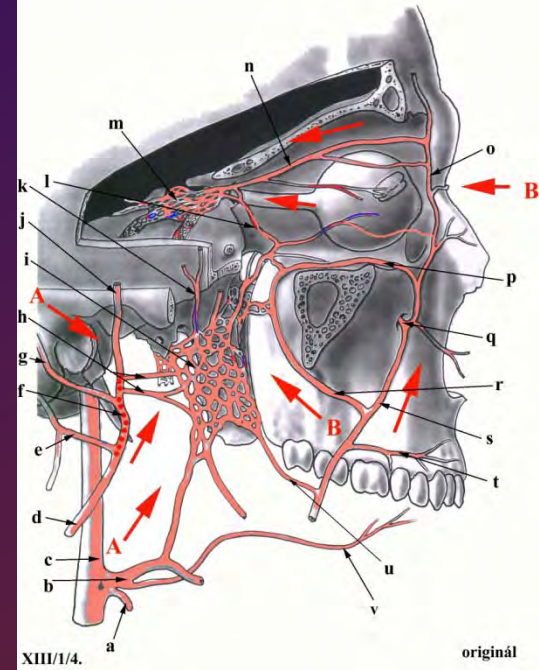
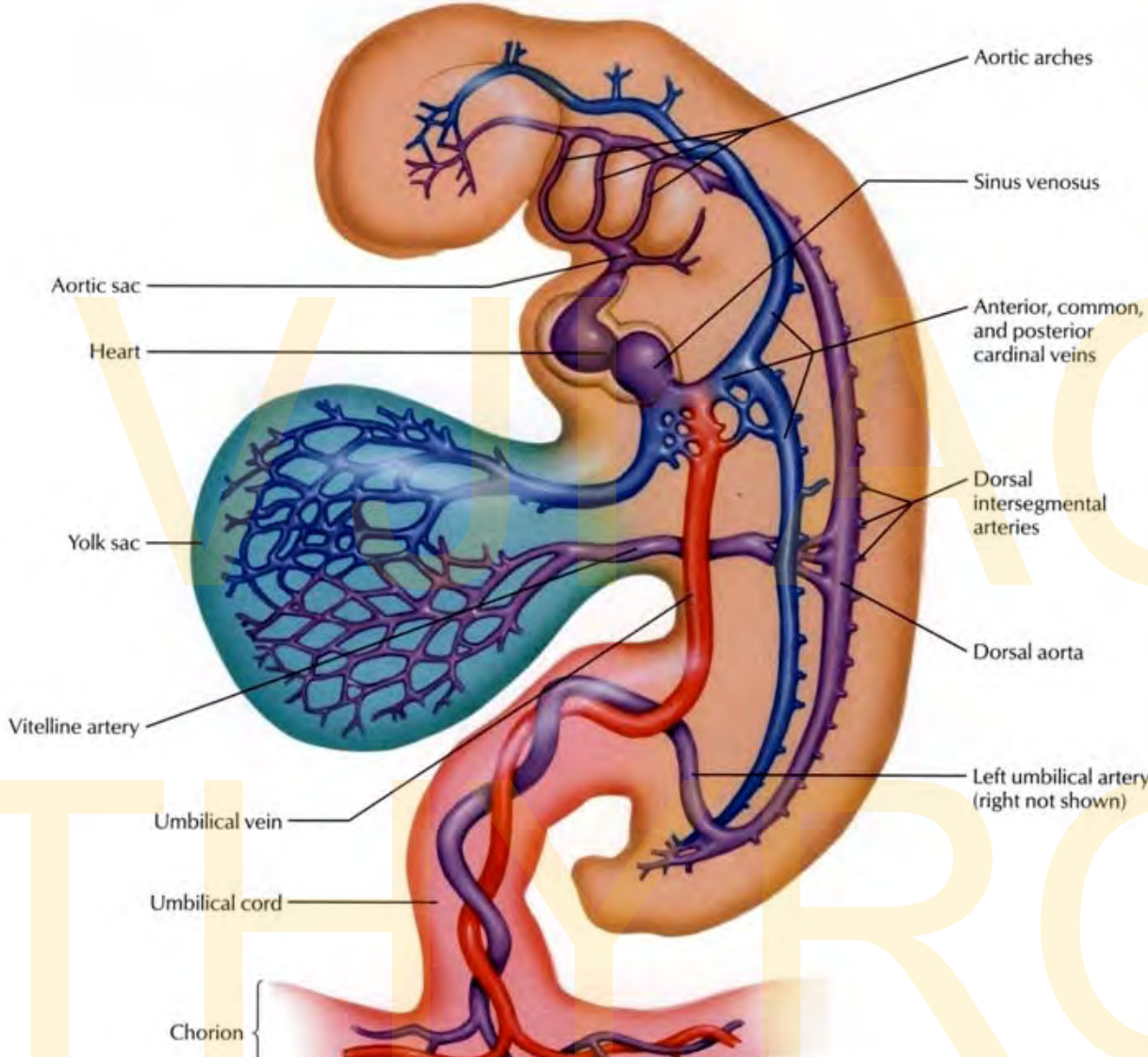


External carotid artery,
subclavian artery, internal
jugular vein and its
tributaries, thyroid gland,
parathyroid glands



By

Ivo Klepáček



Three vascular systems are finally formed:

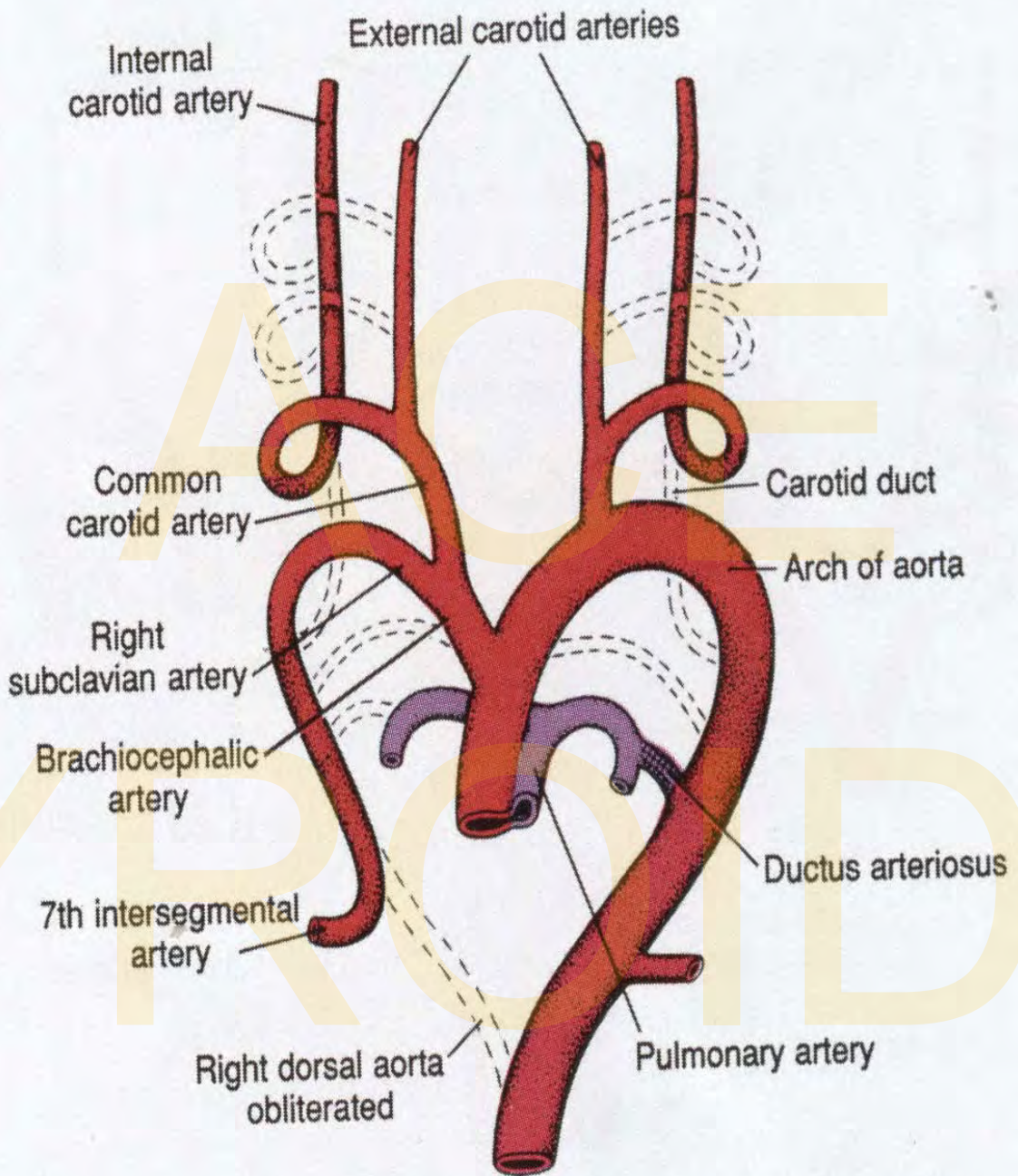
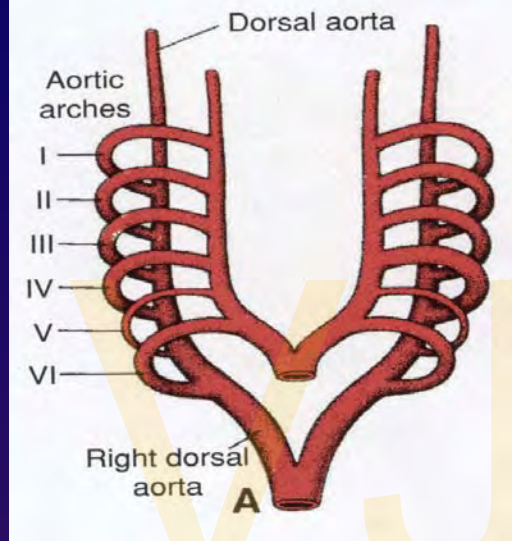
Intraembryonic (cardinal); aortic sac (later gives rise aortic arches)

Vitelline (aa. + vv.)

Placental (umbilical aa. + vv.)

Development of the vascular system

Day 27



1st – maxillary artery

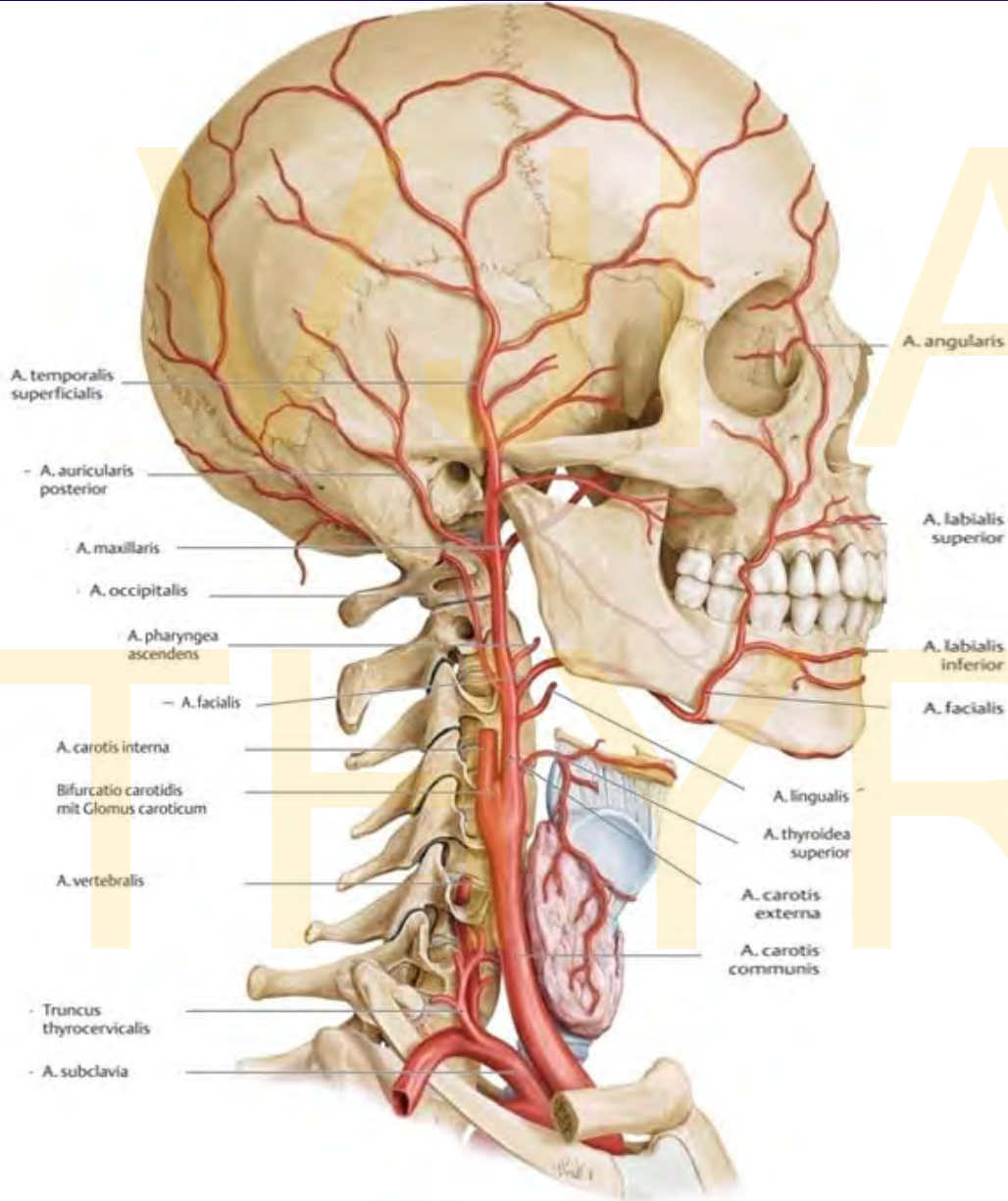
2nd – hyoid, stapedial aa.

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.

Main arteries

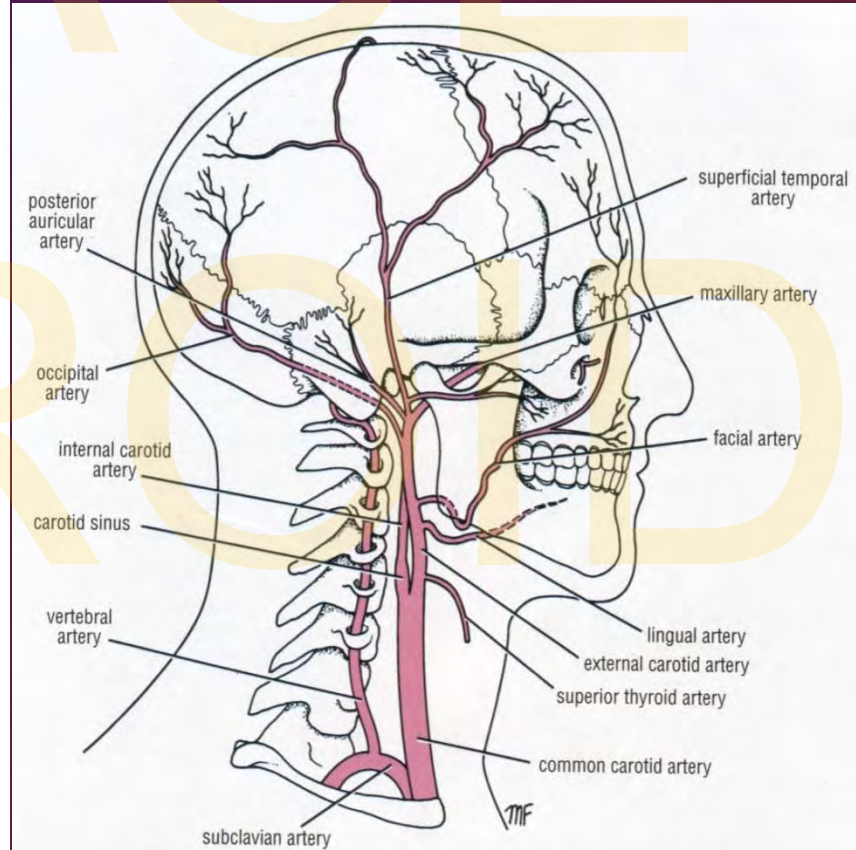


Common carotid artery (left)

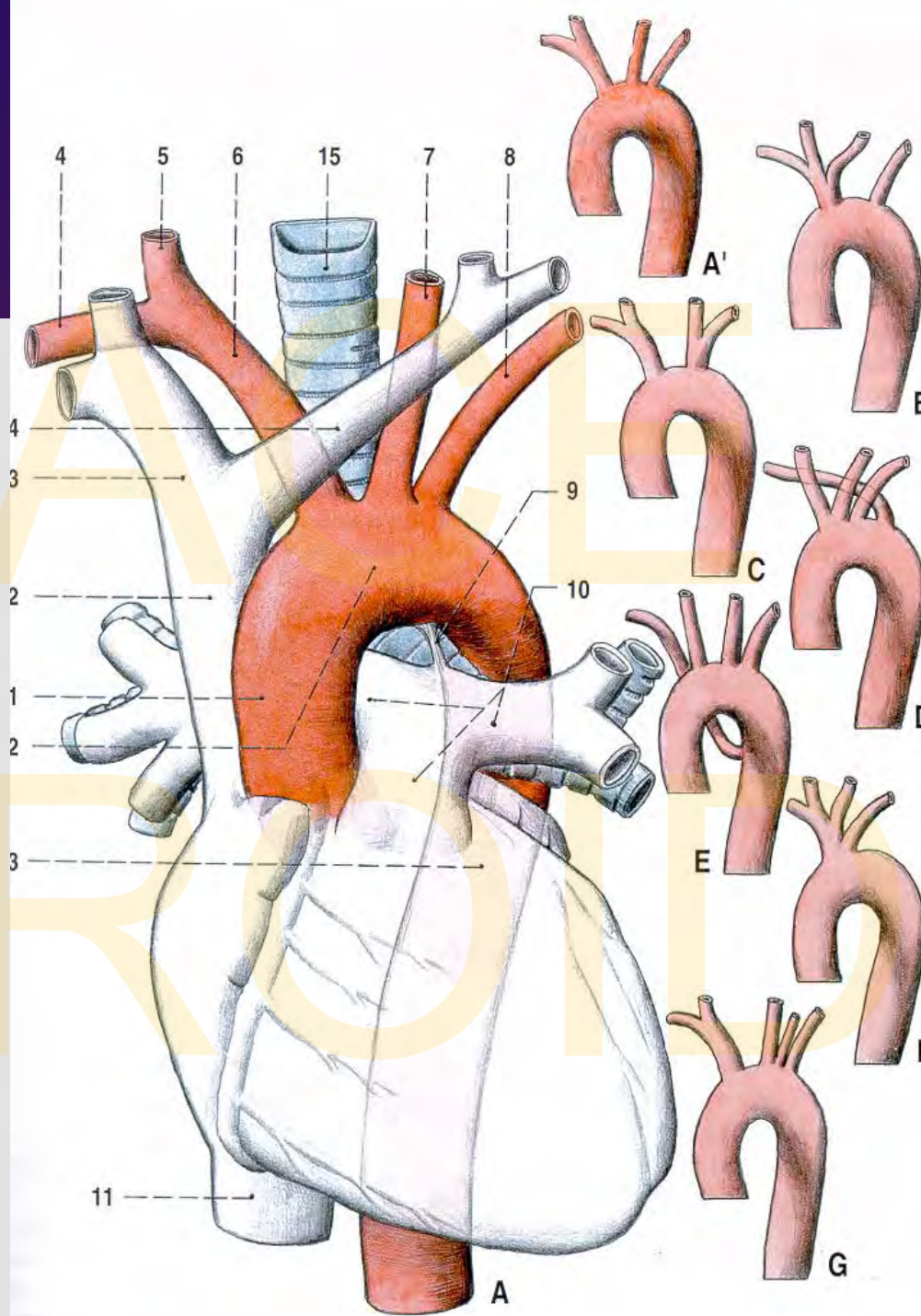
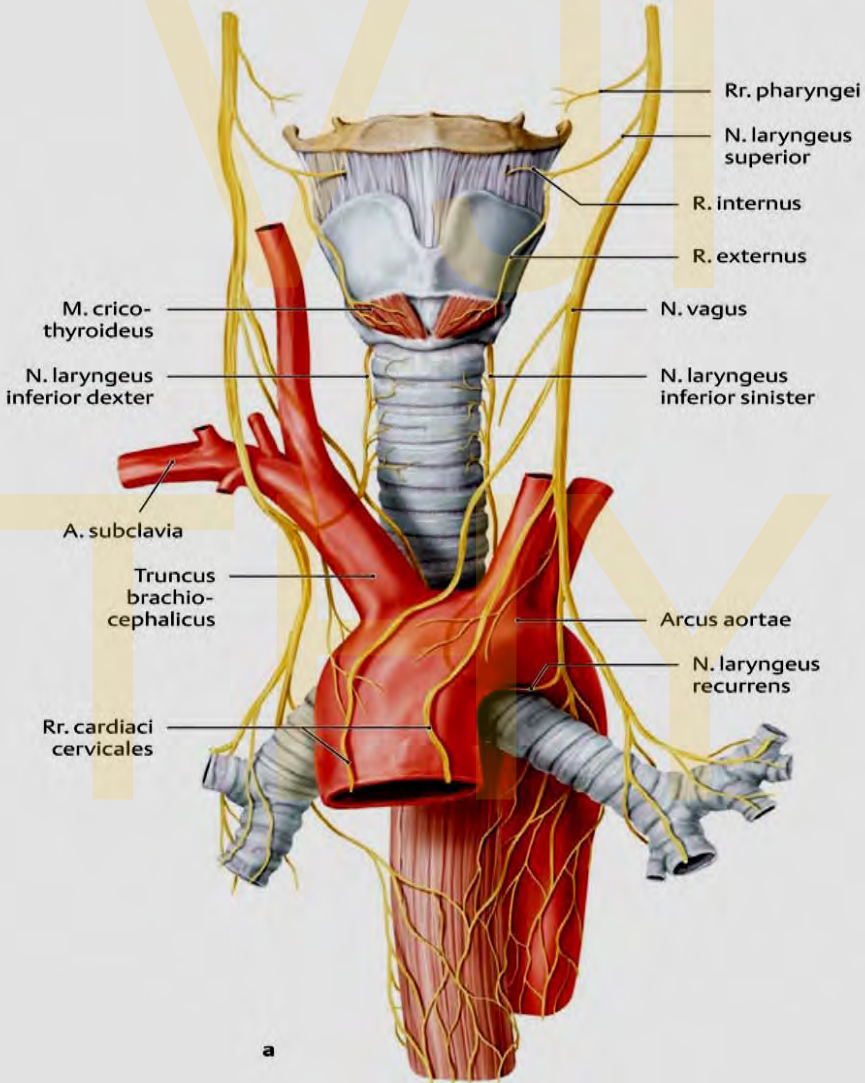
Brachiocephalic trunk (right)

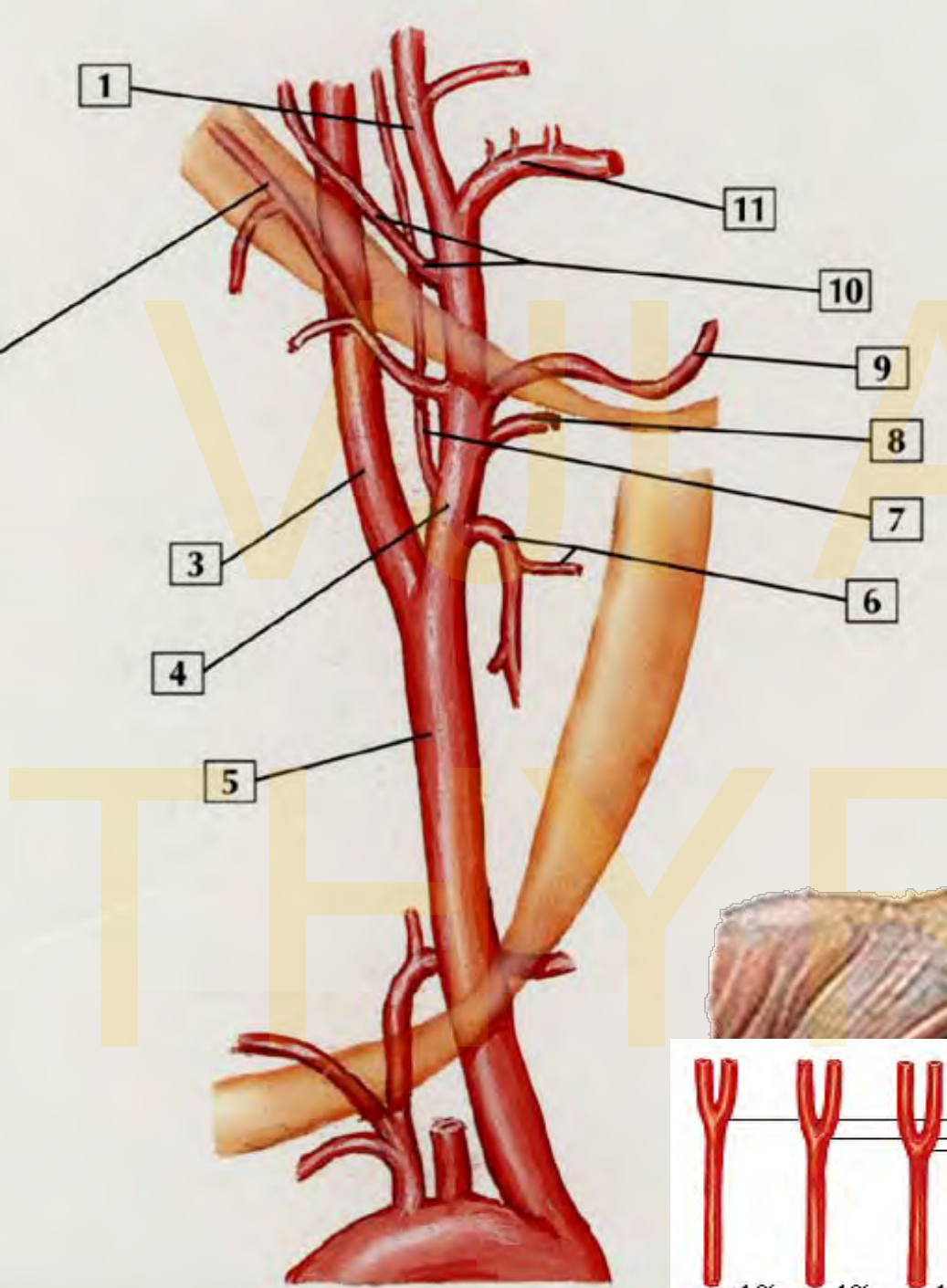
Internal carotid artery

External carotid artery

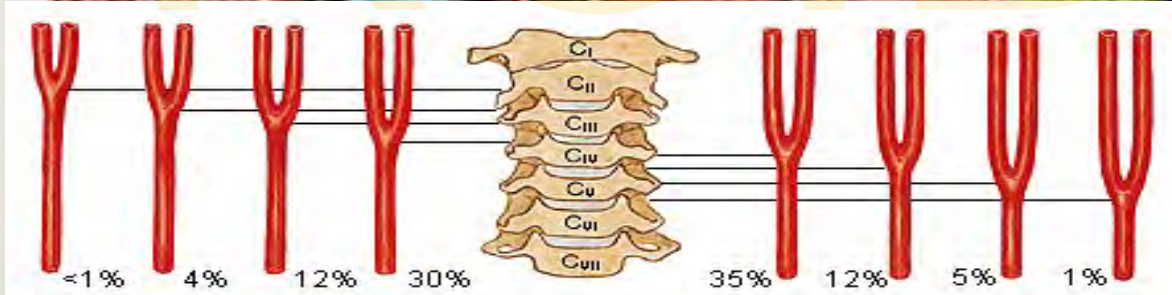


Variations of the aortic arch branches

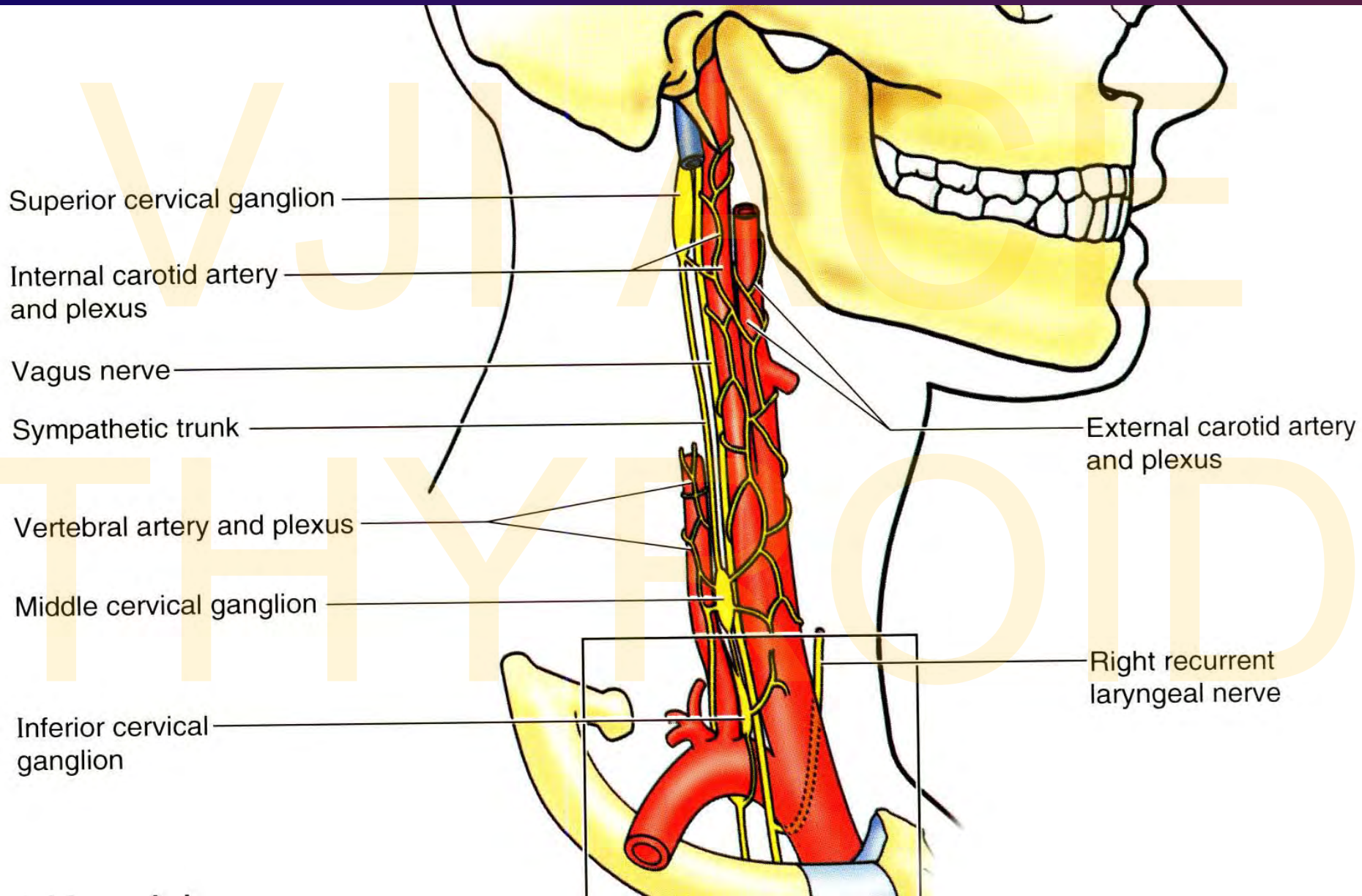




Fascia
 pretrachealis
 a ACC
 Pretracheal
 fascia and ACC



Sympathetic nerve trunks



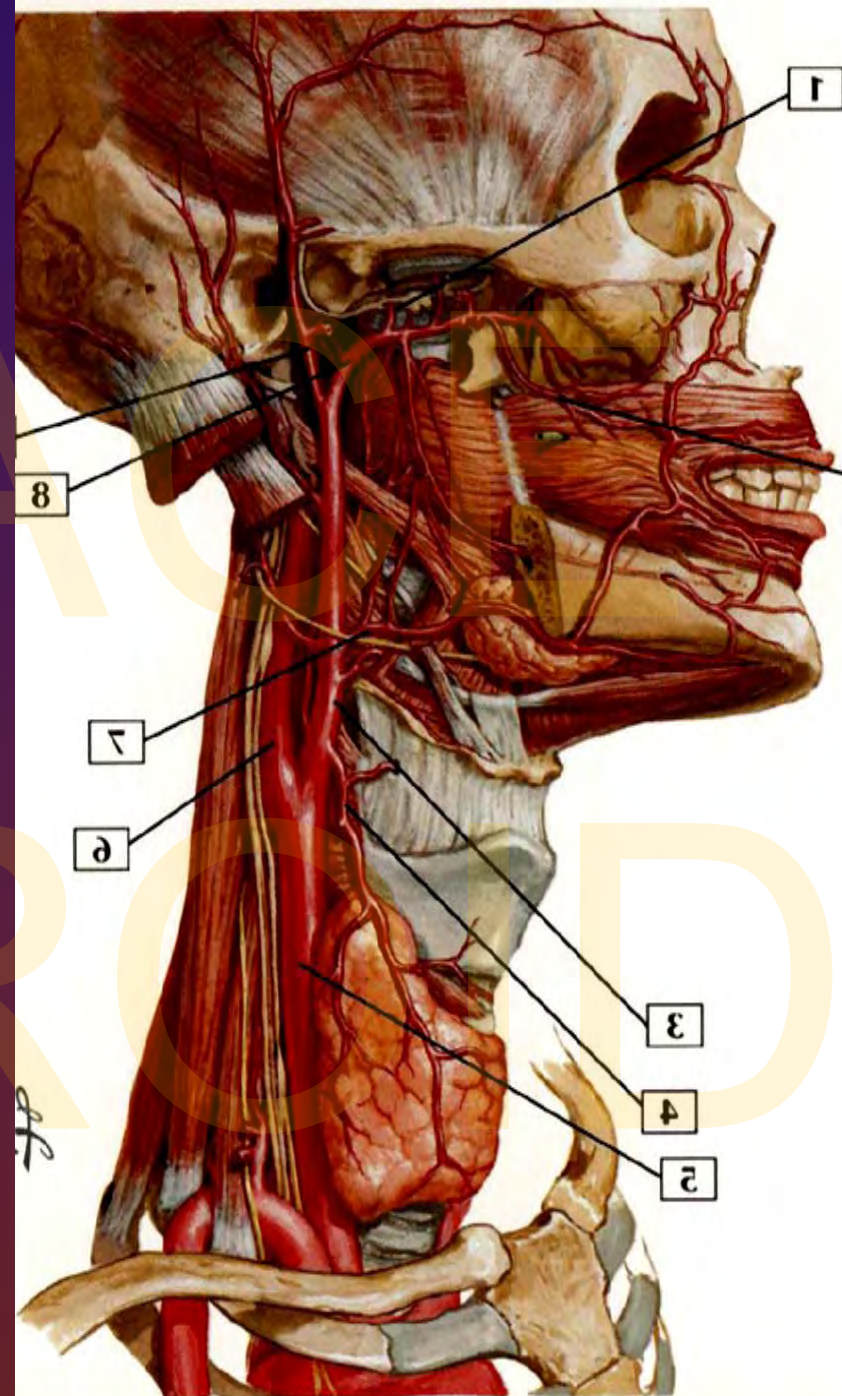
Common carotid artery

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

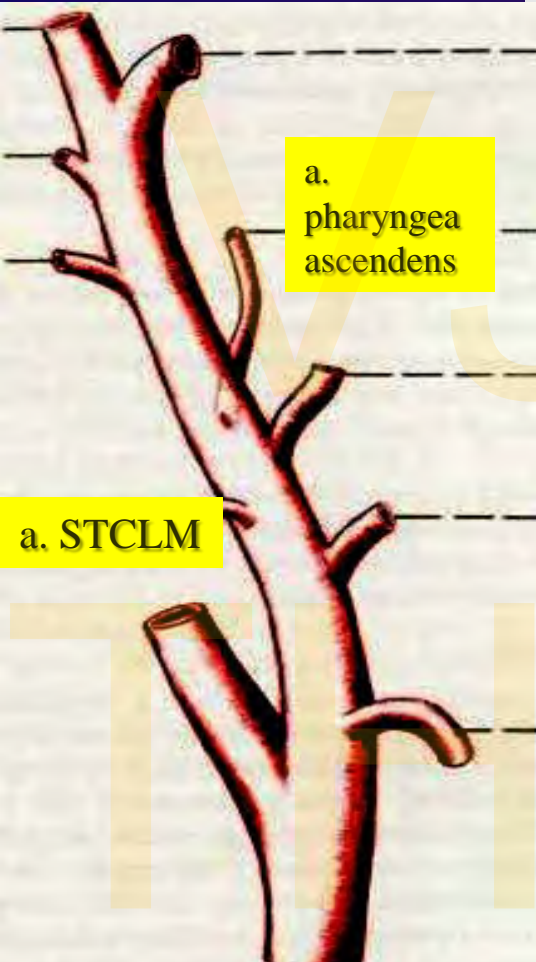
Posteriorly – transverse process of the C4 vertebrae, prevertebral muscles, sympathetic trunk

