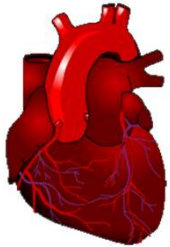


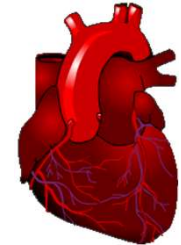


Systematic Anatomy

Locomotor system - Part 2



Articulation of trunk bones

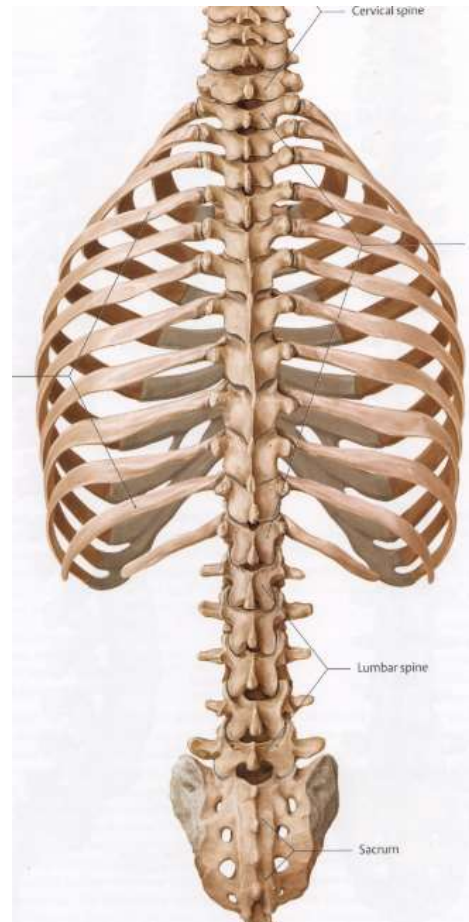


Cranial bones and their articulation

Dr.& Prof. Hongqi Zhang (张红旗)

