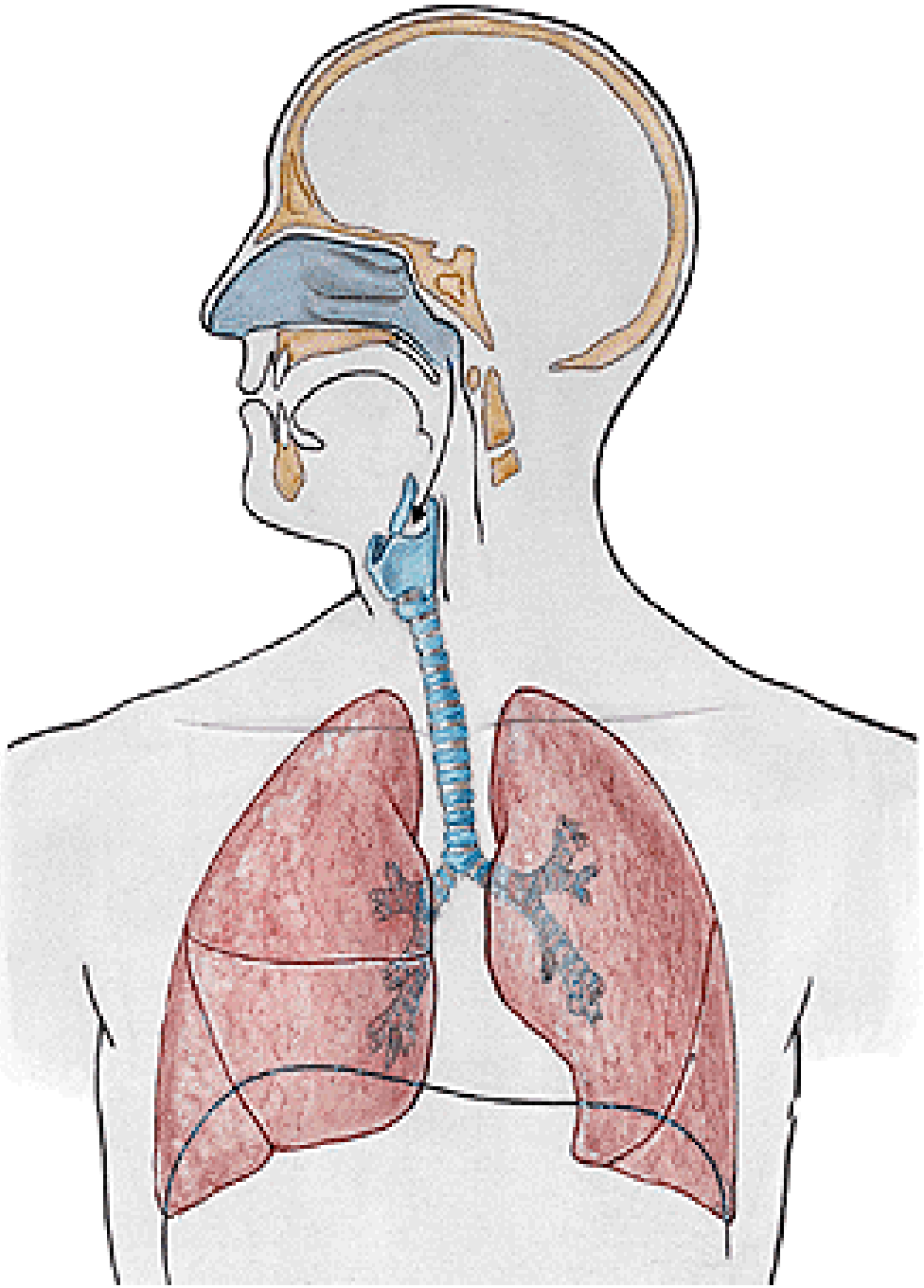
RESPIRATORY SYSTEM

RNDr. Michaela Račanská, Ph.D.



Upper respiratory tract

Cavum nasi

Pharynx

Lower respiratory tract

Larynx

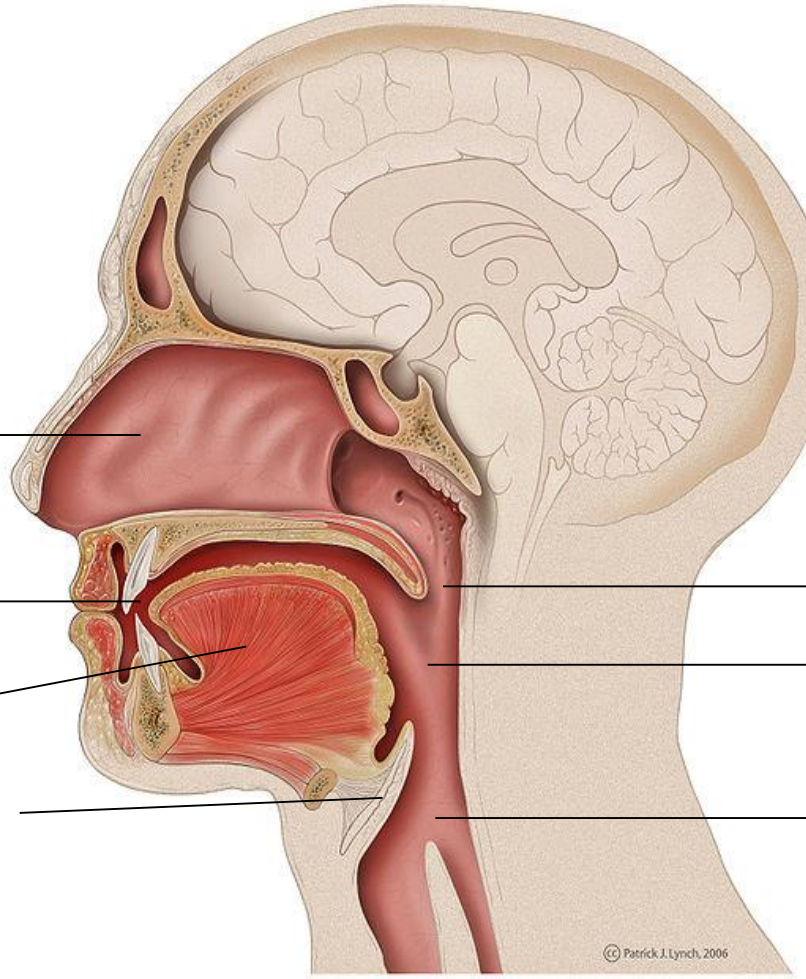
Trachea

Bronchi

Respiratory organ

Lungs

Upper respiratory tract



http://commons.wikimedia.org/wiki/File:Head_lateral_mouth_anatomy.jpg

Nasal cavity

Oral cavity

Tongue

epiglotis

- Prevents enter of the food to the trachea

nasopharynx

oropharynx

laryngopharynx

pharynx

NASUS EXTERNUS

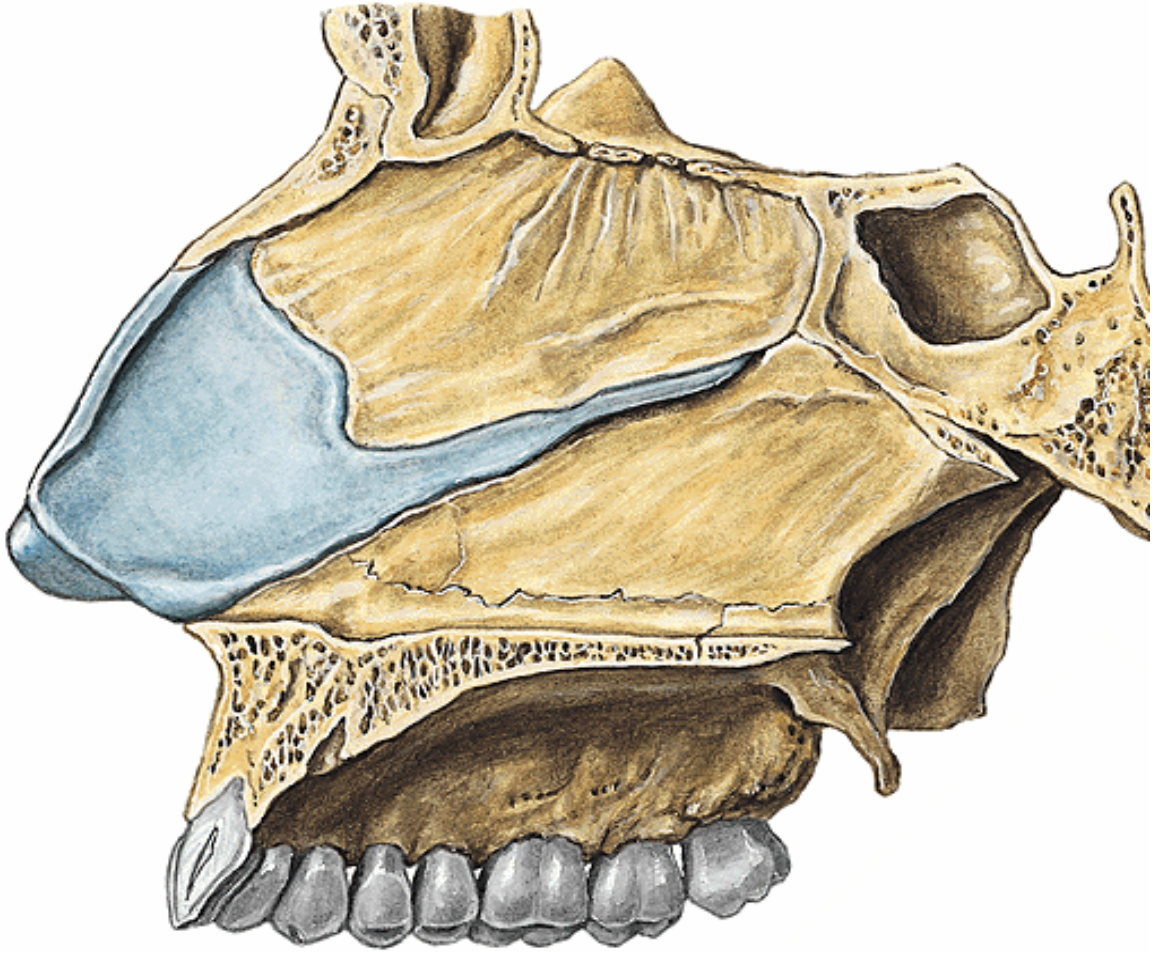
Radix nasi
Dorsum nasi
Apex nasi
Nares
Alae nasi

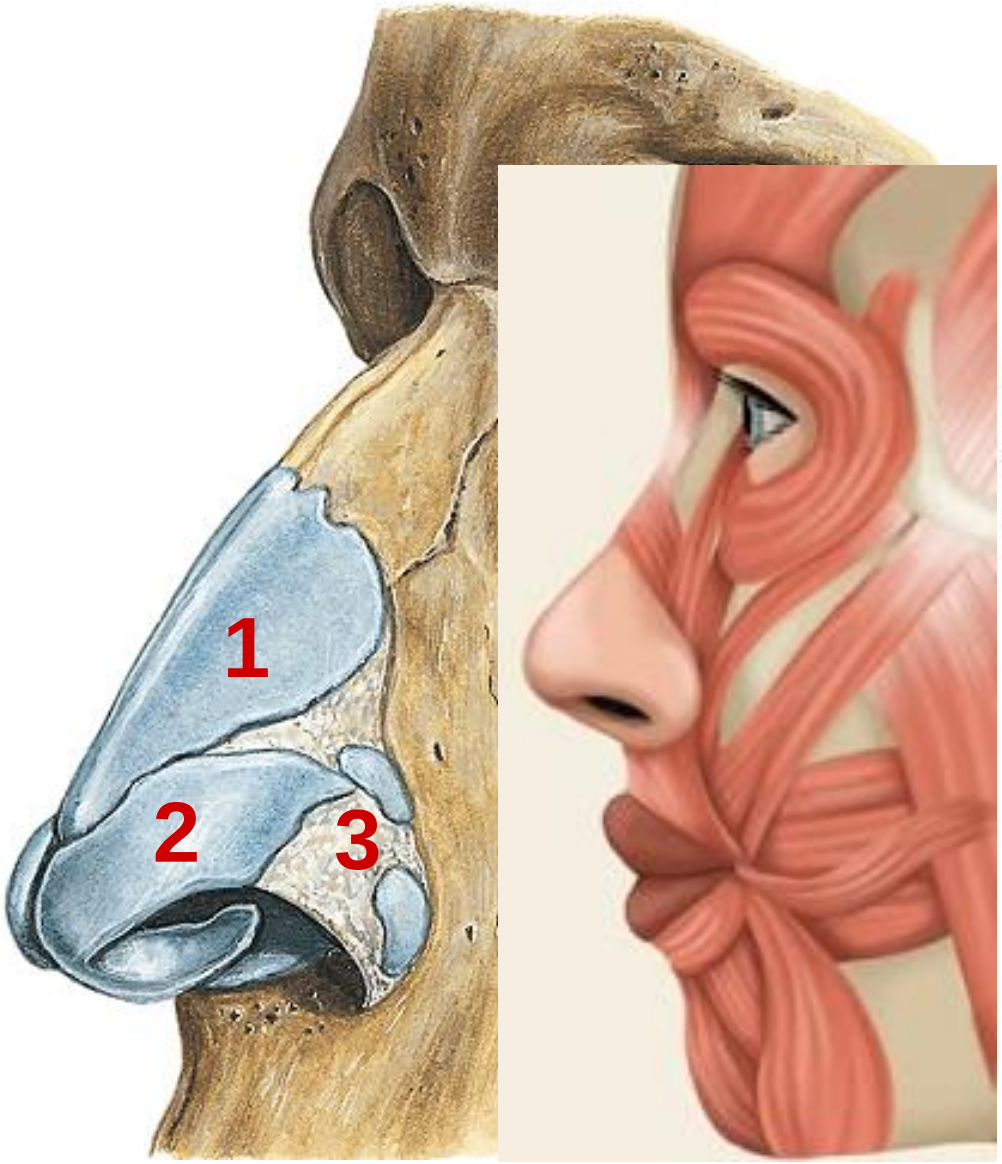
Layers

- skin
- muscles
- bones + cartilages

Nares - Choanae

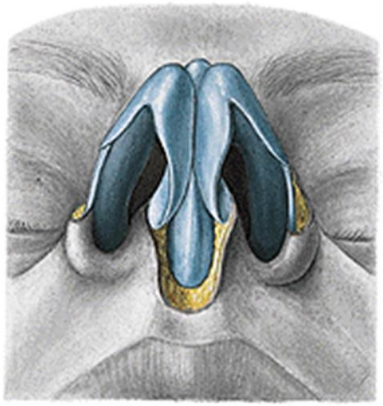
Cartilago septi nasi

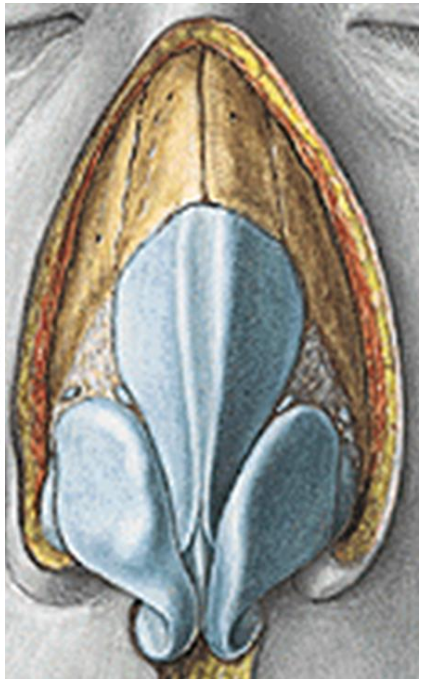




1 Cart. nasi lat.

2 Cart. alaris major
crus mediale
crus laterale

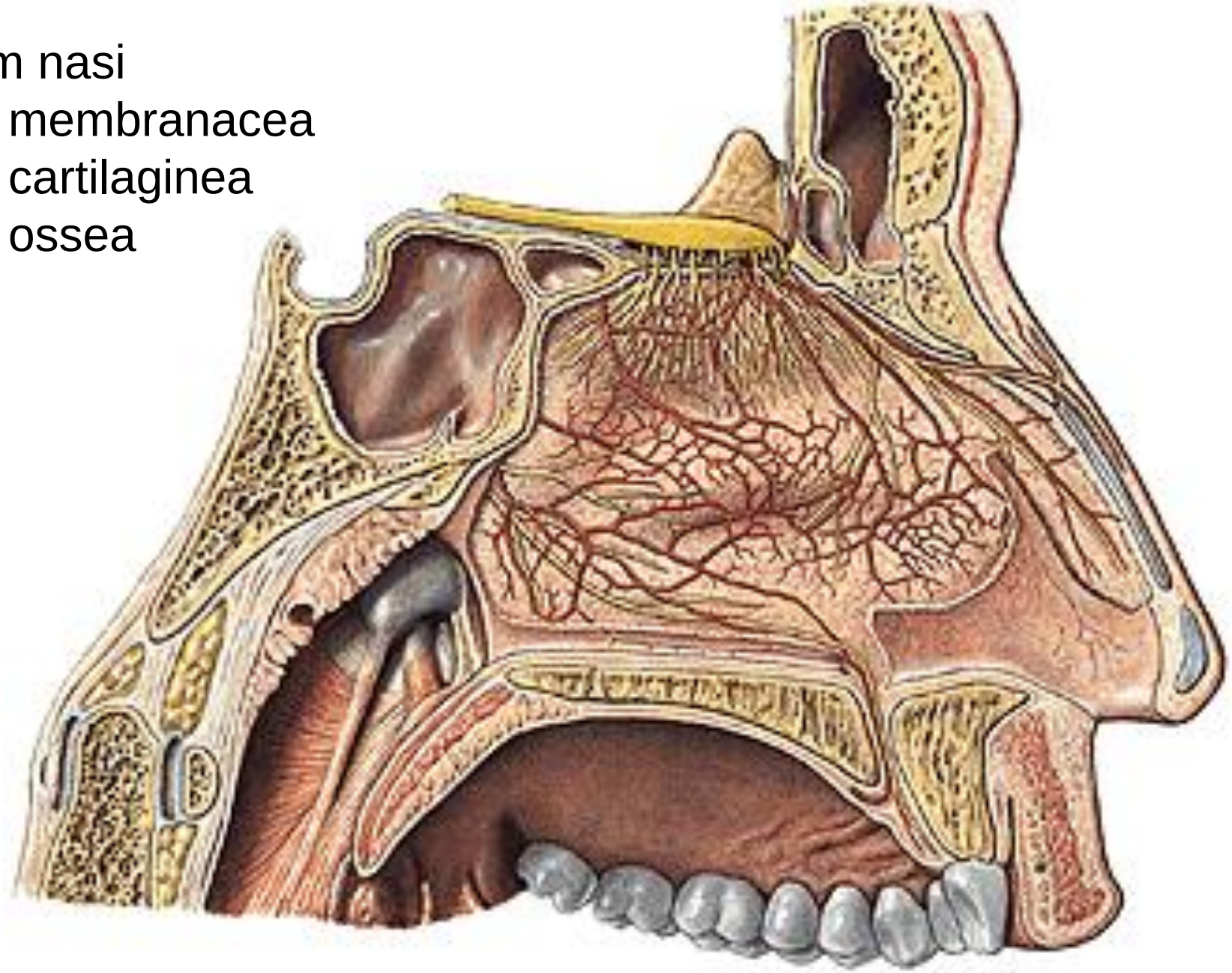




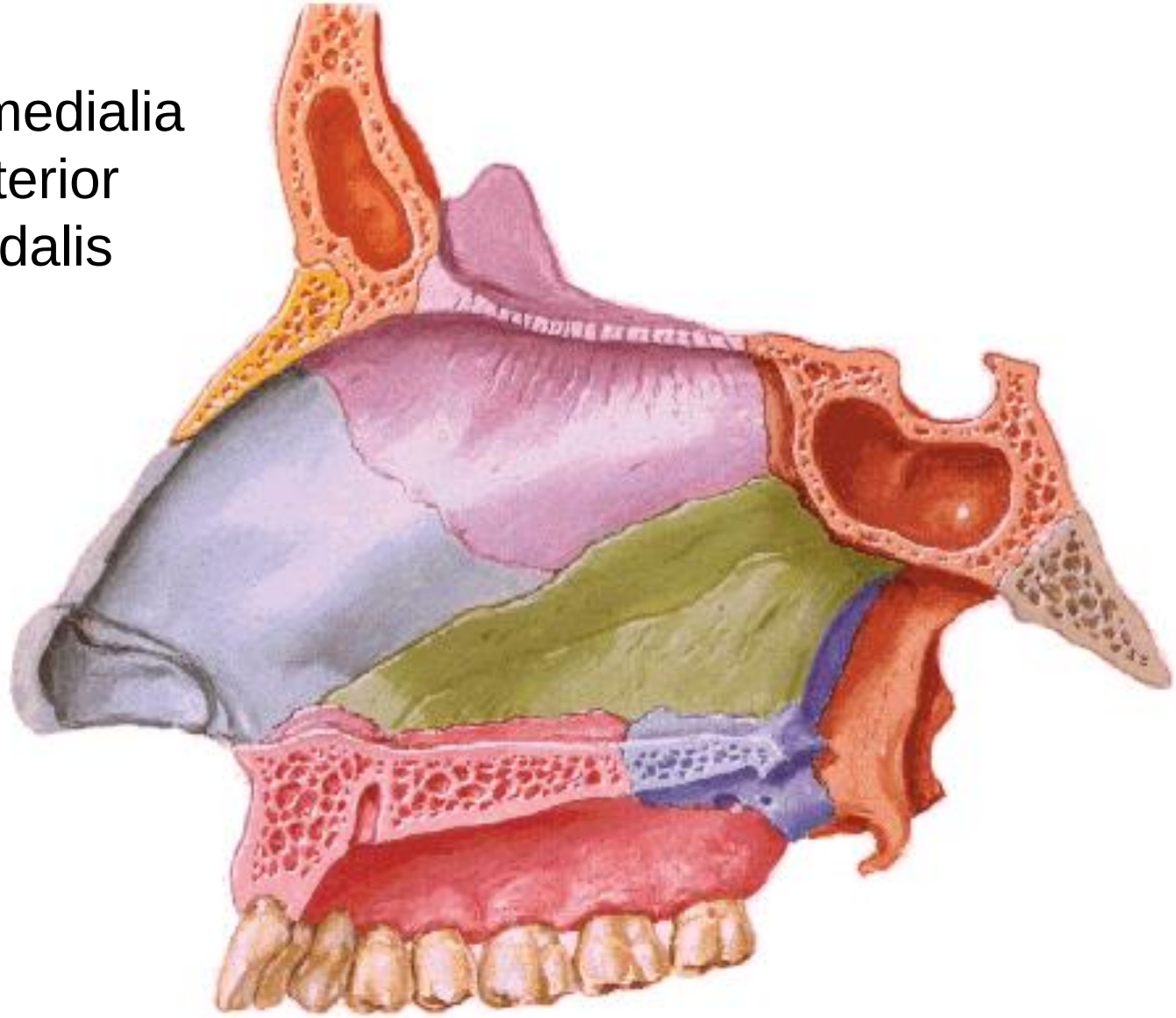
3 Cartt. alares minores

Cartt. nasales accessoriae

Septum nasi
- pars membranacea
- pars cartilaginea
- pars ossea

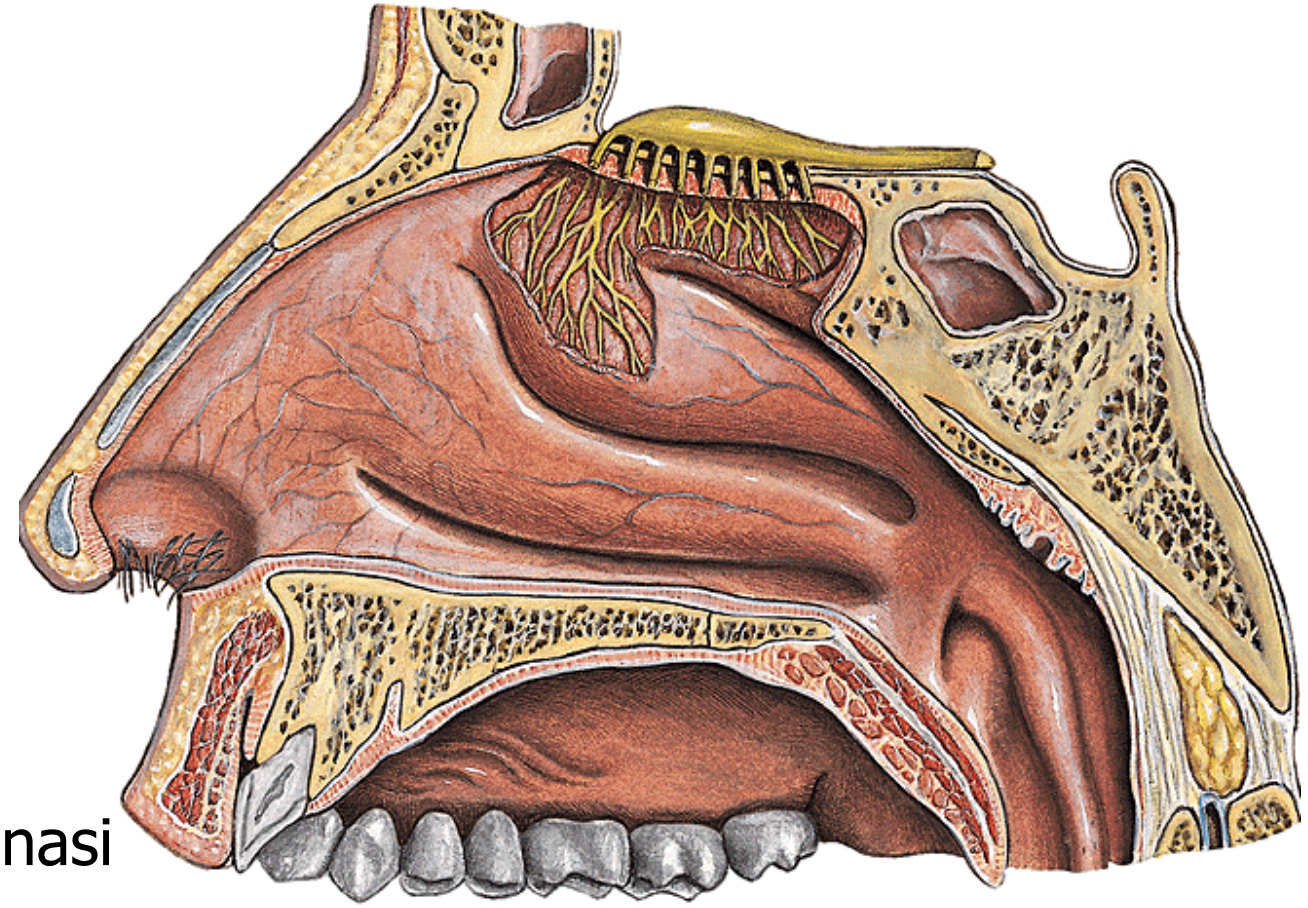


SEPTUM NASI
Cartilagines alares majores – crura medialia
Cartilago septi nasi – processus posterior
Lamina perpendicularis ossis ethmoidalis
Vomer



Cavum nasi

- Vestibulum
- Cavum nasi propr. - regio olfactoria, respiratoria

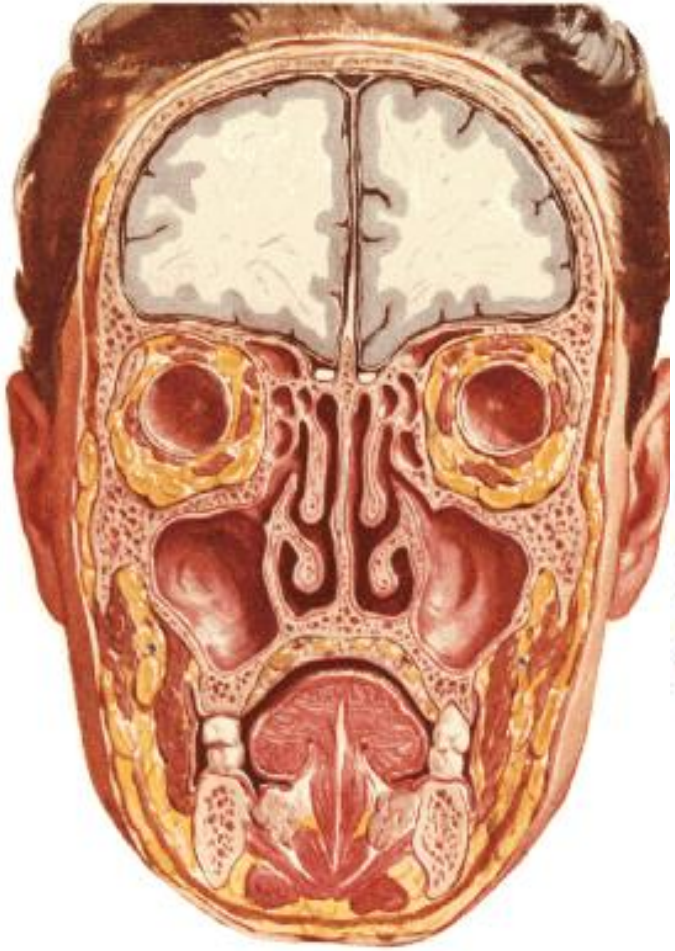


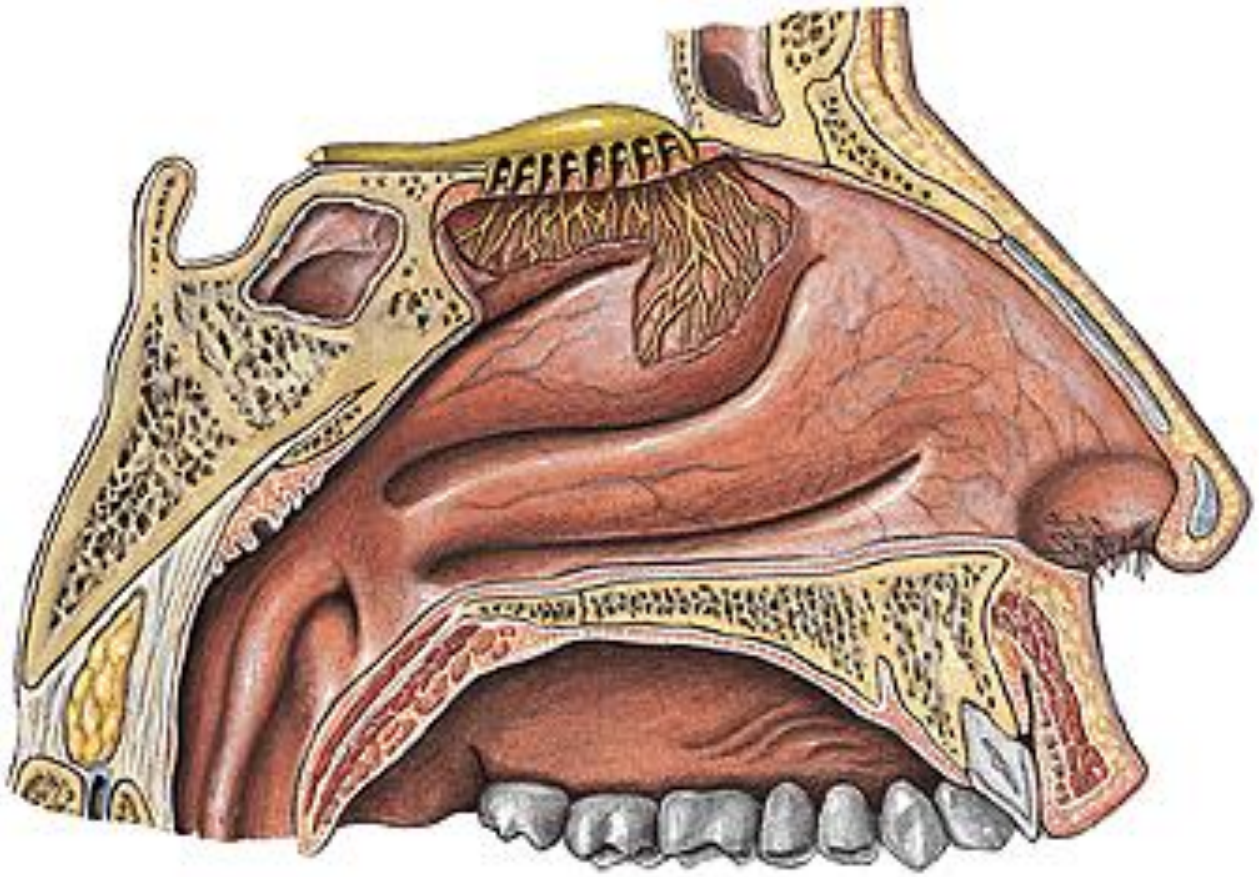
Limen nasi
Vibrissae

Recessus apicis nasi

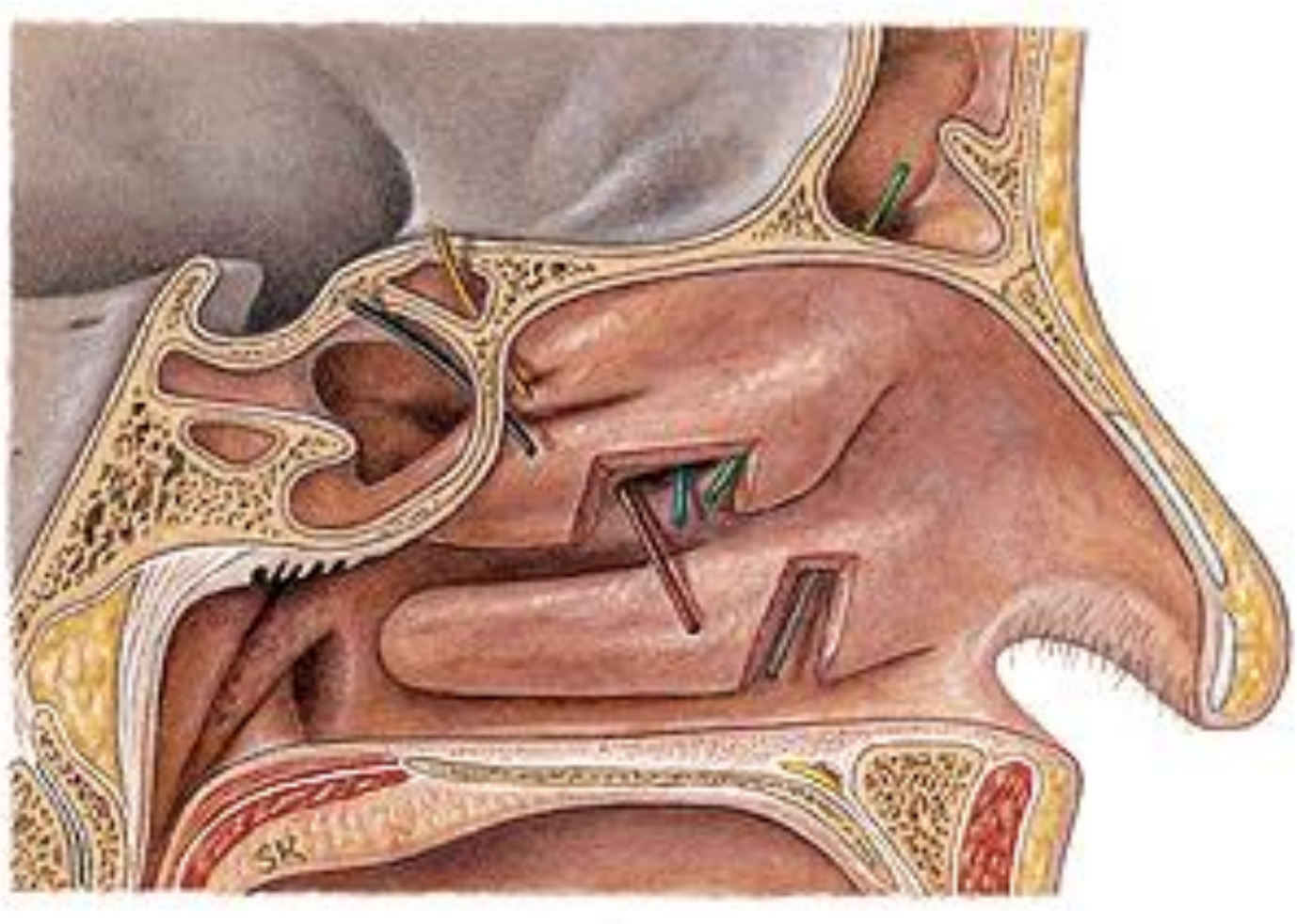
CAVITAS NASI

- cavitas nasi propria – meatus nasi sup., medius, inf.
  meatus nasi communis, meatus nasopharyngeus, choanae





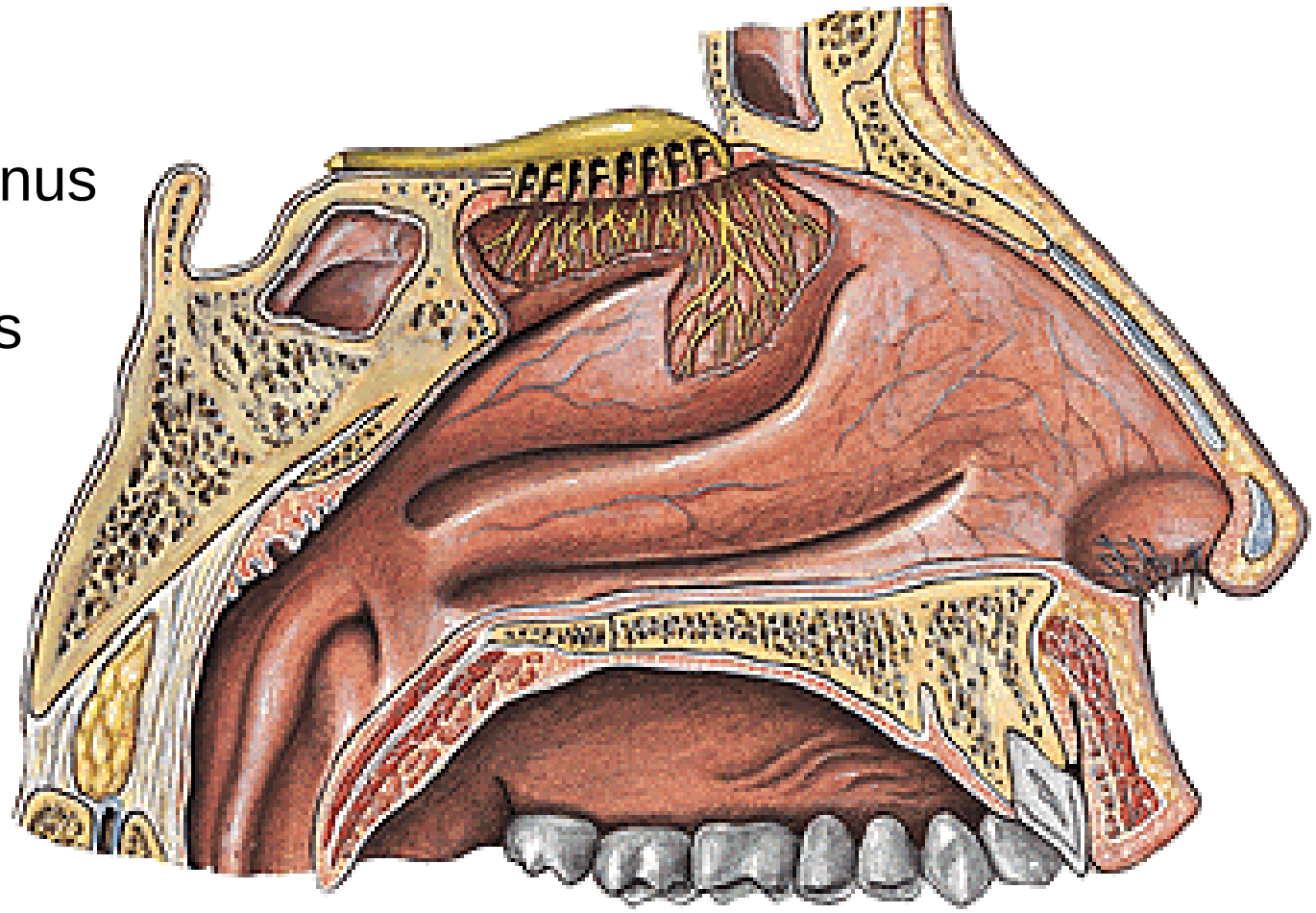
Meatus nasi inf. – ductus nasolacrimalis
Meatus nasi medius – hiatus semilunaris – sinus maxillaris, sinus frontalis, cellulae ethmoidales anteriores
Meatus nasi sup. – cellulae ethmoidales posteriores, sinus sphenoidalis