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

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



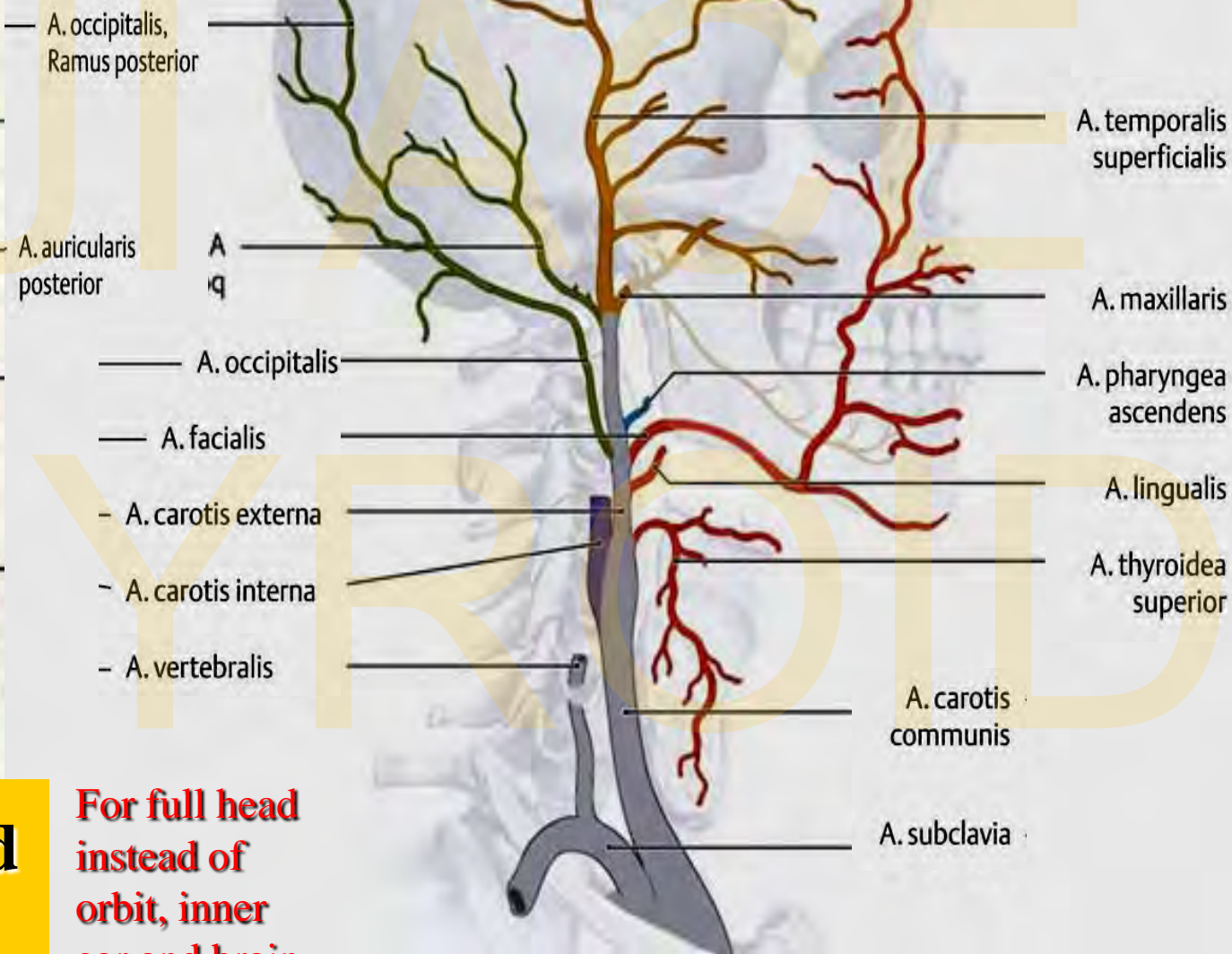
Arteria carotis externa ACE



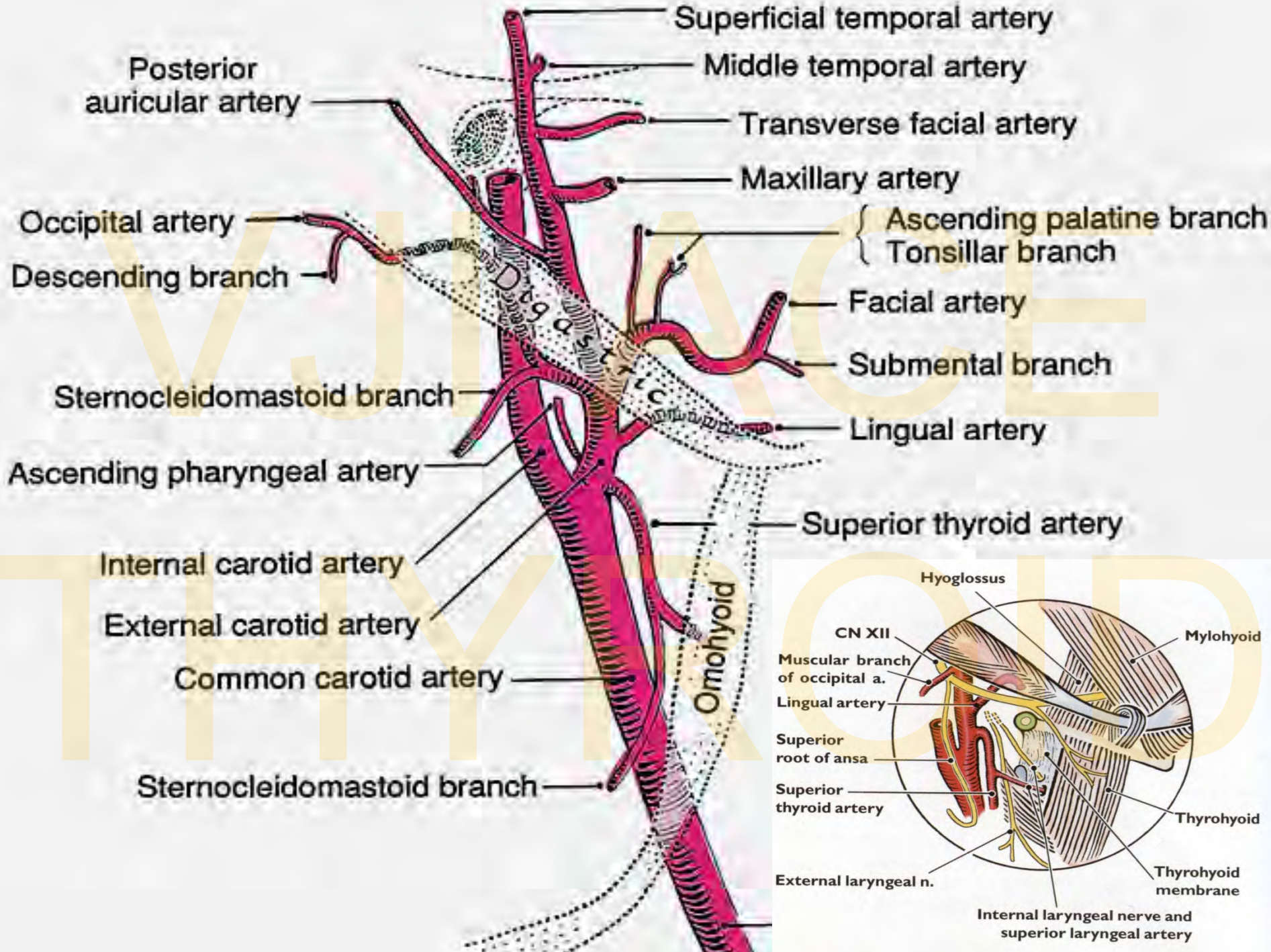
External carotid artery ECA

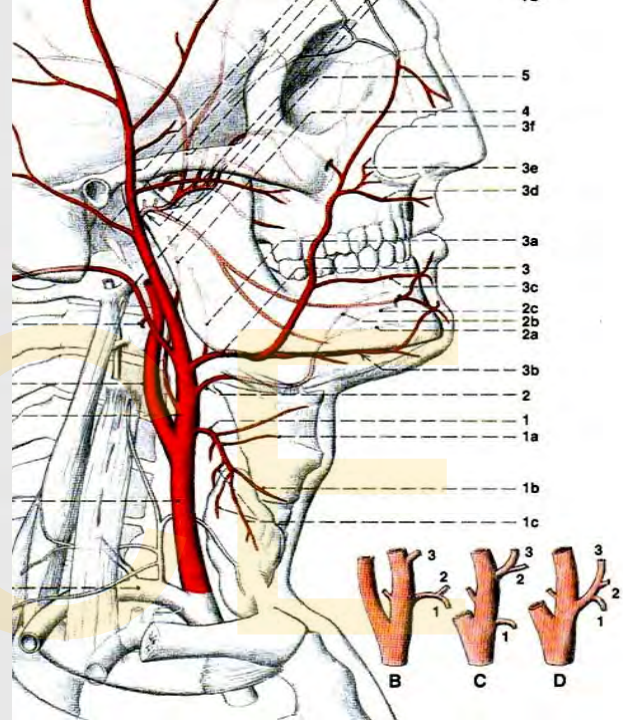
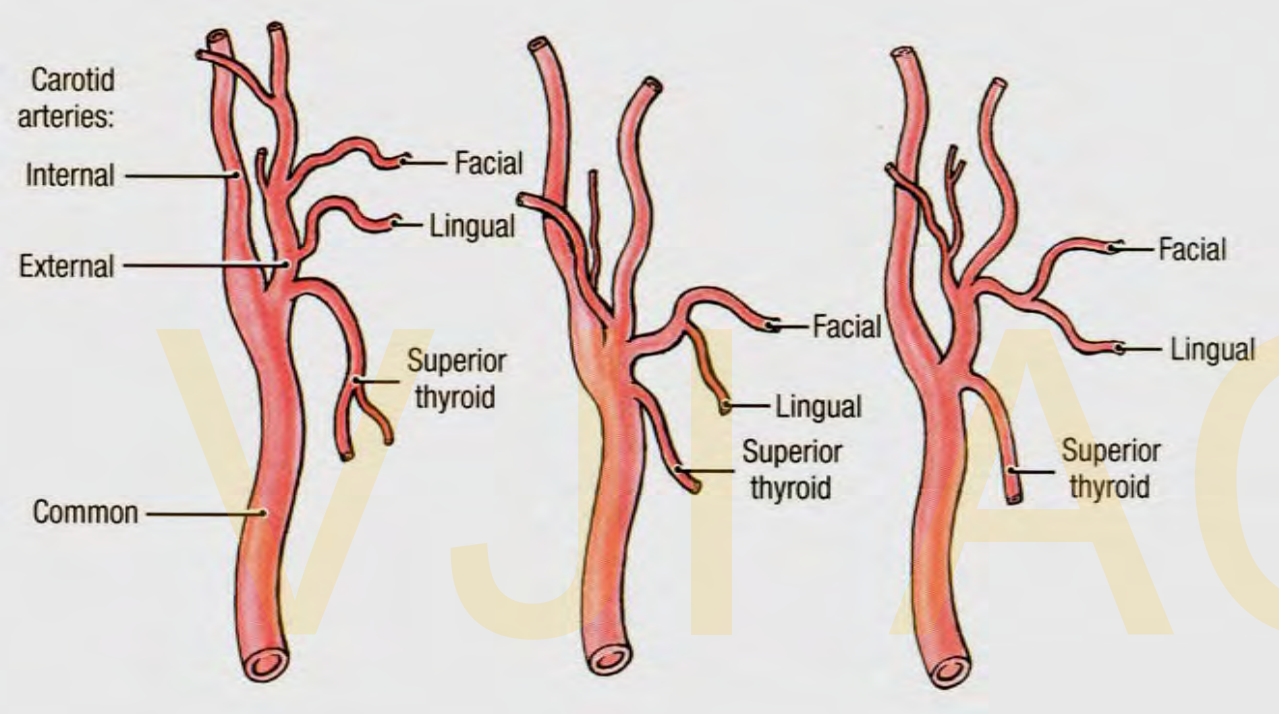
branches:

Temporalis superficialis, maxillaris, thyroidea sup., lingualis, pharyngea ascendens, auricularis posterior, occipitalis

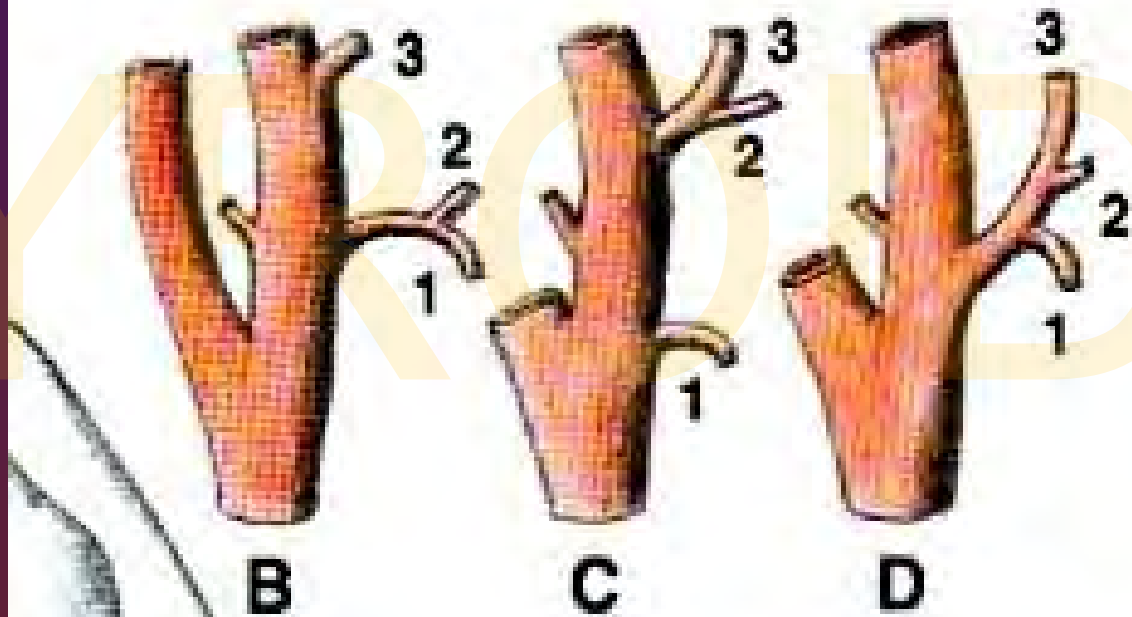


For full head instead of orbit, inner ear and brain





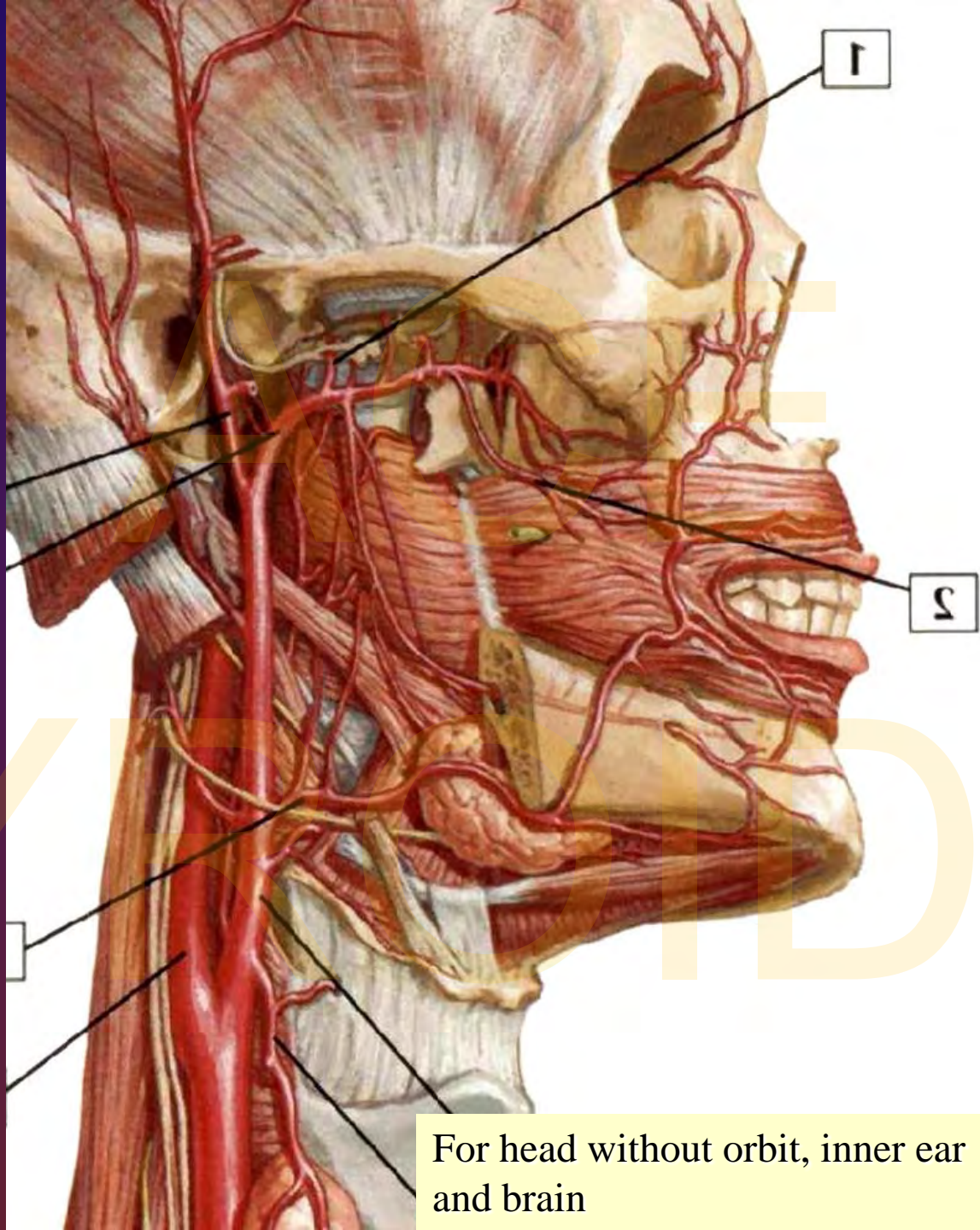
Variety Varieties



External carotid artery ECA

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

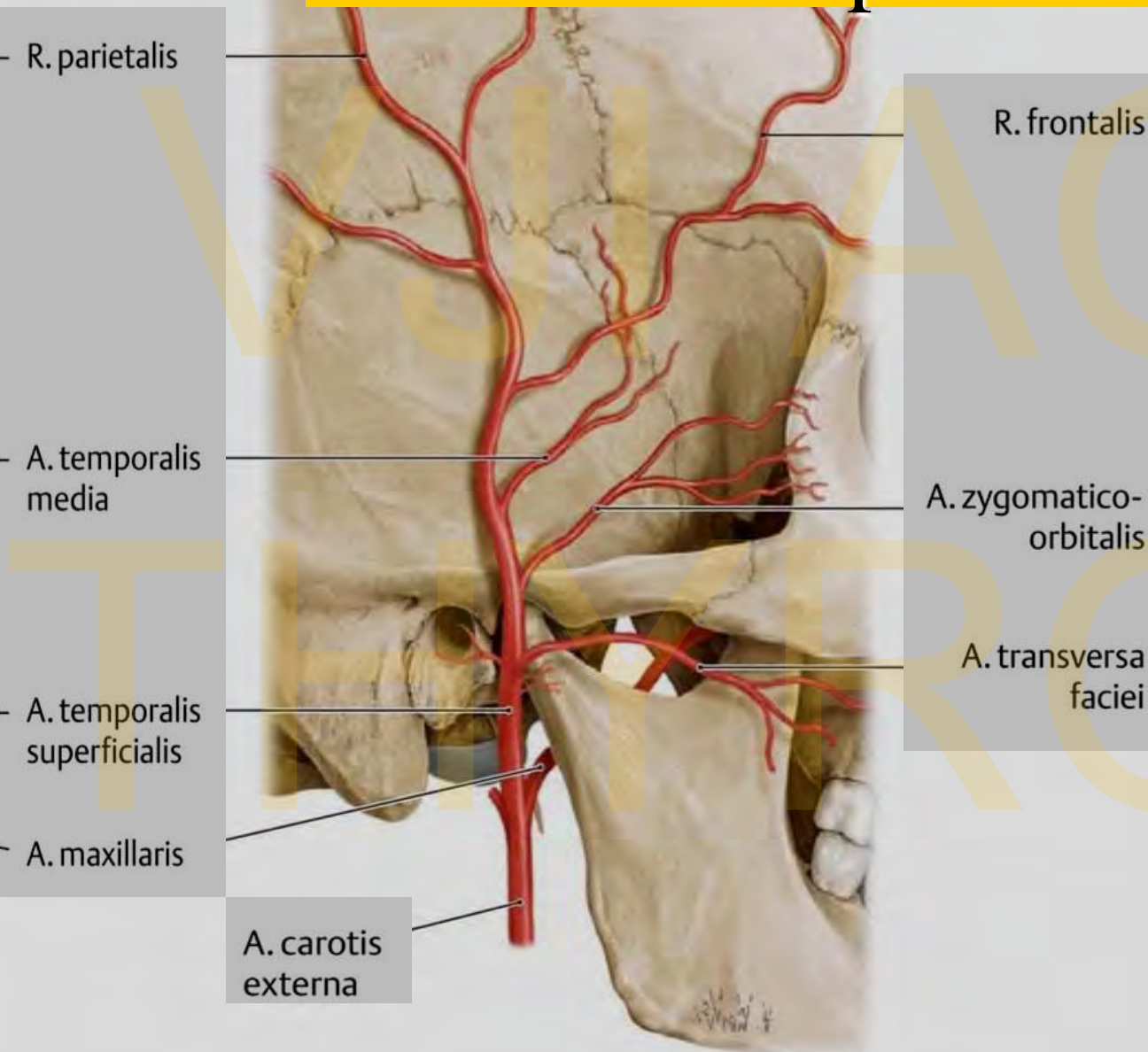
Medially – wall of the pharynx, internal carotid artery, stylopharyngeus, pharyngeal branch of the vagus



For head without orbit, inner ear and brain

Superficial temporal artery

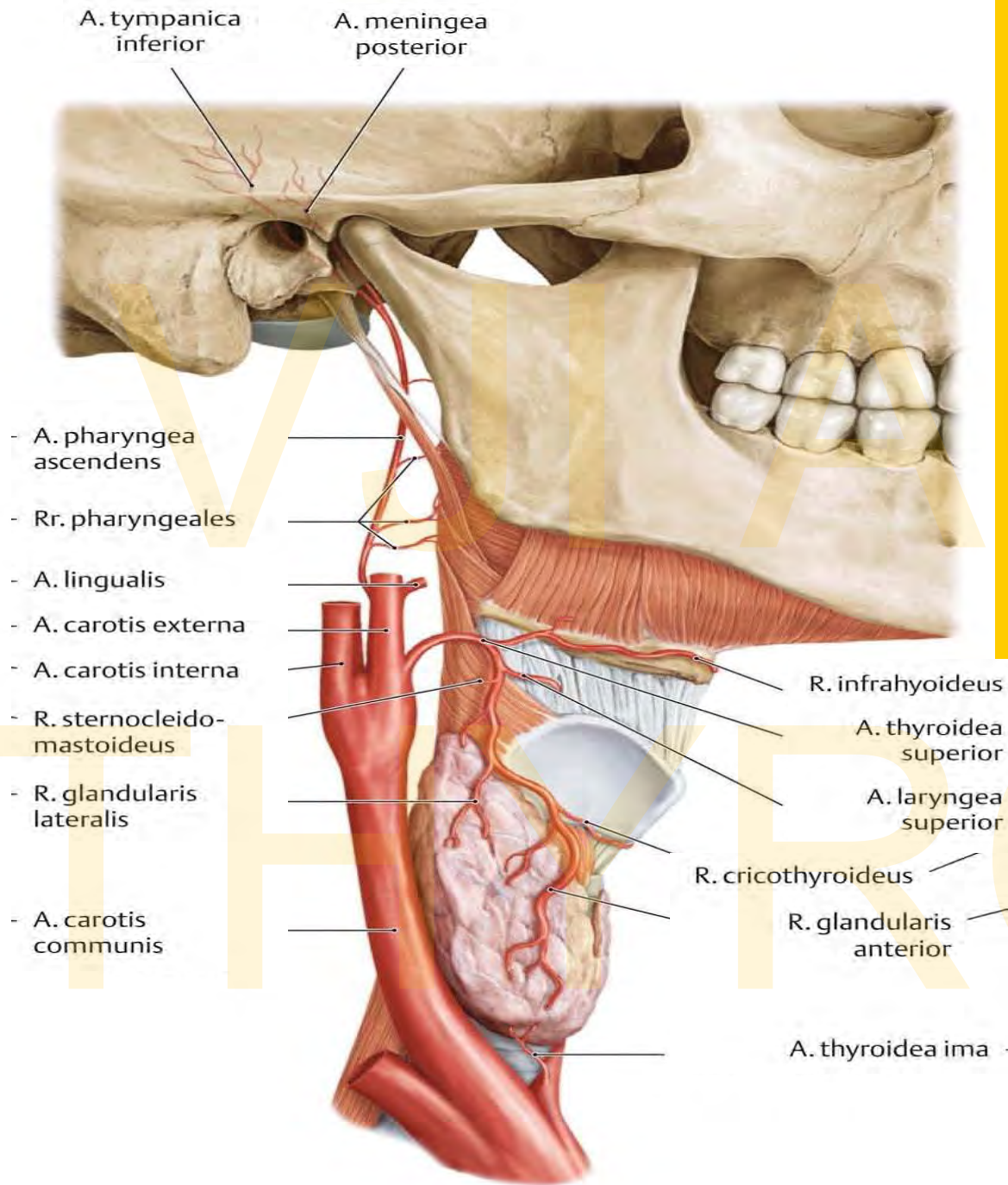
Arteria temporalis superficialis



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

Superior thyroid a., Arteria thyroidea superior

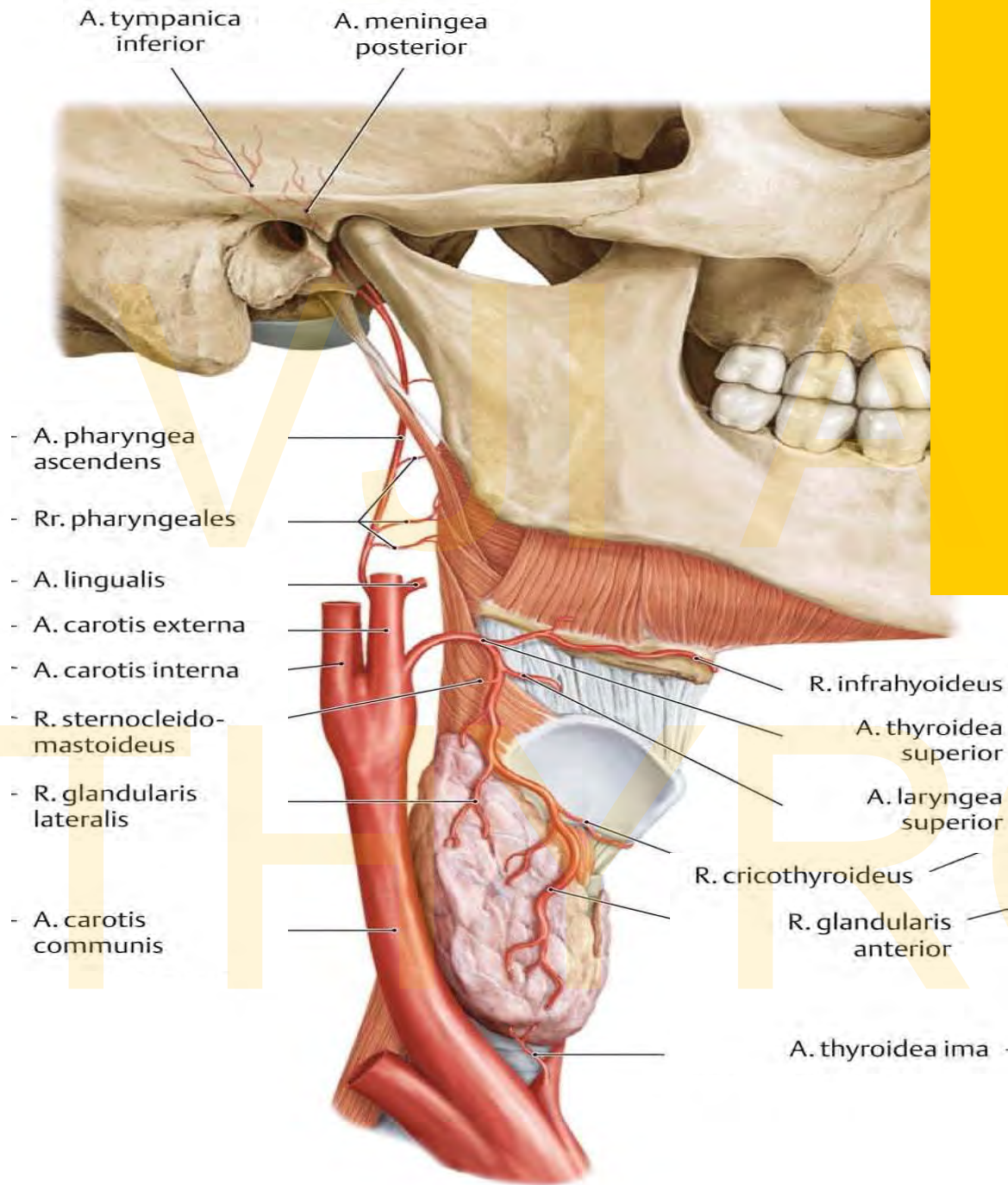


For thyroid gland;
Ventral branch anastomoses
with the same contralateral
opposite artery ;
Dorsal branch anastomoses
with inferior thyroid a.,

- glandular branches
- superior laryngeal a.,
muscular branches

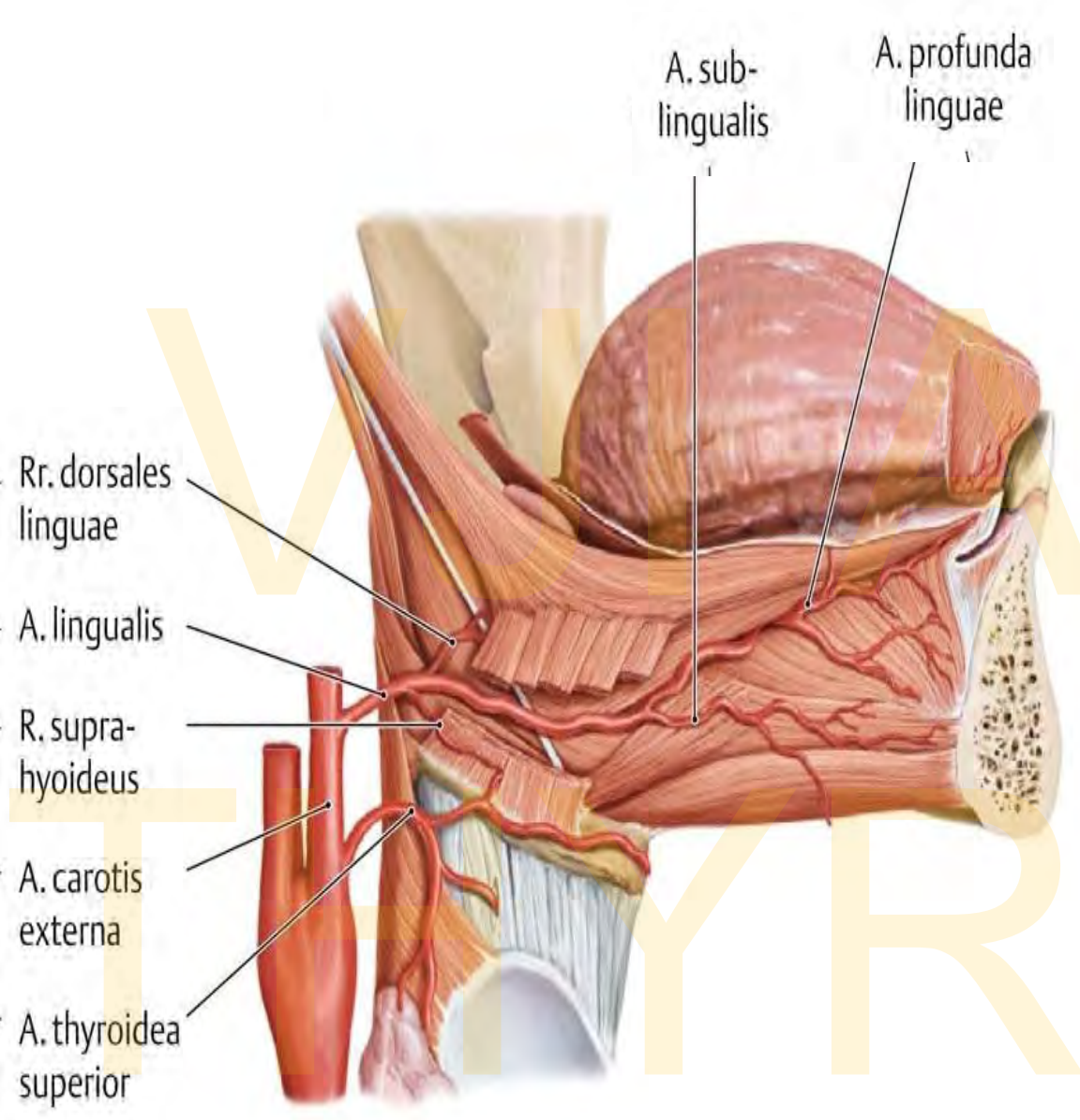
Superior pharyngeal a.,

Arteria pharyngea ascendens



The very thin artery, supplies pharynx

- pharyngeal branches (for truncus sympathicus, vagus, n. hypoglossus and pharynx)
- Meningeal branches (for dura mater)
- inferior tympanic artery (for tympanic cavity)



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)

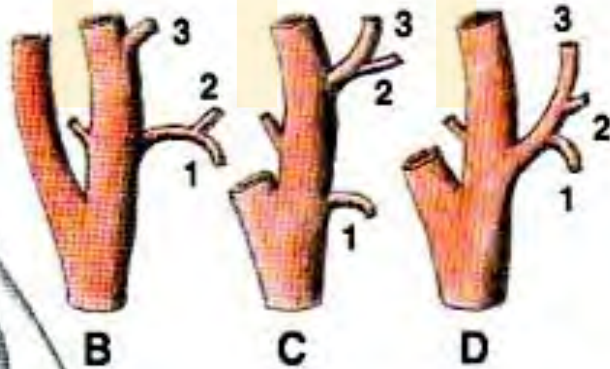
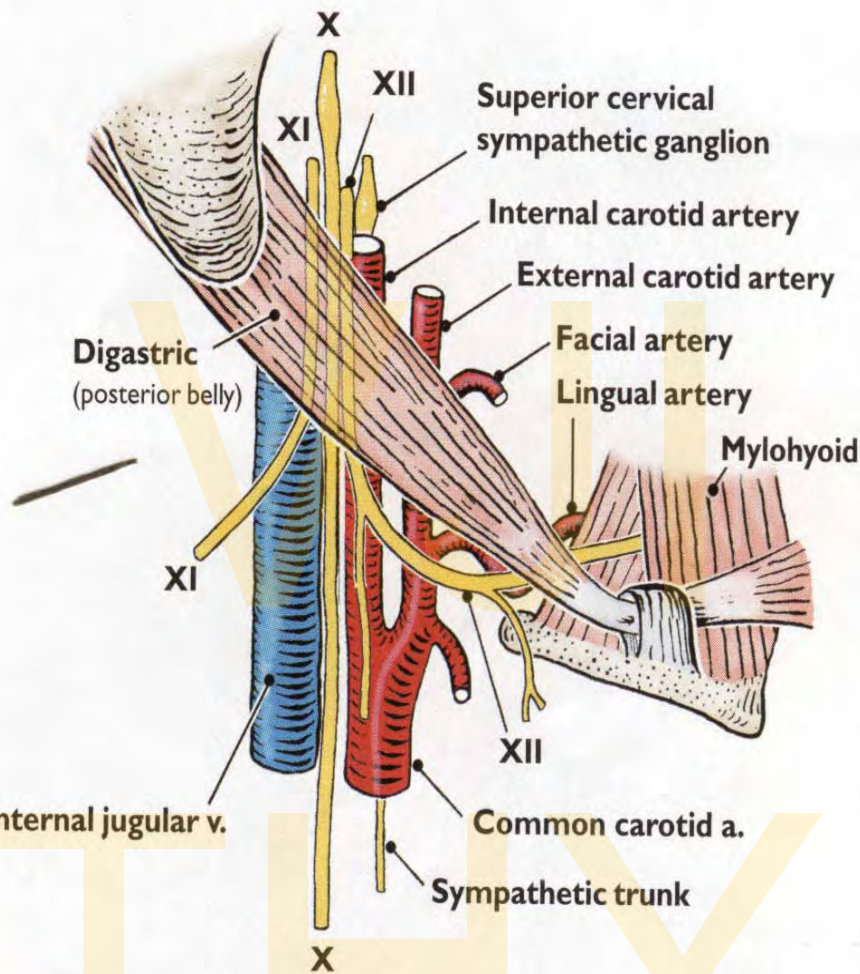
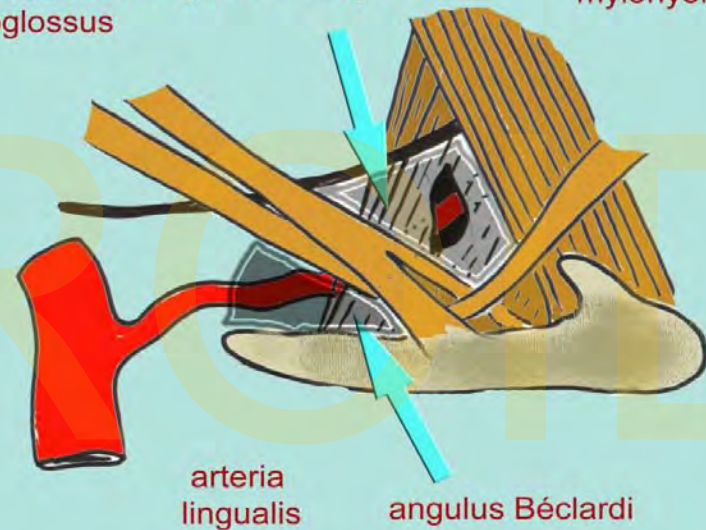
Arteria lingualis - inside paralingual canal (canalis paralingualis)

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



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

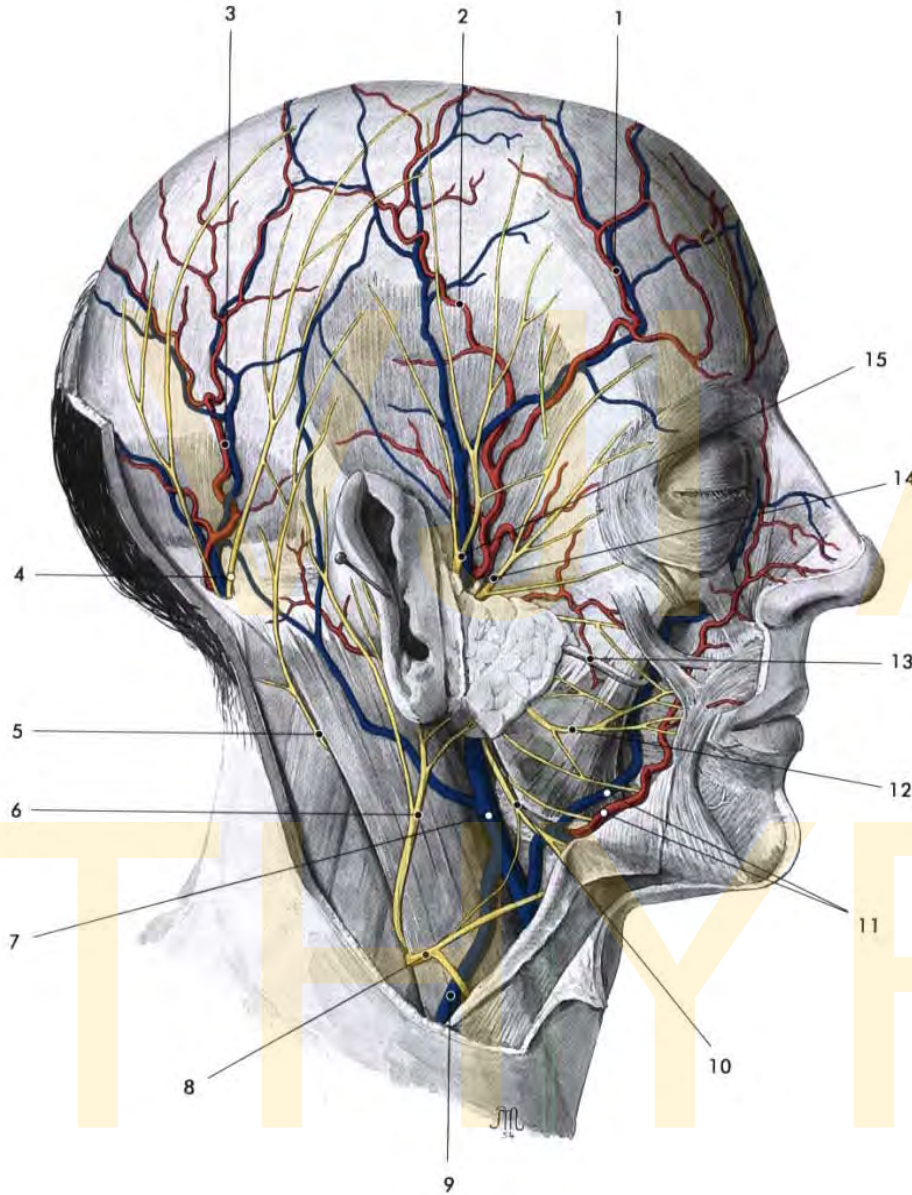
nervus tetragonum Pirogovi
 hypoglossus musculus
 mylohyoideus



N. Pirogov

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

Facial artery Arteria facialis



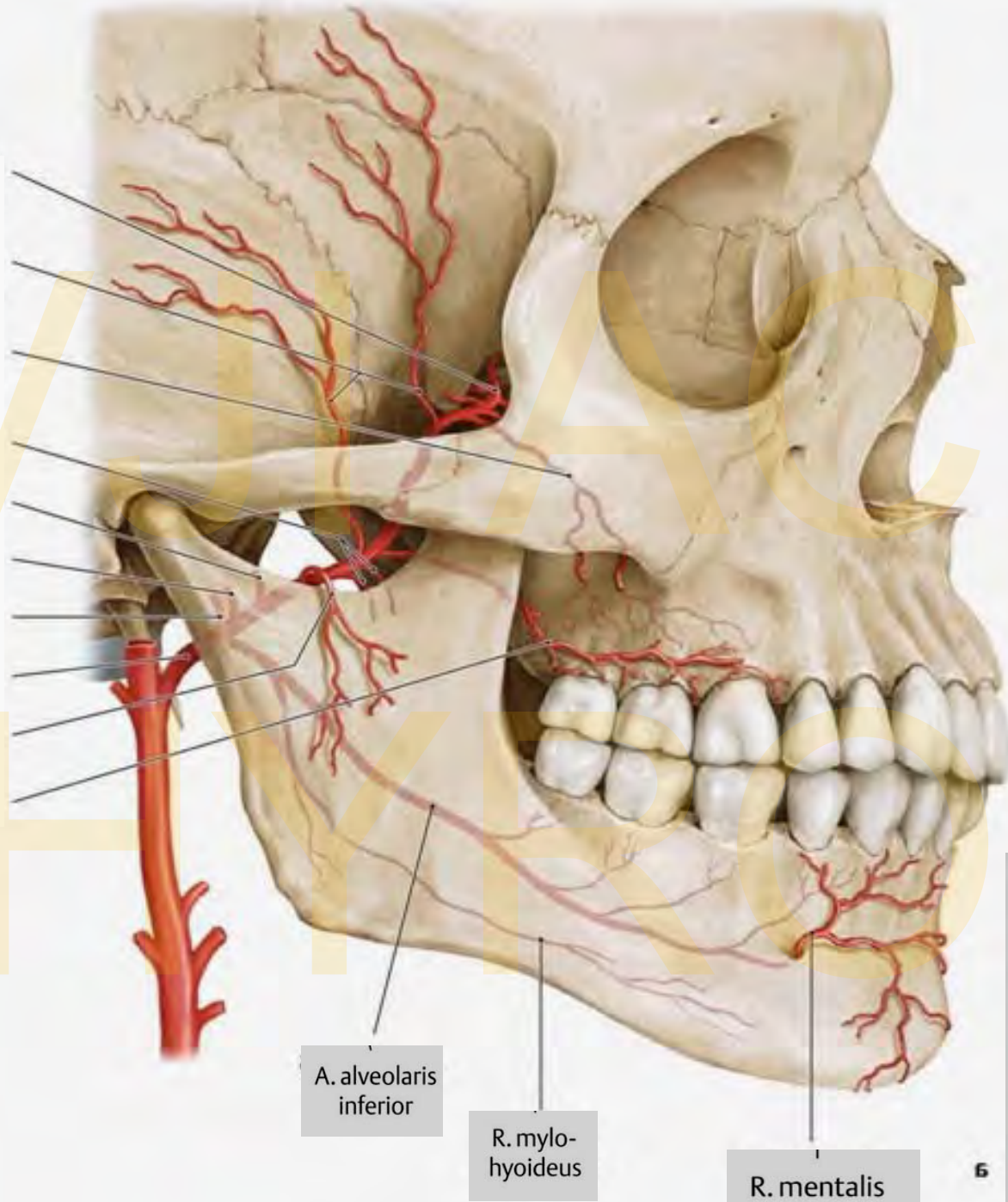
For neck and face;

- 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.