Email: zhanghq58@126.com

Bones of the trunk - 51



Trunk bones 51 in adult

Vertebrae 24

Cervical 7

Thoracic 12

Lumbar 5

Sacrum 1

Coccyx 1

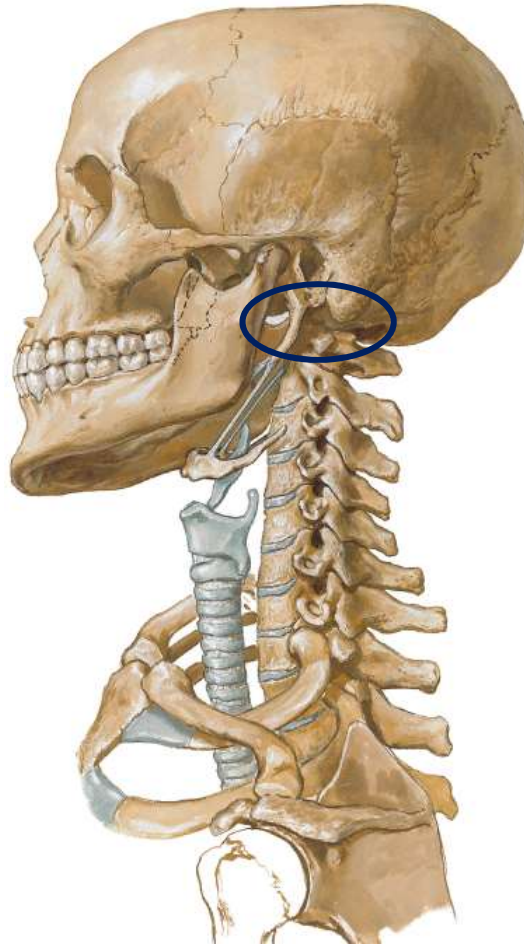
Sternum 1

Rib 24

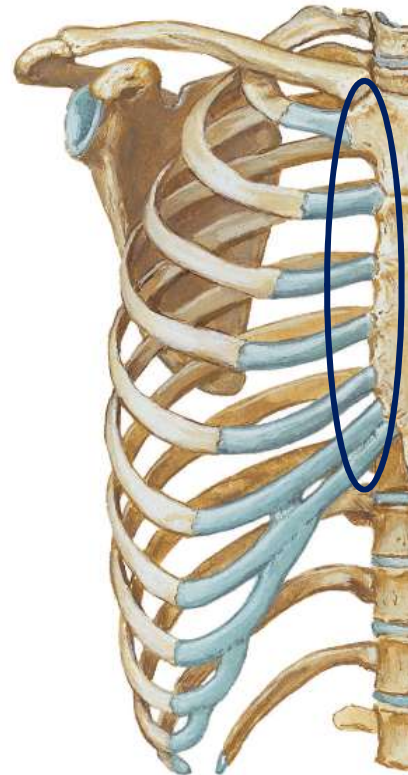
The joints of bones of the trunk



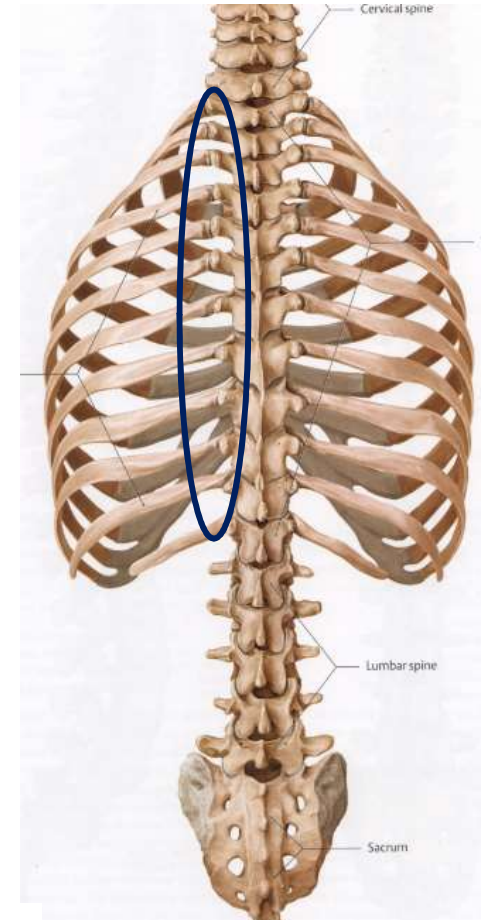
Ant.view



Lat.view



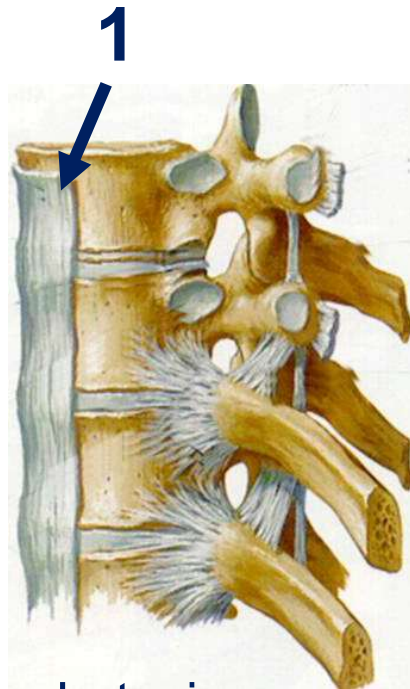
Ant.view of
thoracic cage 3



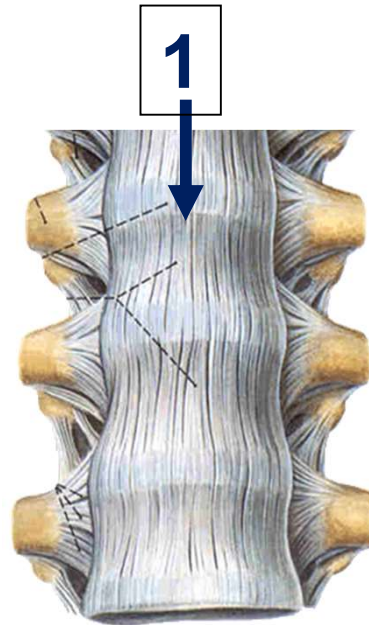
Post.view of
thoracic cage

Combination associated with vertebral body

- 1- **Ant.longitudinal lig.** (From foramen magnum to the $S_1 \sim S_2$)
- 2- **Post.longitudinal lig.** (From C_2 to sacrum)
- 3- **Intervertebral disc** (23). - between neighbouring vertebral bodies