Superior wall: cartilago nasi lateralis, os nasale,
pars nasalis ossis frontalis, lamina cribrosa
ossis ethmoidalis, corpus ossis sphenoidalis

Inferior wall:
processus palatinus maxillae, lamina horizontalis ossis palatini

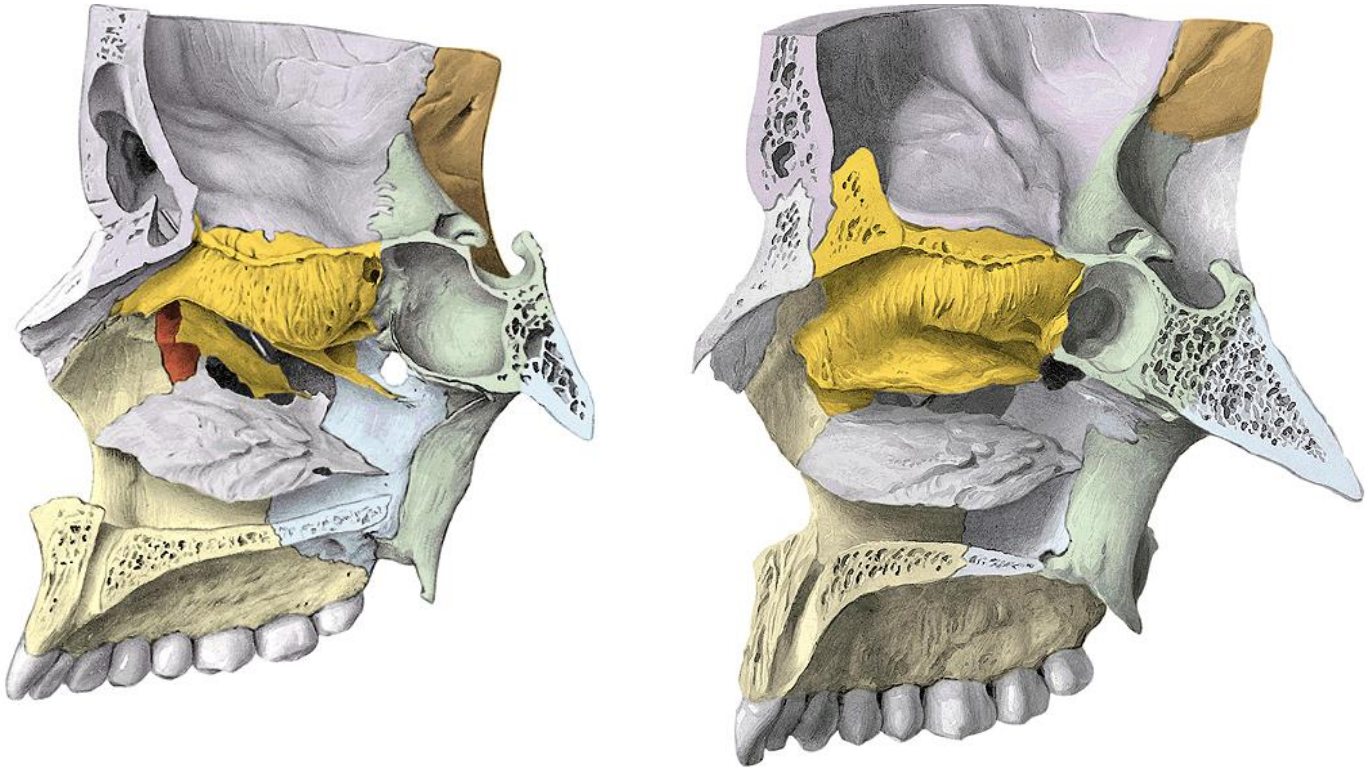
canalis incisivus



Lateral wall:
proc. frontalis and corpus maxillae, os lacrimale,
os ethmoidale, lamina perpendicularis ossis palatini, sphenoid

Concha nasalis superior (os ethmoidale)
Concha nasalis media (os ethmoidale)
Concha nasalis inferior

} Enlarge the surface of nasal cavity

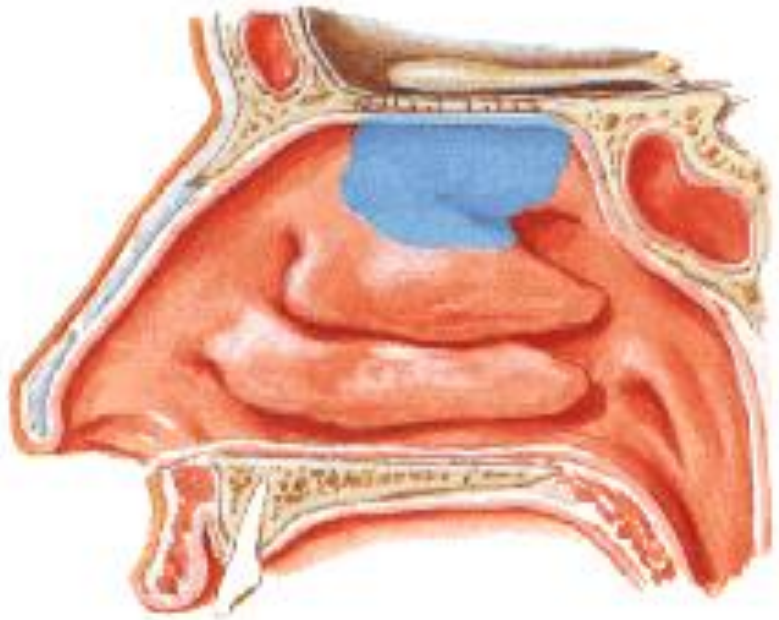


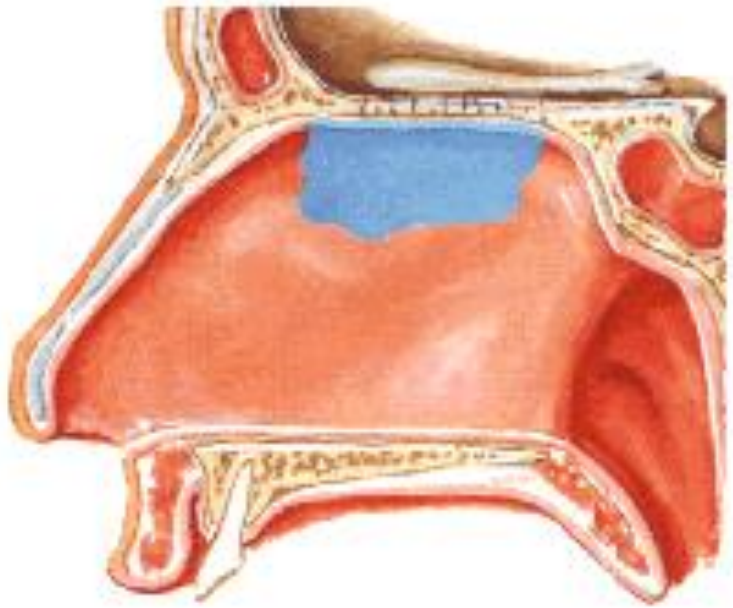
NASAL MUCOSA

Regio respiratoria

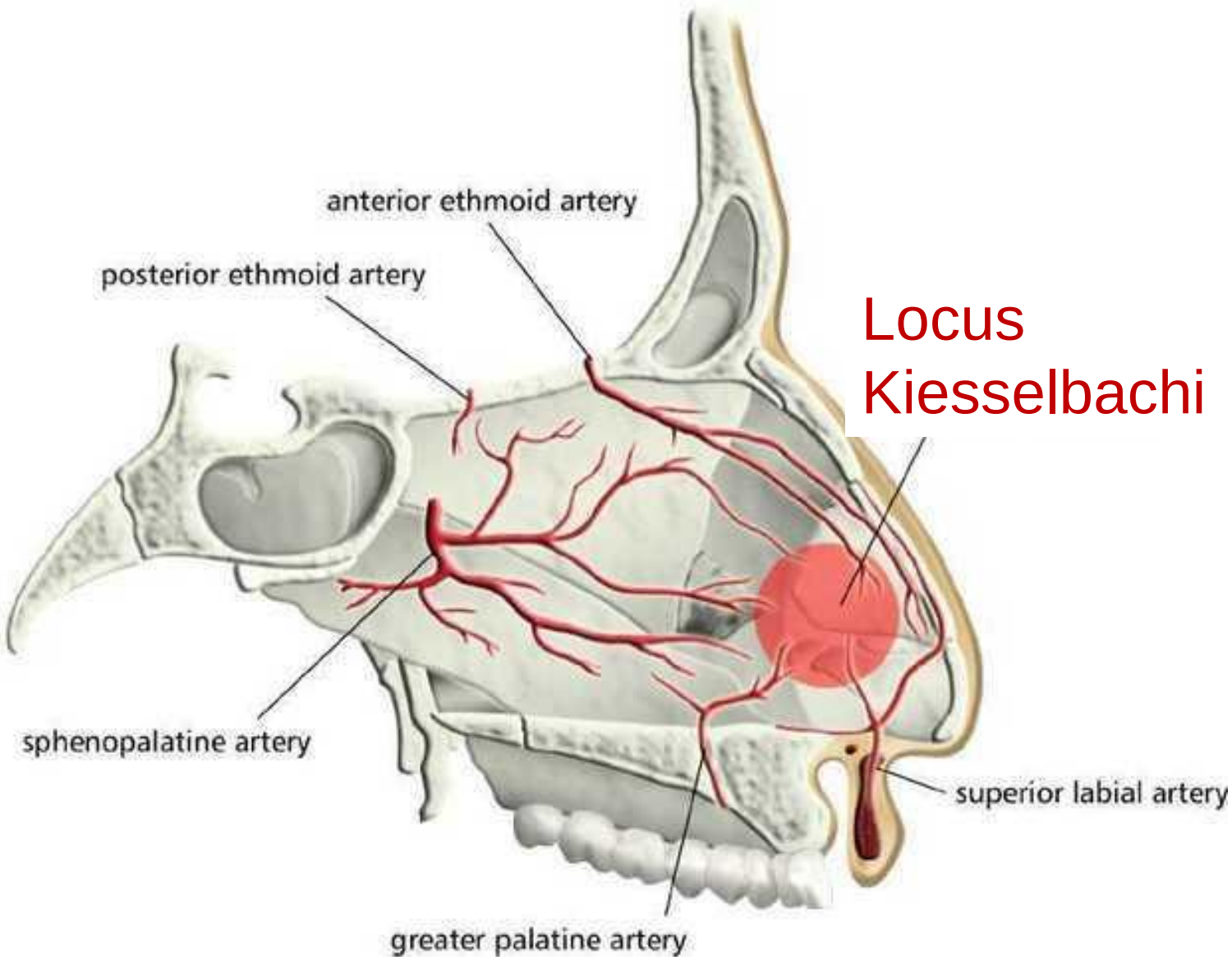
plexus cavernosi - epistaxis

Regio olfactoria



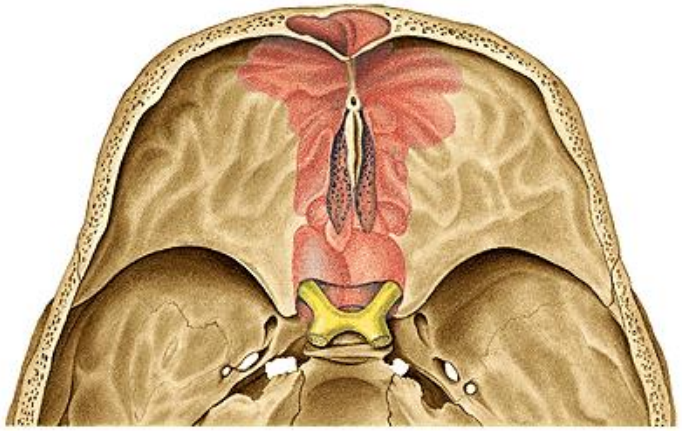


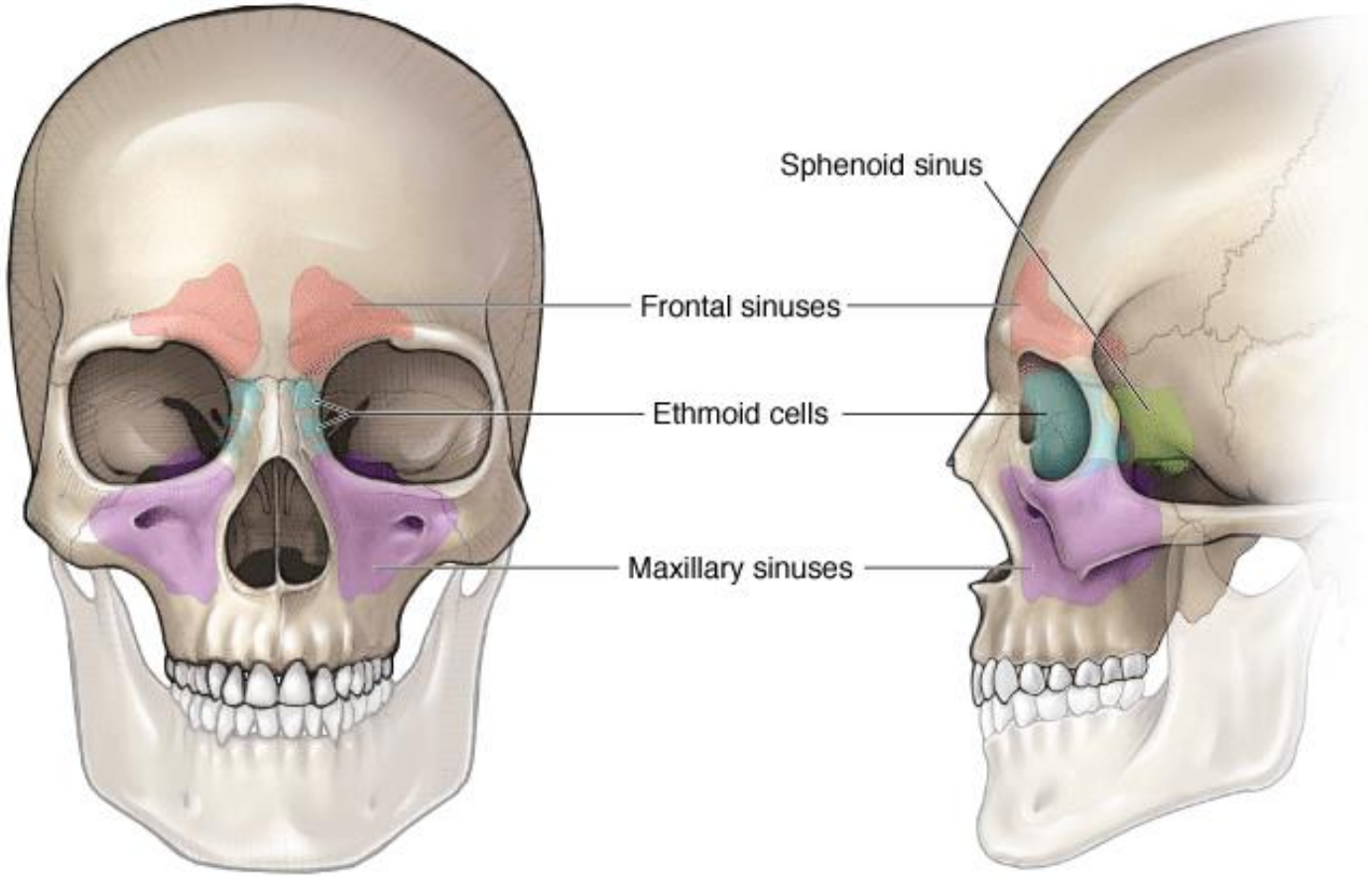
Epistaxis

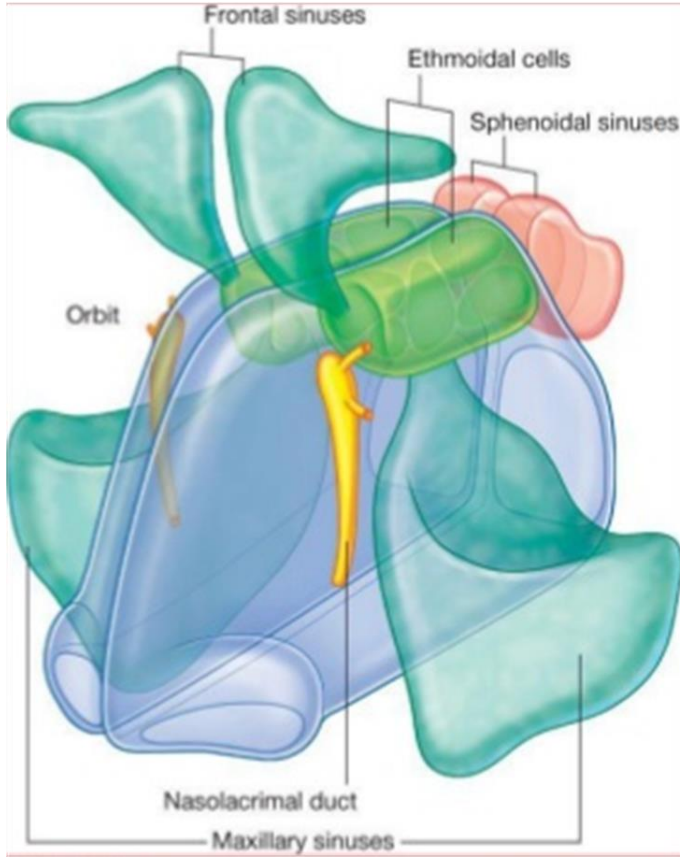

anterior ethmoid artery
posterior ethmoid artery
Locus
Kiesselbachi
sphenopalatine artery
superior labial artery
greater palatine artery

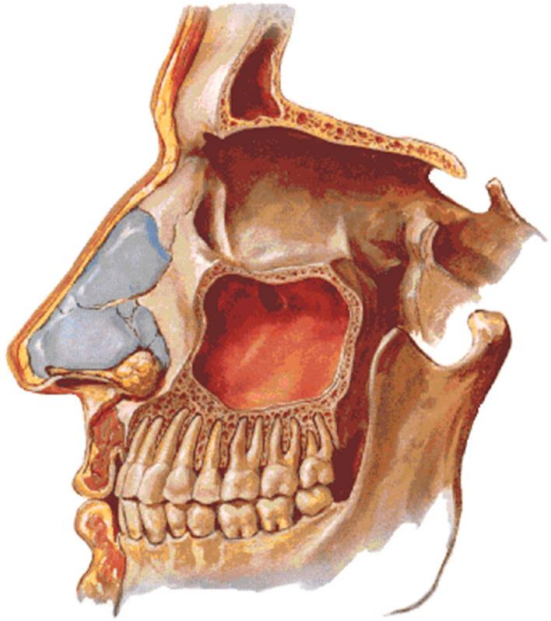
SINUS PARANASALES

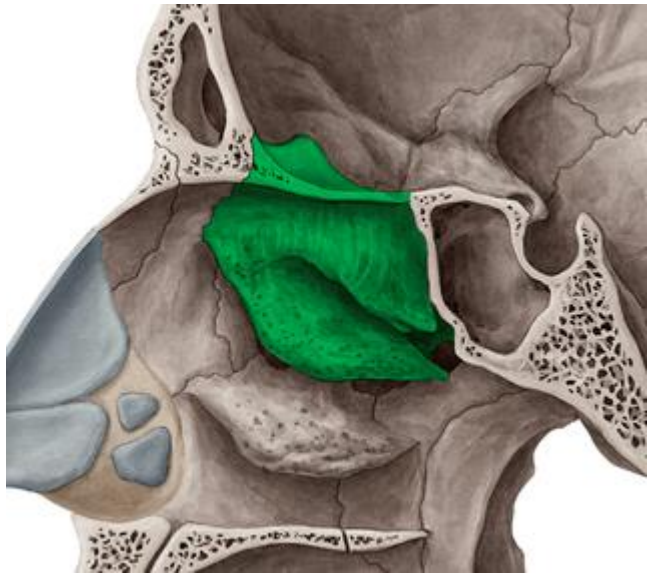
Sinus maxillaris
Sinus frontalis
Sinus ethmoidales
Sinus sphenoidalis

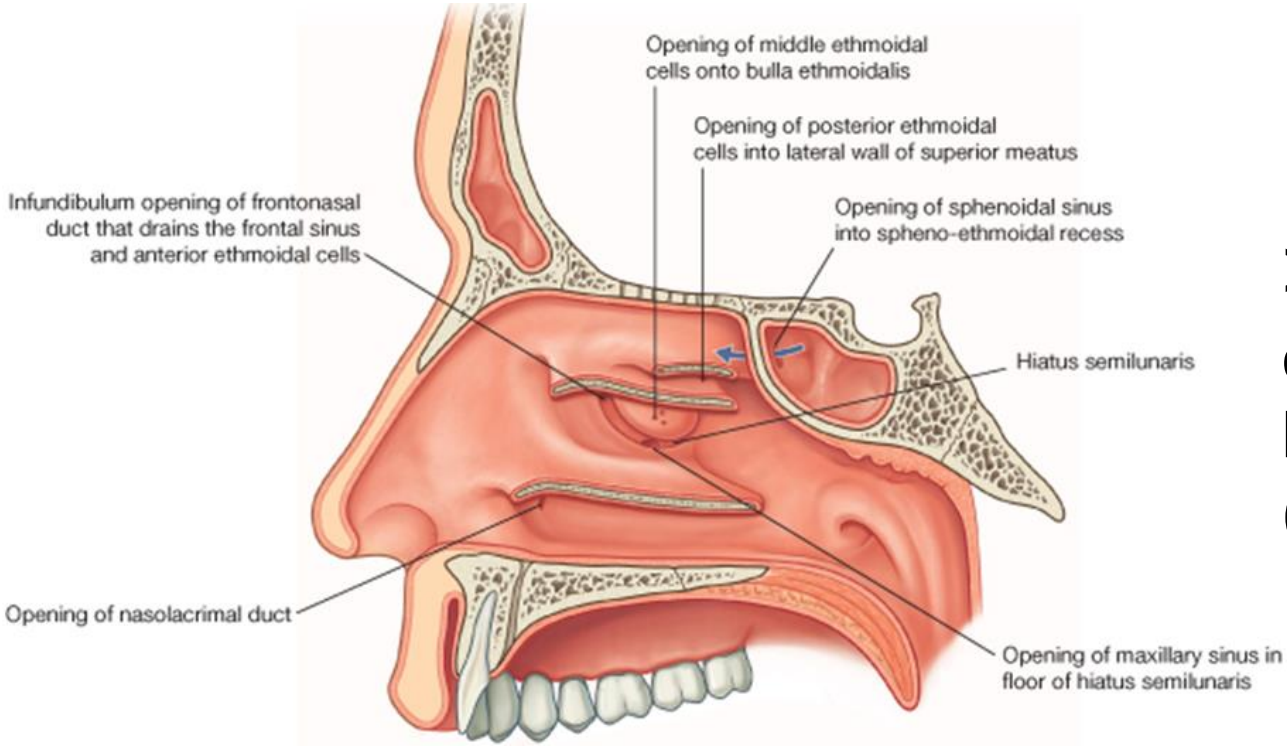








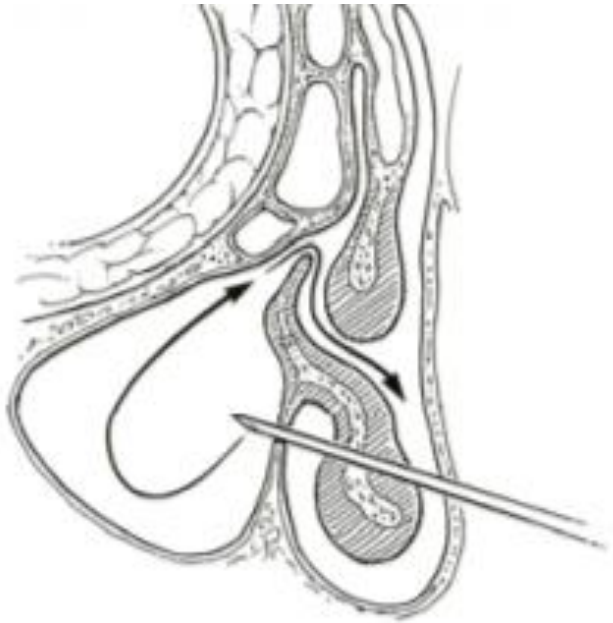


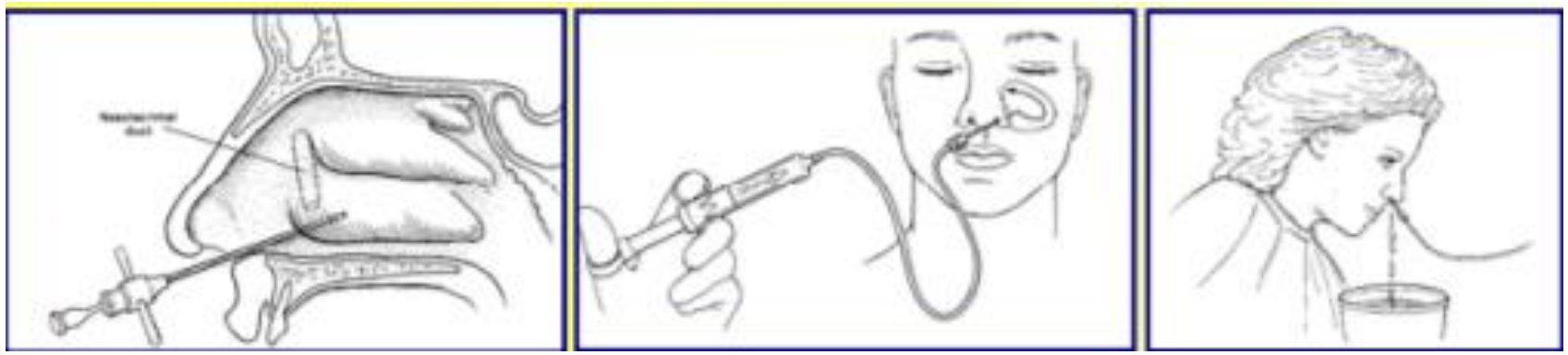


Hiatus semilunaris

> infundibulum ethmoidale
hiatus sinus maxillaris
(Antrum of Highmore)

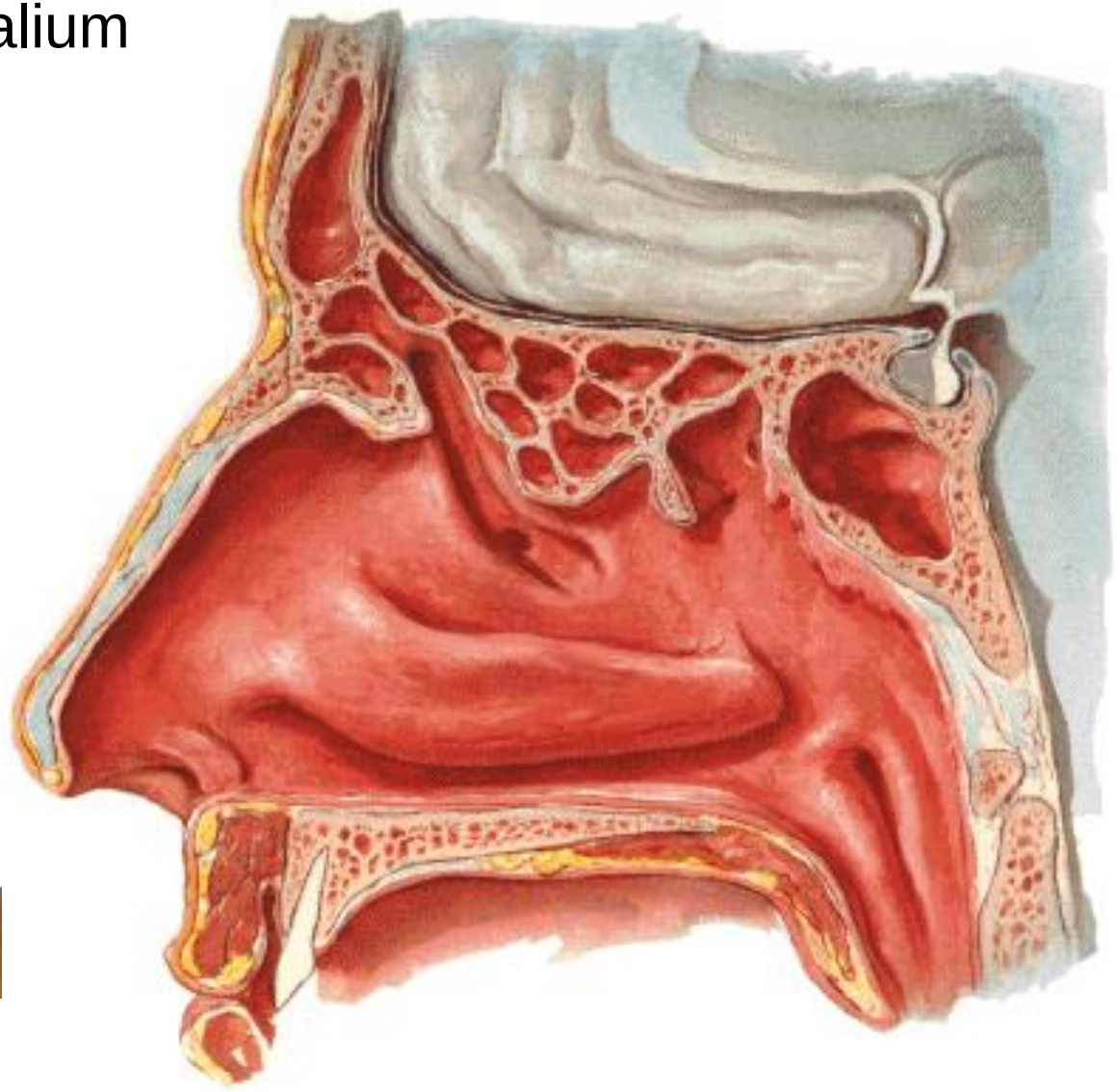
Maxillary sinus puncture (Antral washout)

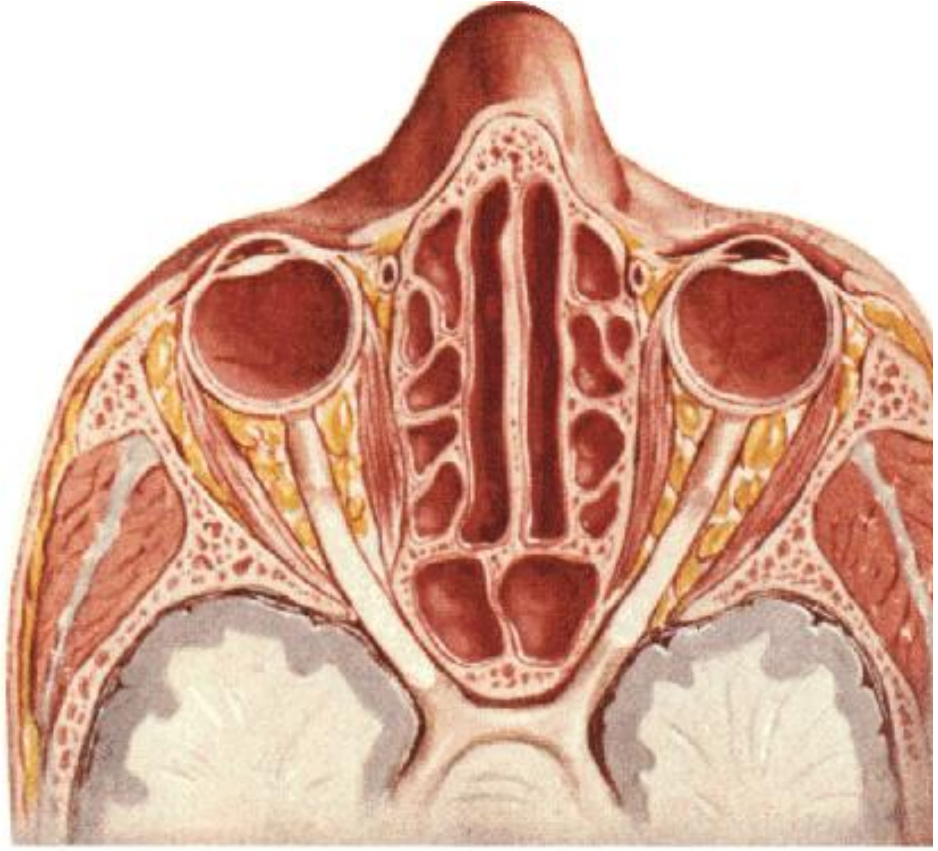


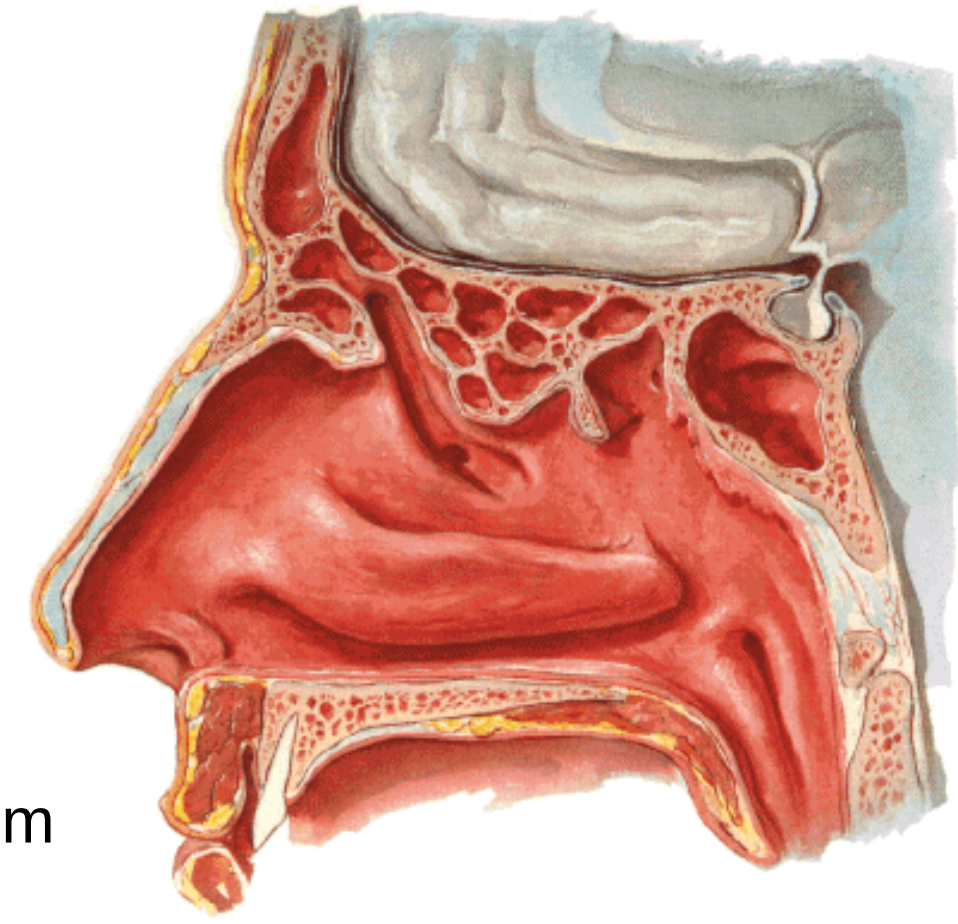


SINUS FRONTALIS

Septum sinuum frontalium
Hiatus semilunaris

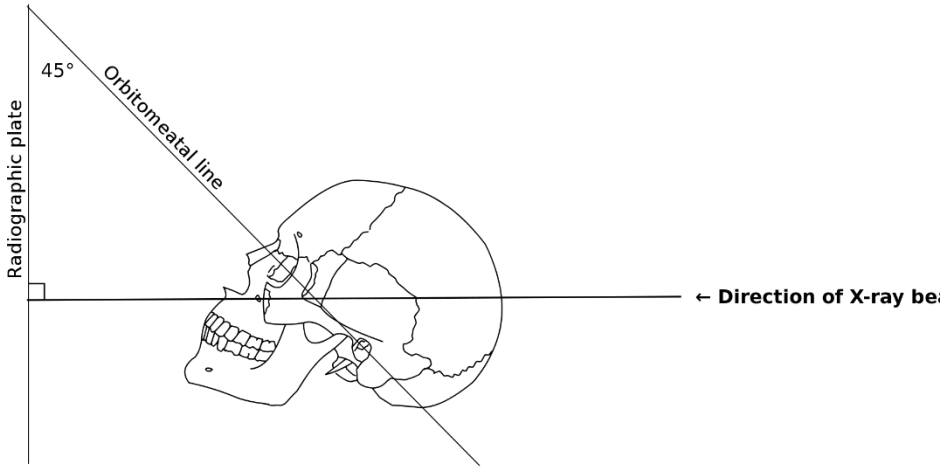






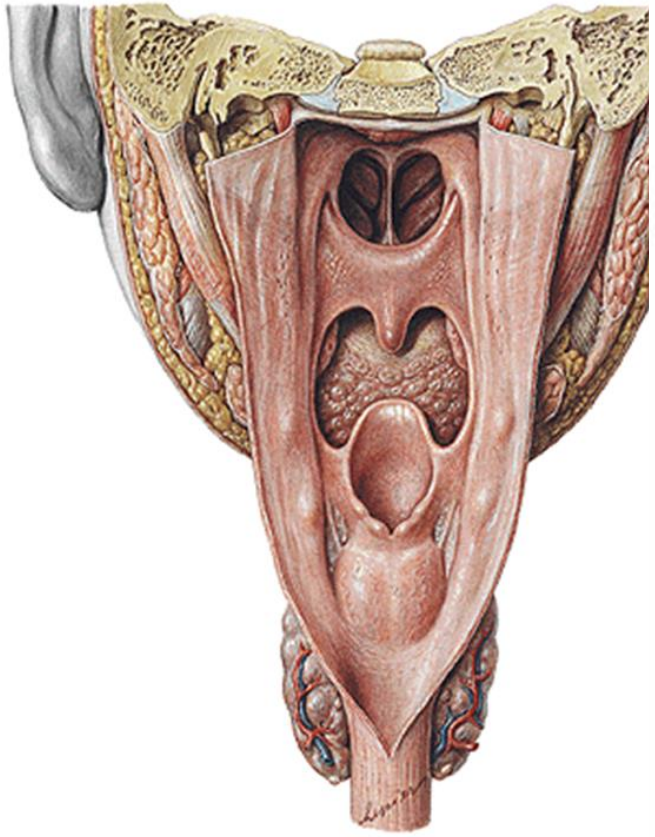
CELLULAE ETHMOIDALES
SINUS SPHENOIDALIS
Septum sinuum sphenoidalium
Apertura sinus sphenoidalis

Waters' (Occipitomental) view



Water's radiographic view of skull

PHARYNX



Nasopharynx base – soft palate (tuba auditiva, tonsilla pharyngea)

Oropharynx (C2-4) - isthmus faucium with oral cavity (Waldeyer´s lympoepithelial ring)

