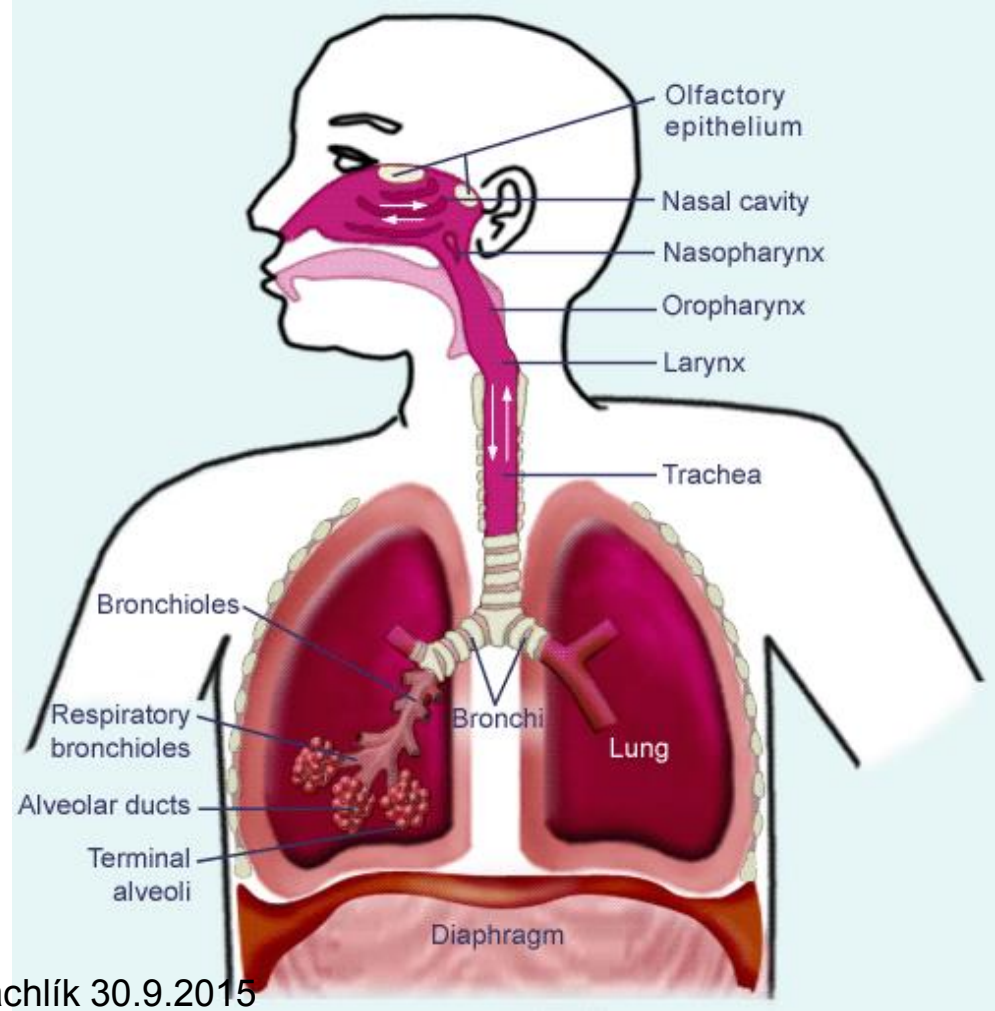
Respiratory system I.

Anatomical division

- **upper respiratory tract**
  - nasal cavity (*cavitas nasi*)
  - paranasal sinuses (*sinus paranasales*)
  - nasopharynx
- **lower respiratory tract**
  - larynx
  - trachea
  - bronchial tree (*arbor bronchialis*)
  - respiratory section



ENT division

- upper respiratory tract
  - nasal cavity
  - paranasal sinuses
  - nasopharynx
  - larynx – cranial half
- lower respiratory tract

border: rima glottidis (plicae vocales)

  - larynx – caudal half
  - trachea
  - brochial tree
  - respiratory section

Surgical division

- upper respiratory tract
  - nasal cavity
  - paranasal sinuses
  - nasopharynx
  - larynx
- lower respiratory tract

border: apertura thoracis sup.

  - trachea
  - bronchial tree
  - respiratory section

Functional division

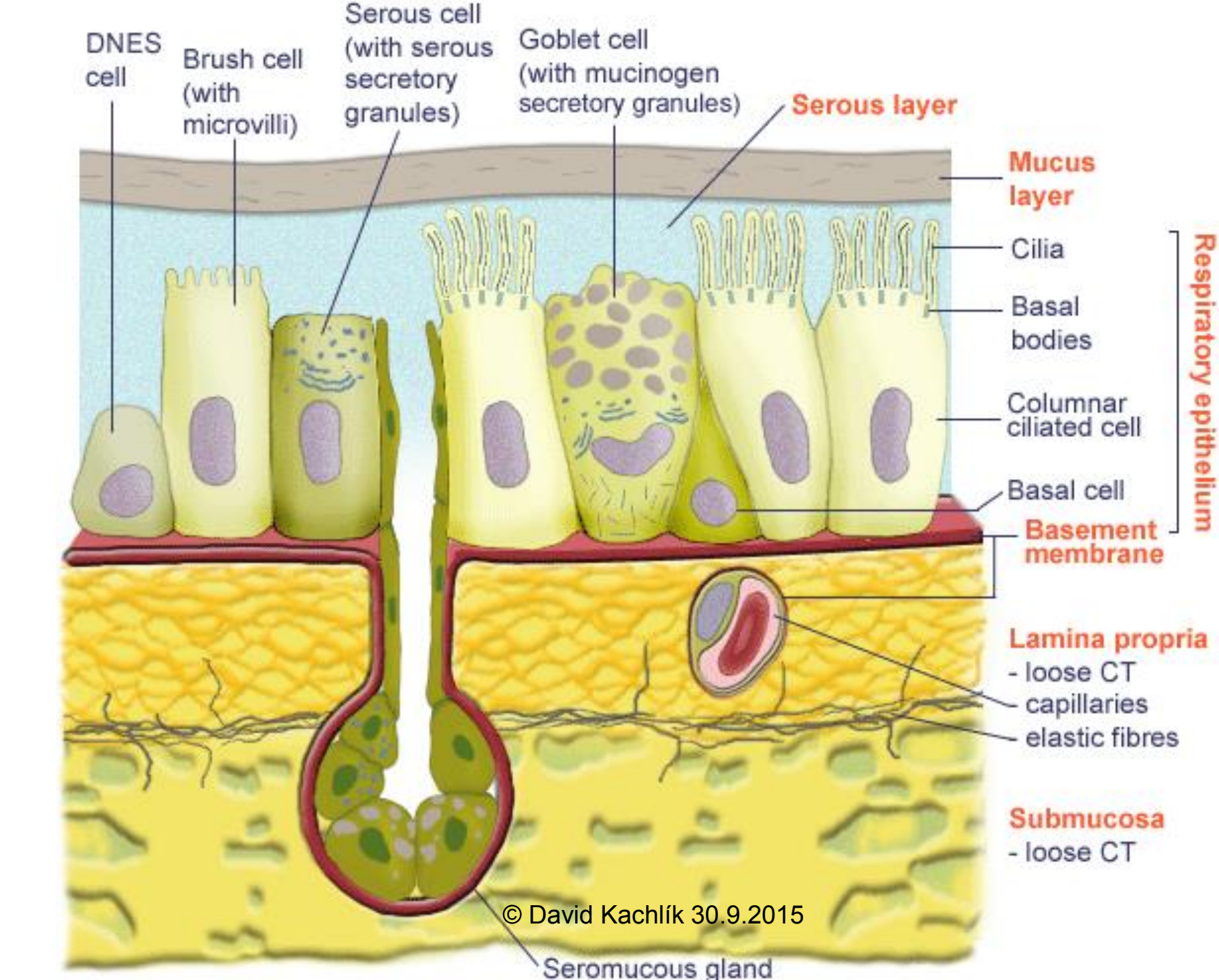
- conductive part
  - extrapulmonary
    - nasal cavity, paranasal sinuses, larynx, pharynx, trachea, principal bronchi
  - intrapulmonary
    - bronchial tree (bronchi and bronchioli)
- respiratory part
  - alveolar tree

Structure of respiratory tract wall

- ***tunica mucosa* (mucosa)**
  - *epithelium*
    - pseudostratified ciliated columnar epithelium (respiratory epithelium)
    - nonkeratinized stratified squamous epithelium
  - *lamina basalis*
  - *lamina propria*
    - glands (seromucous tuboalveolar), lymph nodes (*noduli lymphoidei*)
- ***tunica fibromusculocartilaginea***
  - collagen and elastic connective tissue (also, as ligaments – *larynx, trachea*)
  - smooth muscles (*trachea, bronchi*)
  - striated muscles (*larynx*)
- ***tunica serosa*** or ***tunica adventitia***
  - tunica serosa (*pleura*) has following layers:
    - *mesothelium*
    - *lamina basalis*
    - *lamina propria*
    - *tela subserosa*

Epithelium of the respiratory system

- pseudostratified ciliated columnar epithelium (*epithelium pseudostratificatum columnare ciliatum*)
  - ciliated cell (*epitheliocytus ciliatus*)
  - goblet cell (*exocrinocytus caliciformis*)
  - epithelial cell with microvilli (*epitheliocytus microvillosus*) = *sensory cell*
  - basal epithelium cell (*epitheliocytus basalis*)
  - respiratory endocrine cell *(endocrinocytus respiratorius*) = *DNES*
- stratified squamous epithelium (*epithelium stratificatum squamosum*)



Nose (*Nasus*)

description: radix (*root*), dorsum, apex (*tip*), alae, nares (*nostrils*)

„columella“

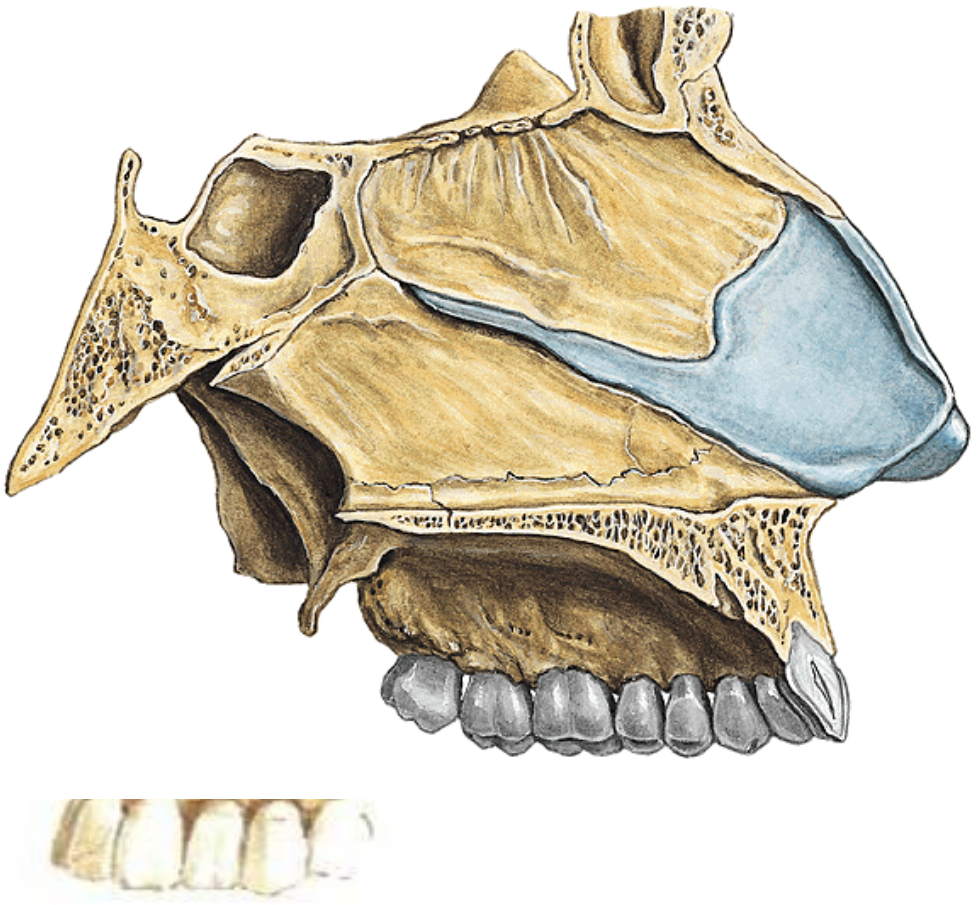
cartilages:

hyaline, collagen II

- c. septi nasi (*septal nasal c.*) (proc. lateralis et posterior)
- c. alaris major (*major alar c.*)
- cc. alares minores (*minor alar cc.*)
- cc. nasi accessoriae (*accessory nasal cc.*)
- c. vomeronasalis *Jacobsoni (vomeronasal c.)*

skin: thin, movable, numerous glands

muscle: m. nasalis (n.VII)



Nose – *vascular supply*

arteries: arteria carotis externa →

- a. facialis → **a. lateralis nasi**
- a. maxillaris → **a. infraorbitalis**

arteria carotis interna →

- a. ophthalmica → **a. dorsalis nasi**

veins:

- **v. angularis** → v. facialis *(no valves)* → v. jugularis interna
- v. ophthalmica sup. + inf. → dural venous sinuses
- v. profunda faciei → plexus pterygoideus *(and hence the cavernous sinus)*

Infection may spread from the face to the intracranial venous sinuses!

Nose - *innervation*

- motor – **n. facialis** (*m. nasalis)*

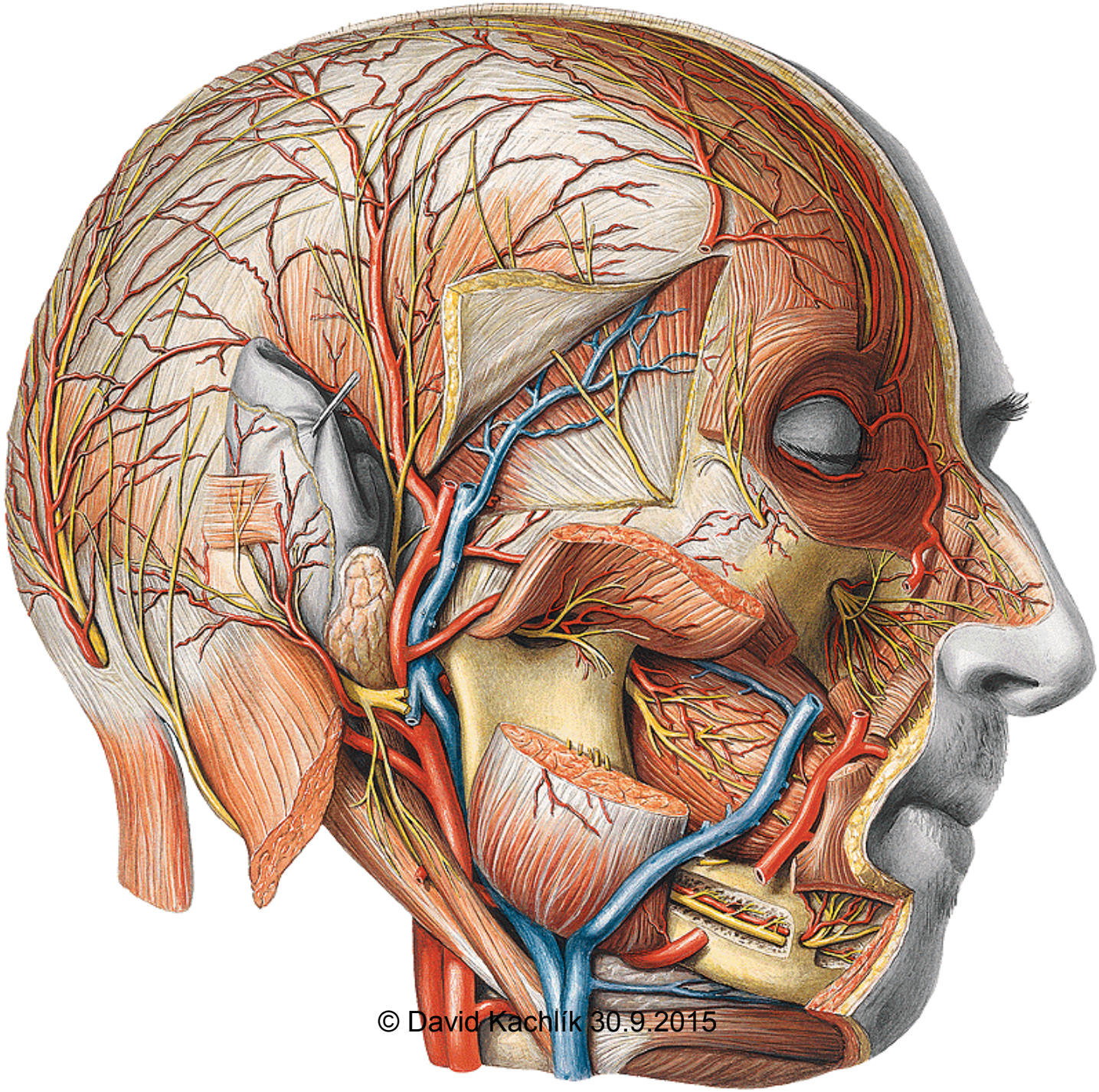
- sensory – **n. trigeminus**

  ➔ n. ophthalmicus → n. nasociliaris

  ➔ n. ethmoidalis ant. → r. nasalis externus

  ➔ n. infratrochlearis

  → n. maxillaris → n. infraorbitalis → rr. nasales externi



Nasal cavity (*Cavitas nasi*)

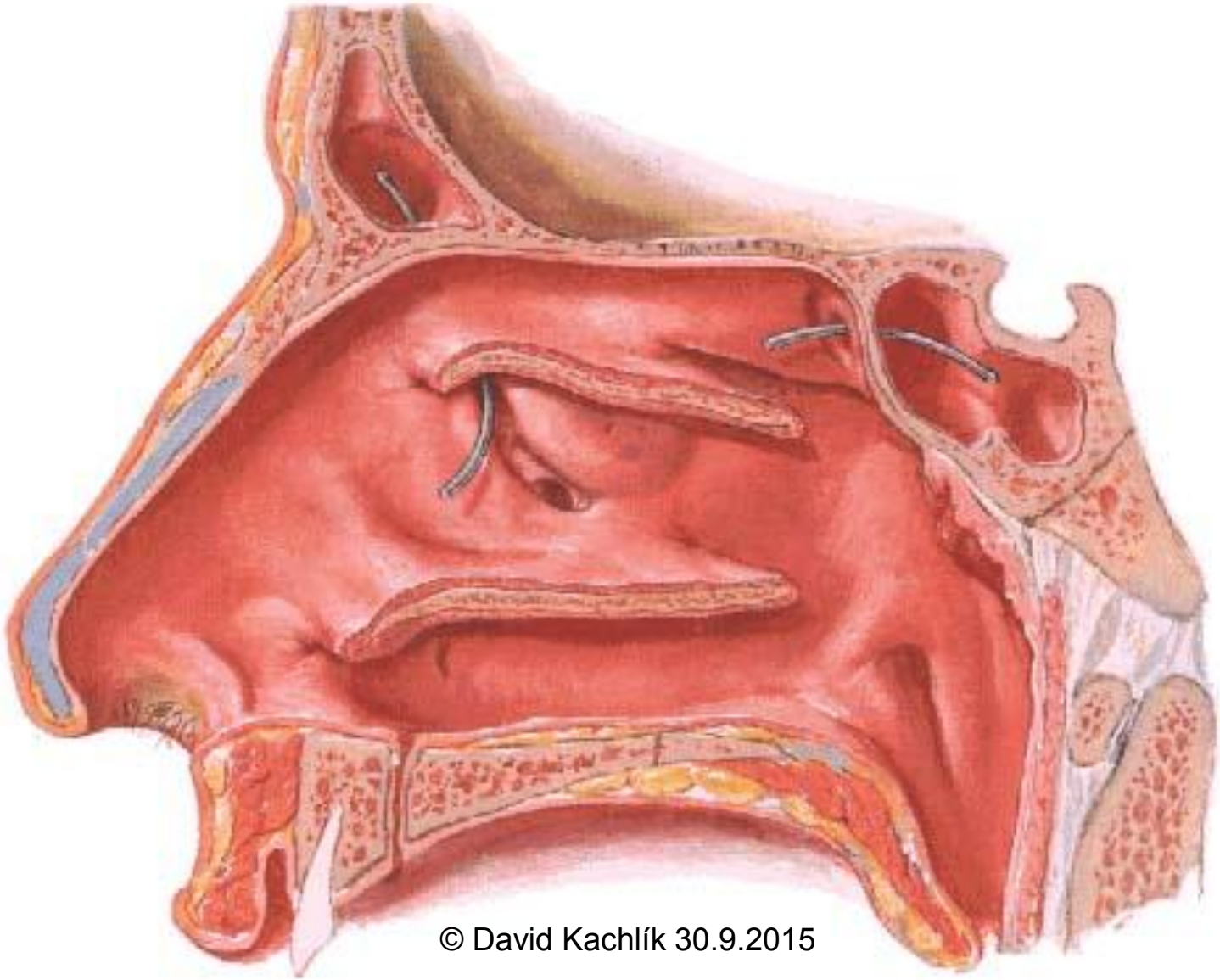
- nasal vestibule (*vestibulum nasi*)
  - bordered by limen nasi (transition point of the nonkeratinized stratified squamous epithelium)
  - vibrissae (*hairs of vestibule of nose*) + glandulae sudoriferae nasales (apocrine)
  - recessus apicis nasi
- nasal cavity proper (*cavitas nasi propria*)
  - pars respiratoria (respiratory epithelium)
  - pars olfactoria (olfactory epithelium)

nasal glands (*glandulae nasales*)

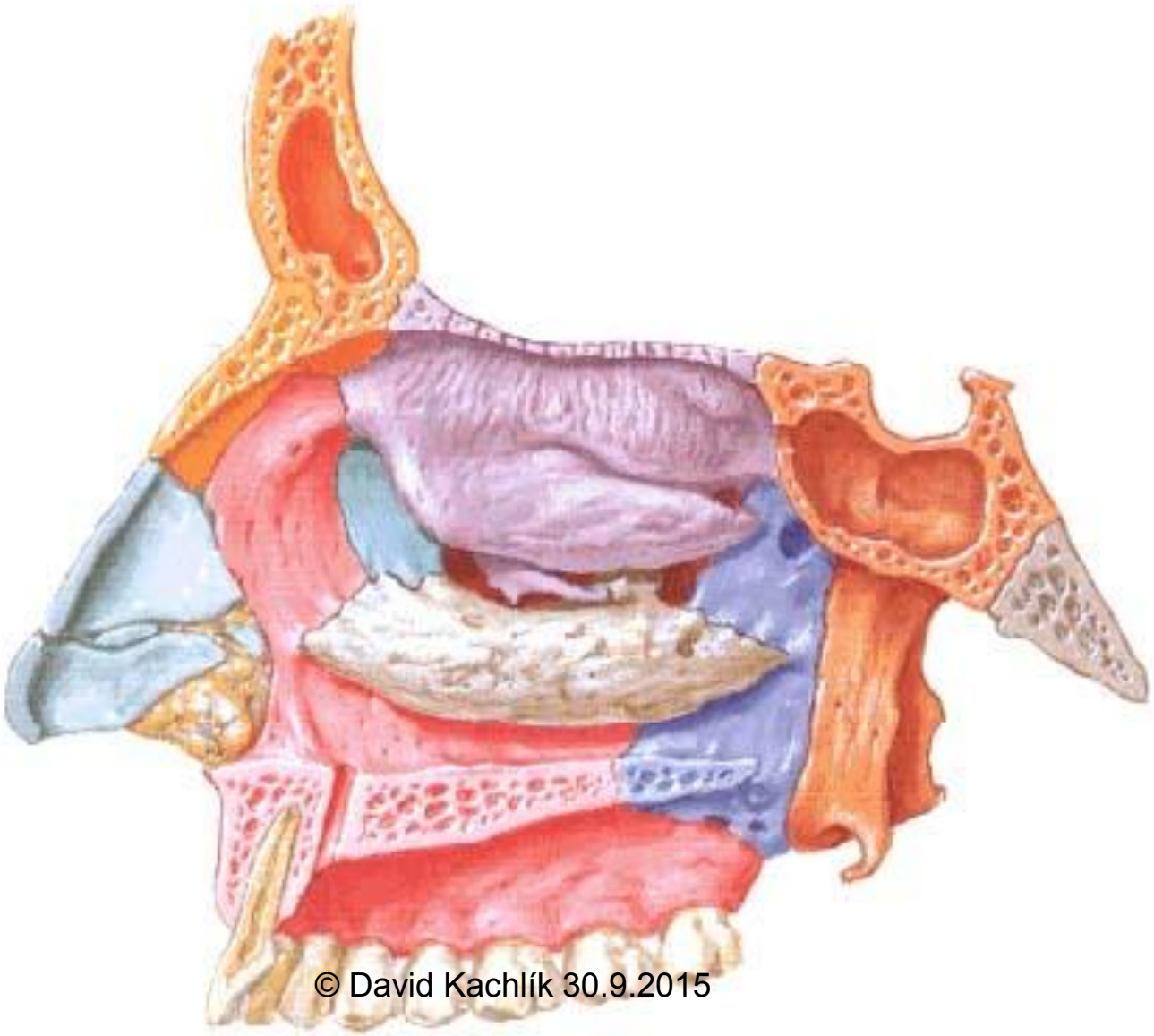
  - seromucous, tuboalveolar

moistening, warming-up and purification of the air

Lateral Nasal Wall - Nasal Conchae Removed



Lateral Nasal Wall - Bony Structure



Nasal cavity
bony borders I.

- cranially:

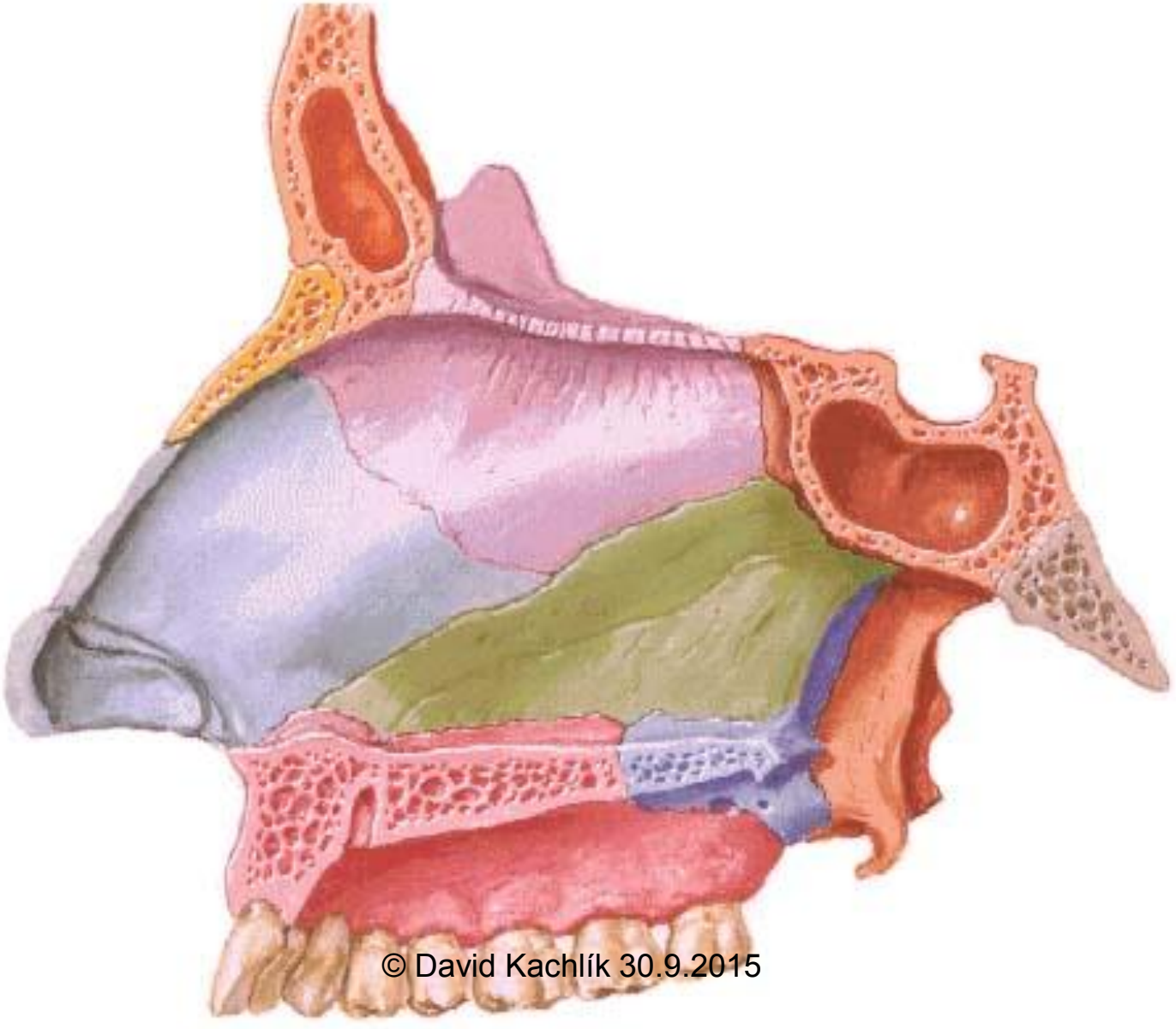
ossa nasalia *(foramen nasale*), pars nasalis o. frontalis, lamina cribrosa o. ethmoidalis *(foramina cribrosa*), corpus o. sphenoidalis

- laterally:

processus frontalis + facies nasalis maxillae, os lacrimale, labyrinthus ethmoidalis, lamina perpendicularis o. palatini (*foramen sphenopalatinum*), lamina medialis processus pterygoidei o. sphenoidalis

Medial Nasal Wall [Septum]

Bones and Cartilages



Nasal cavity
bony borders II.

