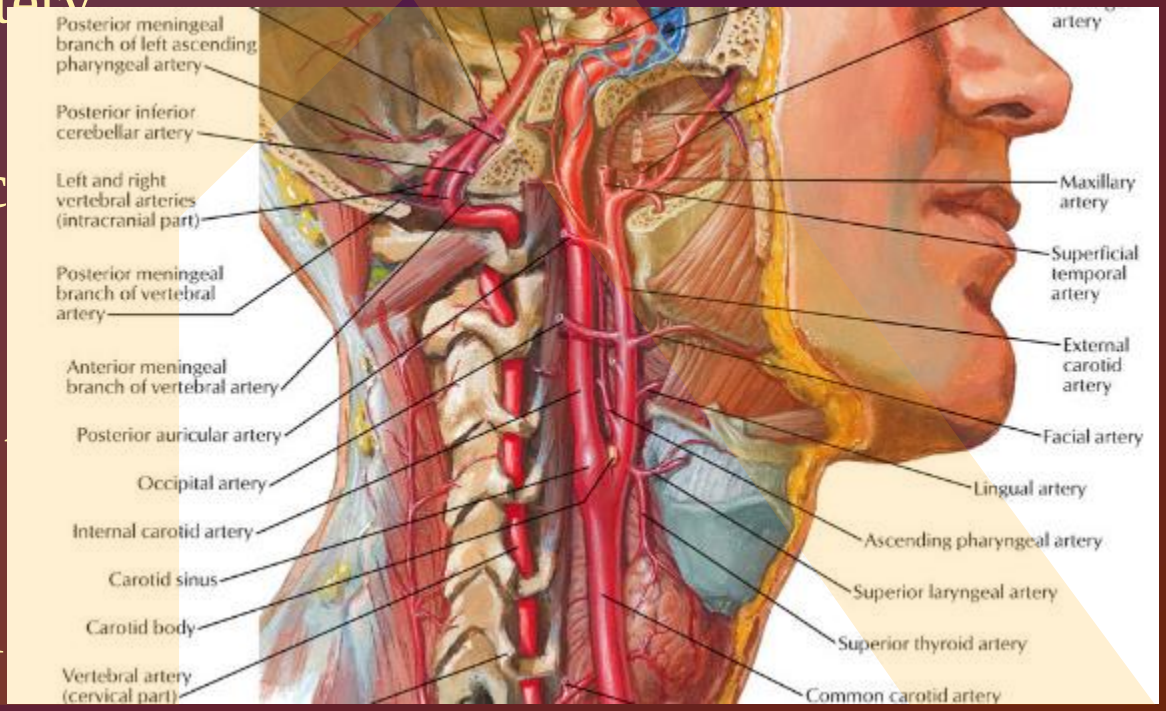
Anterolaterally – below the digastric lies XII. nerve, sternocleidomastoid muscle, fascia, skin

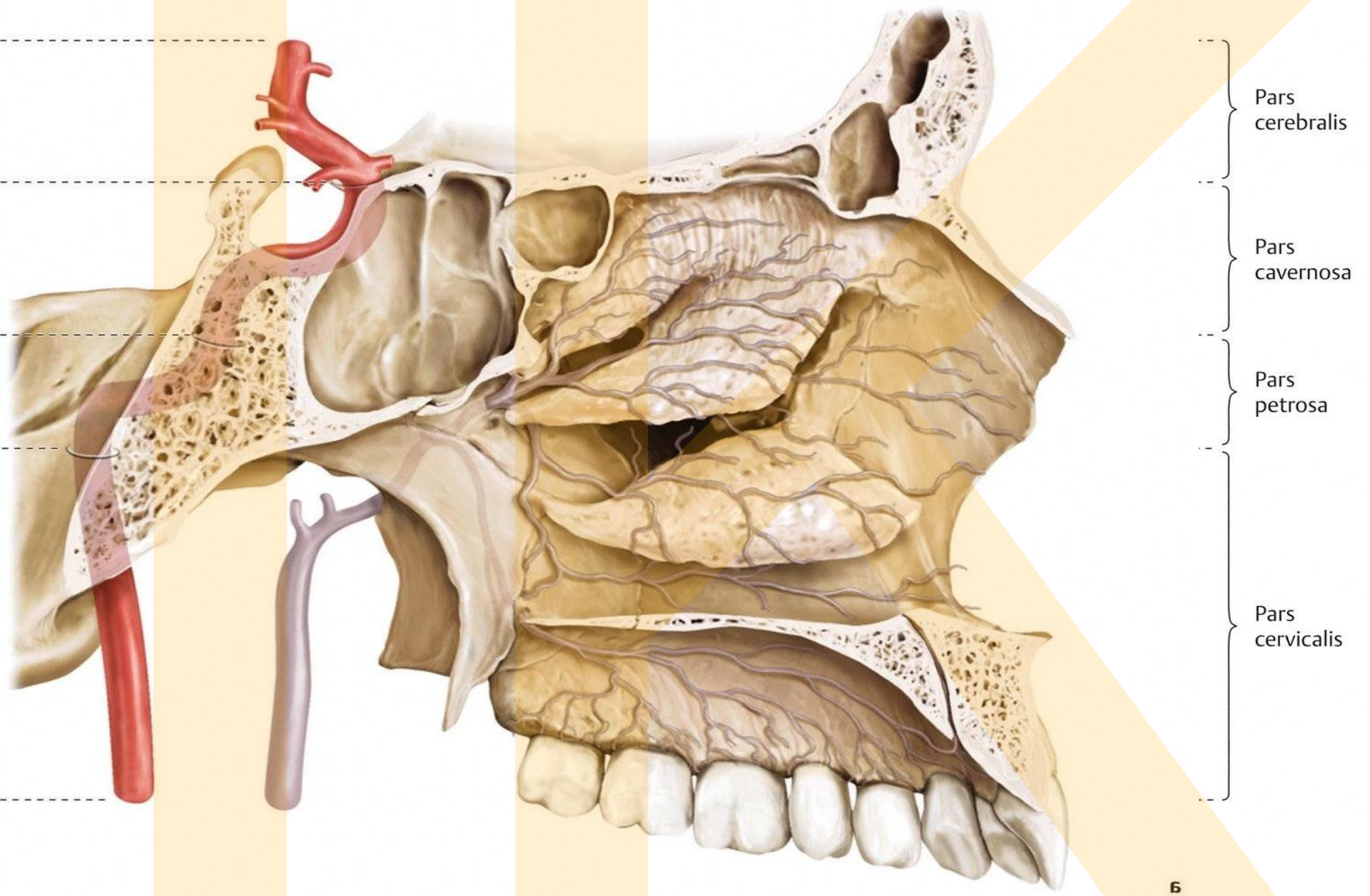
– above the digastric lies the pharyngeal branch of the vagus, IX. nerve, stylohyoid, stylopharyngeus muscles, parotid gland, external carotid artery

Posteriorly – sympathetic
vertebral process

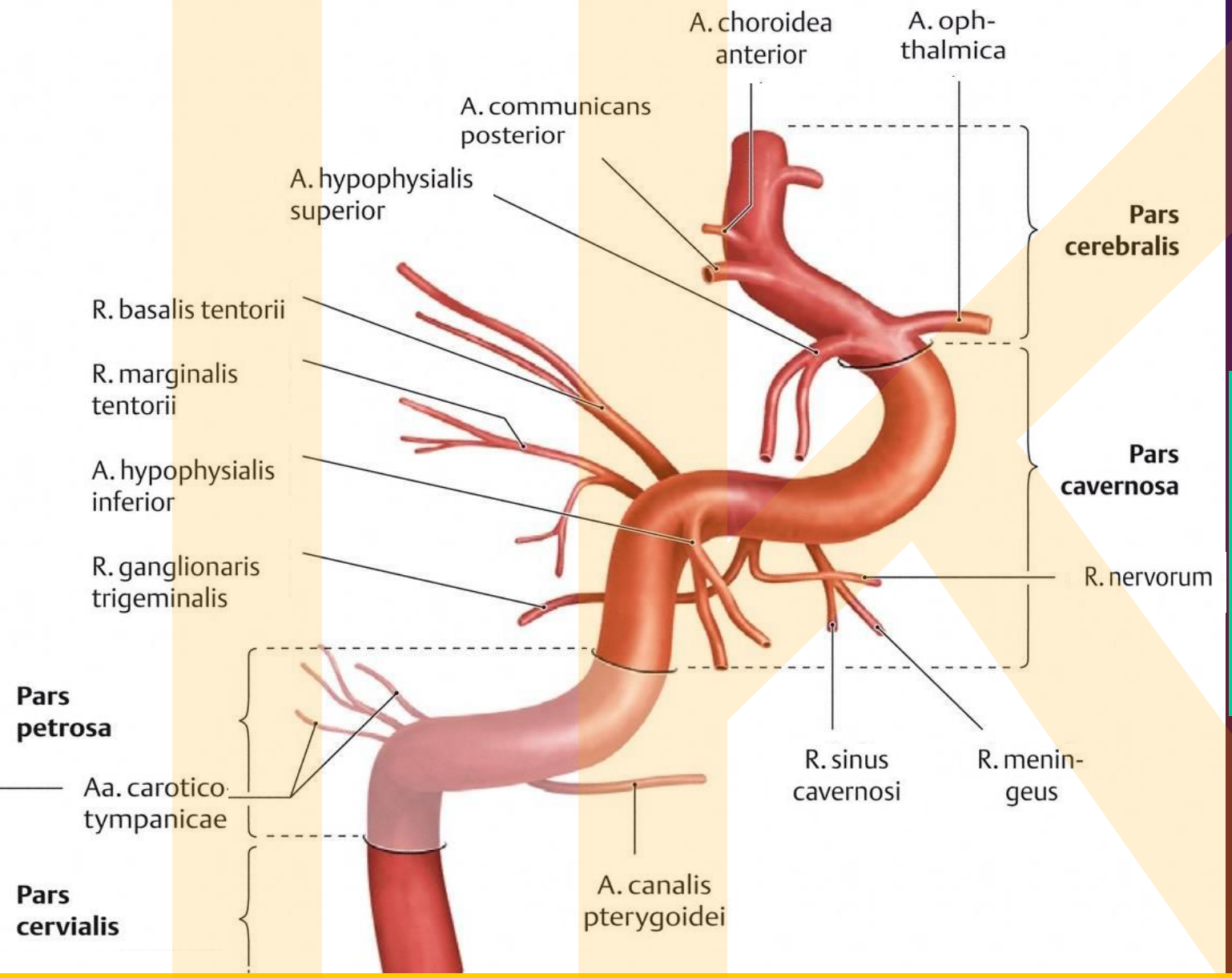
Medially – wall of

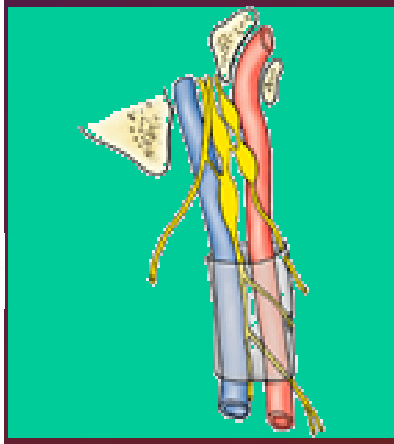
Laterally – internal





Internal carotid artery Arteria carotis interna





Arteria carotis interna – arrangement of the intracranial arteries

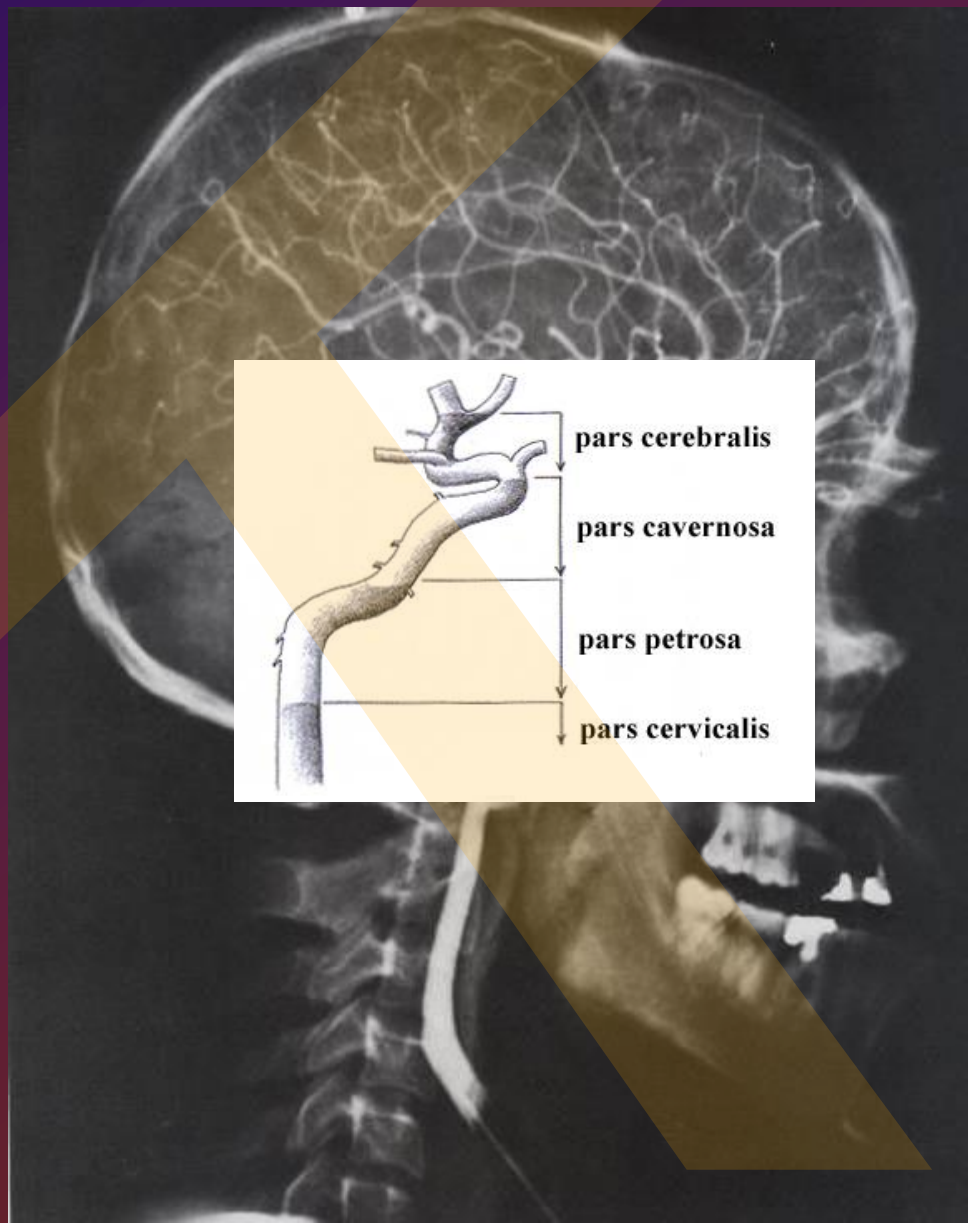
Internal carotic artery ICA

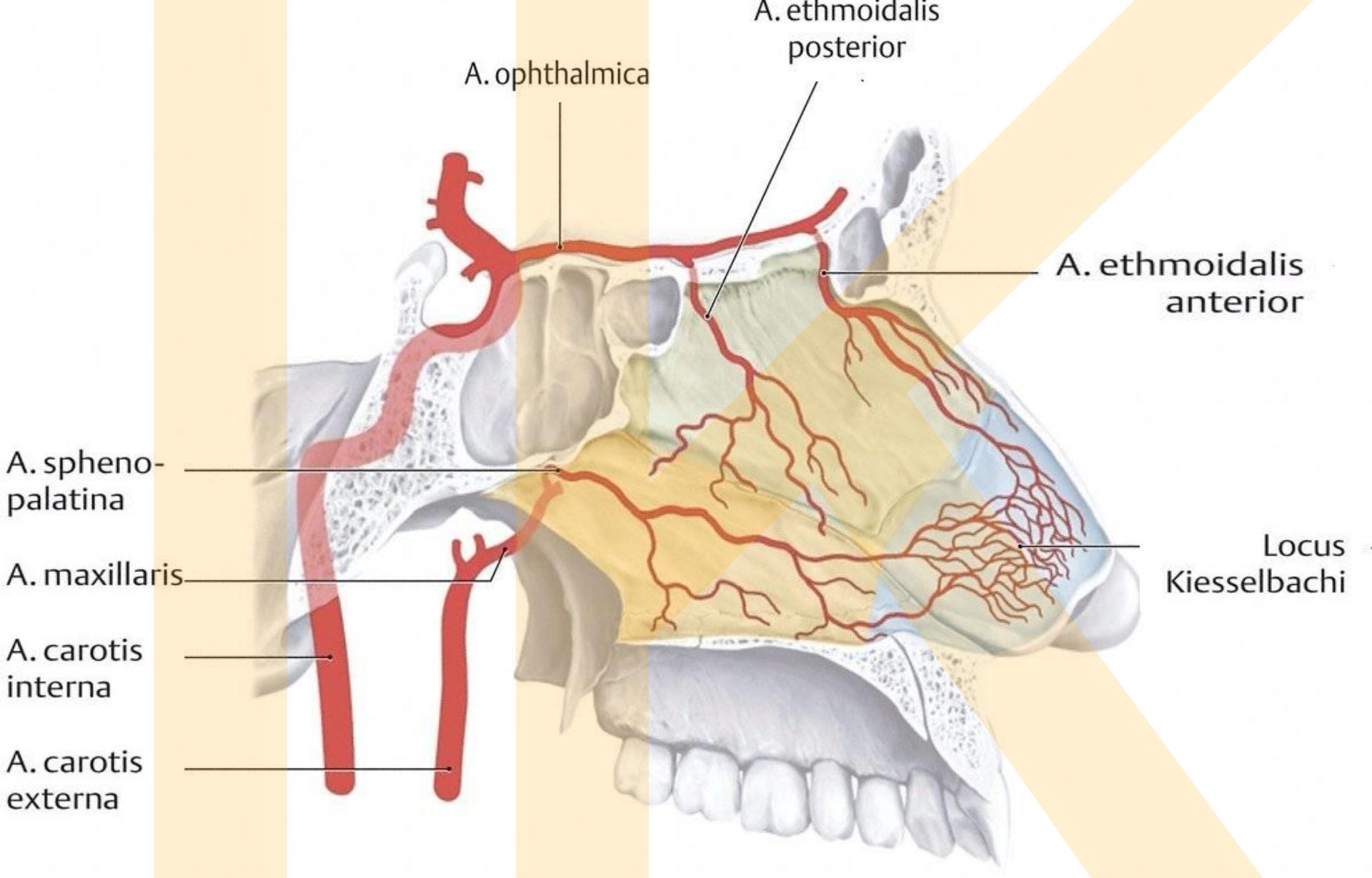
Carotic sinus (baroreceptor)

- **Cervical part** – sinus caroticus, no branches
- **Petrous part** – caroticotympanic aa.
- **Cavernous part** – meningeal branch, hypophysial br. ganglionic trigeminal inferior brr.
- **Cerebral part** – ophtalmic a., (right angle), superior hypophysial a., communicans posterior a., choroid anterior a.
- **Terminal branches:**
  - **Anterior cerebral a.**
  - **Medial cerebral a.**

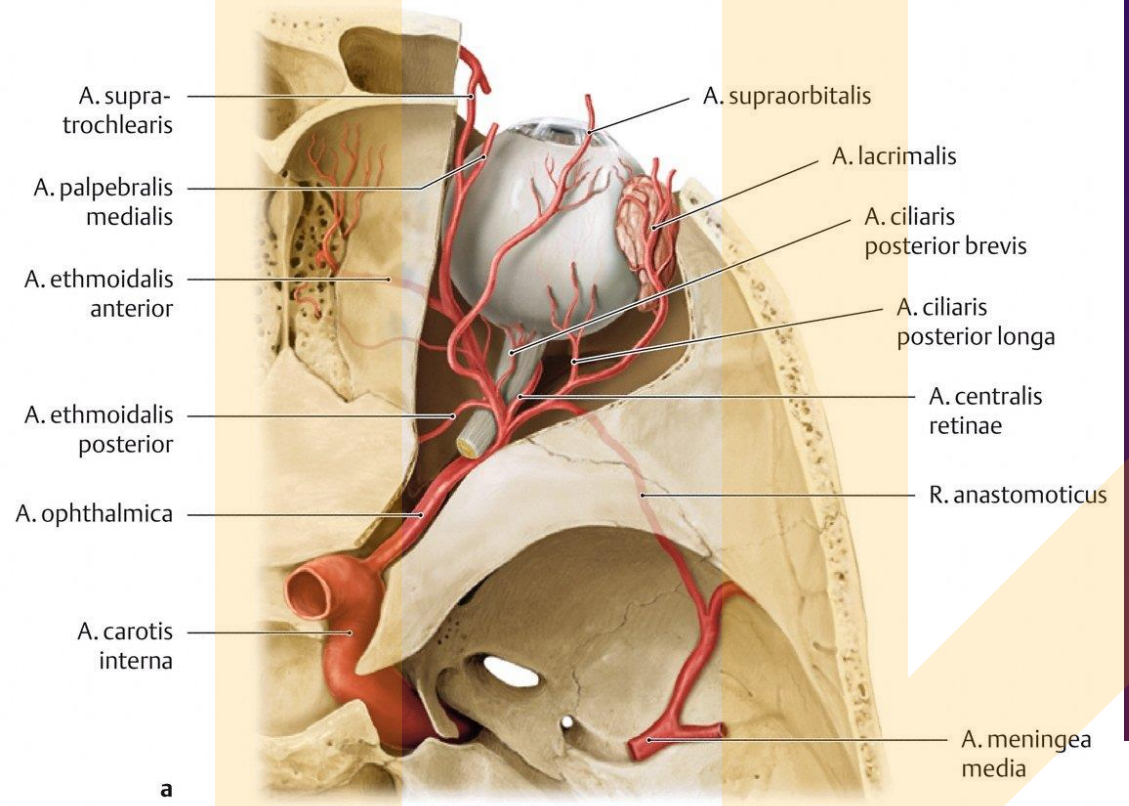
Carotic siphon

Willis´ circle (circulus arteriosus cerebri *Willisi)*



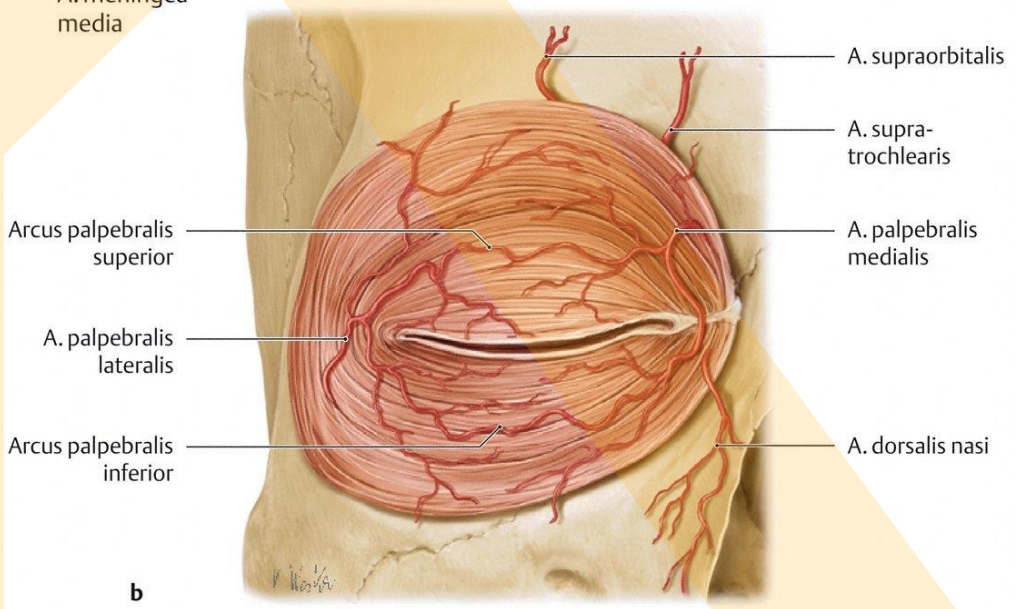


ICA has anastomoses with maxillary artery in nasal septum

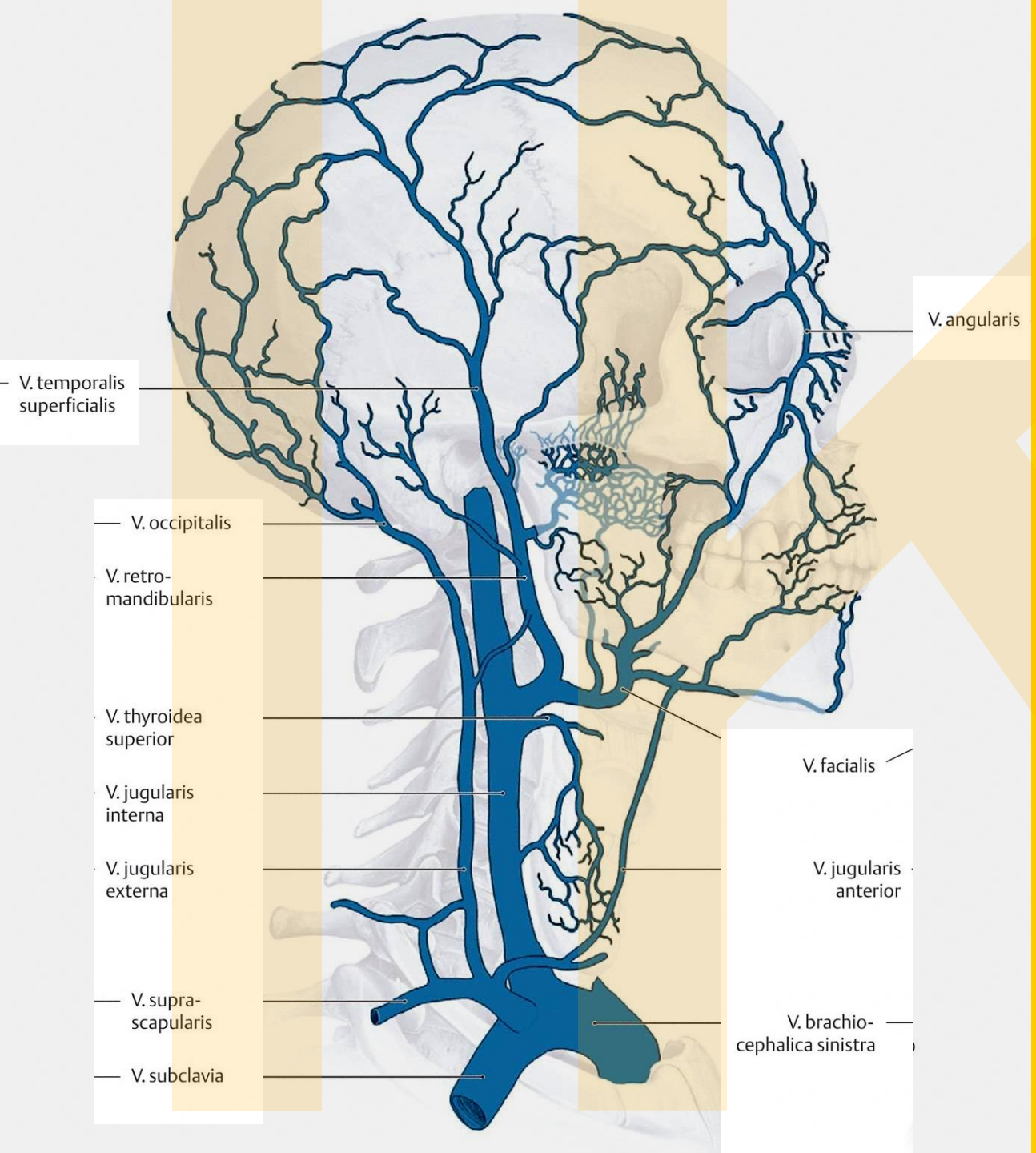


B A. ophthalmica

Ophtalmic artery
Arteria ophtalmica



B A. ophthalmica



Superficial veins:

