

# Neurocranium. Os temporale, Os sphenoidale



*To be, or not to be, that is the question..."  
(by: William Shakespeare  
from Hamlet, spoken by Hamlet)*

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*Budapest*

*Ungarn*

*2019*

# Knochen des Schädels

Anatomisch unterscheidet man somit den

**Hirnschädel** (lat. *Neurocranium*), der eine stabile Hülle um das [Gehirn](#) bildet.

**Gesichtsschädel** (lat. *Viscerocranium*), der die Grundlage für das [Gesicht](#) bildet. Als Adjektiv wird für Teile des Gesichtsschädels auch *kraniofacial* (*facies* = Gesicht) verwendet.

## Die Knochen des Hirnschädels

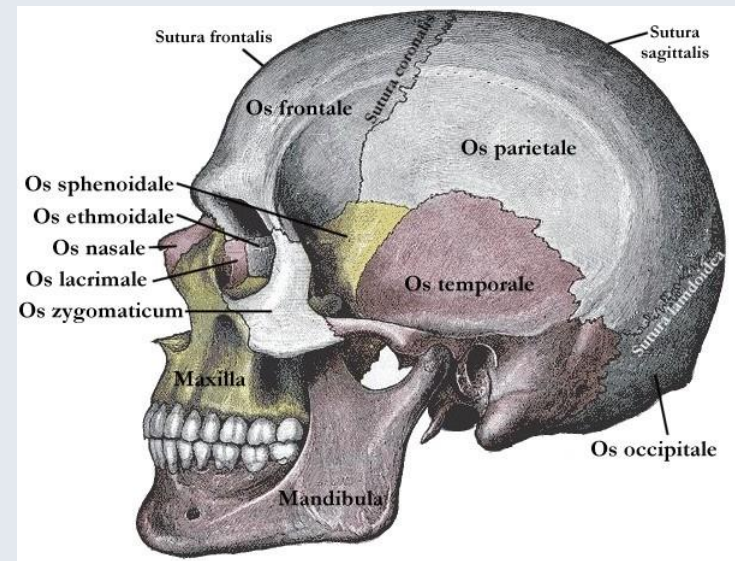
[Morphologisch](#) wird der Hirnschädel in das *Schädeldach* (Calvaria, [Schädelkalotte](#)) und die [Schädelbasis](#) unterteilt, welche die [Schädelhöhle](#) umgeben.

Der Hirnschädel wird gebildet durch

1. das unpaarige [Hinterhauptbein](#) (lat. *Os occipitale*),
2. das paarige [Scheitelbein](#) (lat. *Os parietale*),
3. das paarige [Schläfenbein](#) (lat. *Os temporale*) und
4. das unpaarige [Keilbein](#) (lat. *Os sphenoidale*) sowie
5. einen Teil des [Stirnbeins](#) (lat. *Os frontale*)
6. das unpaarige [Siebbein](#) (lat. *Os ethmoidale*)

Von manchen Autoren wird das ganze Stirnbein dem Hirnschädel zugeordnet.

Der Hirnschädel ist durch die [Kopfgelenke](#) mit der [Halswirbelsäule](#) verbunden.

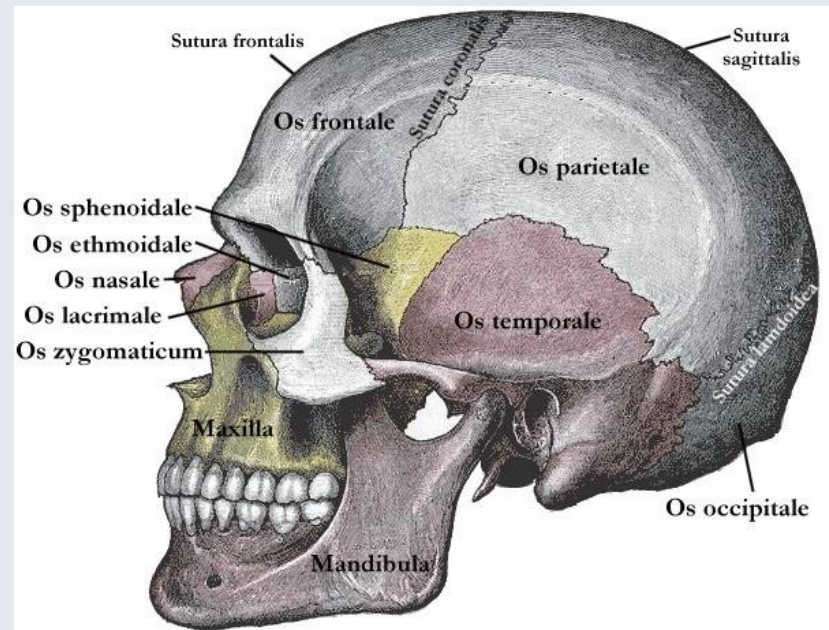


# Die Knochen des Gesichtsschädels

Zum Gesichtsschädel gehören u. a. jene [Knochen](#), die die [Augen-](#) und [Nasenhöhlen](#) und die [Mundhöhle](#) bilden.

Im Einzelnen sind das:

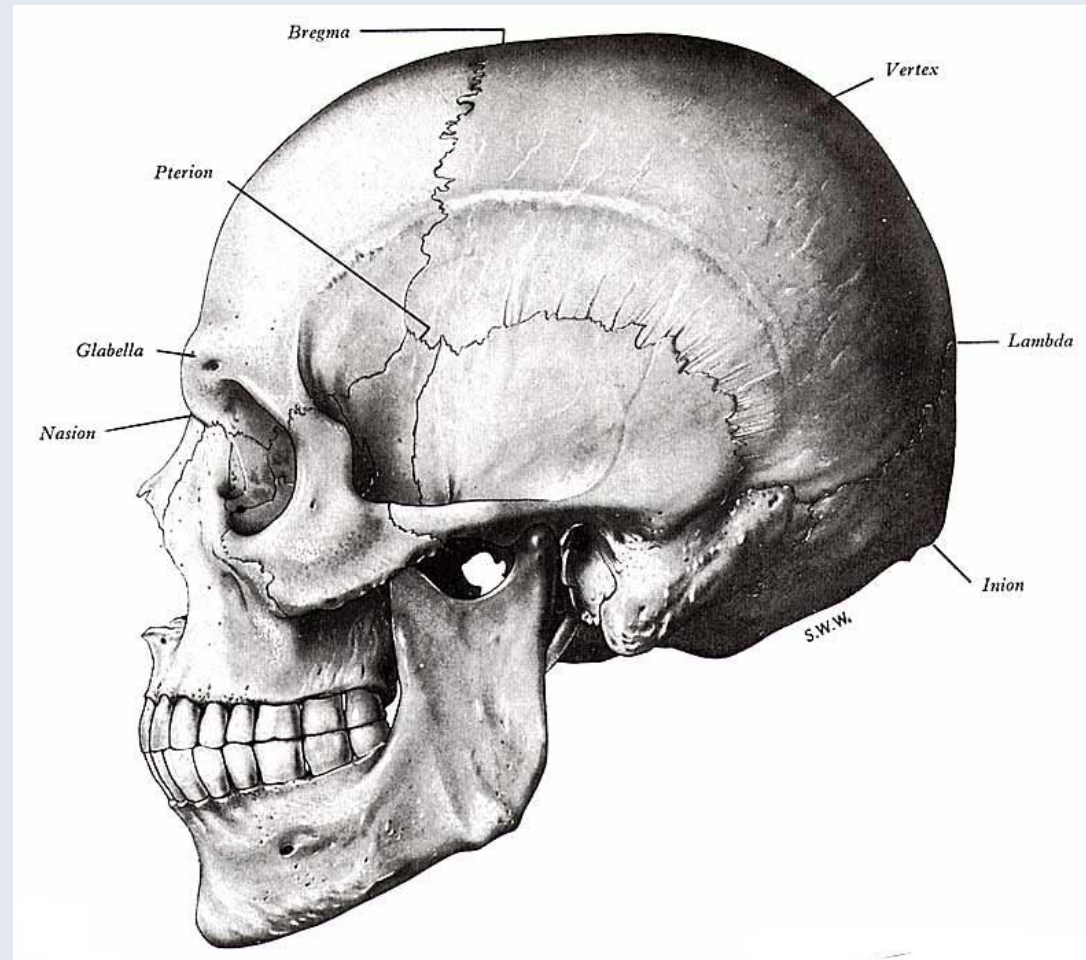
1. jene Teile des [Stirnbeins](#), die die Augenhöhle mitbilden
2. das paarige [Jochbein](#) (lat. *Os zygomaticum*)
3. der [Oberkiefer](#) (lat. *Maxilla*), in Wirklichkeit ein paariger Knochen
4. das paarige [Zwischenkieferbein](#) (lat. *Os incisivum*, zool. *Prämaxillare*), das beim Menschen schon vor der Geburt mit dem Oberkiefer verschmilzt
5. der unpaarige [Unterkiefer](#) (lat. *Mandibula*)
6. das paarige [Nasenbein](#) (lat. *Os nasale*)
7. das paarige [Nasenmuschelbein](#) (lat. *Os conchale inferius*)
8. das paarige [Tränenbein](#) (lat. *Os lacrimale*)
9. das paarige [Gaumenbein](#) (lat. *Os palatinum*)
10. das unpaarige [Pflugscharbein](#) (lat. der *Vomer*)



# Gehirnschädel (Cranium cerebrale)

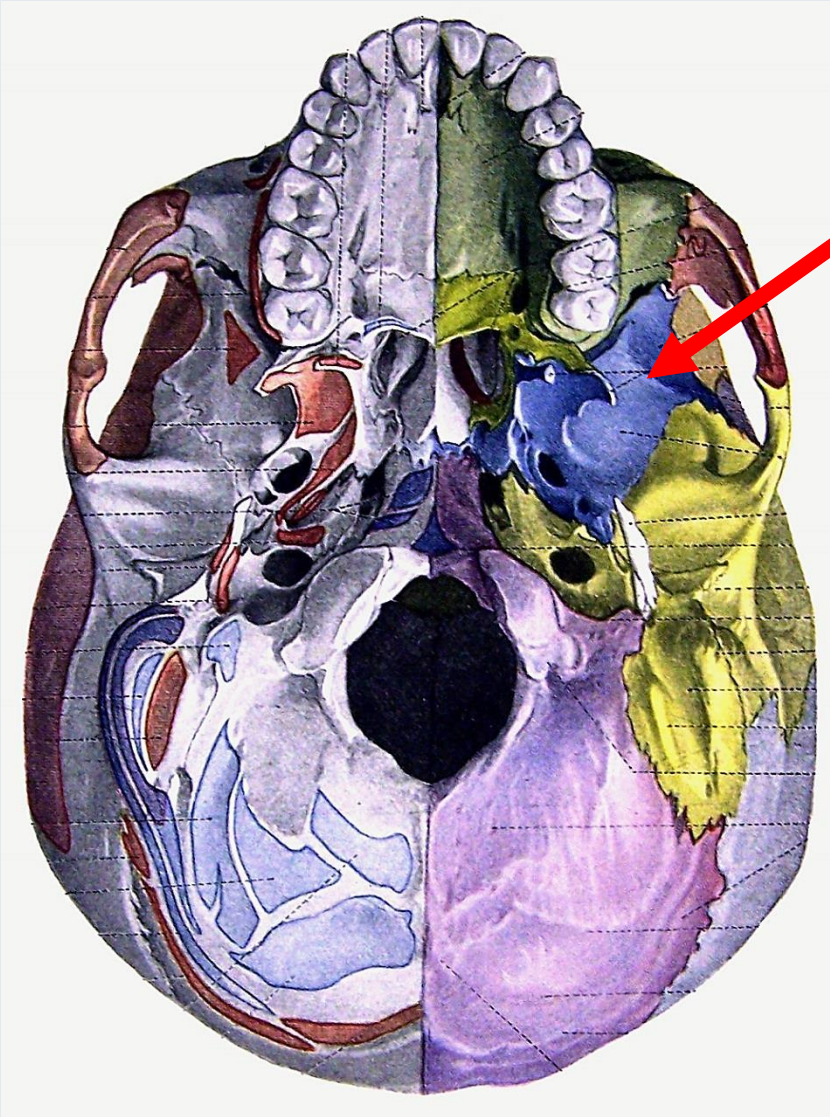
1. Schädeldach (calvaria)
2. Schädelbasis (basis cranii):
  - Basis cranii int.
  - Basis cranii ext.

Protub. occip. ext. → linea nuchae sup. → Anfang der linea temp. → arcus zygomaticus → cista infratemp. → ala major → proc. zygomaticus → margo supraorbitalis → sutura nasofrontalis



# Keilbein

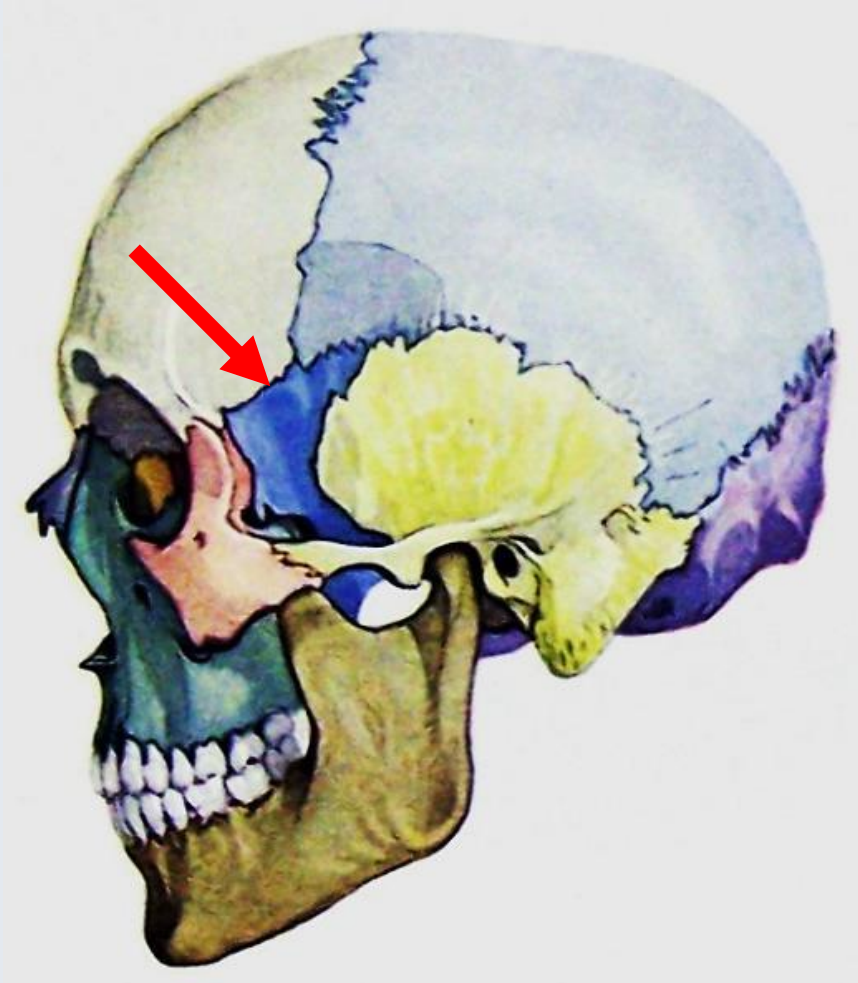
Braus



Teil der äußeren Schädelbasis (mit Corpus, Processus pterygoideus, Ala major)

# Keilbein

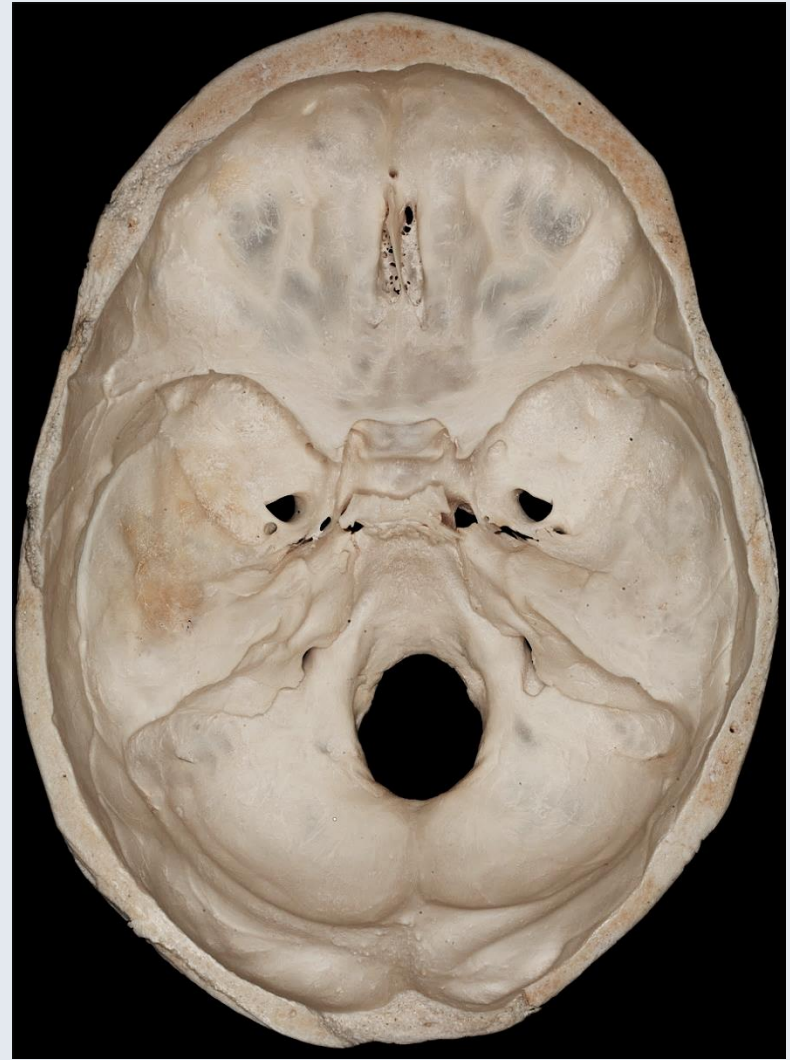
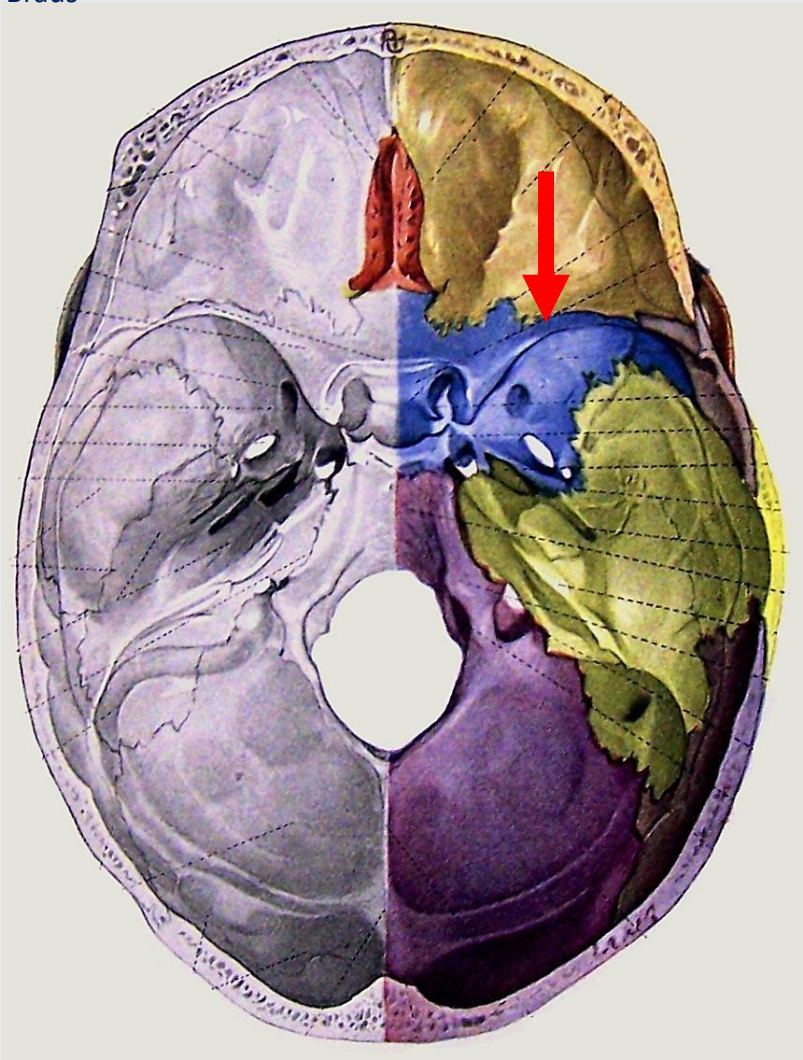
Braus



Teil der Fossa temporalis (Ala major)

# Keilbein

Braus



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

# Keilbein

## **Synchondrosis**

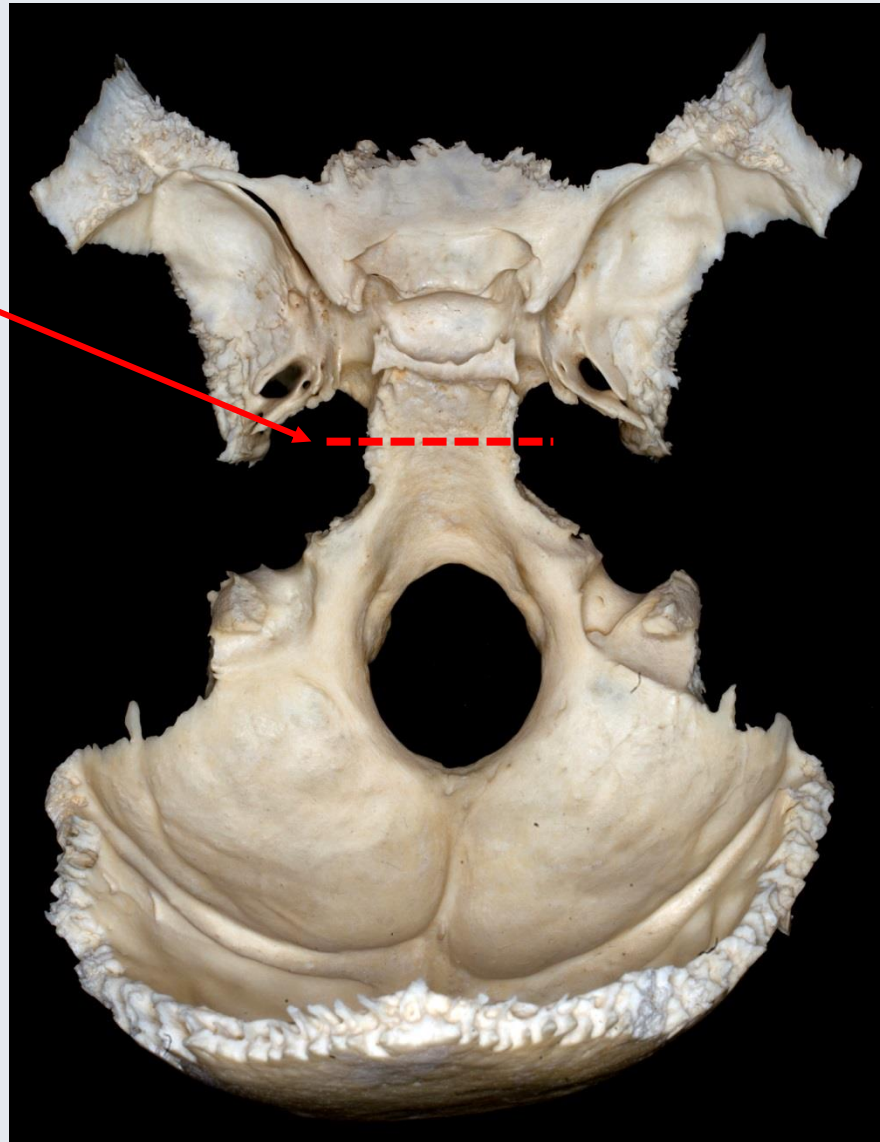
### **sphenooccipitalis:**

verknöchert am Anfang  
des Erwachsenenalters

Über dem ca. 18. Lebensjahr  
lassen sich Os occipitale und Os  
sphenoidale nicht mehr  
voneinander trennen  
(Synostose)

Verbindungen zu den weiteren  
Knochen:

Suturae, die mit der Zeit  
auch oft verknöchern





# Keilbein

[www.hrlfg.eoldal.hu](http://www.hrlfg.eoldal.hu)



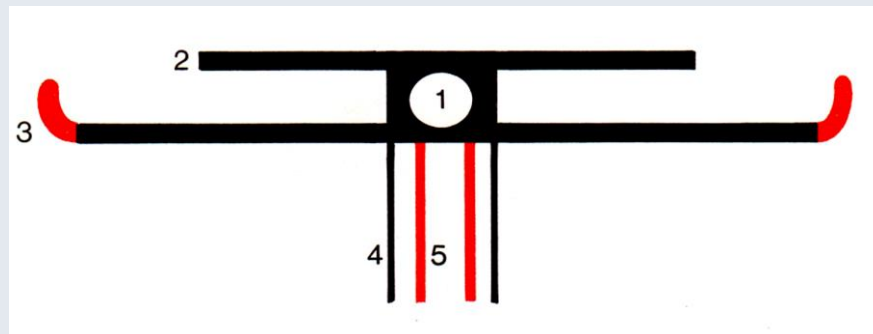
Os sphecoideum ~ Wespe ~ Os vespiforme

Os sphenoidale = keilförmig

Os cuneiforme, alatum, pterygoideum, polymorphon, carinae, colatorii, paxillare



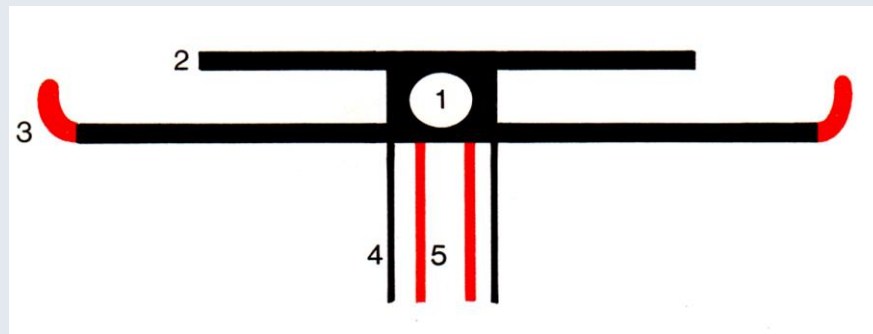
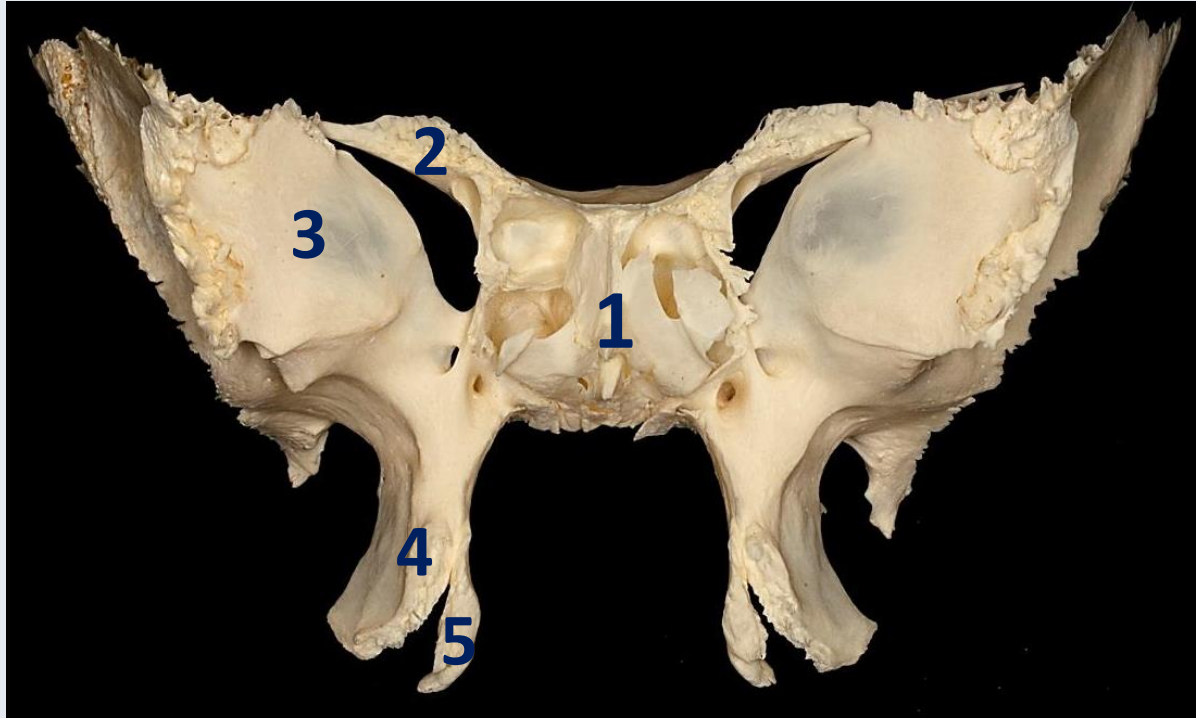
fotó: Semmelweis Egyetem ©



Faller

- 1 Sinus sphenoidalis
- 2 Ala minor ossis sphenoidalis
- 3 Ala major ossis sphenoidalis

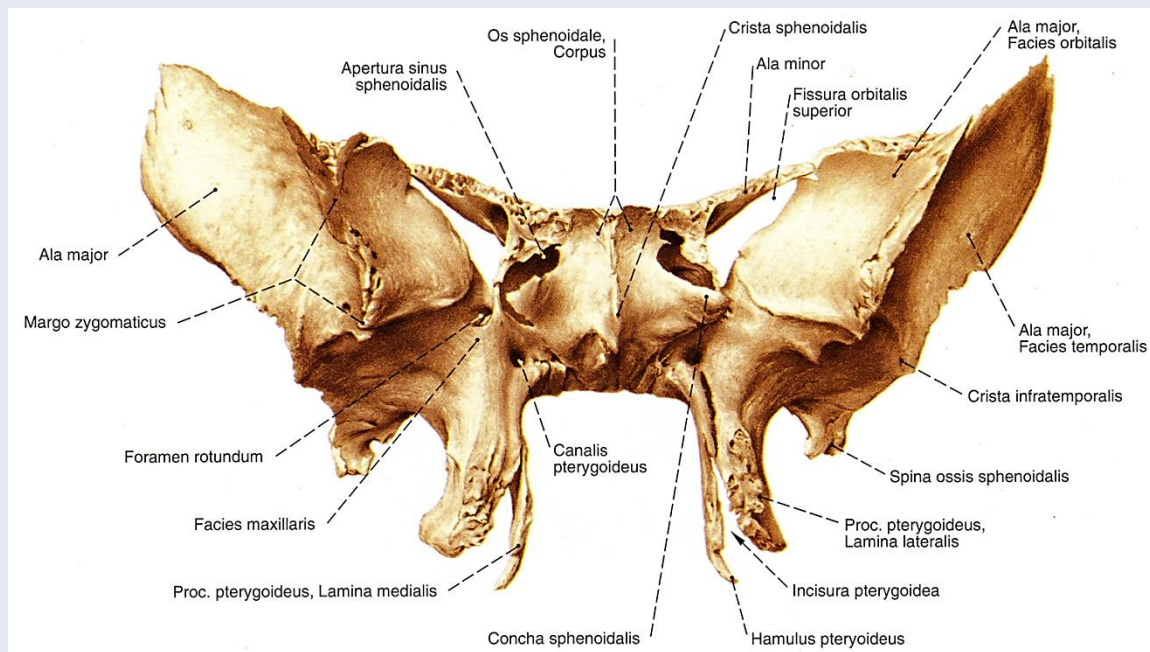
- 4 Lamina lateralis processus pterygoidei
- 5 Lamina medialis processus pterygoidei

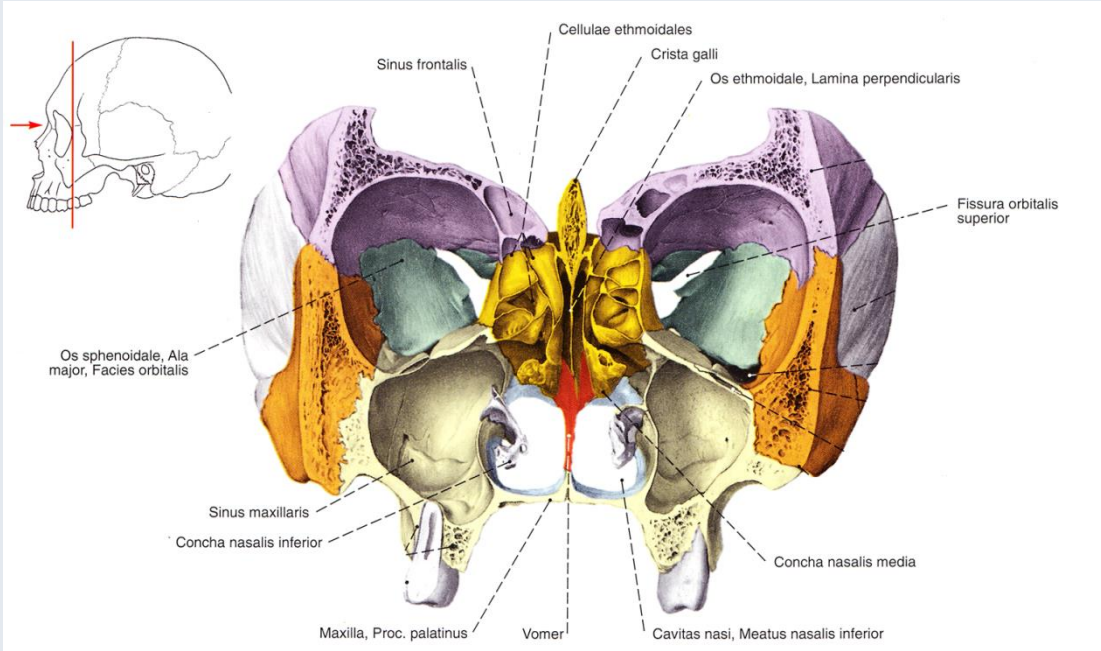


Faller

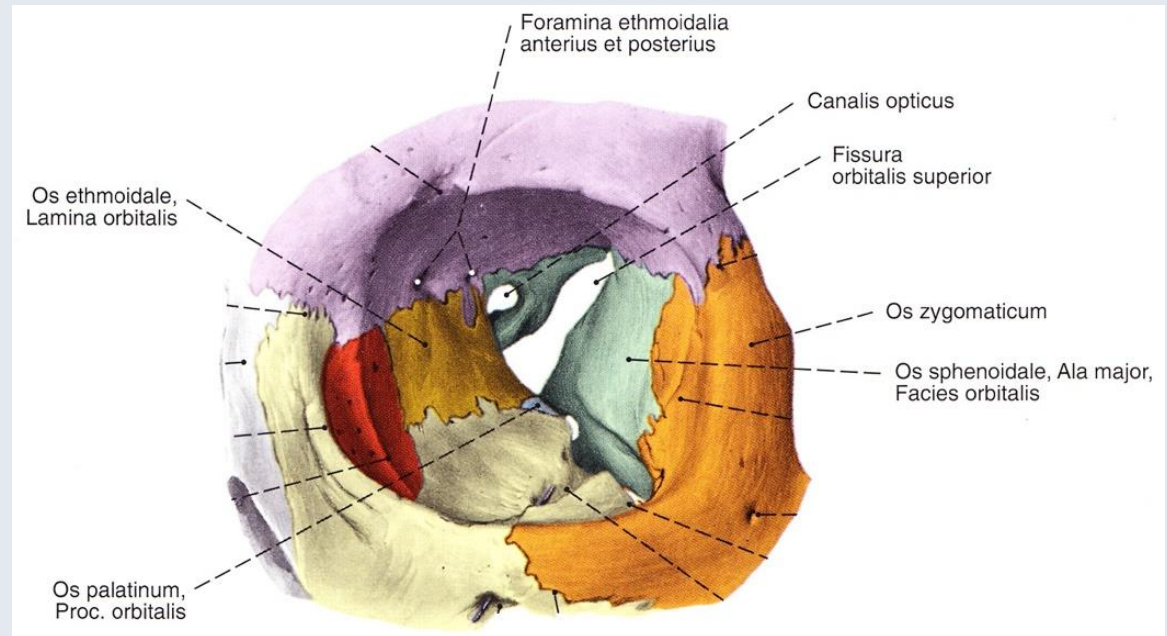
- 1 Sinus sphenoidalis
- 2 Ala minor ossis sphenoidalis
- 3 Ala major ossis sphenoidalis