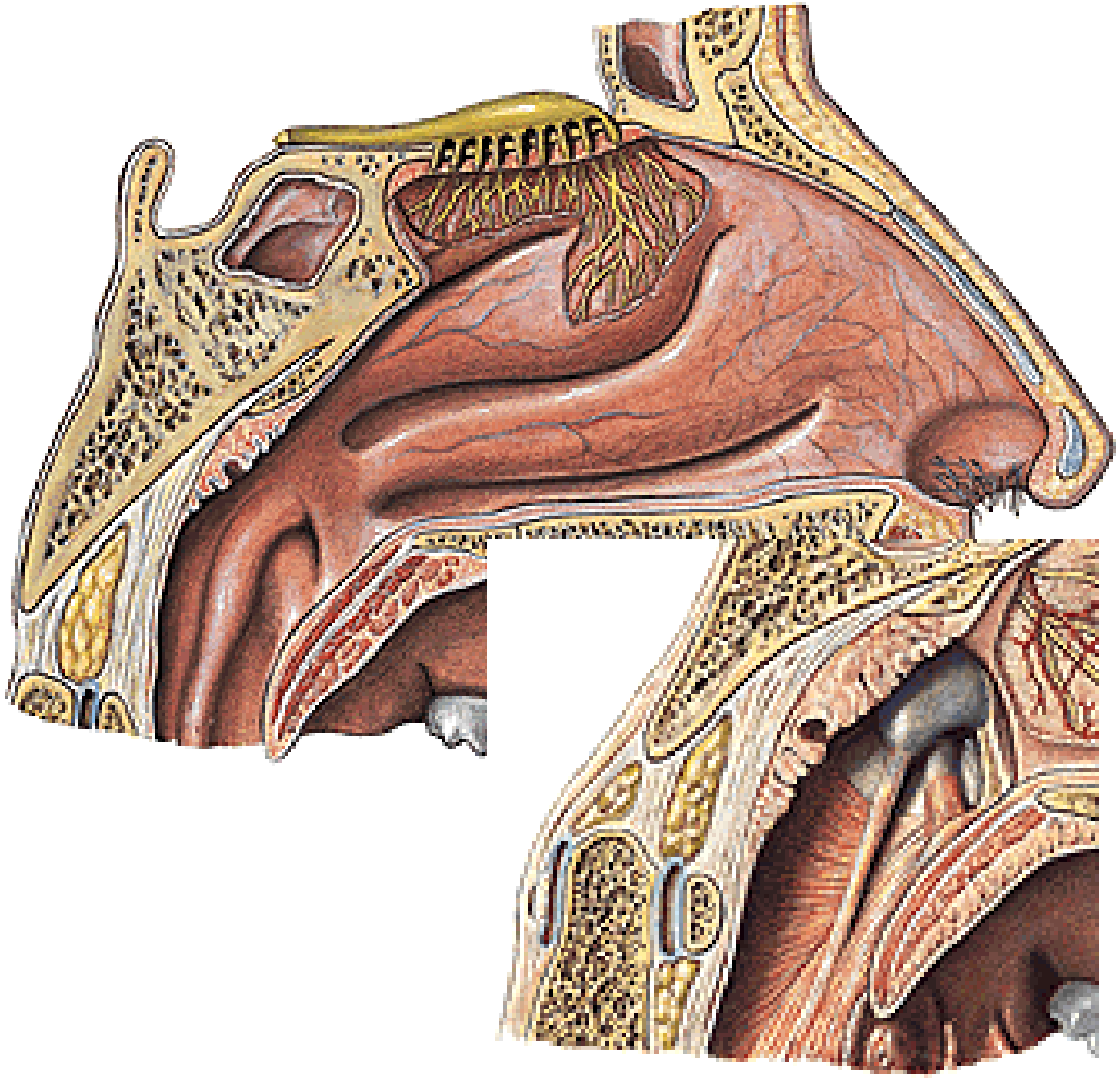
Pars laryngea pharyngis (C4- C6 - oesophagus) in anterior wall - aditus laryngis

NASOPHARYNX

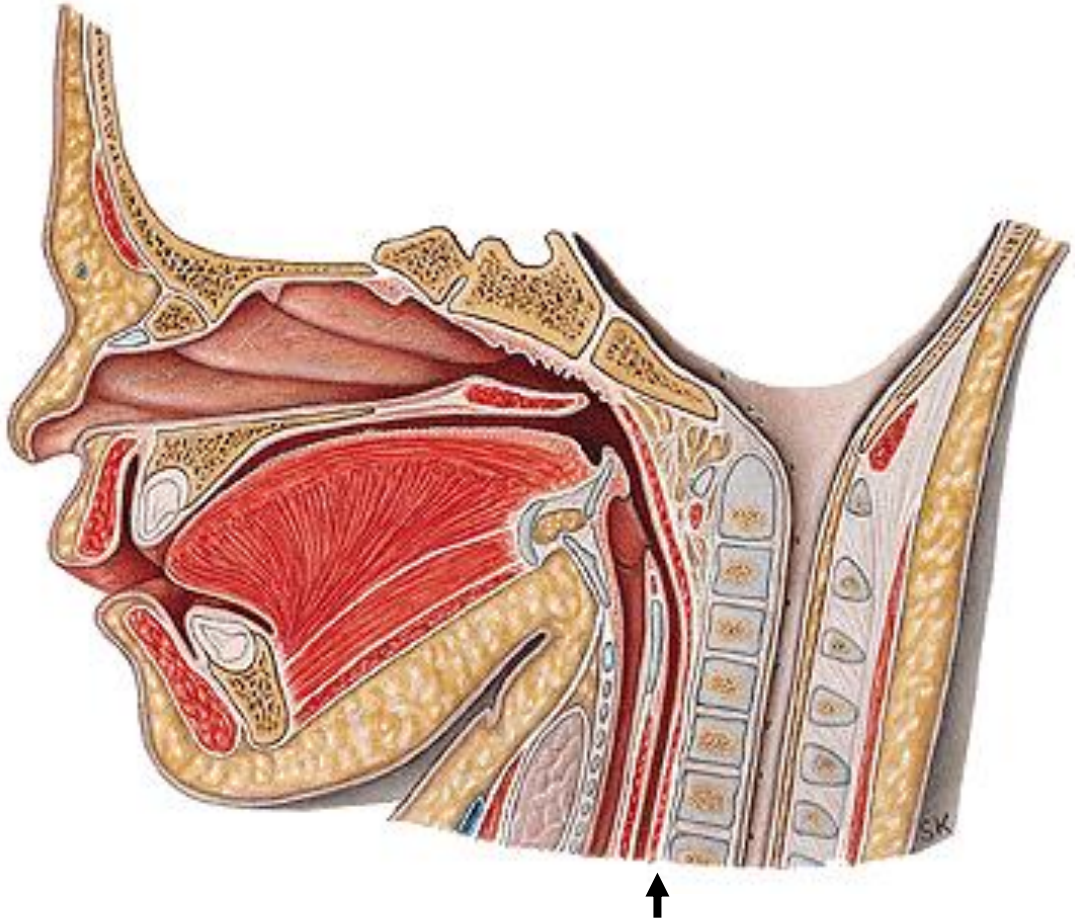
Ostium pharyngeum
tubae auditivae:

Torus tubarius
Plica salpingopharyngea
Torus levatorius
Plica salpingopalatina

Cartilago tubae auditivae
M. salpingopharyngeus
M. levator veli palatini

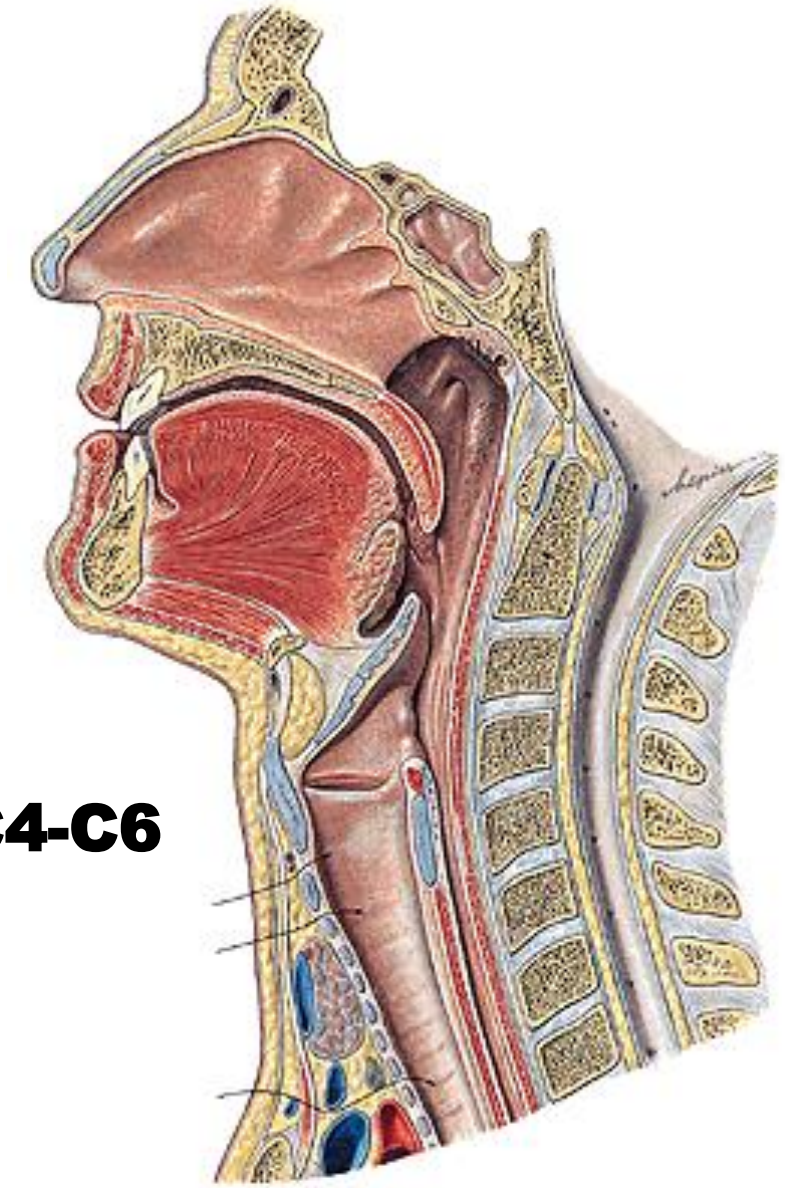


LARYNX



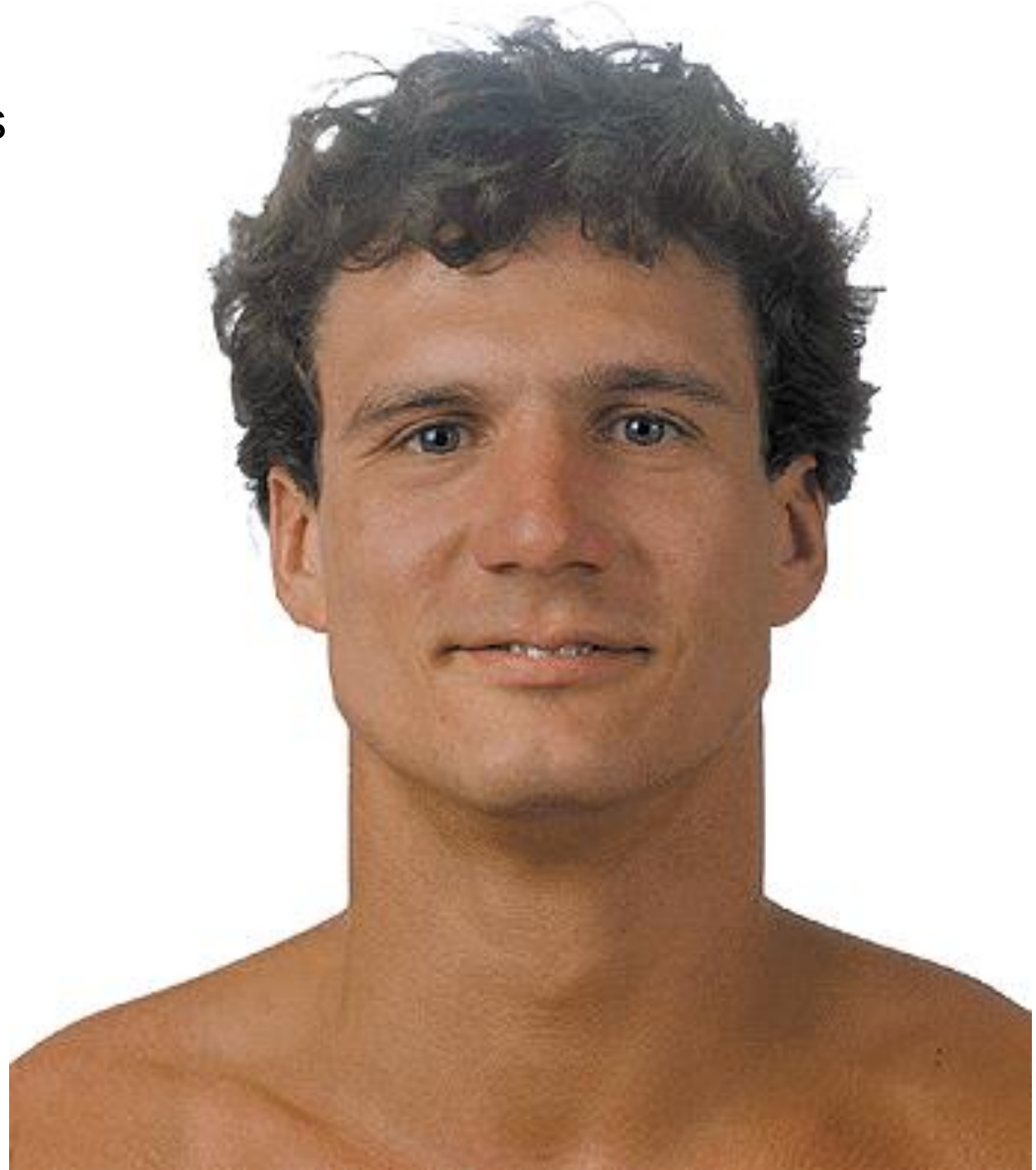
NEONATE

C4-C6



ADULT

Prominentia laryngis



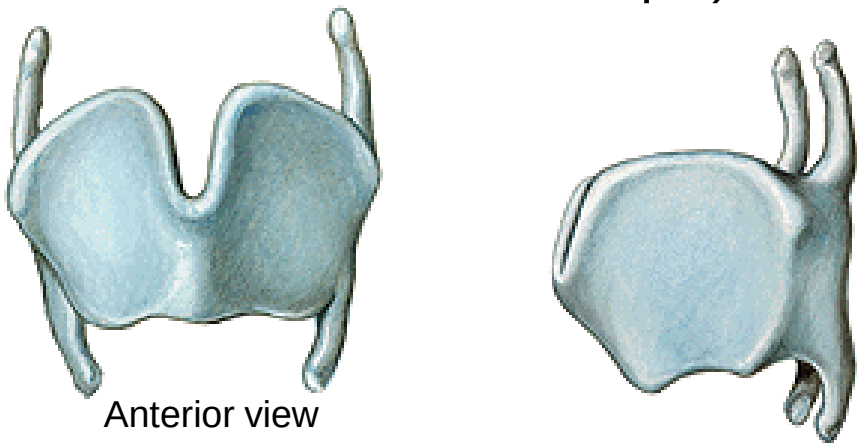
CARTILAGINES LARYNGIS:

Cartilago thyroidea
Cartilago cricoidea
Cartilago arytenoidea
Cartilago epiglottica

Cartilago corniculata
Cartilago cuneiformis

Cartilages

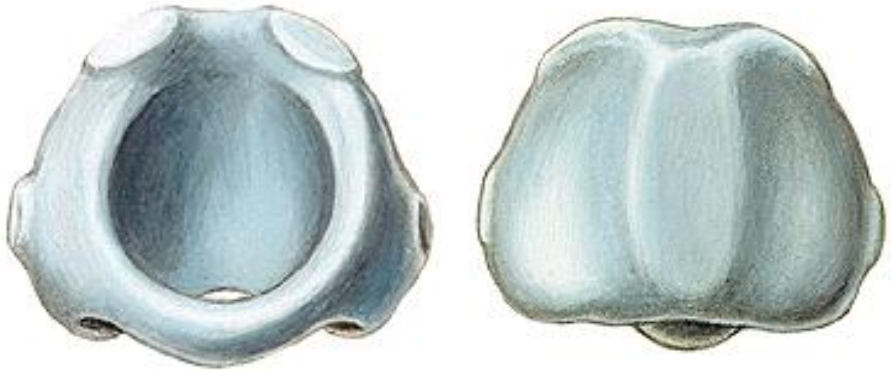
Cart. thyroidea (laminae, cornua, linea obliqua)



Anterior view

Cart. epiglottica (petiolus)

Cart. cricoidea (arcus, lamina)



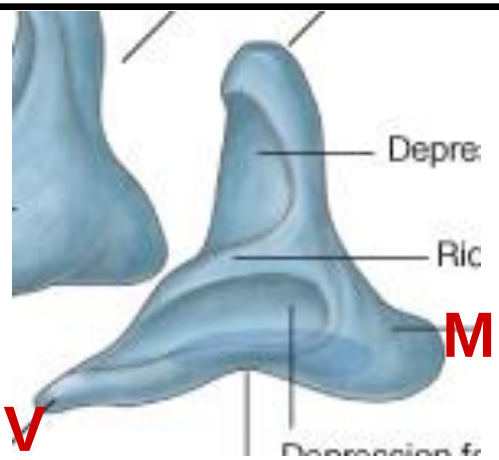
Anterior view

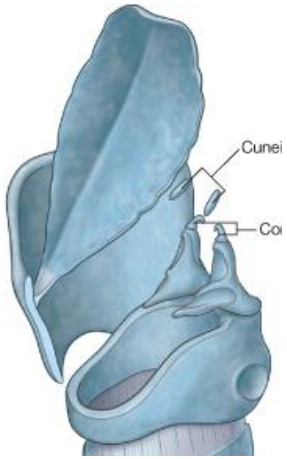
posterior view

Cartt. arytenoideae (proc.muscularis a vocalis)

Cartt. cuneiformes

Cartt. corniculatae





Connections of laryngeal cartilages

Membrana thyrohyoidea

Lig. cricothyroideum (coniotomy)

Membrana quadrangularis

(from epiglottis to the aerytaenoid cartilage, ligg. vestibularia, plica vestibularis)

Conus elasticus

(between ligg.vocalia and arcus cartilaginis cricoideae)

Membrana fibrocartilaginea laryngis

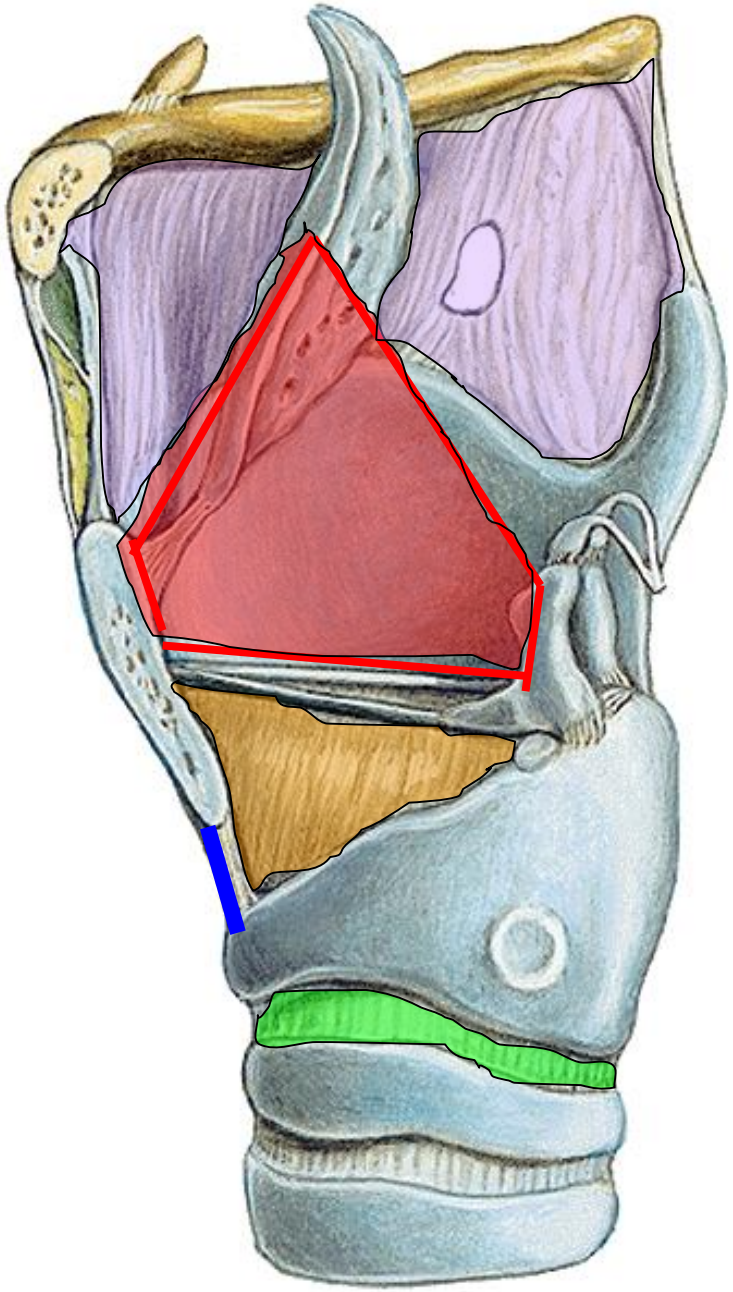
conus elasticus + membrana quadrangularis

Ligg. vestibularia (reinforced margine of membrana quandrangularis)

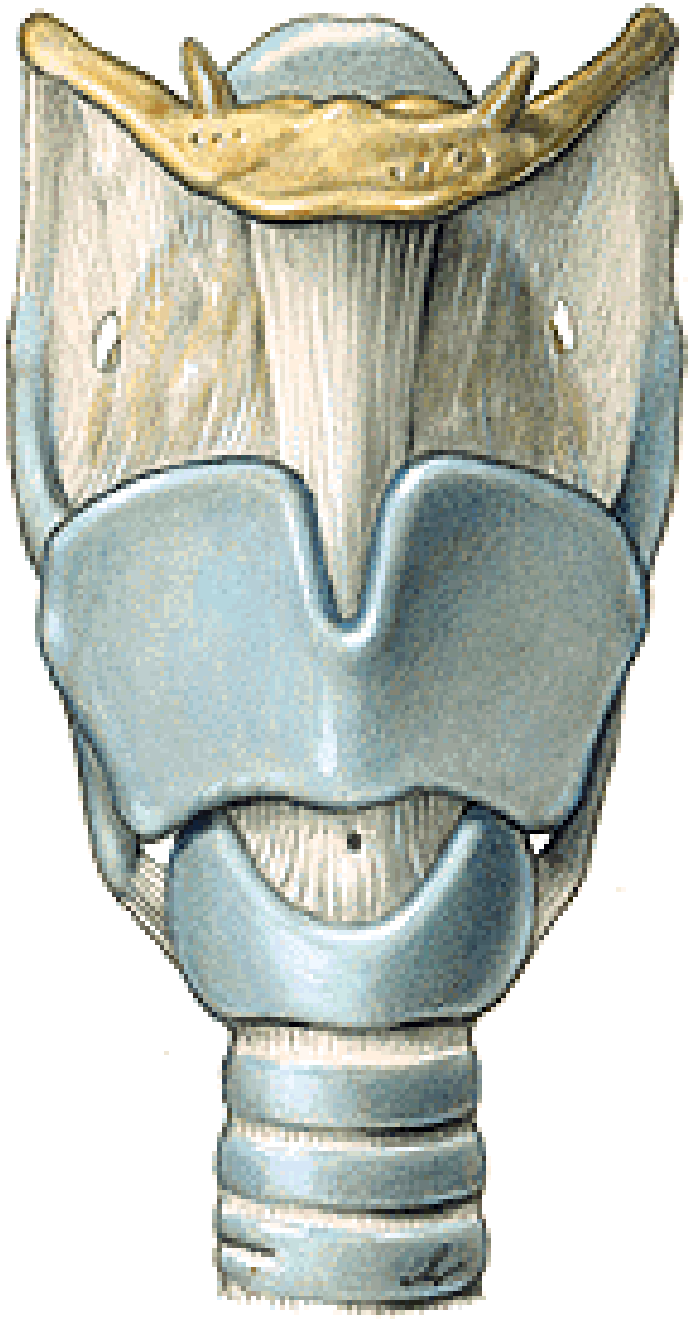
Ligg. vocalia (reinforced margine of conus elasticus)

• squamous epithelium („work“)

Lig. cricotracheale



MEMBRANA THYROIDEA
lig. thyroideum laterale
lig. thyroideum medianum

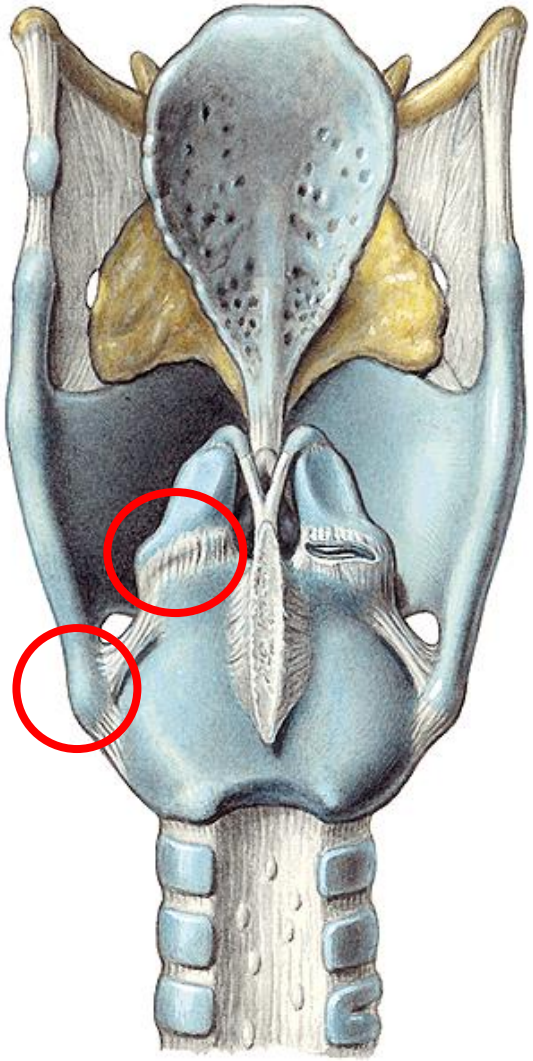


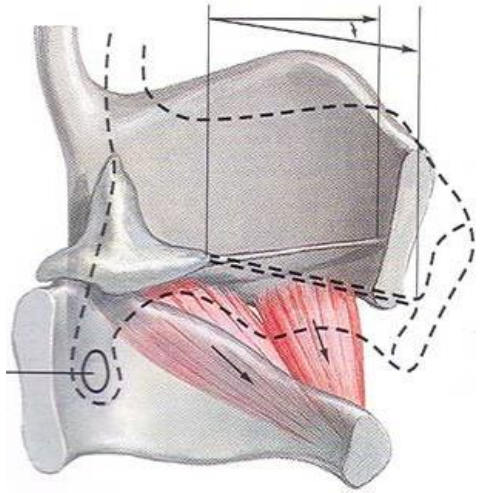
Lig thyroepiglotticum
Lig. hyoepiglotticum
Spatium praeepiglotticum

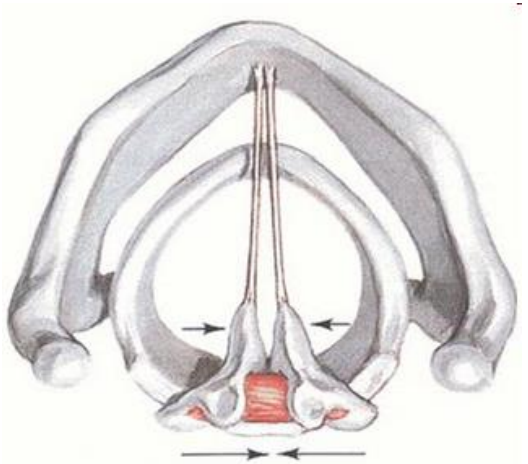
JOINTS:

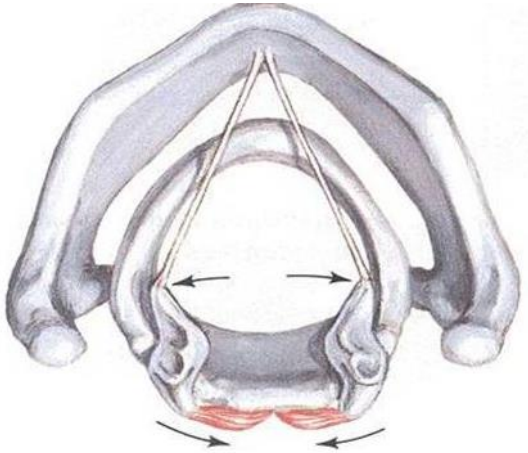
Art. cricothyroidea (rocking movements)

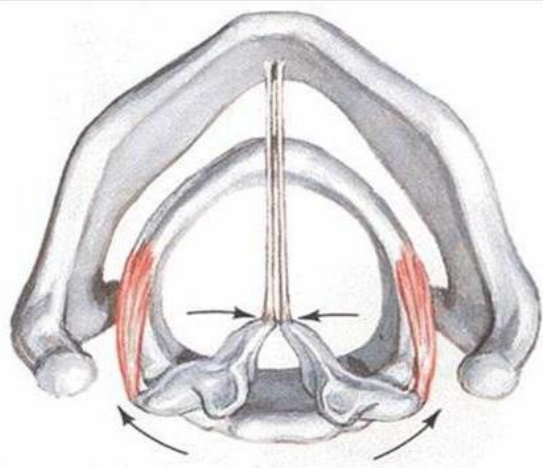
Art. cricoarytenoidea (rotation and translation movements– abduction and adduction of vocal cords)





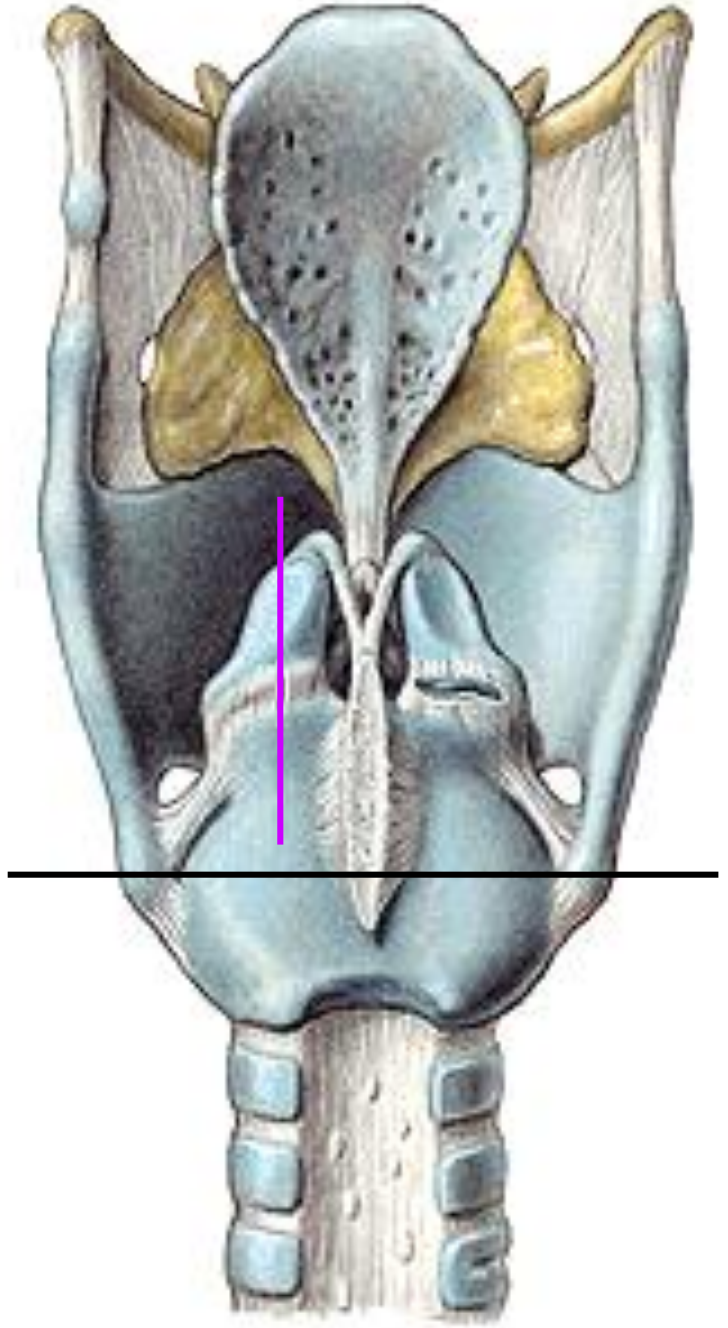






ARTICULATIO CRICOARYTENOIDEA
-lig. cricoarytaenoideum post.

ARTICULATIO CRICOTHYROIDEA



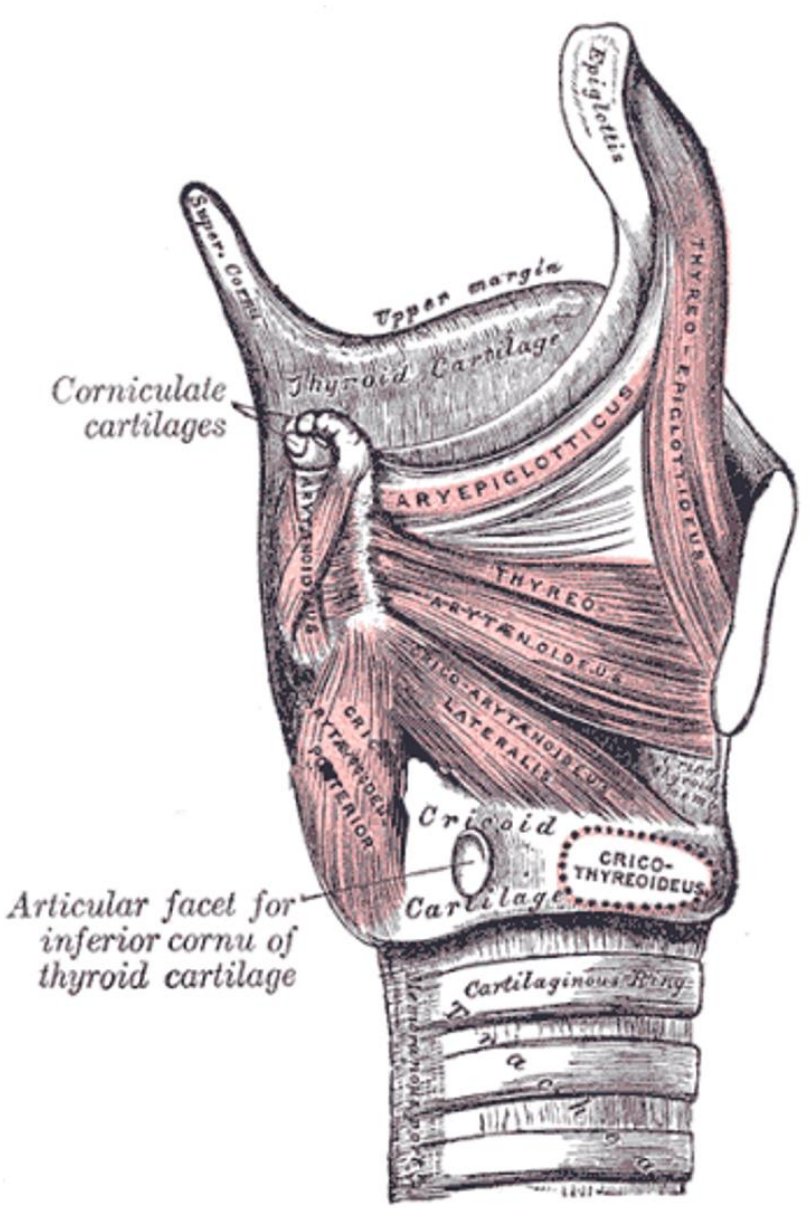
Laryngeal muscles

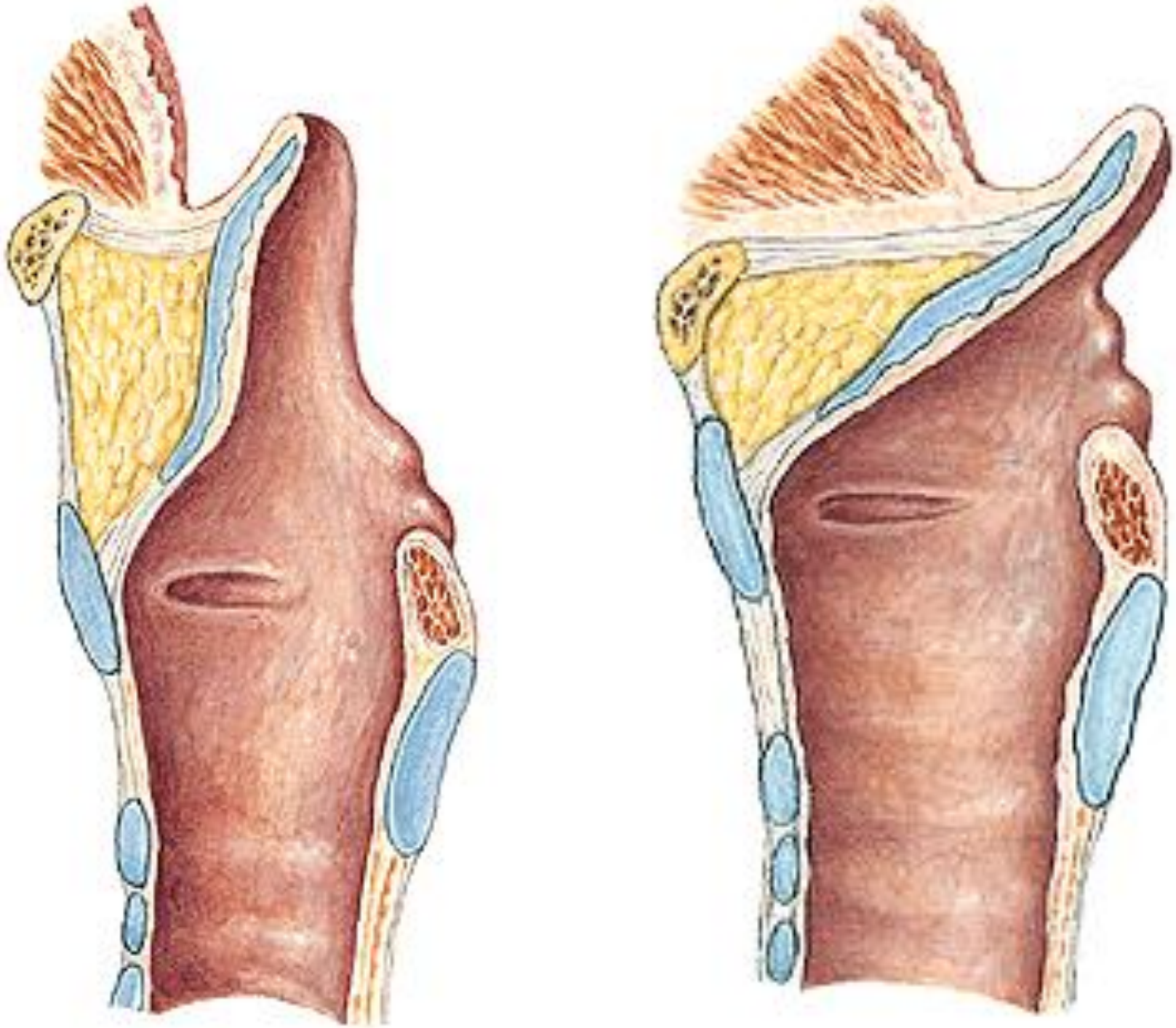
- muscles of the larynx affect lenght, tension and position of the vocal cords and position of the epiglottis affect

1) Muscles that moves with epiglotis

a) **Musculus thyroepiglotticus** opens *aditus laryngis*

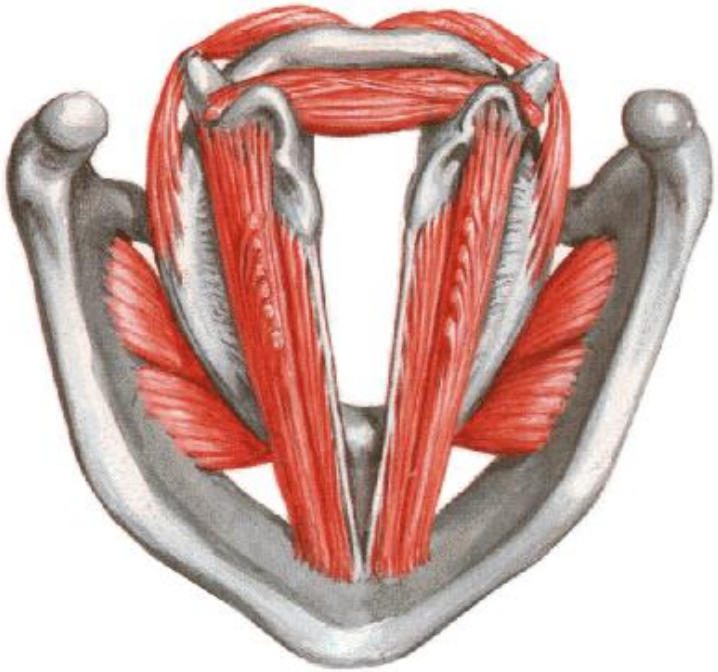
b) **Musculus aryepiglotticus** closes *aditus laryngis*