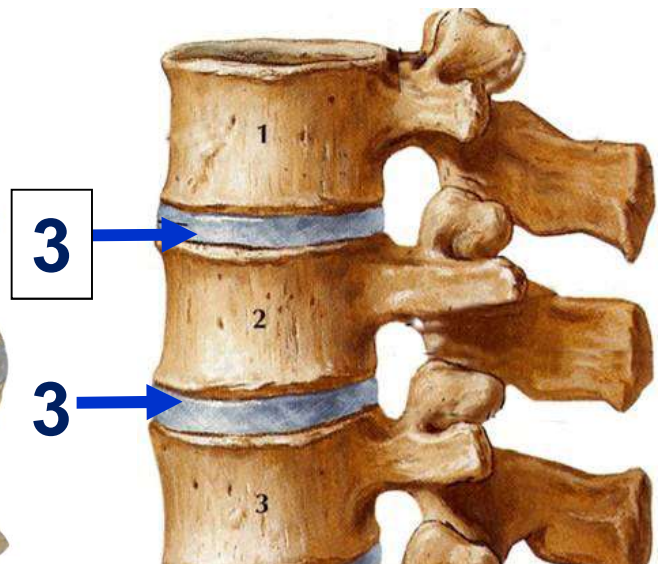
Lat. view



Ant. view



Post.view
Body removed

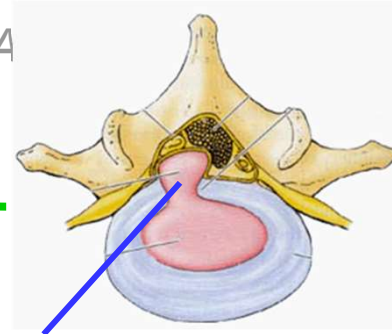


Lat view

Intervertebral disc

ent of A

iversity



Between vertebral bodies

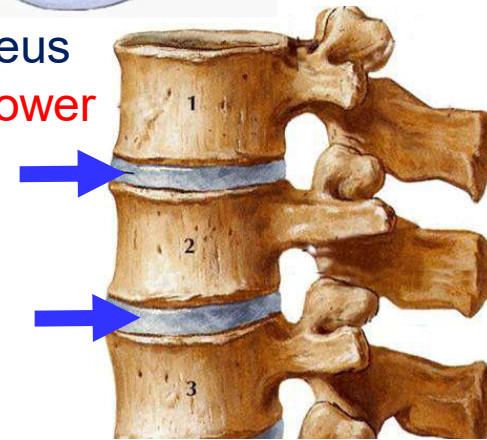
Nucleus pulposus

An inner soft, pulpy,
Highly elastic structure

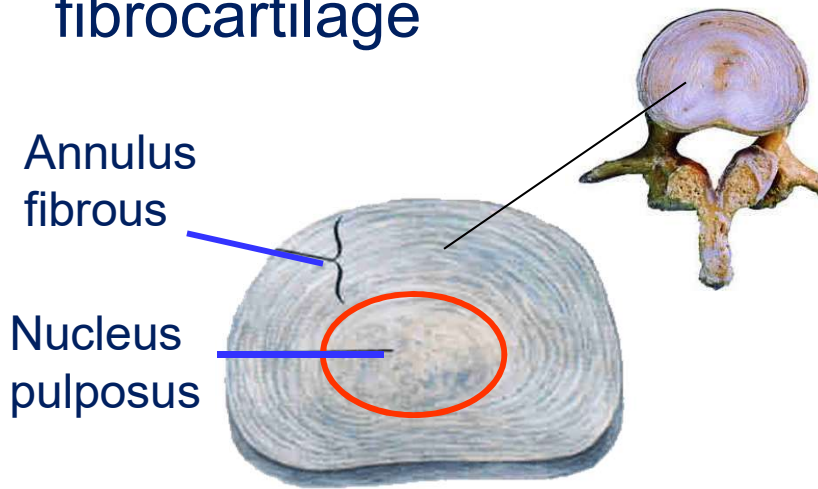
Anulus fibrosus

An outer fibrous ring consisting of
fibrocartilage

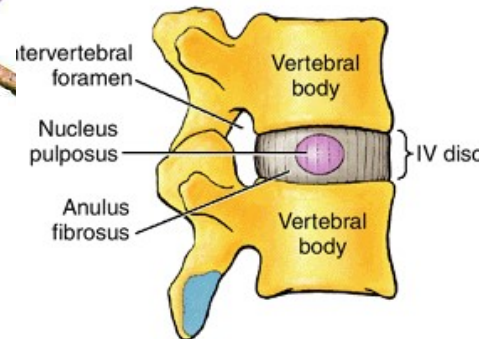
Protrusion of nucleus
pulposus result in **lower
back pain**



Lat. view

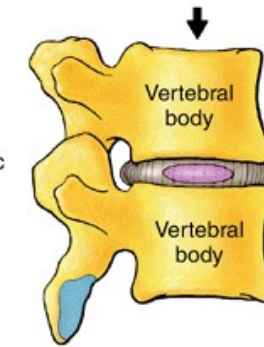


Intervertebral disc

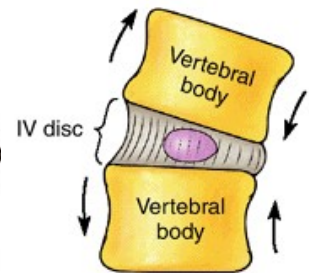


D Lateral view of disc when recumbent

On the bed



E Lateral view of disc when erect (weight bearing)