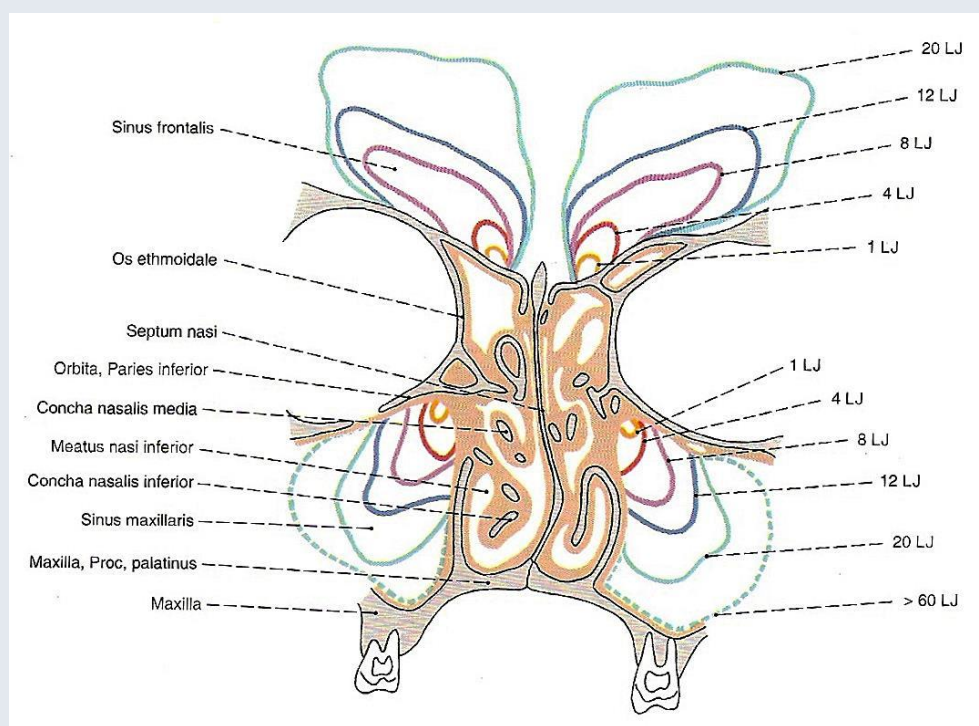
- 4 Lamina lateralis processus pterygoidei
- 5 Lamina medialis processus pterygoidei

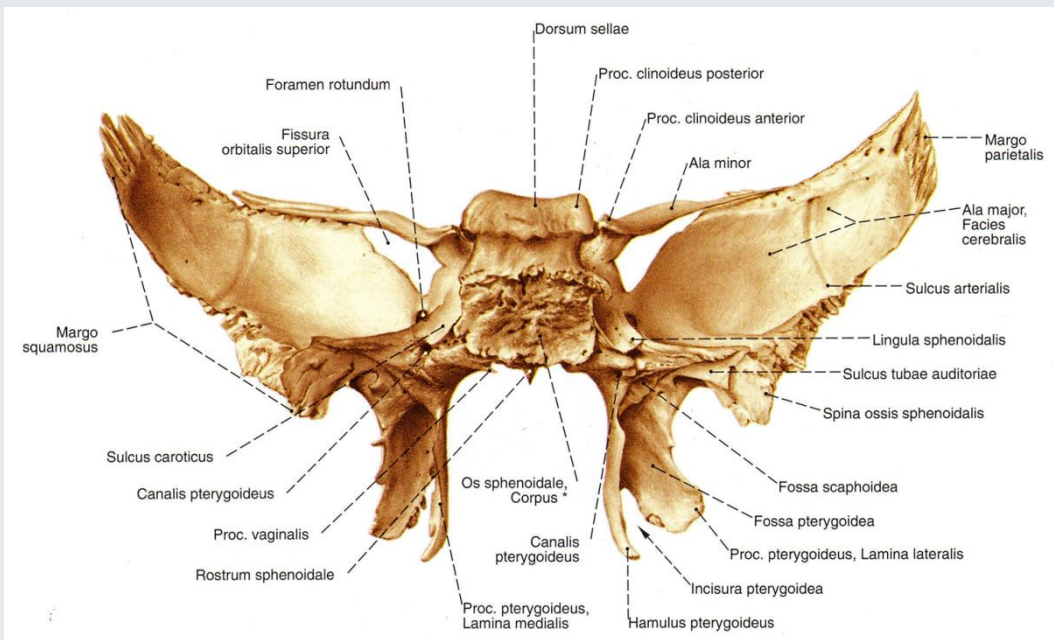




Bildung der hinteren und lateralen Wandstrukturen bzw. Öffnungen (Verbindungen) der Augenhöhle









# Der Ala major

## Oberflächen:

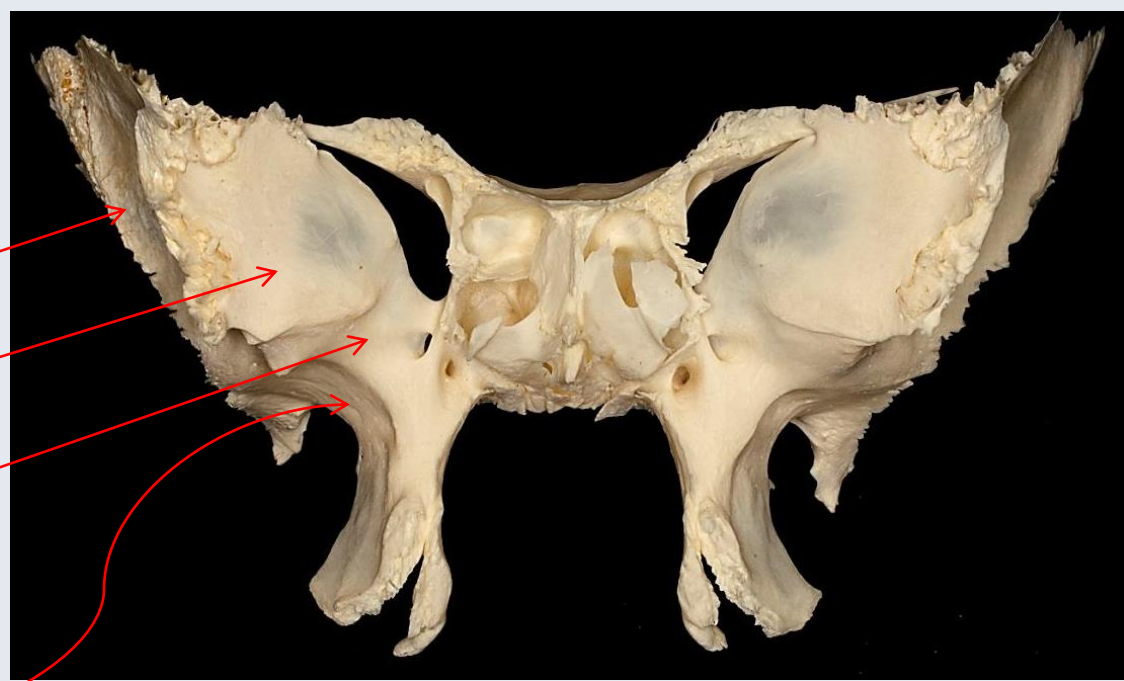
-temporal

- orbital

- maxillar  
(neben dem foramen rotundum)

- infratemporal

- cerebral surface



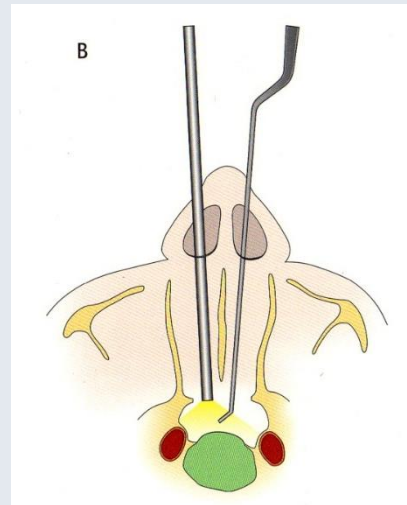
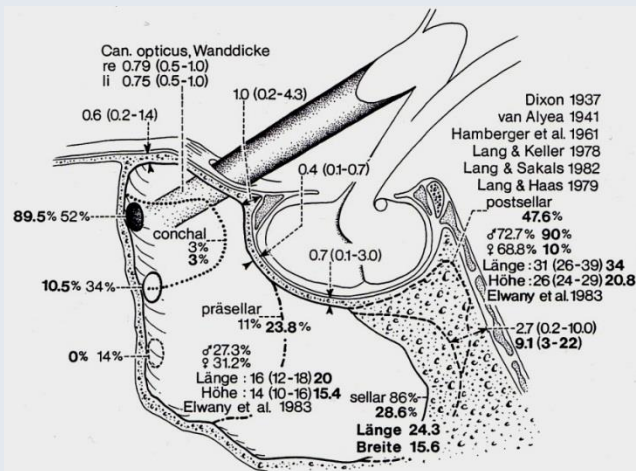
# Keilbeinhöhle - Sinus sphenoidalis; Türkensattel - Sella turcica

Eördögh



Aesculap – B Braun

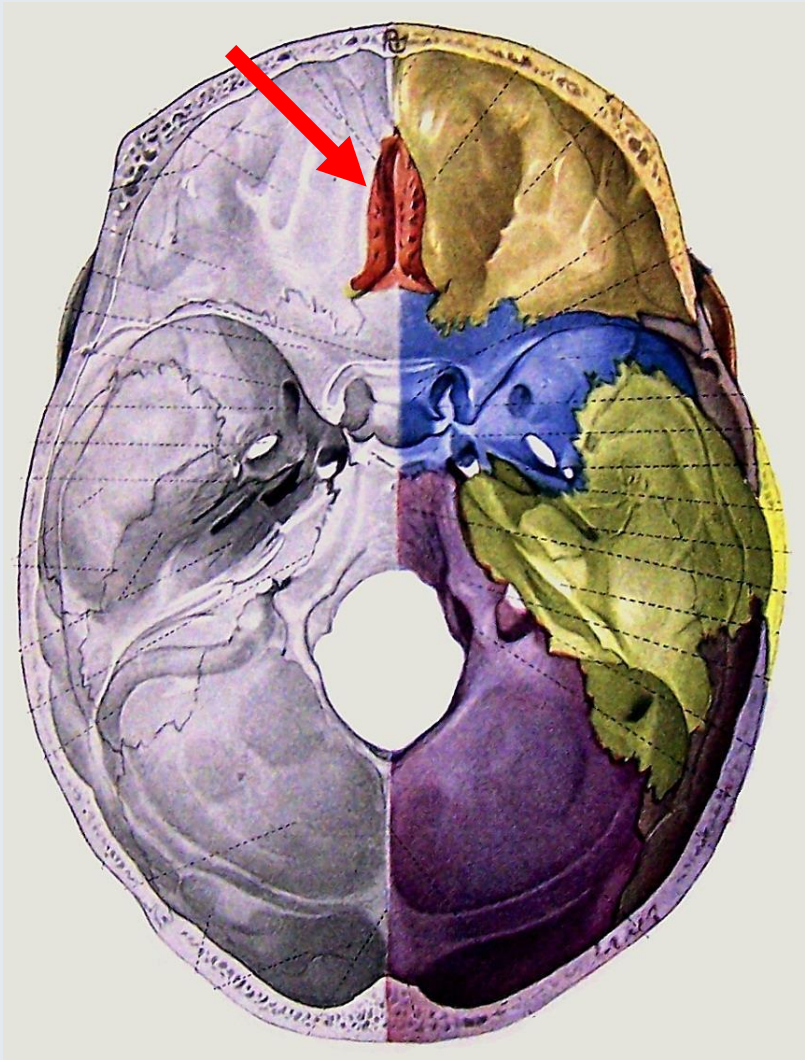
[www.commonswiki.org](http://www.commonswiki.org)



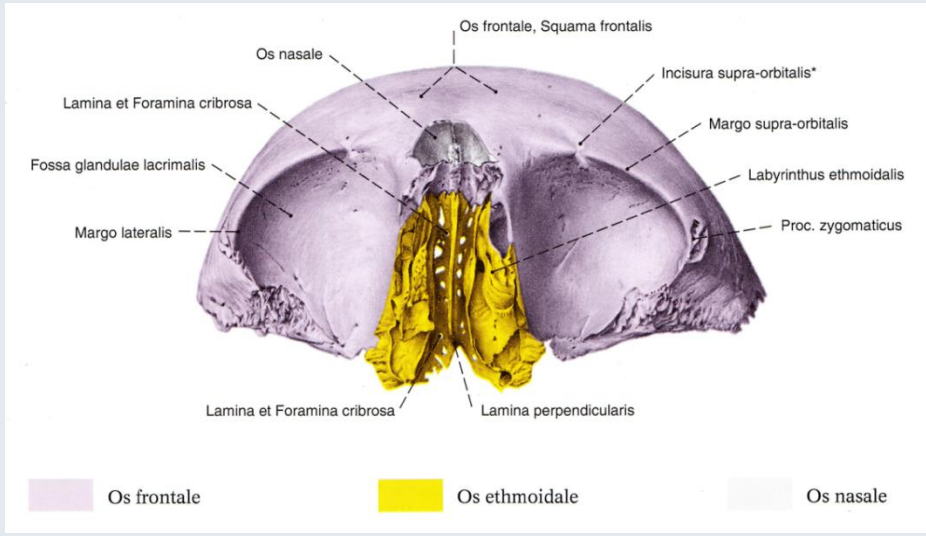
[www.mozaweb.hu](http://www.mozaweb.hu)

Lang

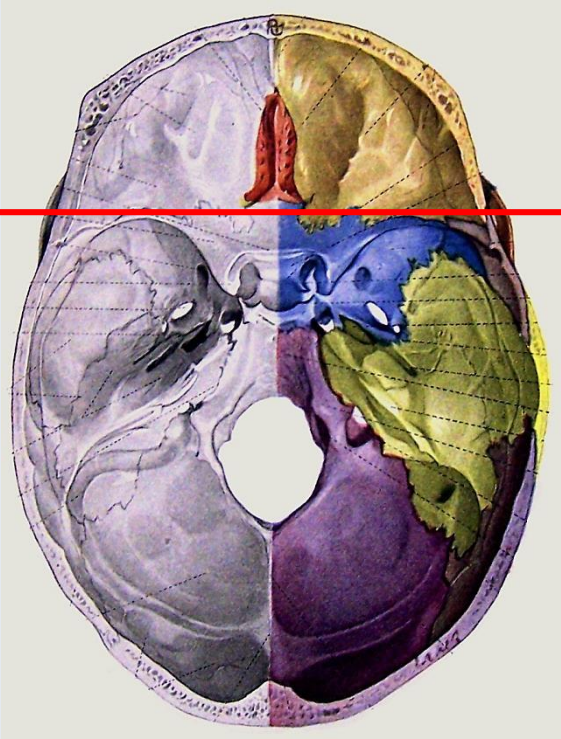
# Siebbein - Os ethmoidale



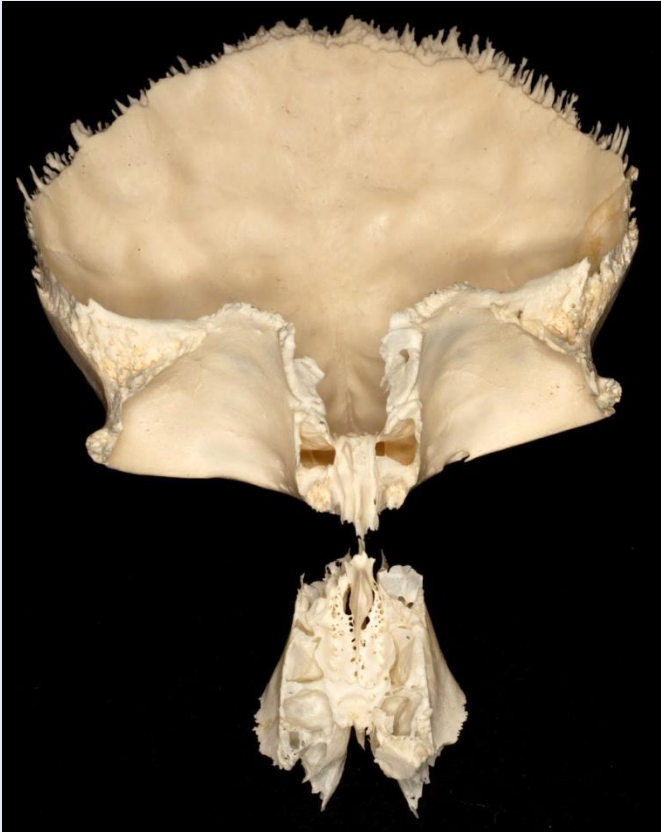
Braus

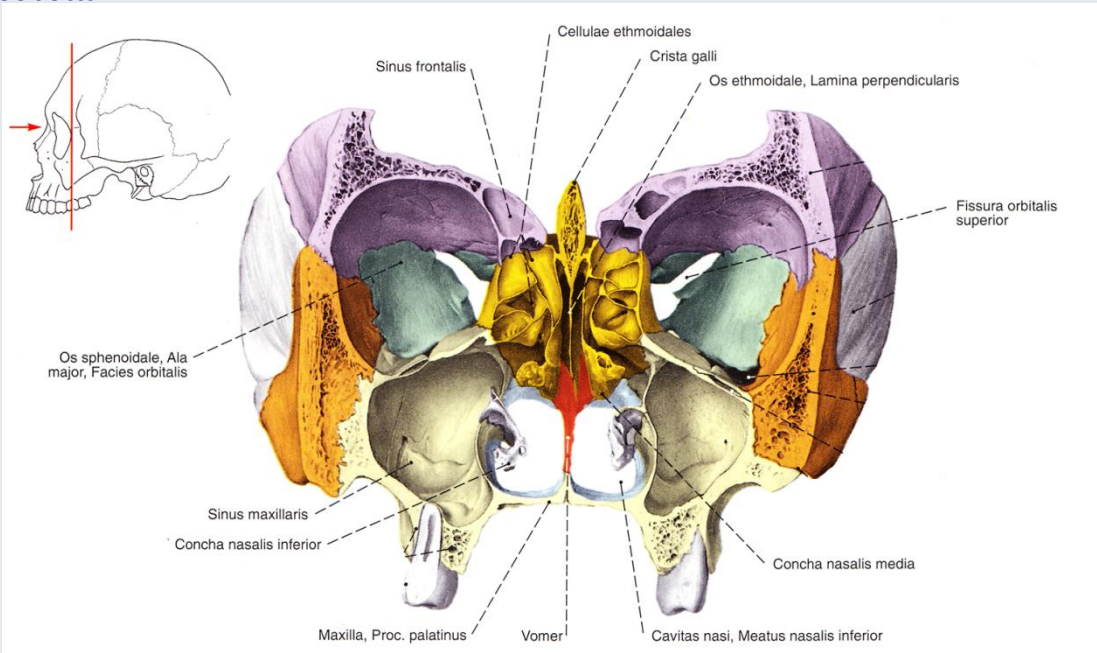


Sobotta

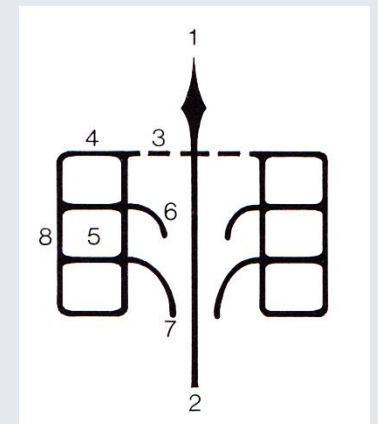


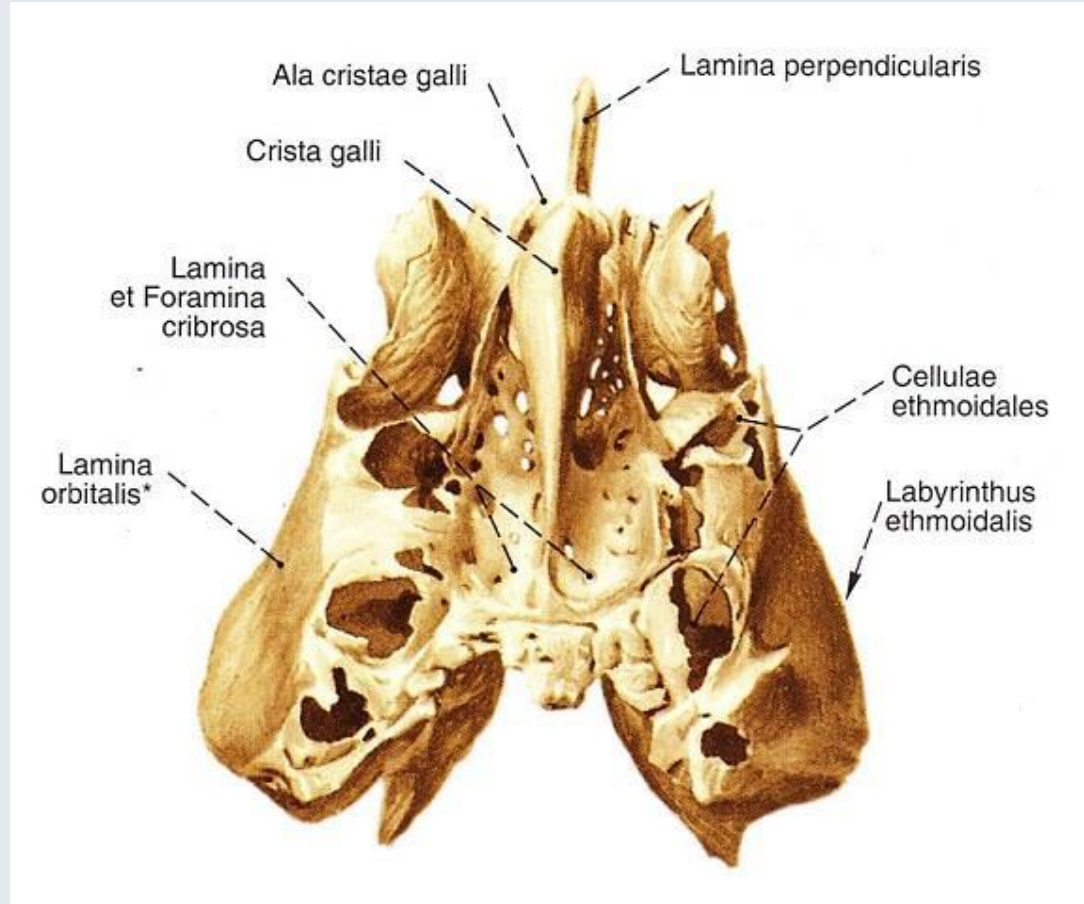
Braus

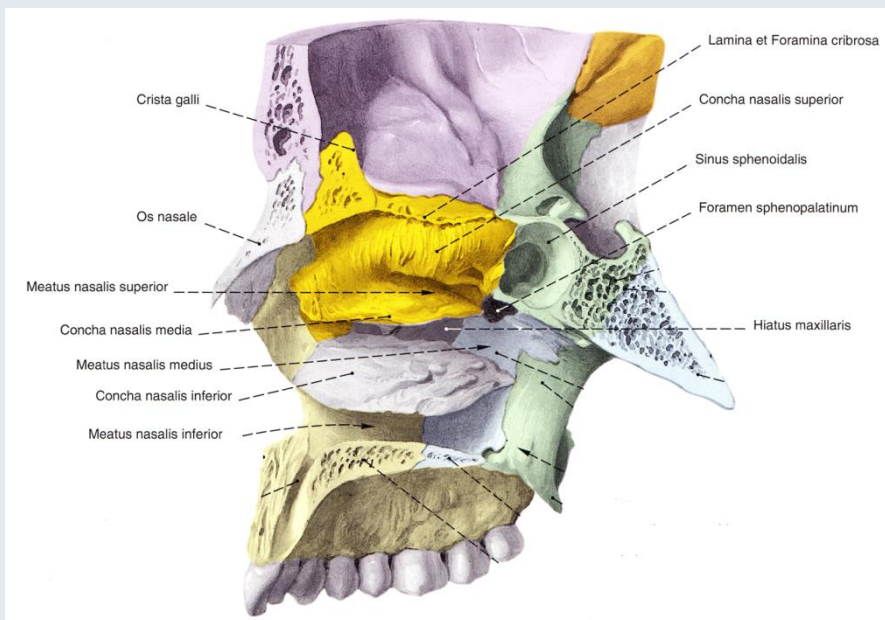




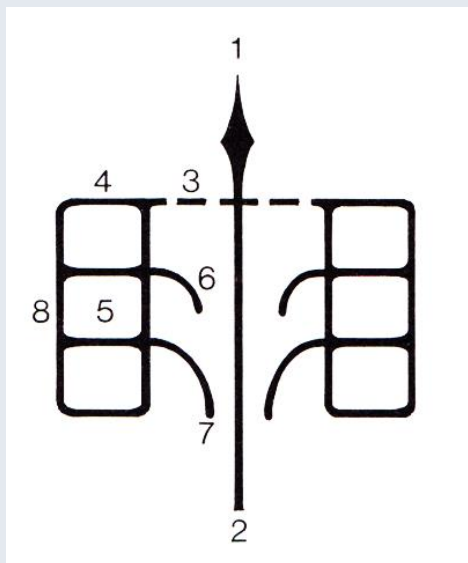
- 1 Crista galli
- 2 Lamina perpendicularis
- 3 Lamina cribrosa
- 4 Labyrinthus ethmoidalis
- 5 Cellulae ethmoidales
- 6 Concha nasalis superior
- 7 Concha nasalis media
- 8 Lamina orbitalis / papyracea







Sobotta

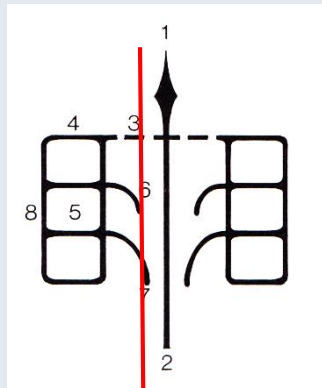


Faller



6 Concha nasi superior  
7 Concha nasi media

Faller



Siebbeinzellen: insg. ca. 30 (=Labyrinthus ethmoidalis)

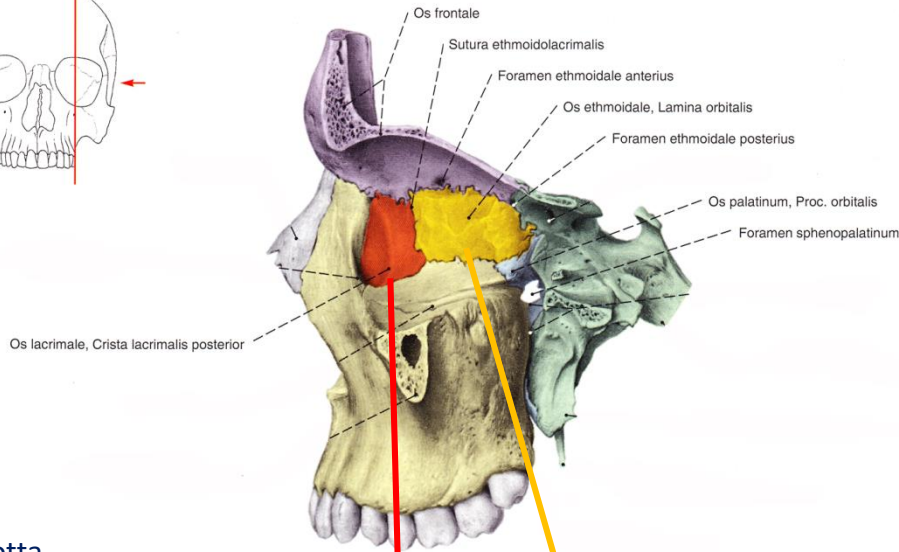
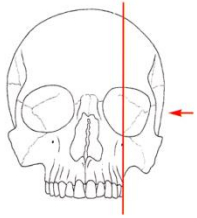
eins der Nasennebenhöhlen

Grenzstrukturen zw. Augenhöhle bzw. Nasenhöhle

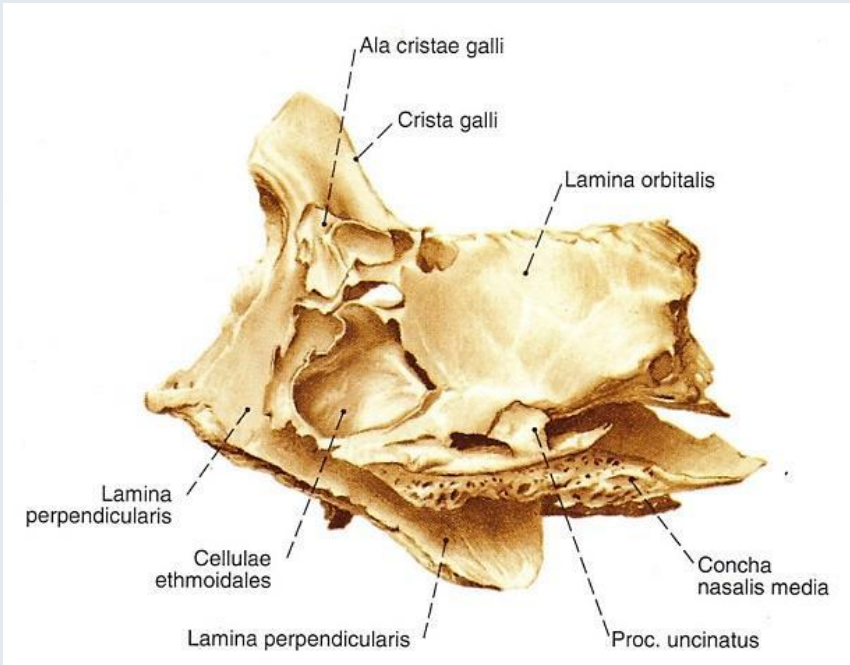
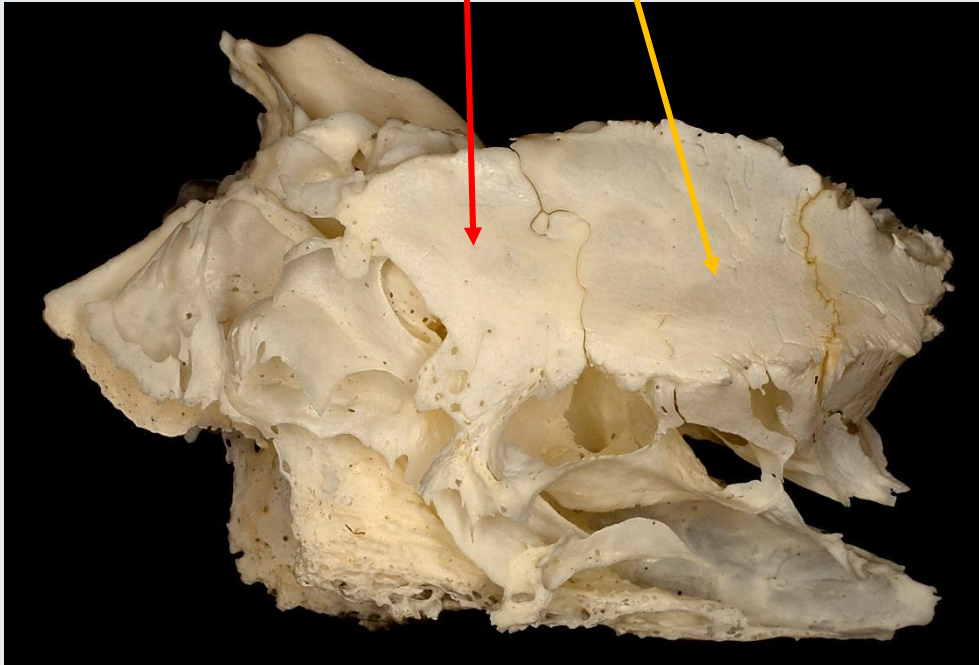
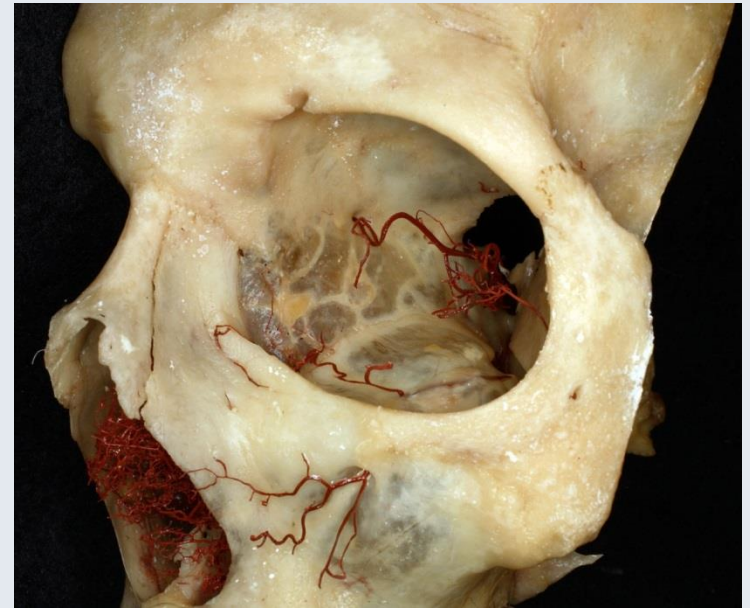
Entzündung: mögliche Komplikationen in der Augenhöhle durch dünne Lamina papyracea