M. thyroarytenoideus
(thyroepiglotticus)
M. vocalis

Rima glottidis – pars intermembranacea
– pars intercartilaginea

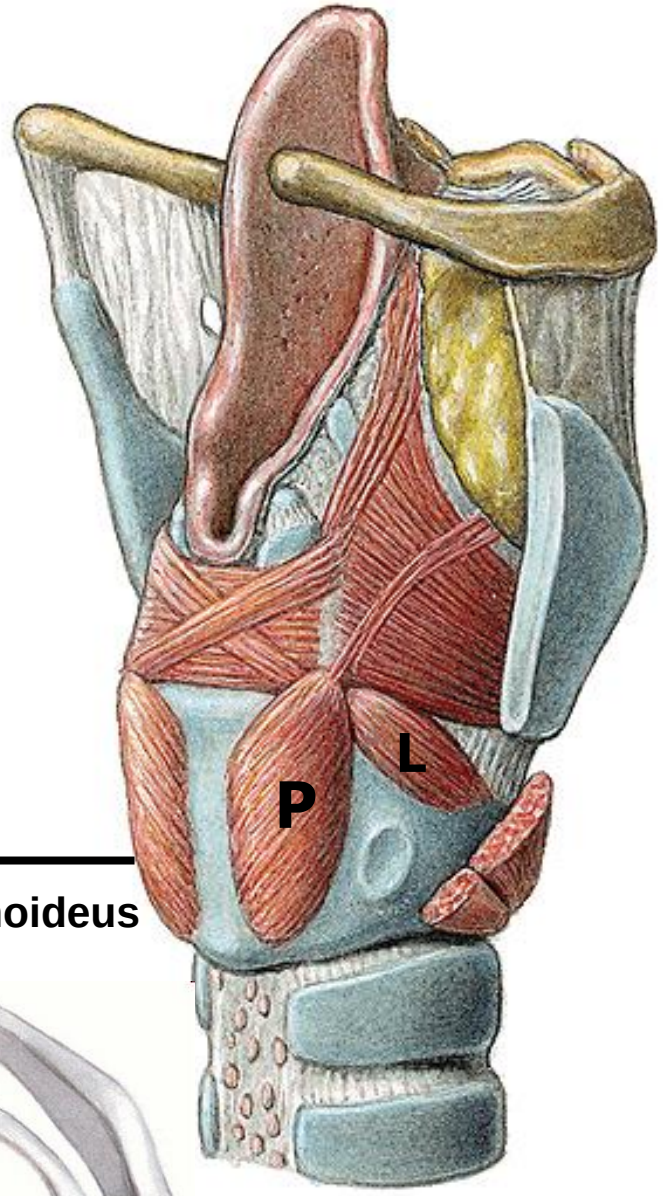


2) Muscles responsible for respiration (abduction) and phonation (adduction) position of vocal cords:

a) **Musculus cricoarytaenoideus lateralis**
closes rima glottis (adduction of vocal cords) - phonation

b) **Musculus cricoarytaenoideus posterior** (musculus posticus) opens rima glottis – **abduktion of vocal cords** (ligg. vocalia) – respiration position

c) **Musculus arytaenoideus**
the strongest adductor



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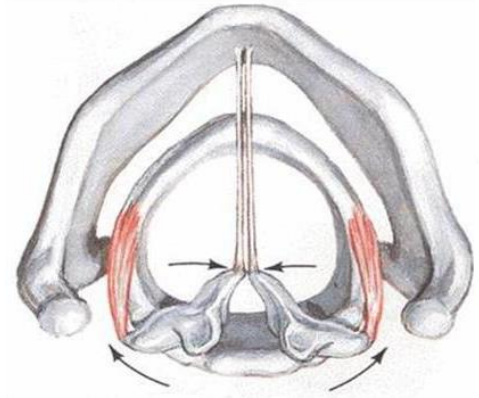
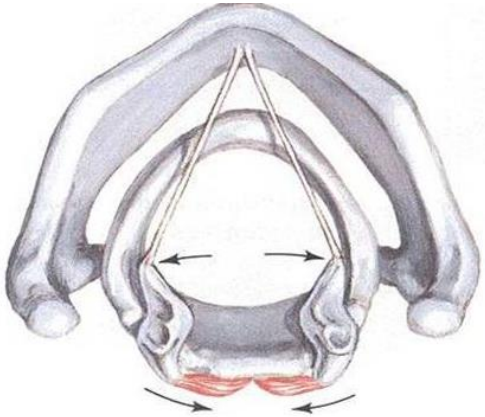
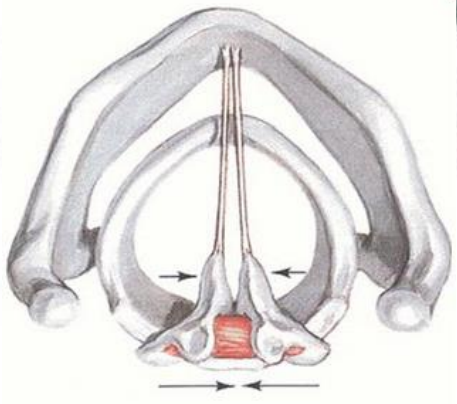
m. cricoarytaenoideus lateralis



m. cricoarytaenoideus posterior

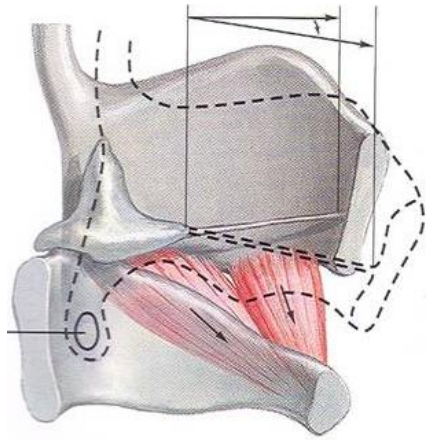


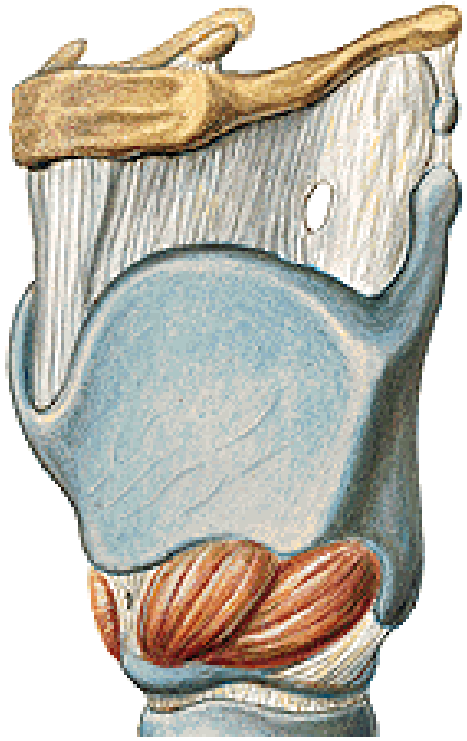
m. arytaenoideus

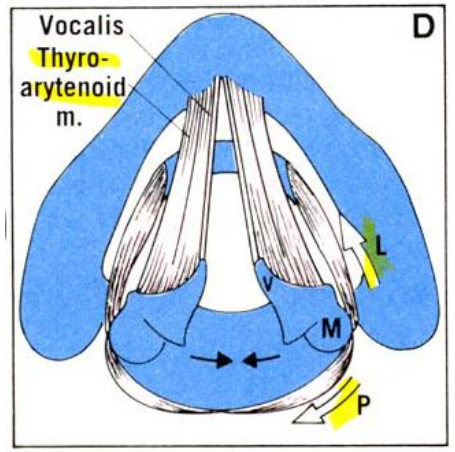


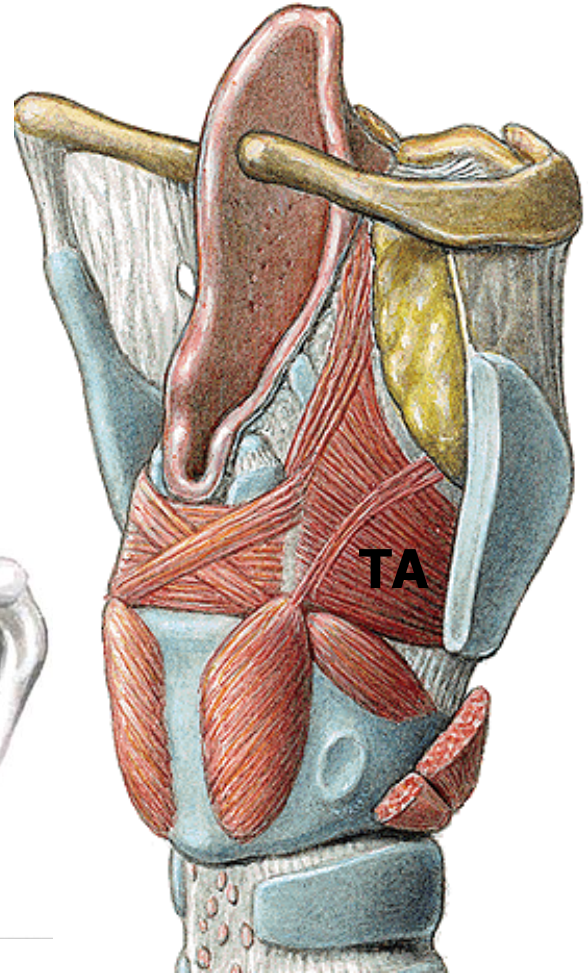
3) Muscles responsible for tension of vocal cords:

a) Musculus cricothyroideus
tenses vocal cords(tensor)

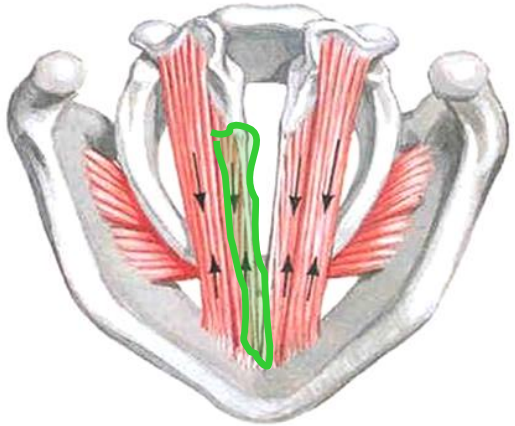








b) Musculus thyroarytaenoideus
relaxation of vocal cords



c) Musculus vocalis
Fine tension

Muscles of the larynx innervate
via *nervus vagus* :

nervus laryngeus superior
(musculus cricothyroideus)

nervus laryngeus inferior
(branch of nervus laryngeus reccurens, all others laryngeal muscles)

Respiration position
Vocal cords in **abduktion**

Phonation position
Vocal cords in **adduktion**

Relaxation of vocal cords- m. thyroarytenoideus

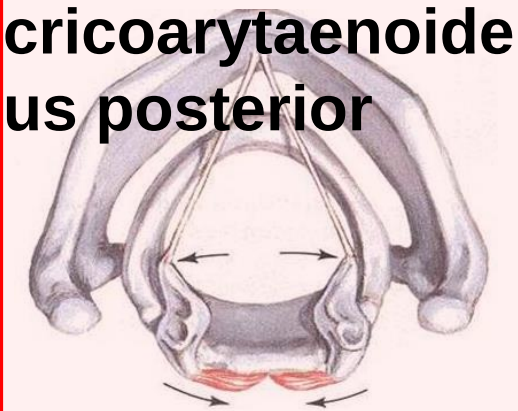
Tesnion of vocal cords - m. cricothyroideus

Submucous layer– oedema

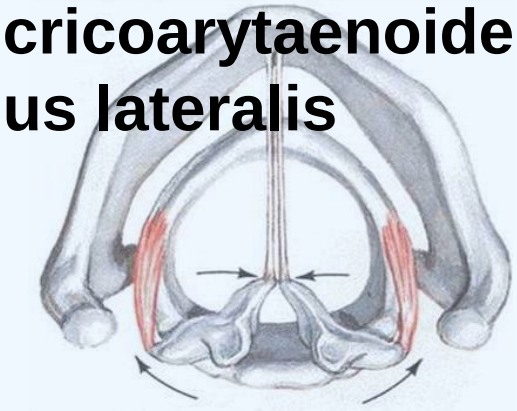
Folliculi lymph. laryngei
Tonsilla laryngea

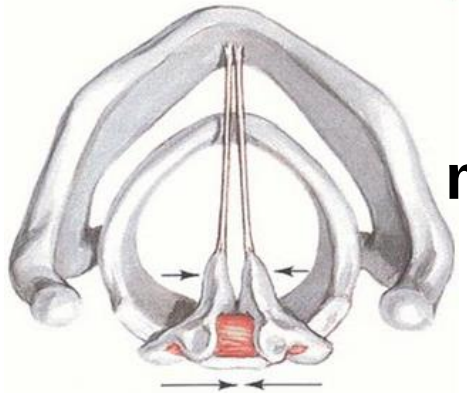
Posterior side of epiglotis- **taste buds**

m. cricoarytaenoideus posterior



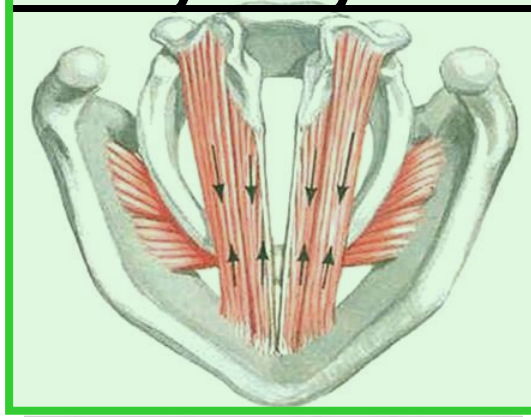
m. cricoarytaenoideus lateralis



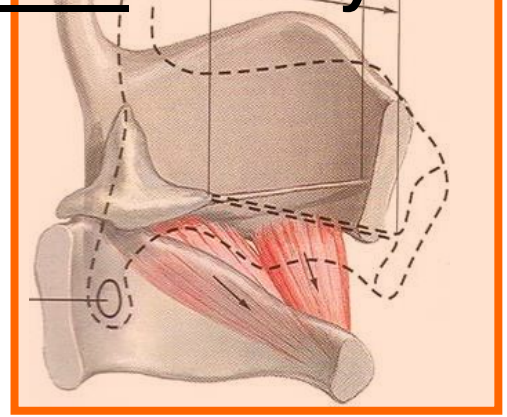


m. arytaenoideus

m. thyroarytaenoideus

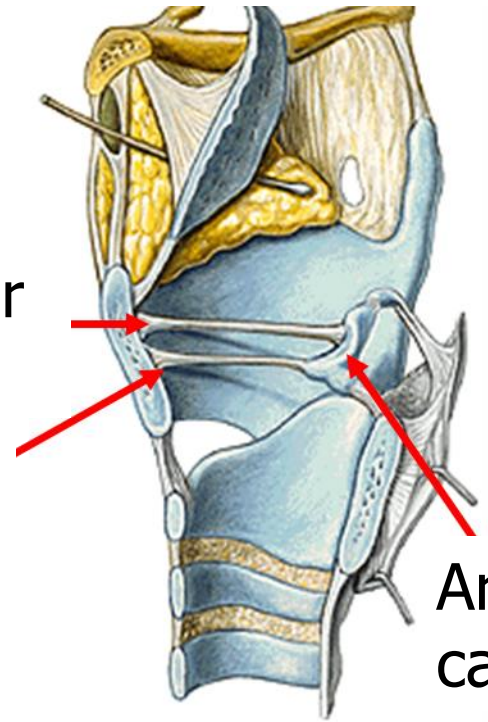


m. cricothyroideus



CAVITAS LARYNGIS

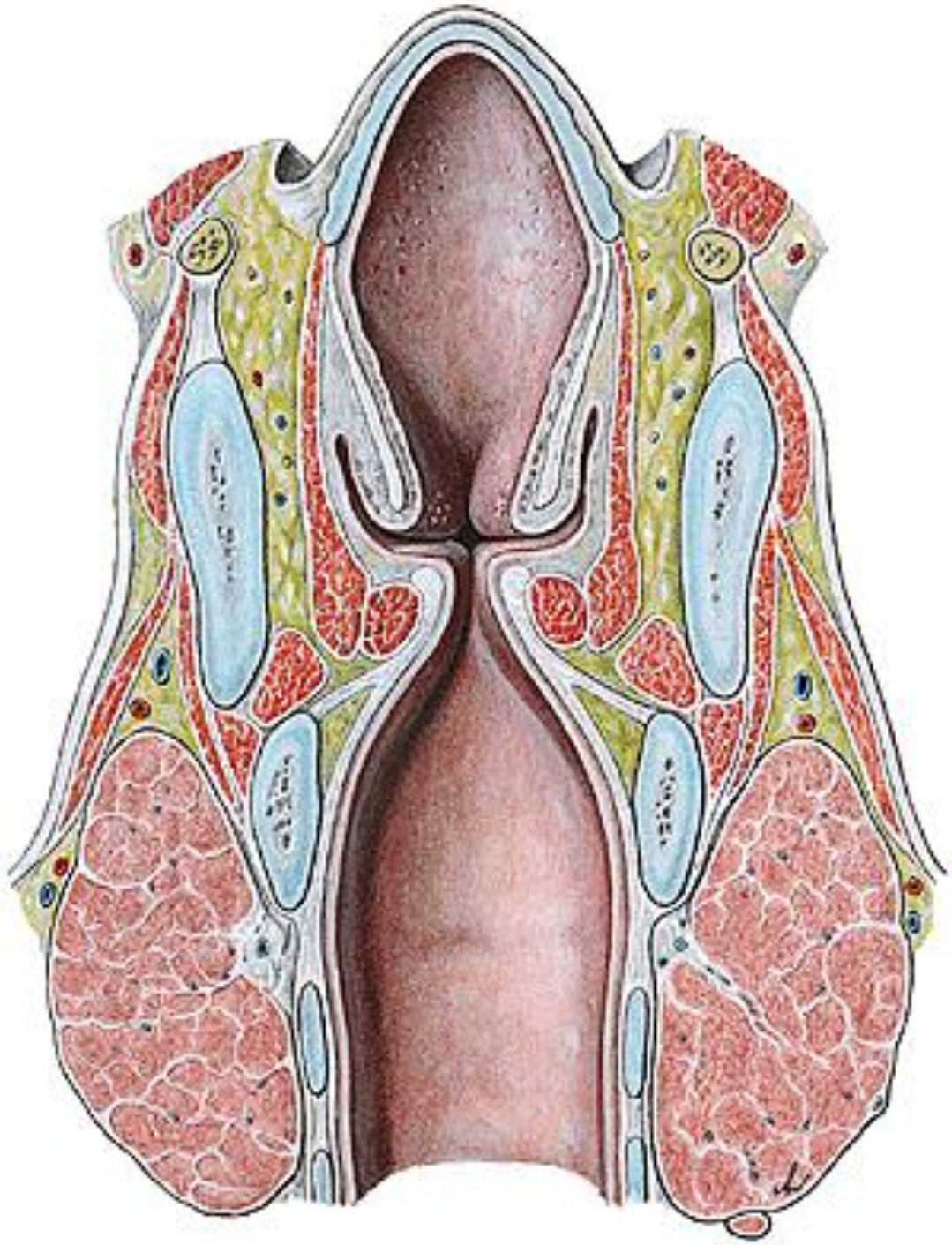
-vestibulum laryngis
-plicae vestibulares
-rima vestibuli
-plicae vocales
-rima glottidis
-glottis
-ventriculus laryngis
-cavitas infraglottica



Vestibular folds

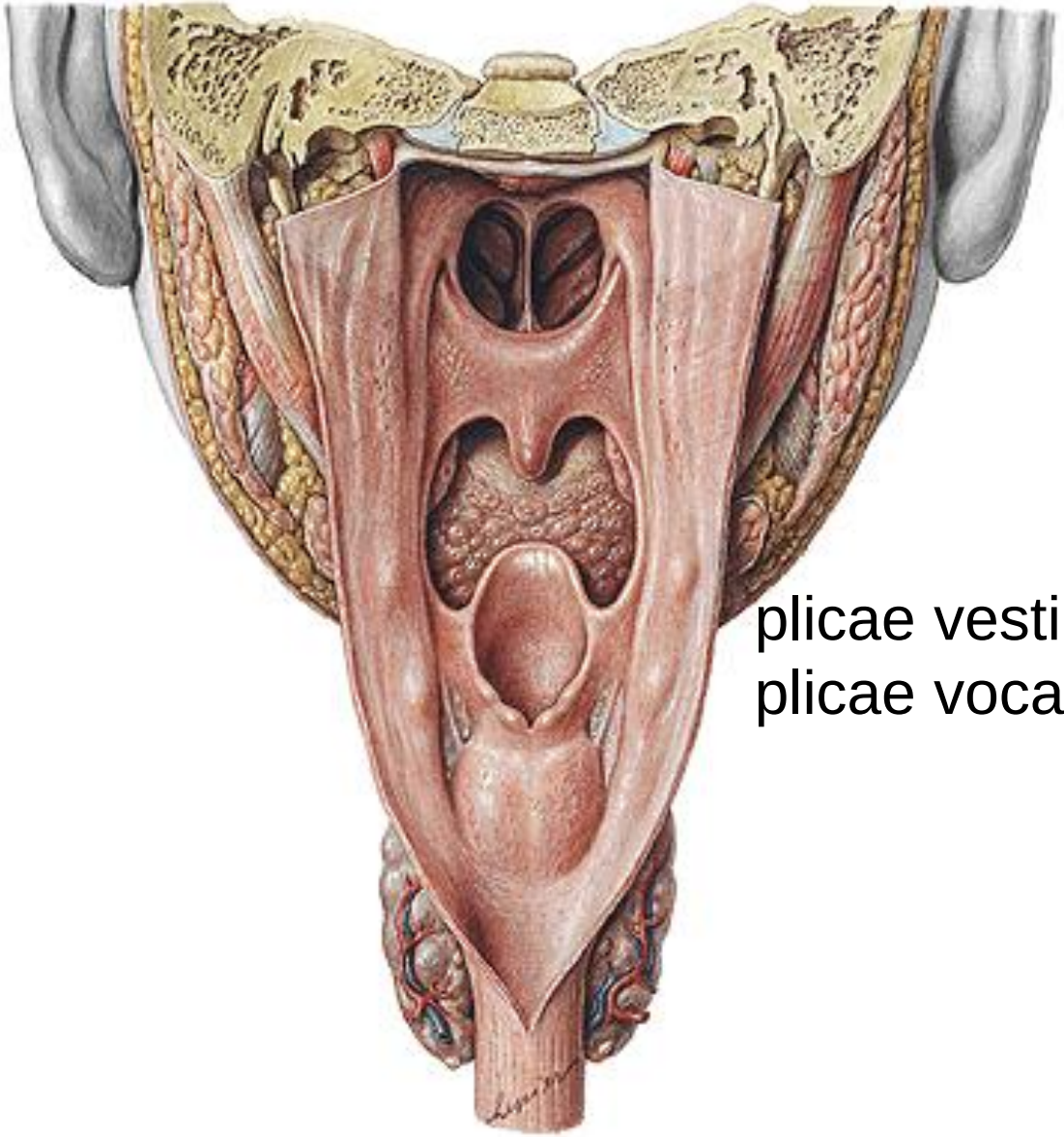
True vocal cords

Arytaenoid cartilage



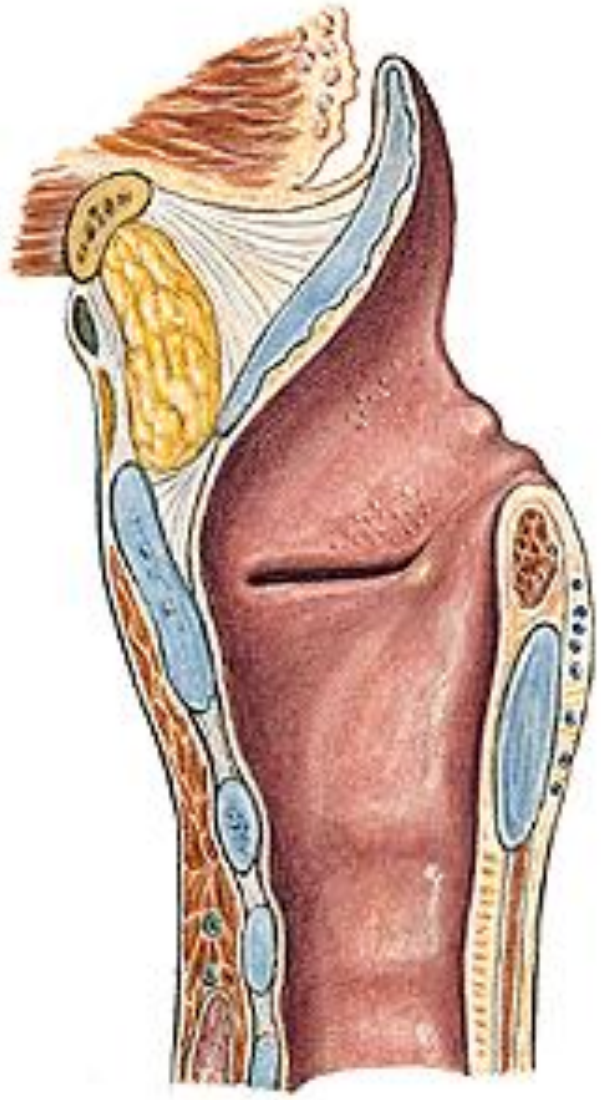
CAVITAS LARYNGIS

-aditus laryngis-plicae aryepiglotticae (tuberculum cuneiforme et corniculatum), plica interarytenoidea,incisura interarytenoidea

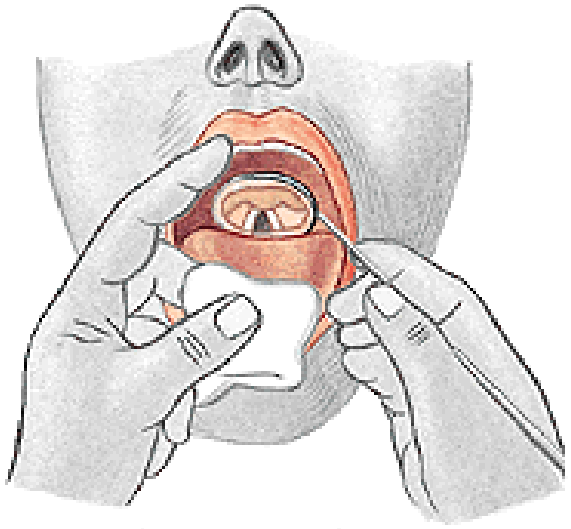


plicae vestibulares

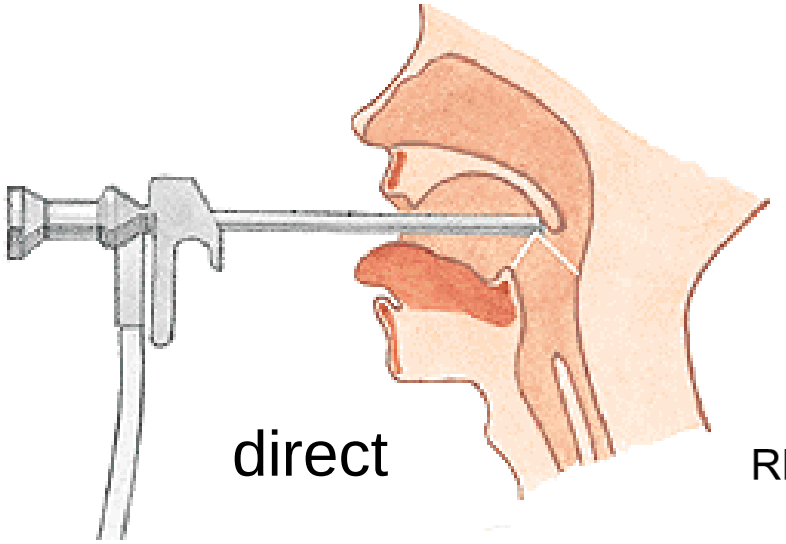
plicae vocales



LARYNGOSCOPY

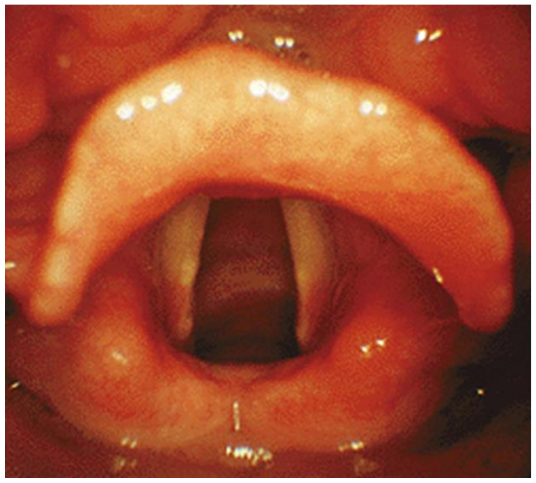


indirect

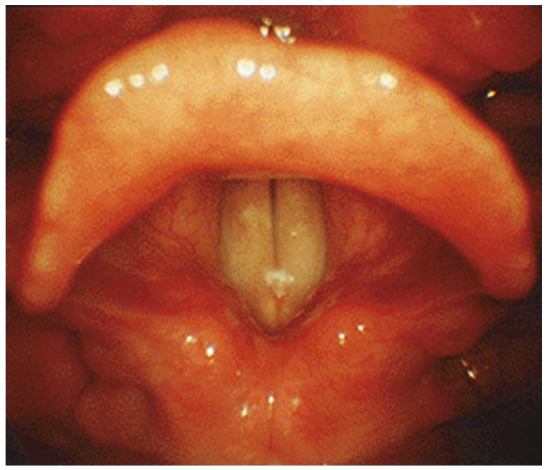


direct

RESPIRATION



PHONATION

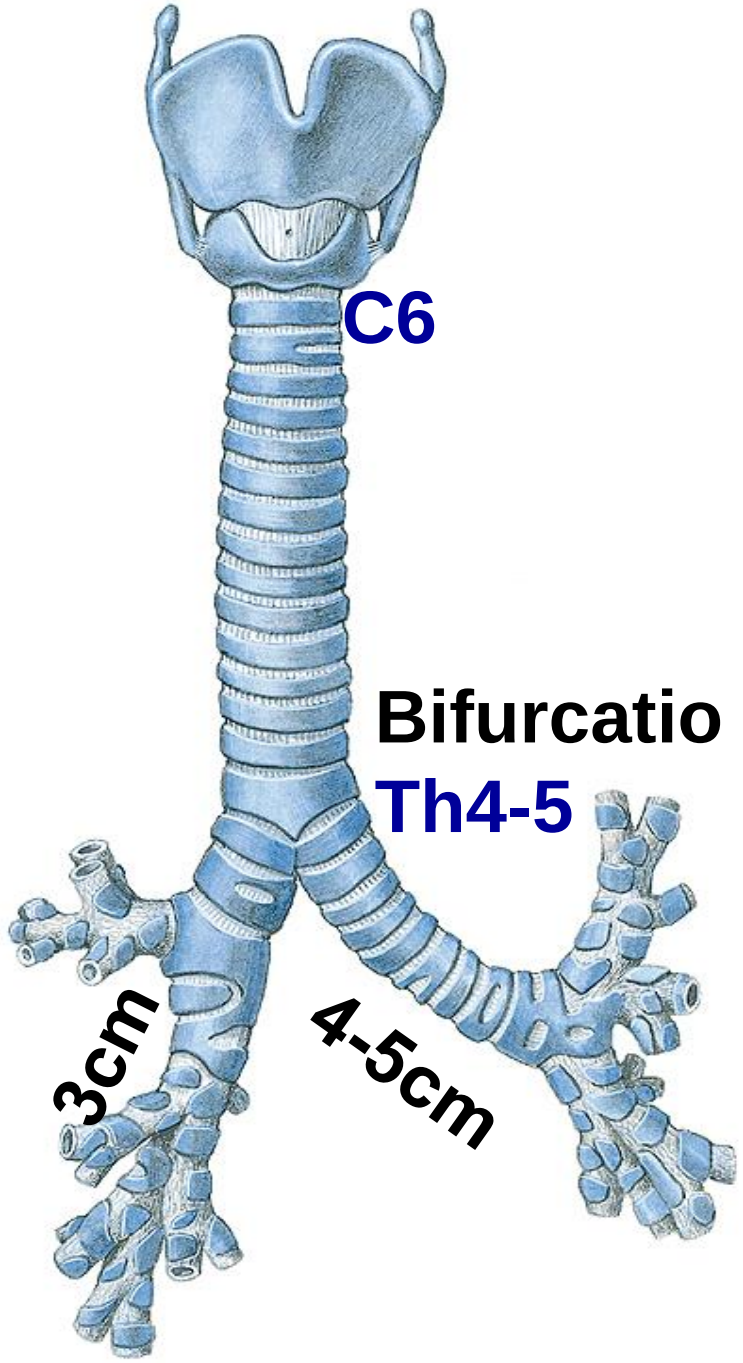


Vocal Cords up close while singing

https://www.youtube.com/watch?v=-XGds2GAvGQ

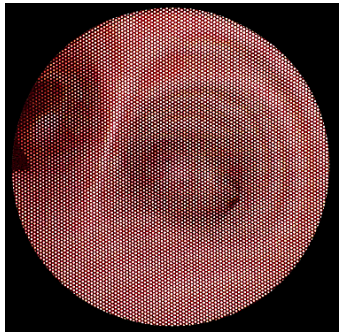
Trachea

12-16cm

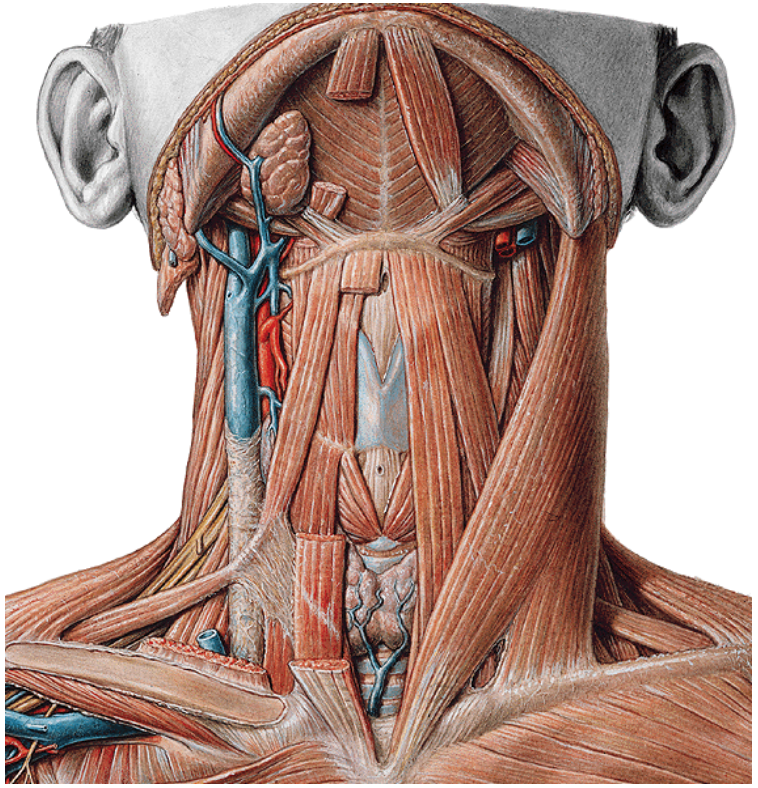


Bronchus principalis

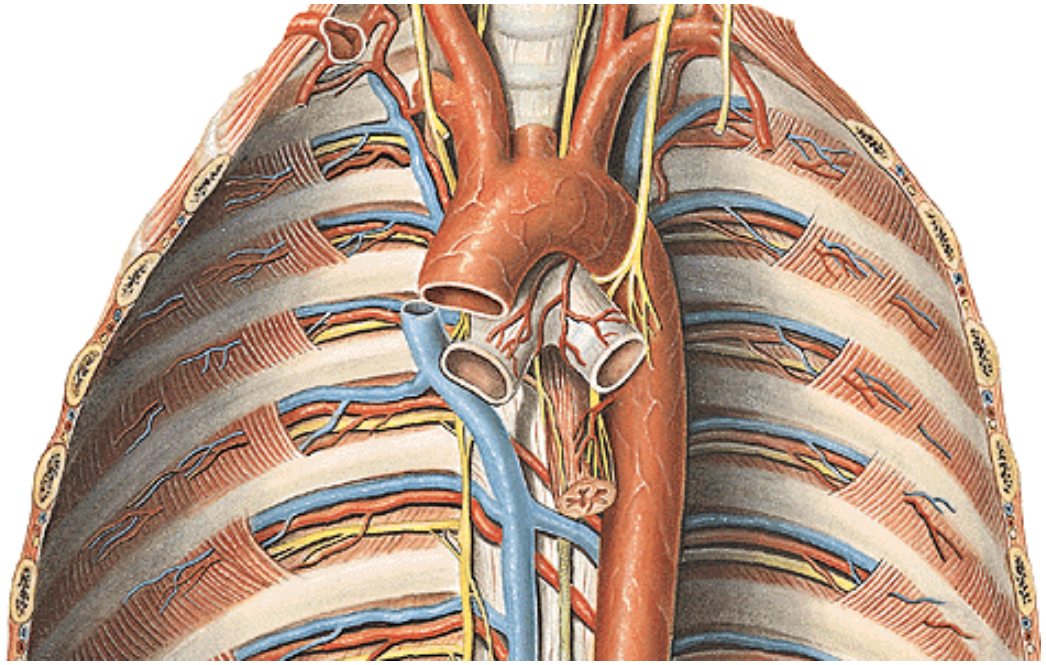
- **dexter**
- **sinister**



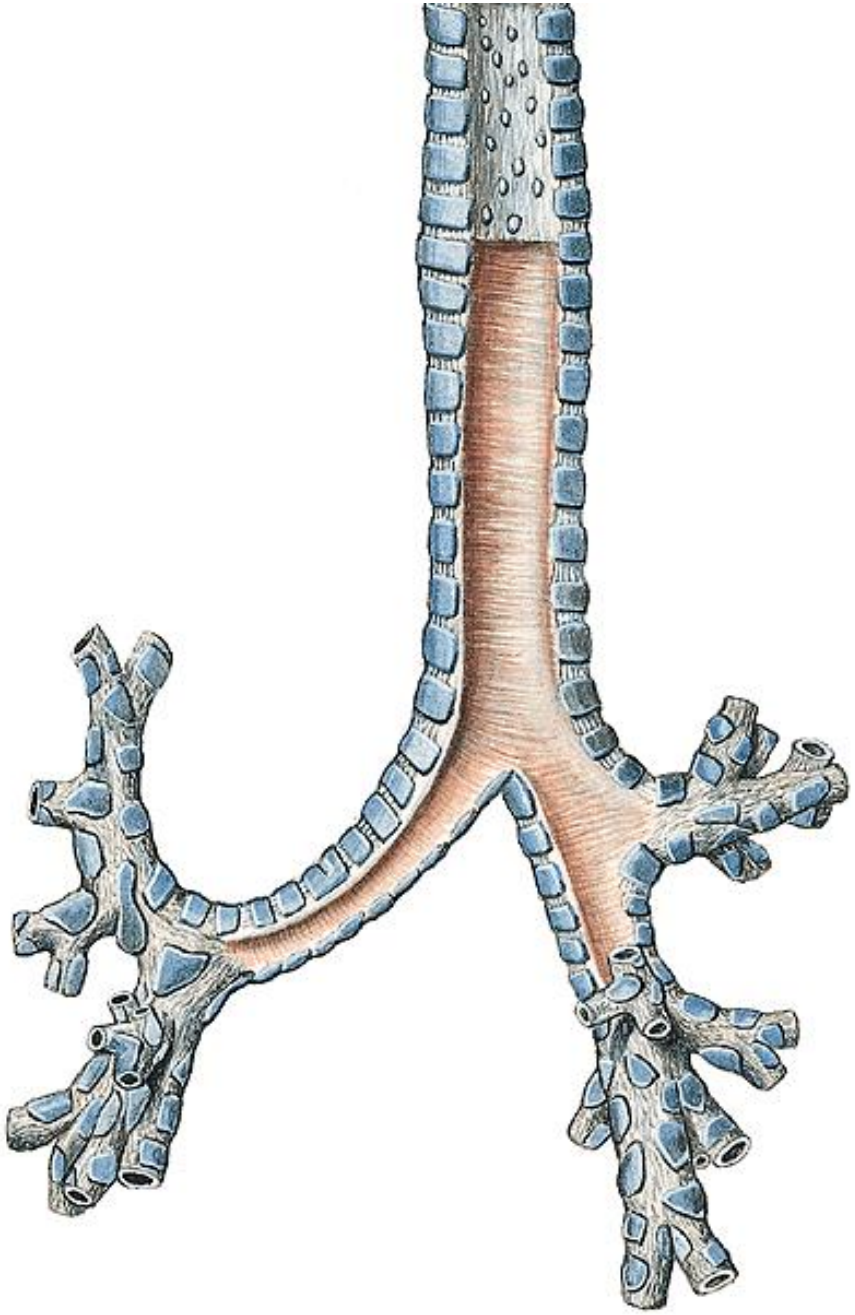
Carina tracheae



Pars cervicalis

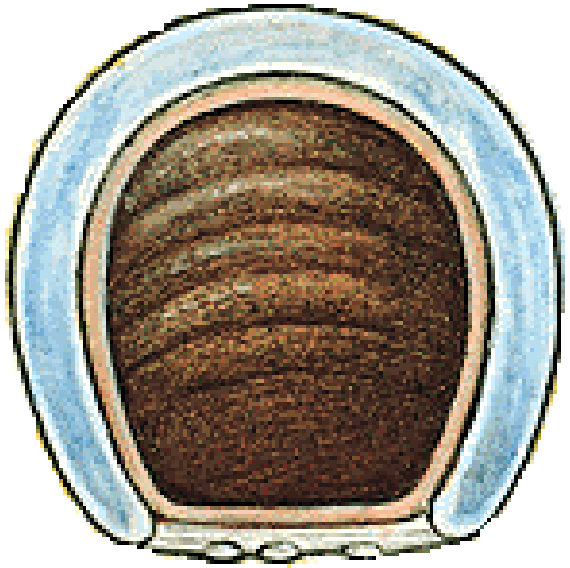


Pars thoracica



Cartilagines tracheales

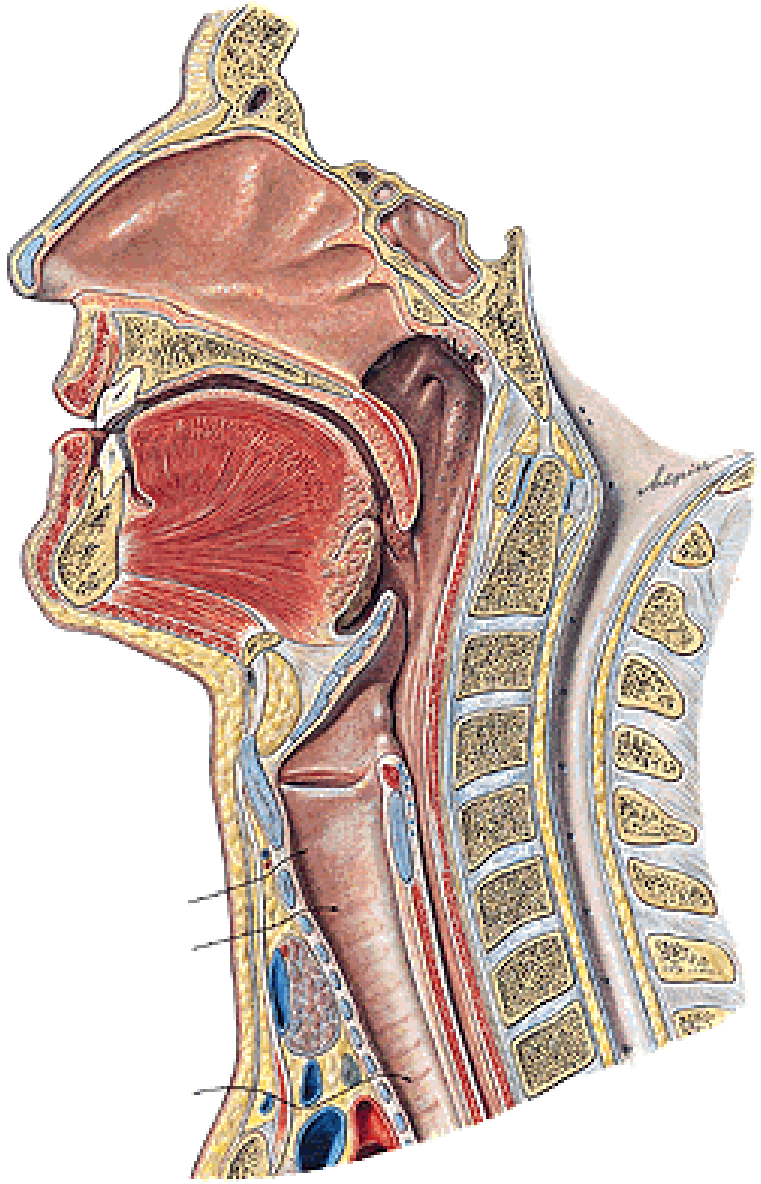
- number (12-15)
- shape
- ligg. anularia