- caudally:

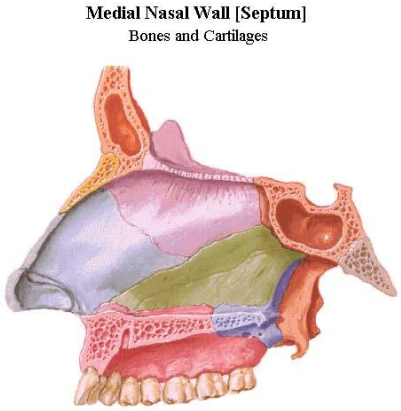
processus palatini maxillae /+os incisivum/ (*canalis incisivus*), lamina horizontalis ossis palatini

- septum - pars ossea:

lamina perpendicularis o. ethmoidalis, vomer (+ spina nasalis anterior maxillae, spina nasalis posterior o. palatini, crista sphenoidalis)

- entry: apertura piriformis (= nostrils)
- exit: choanae (= dorsal nostrils)

Nasal cavity – septum + conchae



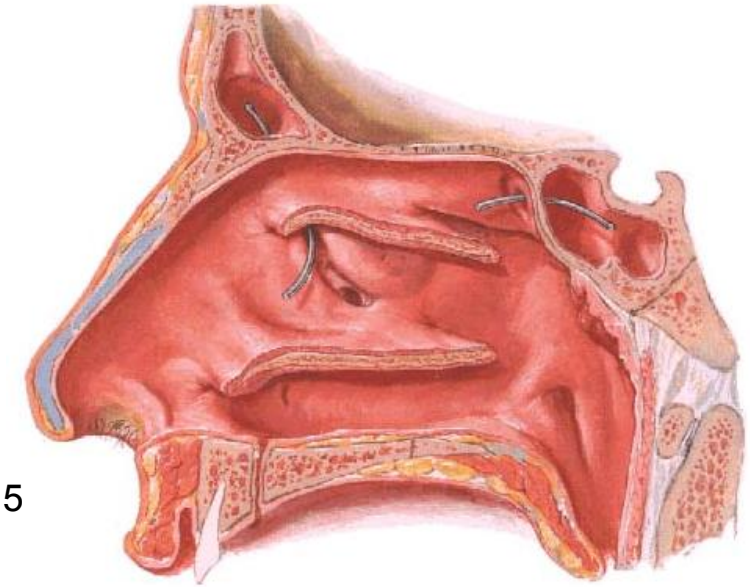
- septum nasi
  - pars ossea
  - pars cartilaginea
  - pars membranacea = pars mobilis septi nasi
    - pars cutanea

deviatio septi (100 %)

- conchae nasales (*„turbinates“*)
  - superior, media, (suprema) – parts of the ethmoidal bone
  - inferior (separate bone)
  - (sphenoidalis – part of os sphenoidale)
  - *remnants of worn-off conchae*
    - bulla ethmoidalis, agger nasi, processus uncinatus conchae nasalis mediae

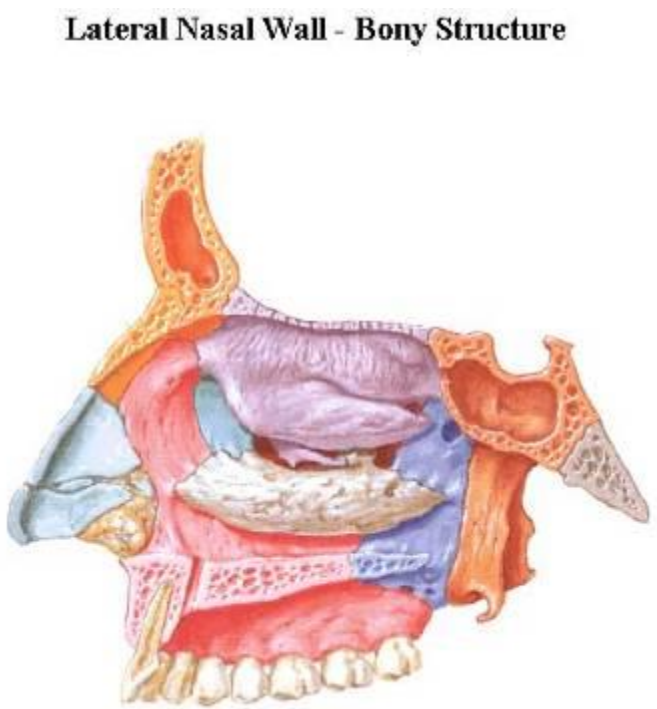
Nasal cavity – meatus

- **meatus nasi superior (*superior nasal meatus*)**
  - recessus sphenoethmoidalis (small concha nasalis suprema)
  - apertura sisus sphenoidalis (small concha sphenoidalis)
- **meatus nasi medius (*middle nasal meatus*)**
  - hiatus maxillaris / semilunaris
  - infundibulum ethmoidale
  - ductus frontonasalis
- **meatus nasi inferior**
  - apertura ductus nasolacrimalis

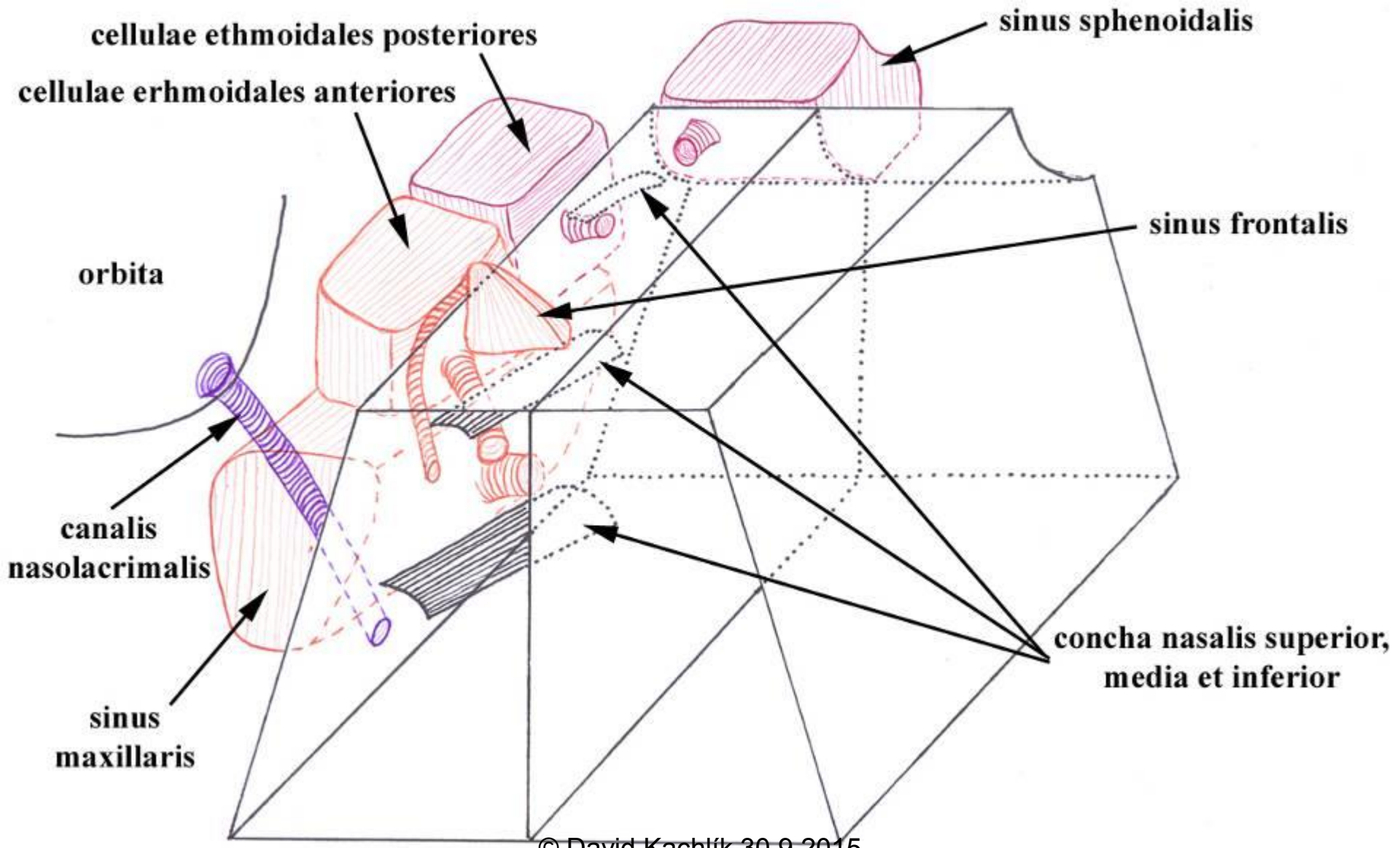


Nasal cavity – meatus

- **meatus nasi communis (*common n. meatus*)**
  - common part without conchae close to the nasal septum
  - *foramen incisivum*
- **meatus nasopharyngeus**
  - common part behind conchae
  - *foramen sphenopalatinum*



CAVITAS NASI + SINUS PARANASALES



Nasal cavity – *arterial supply*

Arteria carotis interna

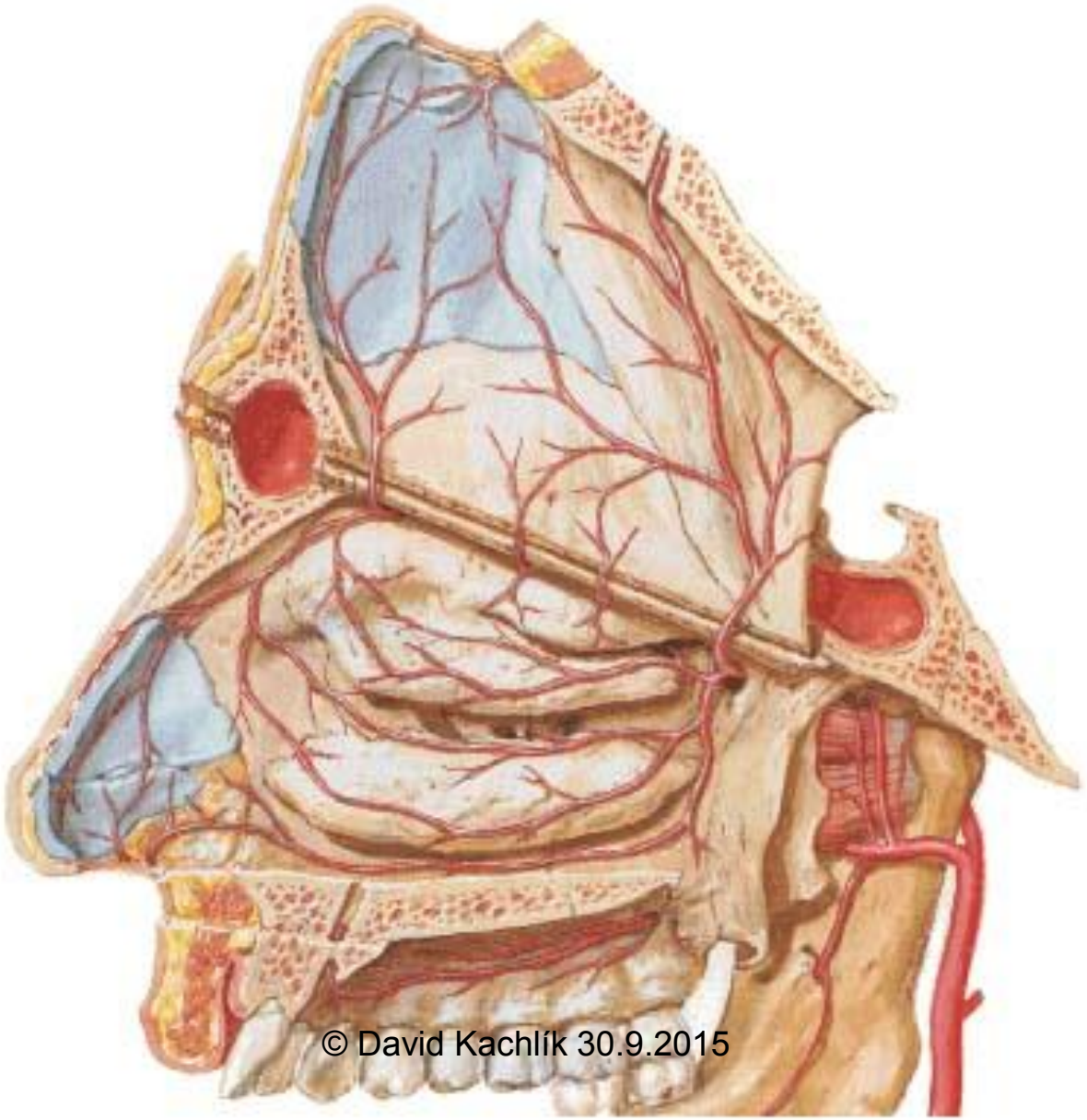
- a. ophthalmica → **a. ethmoidalis ant.** + post.

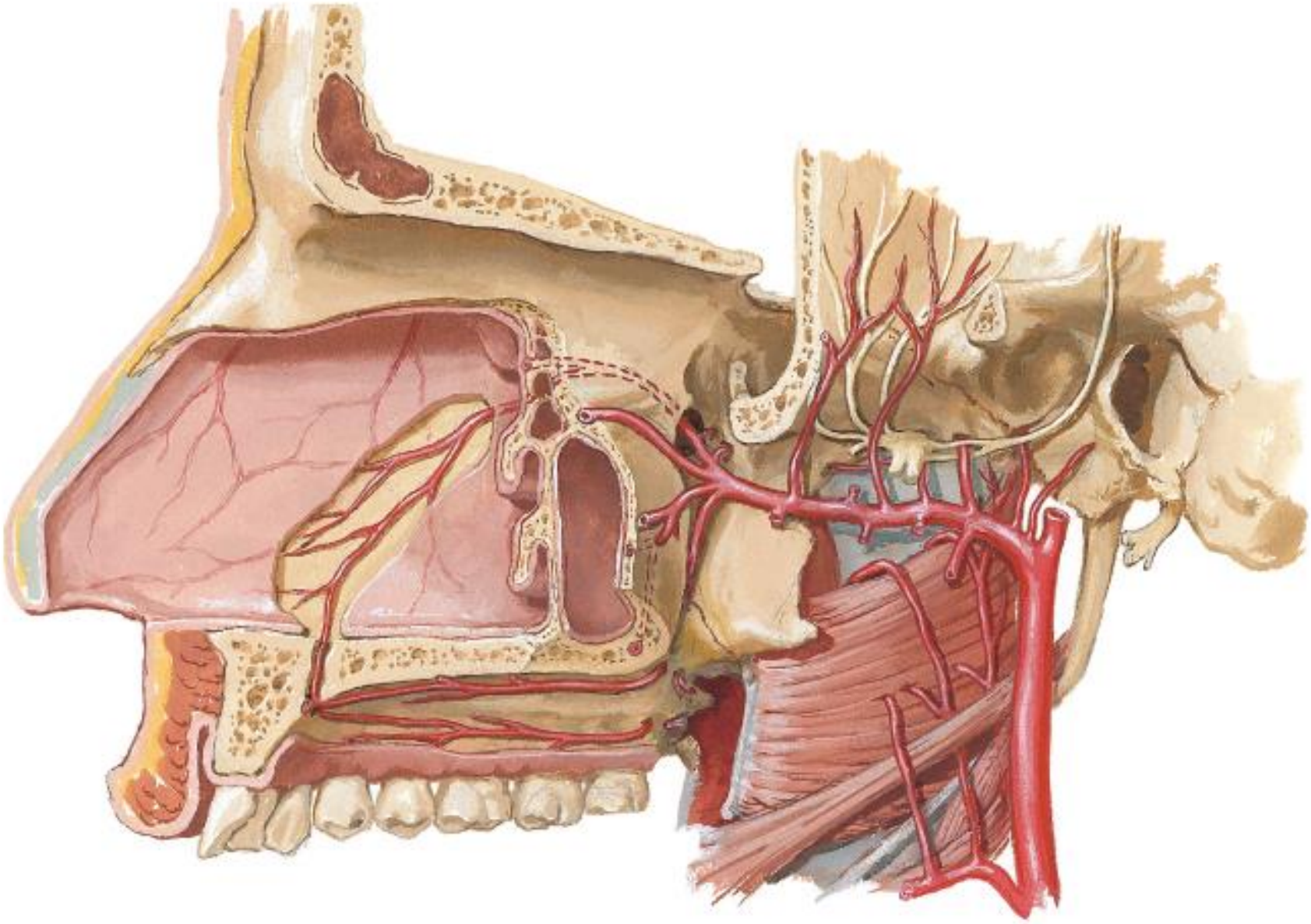
Arteria carotis externa

- a. maxillaris → **a. sphenopalatina** → rr. nasales posteriores lat. + rr. septales posteriores
- a. maxillaris → a. palatina descendens → a. palatina major → sends a branch through *canalis incisivus*
- a. facialis → a. labialis superior */vestibulum/*

Arteries of Nasal Cavity

Schematic Hinge





Nasal cavity – *veins*

plexus cavernosi concharum:

→ v. sphenopalatina → ***plexus pterygoideus***

→ v. maxillaris → v. retromandibularis

→ v. profunda faciei →v. facialis

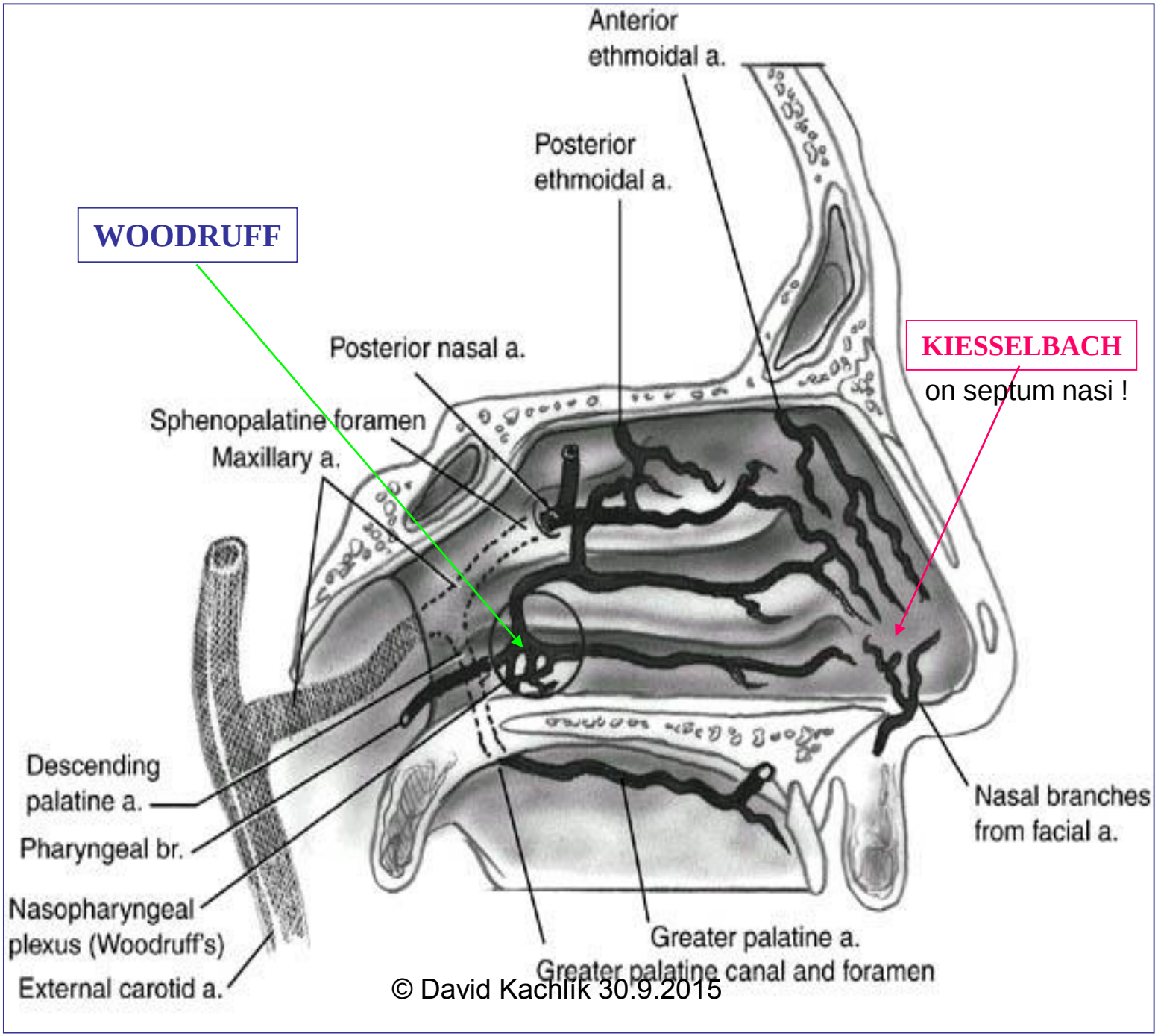
→ vv. ethmoidales → vv. ophthalmicae

→ through *lamina cribrosa* → vv. cerebri

→ v. emissaria foraminis caeci (1 %) → vv. cerebri

Nasal cavity – *clinical notes*

- locus (minoris resistentiae) *Kiesselbachi*
  - on the cartilaginous part of the septum at the level of the inferior concha (= anterior inferior part of the nasal septum)
  - capillary net from 5 arteries: a. labialis sup., a. ethmoidalis ant. + post., a. sphenopalatina, a. palatina major
  - *anterior nasal packing (nasal tamponade)*
- plexus Woodruffi
  - venous plexus on the dorsal part of the inferior nasal meatus
  - *posterior nasal packing (nasal tamponade)*
- dealing with an unstoppable epistaxis
  - *cauterization of* a. sphenopalatina, *embolization of* a. sphenopalatina
- plexus cavernosi concharum



Nasal cavity – *lymph drainage*

- nn.l. **submandibulares** (ventral part)
- nn.l. retropharyngei + cervicales profundi (dorsal part + paranasal sinuses)

- nn.l. parotidei (dorsal part of the floor)
- connections through *lamina cribrosa* with lymph vessels in subarachonideal space

Nasal cavity - *innervation*

- Sensory:
  - **n. olfactorius**
  - axons of the olfactory cells in regio olfactoria unit to form fila olfactoria → through lamina cribrosa → bulbus olfactorius of the olfactory part of the brain
- Sensitive:
  - **n. trigeminus**

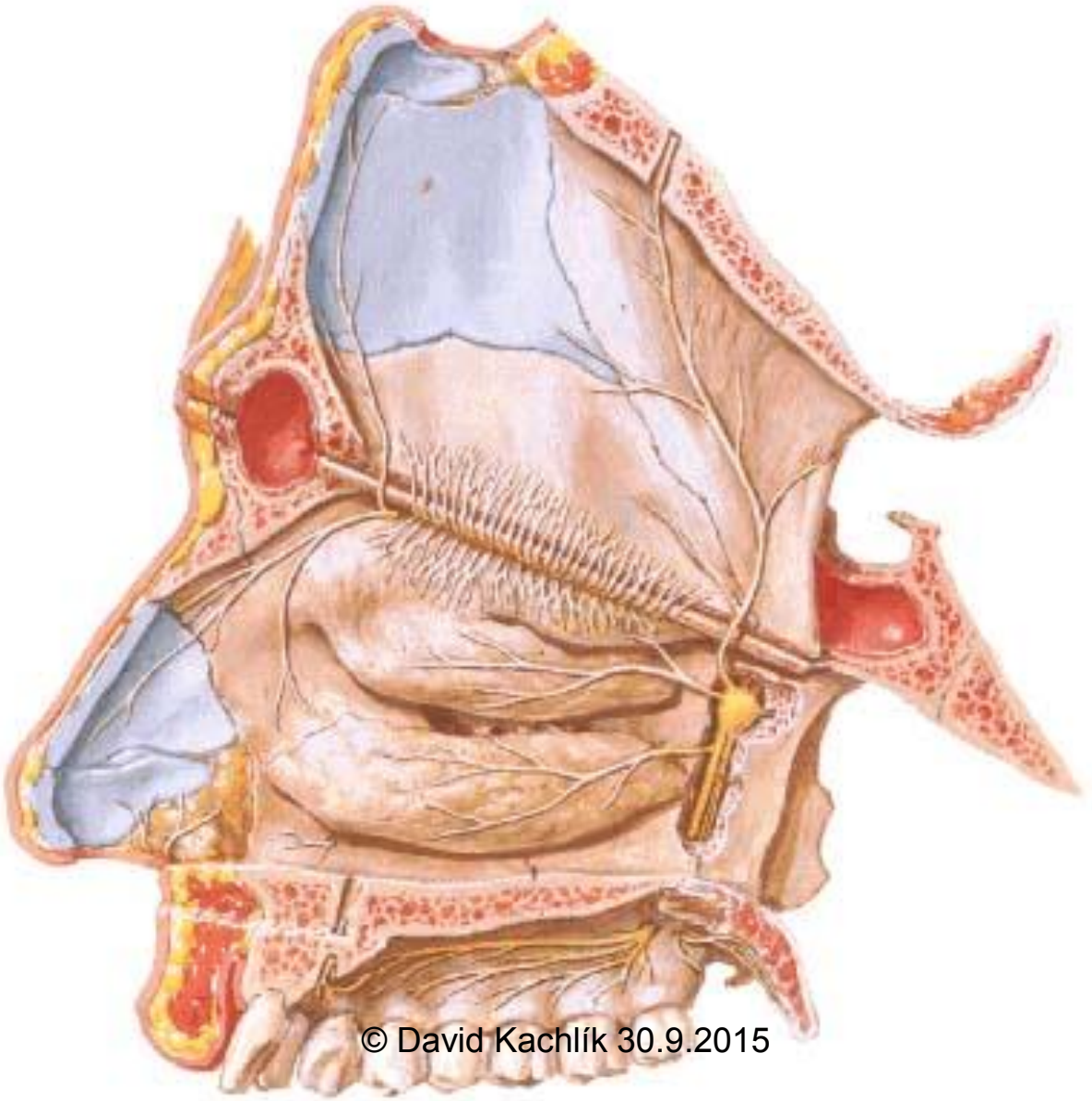
  → n. ophthalmicus → n. nasociliaris → n. ethmoidalis ant. (*roof* + *upper third*)

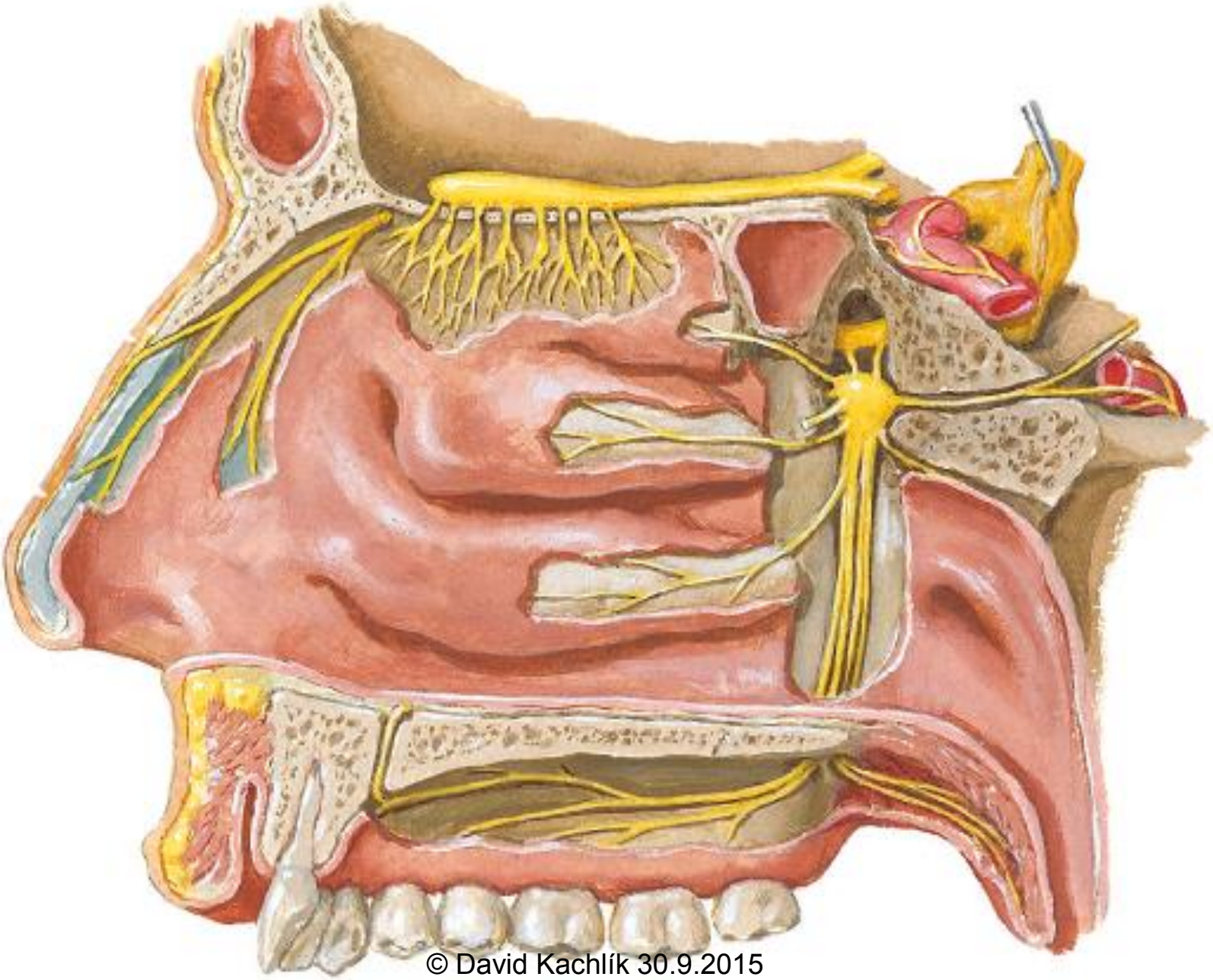
  → n. maxillaris → rr. nasales posteriores (sup. + inf.)

  → n. infraorbitalis (*vestibulum)*
- Autonomic:
  - branches from **ganglion pterygopalatinum**

Nerves of Nasal Cavity

Schematic Hinge





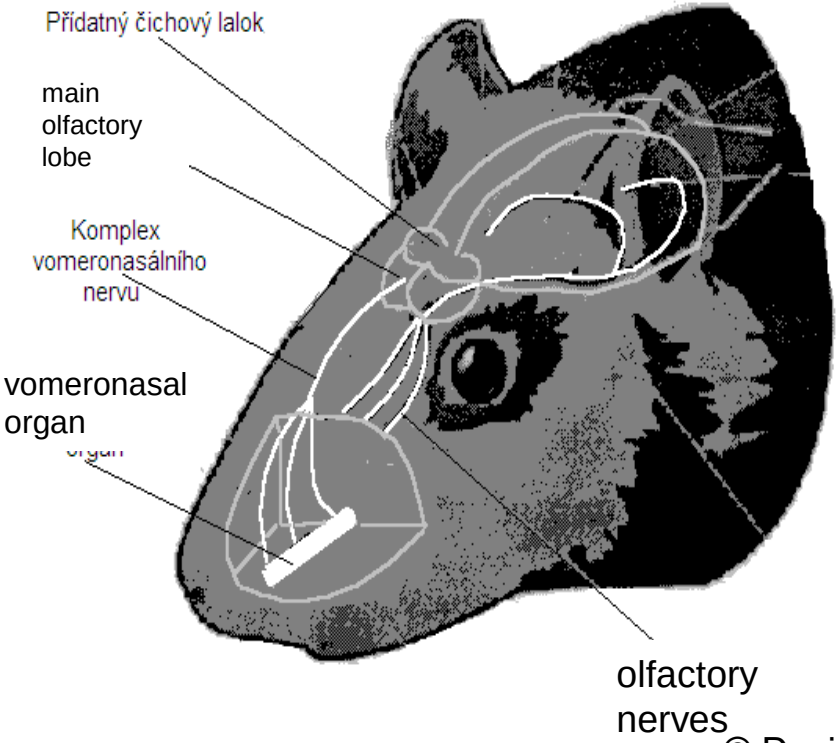
Nerves of Nasal Cavity

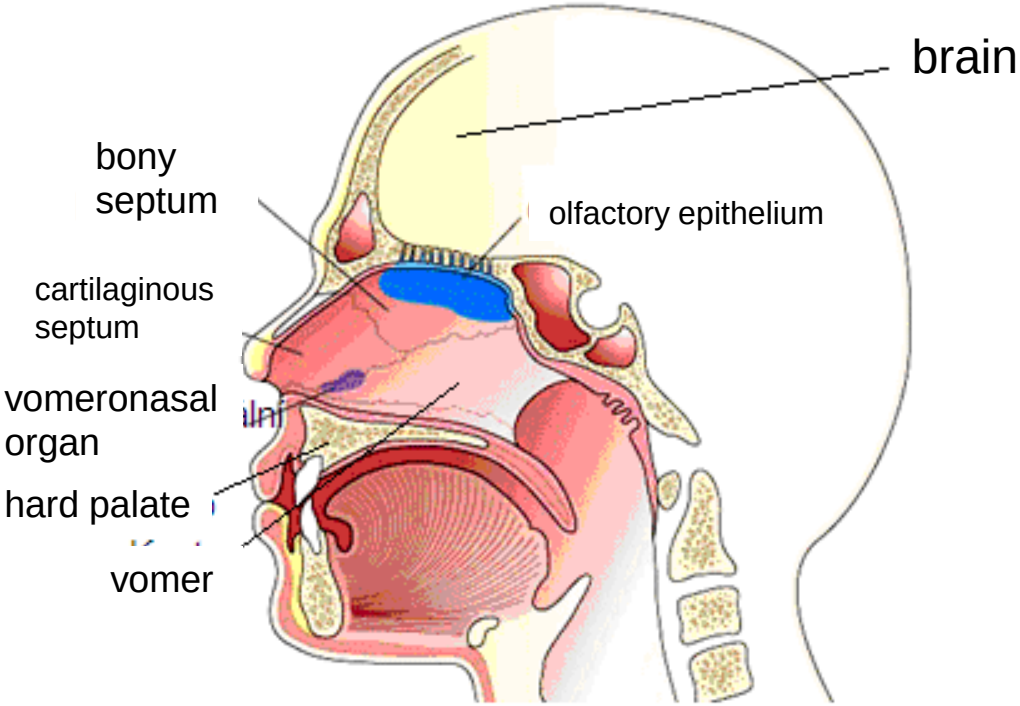
Distribution of Olfactory Mucosa

Organum vomeronasale *Jacobsoni*

- rudimentary organ - pheromones
- reptiles (main olfactory apparatus), rodents
- horses and cats (link to reproduction)
- stimuli from the oral cavity through *canalis incisivus* into the nasal cavity
- chemoreceptors
- inside of cartilago vomeronasalis in septum nasi
- n. vomeronasalis → bulbus olfactorius (n.I) → hypothalamus + corpus amygdaloideum of the brain

Organum vomeronasale *Jacobsoni*



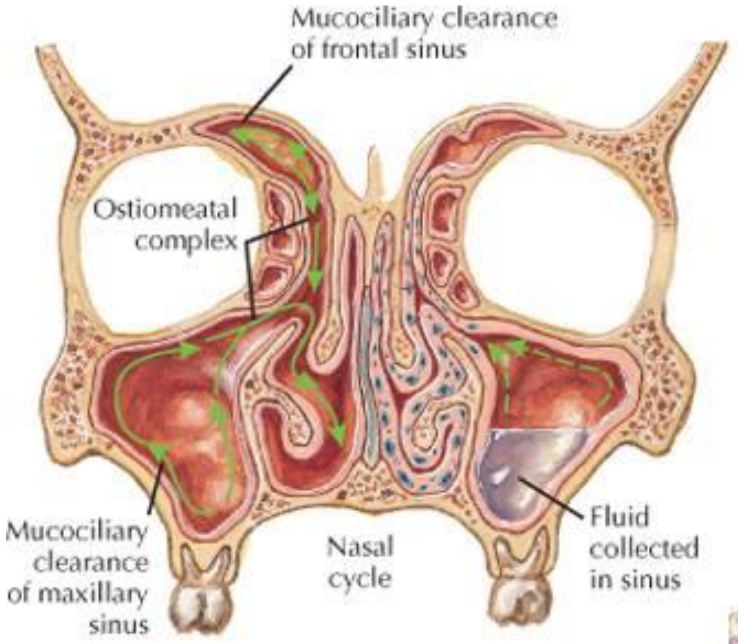


Nasal cavity – *tunica mucosa*

- respiratory epithelium
- transition point of keratinized stratified squamous epithelium

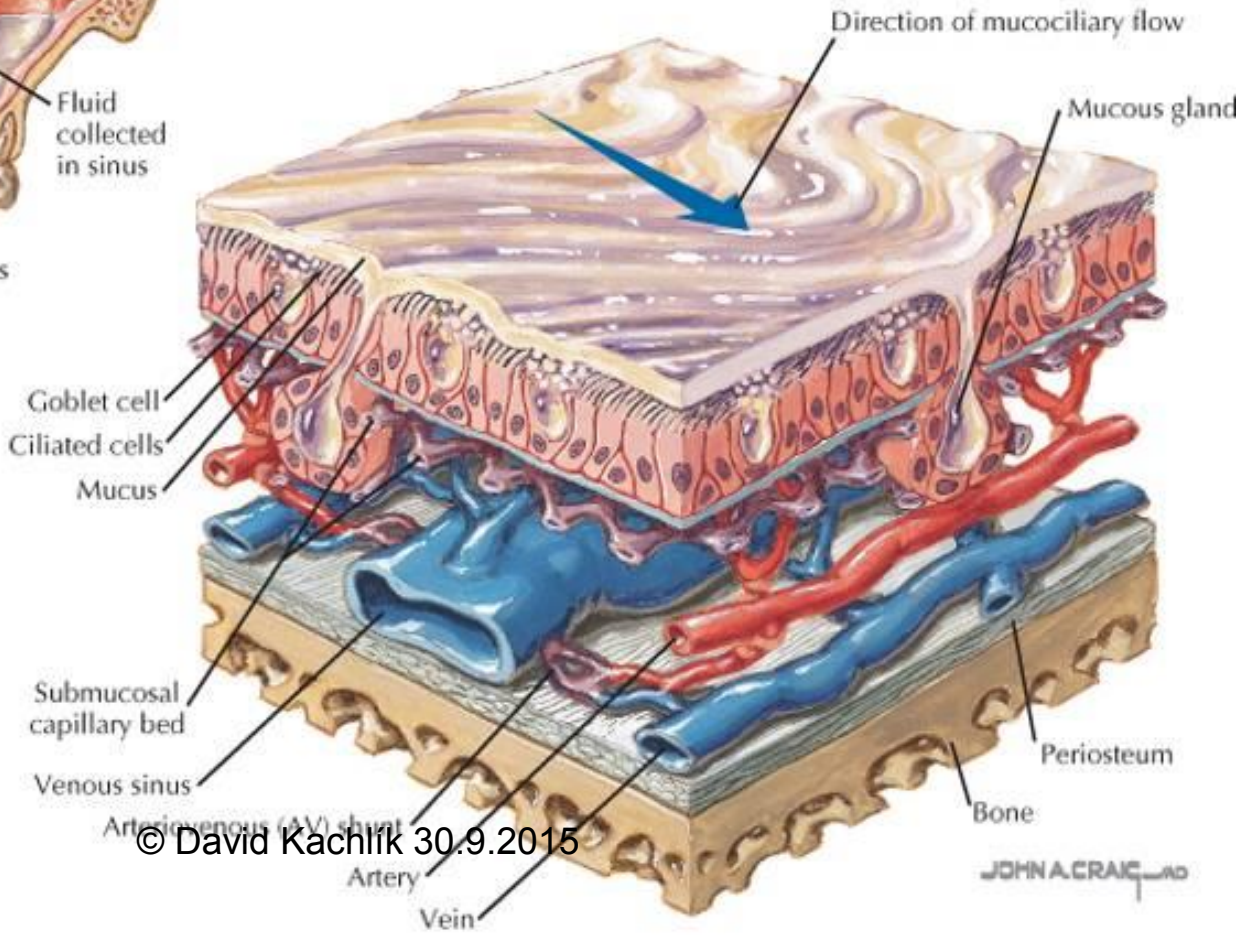
- olfactory epithelium
  - roof, septum and lateral wall down to the level of concha nasalis superior (5 cm^2)
  - pseudostratified columnar epithelium

