

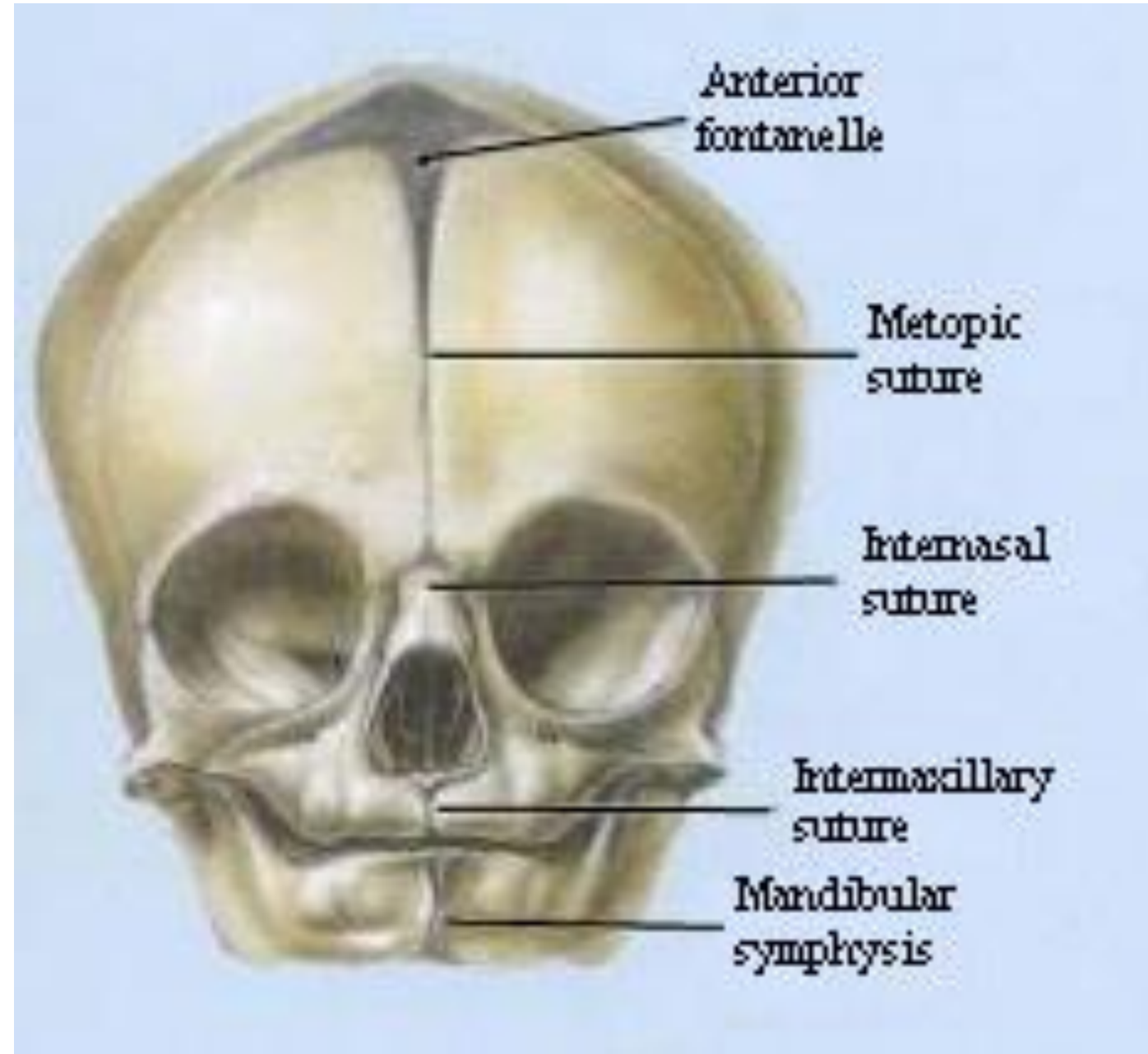
**Age peculiarities and
topography of the skull.**

Joints of the skull.

Lecturer – PhD, Tamara Hacina

THE SKULL AT BIRTH

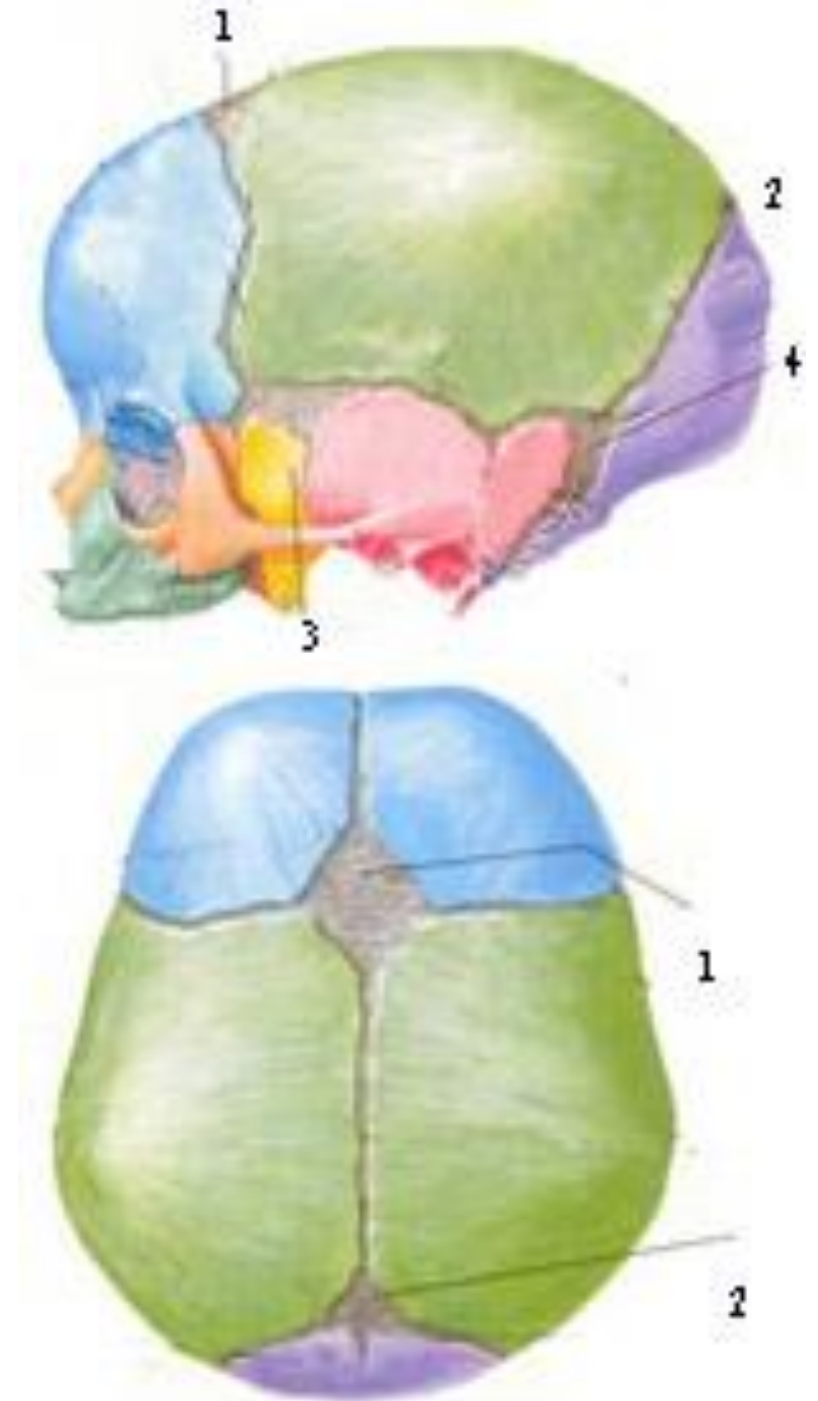
- 1. The face:** is small in size because
 - *the maxilla & mandible are not completely developed* (result of absence of mastication) & the *maxillary sinus is very small*,
 - no teeth
- 2. The mandible:** is divided into 2 halves /unite at the age of one year/
- 3. The frontal bone:** is formed of 2 halves /they start to unite at the age of 2 years & unite completely at 10 years/
- 4. The calvaria (skull cap):** is large because the brain is relatively large in size
- 5. The tuberosities, crests, lines** are not pronounced.



THE SKULL AT BIRTH

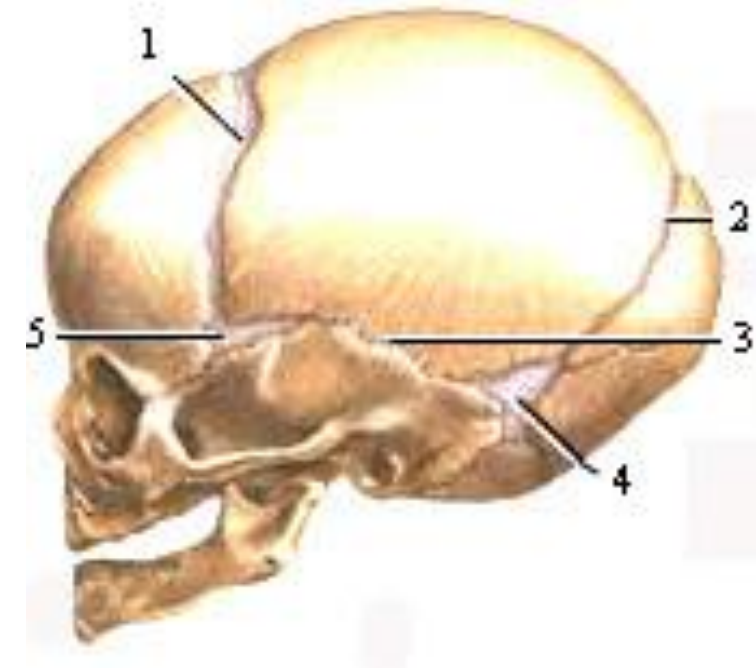
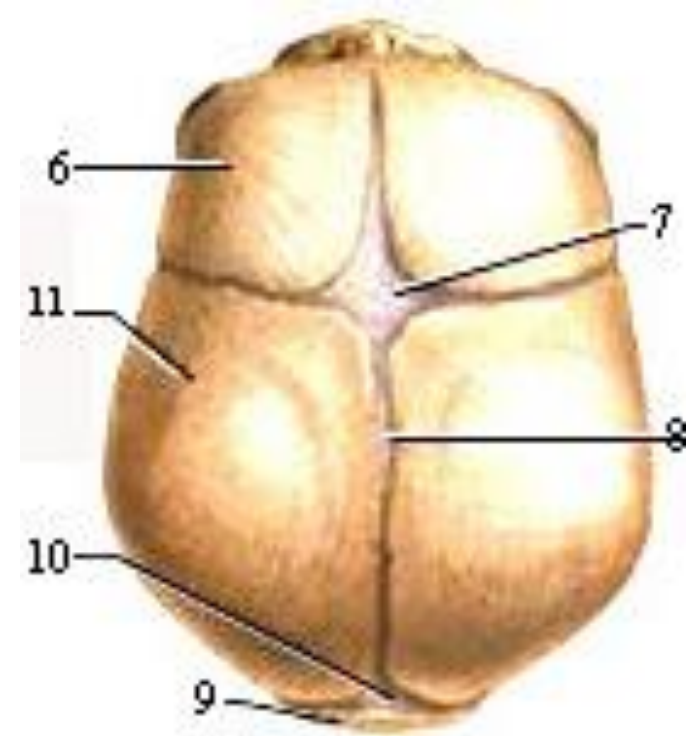
6. The presence of fontanelles

- a) ***Anterior fontanelle or frontal***: a rhomboidal membrane between the 2 parietal bones & 2 halves of the frontal bone /closes at the age of 1-2 years/
- b) ***Posterior fontanelle or occipital***: a triangular membrane between the 2 parietal bones & the occipital bone /it closes at the age of 8 months/
- c) ***Antero-lateral or sphenoid*** fontanelle /on each side at the region of the *pterion*, closes at the age of 3 months/
- d) ***Postero-lateral or mastoid*** fontanelle /on each side at the region of the *asterion*, which also closes at the age of 3 months/

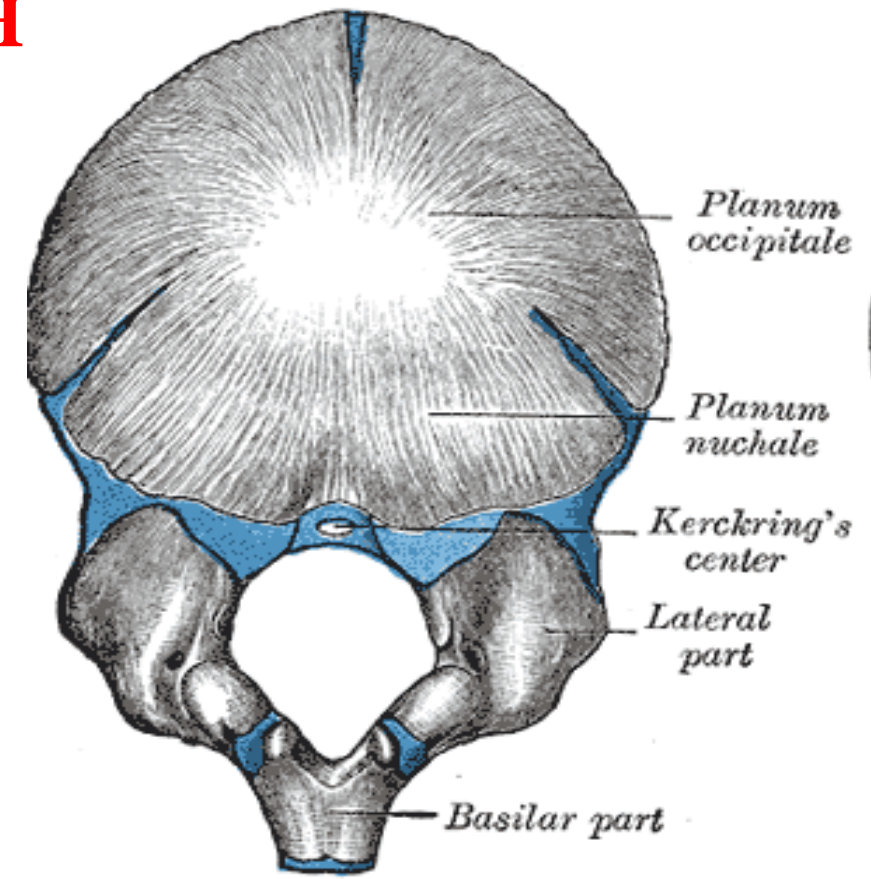
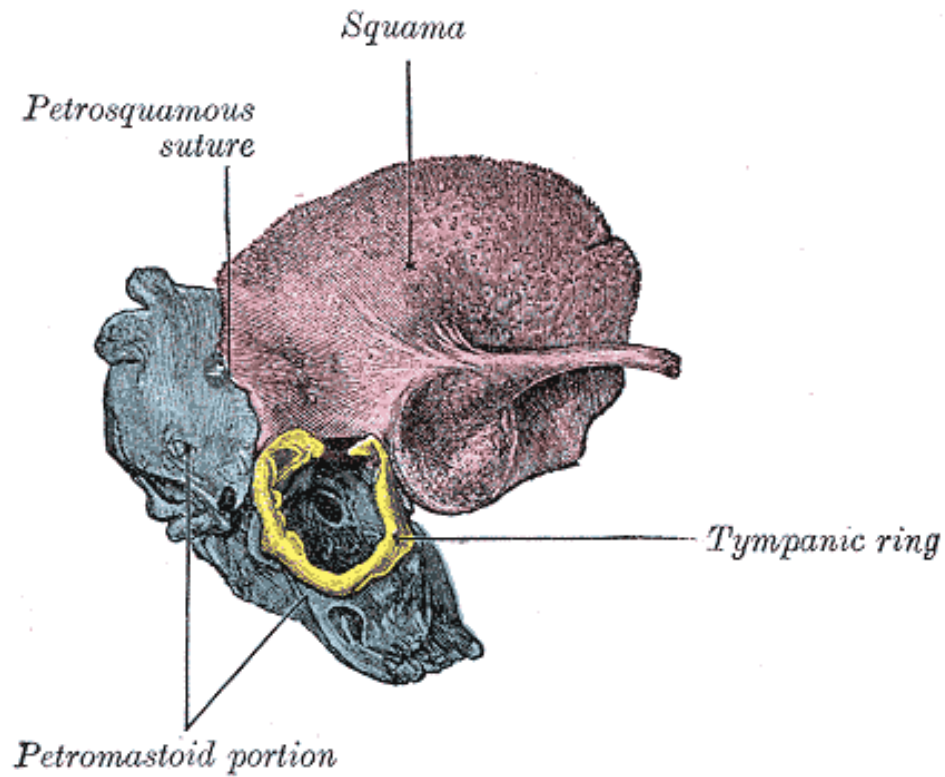


Fontanelles

- The bones of the skull do not move but they show amazing patterns of growth during our lives.
- In newborn different bony plates are not joined together. They are separated by gaps and these are the **fontanelles**.
- In normal conditions 2 fontanelles exist: frontal and occipital.
- At case of premature birth are present lateral fontanelles: sphenoid and mastoid.
- The fontanelles allow the skull to be squashed during birth without causing damage.
- During childhood, the fontanelles close up and the bones become fused together.



THE SKULL AT BIRTH



7. **The occipital bone**: is formed of squamous part, 2 lateral parts & a basilar part which are still separated by cartilage
8. **The basilar parts of sphenoid & of occipital bones** are separated by cartilage
9. **The temporal bone** shows:
 - undeveloped mastoid & styloid processes
 - incomplete tympanic ring and external auditory meatus is formed by cartilagenous part only & the tympanic membrane is superficial

Age changes of the skull

3 periods are distinguished in the **growth** of the skull:

I- the first 7 years;

II- 8-16 years;

III- 16-23 years.