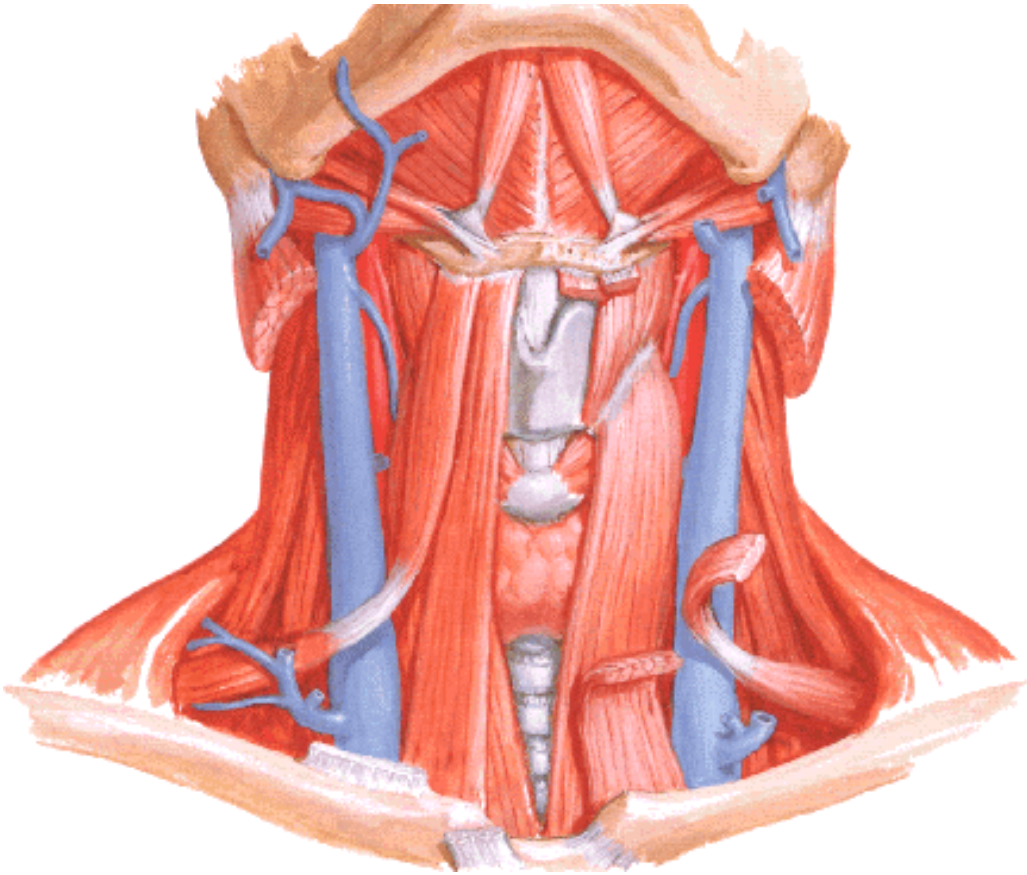
Paries membranaceus

glands, m. trachealis

TOPOGRAPHY OF THE TRACHEA

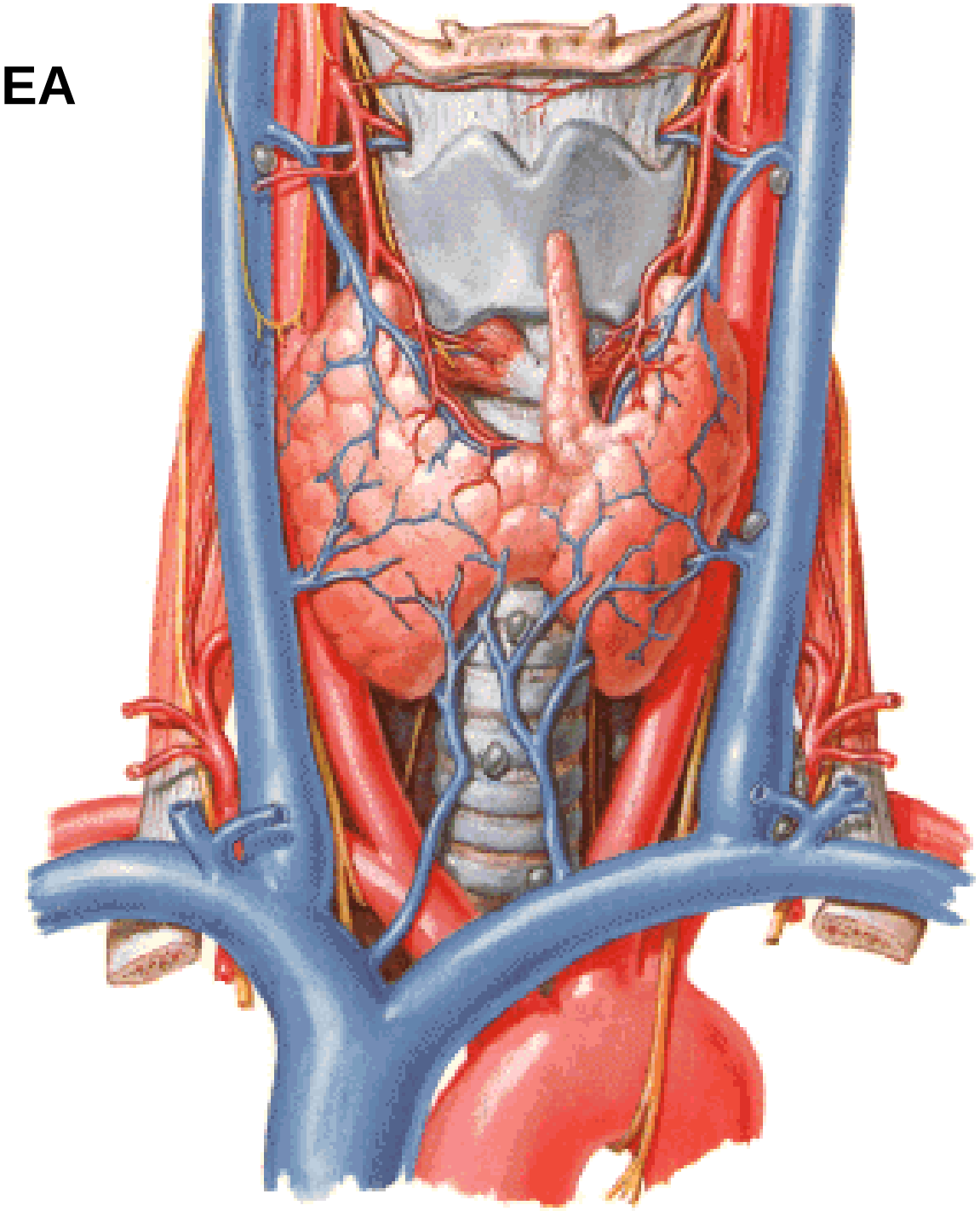


M. sternohyoideus
M. sternothyroideus
Lamina pretrachealis fasciae colli

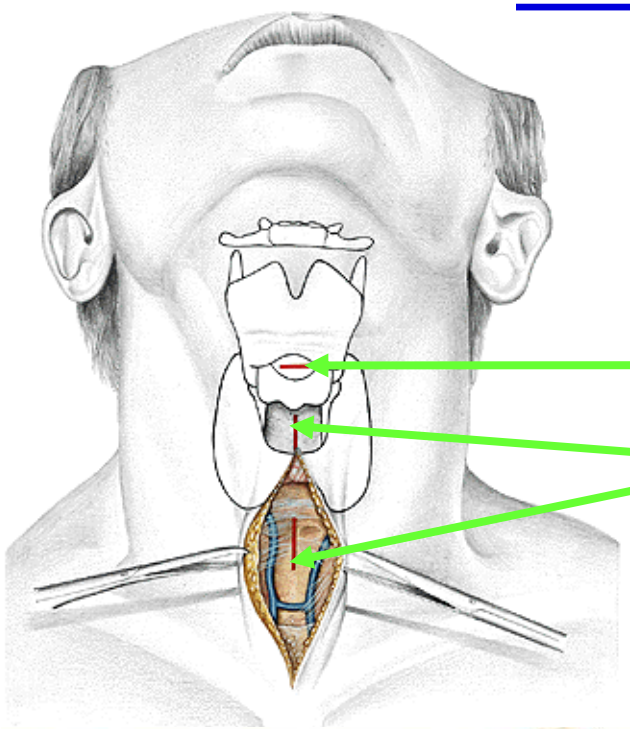


TOPOGRAPHY OF THE TRACHEA

-**isthmus glandulae thyroideae**
-**vv. thyroideae inferiores**
-truncus brachiocephalicus
-arcus aortae
-v. brachiocephalica sinistra
-v. cava sup.
-**a. carotis communis**
-**v. jugularis int.**
-**n. vagus**
-**oesophagus**
-**n. laryngeus recurrens**
-nodi lymph. paratracheales

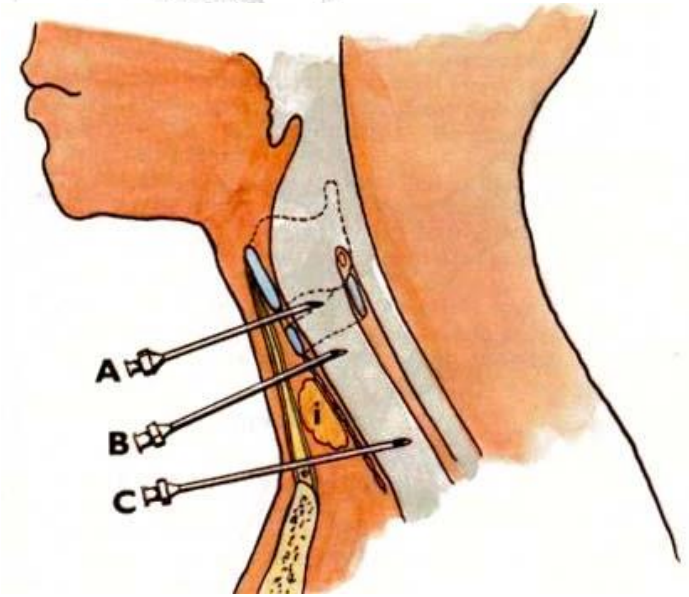


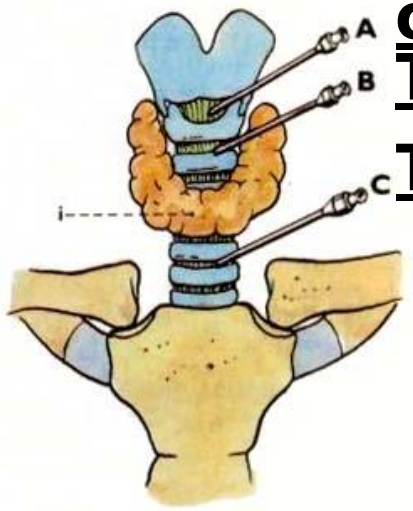
Coniotomy, Tracheotomy



coniotomia (lig. crycothyroideum)

Tracheotomia



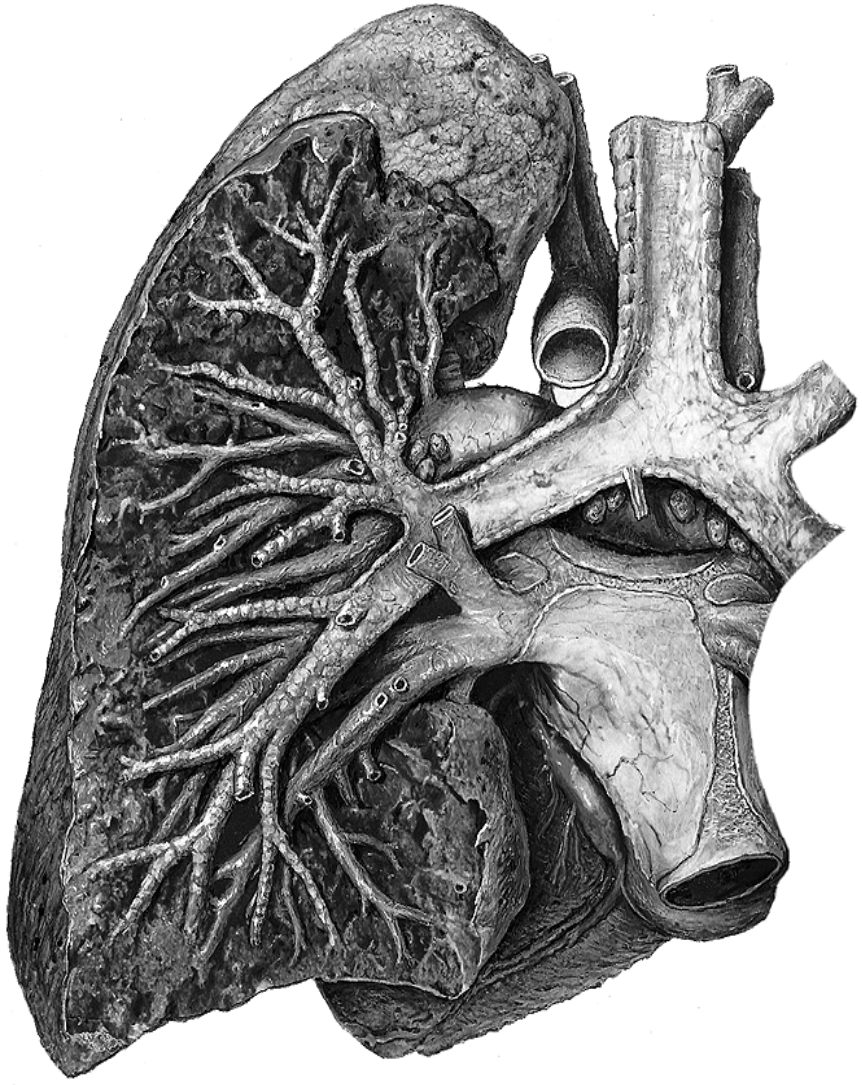


coniotomy

Tracheotomy superior

Tracheotomy inferior

Bronchi

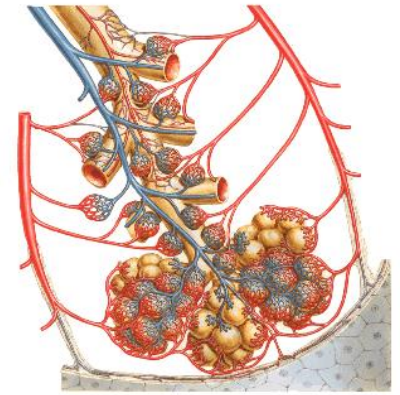


- principales
  - lobares
    - segmentales

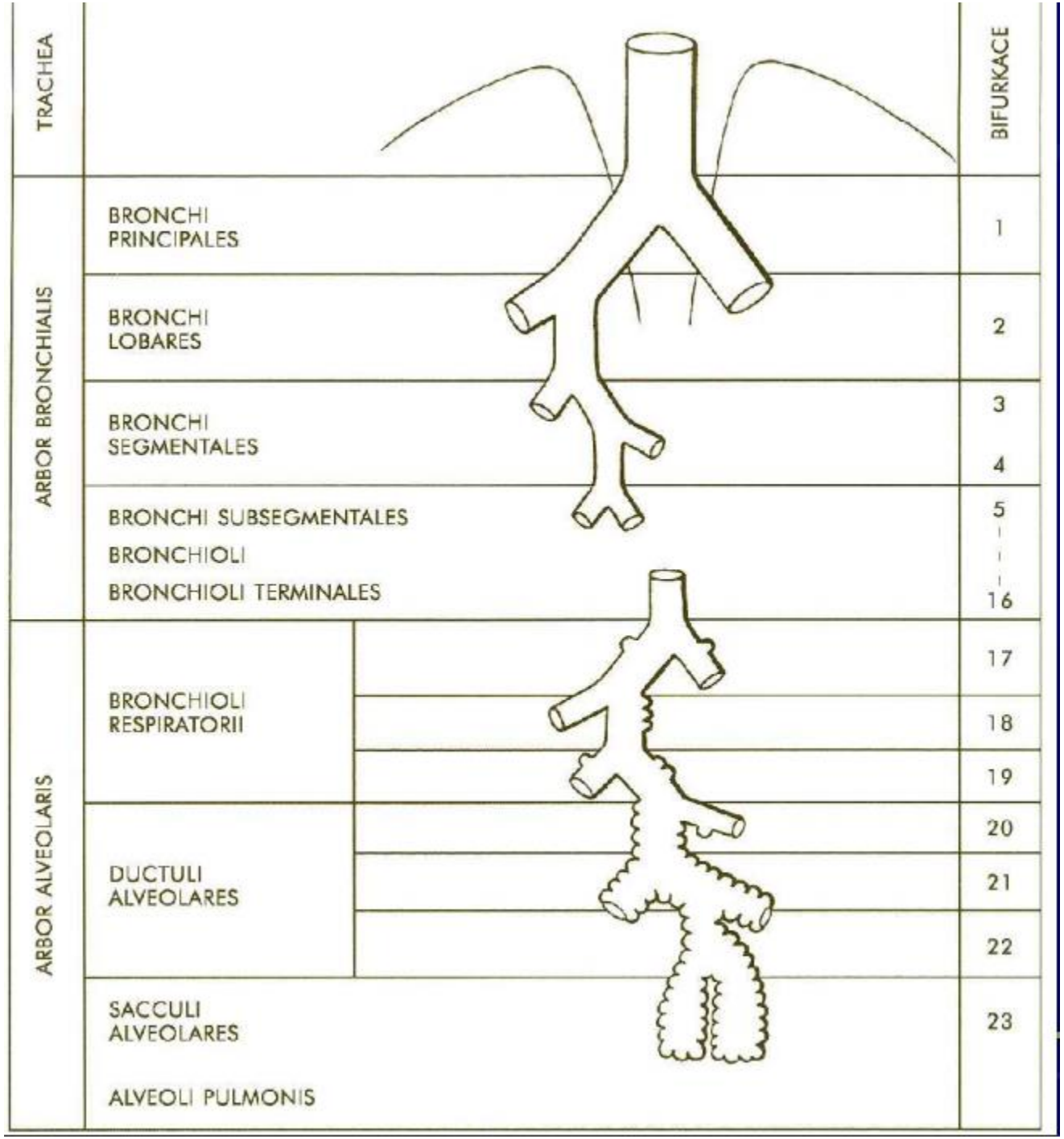
... (arbor bronchialis)

… bronchioli

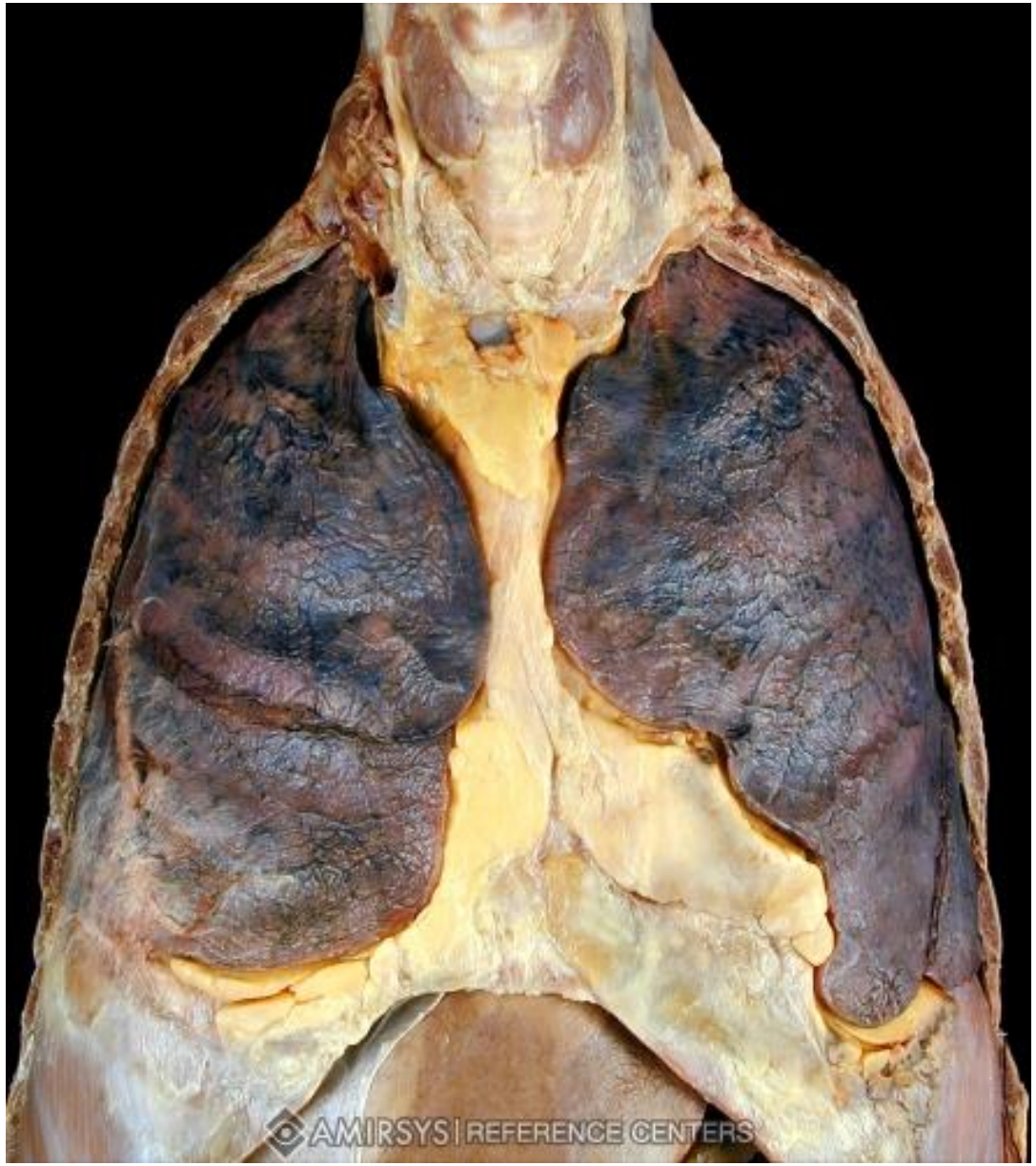
……ALVEOLI



Structure as trachea


TRACHEA
BIFURKACE
ARBOR BRONCHIALIS
BRONCHI PRINCIPALES
1
BRONCHI LOBARES
2
BRONCHI SEGMENTALES
3
4
BRONCHI SUBSEGMENTALES
BRONCHIOLI
BRONCHIOLI TERMINALES
5
16
ARBOR ALVEOLARIS
BRONCHIOLI RESPIRATORII
17
18
19
DUCTULI ALVEOLARES
20
21
22
SACCULI ALVEOLARES
ALVEOLI PULMONIS
23

Pulmo



Basis, apex

Facies

- costalis
- medialis
- diaphragmatica

Margines

- anterior
- inferior
- posterior

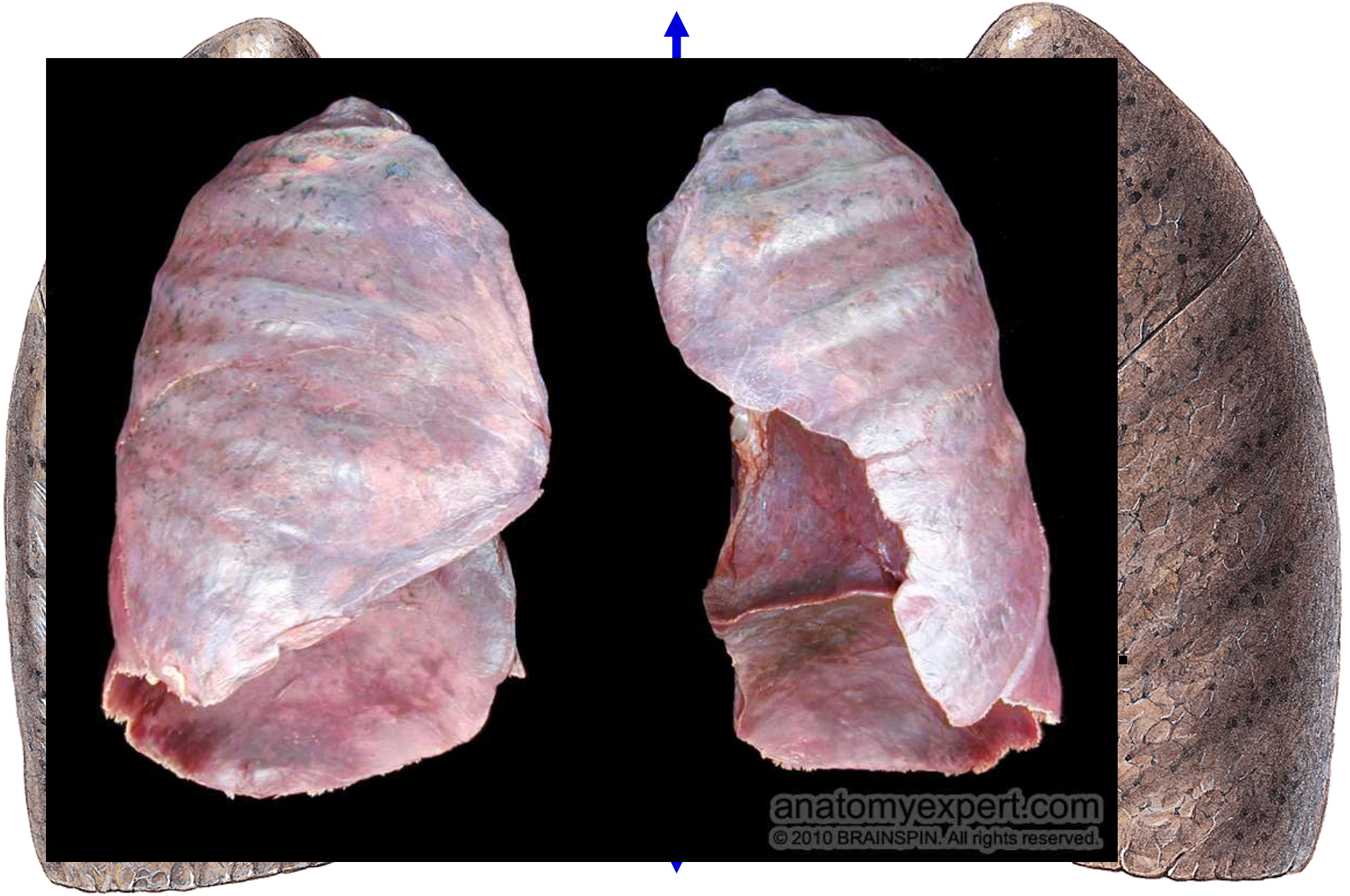
Fissurae

- obligua
- horizontalis

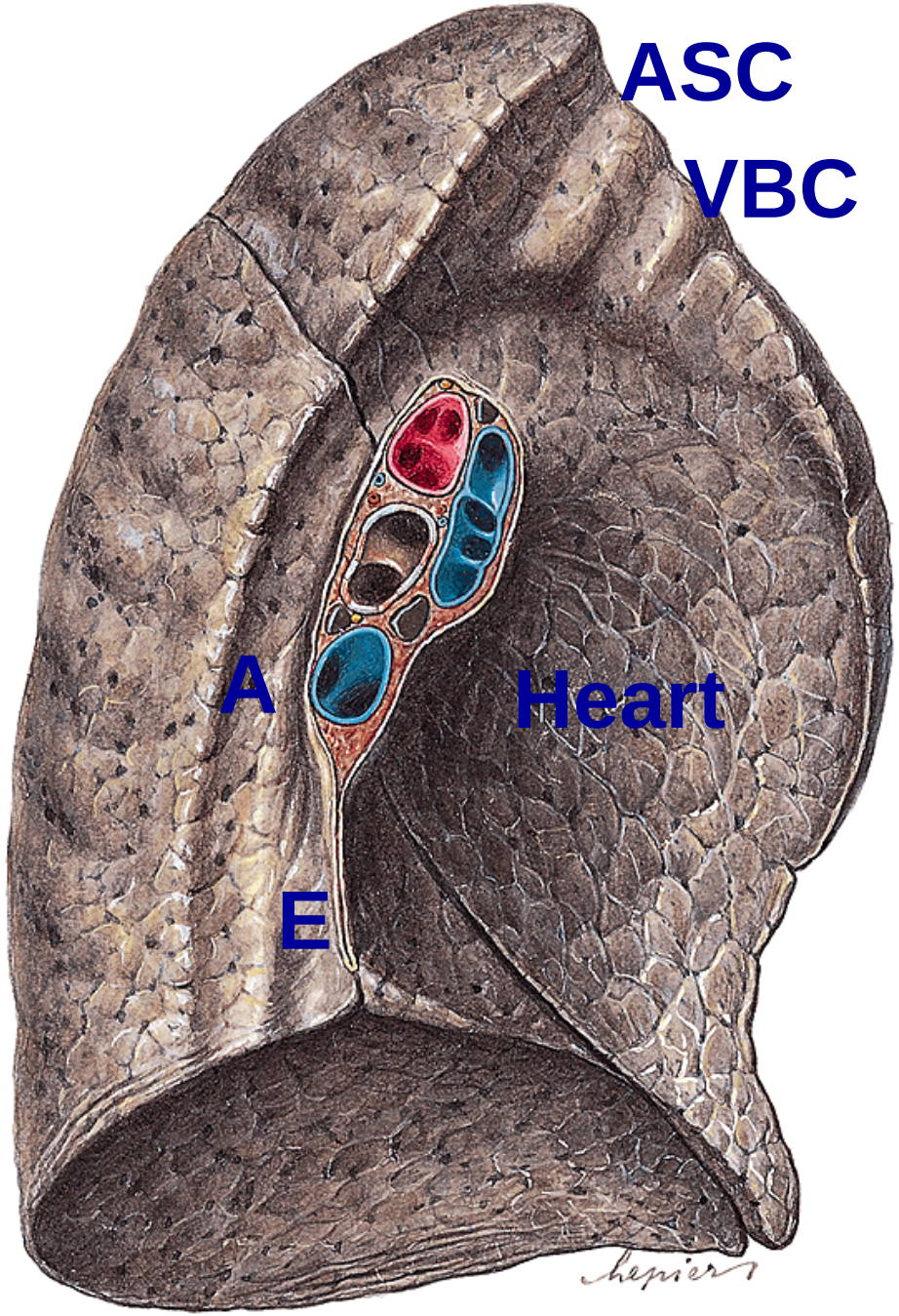
Pulmo dx.

fissura horizontalis (IV. rib)
fissura obliqua (Th4 – VI.rib)

Pulmo sin.



A
B
V

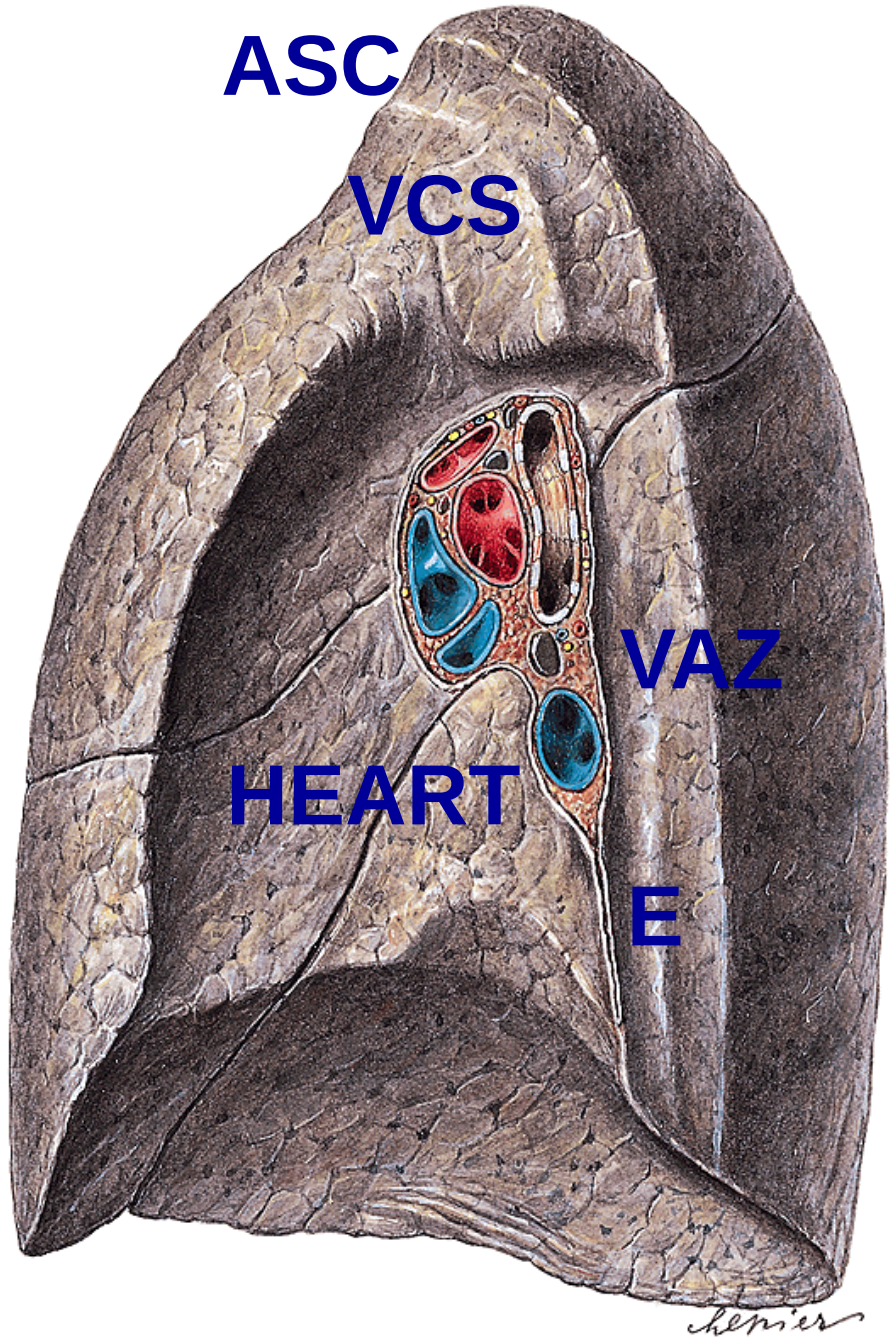


Hilum pulmonis

- bronchus principalis
- a., v. pulmonalis
- aa. bronchiales
- Lymph vessels
- nerves

Pulmo sin.

Incisura cardiaca
Lingula pulmonis



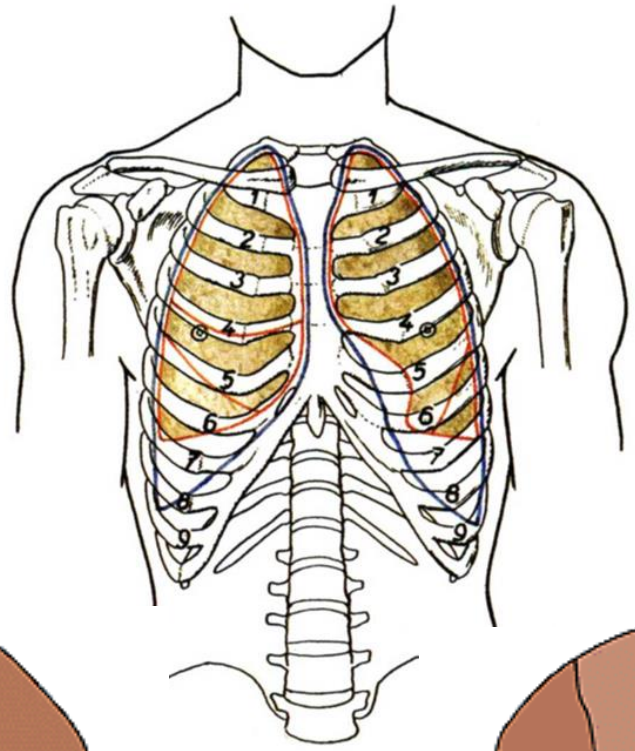
Pulmo dx.

