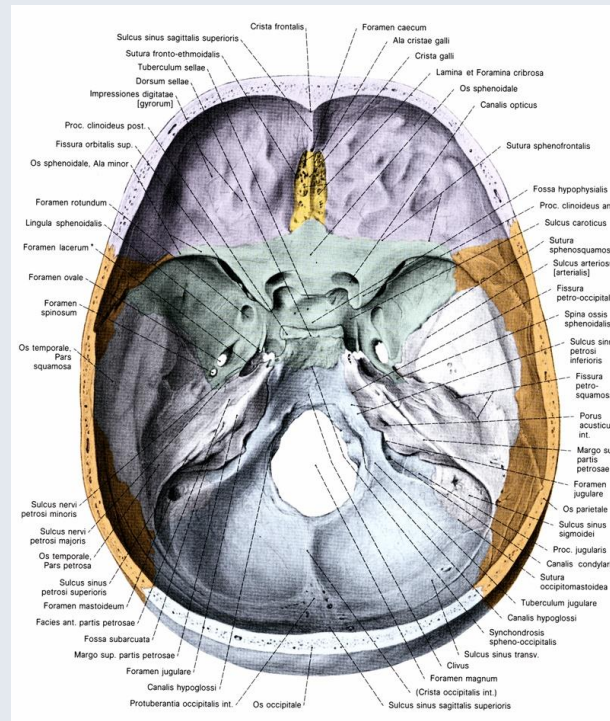


INTRUCTION, COMPISITION AND DEVELOPEMENT OF THE SKULL



PhD., Dr. Dávid Lendvai/Dr. Gábor Baksa

Semmelweis University

Anatomy, Histology and Embryology Institute

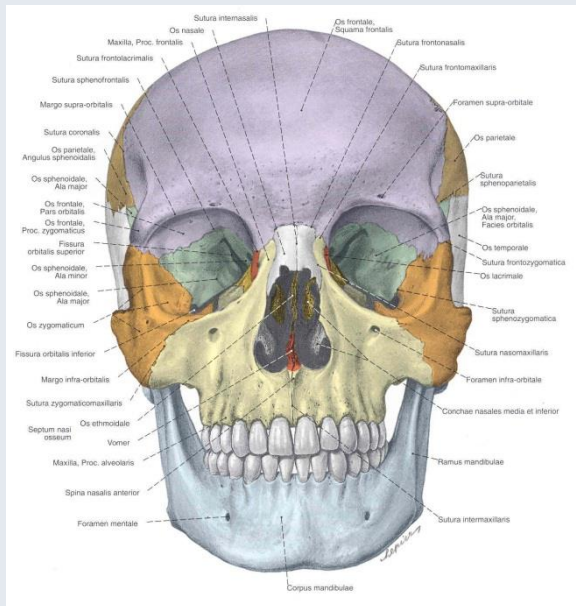
Budapest

2020

MAIN PARTS OF THE SKULL

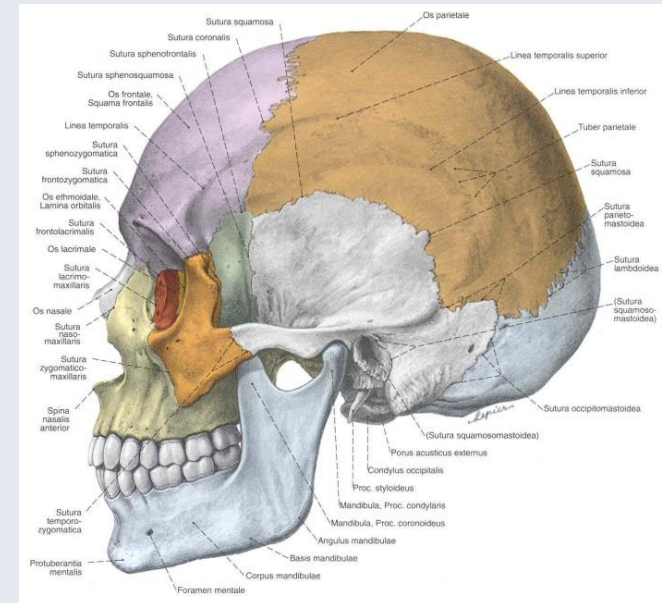
- Constitute by 22 bones:
- neurocranium** (8) – **UNPAIRED**: frontal, occipital, sphenoid, ethmoid bones
PAIRED: temporal, parietal bones
- viscerocranium** (14) -**UNPAIRED**: mandibule, vomer.
PAIRED: nasal, maxilla, zygomatic, lacrimal, palatine, inferior nasal concha

Their role – formation of cavities, protect viscera, voice formation, initial portions of the gastrointestinal and respiratory systems, insertion of muscles (mastication, head movements)



Cavities:

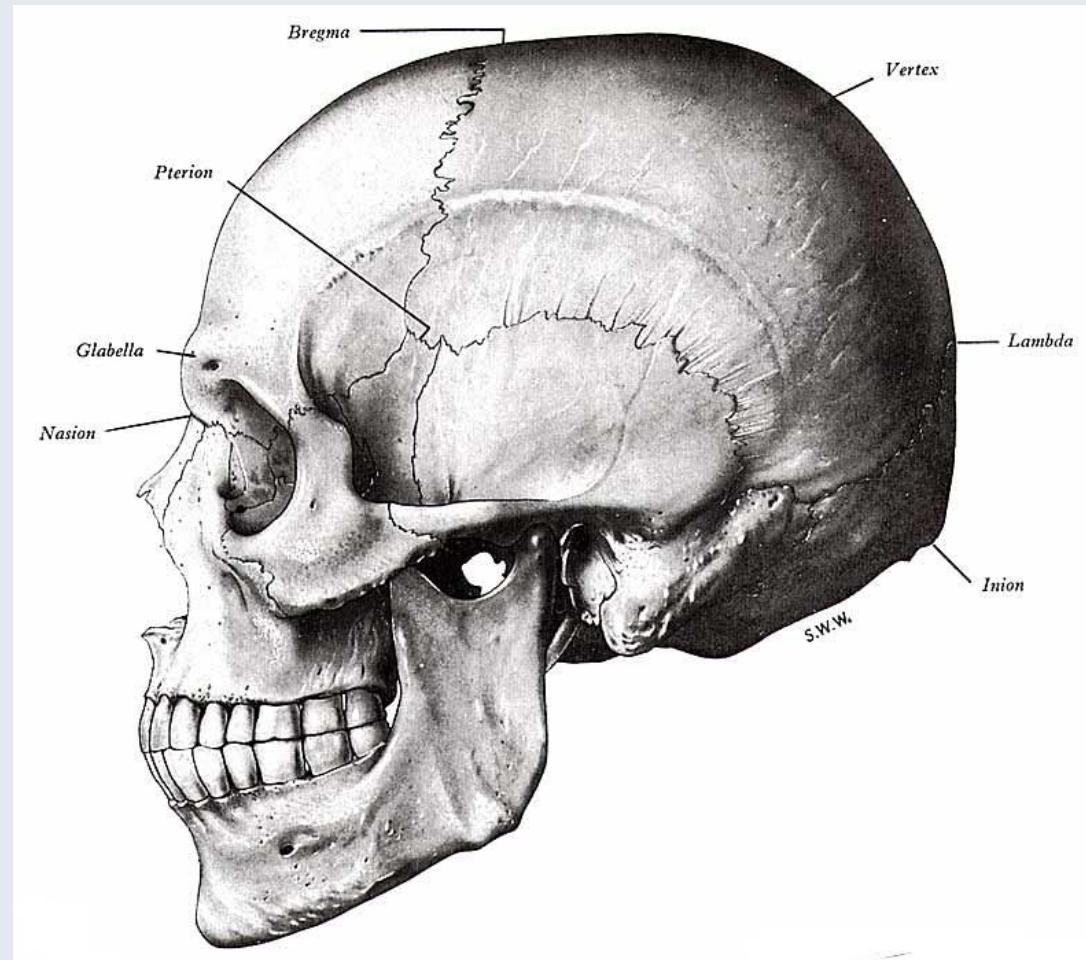
- **Cranial cavity,**
- **Nasal cavity,**
- **Paranasal sinuses**
- **Oral cavity,**
- **Orbit,**
- **(Tympanic cavity,**
- **Inner ear)**



Cranium cerebrale

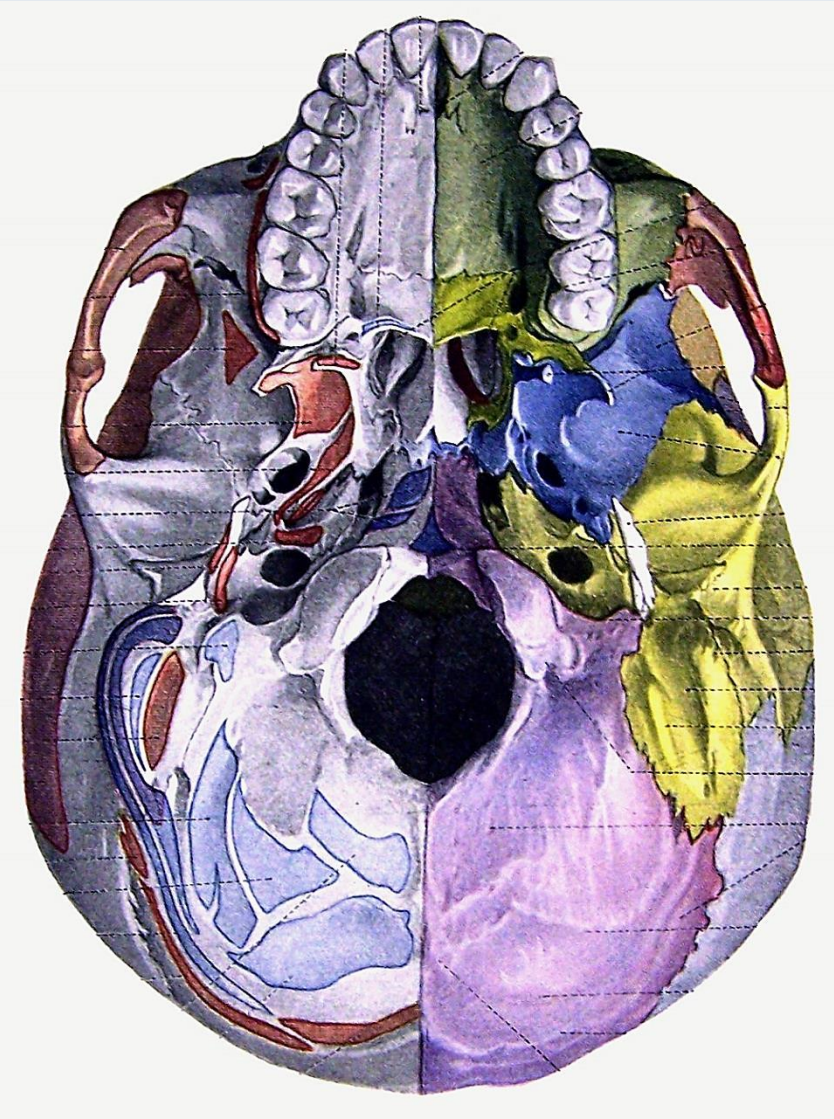
1. calvaria
2. Skull base:
 - Basis cranii int.
 - Basis cranii ext.

Protub. occip. ext. → linea nuchae sup. → beginning of the linea temp. → zygomatic arch → infratemp. crest → ala major → zygomatic process → supraorbital margin → nasofrontalis suture



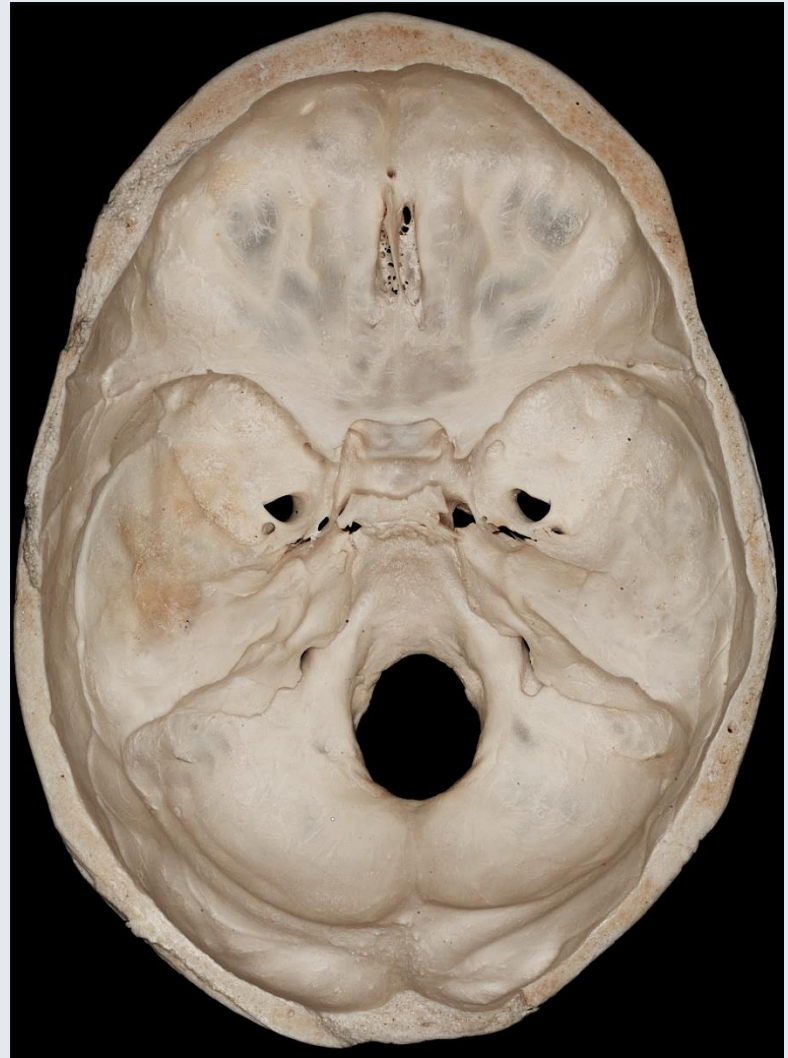
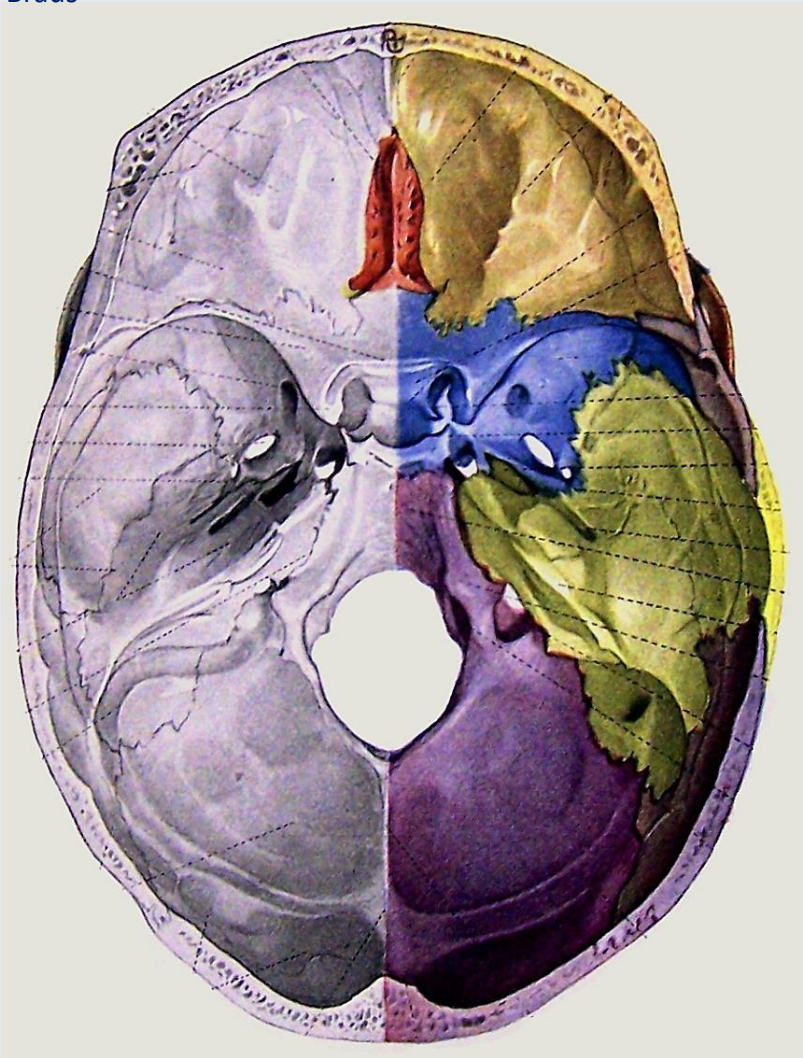
External skull base

Braus



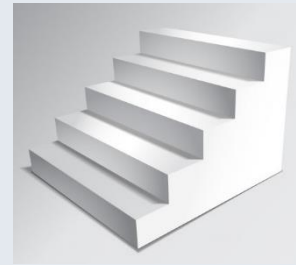
Internal skull base

Braus



Teil der inneren Schädelbasis (Corpus, Ala minor, Ala major)

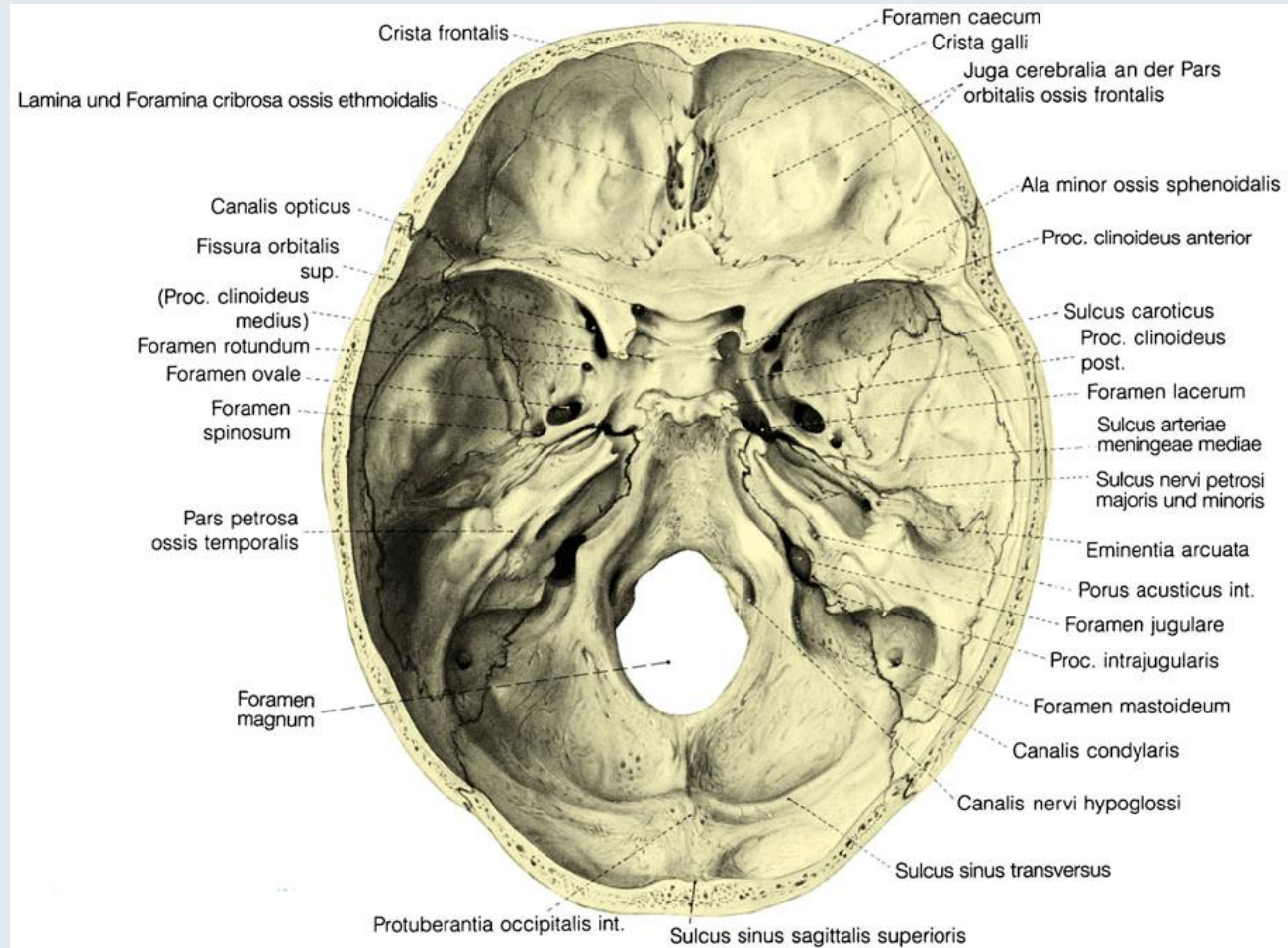
Basis cranii interna



Fossa cranii ant.

Fossa cranii media

Fossa cranii post.



Fossa cranii ant.

Formed by:

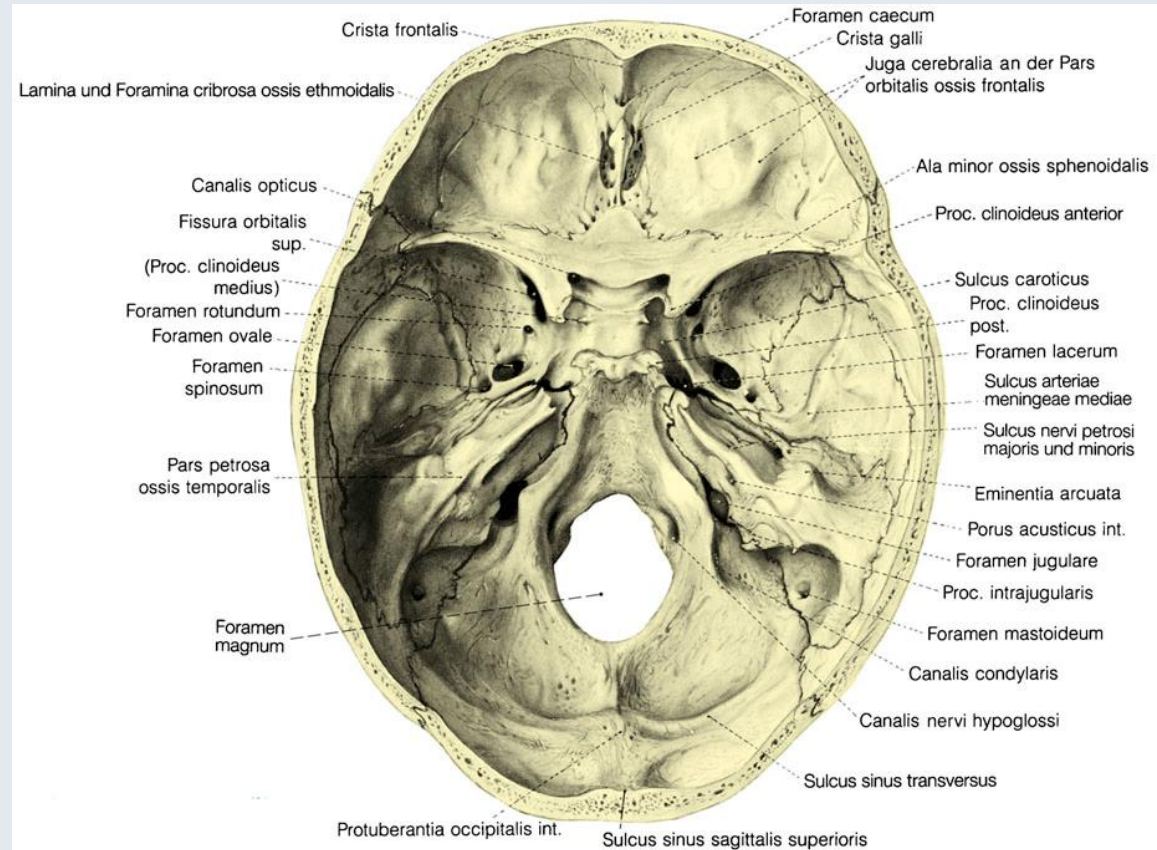
- Os ethmoidale (lamina cribrosa)
- Os frontale (pars orbitalis)
- Os sphenoidale (jugum sphenoidale, alae minores)

Borders:

- Alae minores
- Sulcus prechiasmatis

Connections:

- Foramen coecum → nasal cavity
- Foramina et lamina cribrosa → nasal cavity



Fossa cranii med.

Formed by:

Mittlerer Teil (pars sellaris):

- Corpus ossis sphenoidalis

Lat. Teilen (p. temporalis):

- Ala major ossis sphenoidalis
- Os temporale: p. squamosa, p. Petrosa facies ant.

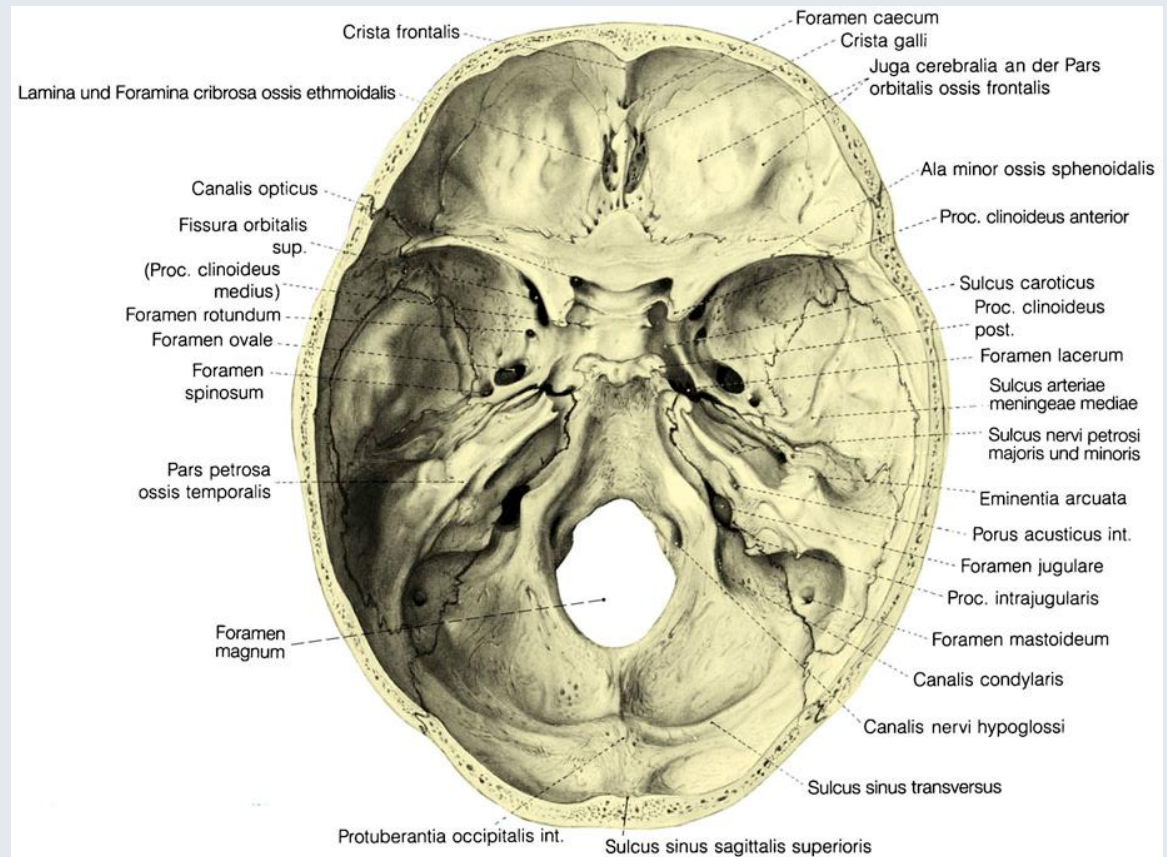
Borders :

anterior:

- Ala minor,
- Sulcus prechiasmatis

posterior:

- Dorsum sellae
- Margo sup. partis petrosae



Fossa cranii med.

Connections:

Canalis opticus → orbita

Fissura orbitalis sup. → orbita

Foramen rotundum → fossa pterygopalatina

Canalis nervi petrosi majoris → canalis facialis

Canalis nervi petrosi minoris → tympanic cavity

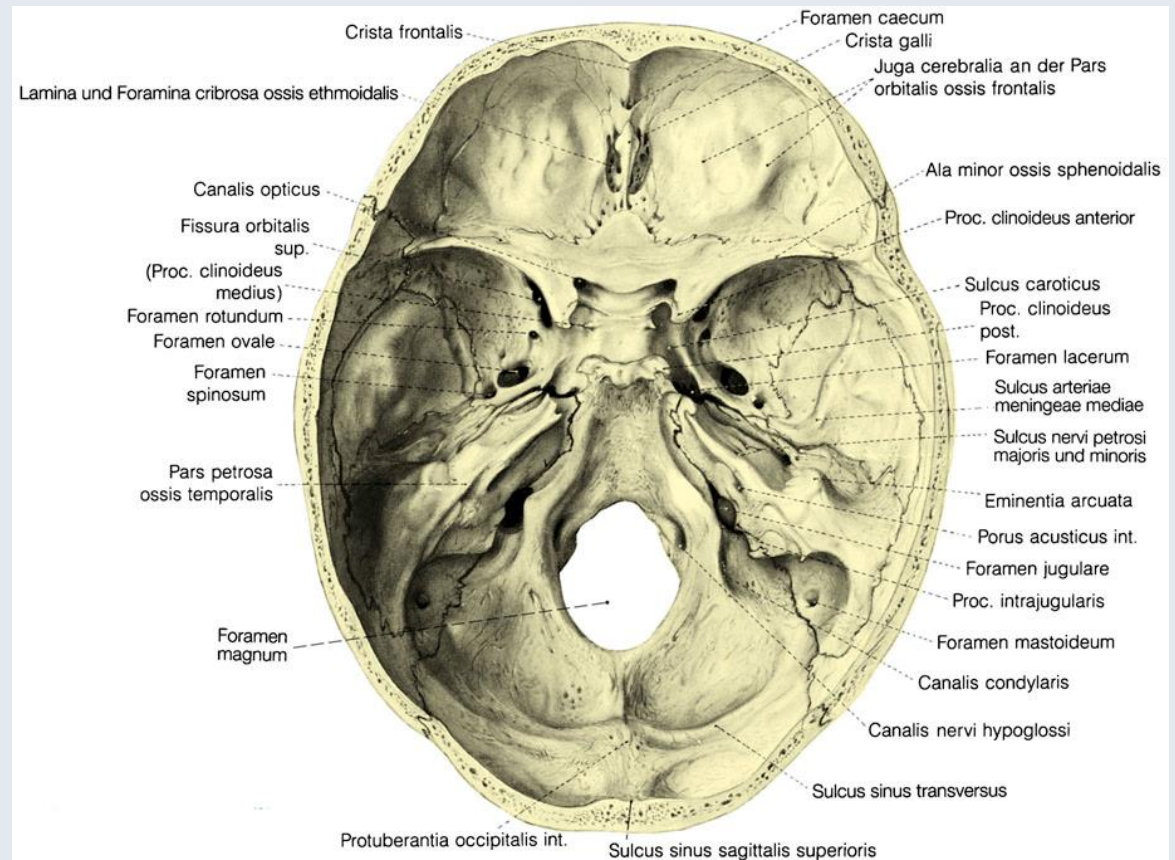
Foramen spinosum

Foramen ovale

Canalis caroticus

Foramen lacerum

Fissura sphenopetrosa



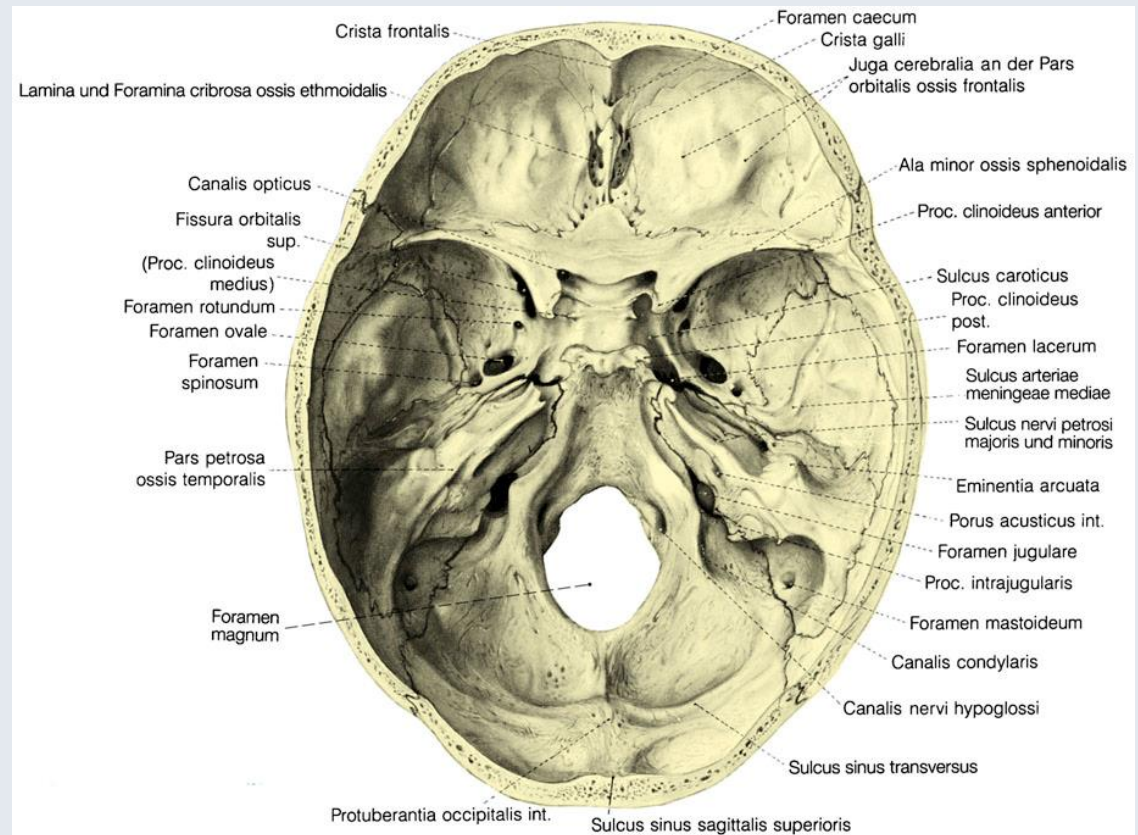
Fossa cranii posterior

Formed by:

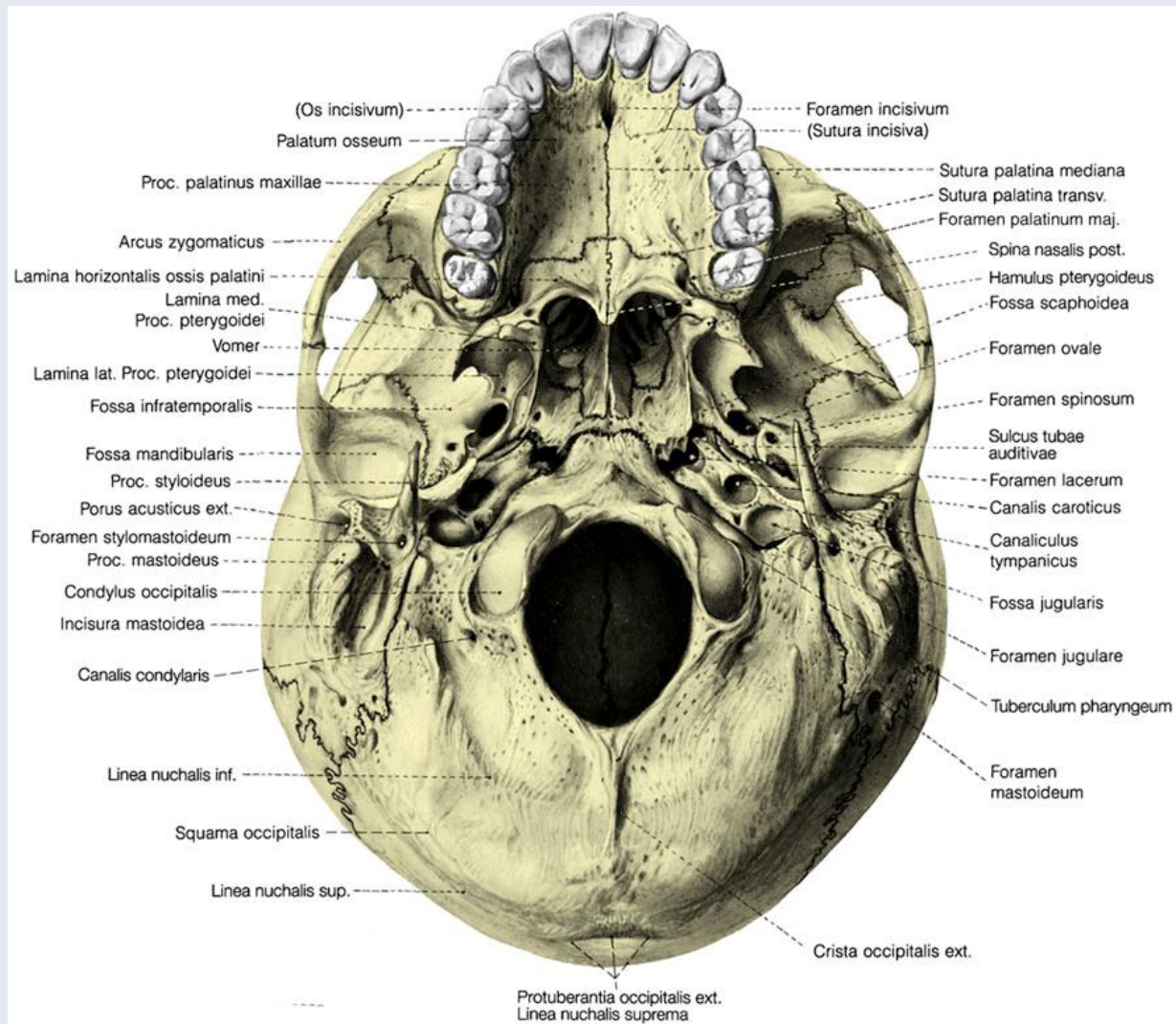
- Os occipitale
- Os temporale (p. mastoidea, facies post. Partis petrosae)
- Os sphenoidale (dorsum sellae)

Borders:

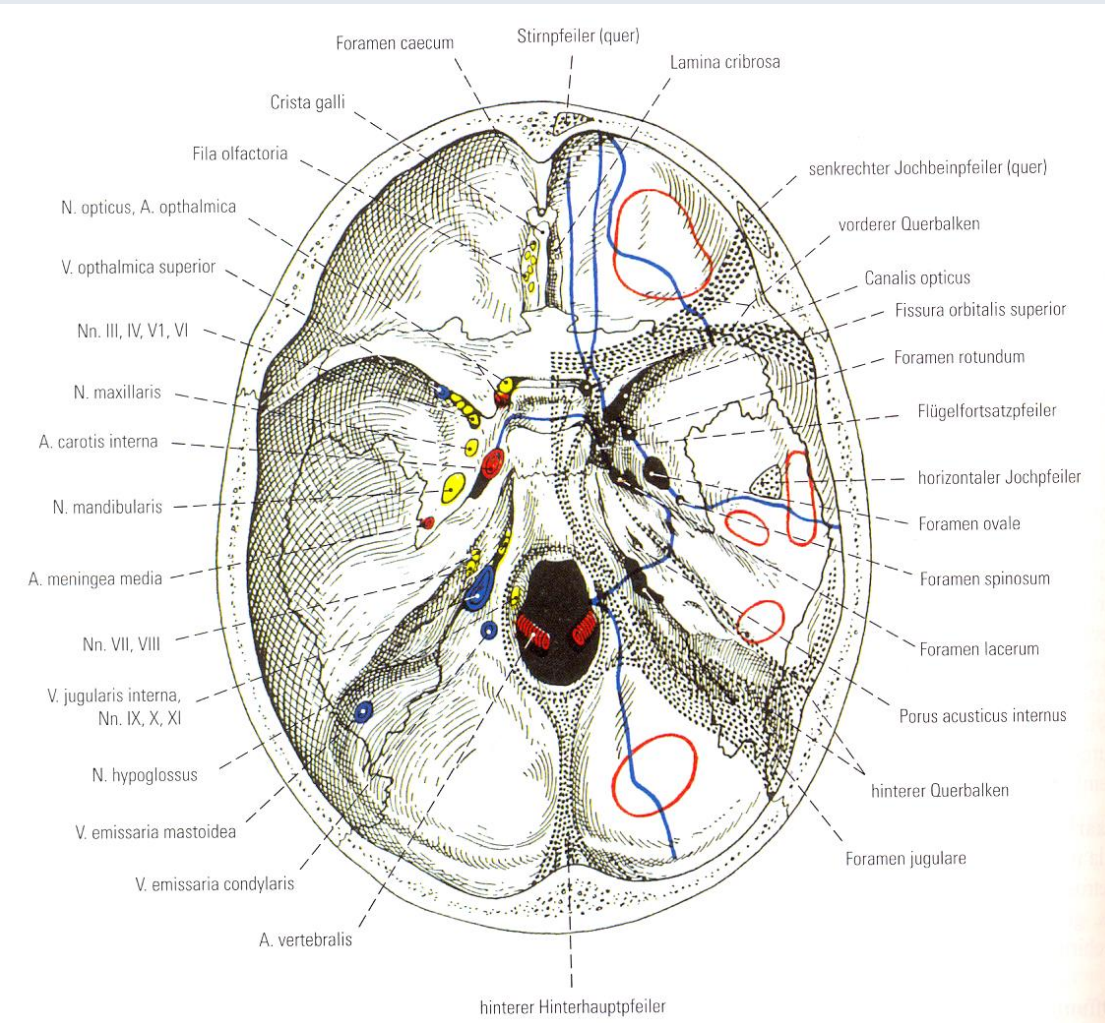
- Dorsum sellae
- Margo sup. partis petrosae
- Protuberantia occipitalis int.
- Sulcus sinus transversus



Basis cranii externa



Fractures



Fractures of the skull:

Fossa cranii ant.:

Raccoon eye hematoma Nasan bleeding with liquor

Fossa cranii media:

Bleeding from the ear

Fossa cranii post.:

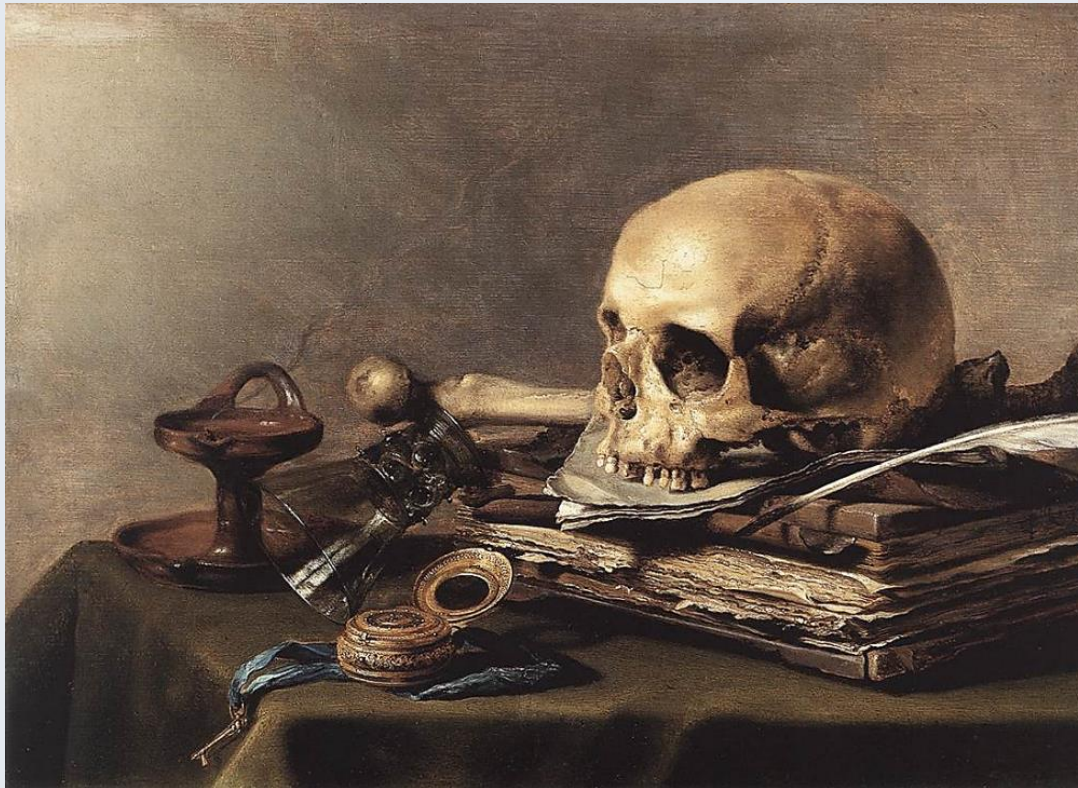
Hematoma behind the proc. mastoid, bleeding in the spatium retropharyngeum

Red: weak areas

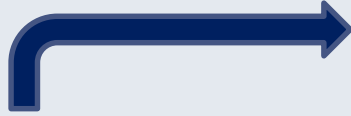
Black spotted: Reinforced bones in the direction of the lines of force

Blue: typical break lines

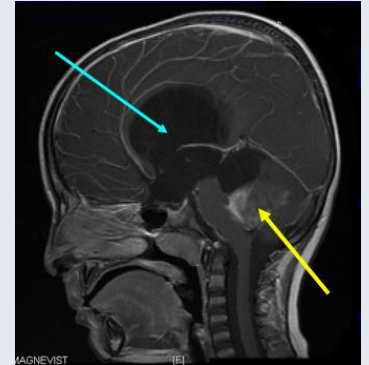
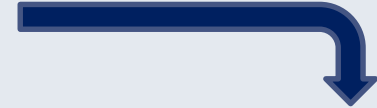
Why do we need the neuroanatomy?



Picture: Peter Claesz – Vanitas (still-life, 1630.)



www.hydrocephalus.inf



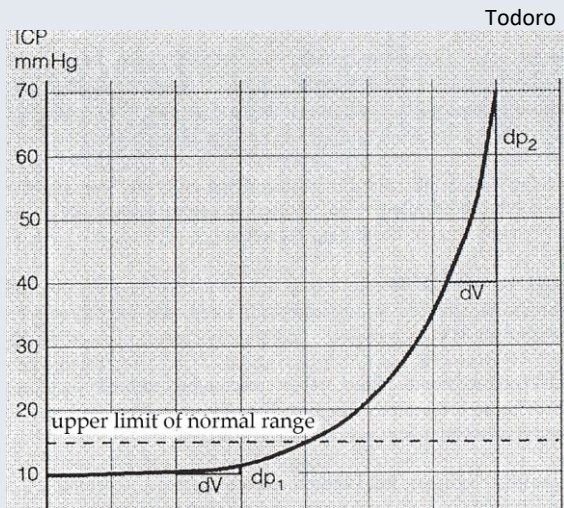
MAGNEVIST
www.totalhealth.co.uk

?



Aesculap - B
Braun





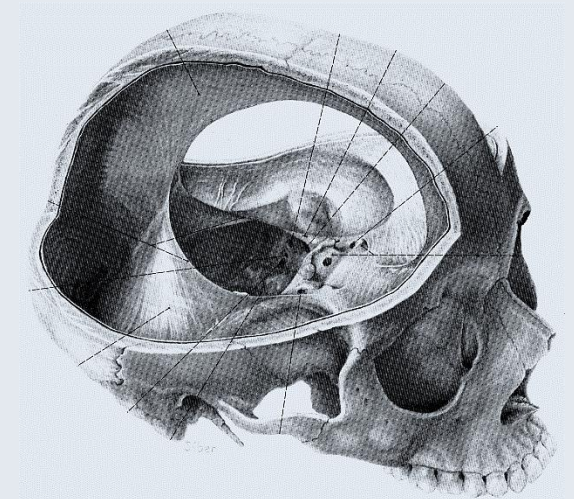
Physiologically volume and pressure are balanced within the skull

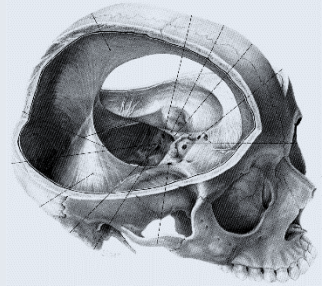
A minimally disturbed balance can be already compensated

Over the normal range of this compensation ability minimal changes in the volume lead to a disproportionately high elevation of intracranial pressure (ICP) (for further see in physiology the **Monroe – Kellie –doctrine: state of volume equilibrium of CSF, blood volume and brain tissue**)

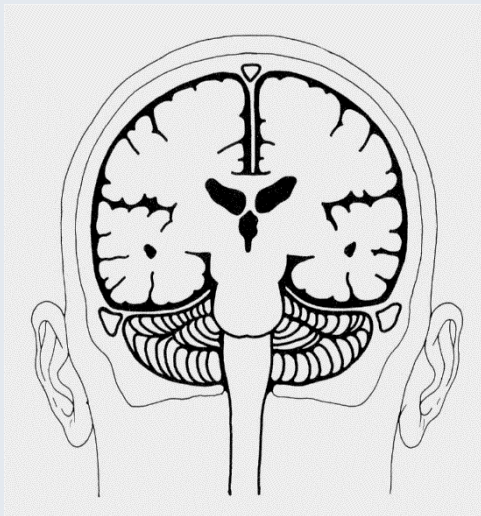
The intracranial anatomy can be described with compartments:

- spaces between meninges (some are only pathologically present)
- structures are „floating” in a fluid compartment (subarachnoidal cisterns)
- fluid is circulating, secretion and resorption are spatially separated (inner and outer CSF spaces)
- knowledge of these compartments is mandatory for understanding of clinical symptoms and treatment options





Compartments - herniations

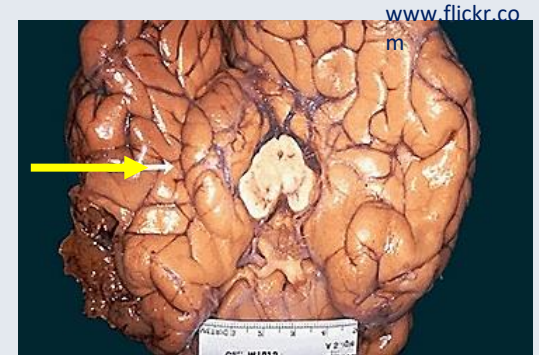


Todorow
-
Oldenkott

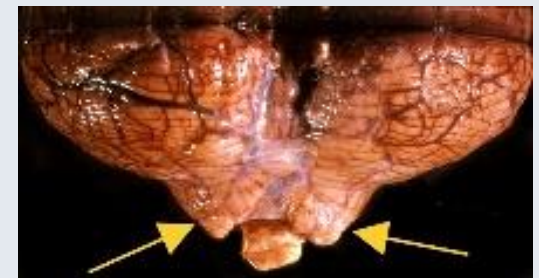
web.squ.edu.co
m



1. *cingular (or subfalcine) herniation (under the **falx cerebri!**)*
2. *uncal (or lateral transtentorial) herniation (through the **incisura tentorii**)*
3. *cerebellar herniation (**tonsillae cerebellares** through the **foramen magnum**)*
4. *transcranial herniation (due to trauma, surgery etc.; through the calvaria)*



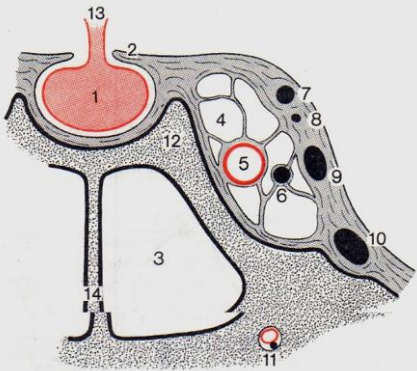
www.flickr.co
m



missinglink.ucsf.ed
u

Cavernous sinus

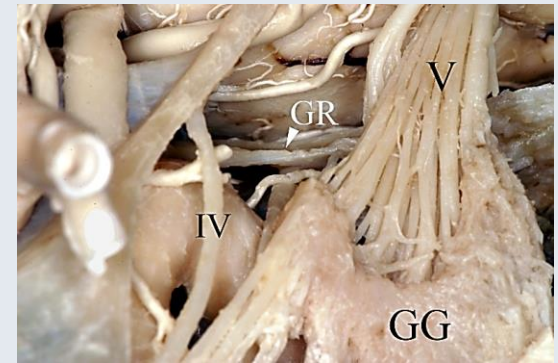
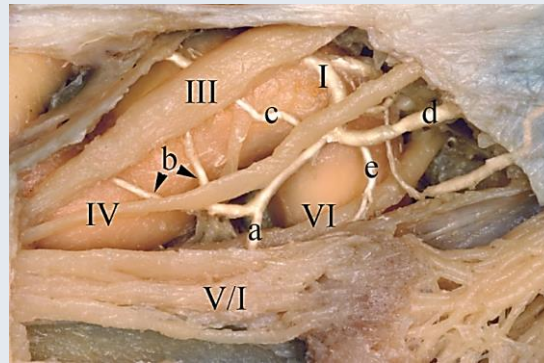
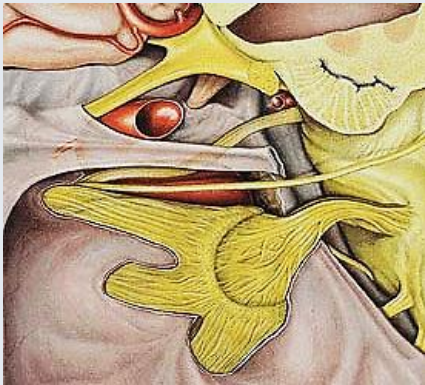
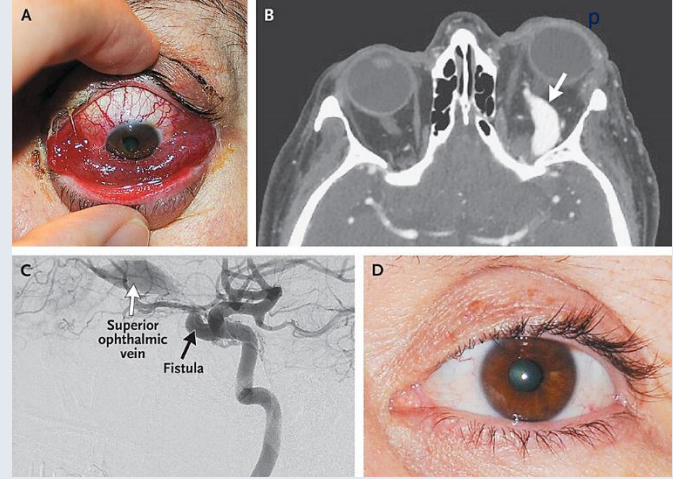
Fall
er



1. Pituitary gland
4. Cavernosus sinus
5. **Internal carotid artery**
6. **Abducent nerve**
7. Oculomotor nerve
8. Trochlear nerve
9. Ophthalmic nerve
10. *Maxillary nerve*

caroticoavernous fistula

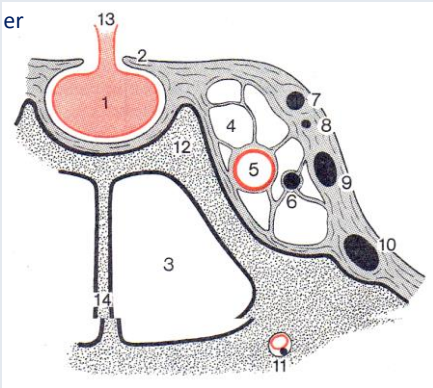
searchp



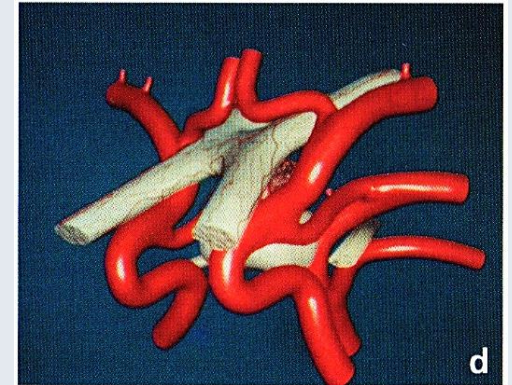
Sobott
a

Pituitary gland – sphenoidal sinus – cavernous sinus – suprasellar pyramid

Fall
er

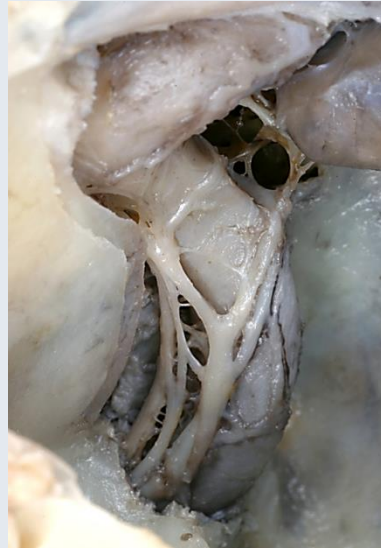


Perneckz



Sobotta



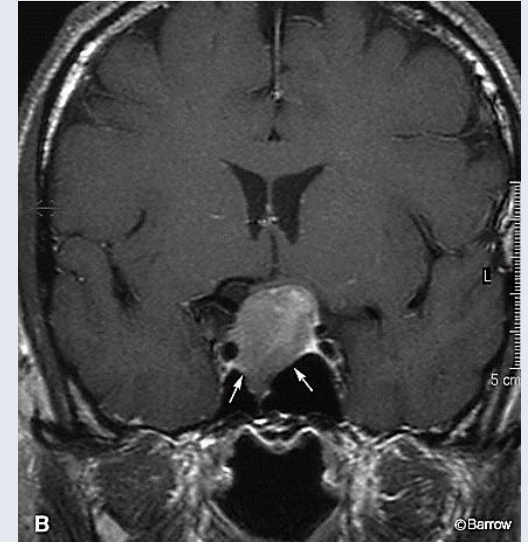




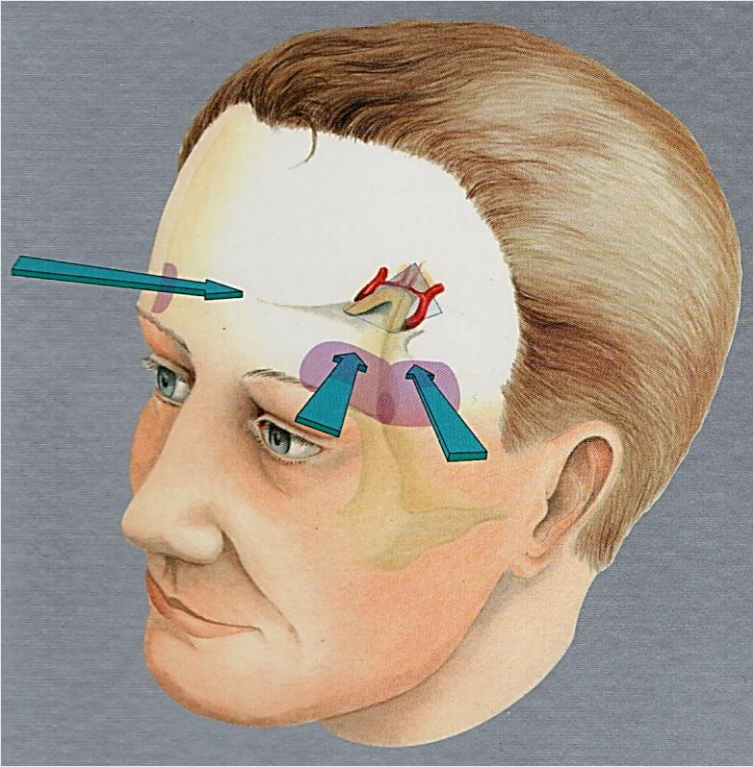
www.radiopedia.org



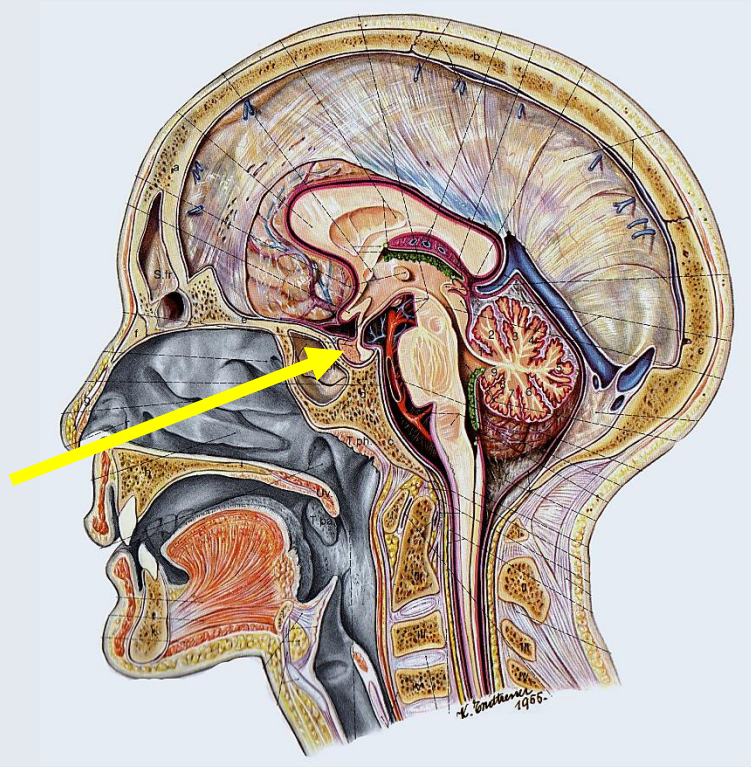
www.cmaj.ca



www.thebarrow.org

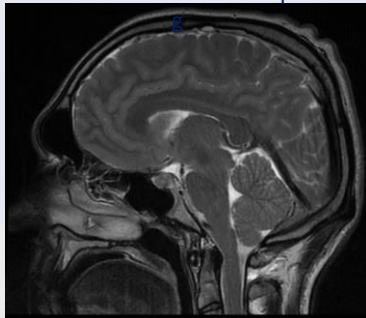
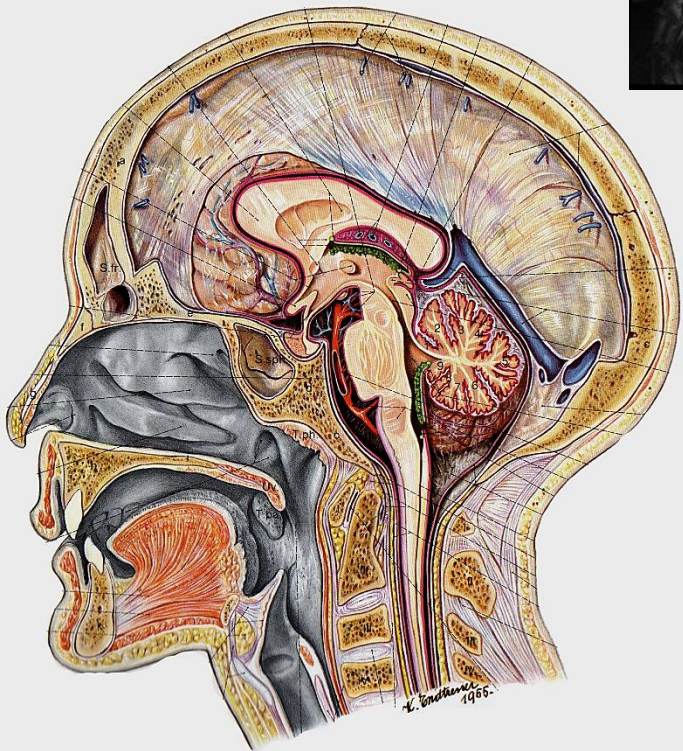
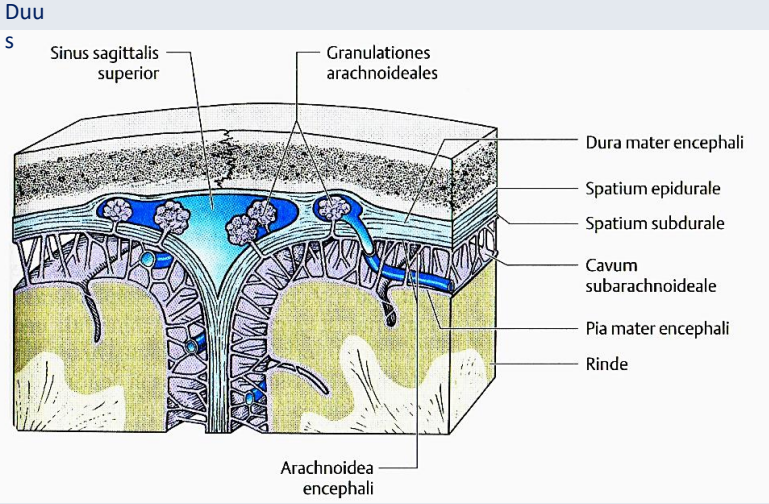


Periecznik
y



Pernko
pf

Leptomeninges - cisterns



- Supratentorial cisterns
- *Perimesencephal cisterns*
- Infratentorial cisterns

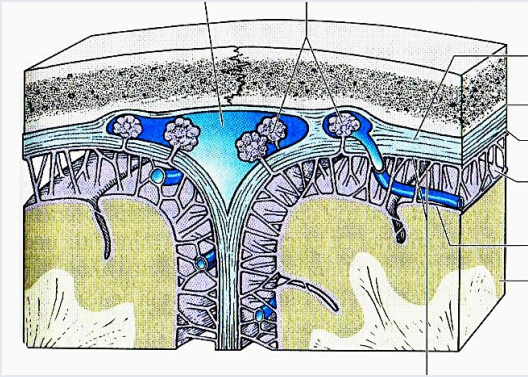
Clinic

- Convexity cisterns
- *Basal cisterns*

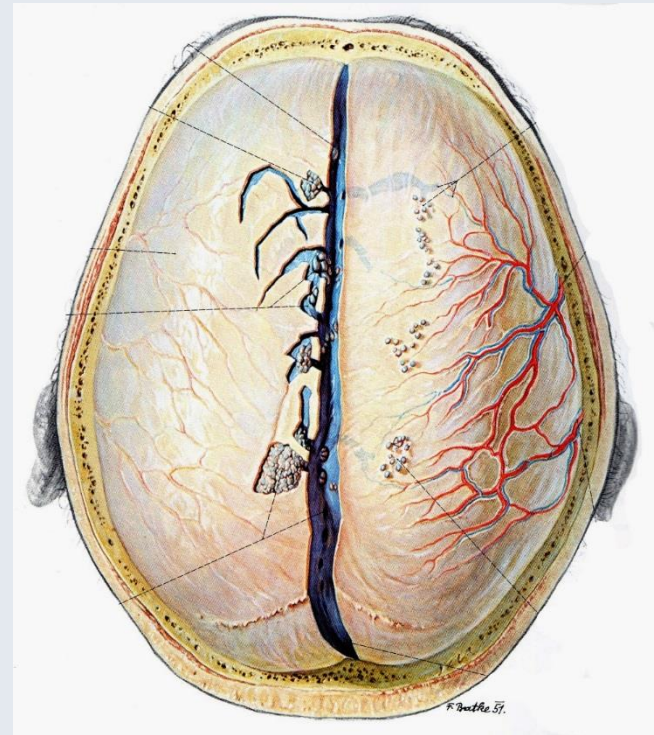
Anatomy

Compartments

Duus

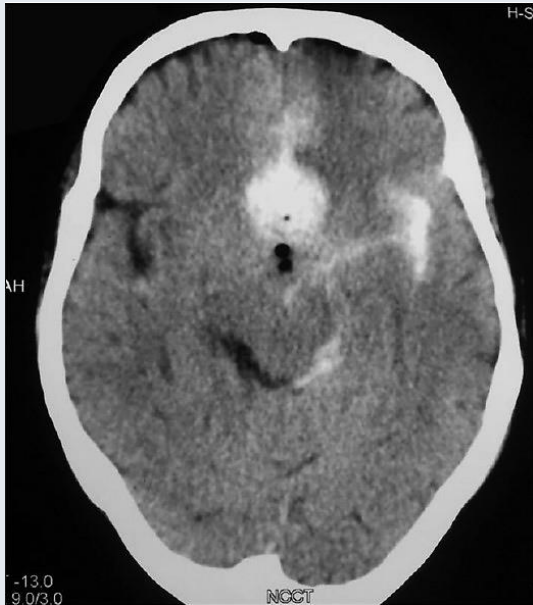


- Ø epidural space
- Ø subdural space
- **subarachnoid space (cisterns)**
- Ø subpial space