Ossification of the **fontanelles**

Pneumatization of the paranasal **sinuses**:

the frontal sinus becomes visible on a radiograph at the end of the 1st year;

the ethmoid cells – at 1 year;

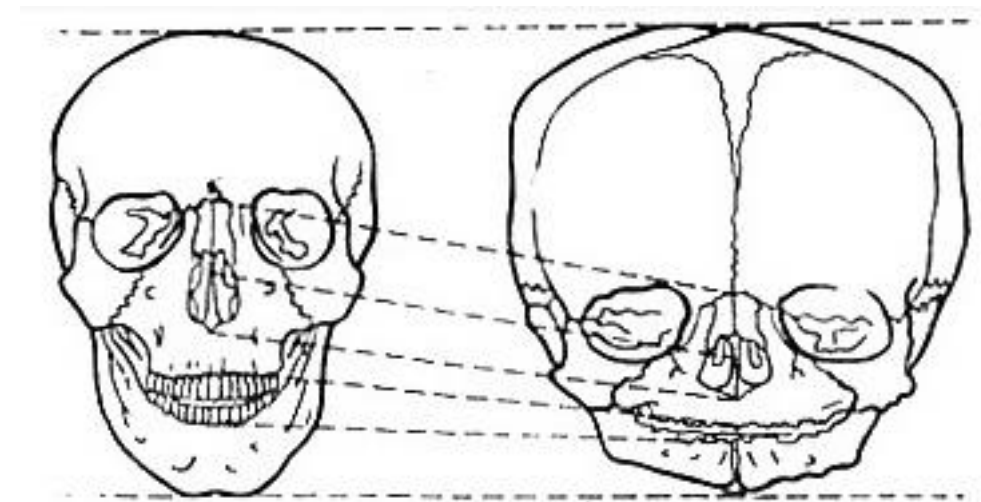
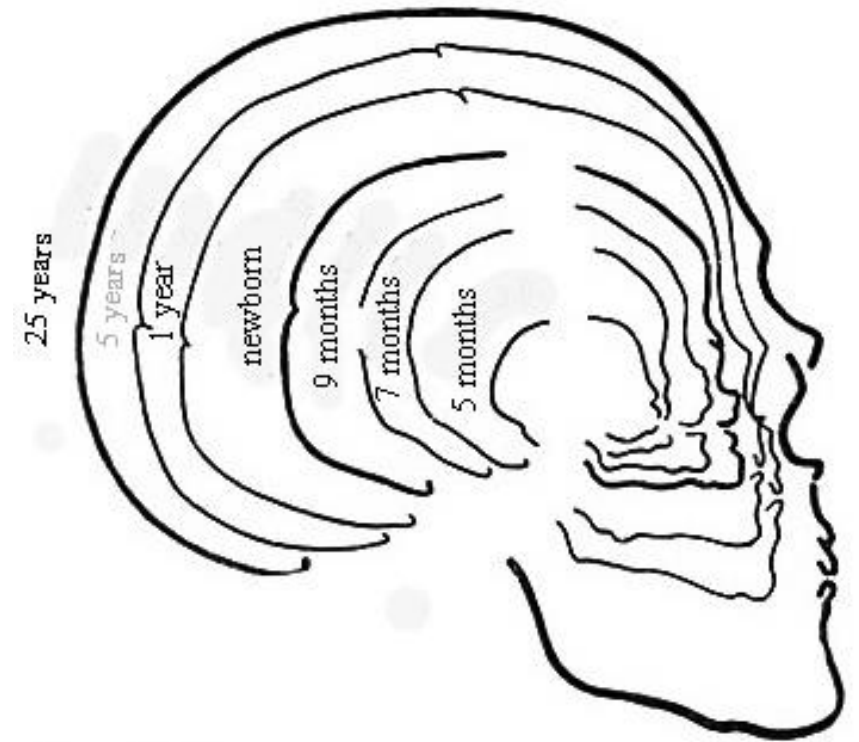
the maxillary sinus reaches full development in period of replacement of deciduous teeth by the permanent teeth.

At mature age the cranial **sutures disappear** (result of convertation of the syndesmoses to synchondroses).

Replacement and **loss** of **teeth**.

The **face** becomes **shorter** (result of the loss of teeth and atrophy of alveolar margins of the jaw bones).

The **angle** between the branch and body **of the mandible** **increases**.



Periods of the Growth of the Skull

- *The first period (the first 7 years)* is characterized by intensive growth, mainly of the posterior part of the skull.
- *The second period (from the age of 7 to the beginning of puberty),* and this is the period of relative rest.
- *The third period, from the beginning of puberty (13-16 years of age) to the end of skeletal growth (20-23 years of age),* is again one of intensive growth, and during this period growth mainly the anterior part of the skull.

Some morpho-functional data of the skull

- Even after visible gaps between the neuroskull bones have closed, the *fibrous suture permits additional growth to occur*.
- Eventually, the bones at that suture fuse together.
- The *metopic suture normally fuses relatively early* (anywhere from 3 to 7 years), although the *other* neurocranial sutures remain patent into *adulthood*.
- The *growth of the face is directly related to the growth of sensory organs and teeth*.
For example, the eyes grow at a rate similar to that of the brain.
- Thus, at birth the orbits are relatively large compared to the rest of the face.
- Throughout development, the face increases in size vertically, and the palate is elongated in association with the formation of teeth.
- Of the three major units of the skull, *the cranial base is structurally the most stable*.
- This portion of the skull allows entry and exit of neurovascular structures, including the spinal cord which passes through the foramen magnum.

The age changes that take place later in the human skull

I. Fusion of the separate parts of bones forming a single bone:


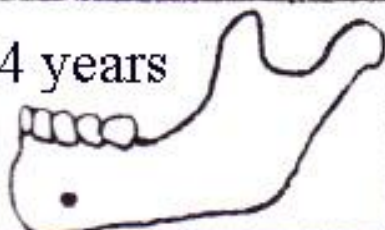
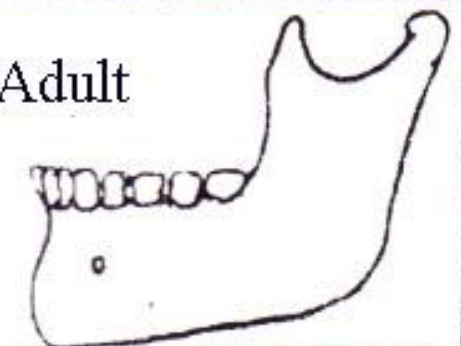

- *Fusion of both halves of the frontal bone* at the site of the frontal suture occurs from 2 years until 7 years of age.
- *Fusion of all parts of the occipital bone* between ages 3 and 5.
- Both *halves of the mandible fuse* at 1-2 years of age.
- *Synostosis between the body of the occipital bone and the sphenoid bone* to form a single *os basilare* at the level of sphenoccipital synchondrosis occurs between the ages of 18-20, and with the development of this synostosis growth of the base of the skull in length ceases.

II. Disappearance of the fontanelles and the formation of sutures with typical serrated contours at 2-3 years of age.

III. Appearance and future development of pneumatization.

The maxillary sinus begins to develop in the 5-6th month of the intrauterine life. It reaches full development in the period of replacement of deciduous teeth by the permanent teeth and is distinguished by great variability.

AGE CHANGES OF THE MANDIBLE

AGE	ANGLE	MENTAL FORAMEN	ALVEOLAR MARGIN
<p>At birth</p> 	<p>About 170* /very obtuse/</p>	<p>Near the lower border</p>	<p>No eruption of teeth</p>
<p>At 4 years</p> 	<p>About 145* /25* less/</p>	<p>Slightly higher in position</p>	<p>Eruption of 10 milk teeth</p>
<p>Adult</p> 	<p>About 120* /25* less/</p>	<p>Midway between the upper and lower border</p>	<p>Eruption of 16 permanent teeth</p>
<p>Old age</p> 	<p>About 145* /like young age again/</p>	<p>Near the upper border</p>	<p>Shows loss of teeth and absorbtion of the alveolar margin</p>

Joint of the skull bones

1) Syndesmoses

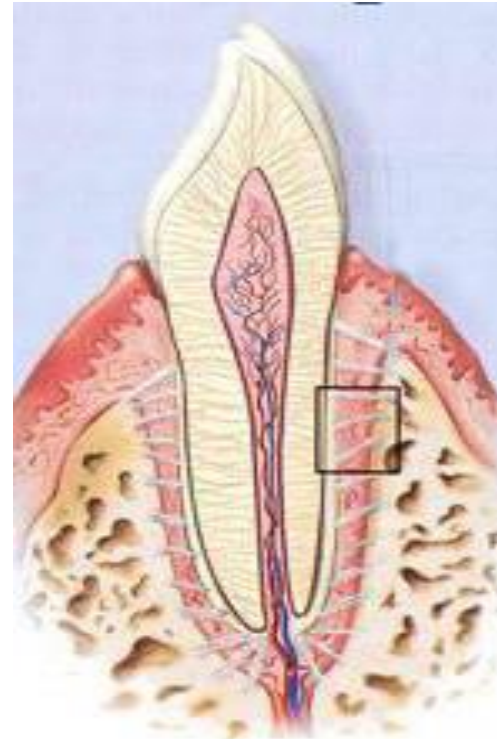
2) Synchondroses

3) Synostoses

4) Diarthrosis

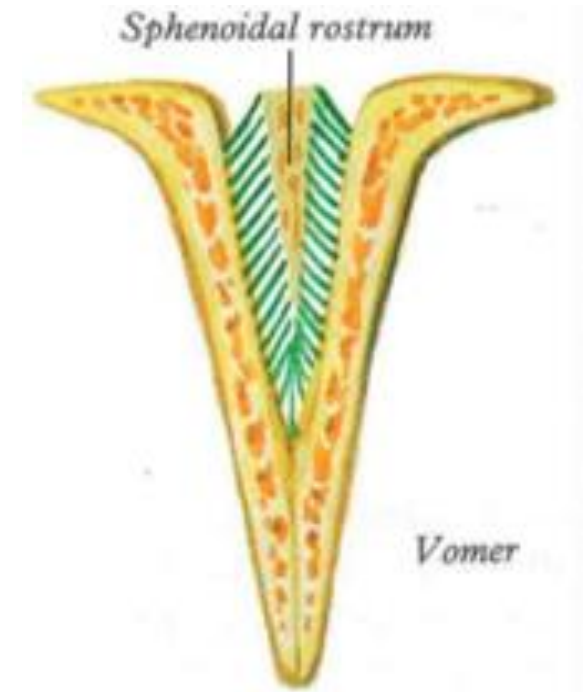
SYNDESMOSES OF THE SKULL

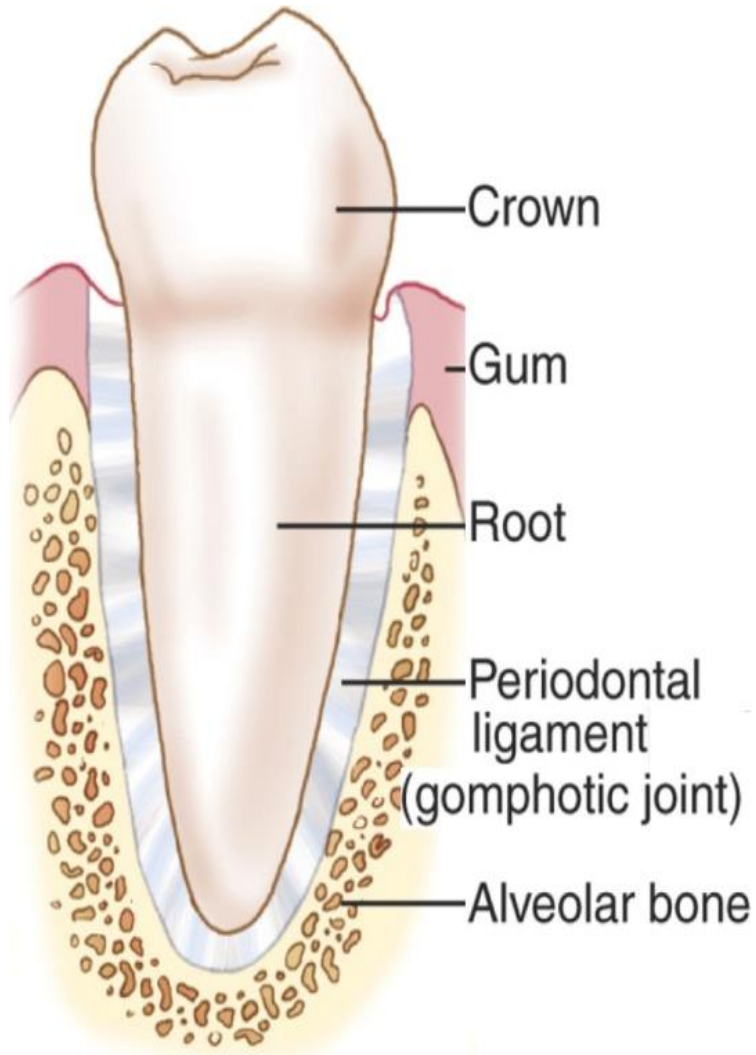
- Lack a synovial cavity
- The articulating bones are held very closely together by dense irregular connective tissue
- Fibrous joints permit little or no movement
- Four types of fibrous joints:
 1. Gomphosis
 2. Schindylesis



-Gomphoses /the roots of the teeth join with the sockets by collagen fibers/

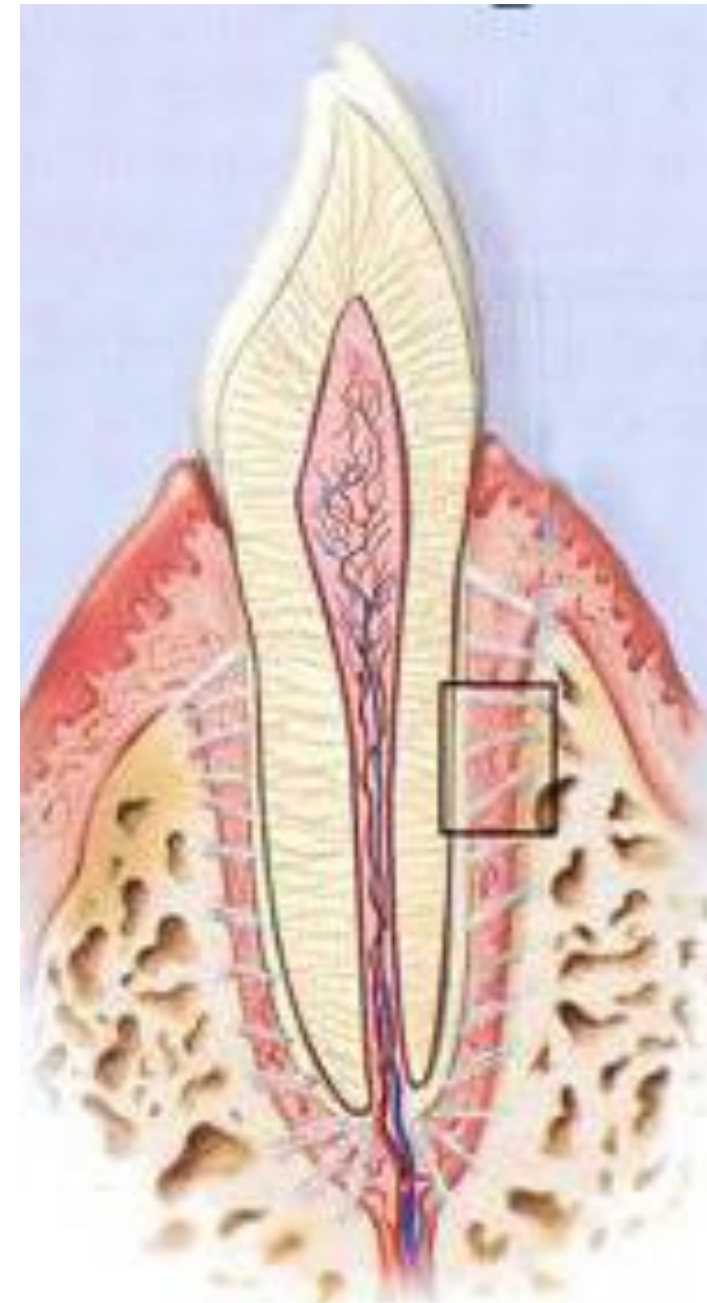
-Schindylesis - is an articulation in which two bones are joined by fitting the ridge of one bone into the groove of another. Also known as a "wedge-and-groove"





The gomphosis

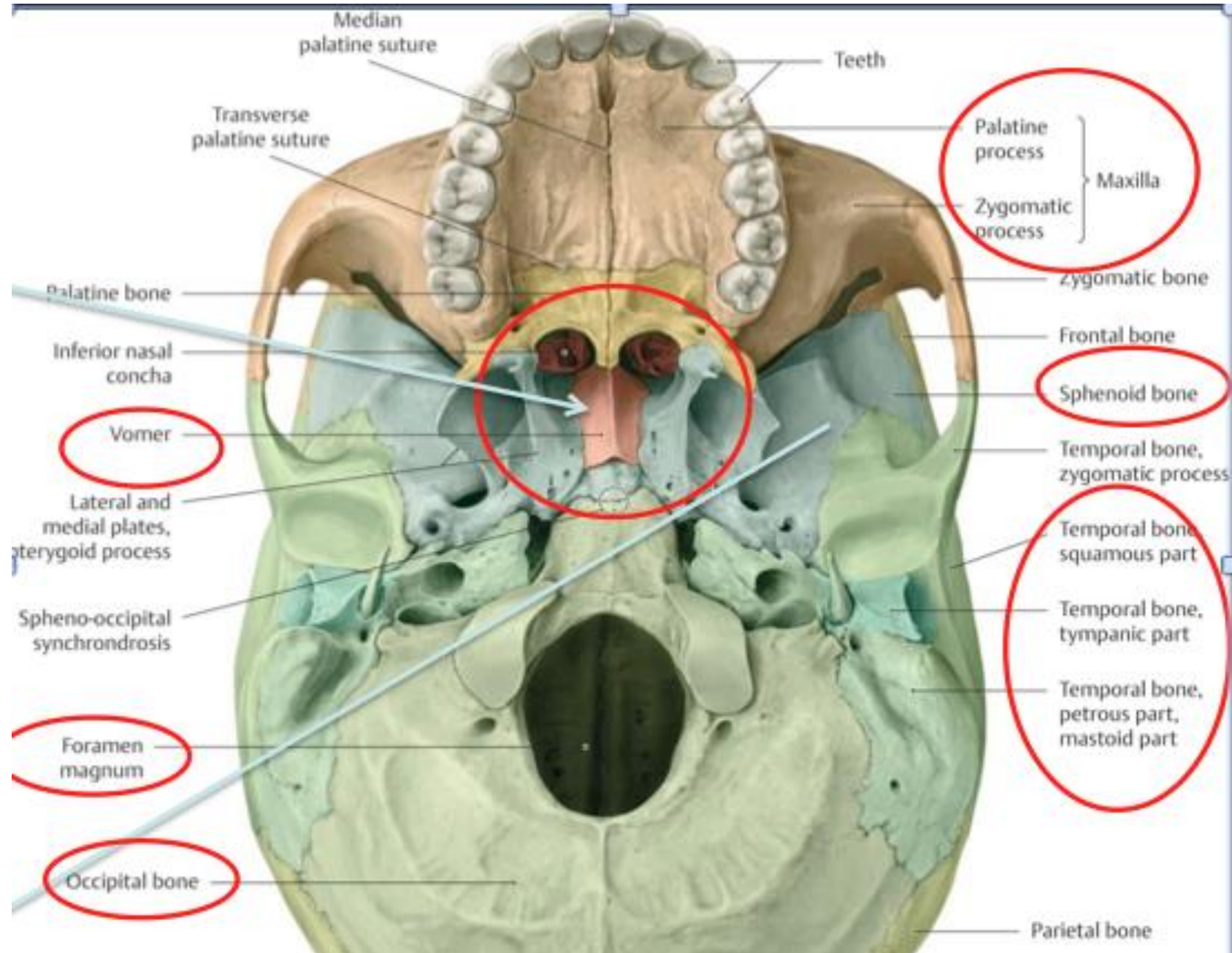
is a joint that binds the [teeth](#) to bony sockets ([dental alveoli](#)) in the [maxillary bone](#) and [mandible](#). The fibrous connection between a tooth and its socket is a [periodontal ligament](#). Specifically, the connection is made between the maxilla or mandible to the cementum of the tooth.