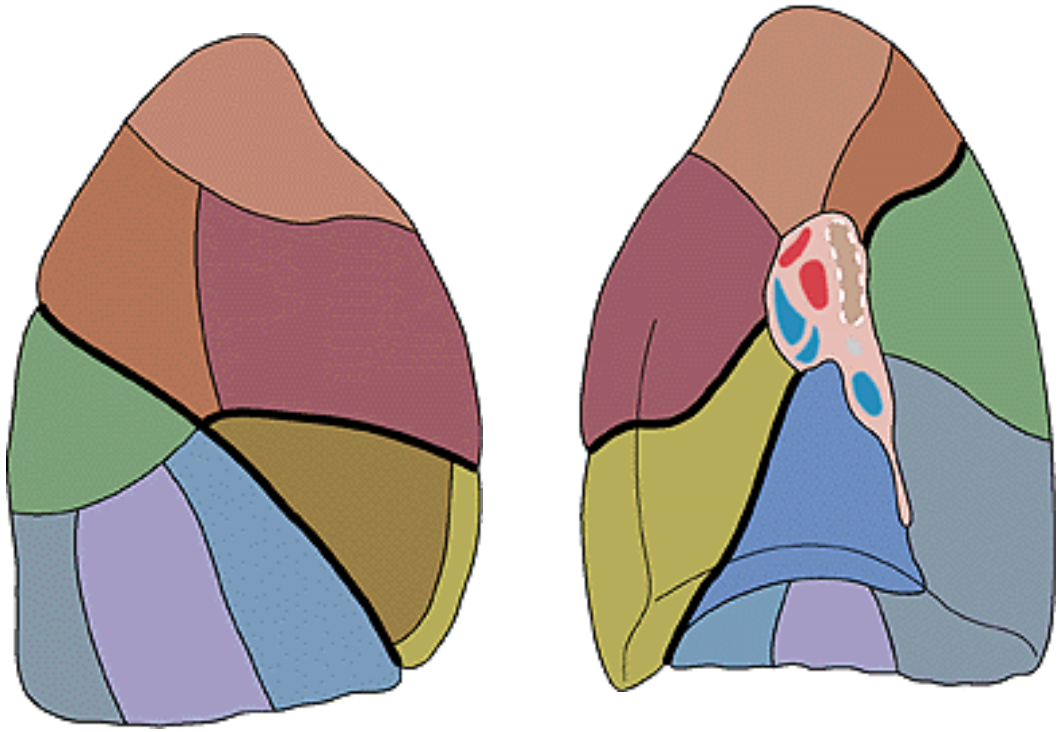
segmenta bronchopulmonalia

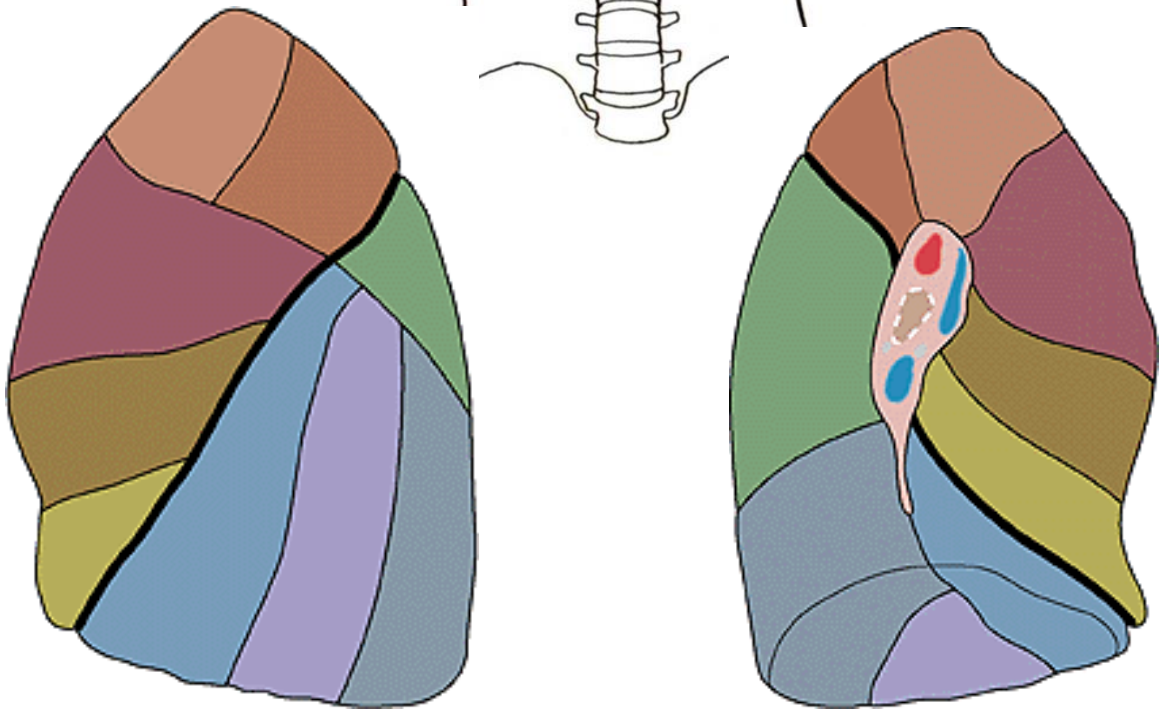
Dextra - 10

Sinistra -10 (8) I. and II. fused

VII. in 90% mising







Nutritive and functional circulation

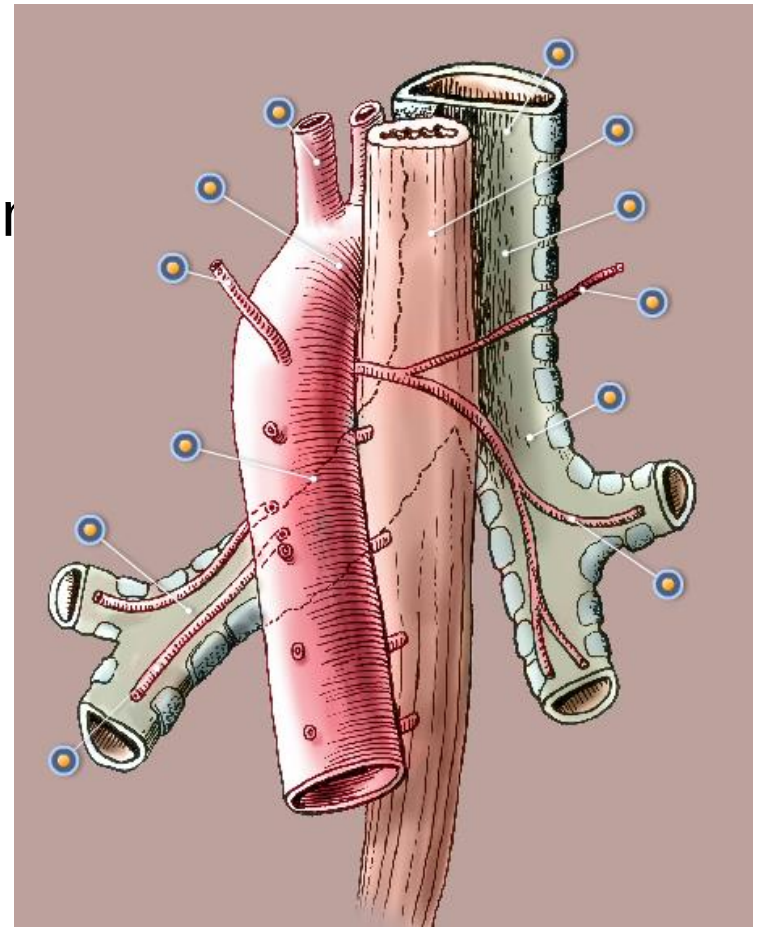
Nutritive circulation

Aorta thoracica (+ intercostal arteries)

- **rami bronchiales** (1 on the right – usually from a. intercostalis tertia, 2 or the left directly from aorta thoracica)

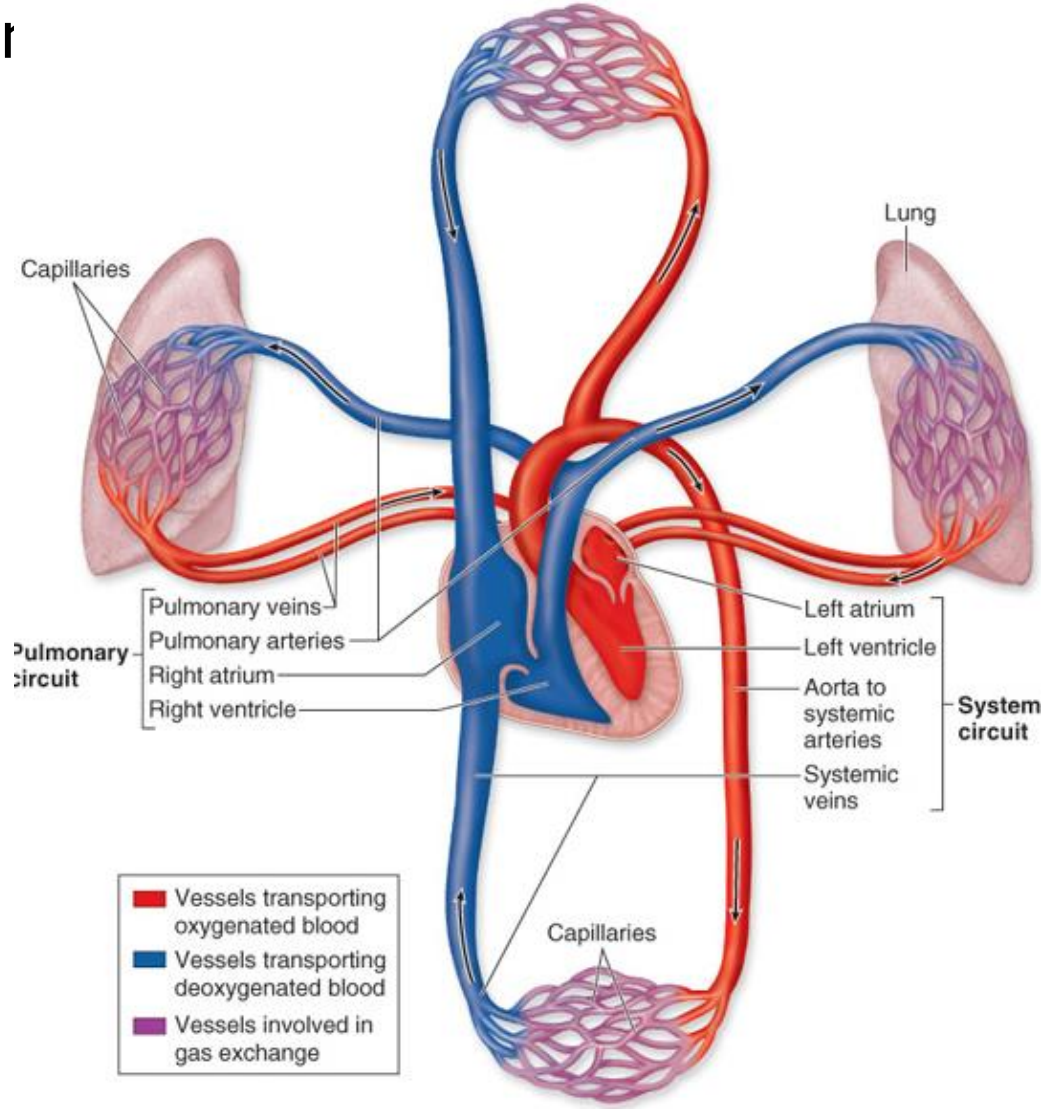
  along bronchi until bronchioli respiratorii
- **venae bronchiales**

  to v. azygos,v. hemiazygos accessoria,vv. intercostales



Functional circulation – small blood circulation

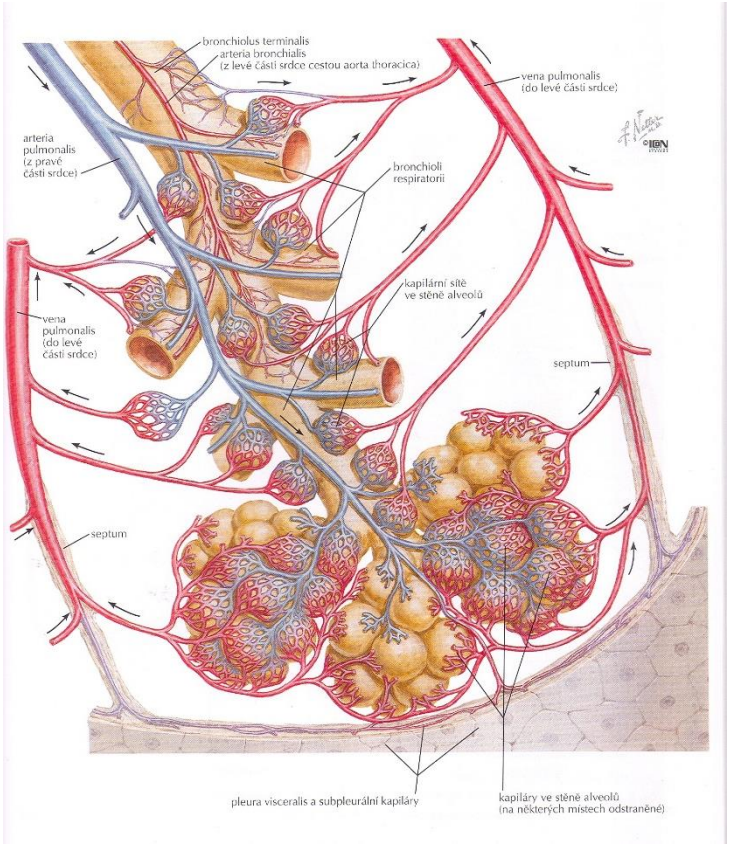
Right heart ventricle ➡ truncus pulmonalis ➡ **arteriae pulmonales** dx.+ sin.(**low oxygen**) ➡ capilaries ➡ 4 **venae pulmonales** (2 dx., 2 sin.) (***rich on oxygen***) ➡ left heart ventricl

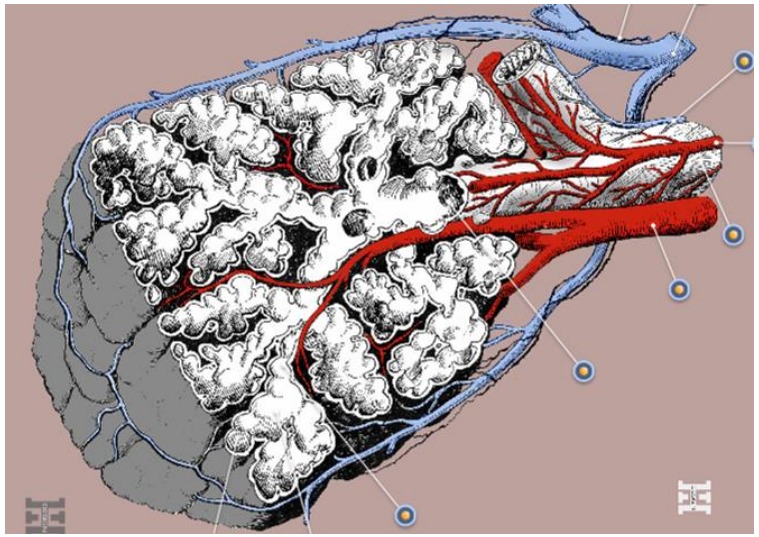


- **branching of the arteries = branching of the bronchi**

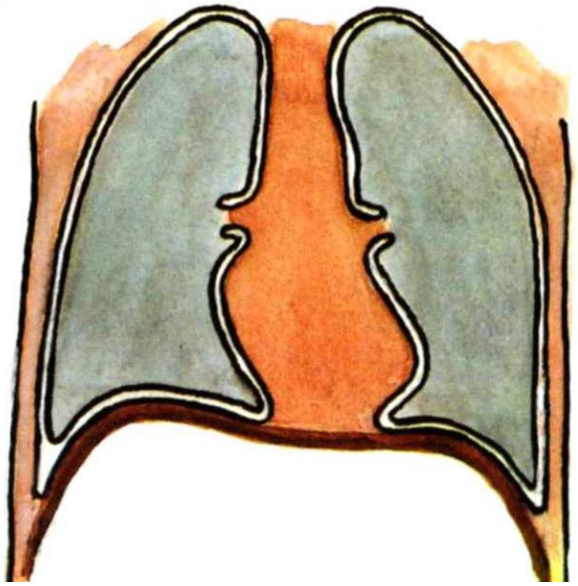
  On the left: hyparterial bronchus (below artery) **ABV**

  On the right: eparterial bronchus (above artery) **BAV**
- **venules not accompanying arteries , passing in septas between lobuli**
- elastic, **low pressure**, muscular layer only in fetuses, in adults from < 1mm





Pleura



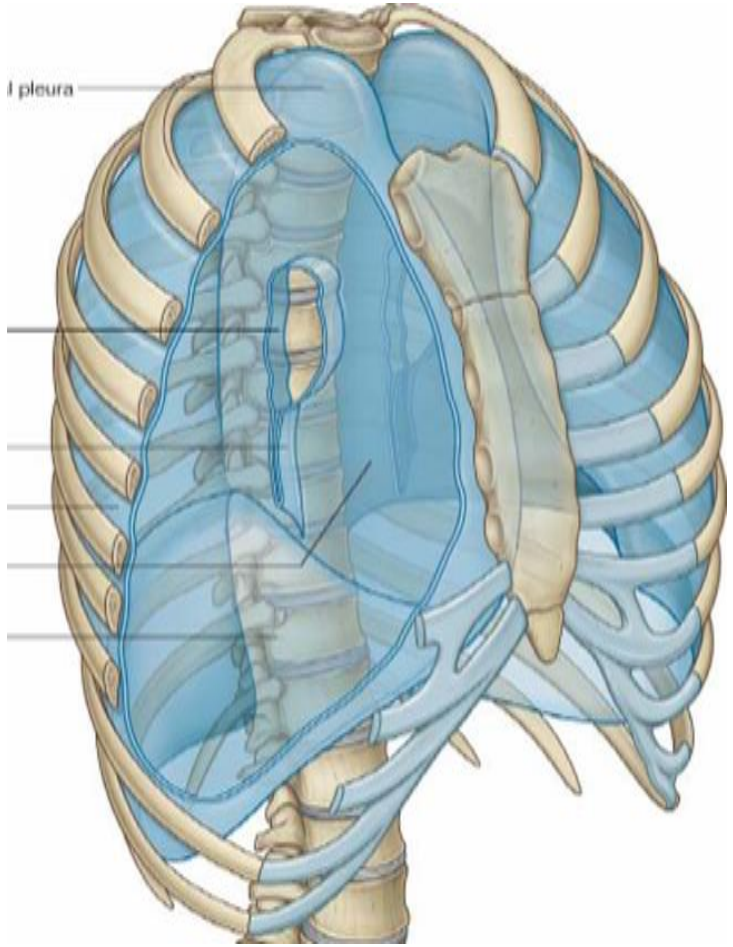
Parietalis

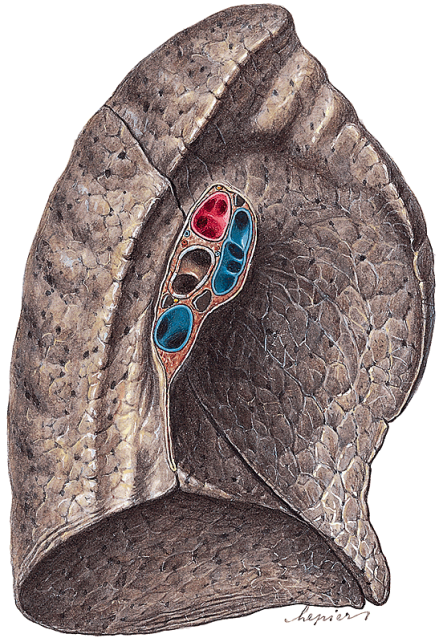
Cupula pleurae

Pleura: costalis

diaphragmatica

mediastinalis





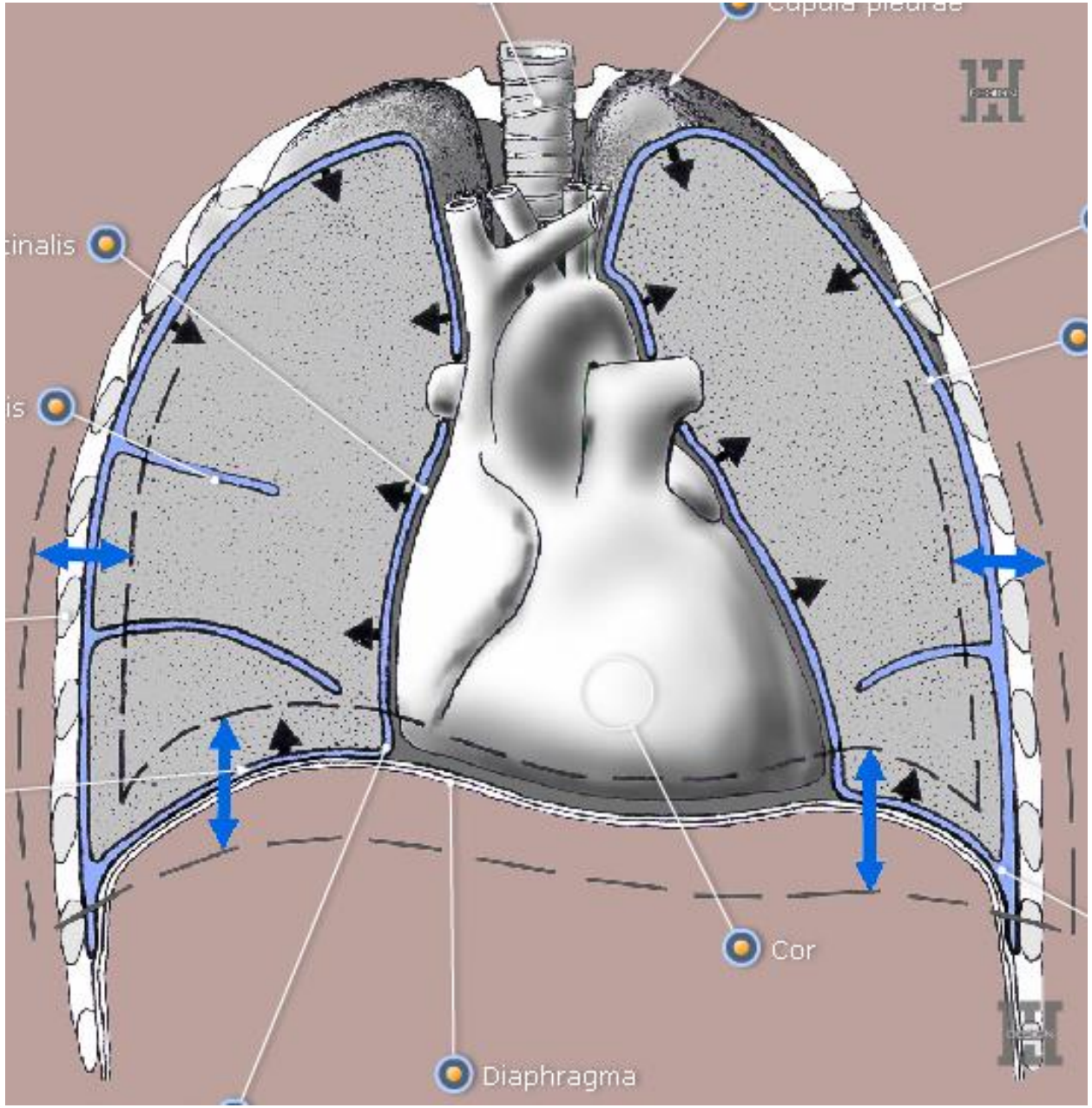
Visceralis

surfactant

Cavitas pleuralis

Recessus pleurae

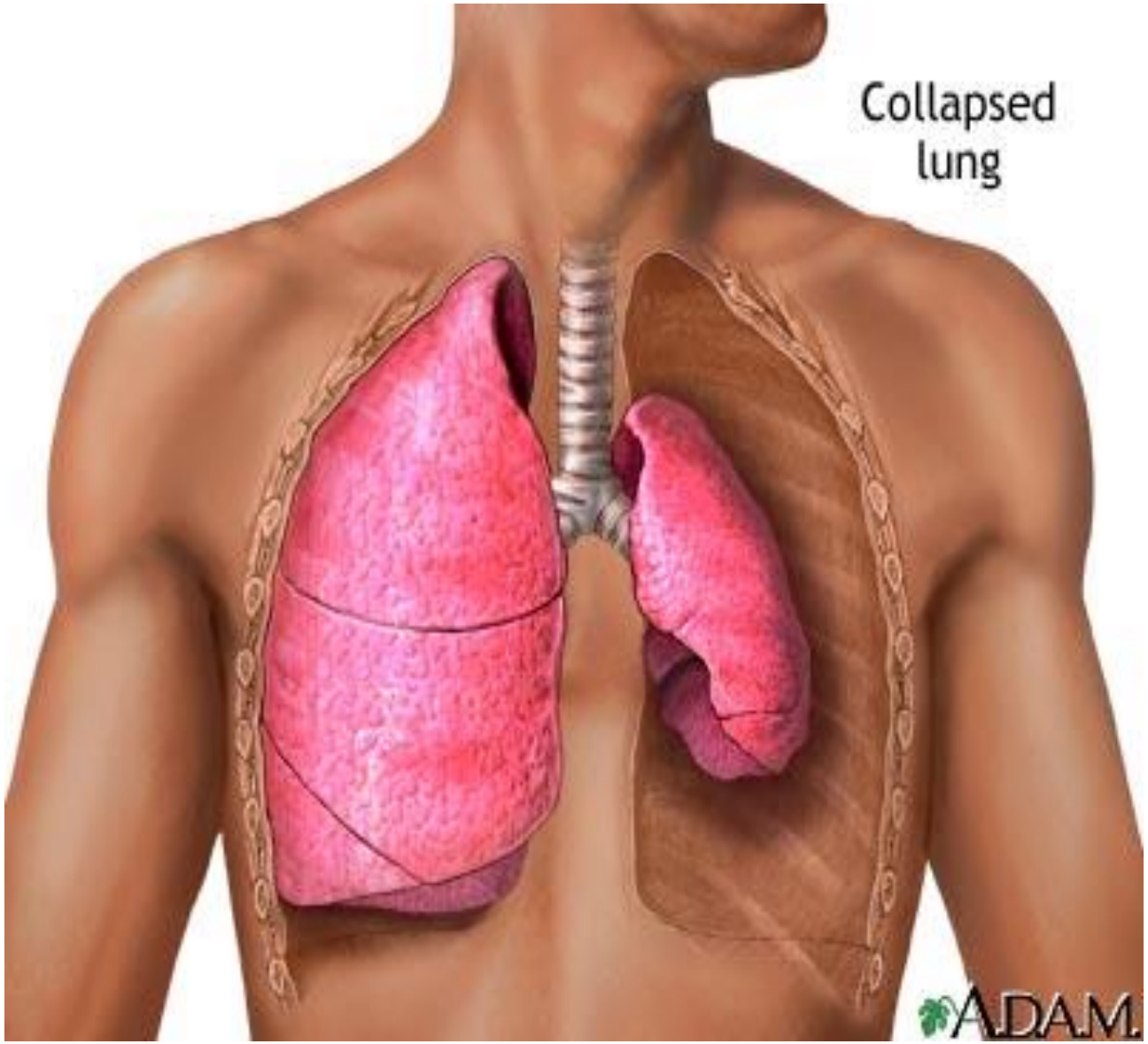
lig. pulmonale

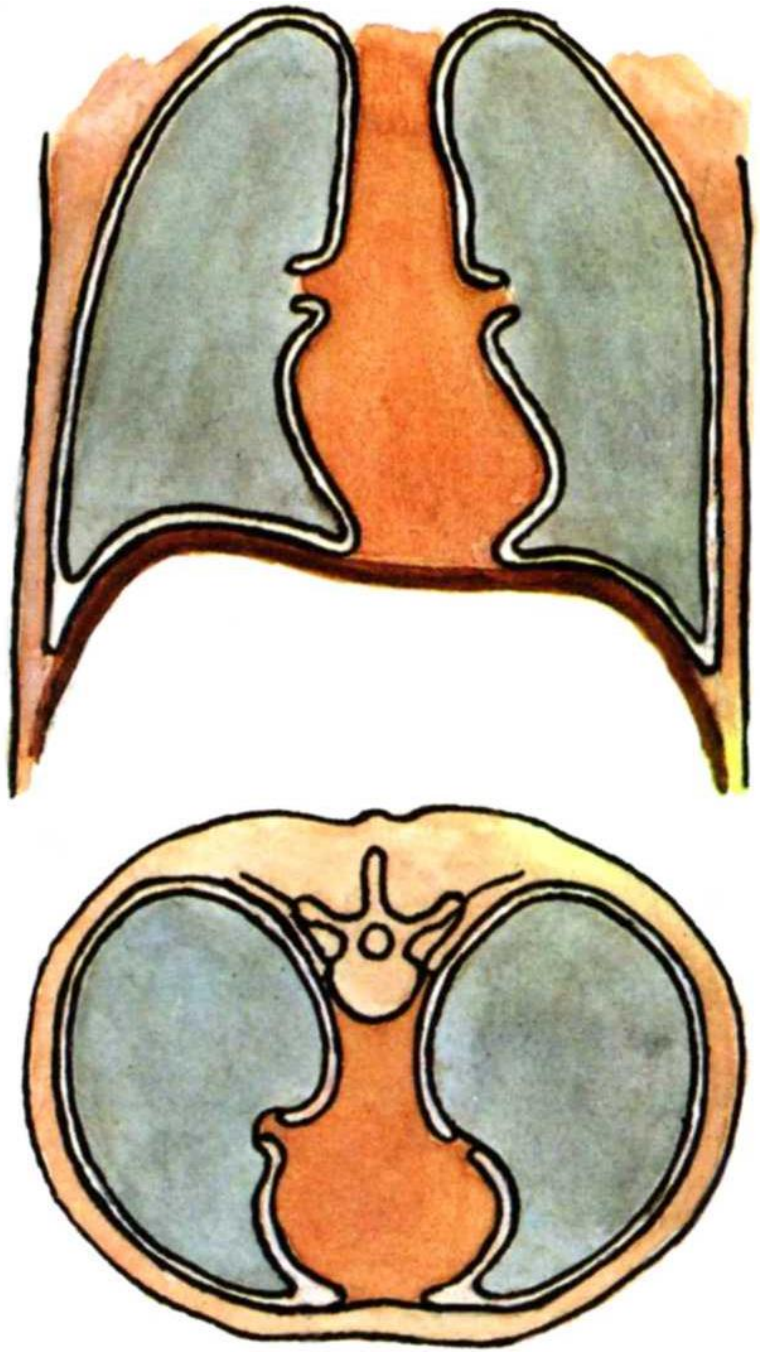

Cupula pleurae
tinalis
is
Cor
Diaphragma


1


1
2

Pneumothorax



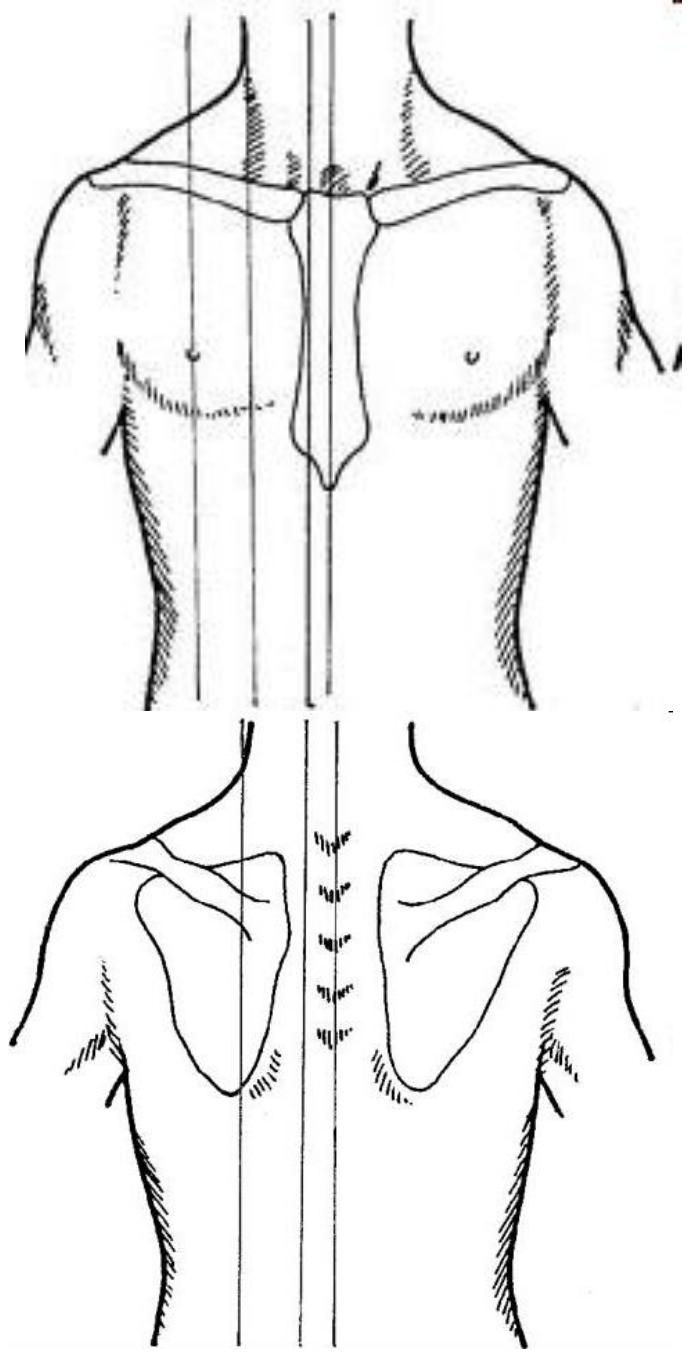


Recessus pleurae

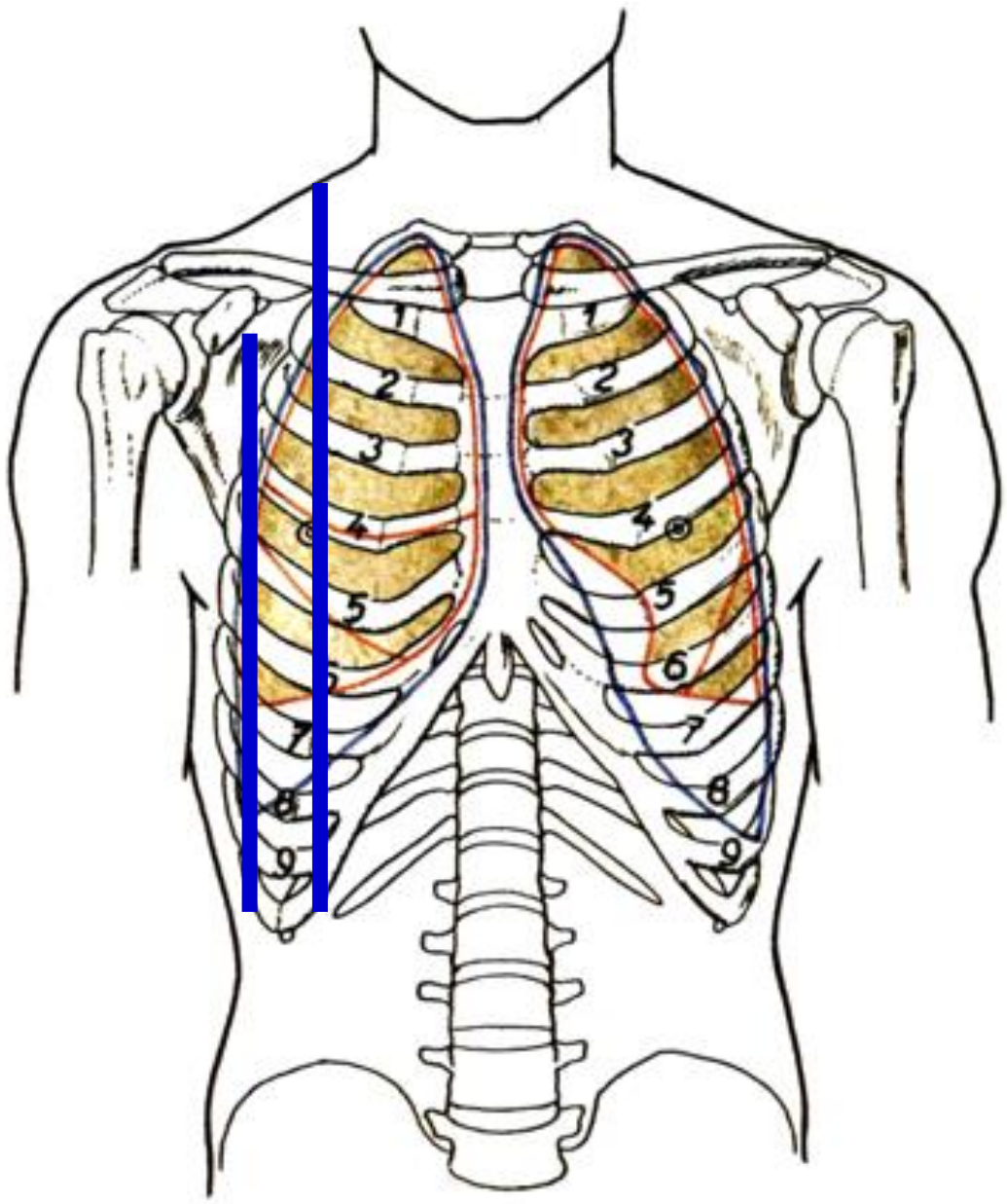
- costo-diaphragmaticus
- phrenico-mediastinalis
- costo-mediastinalis

Pleural borders

<u>Lines for orientation on the thorax:</u>
linea mediana ant.
linea sternalis
linea parasternalis
linea medioclavicularis
linea axillaris ant., med., post.
linea scapularis
linea paravertebralis
linea mediana post.