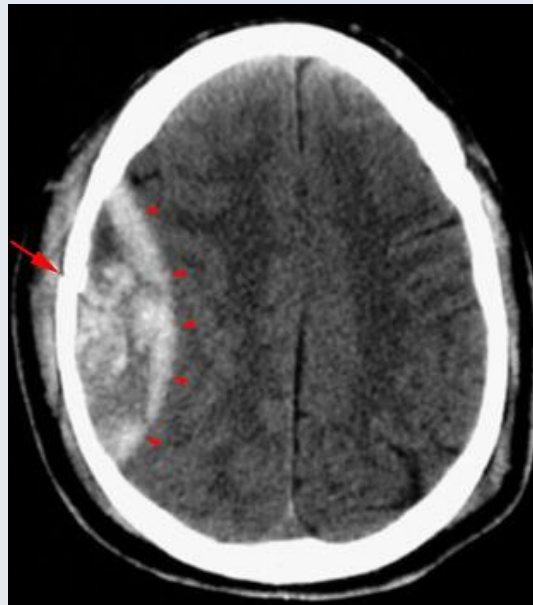
Pernkopf

pathological & physiological compartments – intracranial bleedings



www.neurologyindia.com

subarachnoidal

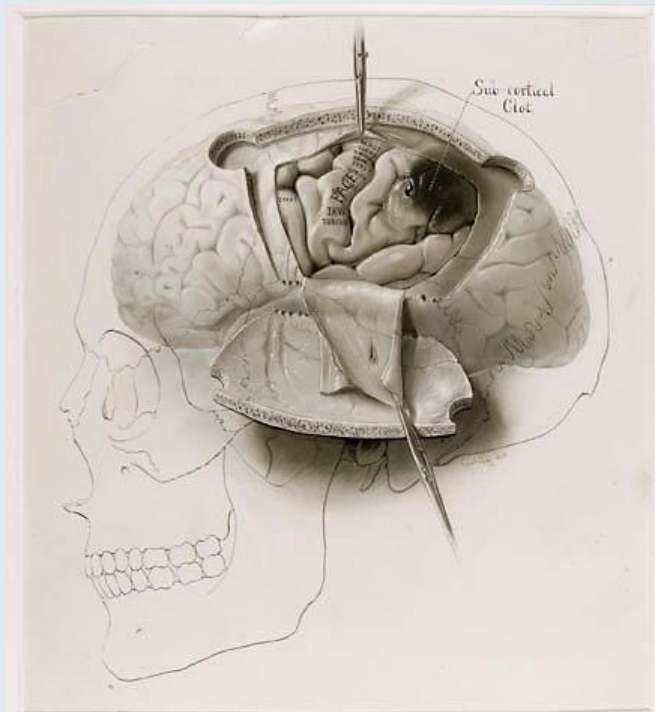


epidural



subdural

Clinical examples; interventions, surgical – anatomical pathways



Harvey Cushing: „sub-cortical clot” (ca. 1909.)
(in: Harvey Cushing’s Ghosts: Death and Hauntings in Modern
Medicine
Shin P - Yale J Biol Med (2011))

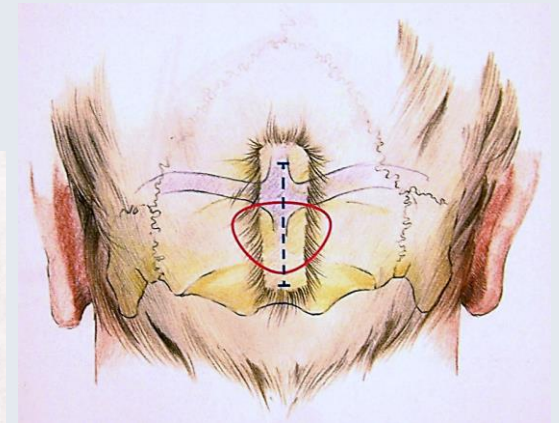


www.pixgood.com

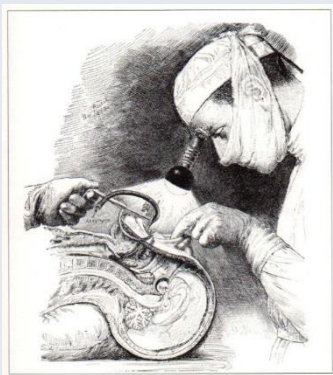
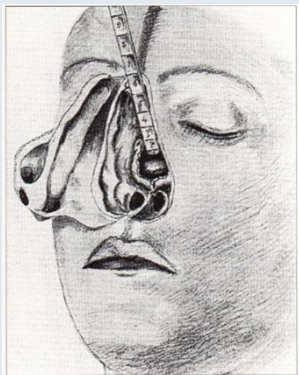
Clinical examples; interventions, surgical – anatomical pathways



Pernecky et al



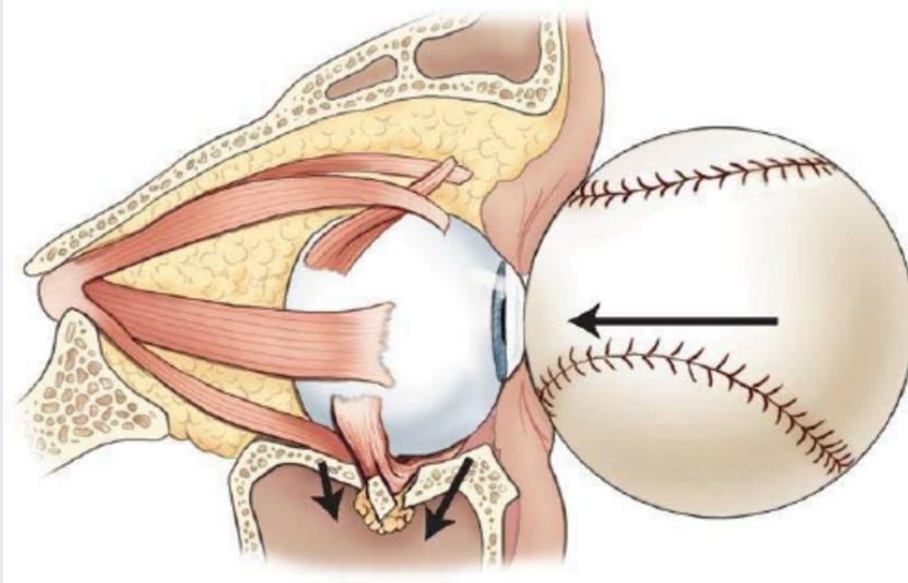
Pernecky & Reisch



Reisch – Baksa – Patonay

Orbit

Blowout Fracture



' Orbital Blowout Fracture And Injuries

This composite image illustrates the clinical presentation and anatomical findings of an orbital blowout fracture. It includes three main views: an overview of the patient's face, an oblique view of the skull, and a coronal section of the orbit.

Overview: Shows a patient with a large, dark, swollen area around the eye (periorbital ecchymosis) and a headache. Labels include: Overview, Headache, Massive Periorbital Hemorrhage, Pain To Eye And Forehead, Edema (Swelling), Difficulty Opening Left Eye, Subconjunctival Hematoma, Blurry Vision, Large Periorbital Ecchymosis, and Hematoma.

Oblique View: Shows a fracture of the orbital floor. Labels include: Nausea, Slurred Speech, Large Depressed Orbital Blowout Fracture Extending To Posterior Orbit, Depressed Fragment Of Bone Medially, Maxilla, Multiple Bone Fragments, and Mandible.

Coronal Section: Shows the internal structures of the orbit. Labels include: Hypo-phthalmic Globe, Sub-conjunctival Hematoma, Orbital Fat, Bone Fragments, Maxillary Sinus, and Hemorrhage.

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Blowout Fracture

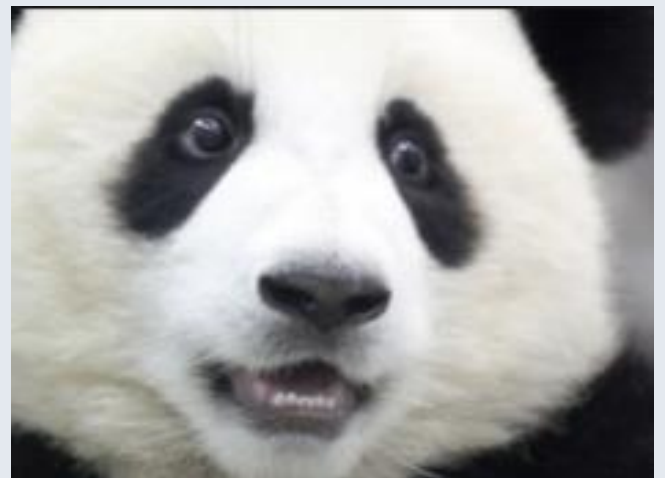


Source: K.J. Knoop, L.B. Stack, A.B. Storrow, R.J. Thurman:
The Atlas of Emergency Medicine, 4th Edition,
www.accessemergencymedicine
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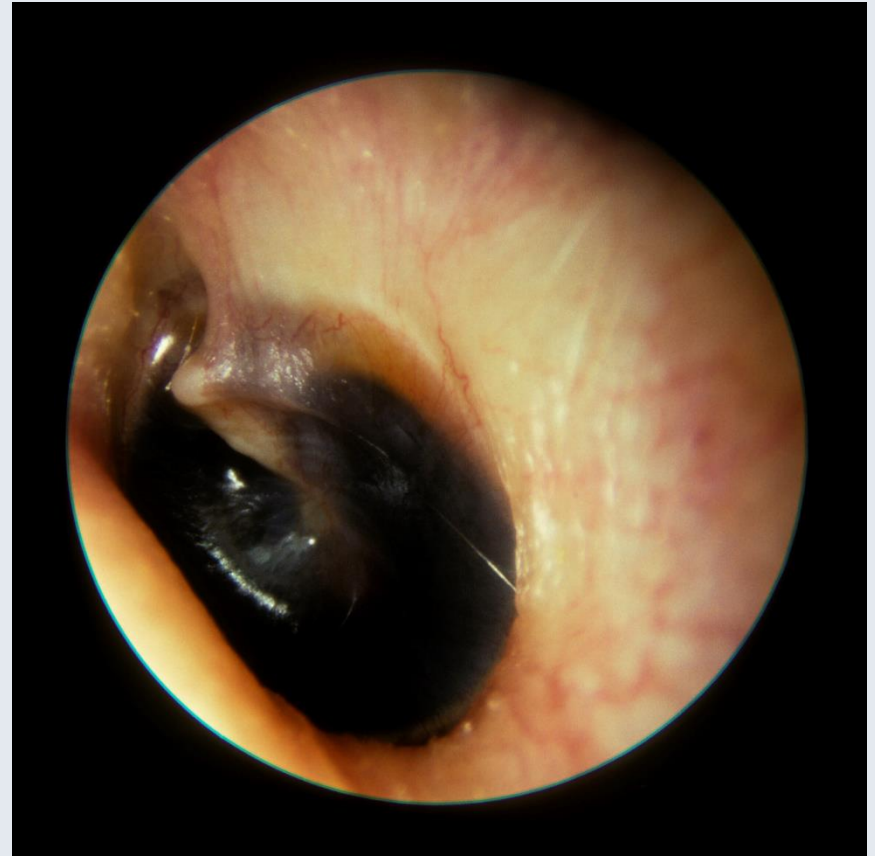


Skull base

Raccoon eyes (also known panda eyes) Or periorbital ecchymosis is a sign of basal skull fracture or subgaleal hematoma, a craniotomy that ruptures the meninges, or (rarely) certain cancer.



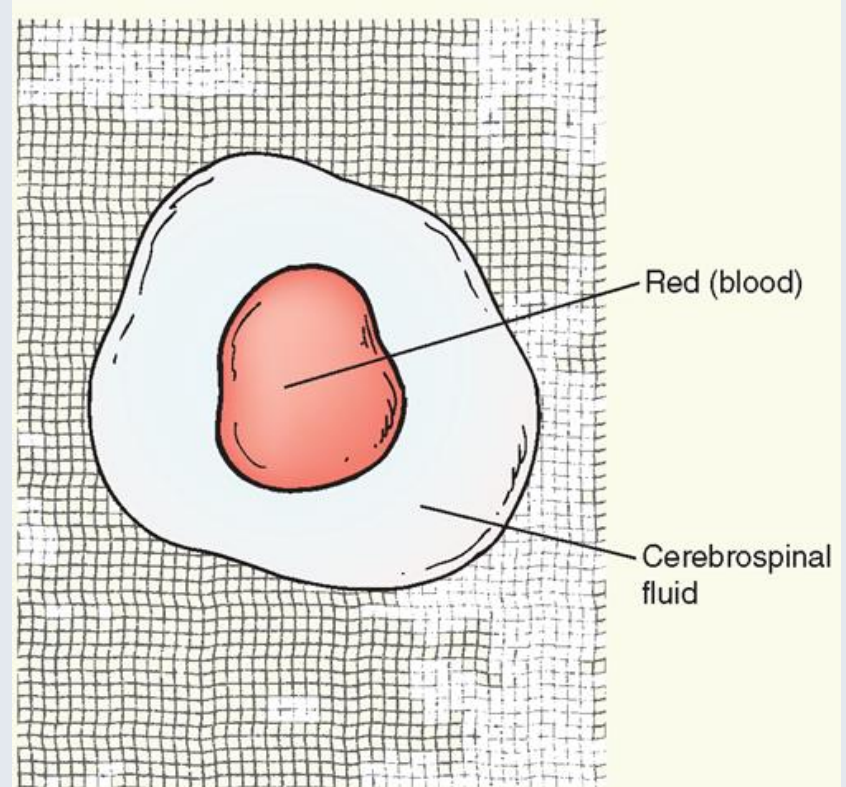
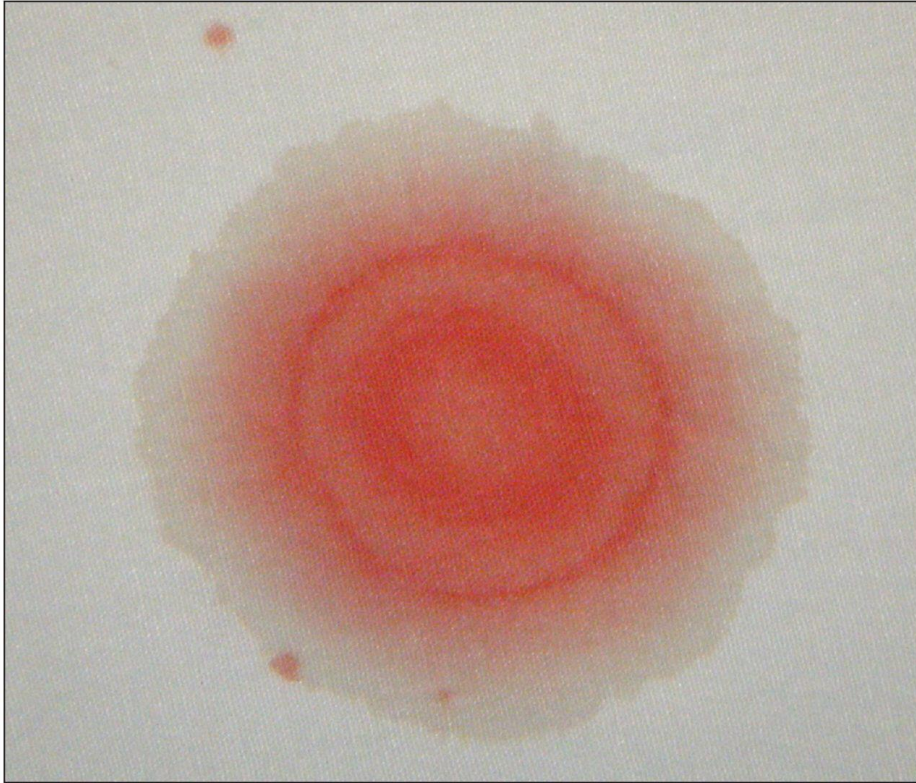
Hemotympanum or **hematotympanum**, refers to the presence of blood in the tympanic cavity of the middle ear. Often the result of basilar skull fracture.



Battle's sign, also known as **mastoid ecchymosis**, is an indication of fracture of middle cranial fossa.



Halo sign



Viscerocranium

A **Le Fort fracture of the skull** is a classic transfacial fracture of the mid face, involving the maxillary bone and surrounding structures in either a horizontal, pyramidal or transverse direction.



Le Fort I

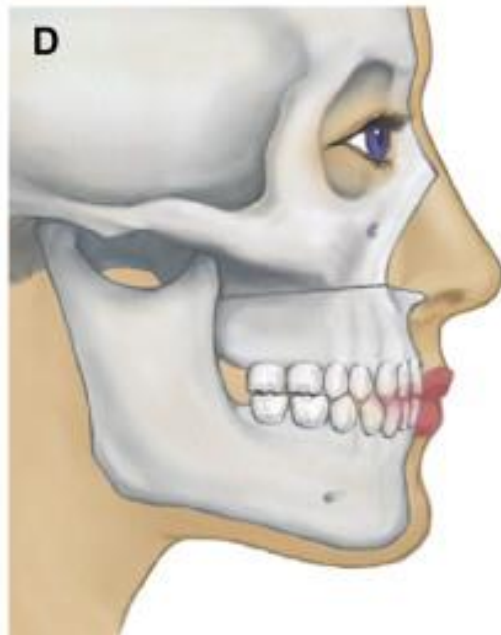
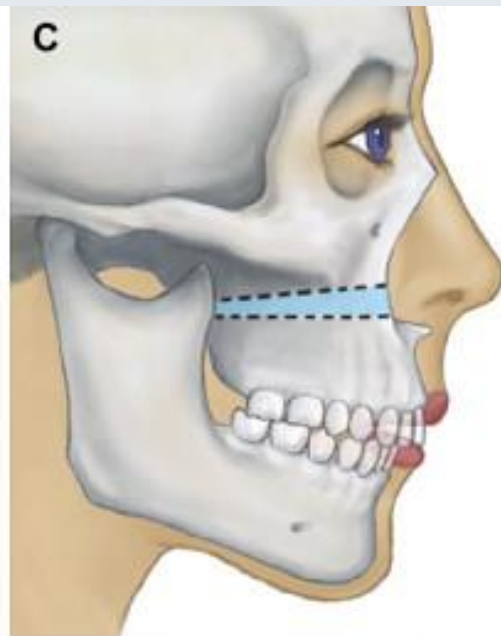
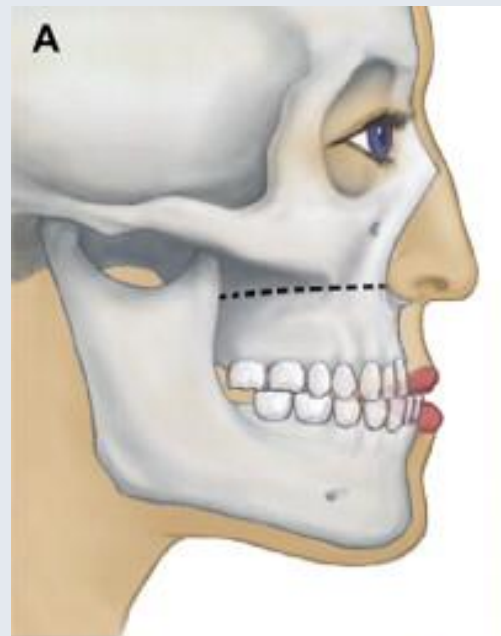


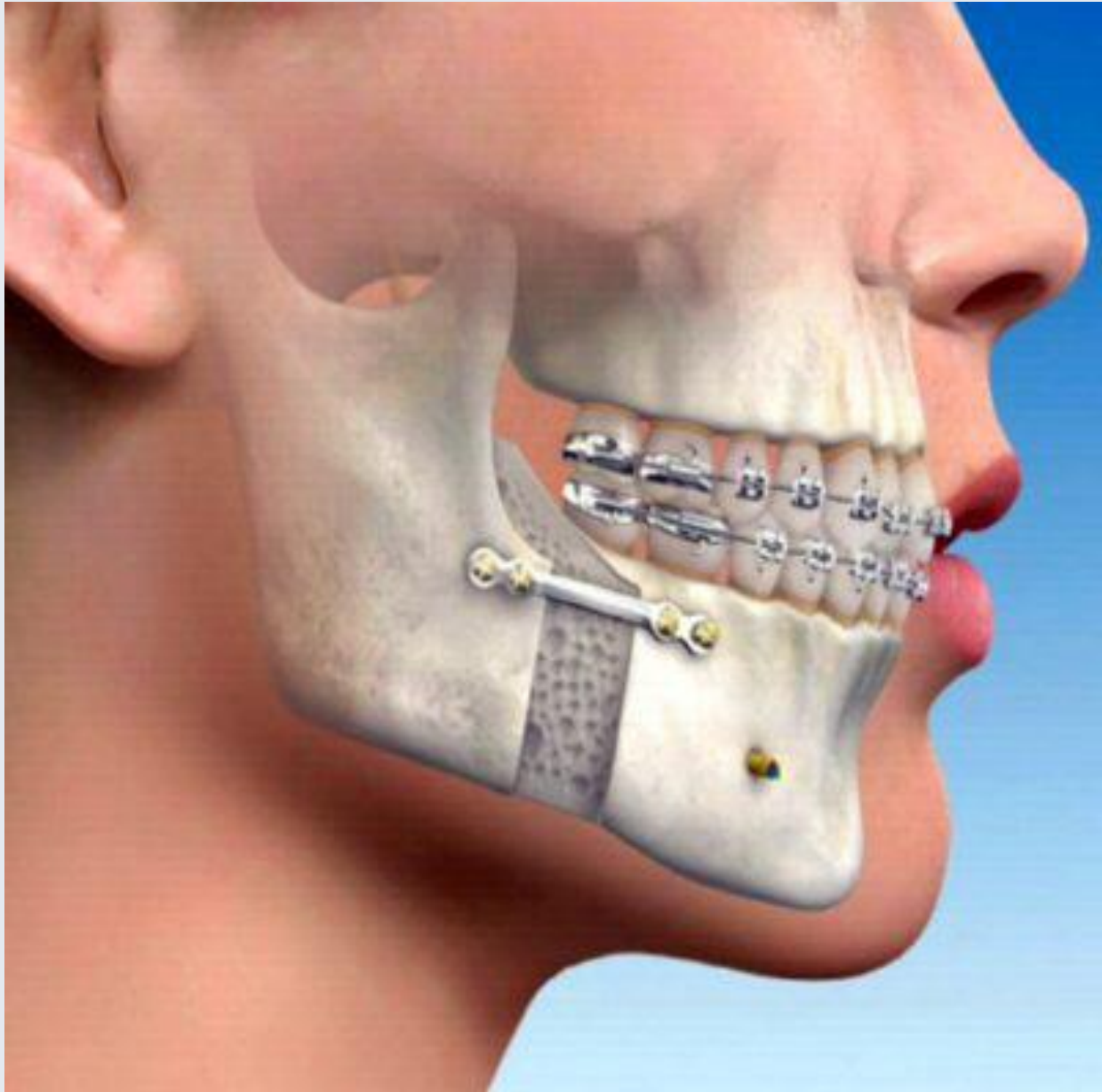
Le Fort II

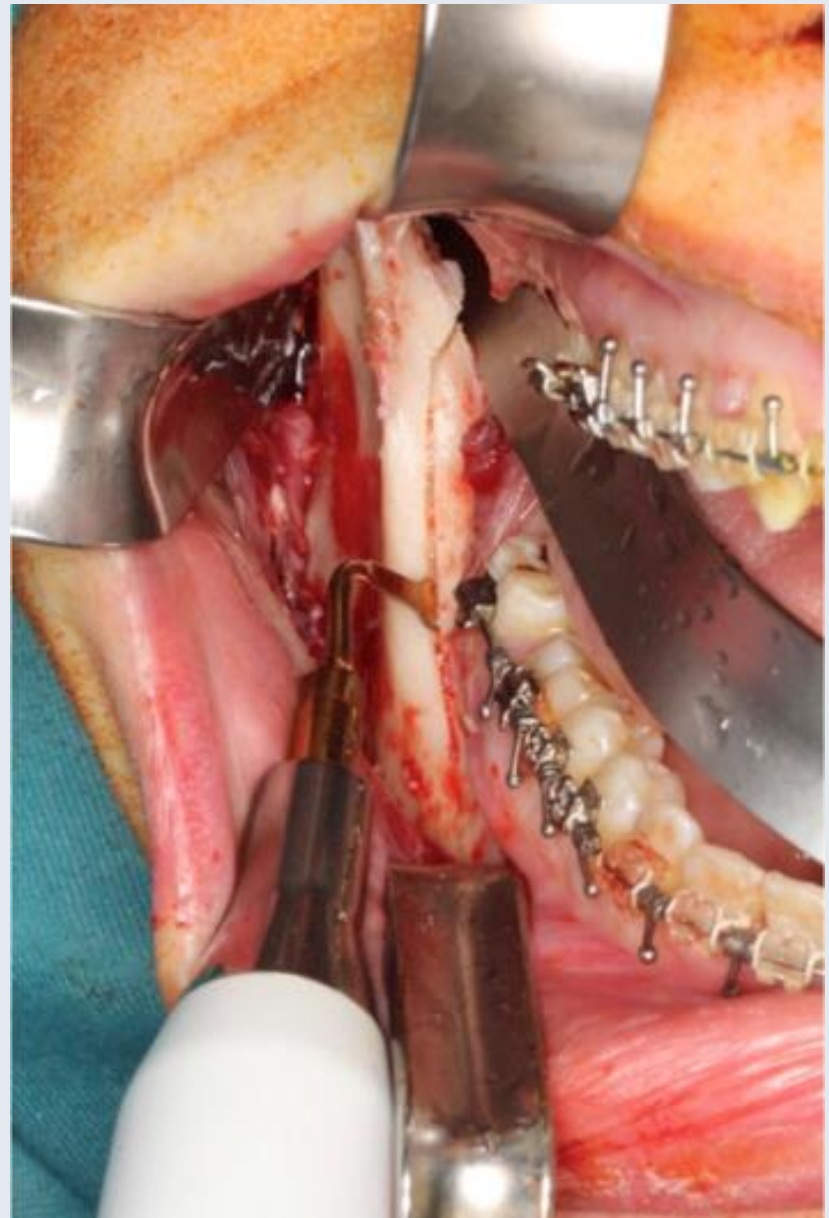


Le Fort III











Proust
A la recherche
du temps perdu



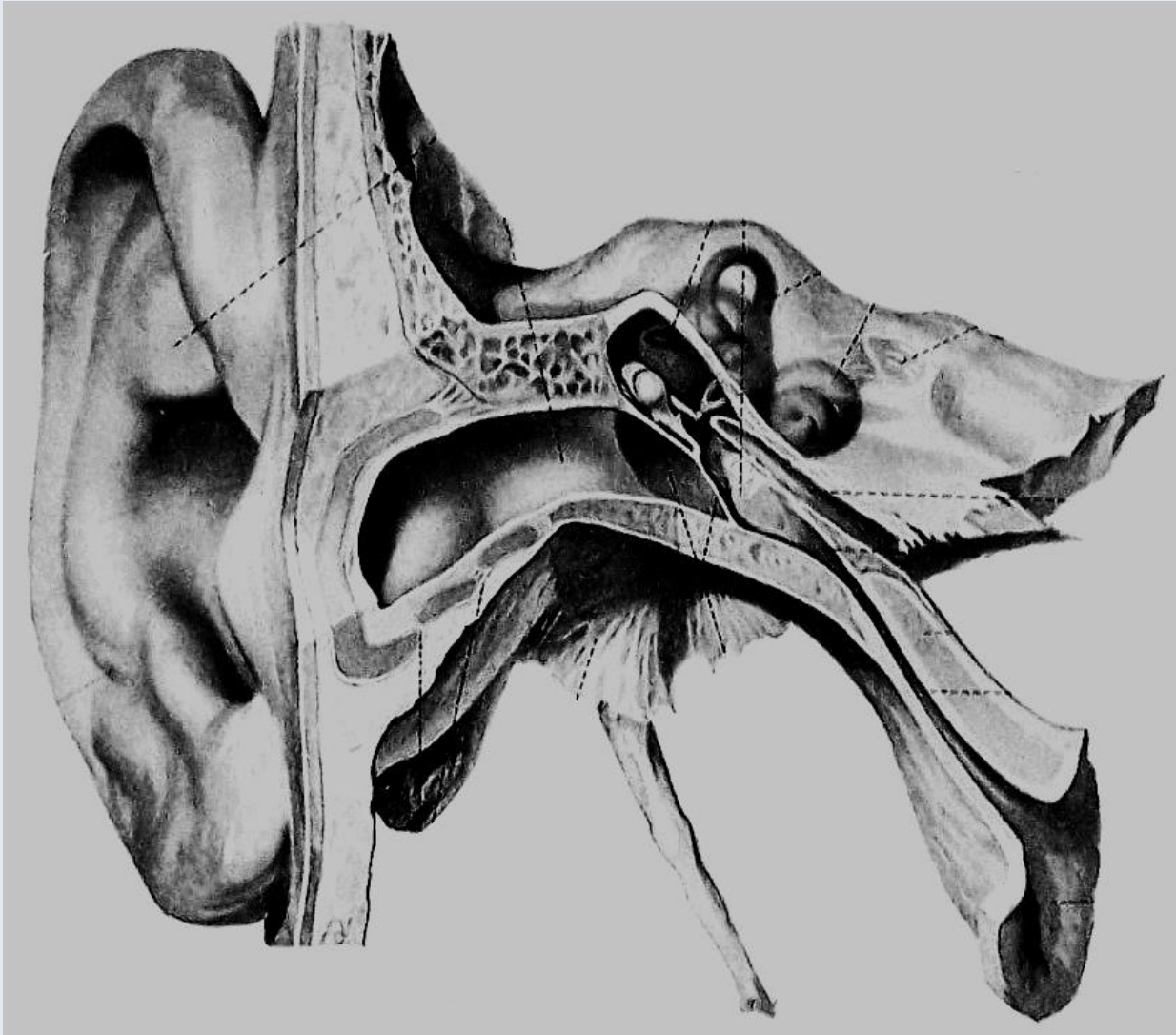
Humanis

„Fuga temporis” = Zeit vergeht

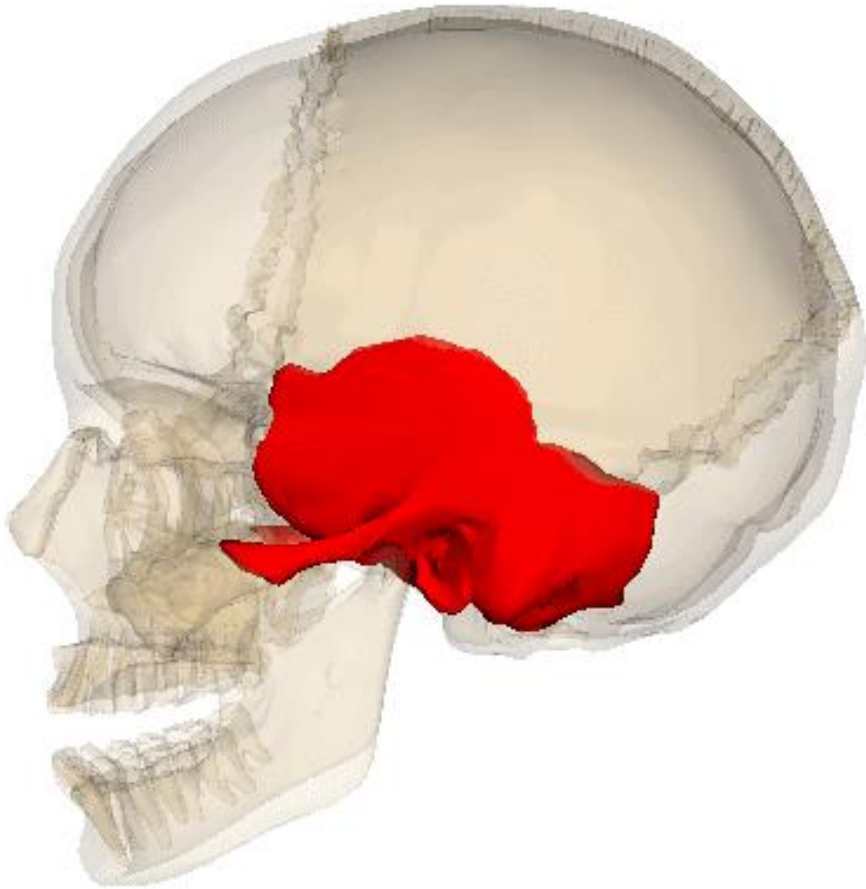
Tempus = Time



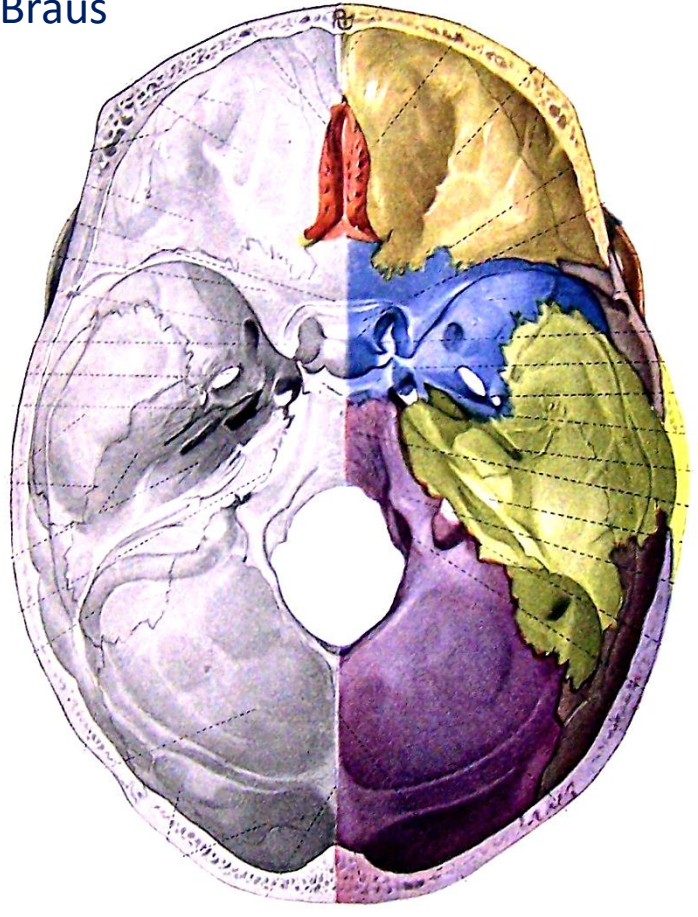
P. P. Rubens: *Virgin in Adoration
before the Christ Child*