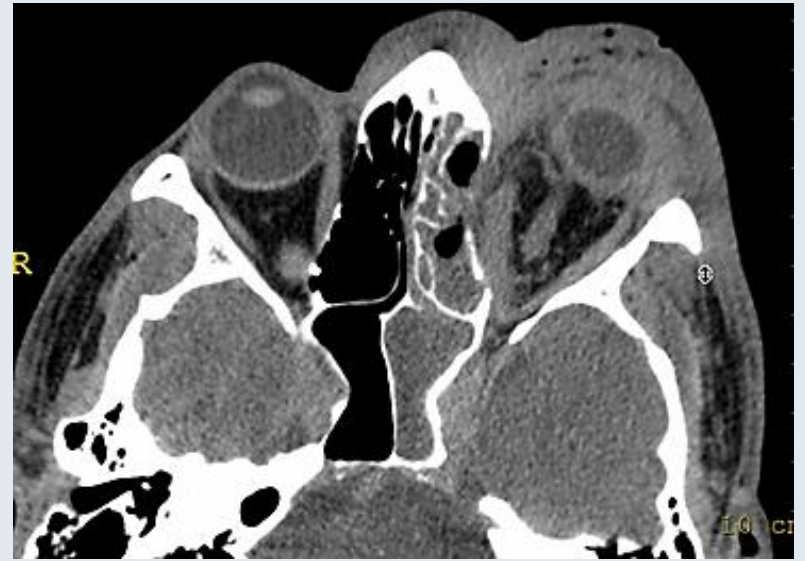
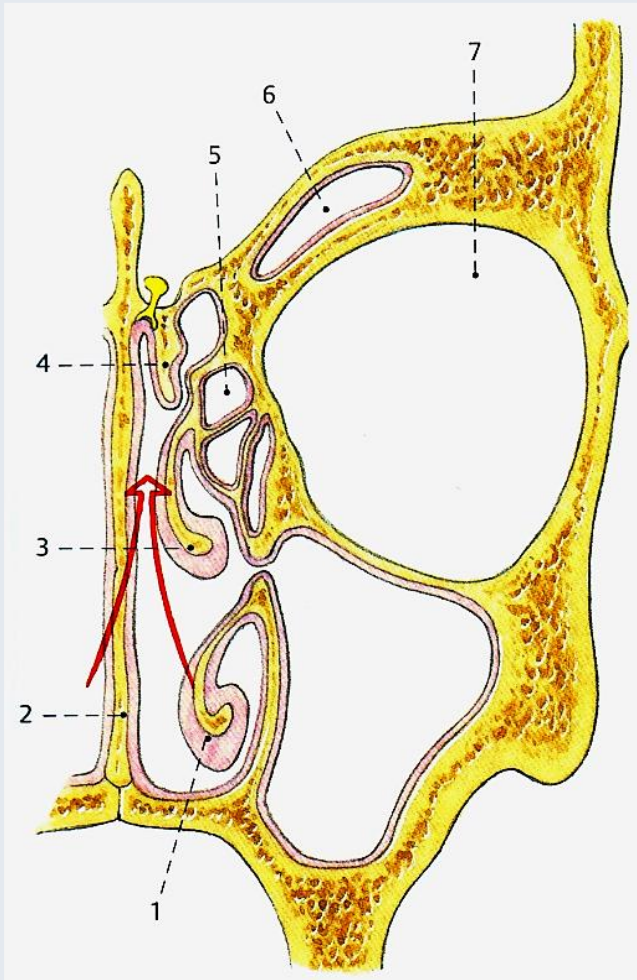


Sobotta



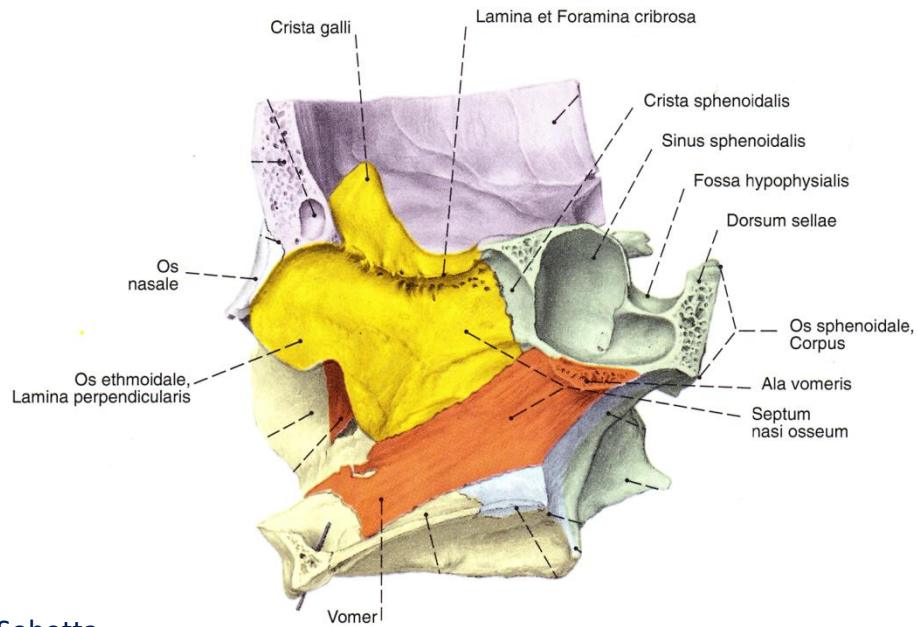
Sobotta

# Thumfart

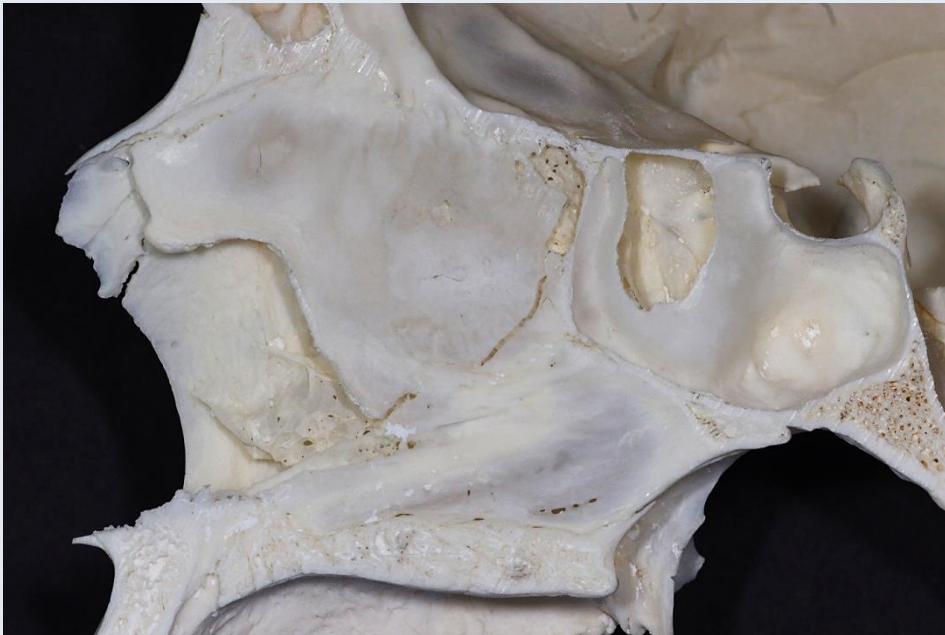
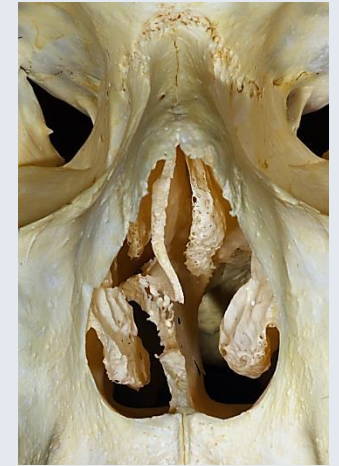


aus der Vorlesung von Hrn. Dr. Magyar Péter

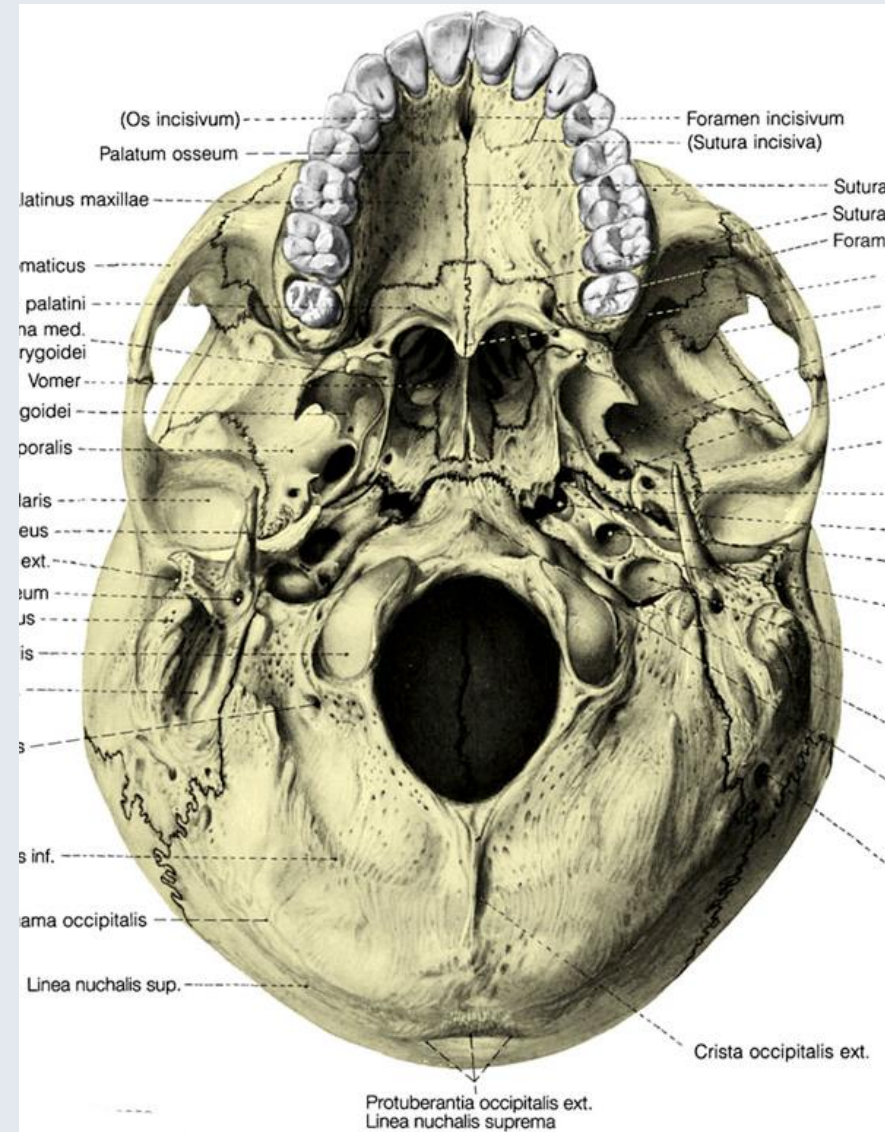
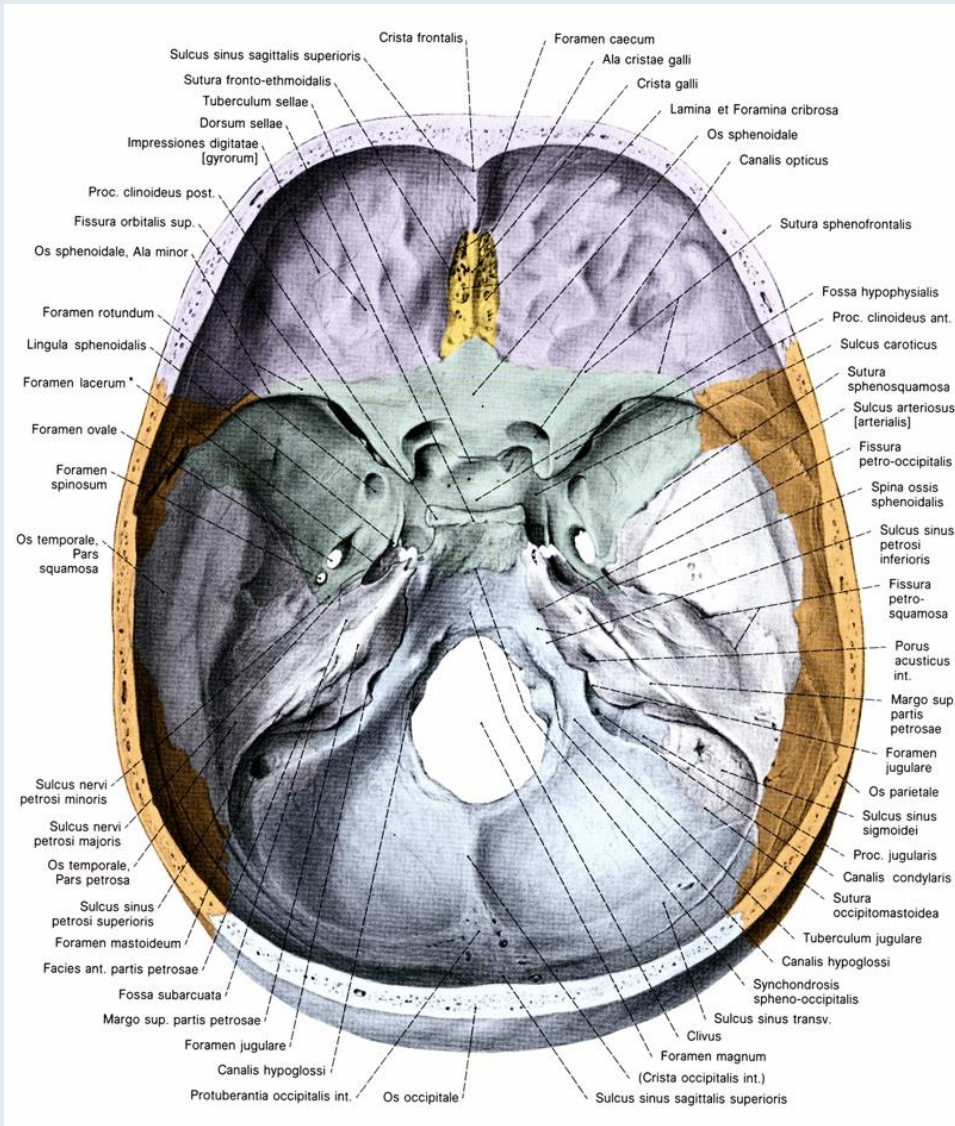




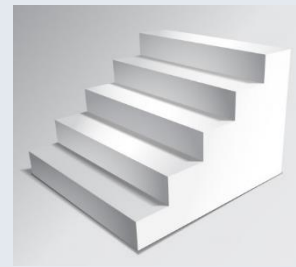
Sobotta



# Der Basis cranii ext. und int.



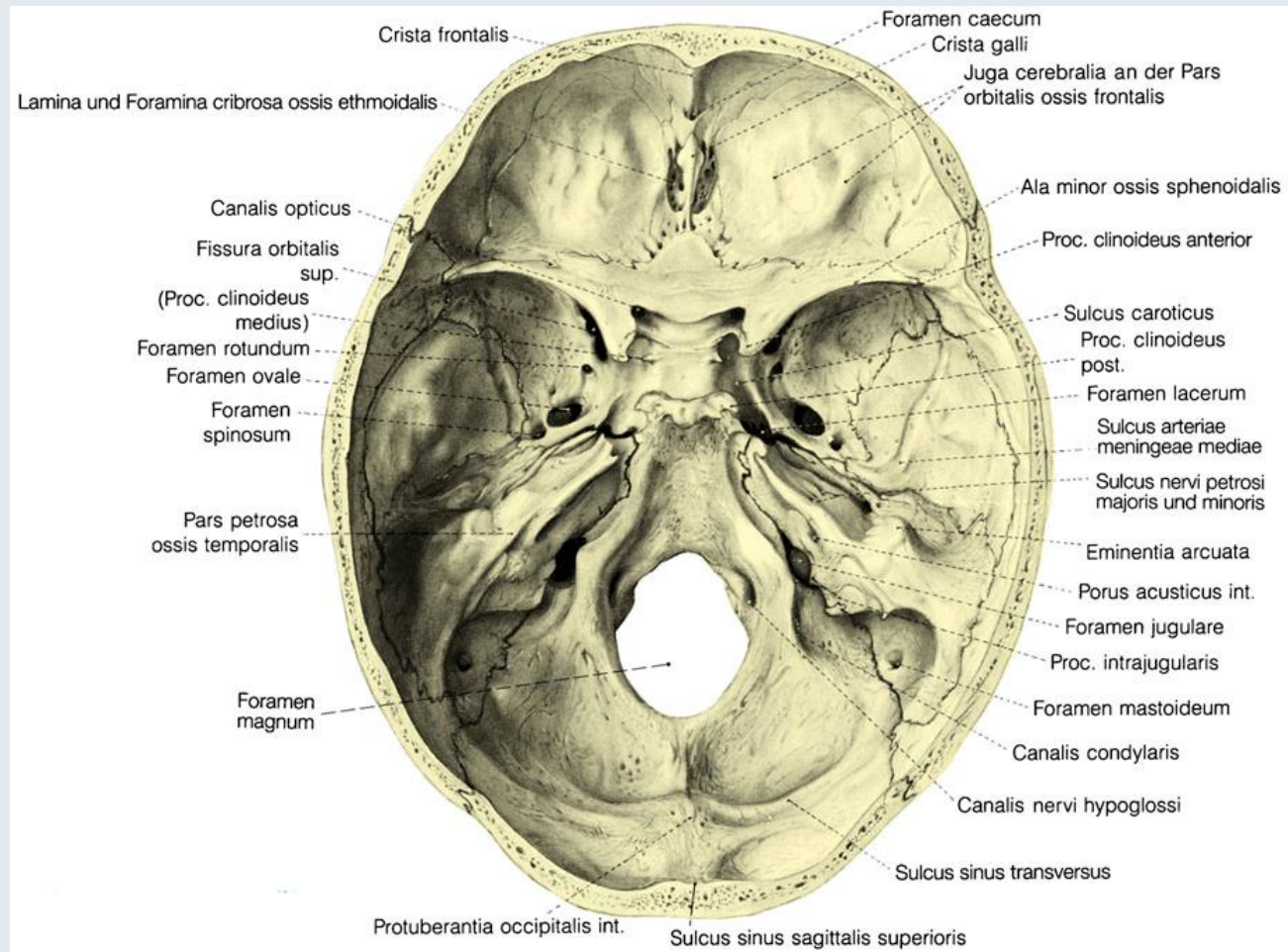
# Basis cranii interna



Fossa cranii ant.

Fossa cranii media

Fossa cranii post.



# Fossa cranii ant.

## Besteht aus:

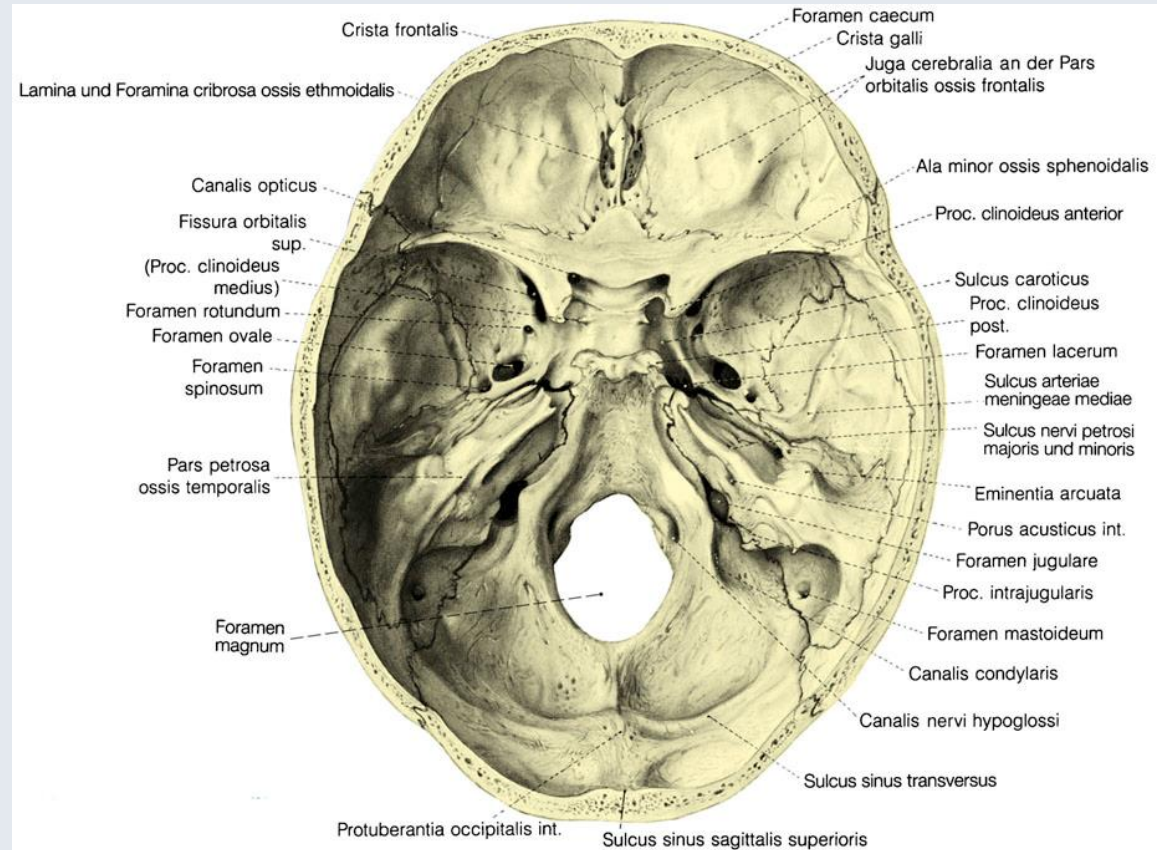
- Os ethmoidale (lamina cribrosa)
- Os frontale (pars orbitalis)
- Os sphenoidale (jugum sphenoidale, alae minores)

## Grenzen:

- Alae minores hintere Grenzen
- Sulcus prechiasmatis vordere Grenze

## Verbindungen :

- Foramen coecum → Nasenhöhle
- Löcher der lamina cribrosa → Nasenhöhle



# Fossa cranii med.

## Besteht aus:

Mittlerer Teil (pars sellaris):

- Corpus ossis sphenoidalis

Lat. Teilen (p. temporalis):

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

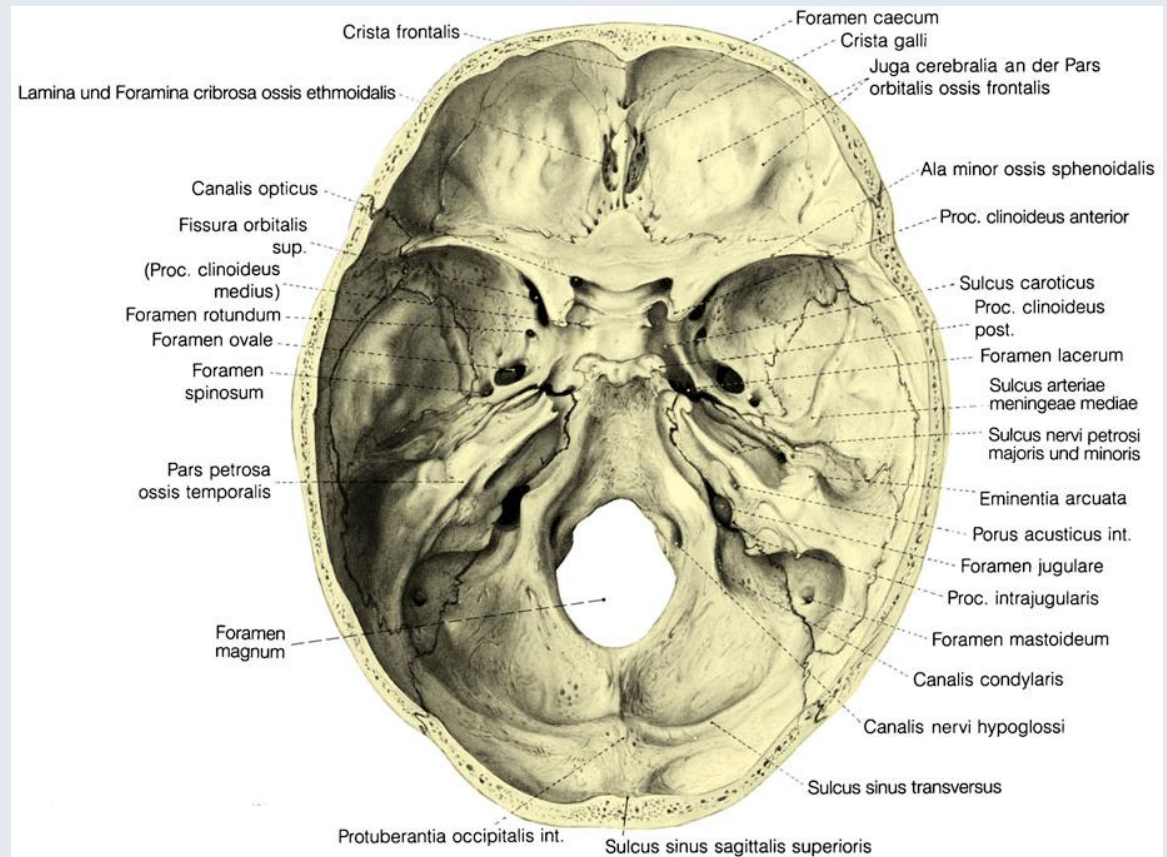
## Grenzen:

Vorne:

- Ala minor (hintere Grenze),
- Sulcus prechiasmatis

Hinter:

- Dorsum sellae
- Margo sup. partis petrosae



# Fossa cranii med.

## Verbindungen:

Canalis opticus → orbita

Fissura orbitalis sup. → orbita

Foramen rotundum → fossa pterygopalatina

Canalis nervi petrosi majoris → canalis facialis

Canalis nervi petrosi minoris → Paukenhöhle

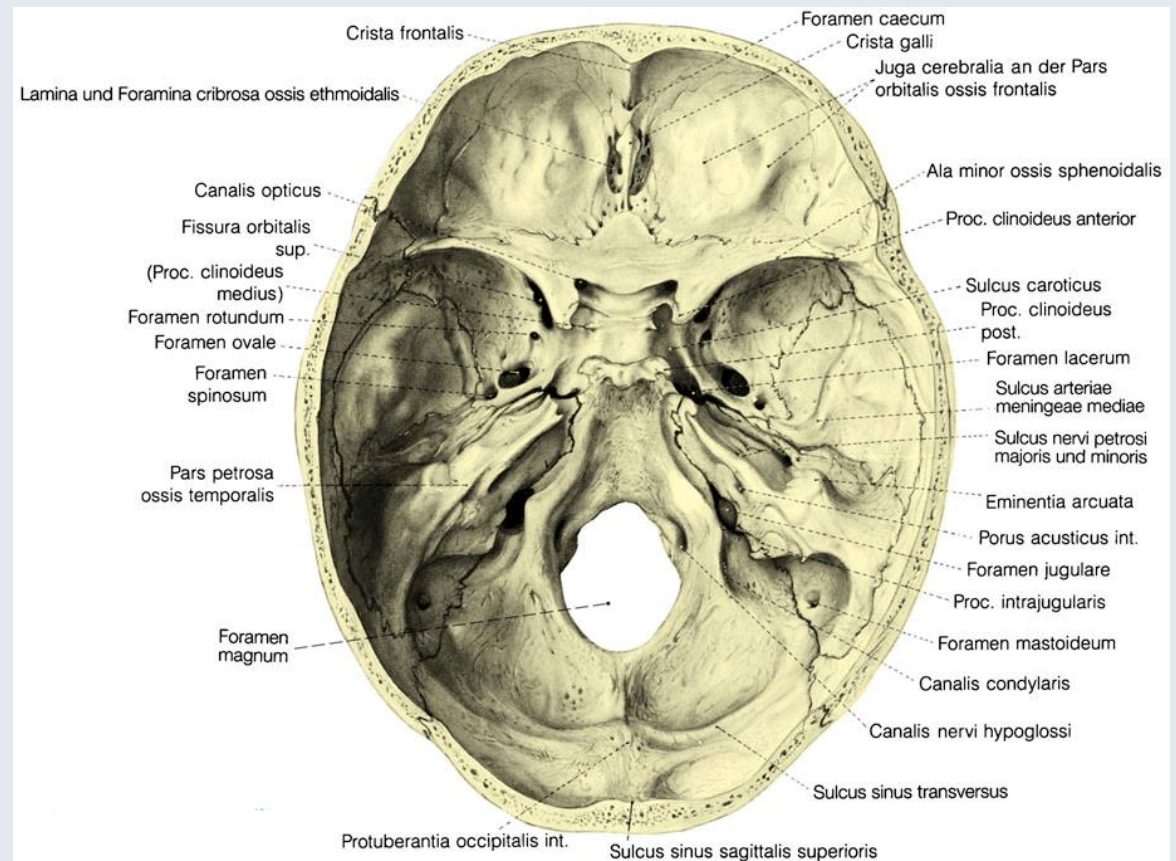
Foramen spinosum

Foramen ovale

Canalis caroticus

Foramen lacerum

Fissura sphenopetrosa





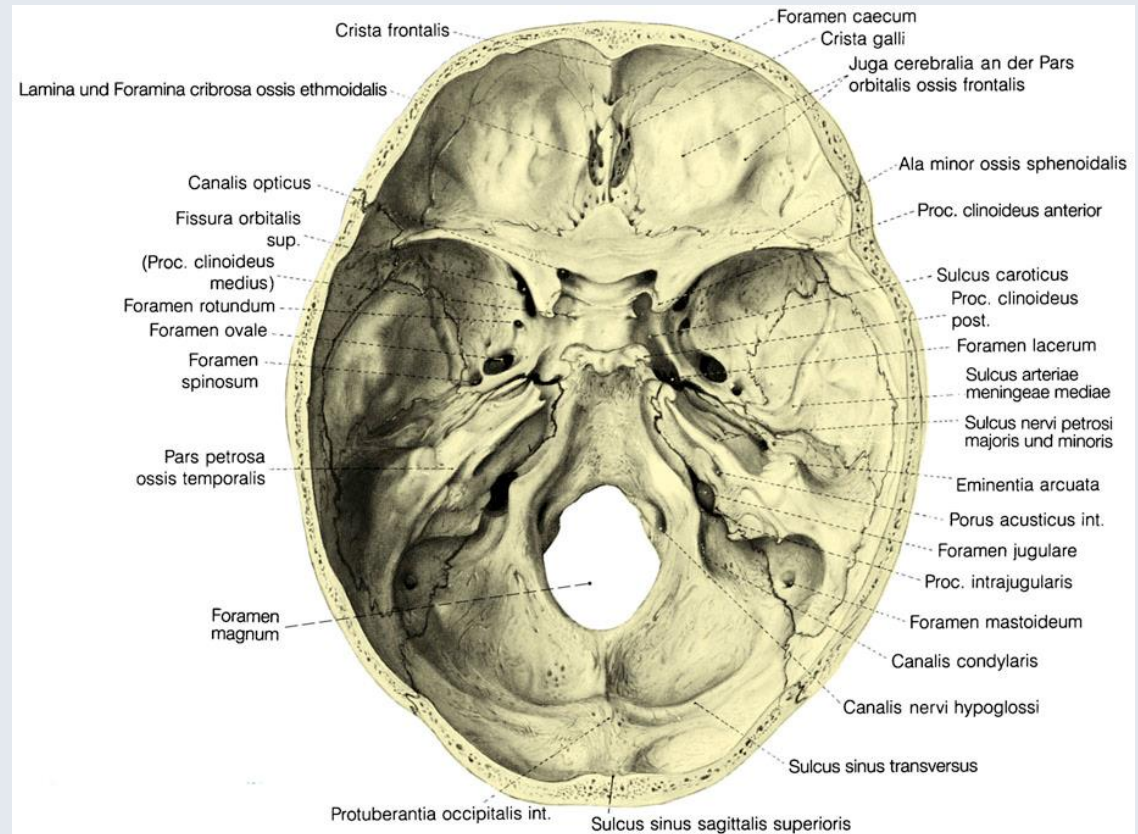
# Fossa cranii posterior

## Besteht aus :

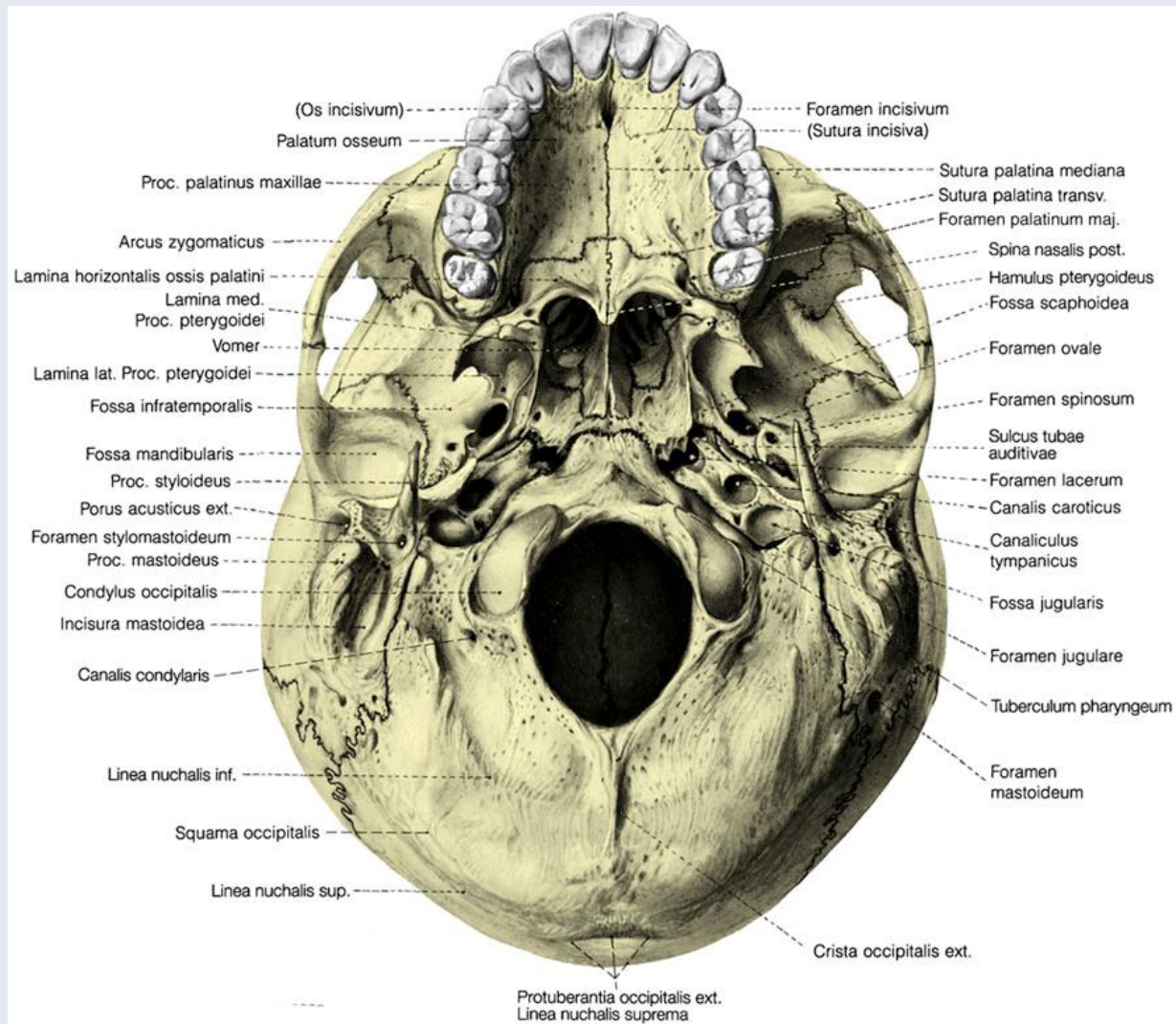
- Os occipitale
- Os temporale (p. mastoidea, facies post. partis petrosae)
- Os sphenoidale (dorsum sellae)