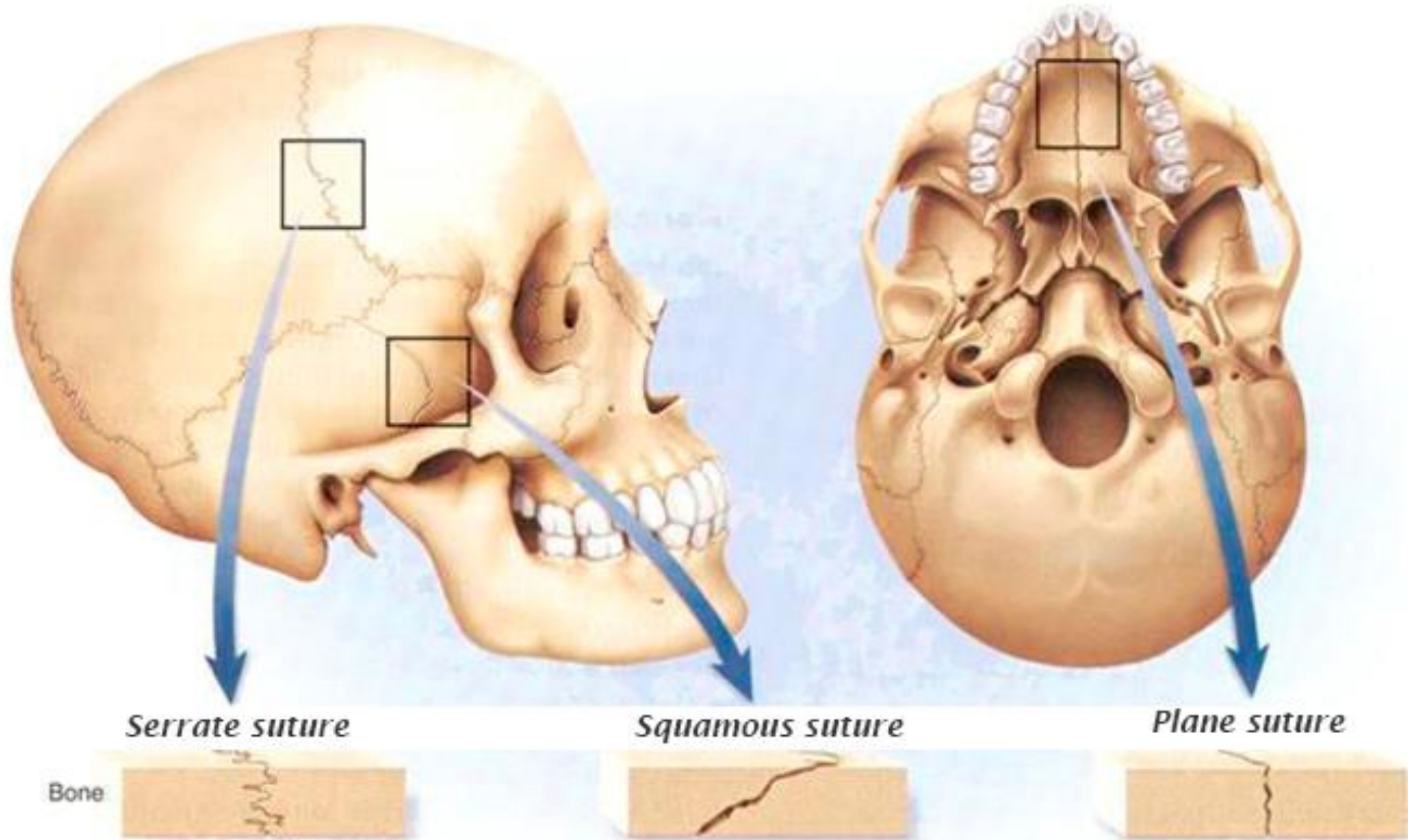
Schindylesis

Schindylesis is that form of articulation in which a thin plate of a bone is received into a cleft or fissure formed by the separation of two laminae in another bone, as in the articulation of the rostrum of the sphenoid bone and perpendicular plate of the ethmoid bone with the vomer.

/ as well as between the vomer and the gap between the maxilla and palatine/.



3. Sutures /it is that form of articulation where the contiguous margins of the bones are united by a thin layer of fibrous tissue; it occurs only in the skull/

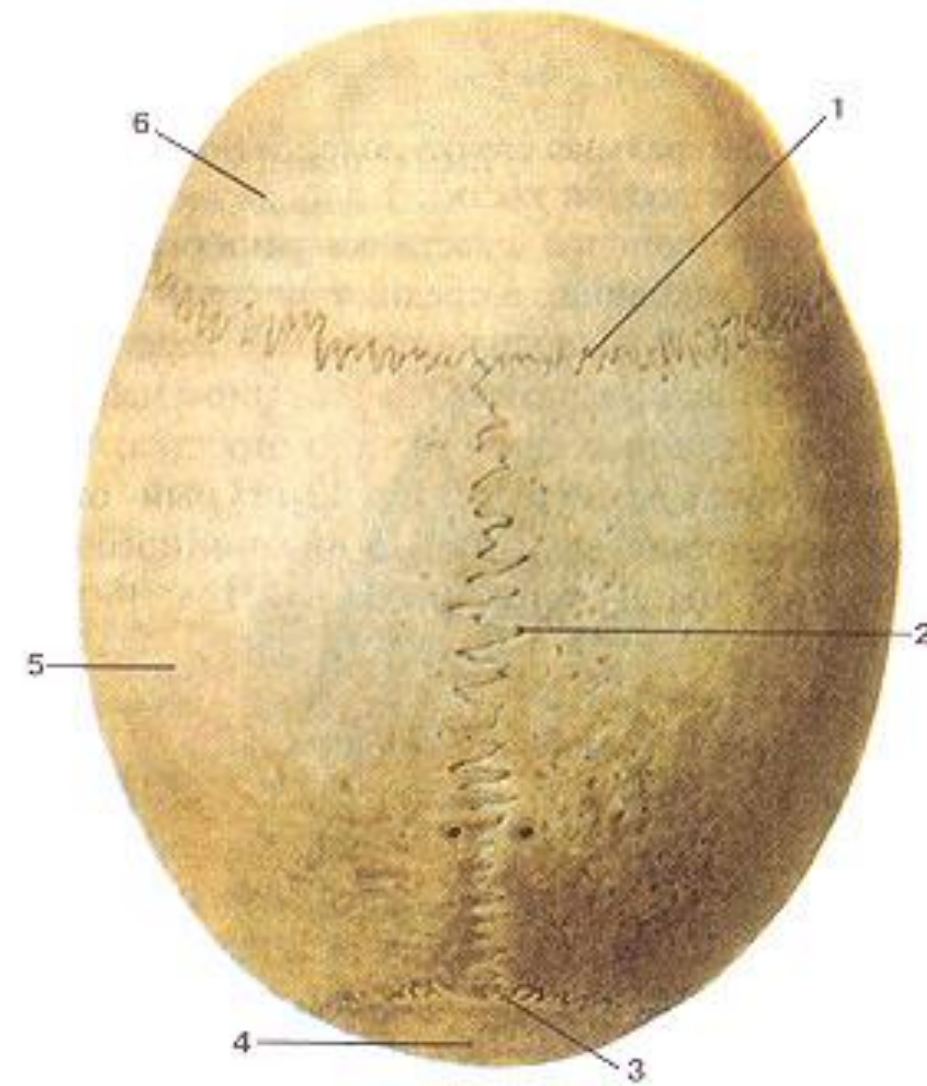
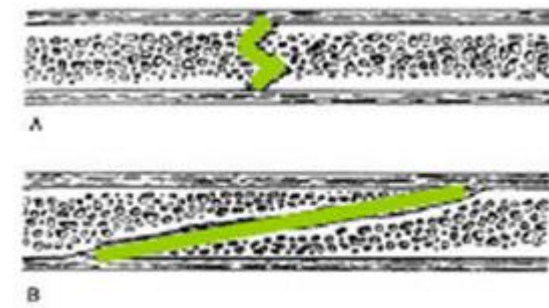


The sutures in the skull of adults

I. True sutures

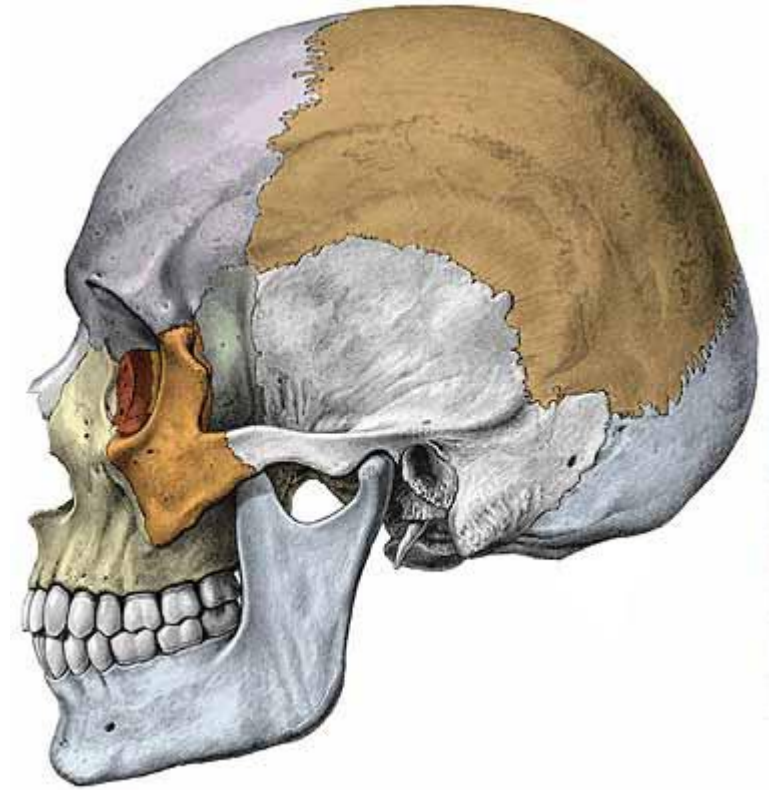
If the margins of the bones are connected by a series of processes, and the indentations interlocked, the articulation is termed a true suture and of these there are three its varieties:

- *The sutura dentata* is so called from the tooth-like form of the projecting processes, as in the suture between the parietal bones.
- In *the sutura serrata* the edges of the bones are serrated like the teeth of a fine saw, as between the two portions of the frontal bone.
- In *the sutura limbosa*, there is besides the interlocking, a certain degree of inclination of the articular surfaces, so that the bones overlap one another, as in the suture between the parietal and frontal bones.