▼ **Frontal section of the nasal cavity and sinuses.**



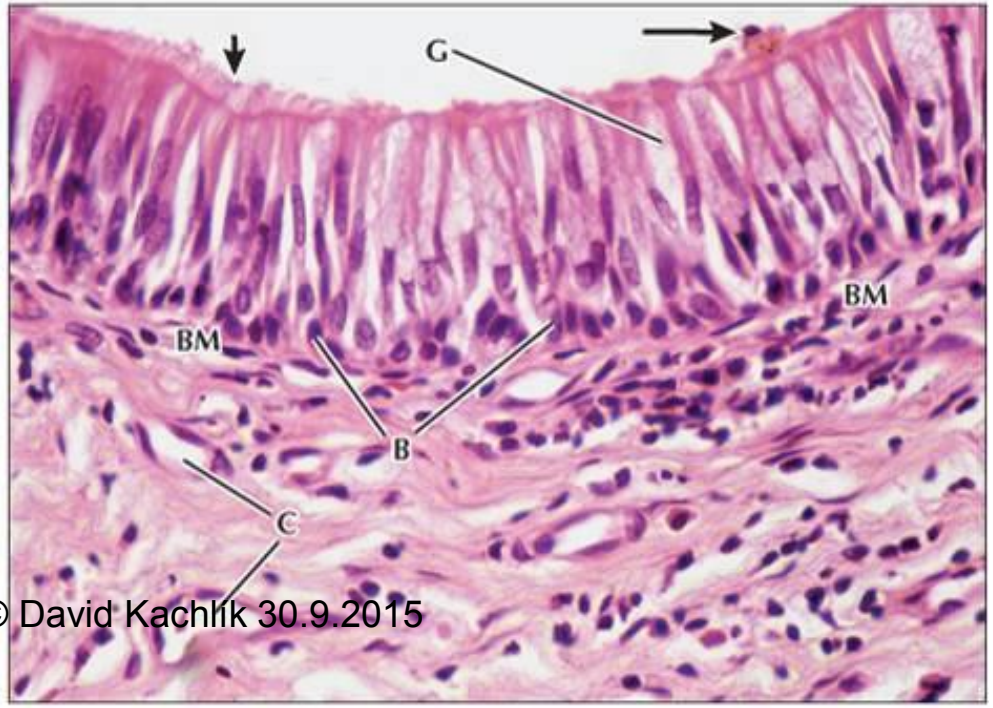
Cilia drain sinuses by propelling mucus (mucociliary clearance) toward small opening into the nasal cavity

▼ **Schematic of the nasal or sinus wall.**



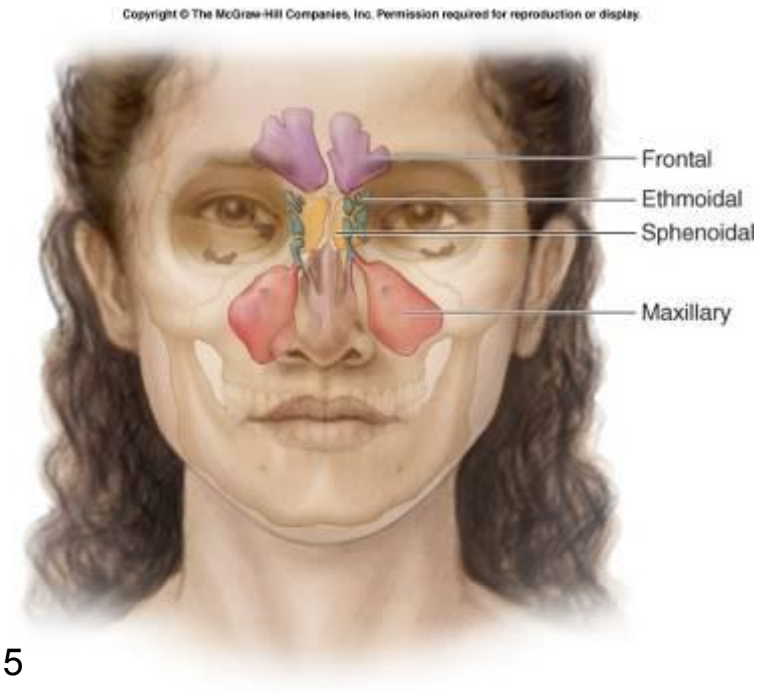
◀ **Low-magnification light micrograph (LM) of a nasal concha.** Respiratory epithelium covers the concha externally and is in direct contact with the nasal cavity lumen (*). Its central core of loose connective tissue contains several thin-walled venous sinuses (**V**) and bony trabeculae (**B**). A small gland in the lamina propria is drained by a duct that opens onto the surface (**arrow**). 100×. *H&E.*

► **LM of respiratory mucosa lining the nasal cavity.** The tall pseudostratified epithelium consists of basal cells (**B**), goblet cells (**G**), and columnar cells bearing apical cilia (**short arrow**). Note the particulate matter (**long arrow**) on the ciliated surface. A thin, imperceptible basement membrane (**BM**) separates the epithelium from underlying lamina propria, which is highly cellular and richly vascularized. This lamina contains a network of capillaries (**C**). 300×. *H&E.*



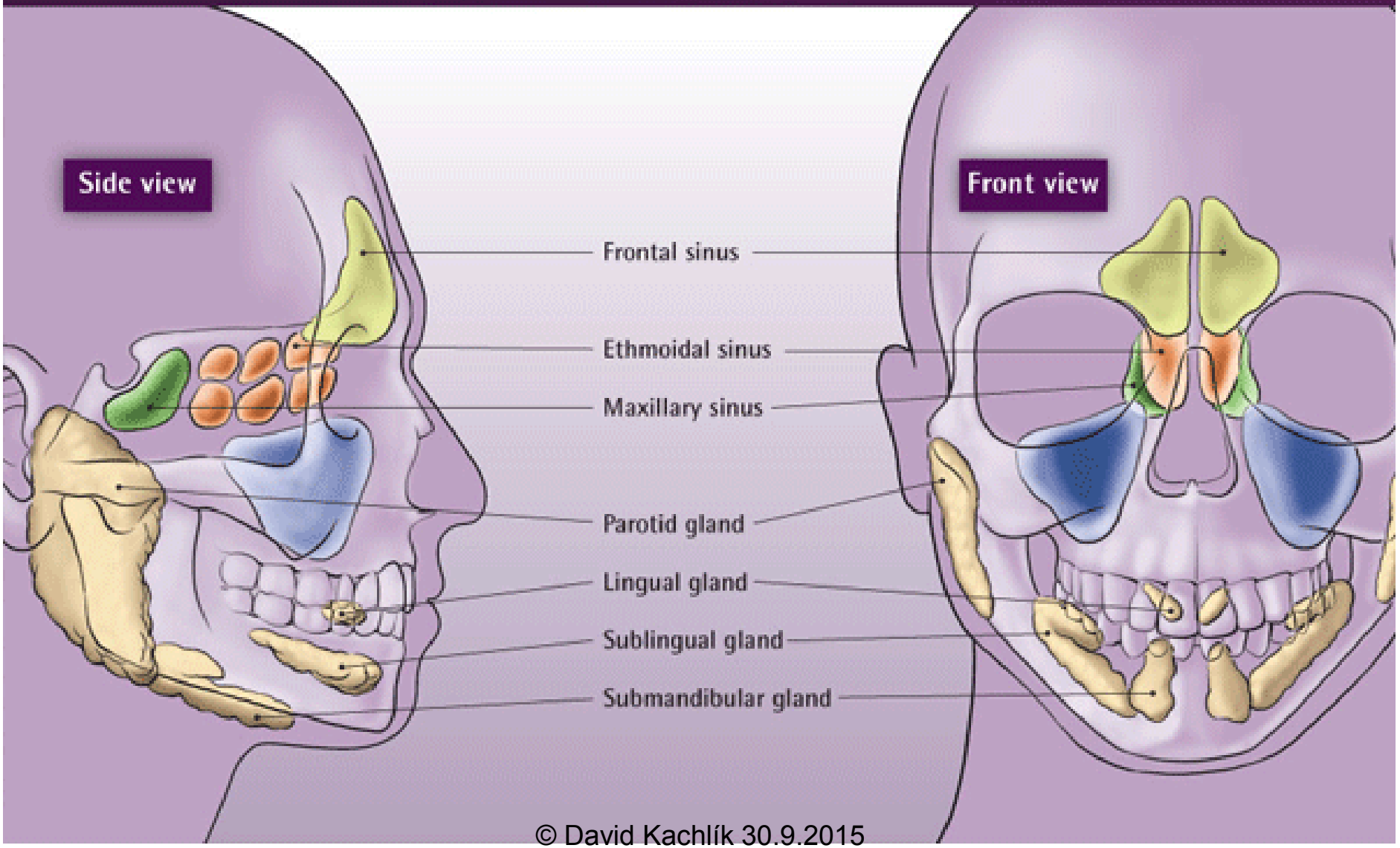
Paranasal sinuses
(*sinus paranasales*)

- sinus maxillaris (antrum *Highmori*) (25 cm^3)
- sinus frontalis (18 cm^3)
- sinus sphenoidalis (6 cm^3)
- cellulae ethmoidales
  - anteriores (+ mediae)
  - posteriores

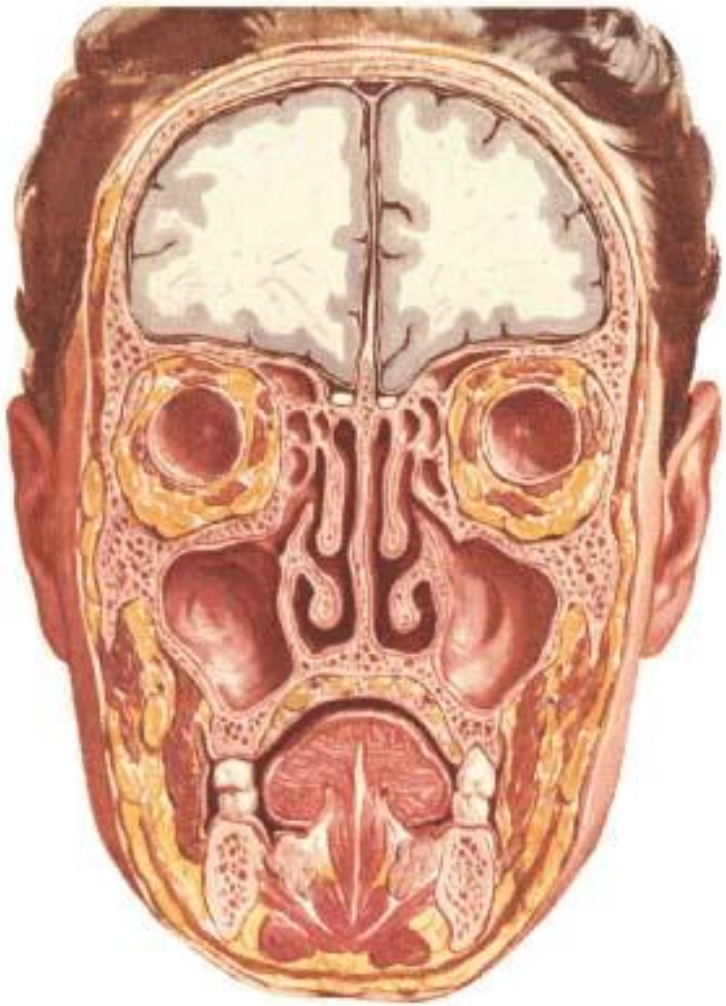


http://trialx.com/curetalk/wp-content/blogs.dir/7/files/2011/05/diseases/Paranasal_Sinuses-1.jpg

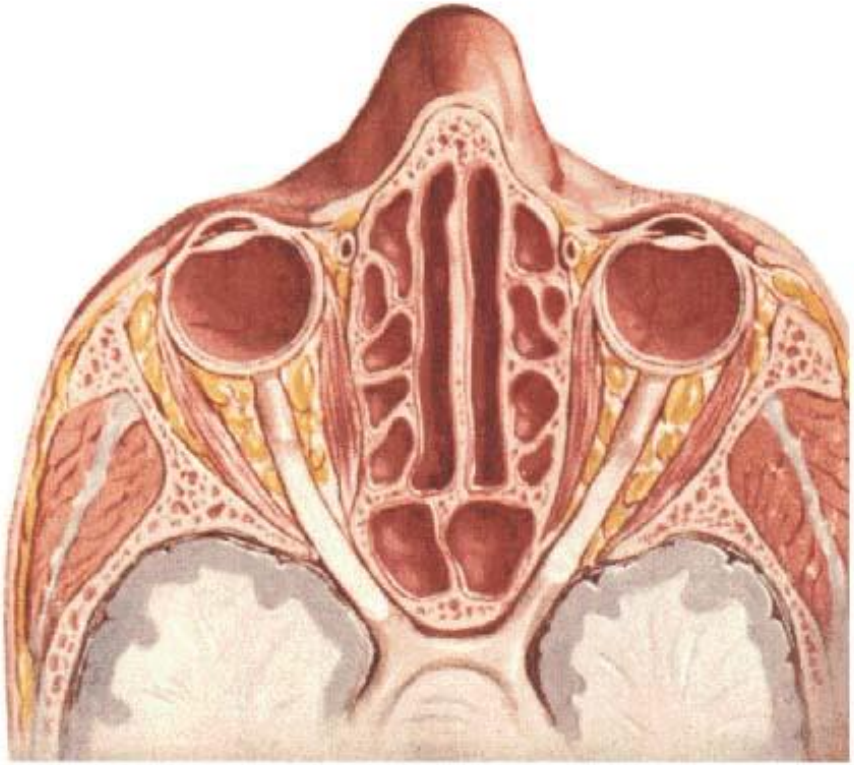
Sinuses

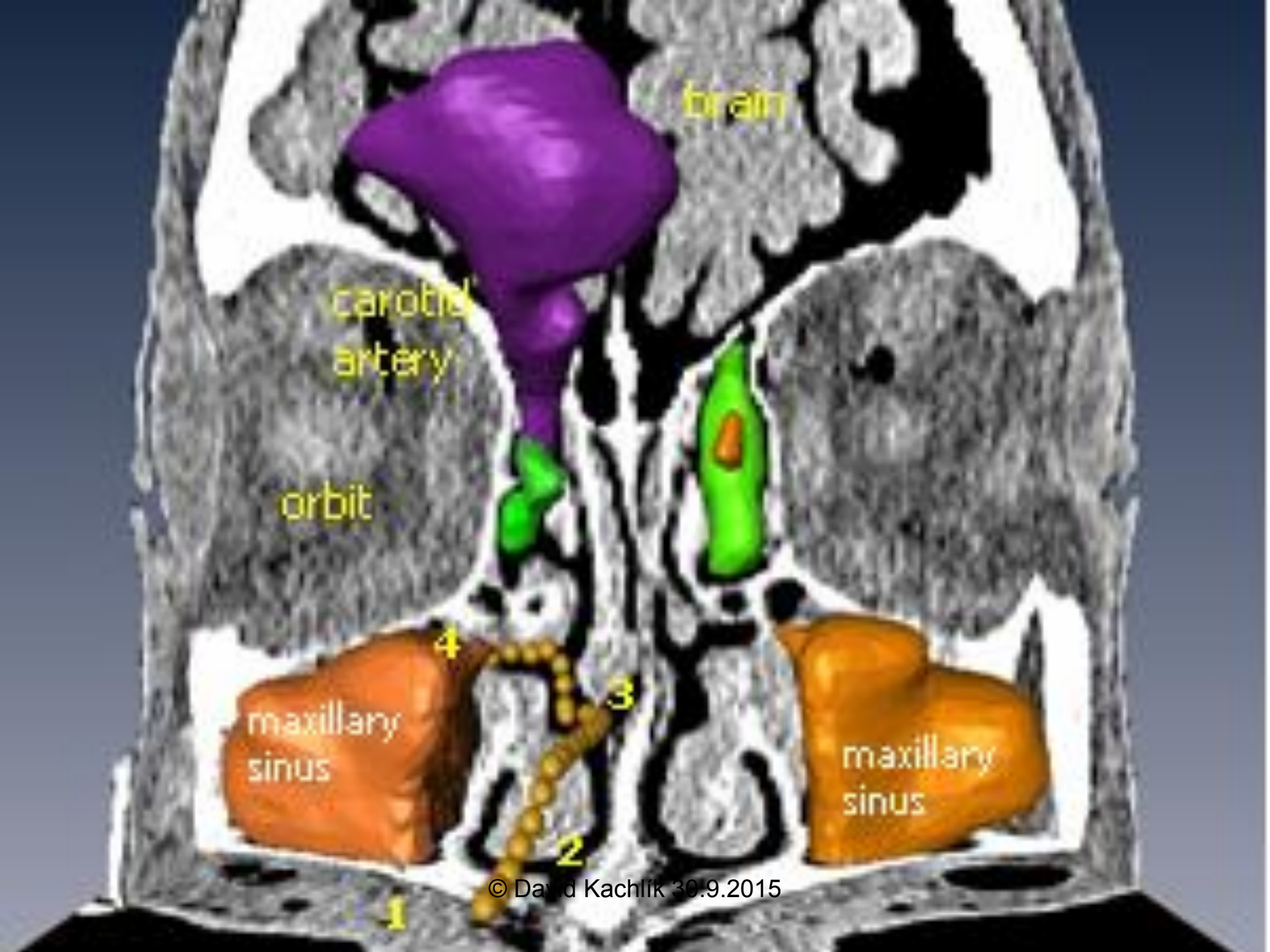


Paranasal Sinuses
Coronal Section

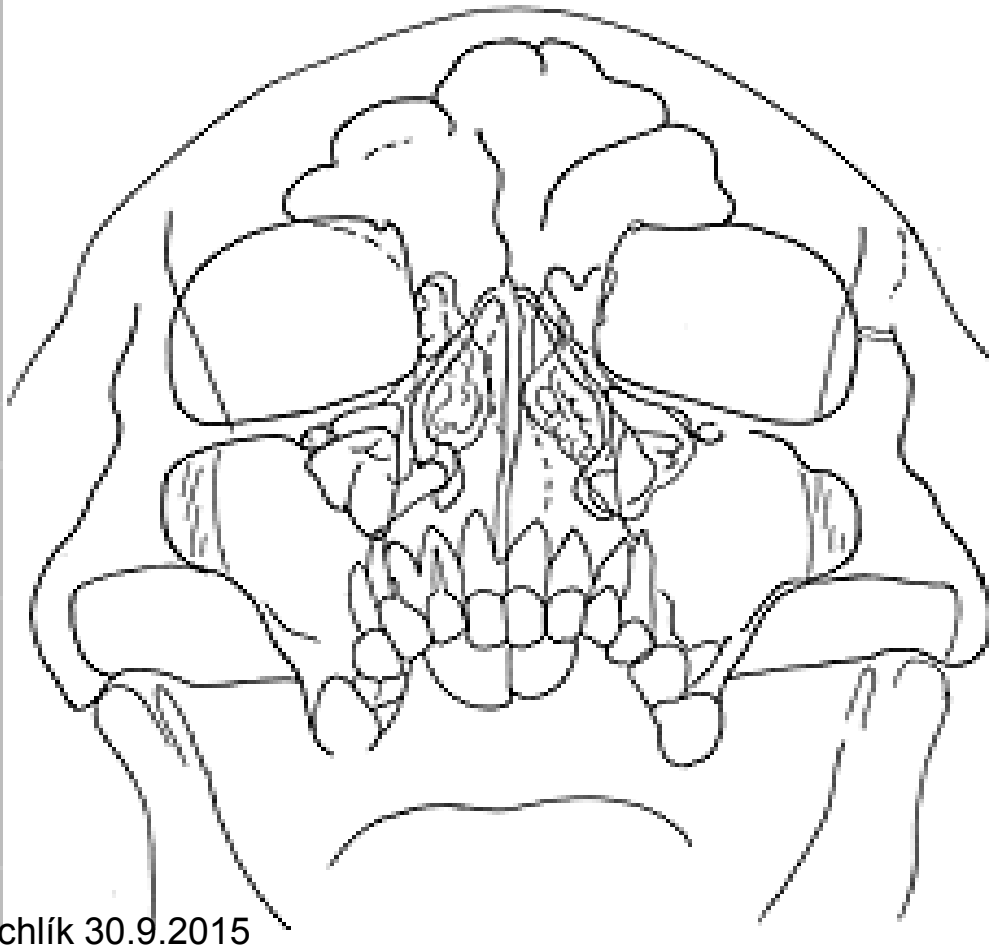


Paranasal Sinuses
Horizontal Section





X-ray of paranasal sinuses



Paranasal sinuses development

Maxilloturbinale

→ concha n. inf.

Ethmoturbinale

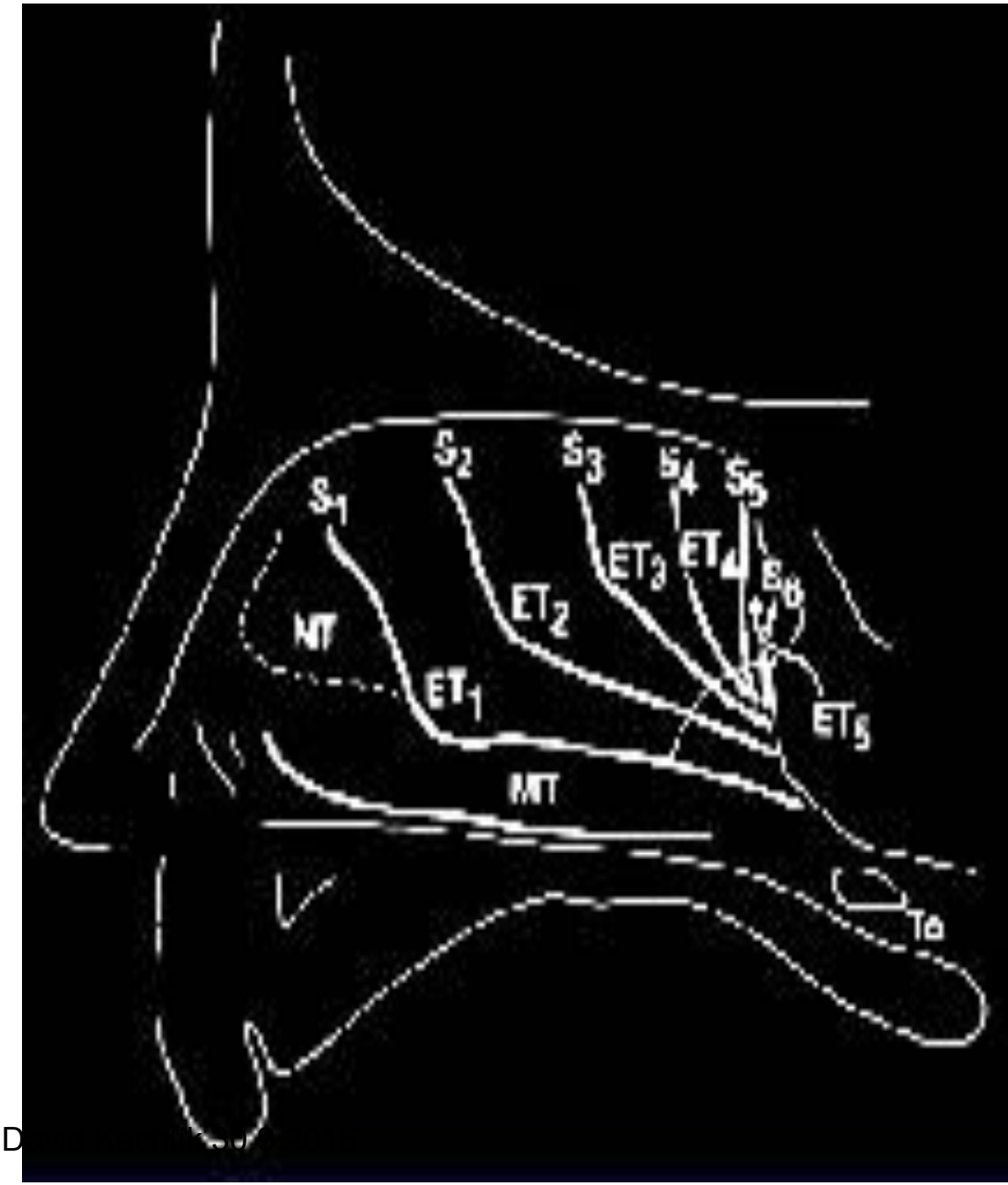
→ concha n. media

→ concha n. superior

→ concha n. suprema

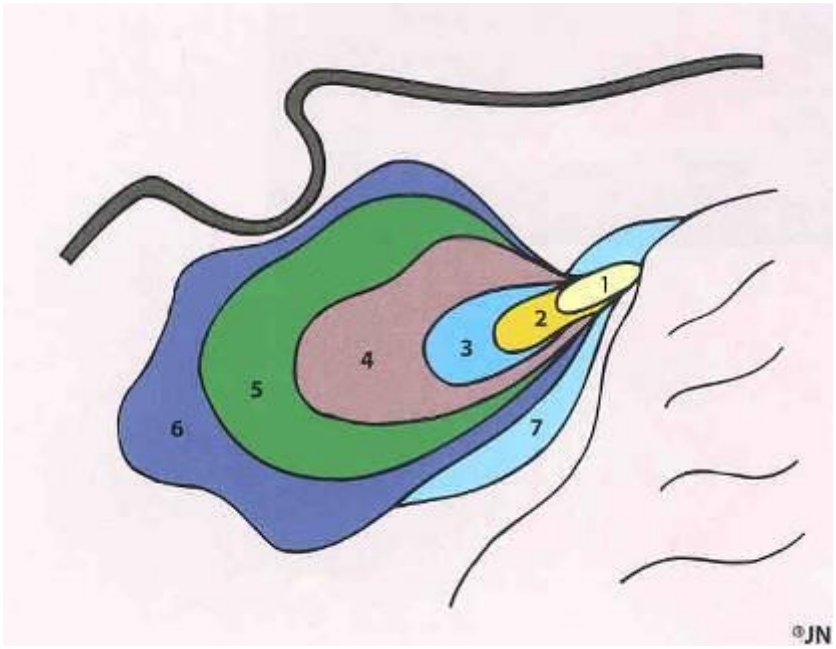
→ agger nasi

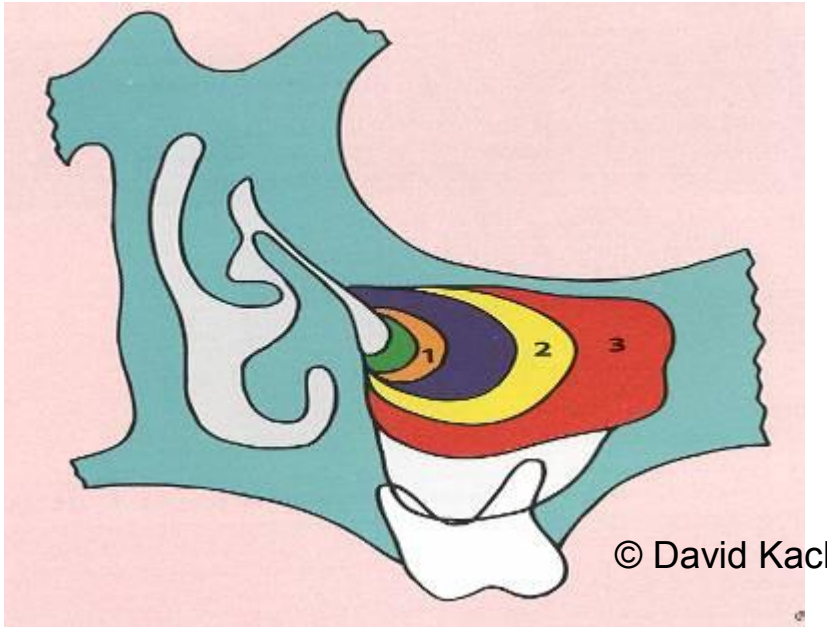
→ proc. uncinatus

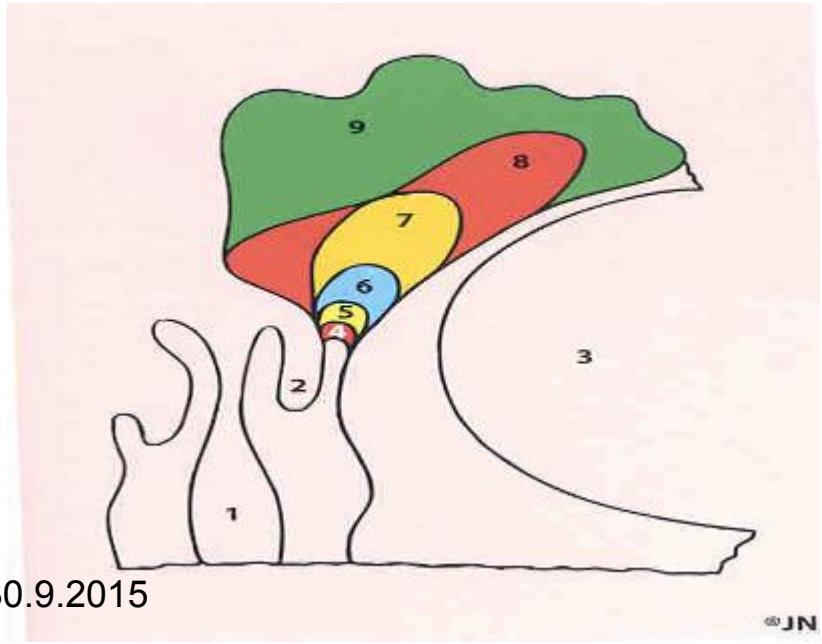


Paranasal sinuses development

- bases formed in the 4th month
- *cellulae ethmoidales* and *sinus maxillares* partially developed
- finished after puberty





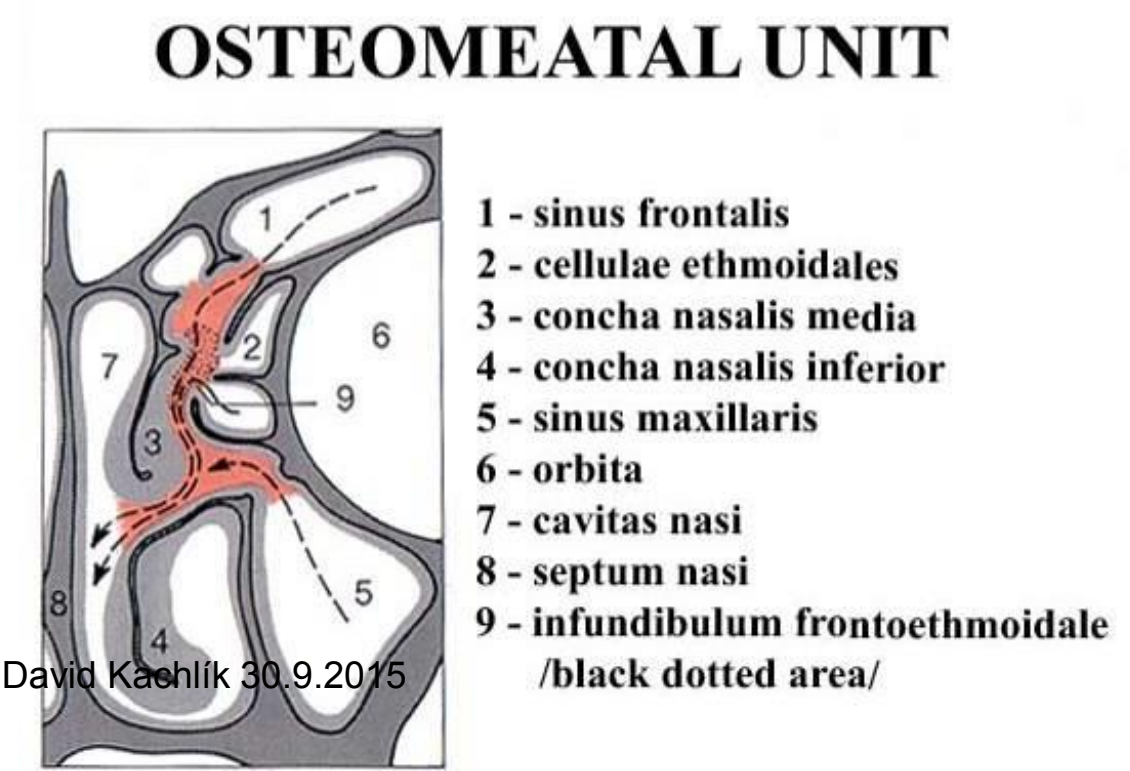


Paranasal sinuses - development

- sinus maxillaris – biphasic growth
  - at birth (filled with fluid)
  - age of 0-3 years (horizontal growth dorsally)
  - age of 6-12 let (perpendicular growth down to teeth)
- sinus frontalis
  - starts after 2nd year, mainly in age of 6-7
  - upt to age of 9 years (resp. up to late pubescence)
- cellulae ethmoidales
  - at birth (filled with fluid)
  - successive growth until age of 12 years
- sinus sphenoidalis
  - up to late pubescence

Paranasal sinuses

- OMU = ostiomeatal unit – openings SM+SF+CEA
- respiratory epithelium
- warming-up and moistening of an air, resonance during phonation



Paranasal sinuses (PS)