Head: facial vein, superficial temporal vein

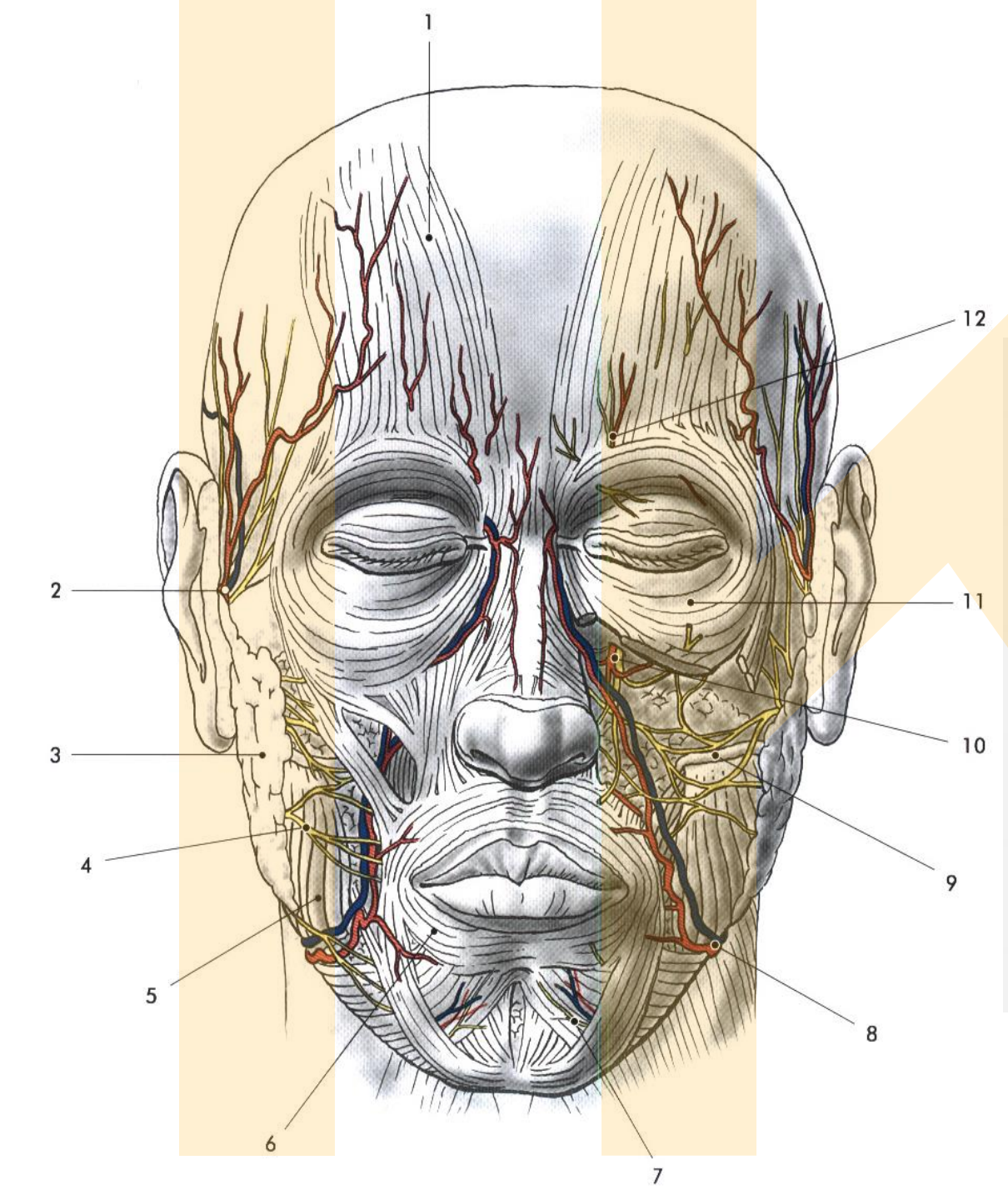
Neck: external jugular, anterior jugular and branches

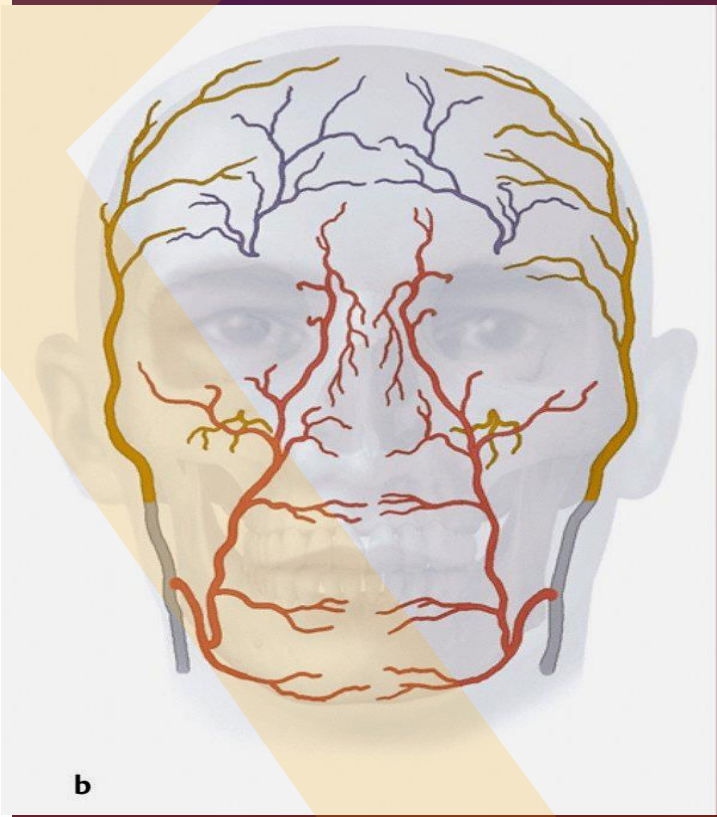
Deep veins Venae profundae:

Head: Pterygoid plexus

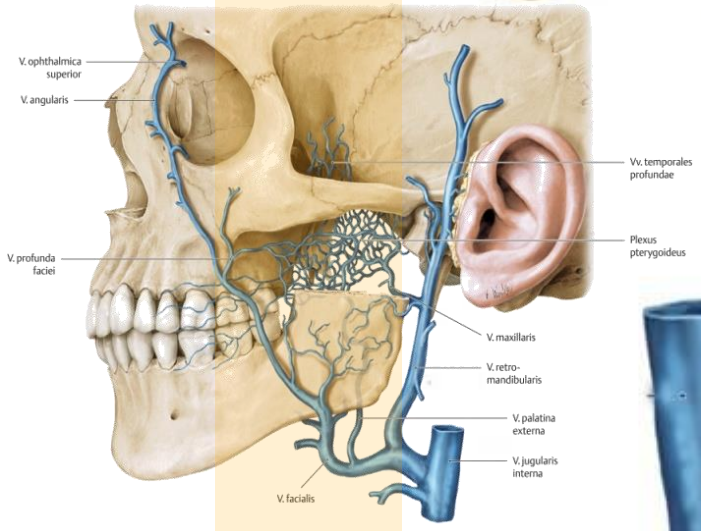
Neck: Internal jugular vein

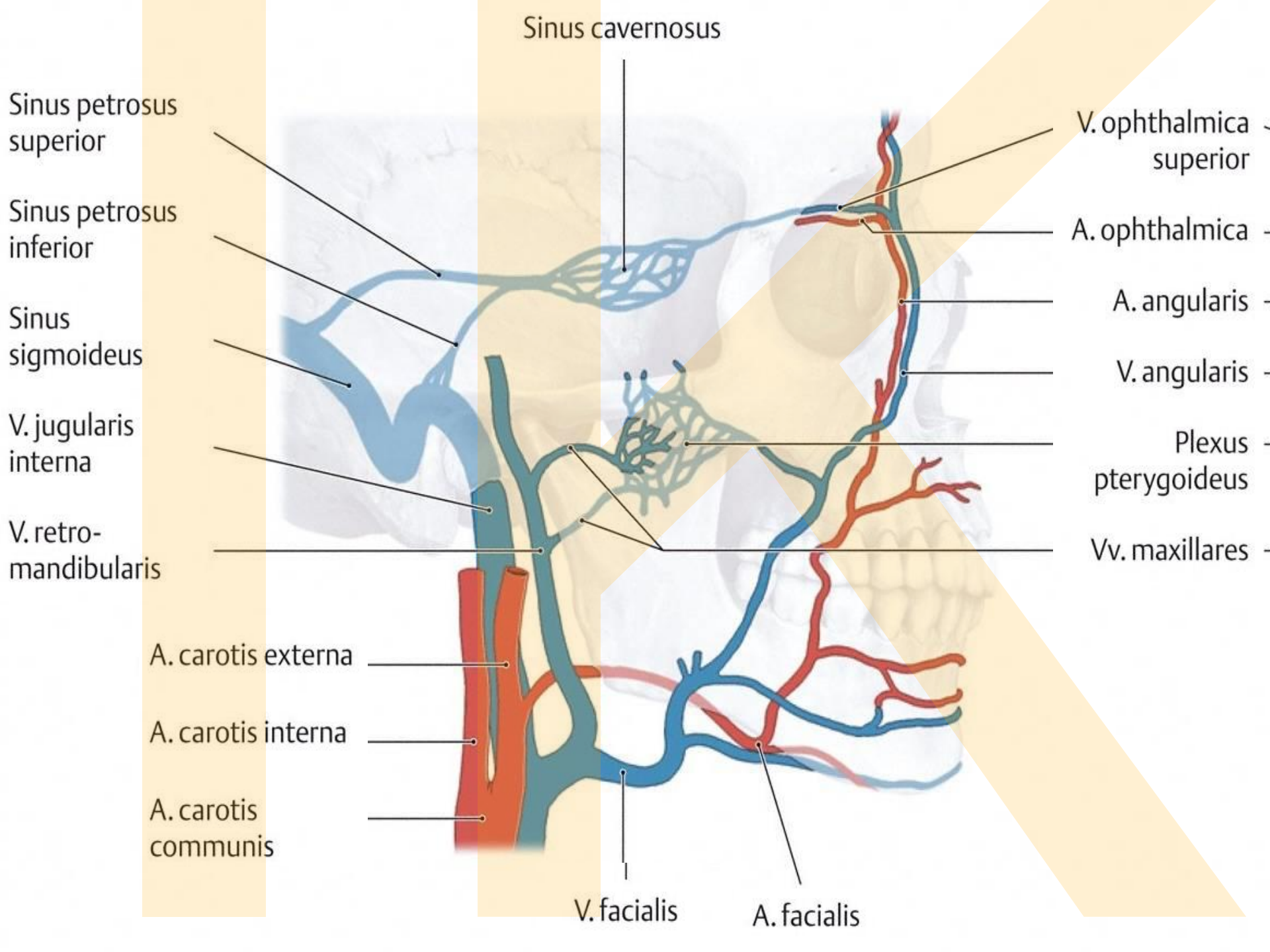
Facial vein
Vena facialis

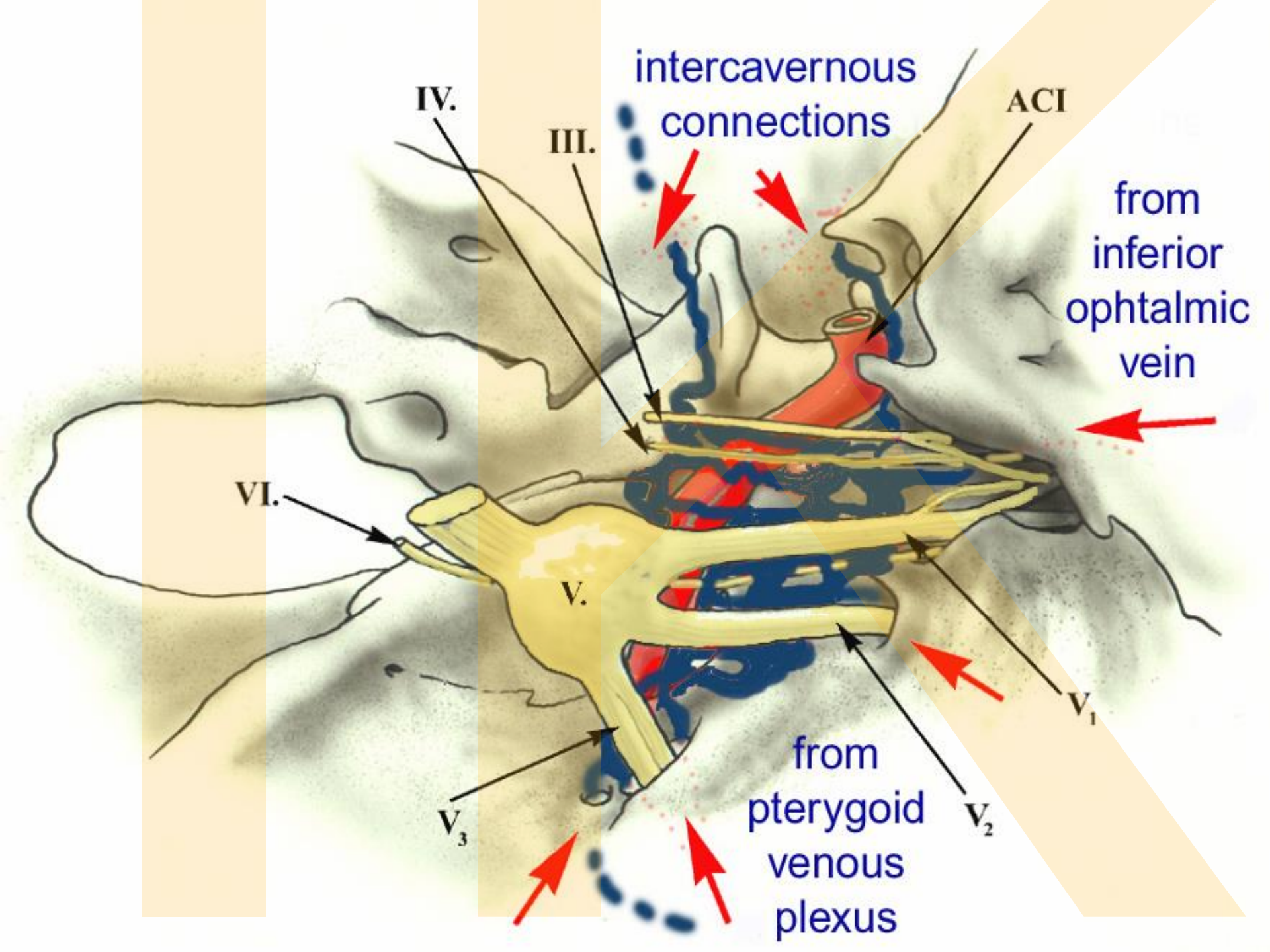


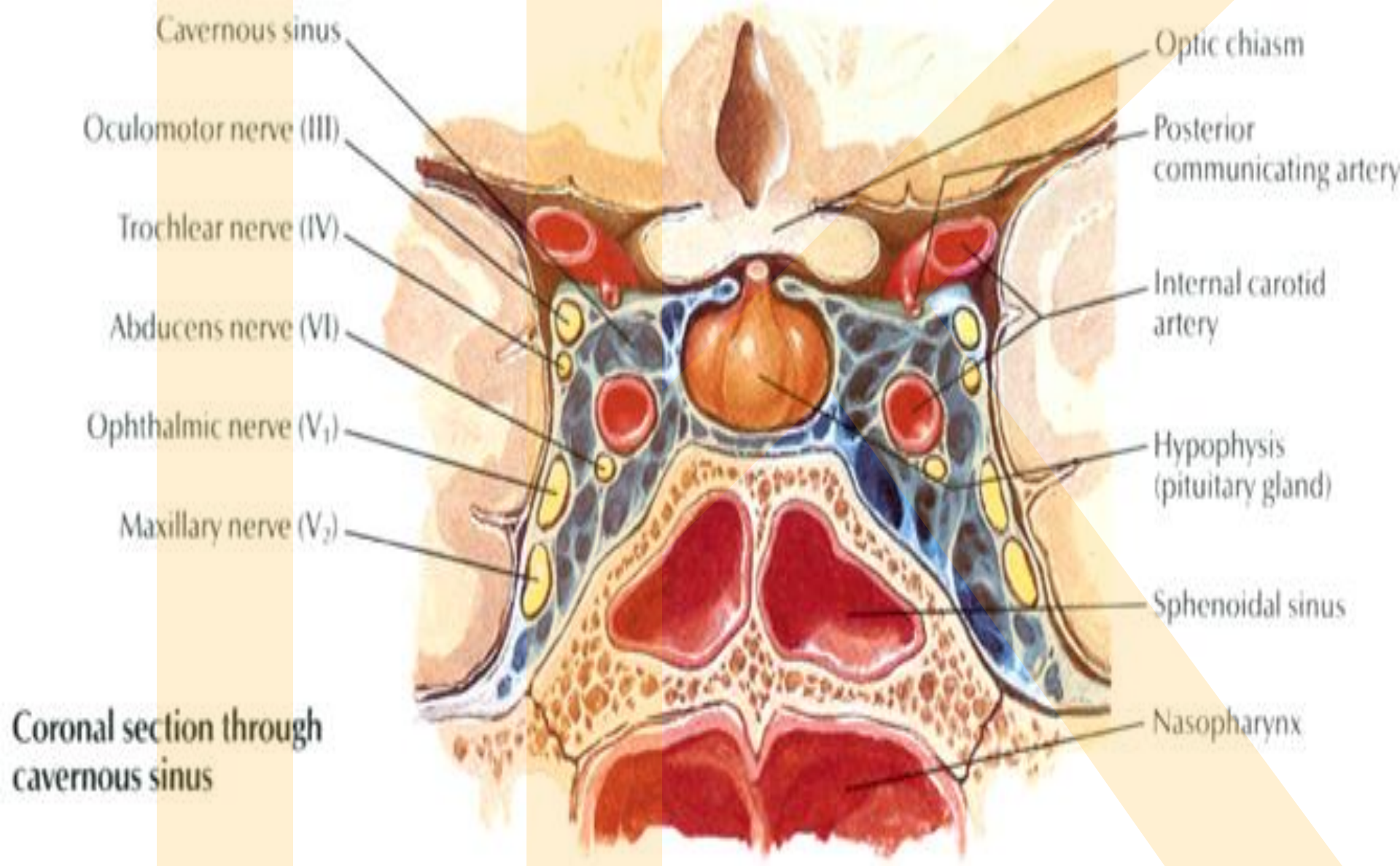


Pterygoid plexus

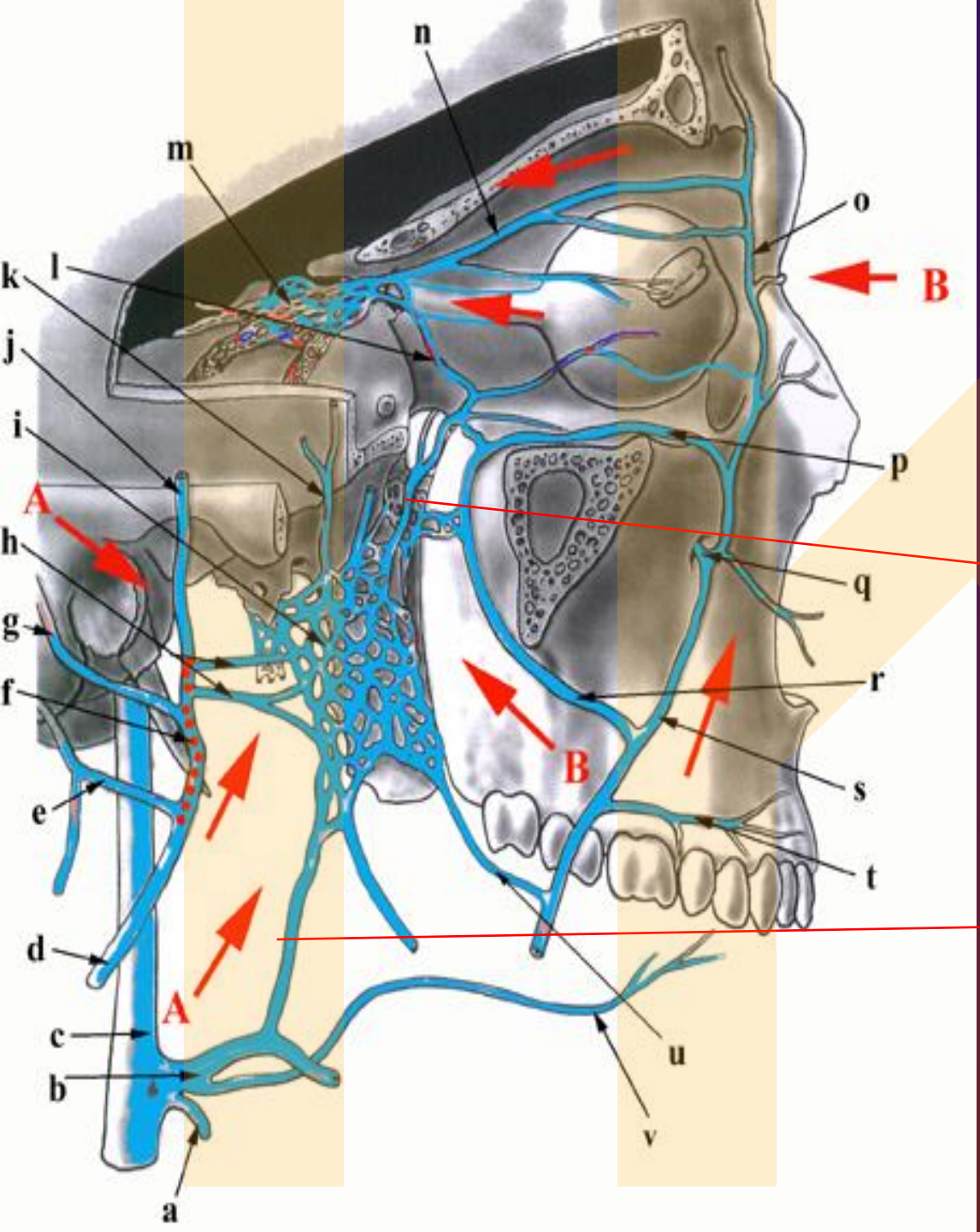



Sinus cavernosus
Sinus petrosus superior
Sinus petrosus inferior
Sinus sigmoideus
V. jugularis interna
V. retro-mandibularis
V. ophthalmica superior
A. ophthalmica
A. angularis
V. angularis
Plexus pterygoideus
Vv. maxillares
A. carotis externa
A. carotis interna
A. carotis communis
V. facialis
A. facialis


intercavernous
connections
IV.
III.
ACI
from
inferior
ophtalmic
vein
VI.
V.
V_1
V_2
V_3
from
pterygoid
venous
plexus