## Grenzen:

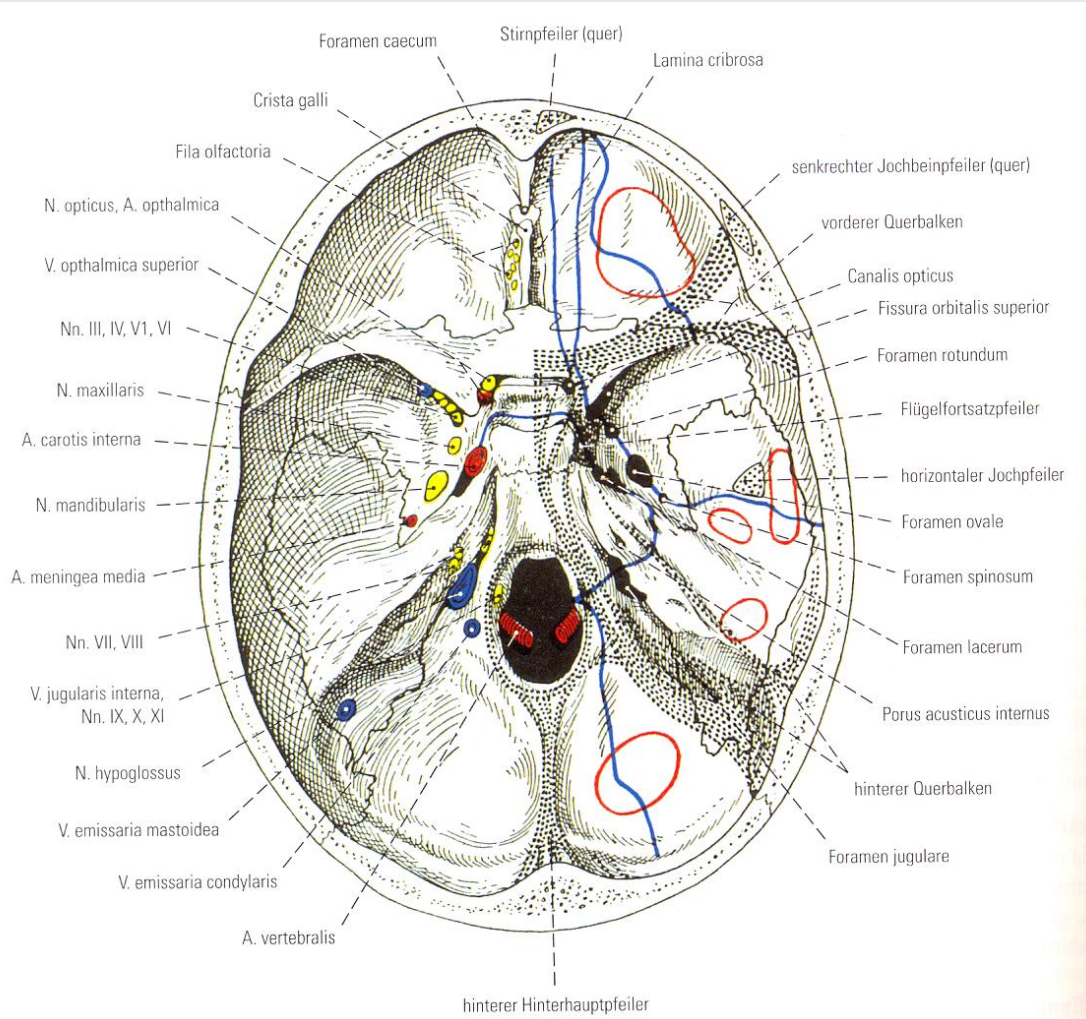
- Dorsum sellae obere Grenze
- Margo sup. partis petrosae
- Protuberantia occipitalis int.
- Sulcus sinus transversus



# Basis cranii externa



# Frakturen



## Frakturen des Schädels:

Fossa cranii ant.:

Papst-Auge hematoma

Nasanbluten mit liquor

Fossa cranii media:

Bluten aus dem Ohr

Fossa cranii post.:

Hematoma hinter dem proc. mastoideus, Blutung im spatium retropharyngeum

**Rot: schwache Gebiete**

Schwarz gepunktet:

Verstärkte Knochen in Richtung der Kraftlinien

**Blau: typische Bruchlinien**

**Proust**  
A la recherche  
du temps perdu



Humanis

„Fuga temporis” = Zeit vergeht

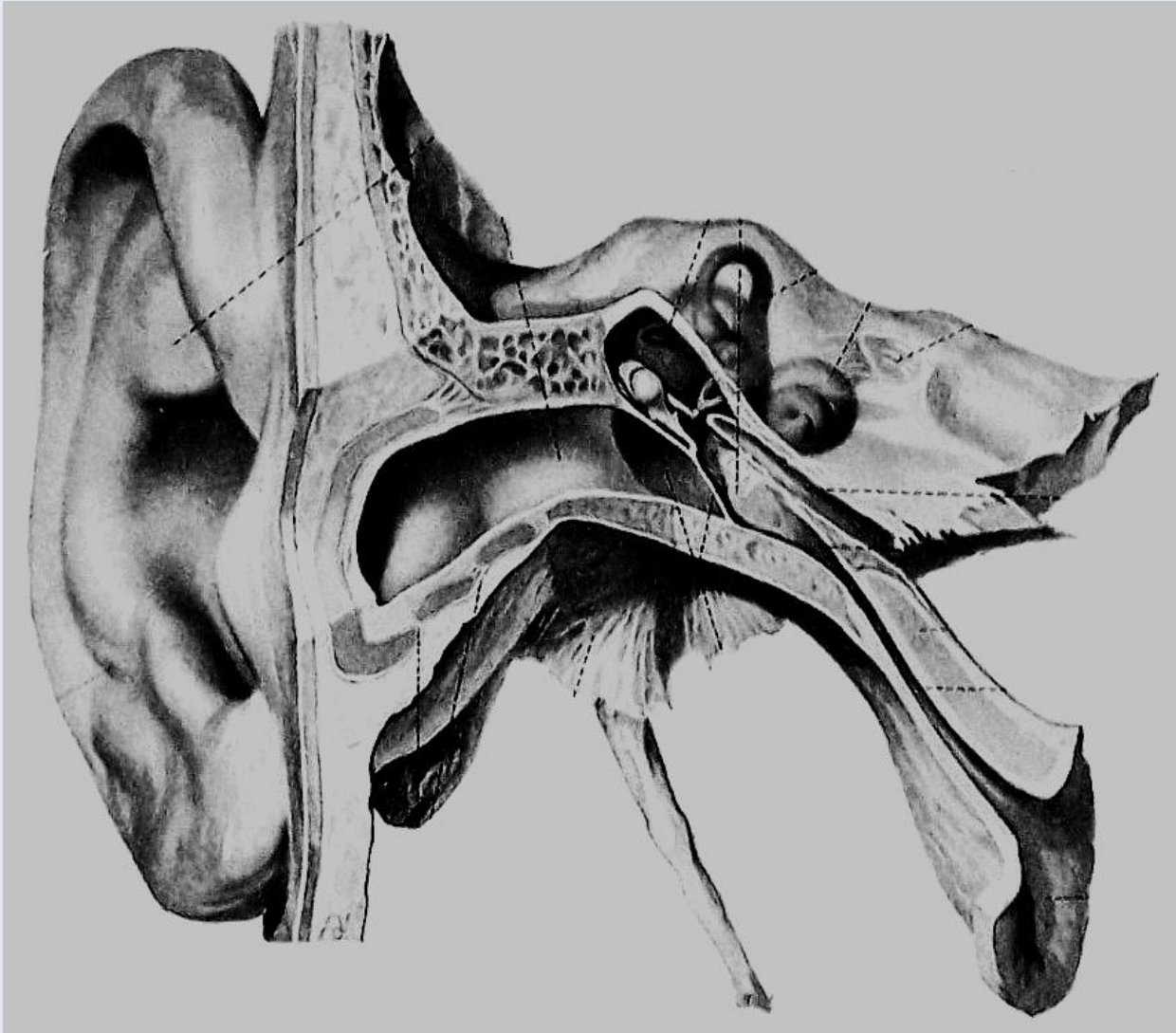
Tempus = Zeit

(Vergrauung)

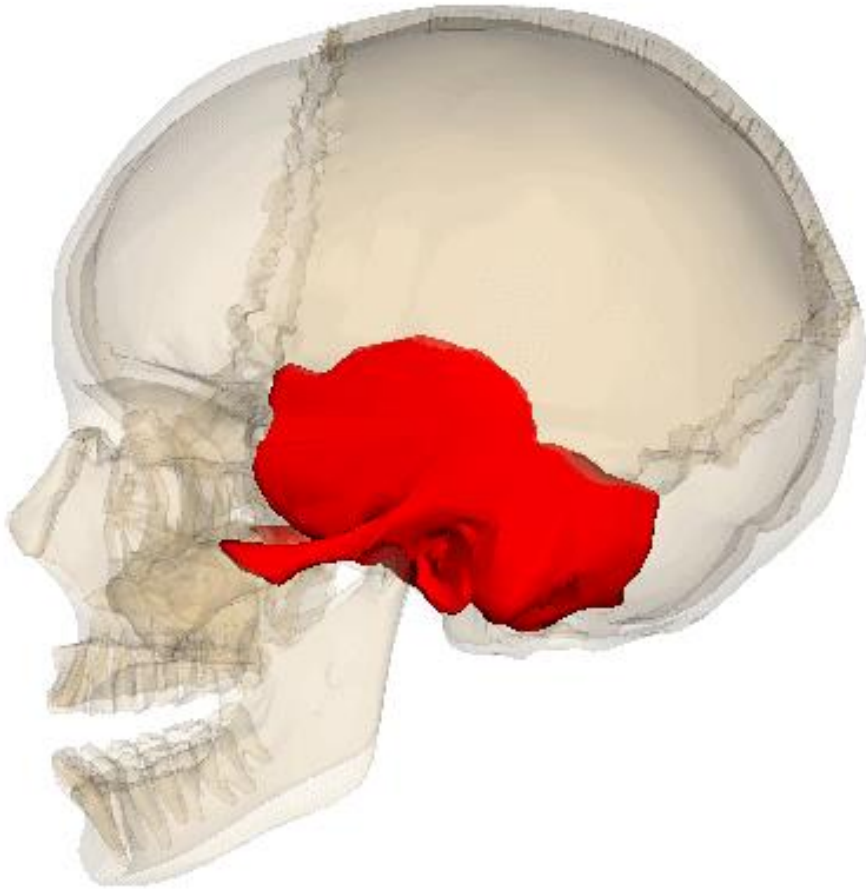


P. P. Rubens: *Virgin in Adoration  
before the Christ Child*

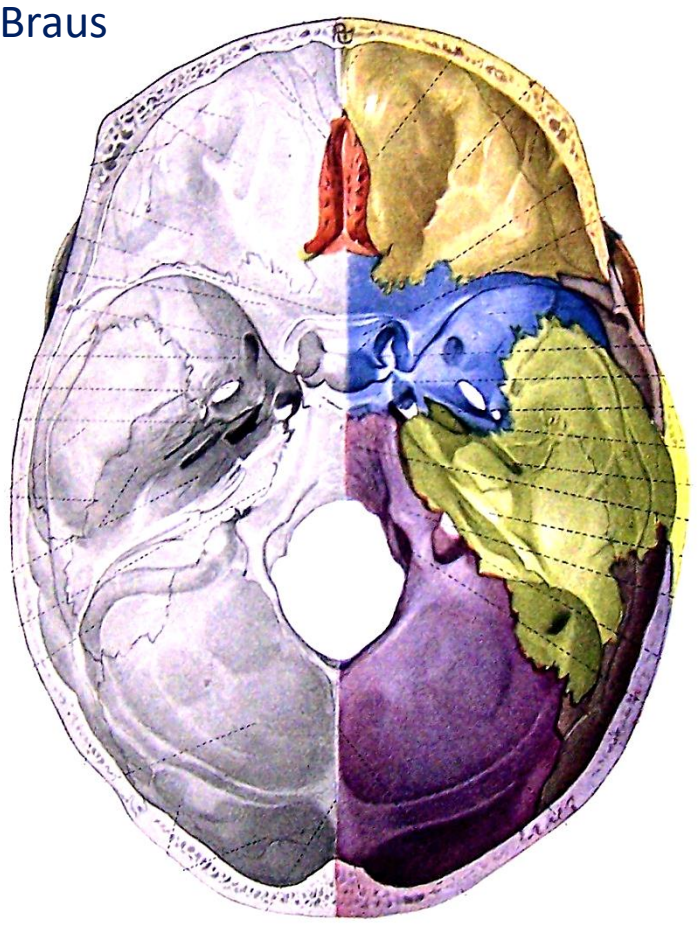
„Schläfenbein”



Braus



Braus



Nachbarn:

Keilbein (Os sphenoidale )

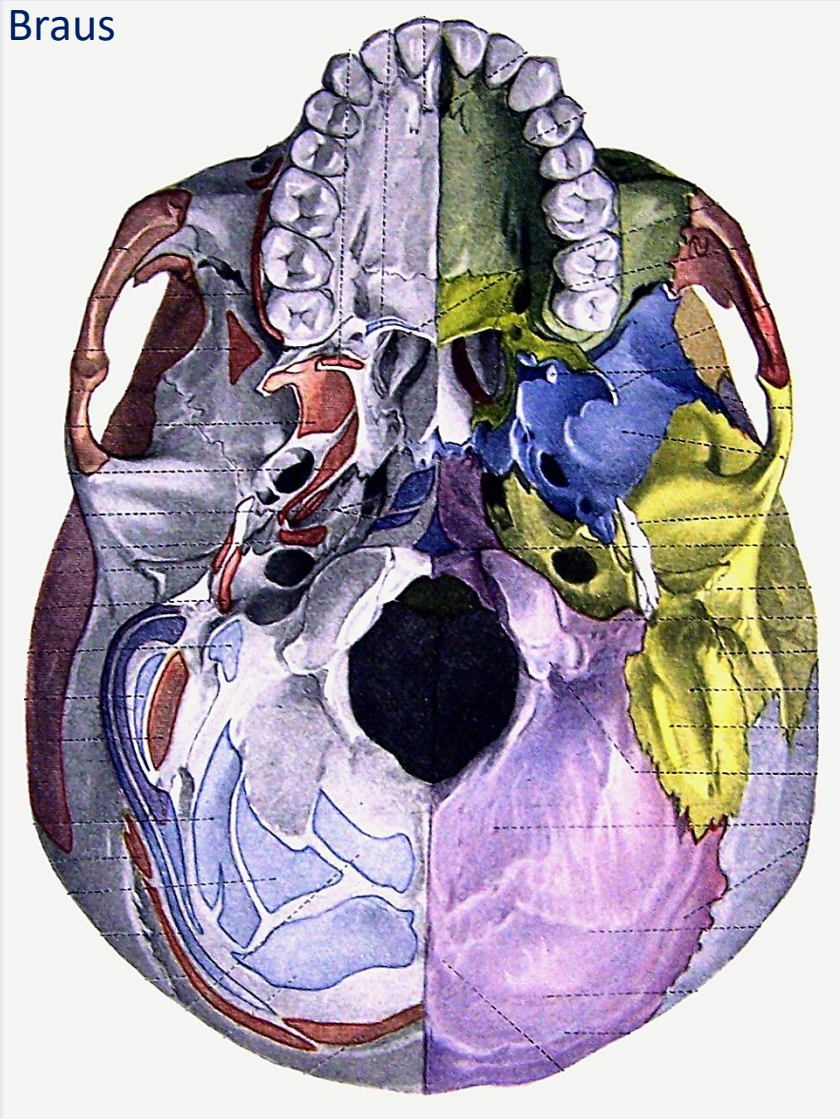
Scheitelbein (Os parietale)

Hinterhauptbein (Os occipitale )

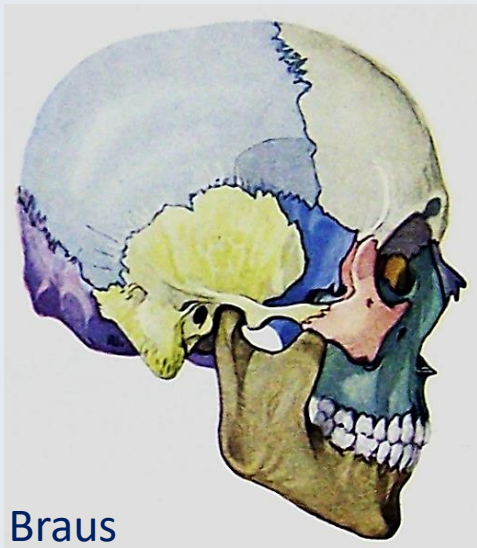
Jochbein (Os zygomaticum)



Braus



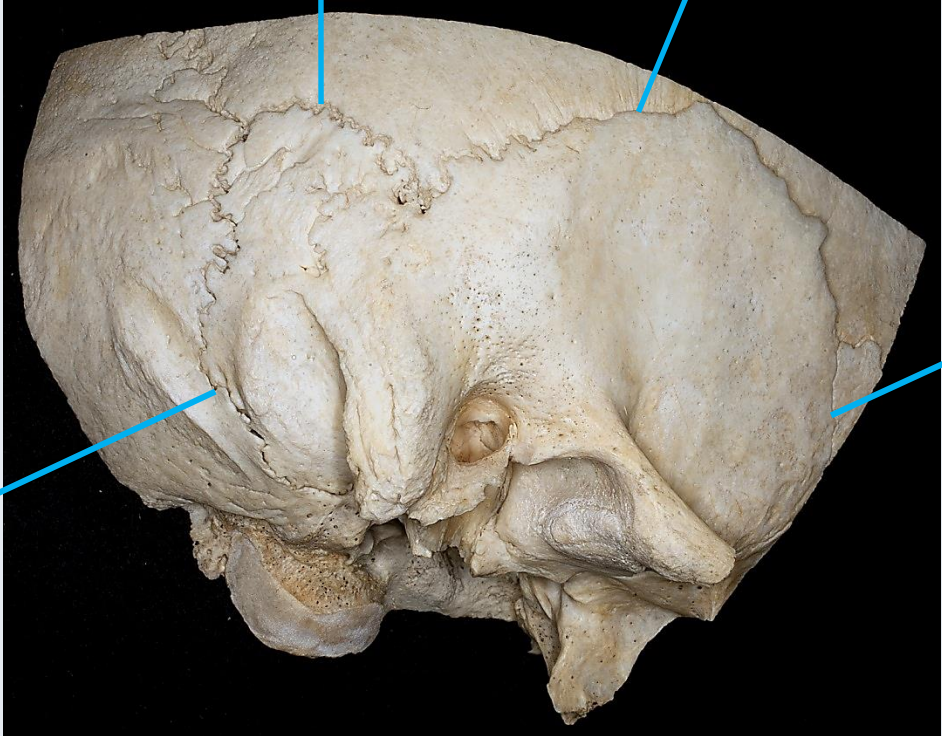




Braus

Sutura Parietomastoidea

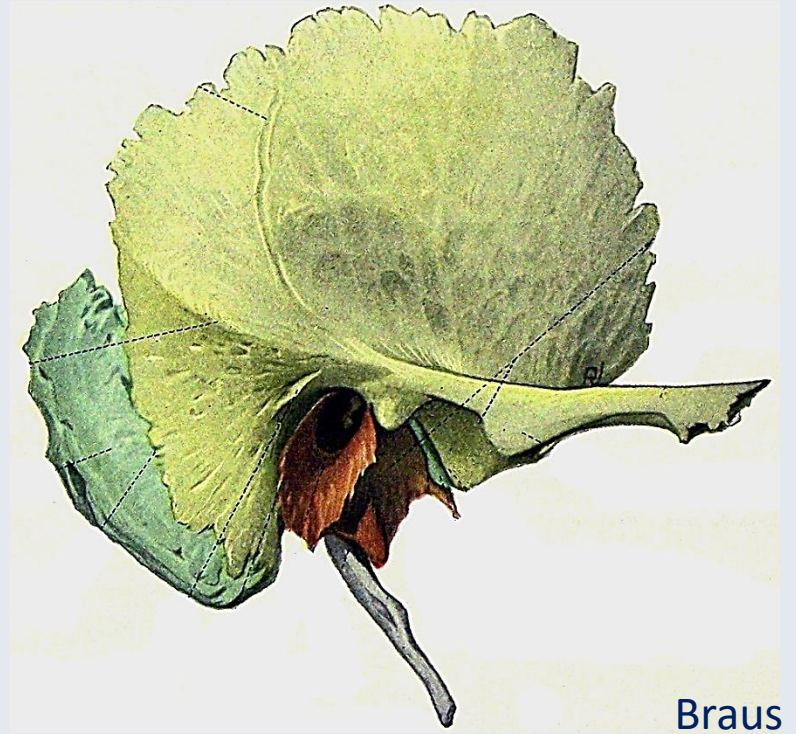
Sutura squamosa



Sutura Occipito-  
mastoidea

Sutura spheno-  
squamosa

Rechter Schläfenbein aus seitlichem Aspekt



Pars Squamosa

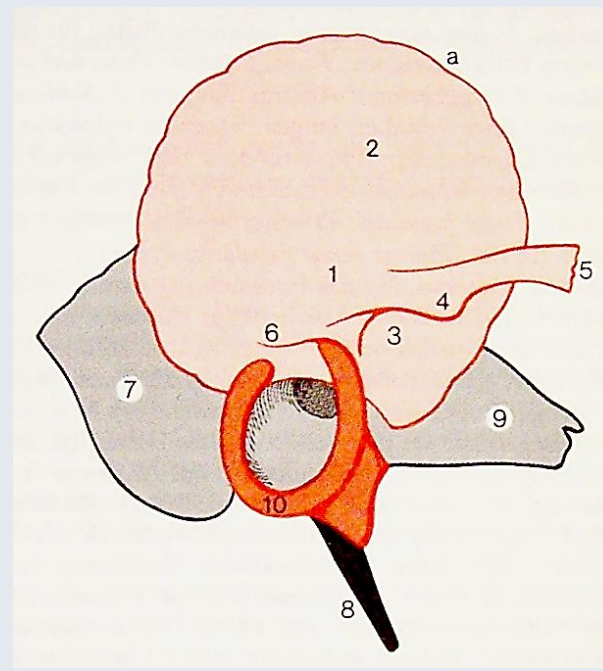
Pars *Mastoidea*

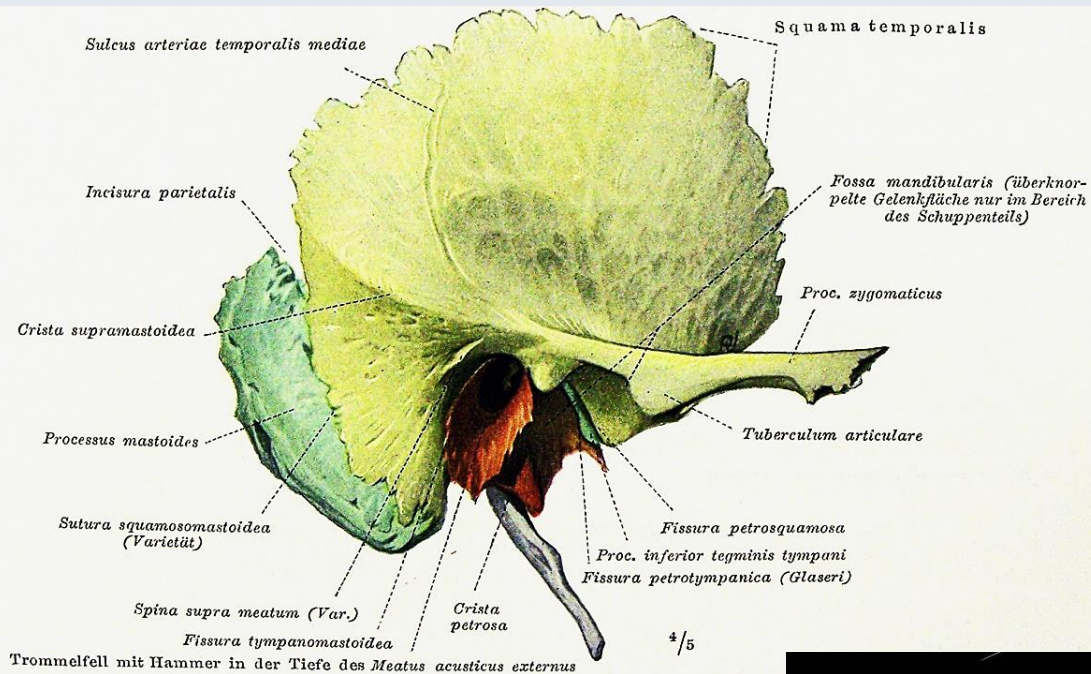
Pars Tympanica

Pars Petrosa

Pars Hyoidea

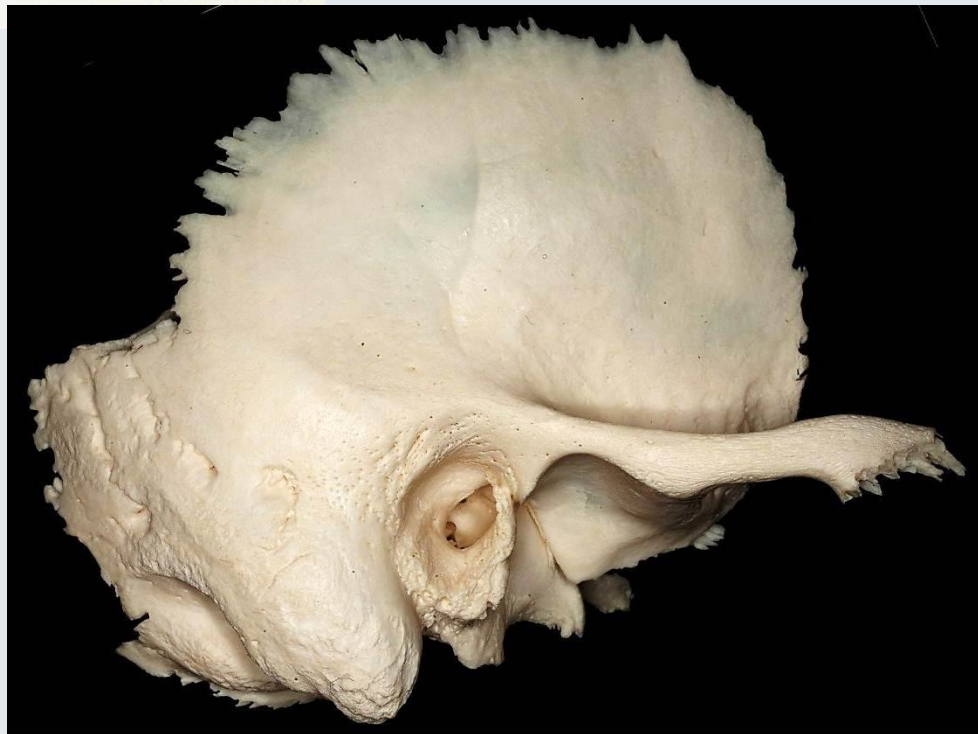
Rechter Schläfenbein aus seitlichem Aspekt

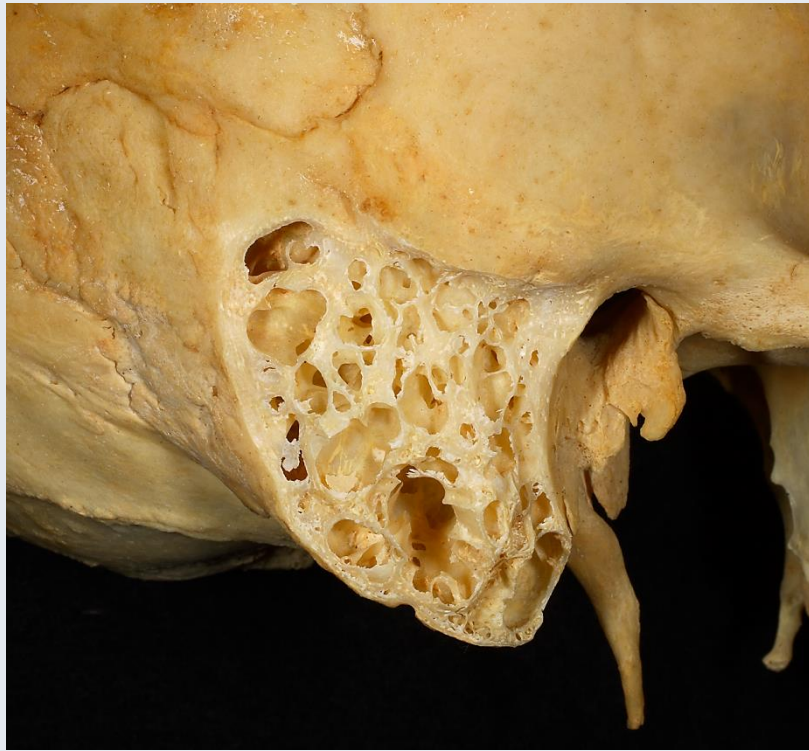




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# Aspectus lateralis



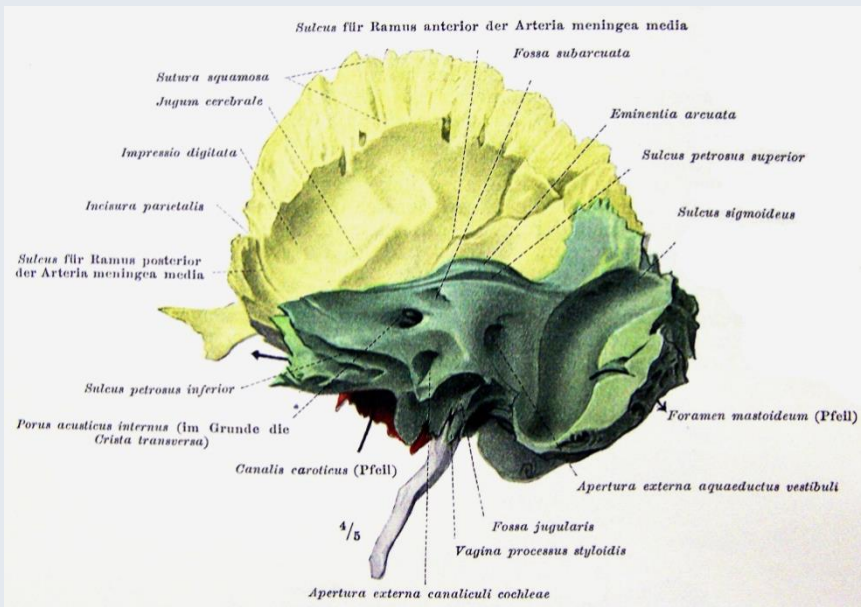


Mastoid-Luftzellen

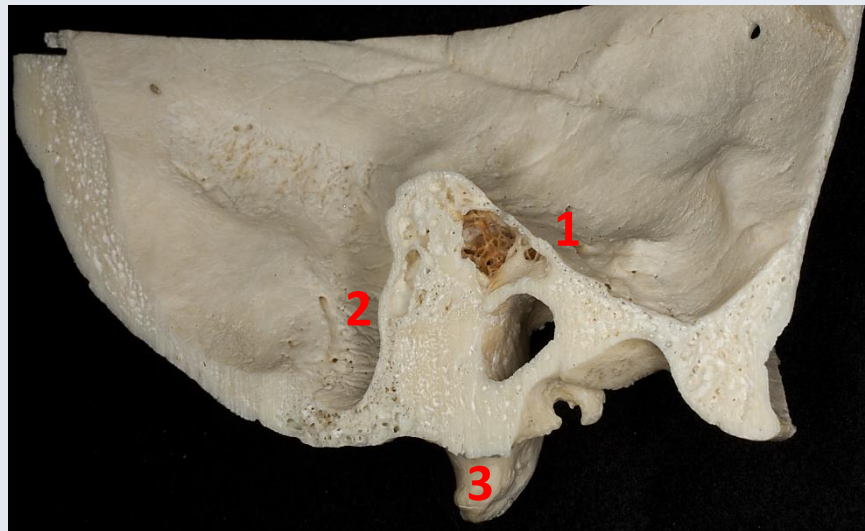
Antrum und Aditus



# Aspectus posterior



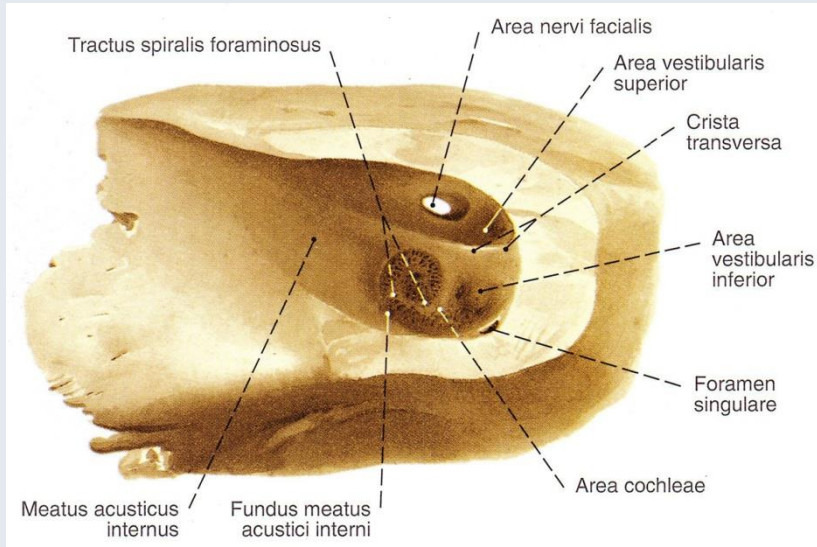
## Braus



Pyramid: 3 oberflächen

1. anterior pyramidal
2. posterior pyramidal
3. inferior pyramidal

## Sobotta



Blick auf den Fundus des  
rechten internen akustischen  
Gehörganges

4 quadranten:

Area facialis

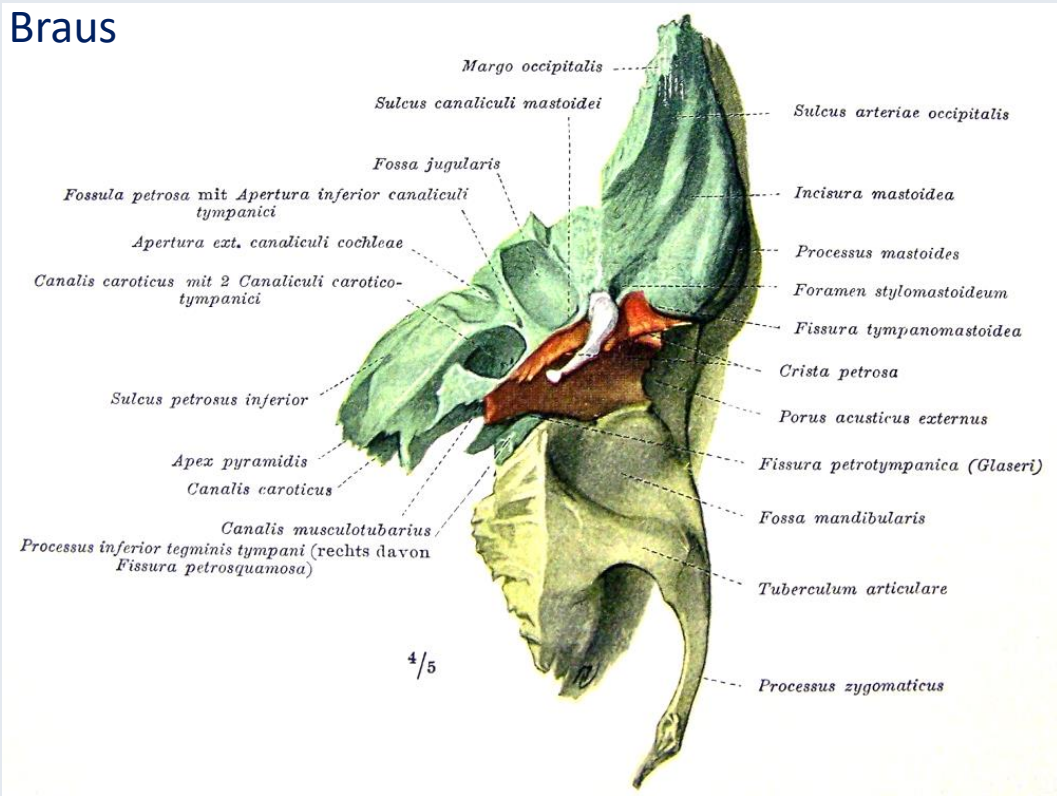
Area vestibularis superior

Area vestibularis inferior und  
singulate foramen

Area cochlearis

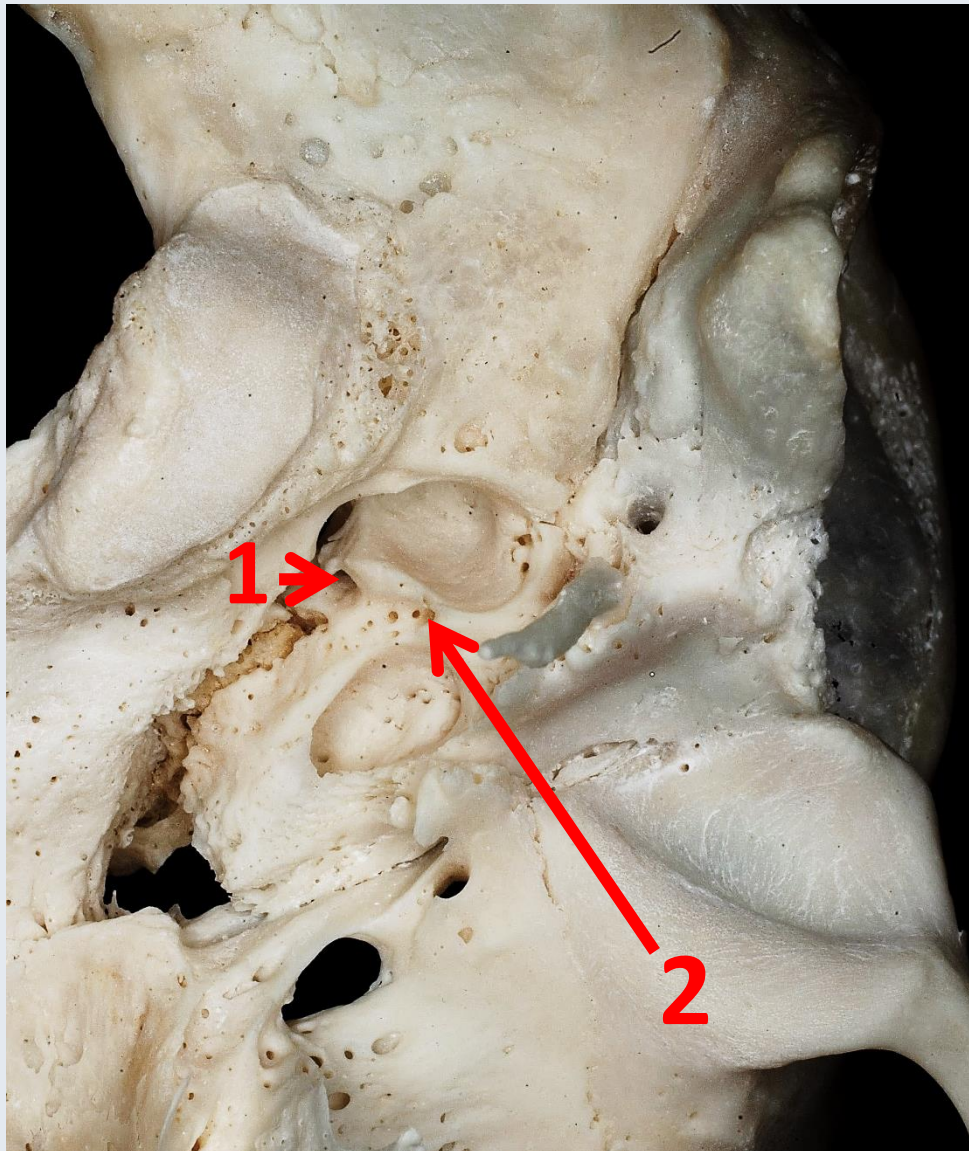


# Braus



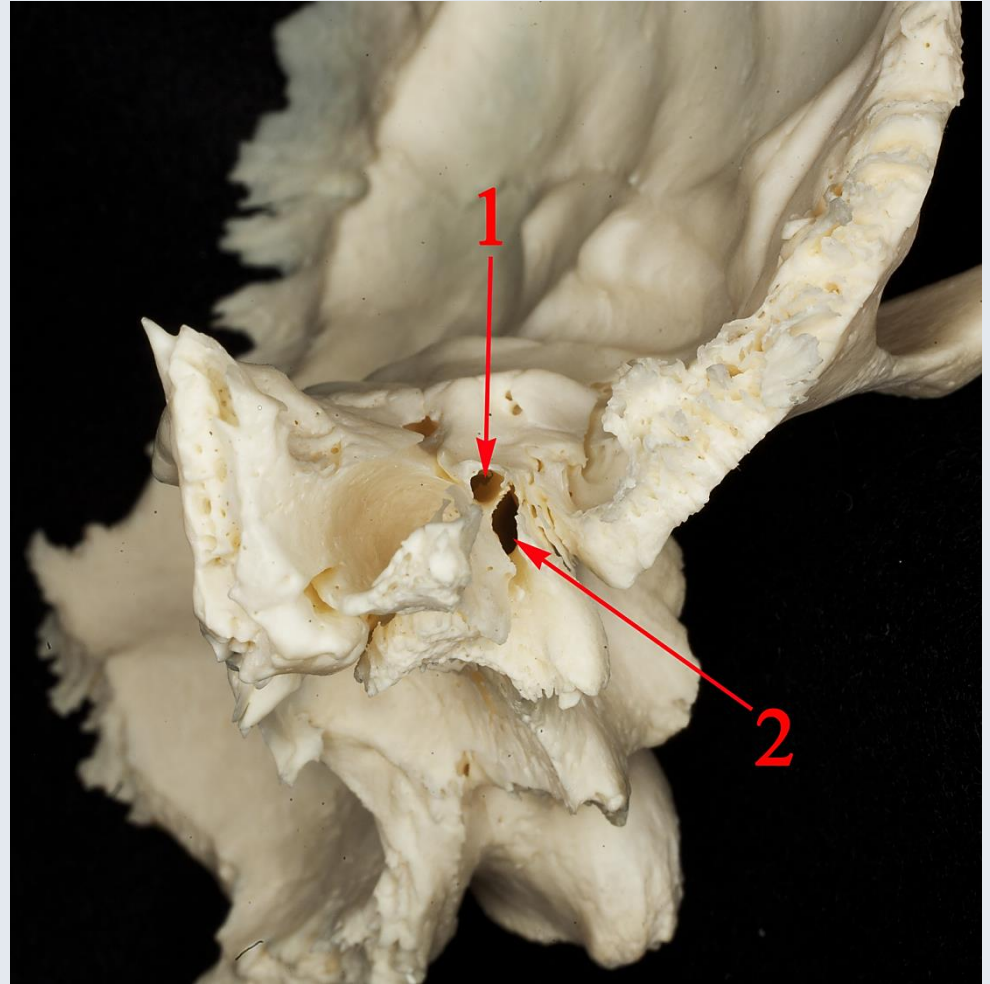
## Aspectus inferior





Braus

1. Ausgangspunkt von canaliculi cochleae  
(medial von der Fossula petrosa, zwischen dem Jugular Foramen und dem Carotis Kanal)
2. Fossula petrosa und tympanic canaliculus  
(seitlich von dem ersteren, auch zwischen zwei vaskulären Öffnungen)



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

Zu finden: parallel zum Karotis-Kanal (außerhalb davon)

Braus



## Tegmen tympani

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

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**ANNALS  
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### Development of the anterior chordal canal

Miklós Tóth<sup>a,\*</sup>, Gerhard Moser<sup>b</sup>, Lajos Patonay<sup>c</sup>, Imre Oláh<sup>a</sup>

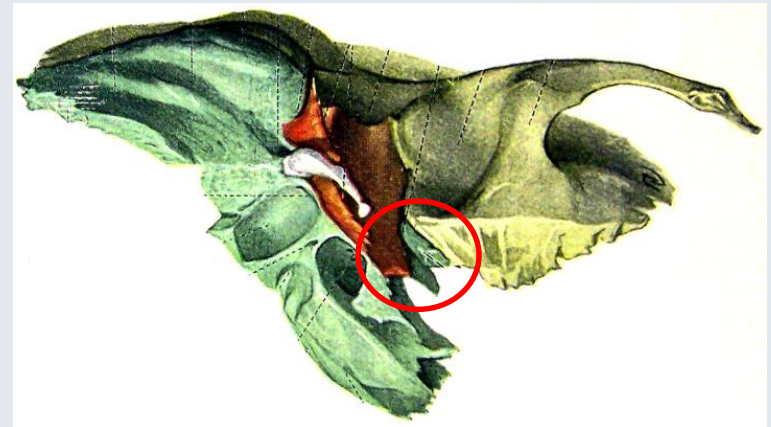
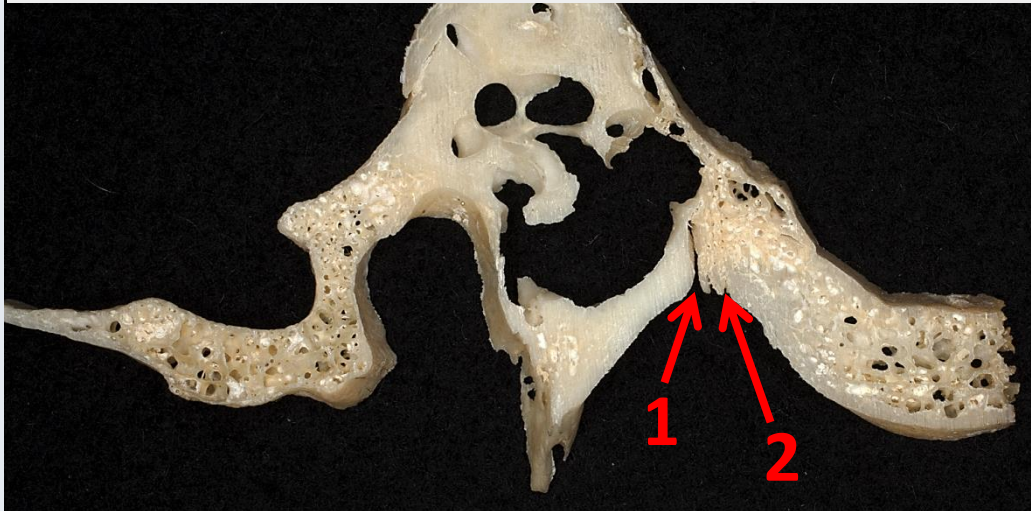
<sup>a</sup>Department of Human Morphology and Developmental Biology, Faculty of Medicine, Semmelweis University, Tűzoltó utca 58, H-1094 Budapest, Hungary

<sup>b</sup>Department of Otorhinolaryngology, Salzburg University Medical School, Salzburg, Austria

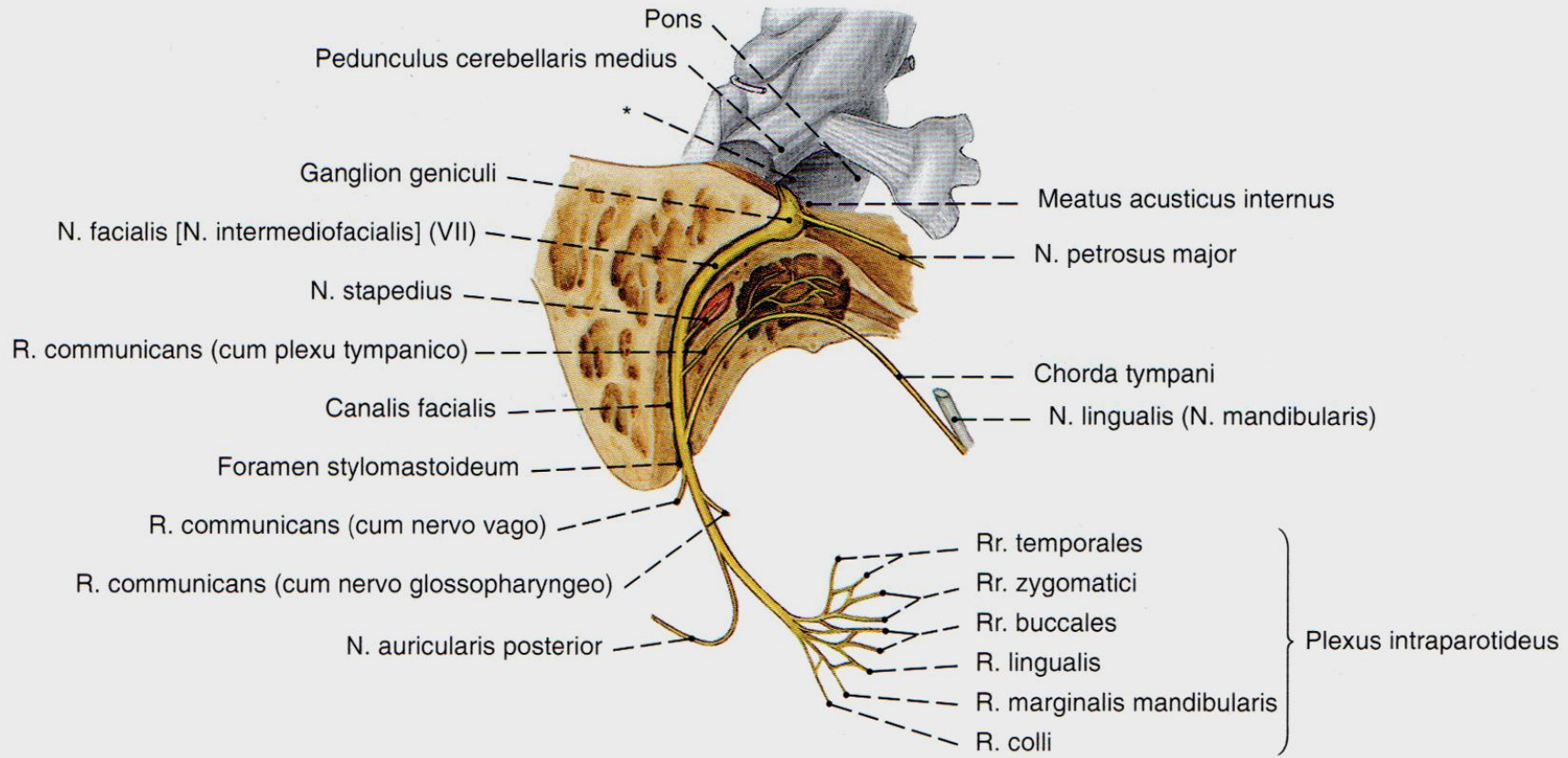
<sup>c</sup>Department of Anatomy, Histology and Embryology, Faculty of Medicine, Semmelweis University, Tűzoltó utca 58, H-1094 Budapest, Hungary

Received 25 January 2005; accepted 5 April 2005

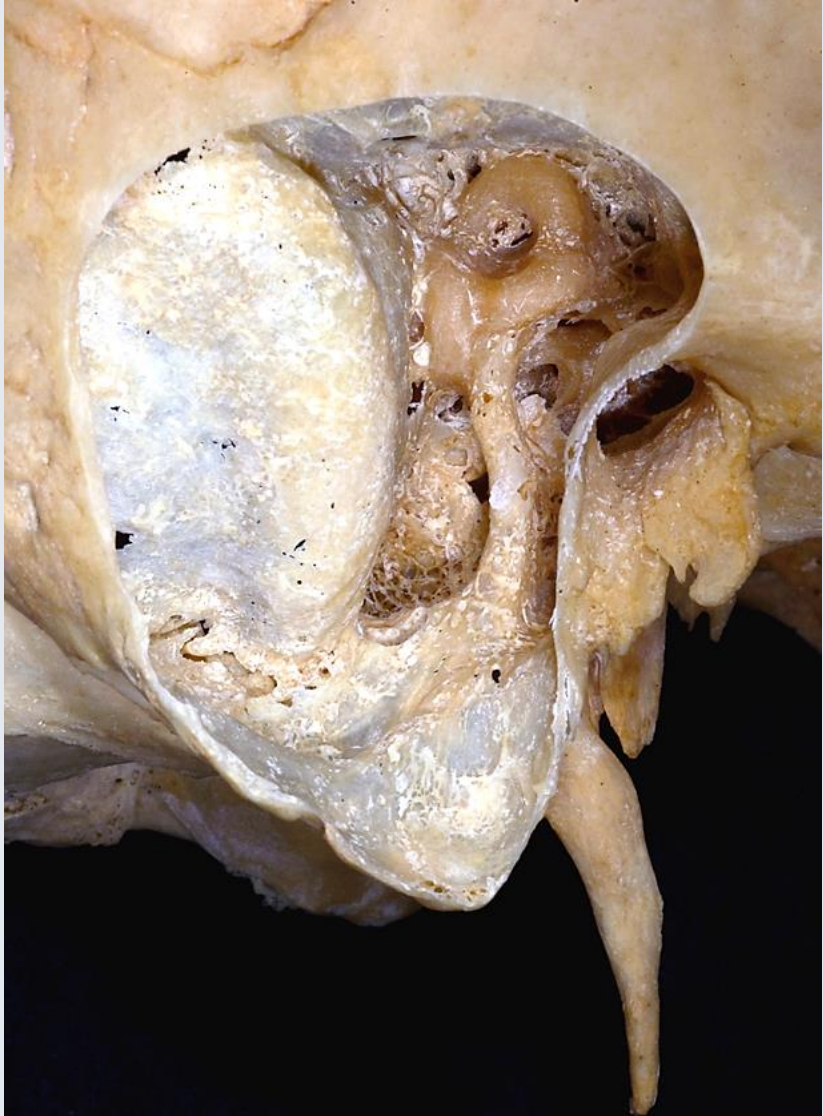
2. Fissura Petrosquamosa

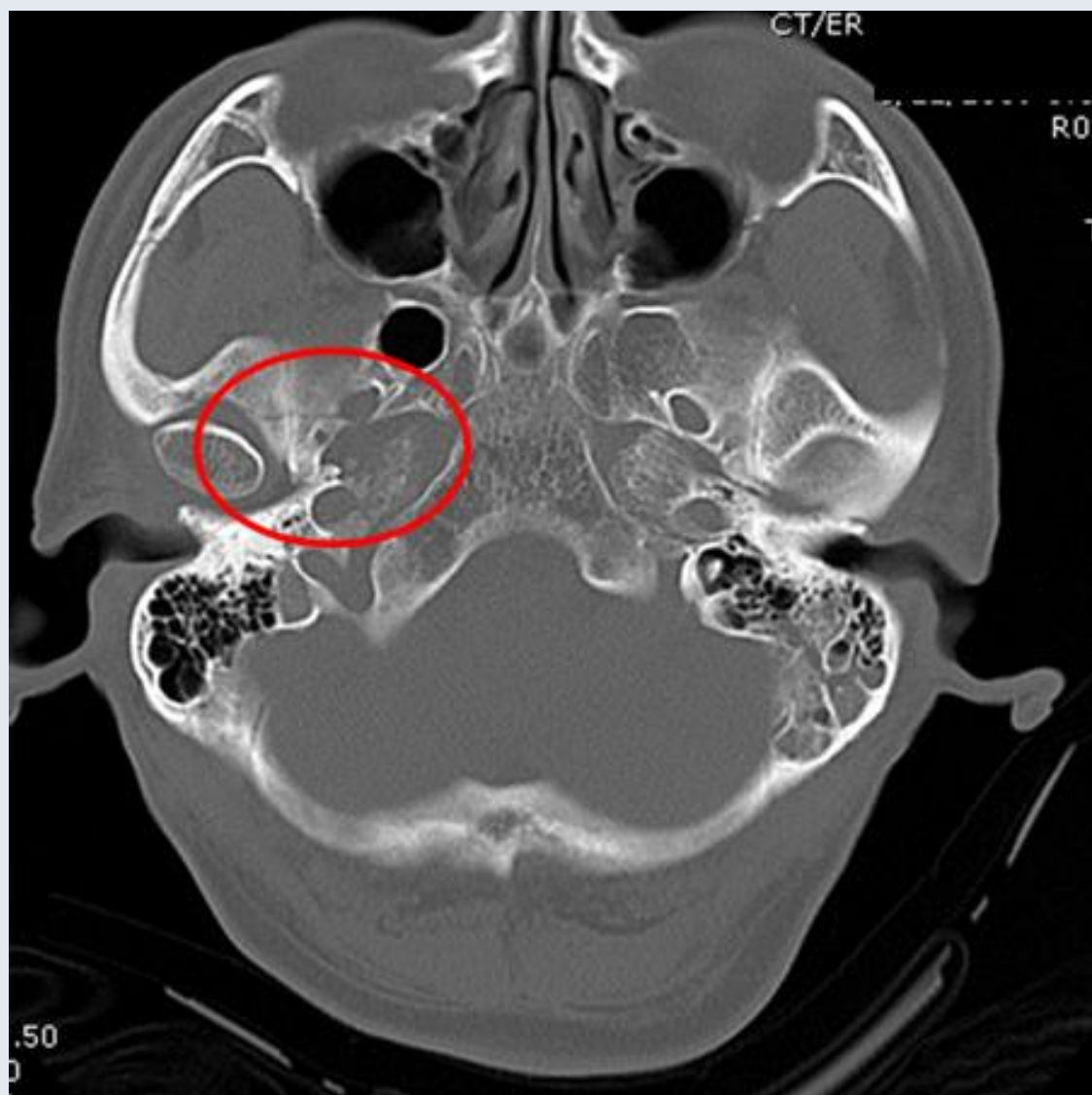


# Facial Kanal (Fallopian Kanal)



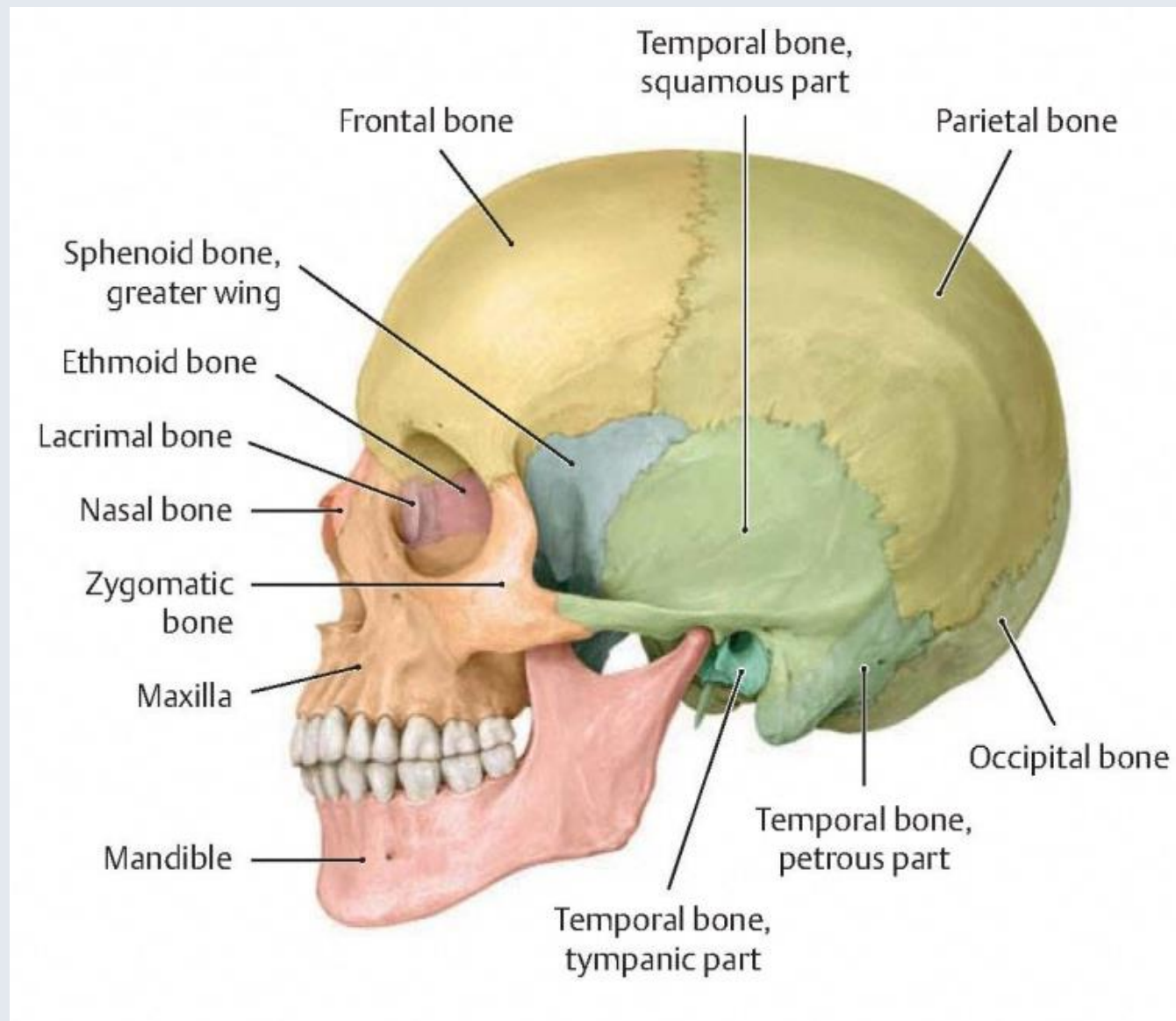
# Facial Kanal (Fallopian Kanal)





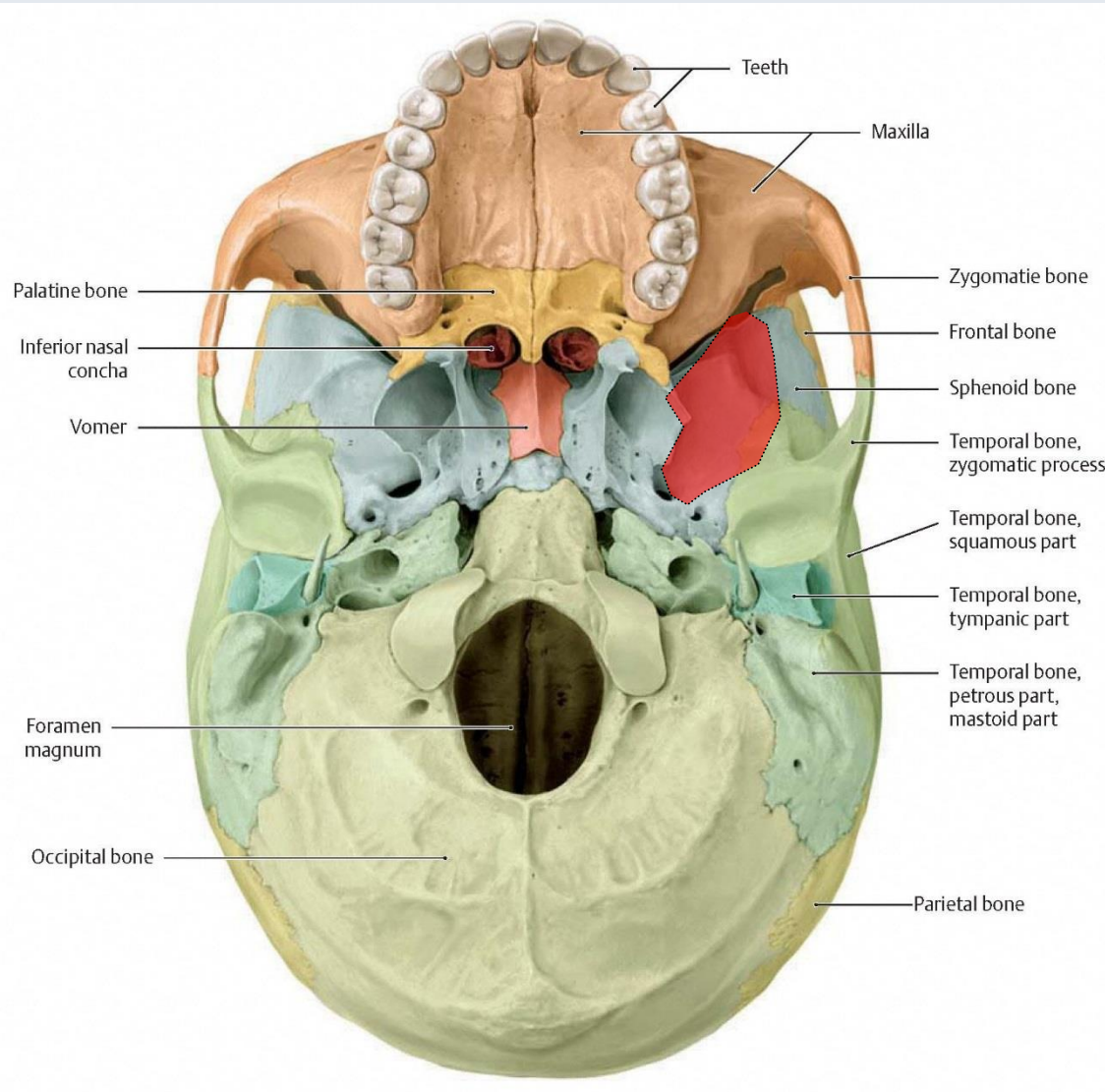
Fossa temporalis et infratemporalis

# Topographie





# Fossa infratemporalis



# Grenzen der Fossa infratemporalis

## VORNE

Tuber maxillae  
Facies infratemporalis maxillae

## HINTEN

Tuberculum articulare (Articulatio temporomandibularis)