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

Arteria maxillaris – branches

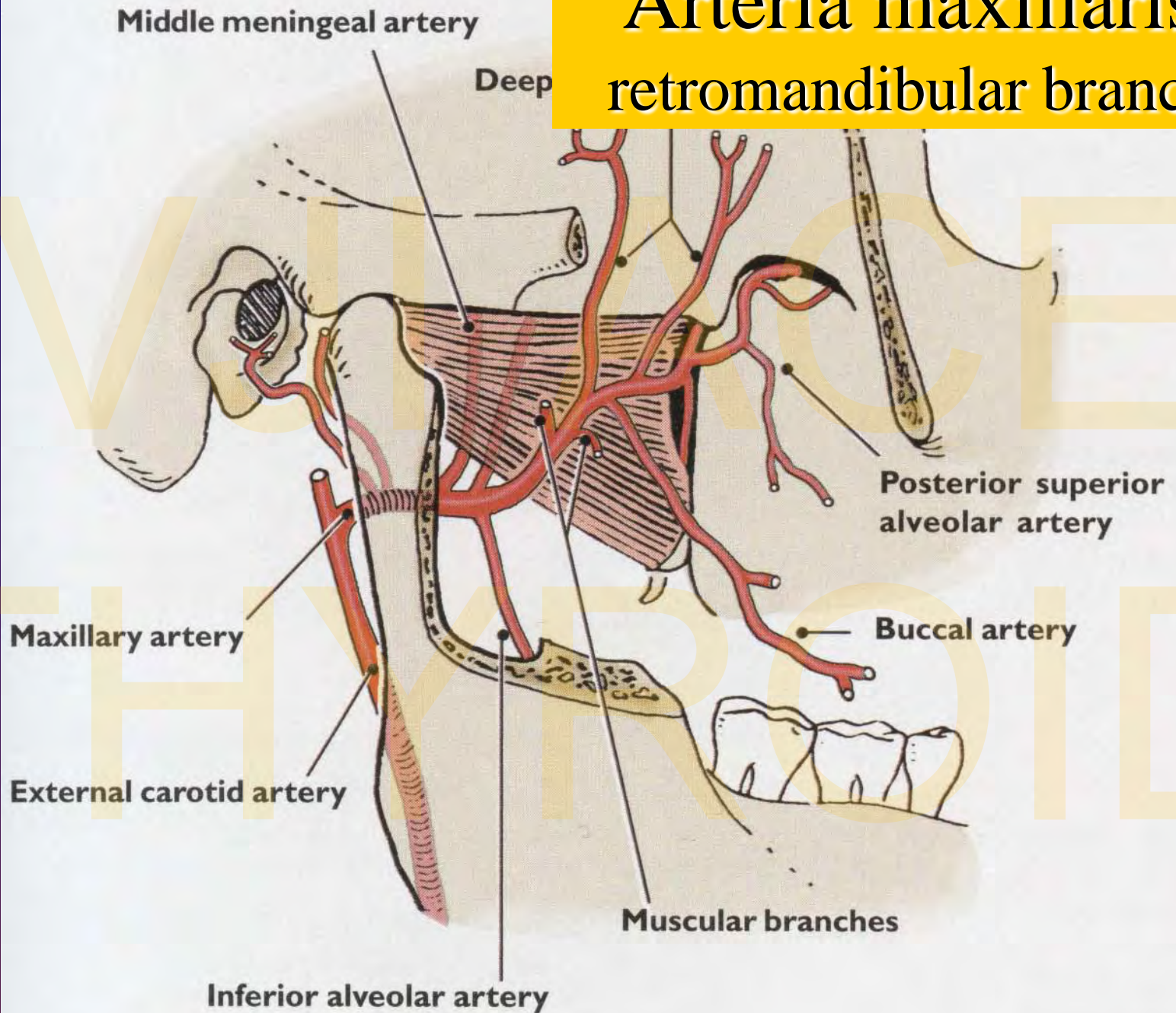
- A. sphenopalatina
- Aa. temporales profundae
- A. alveolaris superior posterior
- Rr. pterygoidei
- A. meningea media
- A. auricularis profunda
- A. tympanica anterior
- A. maxillaris
- A. masseterica
- A. buccalis



6

d

Arteria maxillaris – retromandibular branches



Arteria maxillaris – retromandibular part

A. sphenopalatina

Aa. temporales profundae

A. alveolaris superior posterior

Rr. pterygoidei

A. meningea media

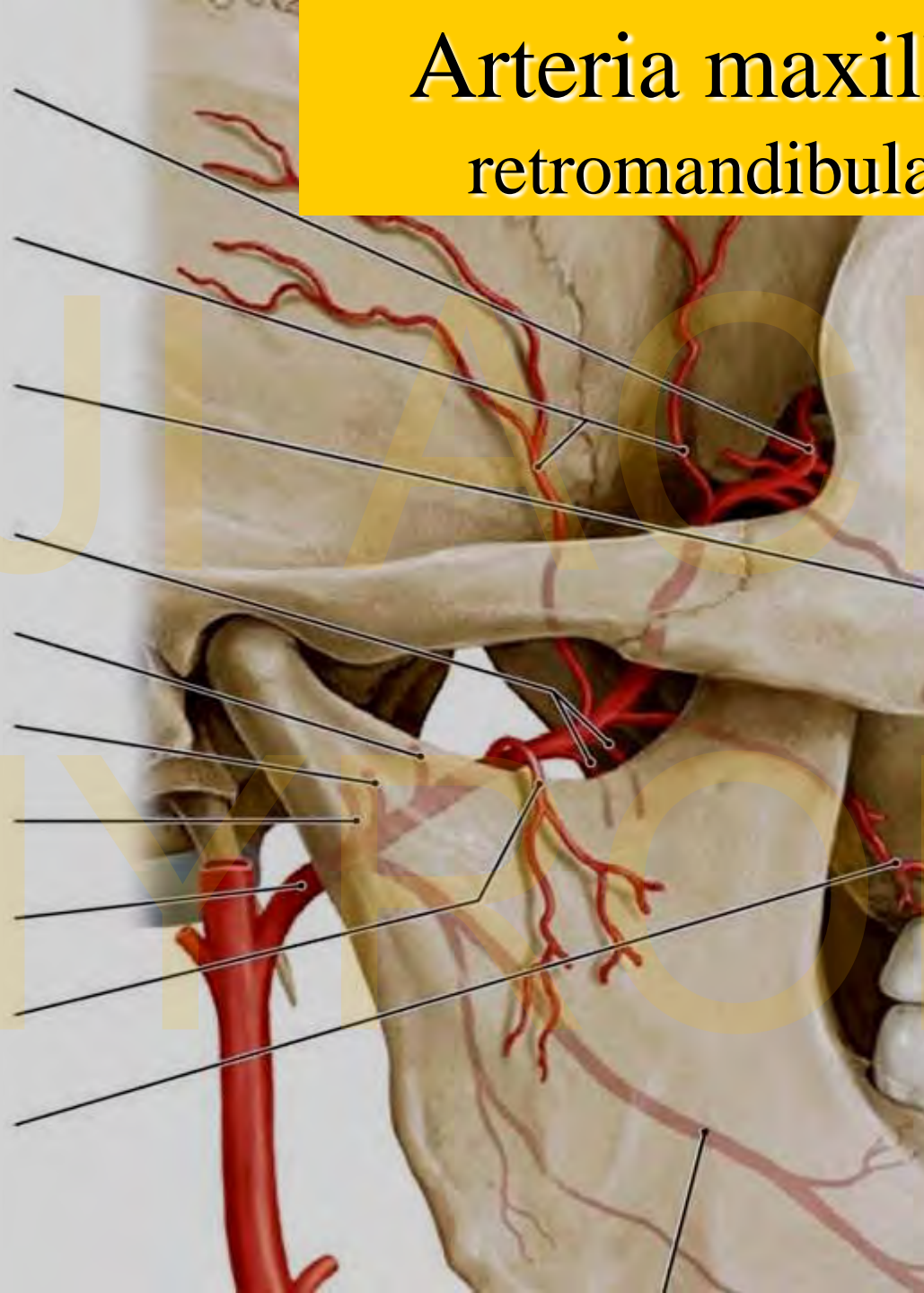
A. auricularis profunda

A. tympanica anterior

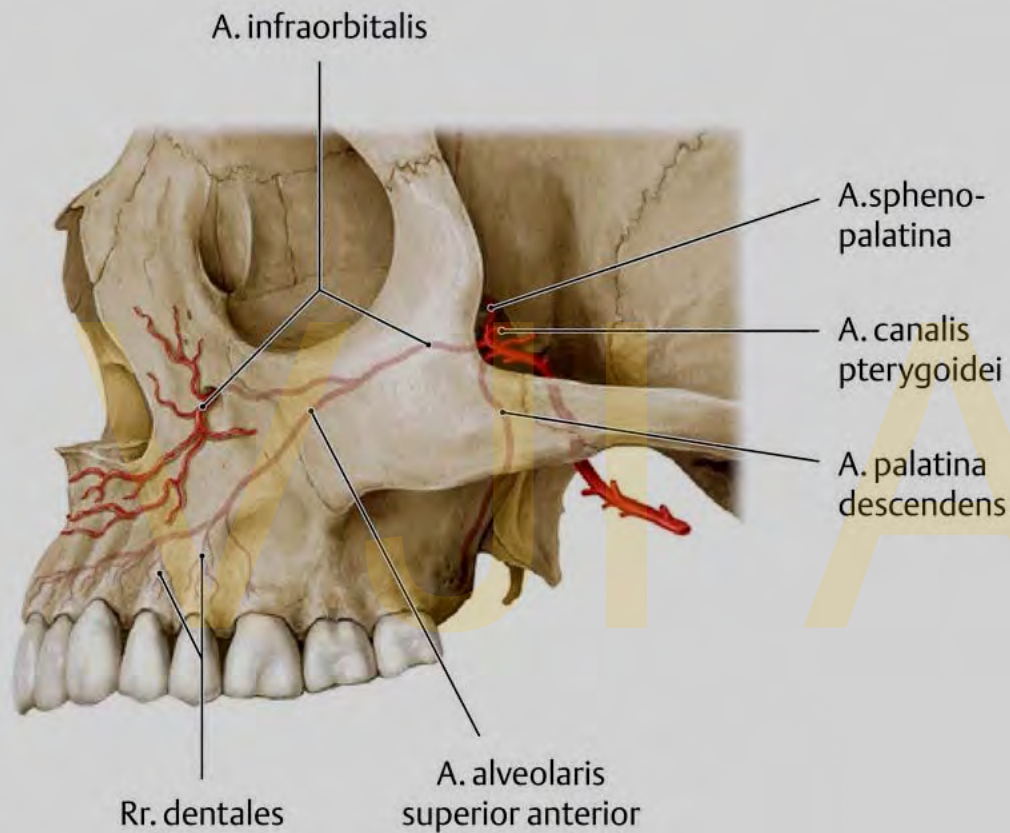
A. maxillaris

A. masseterica

A. buccalis

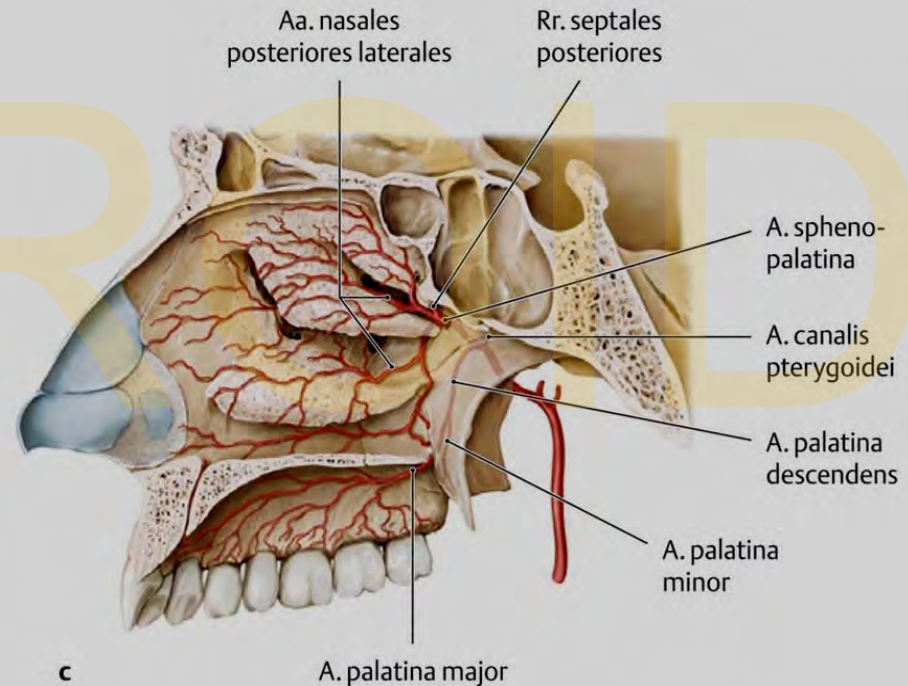


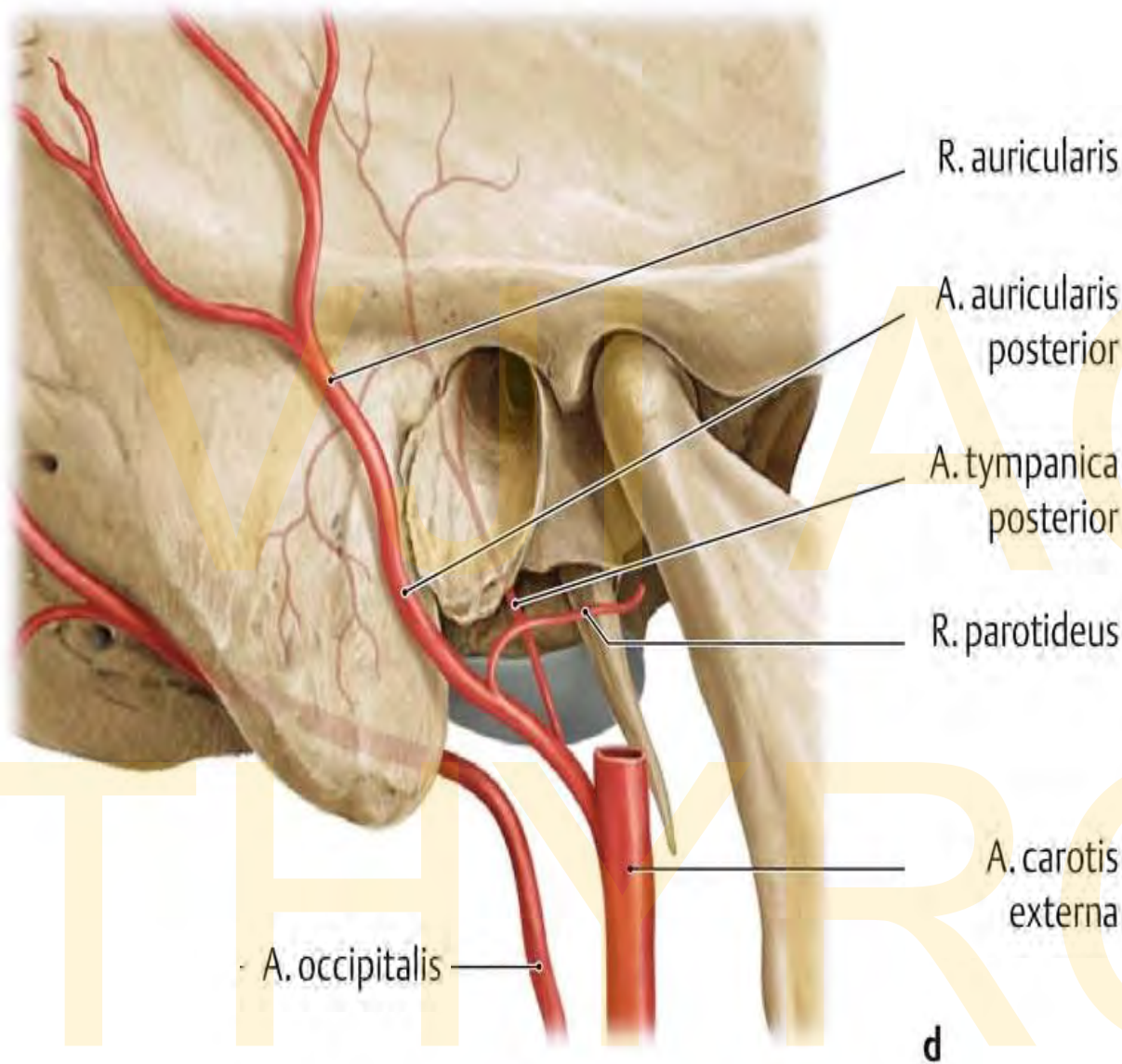
- a. auricularis profunda
- a. tympanica anterior
- a. meningea media
- a. alveolaris inferior



- 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





For soft meningeal membranes;

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

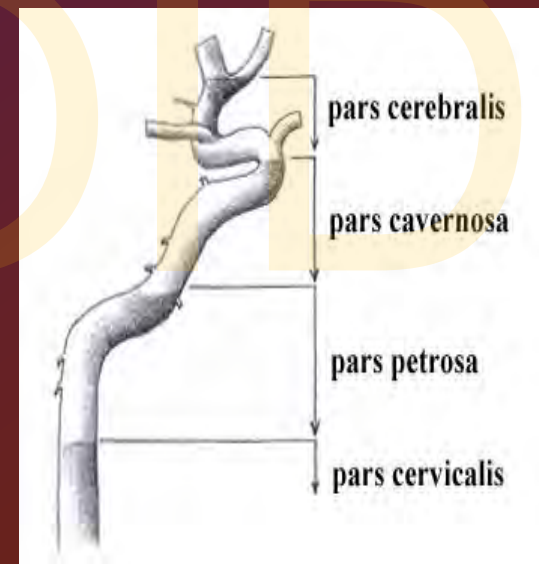
Internal carotid artery ICA

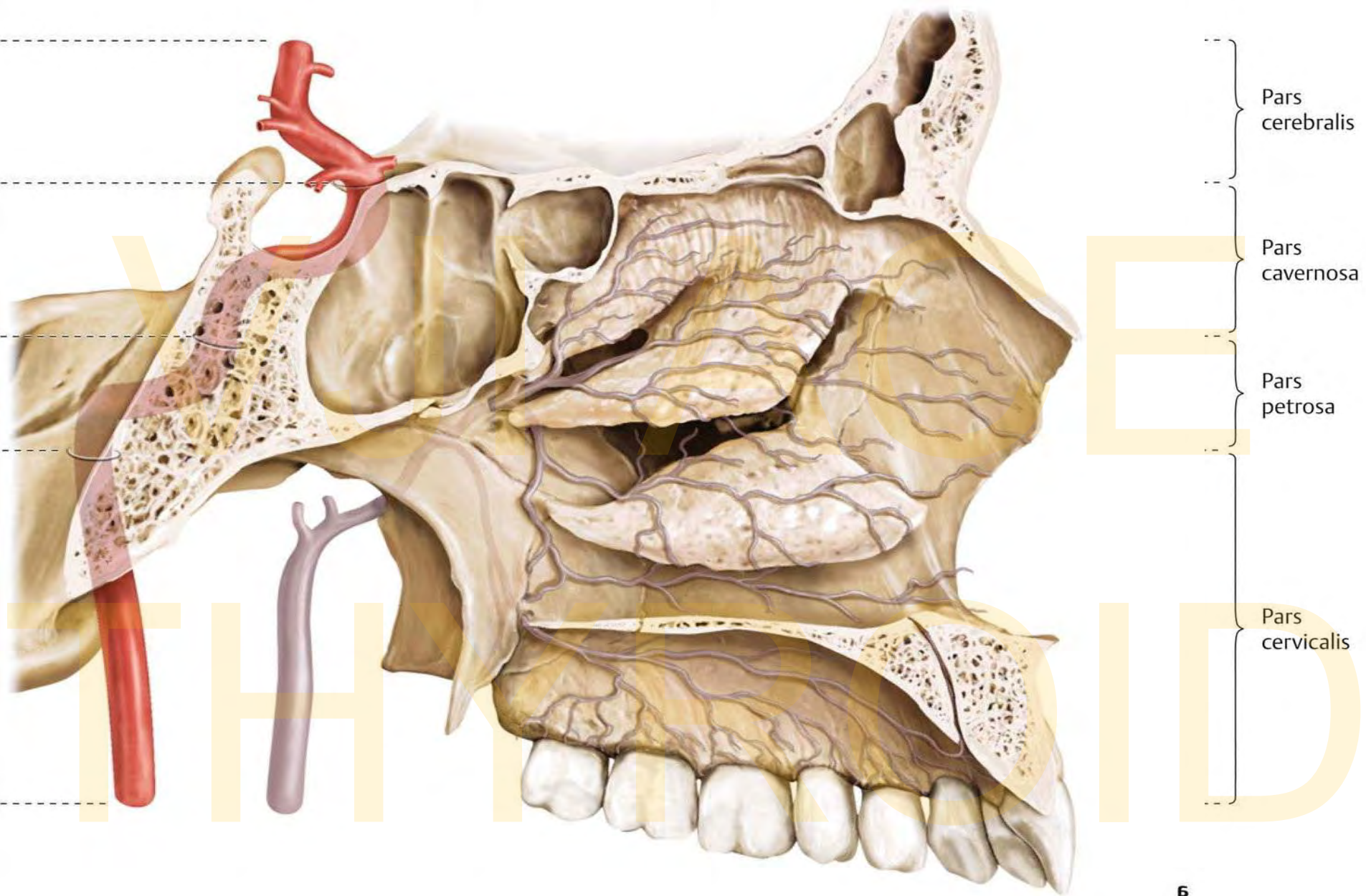
Carotic sinus (baroreceptor)

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

Carotic siphon

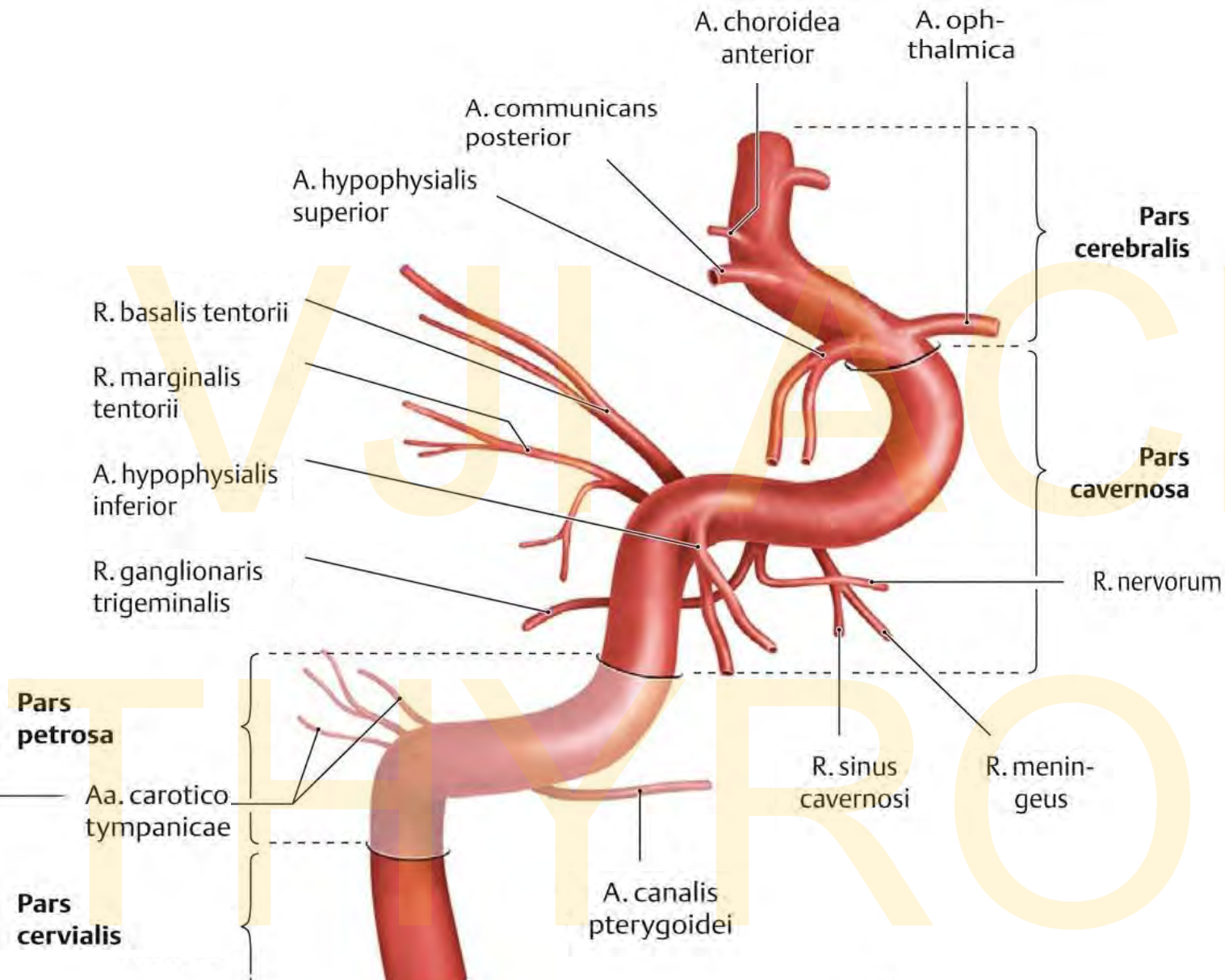
Willis circle (circulus arteriosus cerebri *Willisi*)





6

Internal carotid artery *Arteria carotis interna*



Internal carotid artery - intracranial branches

Internal carotid artery ICA

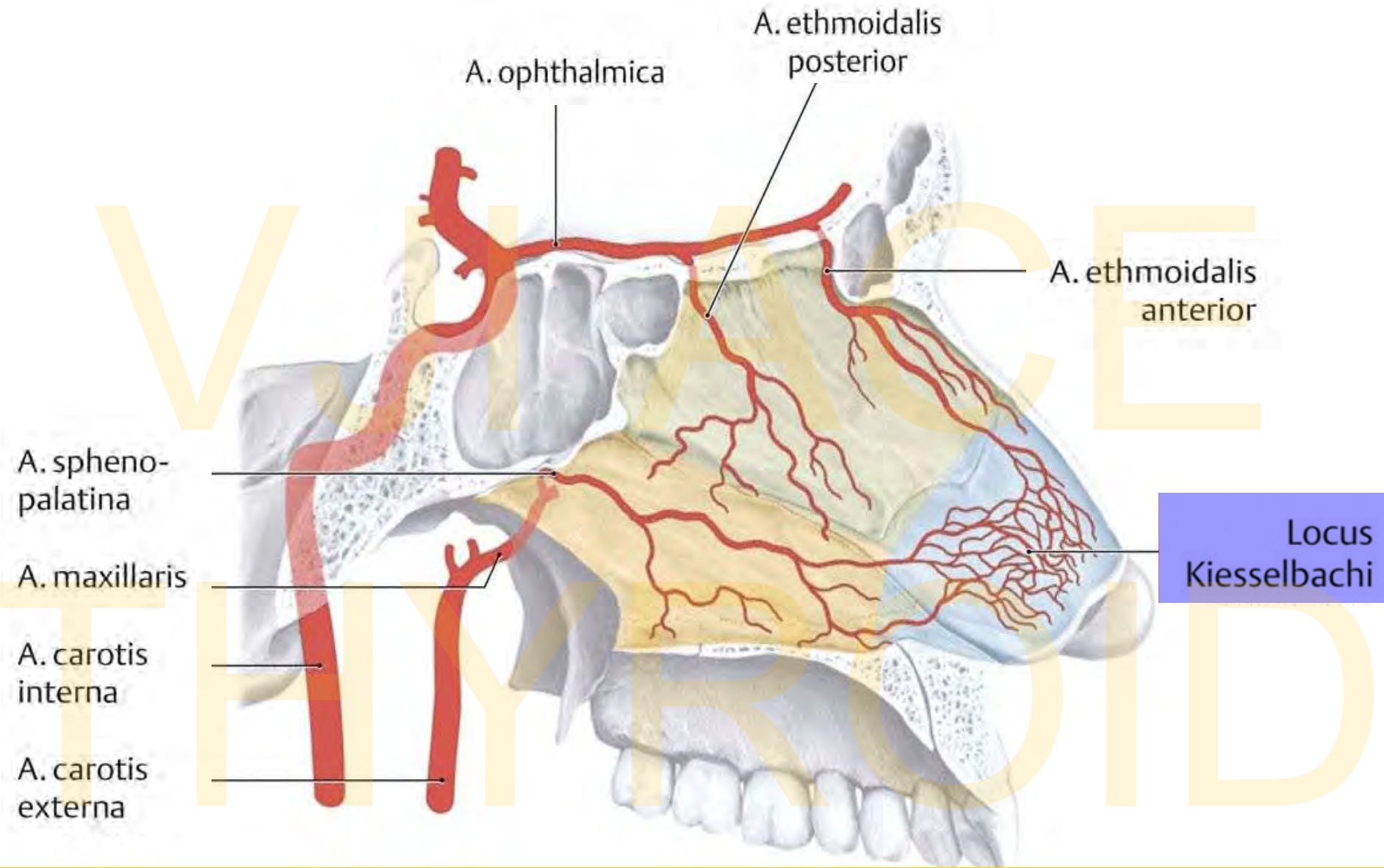
Anterolaterally – below the digastric lies XII. nerve, sternocleidomastoid muscle, fascia, skin

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

Posteriorly – sympathetic trunk, longus capitis muscle, transverse vertebral process

Medially – wall of the pharynx, superior laryngeal nerve

Laterally – internal jugular vein, X. nerve



ACI has anastomoses with maxillary artery in nasal septum

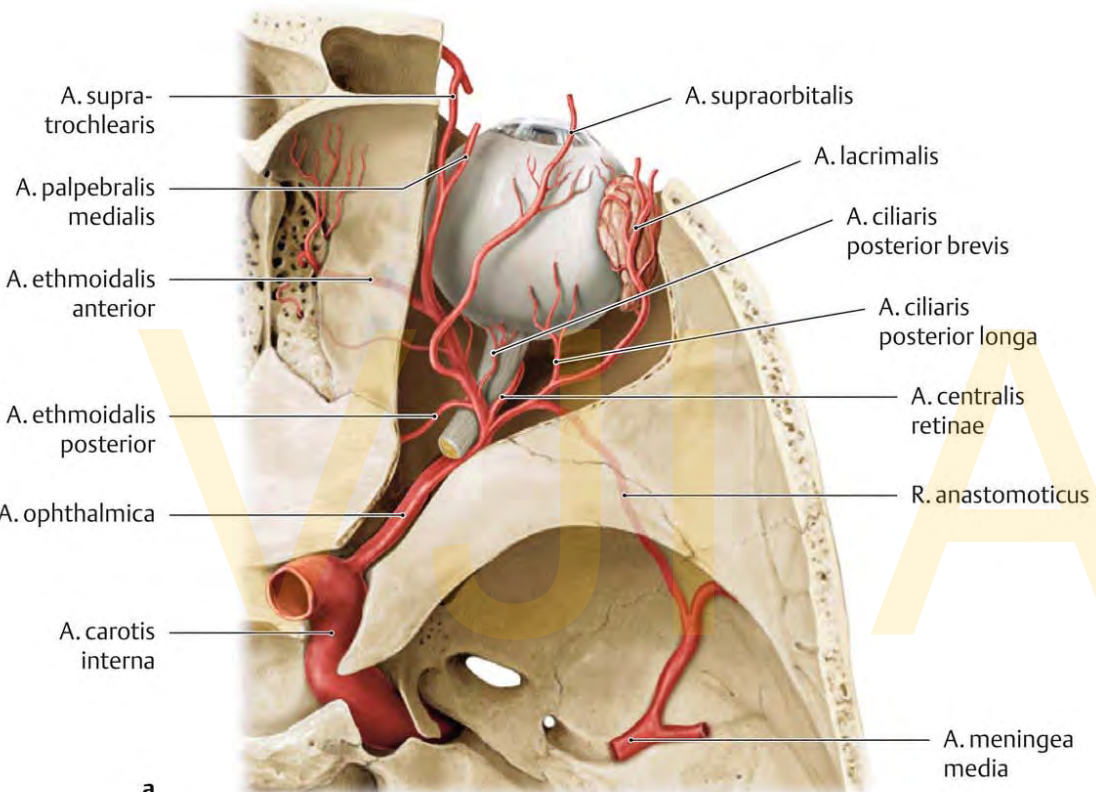
Willis' arterial cerebral circle

circulus arteriosus cerebri
Willisi



ophthalmic a.

Thomas Willis
(1621-1673),
an English
physician



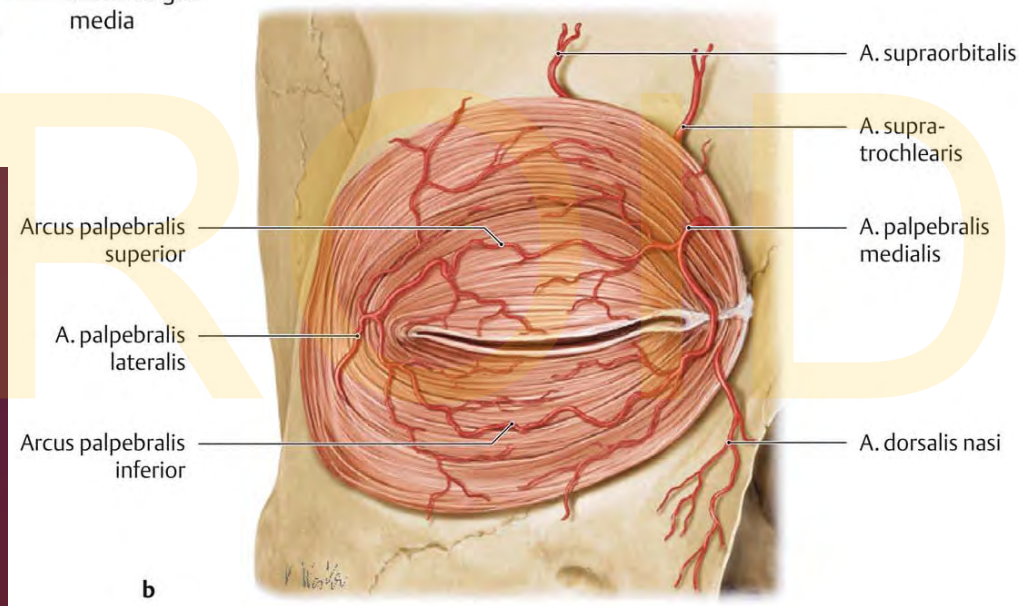
a



B A. ophthalmica

Ophtalmic artery

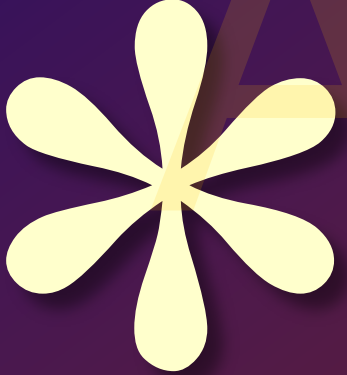
Arteria ophtalmica



b

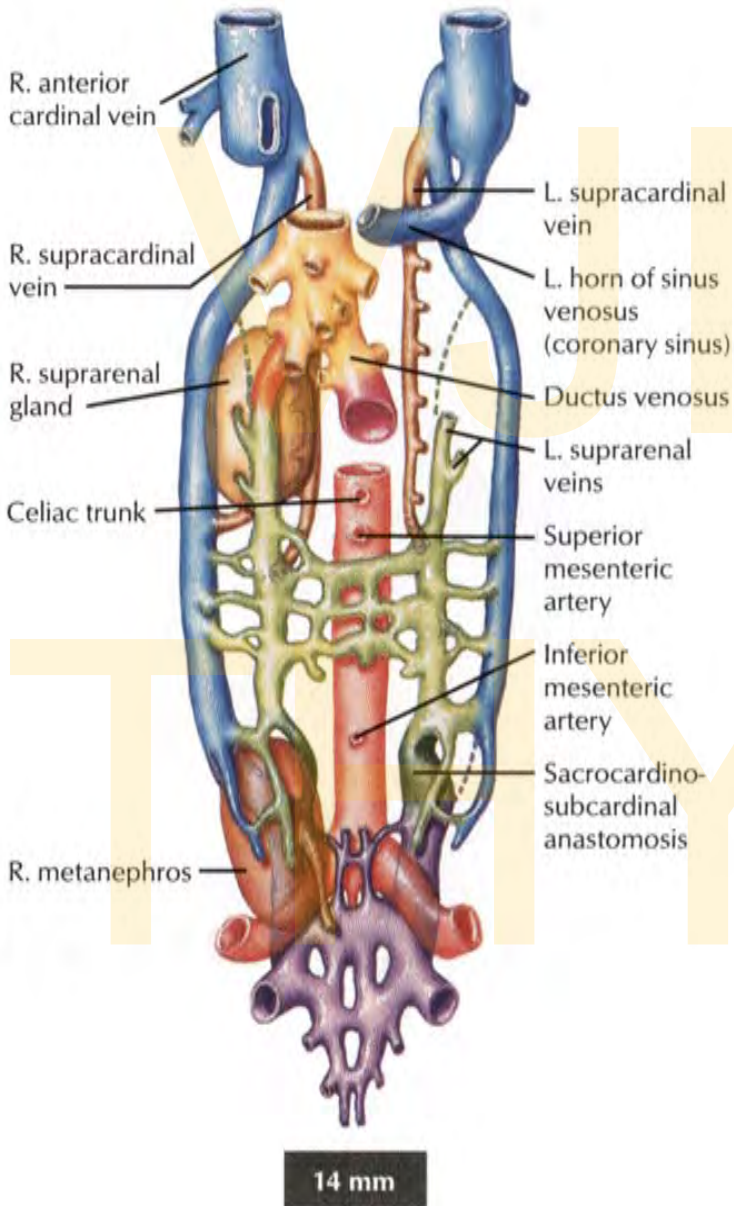
B A. ophthalmica

VJIACE

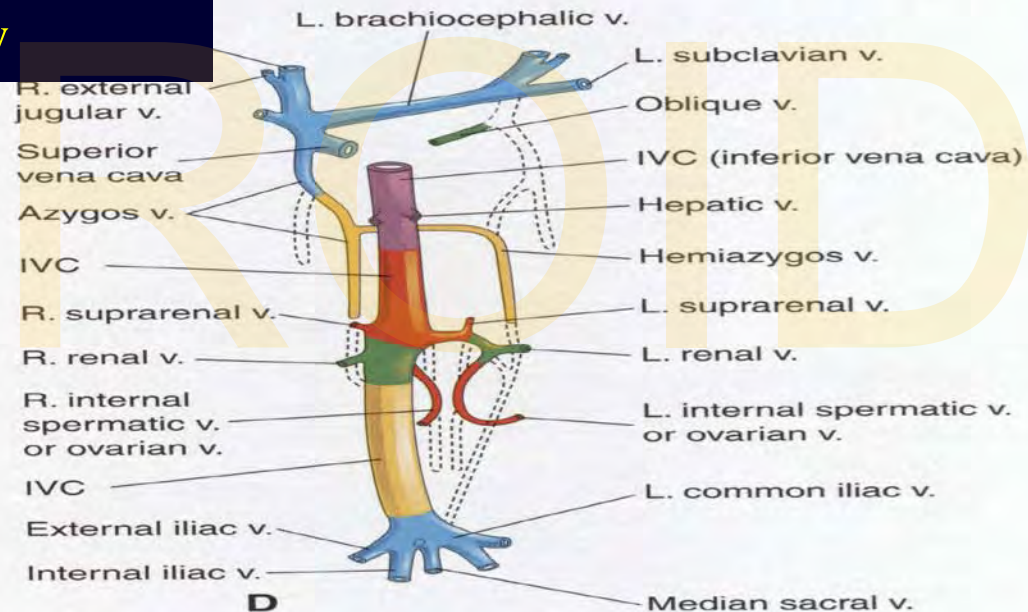
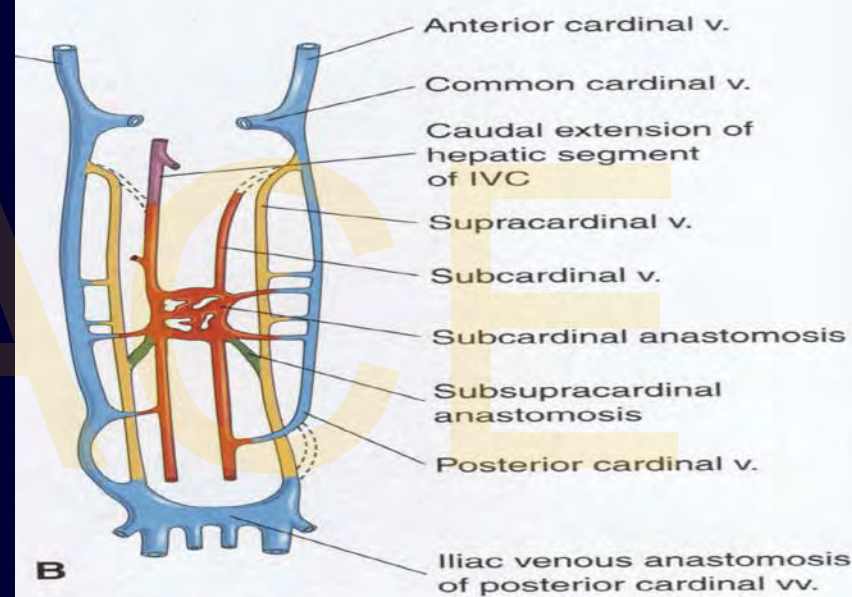