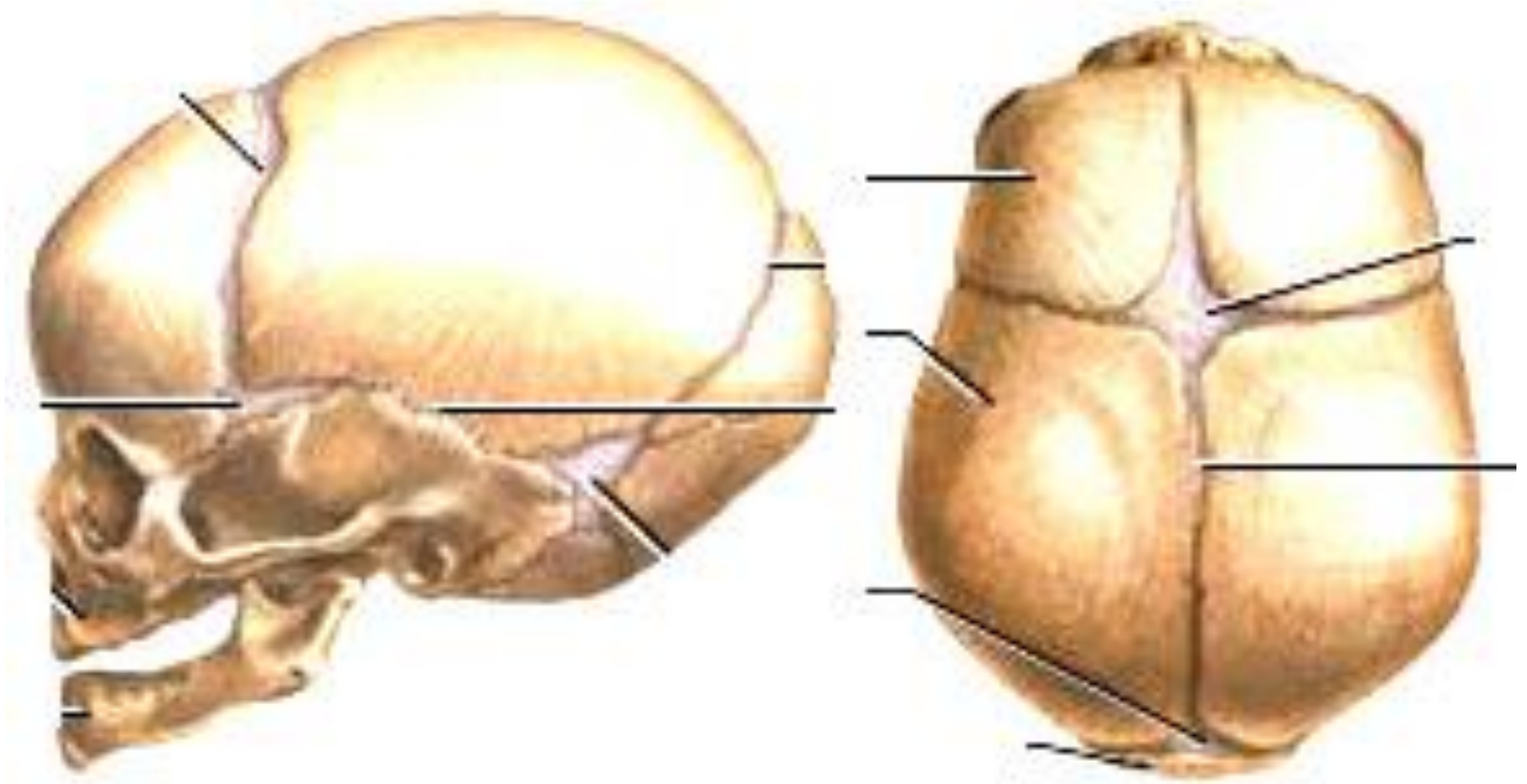


II. False sutures

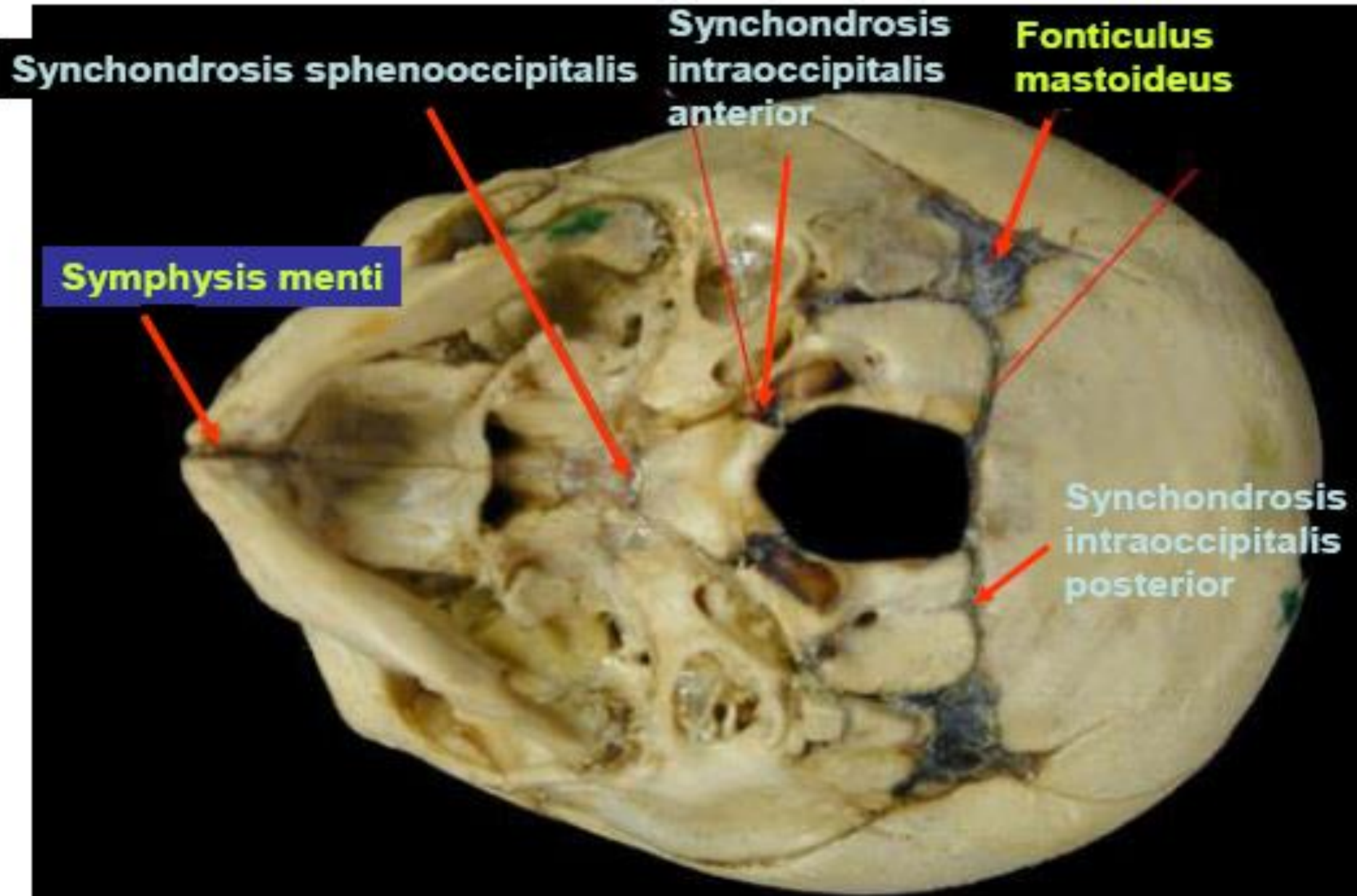
- When the articulation is formed by roughened surfaces placed in apposition with one another, it is termed a *false suture*, of which there are two kinds:
 - *the sutura squamosa*, formed by the overlapping of contiguous bones by broad bevelled margins, as in the squamosal suture *between the temporal and parietal*, and
 - *the sutura harmonia*, where there is simple apposition of contiguous rough surfaces, as in the articulation between the maxillæ, or *between the horizontal parts of the palatine bones*.



4. Fontanelles /are soft spots on a baby's head which, during birth, enable the bony plates of the skull to flex, allowing the child's head to pass through the birth canal/



II. Synchondroses of the skull



Cartilaginous and fibrous connection on the newborn skull

III. JOINTS (SYNOVIAL JOINTS) = DIARTHROSES

- **Synovial cavity** allows a joint to be freely movable
- **Ligaments** hold bones together in a synovial joint
- **Articular Capsule** - a sleeve-like capsule encloses the synovial cavity and is composed of two layers: - *an outer fibrous capsule*, - *an inner synovial membrane*.

Synovial Fluid is secreted by the synovial membrane

It reduces friction by:

- lubricating the joint
- absorbing shocks
- supplying oxygen and nutrients to the cartilage
- removing carbon dioxide and metabolic wastes from the cartilage

Articulatio temporomandibularis

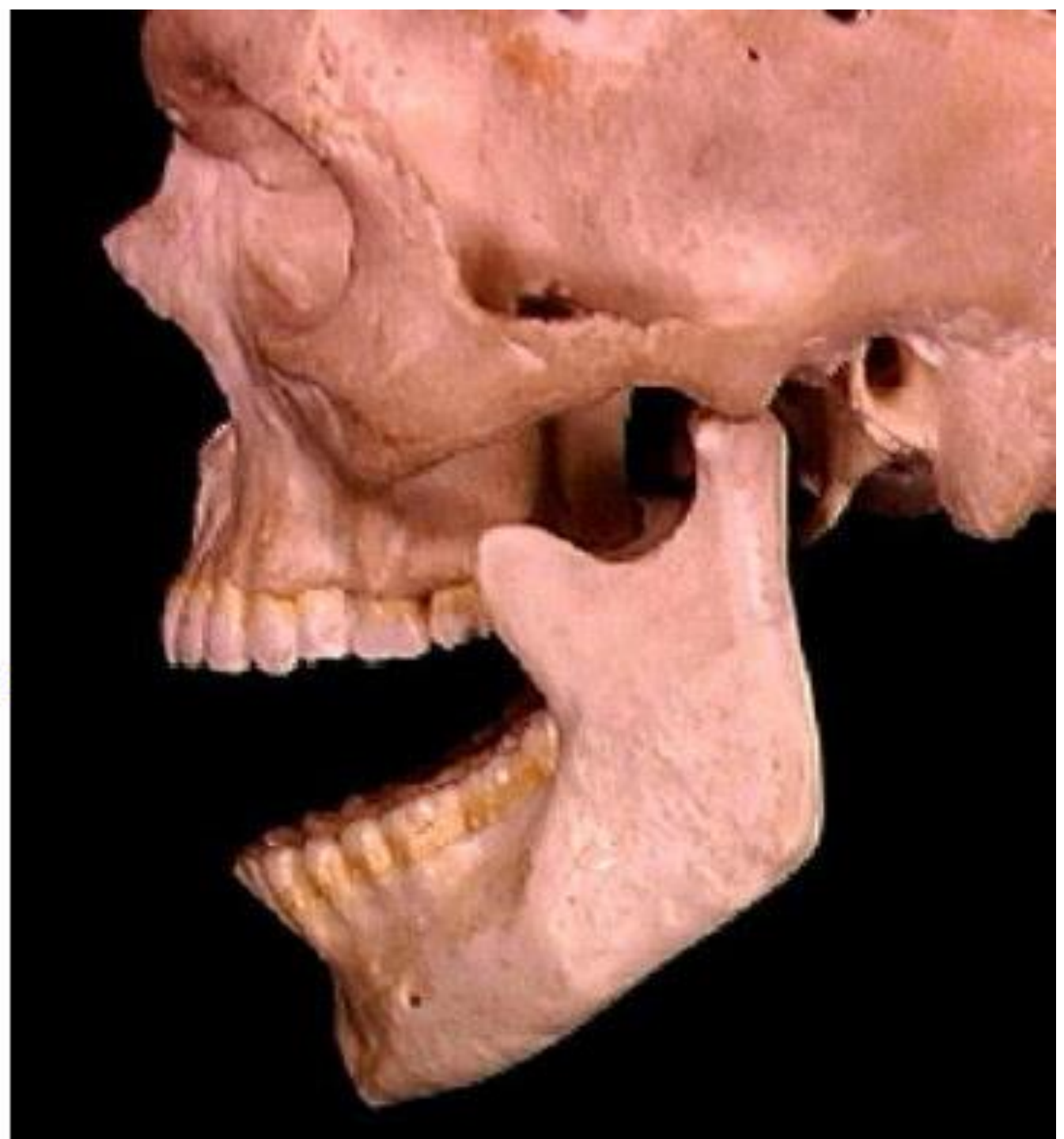
complex– **discus**

head: **caput mandibulae**

fossa: **fossa mandibularis,**
tuberculum articulare

**Articular surfaces are covered
by fibrous cartilage**

Movements : depression
elevation
protraction
retraction
lateropulsion



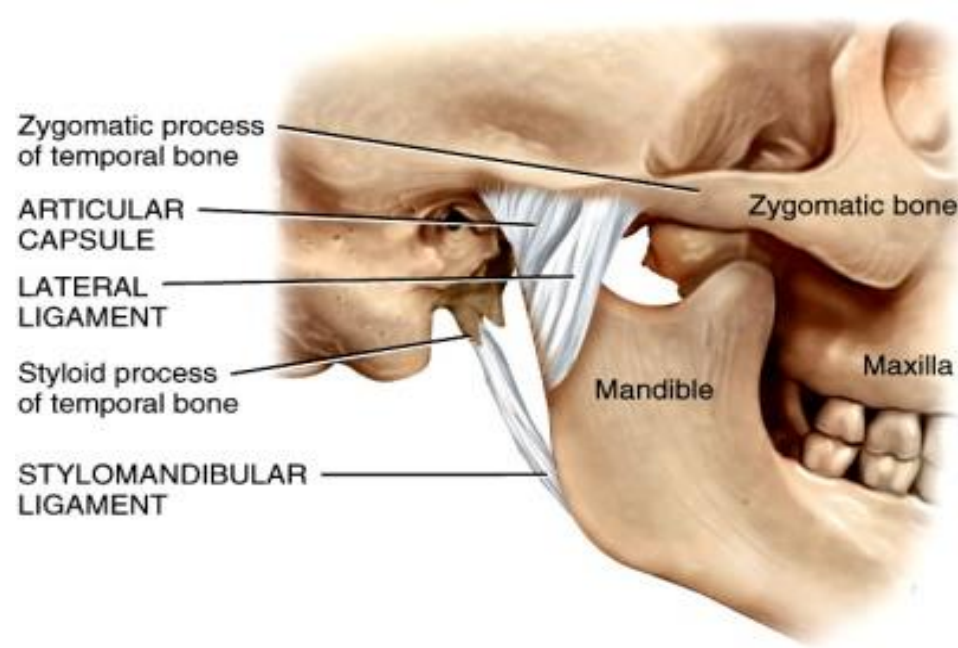
DIARTHROSES OF THE SKULL

- **Temporo-mandibular Joint**

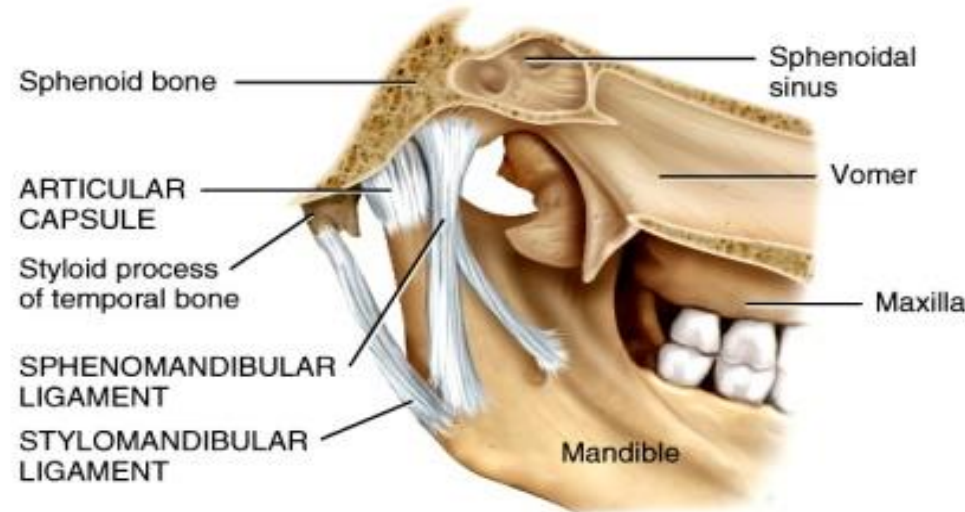
Combined hinge joint formed by the mandible and the temporal bone