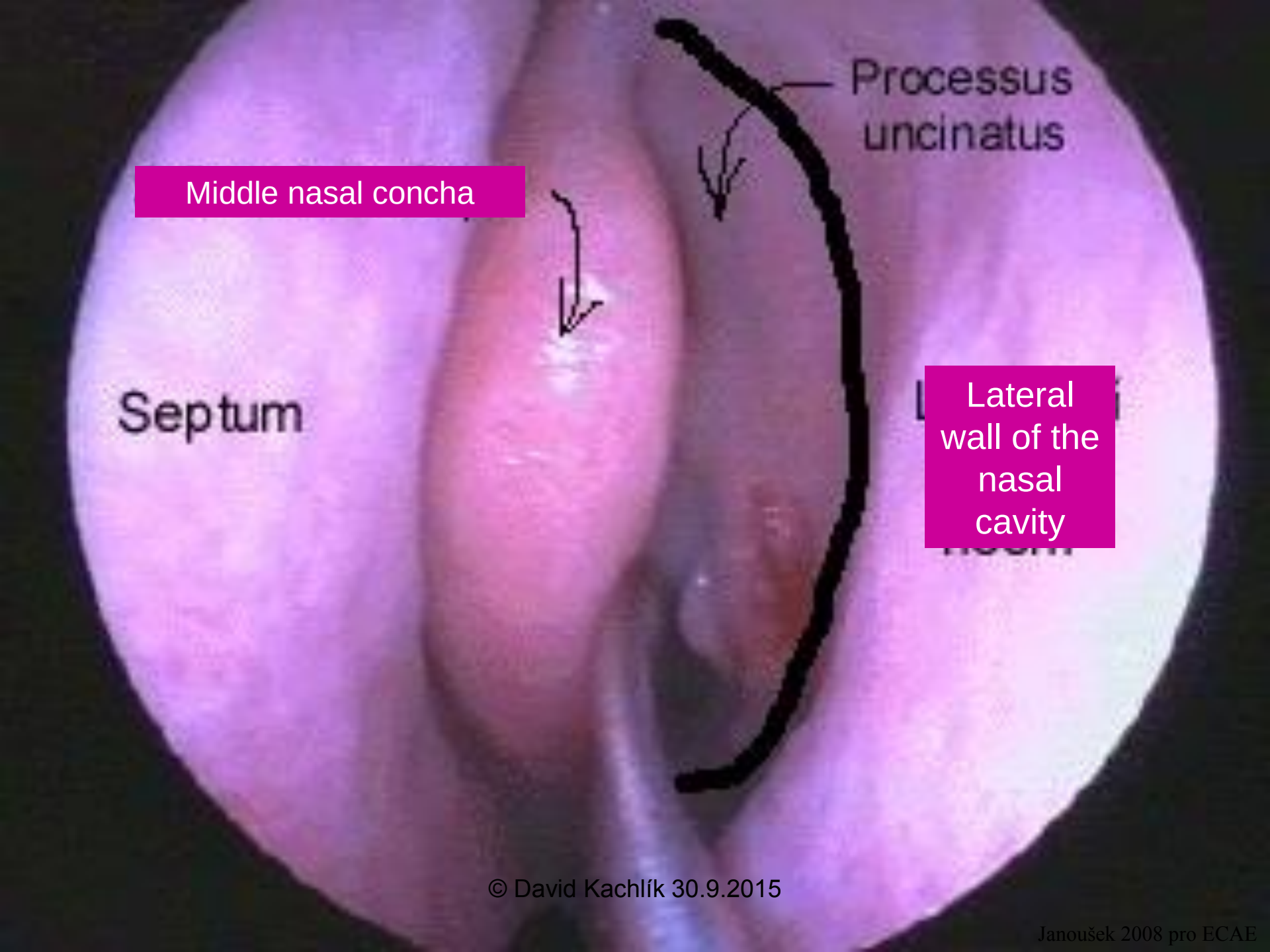
vascular supply corresponds to nasal cavity + following:

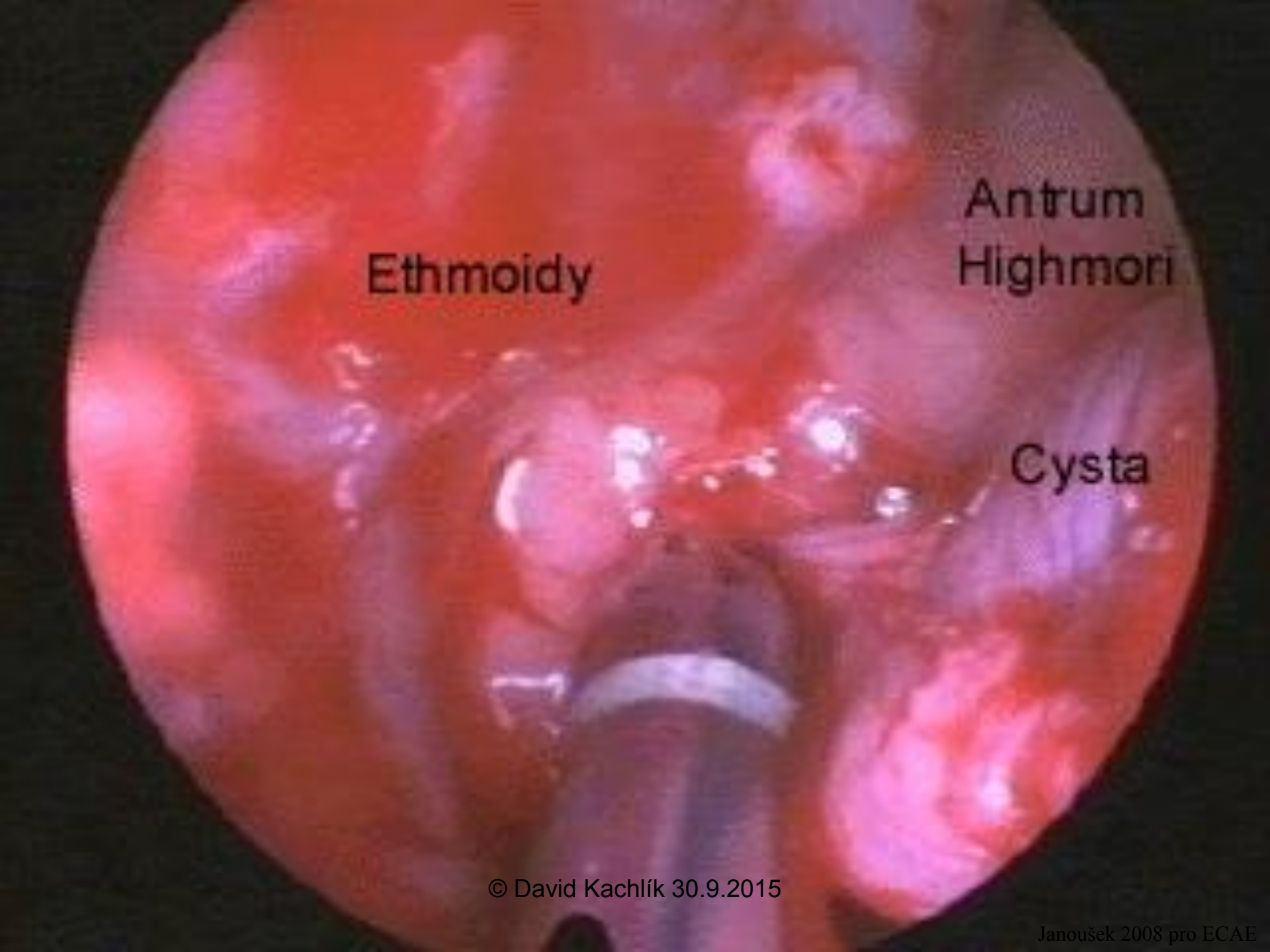
- a. infraorbitalis, aa. alveolates superiores anterioreas et posteriores *for sinus maxillaris*
- r. pharyngeus a. maxillaris *for sinus sphenoidalis*

innervation corresponds to nasal cavity

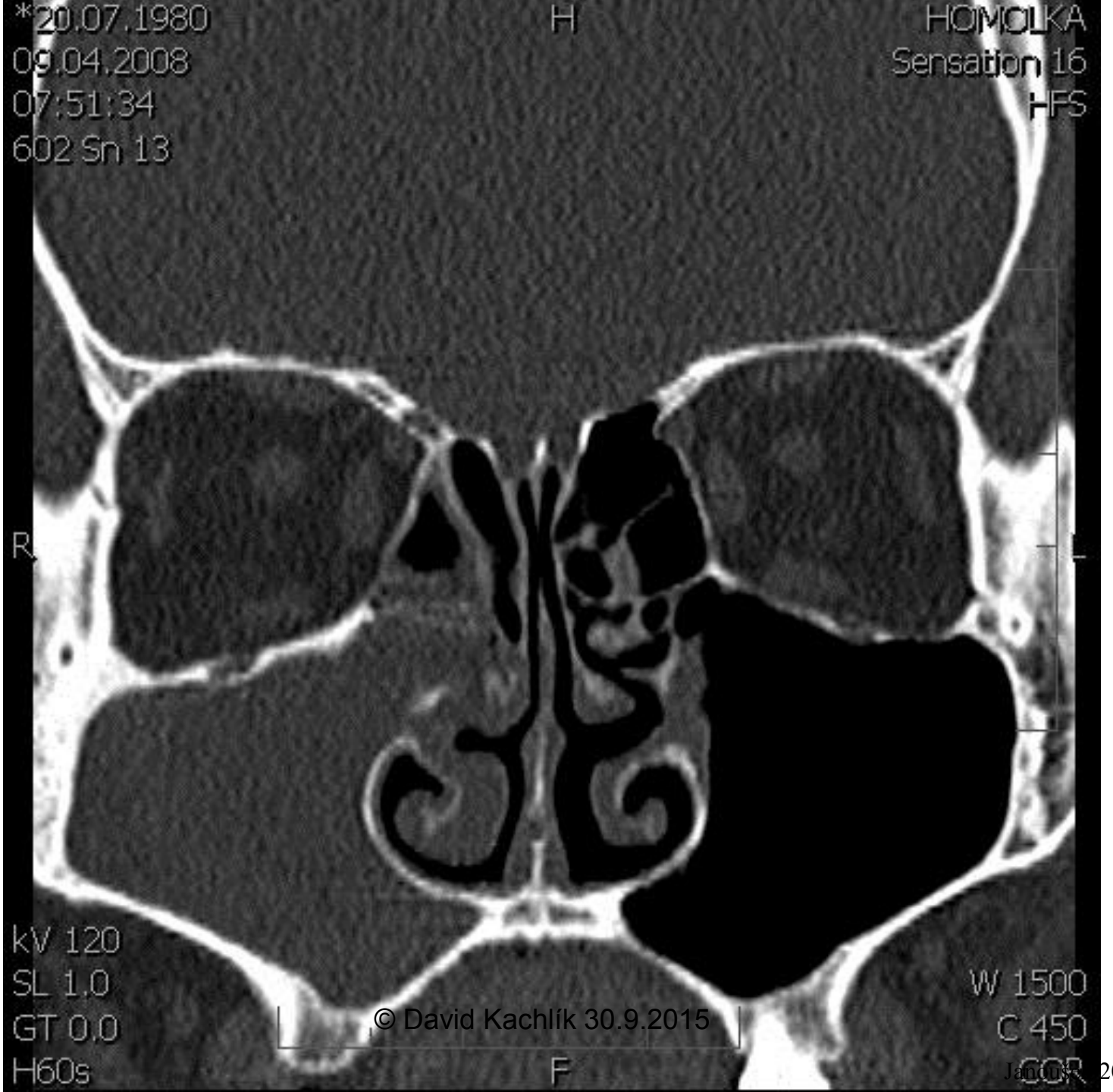
Nasal cavity + PS – *clinical notes*

- epistaxis (bleeding from the nose) - locus Kiesselbachi, plexus Woodruffi, a. sphenopalatina
- liquorrhea (the flow of the cerebrospinal fluid from the nose) – fractures of the base of the skull
- sinusitis
  - puncture through the nasal cavity (for s. maxillaris at the level of the inferior nasal meatus – inferior antrotomy)
  - suction
  - FES (= functional endonasal surgery)
- surgical approach to hypophysis through sinus sphenoidalis
- sinus maxillaris – teeth
- cellulae ethmoidales – orbit
- examination: rhinoscopy (anterior, posterior), diaphanoscopy, X-ray, CT





Janoušek 2008 pro ECAE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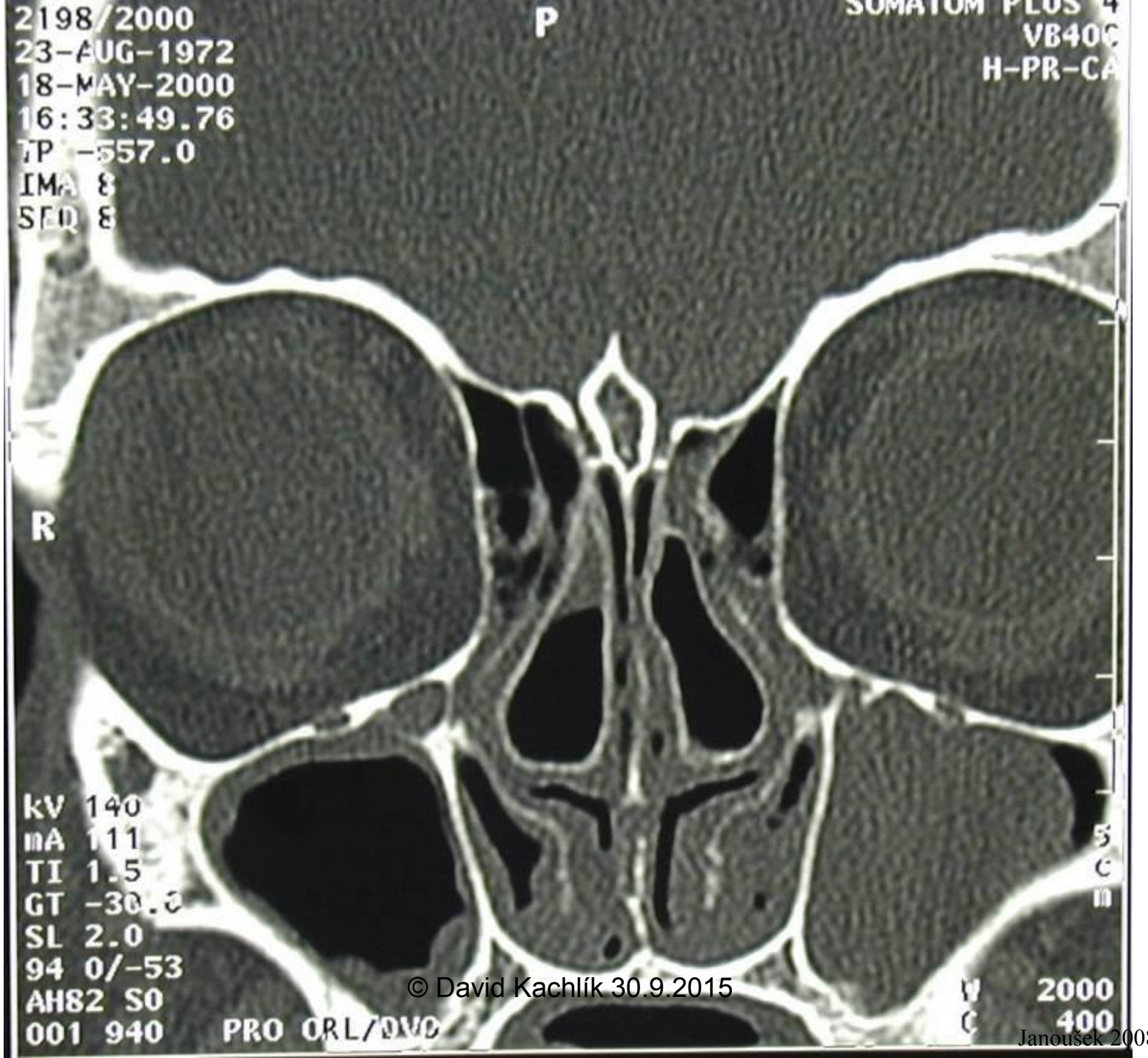
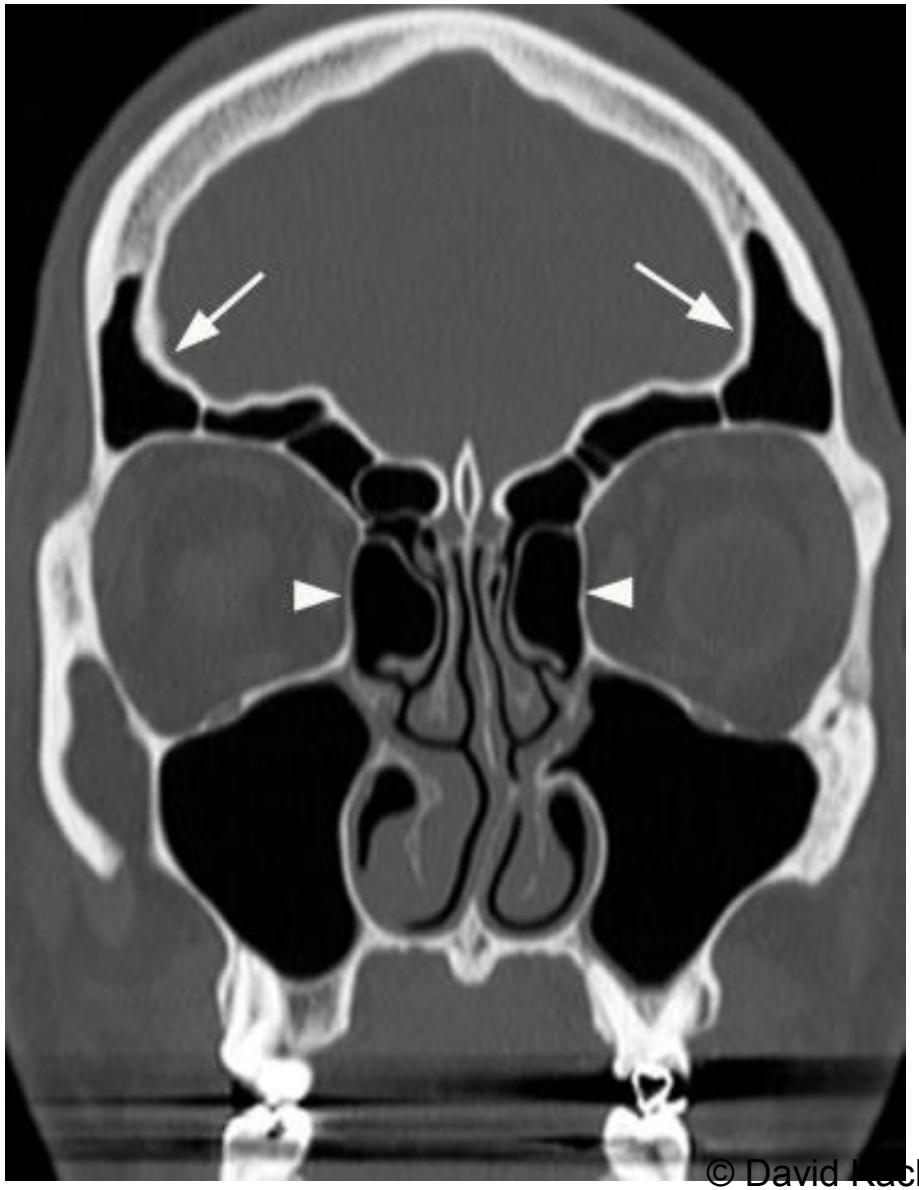
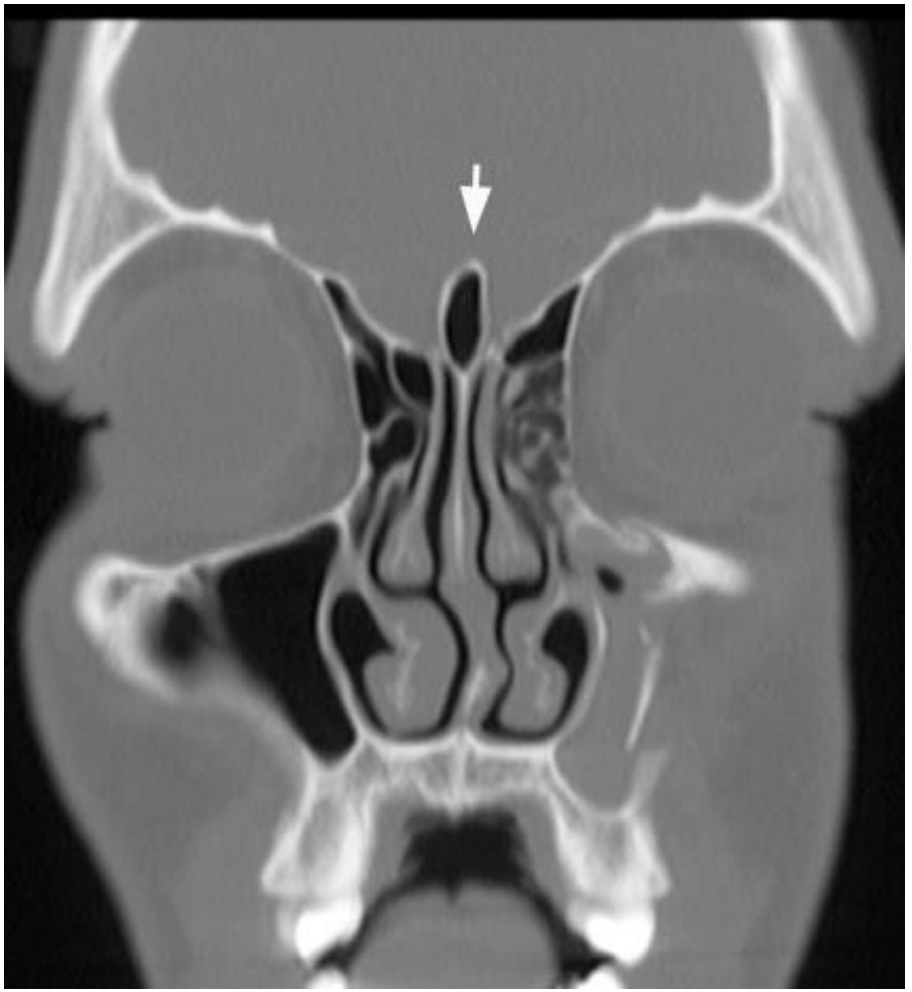
© David Kachlík 30.9.2015







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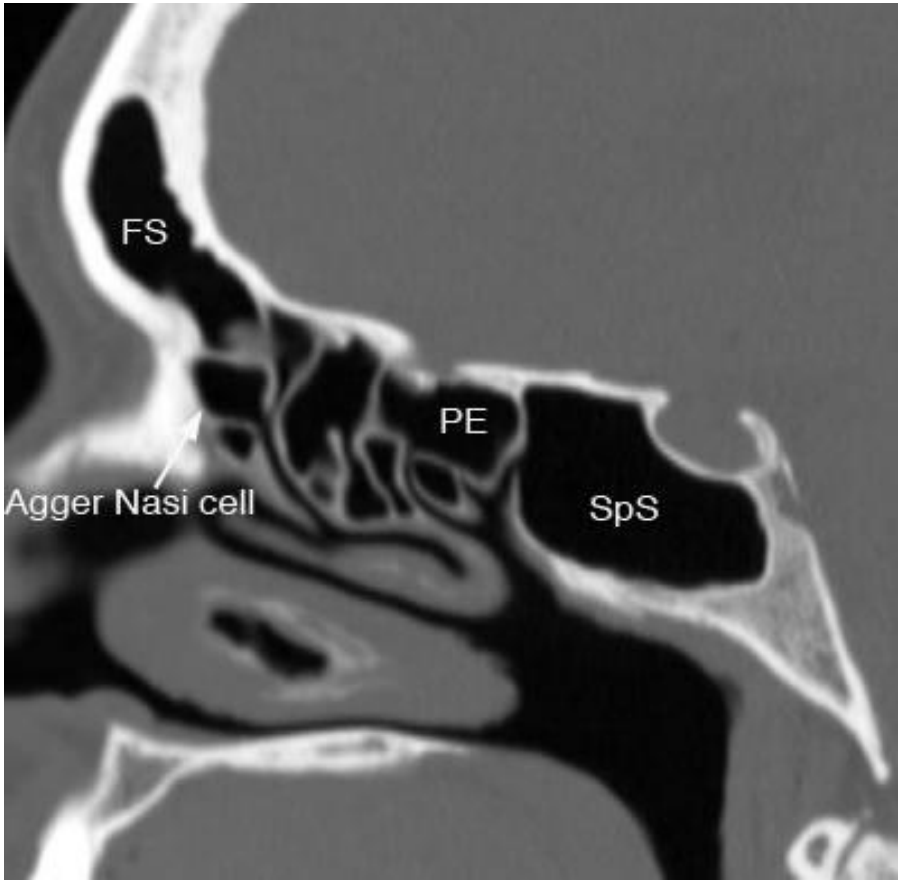
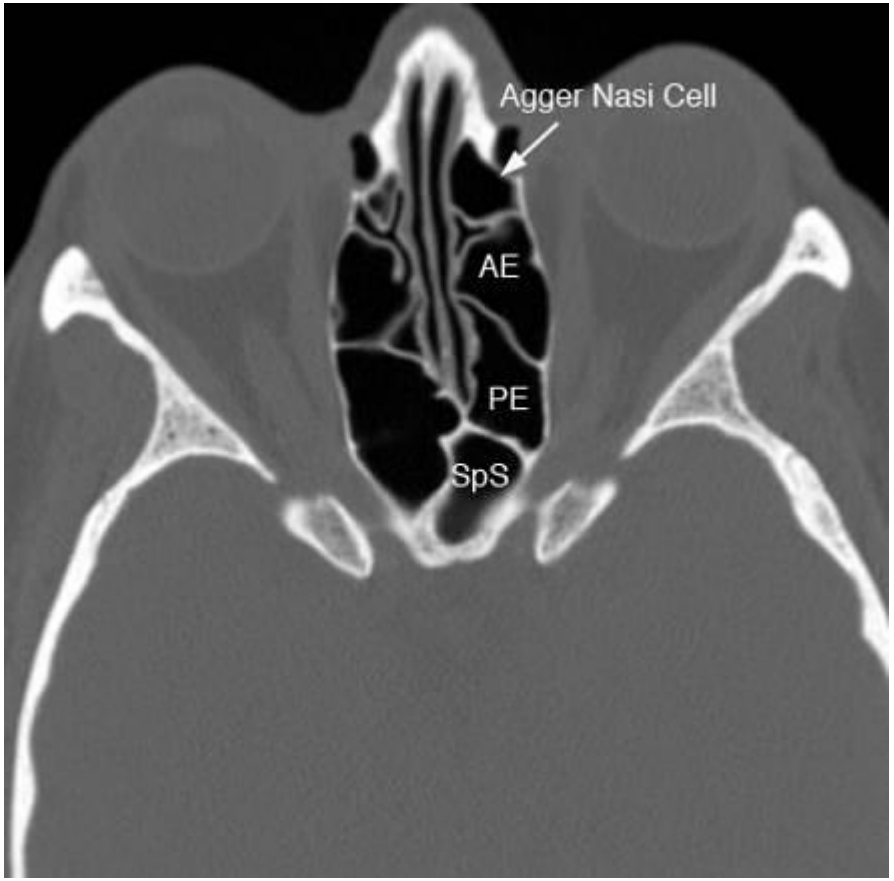
Agger nasi





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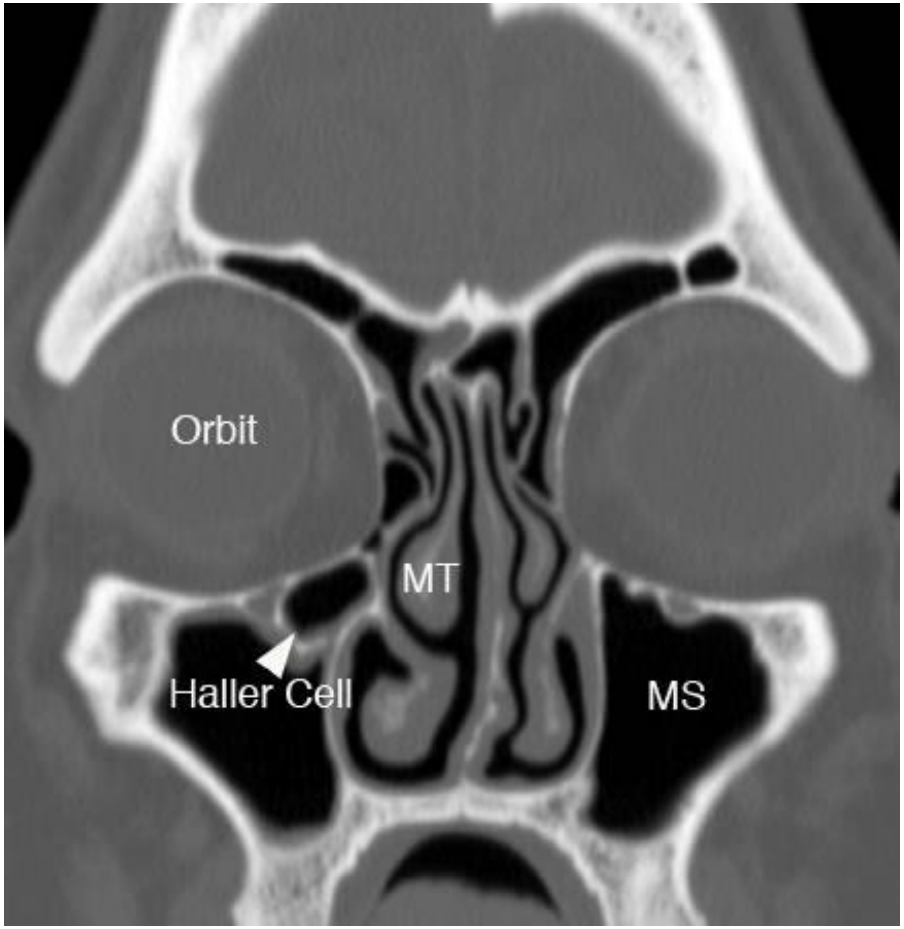
Haller‘s cells



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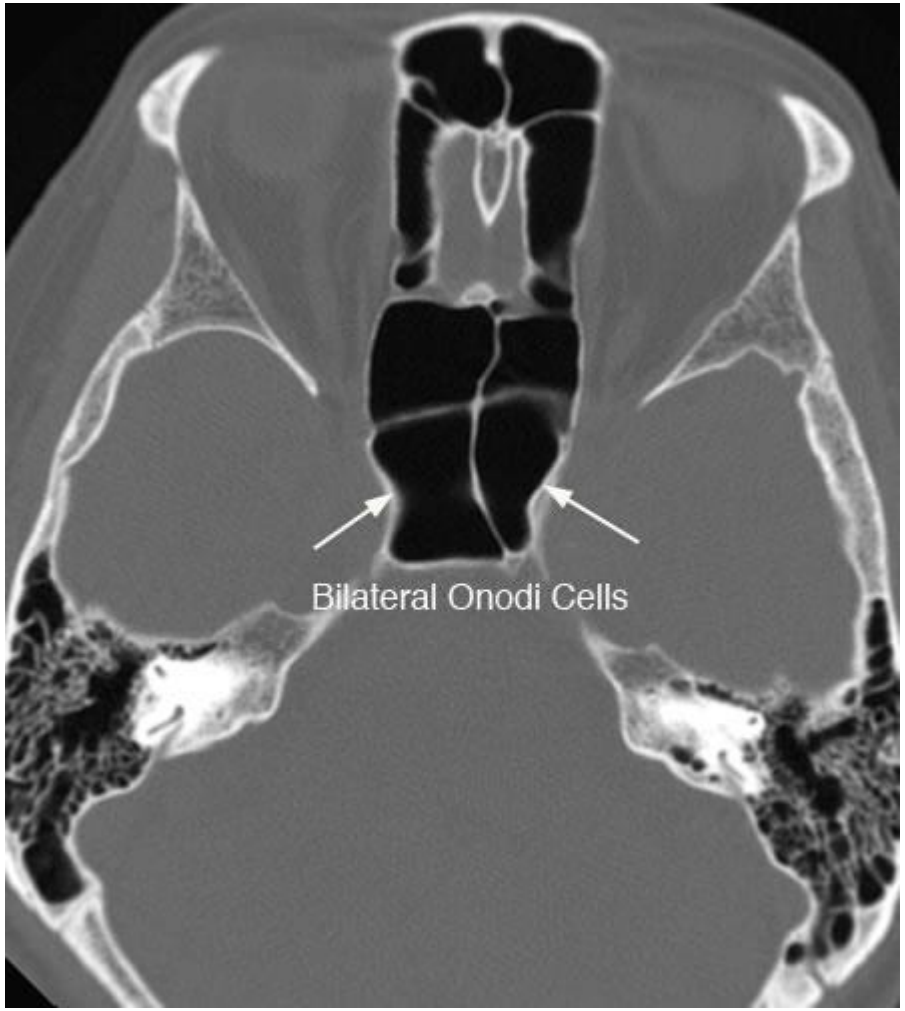
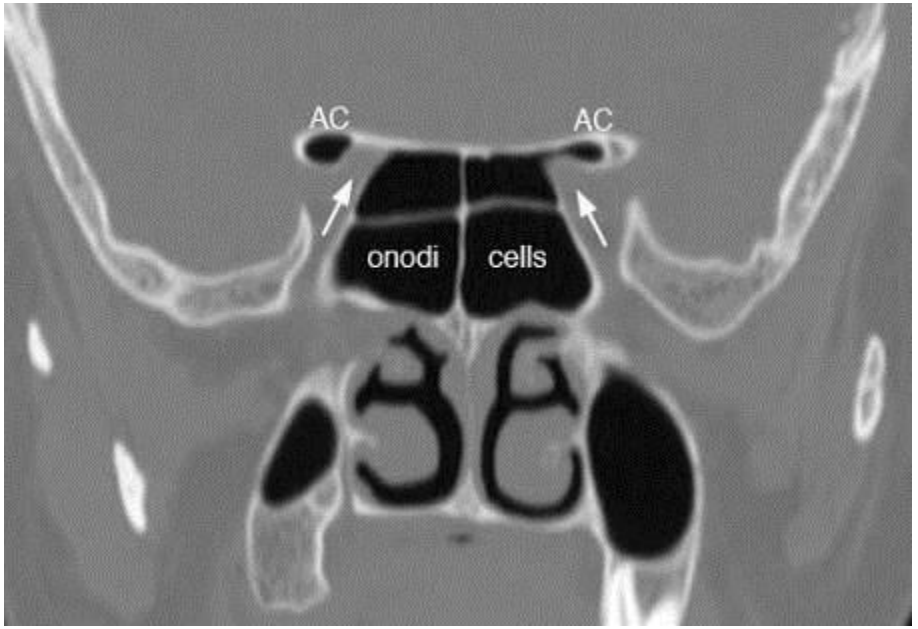
Onodí‘s cells