## OBEN

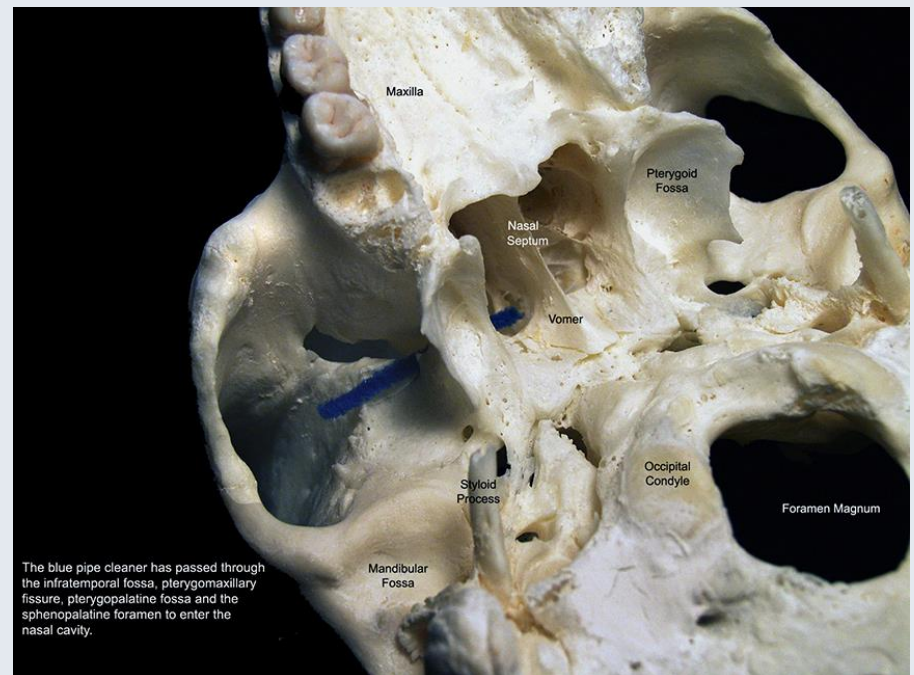
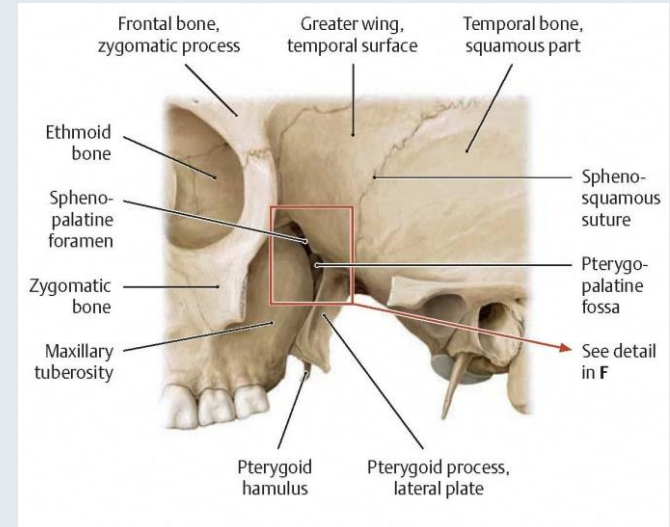
Facies infratemporalis (ala majoris ossis sphenoidalis)  
Squama ossis temporalis (bis der crista infratemporalis)

## AUSSEN

Ramus mandibulae  
Processus coronoideus  
Arcus zygomaticus

## INNEN

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



# DIE LAGE DER FOSSA INFRATEMPORALIS BZW. FOSSA PTERYGOPALATINA



## Fossa infratemporalis

Fissura pterygomaxillaris

Fissura orbitalis inferior II. (vorderer, lateraler Teil)

Foramen ovale

Foramen spinosum

Fissura petrotympanica (*Glaseri*)

Foramina alveolaria

Fissura petrosquamosa

## Wohin (woher)

Fossa pterygopalatina

Orbita

Fossa cranii media

Fossa cranii media

Cavum tympani

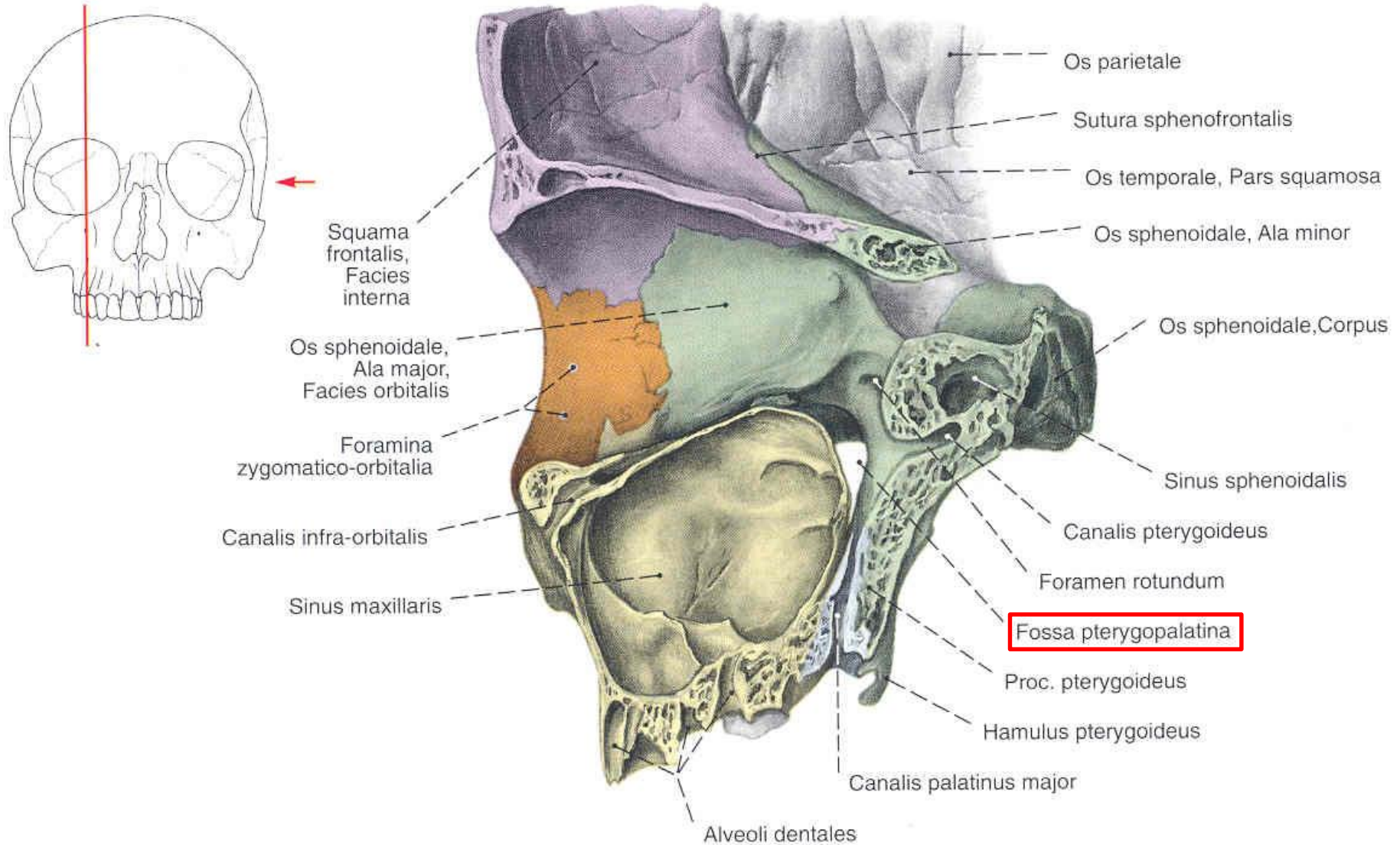
Zu den oberen Zähne in  
*canales alveolares* von Maxilla

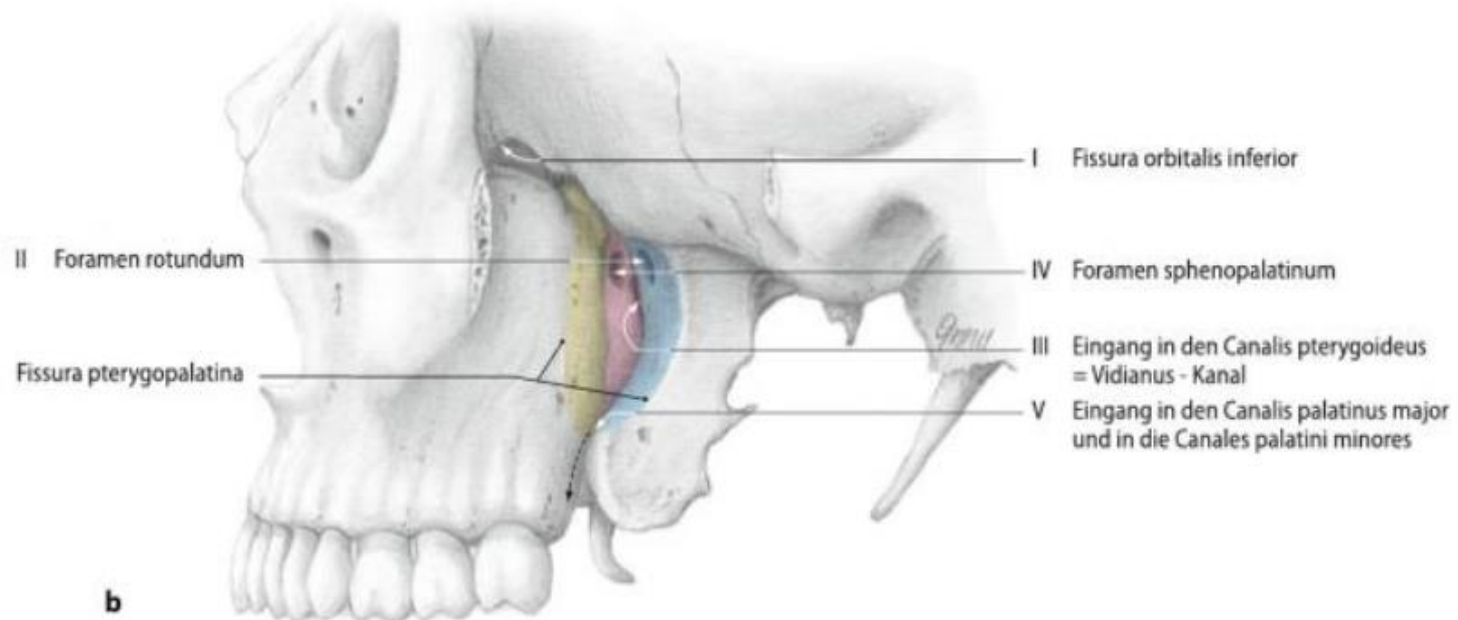
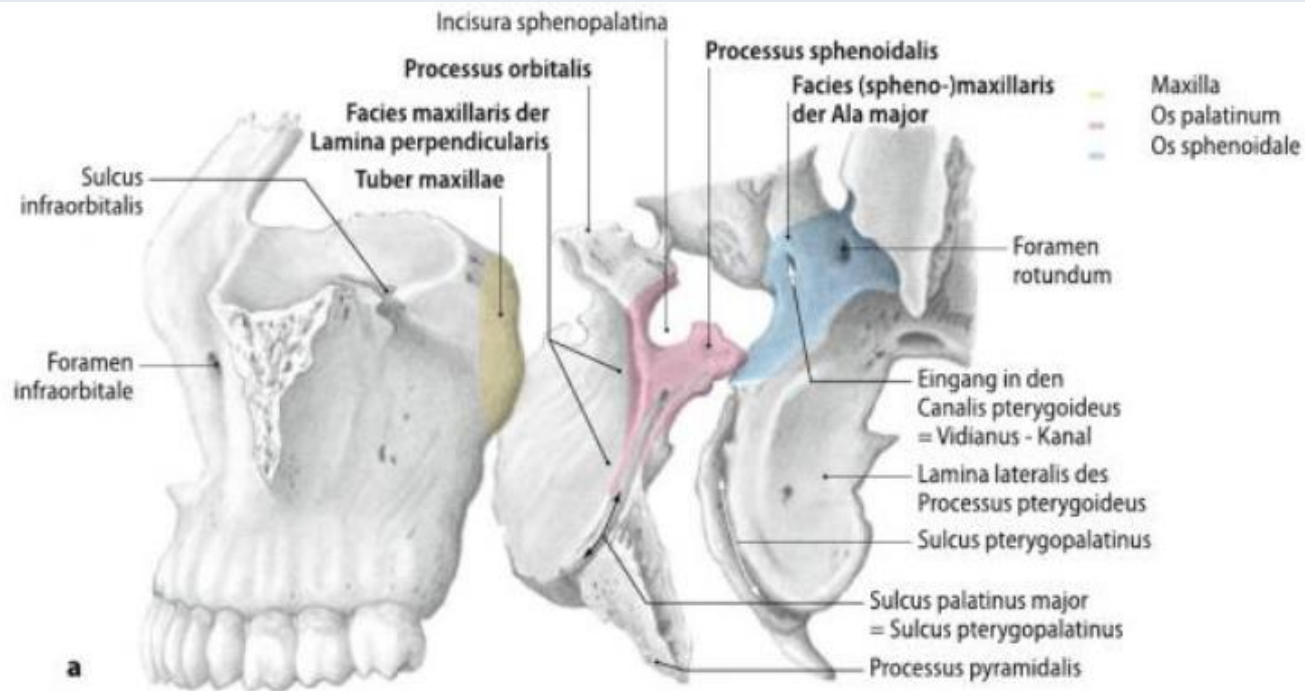
Fossa cranii media

Fossa pterygopalatina

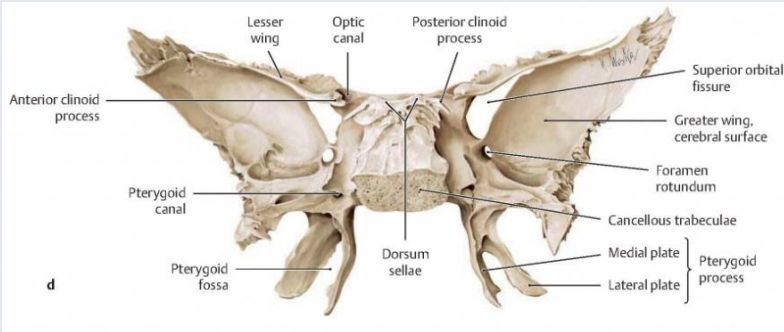
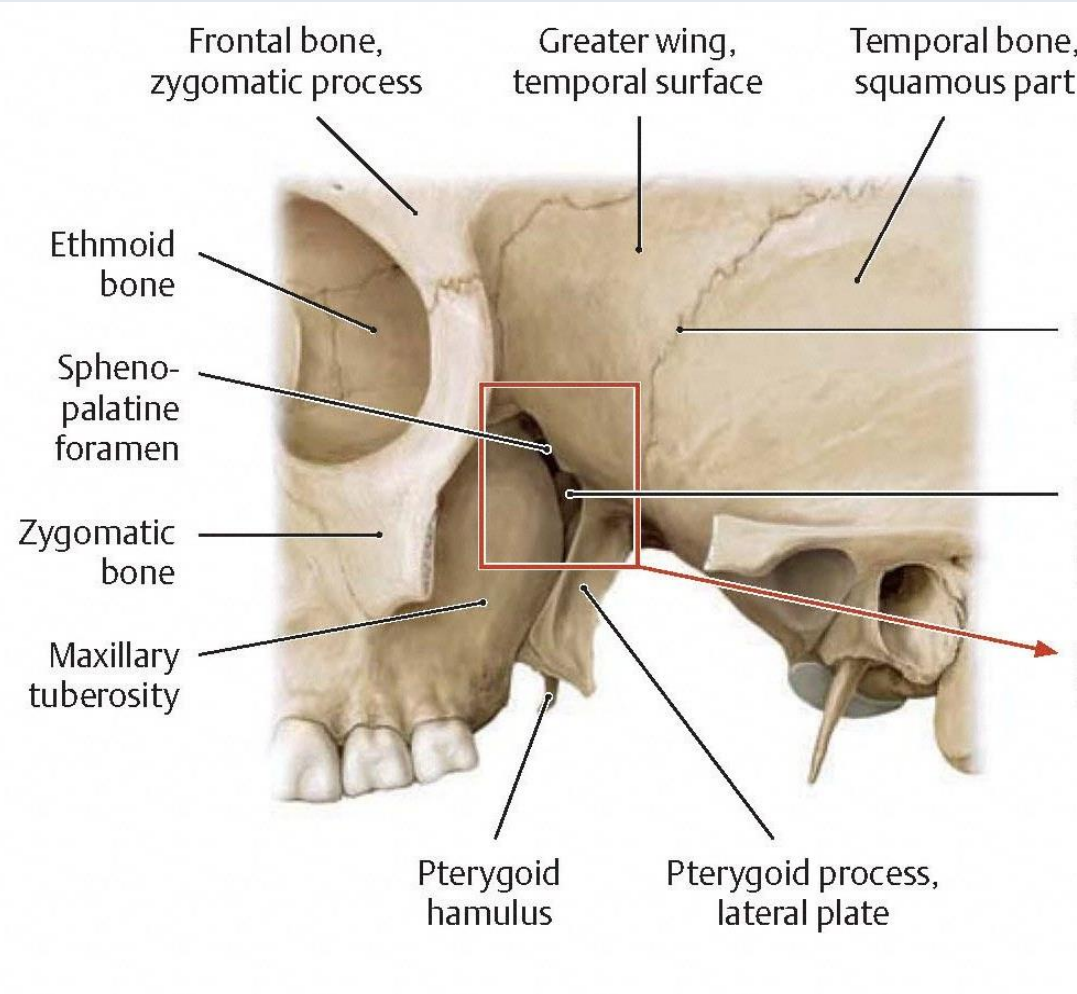


# Fossa pterygopalatina





# Grenzen der Fossa pterygopalatina



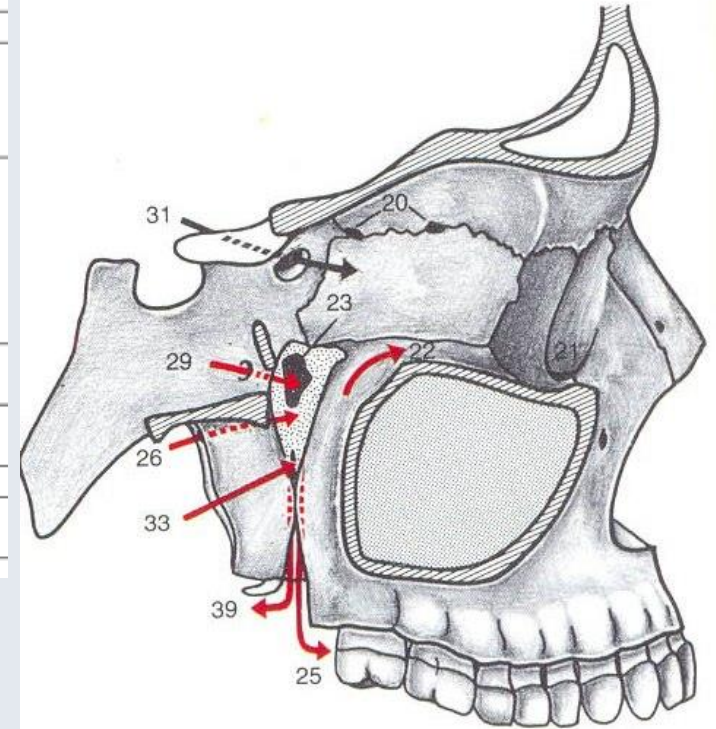
Anterior	Tuber maxillae
Posterior	Processus pterygoideus mit ala major facies maxillaris
Medial	Lamina perpendicularis ossis palatini+ Proc. orbitalis und Proc. sphenoidalis
Lateral	Fossa infratemporalis (durch der fissura pterygo-maxillaris)
Superior	Ala major ossis sphenoidalis mit Corpus Ossis sphenoidalis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



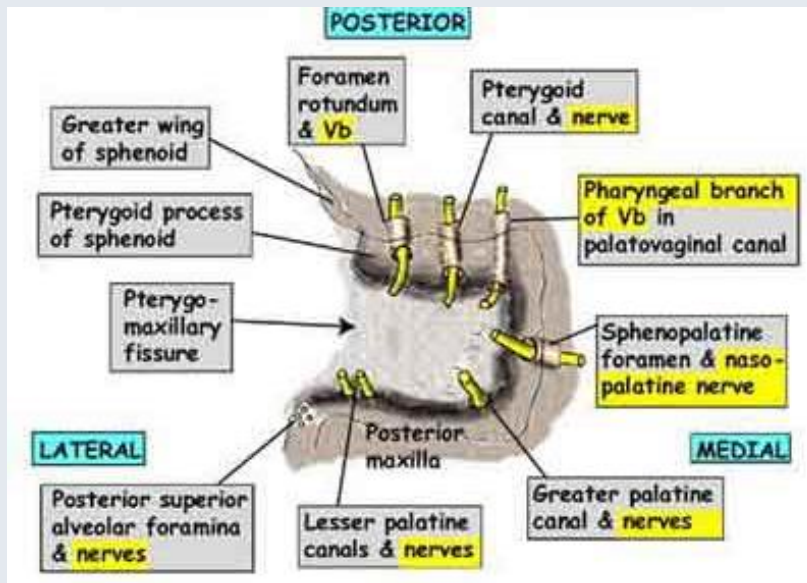
# Die Verbindungen der Fossa pterygopalatina

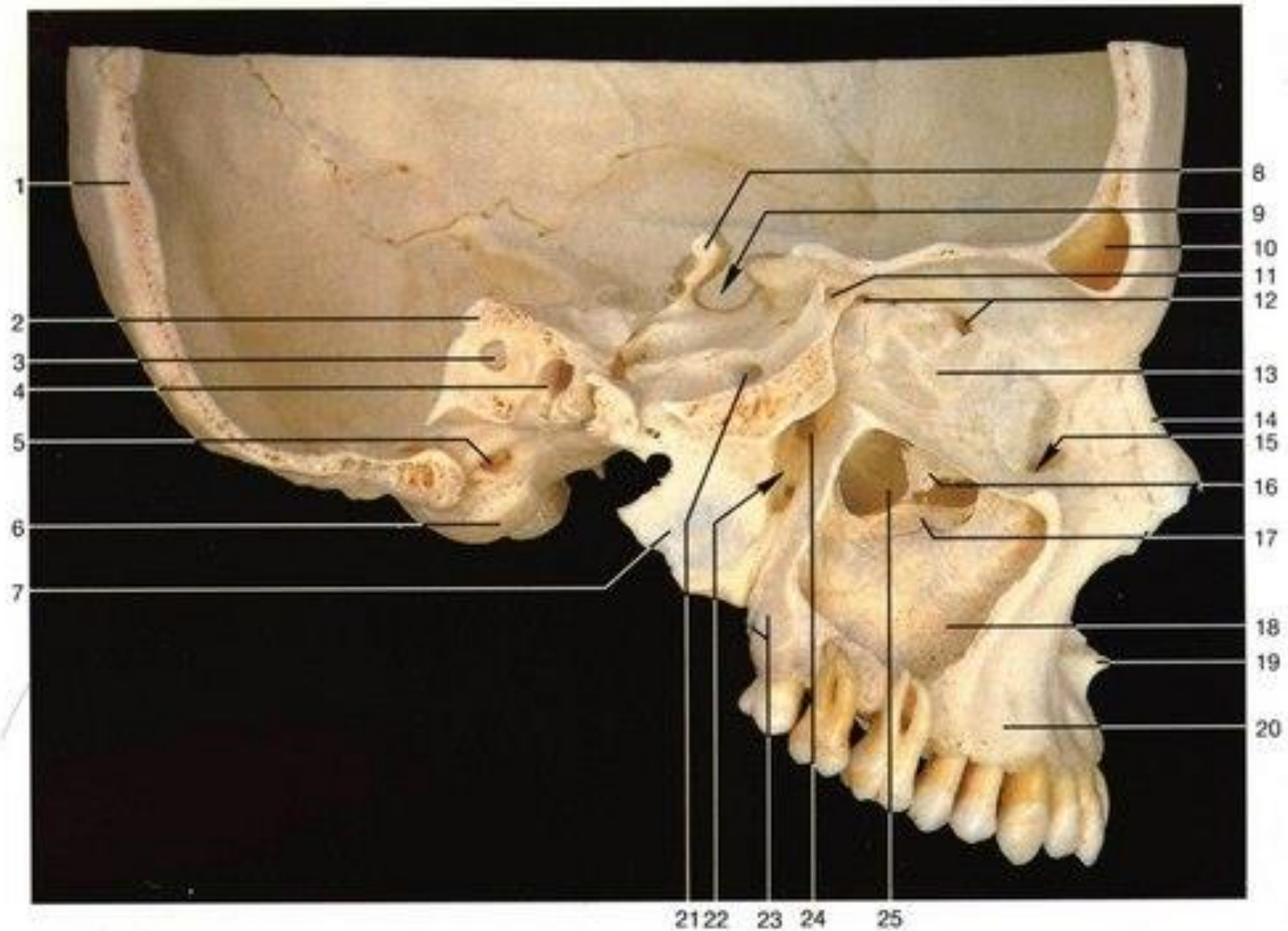
## Fossa pterygopalatina (seu Fossa sphenopalatina)

	Wohin (woher)
Canalis pterygoideus ( <i>Vidii</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)

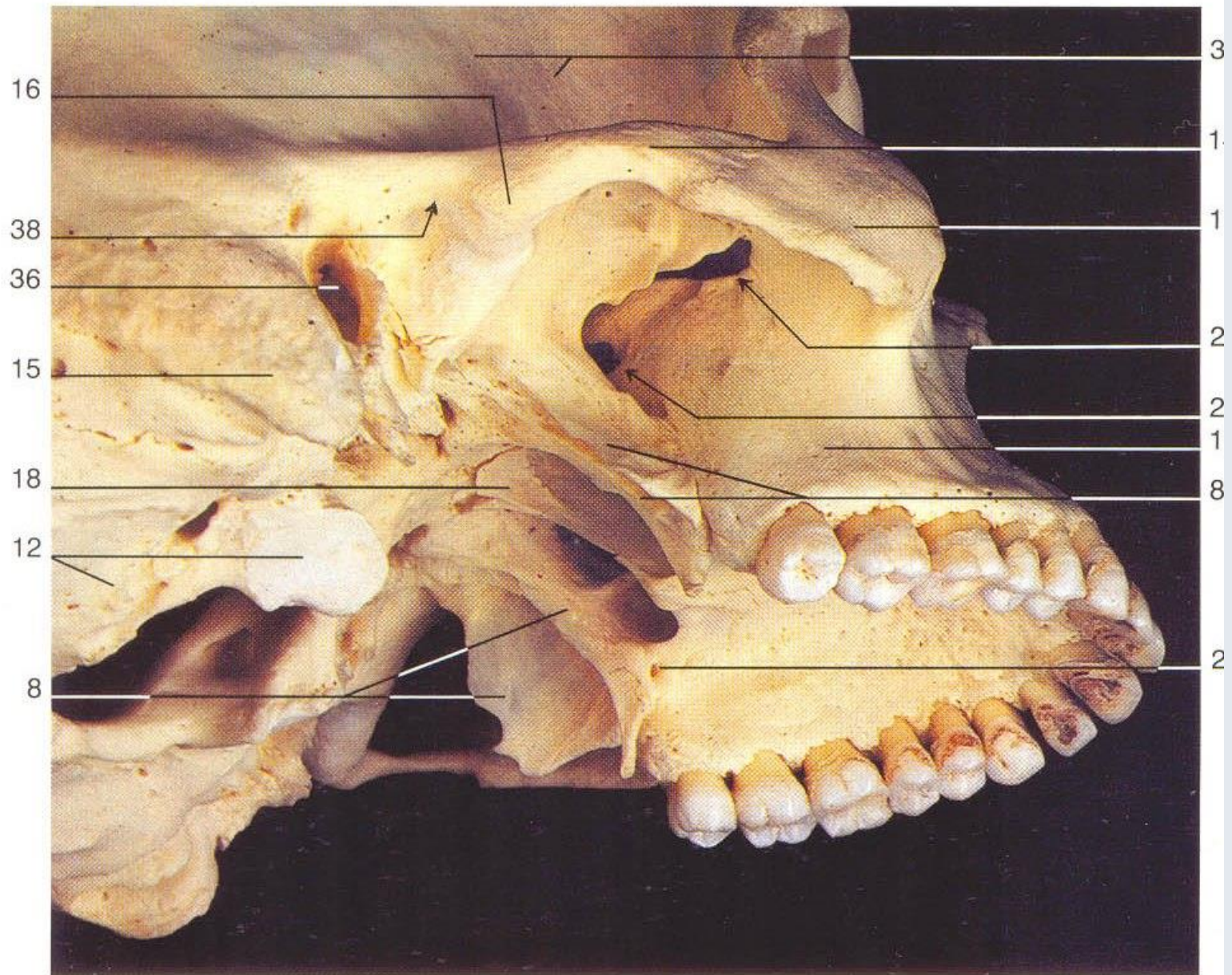


Openings and canals of the pterygopalatine fossa. Schematic drawing.

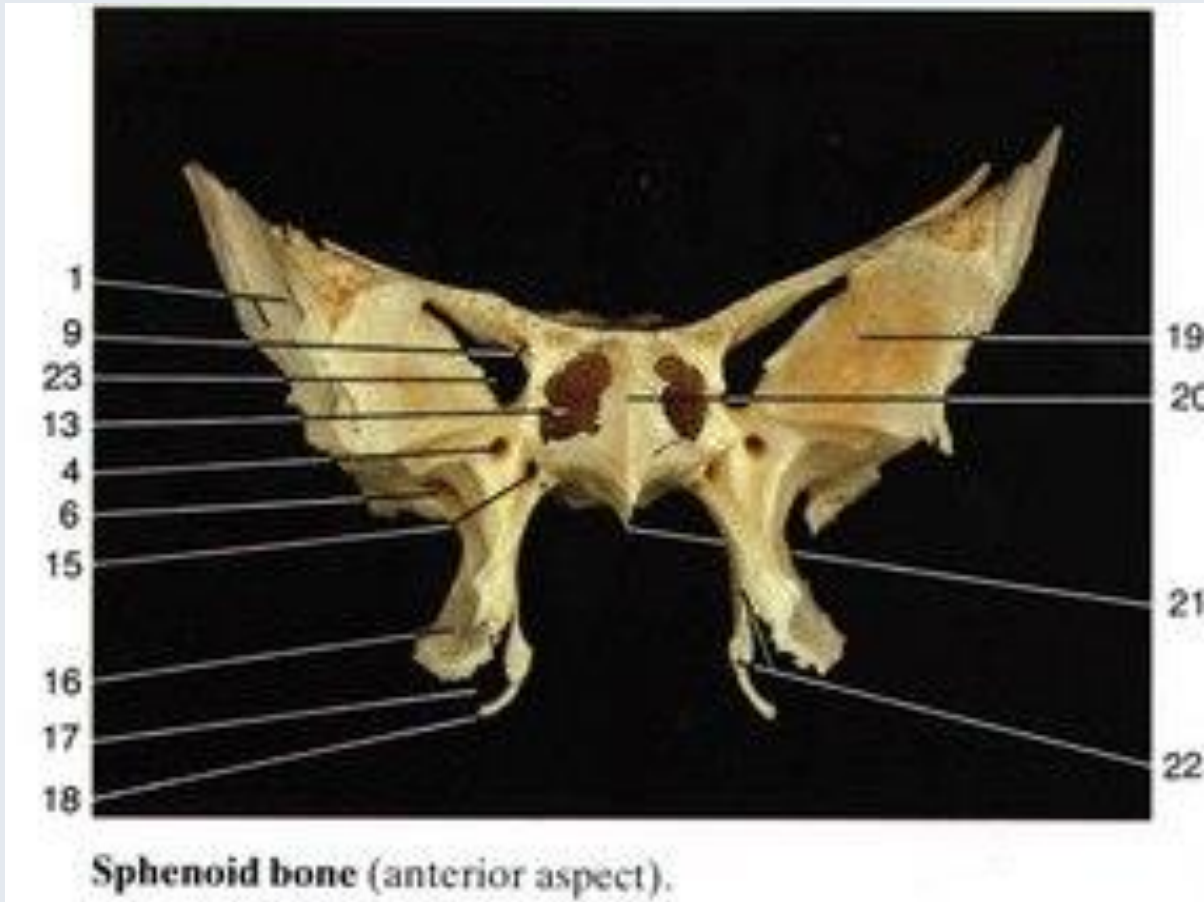
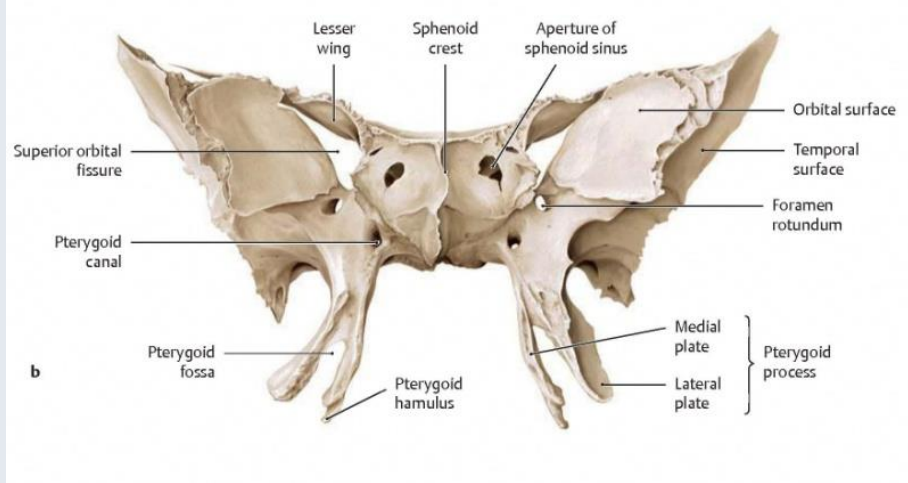