Coronal section through cavernous sinus



Pterygoid venous plexus

and its tributaries:

n superior ophtalmic

p inferior ophtalmic

n infraorbital

vein to pterygoid plexus

(through foramen ovale – rete)

r deep facial

u buccal

inferior alveolar vein

... retromandibular vein

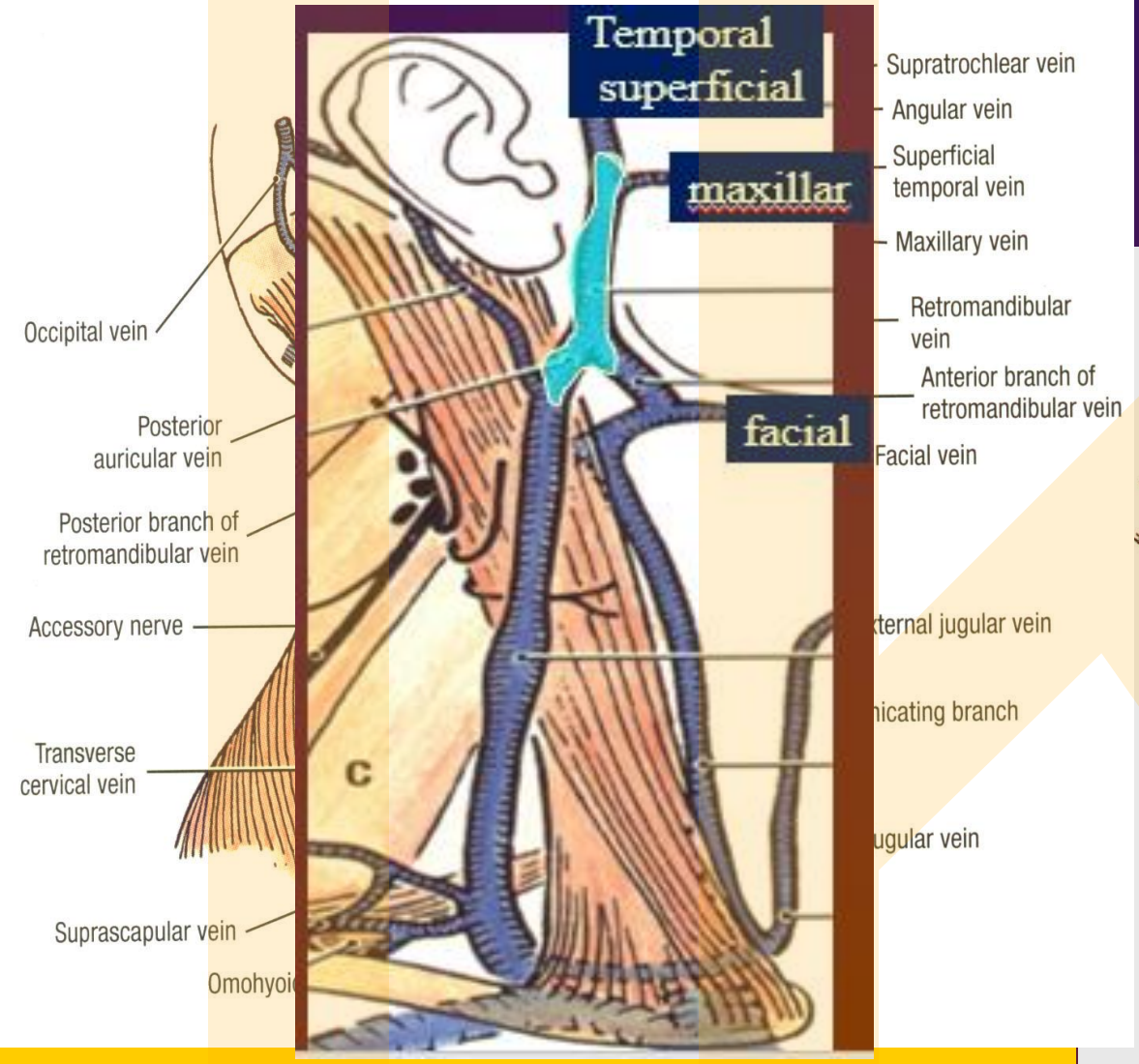
h maxillary veins

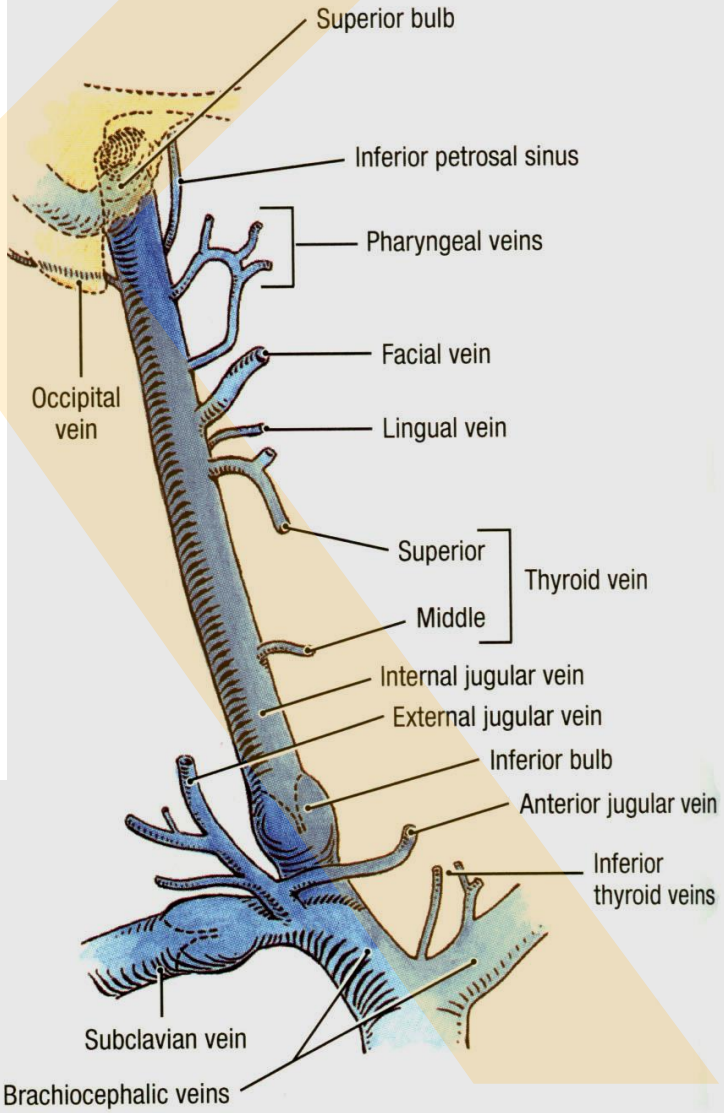
superficial veins

External jugular vein

Anterior jugular vein

Venous jugular arch





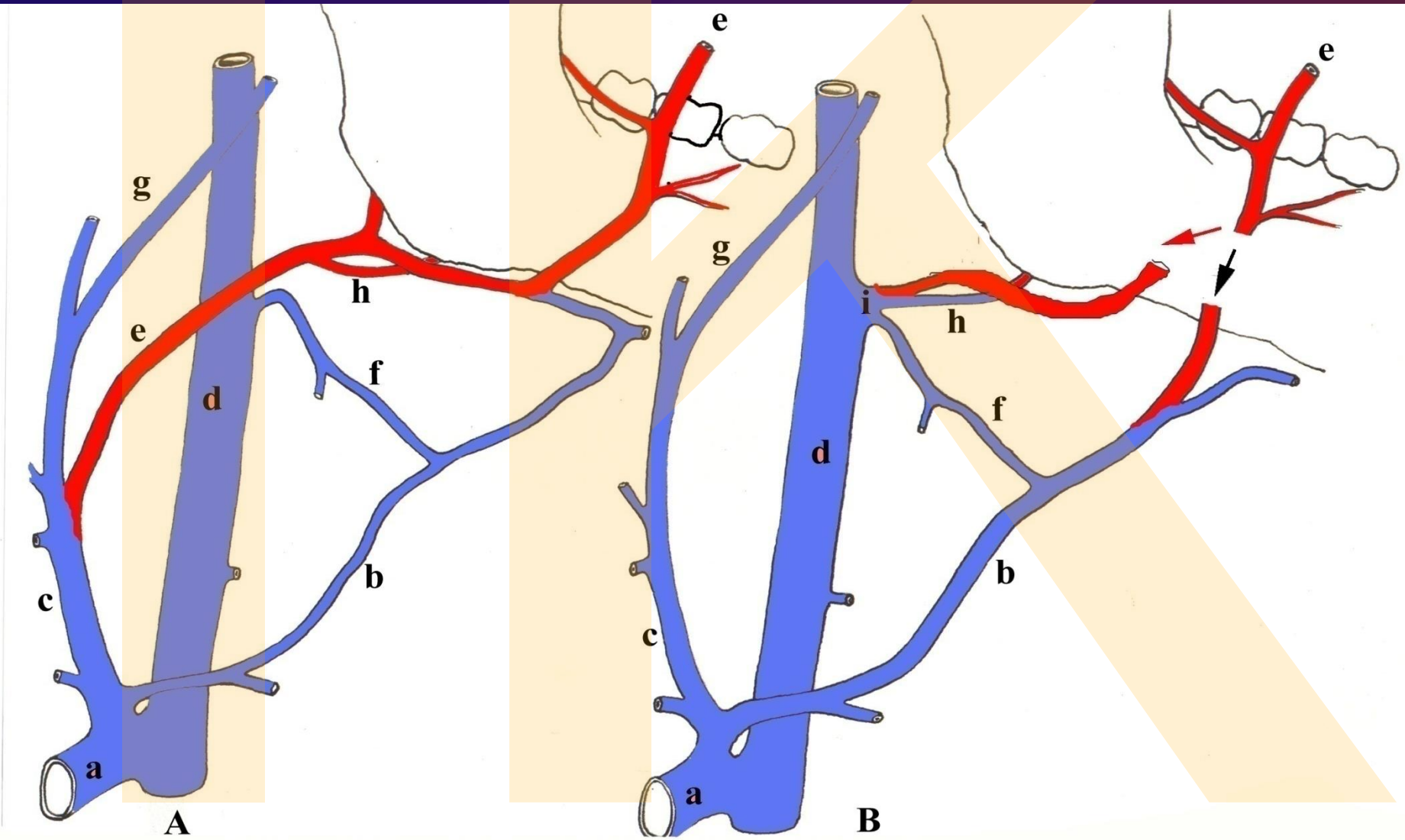
Internal jugularis vein; external jugular vein

Vena facialis can be open into:

external jugular vein

internal jugular vein

anterior jugular vein



Regio colli anterior

vv. profundae (deep)

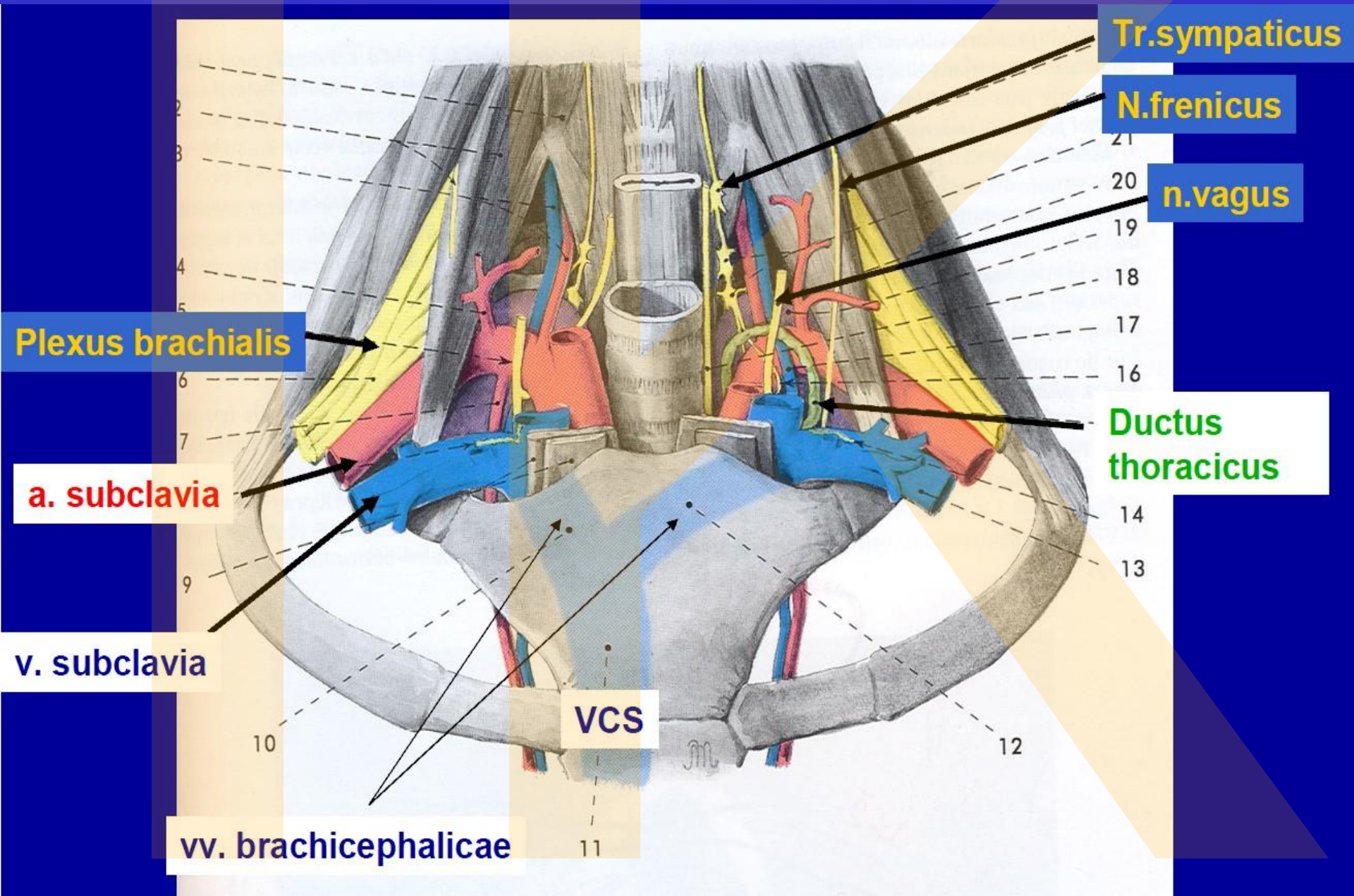
thymus

v. jugularis interna

v. thyroidea media

v. thyroidea inferior

Superior thoracic aperture



Subclavian artery (a. subclavia) – relations and branches

- sulcus arteria subclaviae pulmonis
- apertura thoracis superior
- sulcus arteriae subclaviae costae primae
- fissura scalenorum

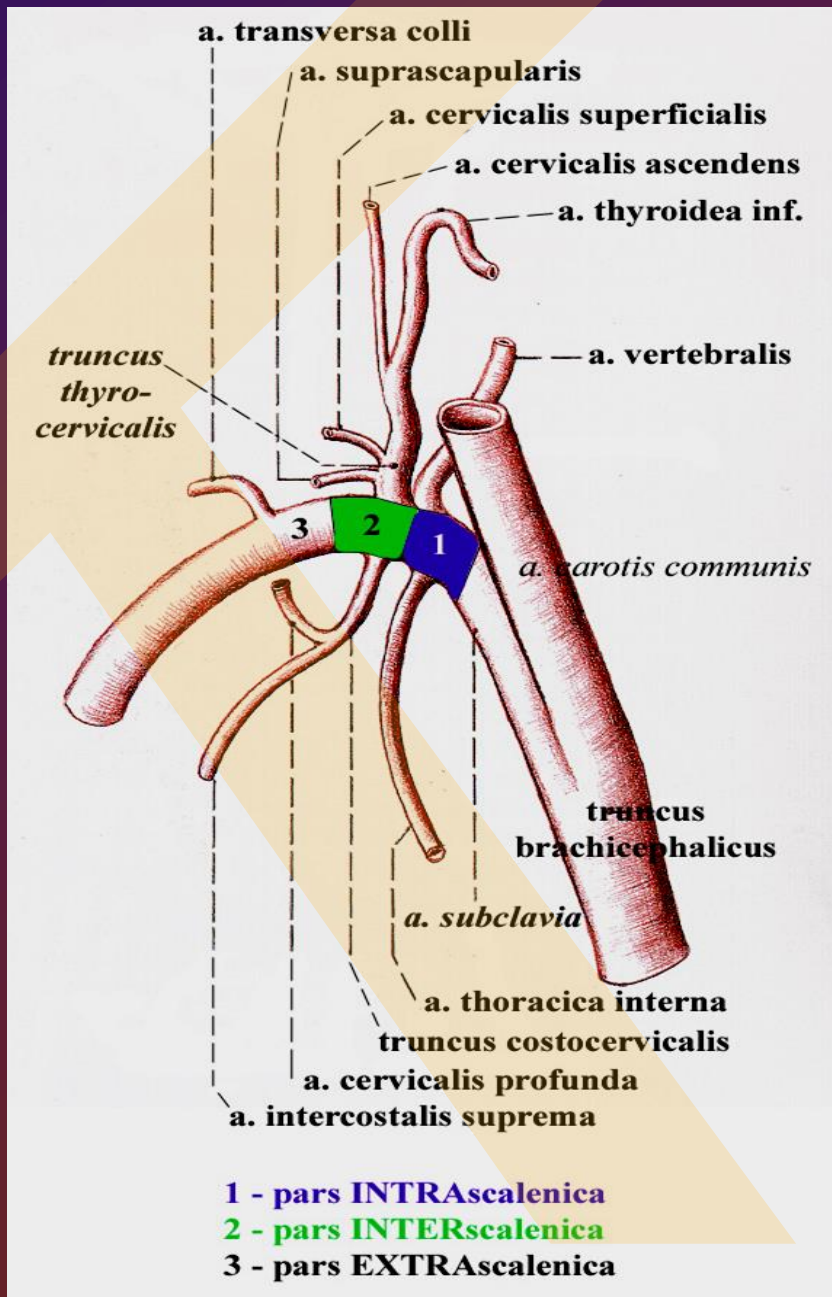
branches exhibit variations

- *(thoracic outlet syndrom)*
- *steal phenomenon* (a. vertebralis)

Arteria subclavia

Arteria vertebralis
Truncus thyrocervicalis
Truncus costocervicalis
arteria thoracica interna

Parts and trunci



Vertebral artery

- **Prevertebral part**

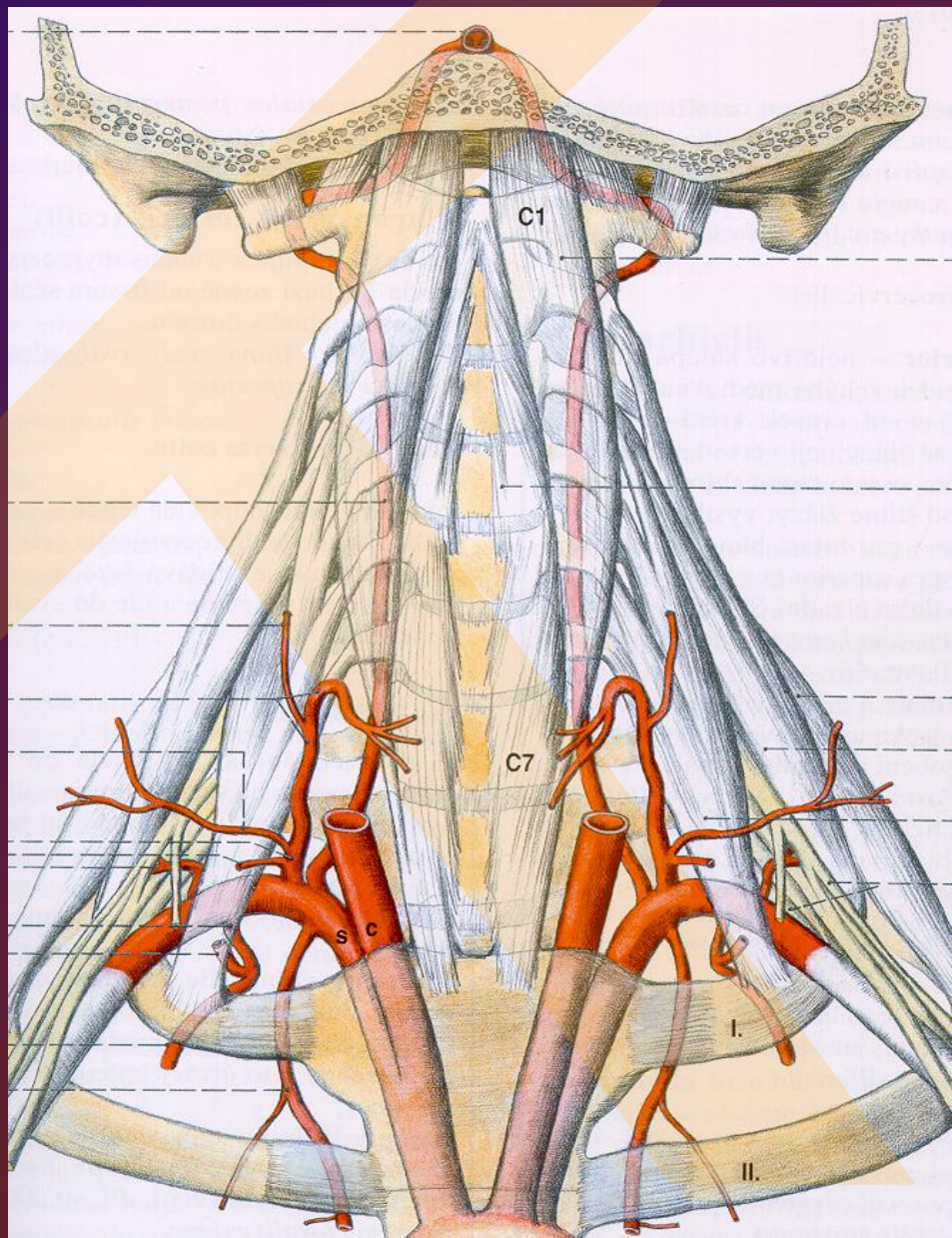
Cervical or transverse part

(C6-C1) → Spinal and muscular branches

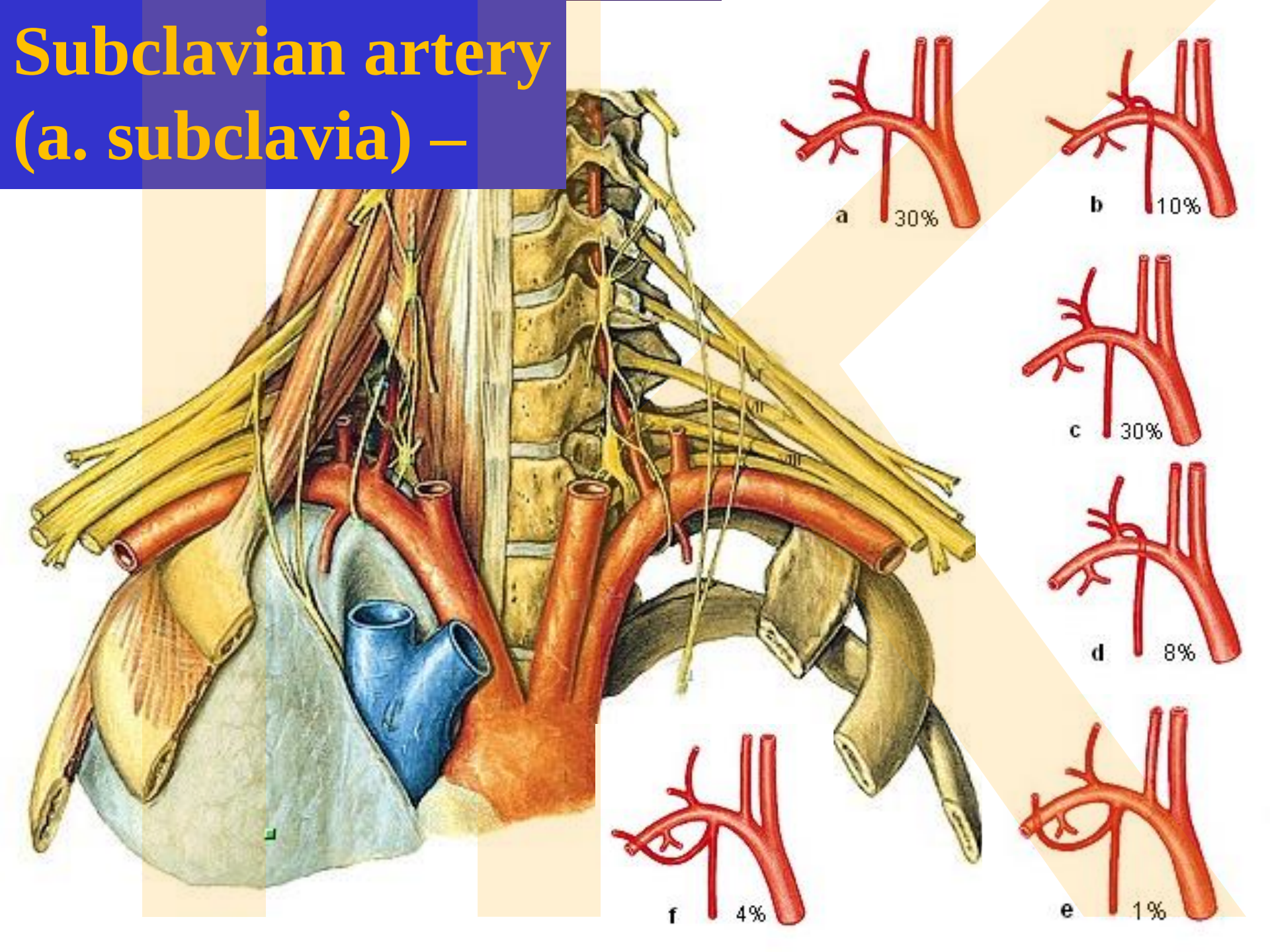
- **Atlantic part** – sulcus a.v., membrana

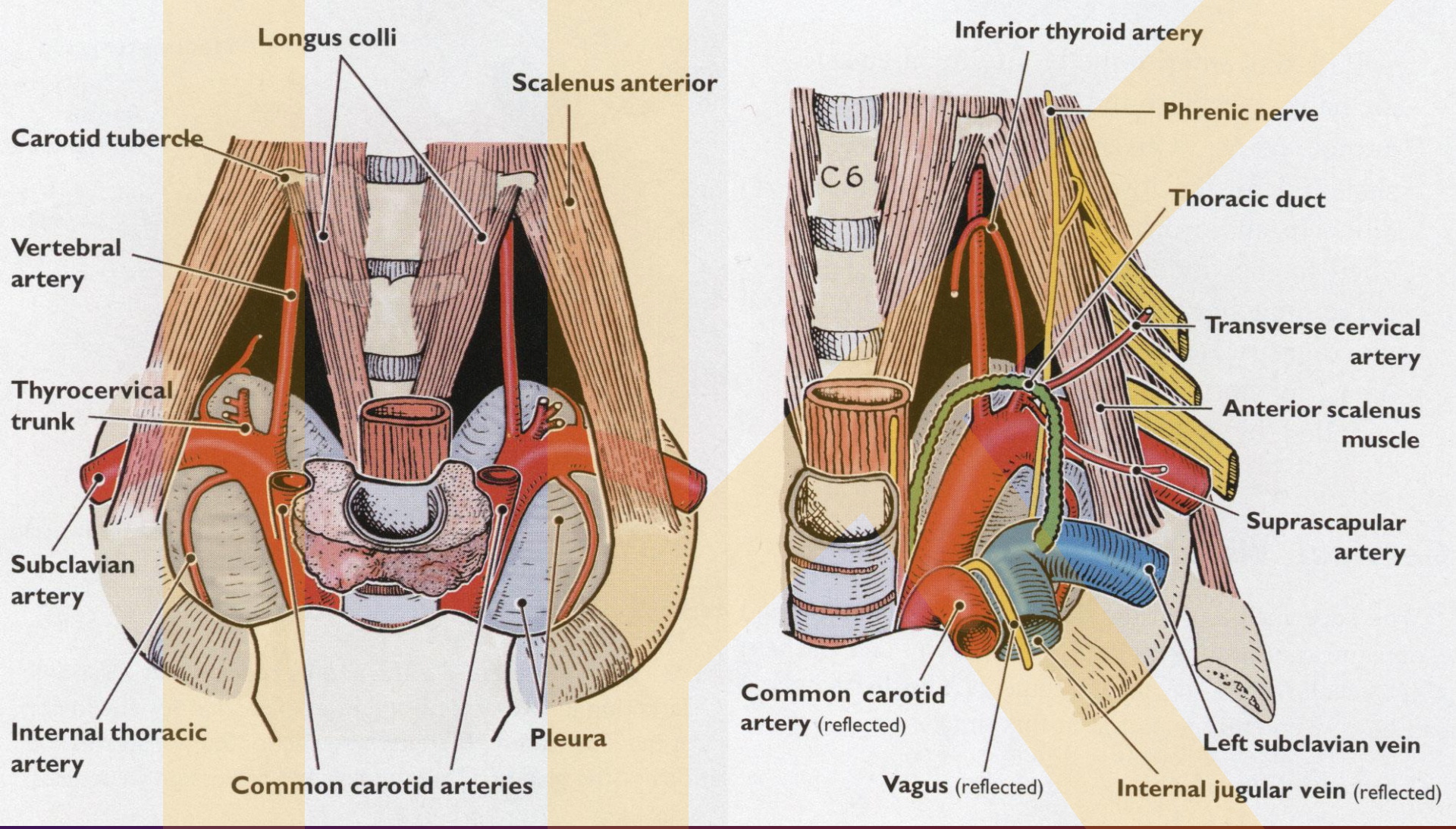
atlantooccipitalis post., foramen occipitale magnum