Braus



Braus



Neighbors:

Os sphenoidale

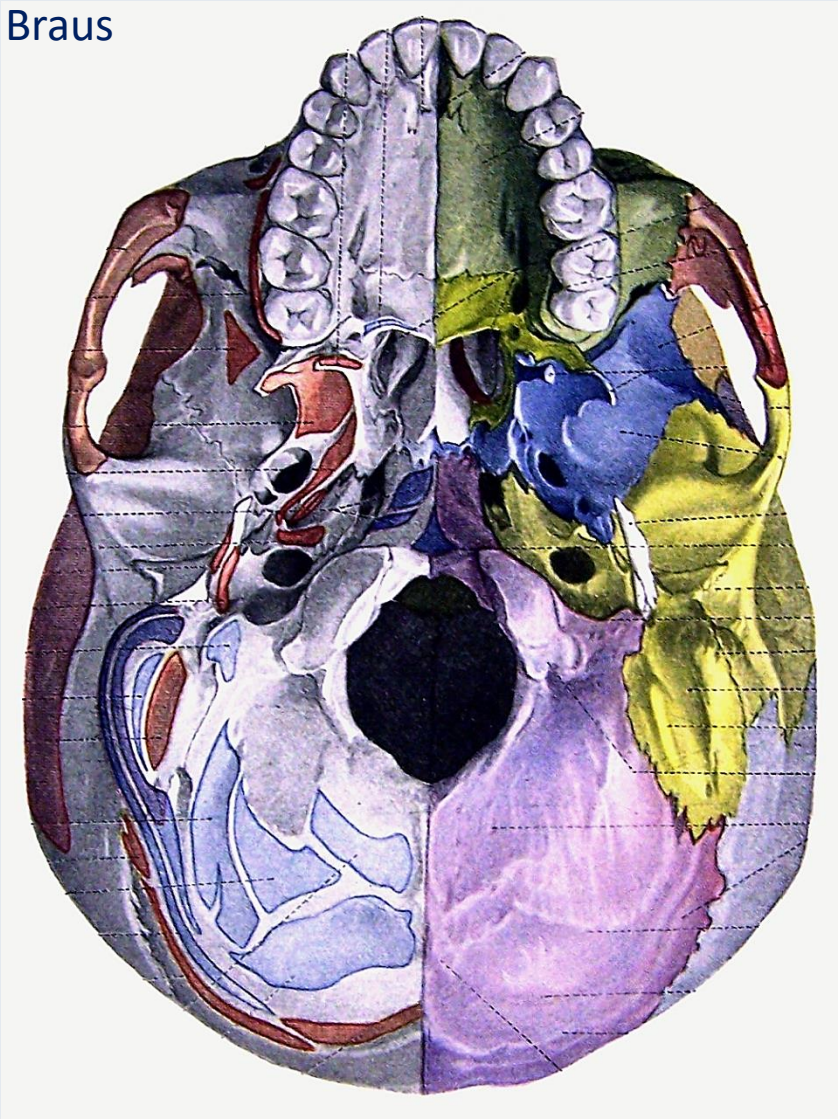
Os parietale

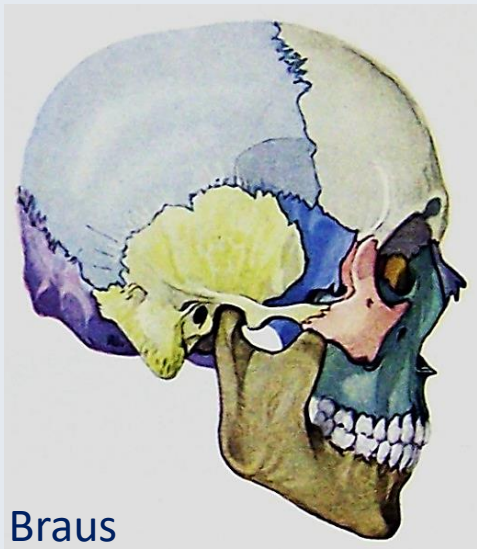
Os occipitale

Os zygomaticum



Braus

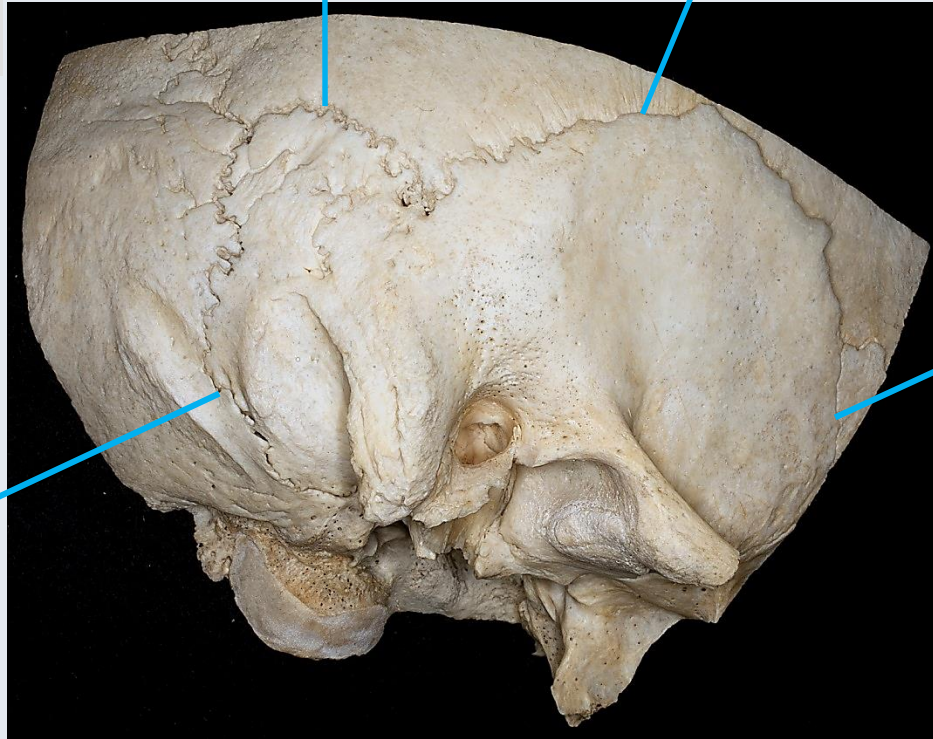




Braus

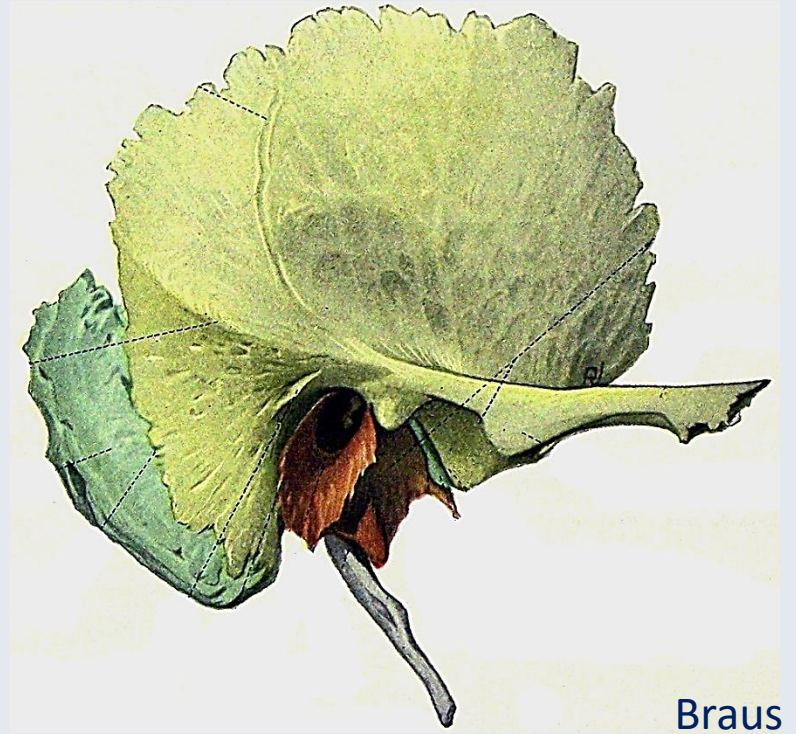
Sutura Parietomastoidea

Sutura squamosa



Sutura Occipito-
mastoidea

Sutura spheno-
squamosa



Pars Squamosa

Pars *Mastoidea*

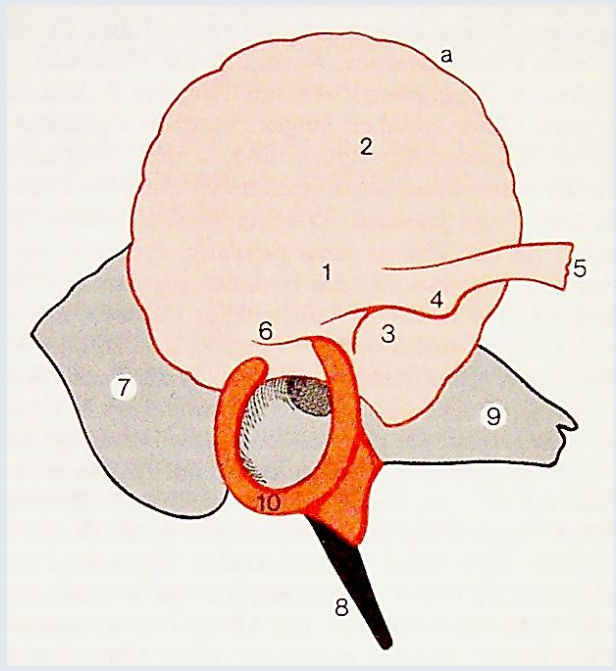
Pars Tympanica

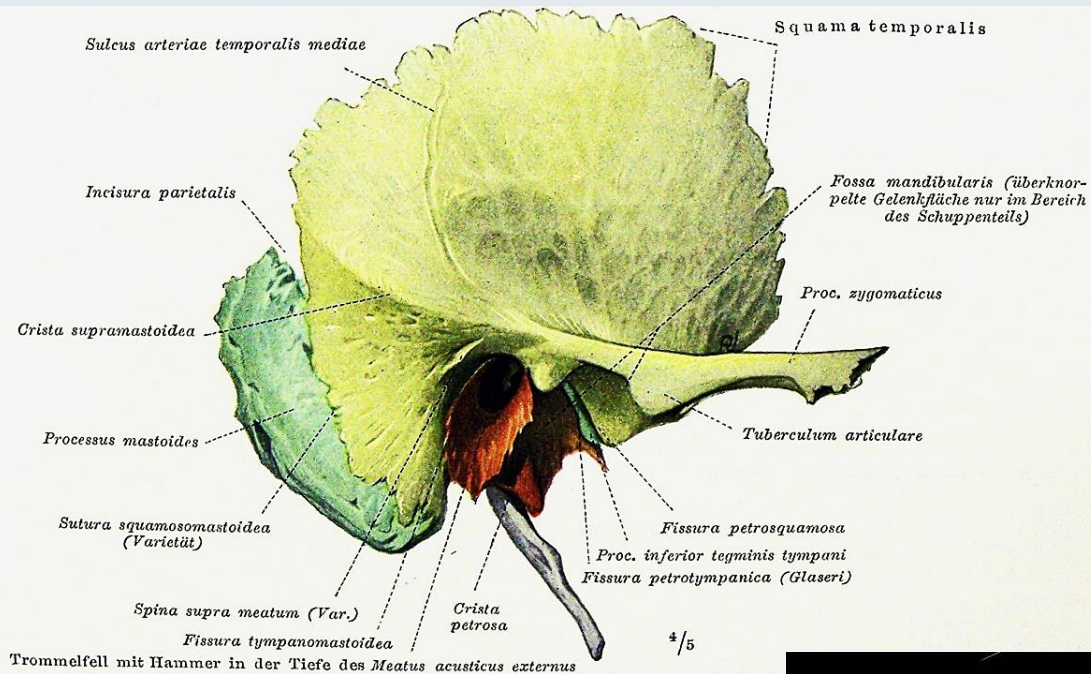
Pars Petrosa

Pars Hyoidea

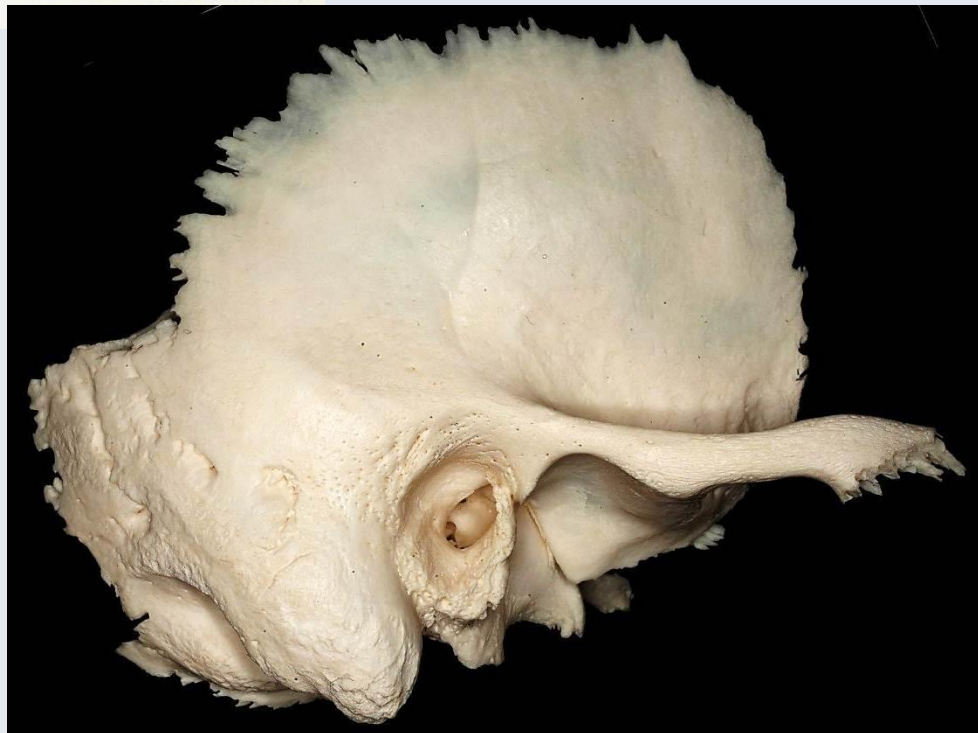
Rechter Schläfenbein aus seitlichem Aspekt

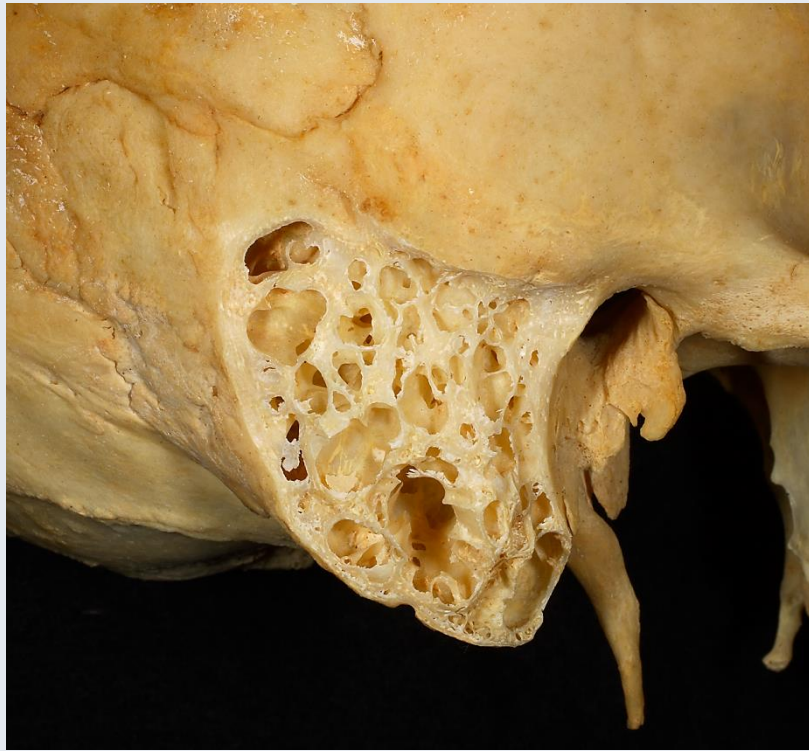
Faller





Aspectus lateralis



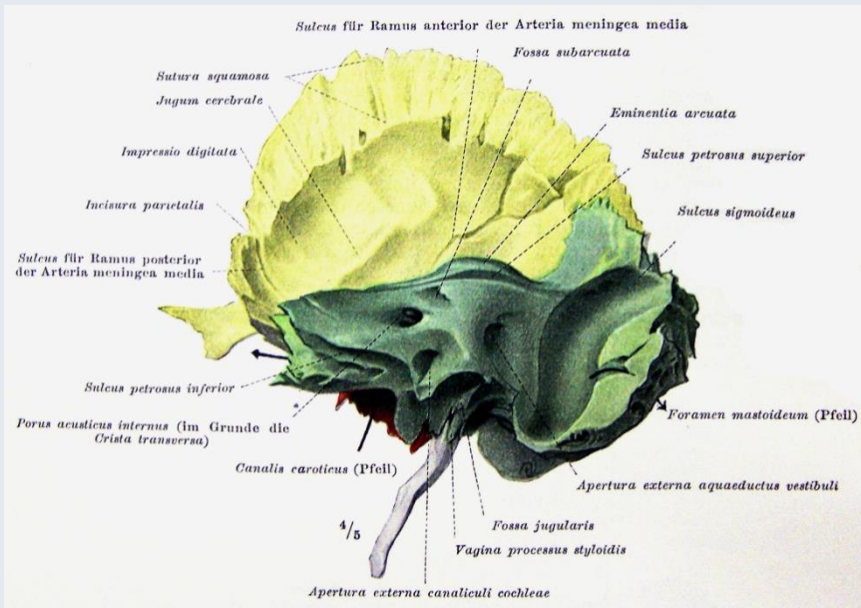


Mastoid-air cells

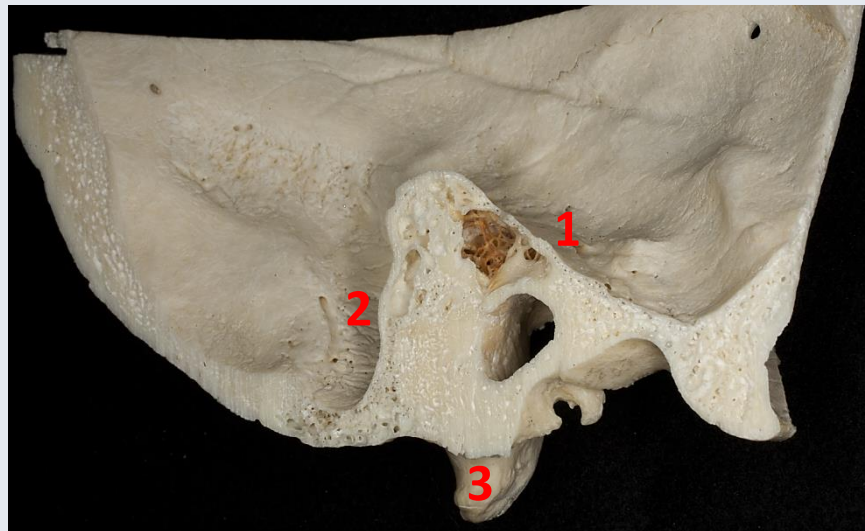
Antrum and Aditus



Aspectus posterior



Braus



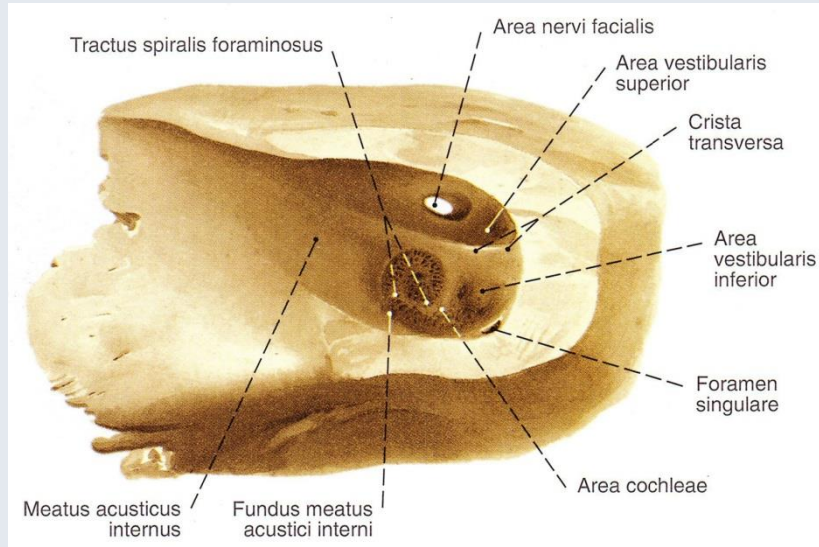
Pyramid: 3 surfaces

1. anterior pyramidal

2. posterior pyramidal

3. inferior pyramidal

Sobotta



4 quadranten:

Area facialis

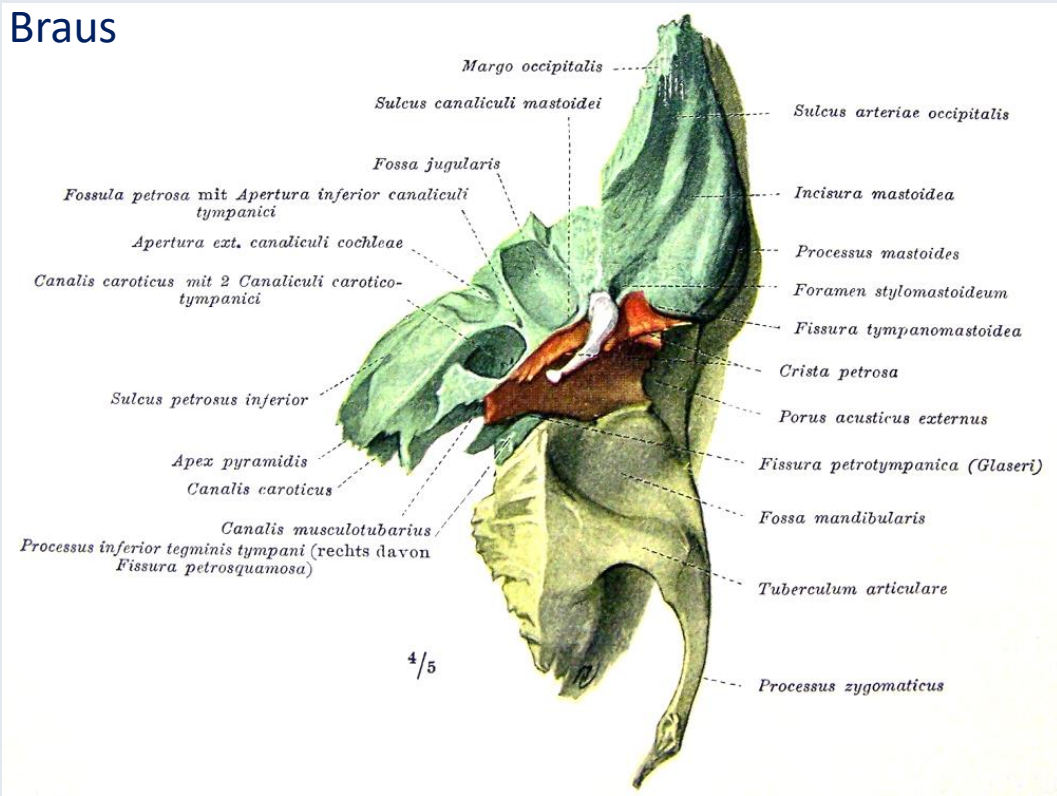
Area vestibularis superior

Area vestibularis inferior und
singulate foramen

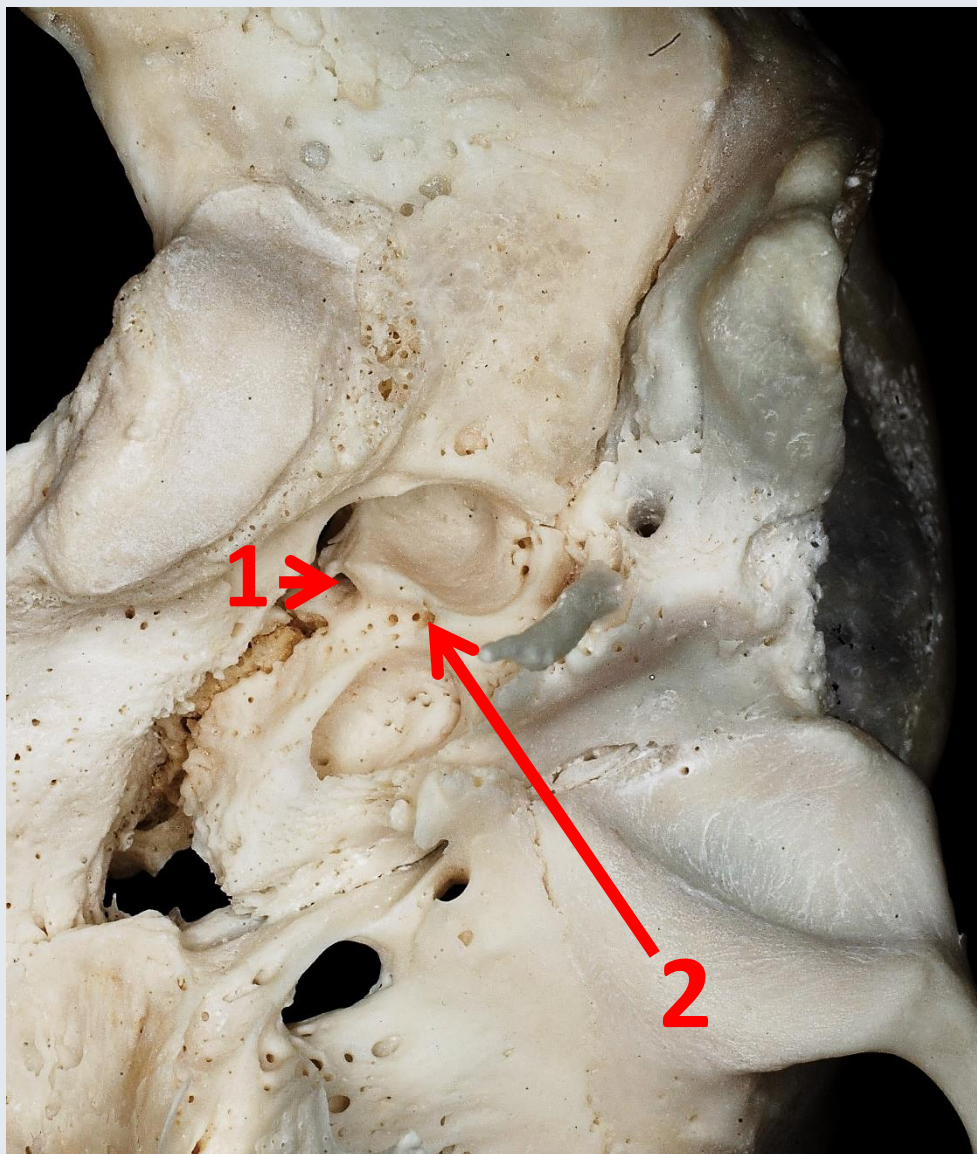
Area cochlearis



Braus

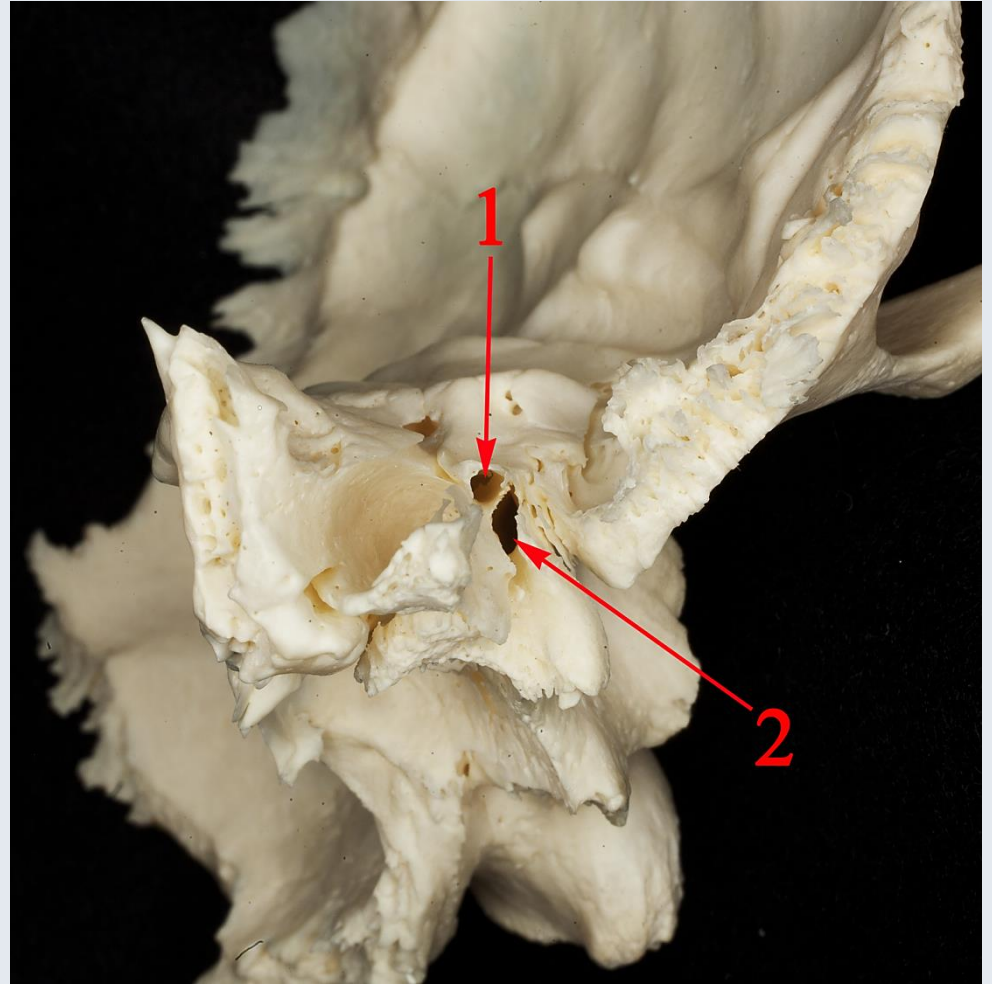


Aspectus inferior



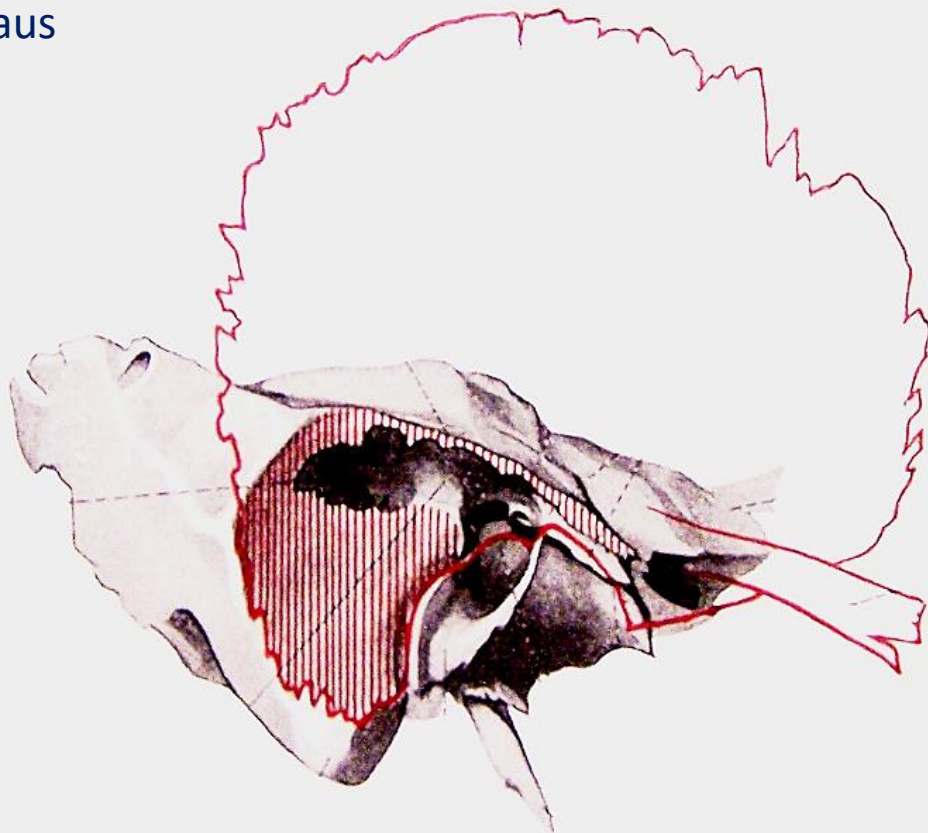
Braus

1. canaliculi cochleae
(medial to the petrosal fossa, between the jugular foramen and the carotid canal)
2. Fossula petrosa and tympanic canaliculus
(laterally from the former, also between two vascular openings)