THYROID

Development of the venous system

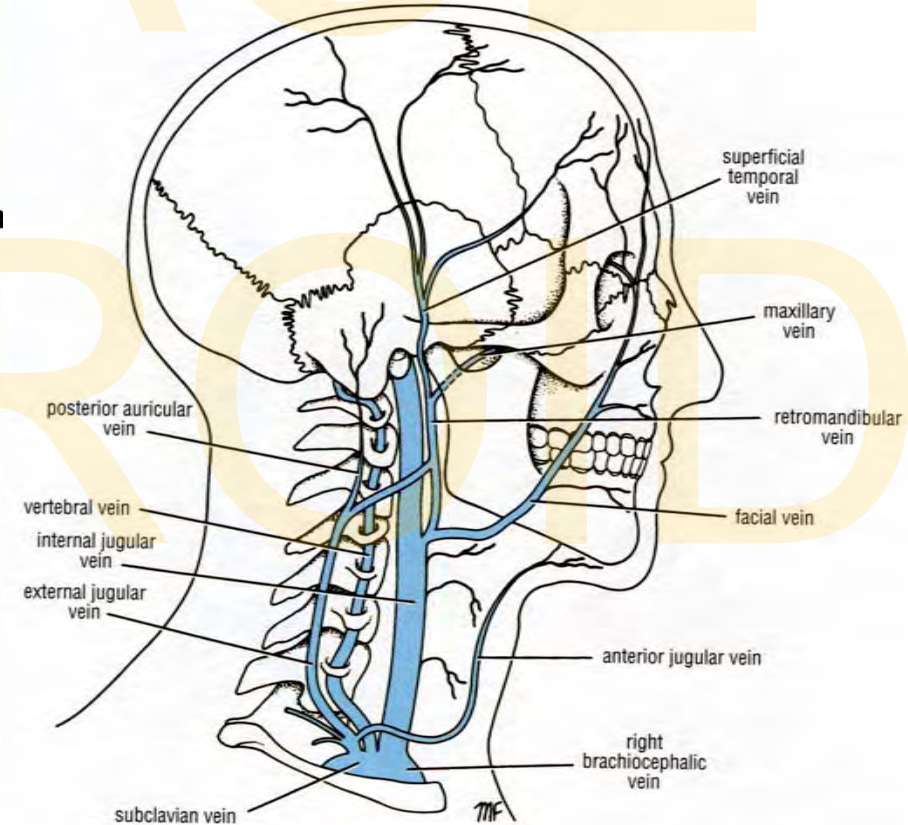
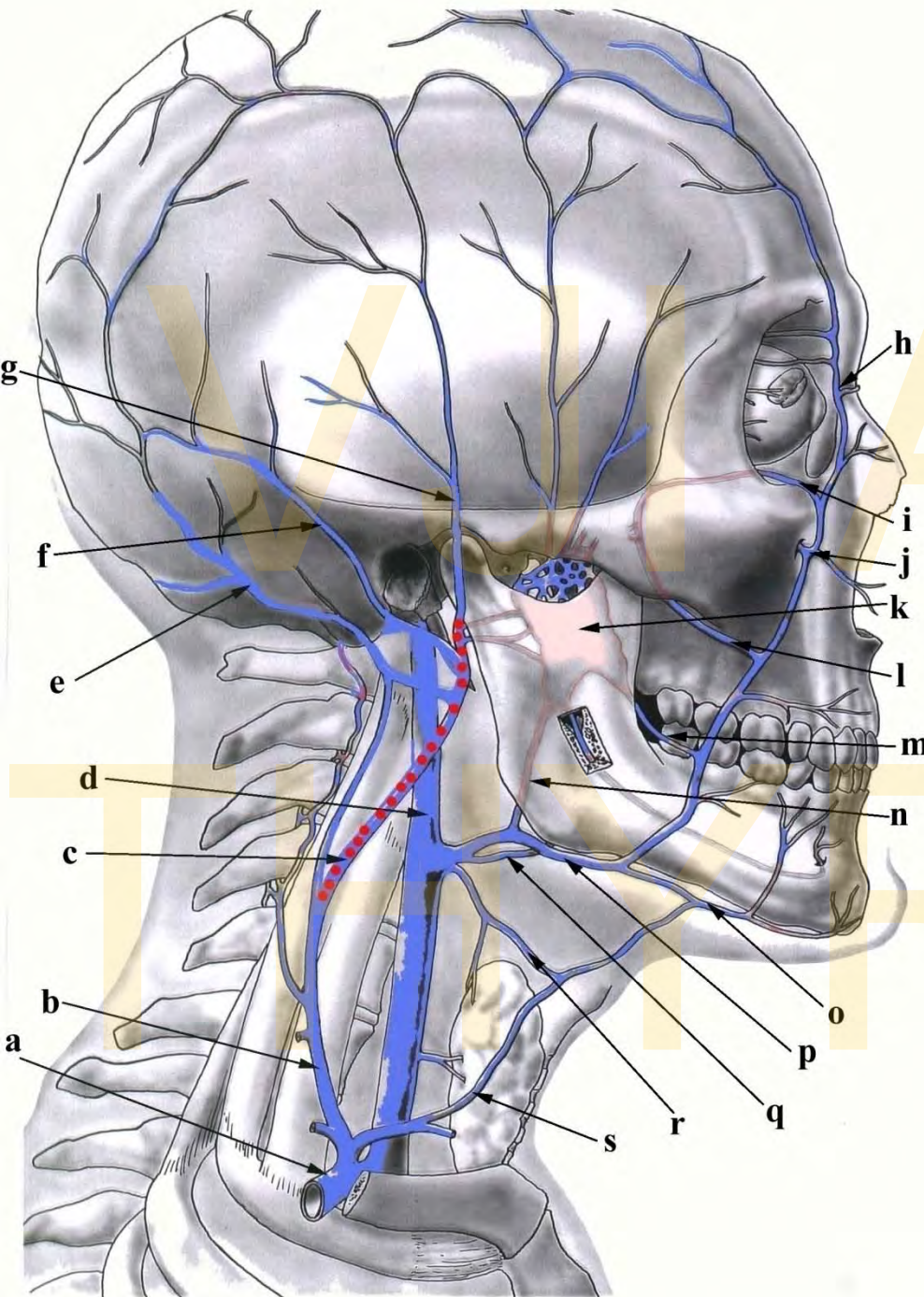


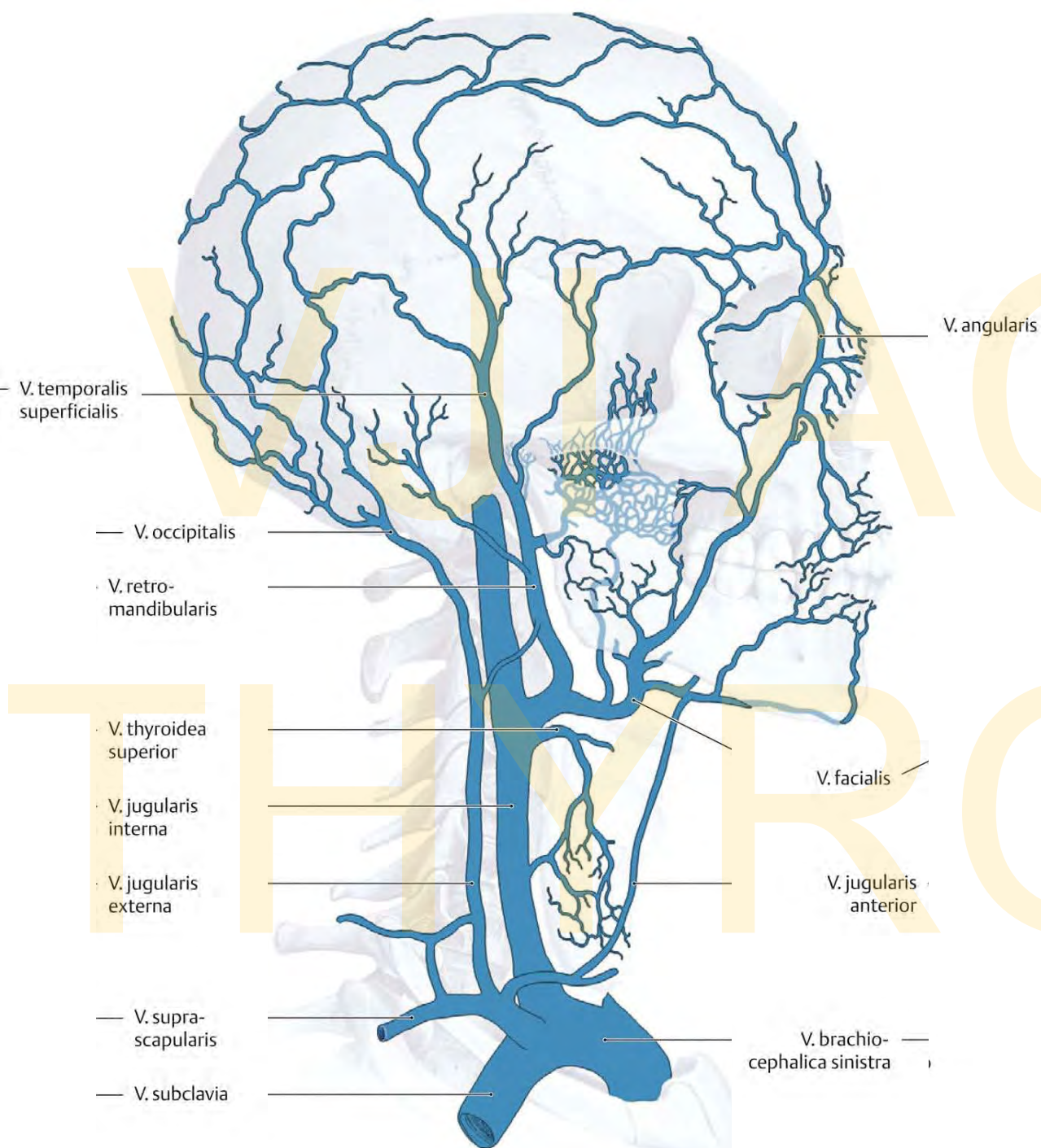
Umbilical veins from the chorion
Vitelline veins from the yolk sac
Cardinal veins from the embryonic body



Venae capitis et colli

Head and neck veins



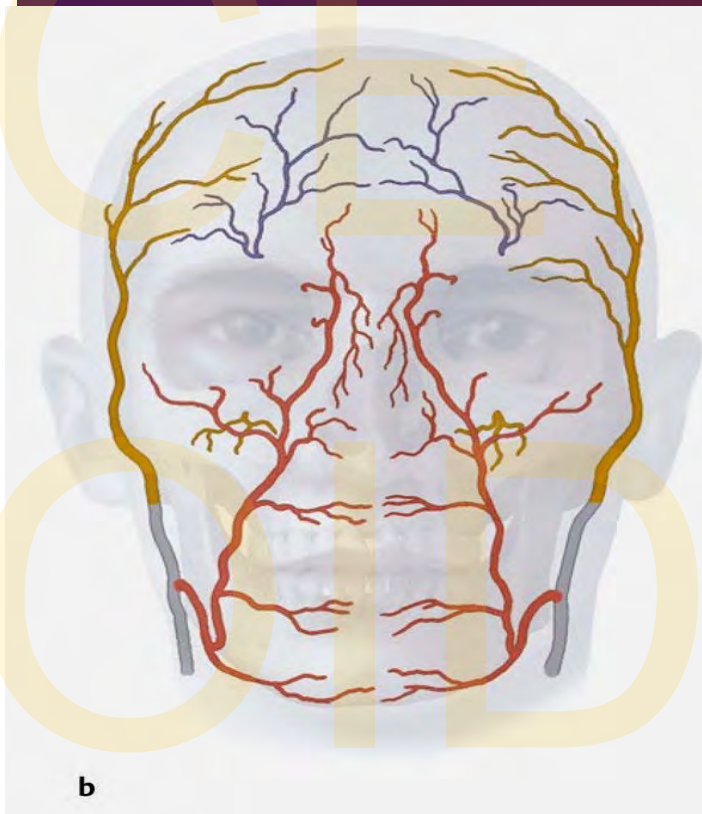
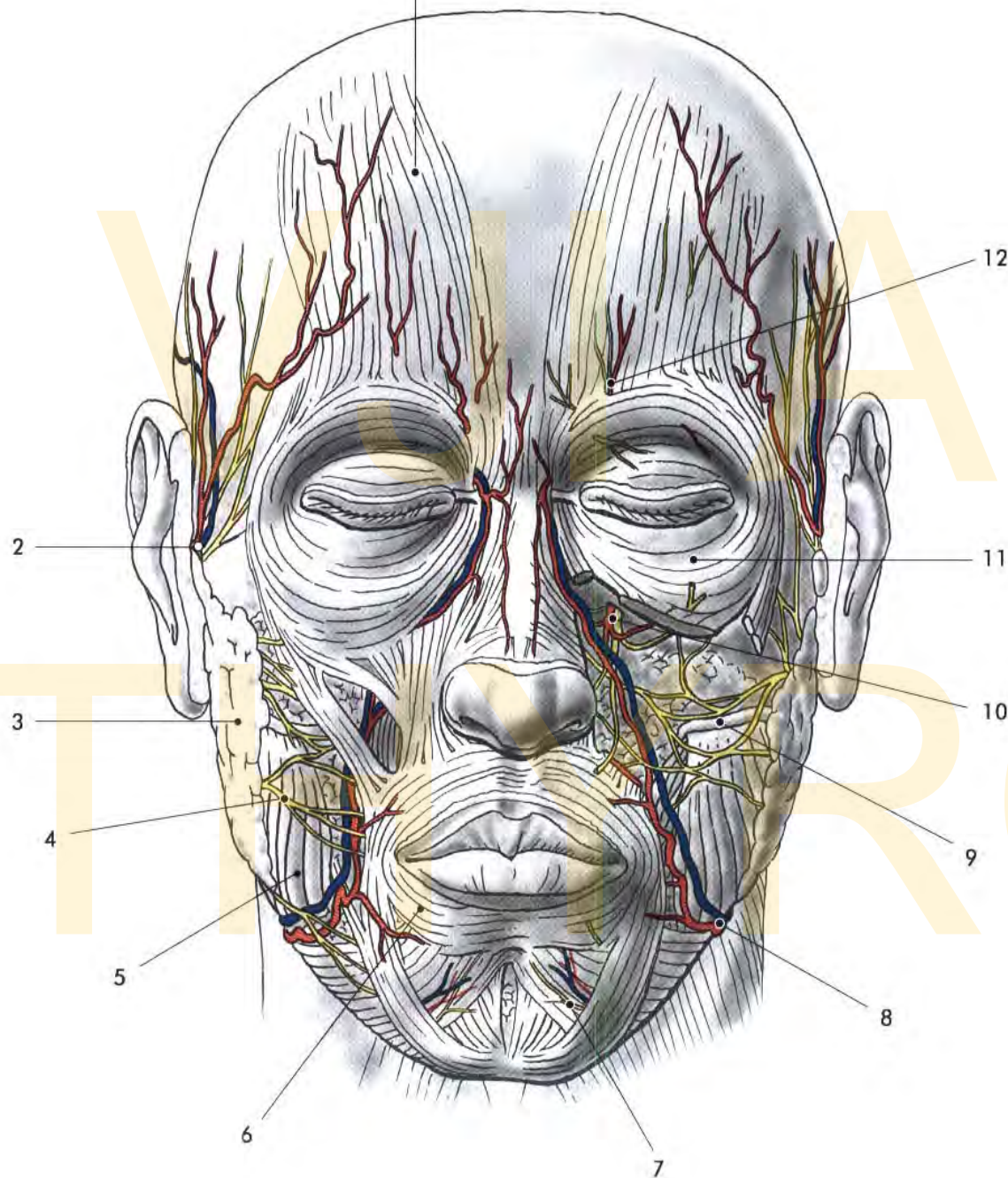


Superficial veins:
 external jugular,
 anterior jugular
 and branches

Deep veins
Venae
profundae:
 Pterygoid plexus
 Plexus
 pterygoideus
 Internal jugular

Facial vein

Vena facialis

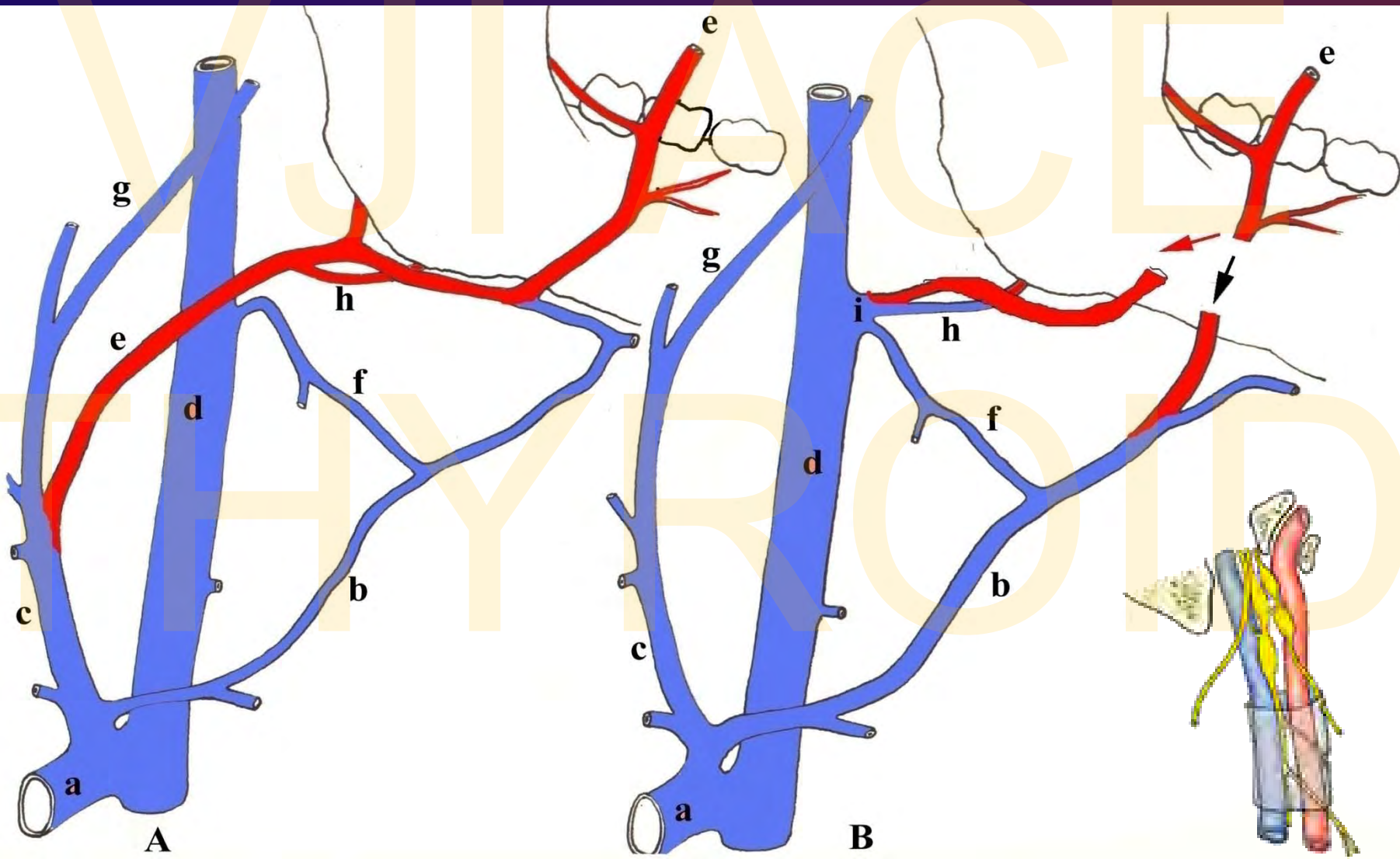


Vena facialis can be open to from:

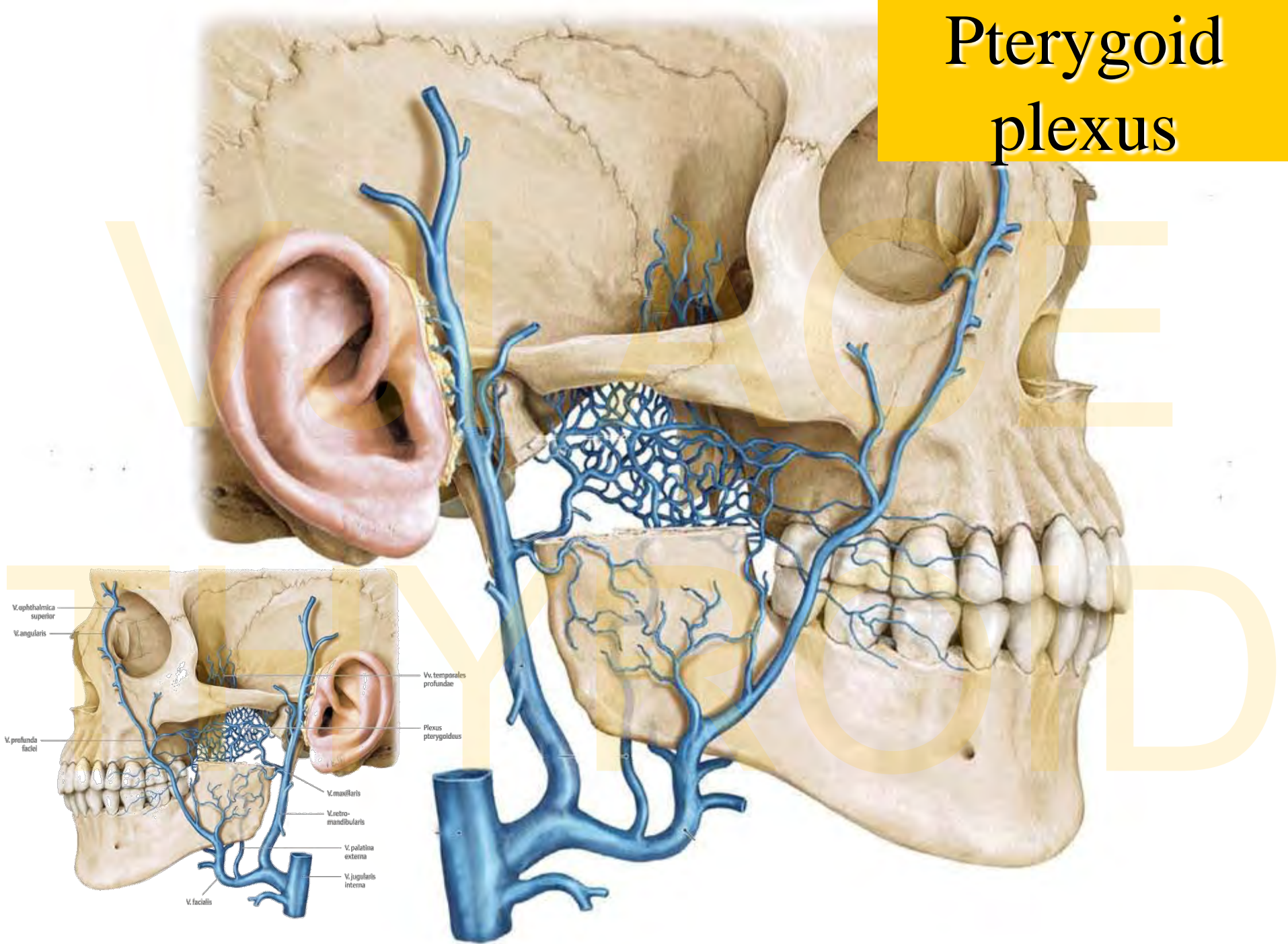
Vena jugularis externa

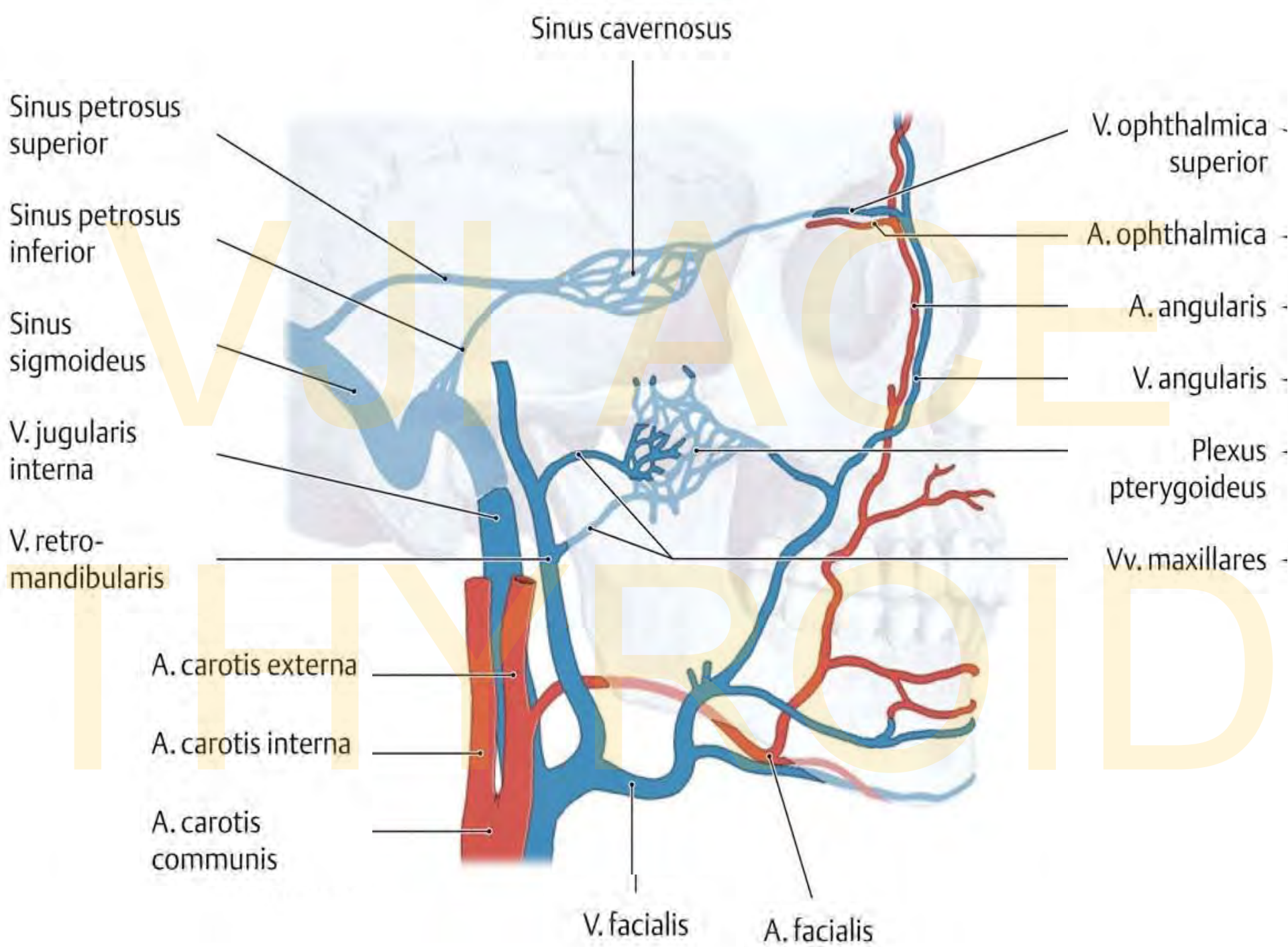
Vena jugularis interna

Vena jugularis anterior



Pterygoid plexus





Pterygoid venous plexus

and its tributaries:

n superior ophthalmic

p inferior ophthalmic

n infraorbital

vein to pterygoid plexus
(through foramen ovale –
rete)