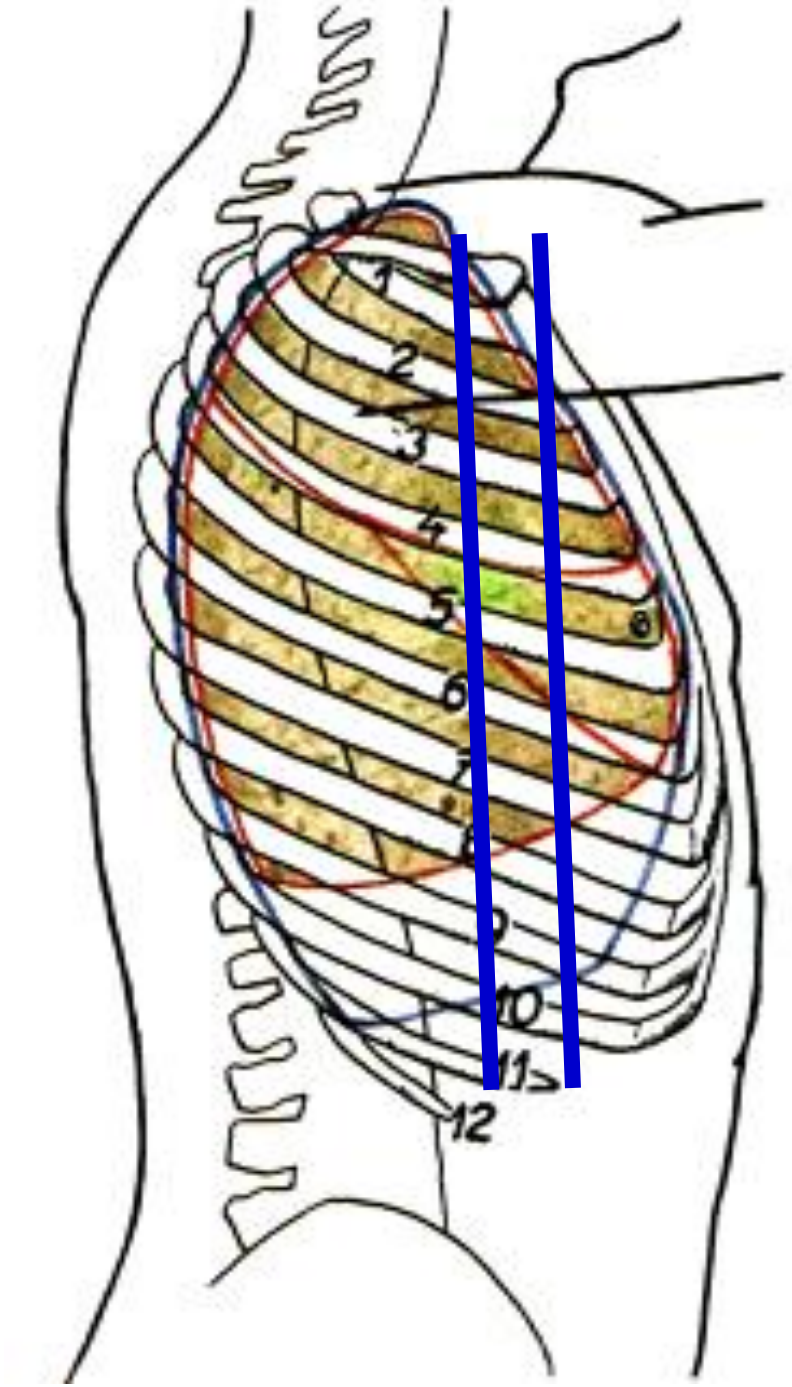
Pleural borders



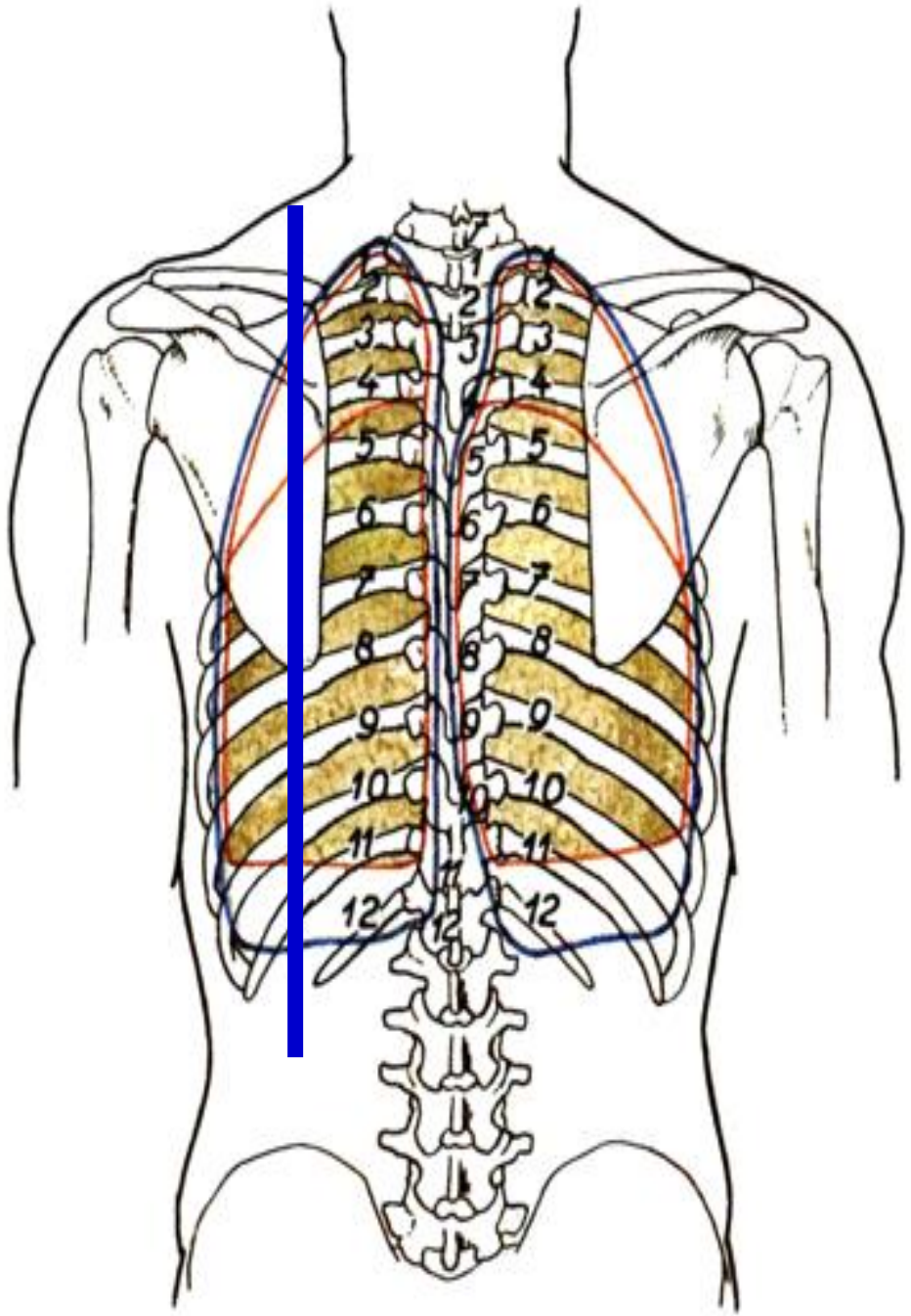
Cupula pleurae:
2 cm above clavicle

Ventral border
mediocaudaly Co 2
caudaly Co 6

Caudal border
medioclavicul. Co 7
anterior axillary line Co 8



Middle axilary Co 9
posterir axilary Co 10



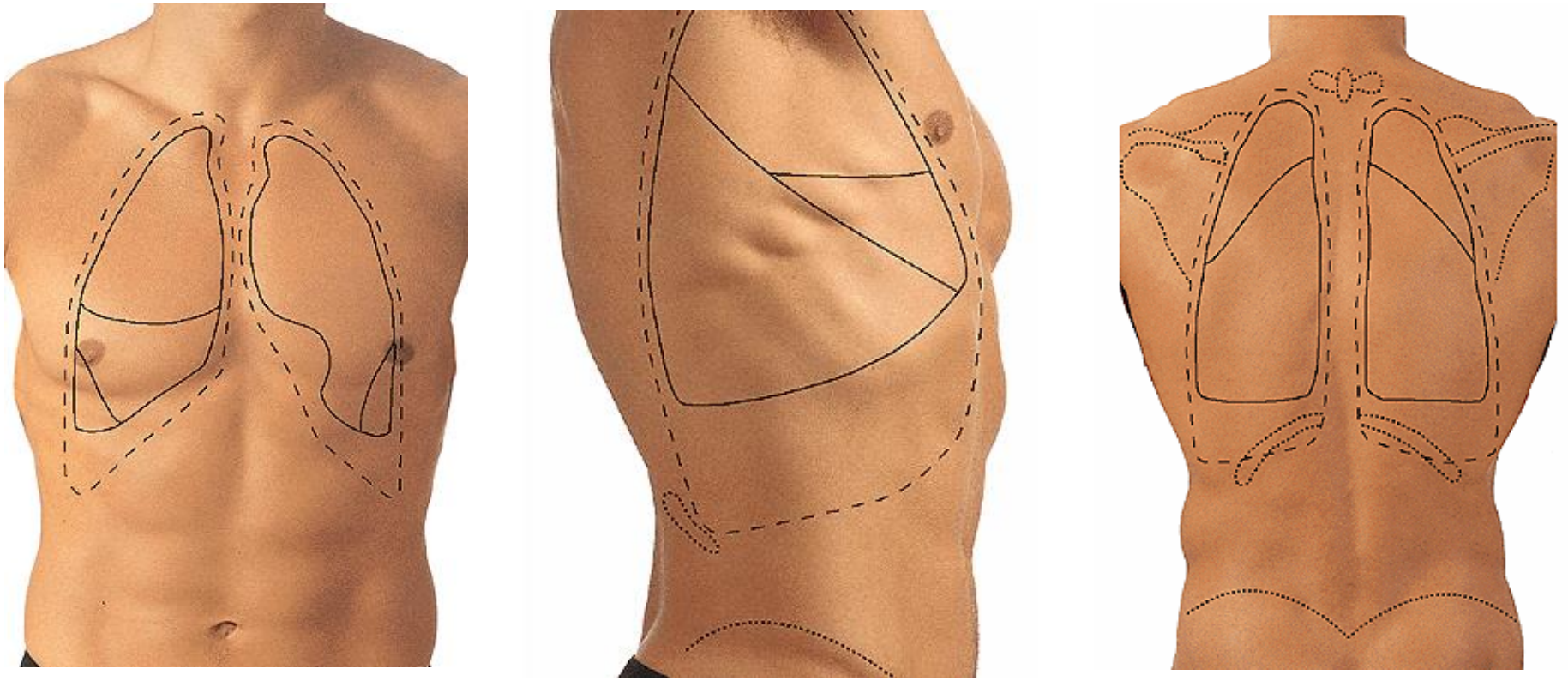
scapular Co 11

Posterior border

from Th12 to cupula pl.

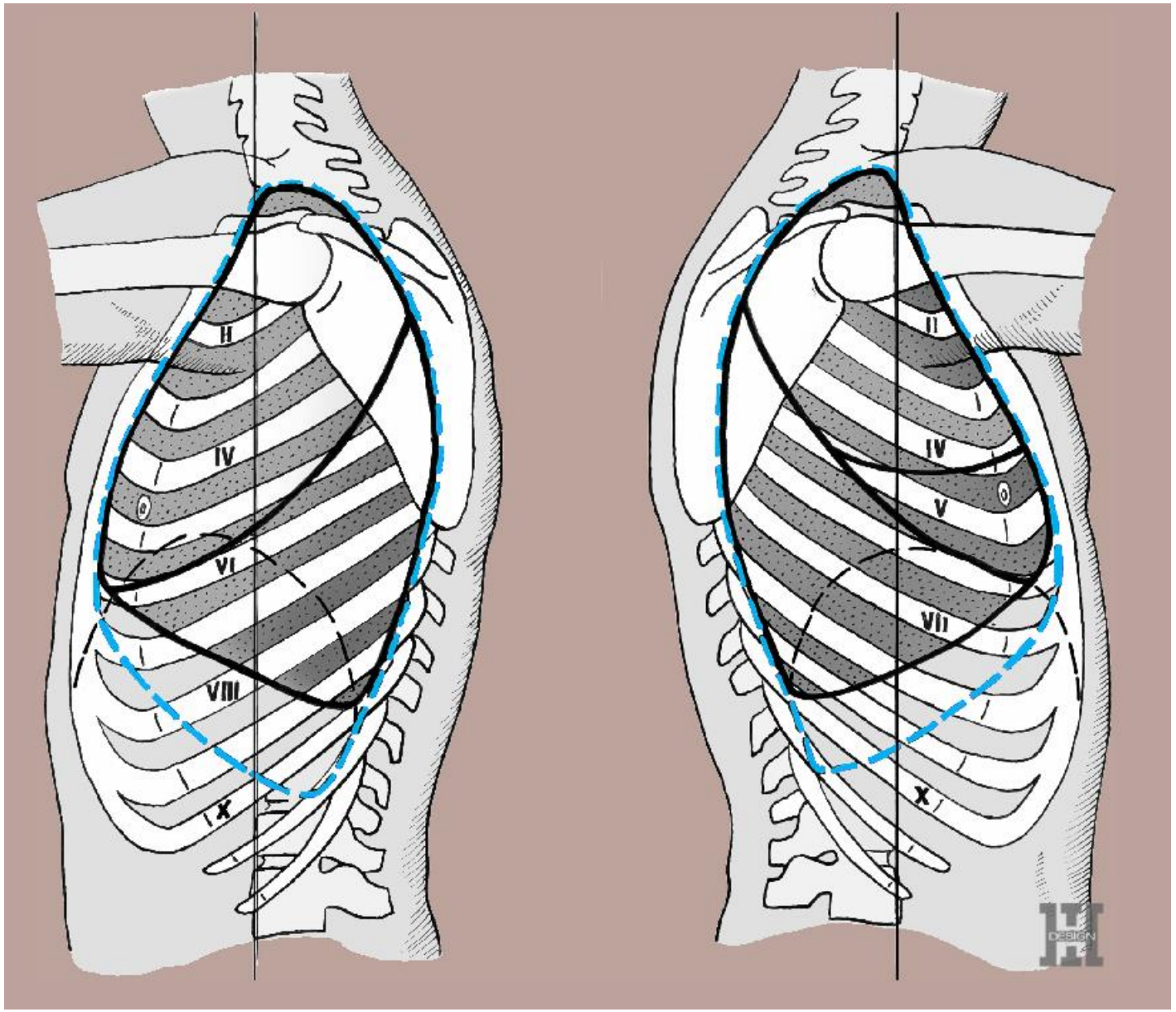
(dx: > recessus retrooesophageus)

Borders of the lung

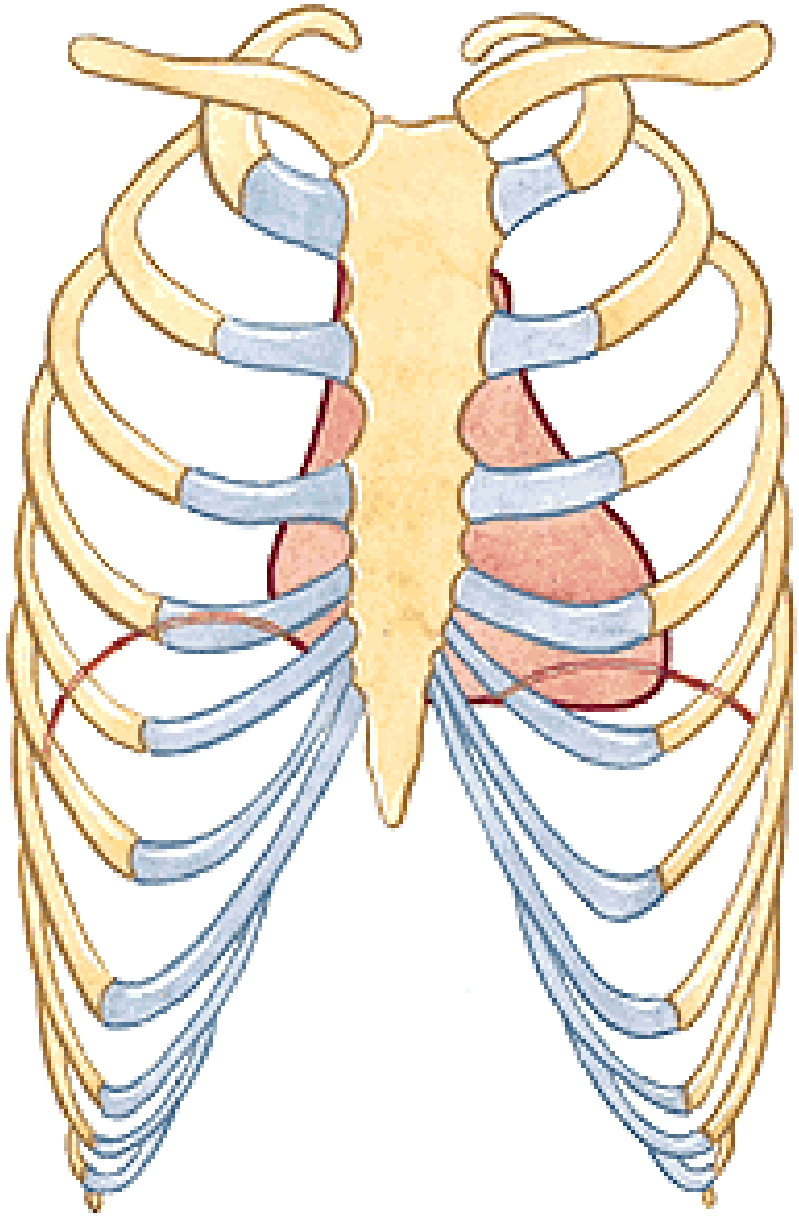


Differs during breathing
Apex in cupula pleurae
Anterior border – inspiration same with pleura
Lower border - 1- 2 ribs higher (normal breathing rate)

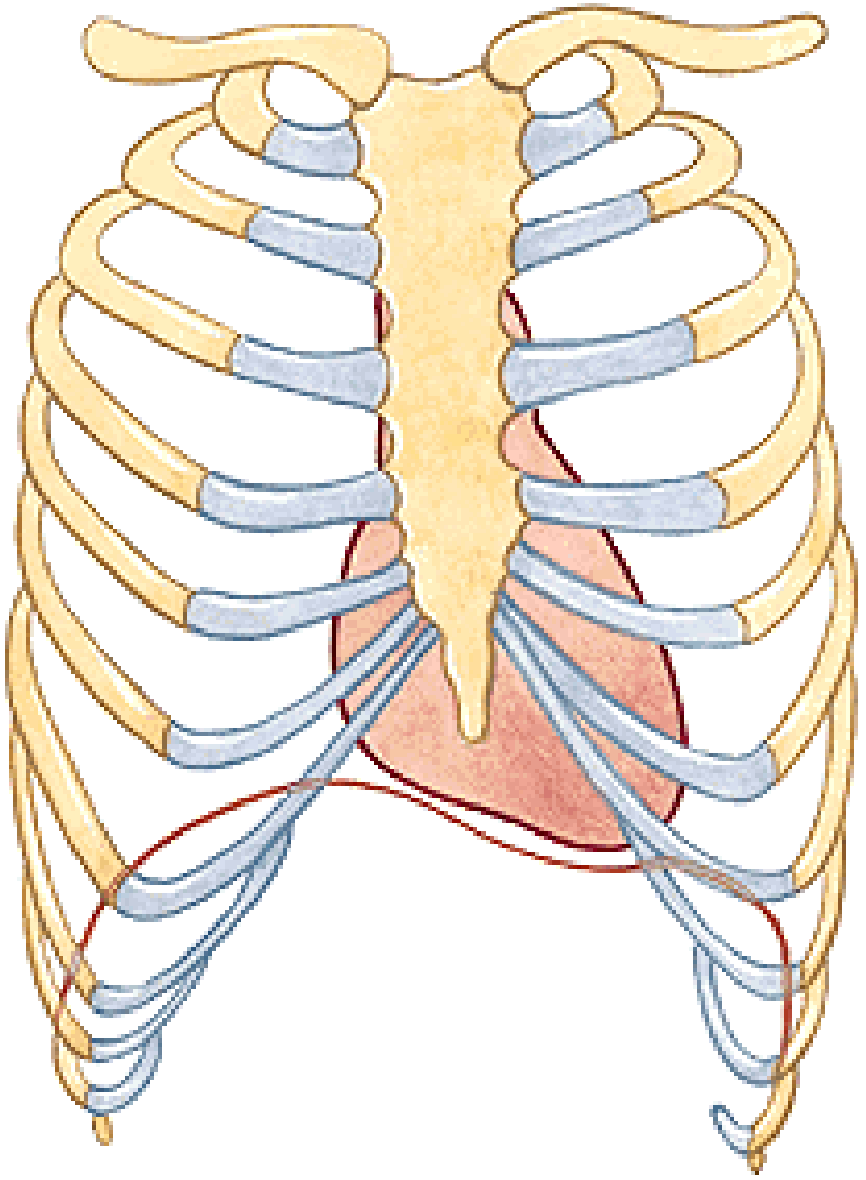
Borders of the lung and pleura



EXPIRATION

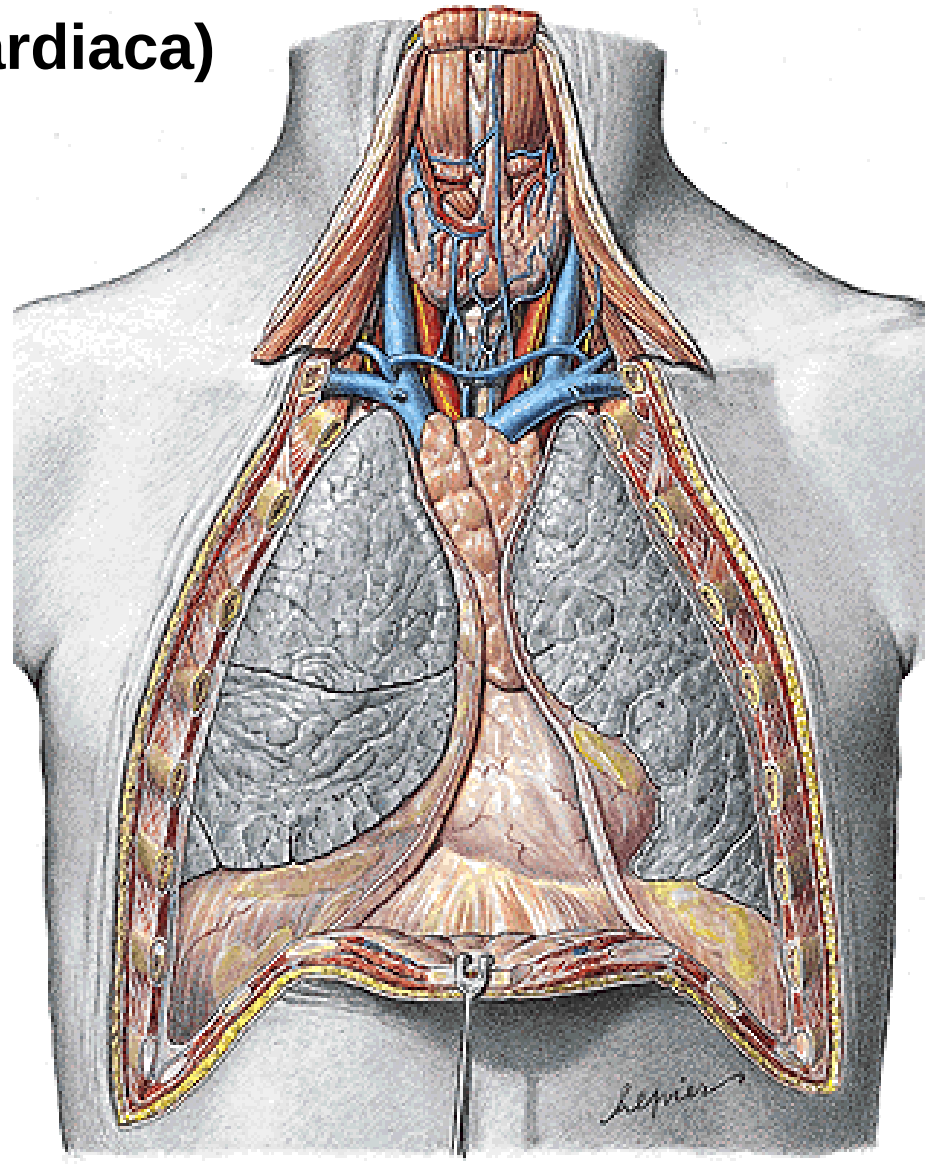


INSPIRATION

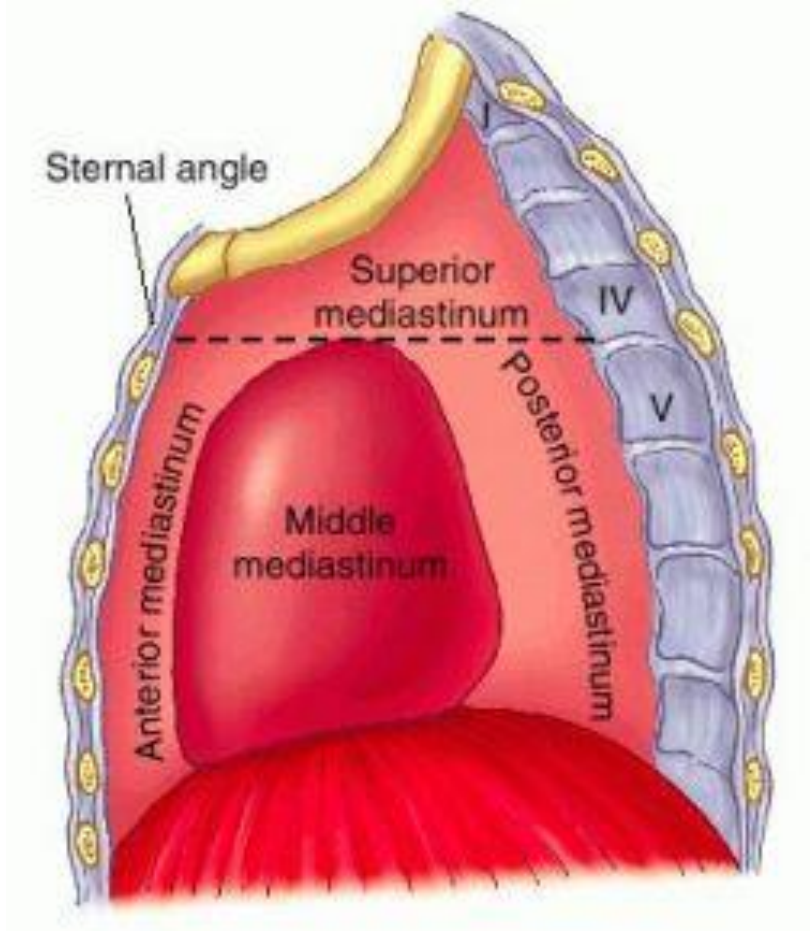


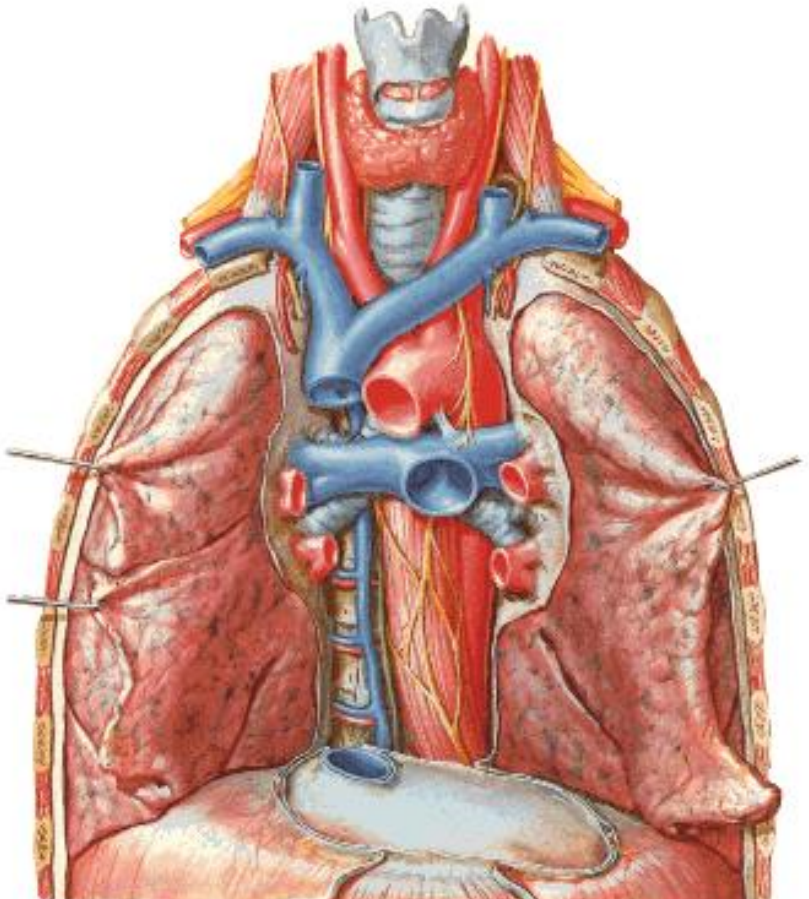
Area interpleuralis sup. (thymica)

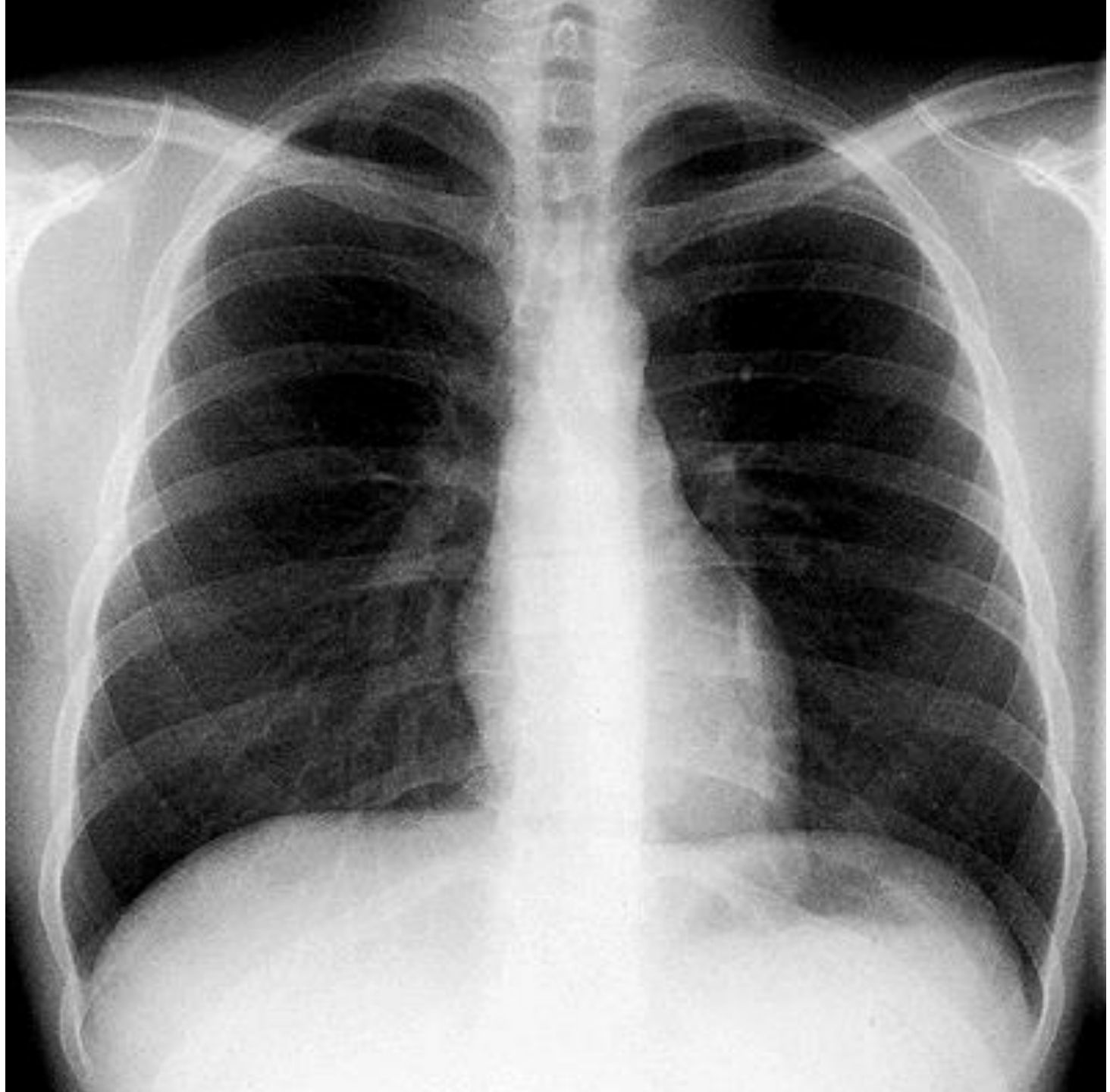
Area interpleuralis inf. (pericardiaca)

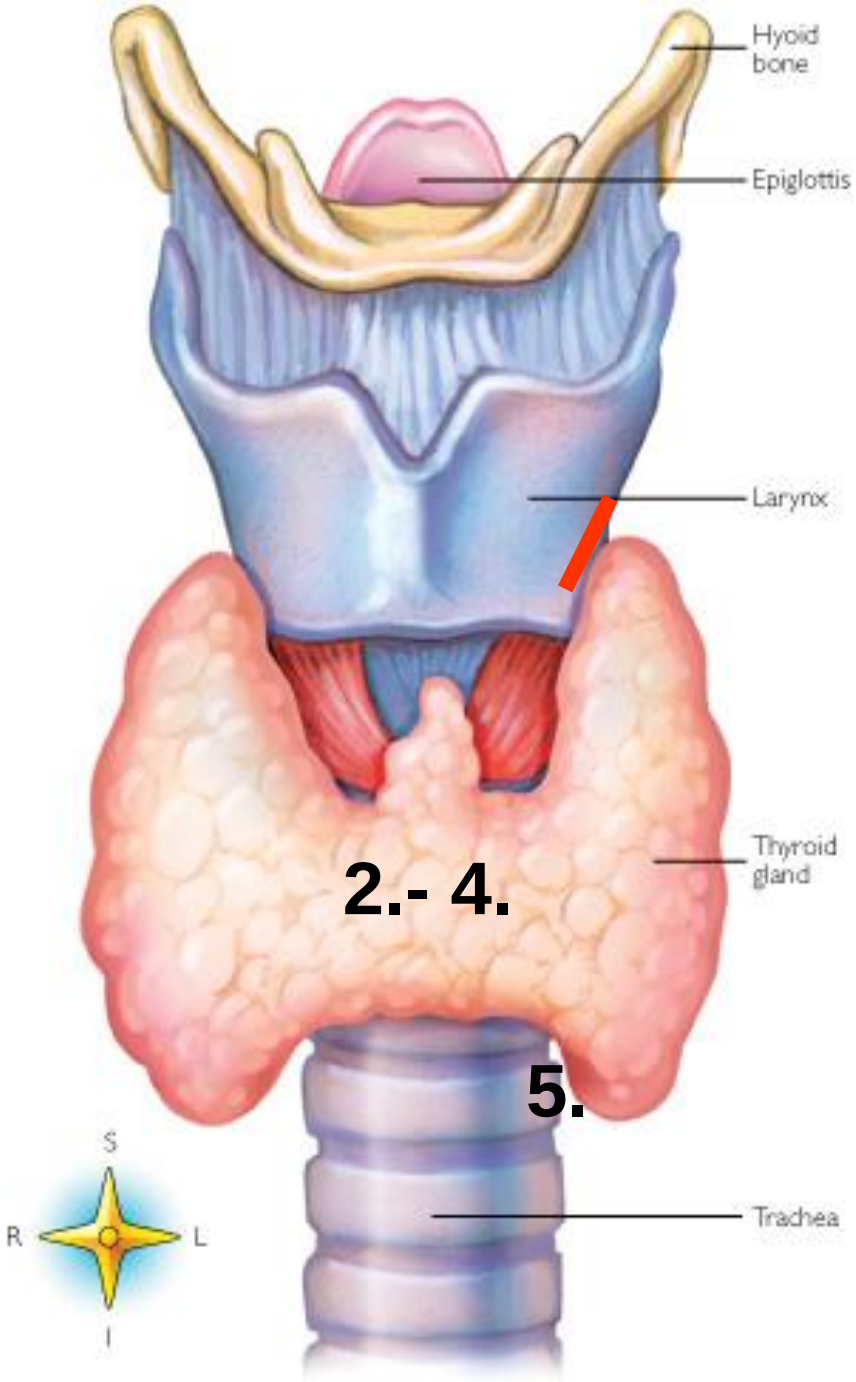


MEDIASTINUM
- superius
- inferius - anterius
- medium
- posterius







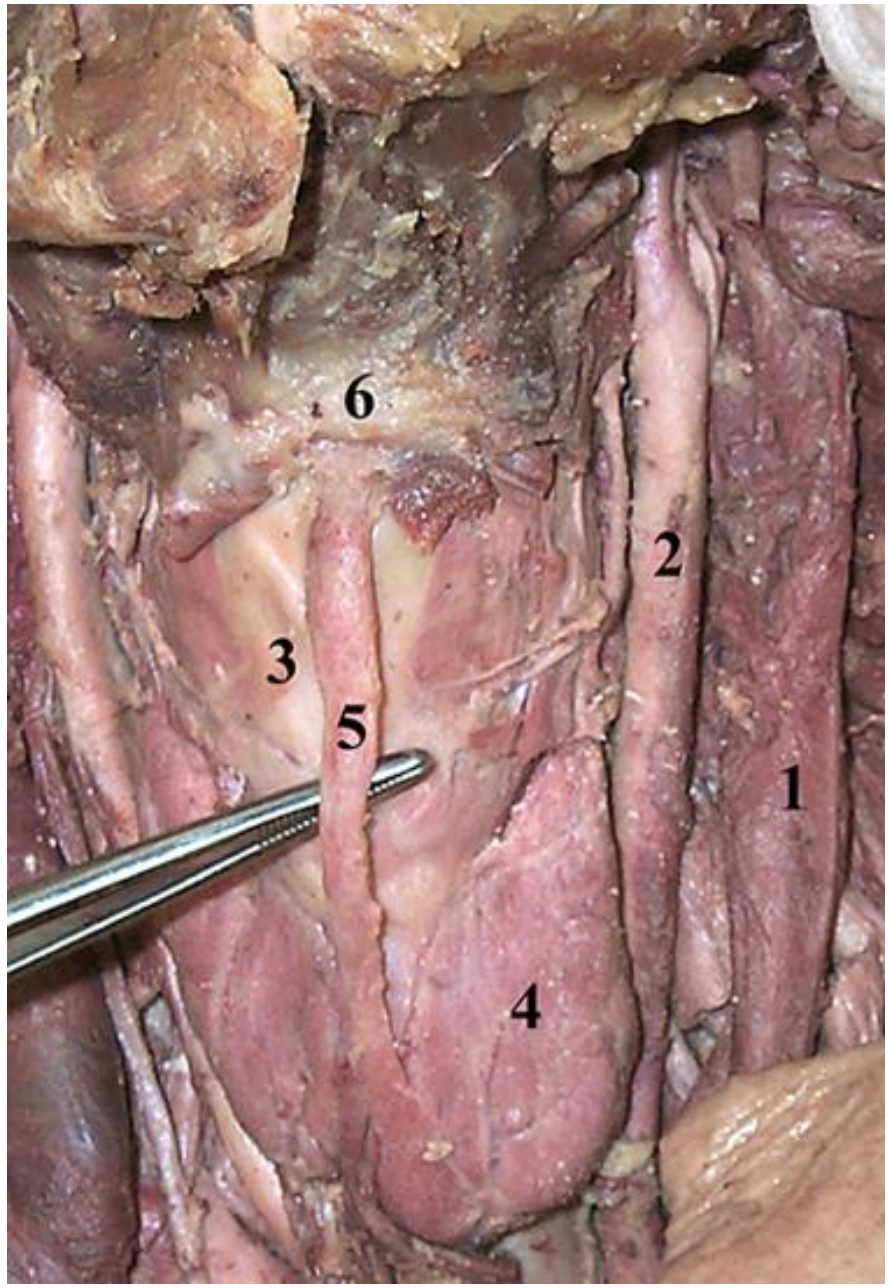


Glandula thyroidea

Endocrine gland

- **Lokalization, topography,**
- **description**

Lobus dexter
Lobus sinister
Isthmus
(lobus pyramidalis)