Canalis Musculotubarius = semicanalis m. tensor tympani (1) + semicanal tubae auditivae (2)

Braus



Tegmen tympani

1. Fissura Petrotympánica (*Glaser'sche Spalte*) (Chorda tympani ???)

Ann Anat 188 (2006) 7–11



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**ANNALS
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Development of the anterior chordal canal

Miklós Tóth^{a,*}, Gerhard Moser^b, Lajos Patonay^c, Imre Oláh^a

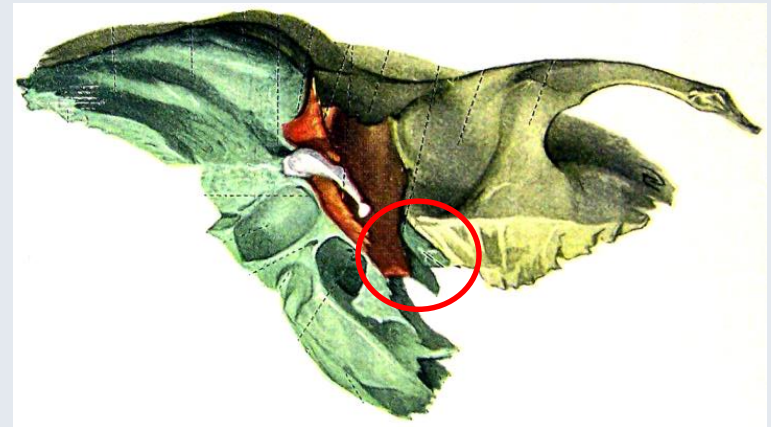
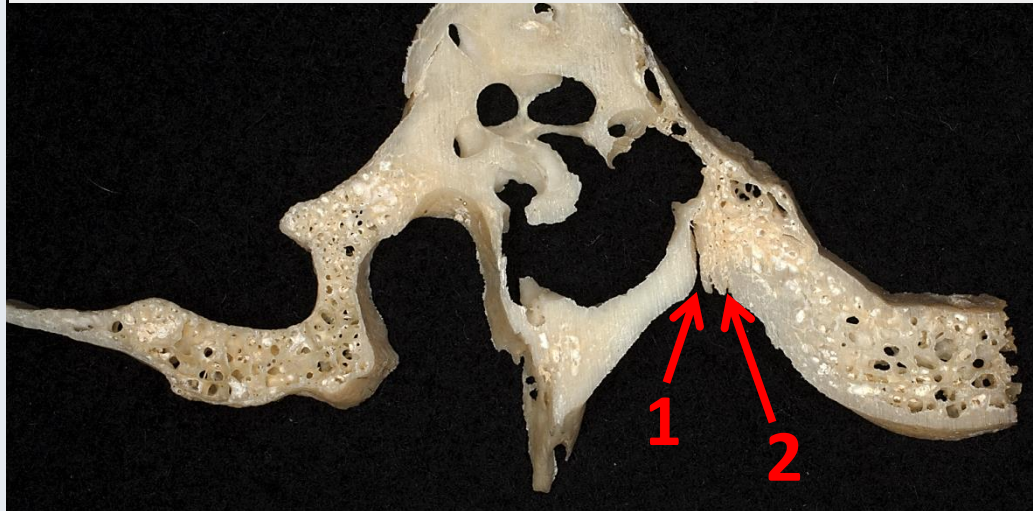
^aDepartment of Human Morphology and Developmental Biology, Faculty of Medicine, Semmelweis University, Tűzoltó utca 58, H-1094 Budapest, Hungary

^bDepartment of Otorhinolaryngology, Salzburg University Medical School, Salzburg, Austria

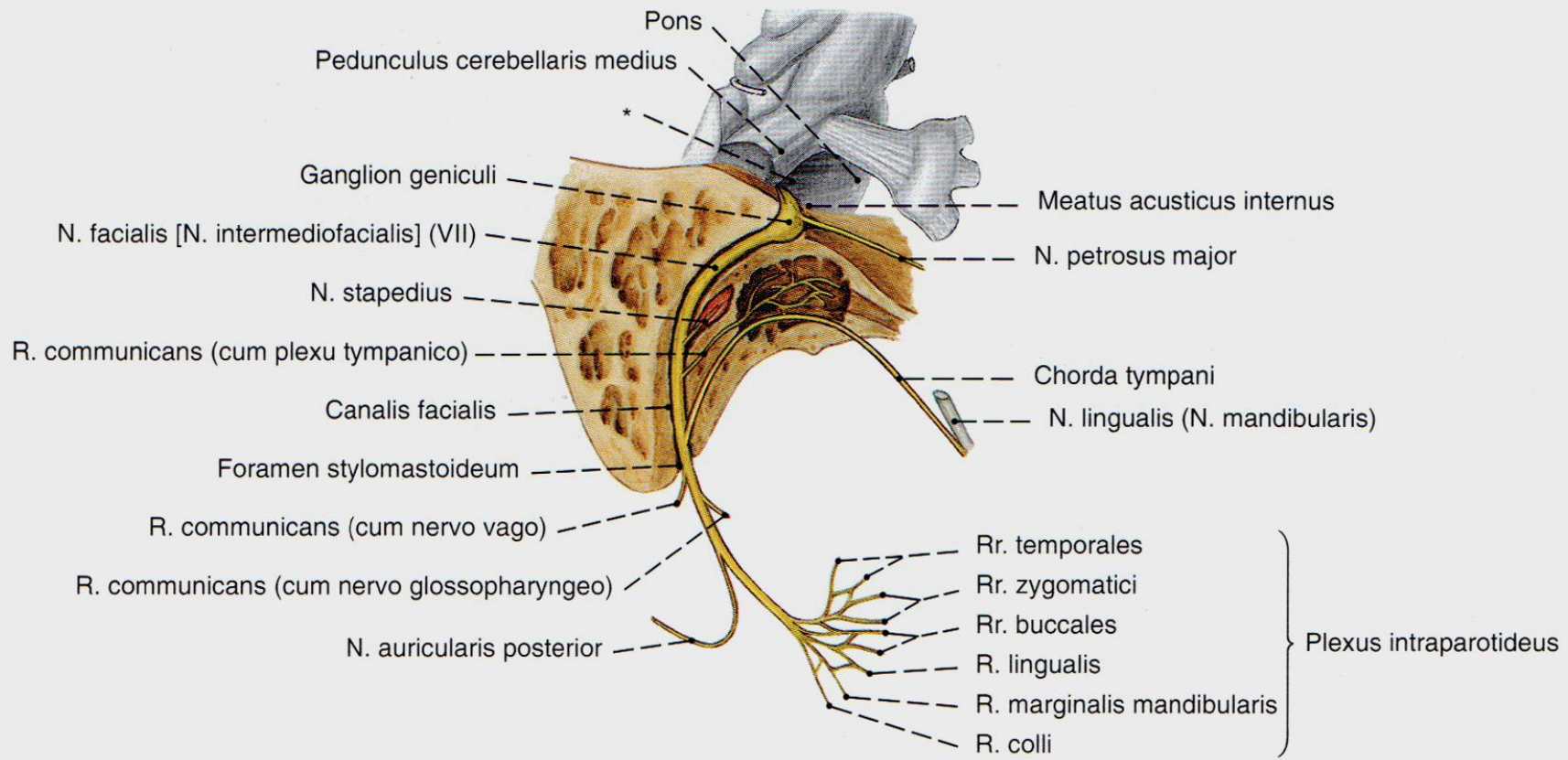
^cDepartment of Anatomy, Histology and Embryology, Faculty of Medicine, Semmelweis University, Tűzoltó utca 58, H-1094 Budapest, Hungary

Received 25 January 2005; accepted 5 April 2005

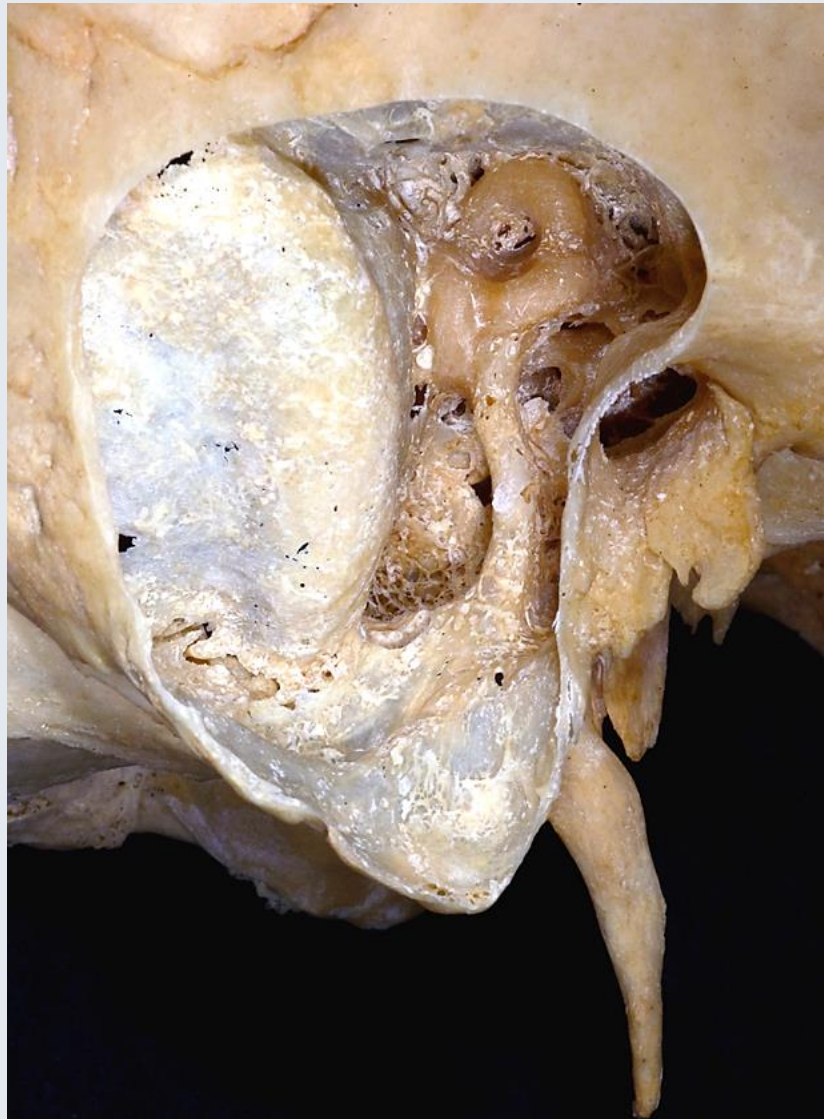
2. Fissura Petrosquamosa

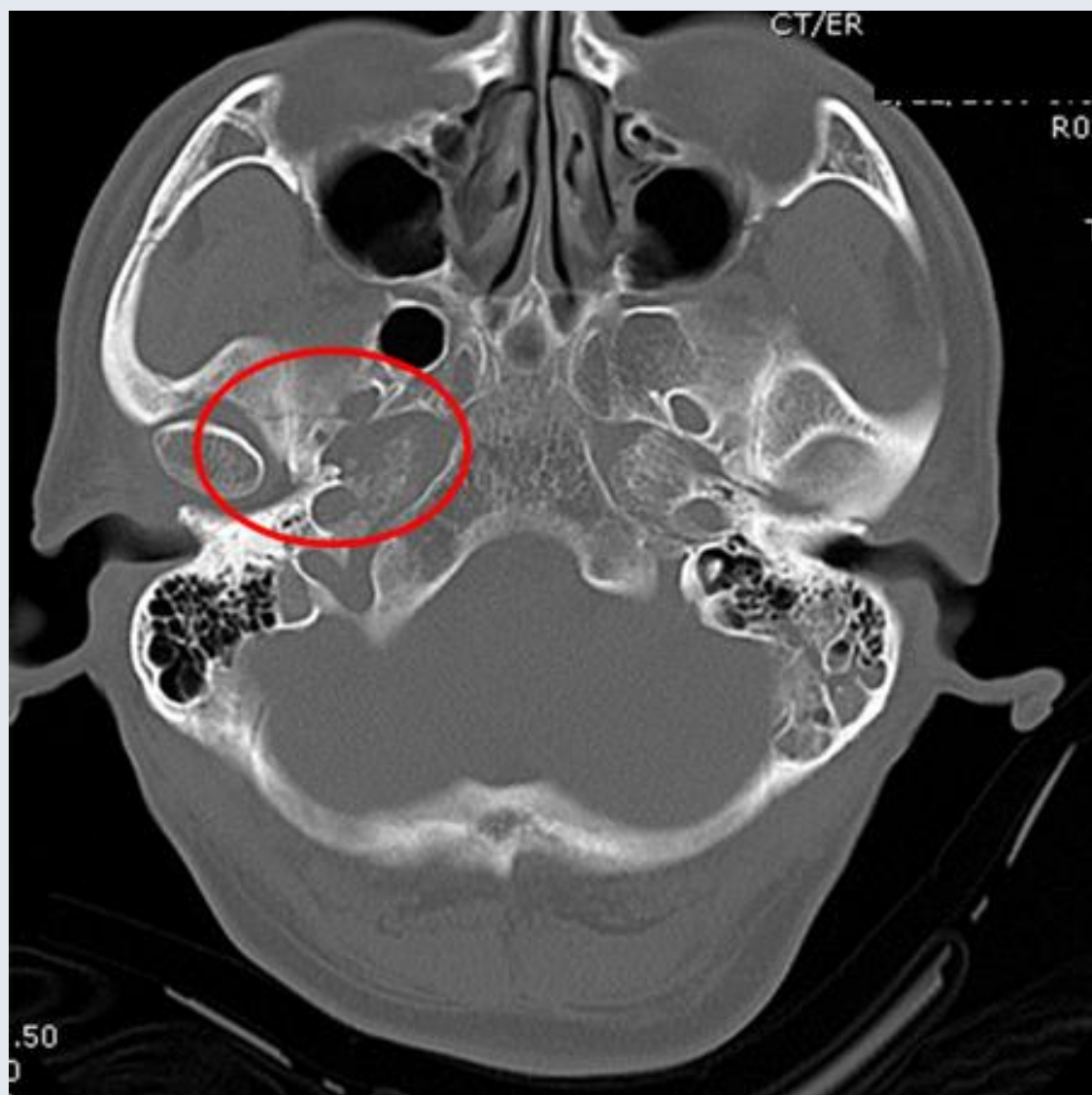


Facial canal (Fallopian canal)



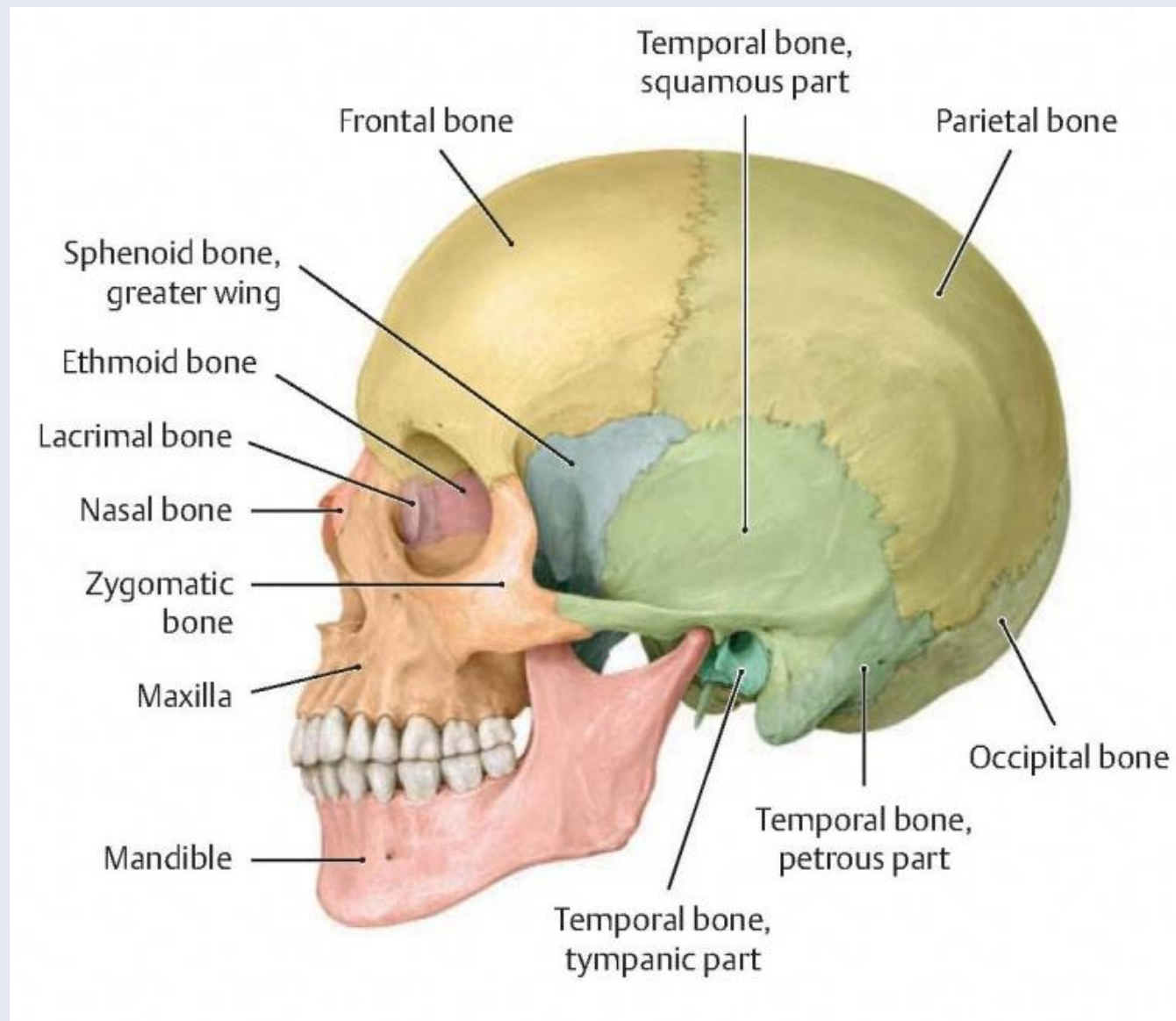
Facial canal
(Fallopian canal)



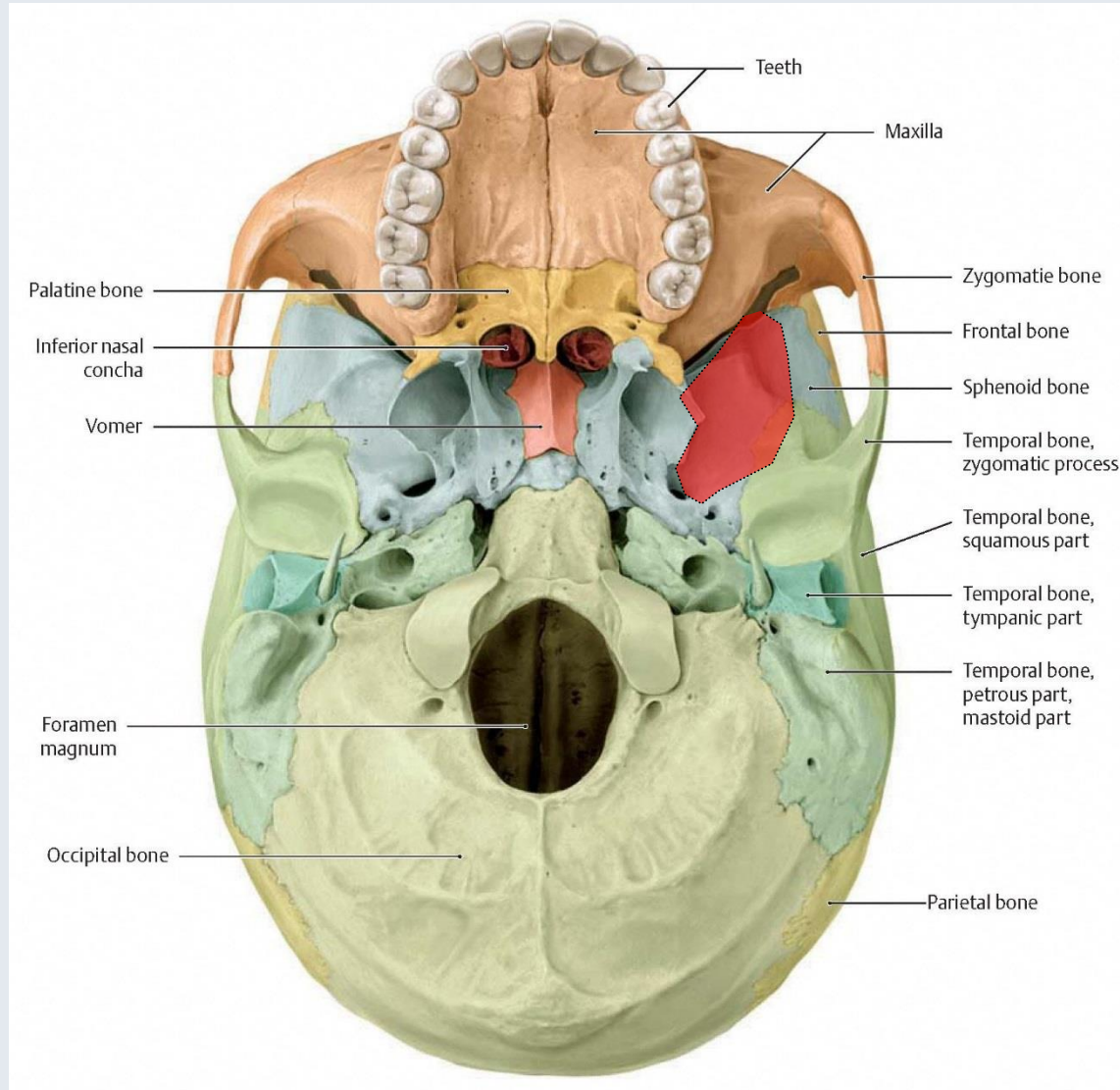


Fossa temporalis et infratemporalis

Topography



Infratemporal fossa



Infratemporal fossa

Anterior

Tuber maxillae
Facies infratemporalis maxillae

Posterior

Tuberculum articulare (Articulatio temporomandibularis)

Upper

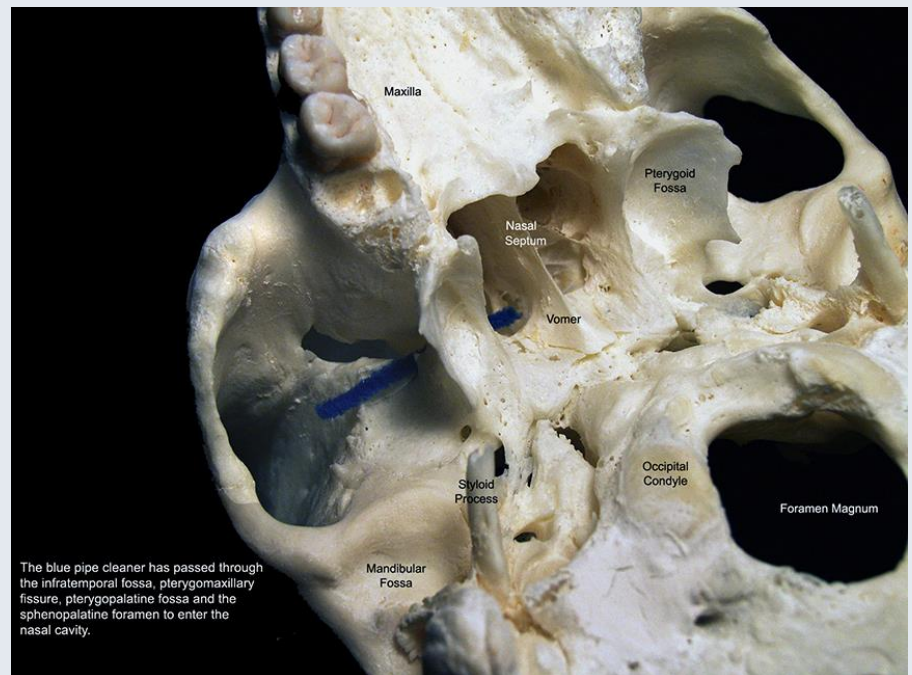
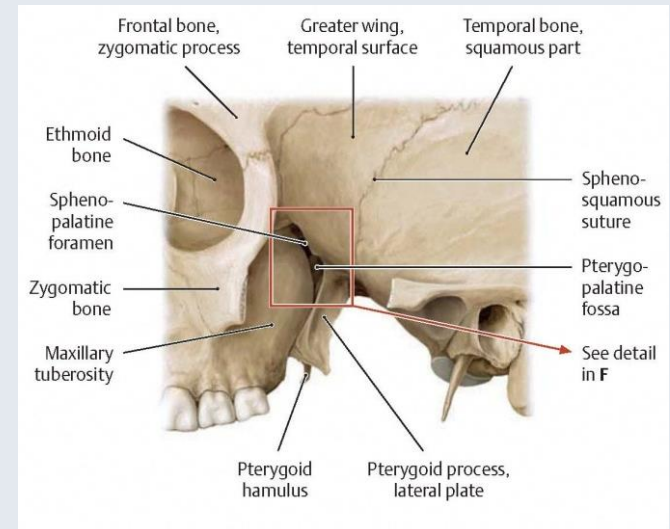
Facies infratemporalis (ala majoris ossis sphenoidalis)
Squama ossis temporalis (bis der crista infratemporalis)

Lower

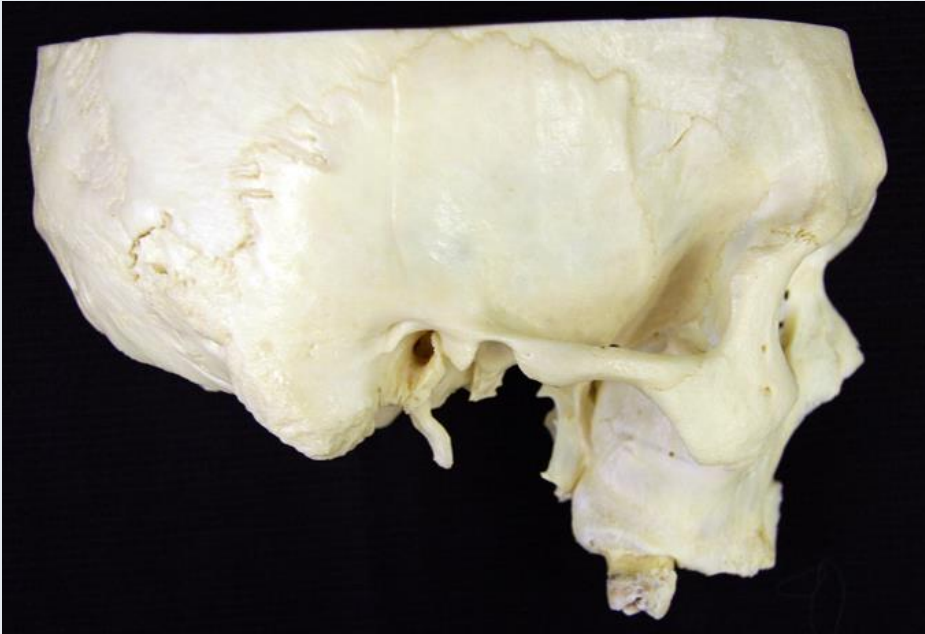
Ramus mandibulae
Processus coronoideus
Arcus zygomaticus

medial

Lamina lateralis processus pterygoidei
Fissura pterygo-maxillaris
Fissura orbitalis inferior (vorderer, lateraler Teil)



INFRATEMPORAL FOSSA AND PTERYGOPALATINE FOSSA

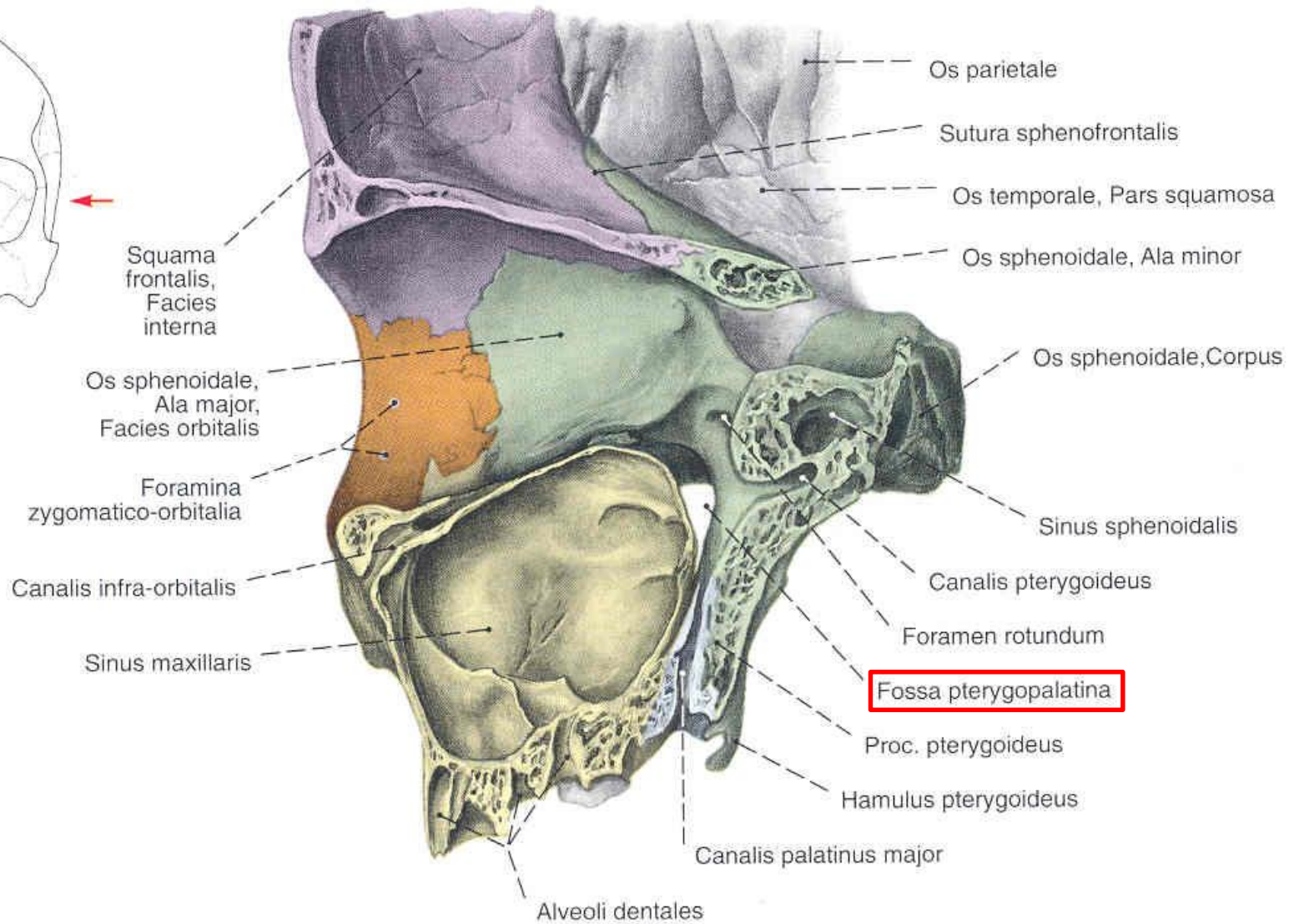
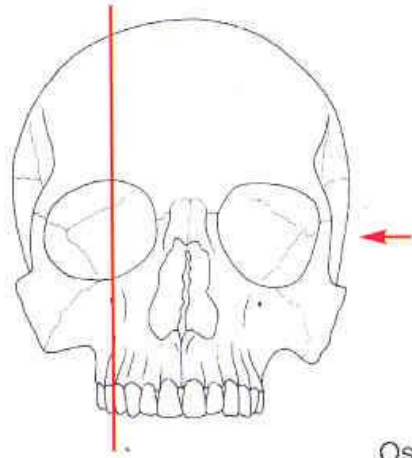