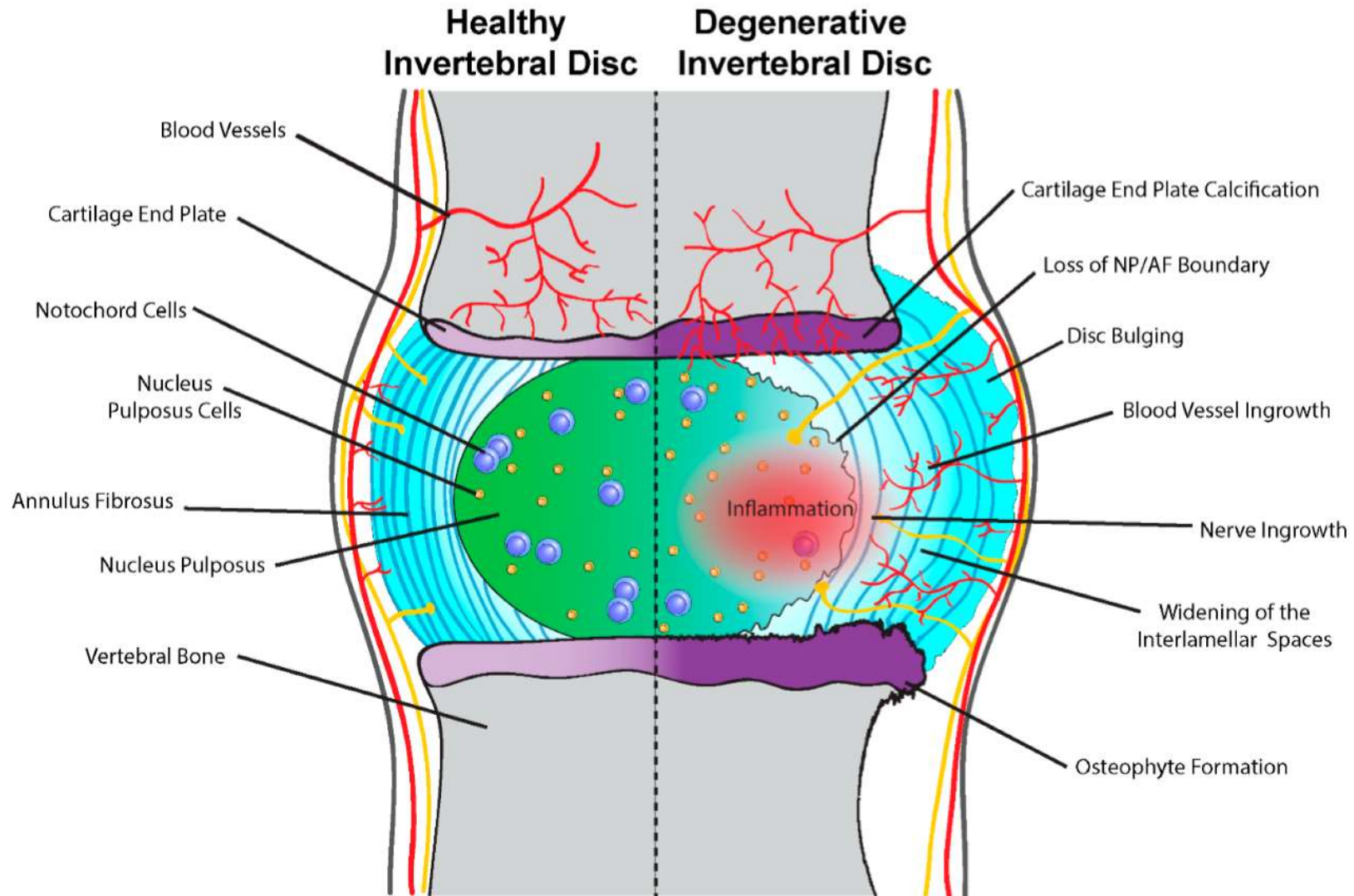


F Anterior view during lateral flexion

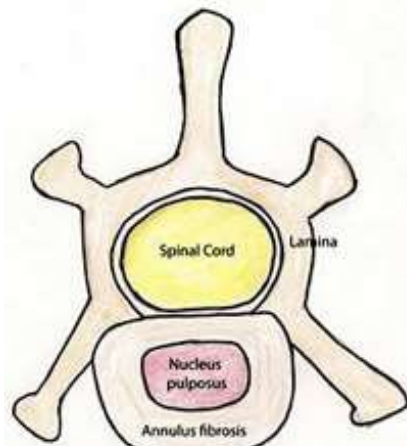
Lat. view

sity

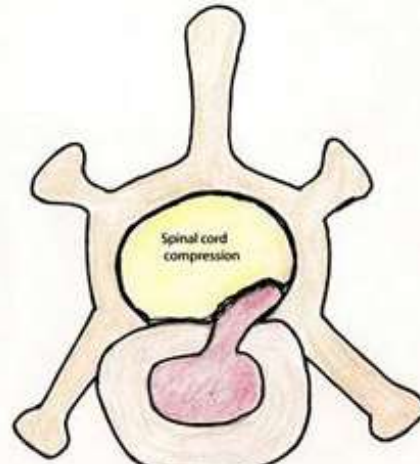
Healthy & degenerative intervertebral disc