Only movable joint between skull bones

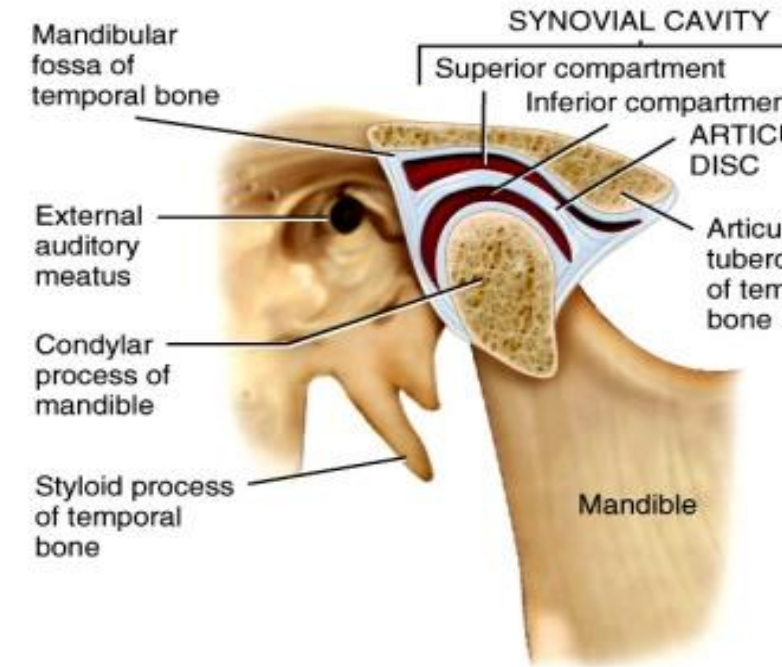
Only the mandible moves



(a) Right lateral view



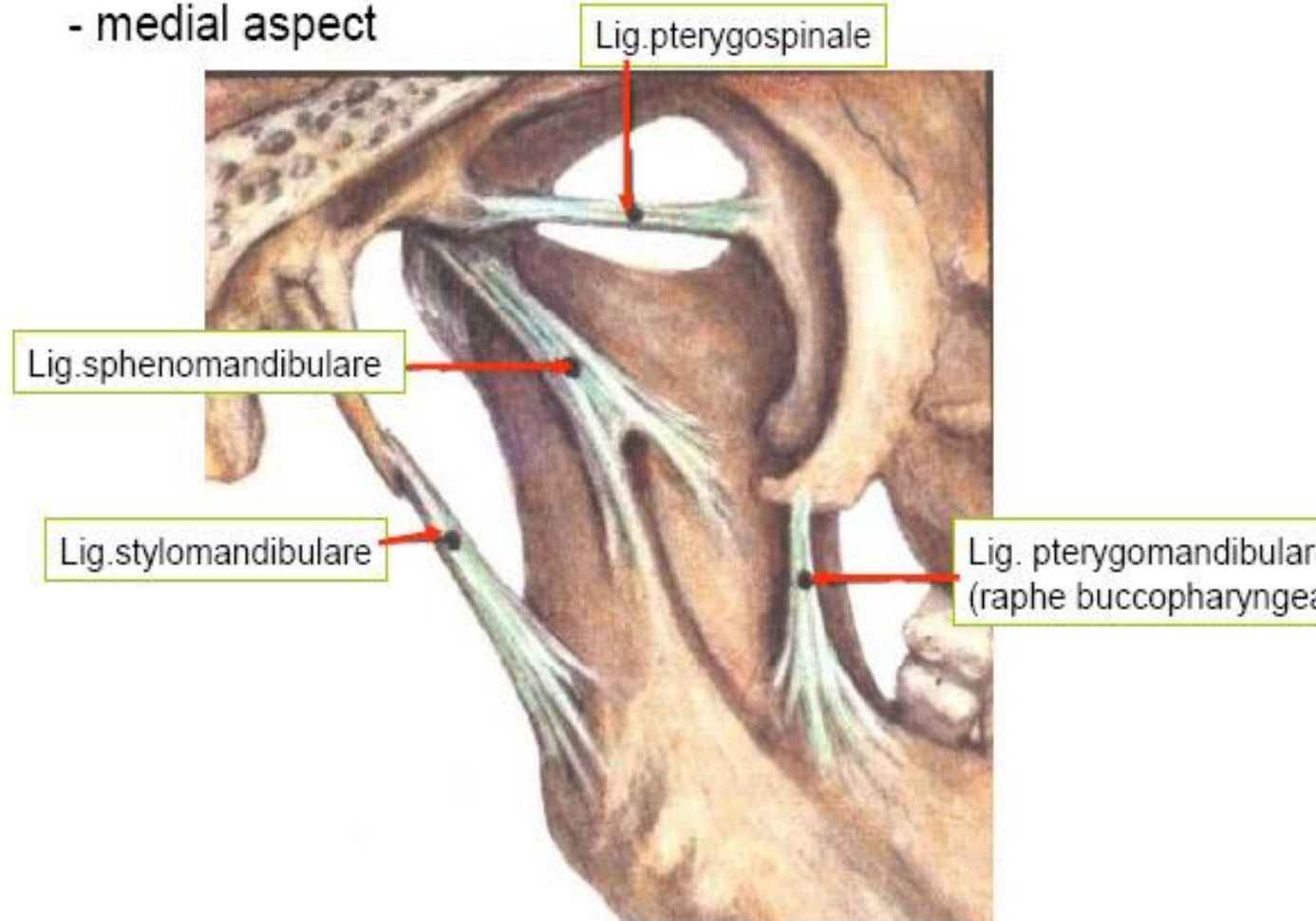
(b) Left medial view



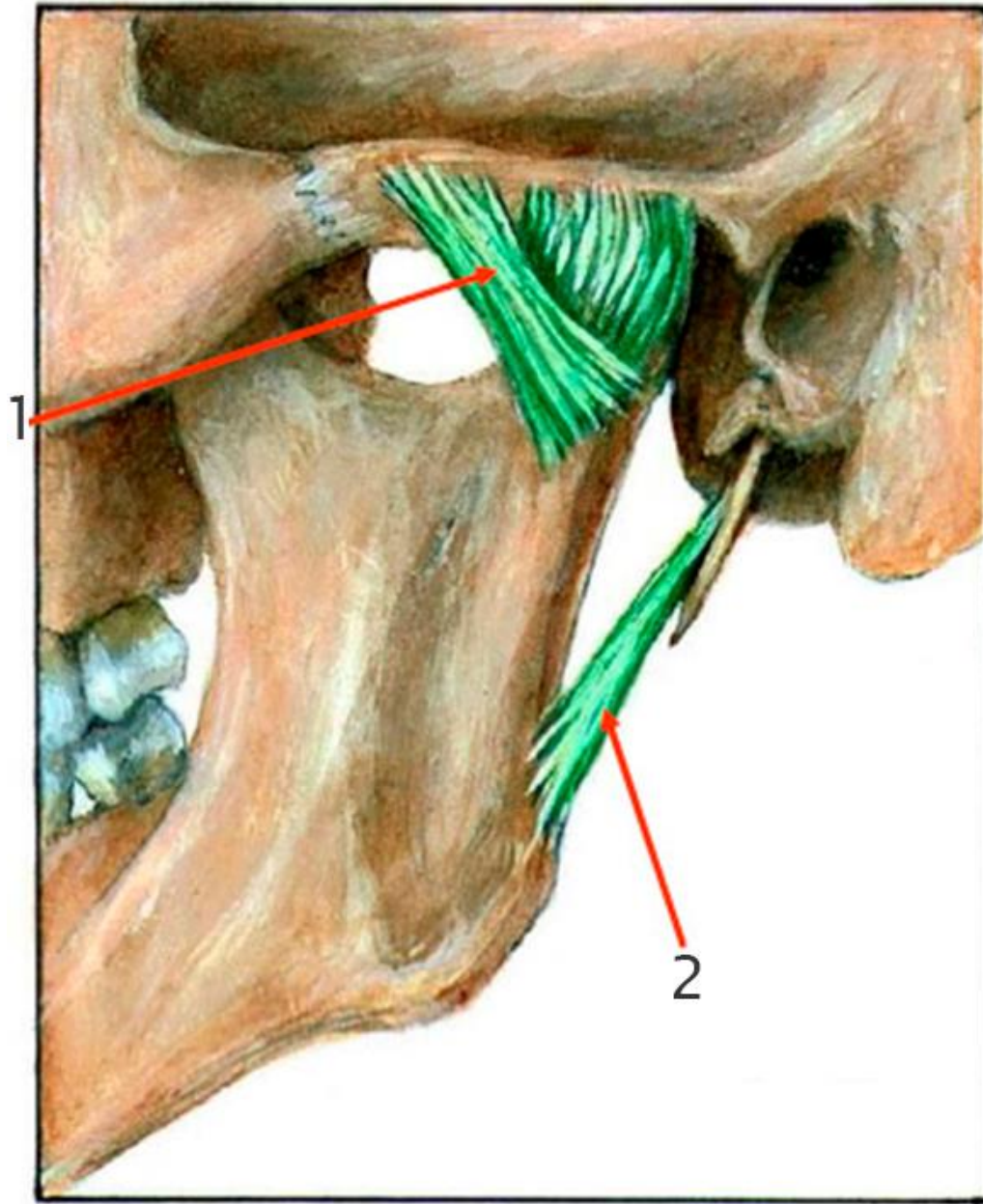
(c) Sagittal section viewed from right

Ligaments of the TMJ

Ligaments of the temporomandibular joint
- medial aspect



Medial aspect



Lateral aspect

1 – lateral lig.; 2 – stylomandibular lig.

Internal structures of the TMJ

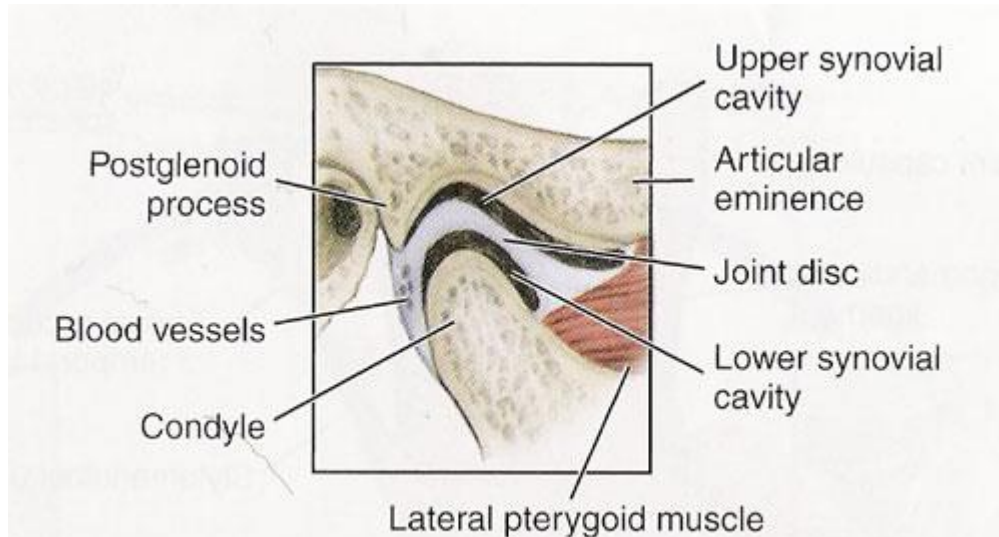
1. **Articular disc** – separates cavity of the joint into two parts:
 - a. superior - above the disc
 - b. inferior - under the disc

3. **Retrodiscal tissue**

- superior retrodiscal lamina - attaches to mandibular (glenoid) fossa and pulls disc back when mandible opens *scave*, thicker on outside edges
- **no vascular or nervous supply** except at edges
- **made of fibrous tissue**

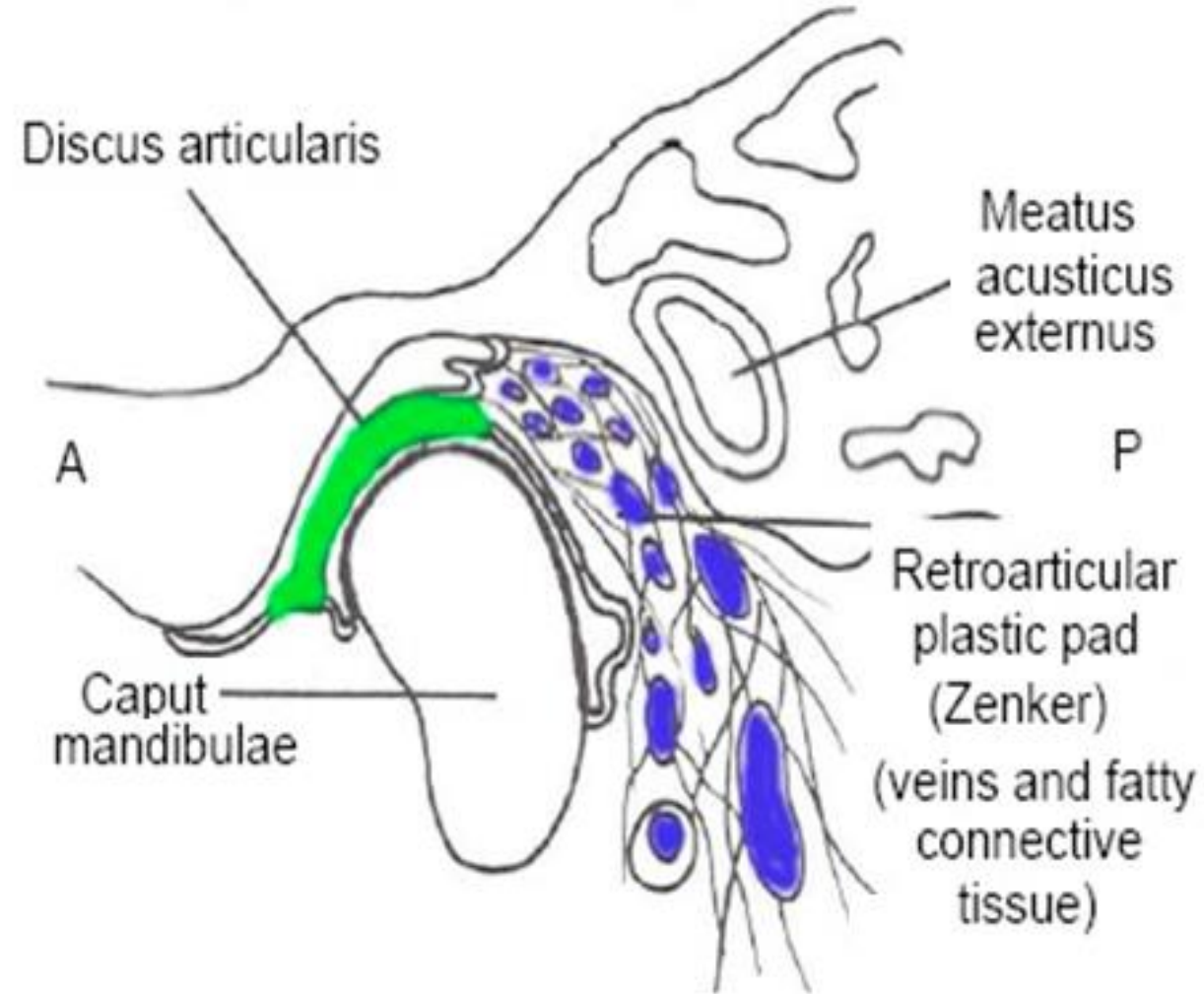
2 **Joint cavities** - TMJ has **2 cavities**:

- a. inferior - below



"Anatomy of the Head and Neck" - Fehrenbach and Herring, Figure 5-4 B, page 133

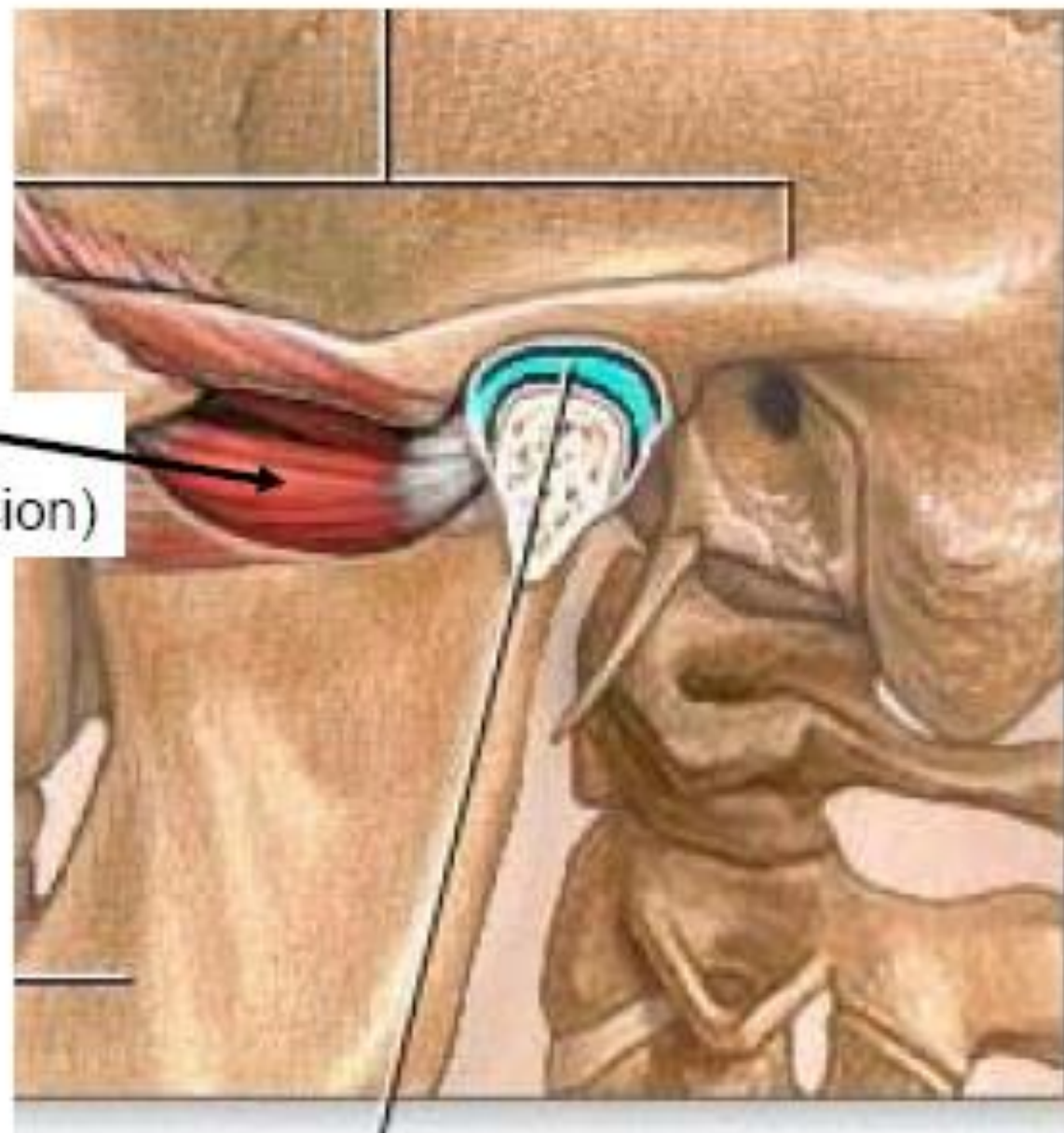
Articulatio temporomandibularis sagittal section (after Frick)



**Position of the caput mandibulae to
the external acoustic meatus**

Temporomandibular joint and m. pterygoideus lateralis

m. pterygoideus lat
(depression, lateropulsion)

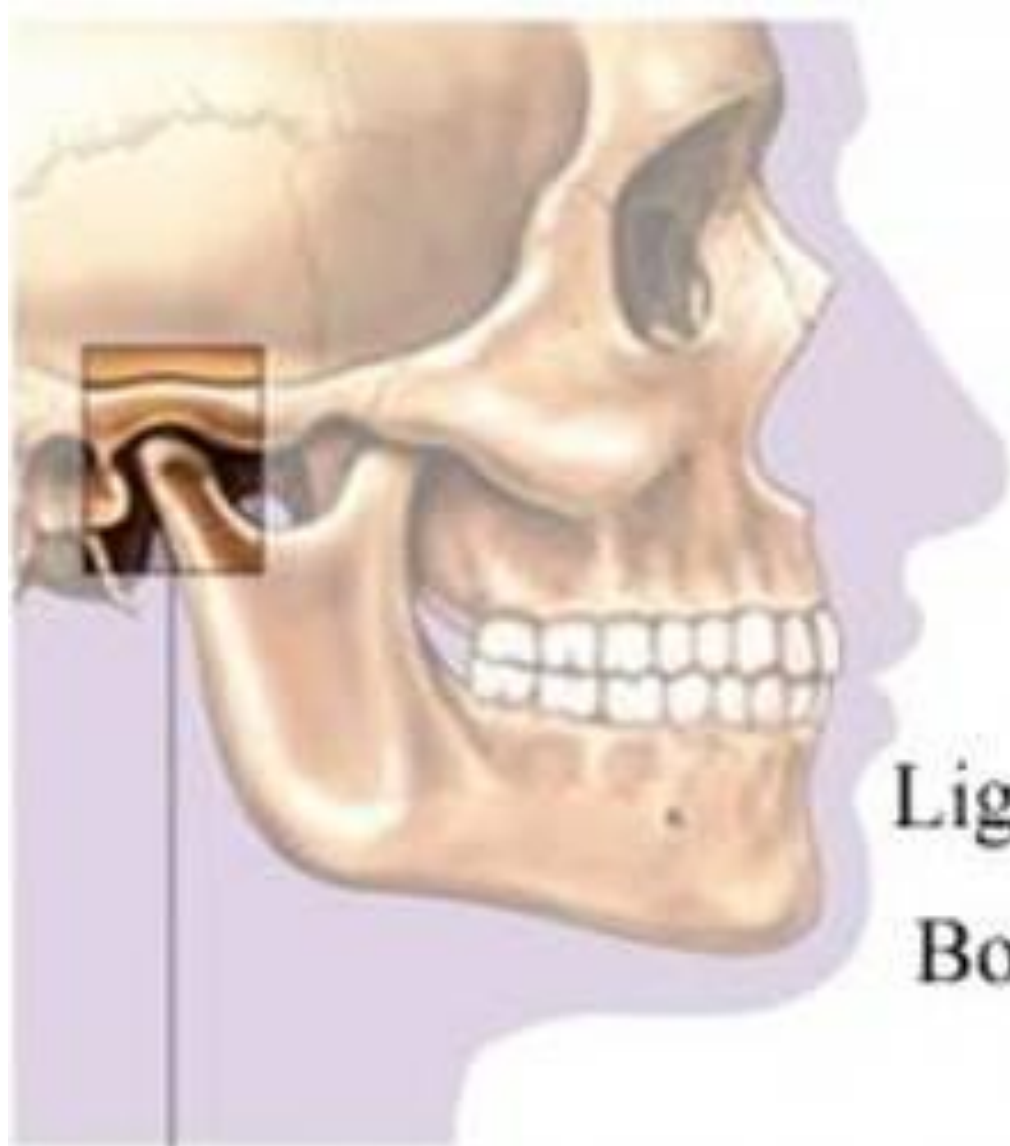


Intra-articular disc



Ligament

Bone



Temporomandibular joint
(TMJ)