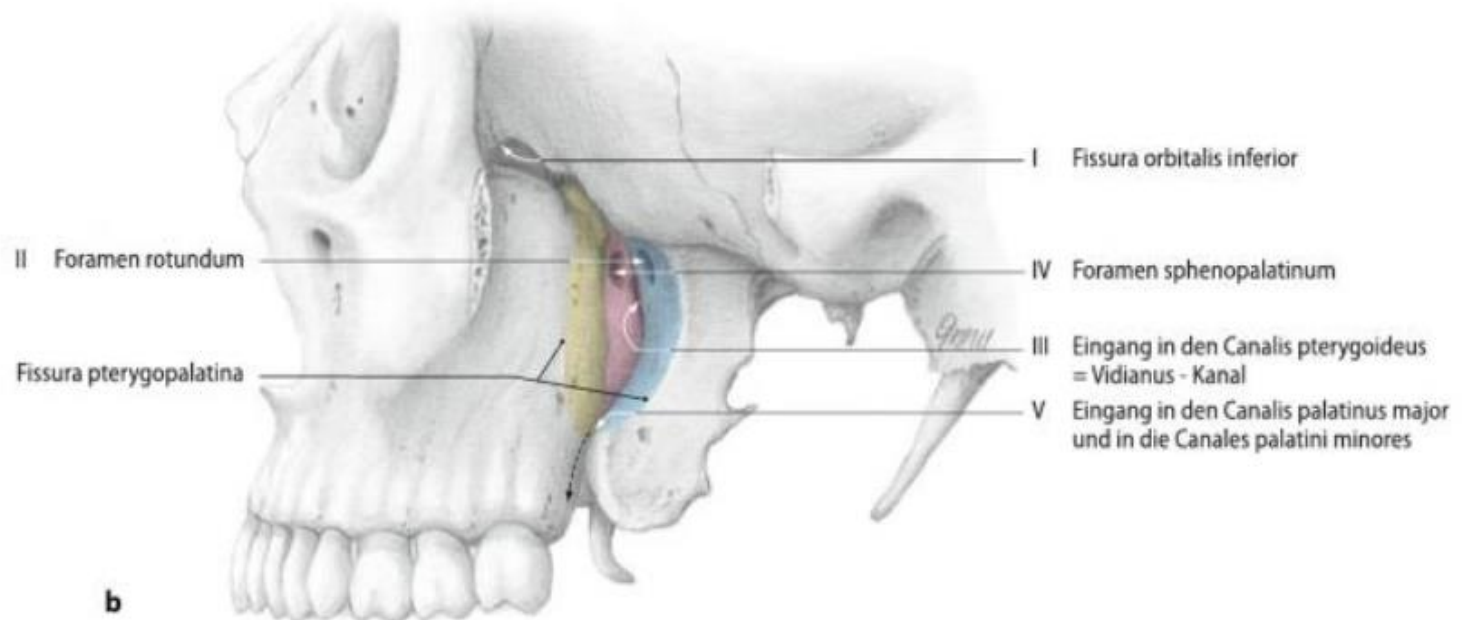
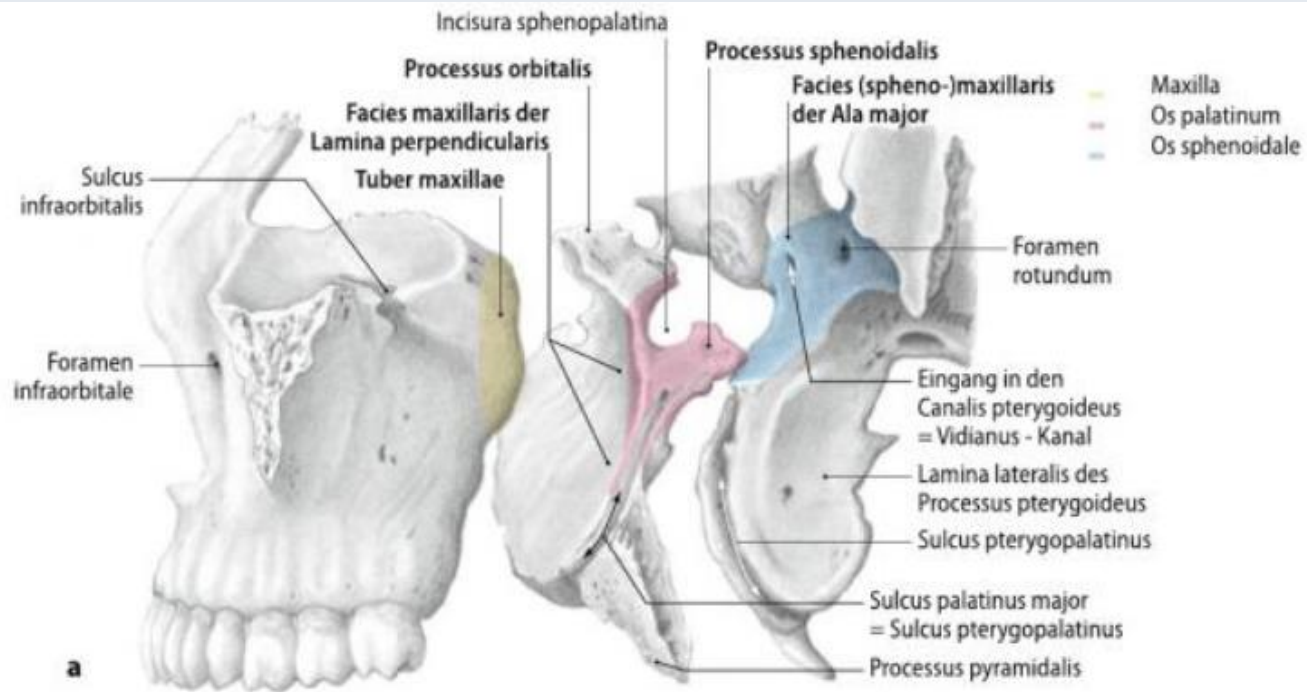
Fossa infratemporalis	Wohin (woher)
Fissura pterygomaxillaris	Fossa pterygopalatina
Fissura orbitalis inferior II. (vorderer, lateraler Teil)	Orbita
Foramen ovale	Fossa cranii media
Foramen spinosum	Fossa cranii media
Fissura petrotympanica (<i>Glaseri</i>)	Cavum tympani
Foramina alveolaria	Zu den oberen Zähne in <i>canales alveolares</i> von Maxilla
Fissura petrosquamosa	Fossa cranii media

Pterygopalatine fossa

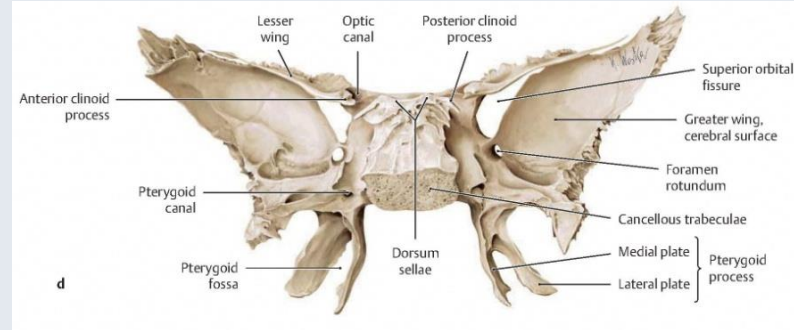
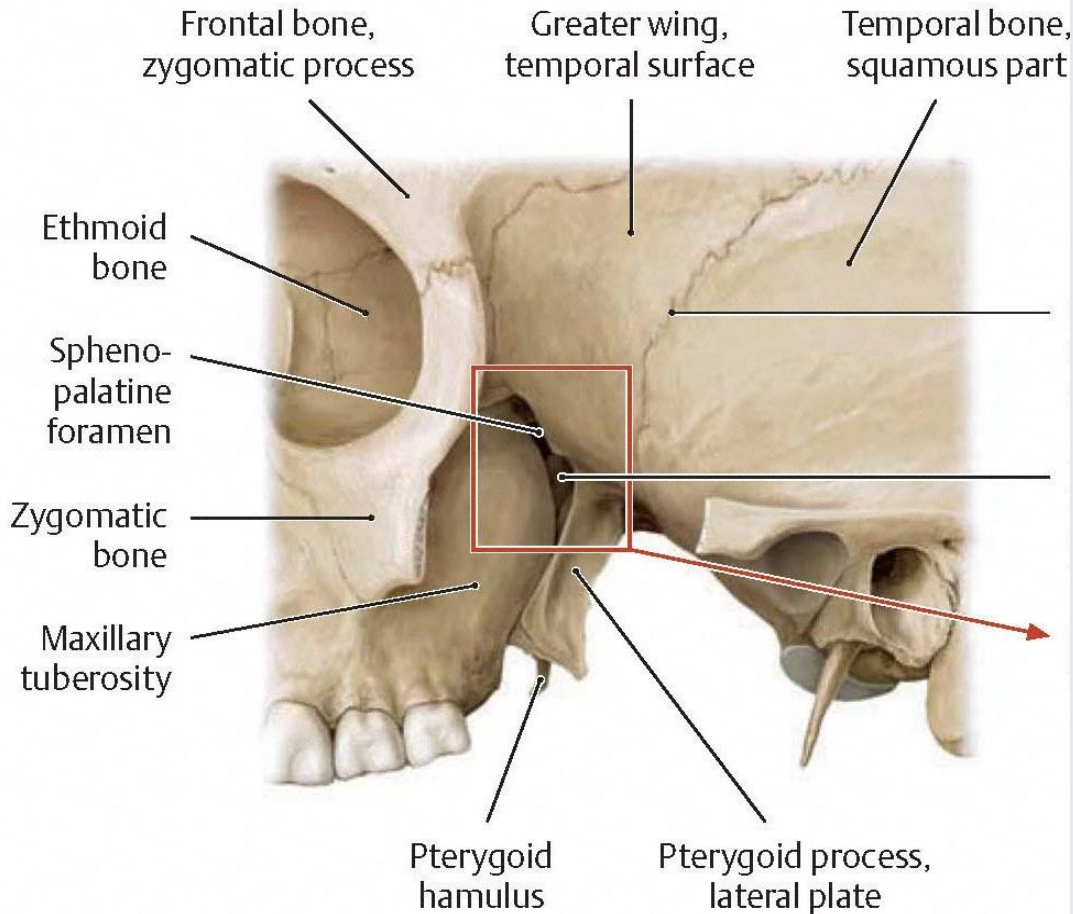


Pterygopalatine fossa





pterygopalatine fossa

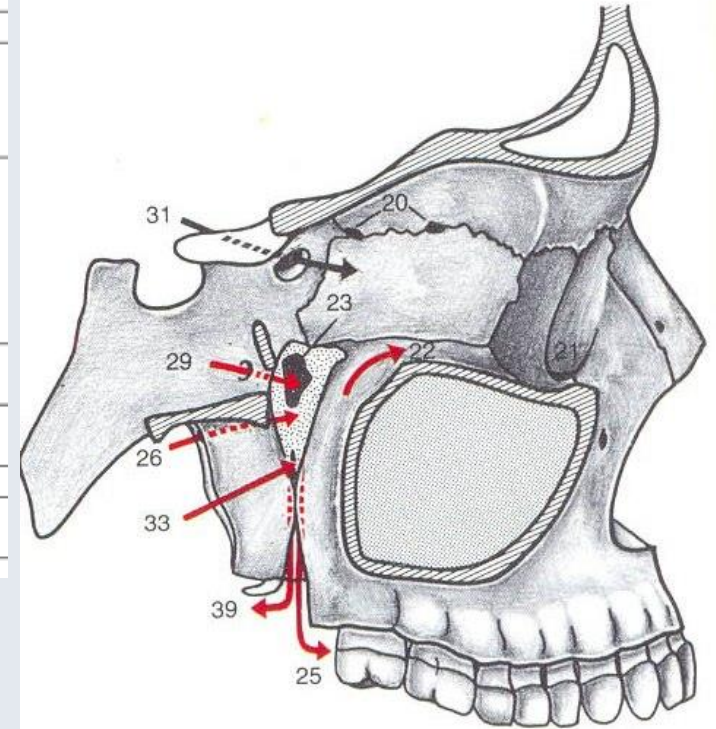


Anterior	Tuber maxillae
Posterior	Processus pterygoideus mit ala major facies maxillaris
Medial	Lamina perpendicularis ossis palatini+ Proc. orbitalis und Proc. sphenoidalis
Lateral	Fossa infratemporalis (durch der fissura pterygo-maxillaris)
Superior	Ala major ossis sphenoidalis mit Corpus Ossis sphenoidalis
Inferior	Processus pyramidalis ossis Palatini

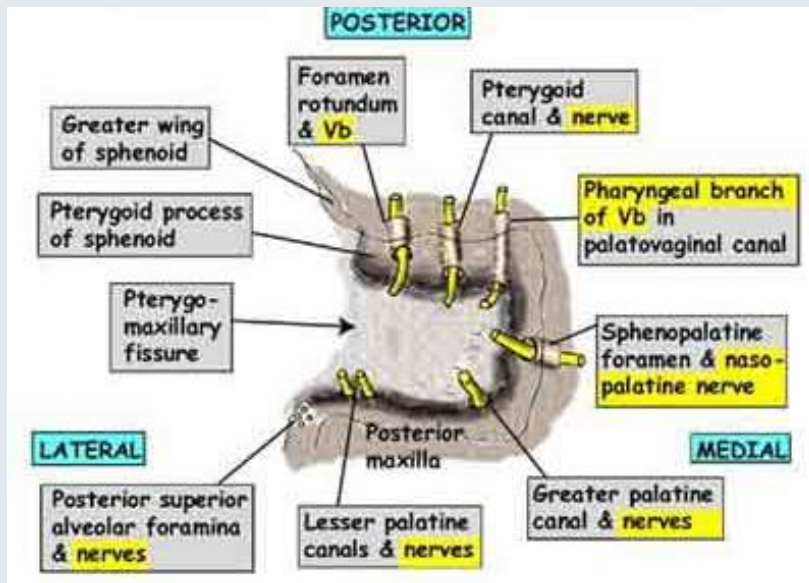
Connections of the pterygopalatine fossa

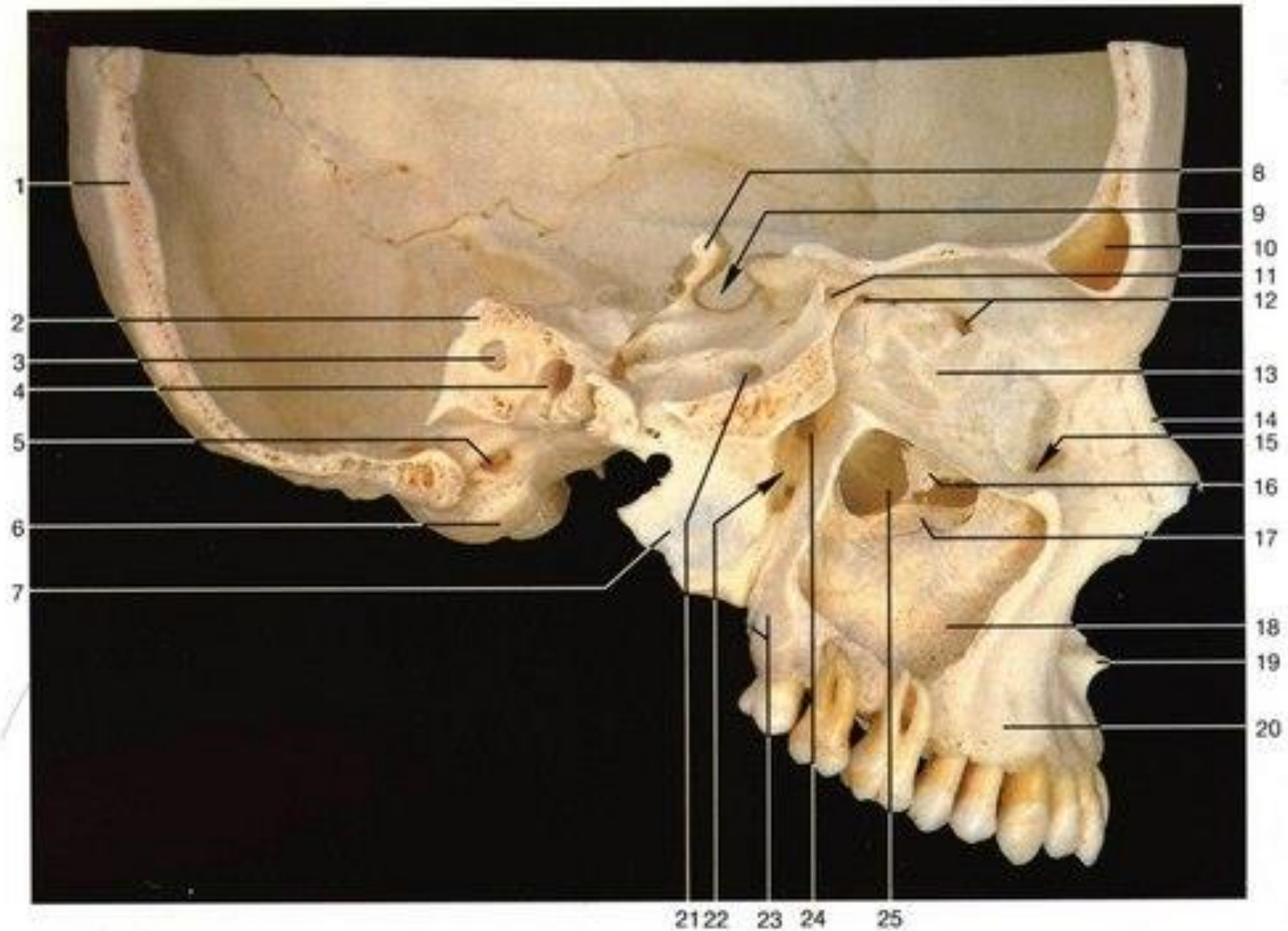
Fossa pterygopalatina (seu Fossa sphenopalatina)

	Wohin (woher)
Canalis pterygoideus (<i>Vidui</i>)	Basis cranii externa
Canalis palatinus major seu Canalis pterygopalatinus/ sphenopalatinus major (öffnet sich mit <i>Foramen palatinum majus</i>)	Cavum oris
Canales palatini minores seu Canales pterygopalatini/ sphenopalatini minores (öffnen sich mit <i>Foramina palatina minora</i>)	
Fissura orbitalis inferior I. (hinterer, medialer Teil)	Orbita
Fissura pterygomaxillaris	Fossa infratemporalis
Foramen rotundum	Fossa cranii media
Foramen sphenopalatinum seu pterygopalatinum	Cavum nasi (Meatus nasi communis)

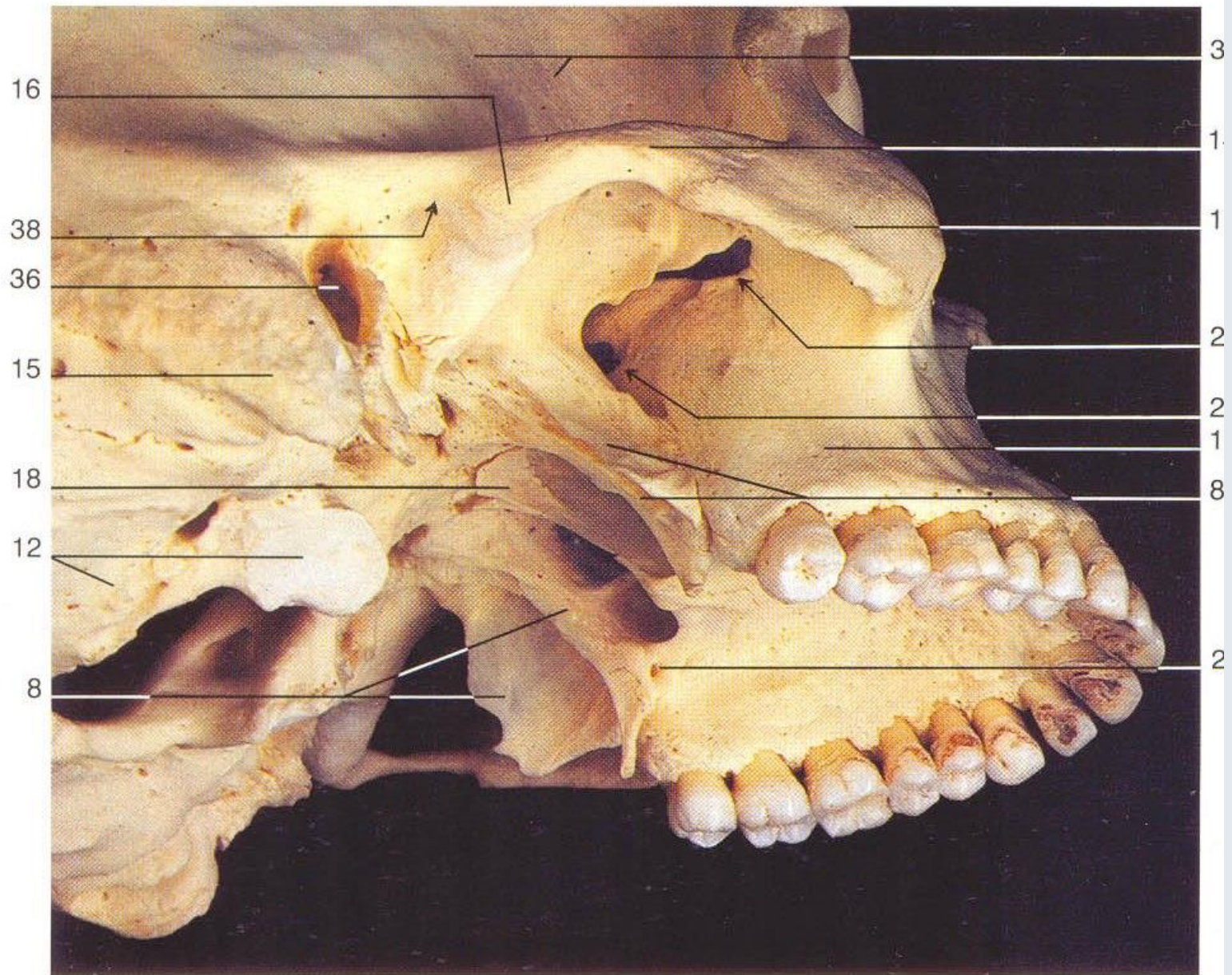


Openings and canals of the pterygopalatine fossa. Schematic drawing.

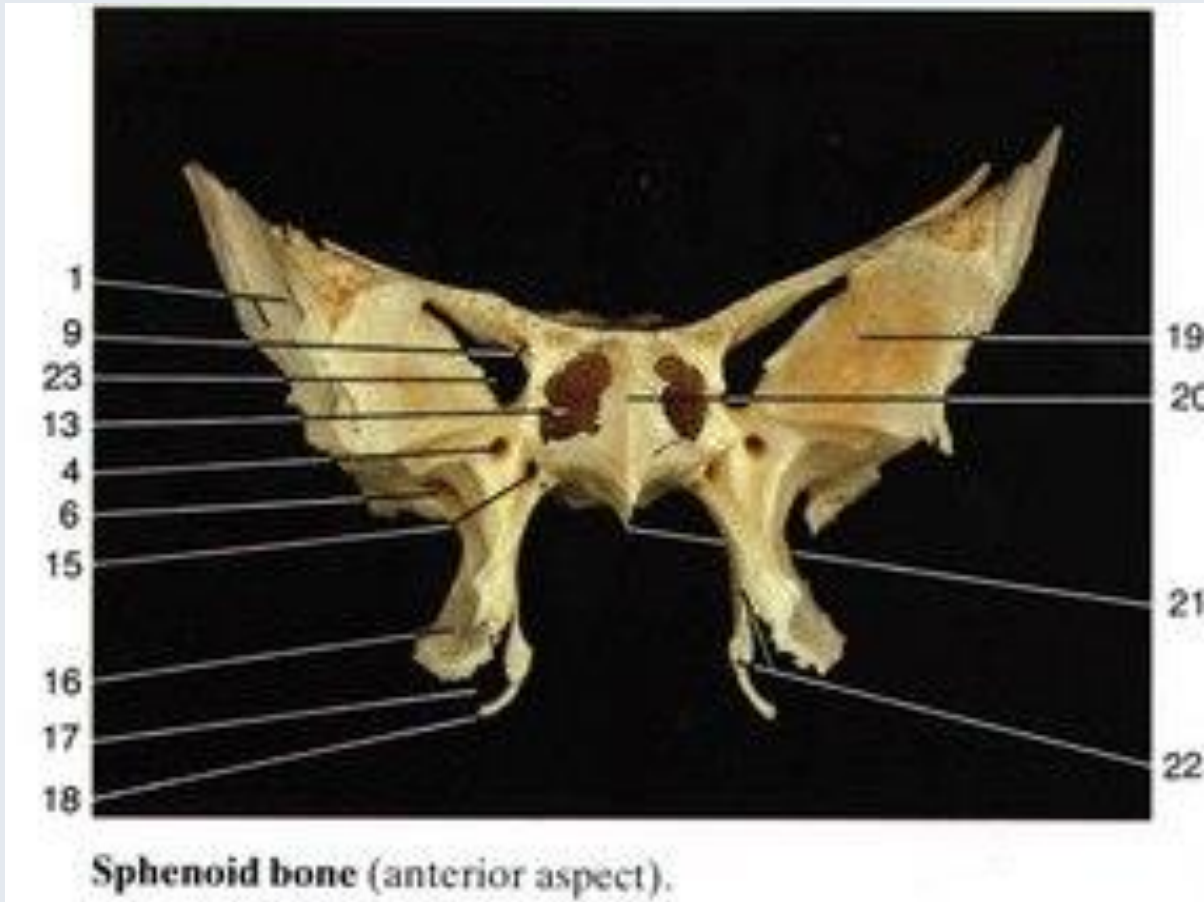
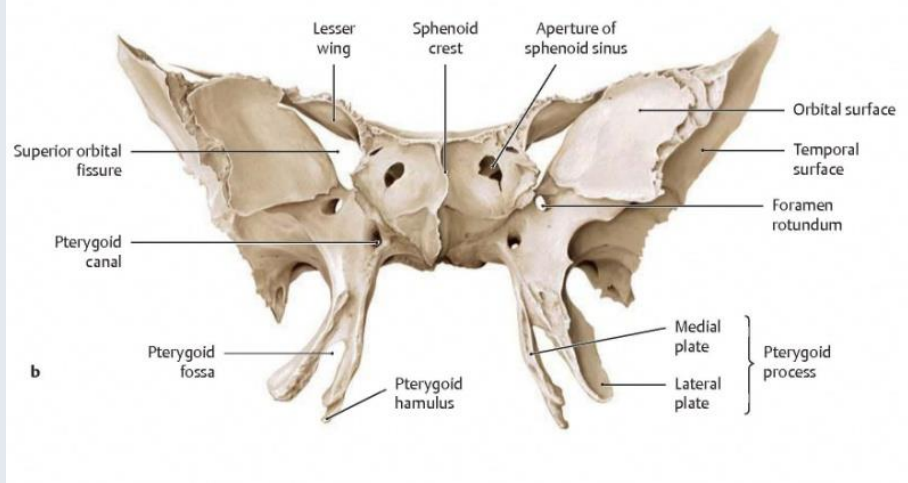


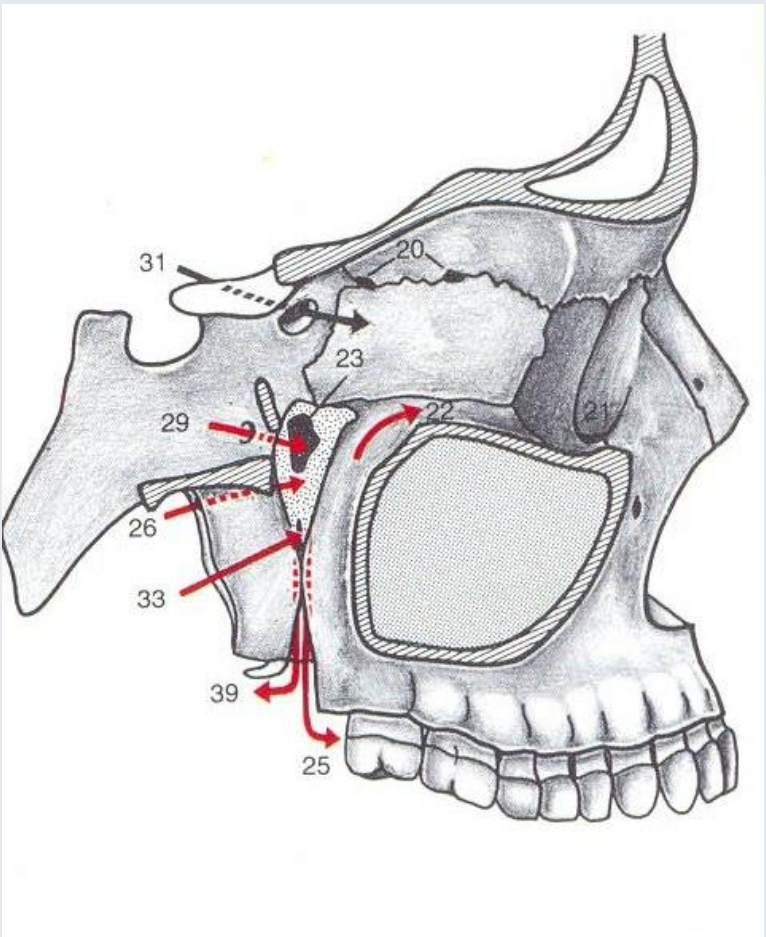


Paramedian section through the skull, right side (lateral aspect). Frontal and maxillary sinus are opened.

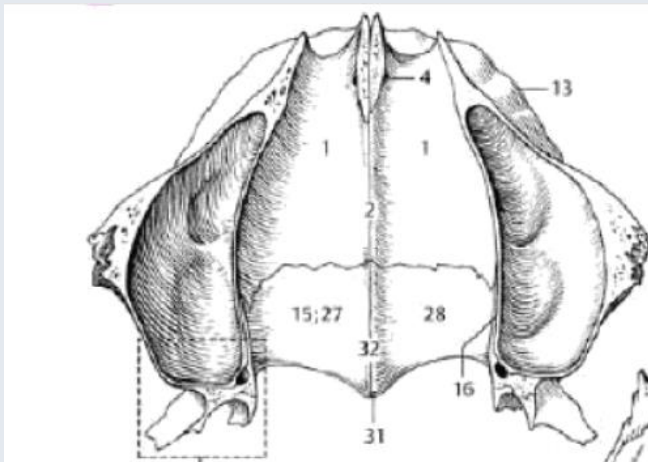


Oblique lateral aspect of the base of the skull. Facial skeleton.

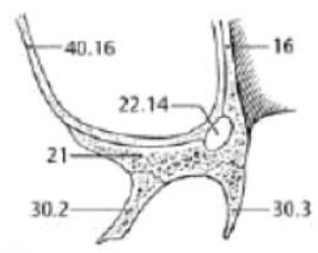




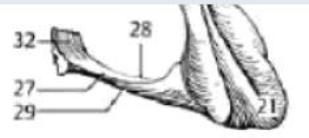
Openings and canals of the pterygo-palatine fossa. Schematic drawing.



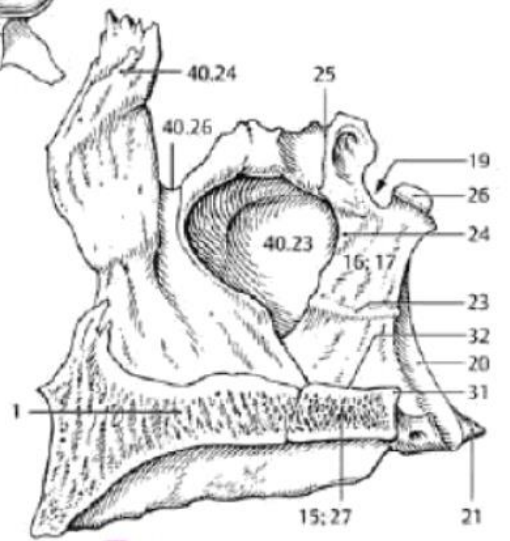
B Harter Gaumen und Oberkieferhöhlen (eröffnet) von oben



C Schematisierter Ausschnitt aus B

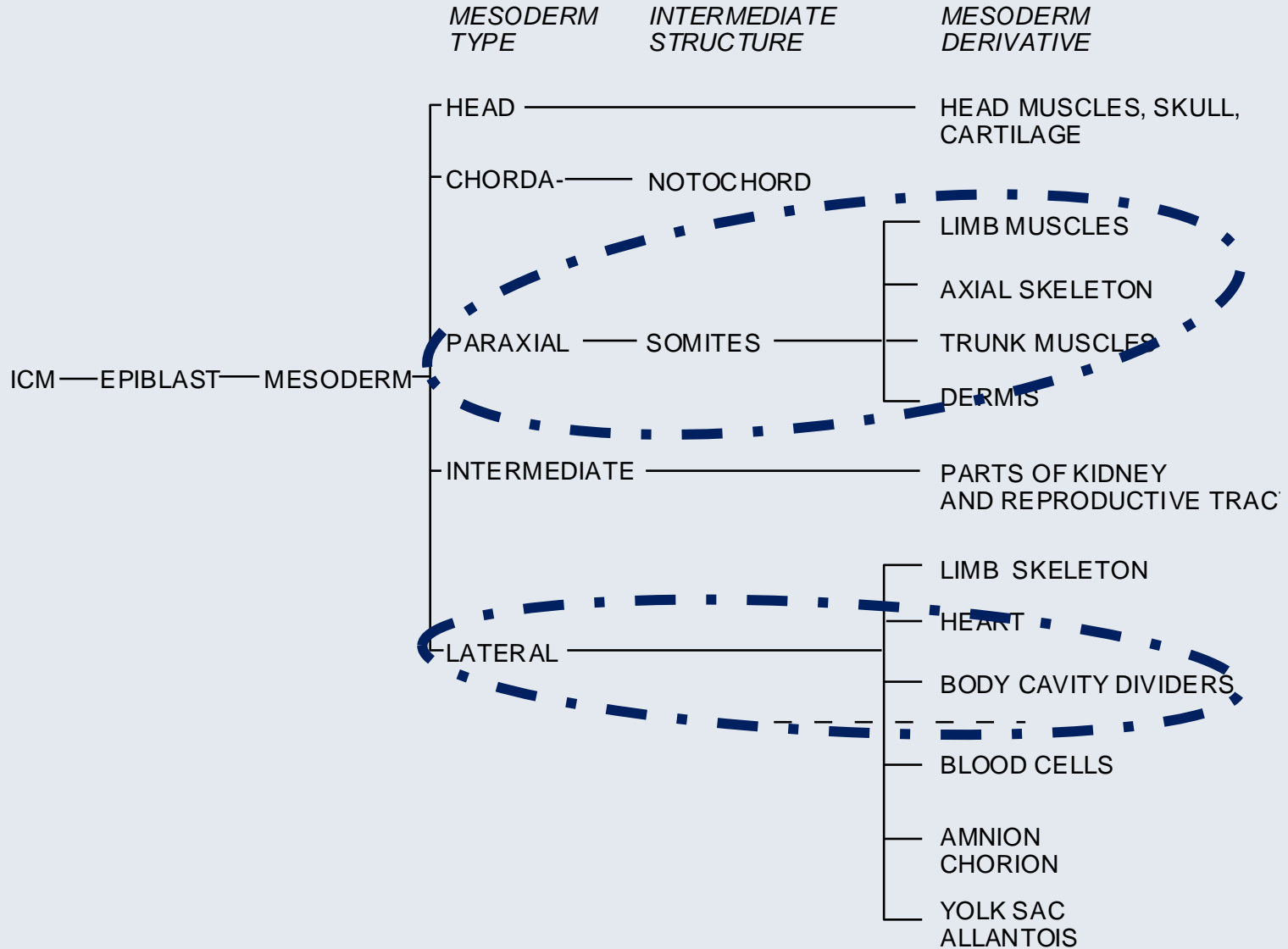


D Rechtes Os palatinum von hinten lateral



E Rechter Oberkiefer von medial

DERIVATEN DES MESODERMS



WHERE DOES THE CRANIUM COME FROM?