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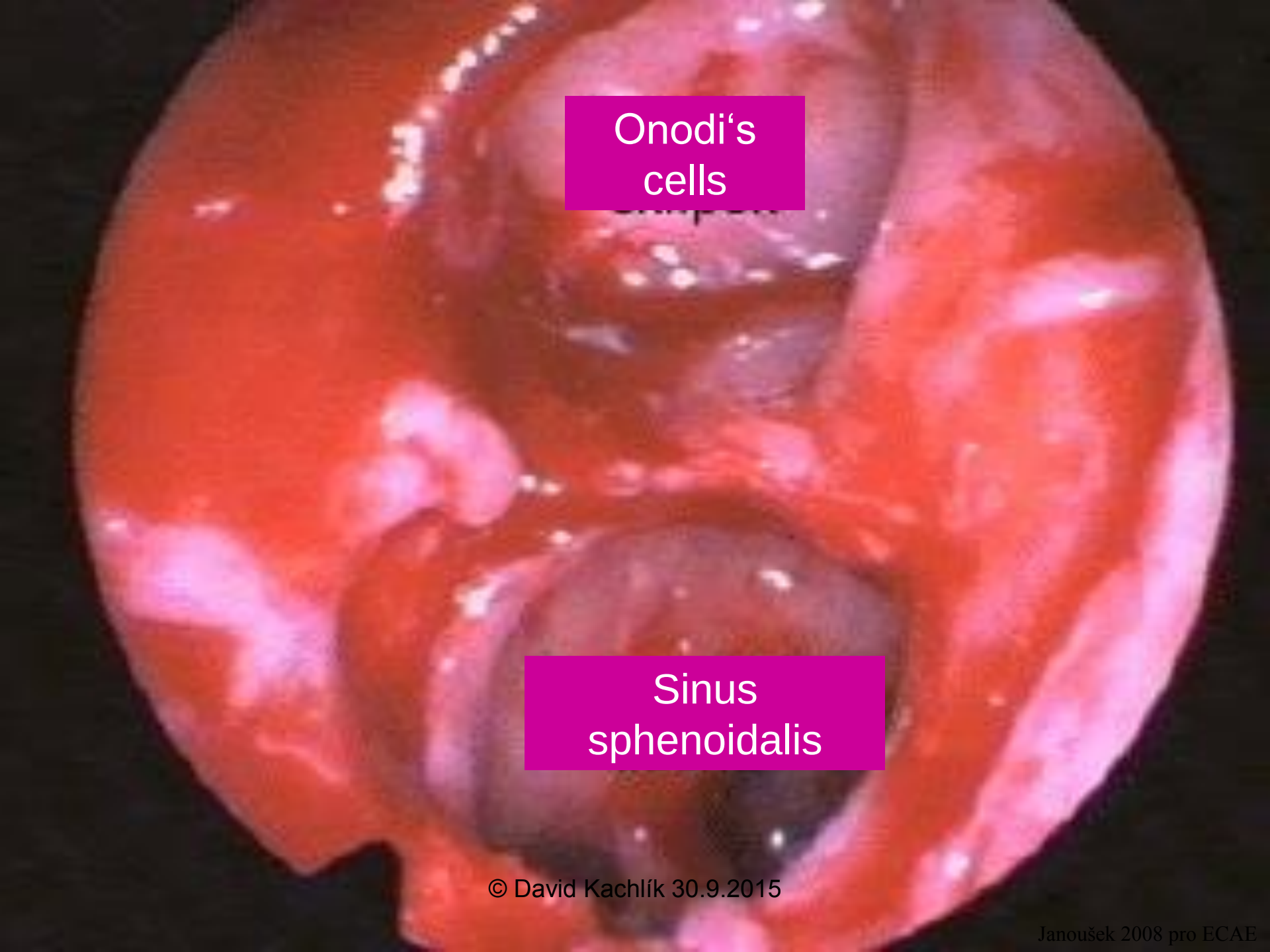
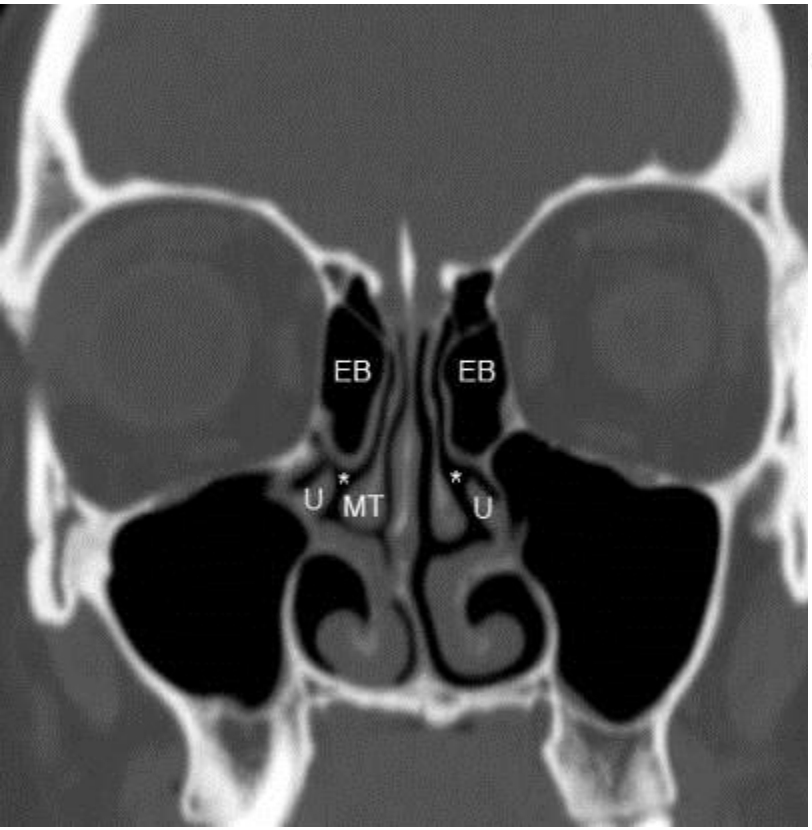
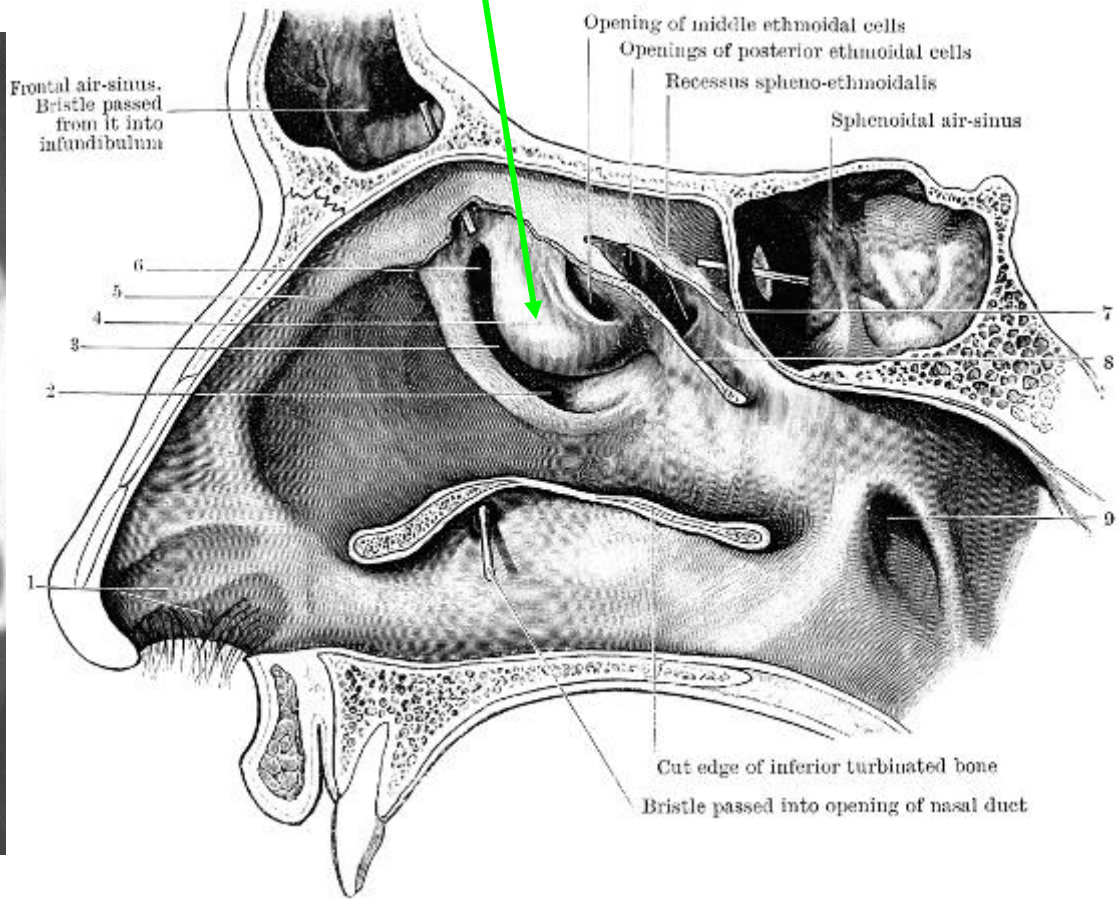


Bulla ethmoidalis





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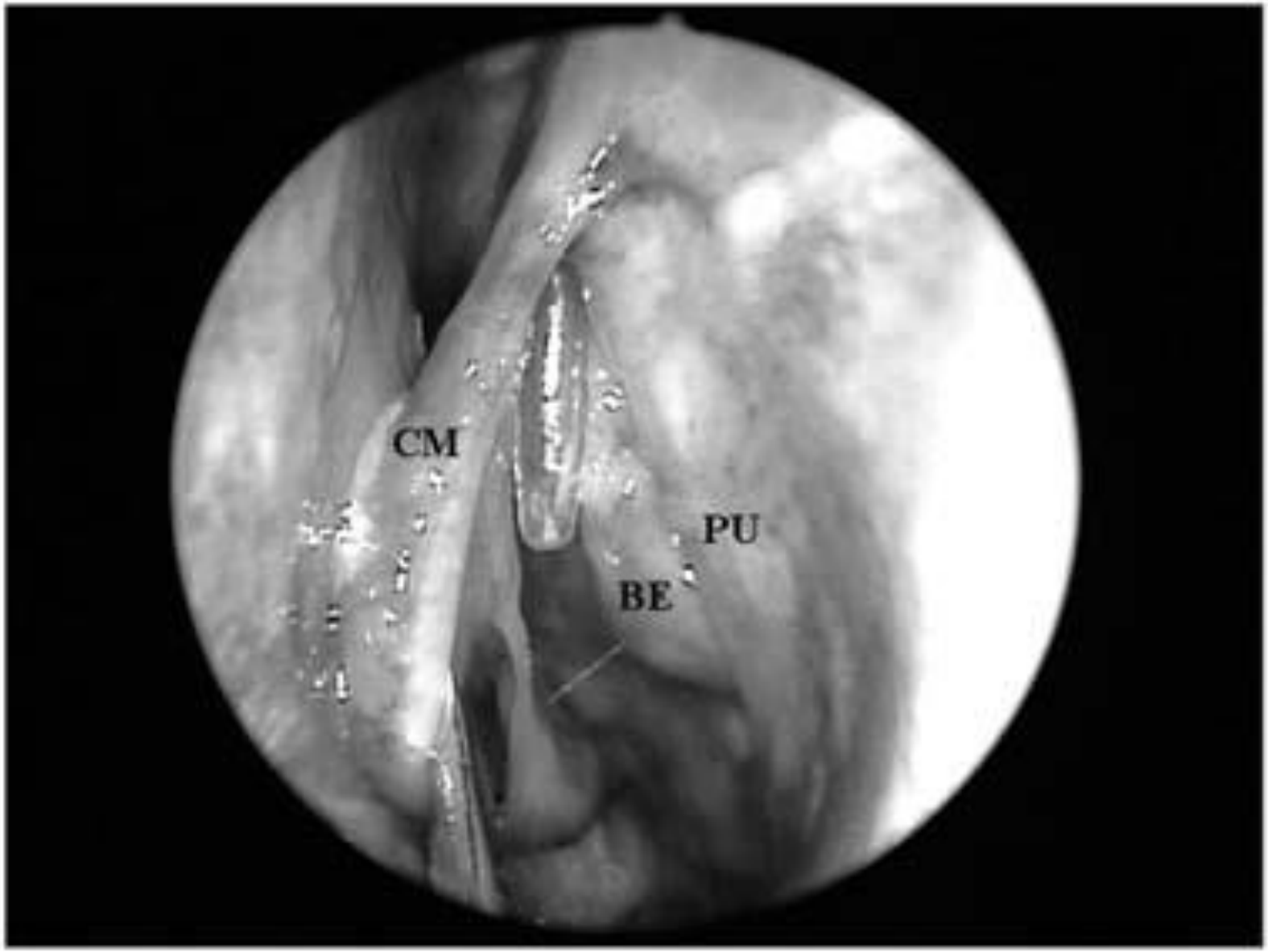
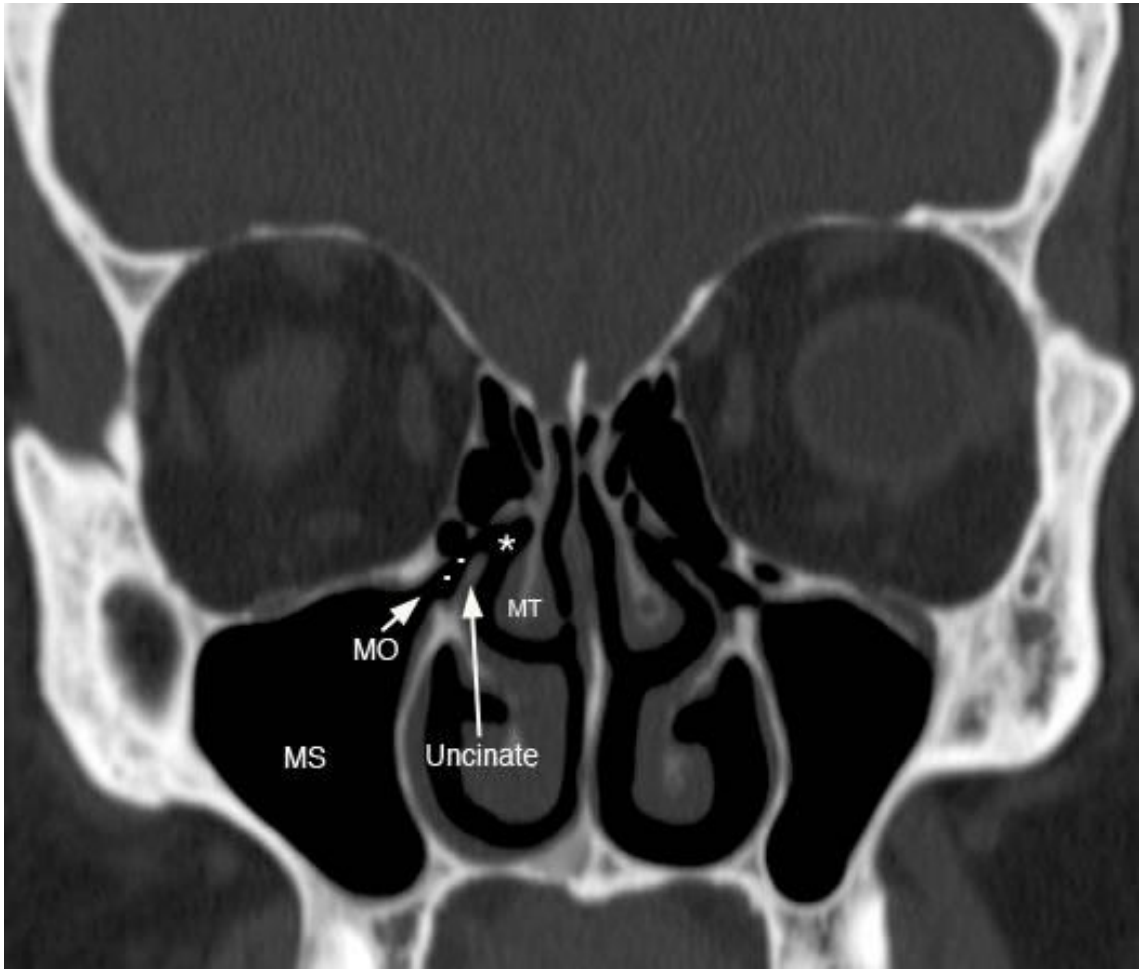
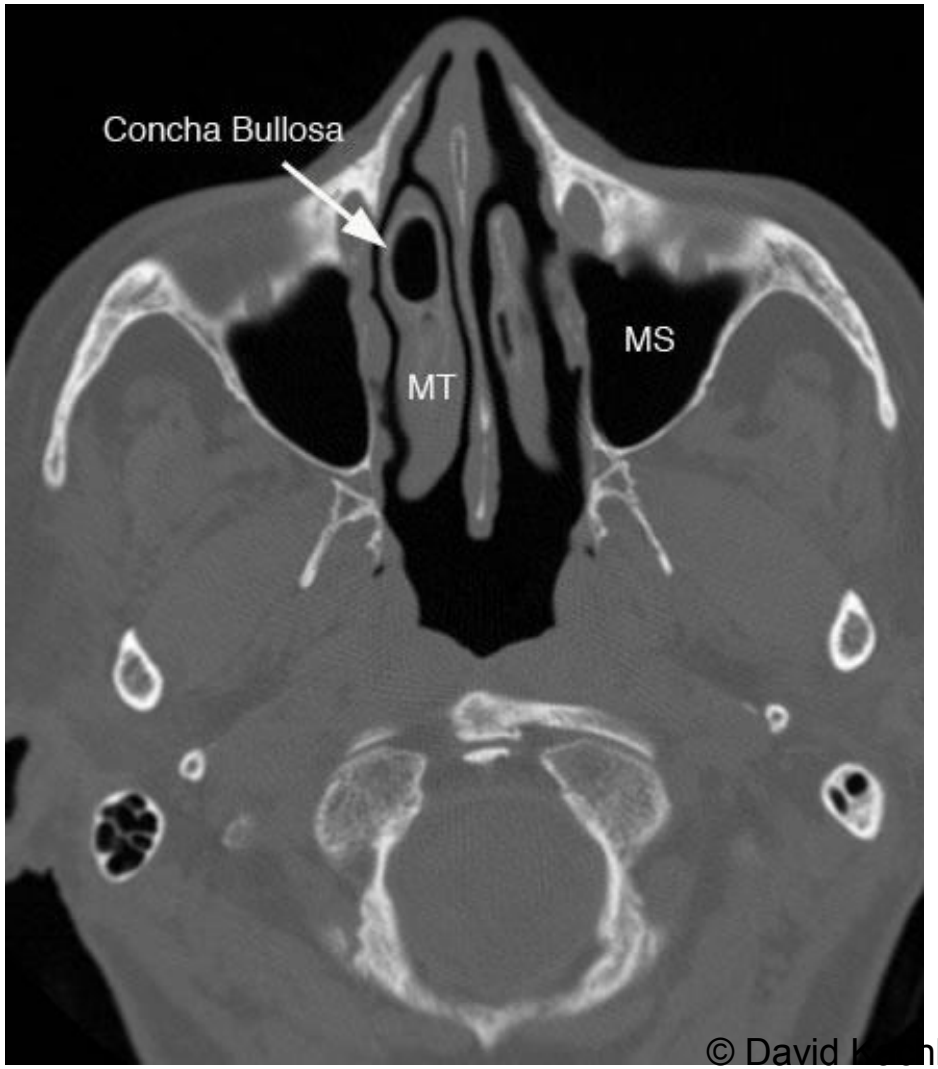


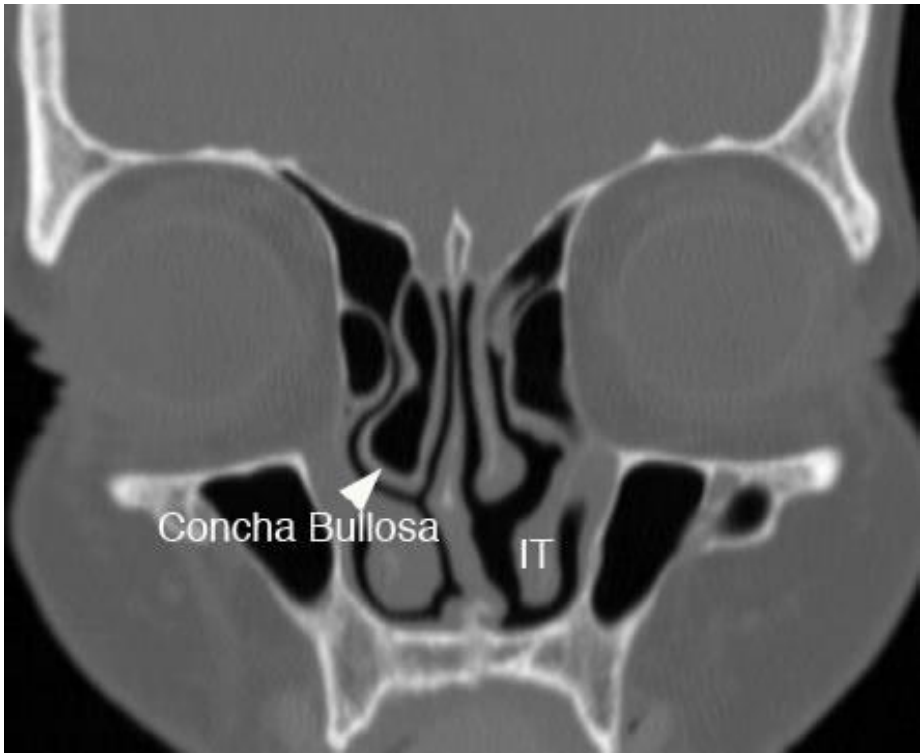
Figure 1. Left nasal cavity endoscopy showing the flexible plastic tube emerging from the middle meatus (CM = middle turbinate; PU = unciform process; BE = ethmoidal bulla).

Processus uncinatus c.n.mediae

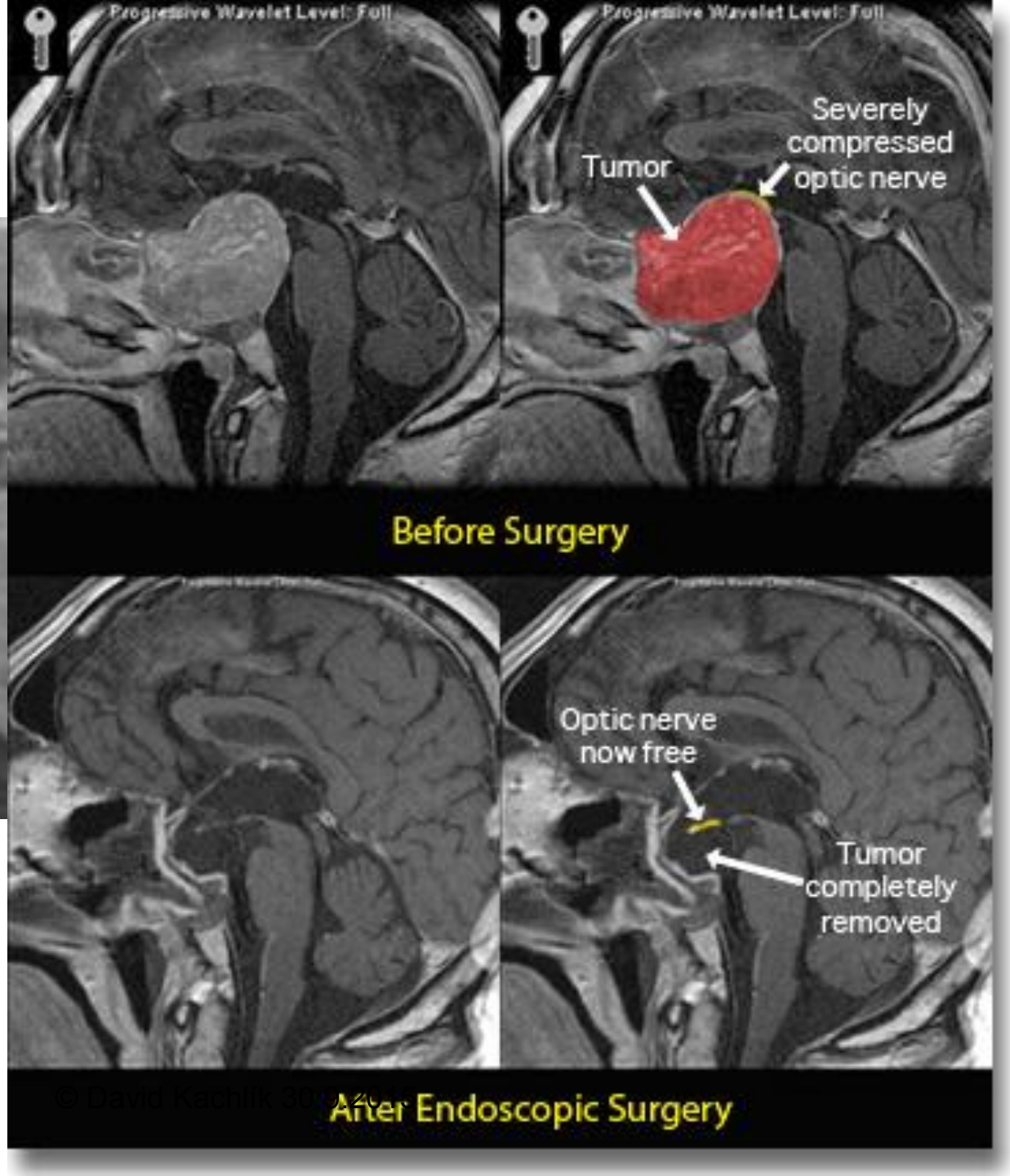


Concha bullosa

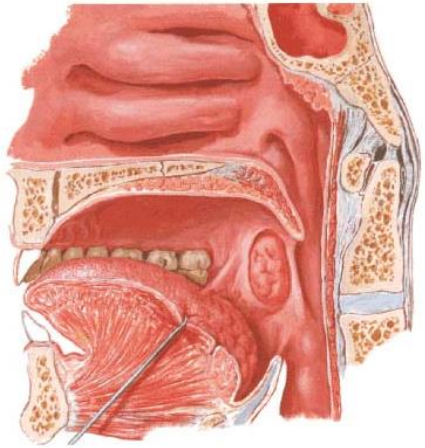




http://uwmsk.org/sinusanatomy2/Maxillary-Normal.html



Pars nasalis pharyngis; *Nasopharynx*

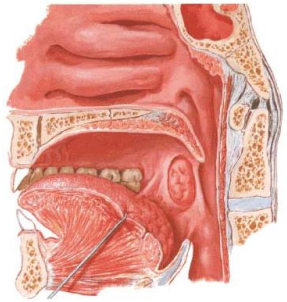


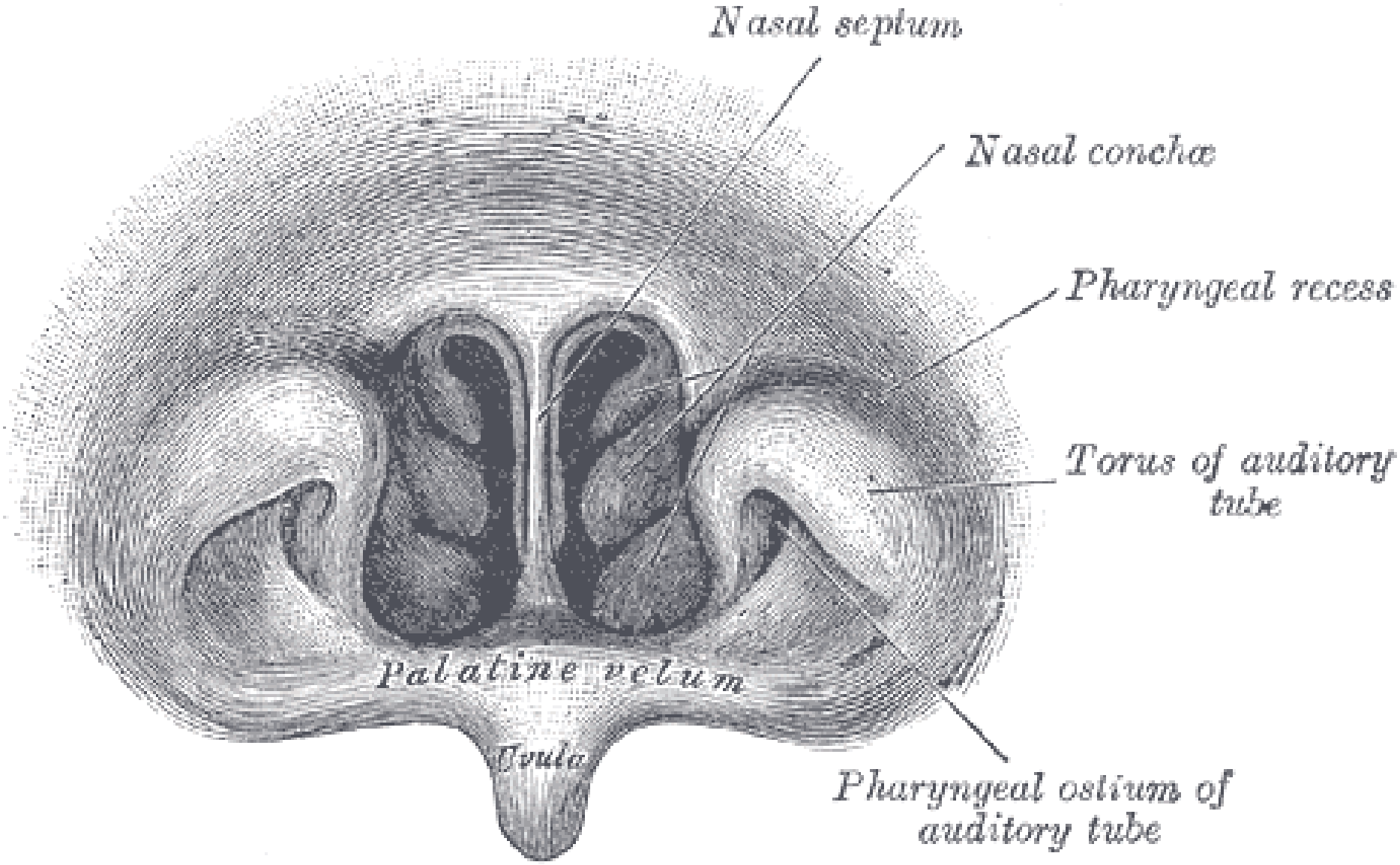
- cranial third of the pharynx
- respiratory epithelium

- **<u>pharyngeal tonsil</u> (*tonsilla pharyngealis Luschkae*)**
  - „adenoid vegetation“
  - *adenotomy (= removing)*
  - *bursa pharyngea* = blind pouch behind the tonsil
    - point of presence of the first lymphatic tissue during the development (relation to chorda dorsalis)

Nasopharynx

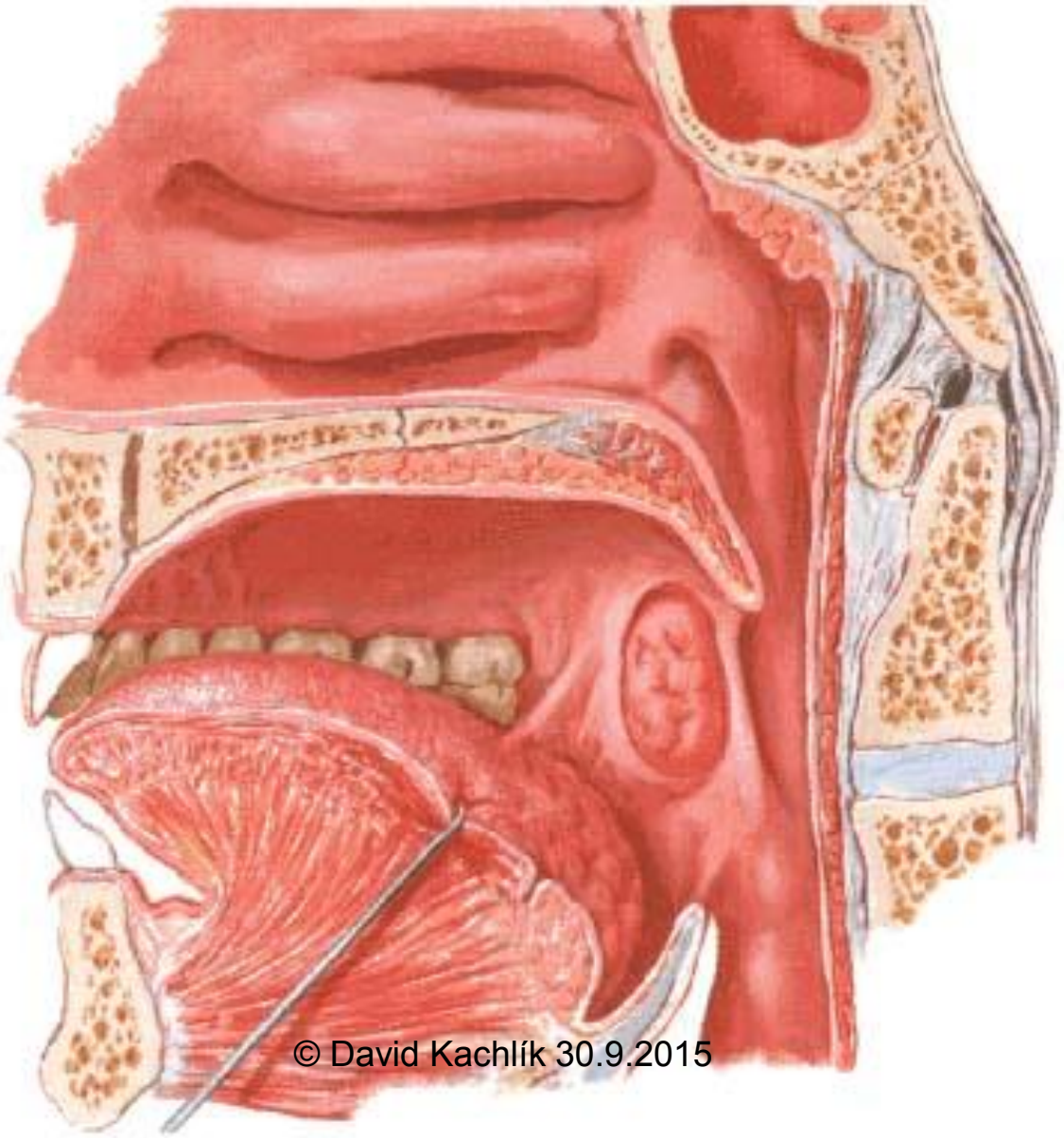
- ostium tubae auditivae
  - tuba auditiva = auditory tube, salpinx, tuba pharyngotympanica, tuba *Eustachii*
  - at the level of the inferior nasal meatus
  - spread of an infection into the tympanic cavity!
- sinus *Morgagni*
  - weakened part of the wall by the entrance of tuba auditiva
  - spread of different processes into spatium parapharyngeum
- recessus pharyngeus *Rosenmülleri*
  - dorsally to torus tubarius – badly transparent by posterior rhinoscopy
- tonsilla tubaria *Gerlachi*
  - at the opening of Eustachian tube