- **Intracranial part**
  - Meningeal brr. a. inferior posterior cerebellar brr. (→ a. spinalis post.)
  - Ant. spinalis branches



Subclavian artery (a. subclavia) –

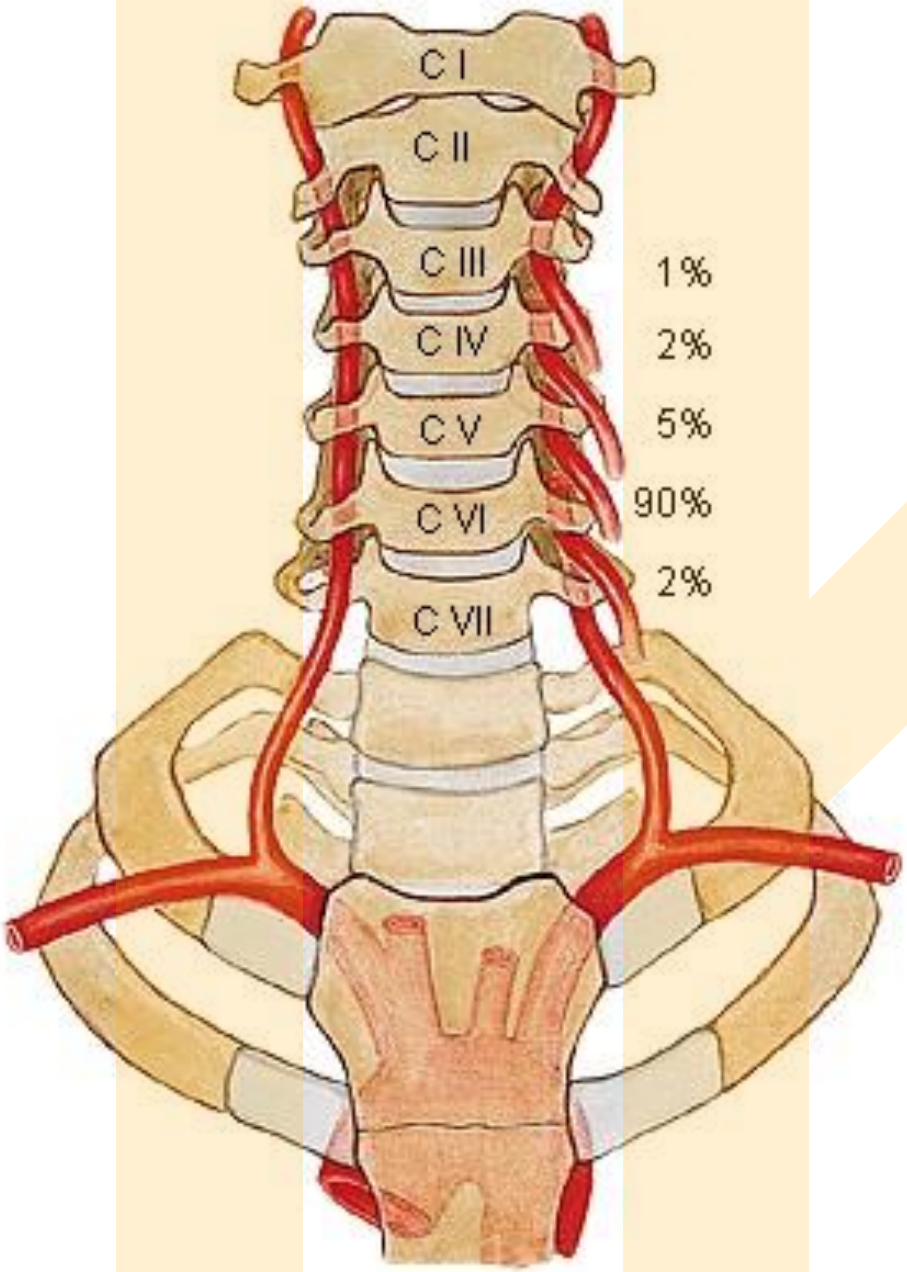


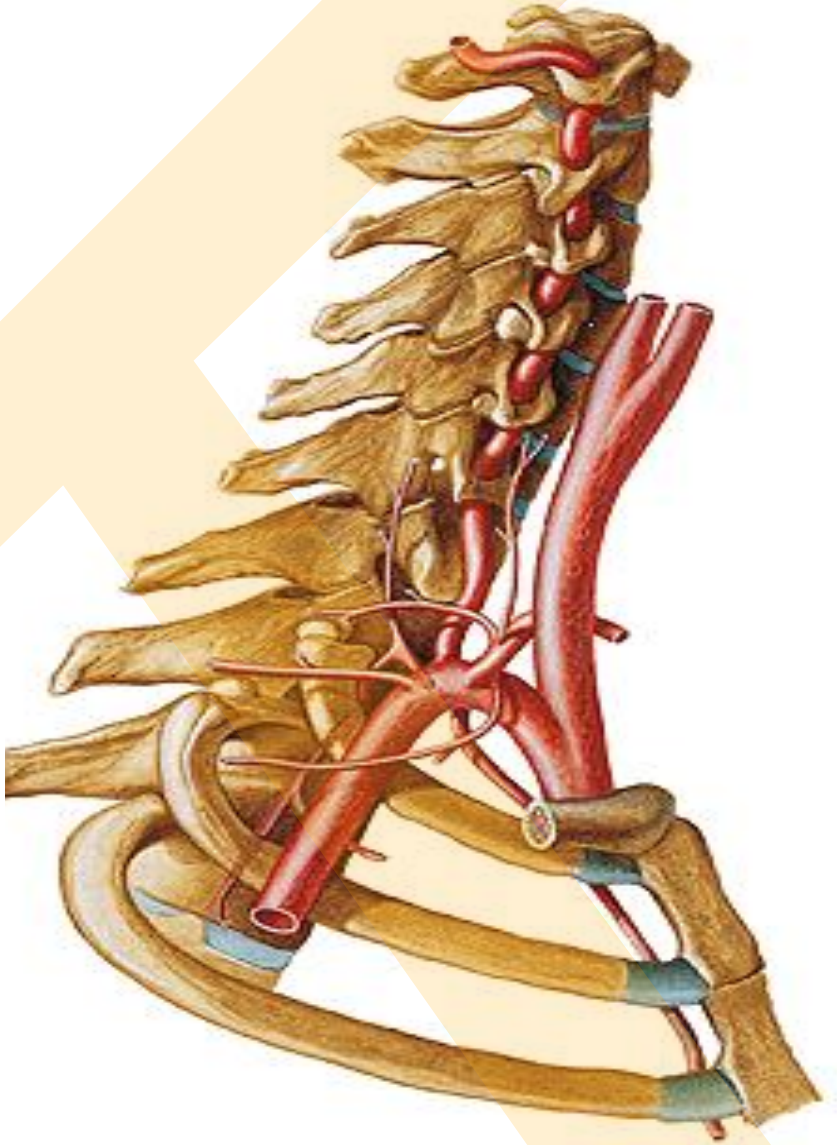


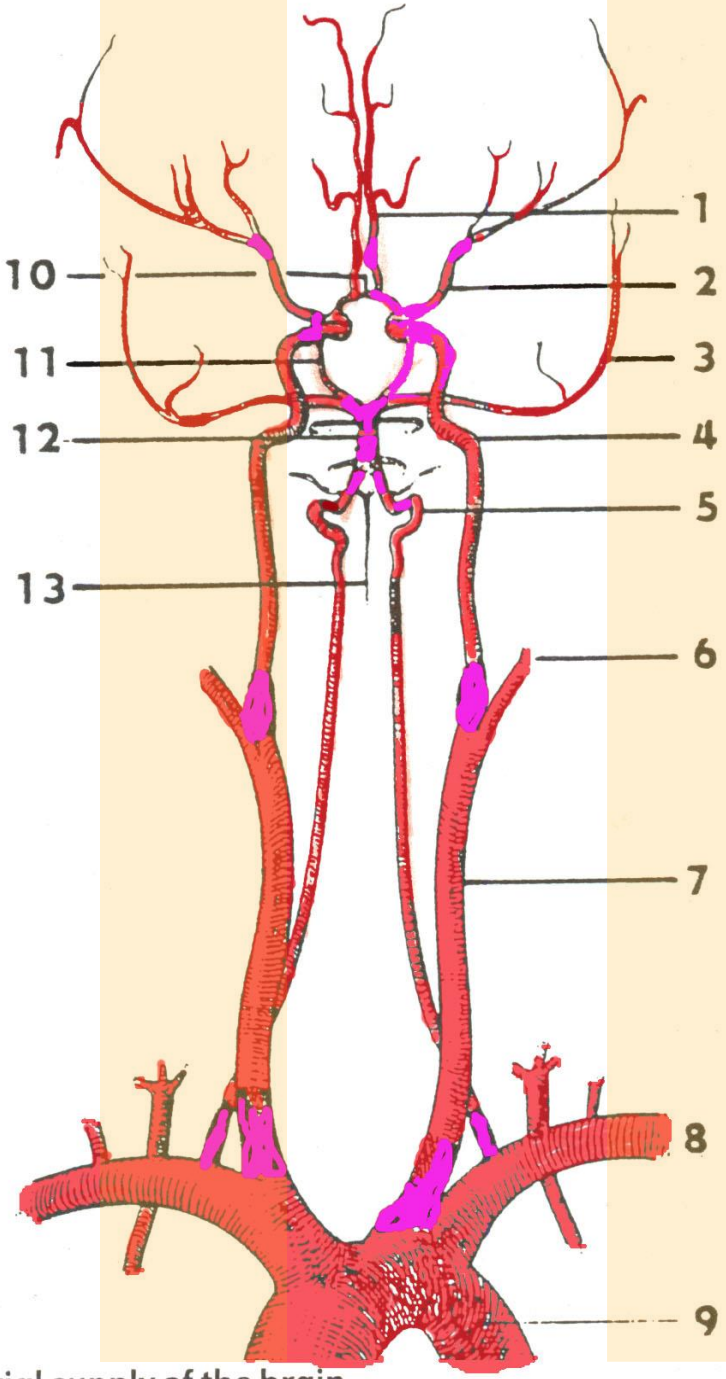
Trigonum scalenovertebrale

Scalenovertebral triangle

a. vertebralis







Arterial supply of the brain.

Blood source for brain:
Carotis interna 80%
Vertebralis 20%

1 – a. cerebri ant.,
2 – a. cerebri media,
3 – a. cerebri post.
4 – a. carotis int.,
5 – a. vertebralis,
6 – a. carotis externa,
7 – a. carotis communis,
8 – a. subclavia,
9 – arcus aortae,
10 – a. communicans anterior,
11 – a. communicans posterior,
12 – a. basilaris,
13 – a. spinalis anterior.

iCATvision

Reconstruction of skull; vertebral artery curves

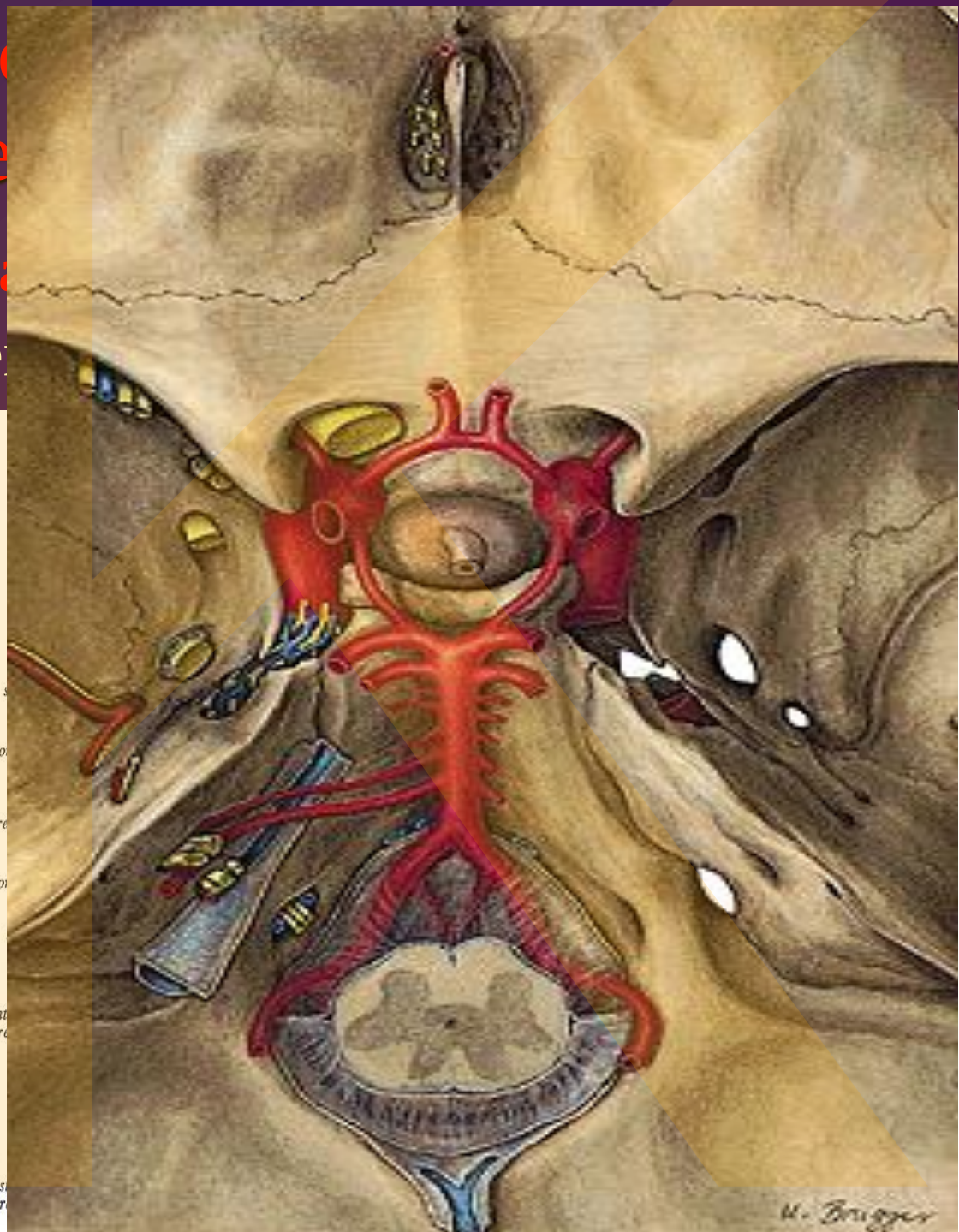
Arteria basilaris + c
arteriosus cere

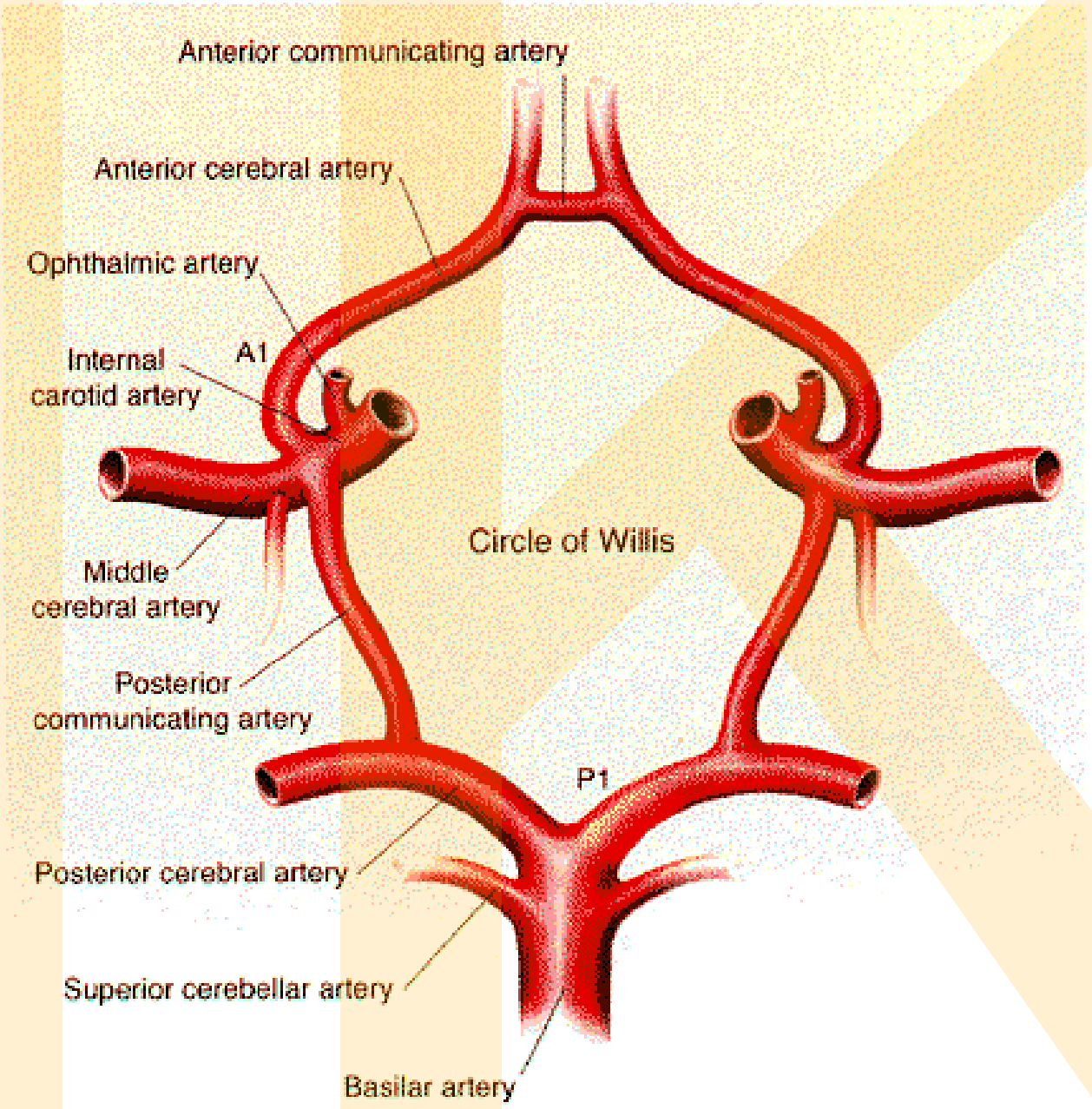
2 aa. vertebrales → **a. ba**

- a. inferior anterior ce
  (→ a. labyrinthi)
- aa. pontis
- aa. mesencephalicae
- a. superior cerebelli

→ aa. cerebri posteriores

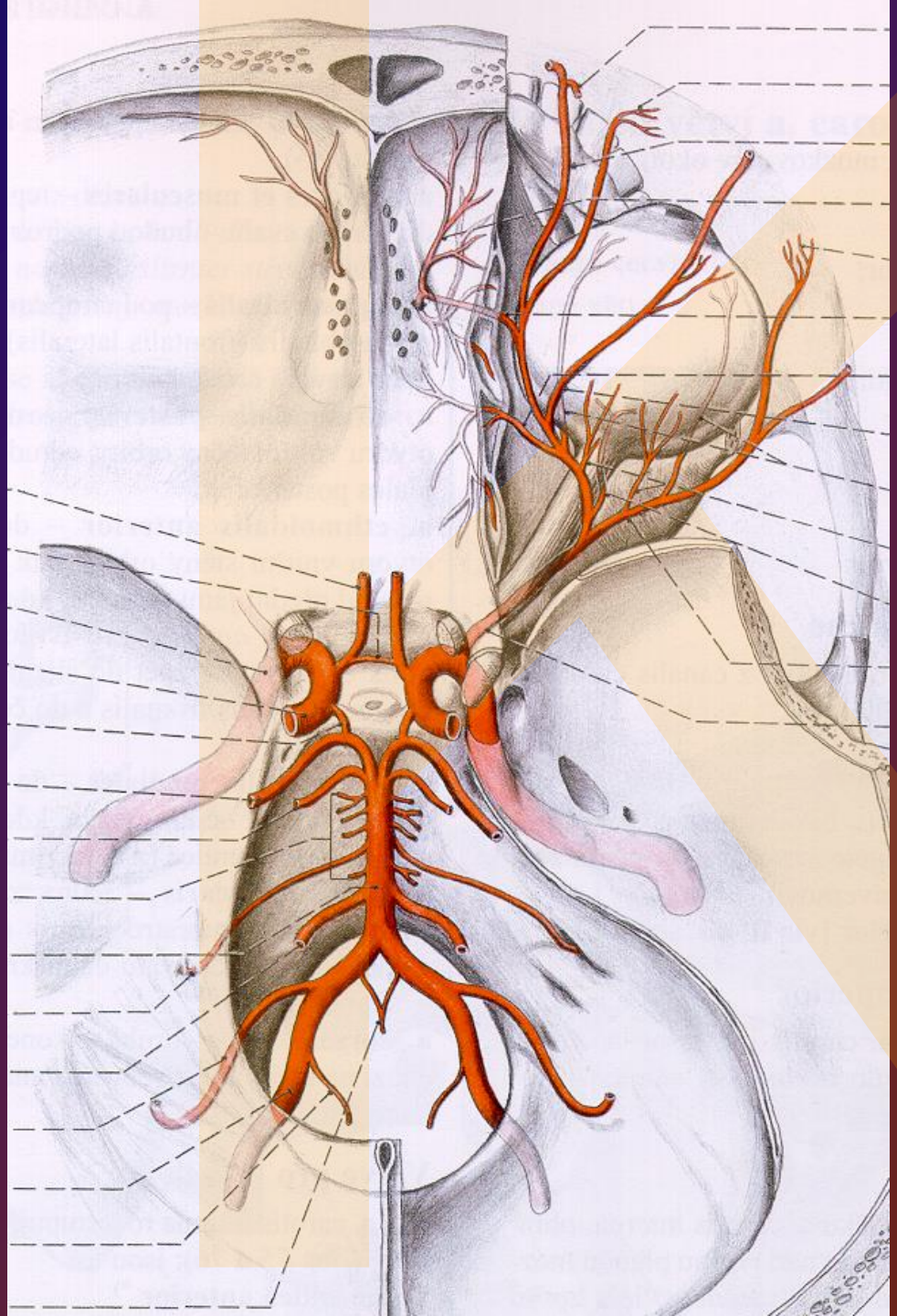
circulus arteriosus cerebri *Willisi*



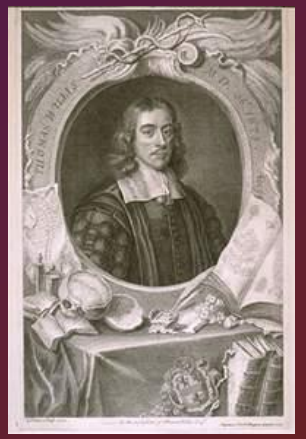

Anterior communicating artery
Anterior cerebral artery
Ophthalmic artery
A1
Internal carotid artery
Middle cerebral artery
Posterior communicating artery
Circle of Willis
P1
Posterior cerebral artery
Superior cerebellar artery
Basilar artery