LATERAL PLATE MESODERM

PARAXIAL MESODERM

NEURAL CREST

In the cervical region

Desmocranium vs Chondrocranium

The cranial components develop by

MEMBRANOUS and **ENDOCHONDRAL** ways

*They produce **Compacta** and **Spongiosa** of the*

Viscerocranium and Neurocranium

CARTILAGINOUS **VISCEROCRANIUM**
NEUROCRANIUM

MEMBRANOUS **NEUROCRANIUM**
VISCEROCRANIUM

COMPONENTS OF THE CRANIUM

NEUROCRANIUM

Chondrocranium

- Occipital
- Sphenoid
- Ethmoid
- Petrous and mastoid part of temporal

Membranous neurocranium

- Interparietal part of occipital
- Parietal
- Frontal
- Squamous part of temporal

VISCEROCRANIUM

Pharyngeal Arch I

Cartilaginous viscerocranium

- Meckel's cartilage
- Malleus
- Incus

Membranous viscerocranium

- Maxillary process (superficial)
 - Squamous part of temporal
 - Zygomatic
 - Maxillary
 - Premaxillary
 - Nasal?
 - Lacrimal?
- Maxillary process (deep)
 - Palatine
 - Vomer
 - Pterygoid laminae
- Mandibular process
 - Mandible
 - Tympanic ring

PHARYNGEAL ARCH II

Cartilaginous viscerocranium

- Reichert's cartilage
- Stapes
- Styloid process

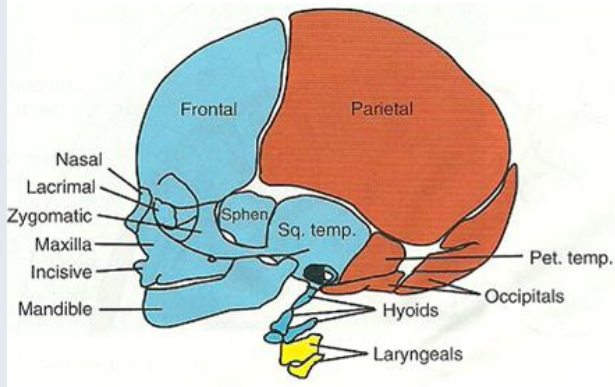
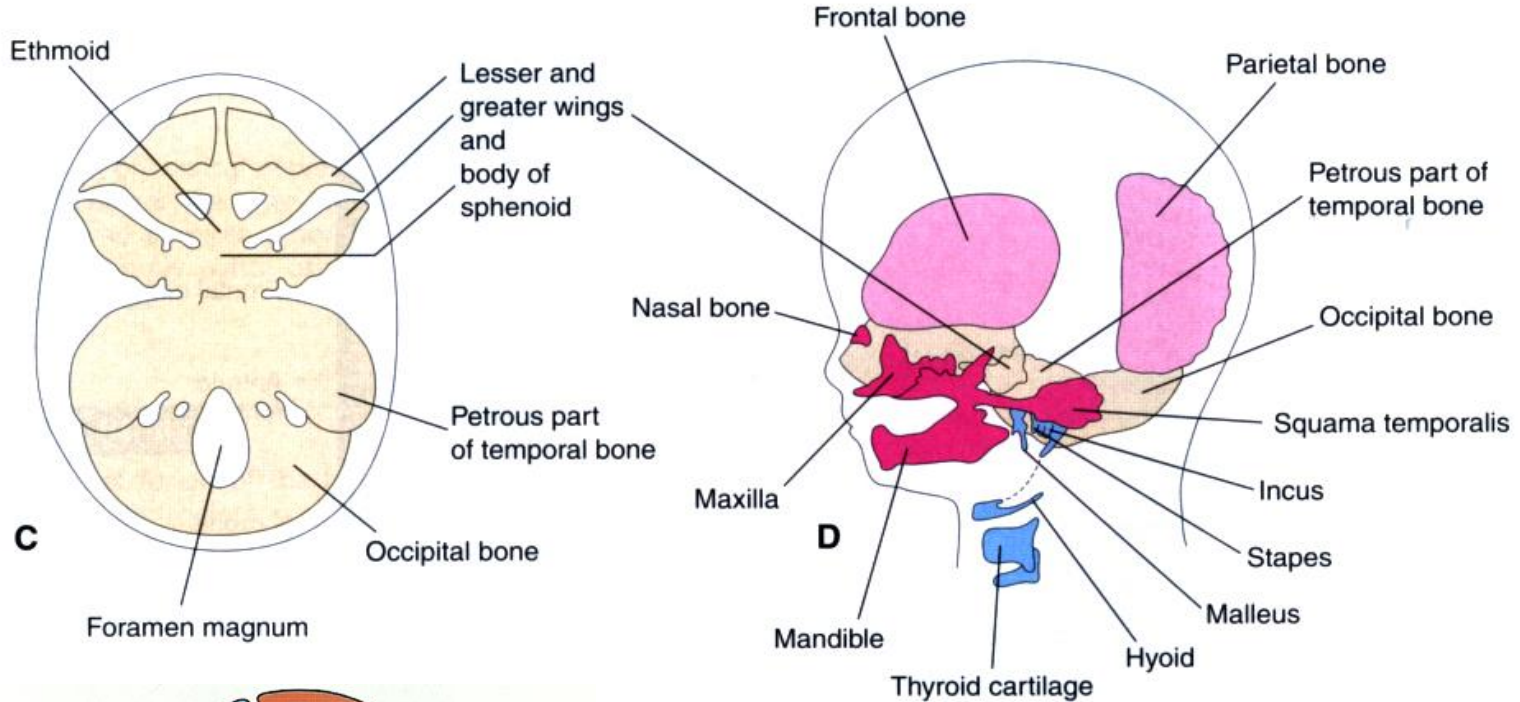
NEUROCRANIUM AND VISCEROCRANIUM

Cartilaginous neurocranium

Membranous neurocranium

Cartilaginous viscerocranium

Membranous viscerocranium



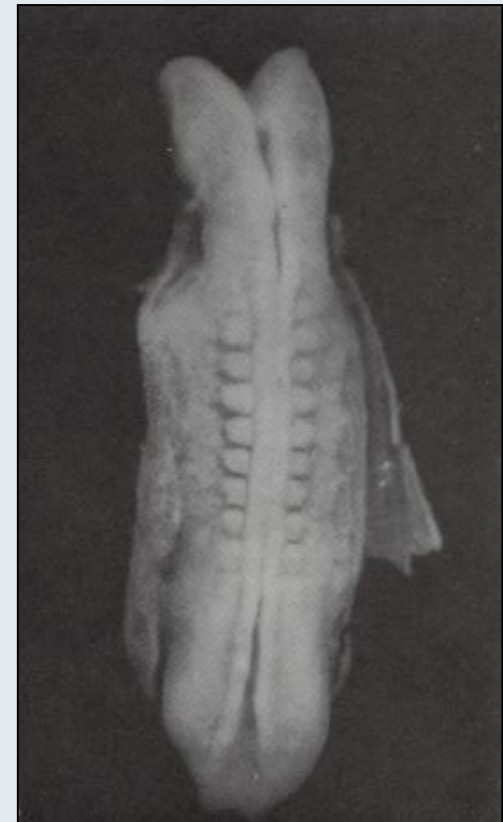
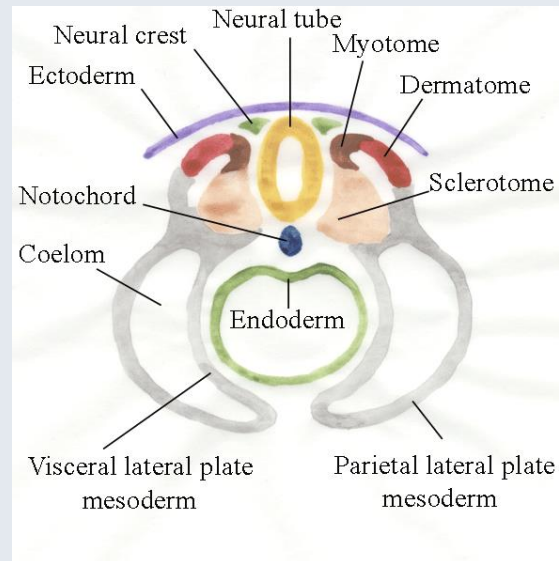
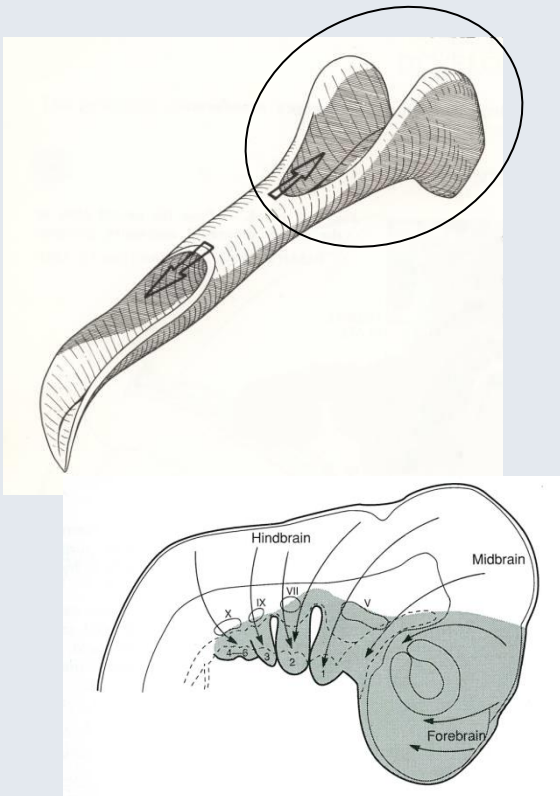
BLUE – neural crest

BROWN – paraxial mesoderm (somites)

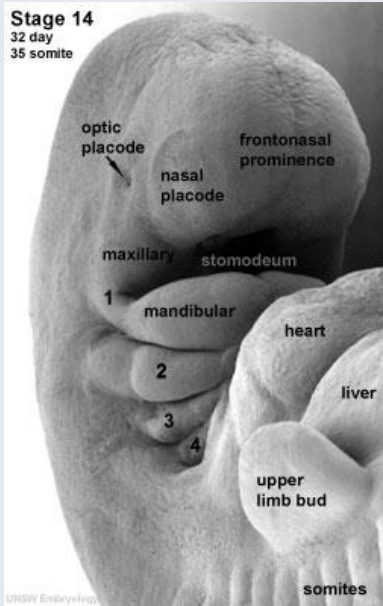
YELLOW – lateral plate mesoderm

EMBRYOLOGICAL ORIGINS OF THE CRANIUM

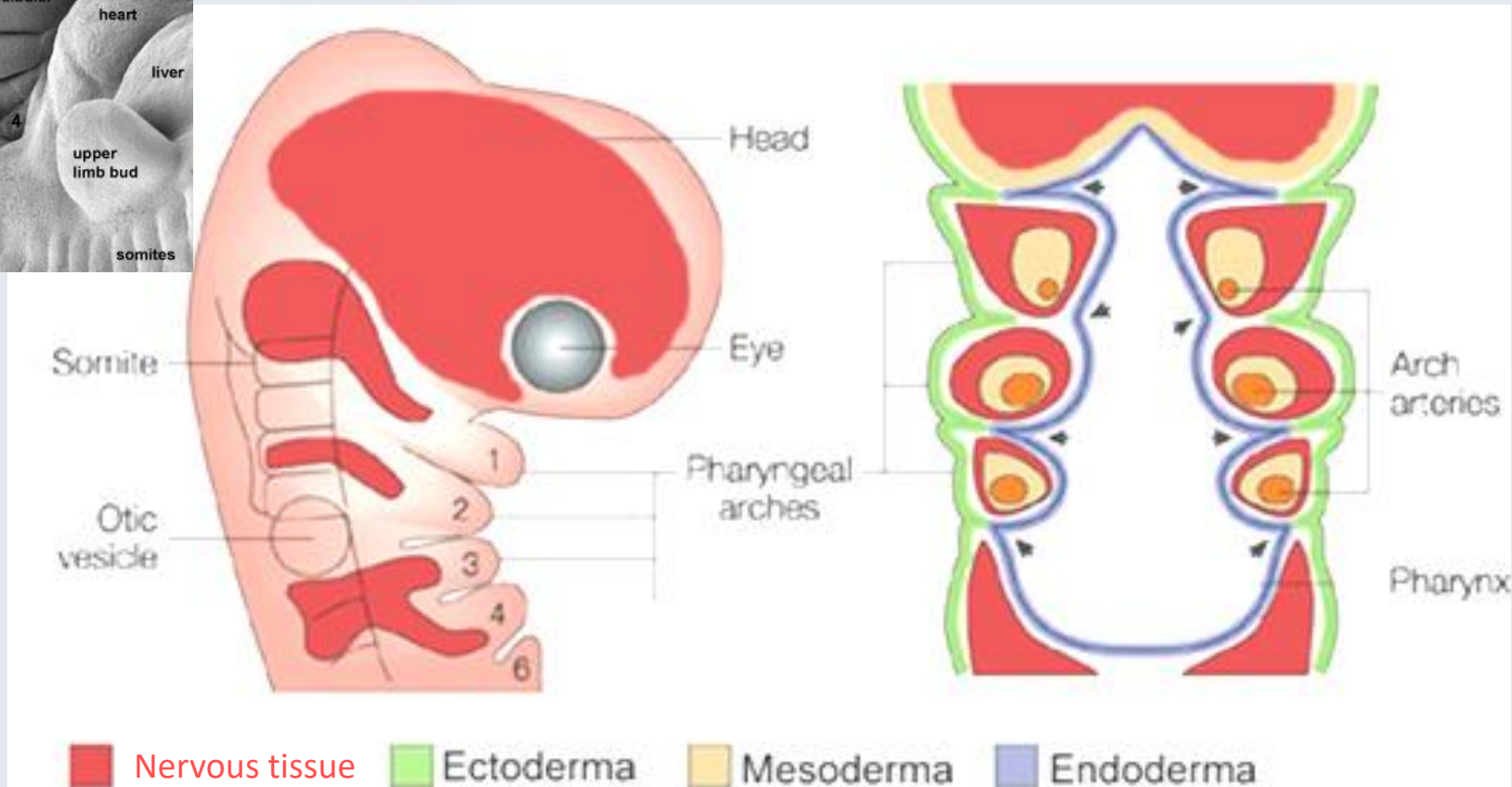
- **Mesenchyme** from around the proximal end of the neural tube
(connective tissue capsule of the **prosencephalon**)
- Neural crest (**ectomesenchyme**)
- The first 3 Somites (**sclerotome**)
- **Mesenchyme** of the 1st and 2nd branchial arches



EMBRYOLOGICAL ORIGINS OF THE CRANIUM



PHARYNGEAL ARCHES, GROOVES, POUCHES AND DERIVATIVES

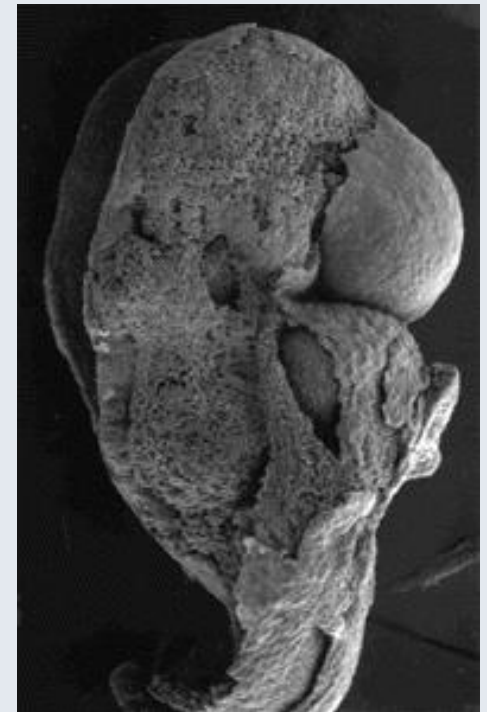
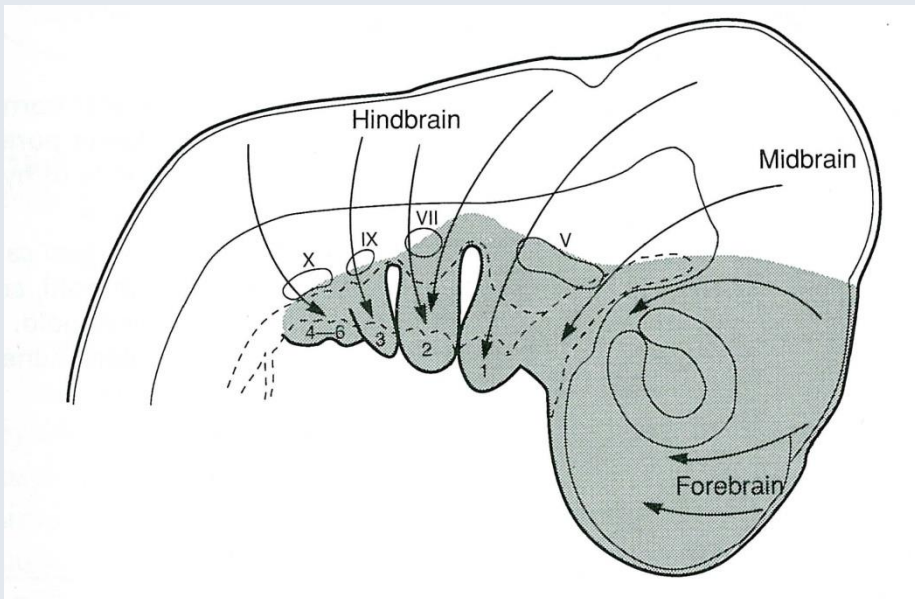


CEPHALIC PRIMORDIA - MESENCHYME

Mesenchyme in general

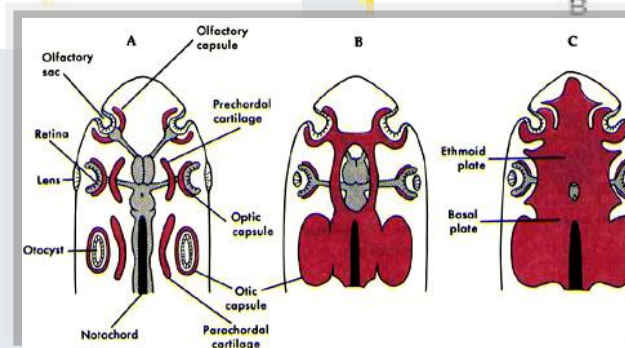
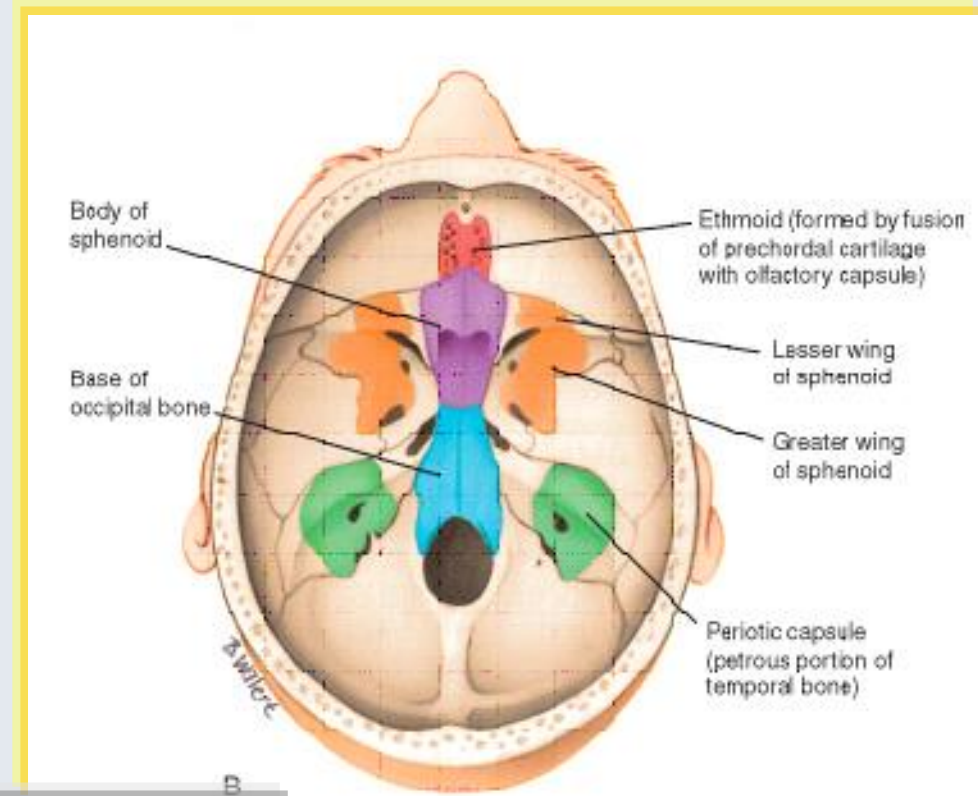
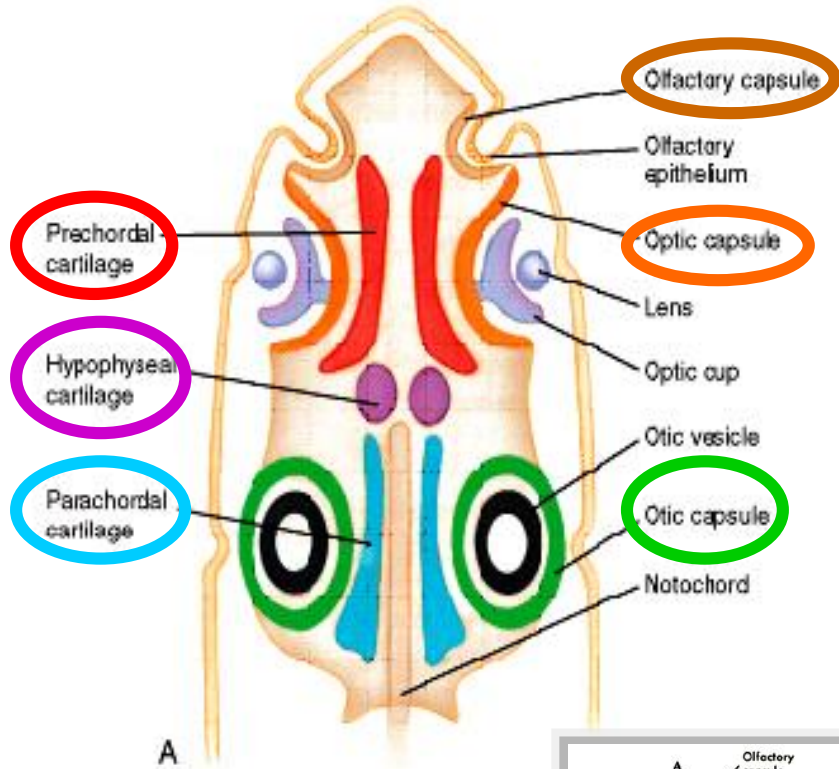
- embryonic connective tissue
- loosely organized
- has the ability to migrate & differentiate into different cell types
- can develop from any germ layer

Ectomesenchyme



CARTILAGINEOUS NEUROCRANIUM - CHONDROCRANIUM

6th week



CARTILAGINEOUS NEUROCRANIUM - *CHONDROCRANIUM*

Parachordal cartilage

Cartilages of the occipital sclerotom



occipital bone surrounding the foramen magnum

Hypophysial cartilage
(around the hypophysis)

body of sphenoid

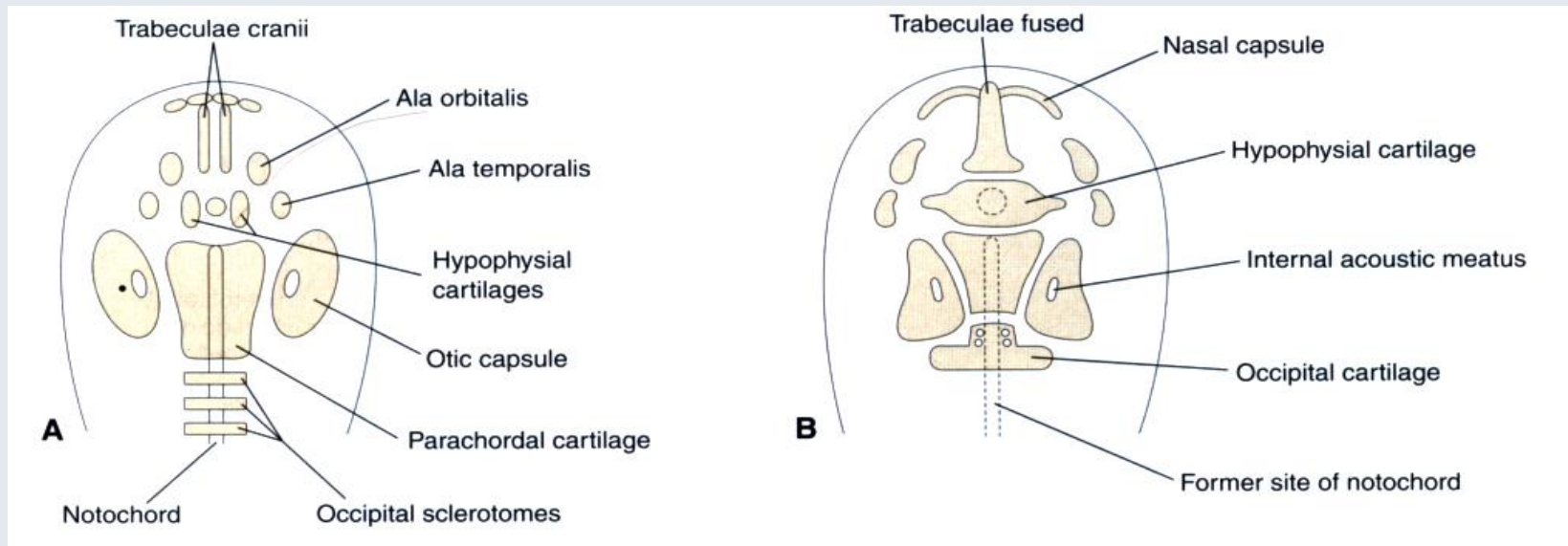
greater wing, lesser wing, lateral plate of the pterygoid process

Otic cartilage
(at the otic placode)

temporal bone: petrous part, mastoid part

Nasal capsule

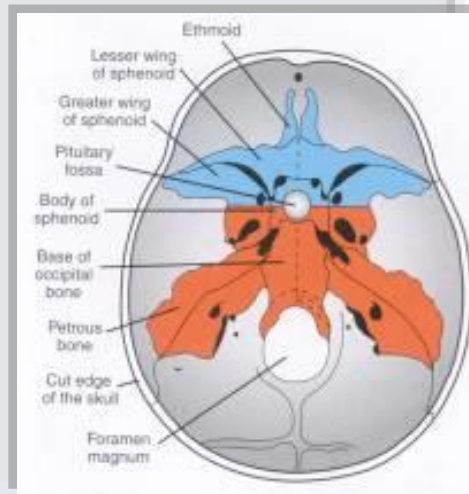
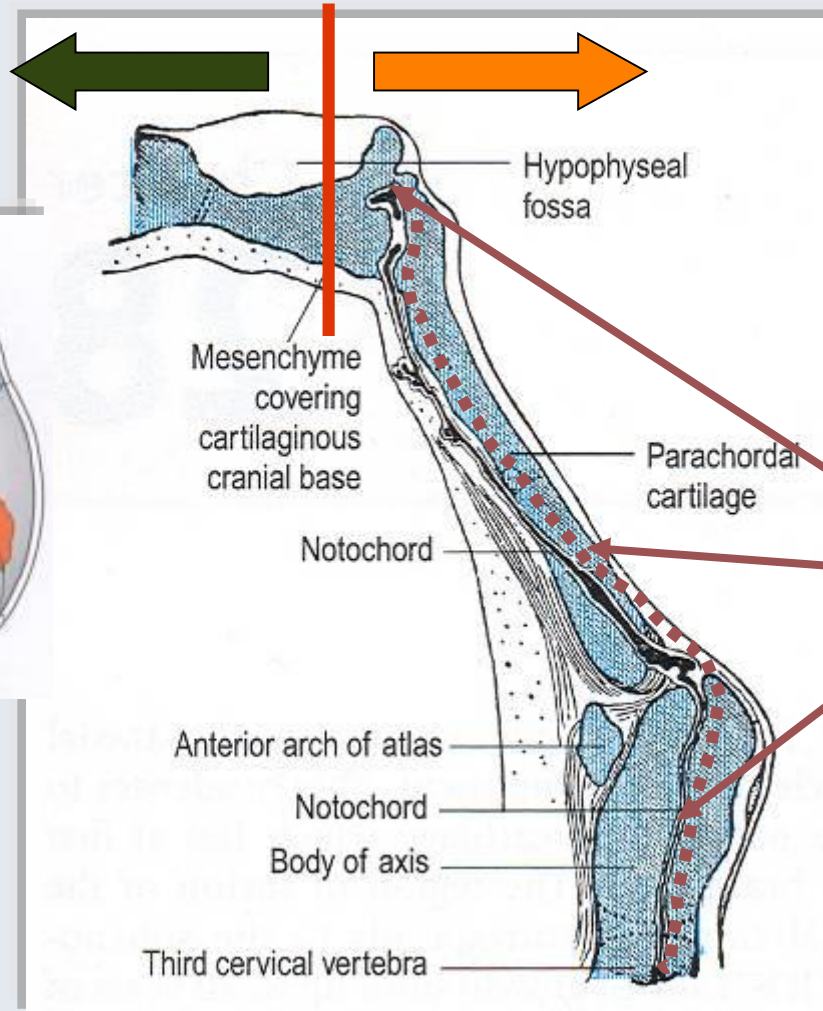
ethmoidal bone, inferior nasal concha, nasal cartilage