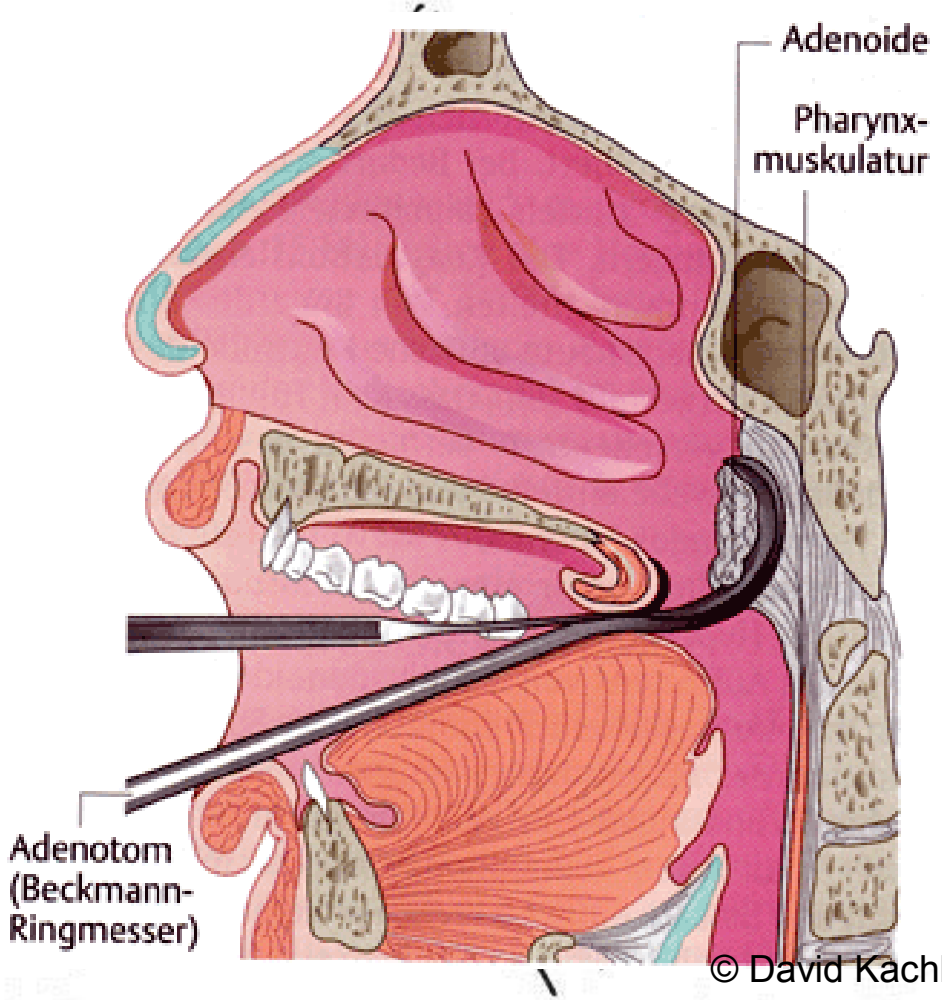


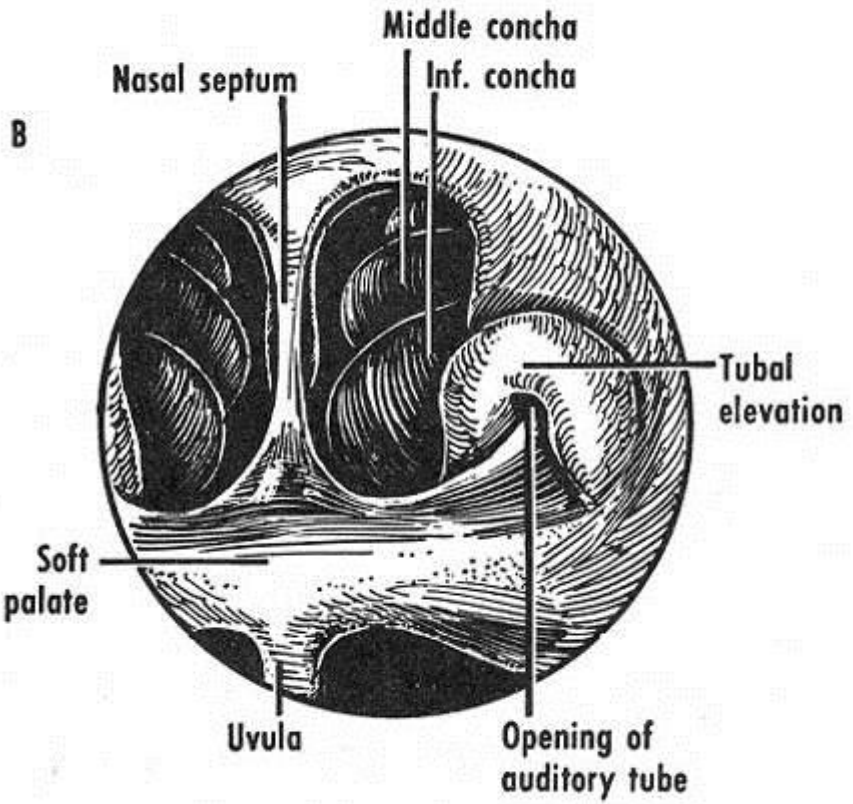
Nasopharynx

Medial Sagittal View



Nasopharynx – *examination, adenotomy*



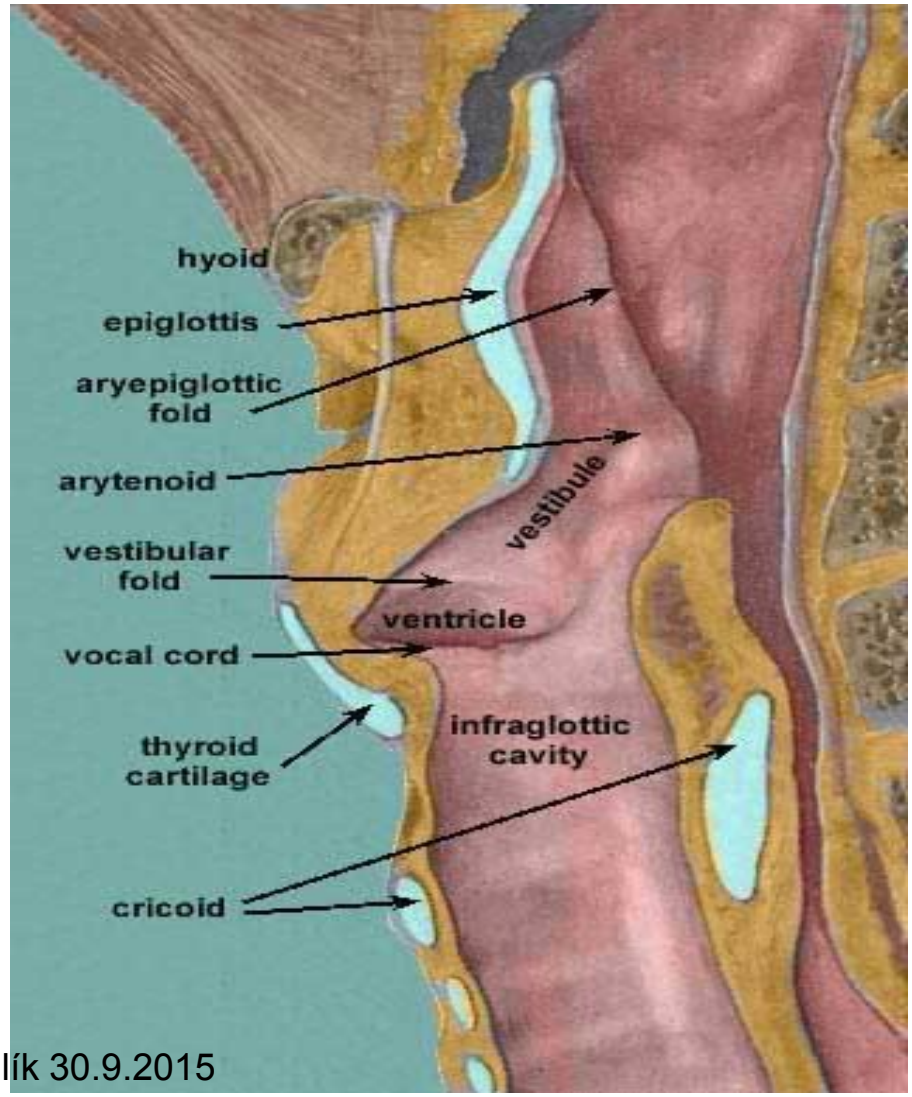


LARYNX

Larynx

- unpaired hollow cartilaginous organ
- sandglass-like shaped
- starts ventrally to pars laryngea pharyngis
- suspended by the hyoid bone and ligaments on the base of the skull

- breathing (*respiration*) and formation of the voice (*phonation*)



Larynx - *cartilages*

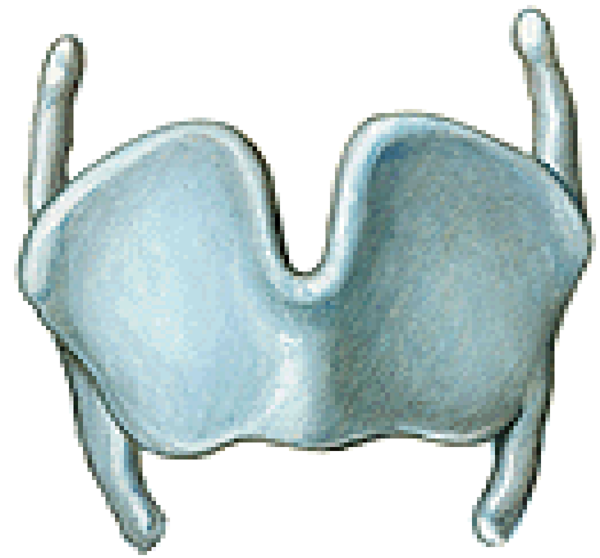
Unpaired:

- cartilago thyroidea (thyroid cartilage)
- cartilago cricoidea (cricoid cartilage)
- cartilago epiglottica (epiglottic cartilage)

Paired:

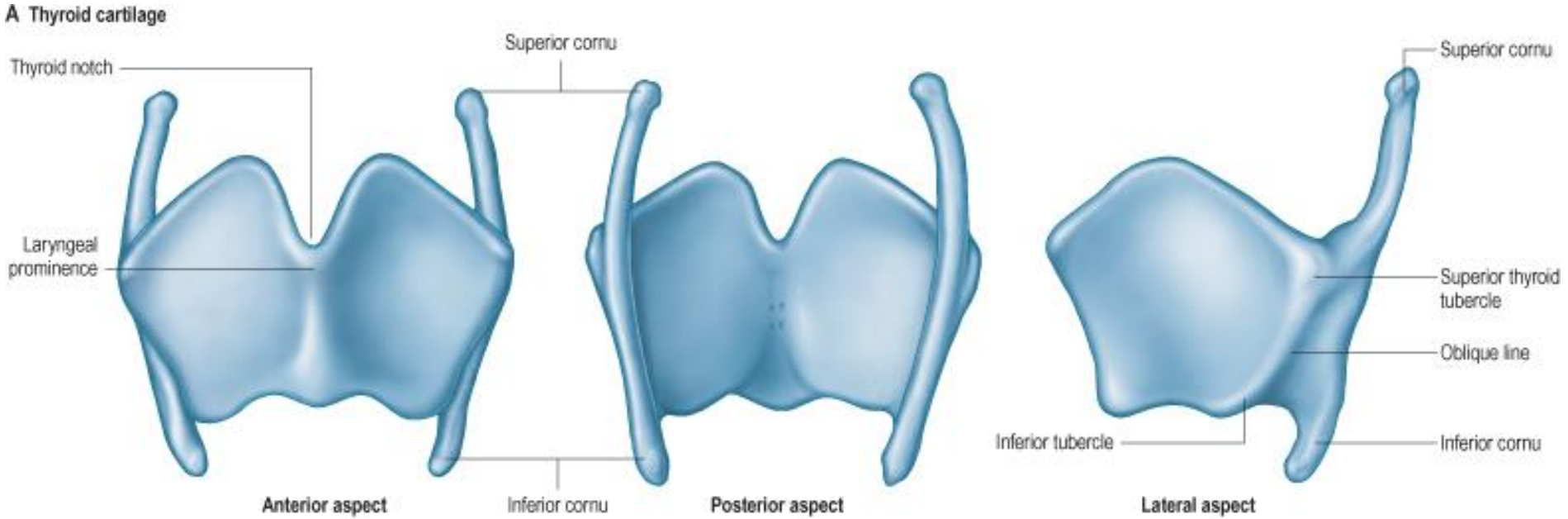
- cartilago arytenoidea (arytenoid cartilage)
- cartilago corniculata *Santorini*
- cartilago cuneiformis *Wrisbergi*
- cartilago triticea
- cartilago sesamoidea (in lig. vocale, plica interarytenoidea)

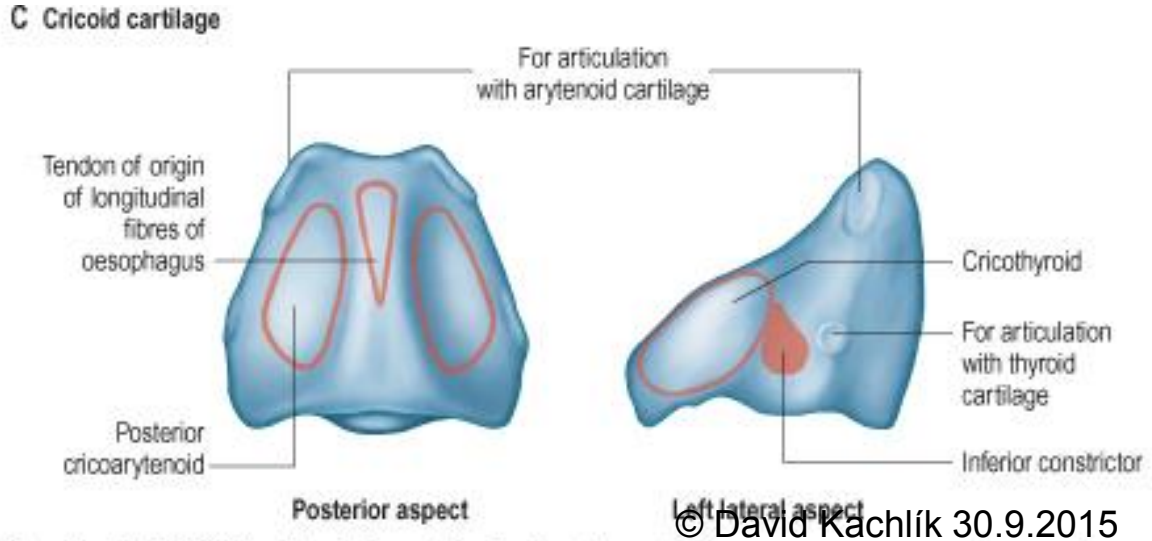
Thyroid cartilage (*cartilago thyroidea*)

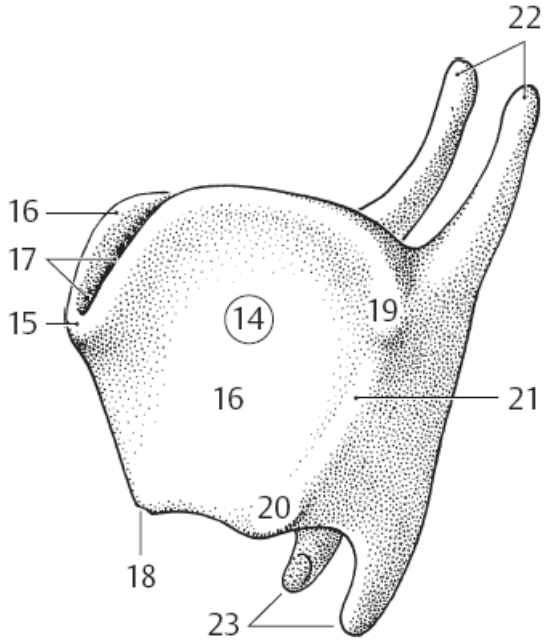


- lamina dextra + sinistra
- prominetia laryngis
- incisura superius + inferius
- cornu superius + inferius
- linea obliqua
- tuberculum thyroideum superius + inferius
- facies articularis cricoidea
- (foramen thyroideum)

ossification from the puberty (ossification centres have typical shape and spreading) → anthropology, forensic medicine







Cartilages of Larynx

Anterior View

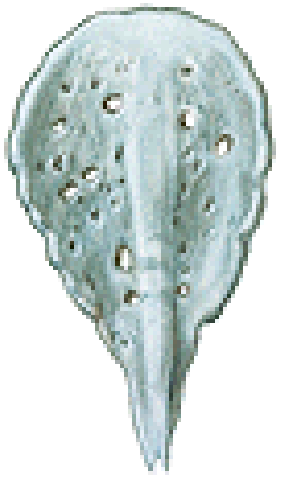
Cartilages of Larynx

Posterior View

Larynx
unpaired cartilages

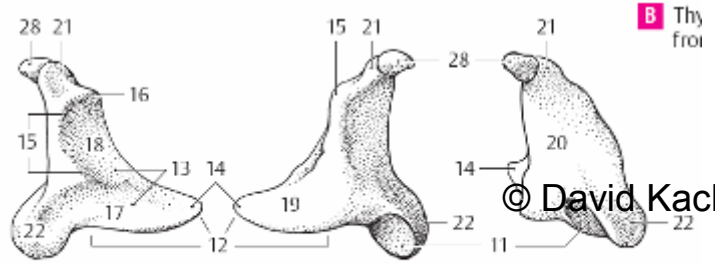
- **criocoid c. (*cartilago cricoidea*)**
  - arcus
  - lamina
  - facies articularis thyroidea
  - facies articularis arytenoidea

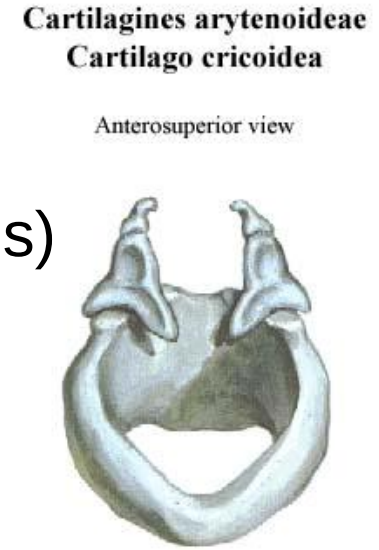
- **epiglottic c. (*cartilago epiglottica*)**
  - petiolus (stalk)
  - tuberculum
  - *elastic cartilage*



Arytenoid cartilage (*cartilago arytenoidea*)

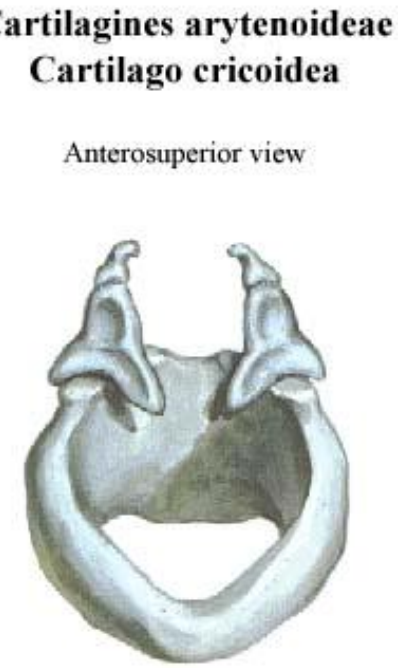
- basis (facies articularis *for cartilago cricoidea*)
- apex (m. transversus obliquus)
- processus vocalis (lig. vocale, m. vocalis)
- processus muscularis (m. cricoarytenoideus lat. + post., m. arytenoideus transversus + obliquus)
- facies medialis, posterior, **anterolateralis,**
  - cranially: fovea triangularis (glands)
  - colliculus, crista arcuata
  - caudally: fovea oblonga (m. thyroarytenoideus)





Larynx
paired cartilages

- cartilago corniculata *Santorini*
- cartilago cuneiformis *Wrisbergi*
  - both are *fibroelastic*
  - elongate apex cartilaginis arytenoideae
    - apex → c. corniculata → c. cuneiformis
- cartilago triticea
- cartilago sesamoidea (in lig. vocale, plica interarytenoidea)



Larynx – *joints*

articulatio cricoarytenoidea

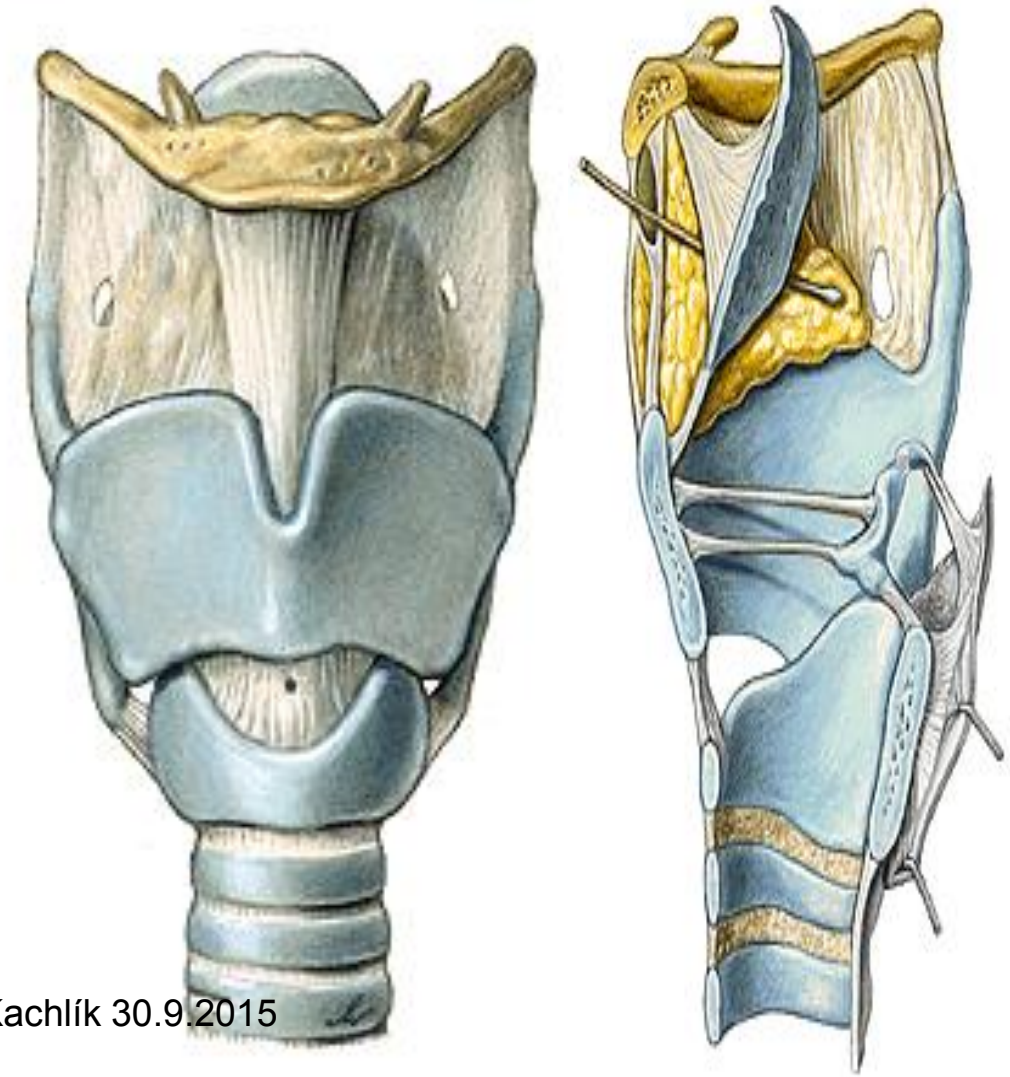
- *elipsoid*
- lig. cricoarytenoideum

articulatio cricothyroidea

- *spheroid*
- lig. ceratocricoideum

Larynx
ligaments

- membrana thyrohyoidea
- lig. thyrohyoideum lat. + medianum
- lig. cricothyroideum medianum
- lig. cricotracheale
- lig. cricopharyngeum
- lig. thyroepiglotticum
- lig. hyoepiglotticum
- *corpus adiposum preepiglotticum*
- *bursa retrohyoidea + infrahyoidea*
- **lig. vocale**
- **conus elasticus**

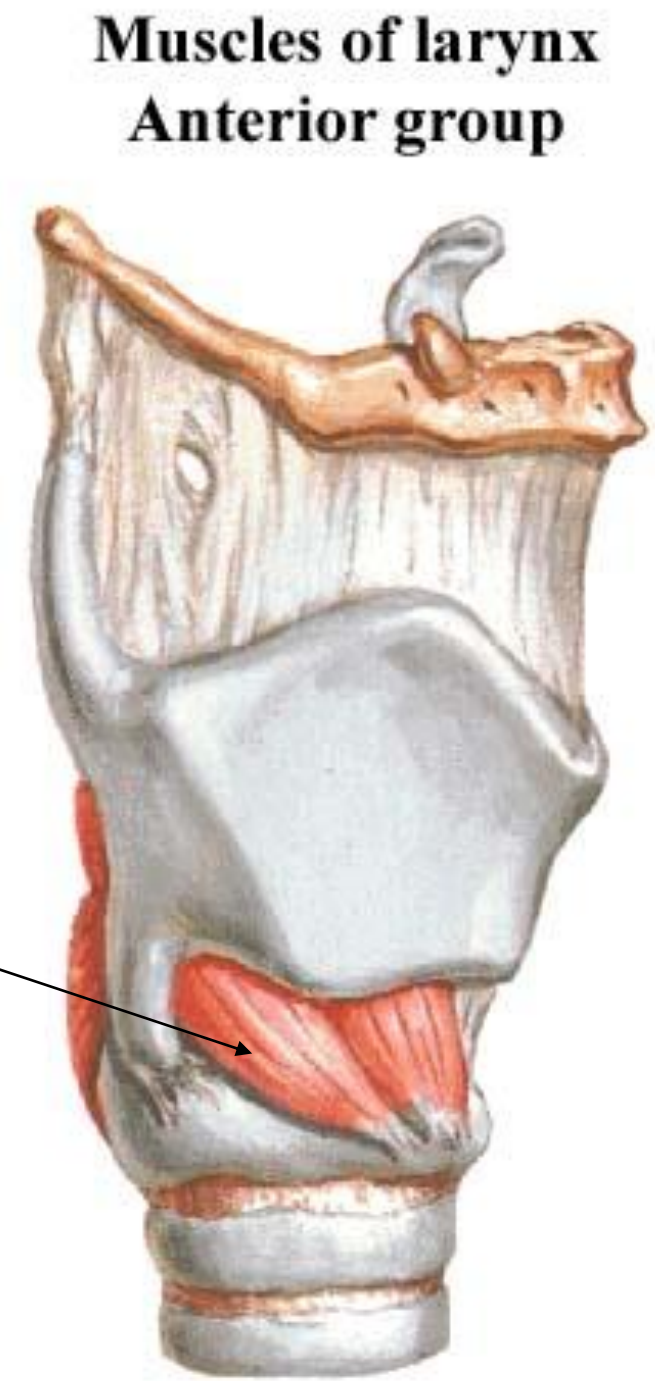


Larynx – *muscles*

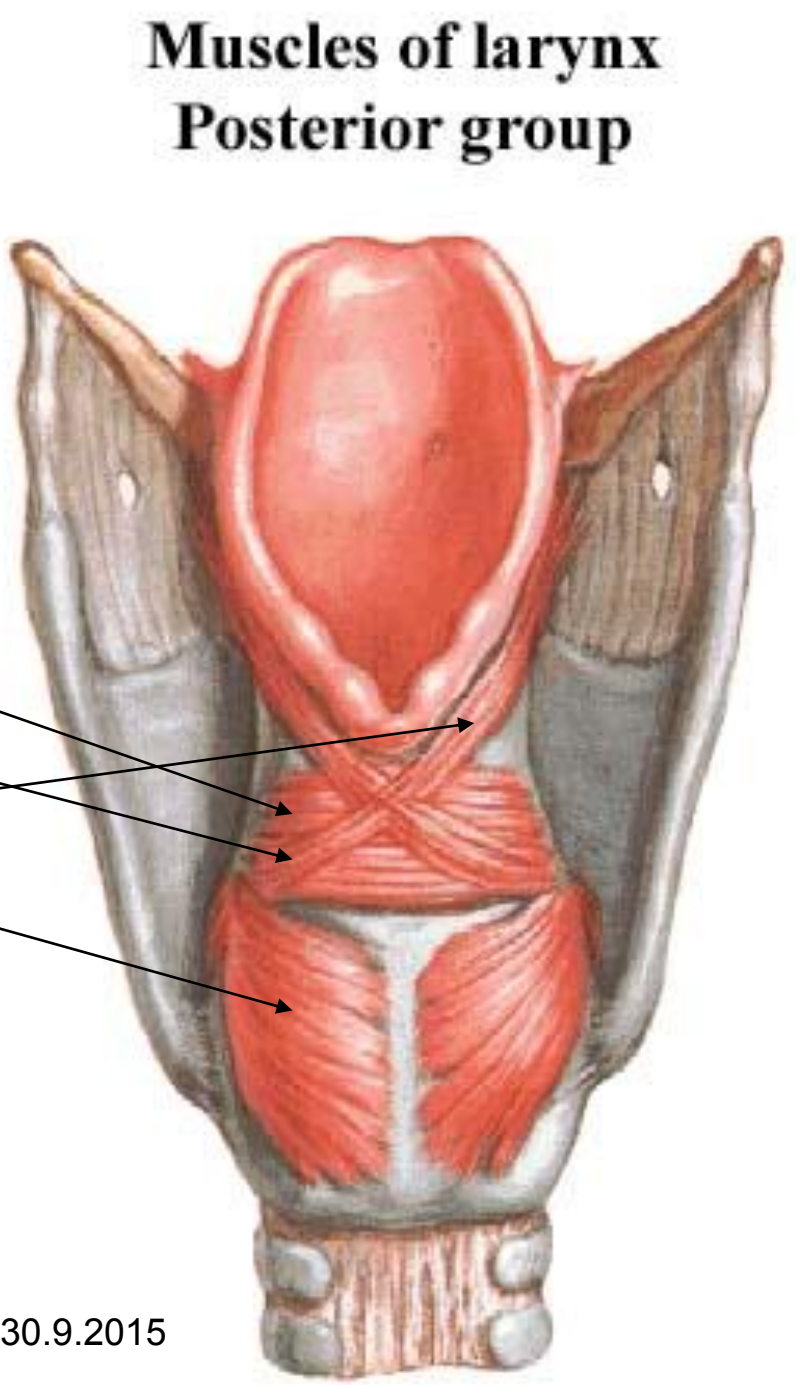
anterior group

- musculus cricothyroideus

← n. laryngeus sup.