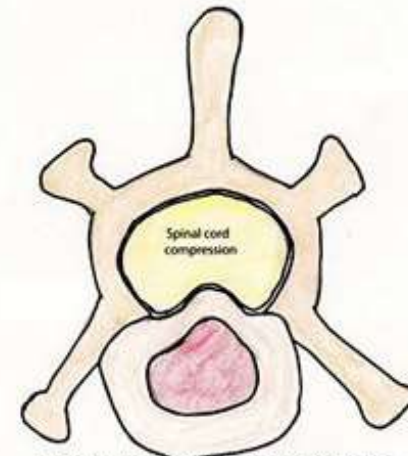
Intervertebral disc



Normal Intervertebral Disc

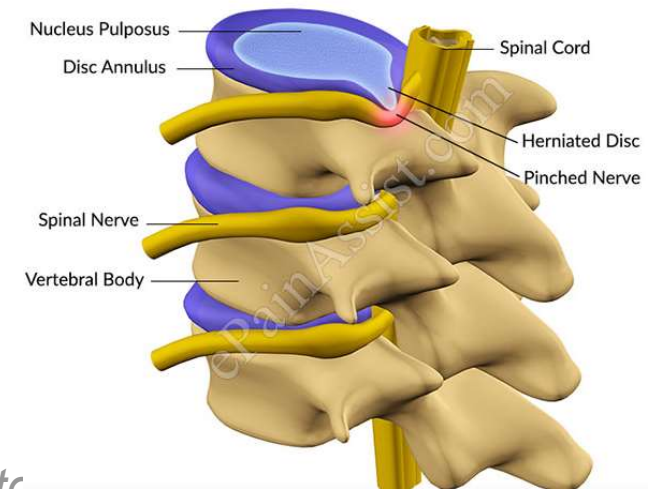
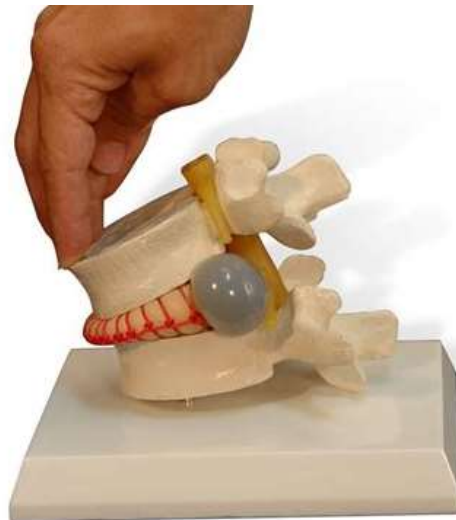
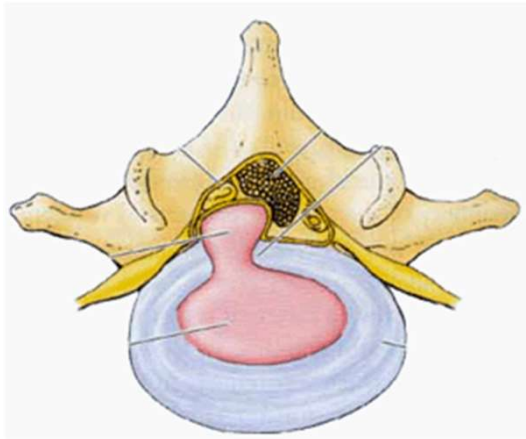