circulus arteriosus cerebri *Willisi*

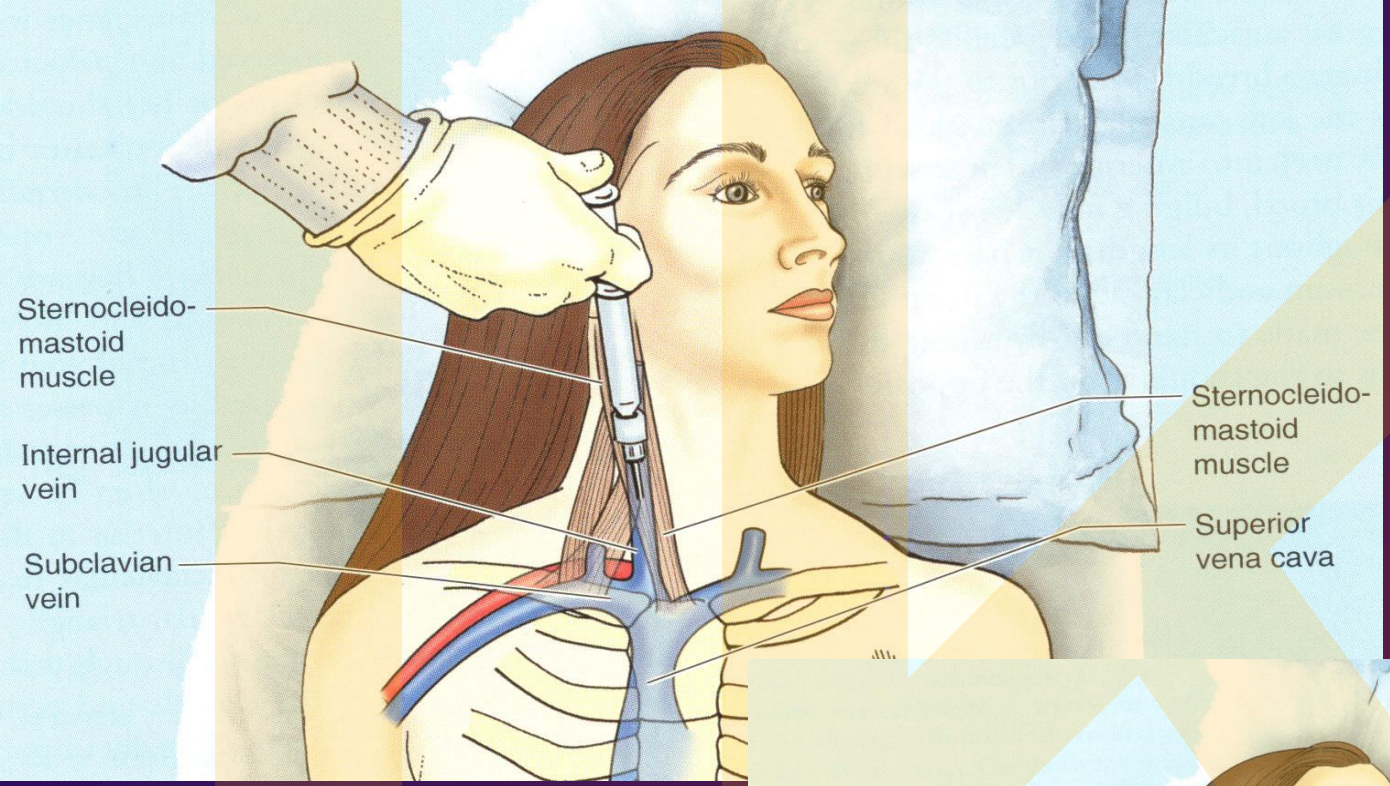
Arterial circle of *Willis*

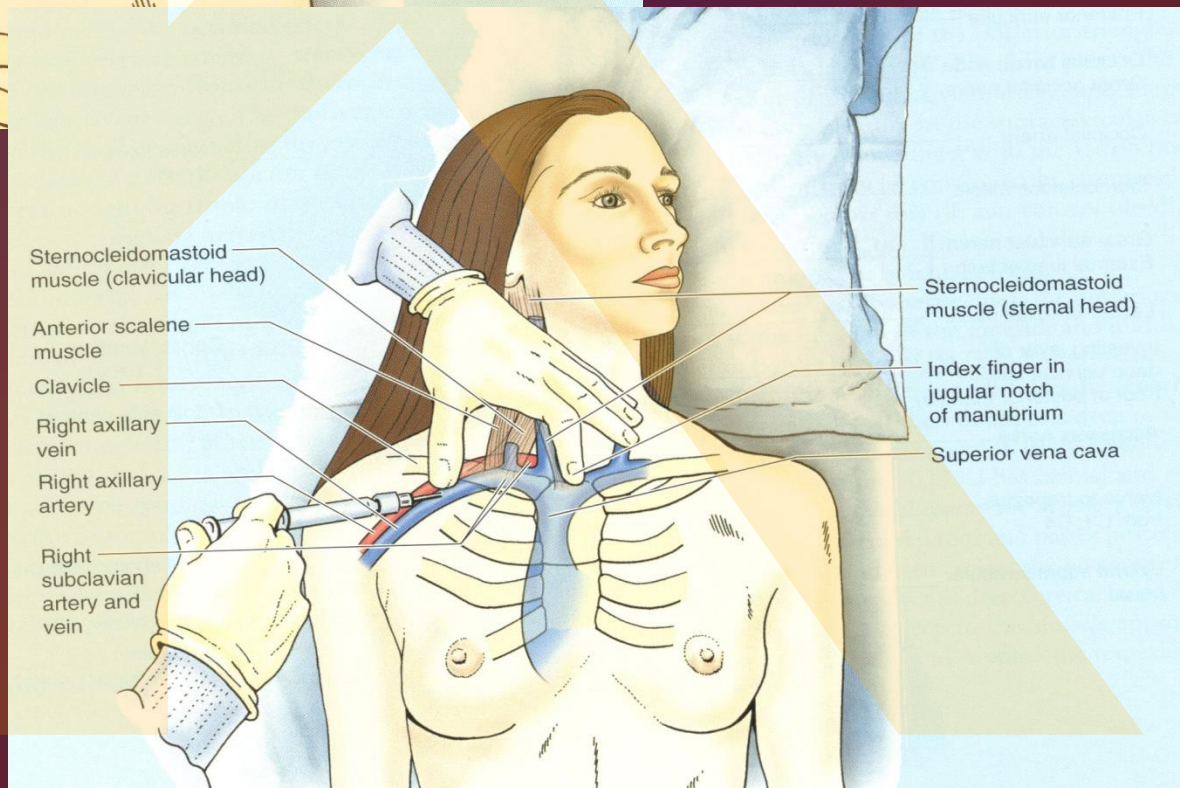


a. ophtalmica

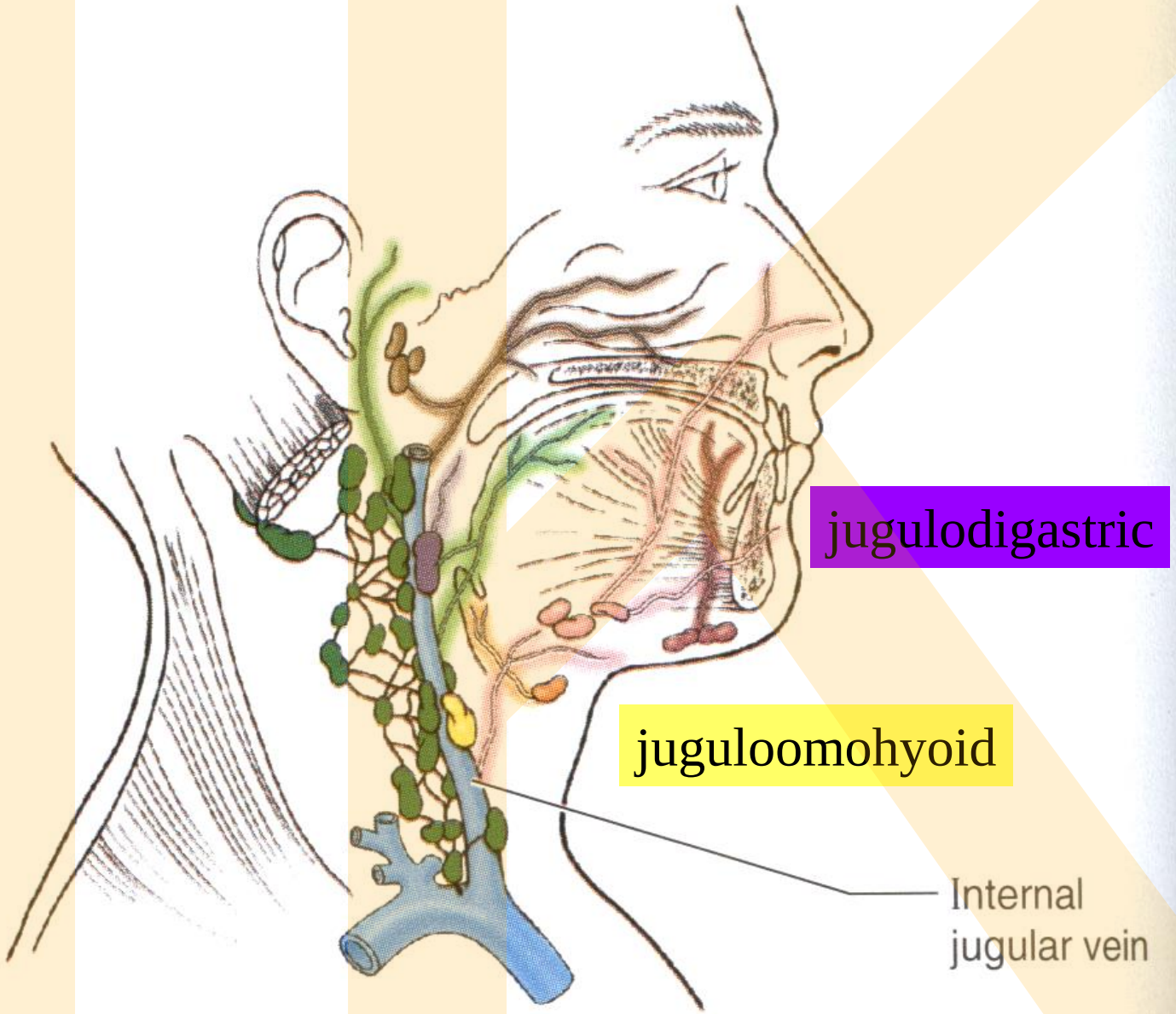


Thomas Willis (1621-1673), English medic





Intravenosni injekce
Intravenous injection



Lateral view

Syndrome „thievish“ subclavian a.

Ligature on a.subclavia:

• Subclavian a. “steals“ blood using vertebral artery for upper extremity

Diplopia, diziness, syncope, comatose

• Pulsation on irritated side, poor pulsation, low blood pressure

Shunts (collaterals) open during collapse of vertebral a.:

1-a.carotis communis

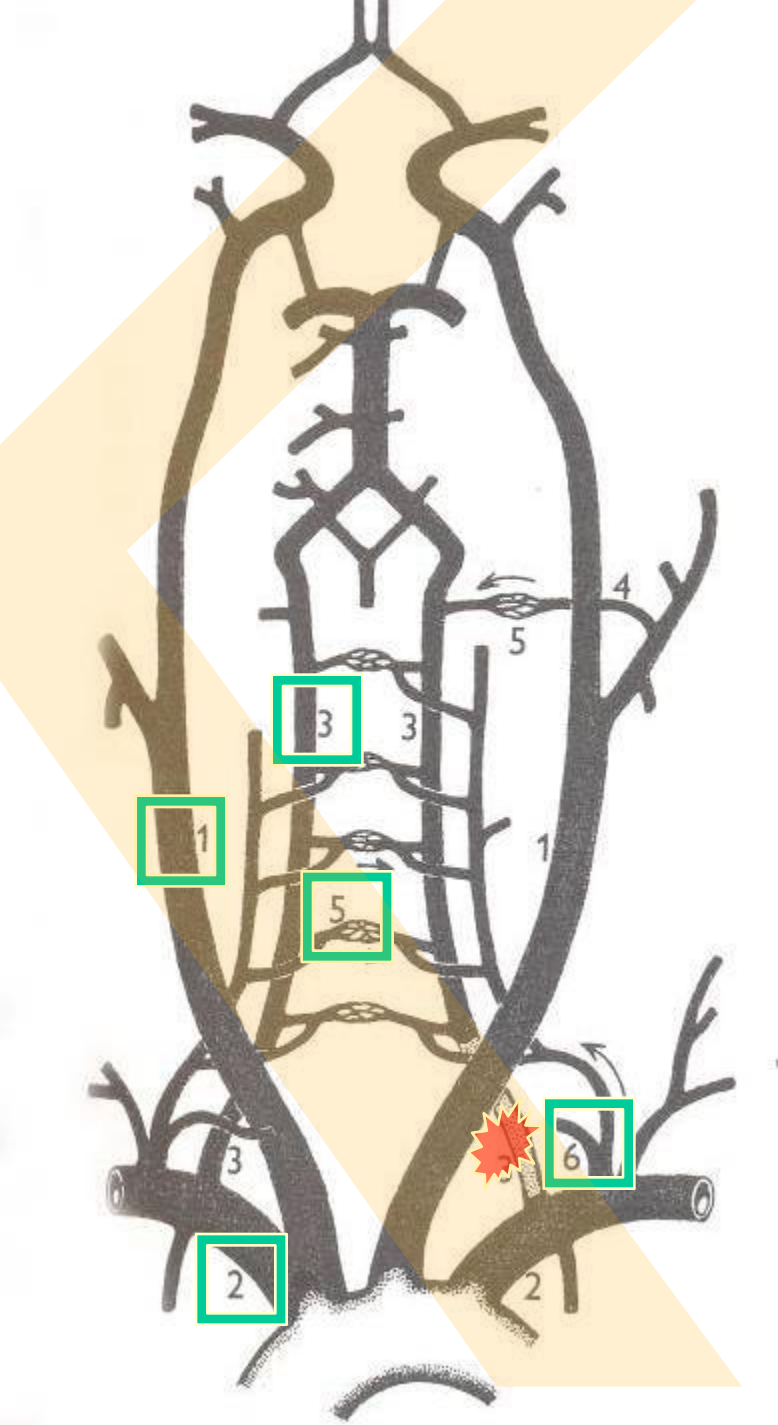
2-a.subclavia

3-a.vertebralis

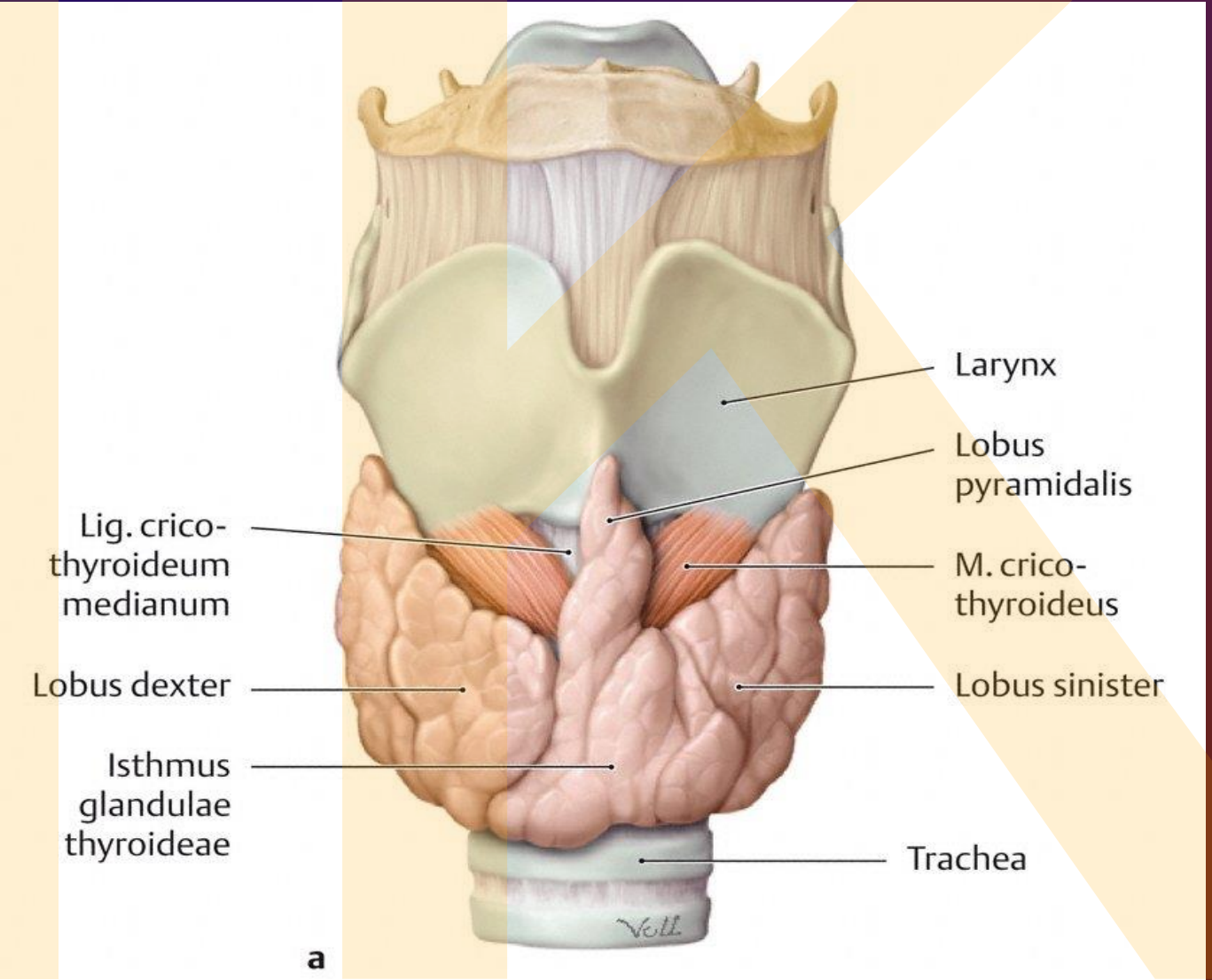
4-a.occipitalis

5-rami spinales et musculares

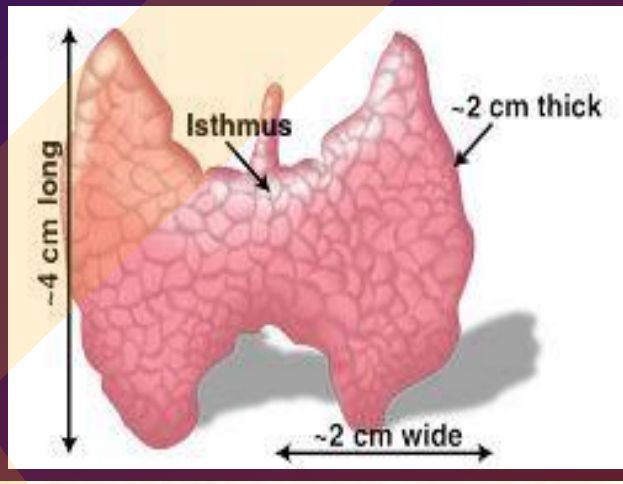
6-truncus thyrocervicalis



Glandula thyroidea
Thyroid gland

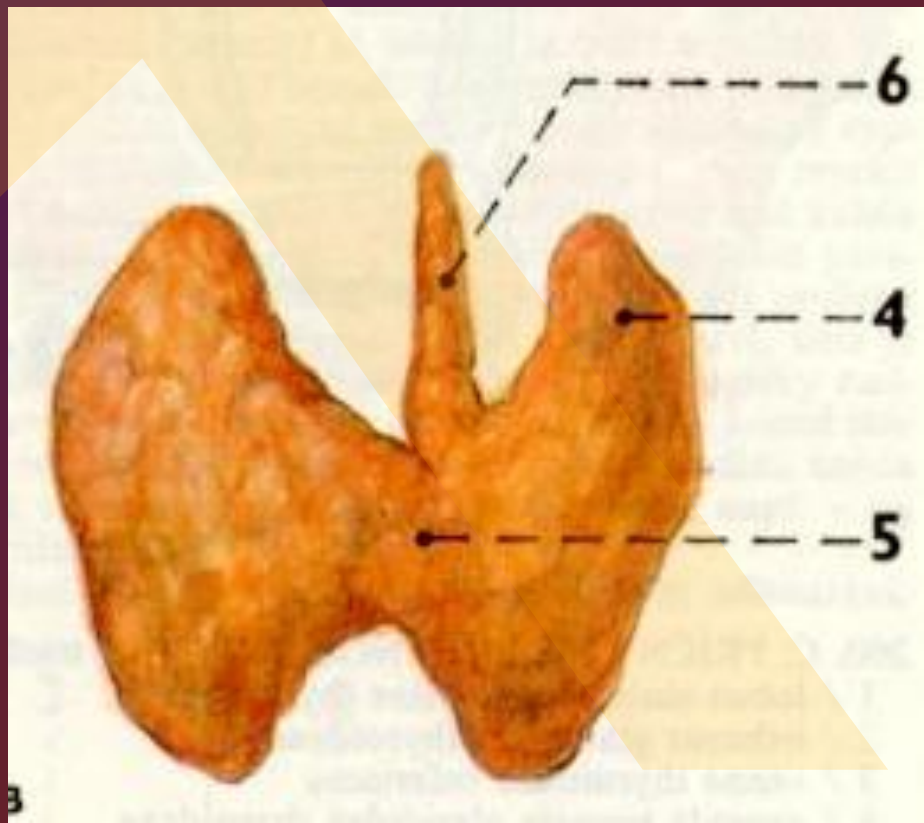


Thyroid gland – structure and role



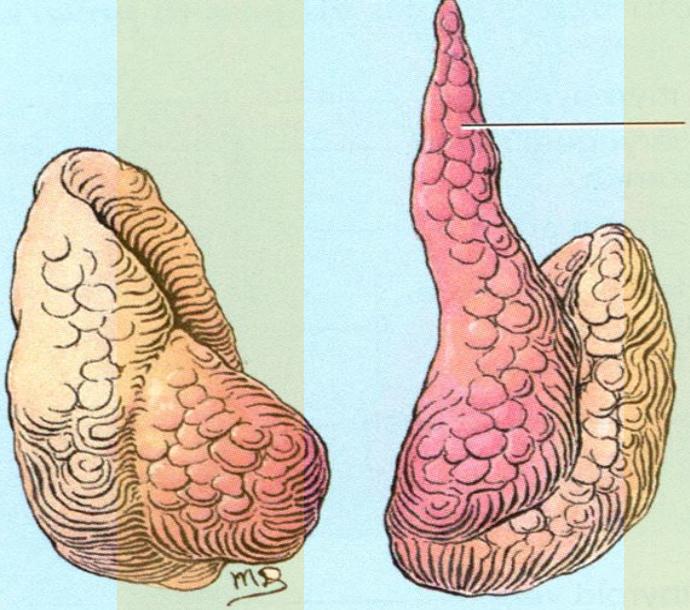
Parts

Lobus dx., sin. (4)
isthmus (6)
lobus pyramidalis (6)