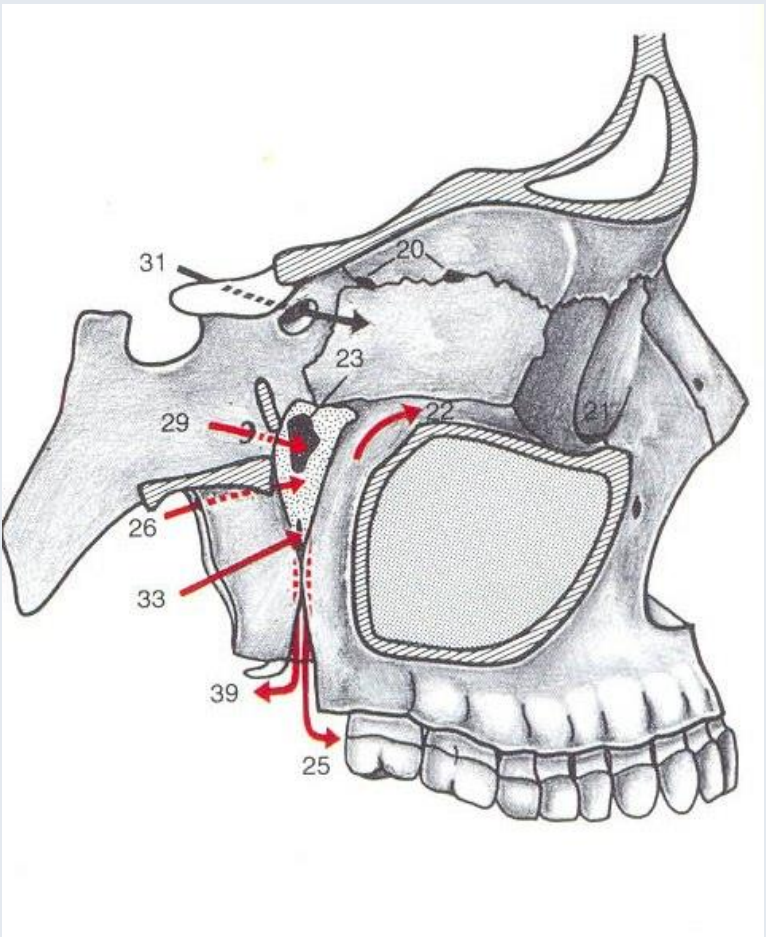


**Paramedian section through the skull, right side (lateral aspect). Frontal and maxillary sinus are opened.**

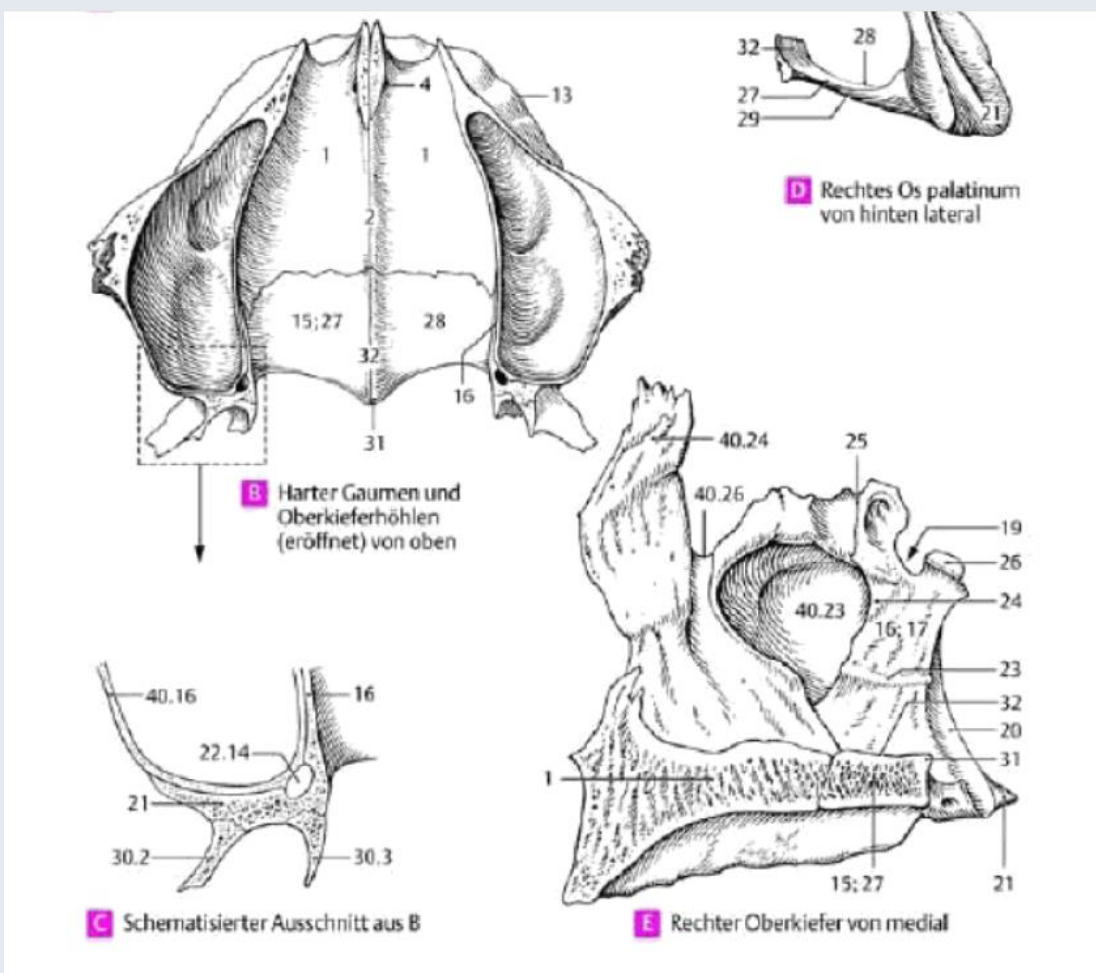


**Oblique lateral aspect of the base of the skull. Facial skeleton.**

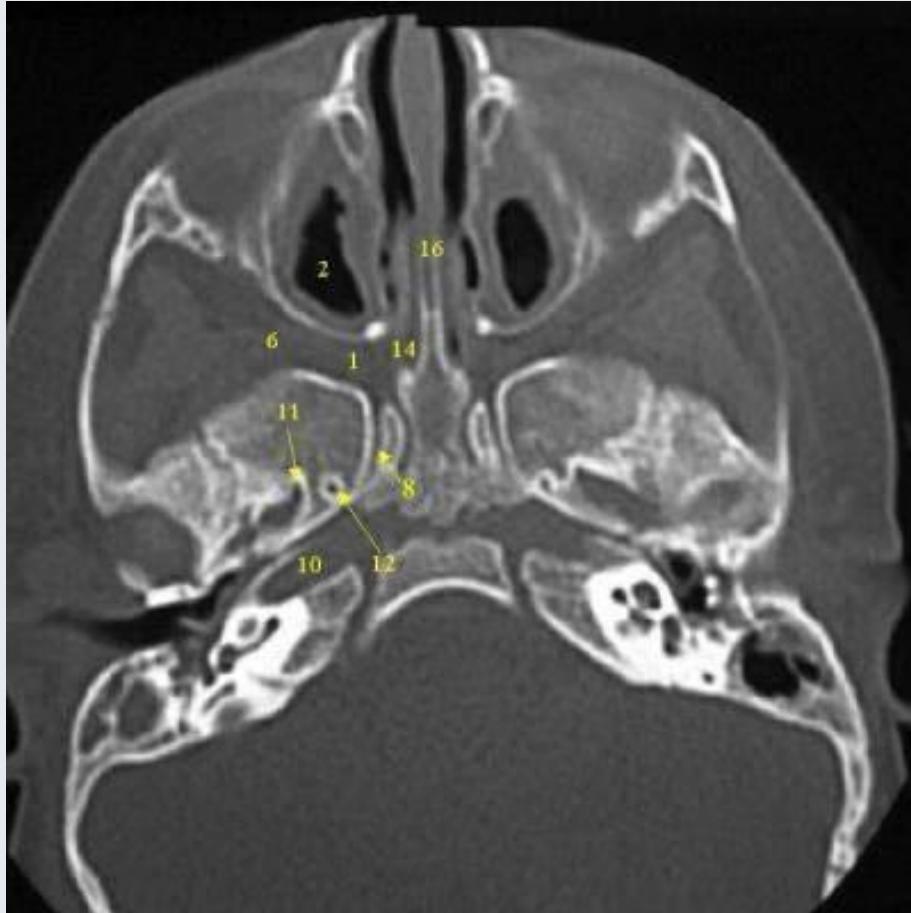




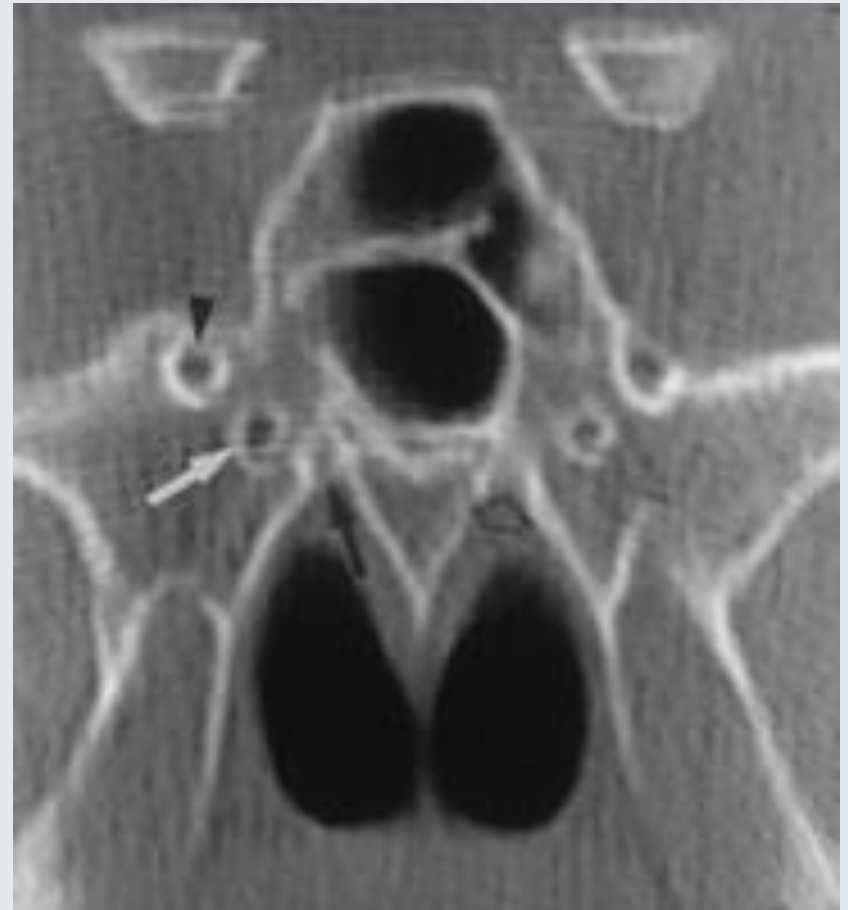
**Openings and canals of the pterygo-palatine fossa. Schematic drawing.**



# DIE FOSSA PTERYGOPALATINA 1. RTG (CT) AUFNAHMEN



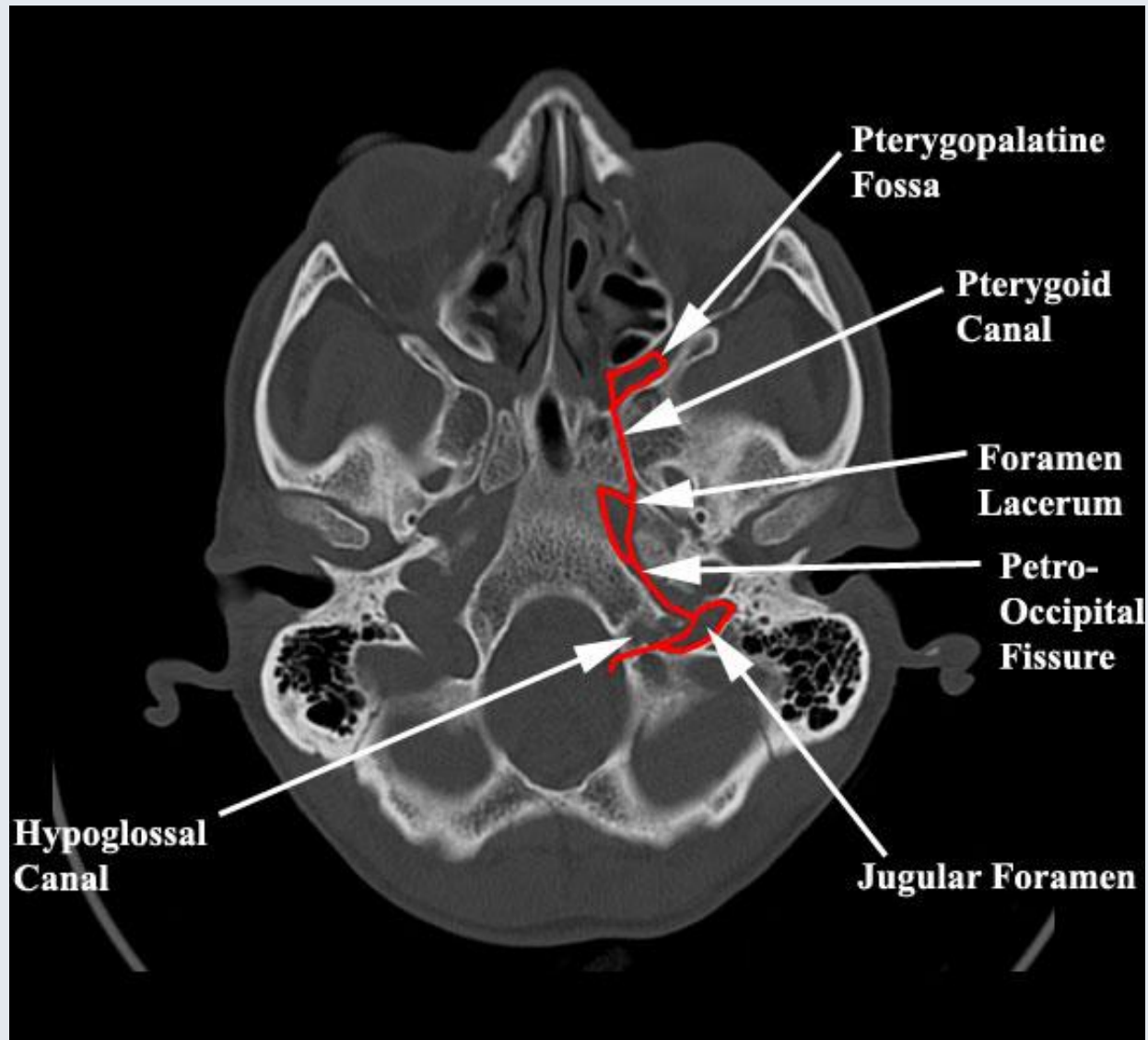
**HORIZONTALSCHNITT**



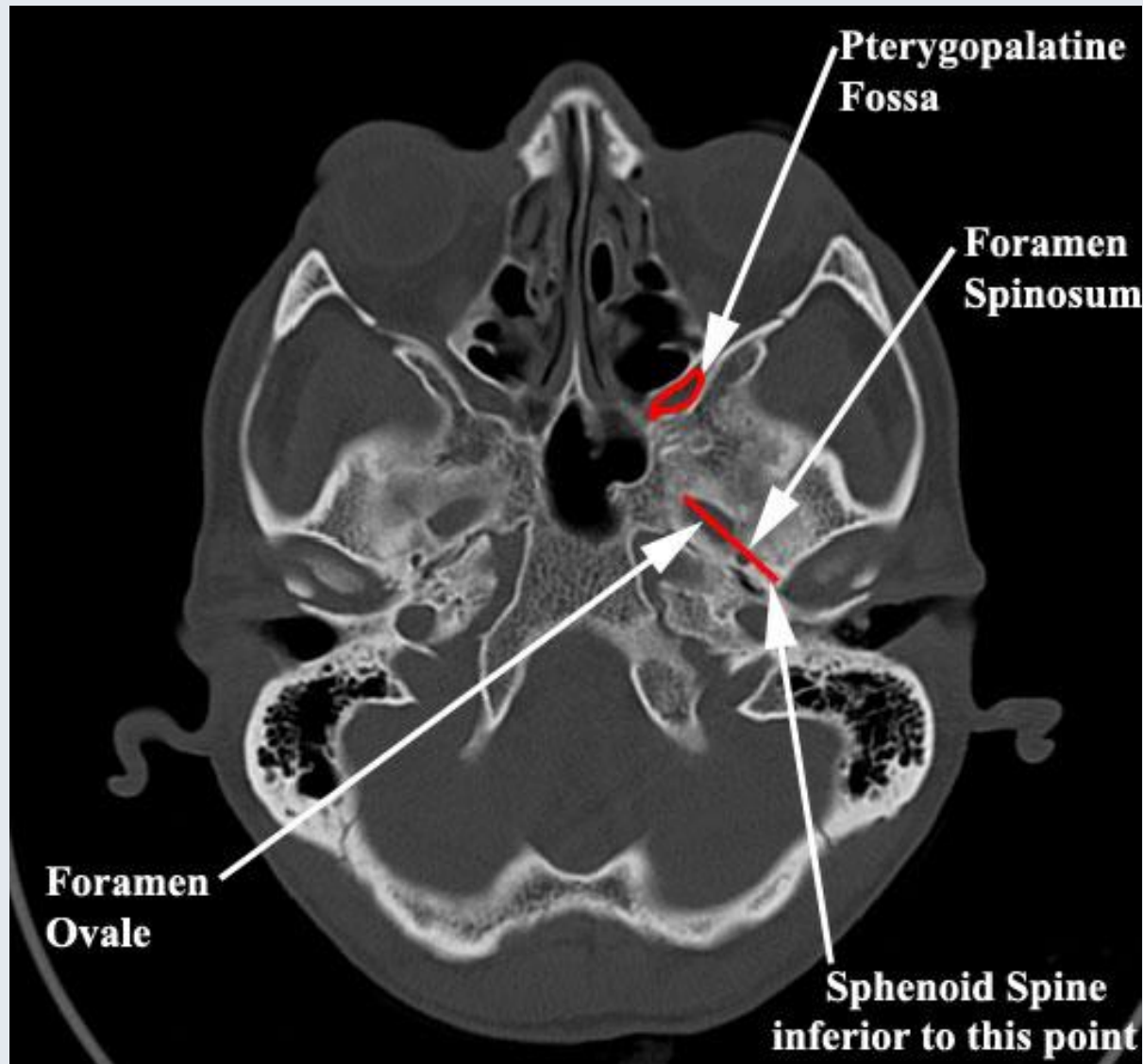
**FRONTALSCHNITT**

# DIE FOSSA PTERYGOPALATINA 2.

## RTG (CT) AUFNAHMEN

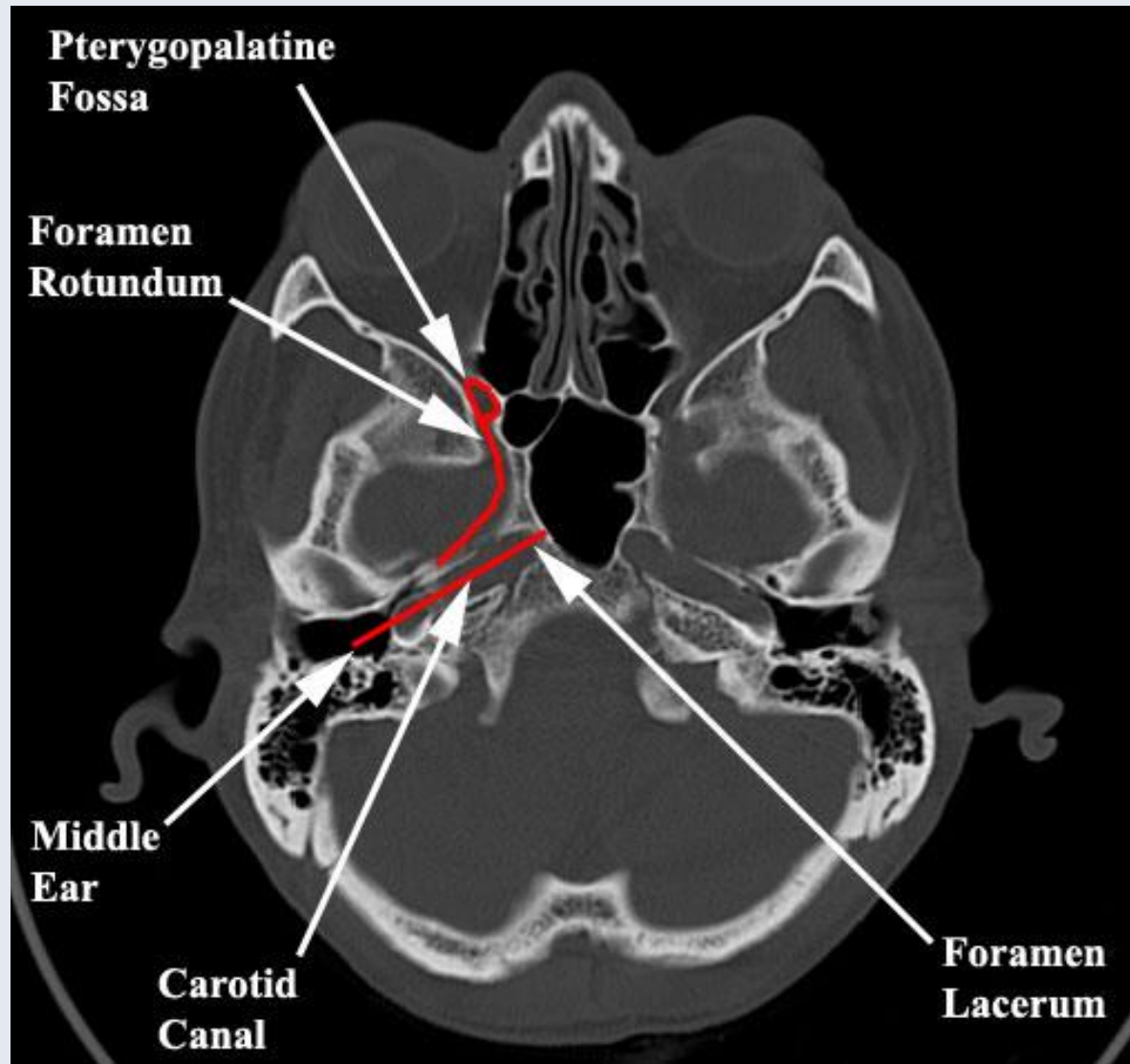


# DIE FOSSA PTERYGOPALATINA 3. RTG (CT) AUFNAHMEN

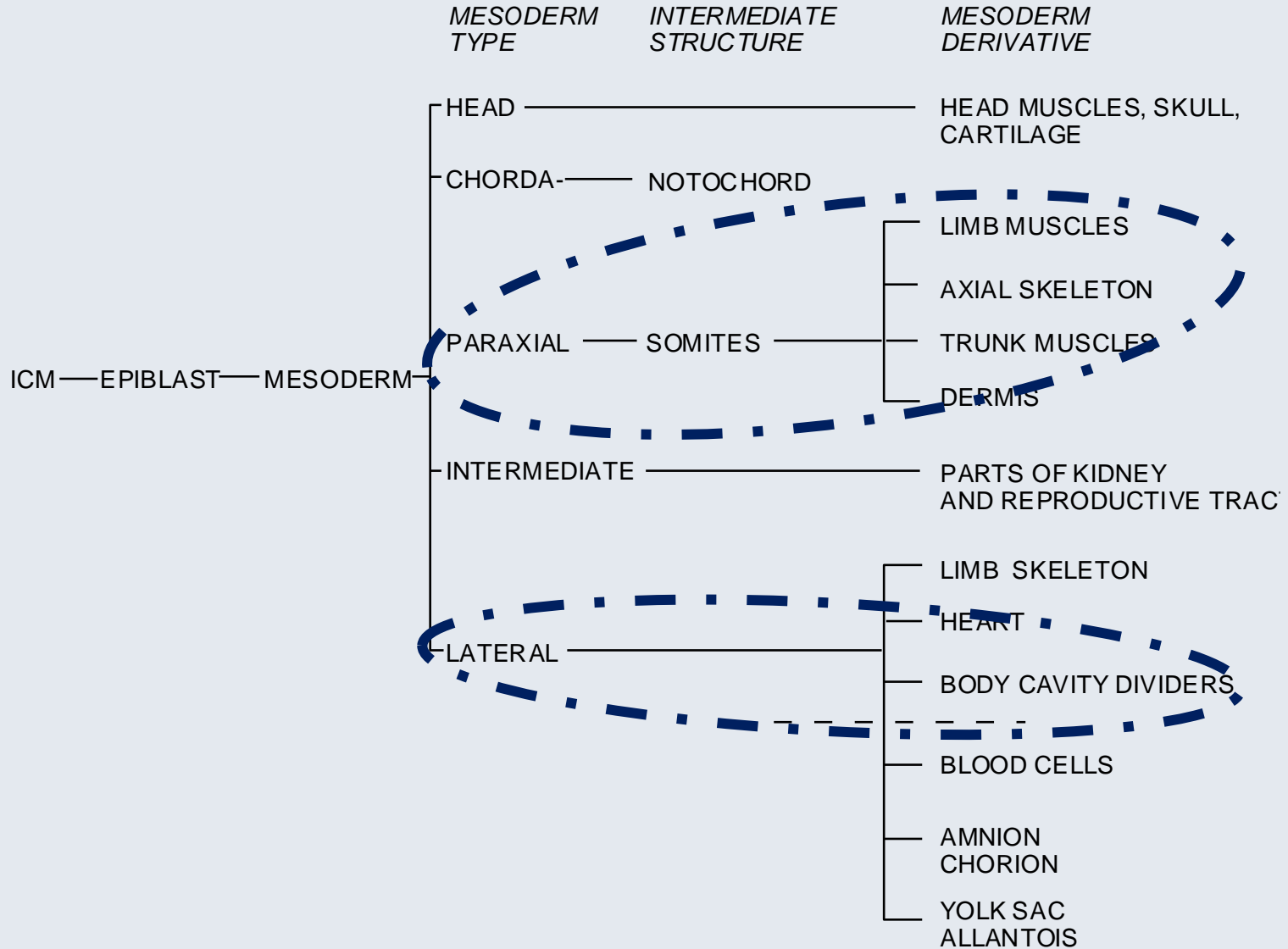




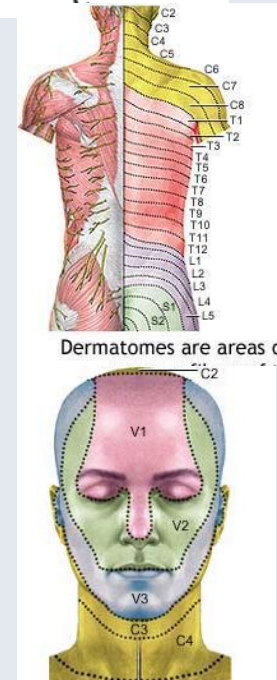
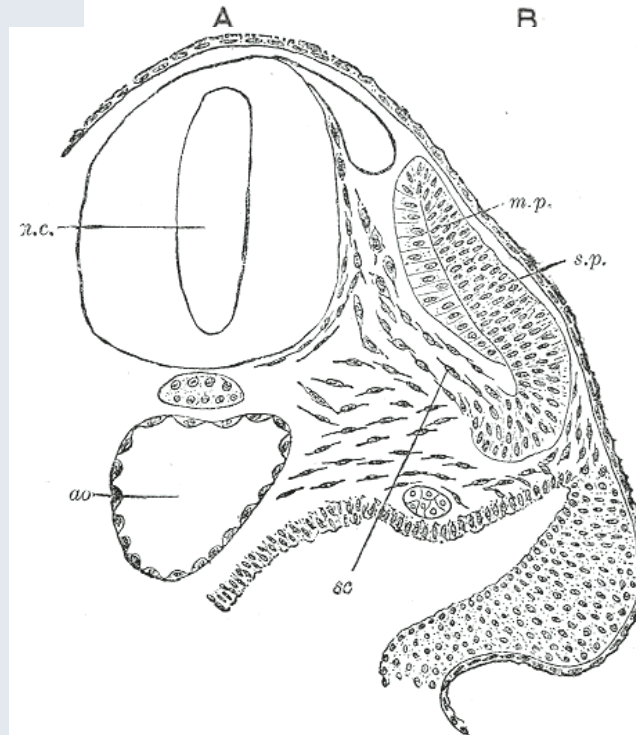
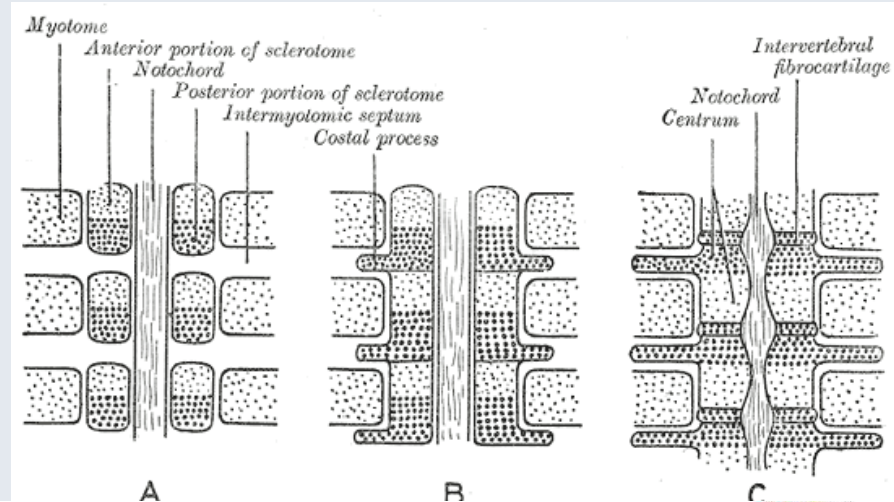
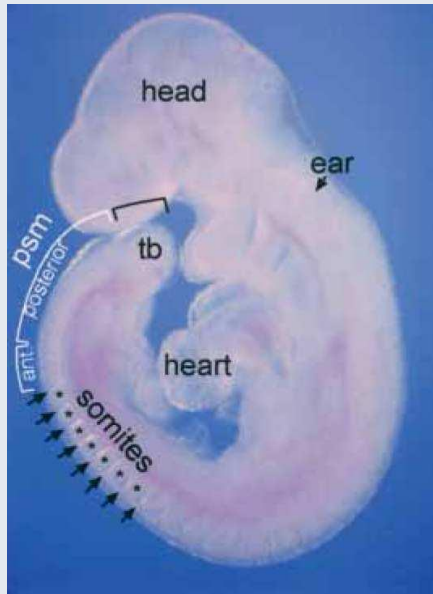
# DIE FOSSA PTERYGOPALATINA 4. RTG (CT) AUFNAHMEN



# DERIVATEN DES MESODERMS



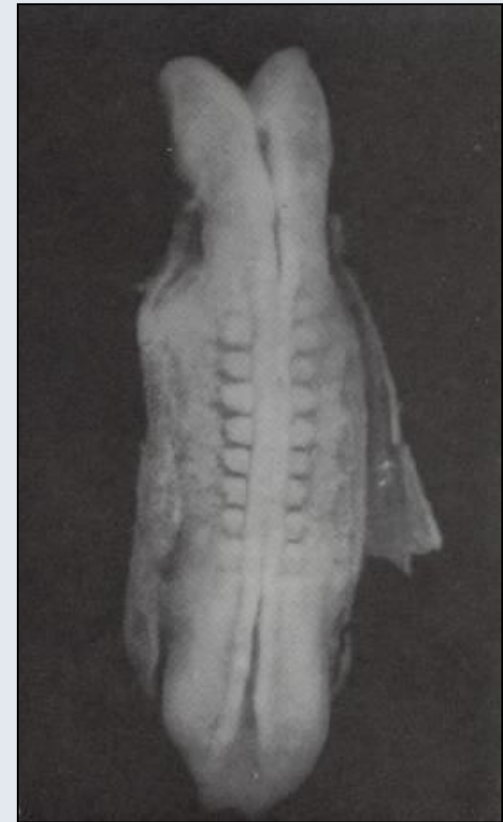
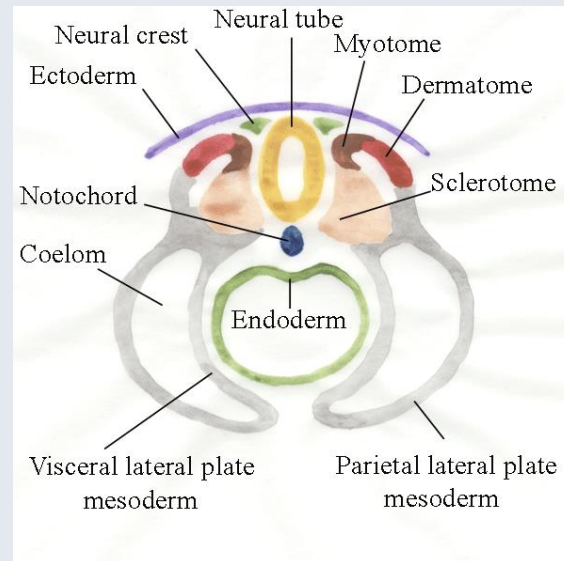
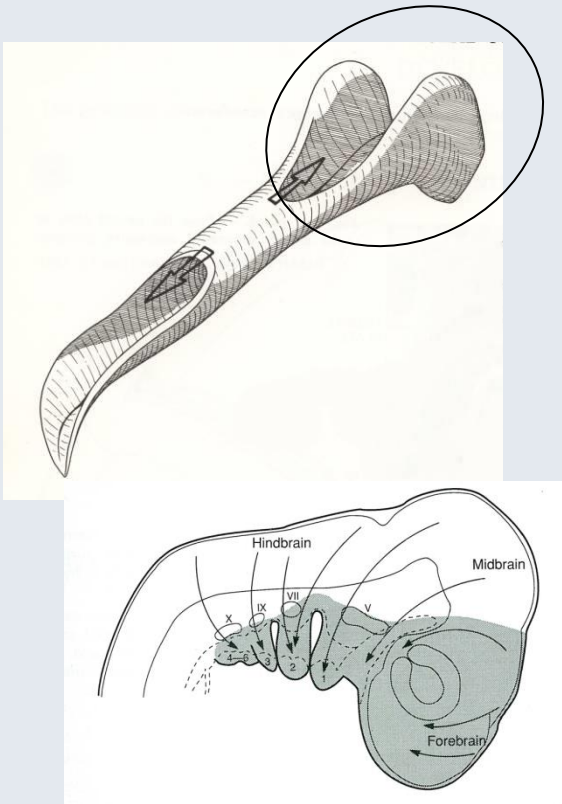
# SOMITOGENESE UND DIFFERENZIERUNG