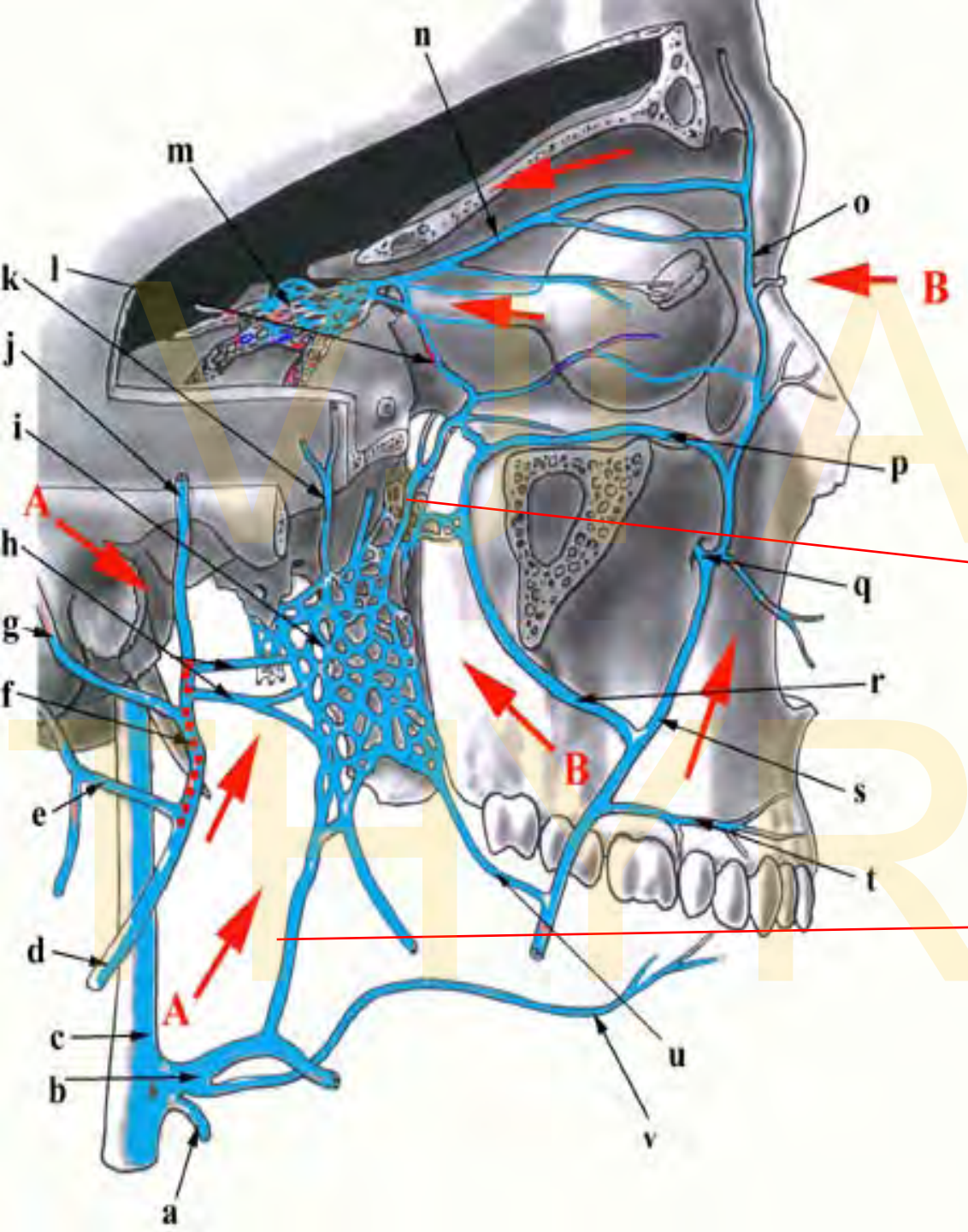
r deep facial

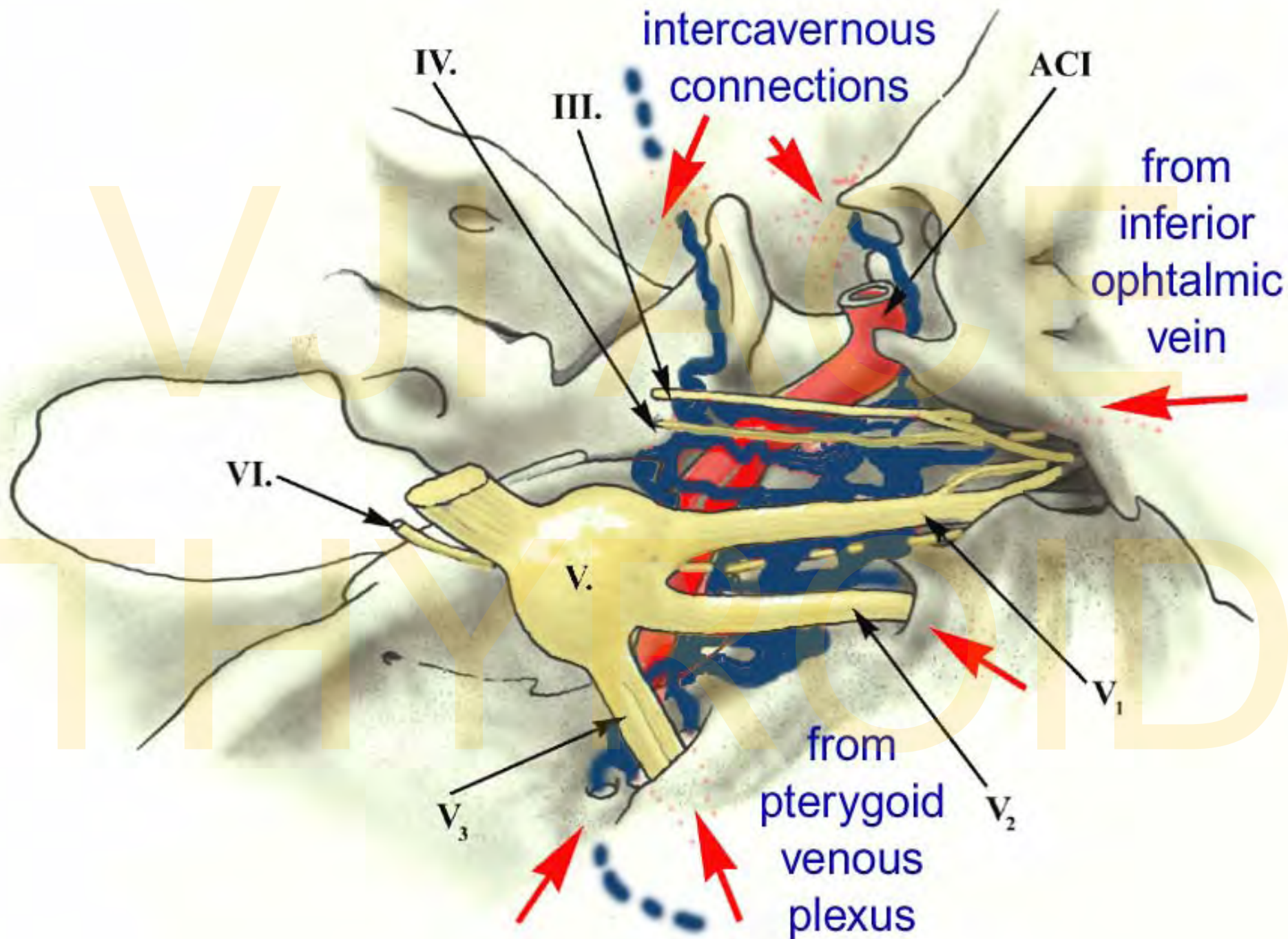
u buccal

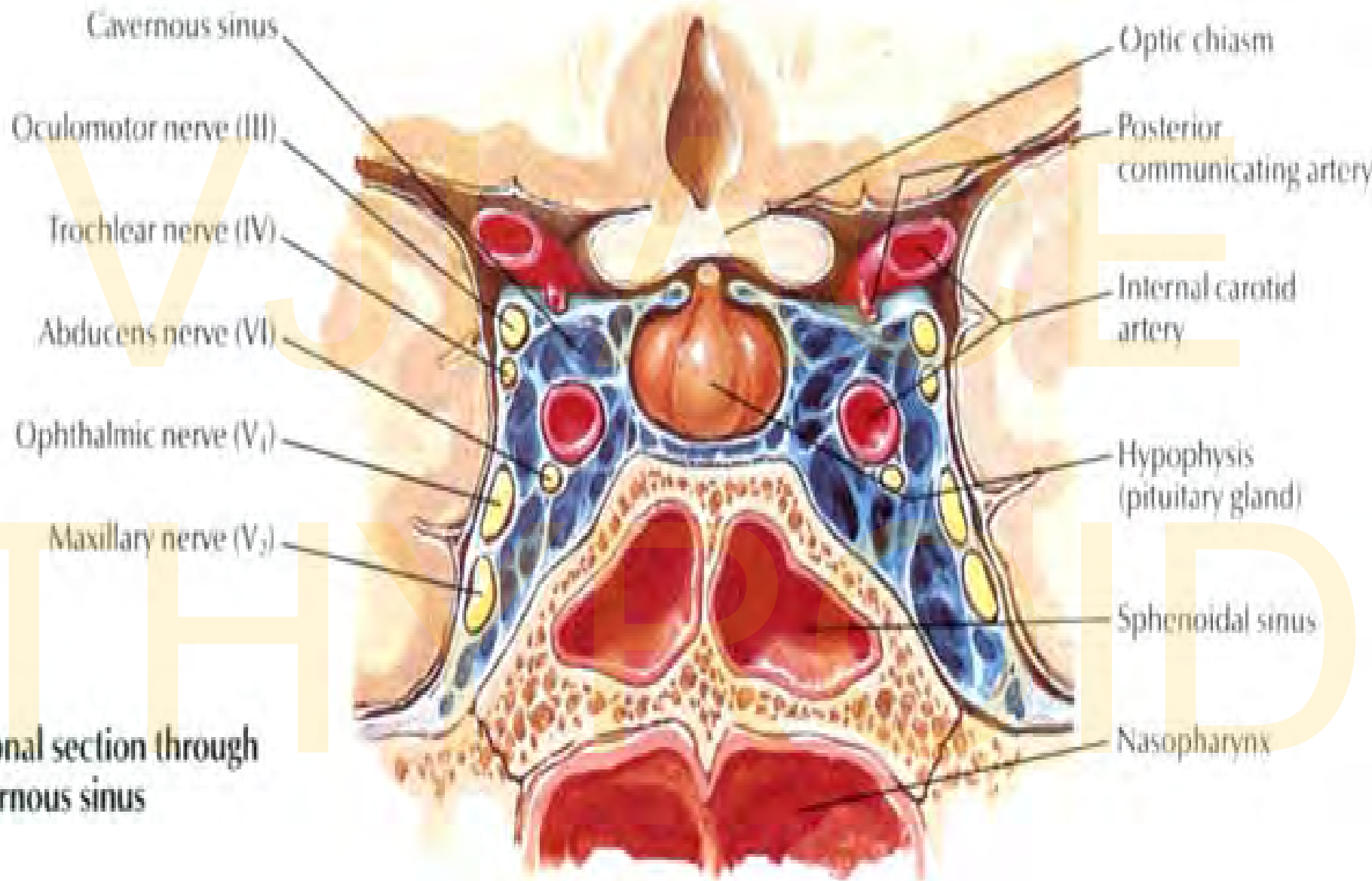
inferior alveolar vein

... retromandibular vein

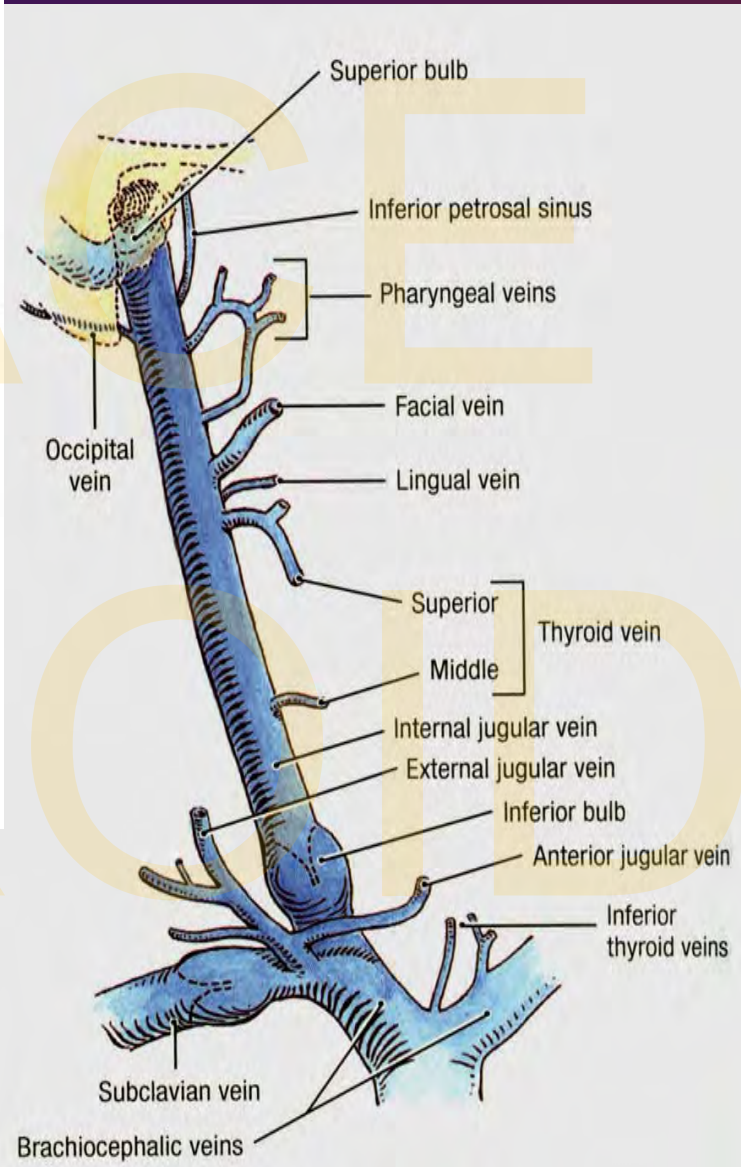
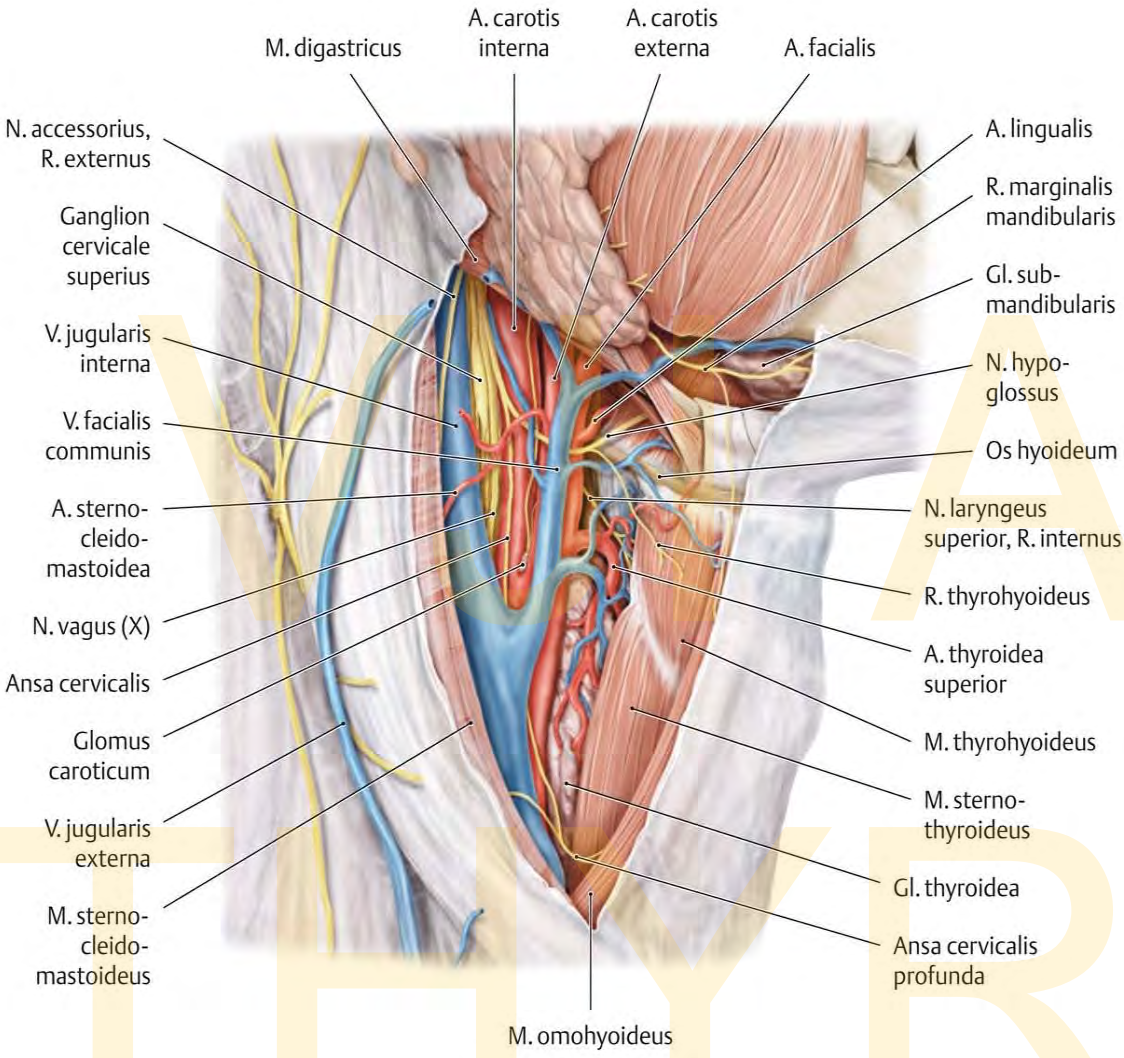
h maxillary veins







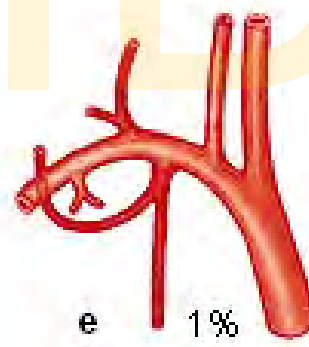
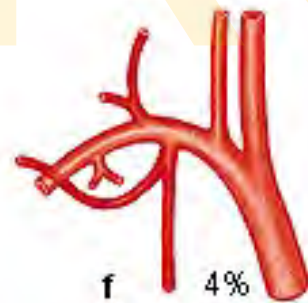
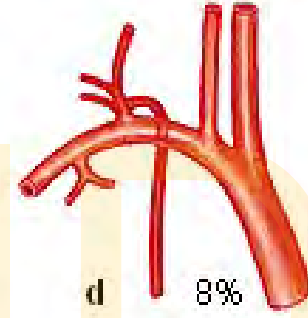
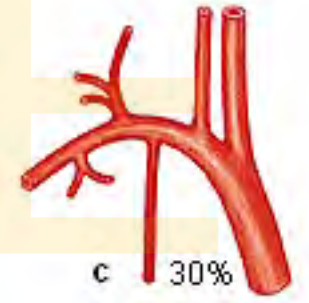
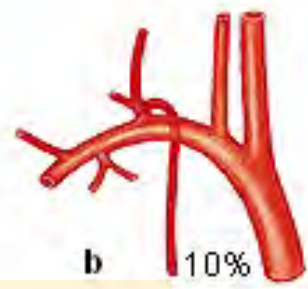
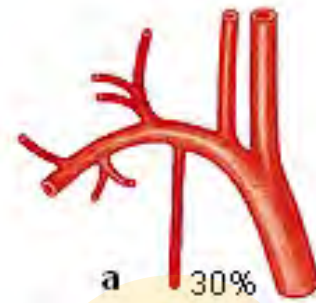
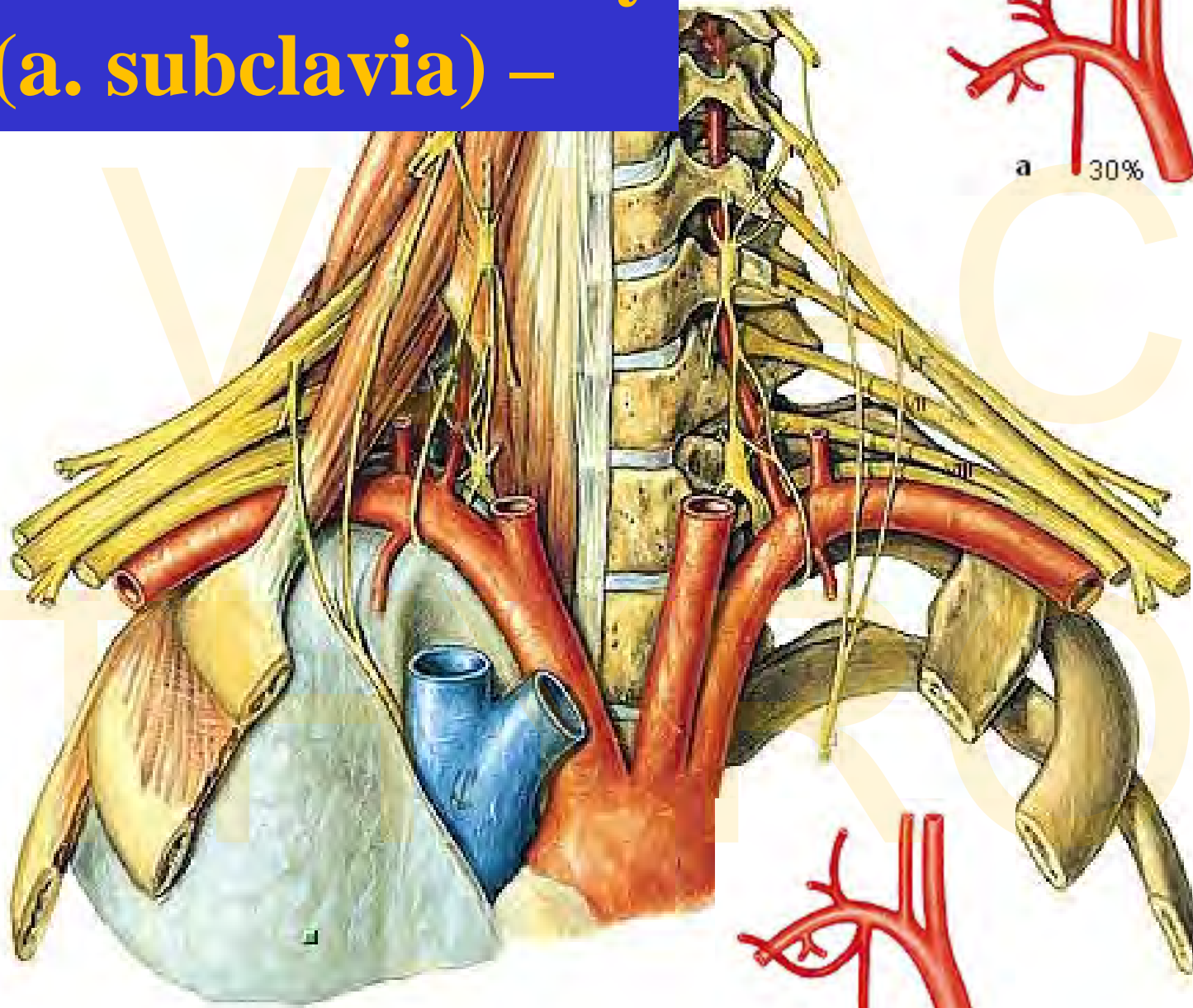
Coronal section through cavernous sinus



Internal jugular vein

Vena jugularis interna

Subclavian artery (a. subclavia) –



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

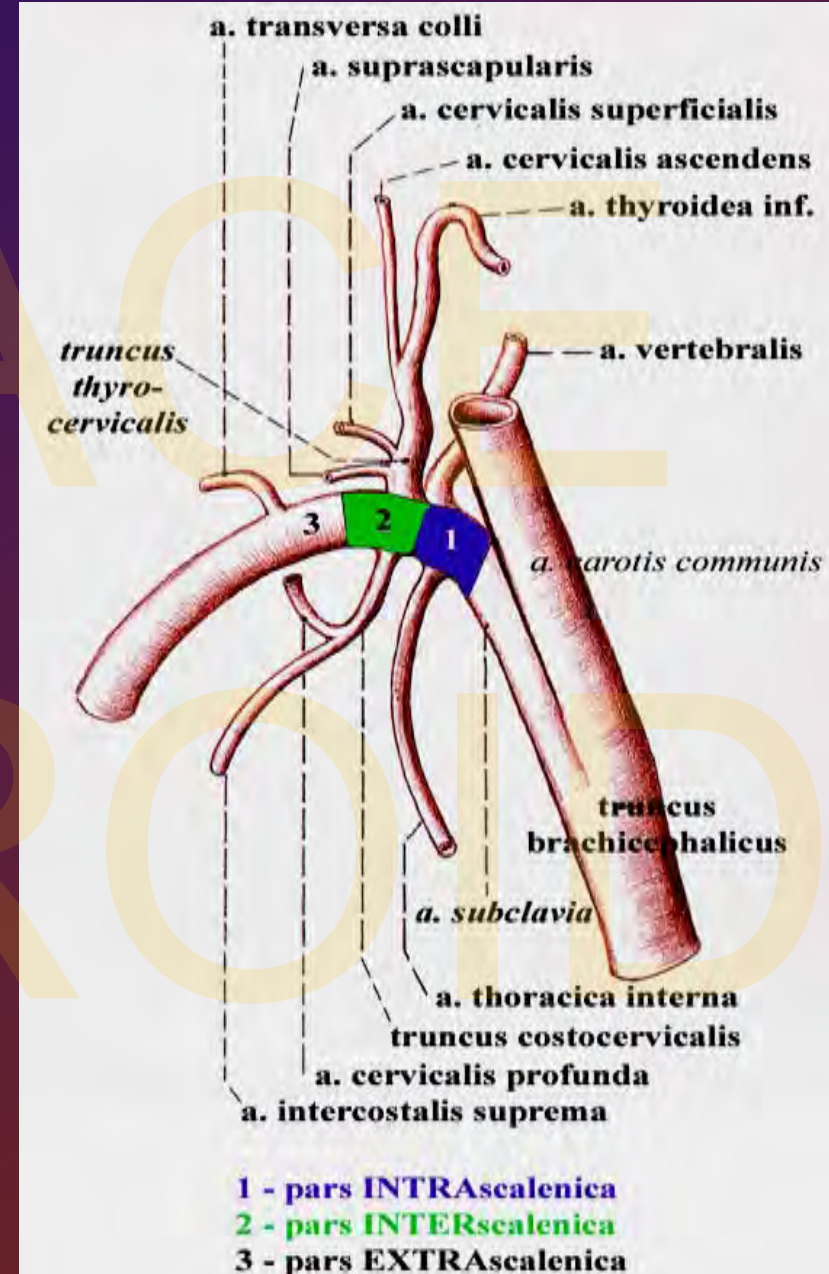
Arteria vertebralis

Truncus thyrocervicalis

Truncus costocervicalis

arteria thoracica interna

Parts and trunci



Vertebral artery

❖ Prevertebral part

Cervical or transverse part

(C6-C1) → Spinal and muscular branches

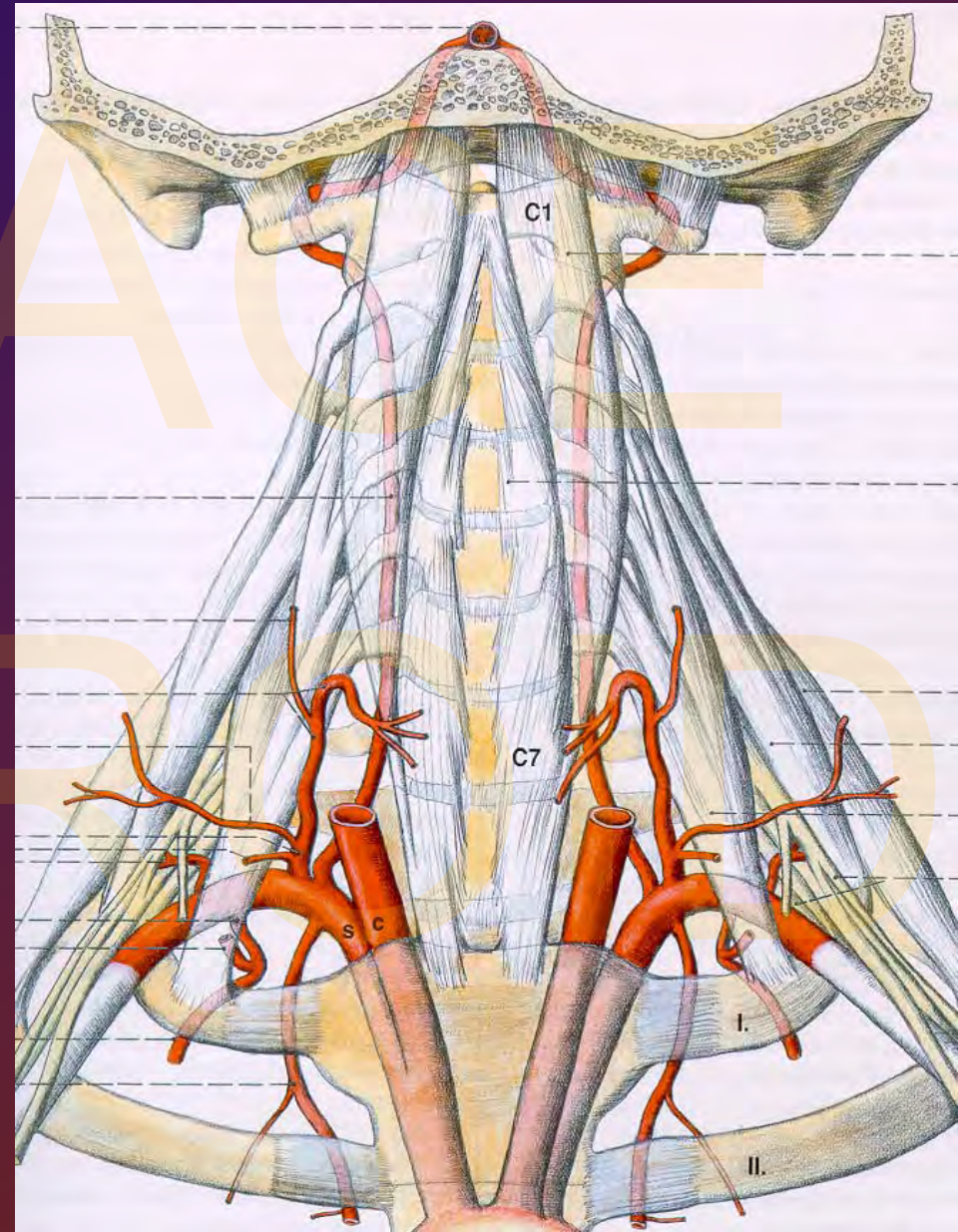
❖ **Atlantic part** — sulcus a.v.,
membrana

atlantooccipitalis post., foramen occipitale
magnum

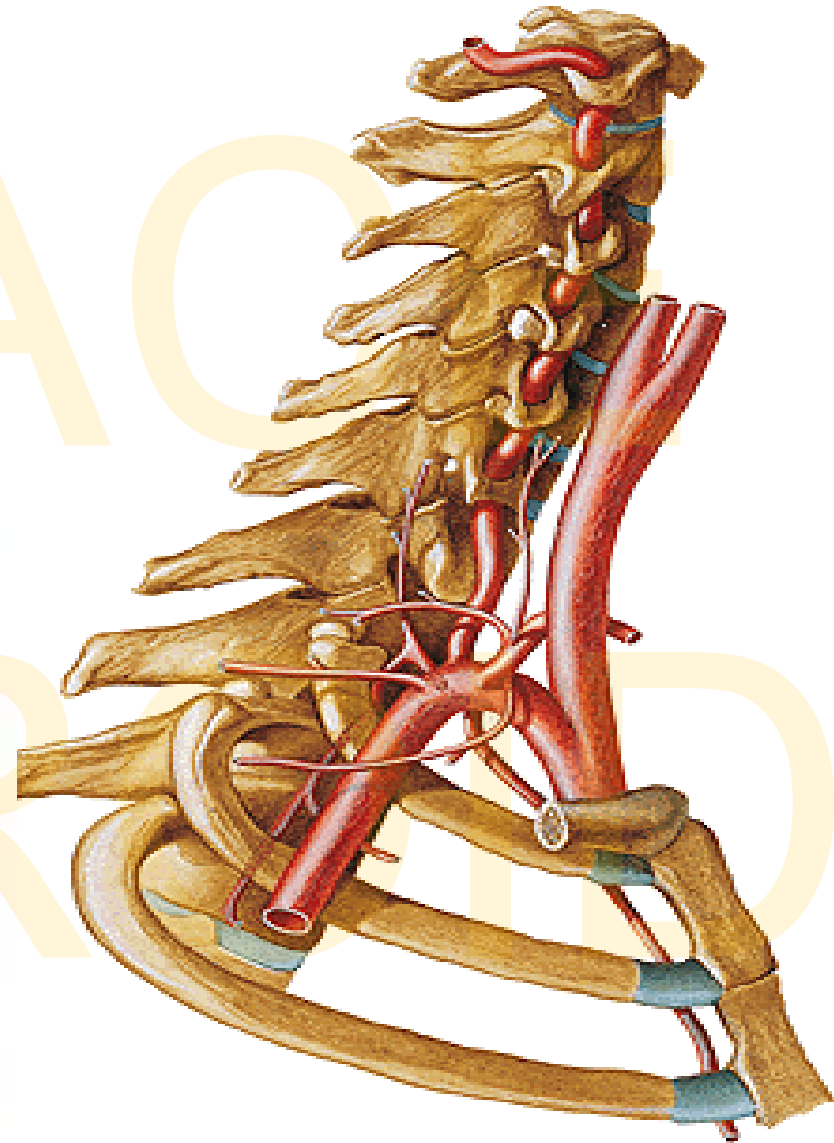
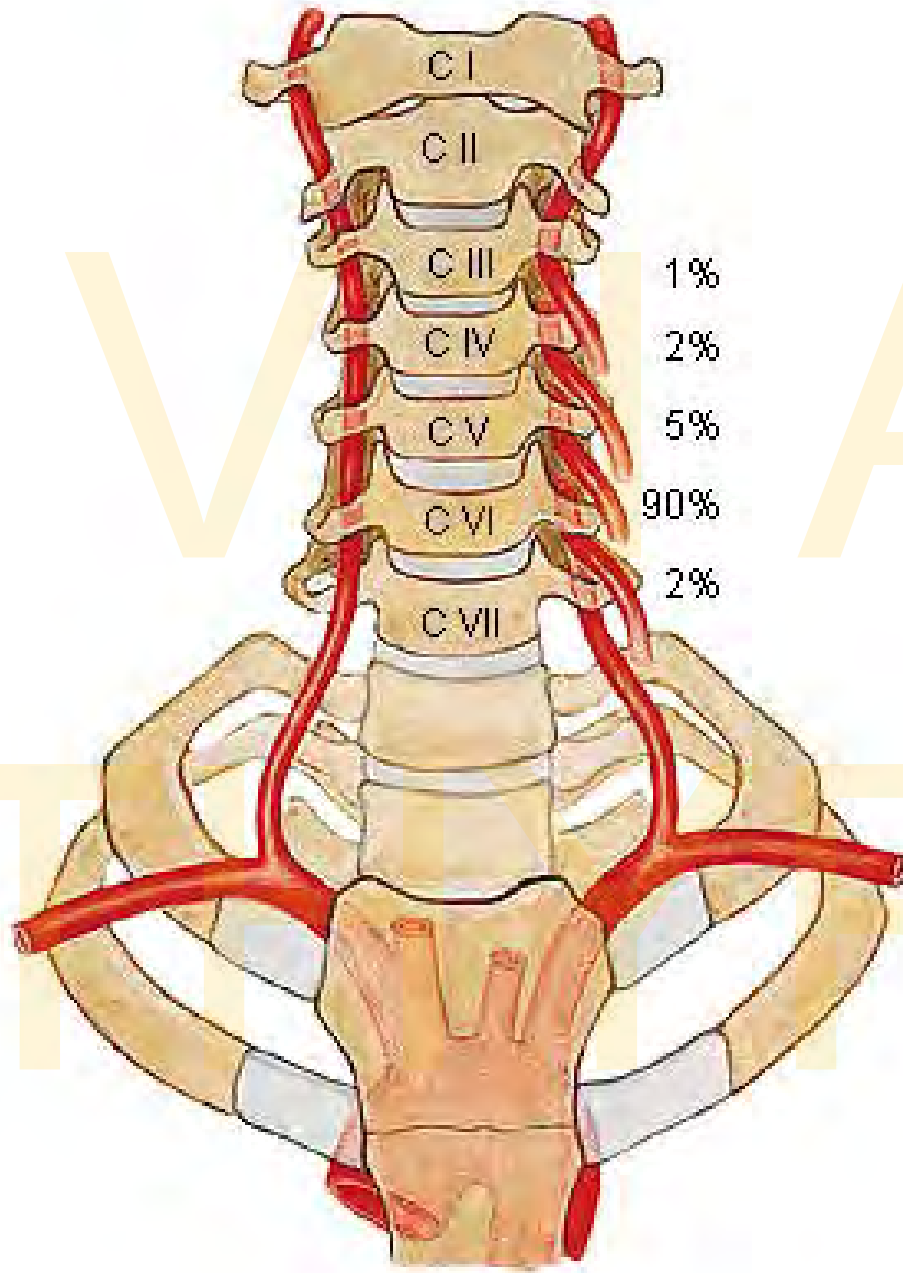
❖ Intracranial part

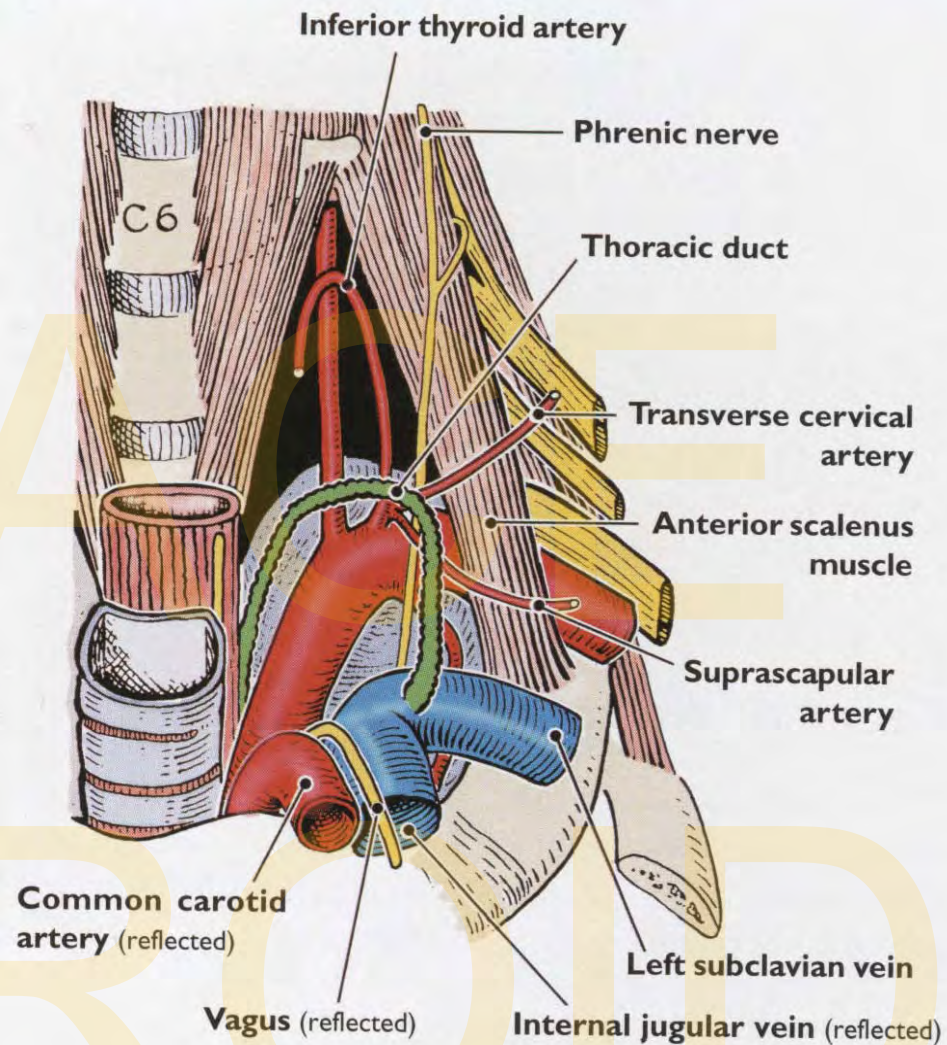
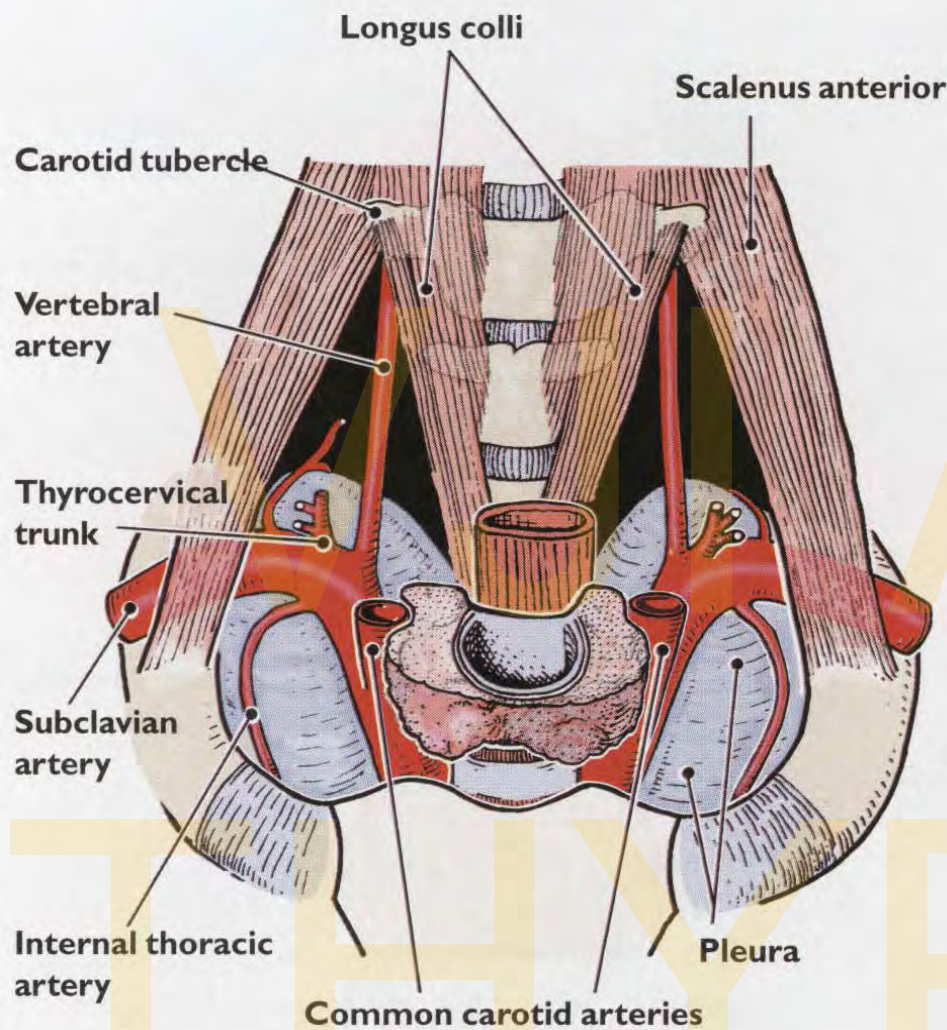
❖ Meningeal brr. a. inferior
posterior cerebellar brr. (→
a. spinalis post.)

❖ Ant. spinalis branches



a. vertebralis



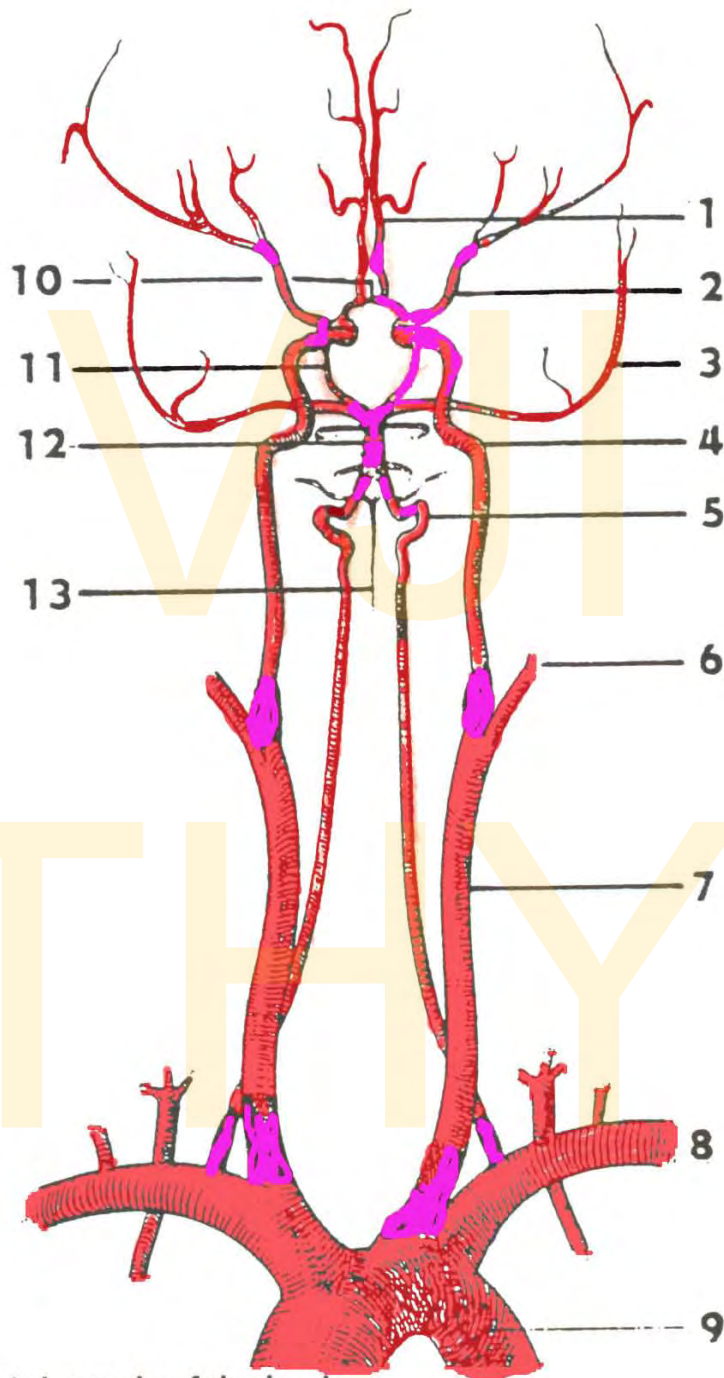


Trigonum scalenovertebrale
Scalenovertebral triangle

Blood source for brain:

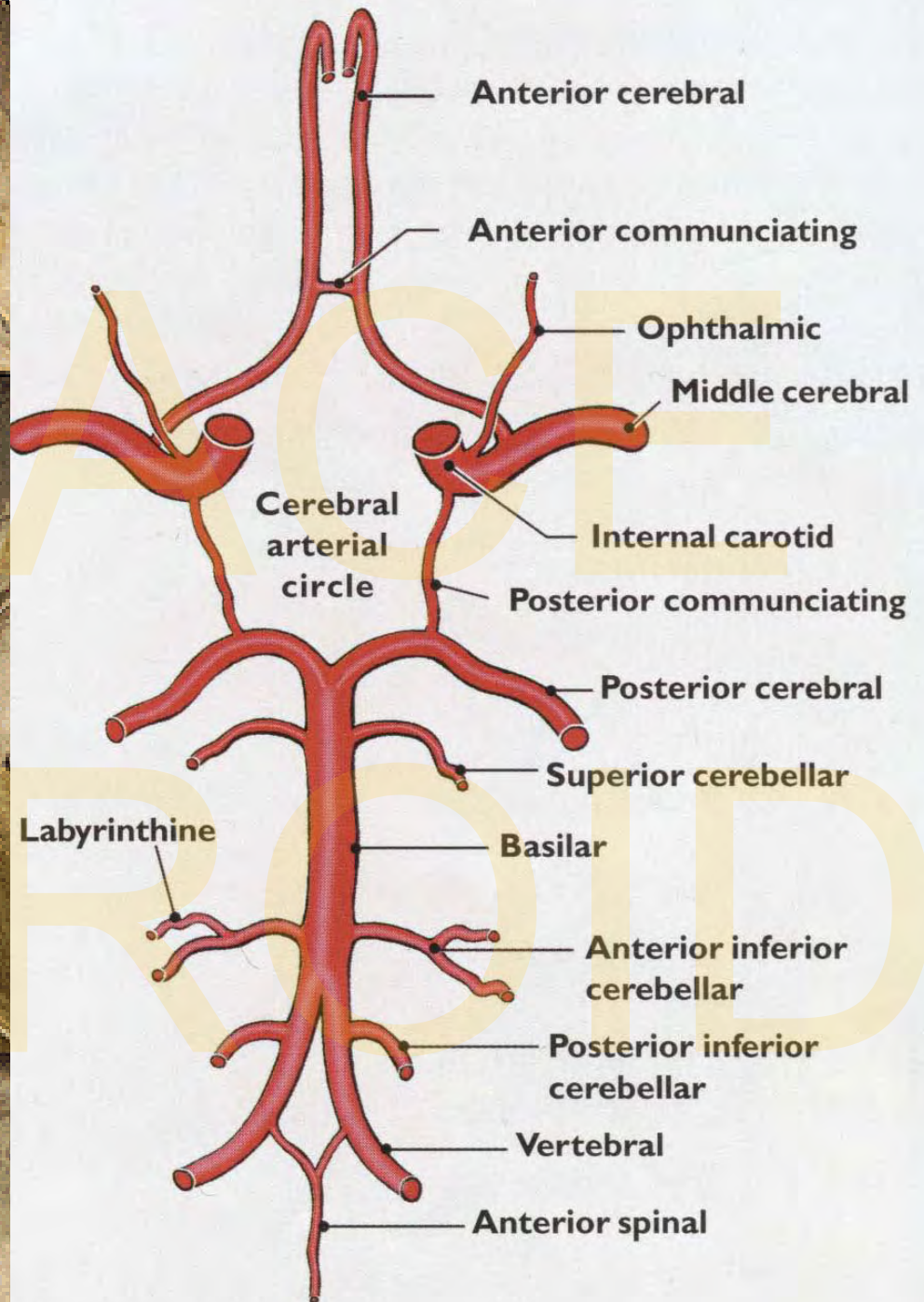
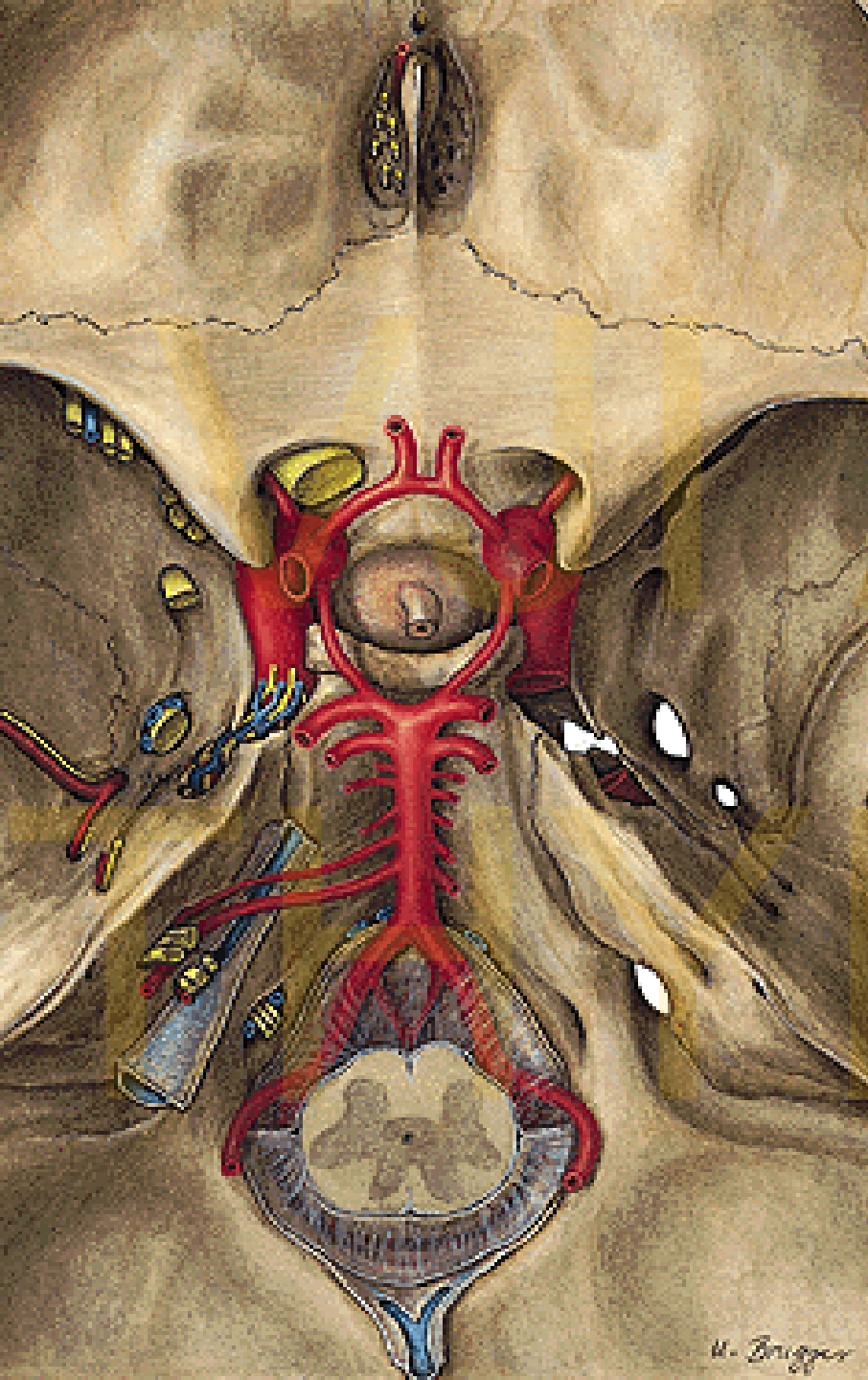
Carotis interna 80%

Vertebralis 20%

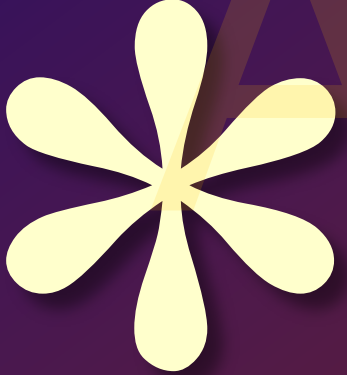


Arterial supply of the brain.