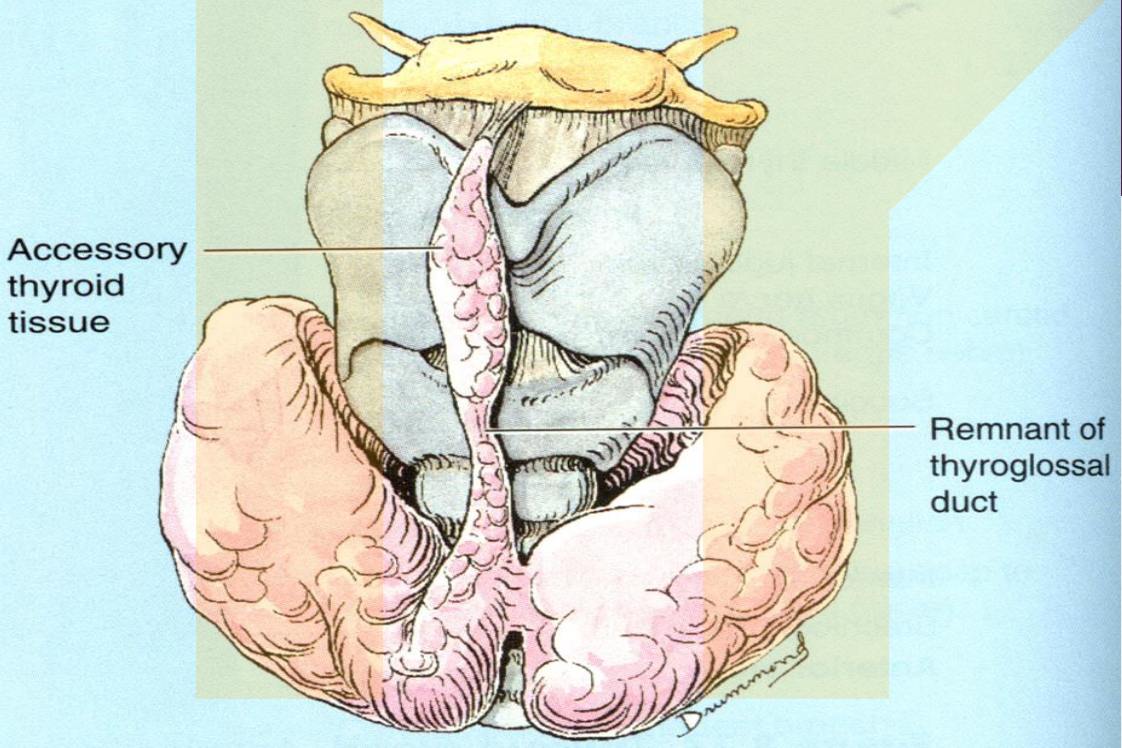


Metabolic role

- **thyroxin** T_4, **trijodtyronin** T_3
- calcitonin

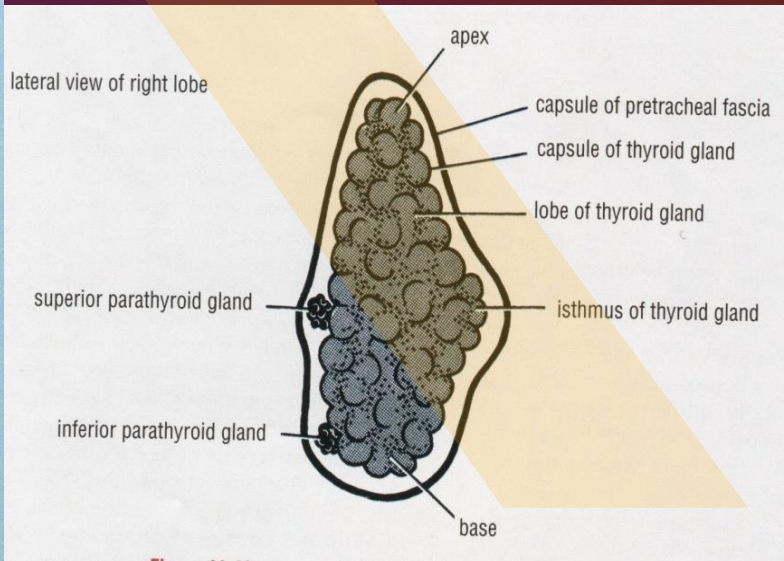


Absence of isthmus



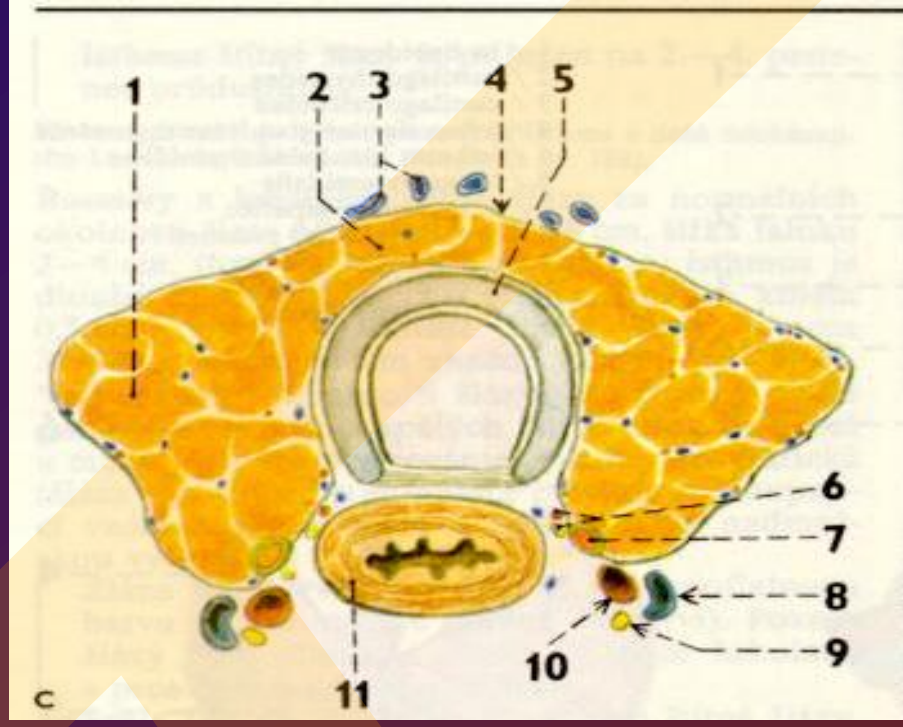
External forms, covers, varieties

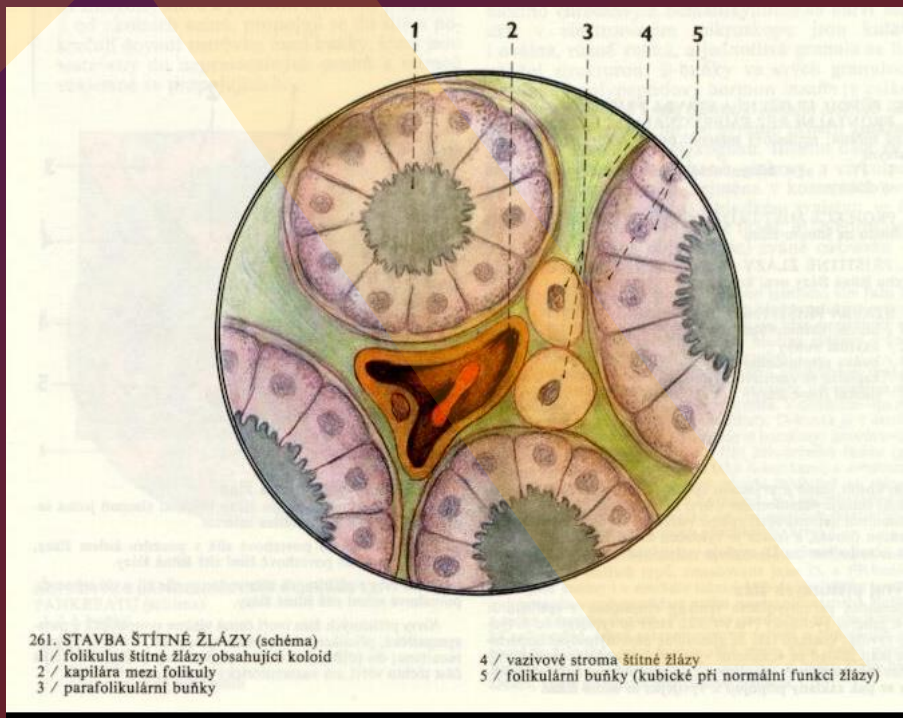
Capsula propria
Fascia perithyroidea



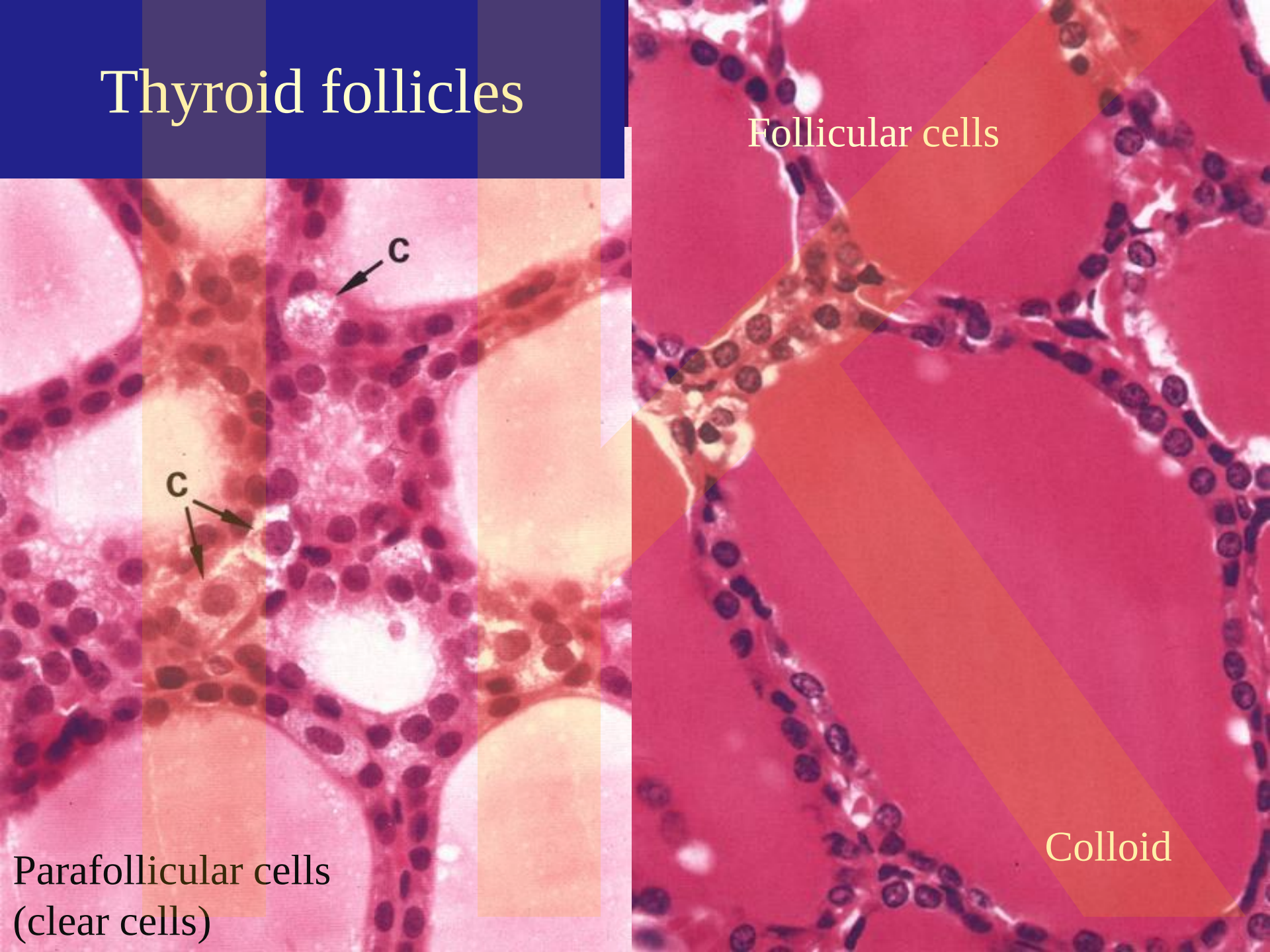
Thyroid gland - structure

- capsule
- septated internal space
- follicles (50 - 900 um)
  - Ball-like
  - One-layered epithelium lining follicles
  - Contains colloid - thyreoglobulin
- Follicular cells - thyreoglobulin, (accelerates metabolic activity and growth)
- Parafollicular cells - calcitonin (decreases Ca level in blood and supports Ca accumulation in bones)



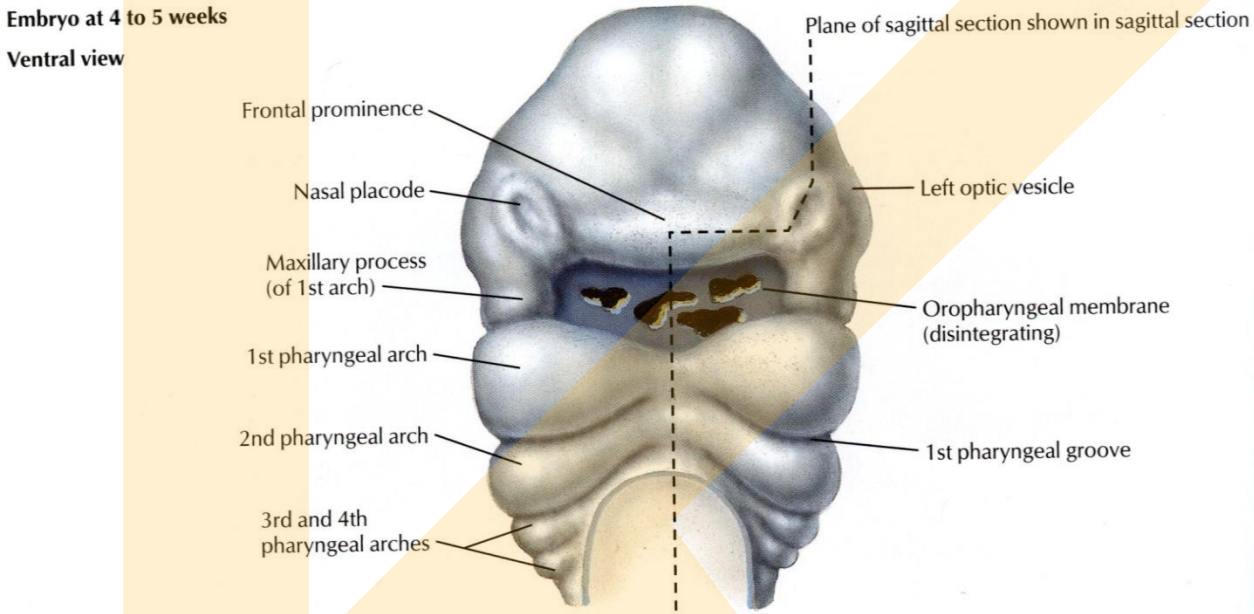


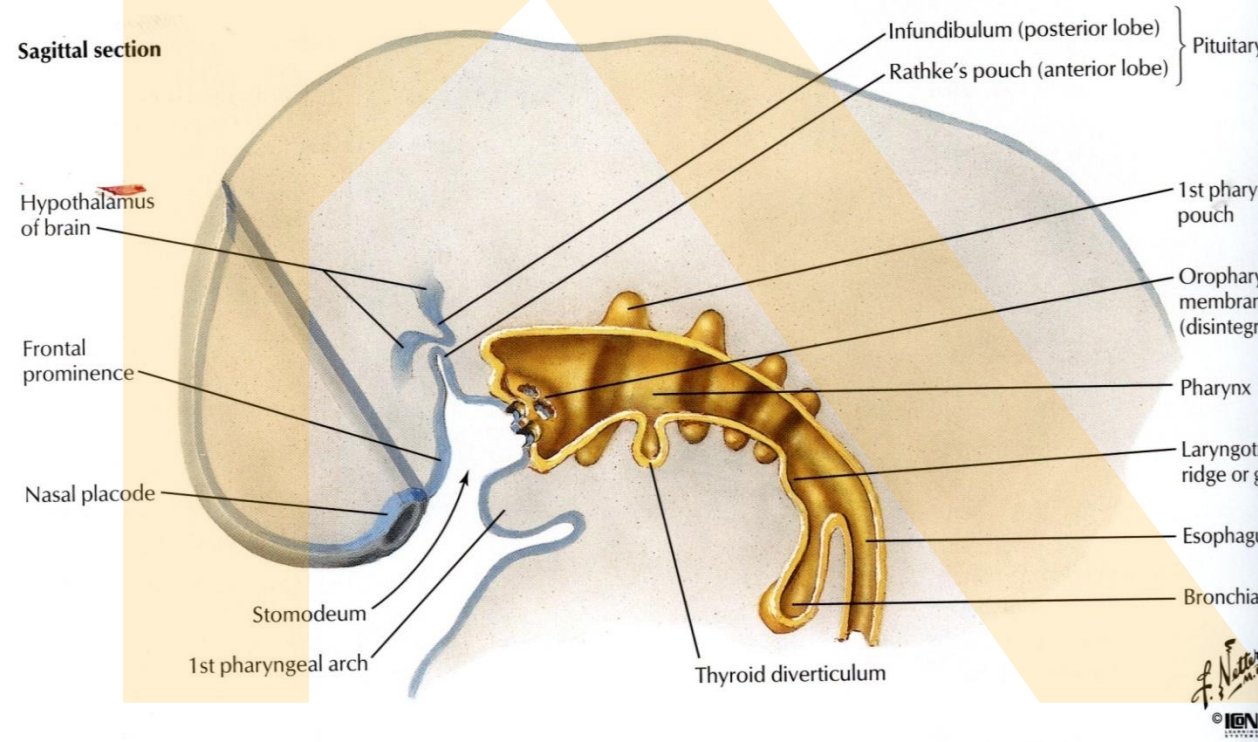
Thyroid follicles



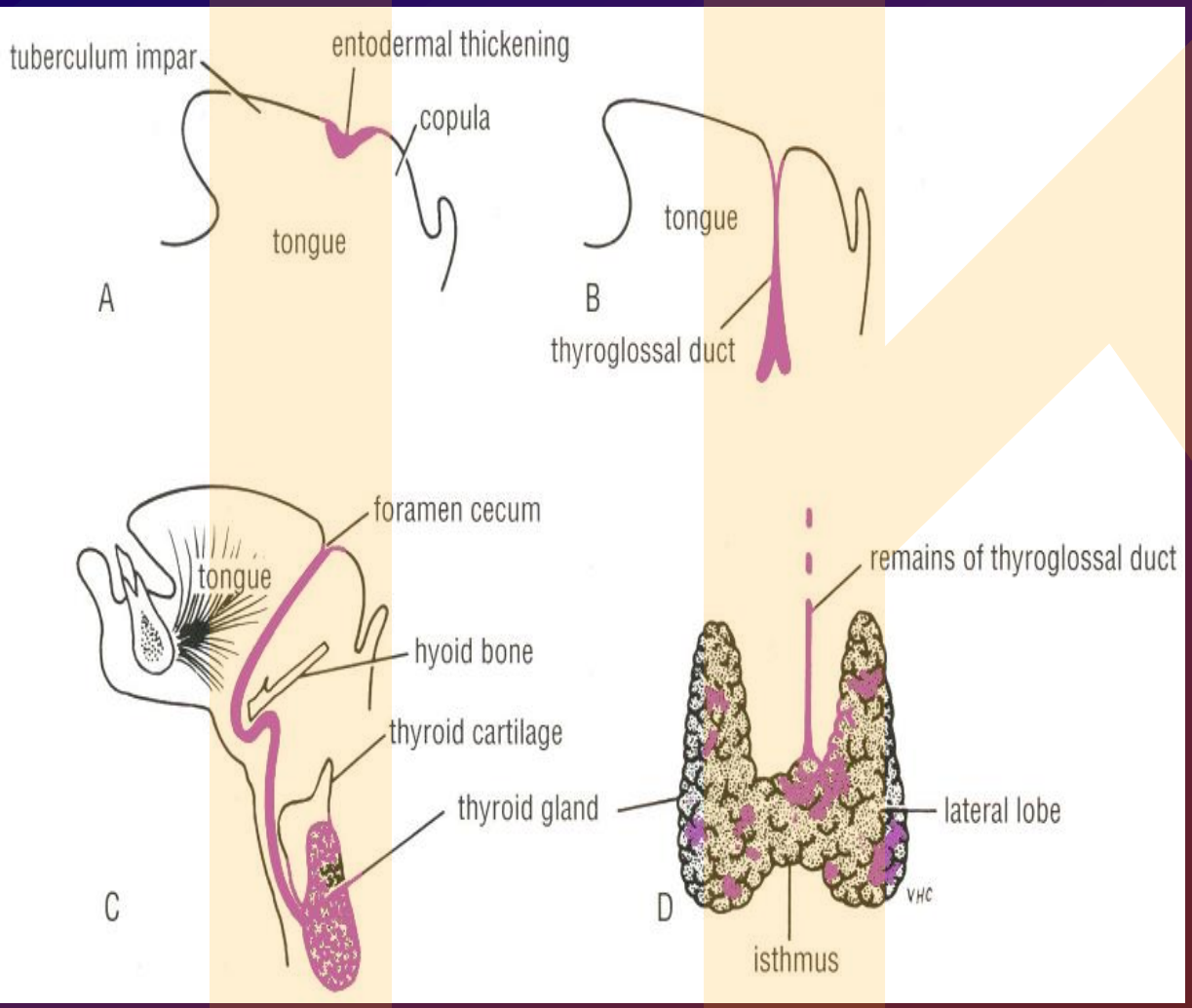
Thyroid gland - development

Develops from the epithelial proliferation in the point between copula and tuberculum impar





Thyroid gland - development



From day 24

Endodermal pouch to primitive pharynx

Descent to the suprasternal area (*thyroglossal duct, foramen caecum*

Formation of the lobes (even pyramidal lobe)

Appearance of the parathyroid glands

Descent of the thyroid primordia during development can be followed by anomalies

Thyroglossal duct –

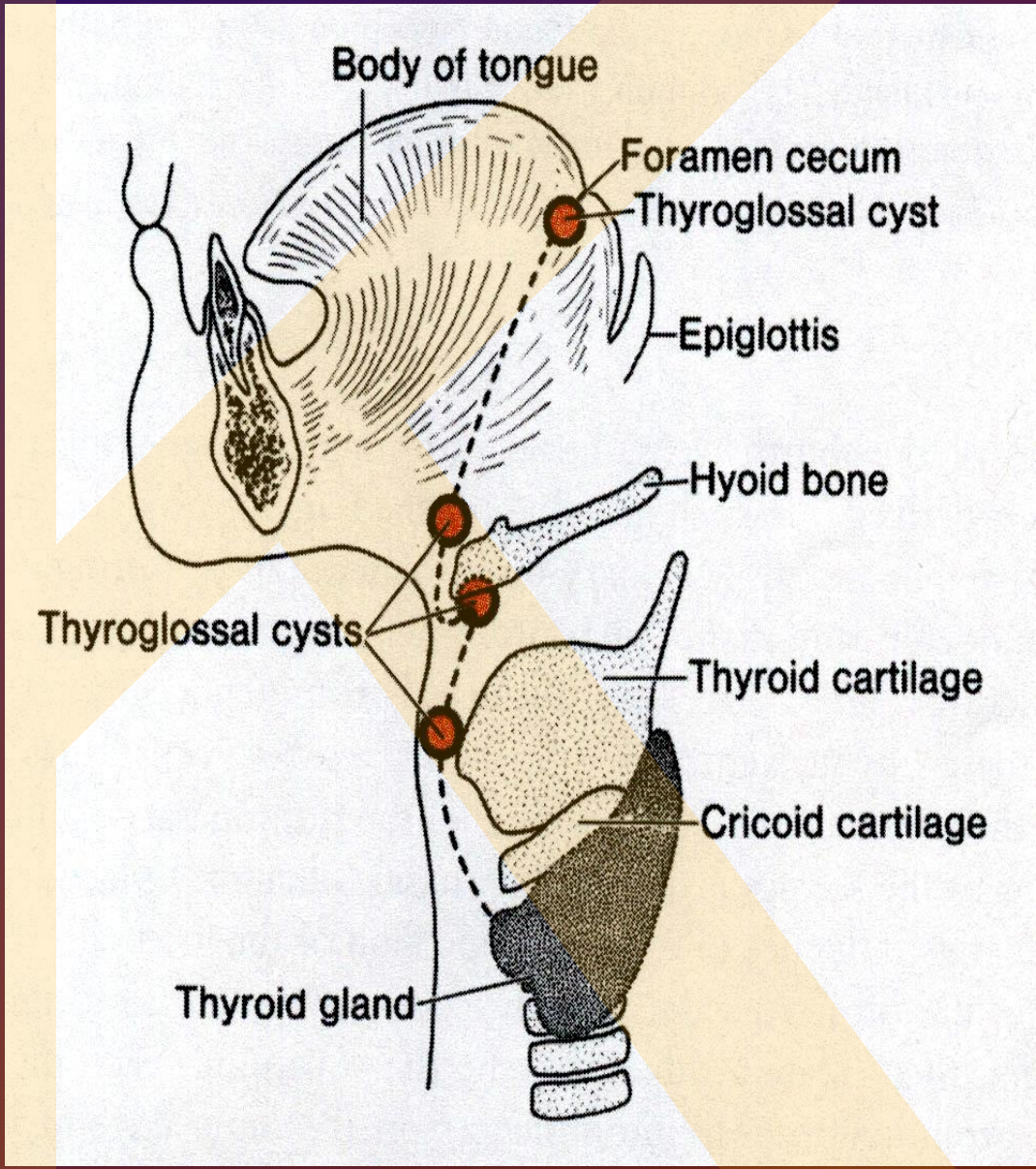
Persisting canal between tongue and gland

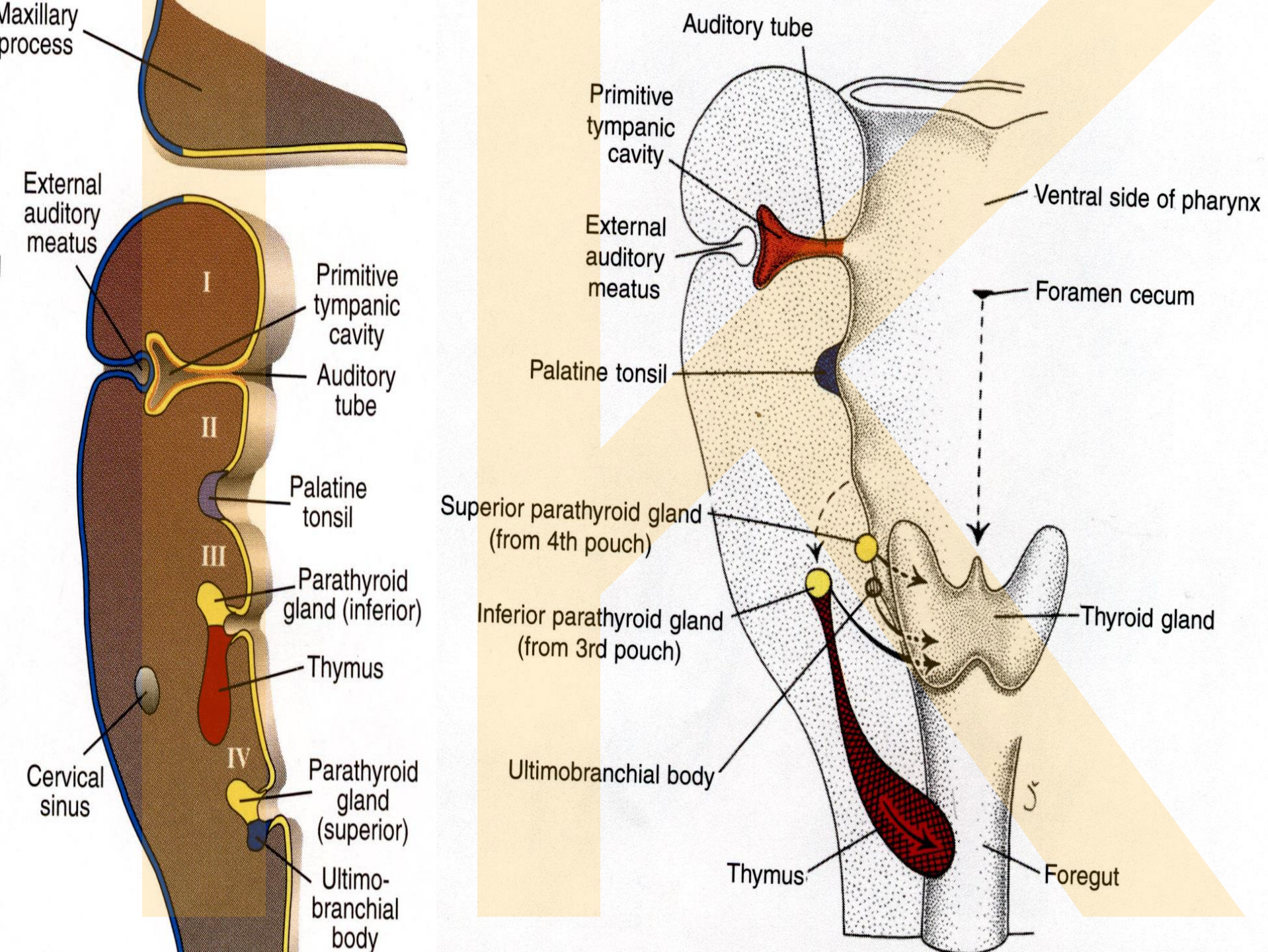
Thyroglossal cyst + thyroglossal fistula –

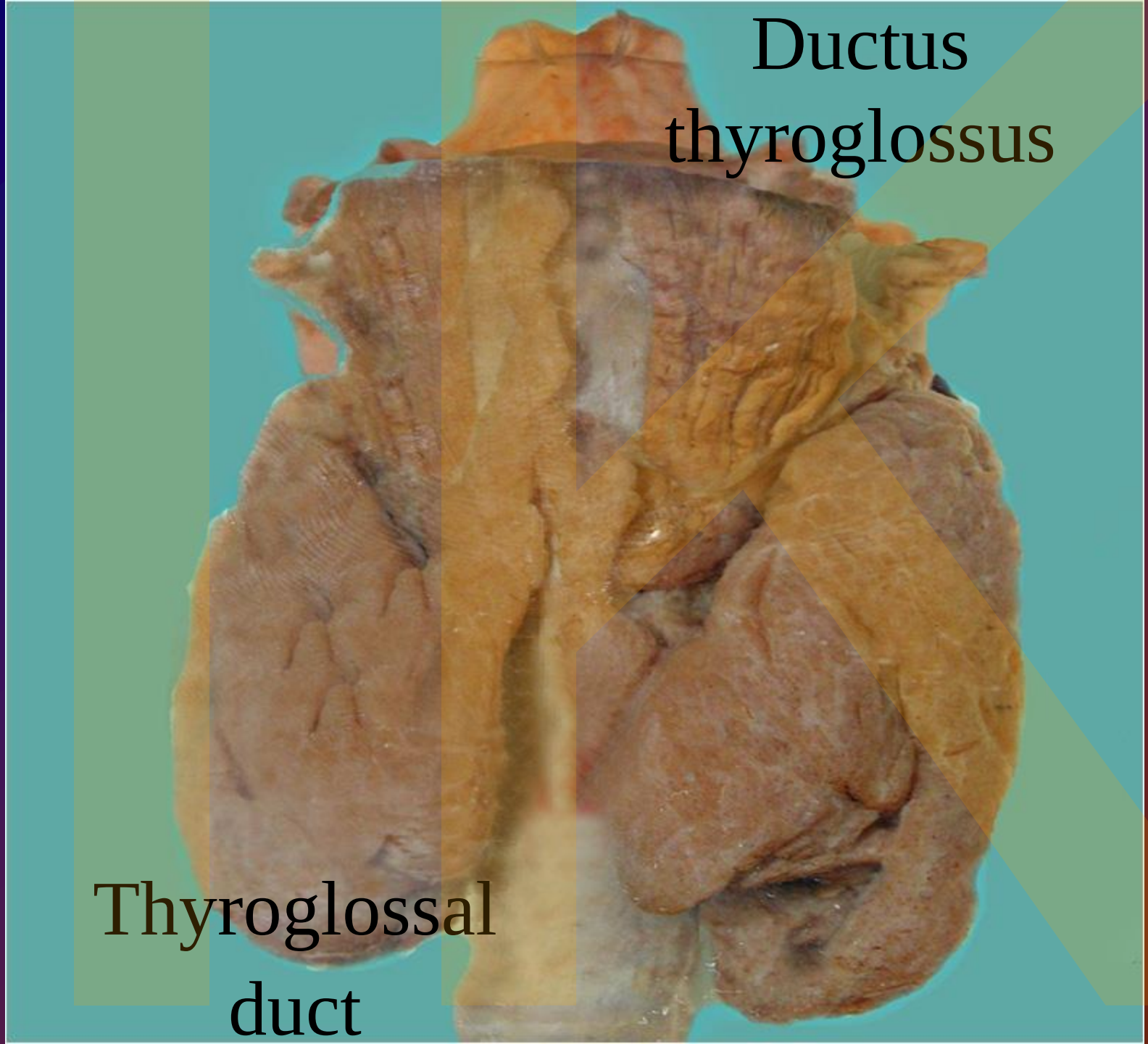
Lie in the midline of the neck at any point along the migratory pathway of the thyroid gland, can be connected with outside by a fistulous canal