CARTILAGINEOUS NEUROCRANIUM - CHONDROCRANIUM

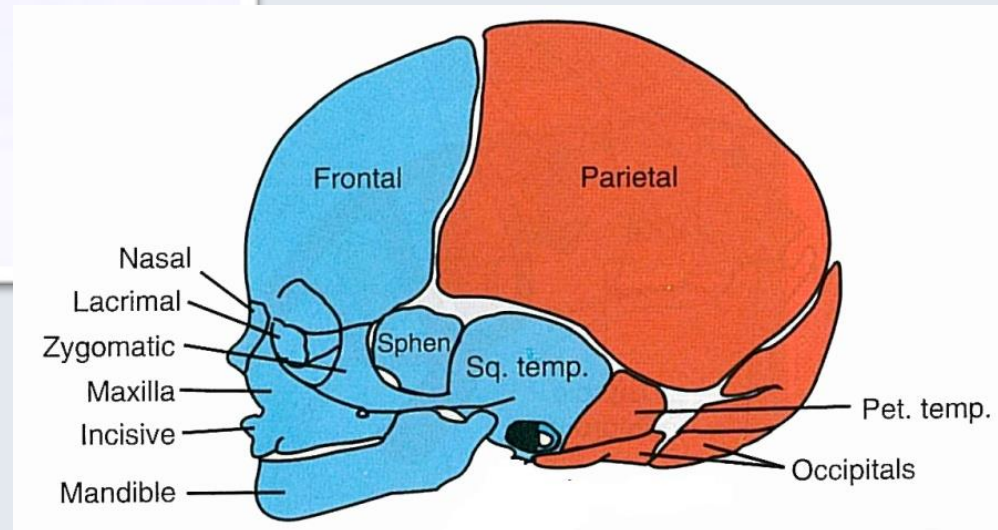
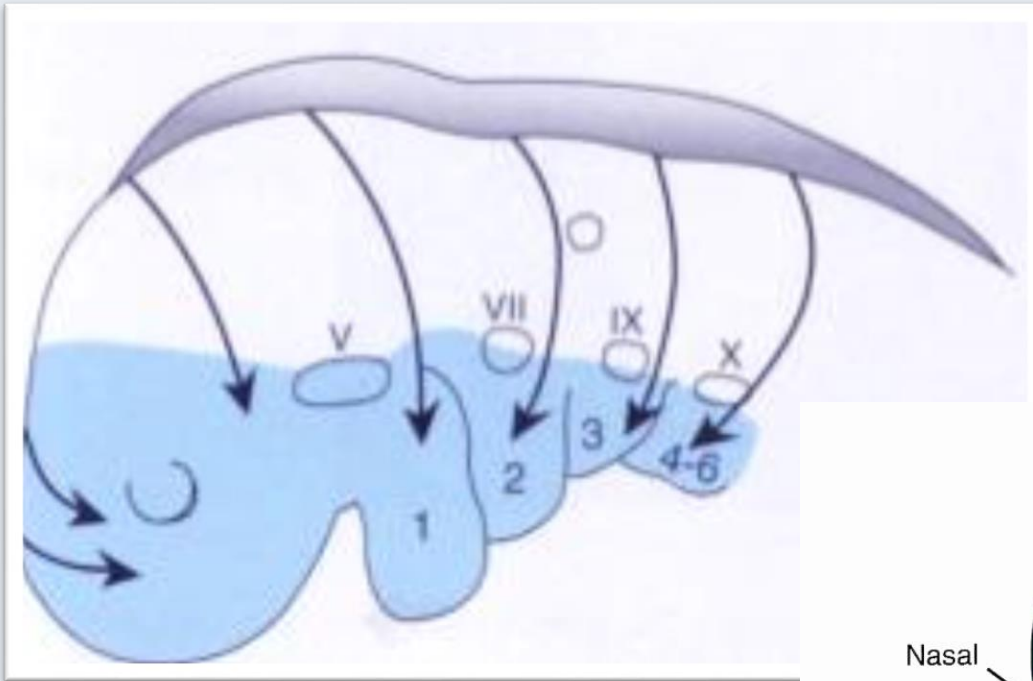
in front of rostral end of notochord
neural crest
praechordal chondrocranium

at the level of notochord
paraxial mesoderm
chordal chondrocranium



notochord

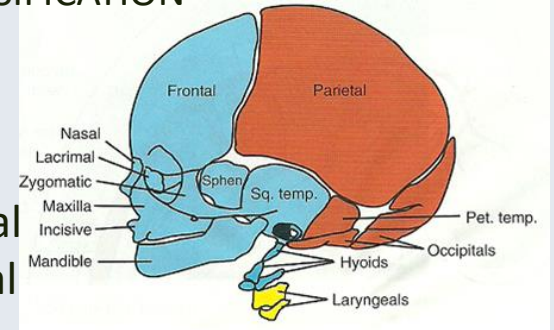
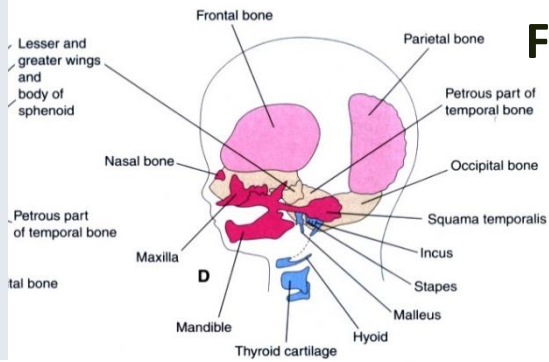
NEURAL CREST MESENCHYME (ECTOMESENCHYME) COMPOSES THE FRONTAL BUT NOT THE PARIETAL BONE



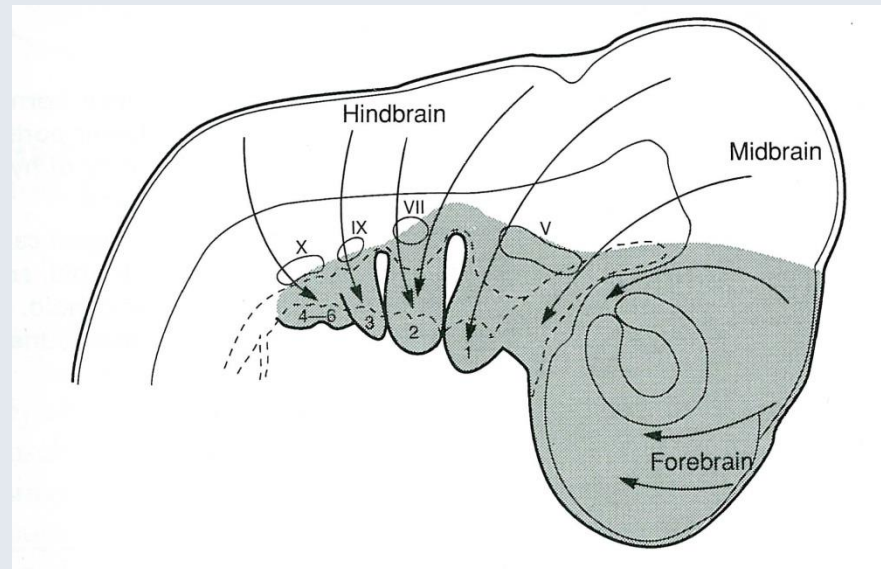
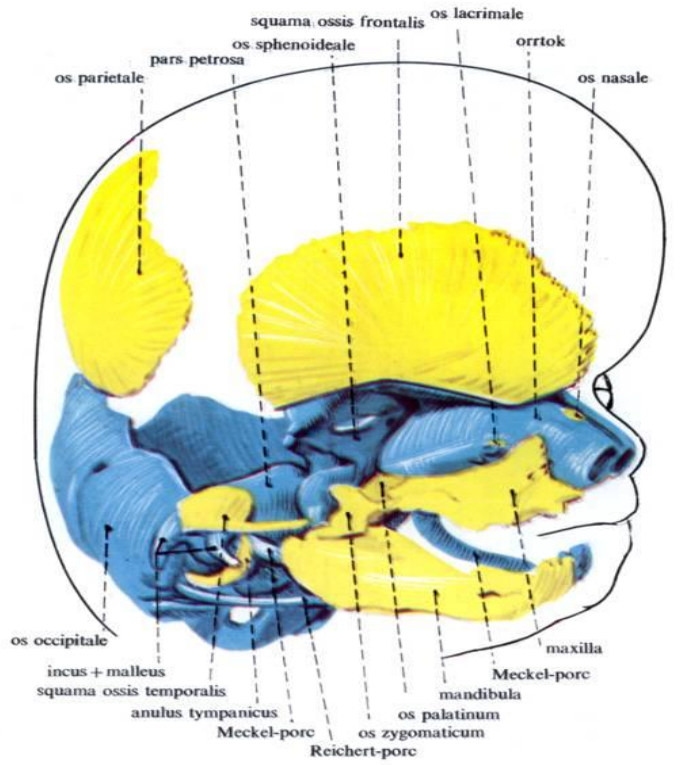
MEMBRANOUS NEUROCRANIUM

FLAT BONES - ENDOCHONDRAL OSSIFICATION

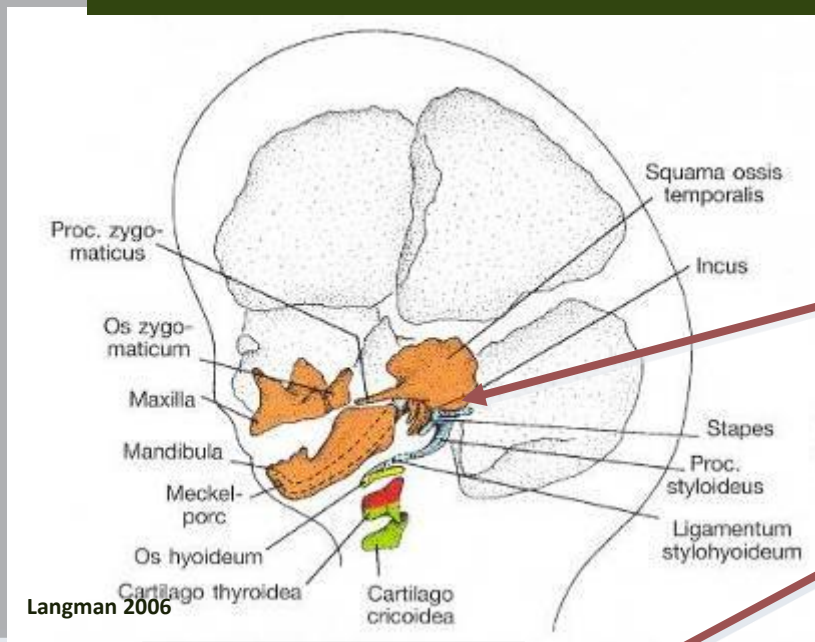
frontal,
parietal
tympanic part
squamous part of temporal
squamous part of occipital



the cells derive from both the
NEURAL CREST and PARAXIAL MESODERM



CARTILAGENOUS VISCEROCRANIUM BONES OF THE FACIAL SKELETON



Langman 2006

**Circumoral first pharyngeal arch
mandibular prominence**

**Meckel's cartilage
dorsal end
rudiments of incus, malleus**

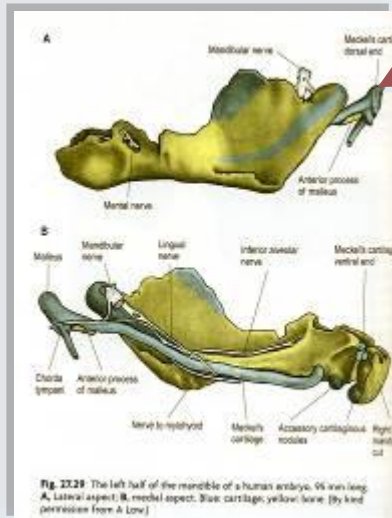
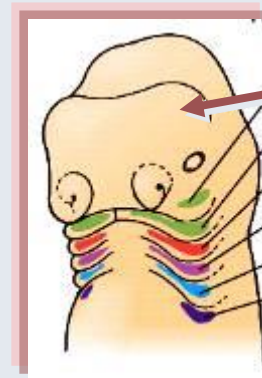


Fig. 22.29 The left half of the mandible of a human embryo. (G. van den Broek) A, lateral aspect; B, medial aspect. Blue: cartilage; yellow: bone (by kind pervasion from A to B).



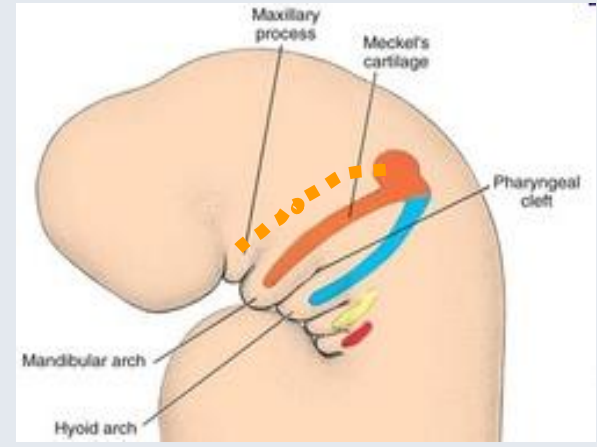
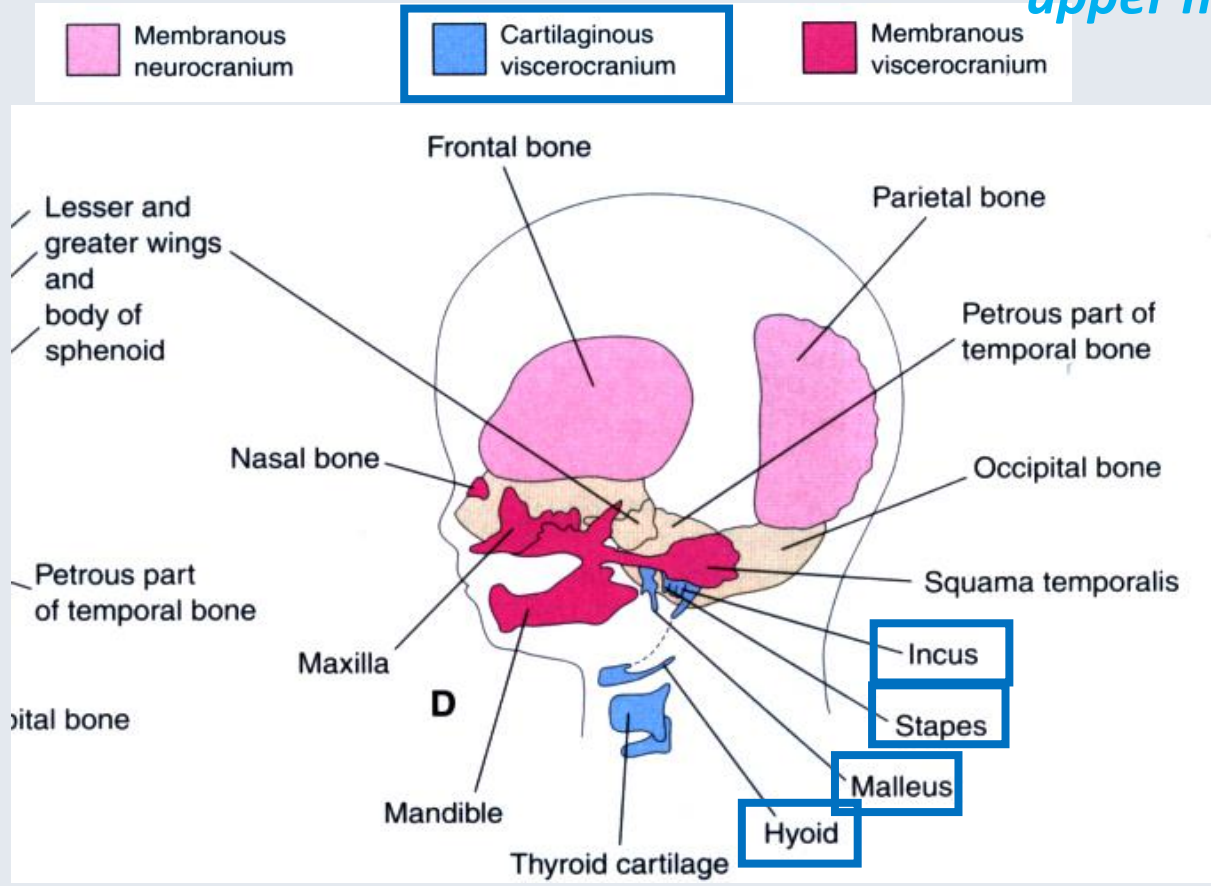
**Second pharyngeal arch
Reichert's cartilage
stapes,
temporal
styloid process**

CARTILAGINEOUS VISCEROCRANIUM

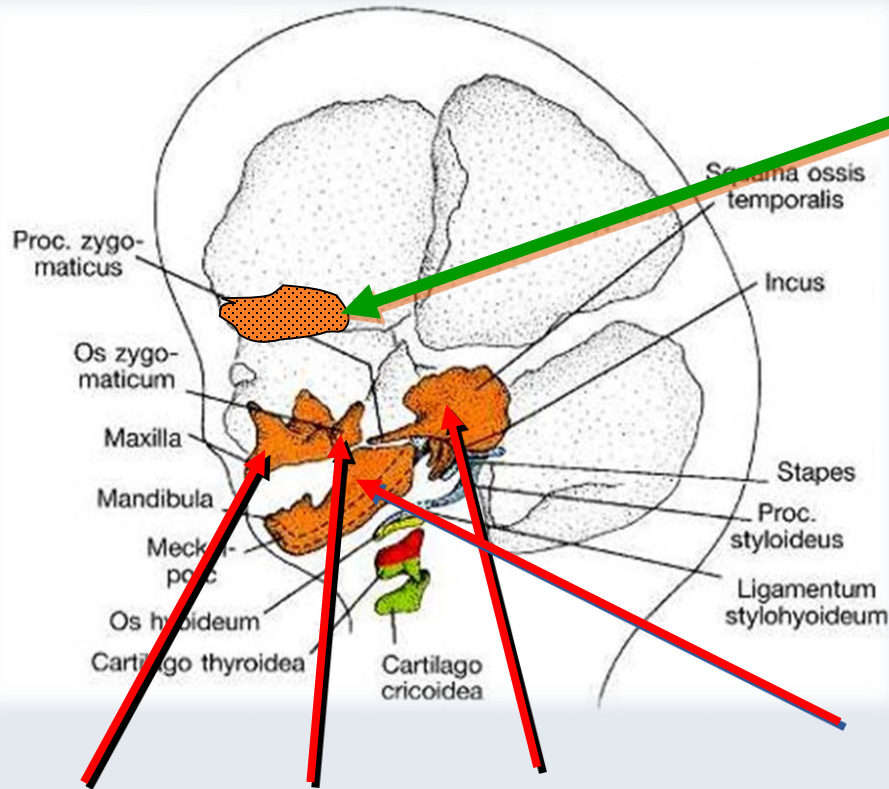
1. **Pharyngeal arch** – (Meckel’s cartilage) forms **MALLEUS and INCUS**

2. **Pharyngeal arch** - (Reichert’s cartilage) forms **STAPES**

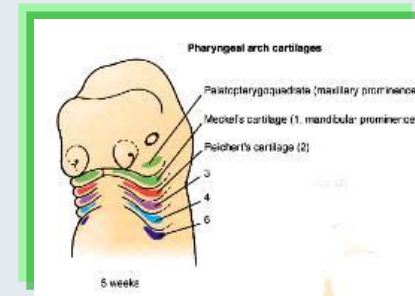
**styloid proc. of the temporal bone
upper half and lesser wing of the
hyoid bone**



MEMBRANOUS VISCEROCRANIUM BONES OF THE FACIAL SKELETON



frontonasal prominence
frontal bone
orbital and nasal parts



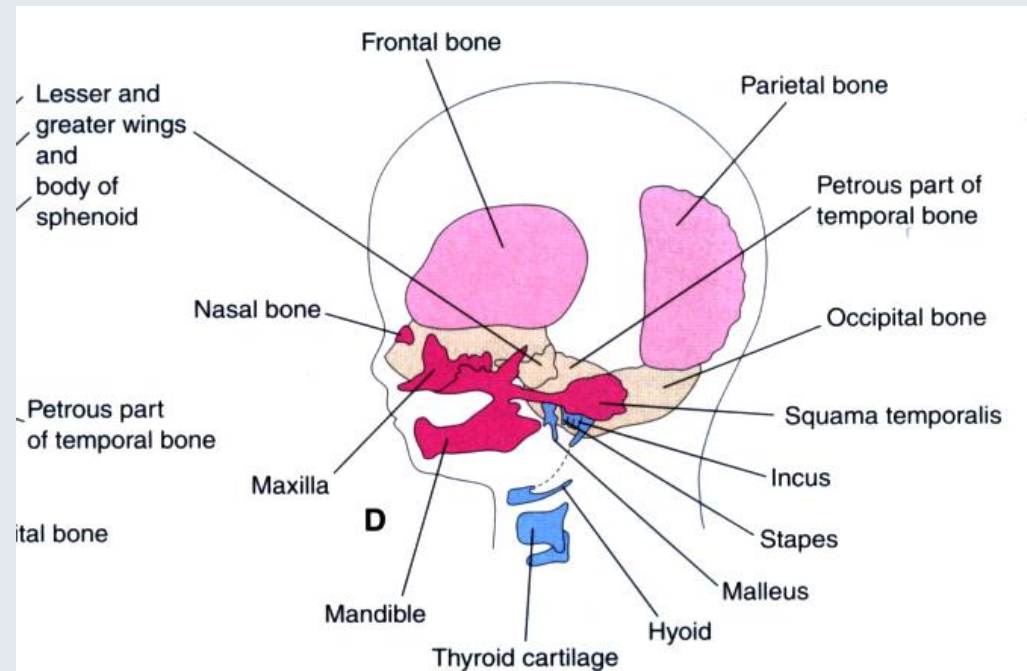
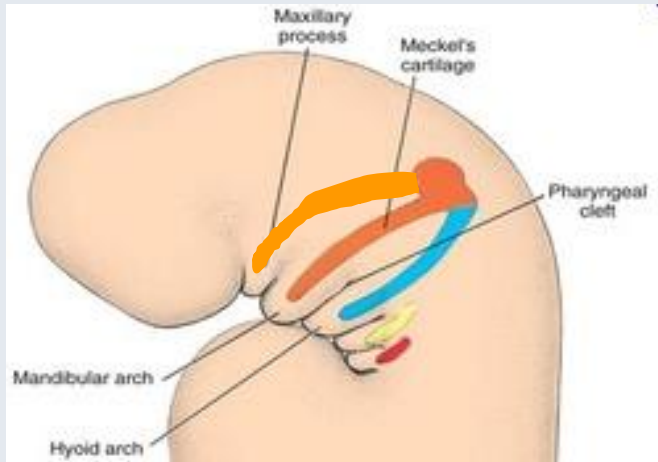
first pharyngeal arch
two prominences:
mandibular and maxillary prominences

maxilla, zygomatic, temporal squama
membrane bones
maxillary prominence

mandible
intramembranous ossification
around the ventral part of Meckel's cartilage
mandibular prominence

MEMBRANOUS VISCEROCRANIUM

1. Pharyngeal arch



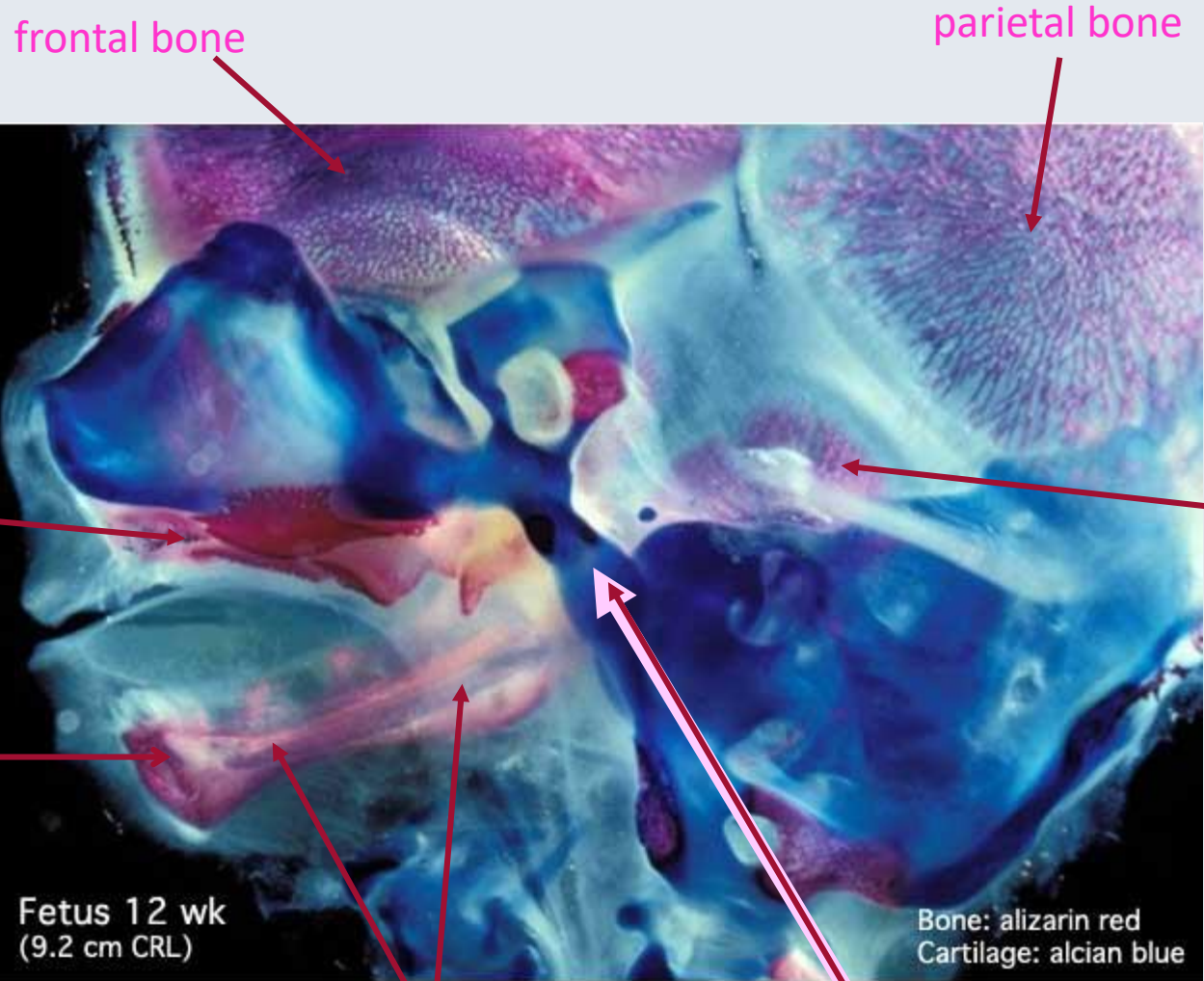
Dorsal subdivision **MAXILLARY process**

DERIVATIVES : *maxilla, zygomatic bone, vomer and palatine bone, temporal squama (later joins the neurocranium)*

Ventral subdivision **MANDIBULAR process** (*contains the Meckel's cartilage*)

DERIVATIVES: *mandible (but the **condyle** is formed by endochondral ossification)*

FETAL CRANIUM

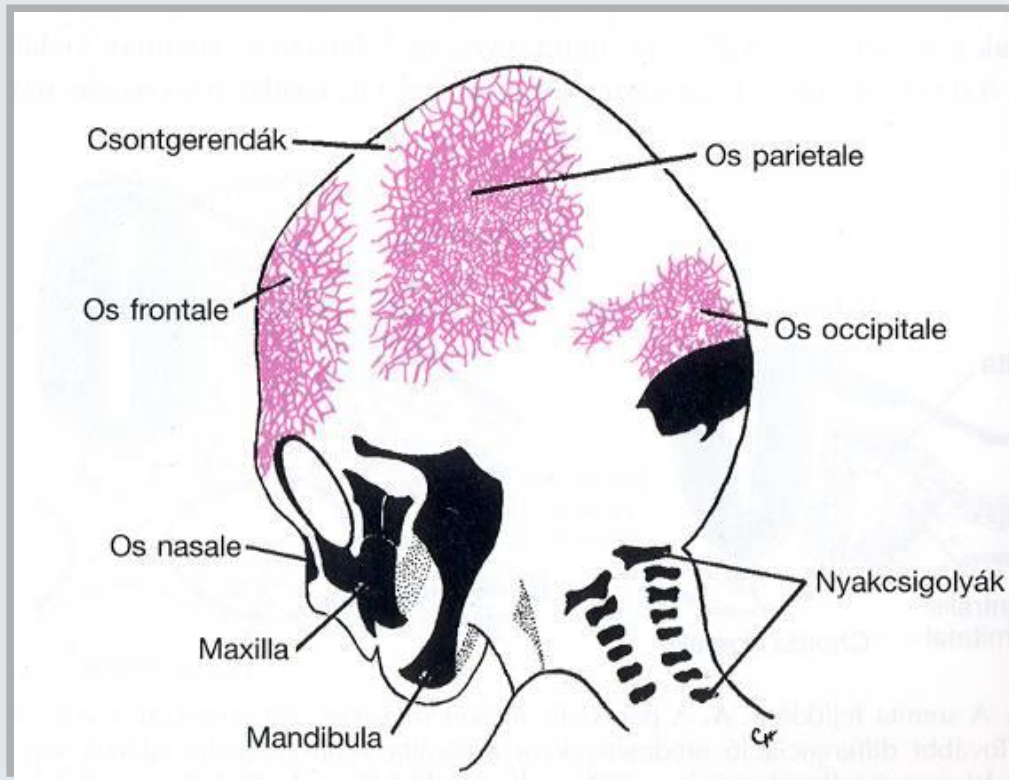


Ossifying Meckel's cartilage

chondral basicranium

MEMBRANOUS NEUROCRANIUM, CALVARY

3rd month



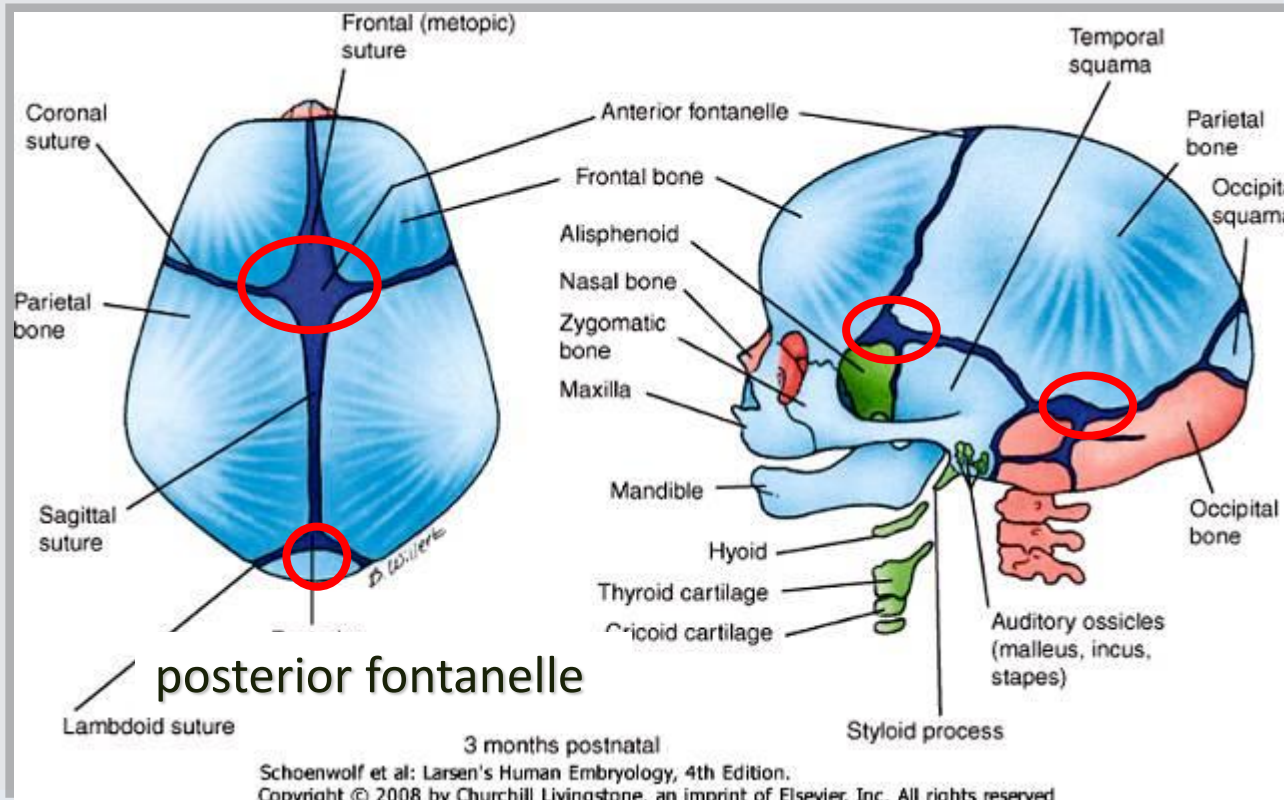
-primary ossification centre



spiculum

MEMBRANOUS NEUROCRANIUM SUTURES AND FONTANELLES

anterior fontanelle



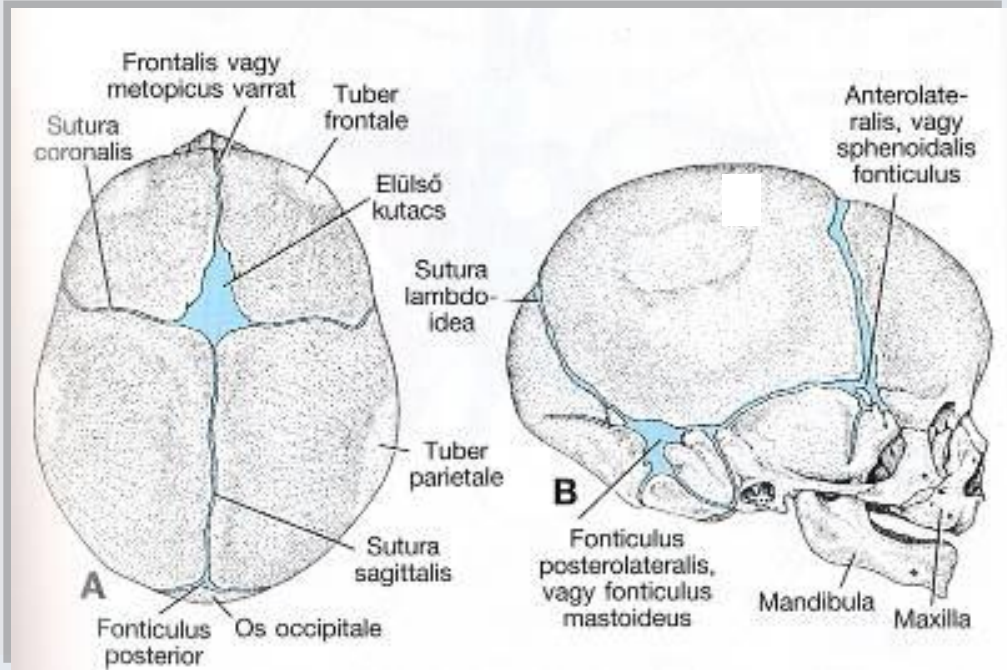
anterolateral
fontanelle

posterolateral
fontanelle

The connective tissue of the sutures/ fontanelles derives from the neural crest and acts as an

ORGANIZER

SKULL OF A NEWBORN



anterior fontanelle
(closes in the middle of 2nd year)



Location of the parietal eye of reptiles
(phylogenetic relevance)



CRANIOFACIAL MALFORMATIONS



Langman 2006

Scaphocephaly



**FGF Receptor 3
mutation**

**Clover leaf
Syndrome**



Craniosynostosis



B

Langman 2006

Turriccephaly

CRANIOFACIAL MALFORMATIONS



brachicephaly



dolichocephaly



trigonocephaly



INTERPARIETAL OR INCA BONE

BONY INCLUSION IN THE LAMBDOID SUTURE

A



B



THANK YOU VERY MUCH FOR YOUR ATTENTION