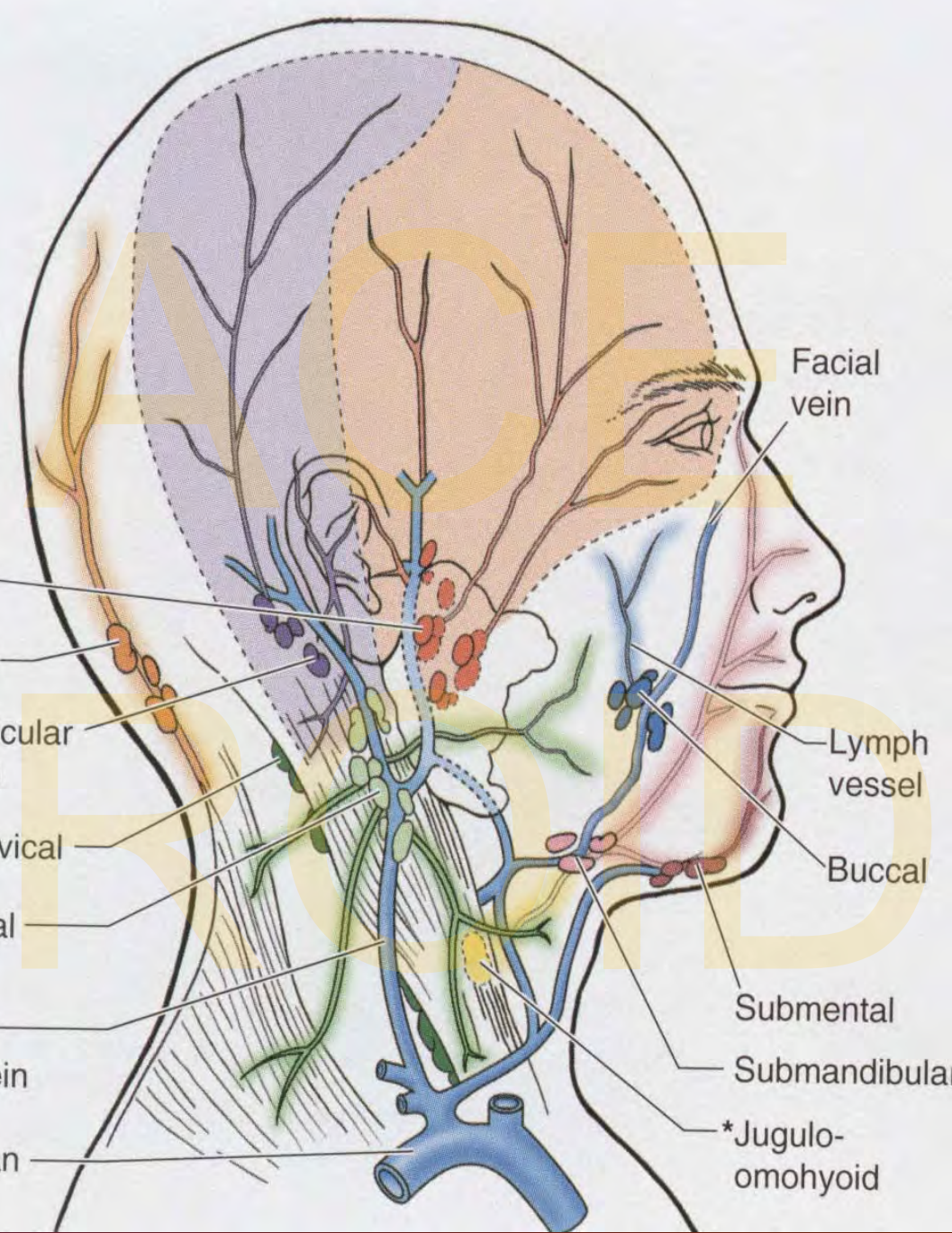
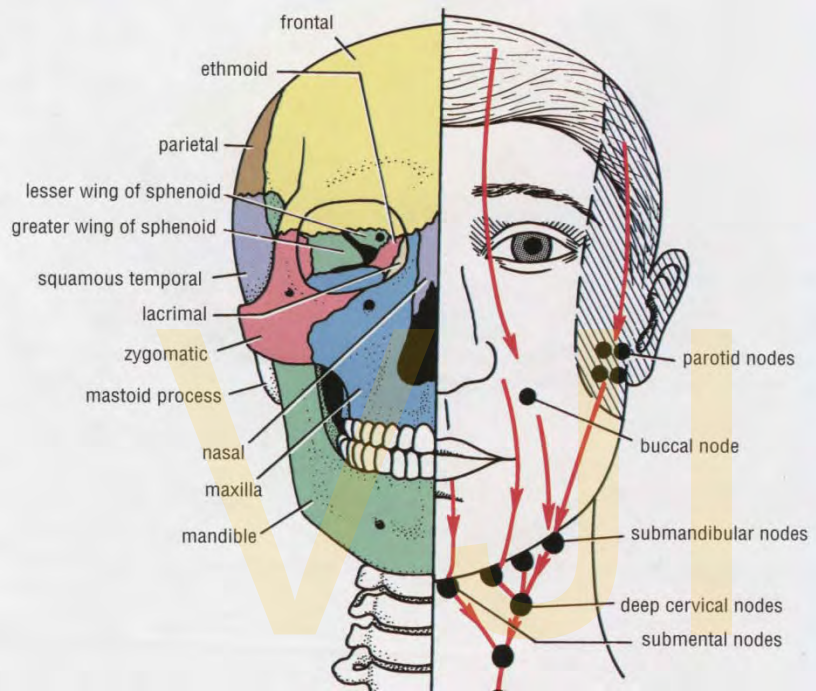
- 1 - a. cerebri ant.,
- 2 - a. cerebri media,
- 3 - a. cerebri post.
- 4 - a. carotis int.,
- 5 - a. vertebralis,
- 6 - a. carotis externa,
- 7 - a. carotis communis,
- 8 - a. subclavia,
- 9 - arcus aortae,
- 10 - a. communicans anterior,
- 11 - a. communicans posterior,
- 12 - a. basilaris,
- 13 -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



VJIACE

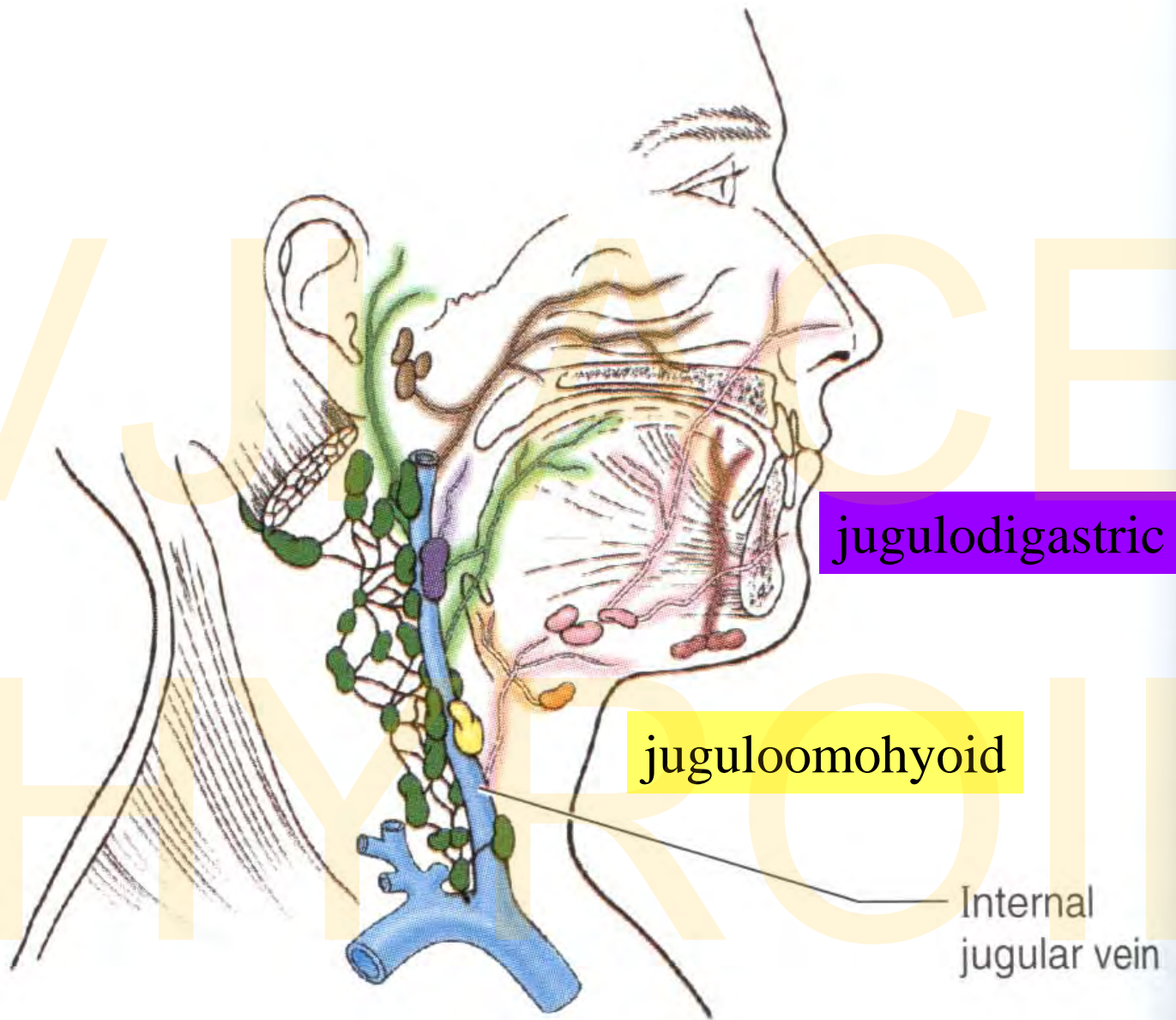


THYROID



Lymph outflow from the head tissues

- Parotid
- Occipital
- Retroauricular (mastoid)
- Deep cervical
- Superficial cervical
- External jugular vein
- Subclavian vein
- Facial vein
- Lymph vessel
- Buccal
- Submental
- Submandibular
- *Jugulo-omohyoid



jugulodigastric

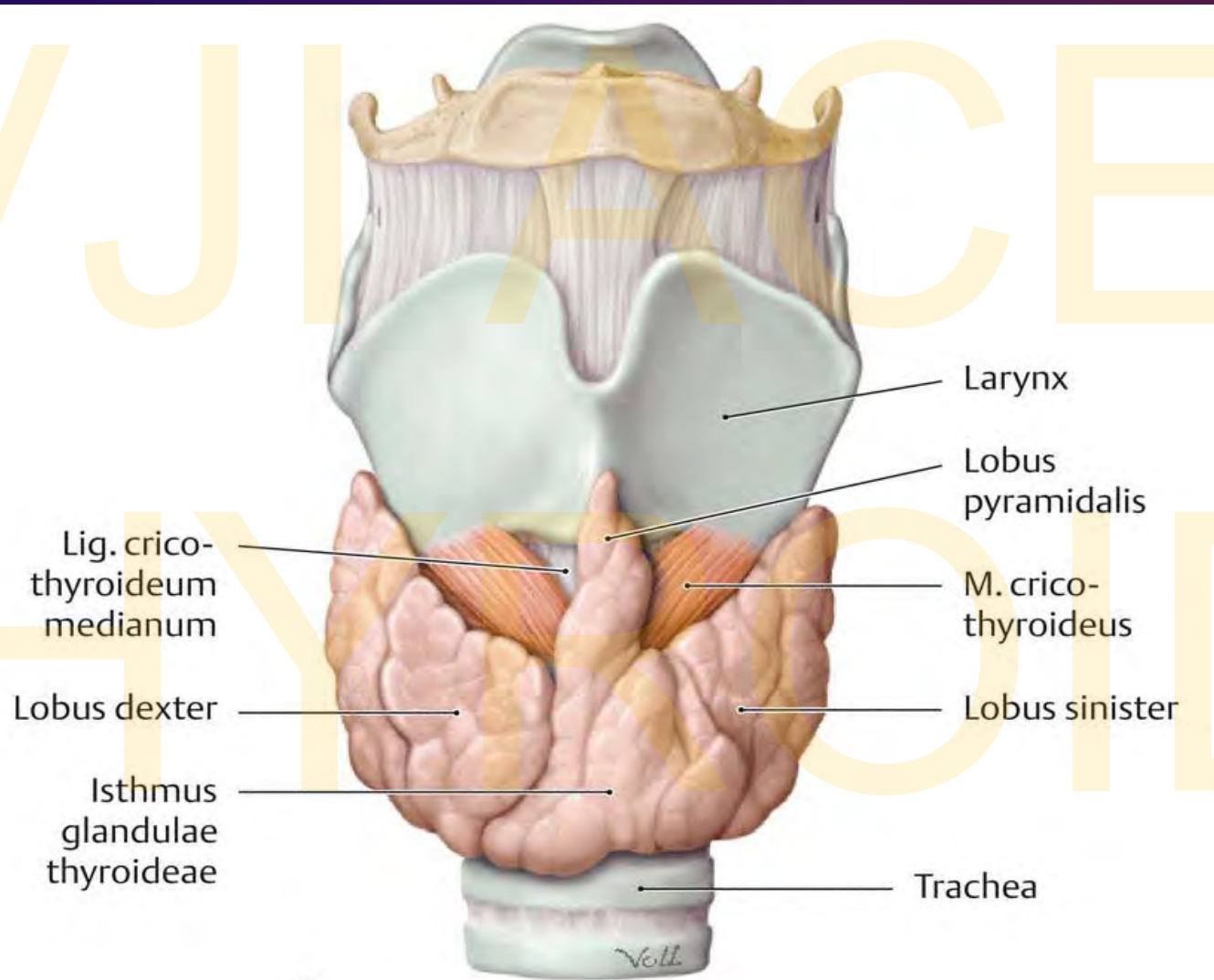
juguloomohyoid

Internal
jugular vein

Lateral view

Glandula thyroidea

Thyroid gland



a

Thyroid gland – structure and role

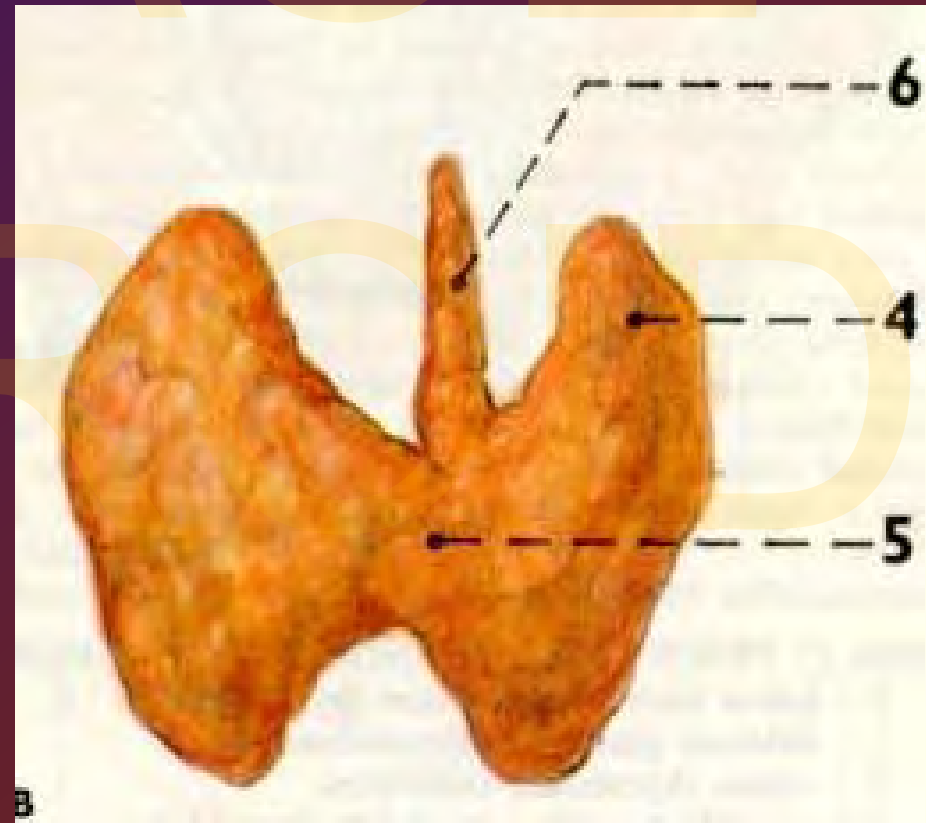
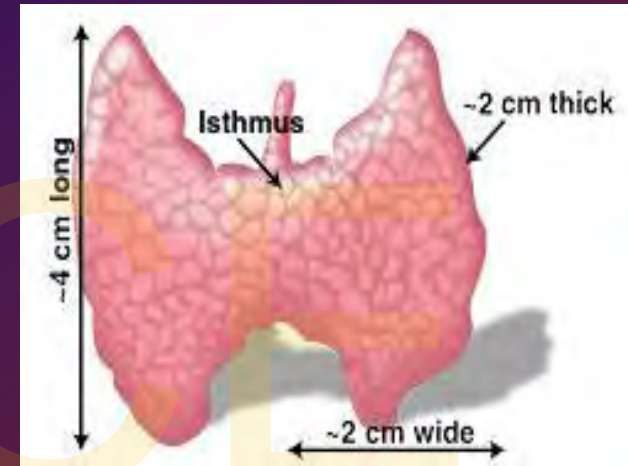
Parts

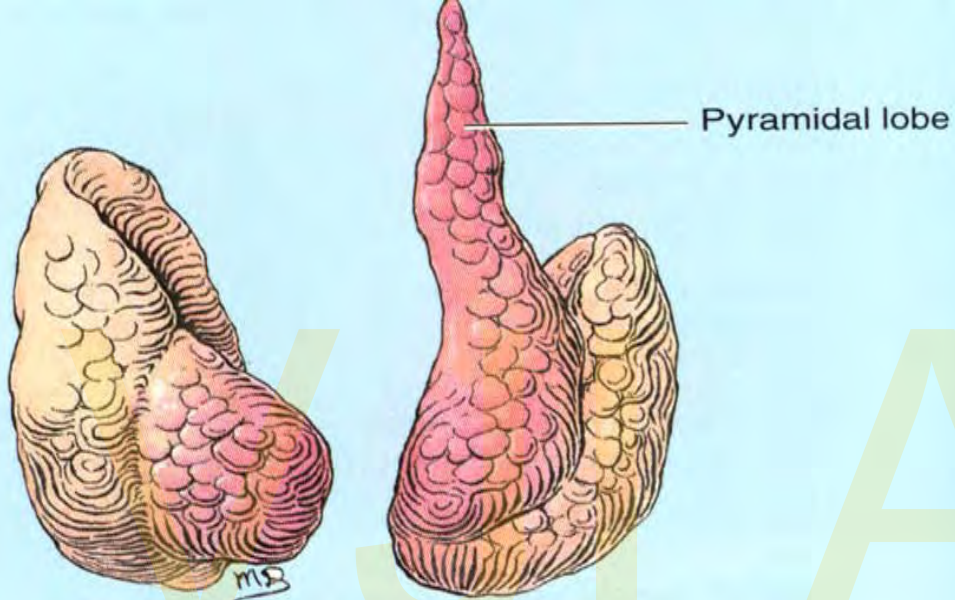
Lobus dx., sin. (4)
isthmus (6)

lobus pyramidalis (6)

Metabolic role

- ❖ thyroxin T_4 ,
trijodtyronin T_3
- ❖ calcitonin

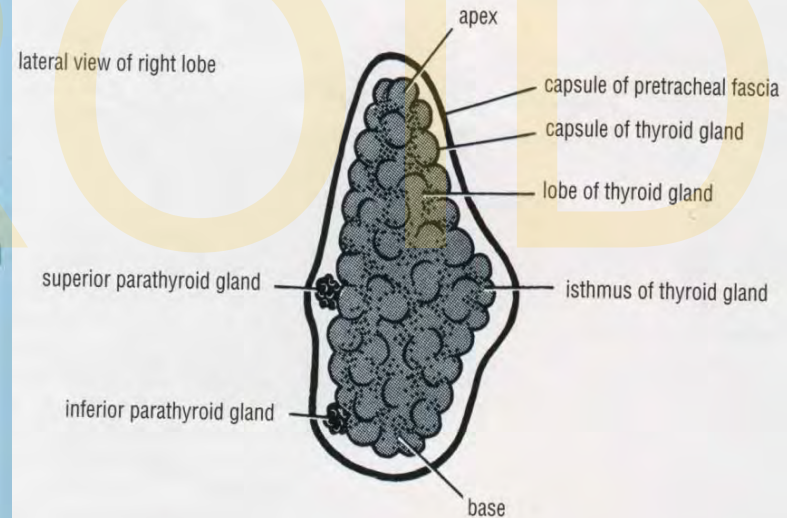
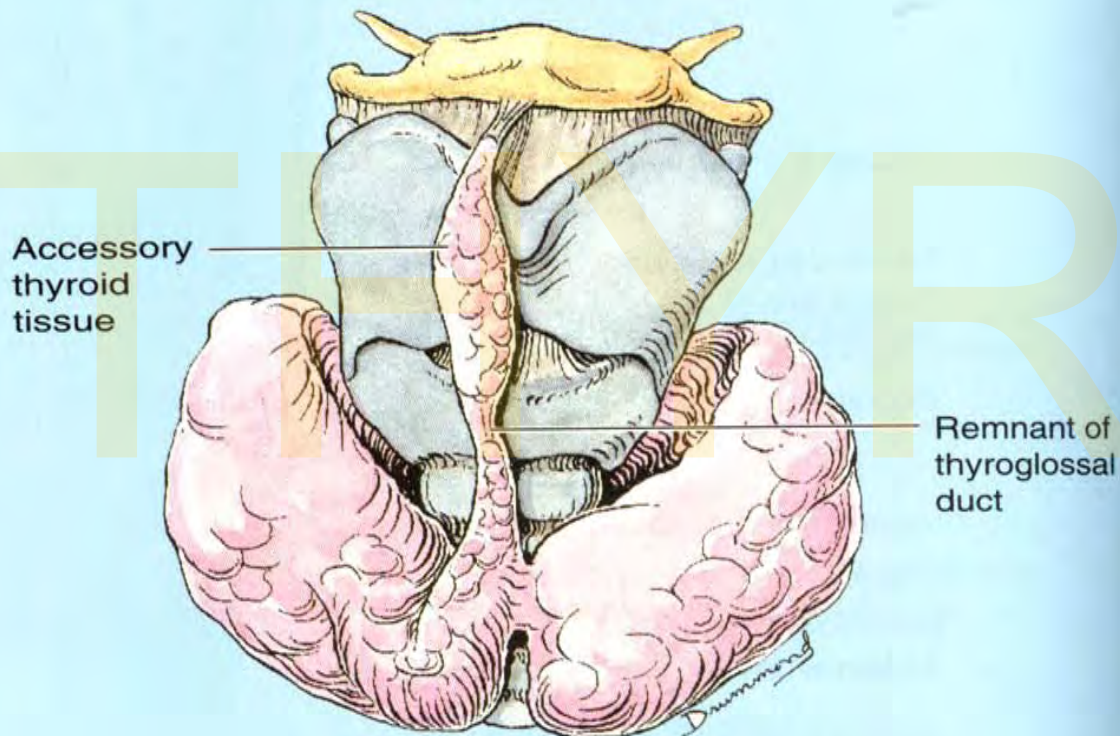




Absence of isthmus

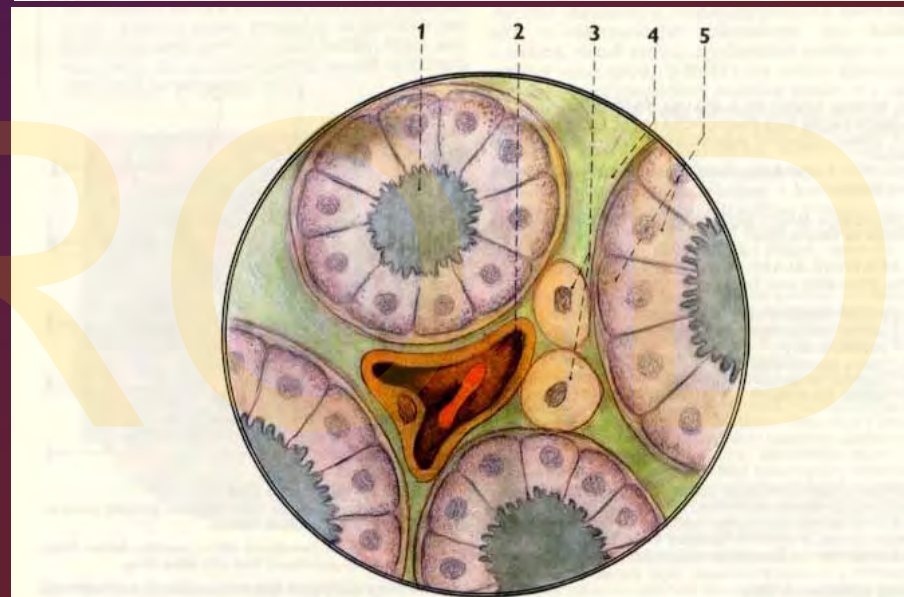
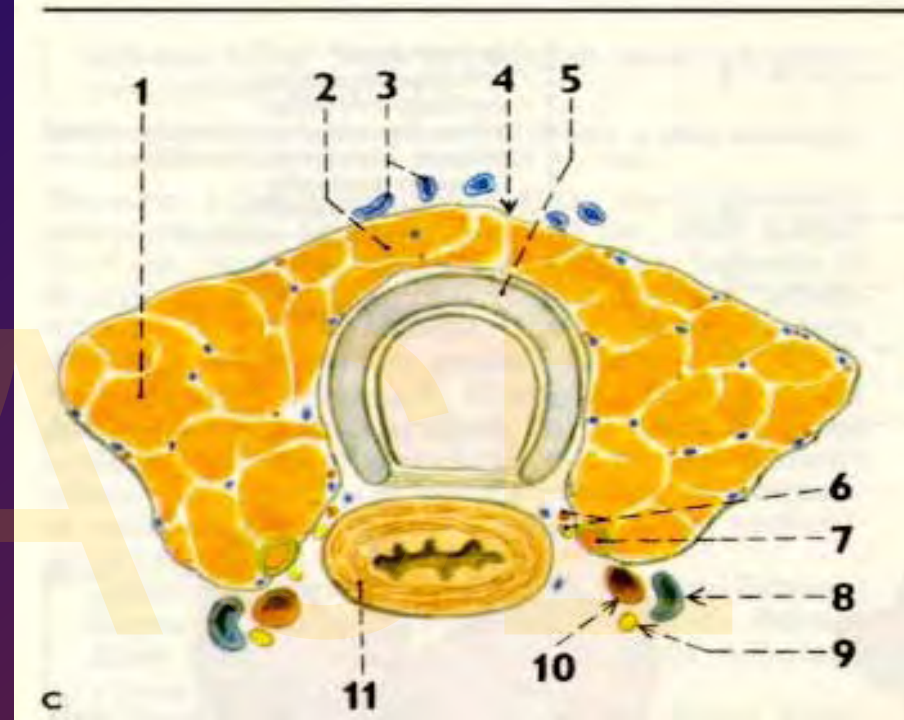
External forms,
covers, varieties

Capsula propria
Fascia perithyroidea



Thyroid gland - structure

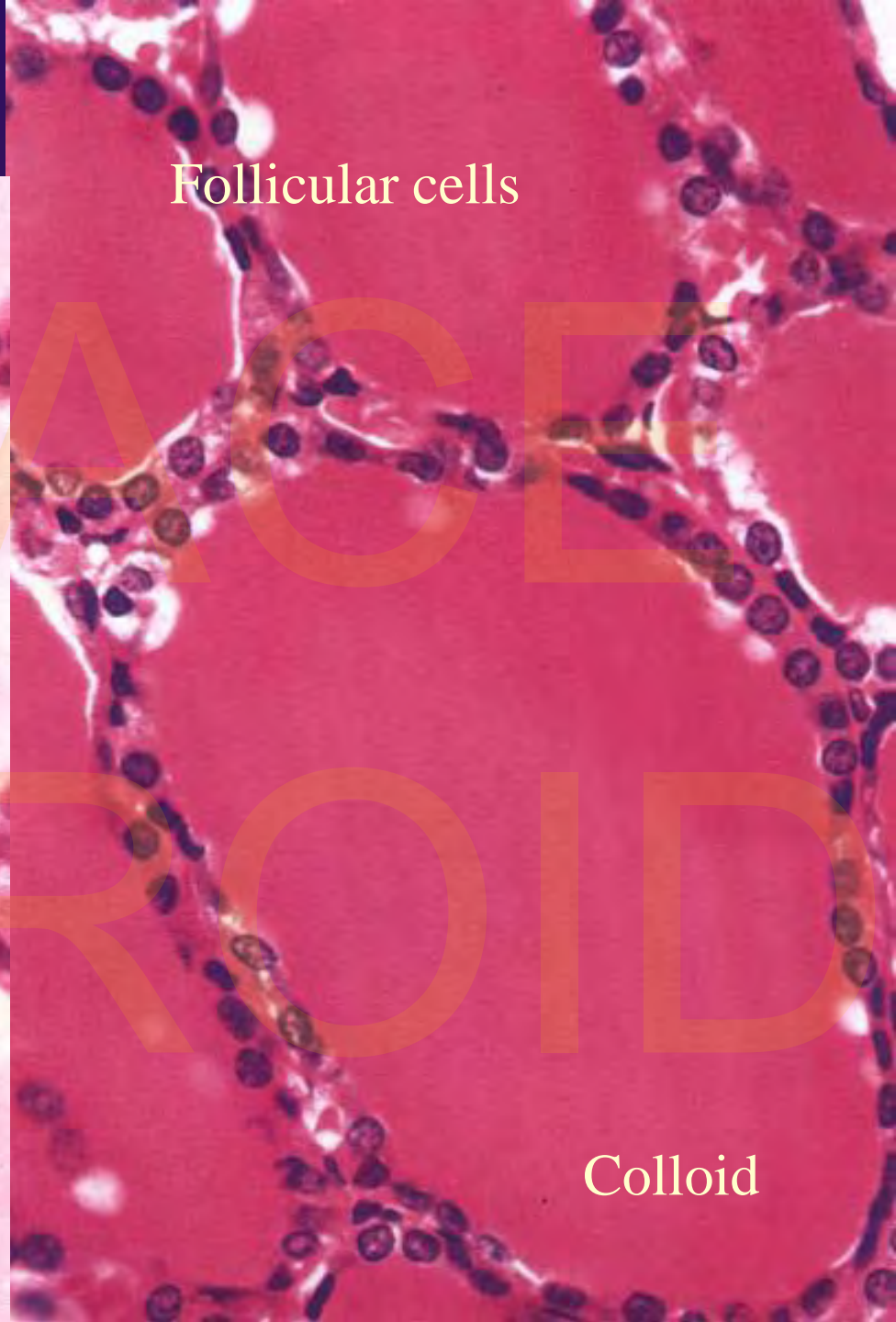
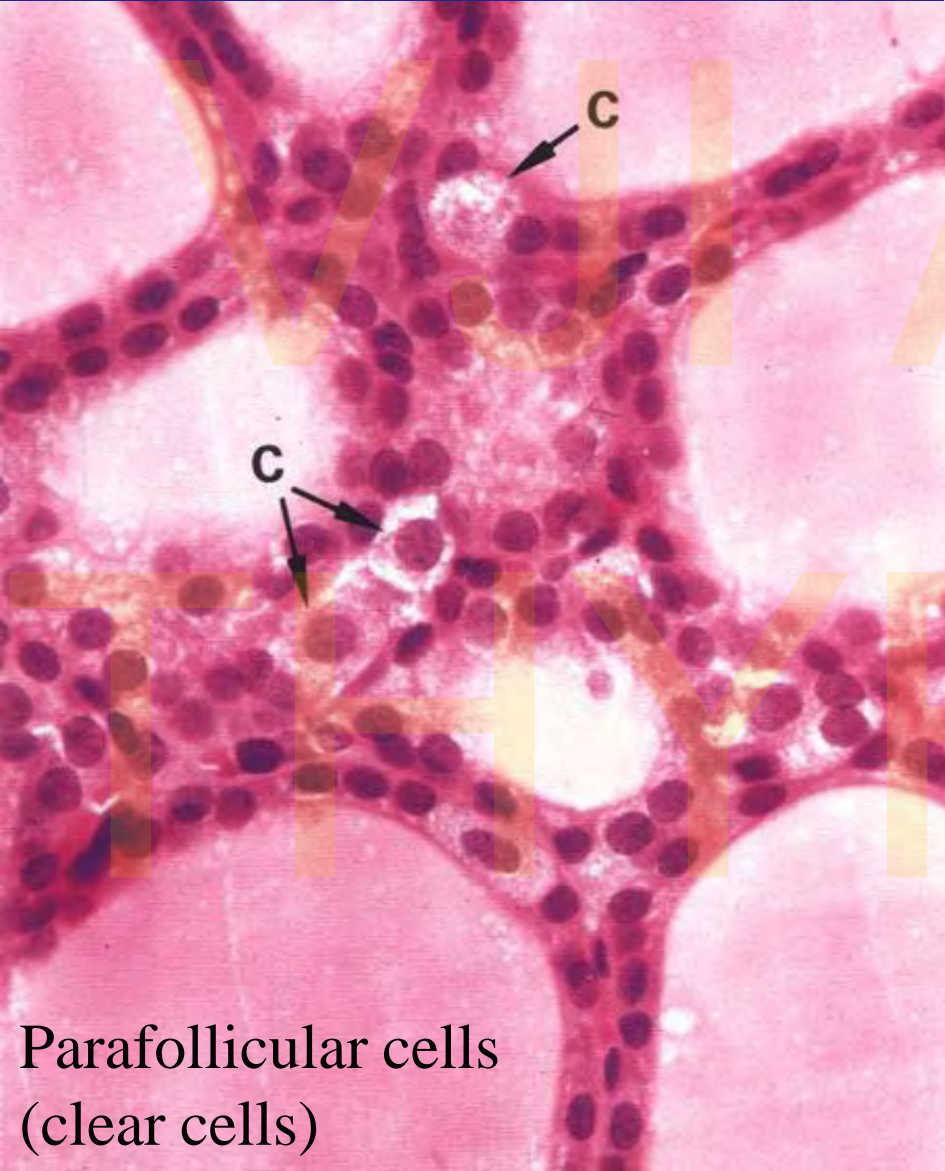
- ❖ capsule
- ❖ septated internal space
- ❖ follicles (50 - 900 μm)
 - ❖ Ball-like
 - ❖ One-layered epithelium lining follicles
 - ❖ Contains colloid - thyreoglobulin
- ❖ **Follicular cells** - thyreoglobulin, (accelerates metabolic activity and growth)
- ❖ **Parafollicular cells** - calcitonin (decreases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



261. STAVBA ŠTÍTNÉ ŽLÁZY (schéma)
1 / folikulus štítné žlázy obsahující koloid
2 / kapilára mezi folikuly
3 / parafolikulární buňky

4 / vazivové stroma štítné žlázy
5 / folikulární buňky (kubické při normální funkci žlázy)

Thyroid follicles



Follicular cells

Colloid

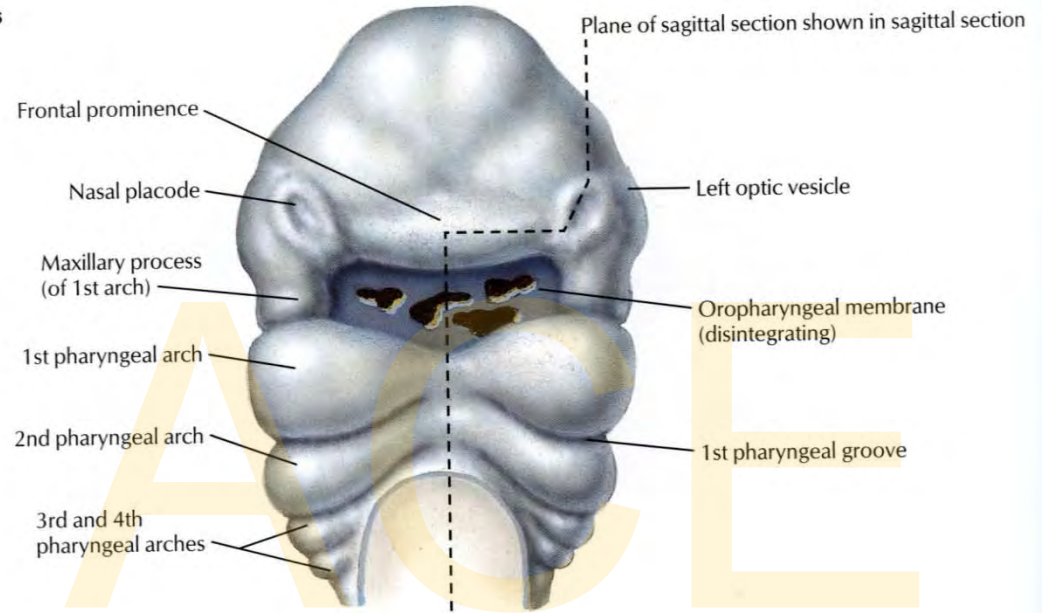
Parafollicular cells
(clear cells)