Aberrant thyroid tissue –

Found in the base of the tongue




Maxillary process
External auditory meatus
I
Primitive tympanic cavity
Auditory tube
II
Palatine tonsil
III
Parathyroid gland (inferior)
Thymus
Cervical sinus
IV
Parathyroid gland (superior)
Ultimo-branchial body
Auditory tube
Primitive tympanic cavity
External auditory meatus
Ventral side of pharynx
Foramen cecum
Palatine tonsil
Superior parathyroid gland (from 4th pouch)
Inferior parathyroid gland (from 3rd pouch)
Thyroid gland
Ultimobranchial body
Thymus
Foregut

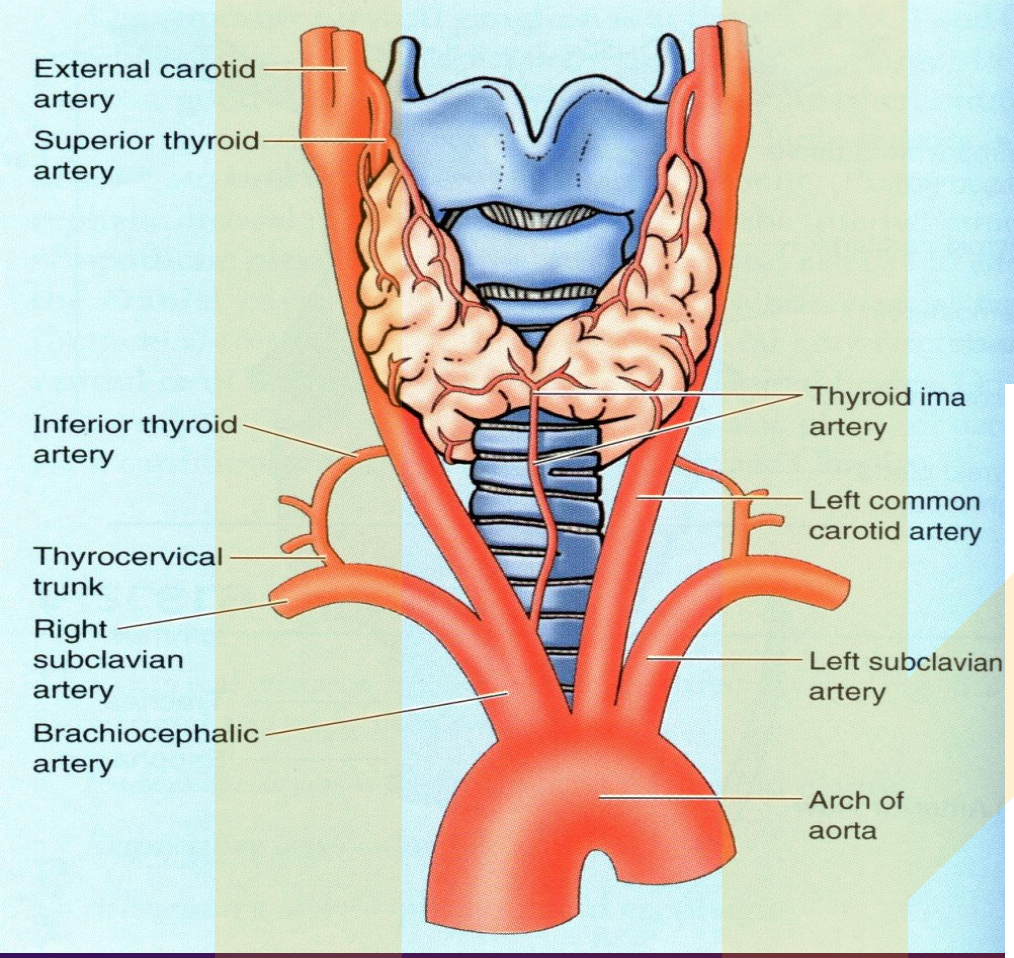

Ductus thyroglossus
Thyroglossal duct

Cysta thyreoglossea

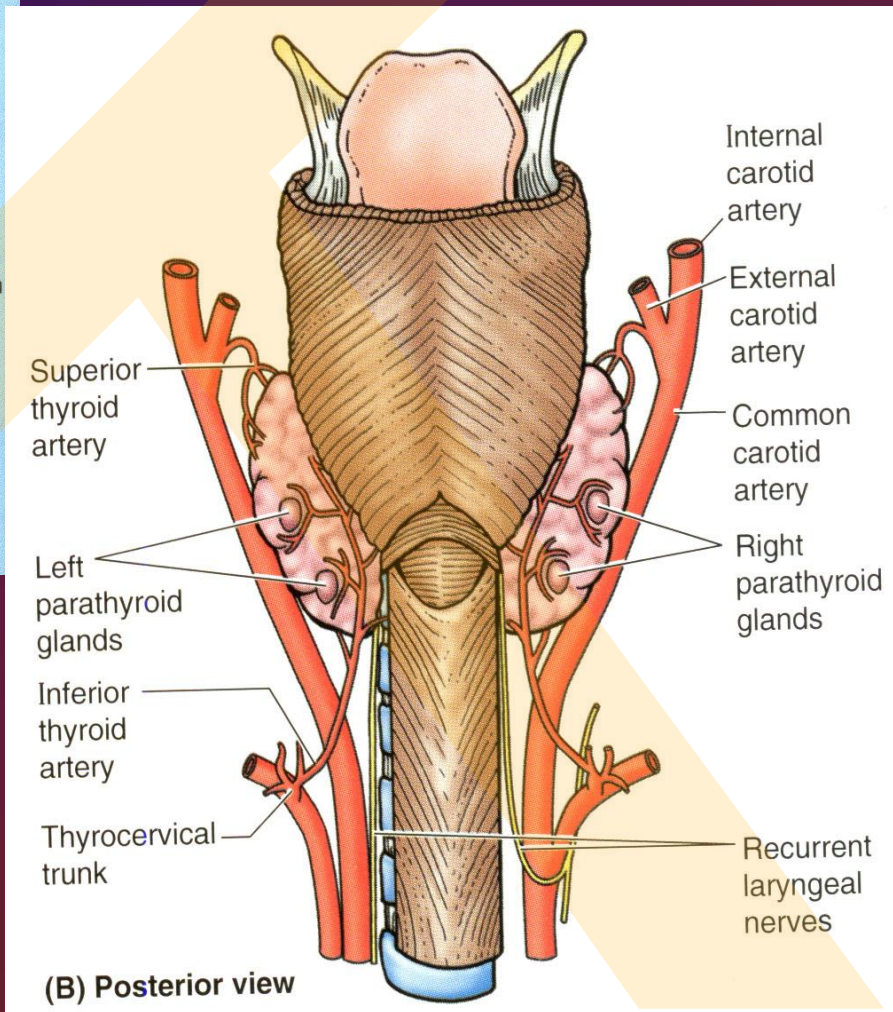
Thyroglossal cyst

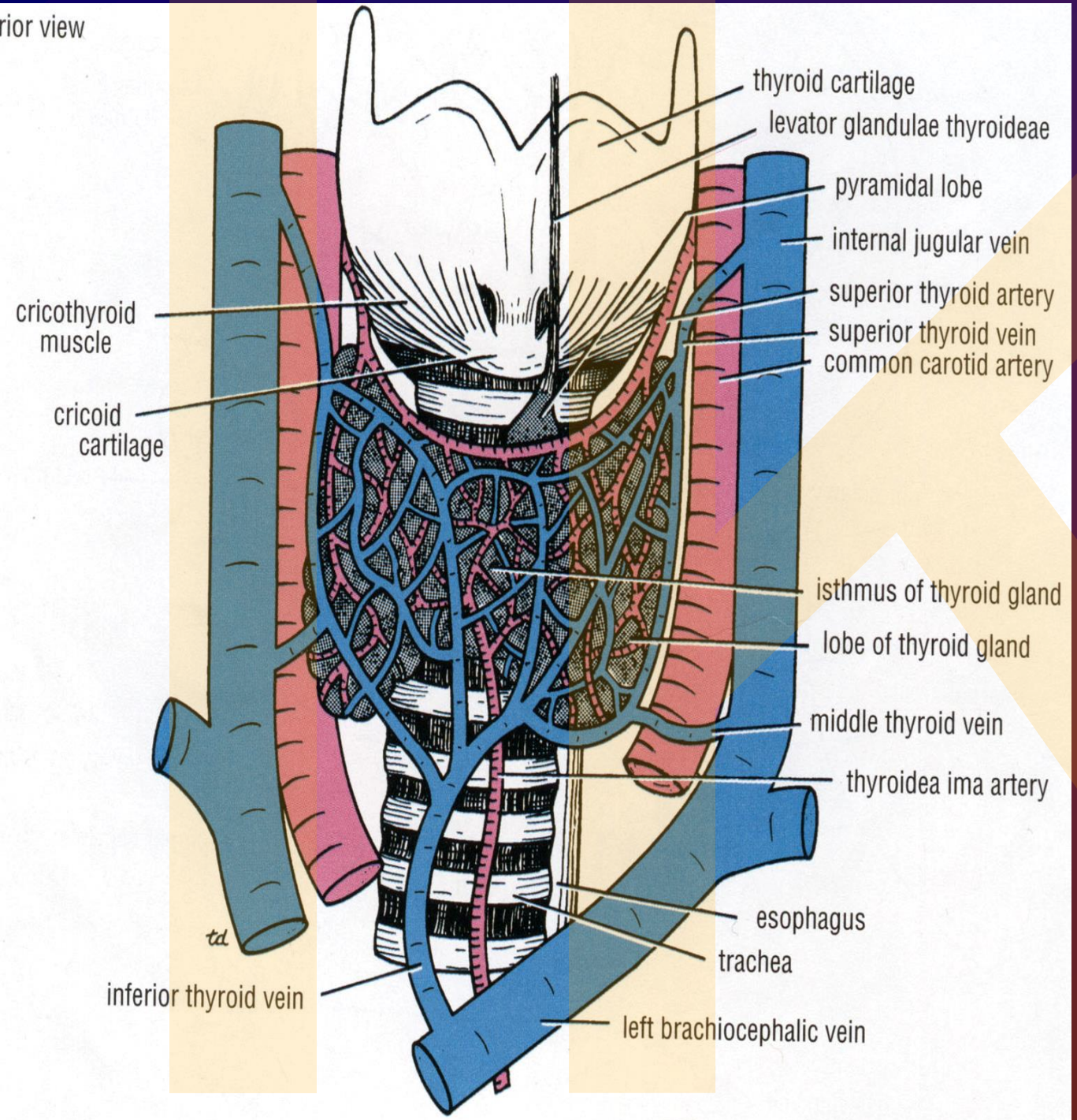
Thyroid gland

Arterial supply



A. thyroidea sup. (from a. carotis ext.)
A. thyroidea inf. (from truncus thyrocervicalis); is crossing
n. laryngeus recurrens
A. thyroidea ima (2% - from arcus aortae)

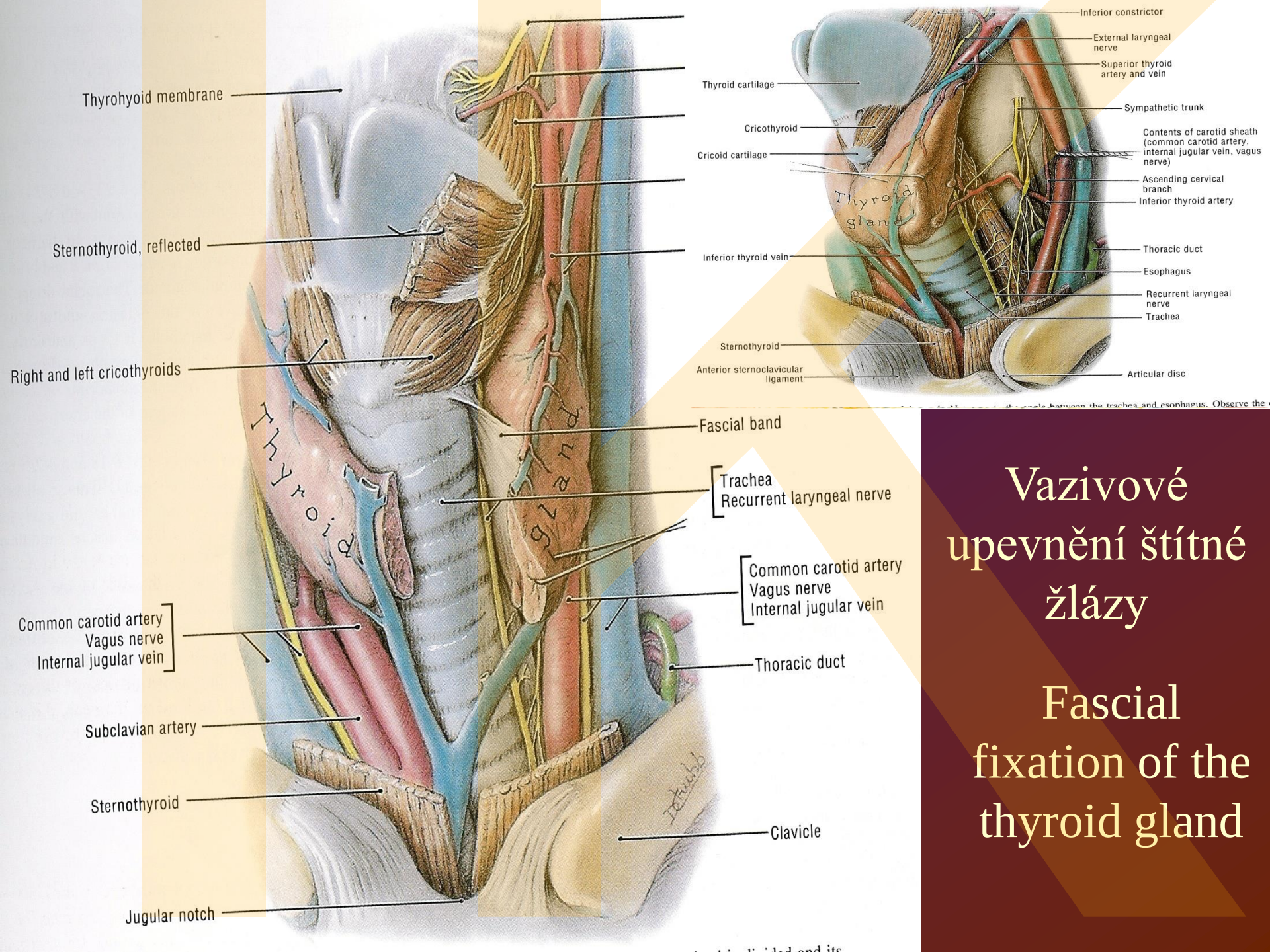




Thyroid gland

Venous supply

Vv. thyroideae sup., mediae et inf.
Plexus thyroideus impar (to v. brachiocephalica sin.)
Lymph bilaterally

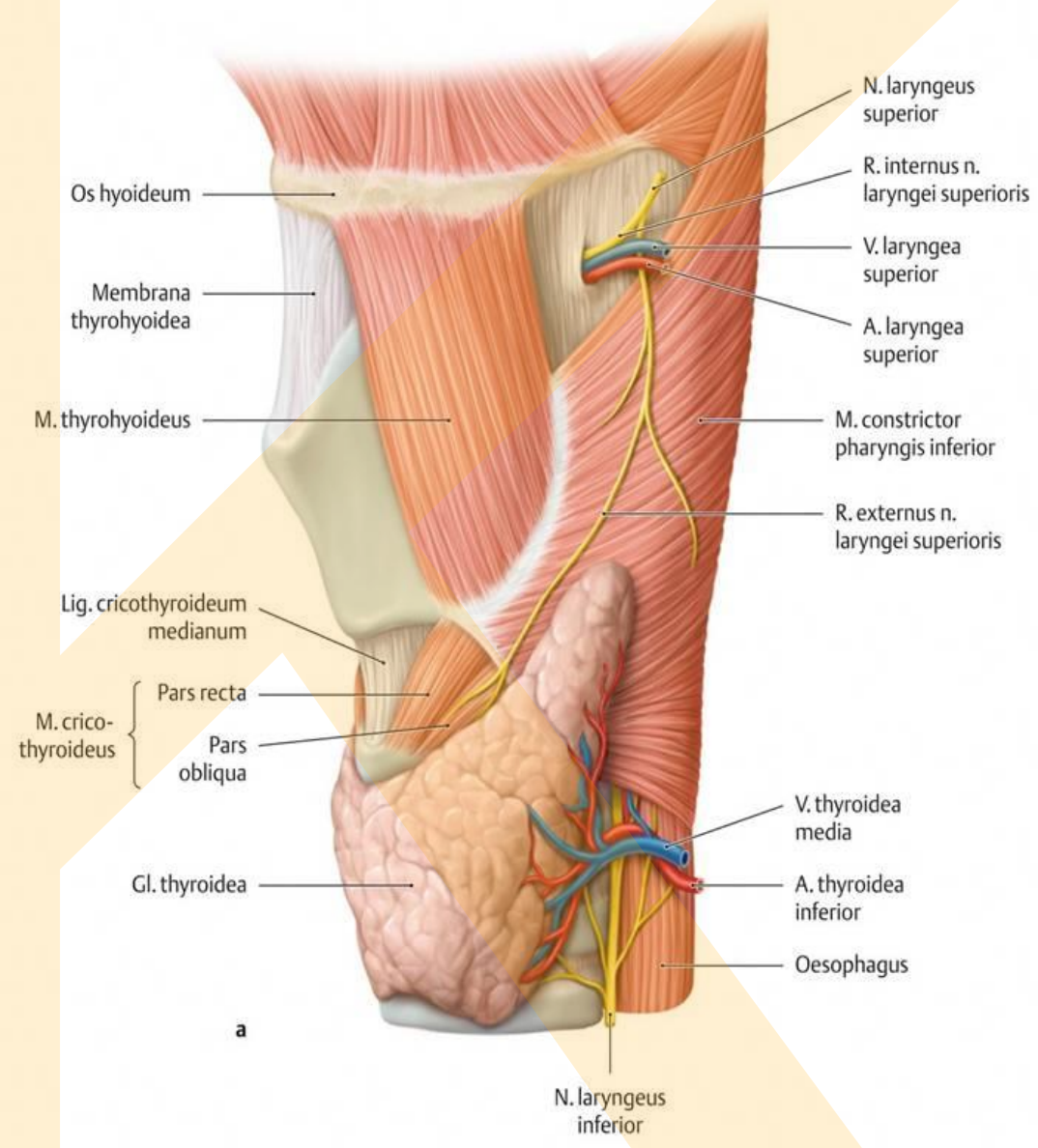


Vazivové upevnění štítné žlázy

Fascial fixation of the thyroid gland

Thyroid gland

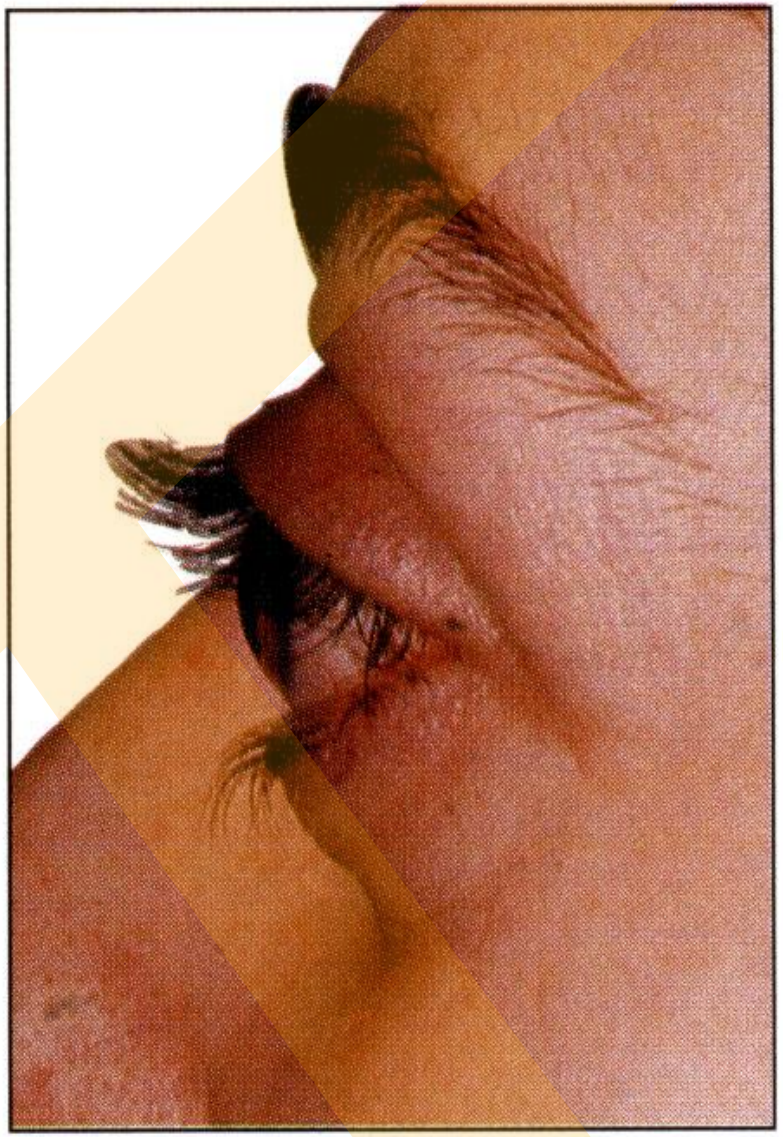
Parathyroid body



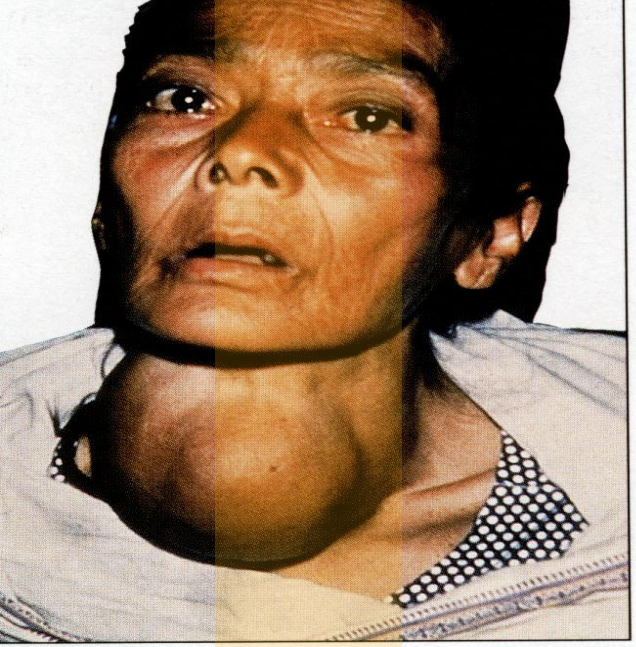
a. thyroidea inferior

n. laryngeus inferior

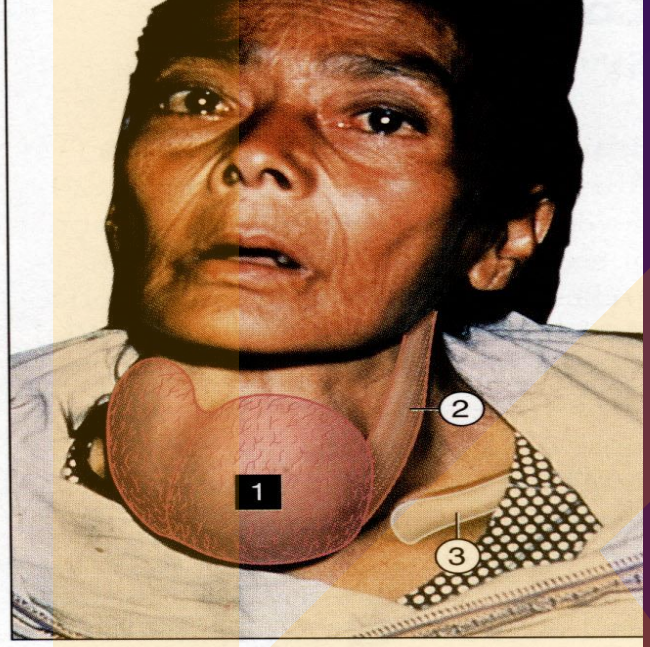
(B) Scintogram showing diffuse, enlarged thyroid gland



Appearance of the eyes in hyperthyroidism – proptosis, lid retraction, chemosis



ig. 2.17 Multinodular goitre with dominant
odule



Key
1 Goitre with dominant nodule
2 Sternocleidomastoid muscle
3 Clavicle

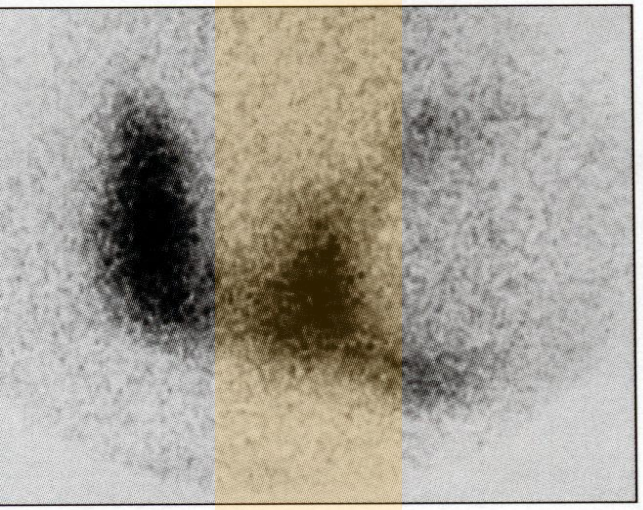
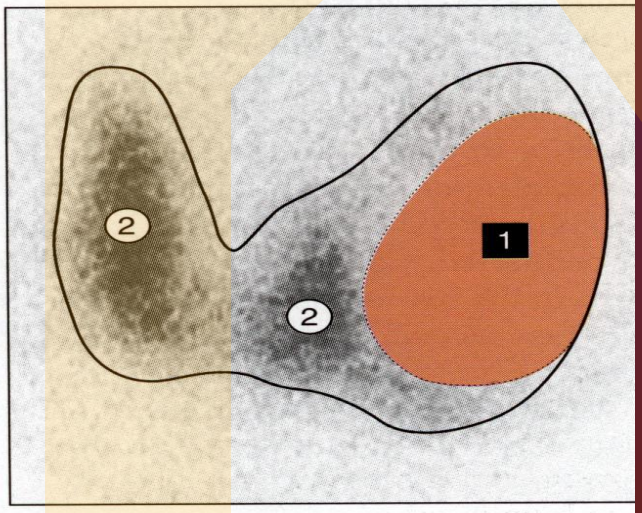
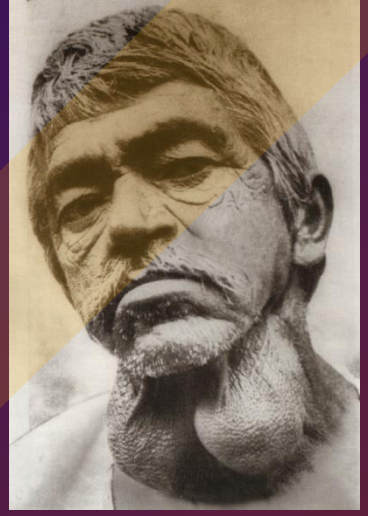