Biomechanics of the TMJ

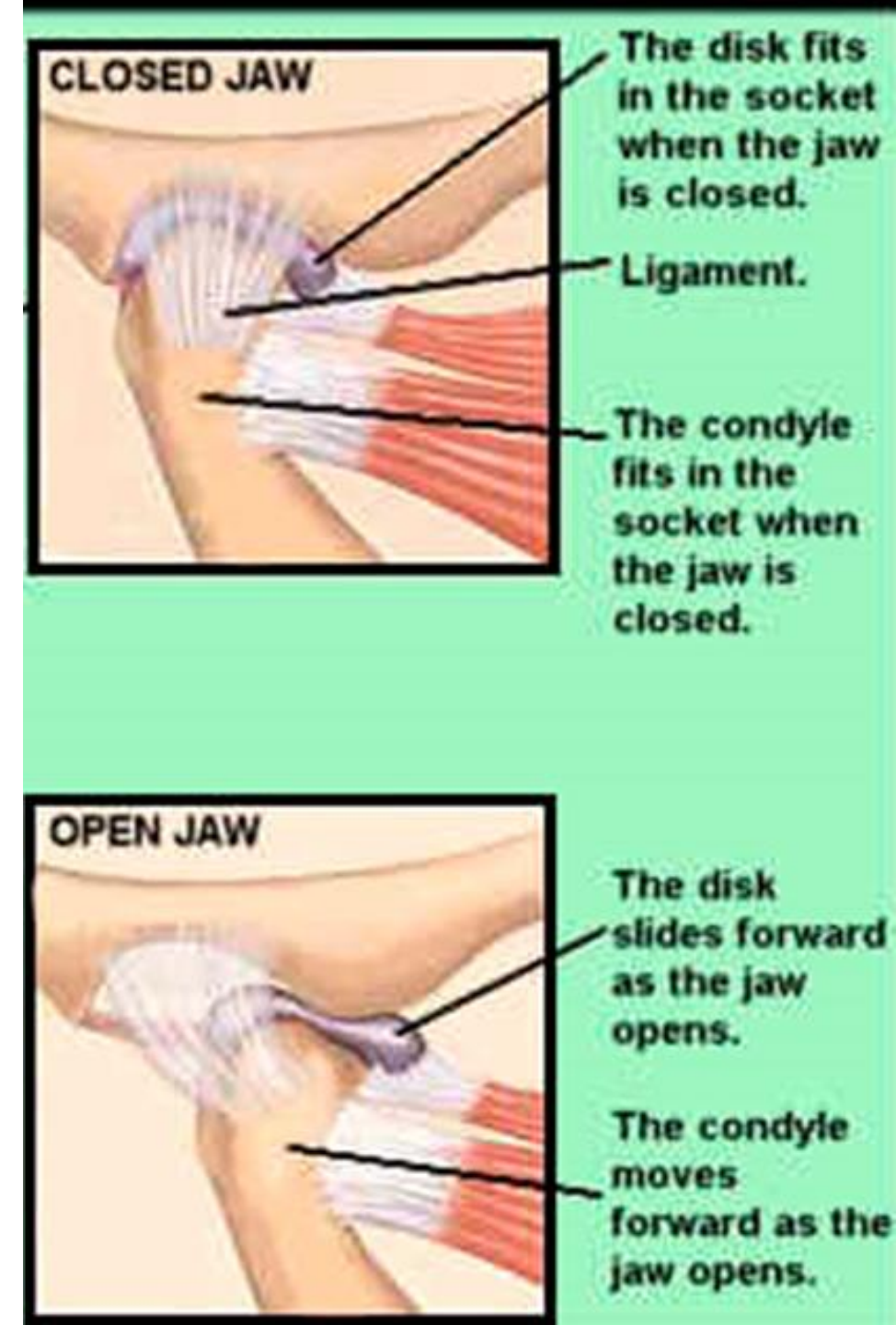
The first motion is *rotation* in lower joint cavity around a horizontal axis through the condylar heads.

The second motion is *translation* in upper joint cavity. The condyle and meniscus move together anteriorly beneath the articular eminence.

In the closed mouth position, *the thick posterior band of the discus lies immediately above the condyle.*

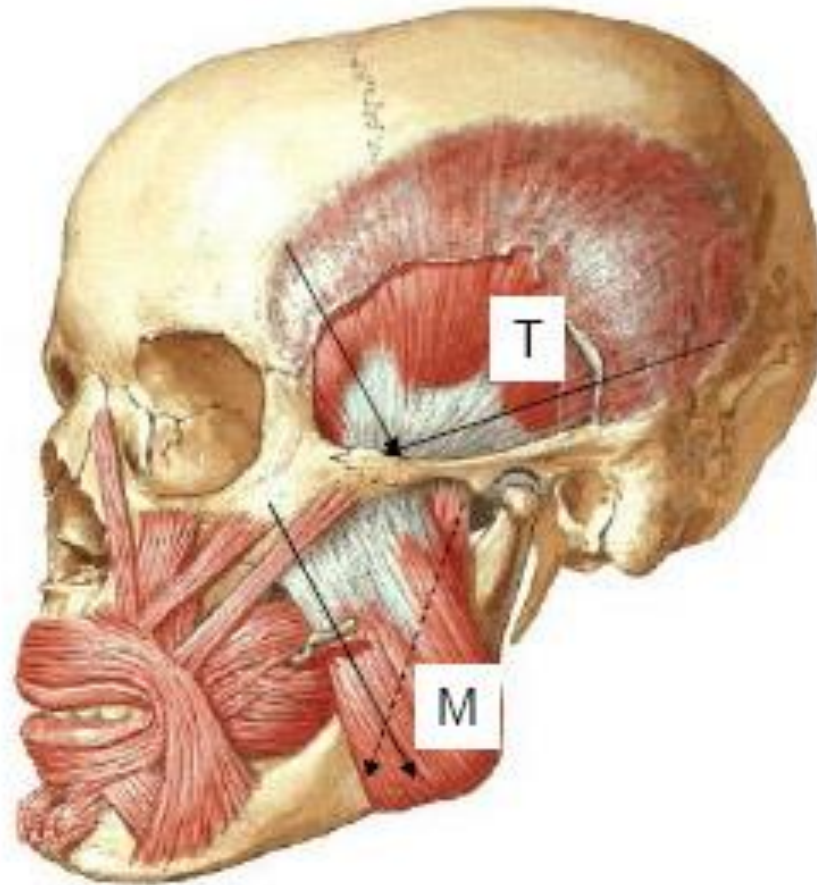
As the condyle moves forward, *the thinner intermediate zone of the discus becomes the articulating surface between the condyle and the articular eminence.*

When the mouth is fully open, *the condyle may lie beneath the anterior band of the discus.*



Movements of TMJ and involved muscles

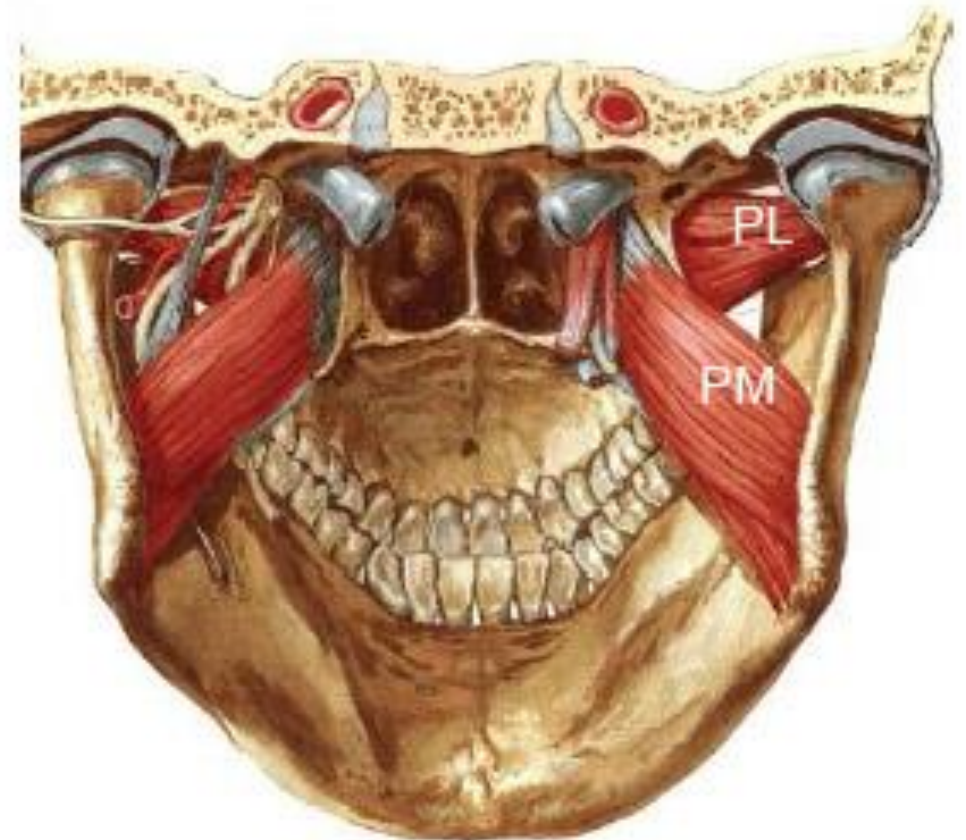
Elevation: m.masseter
m.temporalis
m. pterygoideus medialis



Depression: suprahyoid muscles
m.pterygoideus lat.

Protraction: mm. pterygoidei
m. temporalis
m. masseter

Retraction: m. temporalis
m. masseter (newborn)



Lateropulsion: m.pterygoideus med.
m.pterygoideus lat.

Downward and upward /Depression and elevation/	Forward and backward /Protraction and retraction/	Lateral movements /latero- pulsion/
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It is opening and closure of the mouth;

♦ It takes place in the lower compartment of the joint, between the articular disc and articular head:

1) the first phase - the mandible moves downward, its head first glides together with the disc;

2) the second phase - the mandibular head rotates on the transverse axis passing through both heads.

To open the mouth wide, the heads glide forward and downward with the disc onto the articular tubercles that prevent dislocation of the jaw.

♦ It occurs in the upper compartment of the joint:

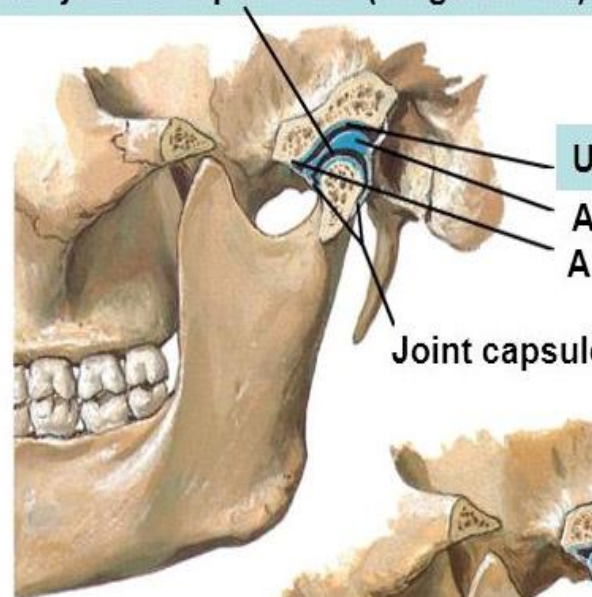
1) the first phase – the head of mandible glides forward with the disc to the articular tubercle.

2) the second phase the head of mandible glides on the tubercle and at the same time rotates about the transverse axis.

♦ The articular head and disc of only one side leaves the articular fossa and approaches the articular tubercle, while the contralateral articular head remains in the articular fossa and rotates on the vertical axis.

MOVEMENTS OCCURRING AT TMJ

Lower joint compartment (hinge action)



A. JAWS CLOSED

Upper joint compartment (gliding action)

Articular disc
Articular tubercle

Joint capsule

Articular tubercle



B. JAWS SLIGHTLY OPENED
(HINGE ACTION PREDOMINATES)



C. JAWS WIDELY OPENED
(HINGE AND GLIDING ACTION COMBINED)

PROTRUSION AND RETRACTION

Protrusion is brought about by simultaneous contraction of the lateral and medial pterygoids of both sides

While

Retraction is mainly due to contraction of the posterior horizontal fibres of temporalis muscle



Topography of the skull

Cranial fossae (communications)

Anterior cranial fossa

Nasal cavity – cribriform plate

Middle cranial fossa

Orbit – optic canal, upper orbital fissure;

Pterygopalatine fossa – round foramen;

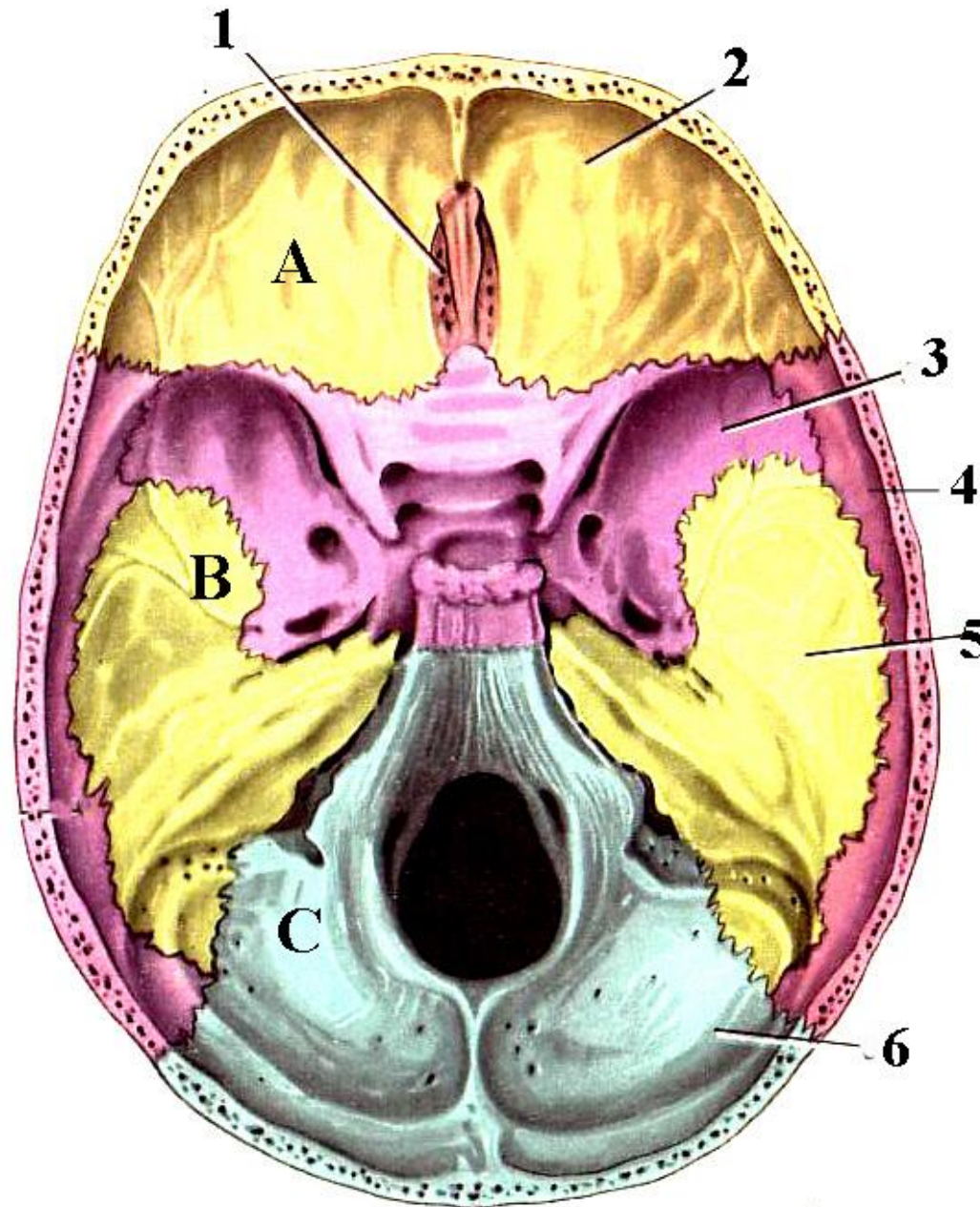
Infratemporal fossa – oval and spinous foramina

Exobase – foramen lacerum

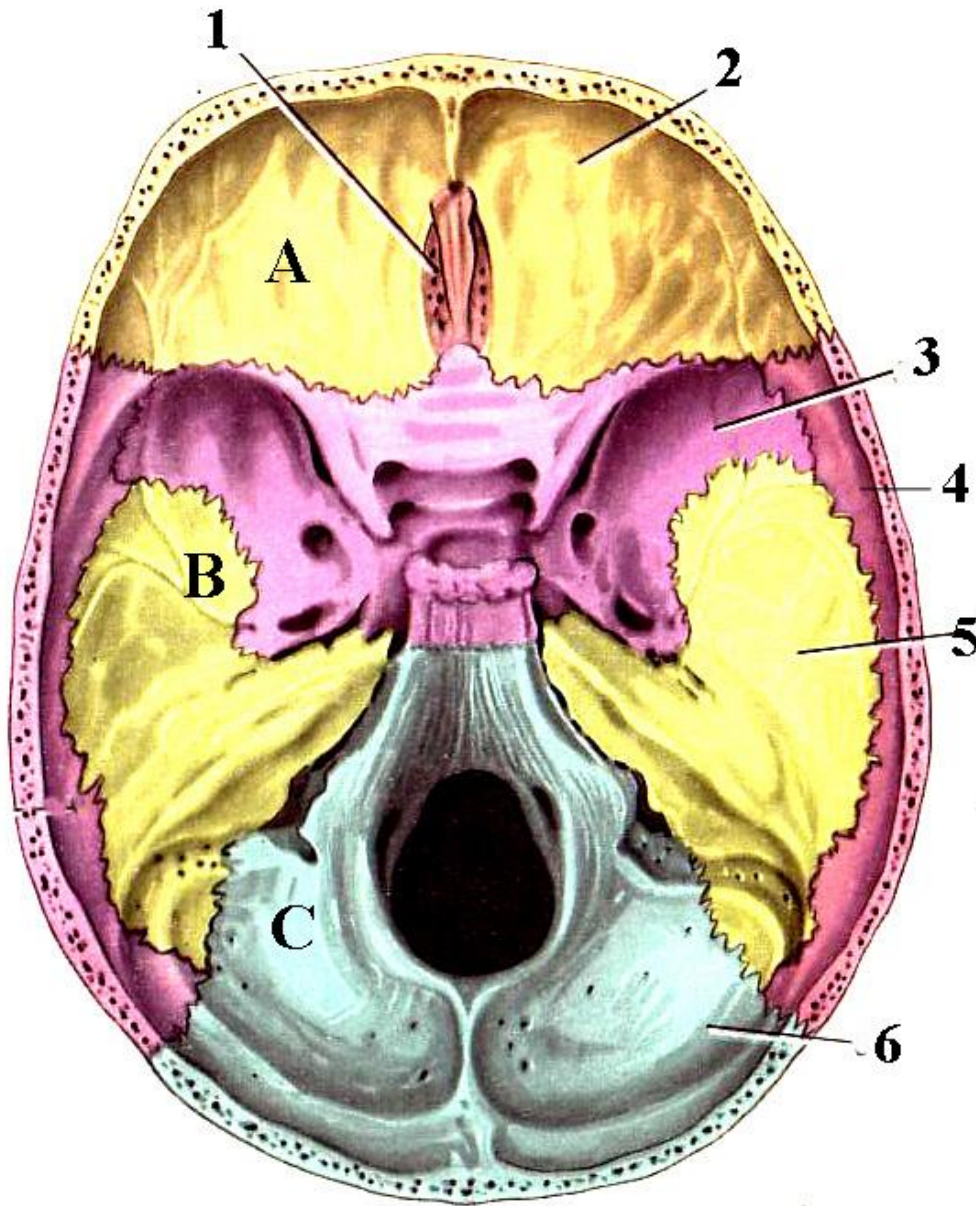
Posterior cranial fossa

Spinal canal – greater occipital foramen;

Exobase – jugular foramen,
canal of hypoglossal nerve



- 1- ethmoid bone;
- 2- frontal bone;
- 3- sphenoid bone;
- 4- parietal bone;
- 5- temporal bone;
- 6- occipital bone.