Thyroid gland - development

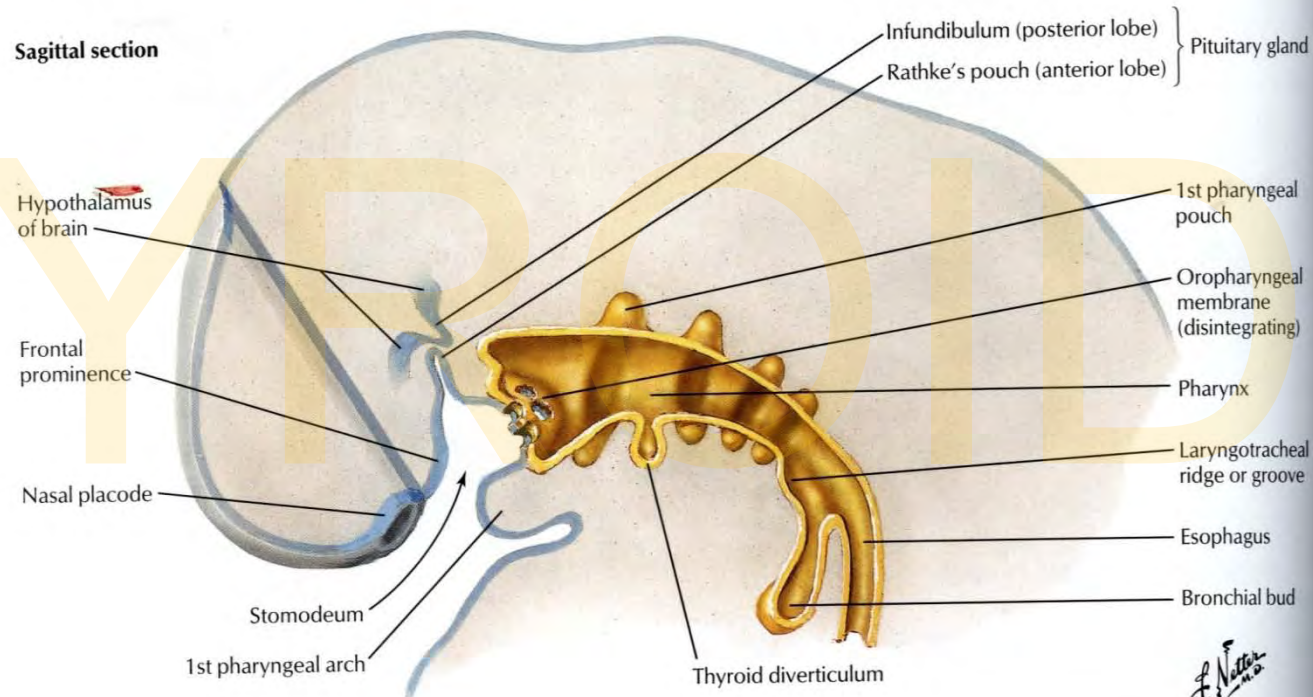
Develops from the epithelial proliferation in the point between copula and tuberculum impar

Embryo at 4 to 5 weeks

Ventral view



Sagittal section



Thyroid gland - development

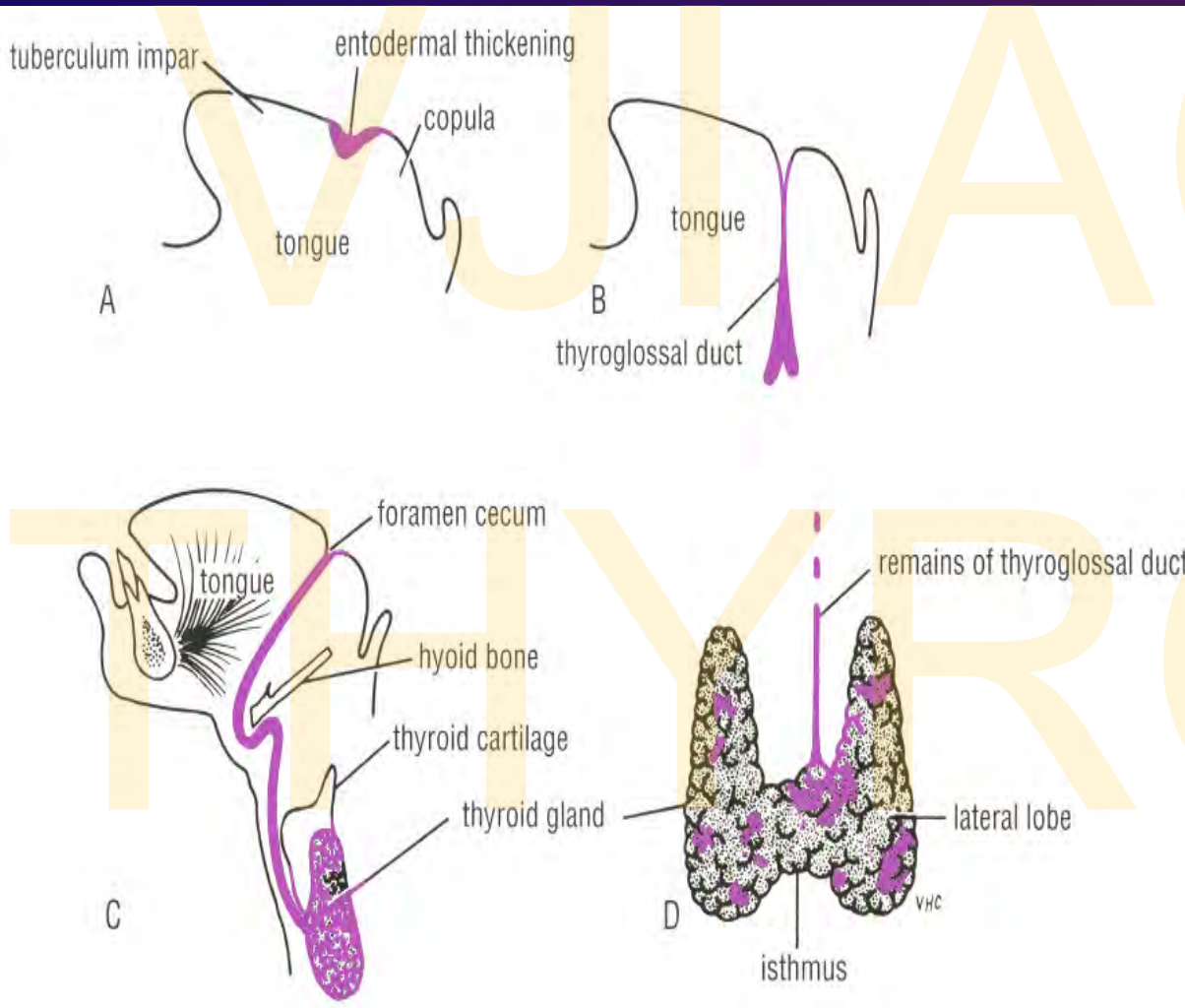
From day 24

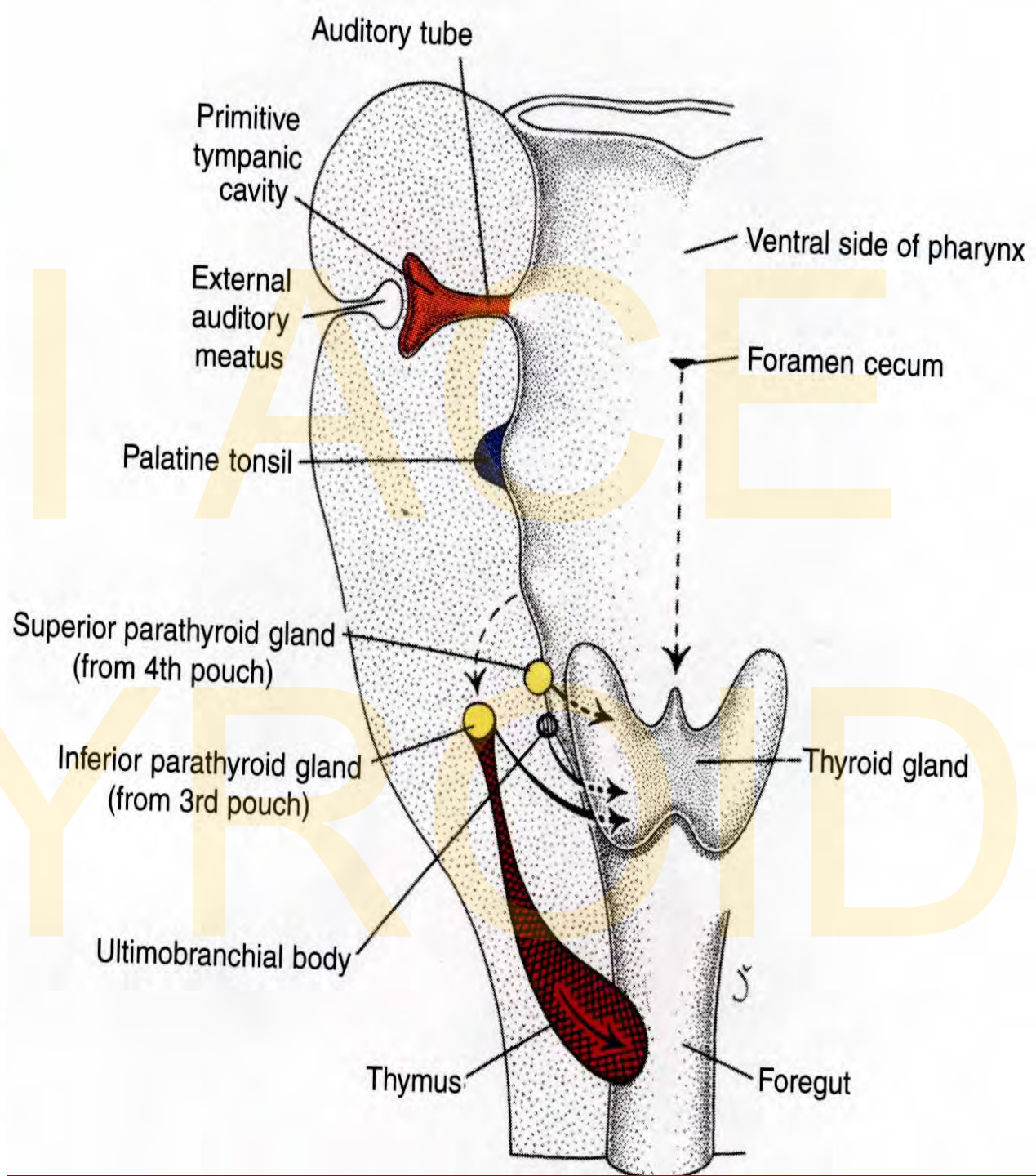
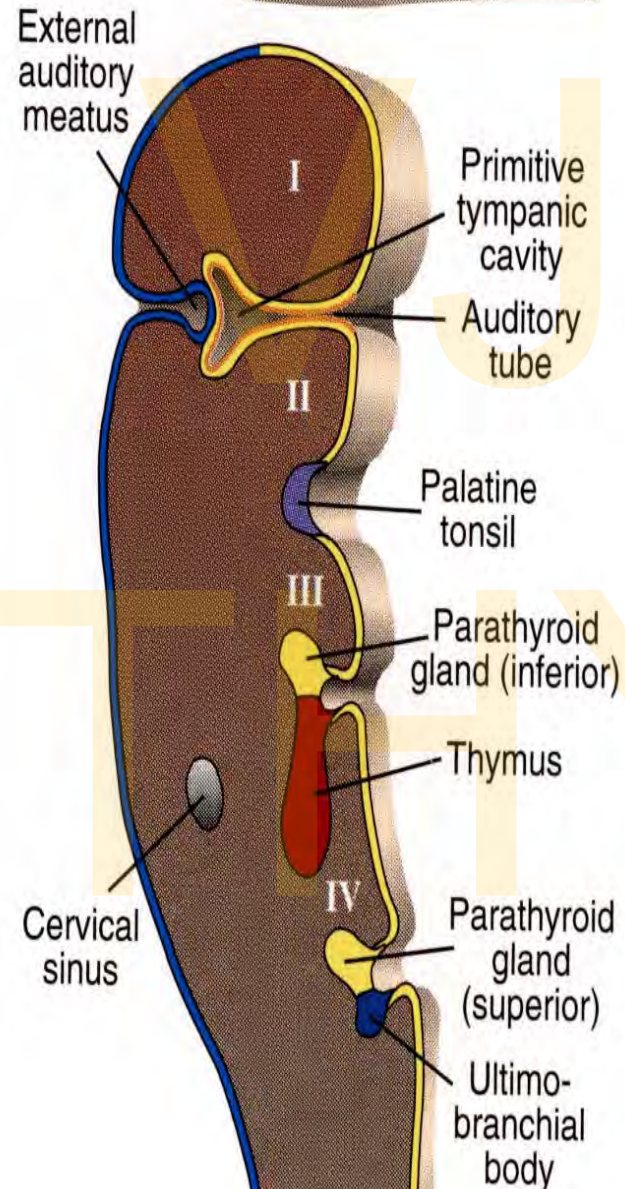
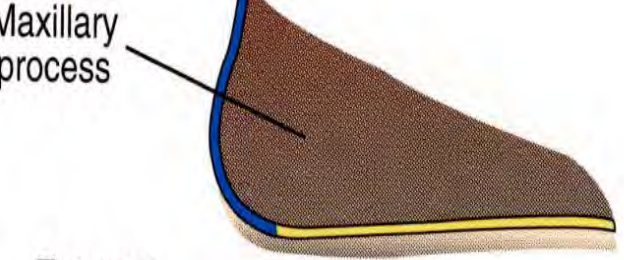
Endodermal pouch to
primitive pharynx

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

Formation of the
lobes (even
pyramidal lobe)

Appearance of the
parathyroid glands





Ductus
thyroglossus

Thyroglossal
duct



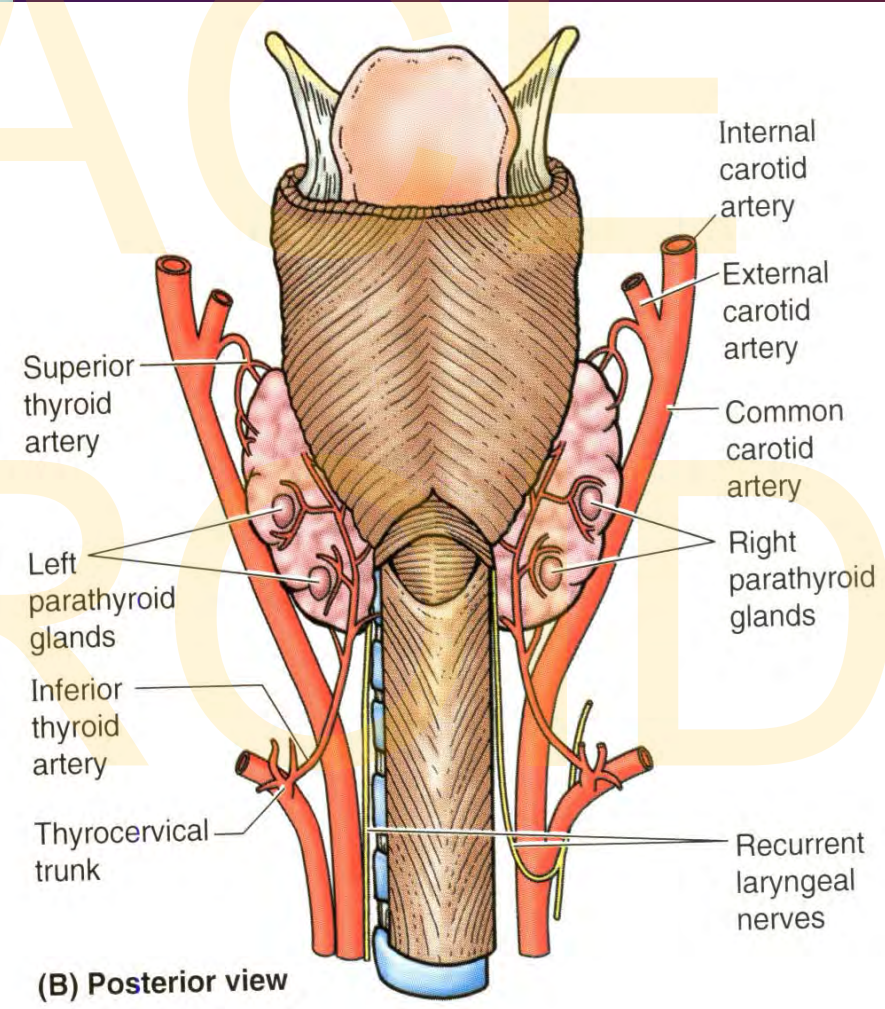
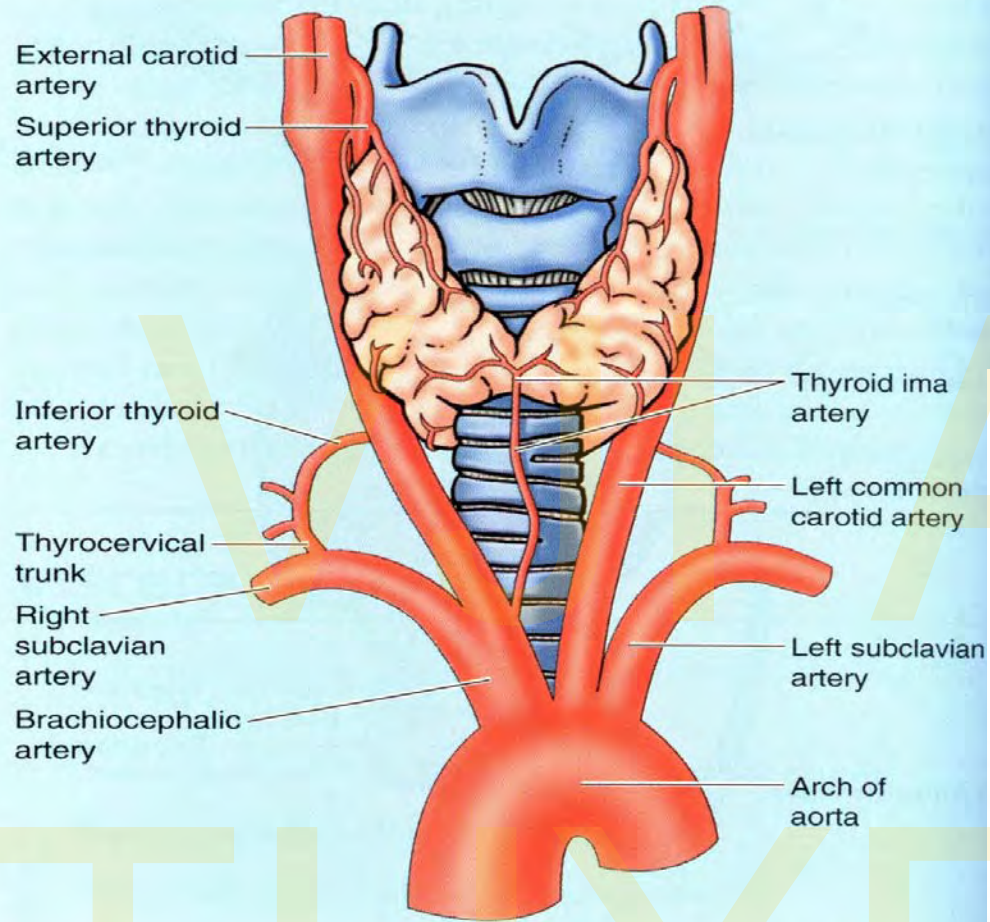
Cysta
thyreoglossea

Thyroglossal
cyst



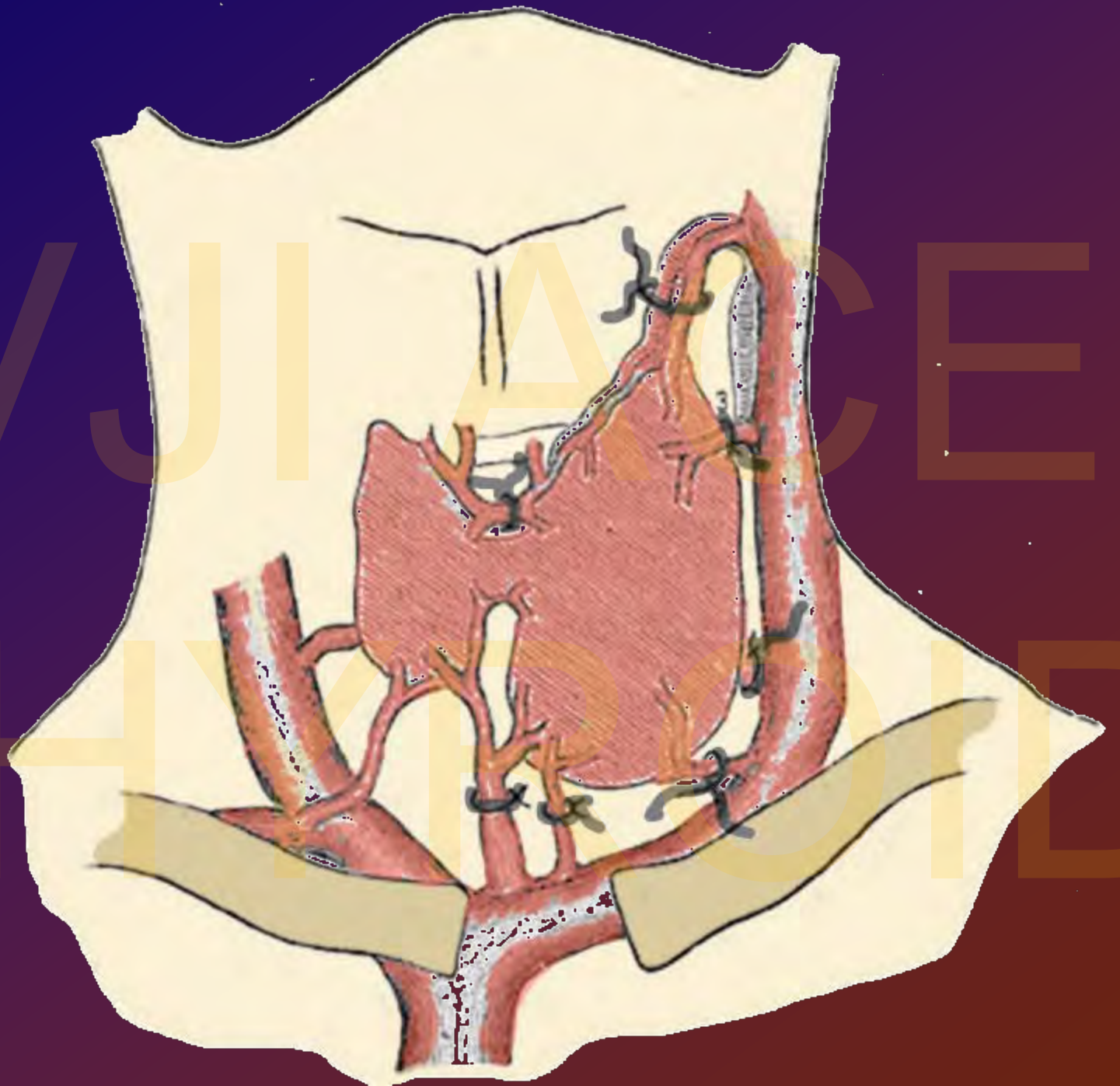
Thyroid gland

Arterial supply

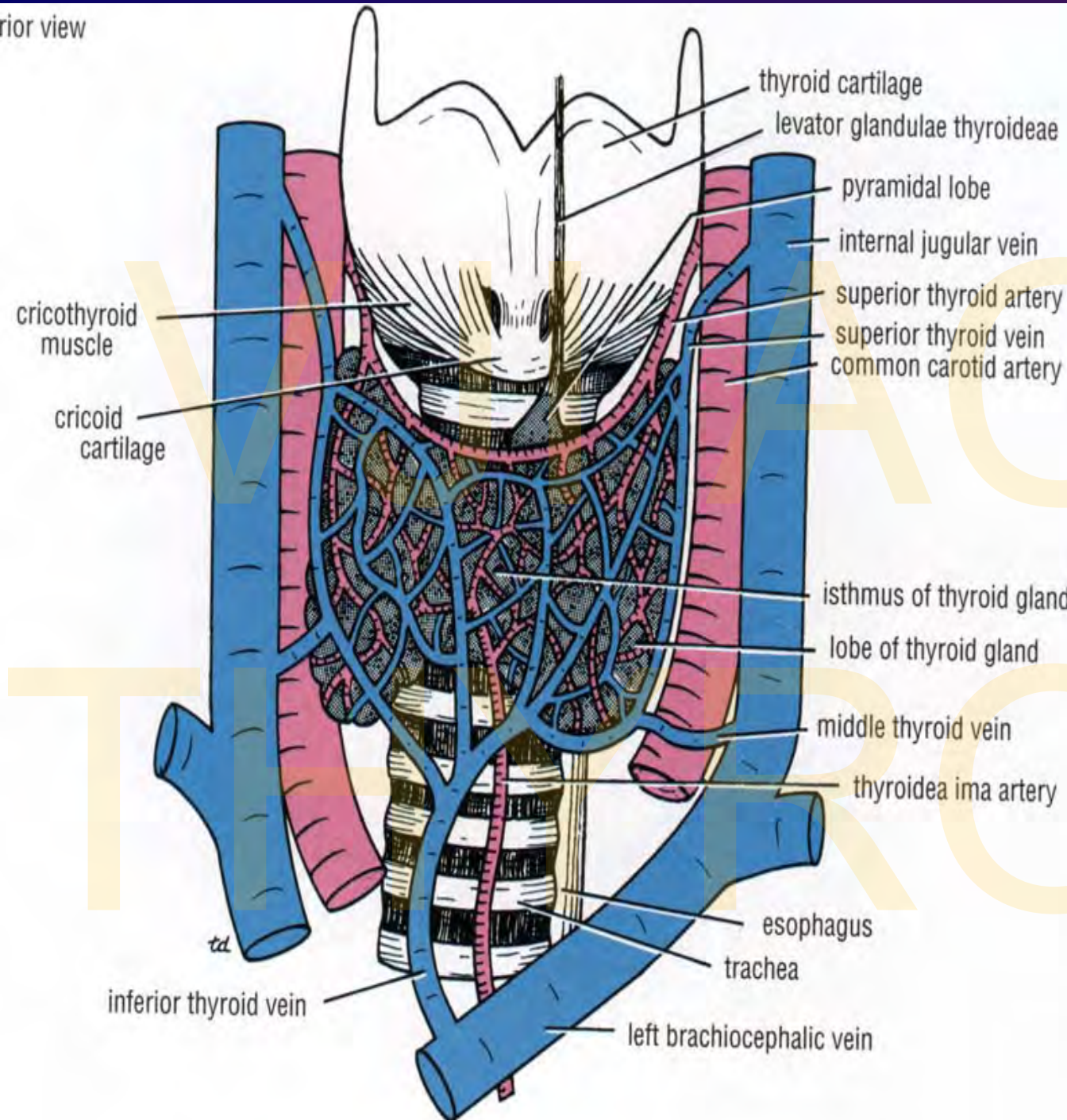


(B) Posterior view

- 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)



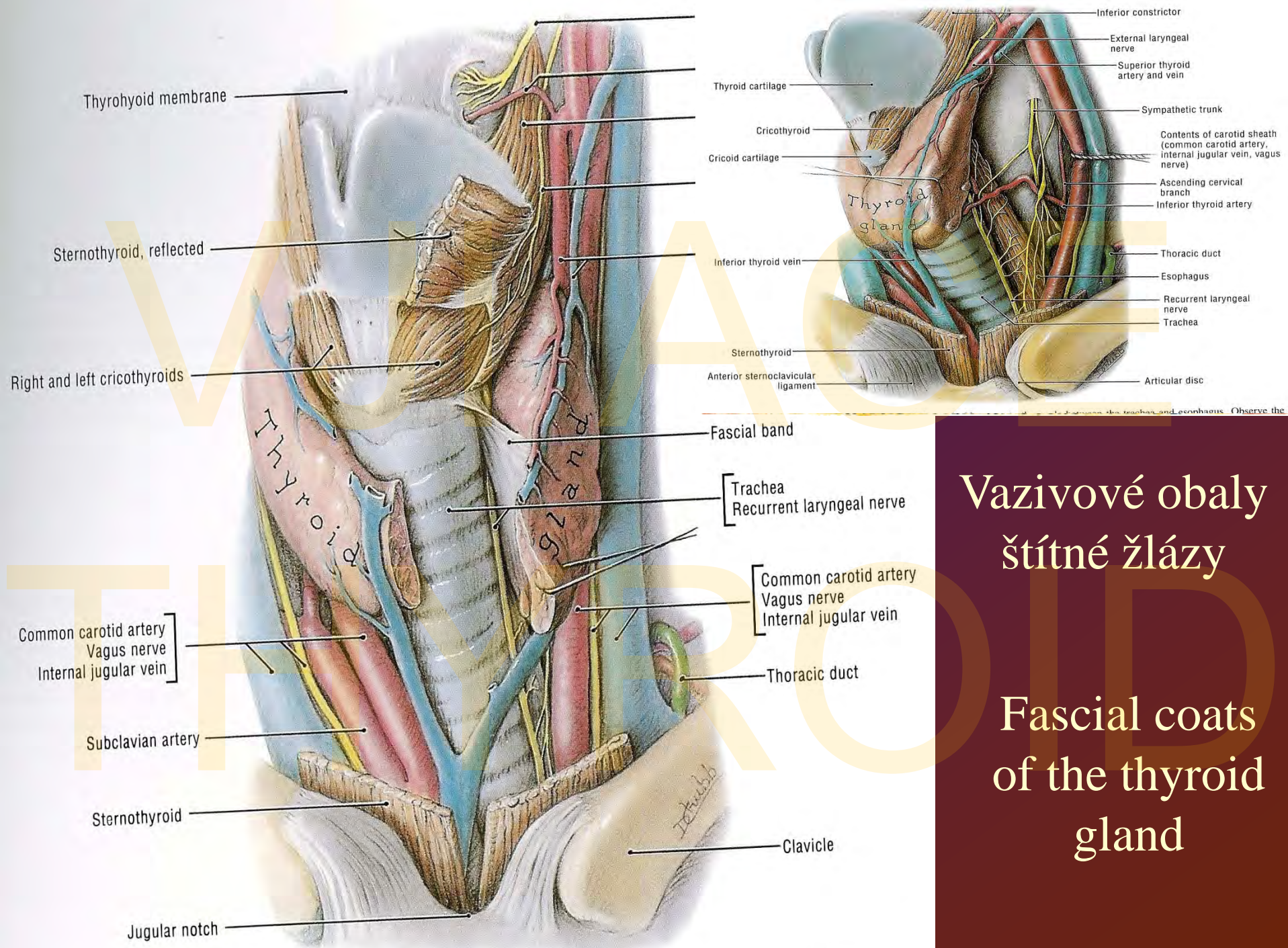
anterior view



Thyroid gland

Venous supply

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



Thyrohyoid membrane

Sternothyroid, reflected

Right and left cricothyroids

Thyroid gland

Common carotid artery
Vagus nerve
Internal jugular vein

Subclavian artery

Sternothyroid

Jugular notch

Thyroid cartilage

Cricothyroid

Cricoid cartilage

Inferior thyroid vein

Sternothyroid

Anterior sternoclavicular ligament

Fascial band

Trachea
Recurrent laryngeal nerve

Common carotid artery
Vagus nerve
Internal jugular vein

Thoracic duct

Clavicle

Inferior constrictor

External laryngeal nerve
Superior thyroid artery and vein

Sympathetic trunk

Contents of carotid sheath
(common carotid artery,
internal jugular vein, vagus nerve)

Ascending cervical branch
Inferior thyroid artery

Thoracic duct

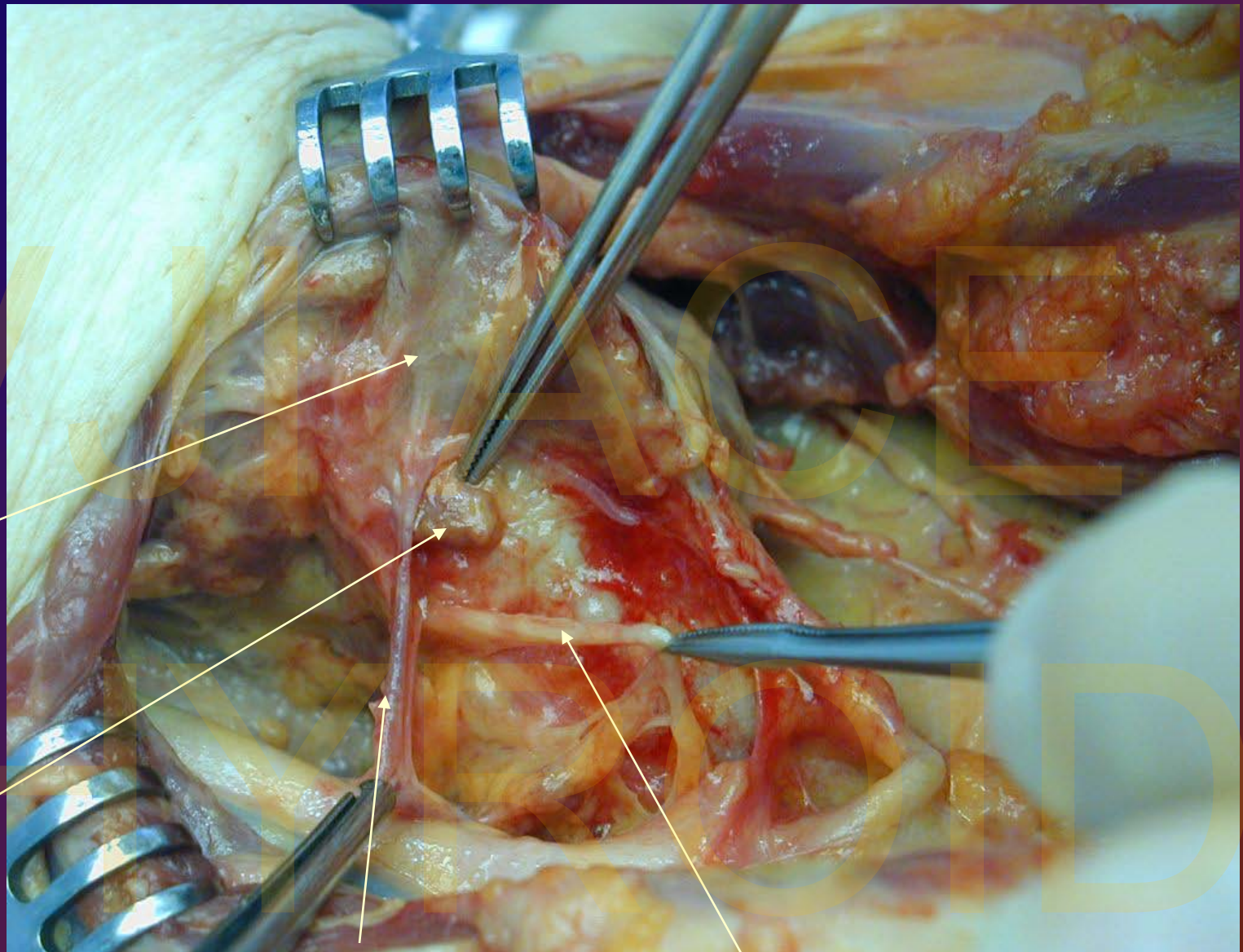
Esophagus

Recurrent laryngeal nerve
Trachea

Articular disc

Vazivové obaly
štítné žlázy

Fascial coats
of the thyroid
gland

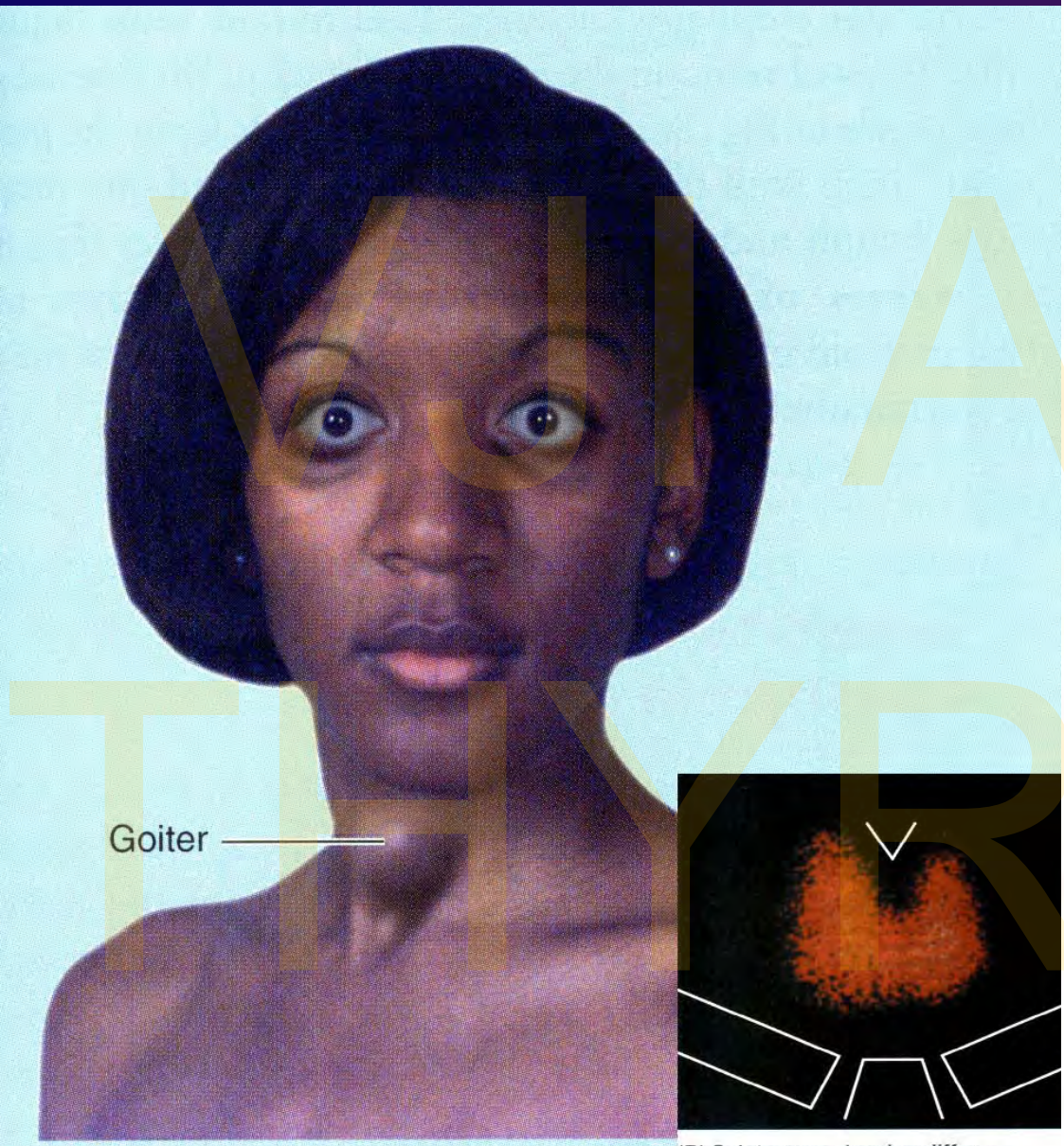


Thyroid
gland

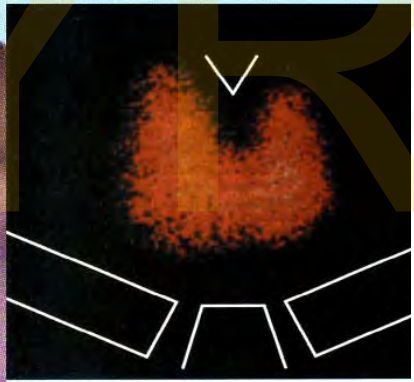
Parathyroid
body

a. thyroidea inferior

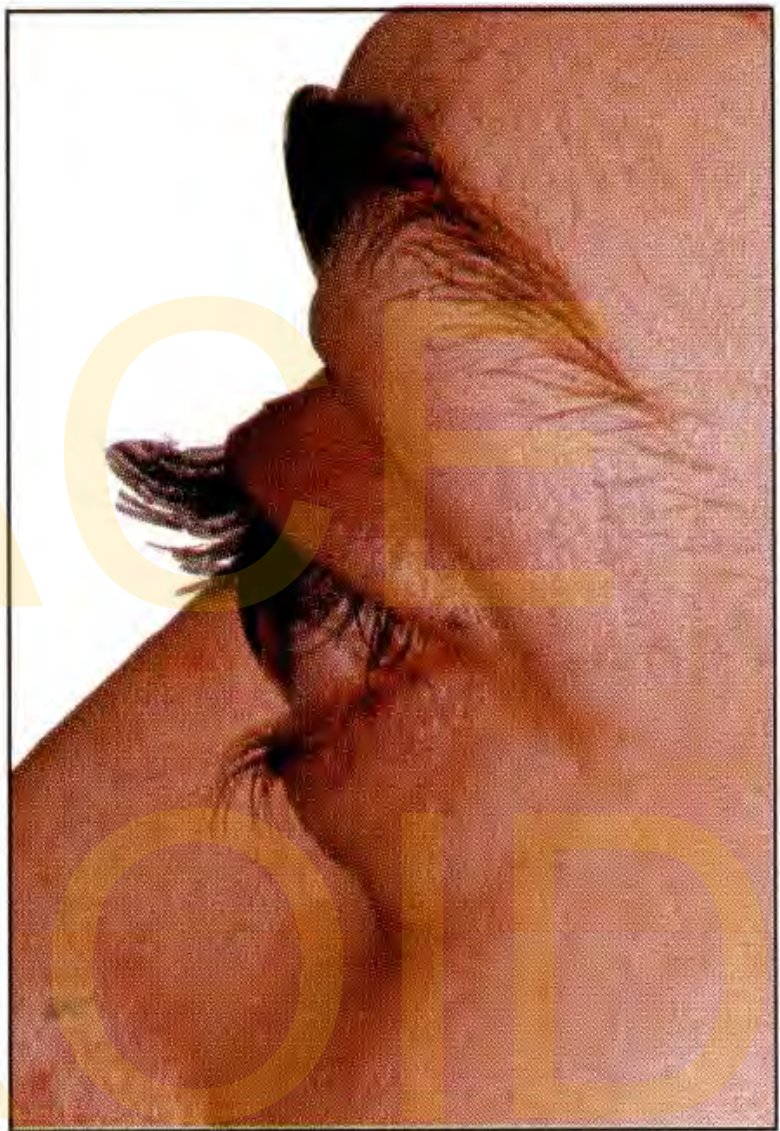
n. laryngeus reccurens



Goiter



(B) Scintigram showing diffuse, enlarged thyroid gland

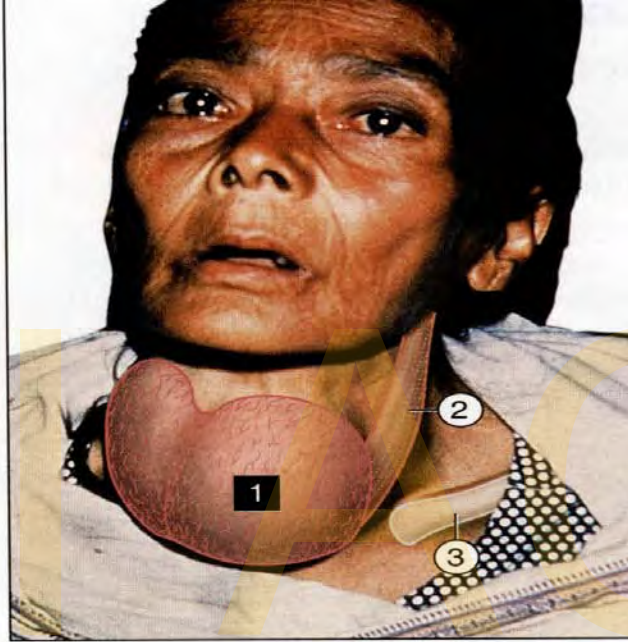


Appearance of the eyes in hyperthyroidism – proptosis, lid retraction, chemosis

A)