Fig. 2.18 Radionuclide scan of thyroid

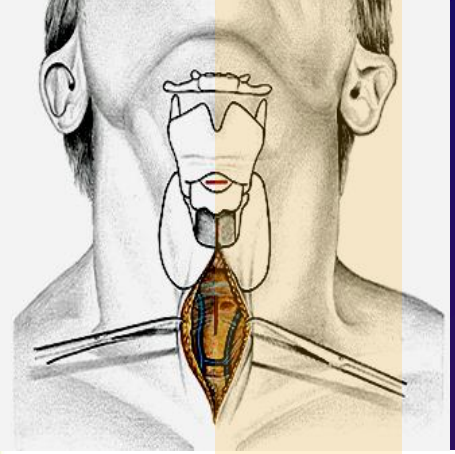


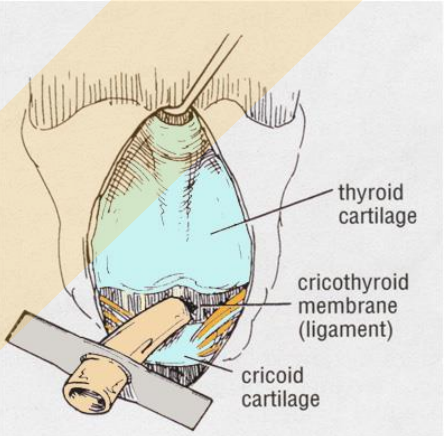
Key
1 'Cold nodule'
2 Normal thyroid

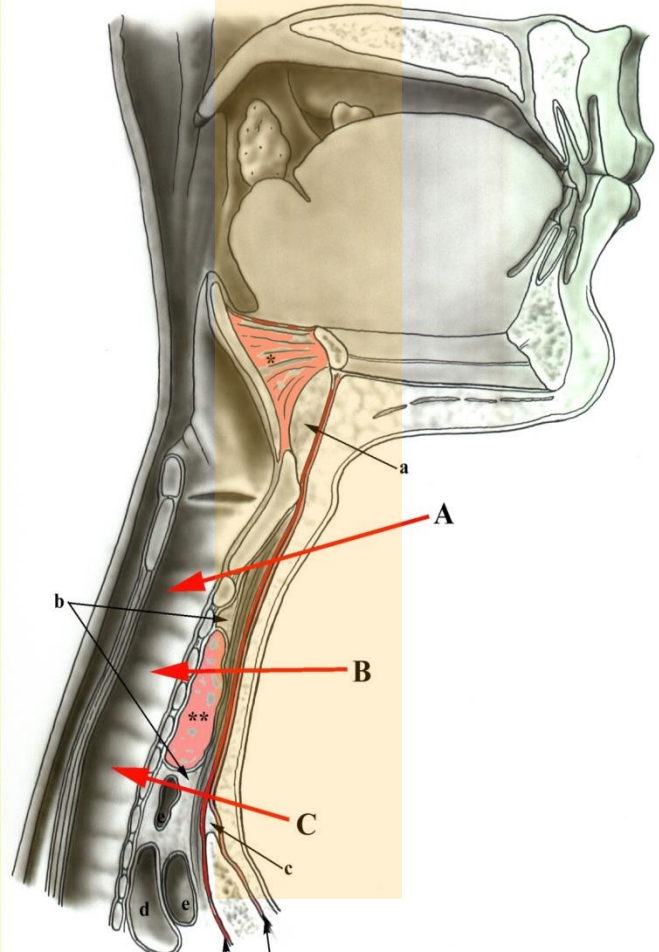


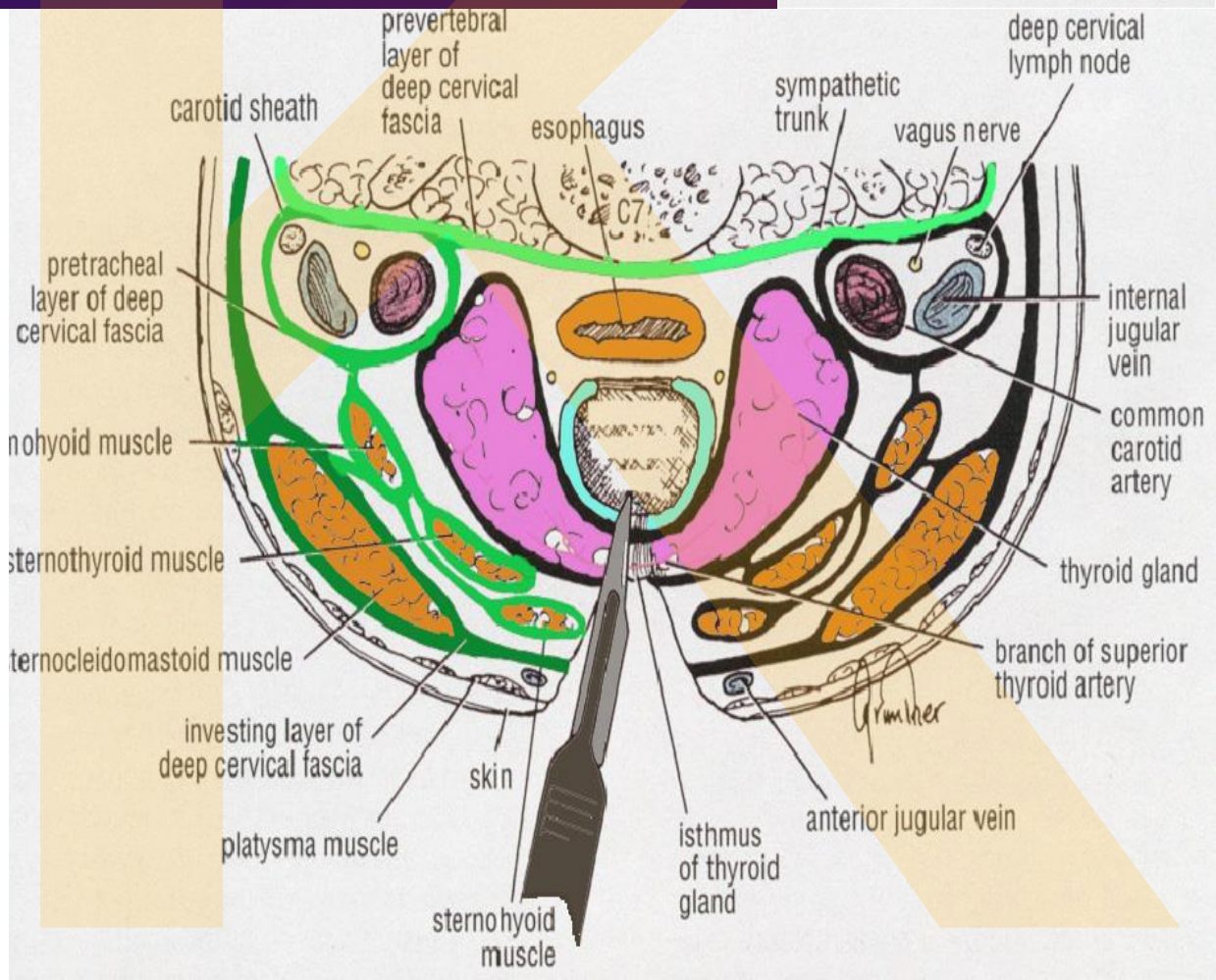
hypothyroidism

Tracheotomy
Tracheostomy





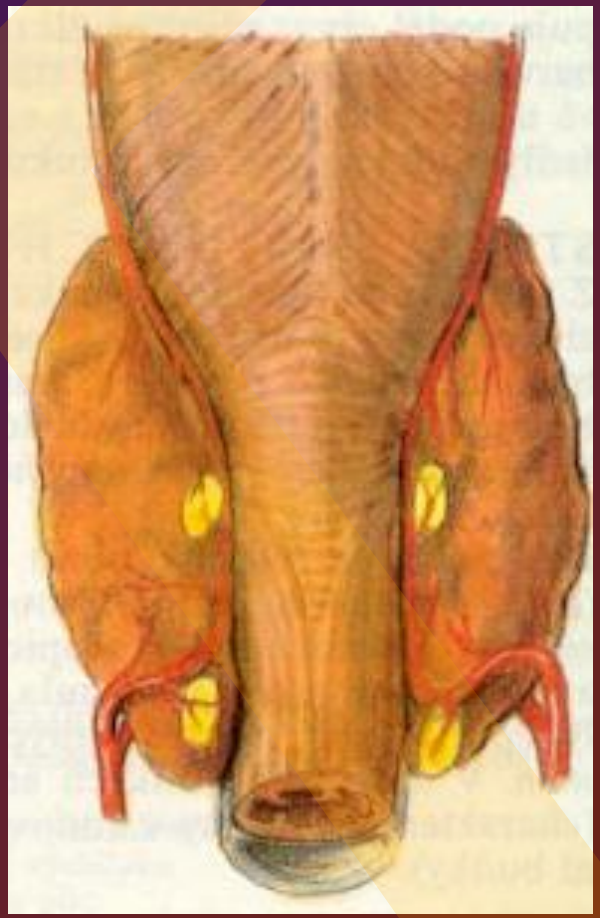




Glandula parathyroidea parathyroid glands

- 2 pirs of the ball-like glands
- drobných kulovitých útvarů
- Theu have role in bone metabolism
- **parathormon** (PTH) increases escape Ca from bones to the blood

- development – from dorsal parts of the III. and IV. Pouch during week 5



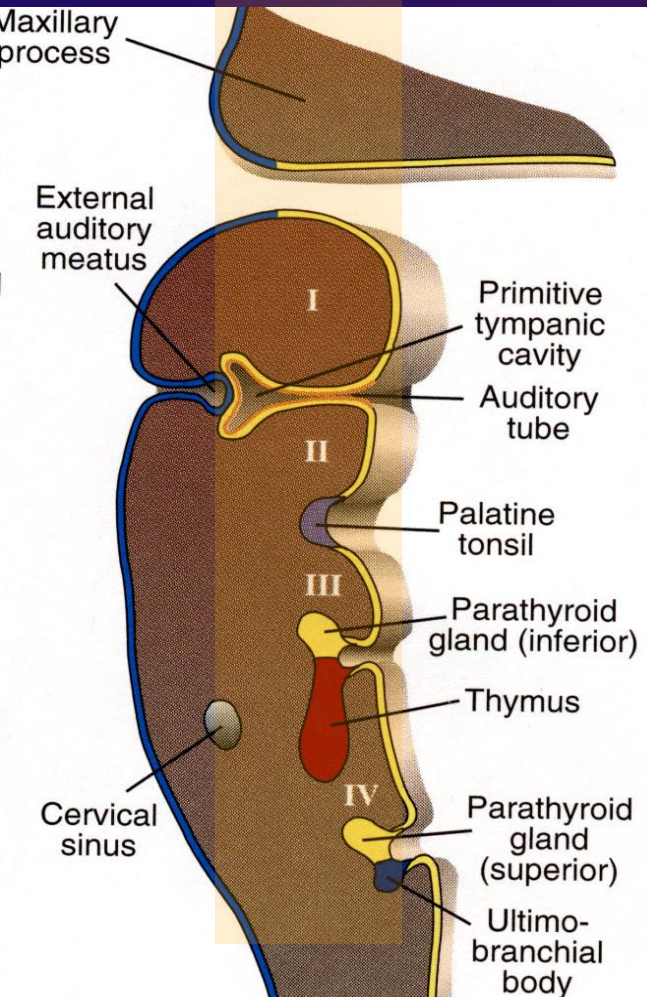
Parathyroid glands

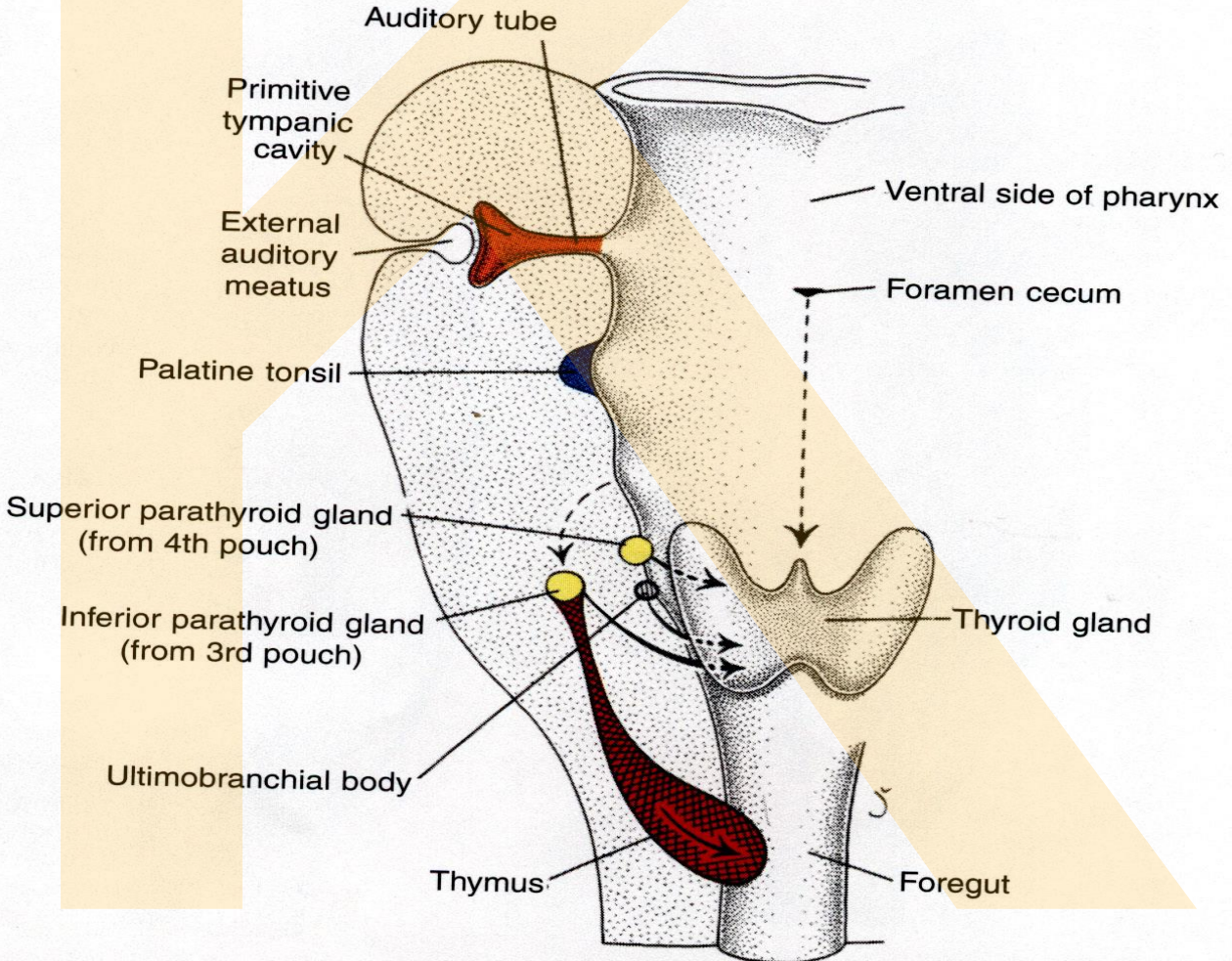
- usually 4 pieces located on the dorsal surface of the thyroid gland, 2 - 6
- Upper bodies (= glandula parathyroidea sup.) at level of area where a. thyroidea inf., n. laryngeus reccurens are crossed
- Lower bodies at levels from angulus mandibulae to pericardium
- vessels: each body has own vessel from a. thyroidea inferior

IMPORTANT

- During full thyroidectomy save minimally one
- During parathyroidectomy save one or one half of it, or it is neccessity to arrange full retransplantation to the antebrachium muscles or to the m. STCLM

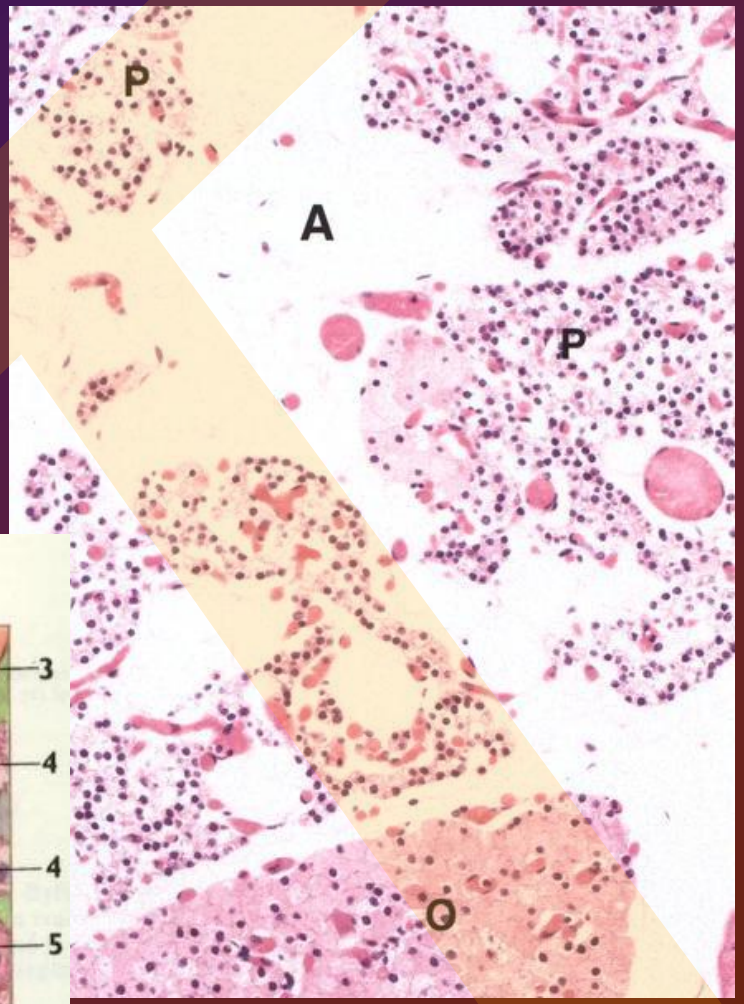
Příštítná tělíska – vývoj
parathyroid glands - development





Parathyroid glands - structure

- capsule + septae
- parenchym is composed of trabeculae
- Main cells – giant cells (4-8 um)

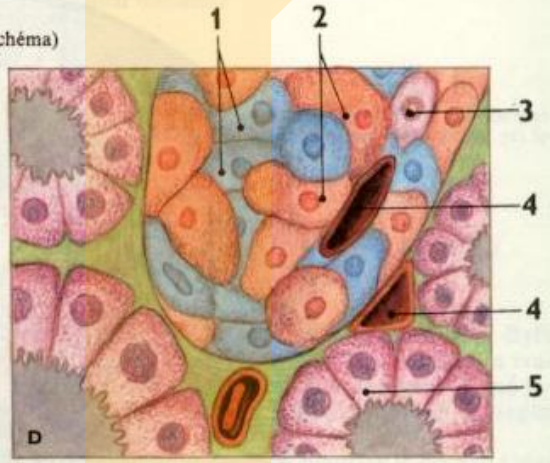


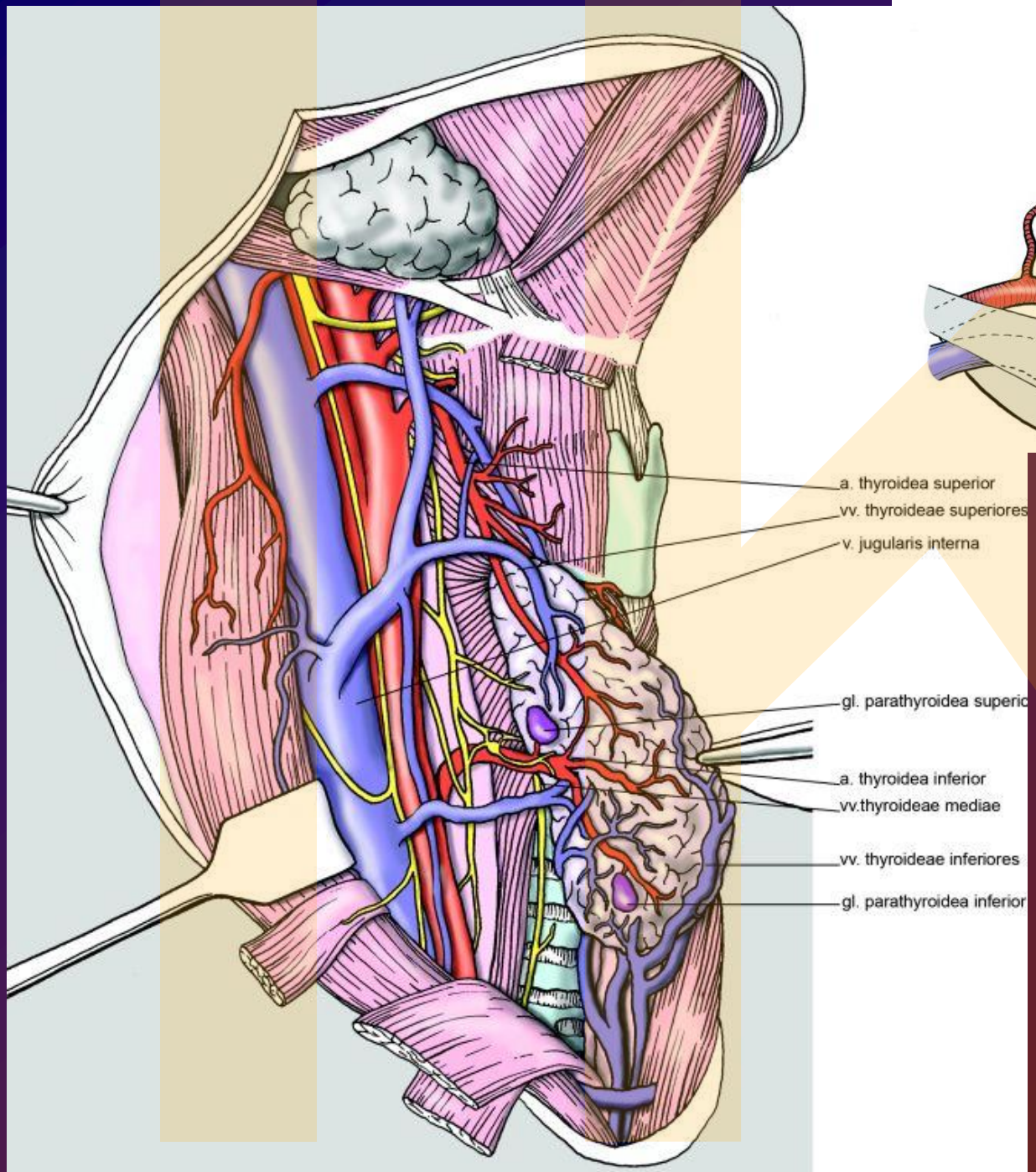
262. PŮVOD, ULOŽENÍ A STAVBA PŘÍŠTÍTNÝCH ŽLÁZ (schéma)
A. FRONTÁLNÍ ŘEZ EMBRYONÁLNÍM HLTANEM, pohled zezadu; epithelový materiál pro příštítné žlázy označen barevně
I.—IV. / 1. až 4. žaberní oblouk, mezi oblouky jsou žaberní výchlipky

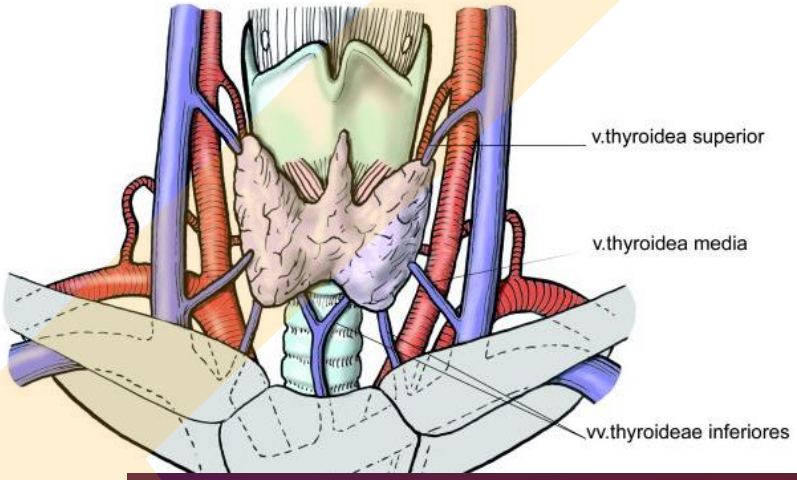
B. PROJEKCE MÍST ULOŽENÍ PŘÍŠTÍTNÝCH ŽLÁZ, při pohledu na štítnou žlázu

C. PŘÍŠTÍTNÉ ŽLÁZY při pohledu zezadu (uložení na povrchu štítné žlázy není konstantní)

D. STAVBA PŘÍŠTÍTNÉ ŽLÁZY (schéma)
1 / hlavní (chromofóbní) buňky
2 / oxyfilní buňky
3 / buňka přechodního typu
4 / kapilára ve vazivovém stromatu
5 / folikul štítné žlázy




a. thyroidea superior
vv. thyroideae superiores
v. jugularis interna
gl. parathyroidea superior
a. thyroidea inferior
vv.thyroideae mediae
vv. thyroideae inferiores
gl. parathyroidea inferior


v.thyroidea superior
v.thyroidea media
vv.thyroideae inferiores

ZDROJE SOURCES

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- Doskočil, Vobořil, Kolaterální řečiště u člověka
- Eliška,Elišková, Kůže a chirurgické přístupy
- Grim, Základy anatomie
- Petrovický a spol., Anatomie 1
- Sobotta , Atlas anatomie člověka
- The Ascending Pharyngeal Artery: Branches, Anastomoses, and Clinical Significance
- Lotfi Hacein-Beya,b, David L. Danielsa, John L. Ulmera, Leighton P. Marka, Michelle M. Smitha, James M. Strottmanna, Douglas Browna,b,c, Glenn A. Meyerb and Phillip A. Wackymc *American Journal of Neuroradiology 23:1246-1256, August 2002*

END