Anterior cranial fossa

Foramen, its site

- Foramen caecum - *between the frontal crest and crista galli*

- Foramina of the cribriform plate of ethmoid

- Anterior ethmoidal foramen /*a slit alongside the anterior end of crista galli/*

- Posterior ethmoidal foramen /*at the posterolateral corner of cribriform plate/*

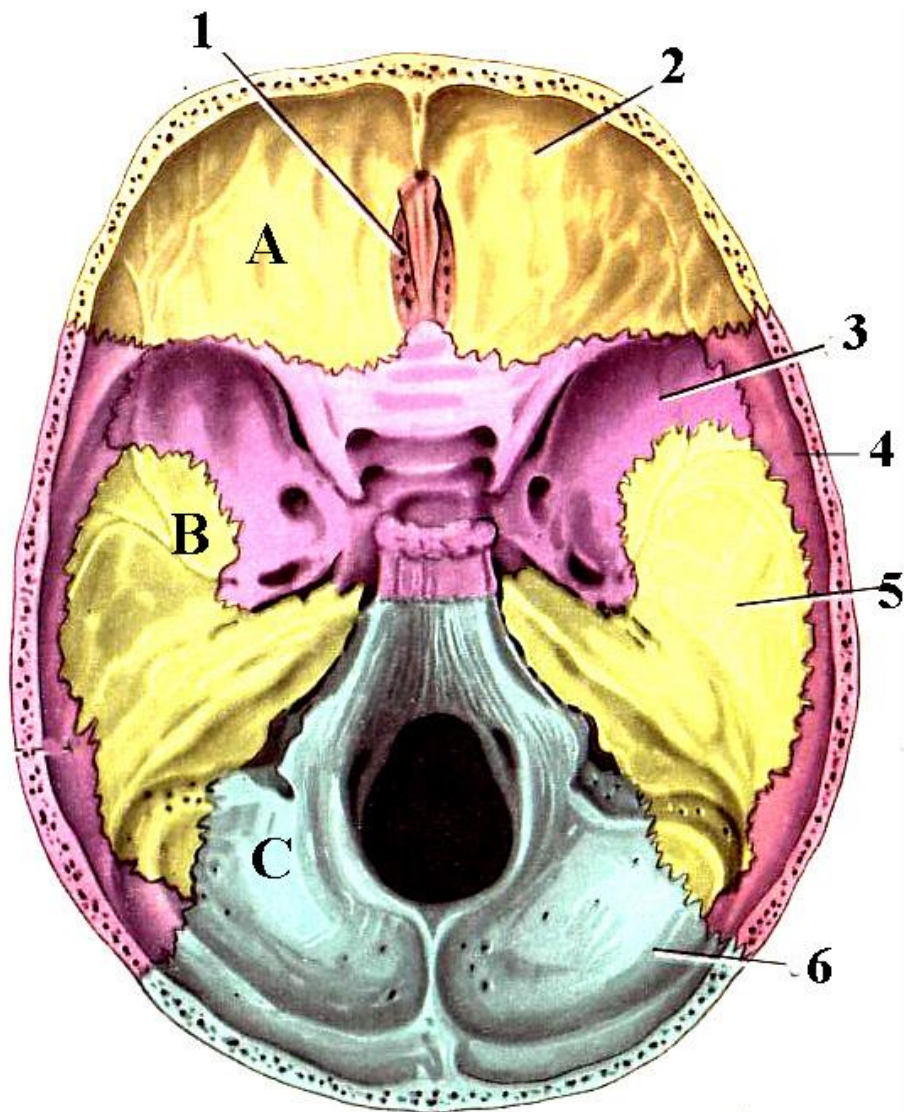
Structures passing

- **usually closed** by fibrous tissue of the falx cerebri,
- sometimes it is patent and transmit an **emissary vein** connecting the superior sagittal sinus with the nasal veins.

- **olfactory nerves**

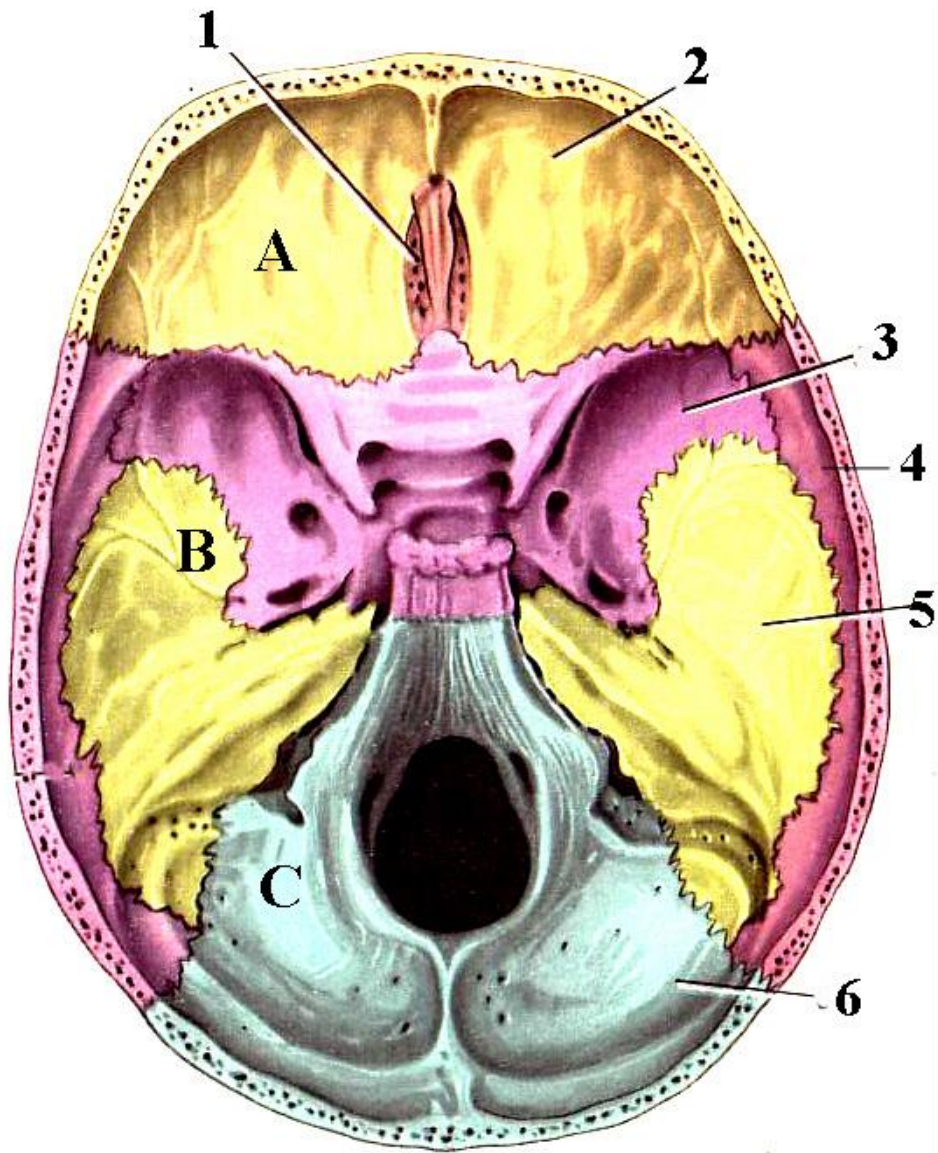
- **anterior ethmoidal nerve and vessels**

- **posterior ethmoidal nerve and vessels**



Middle cranial fossa

Foramen, its site	Opens into	Structures passing
<ul style="list-style-type: none"> • Optic canal /at the base of the lesser wings/ 	<ul style="list-style-type: none"> • Orbit 	<ul style="list-style-type: none"> •optic nerve (I) •ophthalmic artery
<ul style="list-style-type: none"> • Foramen lacerum /in front of the apex of petrous part/ 	<ul style="list-style-type: none"> • Middle part of the exobase 	<ul style="list-style-type: none"> •internal carotid artery •meningeal branch of the ascending pharyngeal artery •emissary vein from the cavernous sinus to the pterygoid venous plexus
<ul style="list-style-type: none"> • Superior orbital fissure /between the lesser and greater wings/ 	<ul style="list-style-type: none"> • Orbit 	<ul style="list-style-type: none"> •oculomotor nerve (III) •trochlear nerve (IV) •ophthalmic nerve (Ist branch of V) •abducent nerve (VI) •ophthalmic veins • maxillary nerve (IInd branch of V)
<ul style="list-style-type: none"> • Foramen rotundum /behind the medial end of the superior orbital fissure/ 	<ul style="list-style-type: none"> •Pterygopalatine fossa 	
<ul style="list-style-type: none"> • Foramen ovale /behind foramen rotundum/ 	<ul style="list-style-type: none"> •Infratemporal fossa 	<ul style="list-style-type: none"> • mandibular nerve (IIIrd branch of V)
<ul style="list-style-type: none"> • Foramen spinosum 	<ul style="list-style-type: none"> •Infratemporal fossa 	<ul style="list-style-type: none"> •middle meningeal artery



Posterior cranial fossa

Foramen, its site	Structures passing
<ul style="list-style-type: none"> Internal auditory meatus /on the posterior surface of the pyramid of temporal bone/ 	<ul style="list-style-type: none"> facial nerve (VII) vestibulocochlear nerve (VIII) internal auditory vessels
<ul style="list-style-type: none"> jugular foramen /at the posterior end of the petro-occipital fissure/ 	<ul style="list-style-type: none"> internal jugular vein glossopharyngeal nerve (IX) vagus nerve (X) accessory nerve (XI)
<ul style="list-style-type: none"> Hypoglossal canal /below and medially to the jugular foramen/ 	<ul style="list-style-type: none"> the hypoglossal nerve (XII)
<ul style="list-style-type: none"> Condylar canal /behind the occipital condyle/ 	<ul style="list-style-type: none"> condylar emissary vein
<ul style="list-style-type: none"> Foramen magnum 	<ul style="list-style-type: none"> lower end of the medulla oblongata
<ul style="list-style-type: none"> Mastoid foramen /opens into the posterior part of the sigmoid sinus/ 	<ul style="list-style-type: none"> mastoid emissary vein

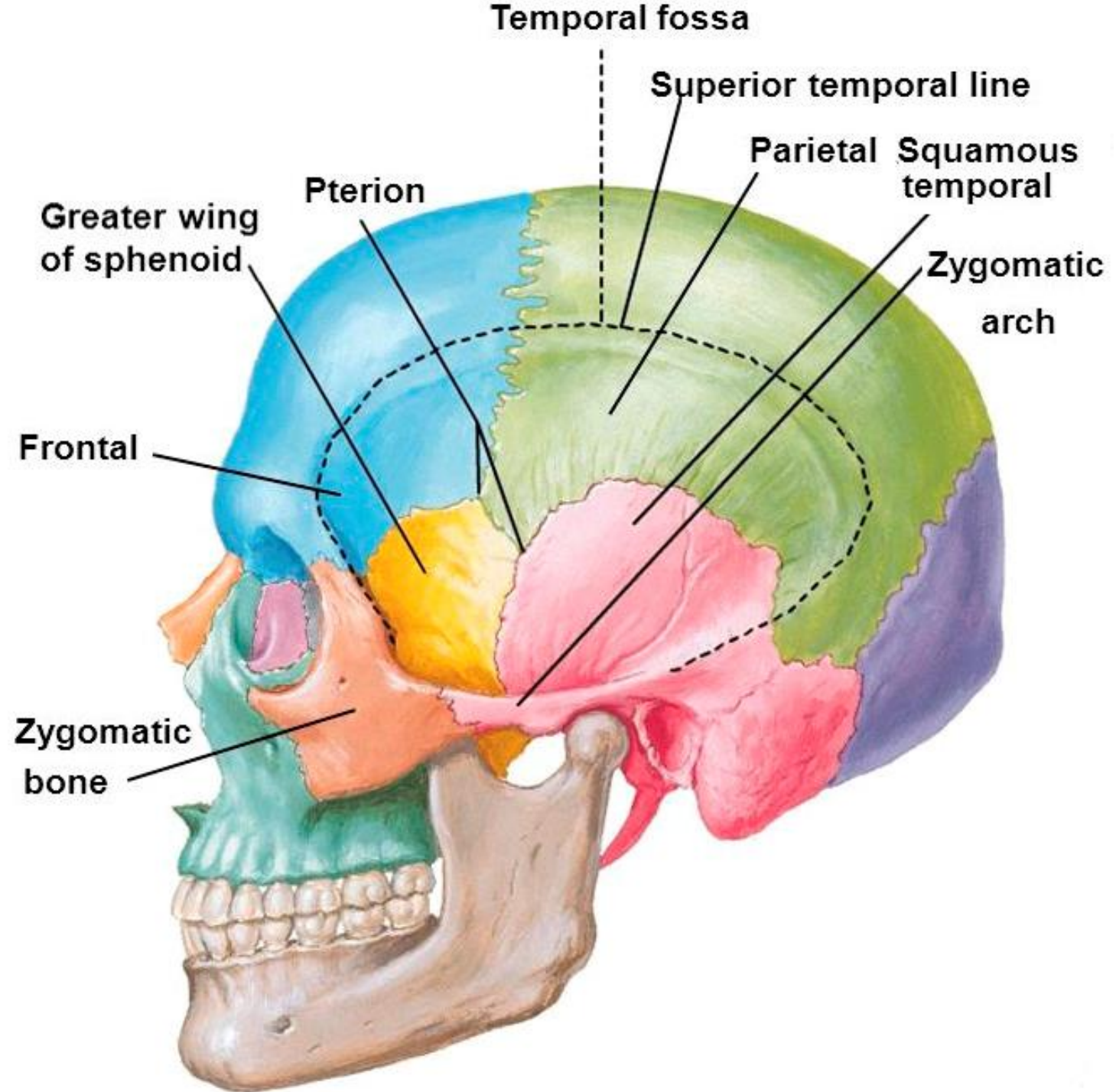
Temporal fossa

Limits:

- above and behind – *superior temporal line*;
- below – *zygomatic arch*;
- anteriorly – *frontal process of zygomatic bone*.

Communication:

- *infratemporal fossa*.



Infratemporal fossa

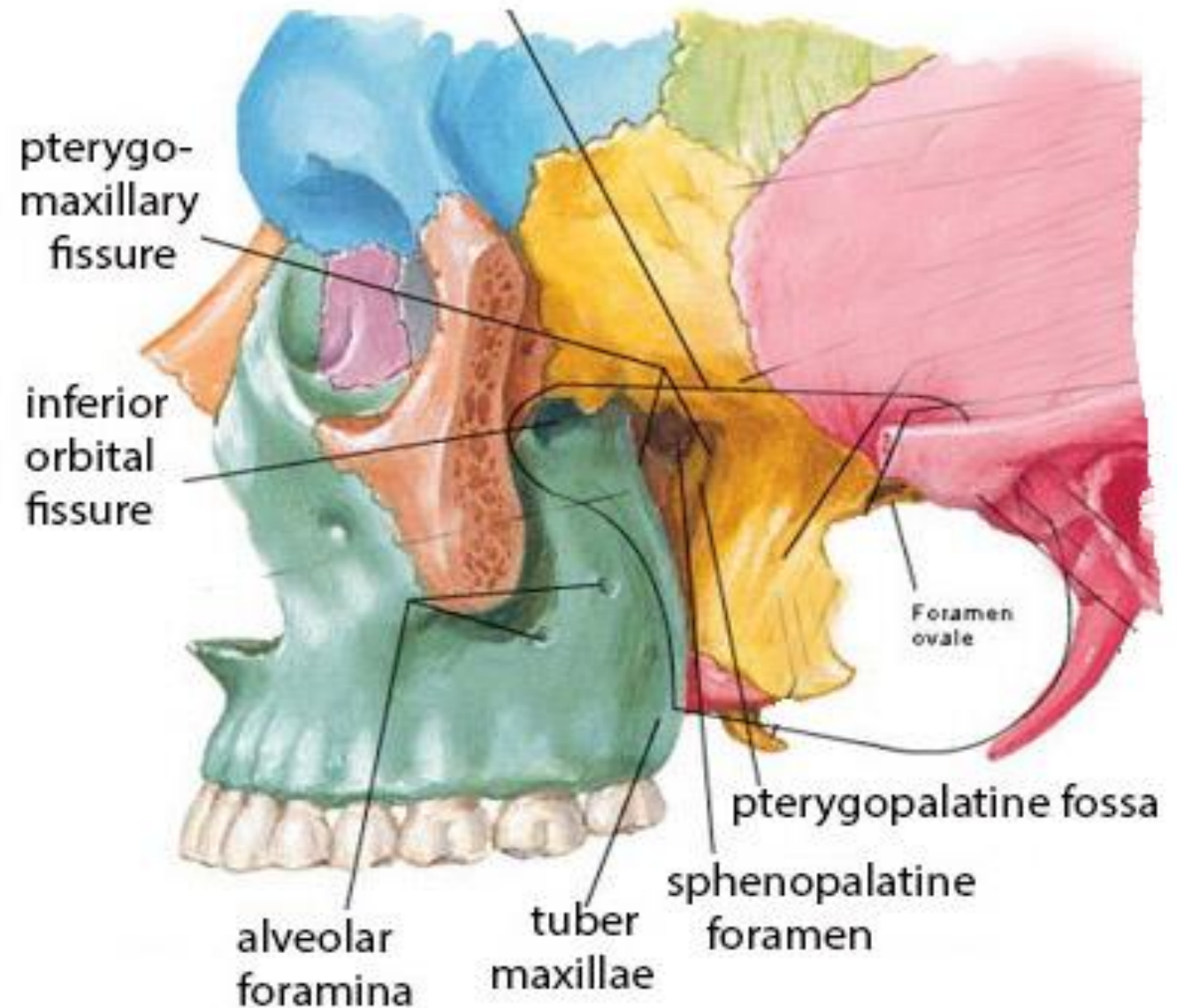
Limits:

anteriorly – *tuber of maxilla*;
medially – *lateral pterygoid plate*;
laterally – *branch of mandible*.