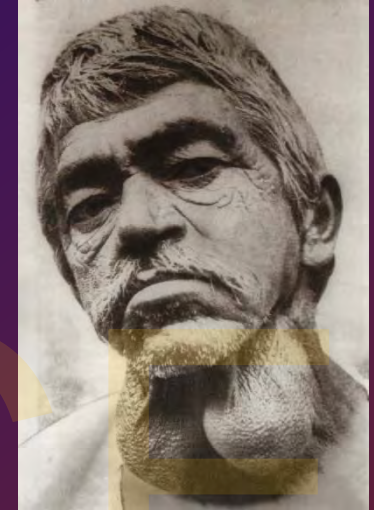


Fig. 2.17 Multinodular goitre with dominant nodule



Key

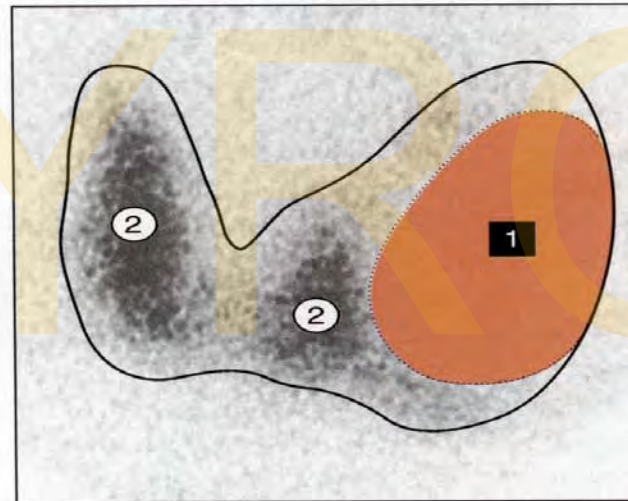
- 1 Goitre with dominant nodule
- 2 Sternocleidomastoid muscle
- 3 Clavicle



hypothyroidism



Fig. 2.18 Radionuclide scan of thyroid

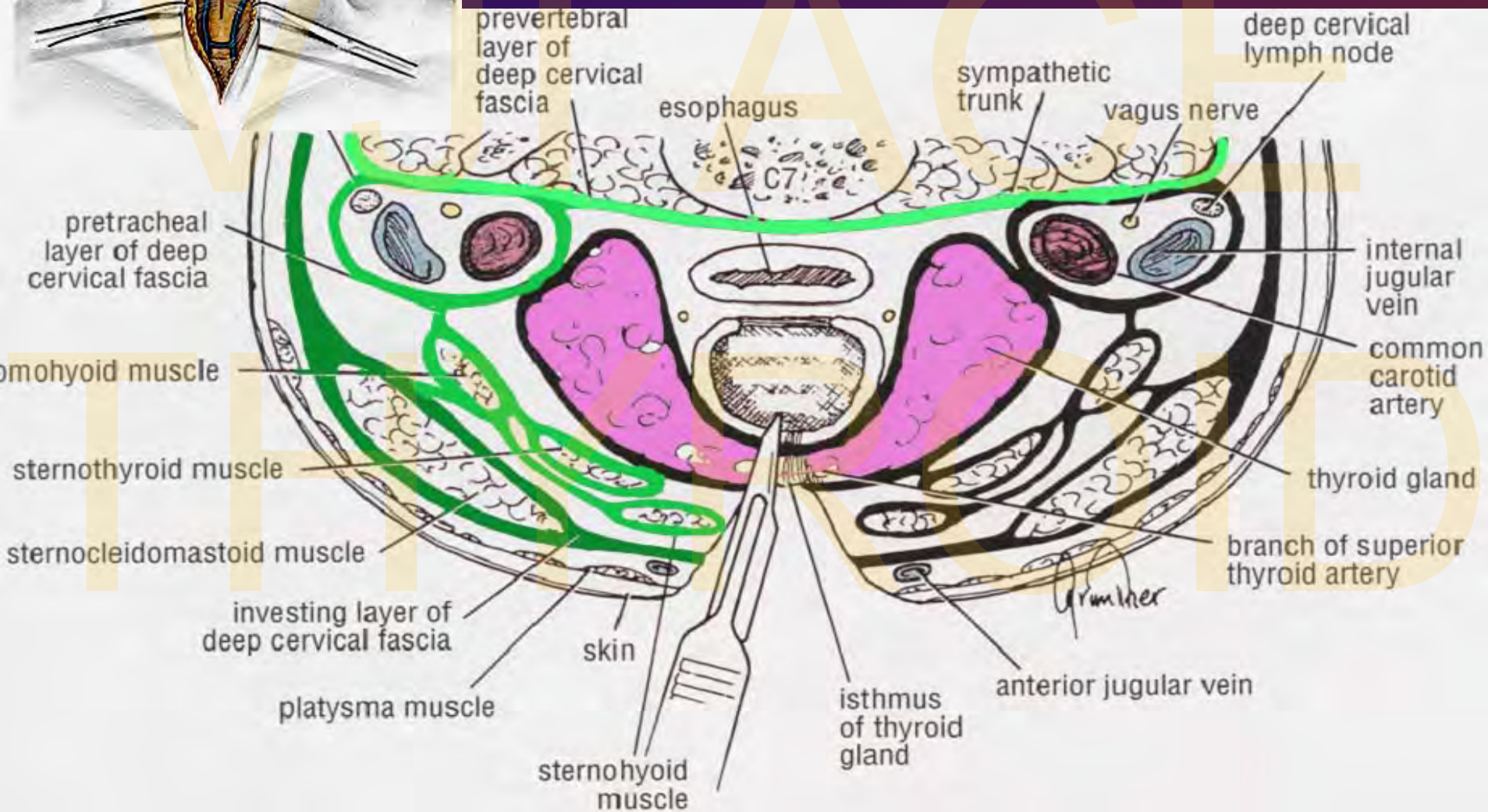
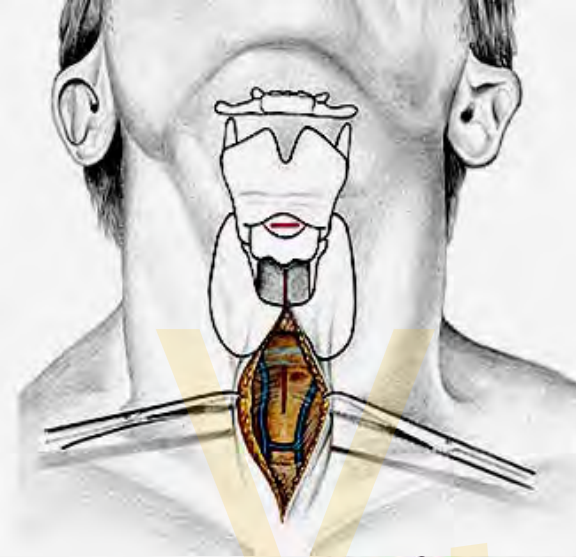


Key

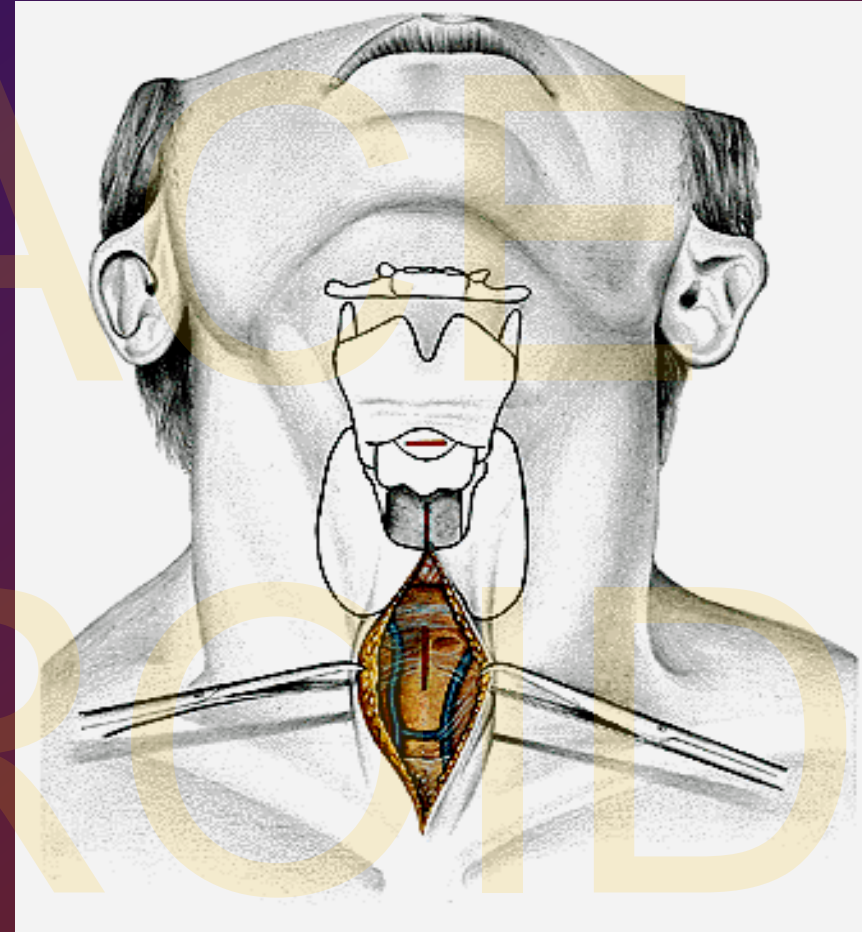
- 1 'Cold nodule'
- 2 Normal thyroid



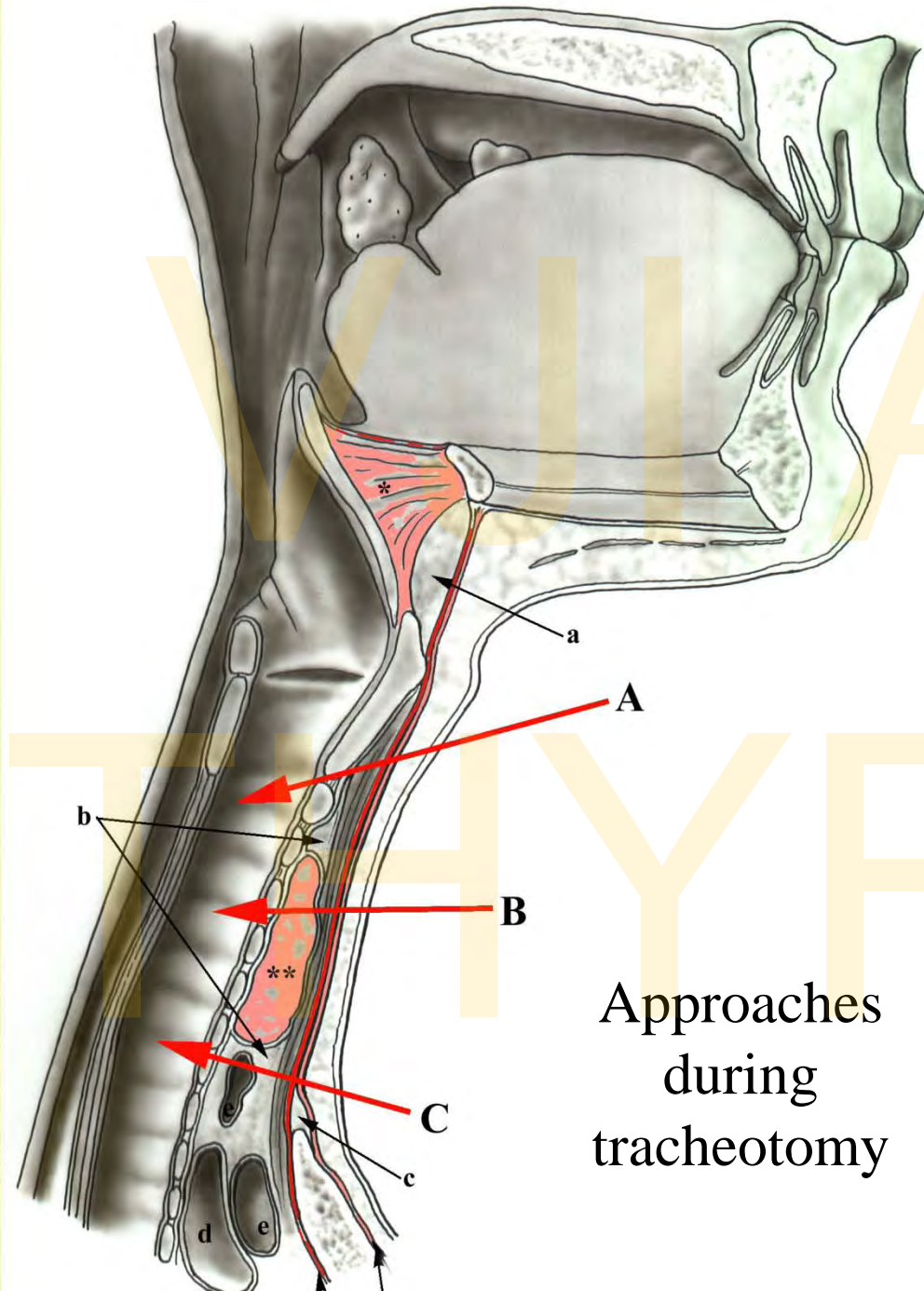
Tracheotomy



Coniotomia Coniotomy



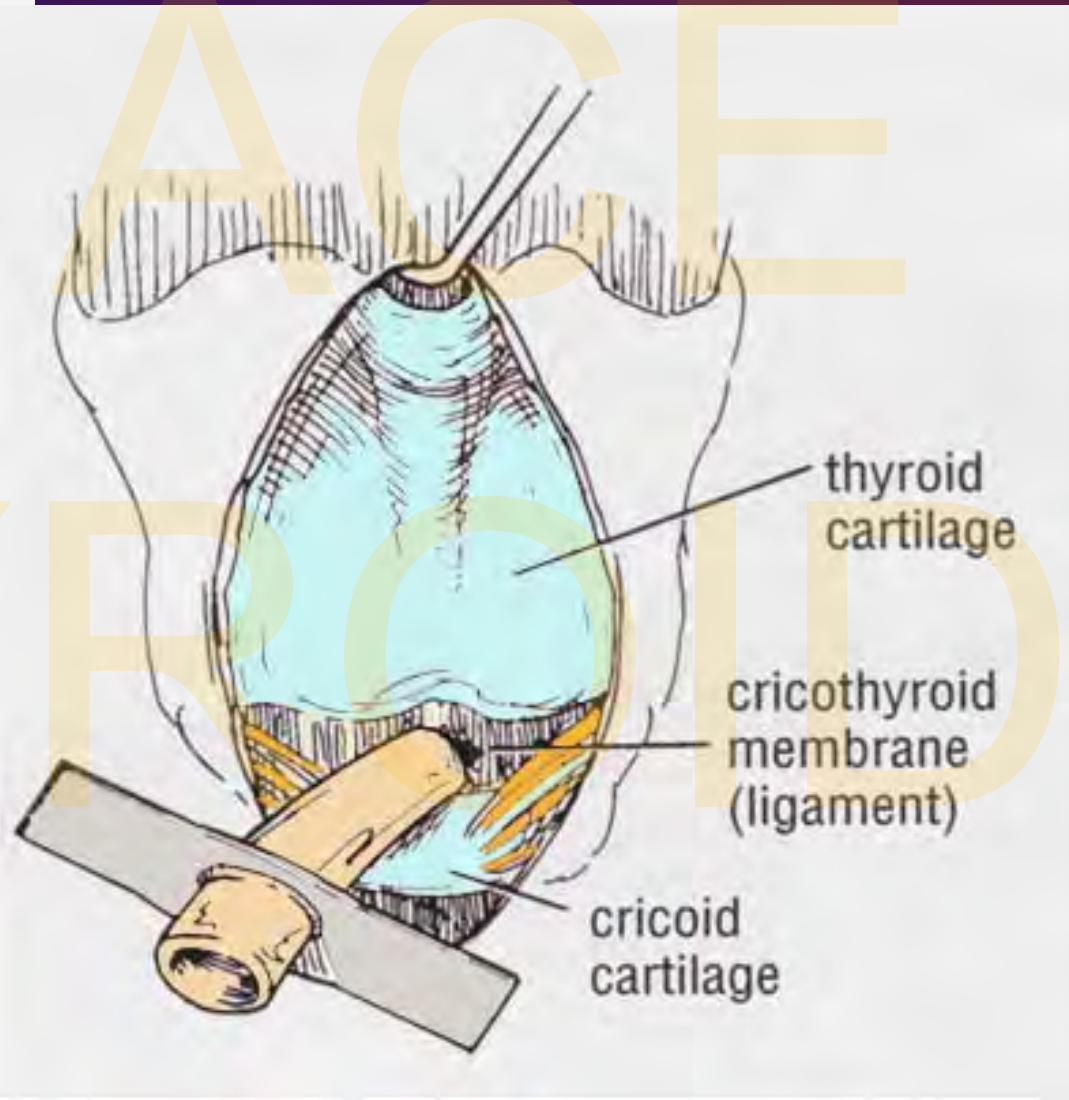
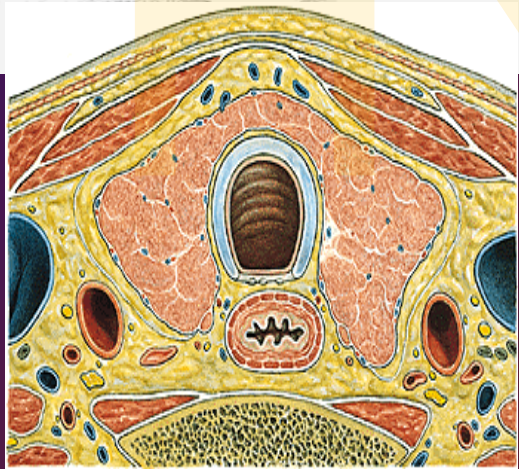
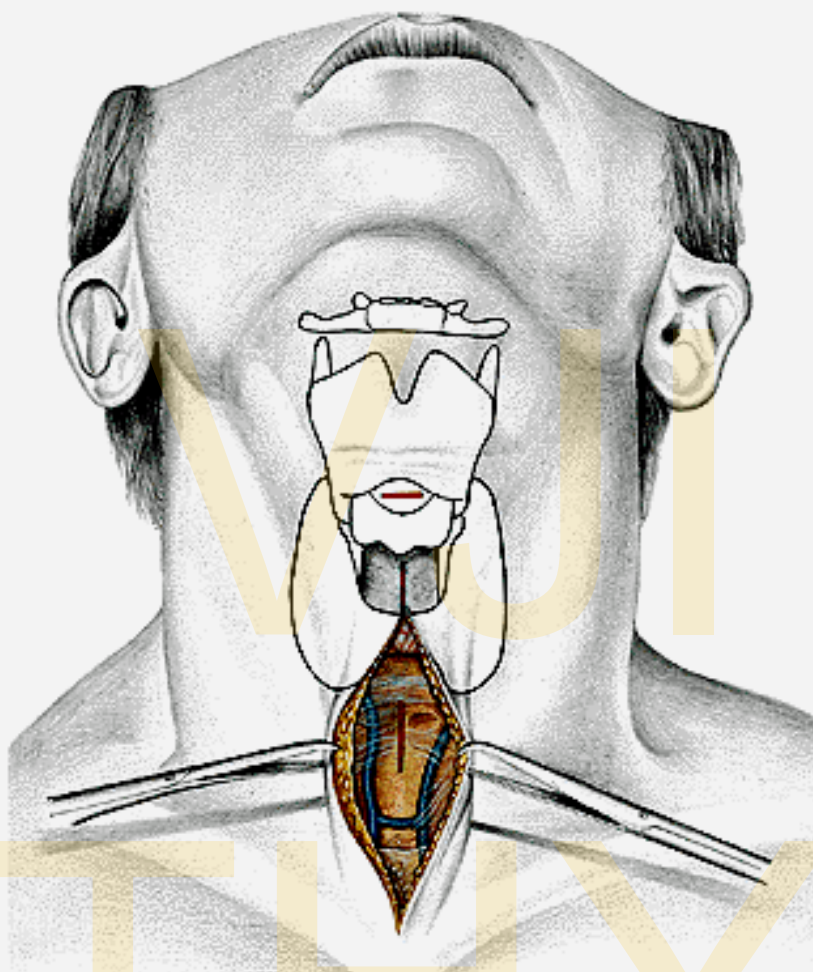
Tracheotomia Tracheotomy

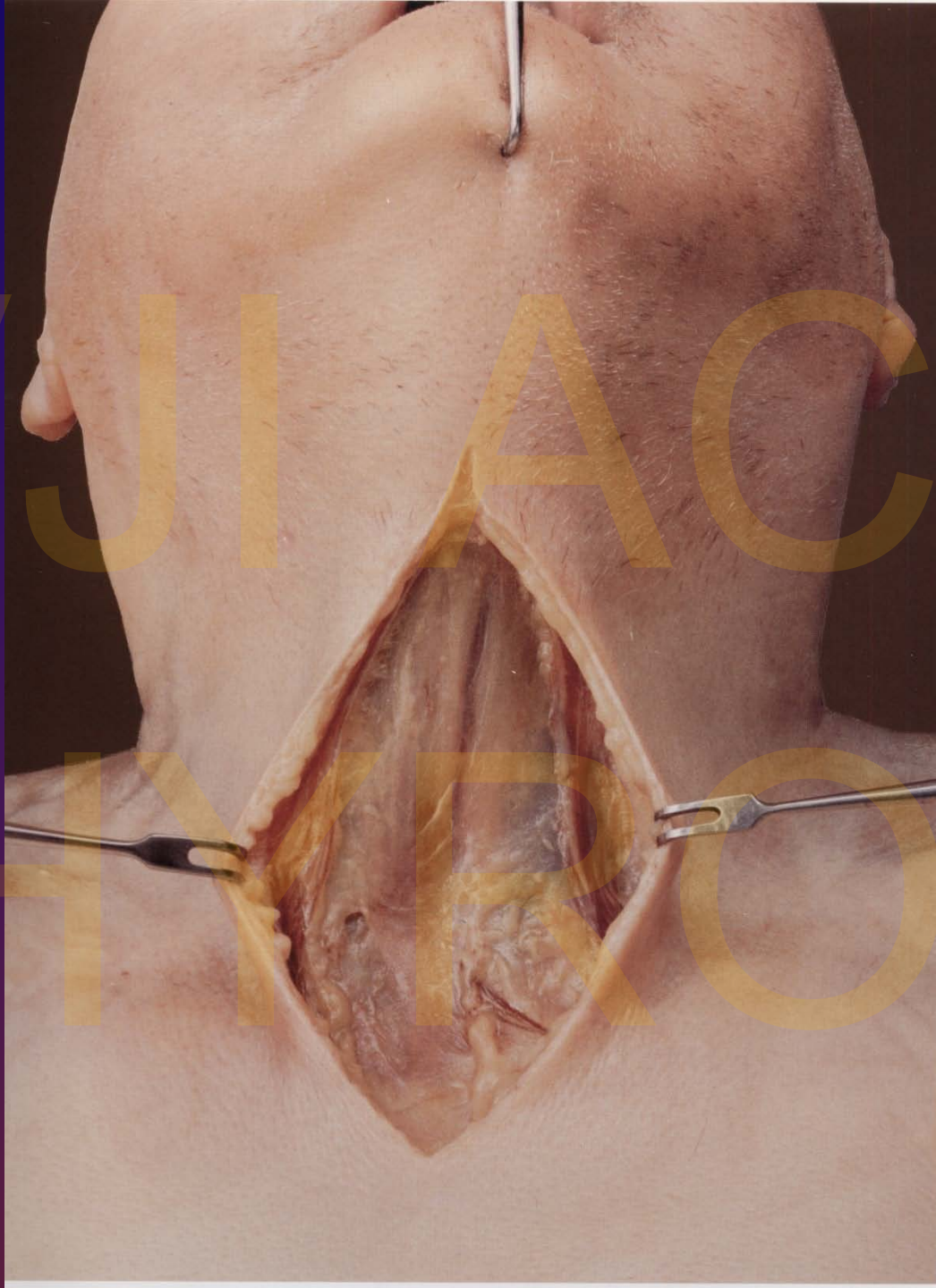


Approaches
during
tracheotomy

Tracheostomia

Tracheostomy





V
U
J
I
A
C
E
T
H
Y
R
O
I
D



V
U
J
I
A
C
E

E

T
H

H
Y
T
H

O
I
D



V
U
I
A
C
E
T
H
I
R
O
I
D



V

QUIA

CE

TH

HYPO

ID



W
J
V
A
C
E
T
H
Y
R
O
I
D



W
JUL
CE
T
H
D
O
ID

Glandula parathyroidea parathyroid glands

- ❖ 2 pairs of the ball-like glands
- ❖ drobných kulovitých útvarů
- ❖ They have role in bone metabolism
- ❖ **parathormon (PTH)** increases release Ca from bones to the blood
- ❖ development – from dorsal parts of the III. and IV. Pouch during week 5



Parathyroid glands

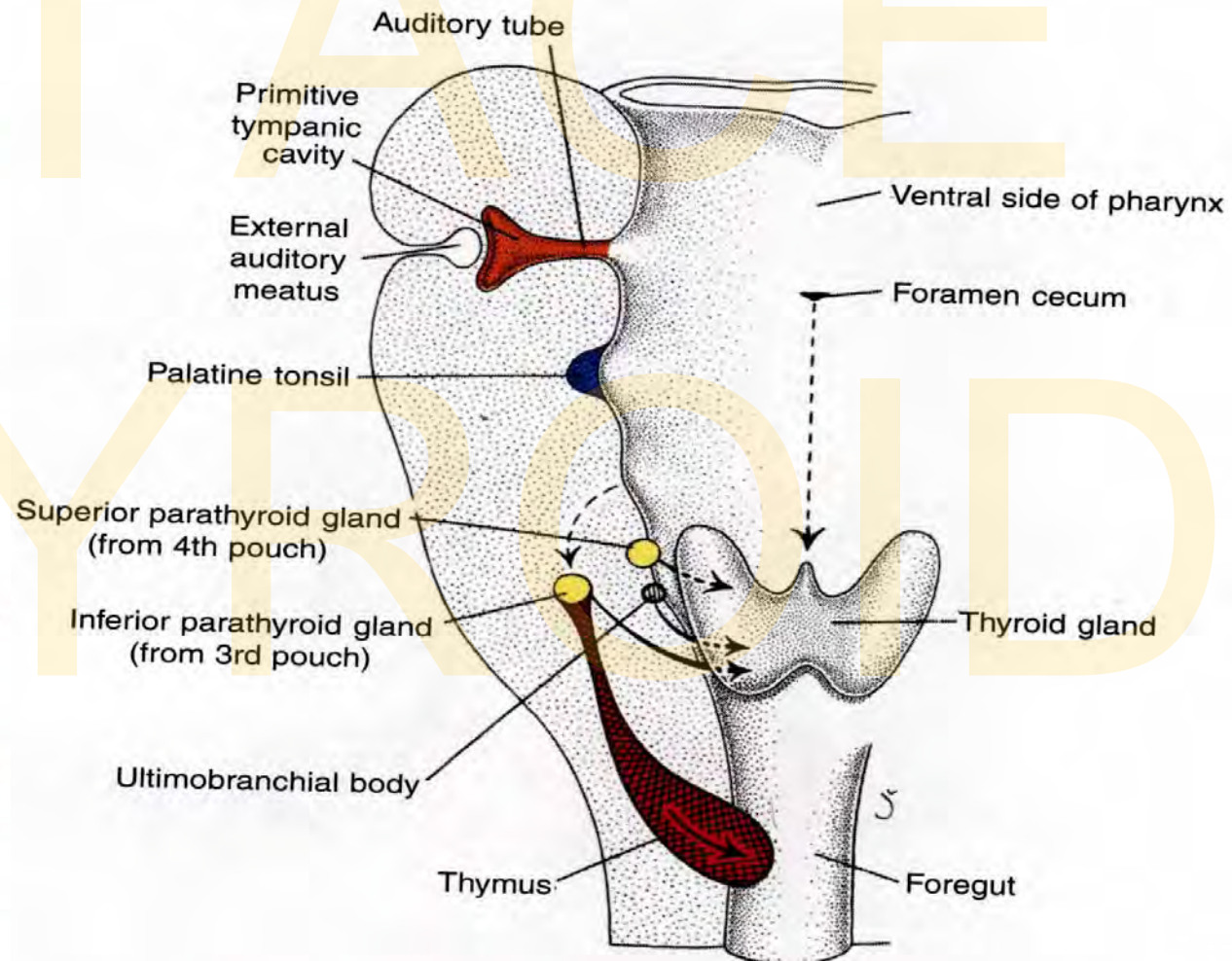
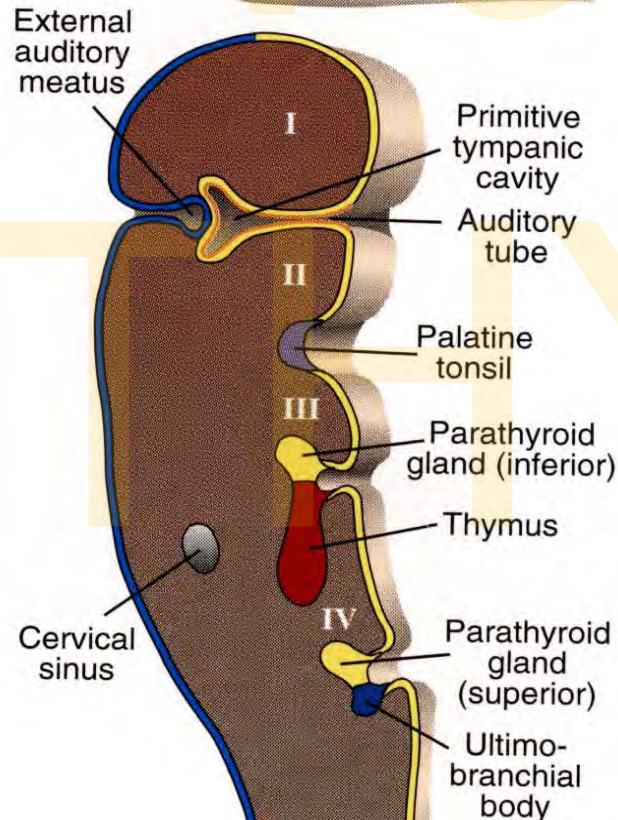
- ❖ usually 4 pieces located on the dorsal surface of the thyroid gland, 2 - 6
- ❖ Upper bodies (= glandula parathyroidea sup.) at level of area where a. thyroidea inf., n. laryngeus recurrens are crossed
- ❖ Lower bodies at levels from angulus mandibulae to pericardium
- ❖ vessels: each body has own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

IMPORTANT

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

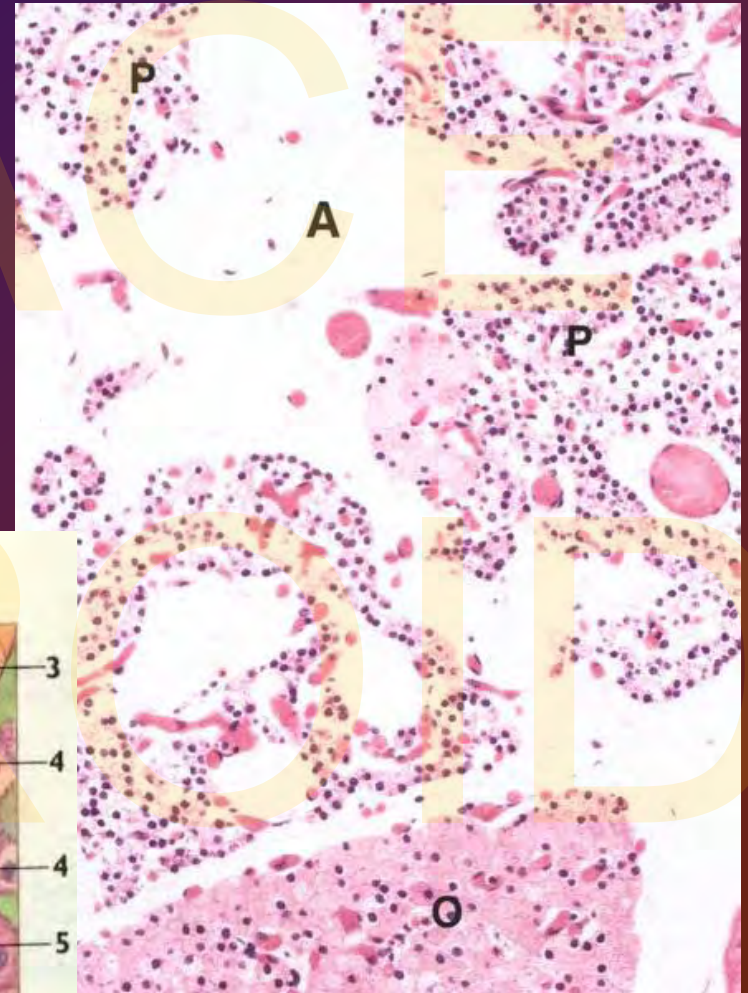
Příštítná tělíska – vývoj

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 HLTADEM, pohled zezadu; epithelový materiál pro příštitné žlázy označen barevně

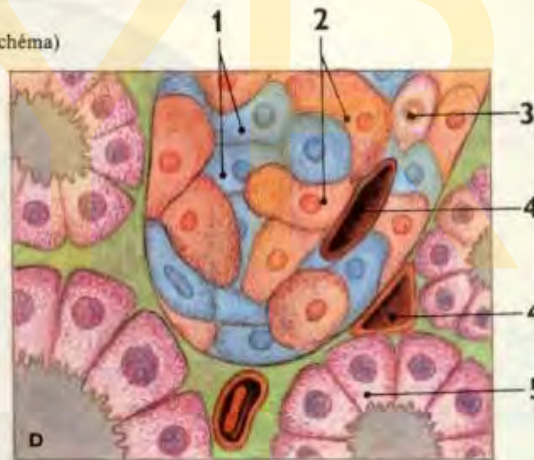
I.–IV. / 1. až 4. žaberní oblouk, mezi oblouky jsou žaberní výchlípky

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



Sources:

www.lf1.cuni.cz

<http://anat.lf1.cuni.cz/internet.htm>

Dauber W: Pocket Atlas of Human Anatomy, Barnes and Noble 2000

E.K.Sauerland: Grant's Dissector 1999

Schuenke et al.: Neck and internal organs. Atlas of anatomy, Thieme

Klepáček, Ivo, Mazánek Jiří a kol: Klinická anatomie ve stomatologii. Praha, Grada, 2001

Netter: Atlas of Human Anatomy, Icon 2003

Berkowitz et al.: Oral Anatomy, Histology and Embryology. 3rd Edition, Mosby 2002

Woelfel, Scheid: Dental Anatomy, 6th ed. Williams & Wilkins, 2002

Schumacher, G. – H.: Anatomia pre stomatologov 1. diel Martin, Osveta, 1992

Čihák, Radomír: Anatomie 1, 2 Praha, Avicenum, 1987, 1988

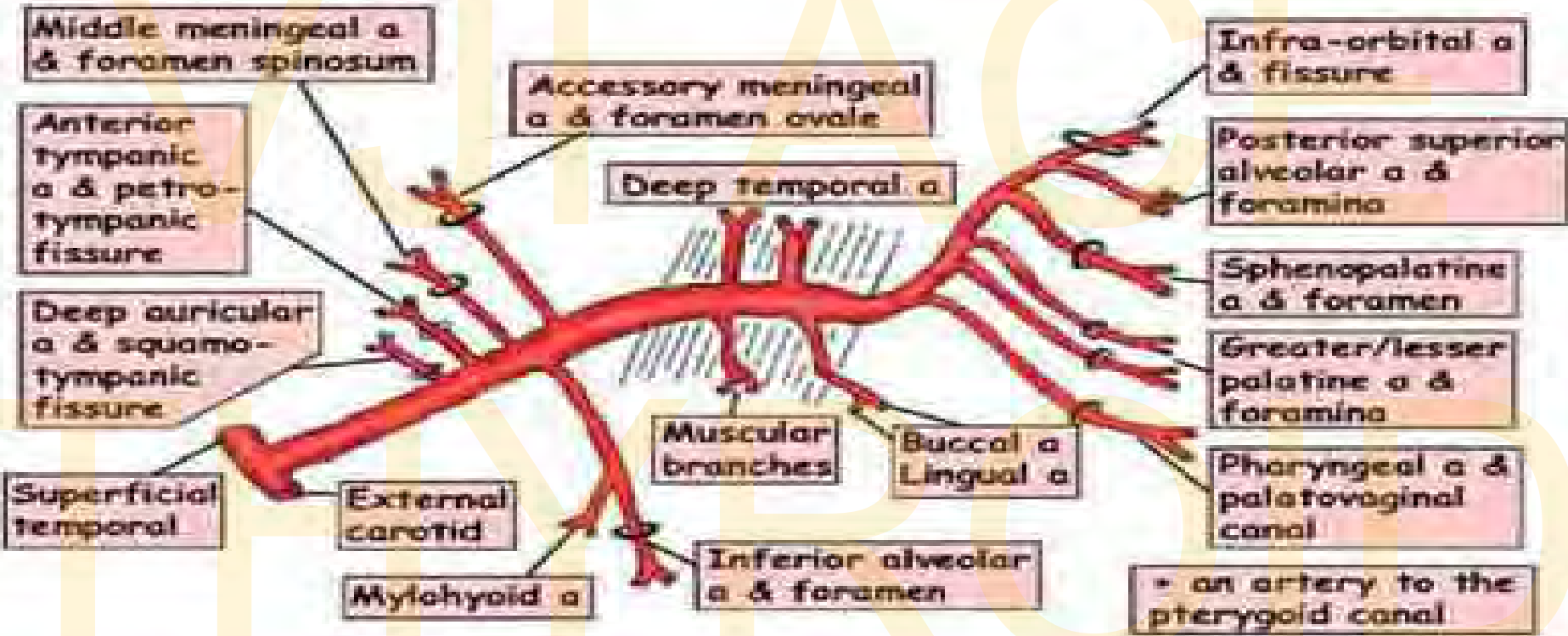
Rohen, Johannes W., Yokochi, Chirio: Human anatomy. Photoatlas of the systemic and topographic anatomy, 1998

Seichert, Václav: A little anatomical atlas, 1999

Own archive

MAXILLARY ARTERY

In infratemporal fossa, either within or lateral to the superficial head of lateral pterygoid muscle. This muscle is shown below



BEFORE LATERAL PTERYGOID 5 BRANCHES INTO BONE

LATERAL OR WITHIN LATERAL PTERYGOID. 4/5 BRANCHES TO SOFT TISSUE

BEYOND LATERAL PTERYGOID 5/6 BRANCHES WITH NERVES