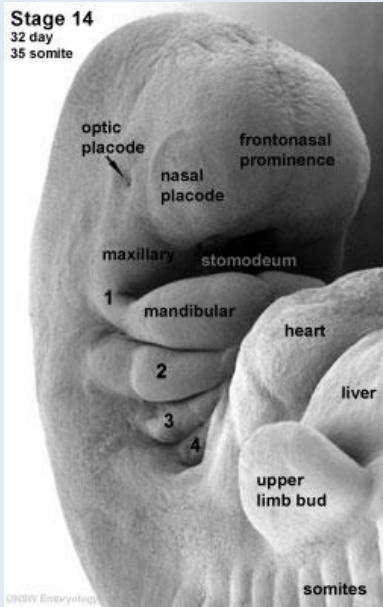
Woche 4.  
 die Somiten lockern auf –  
 wandern um die *chorda* –  
**sclerotom**.  
 Der Rest bleibt als **myotom** -  
 Muskelsegment mit Nerv) , und  
**dermatom** - bildet Dermis és  
 Subcutis

# WOHER STAMMT DAS CRANIUM?

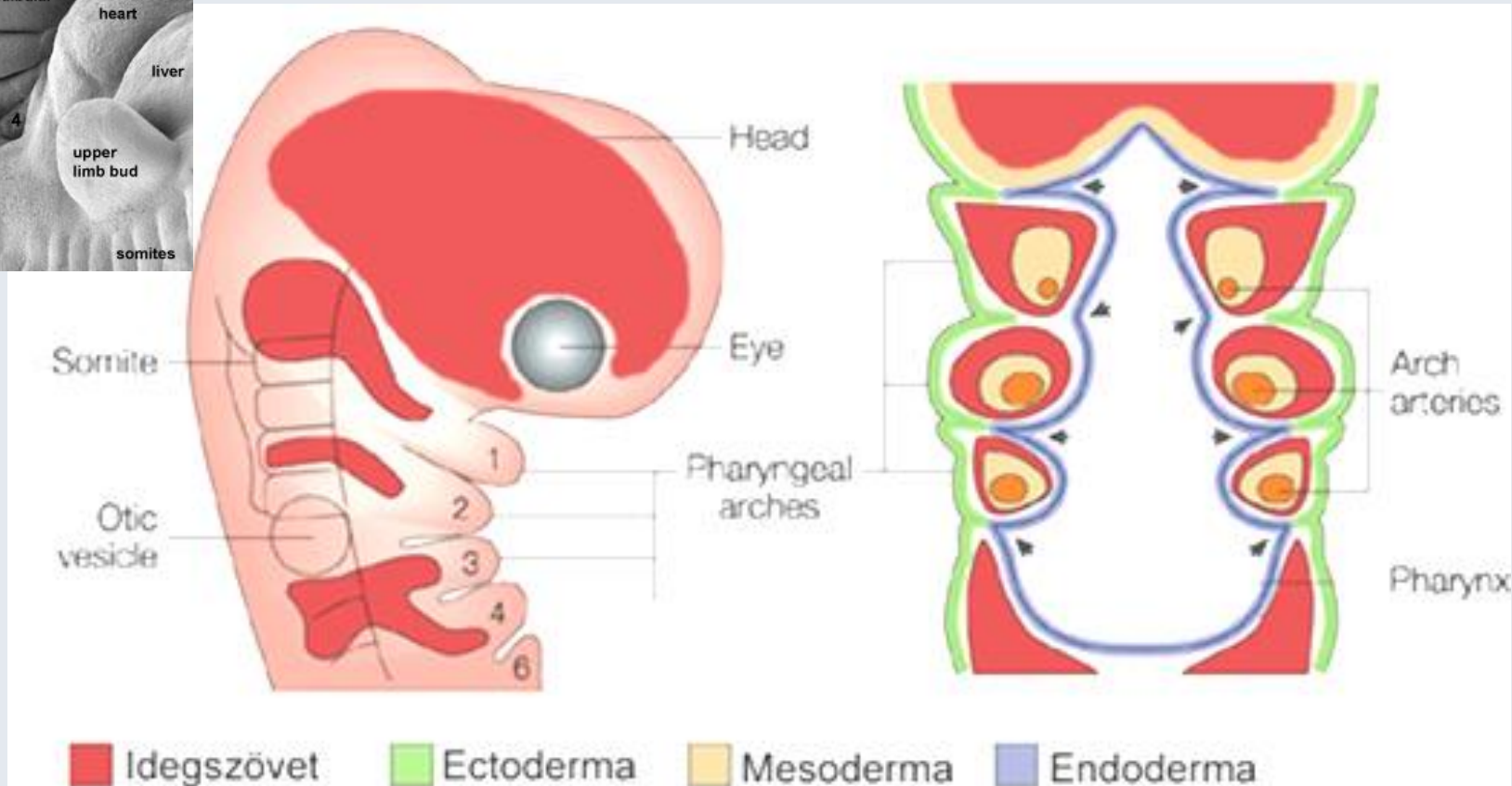
- aus dem Mesenchym um die proximale Ende des Neuralrohrs (bindegewebsche Kapsel des Prosencephalon)
- aus der Neuralleiste (EKTOMESENCHYM)
- aus den ersten 3 Somiten (sclerotom)
- aus dem Mesenchym der ersten und zweiten Kiemenbögen



# WOHER STAMMT DAS CRANIUM?



## Kiemenbögen und Schlundtaschen



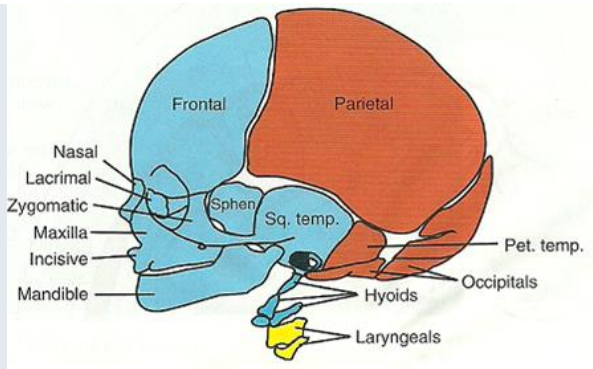
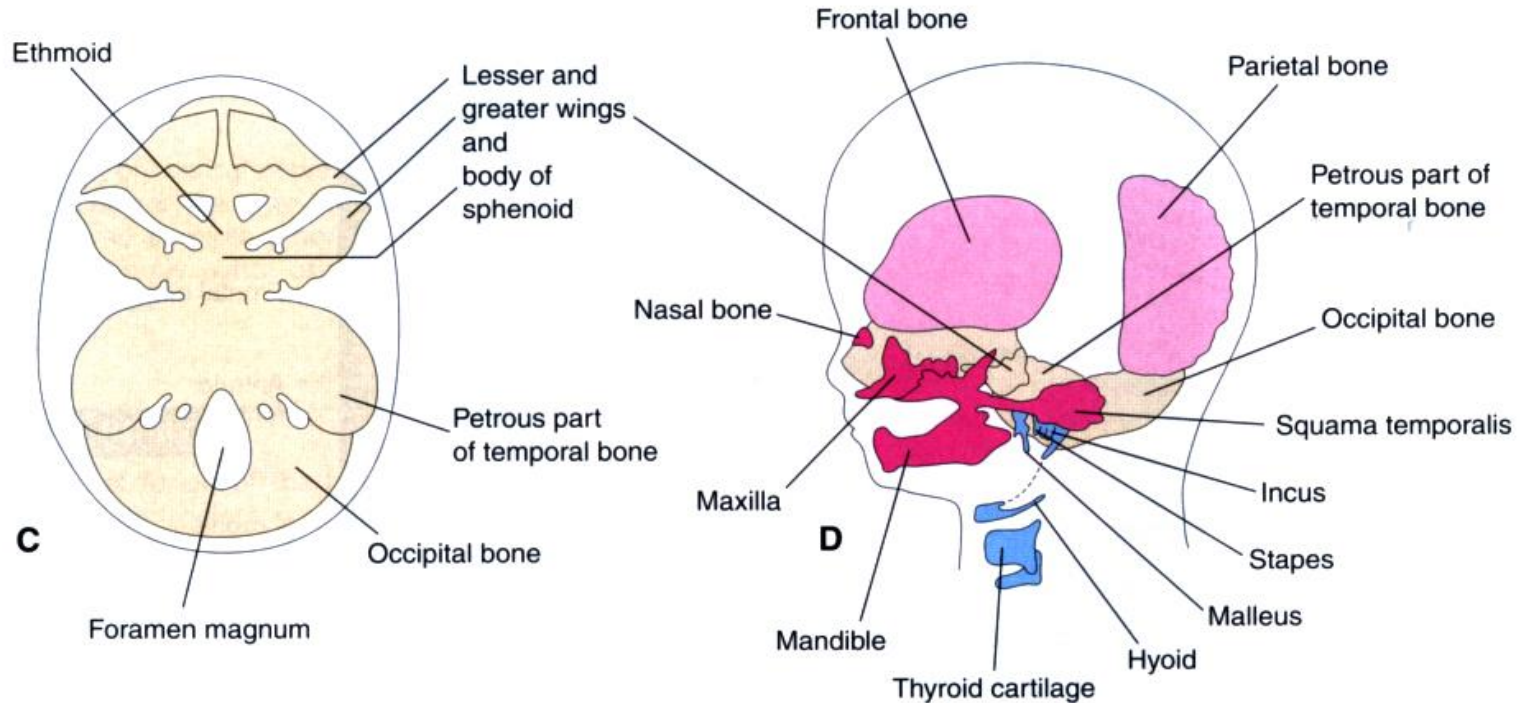
# NEUROCRANIUM UND VISCEROCRANIUM

Cartilaginous neurocranium

Membranous neurocranium

Cartilaginous viscerocranium

Membranous viscerocranium



Blau – Neuralleiste

Braun – Paraxialmesoderm (somiten)

Gelb - Seitenmesoderm

# NEUROCRANIUM - chondrocranium

parachordale Knorpel

Knorpelanlage des  
okzipitalen sclerotoms



os occipitale um das foramen magnum

Hypophysenknorpel  
(um die Hypophyse)

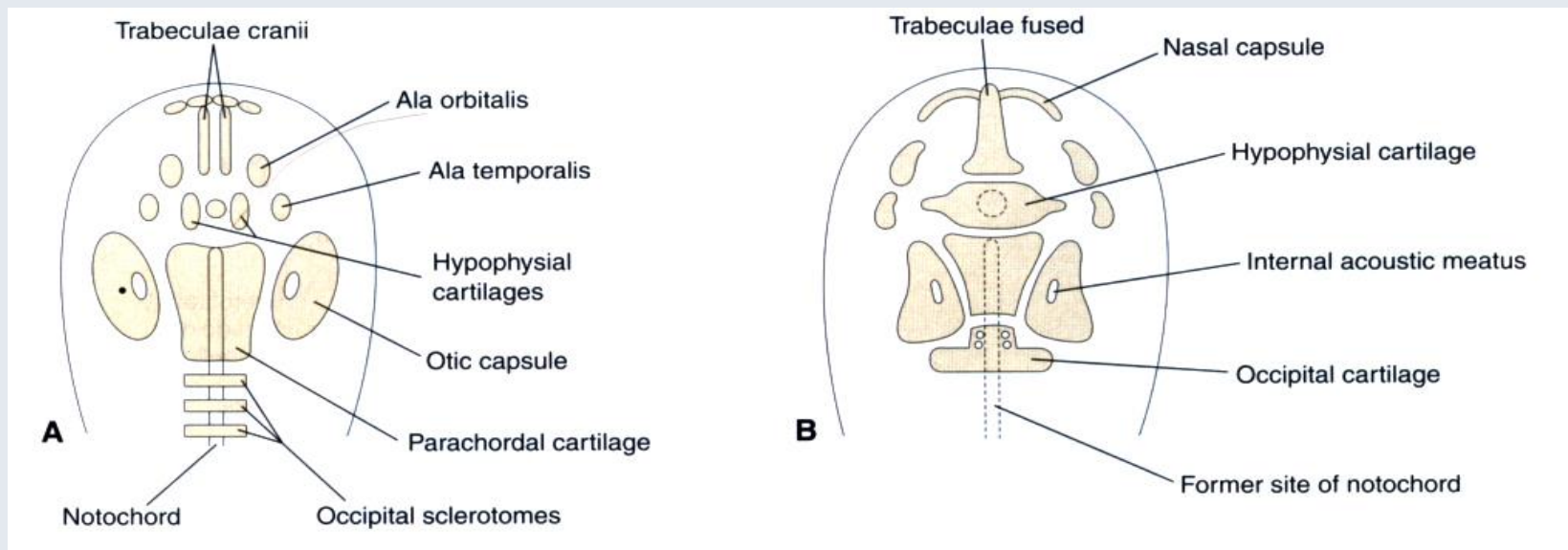
corpus ossis sphenoidalis  
ala major, ala minor,  
lam. lat. proc. pterygoidei

Oticus Knorpelanlage  
(um die Oticusplakode)

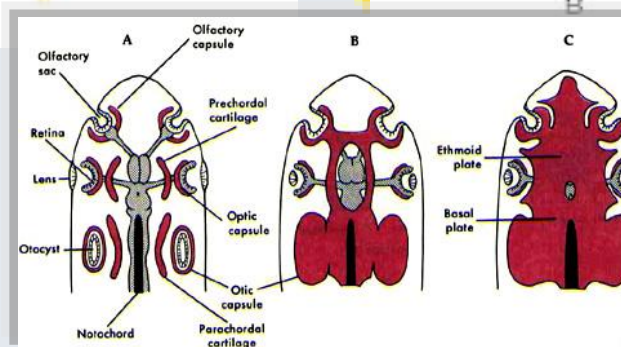
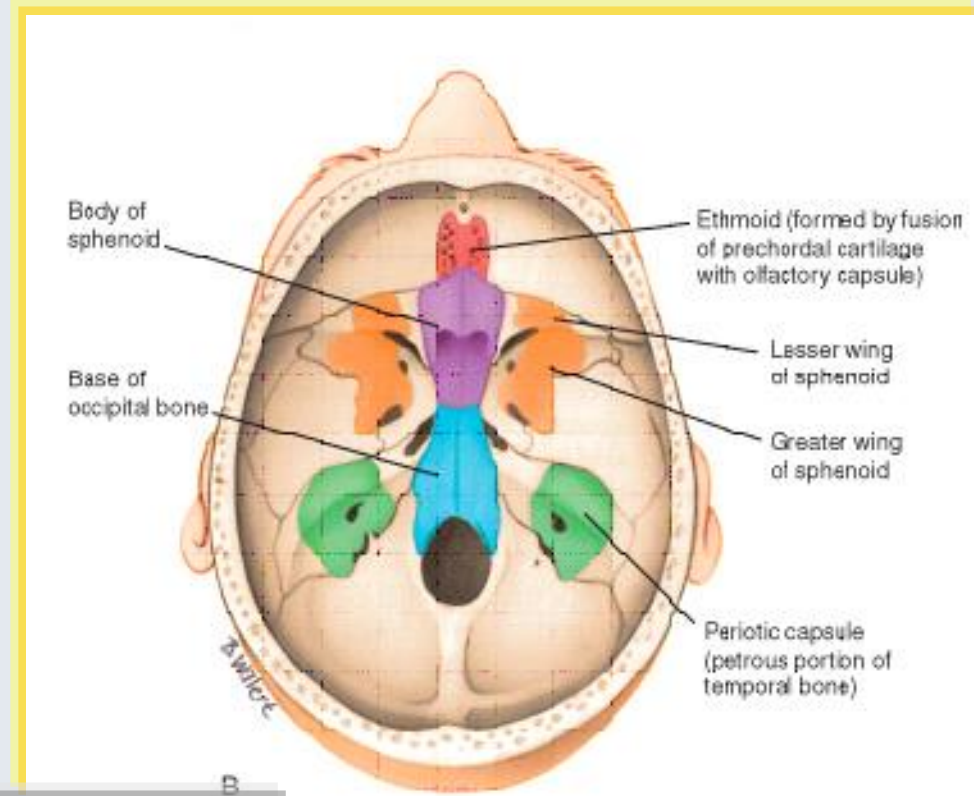
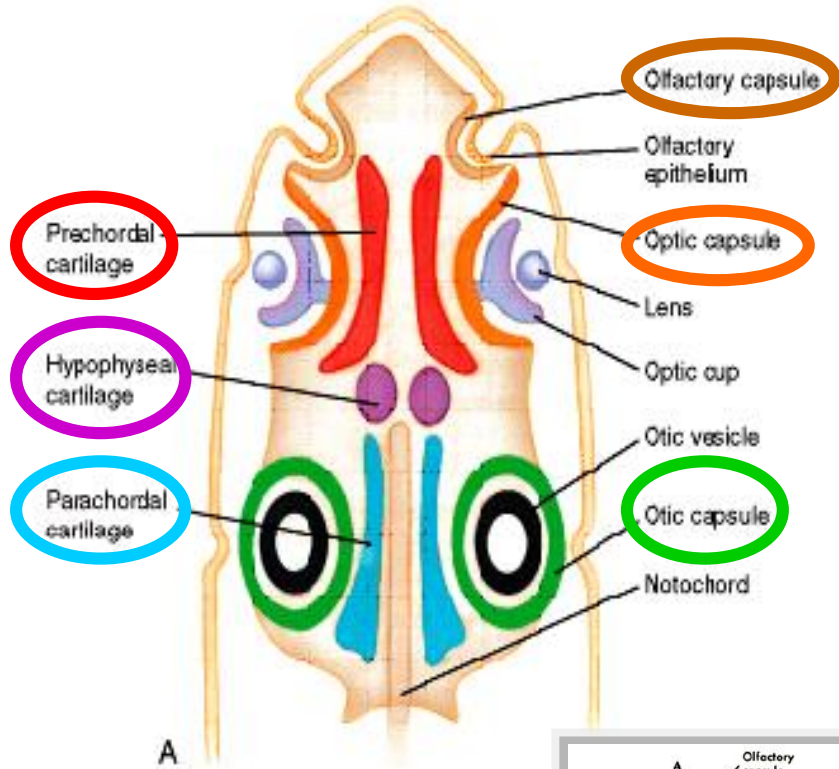
os temporale: pars petrosa, pars mastoidea

Nasenkapsel

os ethmoidale, concha nasalis inferior, Nasenknorpel



# NEUROCRANIUM - chondrocranium



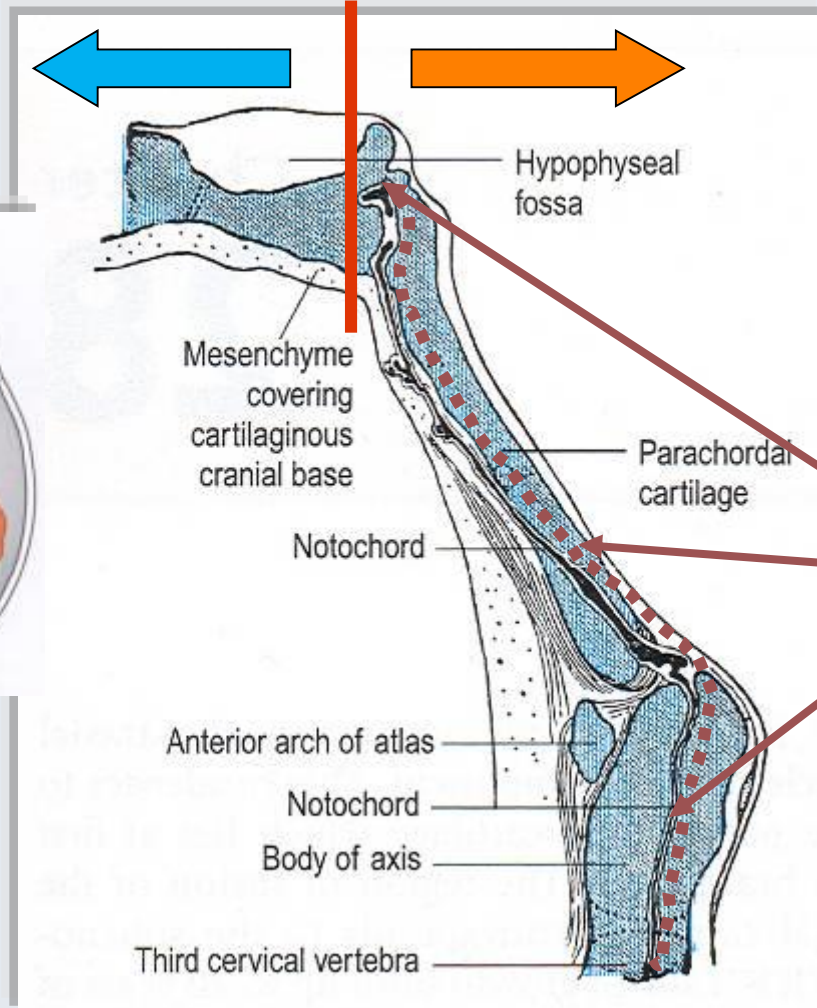
Woche 6



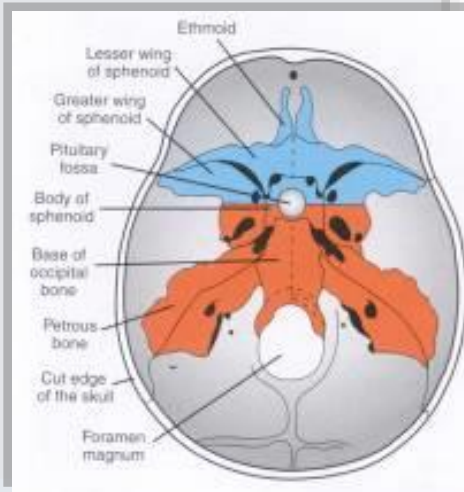
# CHONDROCRANIUM

in front of rostral end of notochord  
neural crest  
praechordal chondrocranium

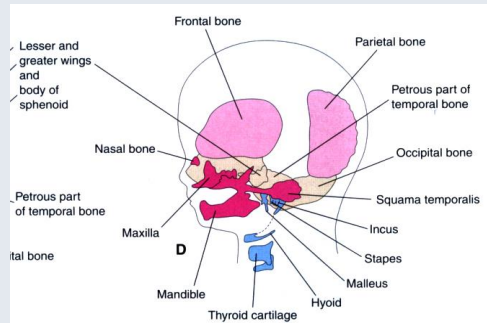
at the level of notochord  
paraxial mesoderm  
chordal chondrocranium



notochord

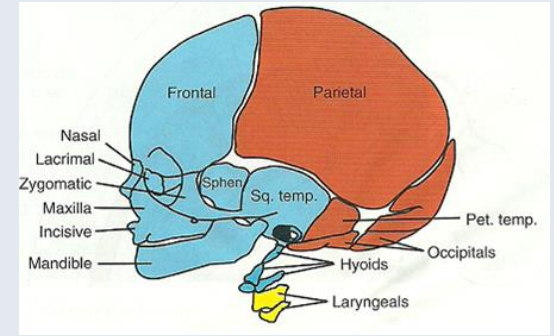


# NEUROCRANIUM - desmocranium

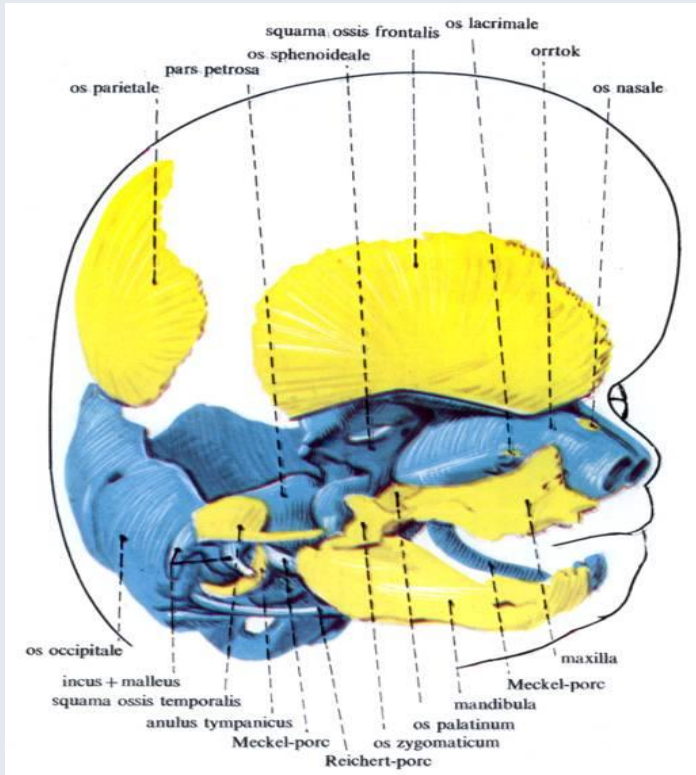


## Flache Knochen:

os frontale,  
parietale,  
pars tympanica und  
squama temporalis,  
squama occipitalis,

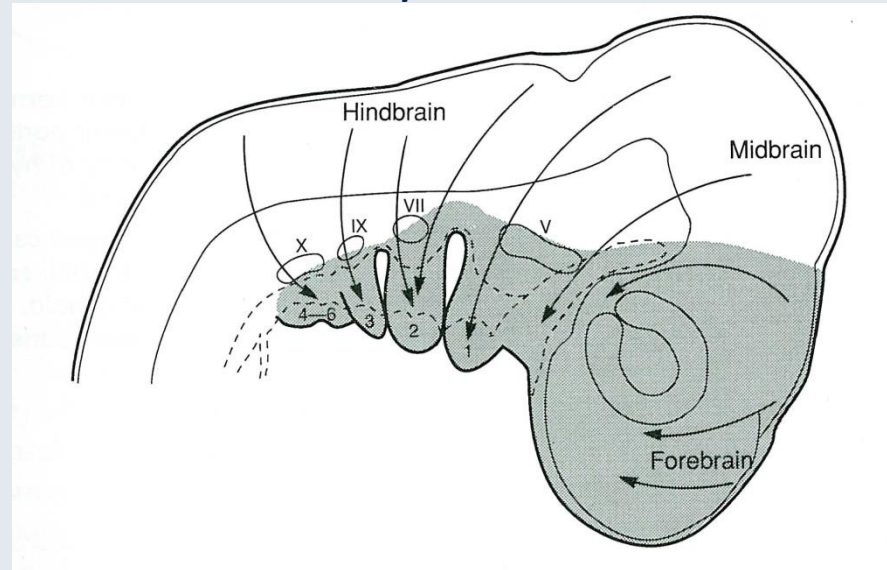


**werden durch desmale  
Verknöcherung gebildet.**



Die Zellen stammen aus :

***Neuralleiste und paraxiales Mesoderm.***

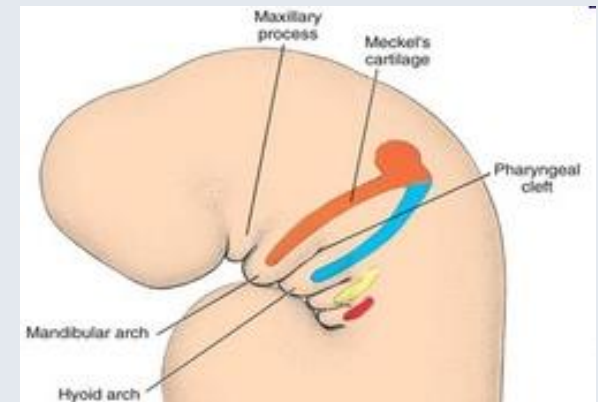
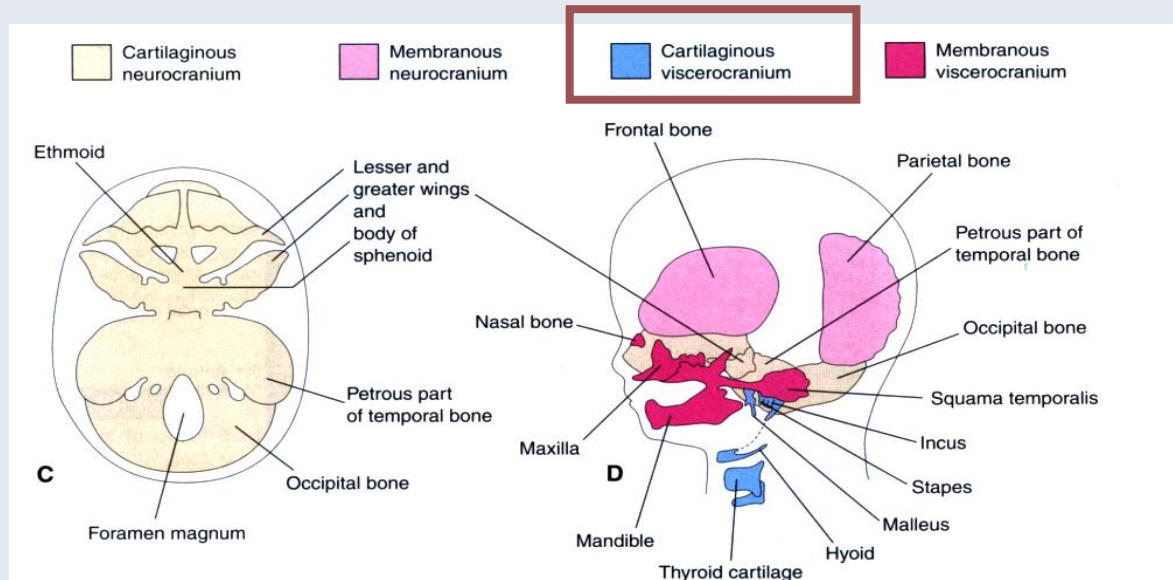


# VISCEROCRANIUM - chondrocranium

1. Kiemenbogen – (Meckelsche Knorpel) wird Hammer und Amboss

2. Kiemenbogen - (Reichertsche Knorpel) wird Steigbügel

proc. styloideus ossis temporalis  
obere Hälfte des Zungenbeinkörpers  
Cornu minus



# VISCEROCRANIUM - desmocranium

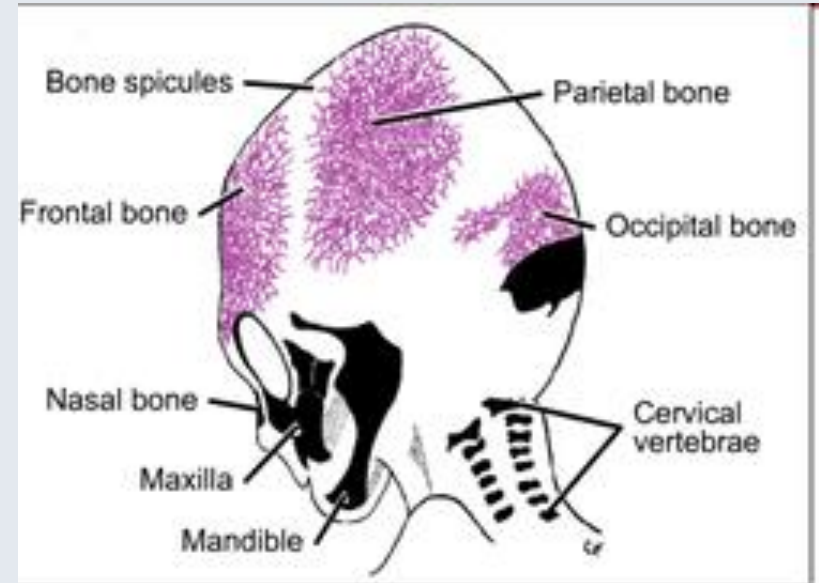
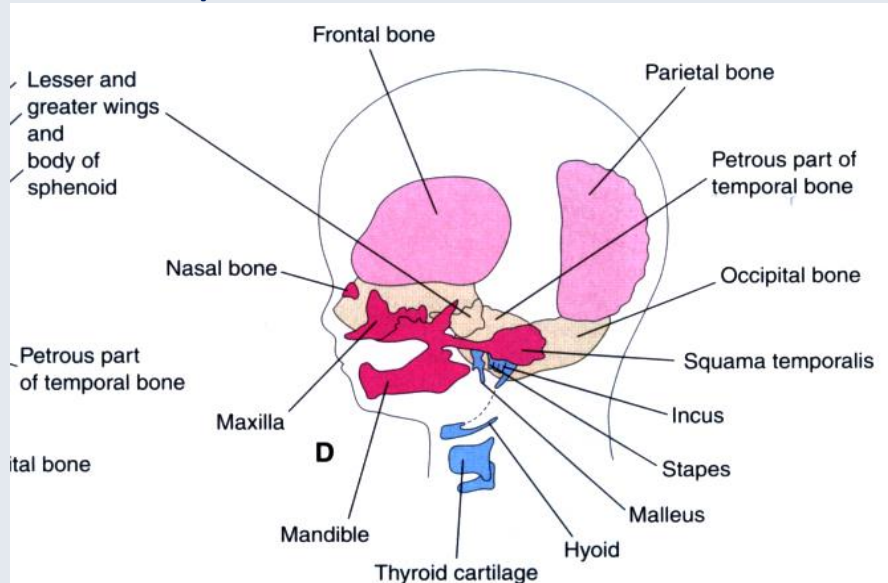
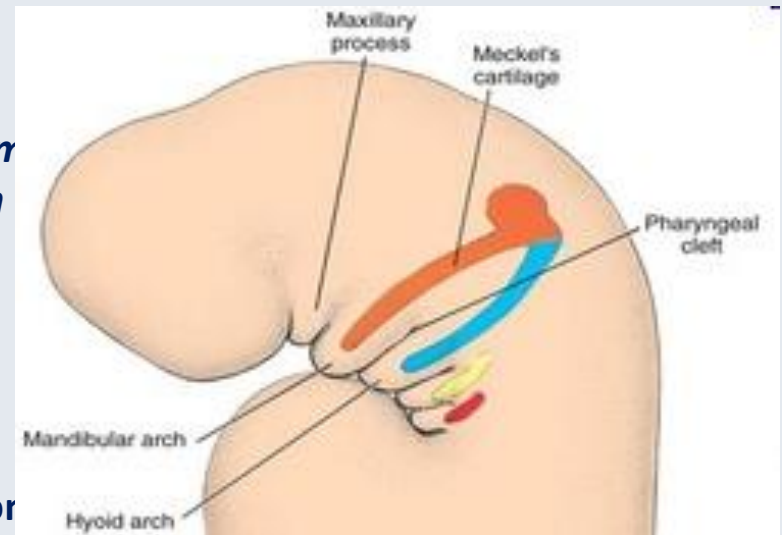
## Der 1. Kiemenbogen

### Dorsale subdivision

*processus maxillaris – DERIVATE :maxilla, os zygomaticum vomer und os palatinum, squama temporalis (später zum neurocranium gehört)*

### Ventrale subdivision

*processus mandibularis (mit dem Meckelschen Knorpel)*  
**DERIVAT: Mandibula**  
**(ABER der condylus wird durch endochondrale ossifikation verknöchert)**





Bone Clones Part No. BC-228-SET (set of 12 fetal skulls)