Larynx – *muscle*



posterior group

- m. arytenoideus transversus
- m. arytenoideus obliquus
  - pars aryepiglottica
- m. cricoarytenoideus post.
  - the only laryngeal muscle opening the rima glottidis

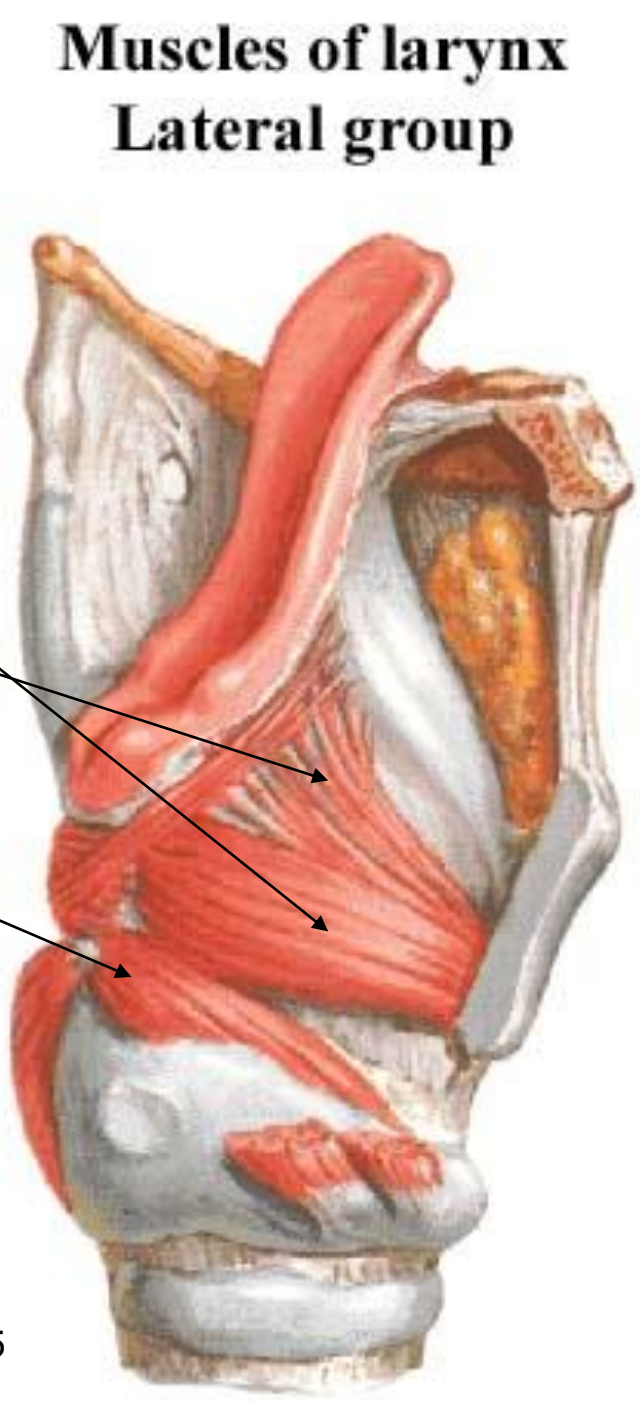
← n. laryngeus recurrens

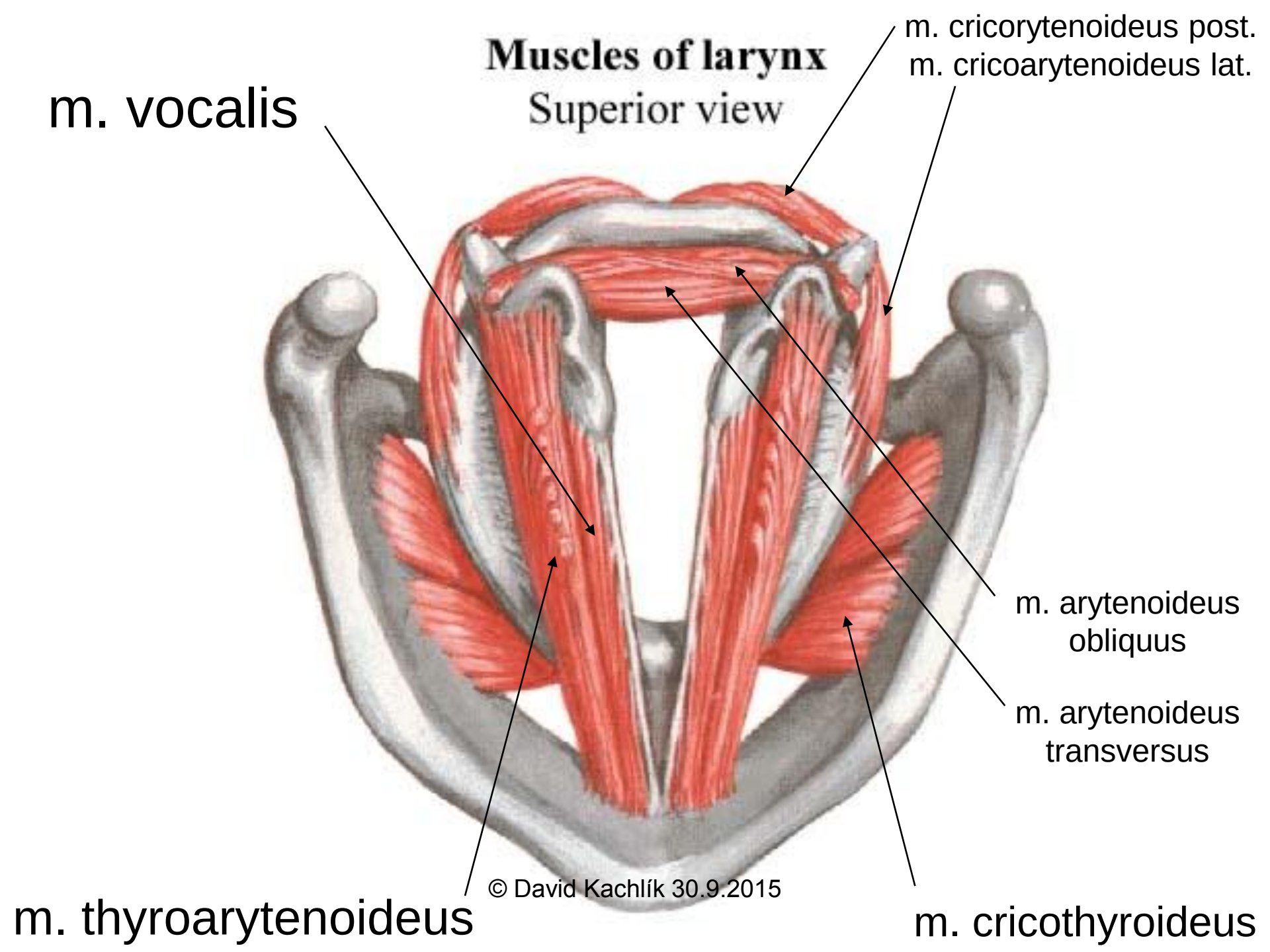
Larynx – *muscles*

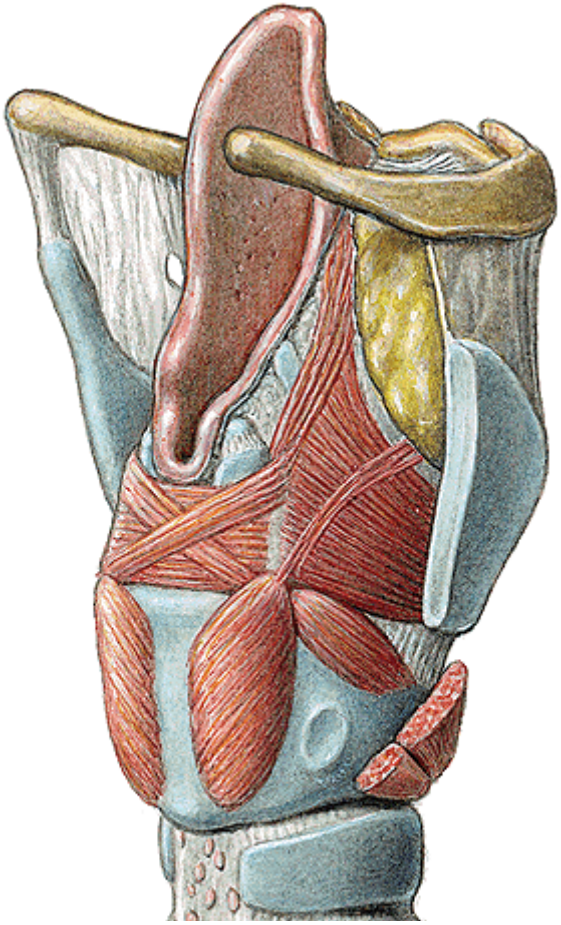
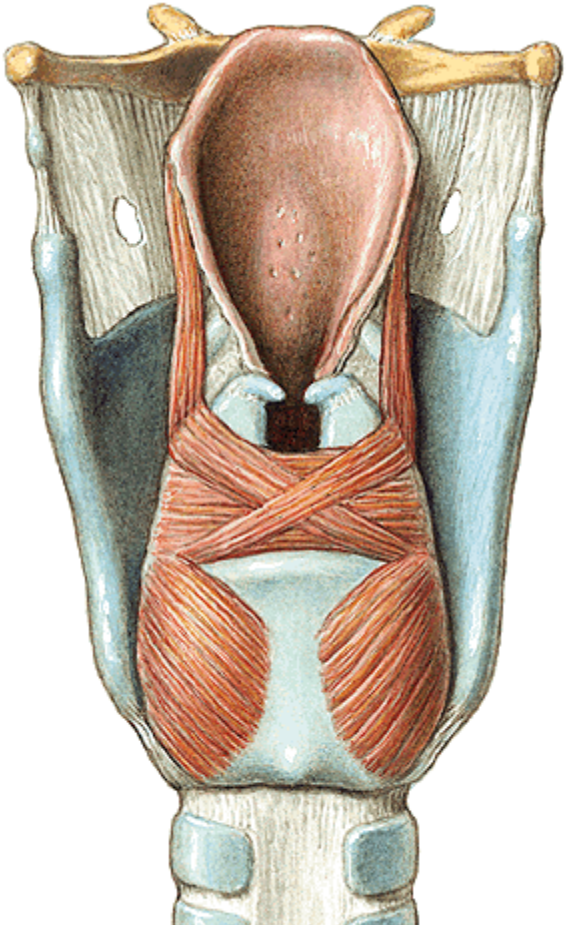
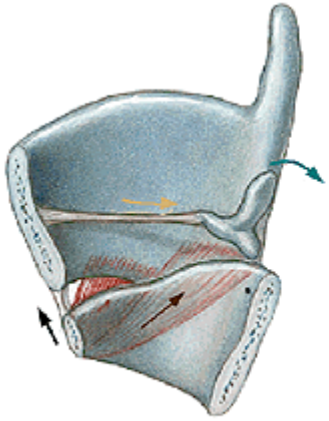
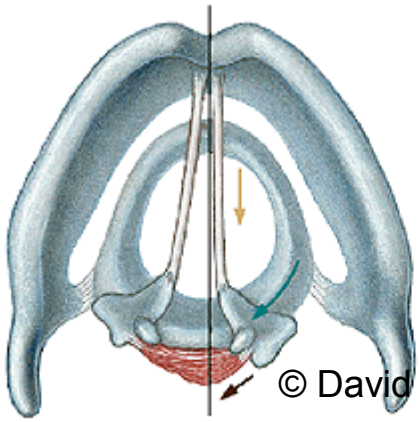
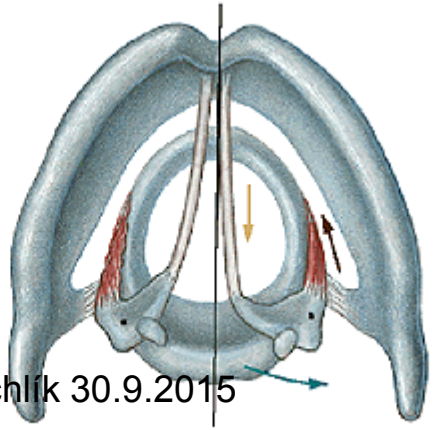
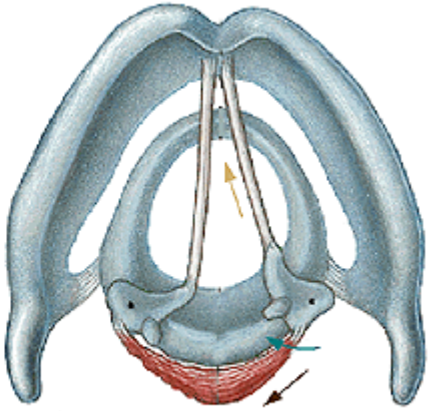
lateral group

- m. thyroarytenoideus
  - pars thyroepiglottica
- m. vocalis
- m. cricoarytenoideus lat.

← n. laryngeus recurrens





Larynx *actions*

vocal cords

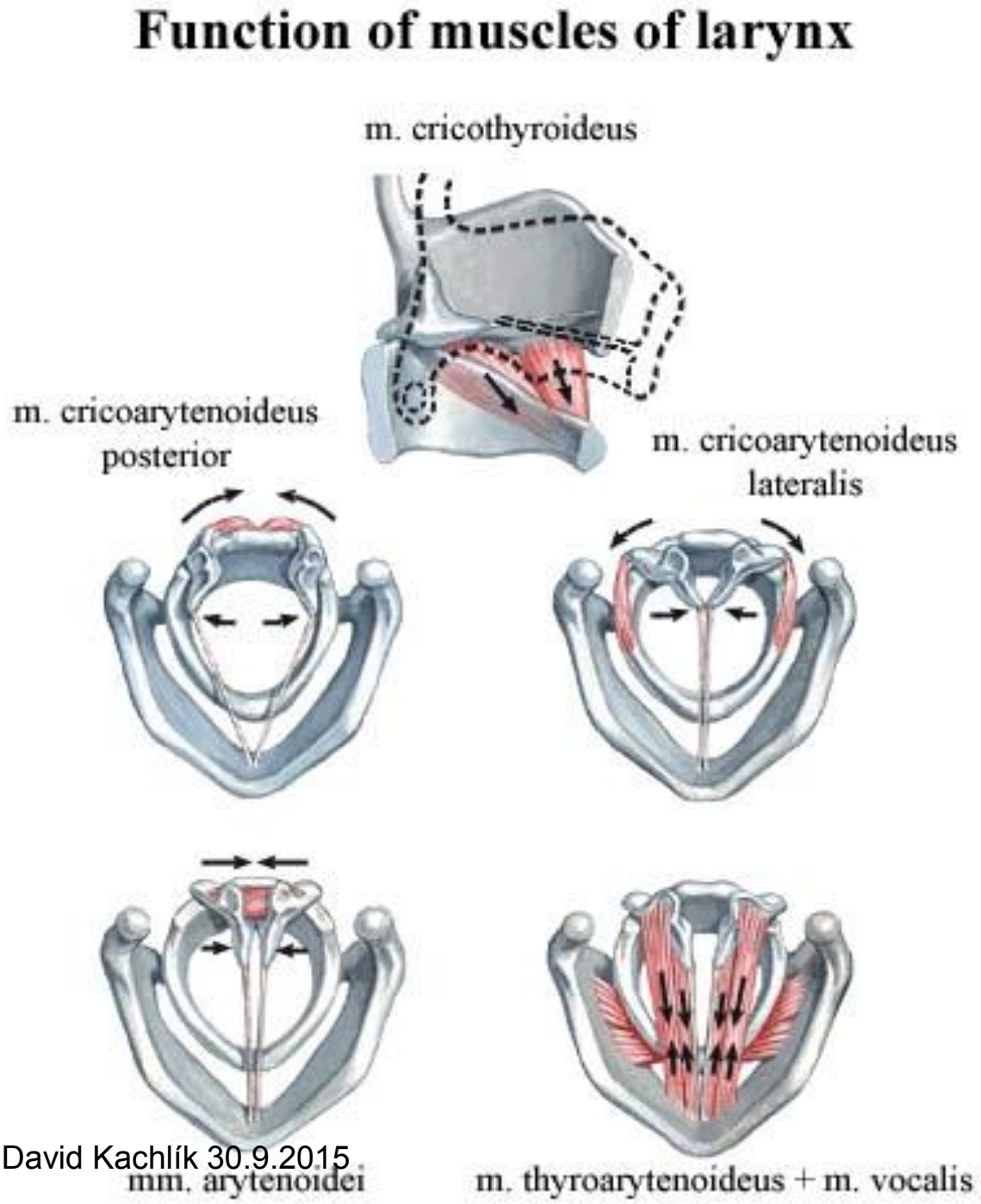
rotation: medial x lateral

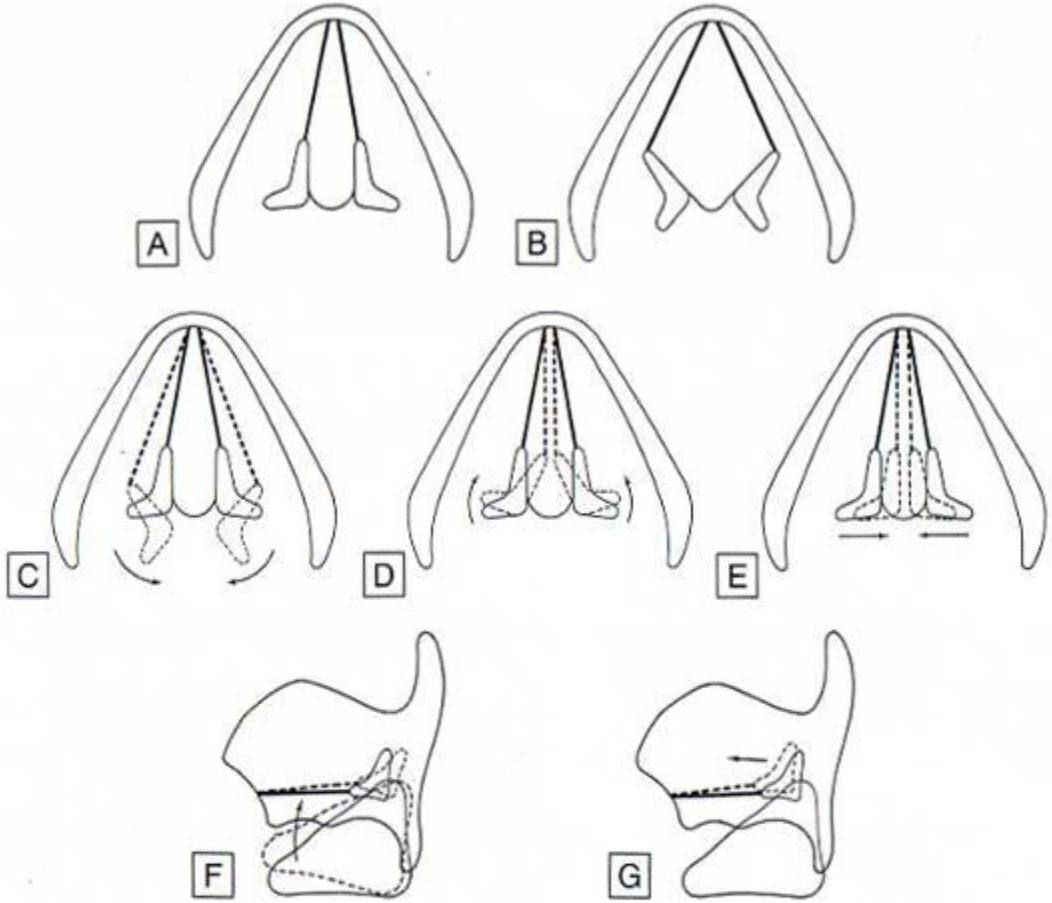
abduction x adduction

shortening x prolongation

aditus laryngis

narrowing x widening





11.28 Different positions of the vocal folds and arytenoid cartilages.

A Position of rest in quiet respiration. The intermembranous part of the rima glottidis is triangular and the intercartilaginous part is rectangular in shape.

B Forced inspiration. Both parts of the rima glottidis are triangular in shape.

C Abduction of the vocal folds. The arrows indicate the lines of pull of the posterior crico-arytenoid muscles. The abducted vocal folds and the abducted, retracted and laterally rotated arytenoid cartilages are shown in dotted outline. Both parts of the rima glottidis are triangular.

D Adduction of the vocal folds. The arrows indicate the lines of pull of the lateral crico-arytenoid muscles. The adducted vocal folds and the medially rotated arytenoid cartilages are shown in dotted outlines.

E Closure of the rima glottidis. The arrows indicate the line of pull of the transverse arytenoid muscle. Both the vocal folds and the arytenoid cartilages are adducted, but there is no rotation of the latter.

F Tension of the vocal folds, produced by the action of the cricothyroid muscles which tilt the anterior part of the cricoid cartilage cranially and so carry the arytenoid cartilages dorsally.

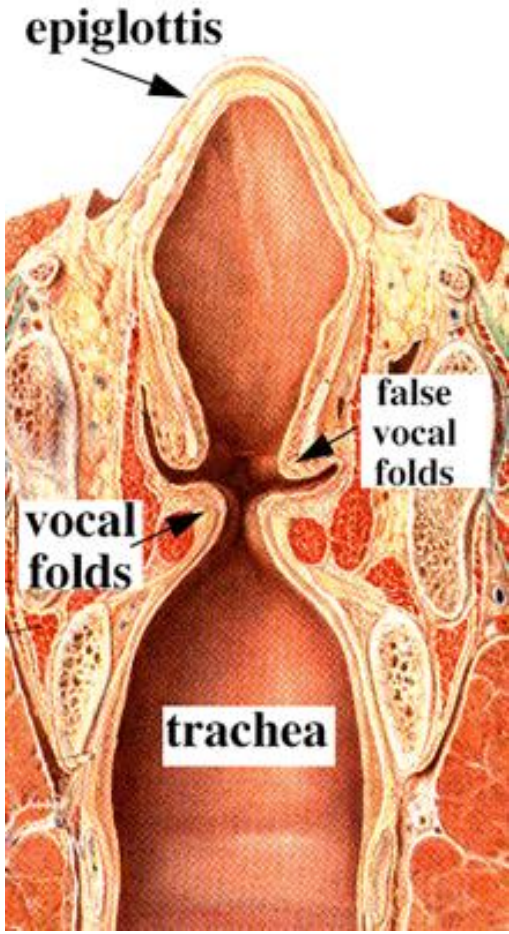
G Relaxation of the vocal folds, produced by the action of the thyroarytenoid muscles, which draw the arytenoid cartilages ventrally.

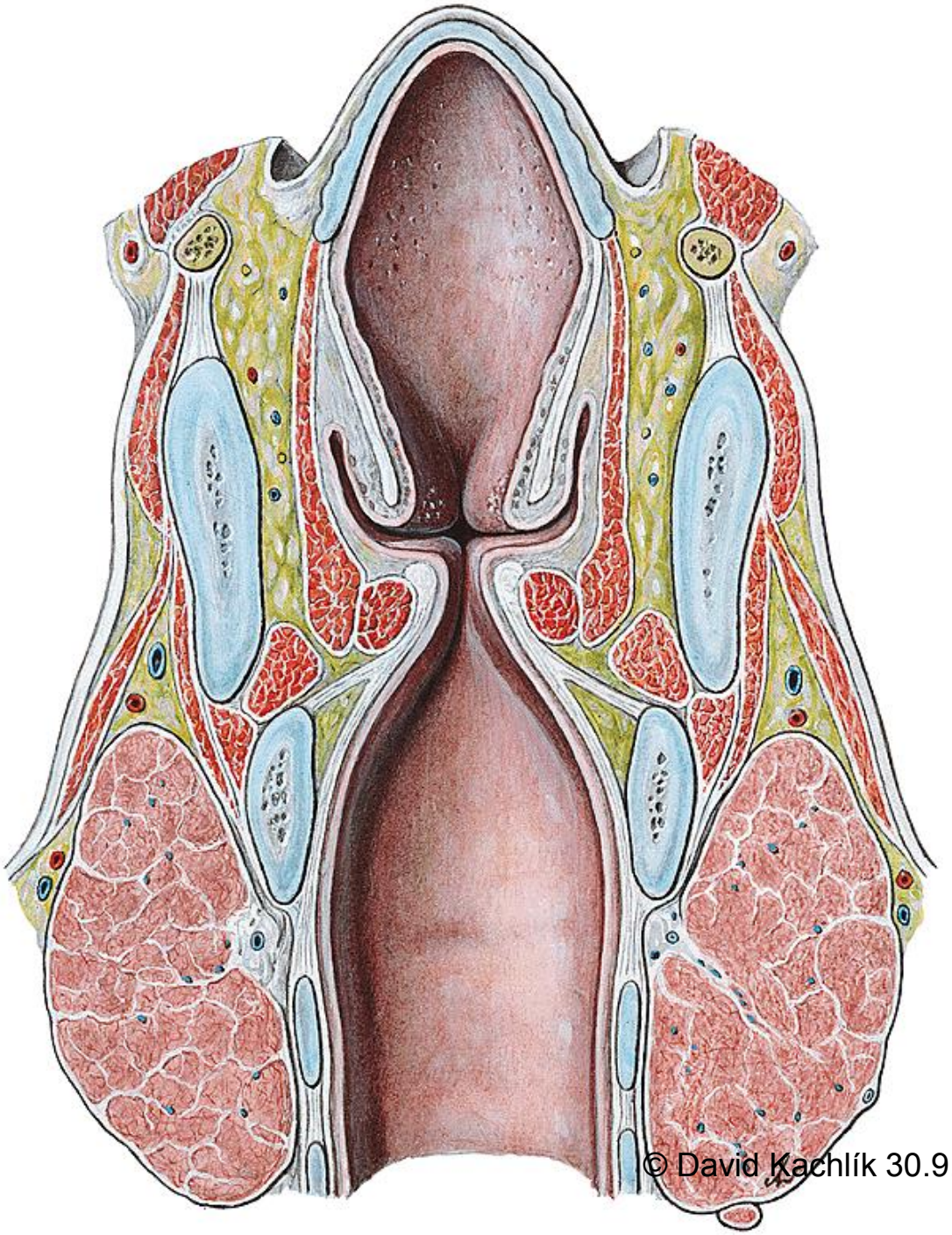
Larynx – *cavity*

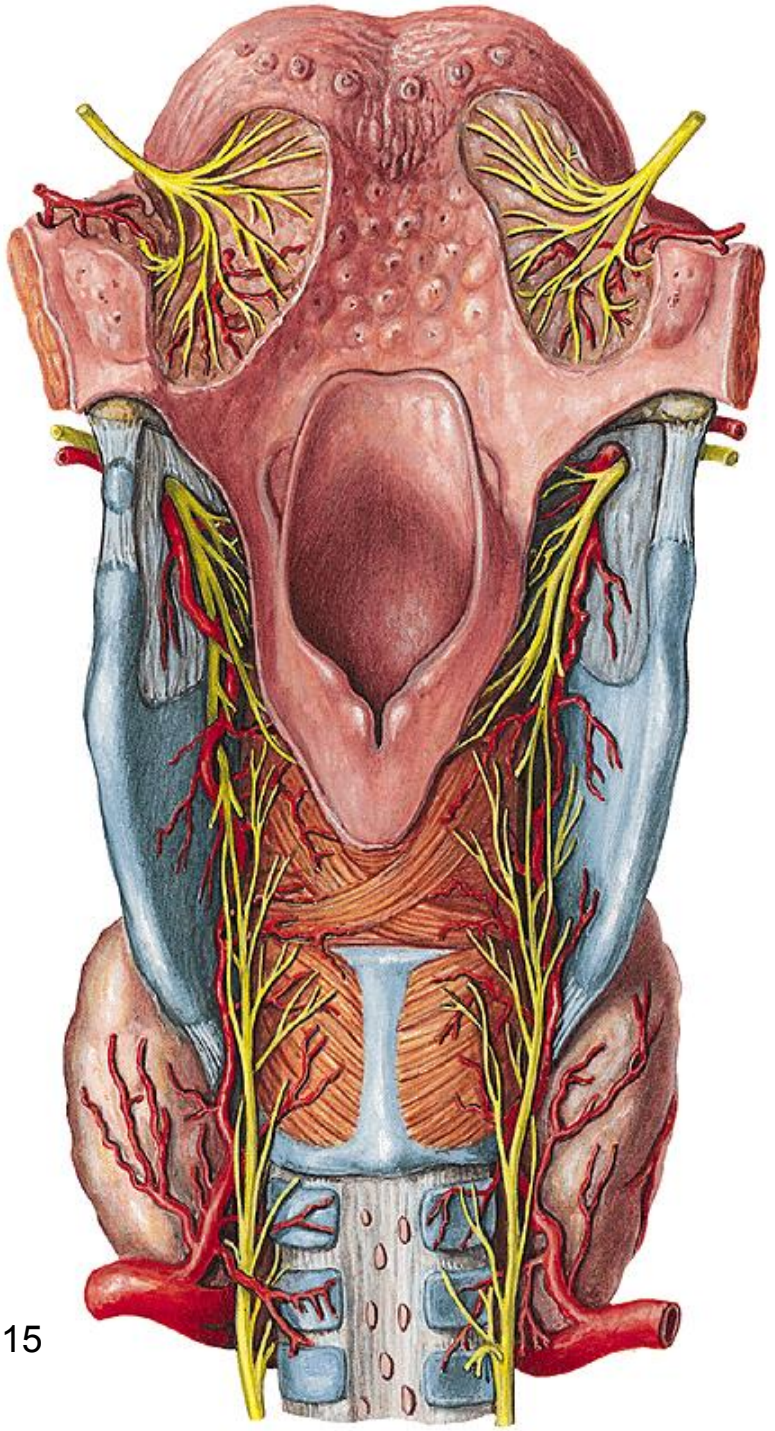
there are valleculae epiglotticae above the inlet

separated by plicae glossoepiglotticae mediana + laterales

- <u>aditus (inlet)</u>
  - epiglottis
  - incisura interarytenoidea
  - plica aryepiglottica – tuberculum corniculatum + cuneiforme
- <u>vestibulum (vestibule)</u> („*supraglottis*“)
  - plicae vestibulares („false vocal folds“)
    - formed by lig. vestibularia – false vocal folds
  - rima vestibuli
  - ventriculus, (sacculus – *newborn, monkey*)

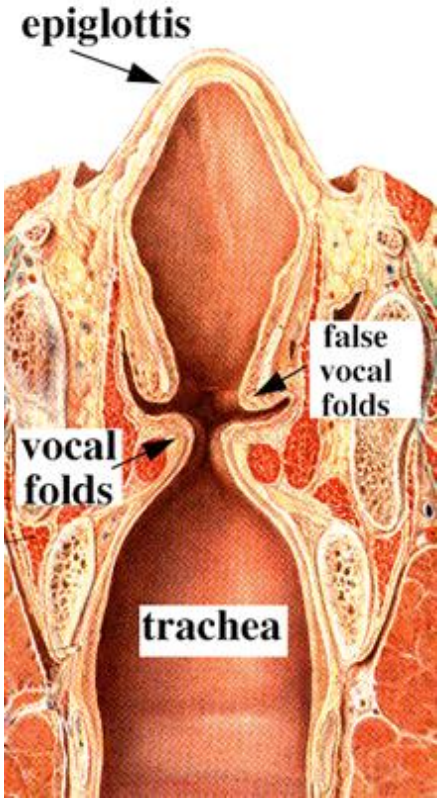






Larynx – *cavity*

- glottis
  - plicae vocales („true“ vocal folds)
  - rima glottidis
    - pars intermembranacea
    - pars intercartilaginea
    - pars interarytenoidea
    - the narrowest point in adults
- cavitas infraglottica („*subglottis*“)
  - the narrowest point in children



Larynx – *vascular supply*

- arteries:
  - a. carotis ext. → a. thyroidea sup. → a. laryngea sup.
  - a. subclavia → a. thyroidea inf. → a. laryngea inf.

  r. cricothyroideus of both sides anastomoses below the cricoid cartilage
- veins:
  - the blood flows into the veins of the thyroid gland, along the arteries
- lymph drainage:
  - nodi lymphoidei cervicales profundi

Larynx - *innervation*

- **n. vagus** (n. X)

motor, sensory, parasympathetic fibres (glands)

→ n. laryngeus **sup.** → r. ext. → *m. cricothyroideus*

→ r. internus → through membrana thyrohyidea / cartilago thyroidea → *mucosa above rima glottidis*

→ n. laryngeus **recurrens** → *for other muscles and the mucosa*

(connection between sensory branches of both nerves = Galenos anastomosis)

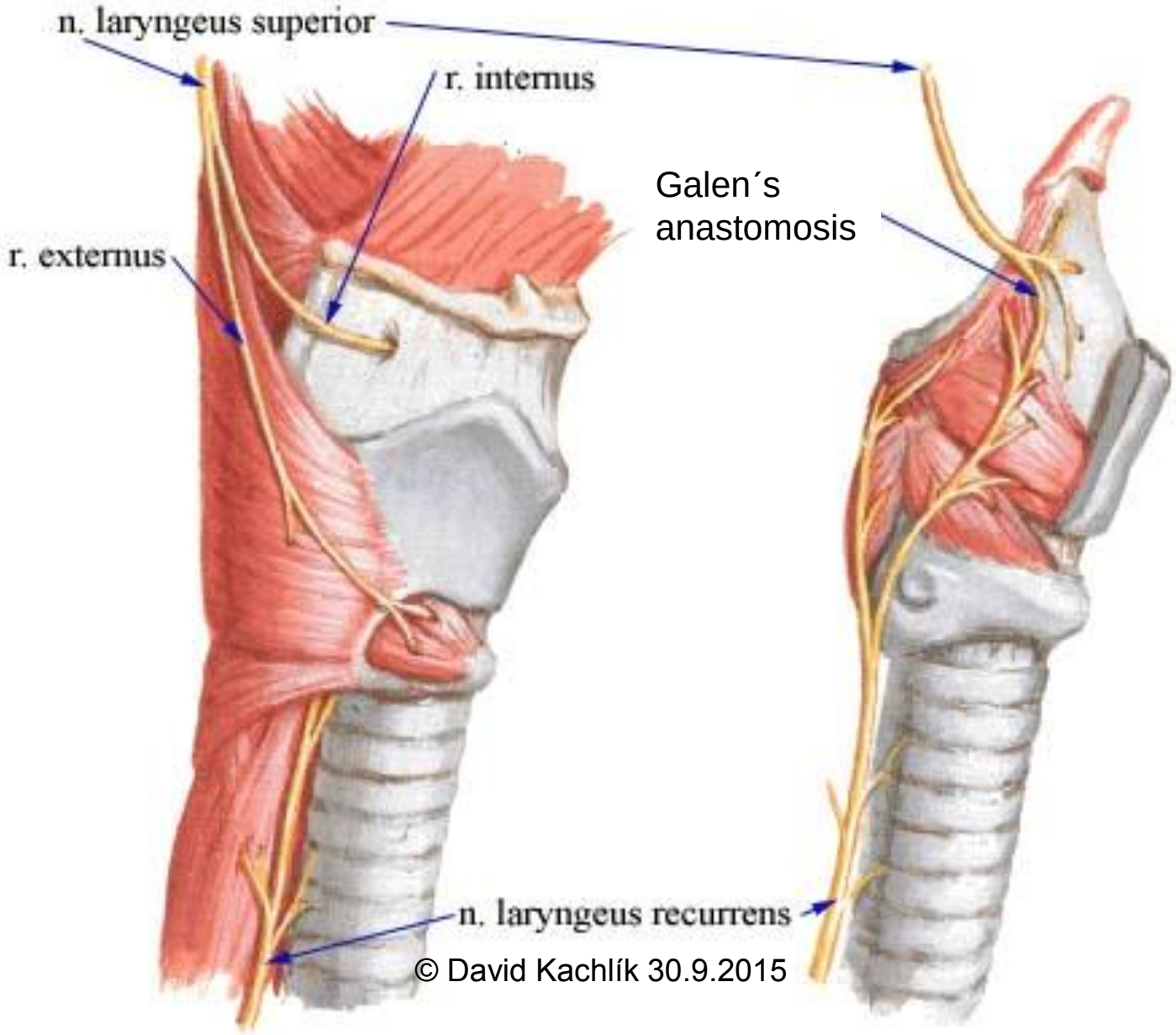
- **truncus sympathicus**

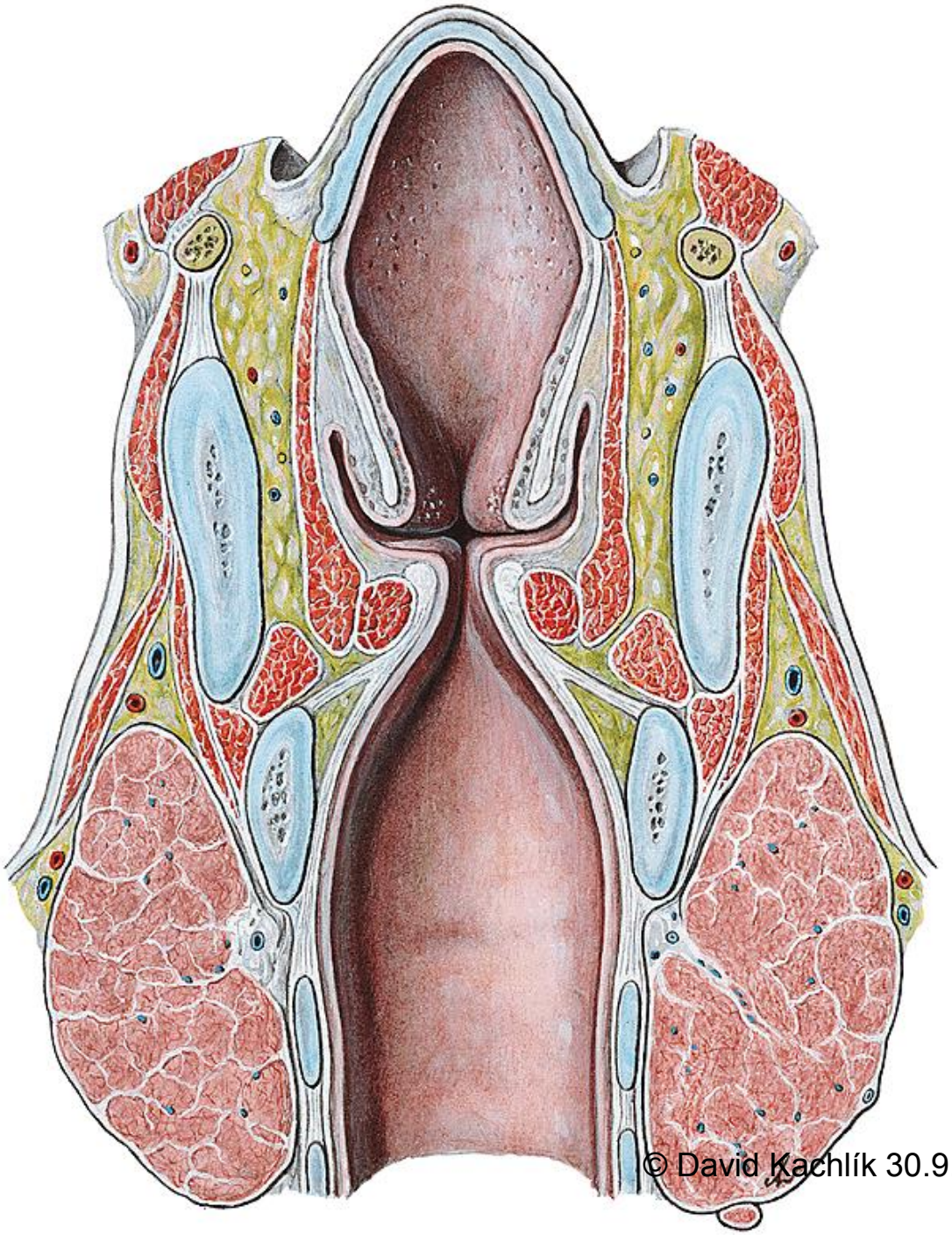
sympathetic fibers (glands)