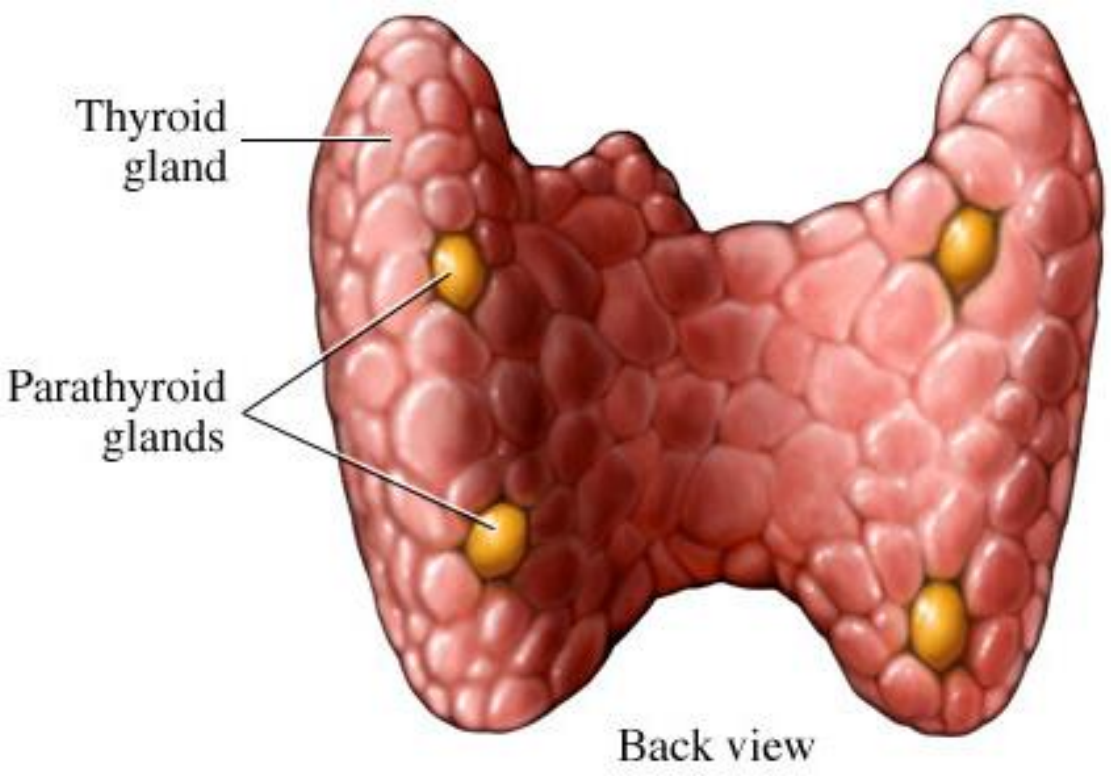
- **structure**

Capsula fibrosa

- f. externa
- Arterial network

fibrous capsule
(capsula propria)
septa - lobuli - folicules

Gll. parathyroideae



- **syntopy**

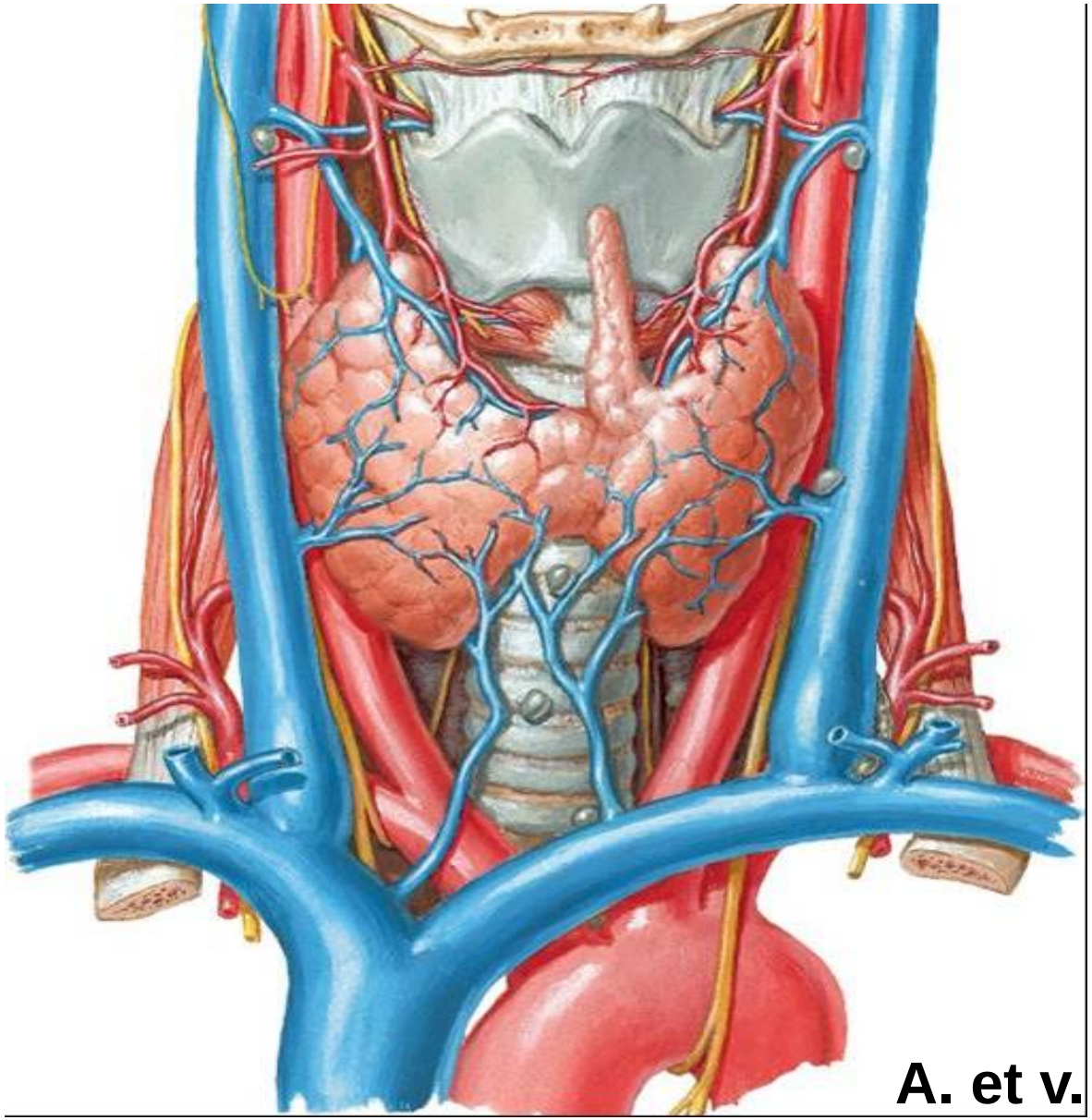
  In the height of the lower margin of cartilago cricoidea

At the lower margin of the lobe of thyroid gland

- **number**
- **structur:**

  Fibrous capsule

  - septa - gland. parenchym

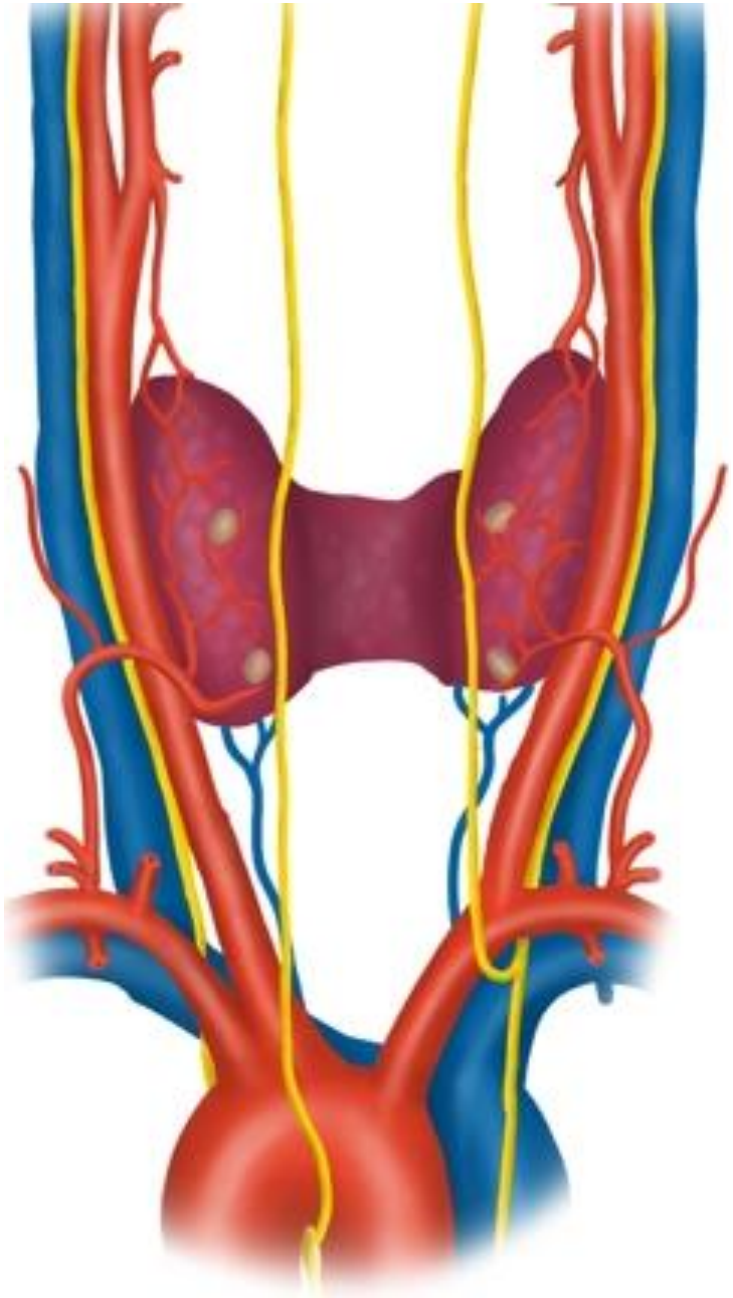


- **supply**

A. et v. thyroidea sup. et inf., a. thyroidea ima, nll. cervicales prof., nll. paratracheales

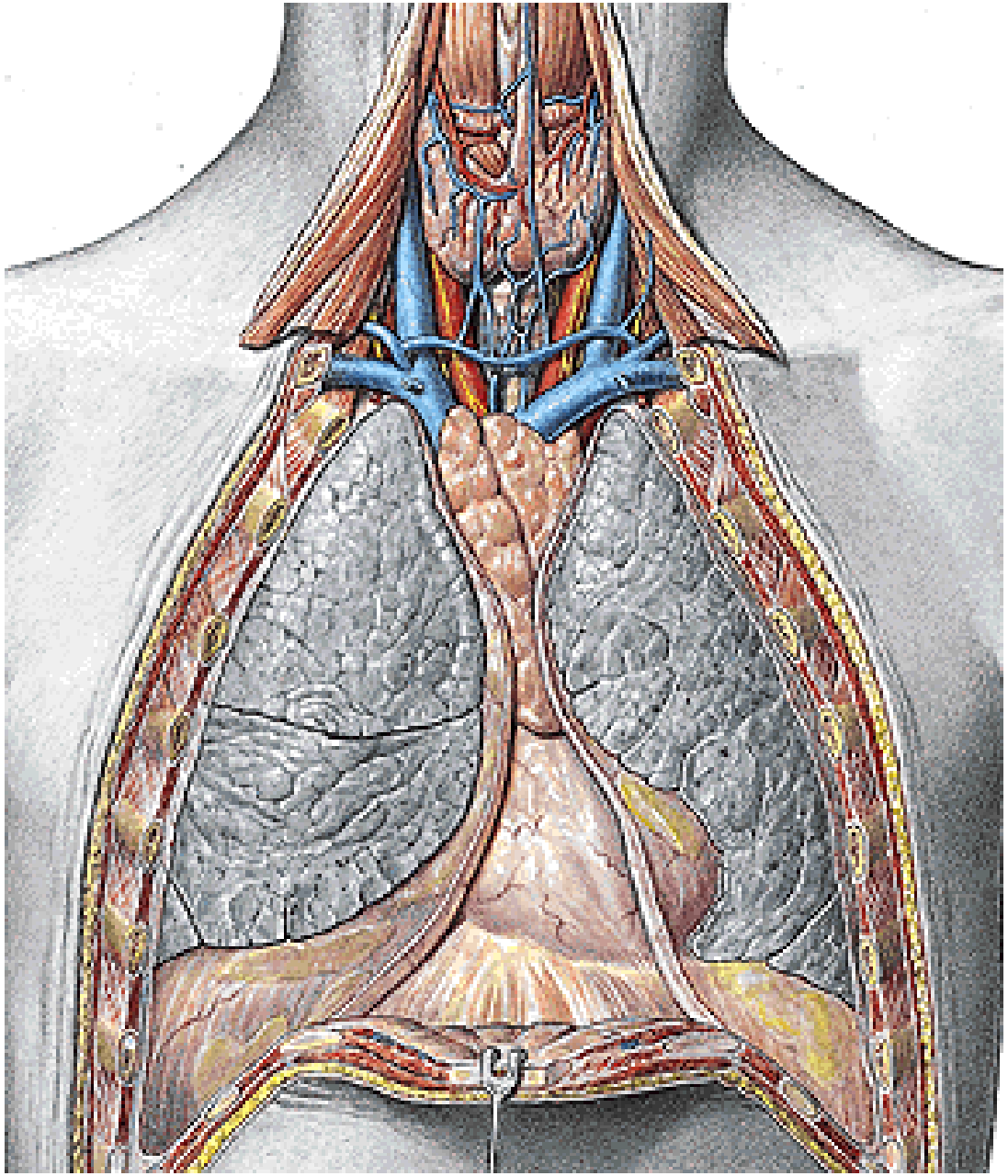
Clinical note

Hyper i hypofunction of the gland results in an enlargement of the gland- struma



During surgery need to respect

n. laryngeus inf. (n. X)



Thymus

Lymphatic system

- **syntopy**
- **description**

  Lobus dexter
  Lobus sinister

- **structure**

  Capsula thymi
  – septa – lobuli
  (cortex, medulla)

newborn: 16 g

2 years: 30 - 40 g

Puberty + – involution

adulthood: 10 g

Old age – atrofy, corpus adiposum thymi

Breathing muscles

- **Inspiration**
  - **Main**: **mm. intercostales externi**, **diaphragma** (mm. scaleni, mm. levatores costarum)
  - **Auxilary:** m. pectoralis major + minor, m. latissimus dorsi, m. serratus anterior + post. sup., m. sternocleidomastoideus, m. subclavius, (m. sternothyroideus, m. sternohyoideus)
  - ***orthopnotická position***

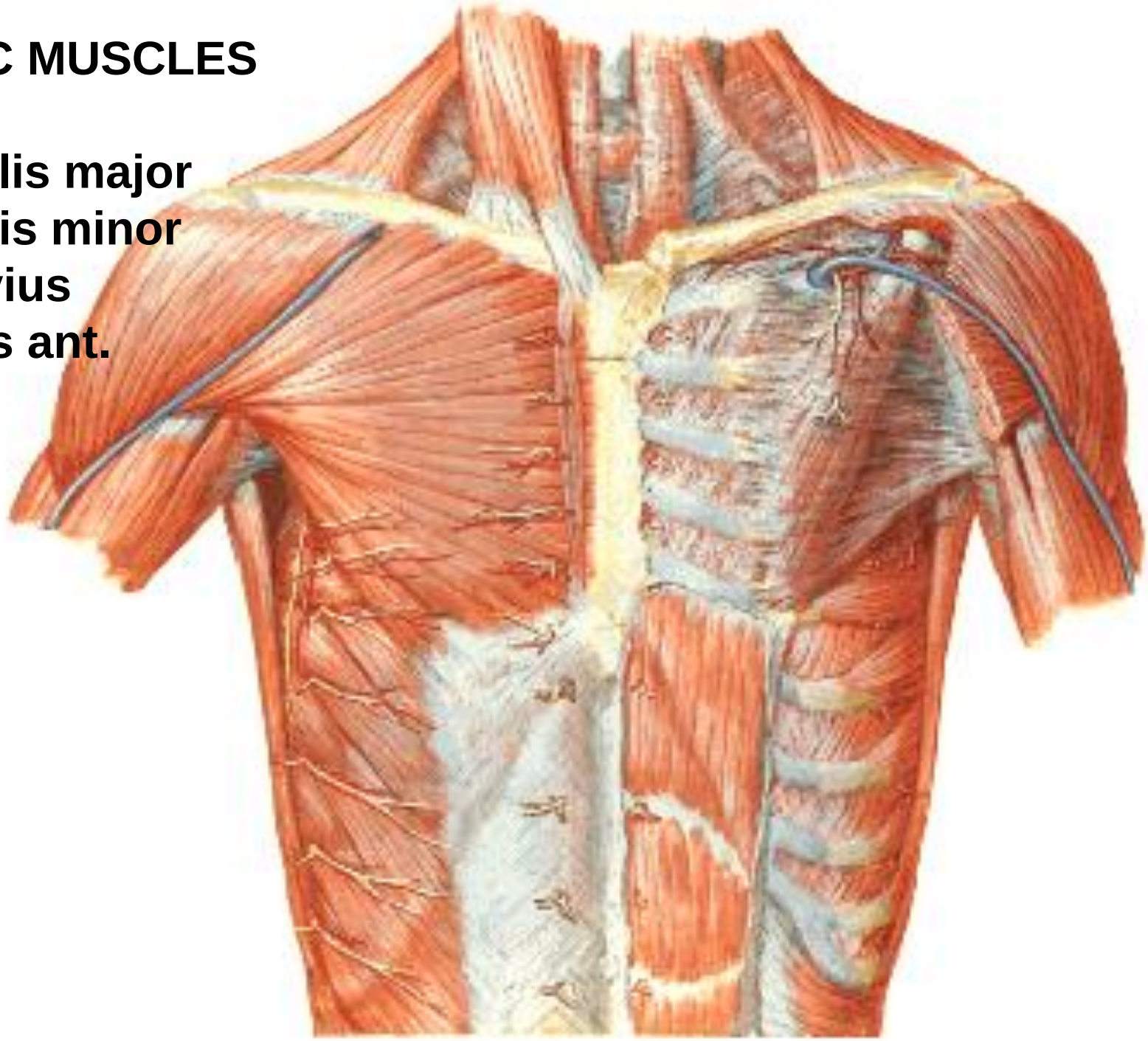
    (expiration)

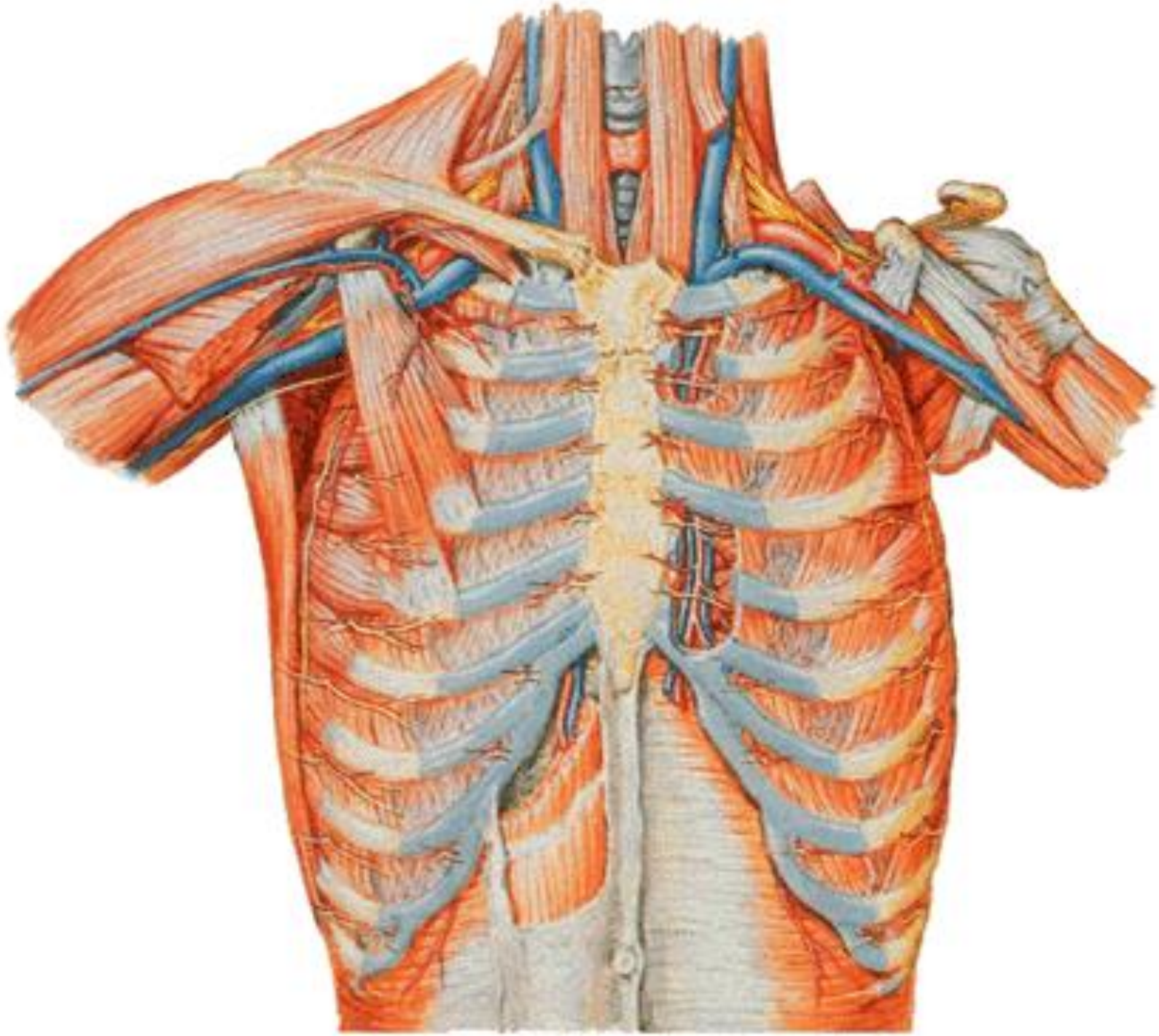
- **Expiration**
  - **main:** mm. **intercostales interni** (+ **intimi,** m. subcostales)
  - **auxilary:** m. rectus abd., m. obliquus abd. ext. + int., m. trasnversus abd., m. serratus post. inf., m. transversus thoracis, (m. quadratus lumborum)

MUSCULI THORACIS

EXTRINSIC MUSCLES

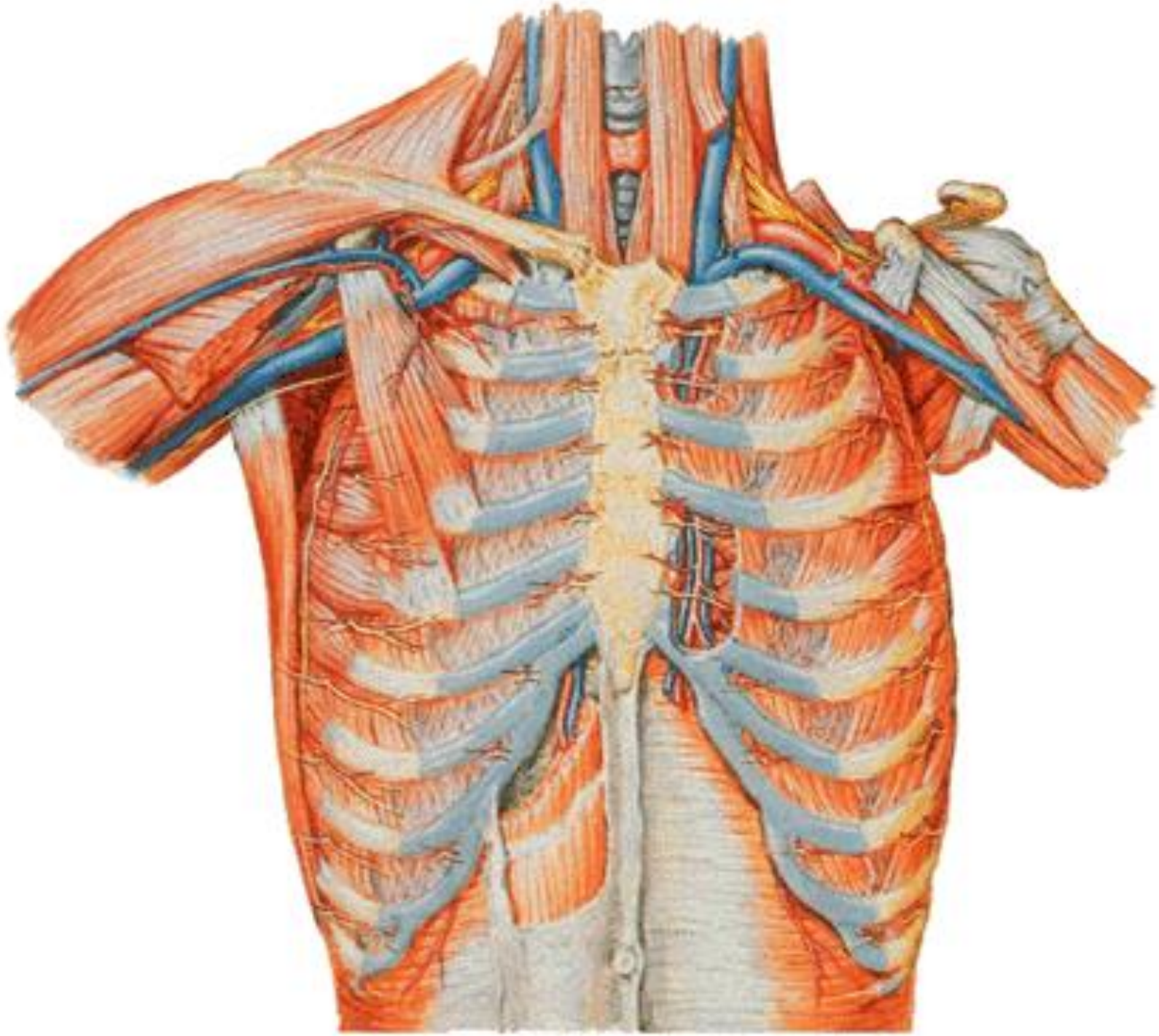
M. pectoralis major
M.pectoralis minor
M. subclavius
M. serratus ant.



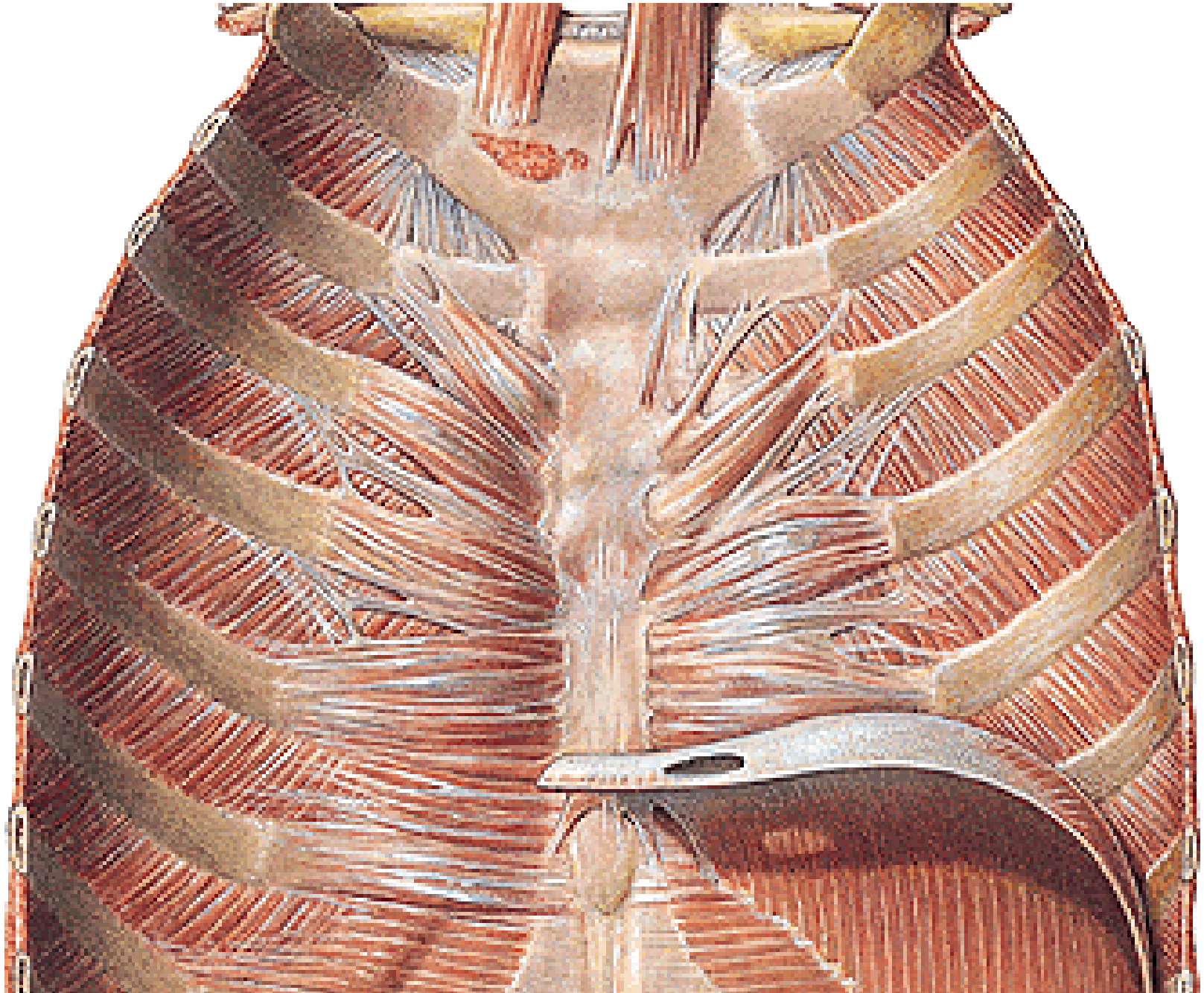


INTRINSIC MUSCLES

M. intercostales externi
M. intercostales interni
M. intercostales intimi
M. subcostales



M. transversus thoracis



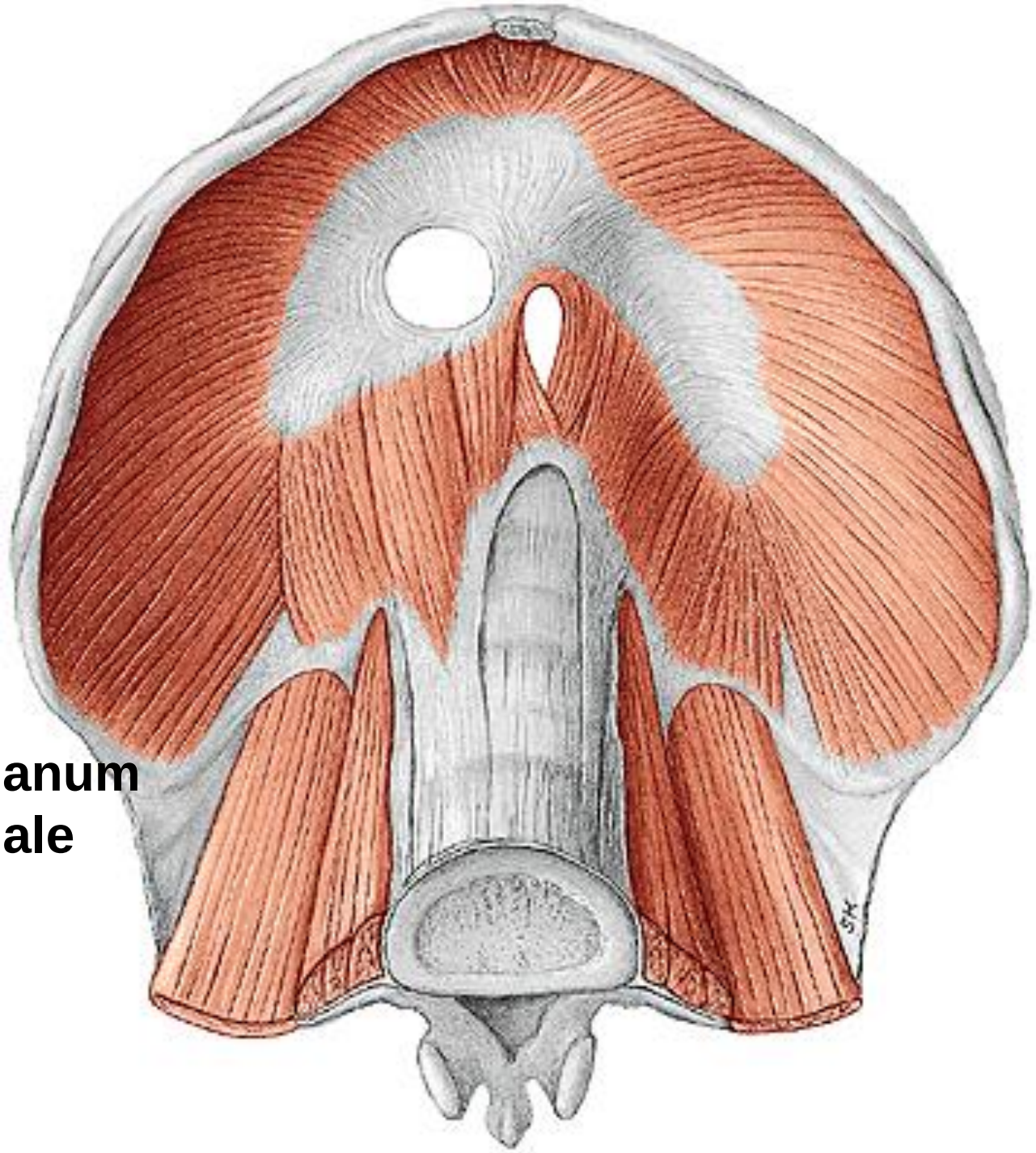
DIAPHRAGM

Centrum tendineum
- **foramen VCI**

Pars sternalis

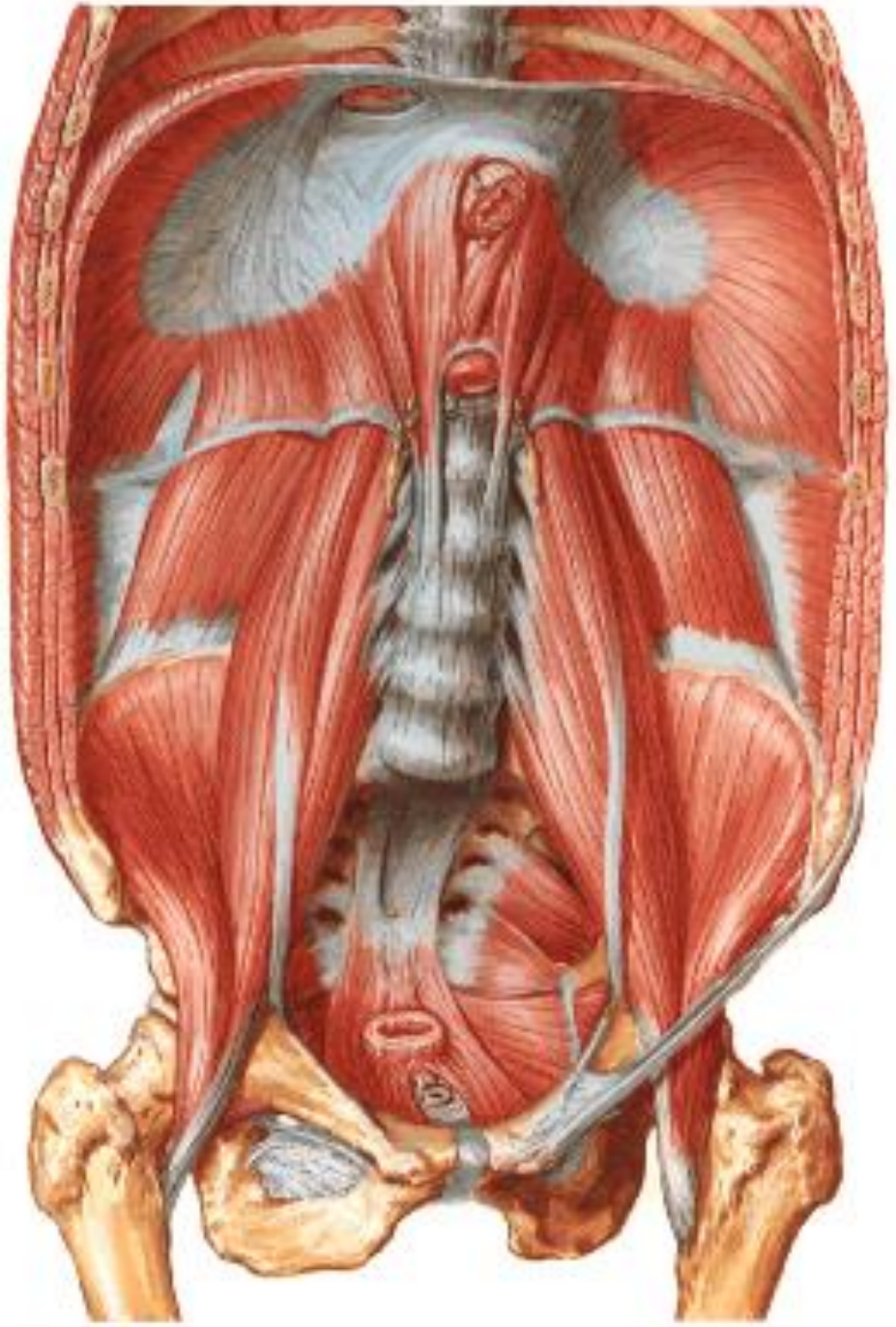
Pars costalis

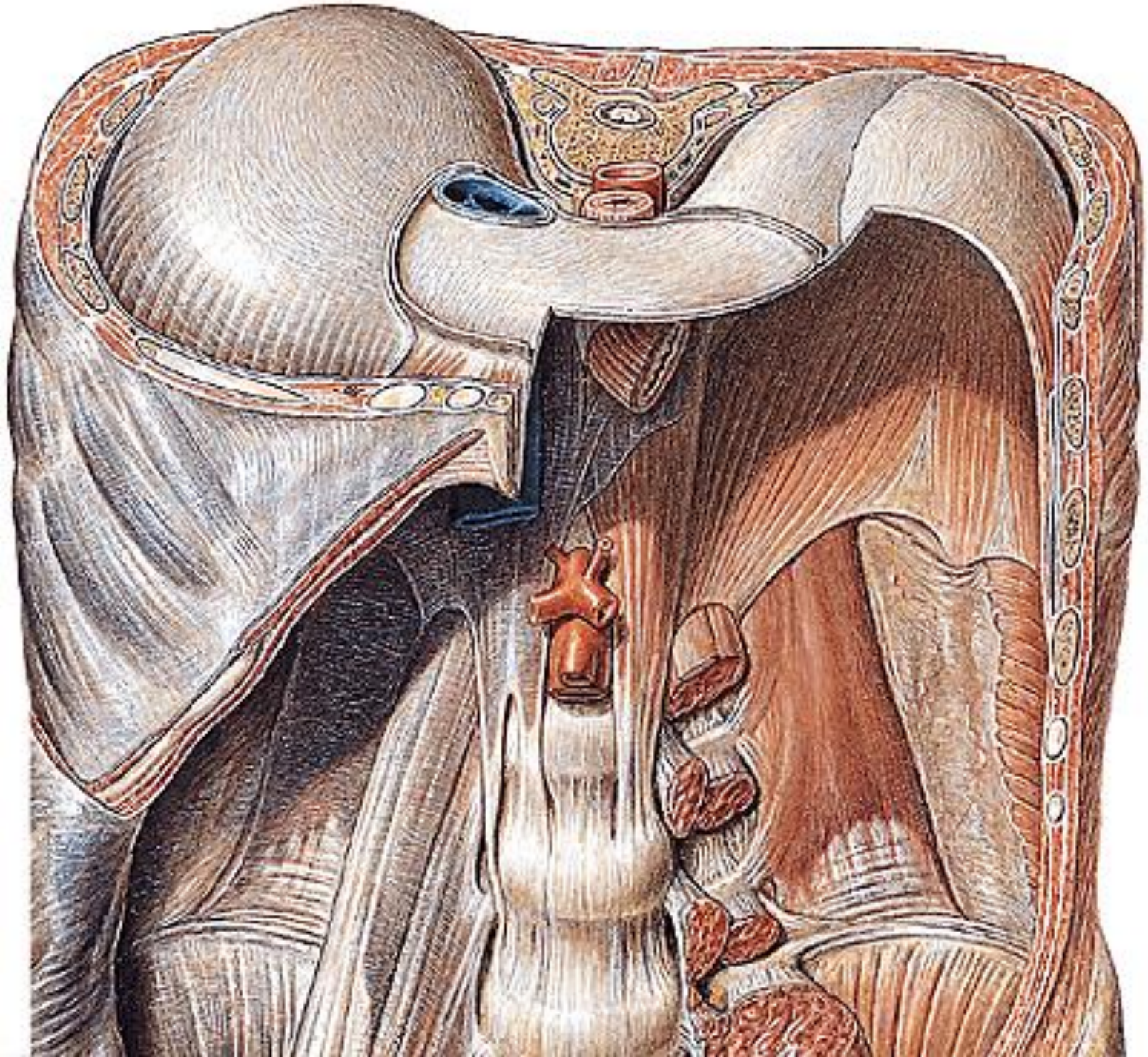
Pars lumbalis
- **crus dextrum**
- **crus sinistrum**
- **lig. arcuatum medianum**
- **lig. arcuatum mediale**
- **lig. arcuatum lat.**



Hiatus esophageus

Hiatus aorticus





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