Communications:

temporal fossa – through the gap deep to the zygomatic arch;
pterygopalatine fossa – pterygomaxillary fissure;
middle cranial fossa – oval and spinous foramina.

INFRATEMPORAL FOSSA
exposed by removal of zygomatic arch
and ramus of the mandible



Limits:

Anterior – *tuber of the maxilla;*

Posterior – *pterygoid process;*

Medial – *perpendicular plate of palatine.*

Communications:

Orbit – inferior orbital fissure;

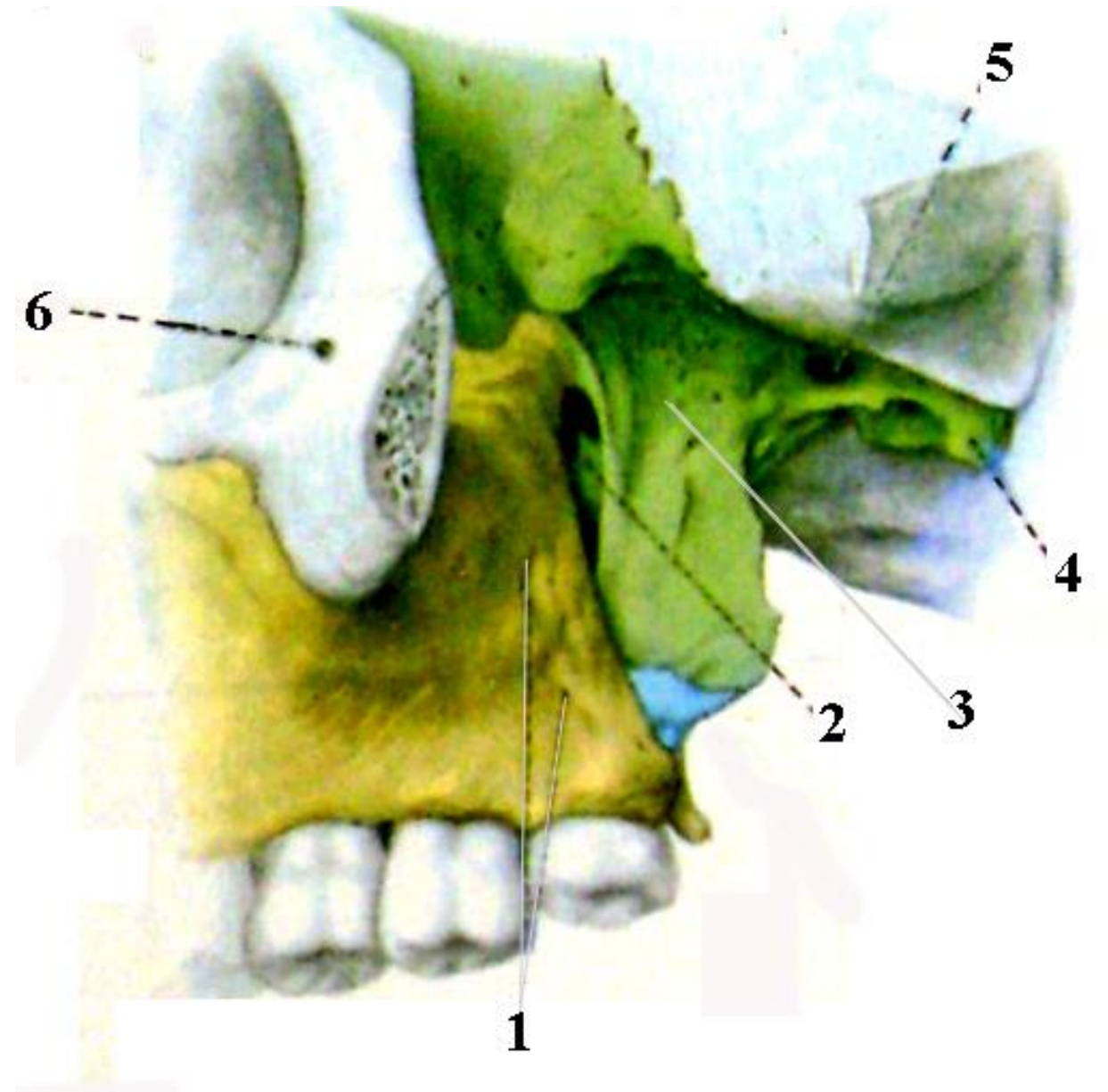
Nasal cavity – sphenopalatine foramen;

Oral cavity – greater palatine canal;

Middle cranial fossa – round foramen;

Exobase of the skull – pterygoid canal.

Pterygopalatine fossa



The orbits = eyesockets

Boundaries:

Upper: orbital part of frontal bone,
lesser wing of sphenoid.

Lower: orbital surface of the maxilla,
zygomatic bone
orbital process of palatine bone.

Laterally: zygomatic bone,
greater wing of sphenoid,
zygomatic process of the frontal bone.

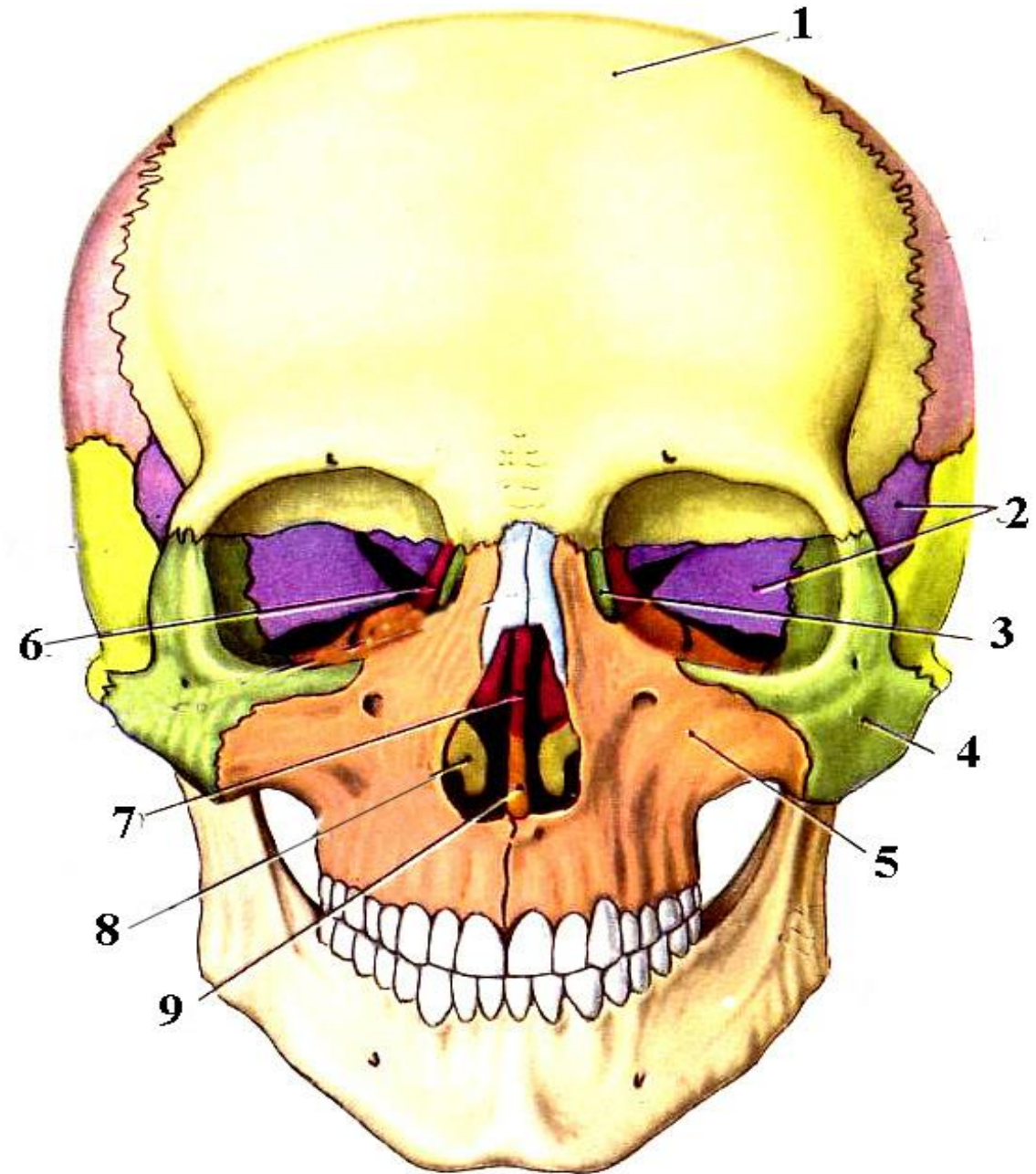
Medially: frontal process of maxilla,
lacrimal bone,
orbital plate of ethmoid,
body of sphenoid

Communications:

Cranial cavity – optic canal, upper orbital fissure,
anterior ethmoid foramen.

Infratemporal and pterygopalatine fossae -
lower orbital fissure;

Nasal cavity – nasolacrimal canal,
posterior ethmoid foramen.



Nasal cavity

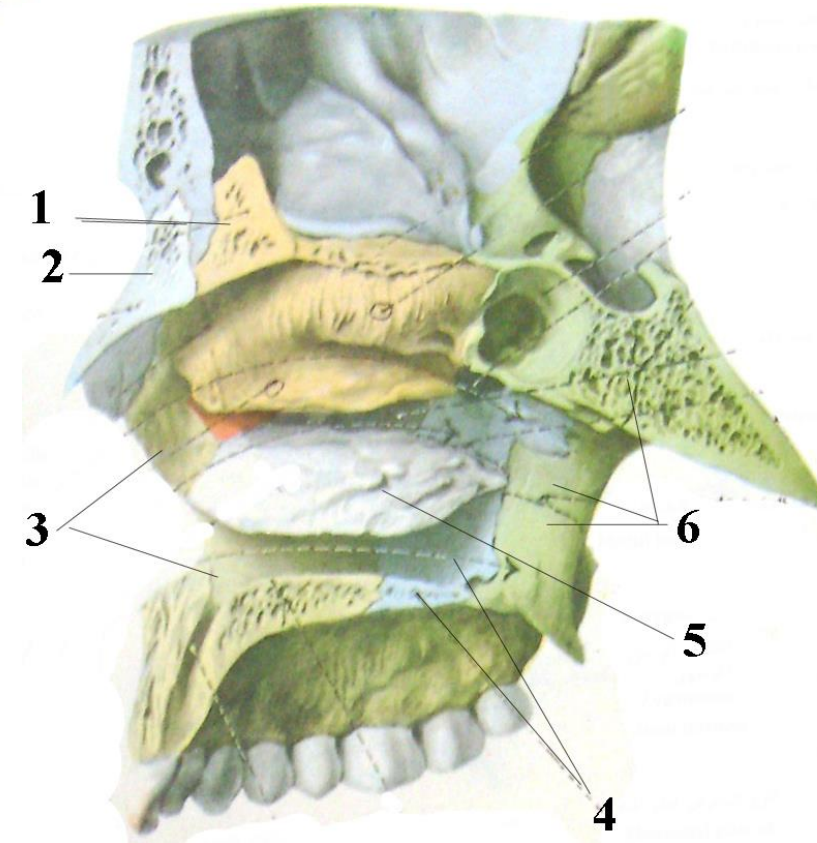
Boundaries:

Upper: nasal bone,
nasal part of frontal bone,
cribriform plate of the ethmoidal bone
body of sphenoid.

Lower: palatine process of the maxilla,
horizontal plate of palatine bone.

Laterally: nasal bone,
frontal process of maxilla,
lacrimal bone,
lower nasal concha,
ethmoid labyrinth,
perpendicular plate of the palatine bone,
medial plate of pterygoid process.

Medially:
vomer
perpendicular plate of ethmoid



Communications of the nasal cavity

Superior nasal meatus:

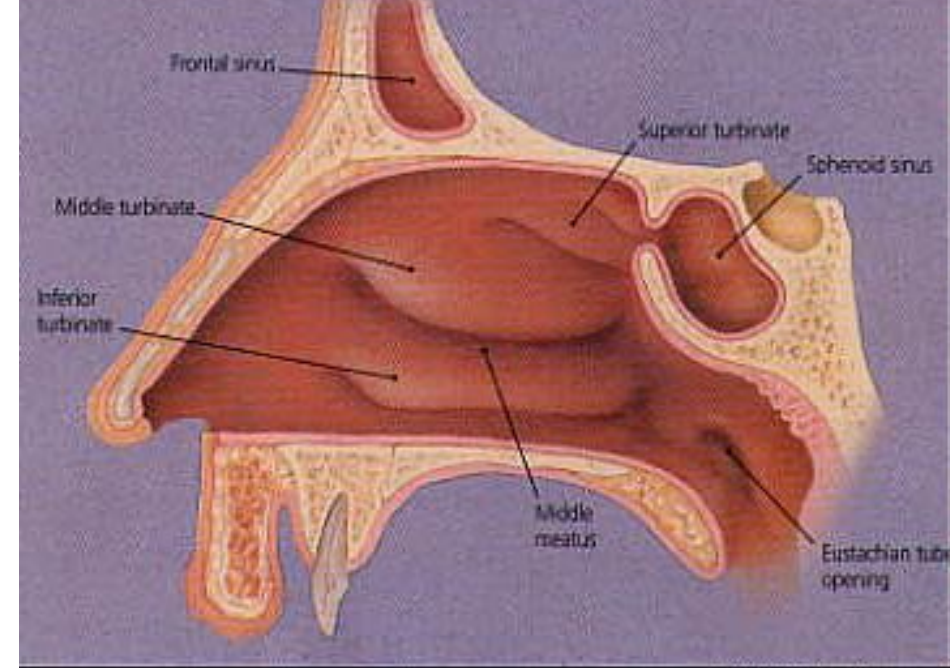
- 1)posterior ethmoid sinus -posterior ethmoid air cells,
- 2)sphenoid sinus,
- 3)anterior cranial fossa – cribriform plate,
- 4)pterygopalatine fossa -sphenopalatine foramen .

Middle nasal meatus:

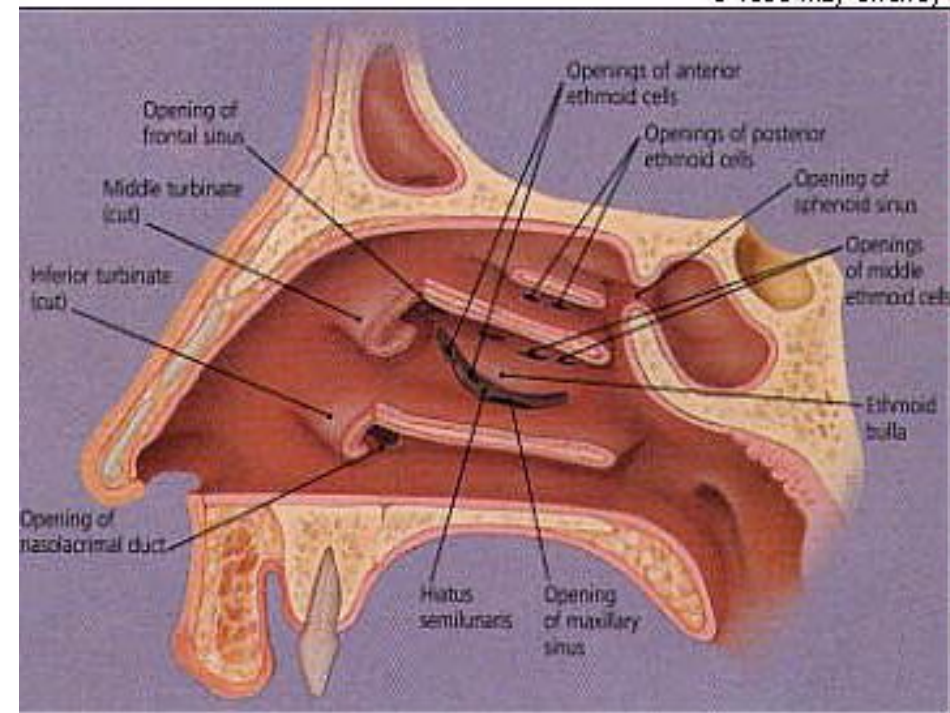
- 1)middle and posterior ethmoid sinuses,
- 2)frontal sinus- ethmoidal infundibulum,
- 3)maxillary sinus - semilunar hiatus.

Inferior nasal meatus:

- 1)the orbit – nasolacrimal duct,
- 2)oral cavity - incisive canal.



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End