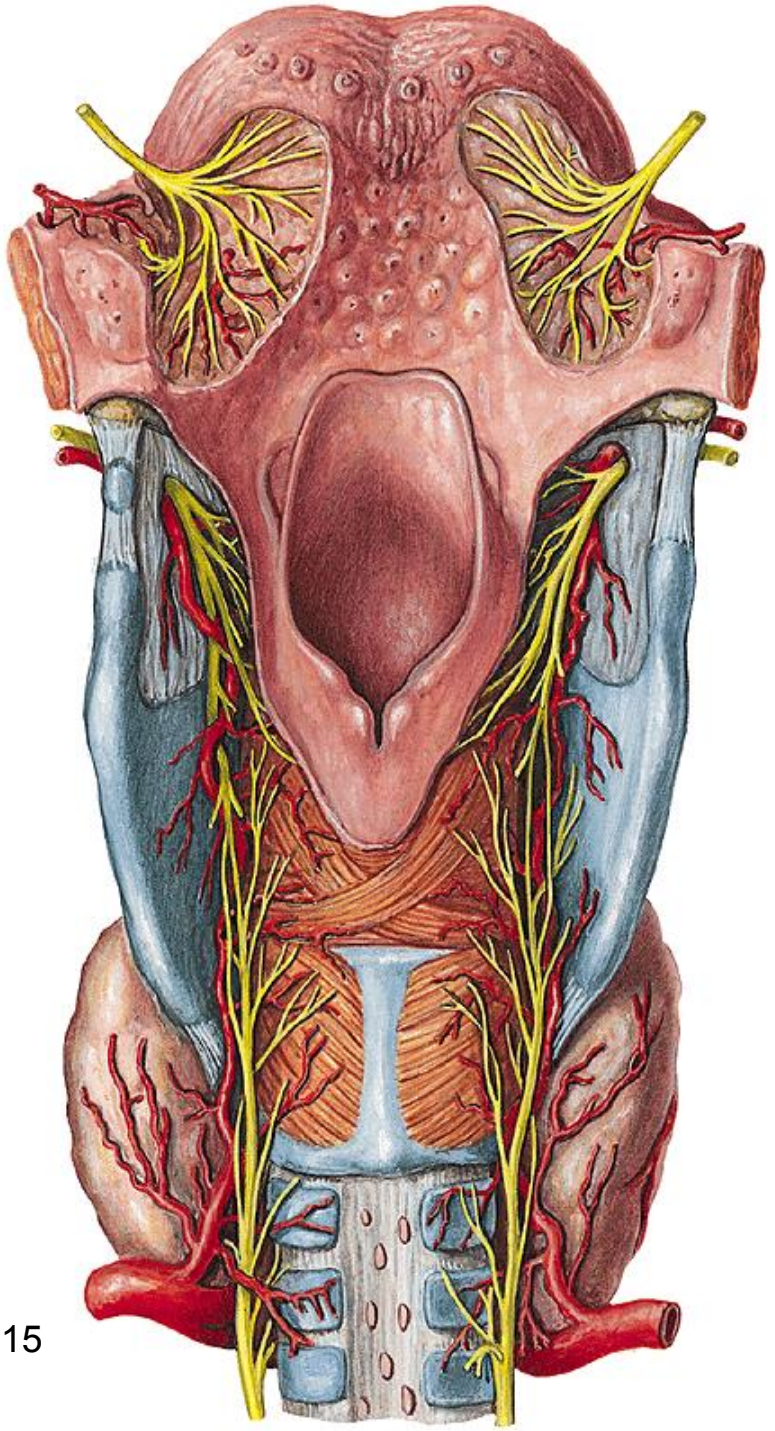
→ ggl. cervicale superius → rr. laryngopharyngei

Nerves of Larynx

Right Lateral Views

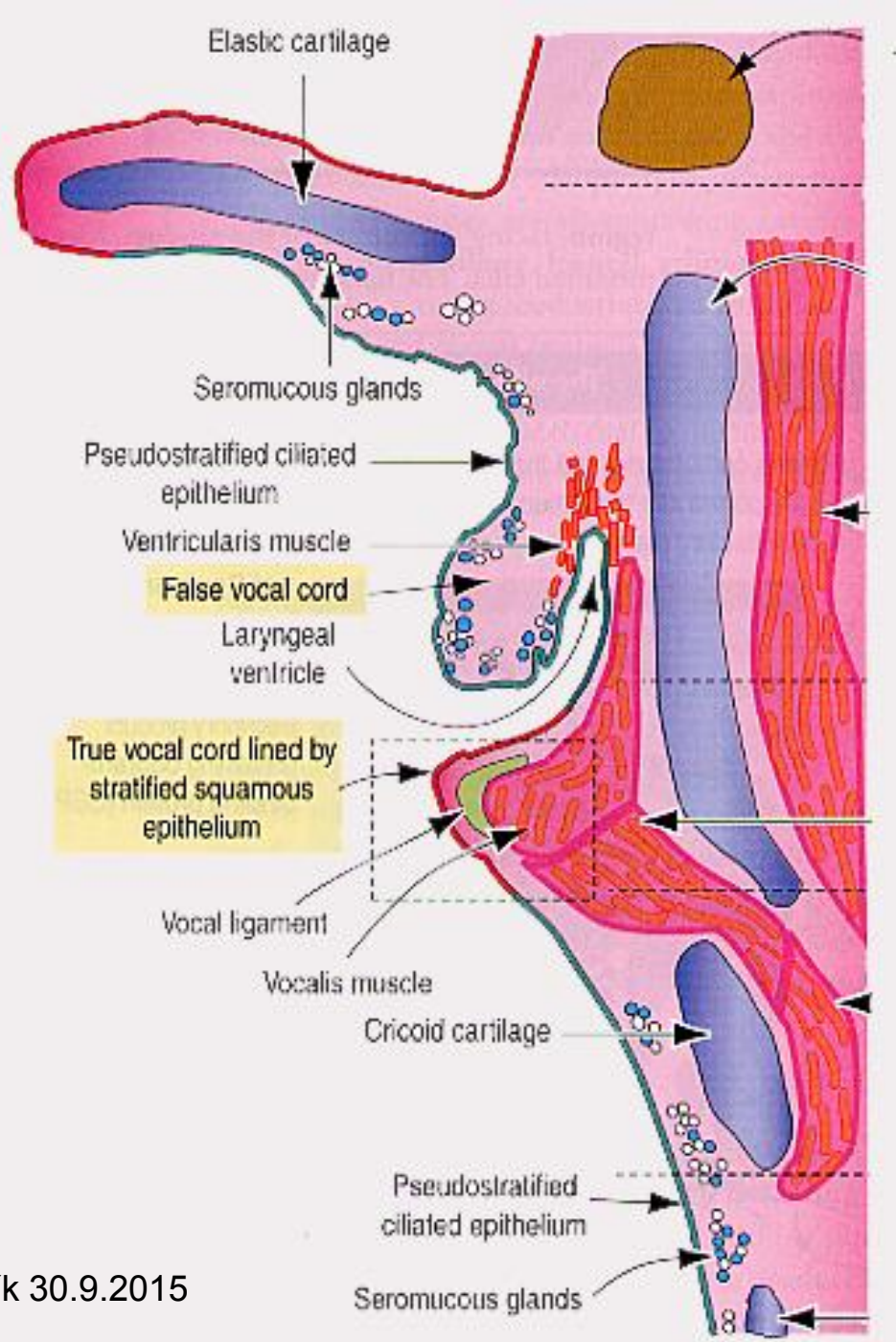




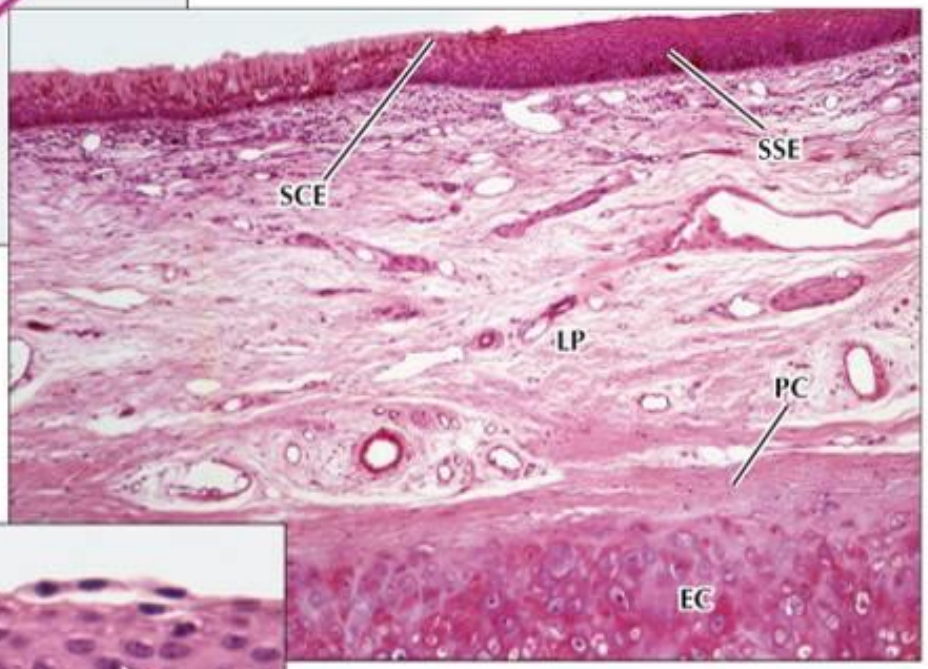


Larynx – *structure*

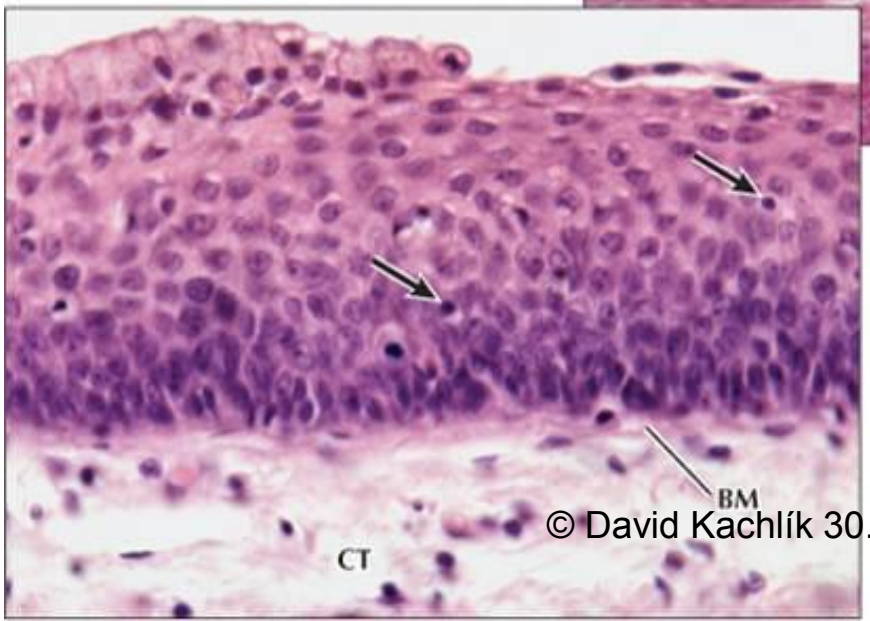
- epithelium on epiglottis:
  - lingual surface
    - nonkeratinized stratified squamous epithelium
  - laryngeal surface
    - respiratory epithelium
- epithelium on plicae vestibulares
  - respiratory epithelium
- epithelium on plicae vocales
  - nonkeratinized stratified squamous epithelium



◀ **LM of the tip of the epiglottis at low magnification.** The epiglottis has a core of elastic cartilage (**EC**). Its lingual surface (at bottom) and free margin (upper right) are covered by nonkeratinized stratified squamous epithelium. Halfway along the laryngeal surface (**arrow**), the epithelium undergoes a transition; it eventually becomes respiratory epithelium. 15×. *H&E.*



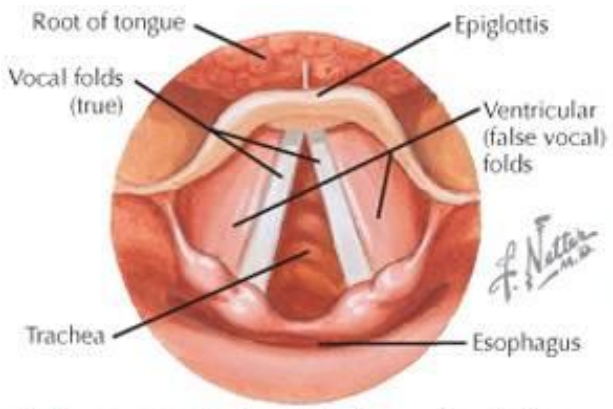
► **LM of part of the epiglottis.** Although the transition is difficult to visualize at this power, the epithelium (at top) undergoes an abrupt change from stratified squamous (**SSE**) to stratified columnar (**SCE**). The lamina propria (**LP**) is highly cellular and contains many blood vessels and nerves. Elastic cartilage (**EC**) covered by perichondrium (**PC**) is below. 70×. *H&E.*



◀ **Details of the epithelial transition at the laryngeal surface of the epiglottis at high magnification.** Nonkeratinized stratified squamous epithelium (to the right) abruptly changes to stratified columnar epithelium (to the left). Such areas of epithelial transition may be sites of tumor formation. A thin basement membrane (**BM**) separates the epithelium from underlying lamina propria, which consists of loose connective tissue (**CT**). **Arrows** point to several intraepithelial lymphocytes. 500×. *H&E.*

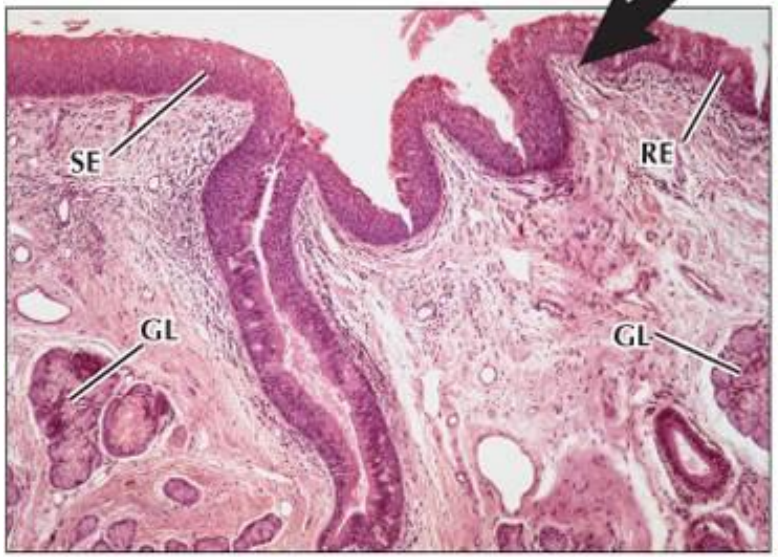
Larynx – *arrangement of wall*

- epithelium firmly adheres at places where the nonkeratinized stratified squamous epithelium is to be found
- mucous connective tissue: membrana fibroelastica
  - vestibulum: membrana quadrangularis (down to plicae vestibulares)
  - cavitas infraglottica: conus elasticus (from plicae vocales to cartilago cricoidea)
  - glandulae laryngis, tonsilla laryngealis
- cartilages – hyaline
  - elastic – *cartilago epiglottica,* fibroelastic - *c. cuneiformis, c. corniculata, apex of processus vocalis c. arytenoideae*
- spatium preepigloticum – fat pad, sparse connective tissue, *surgical approach to epiglottis*

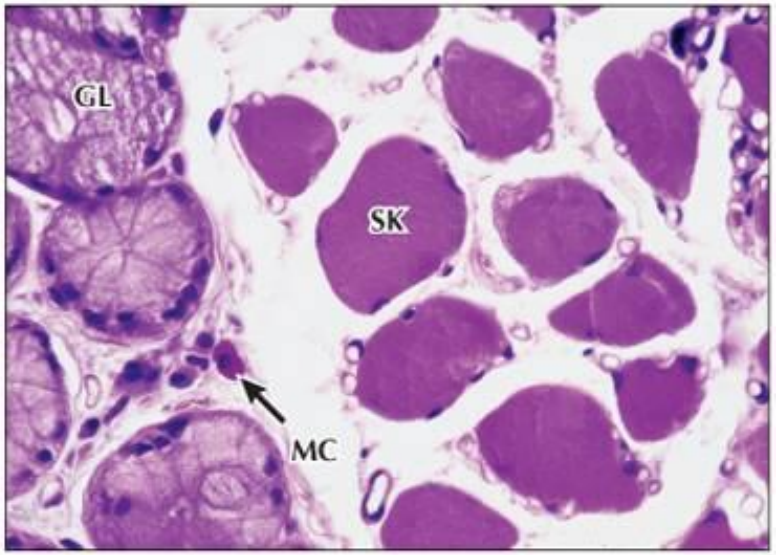


▲ **Laryngoscopic view of the larynx: inspiration.**

► **Frontal section of the larynx.** The vocal cord (**VC**) contains elastic fibers; the false vocal fold (**FF**) contains seromucous glands. Nonkeratinized stratified squamous epithelium covers both folds (**arrows**). An intervening laryngeal ventricle (**LV**) and the vocalis muscle (**VM**) are shown. 15×. *H&E.*



▲ **LM of a ventricular recess in the larynx.** Nonkeratinized stratified squamous epithelium (**SE**) and respiratory epithelium (**RE**) line the mucosal surface. Seromucous glands (**GL**) occupy the lamina propria. 60×. *H&E.*

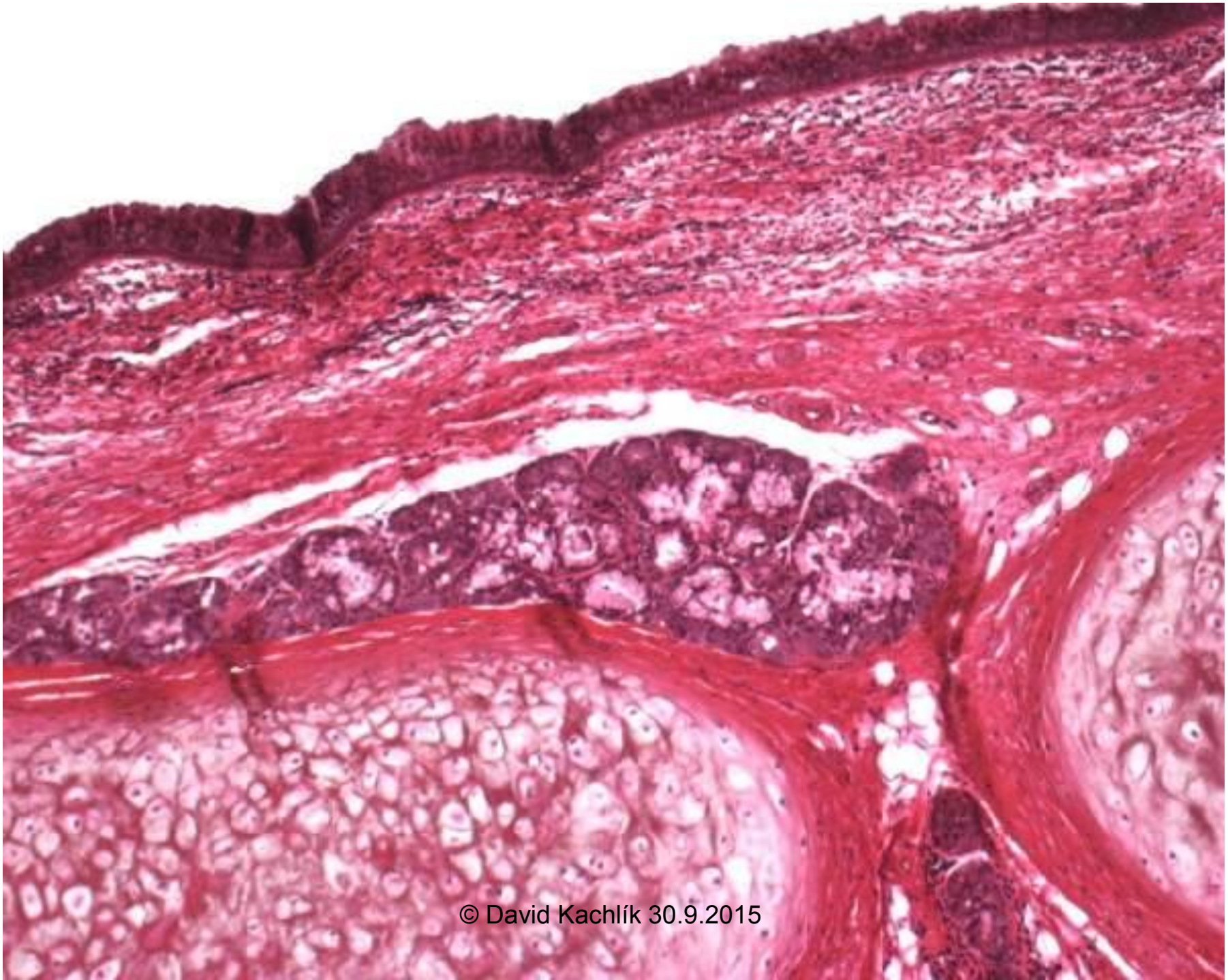


▲ **LM of part of the vocalis muscle of the larynx.** Skeletal muscle fibers (**SK**) in transverse section are close to mucous acini of a gland (**GL**). A mast cell (**MC**) can be seen in the connective tissue. 300×. *H&E.*

Larynx – Reinke´s space

- a space between the vocal ligament and the overlying mucosa
- sparse connective tissue
- *Reinke's edema*
  - a voice disorder from accumulation of gelatinous substance in *Reinke's space*

http://www.voicemedicine.com/reinkes_edema.htm

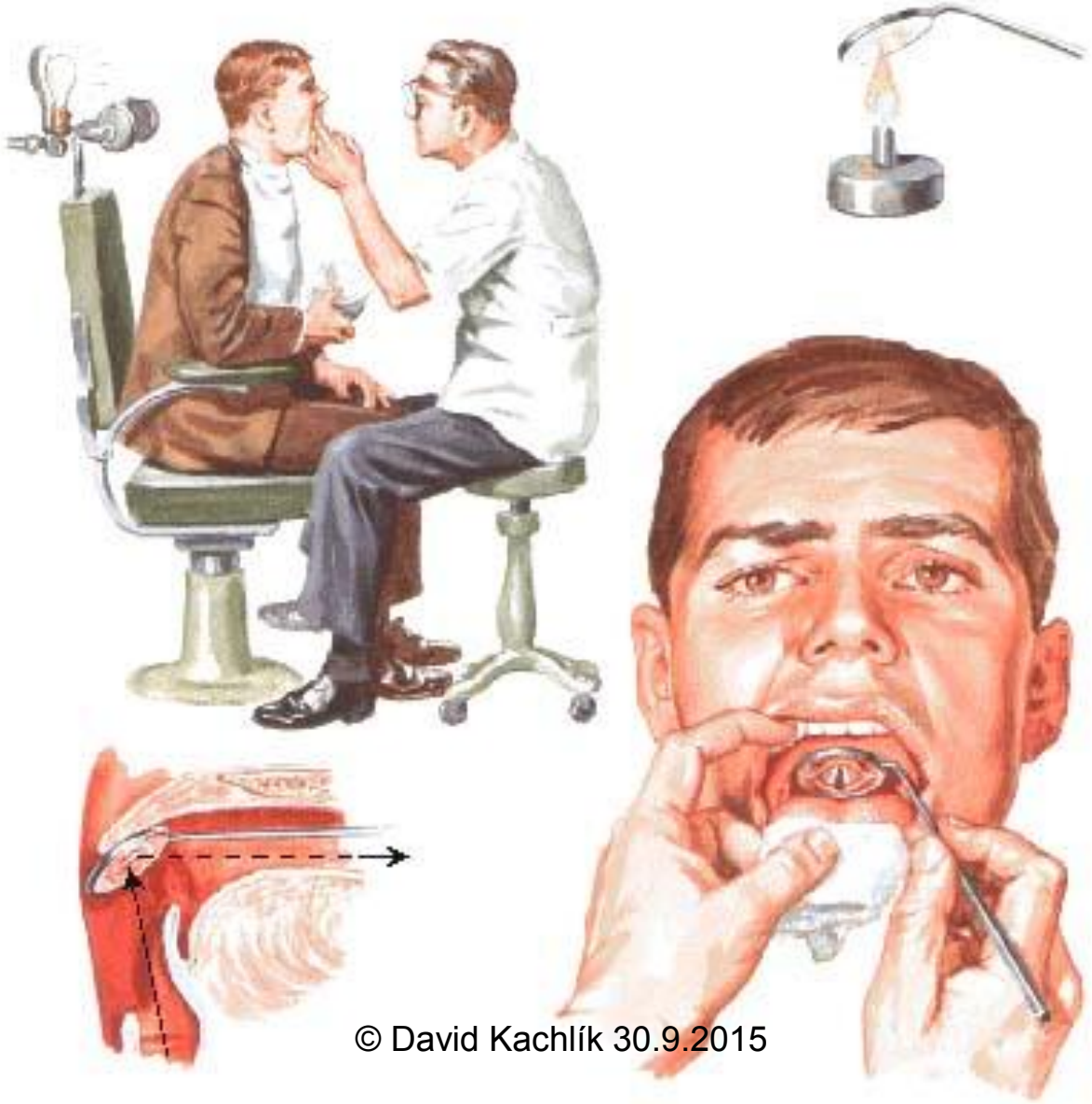


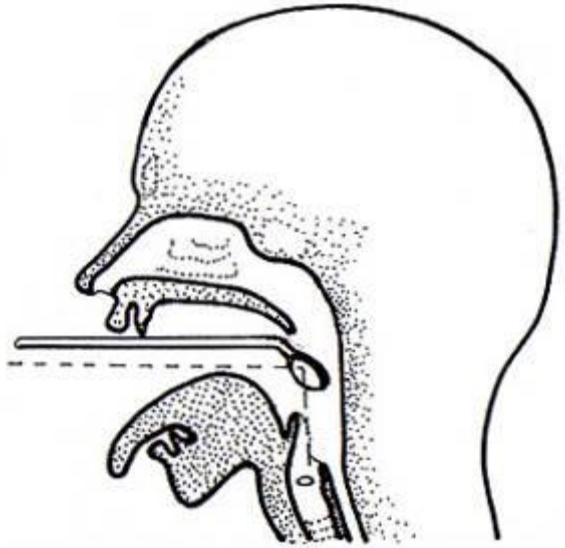
Larynx – *clinical examination*

- indirect laryngoscopy
  - warmed-up mirror, tongue is hold by a gauze, mirror image; gag reflex
  - prism optically-enhanced laryngoscopes
- direct laryngoscopy – normal view, laryngoscope, only in general anesthesia
- CT, (X-ray)

Inspection of Larynx

Technique





Larynx
clinical notes

- the narrowest point – *foreign bodies*
- phonation – *resonance, vocal folds nodules*
- sparse mucosal connective tissue – *oedema during allergic reactions and inflammations*
- laryngitis x epiglottitis

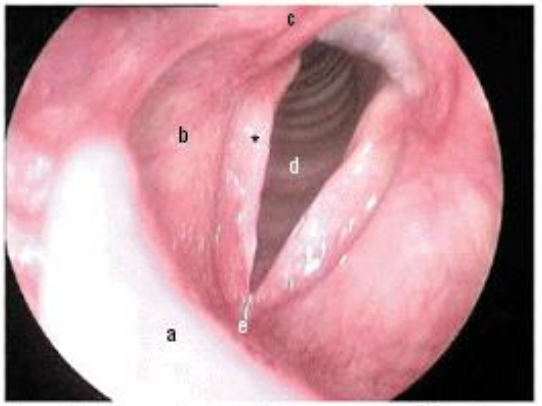
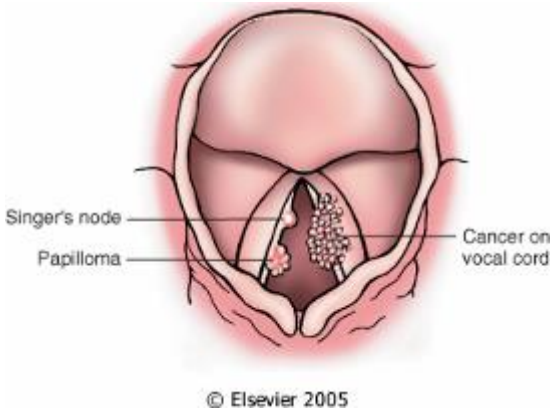
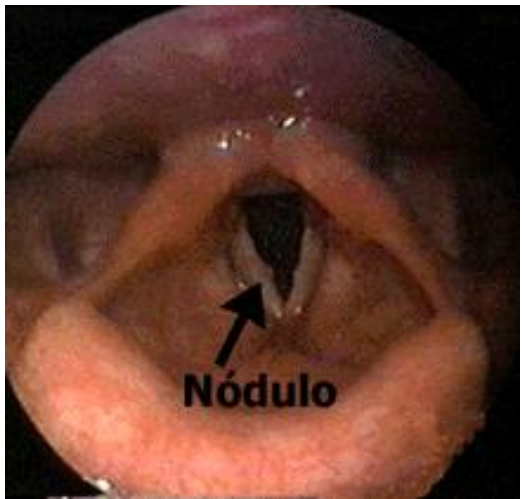


Figure 1. Endoscopic view of larynx. a, epiglottis; b, false vocal cords; c, arytenoid cartilage; d, subglottis; e, anterior commissure; *, true vocal cords.



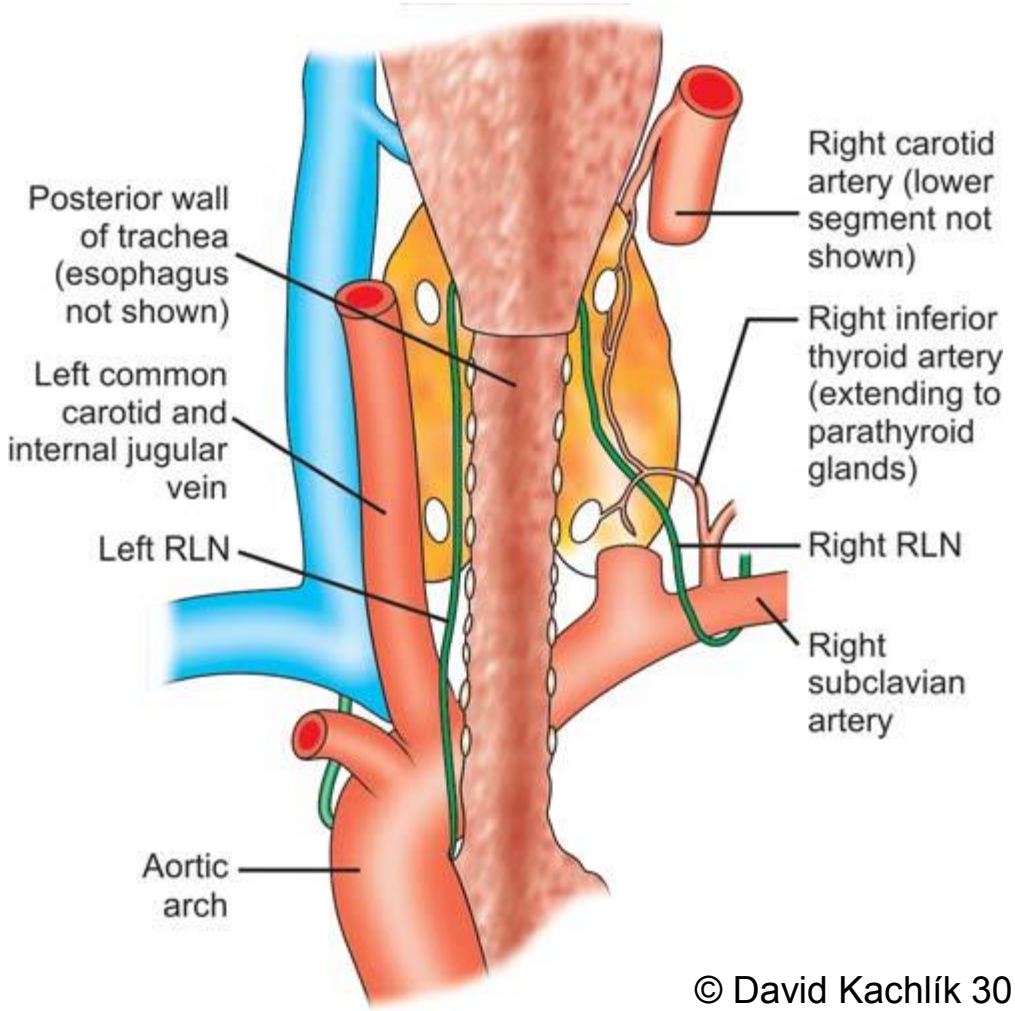


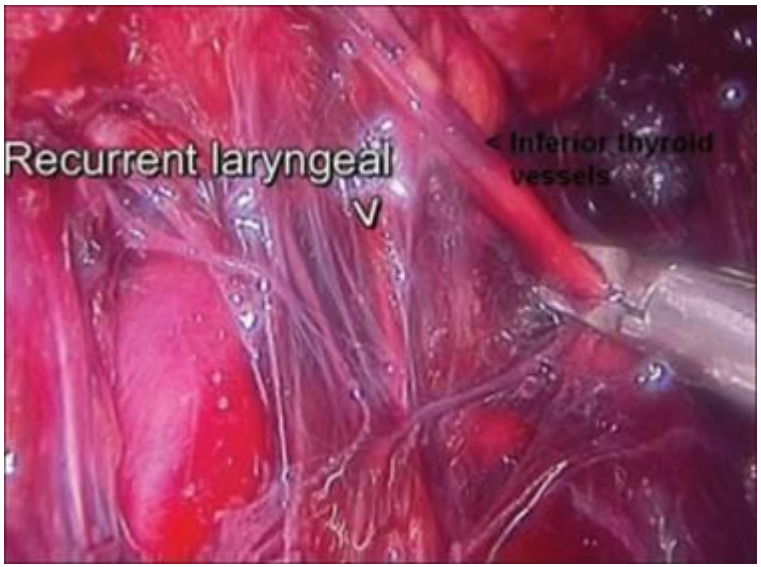
Larynx – *clinical relevance*

- n. laryngeus recurrens
  - close relation to a. thyroidea inferior
  - ! crossing !
  - CAVE by thyroidectomy
    - unilateral malfunction – voice disorder
    - bilateral malfunction – aphonia, breathing disorder

- laryngotomy (coniotomy) = a cut through lig. cricothyroideum, intervention in the field
- tumors – laryngectomy (total, partial)

Relationship of a. thyroidea inferior and n. laryngeus recurrens





http://openi.nlm.nih.gov/detailedresult.php?img=2749190_JMAS-03-91-g004&query=the&fields=all&favor=none&it=none&sub=none&uniq=0&sp=none&req=4&simCollection=3184268_1742-4682-8-33-17&npos=101&prt=3