Type I Hansen's Disc Herniation



Type II Hansen's Disc Herniation

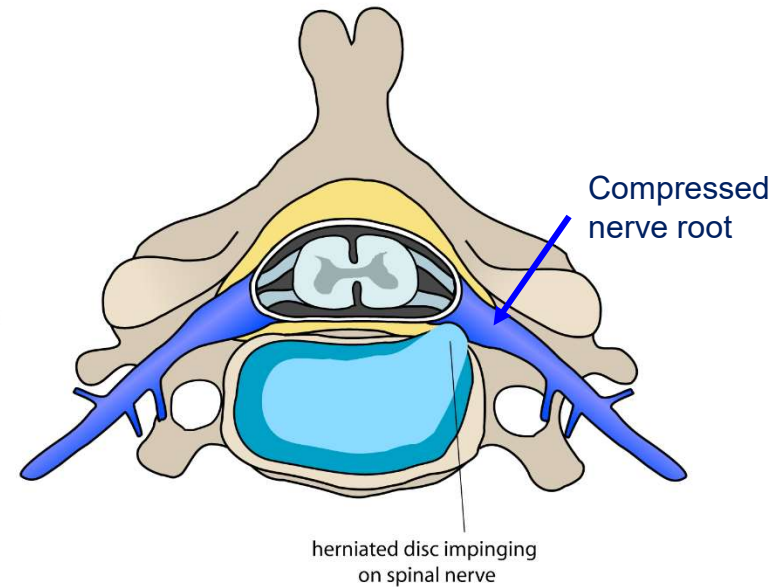
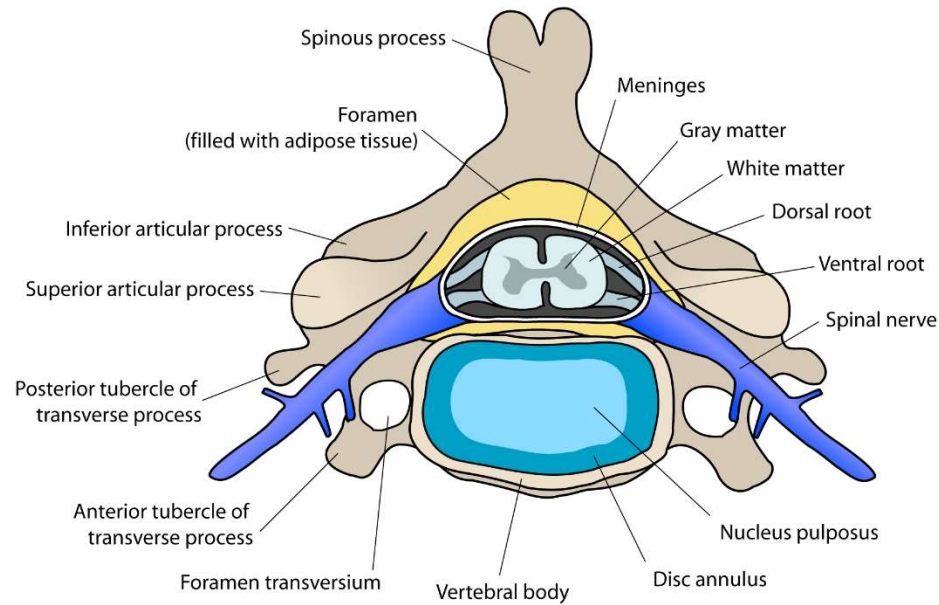
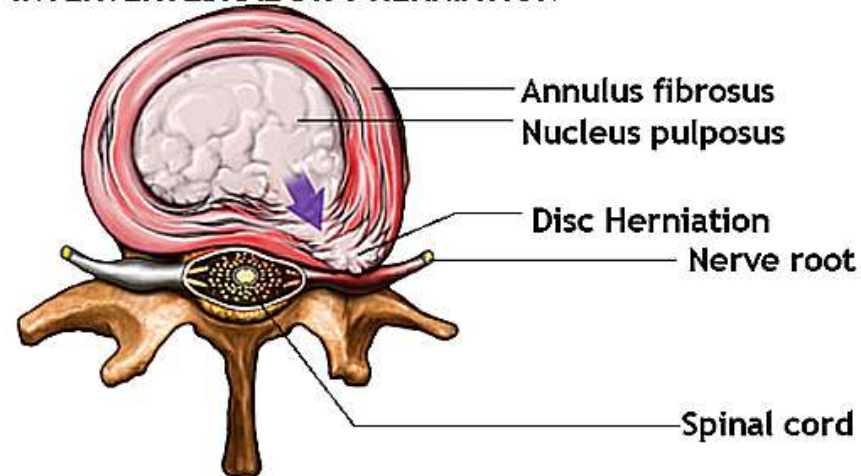
Intervertebral Disc Herniation



Intervertebral disc



INTERVERTEBRAL DISC HERNIATION



Function of ant.post longitudinal lig. & vertebral disc

◆ Ant.longitudinal lig.

Maintains **stability** of intervertebral disc & bodies

Prevents **hyperextension** of the vertebral column

◆ Post.longitudinal lig.

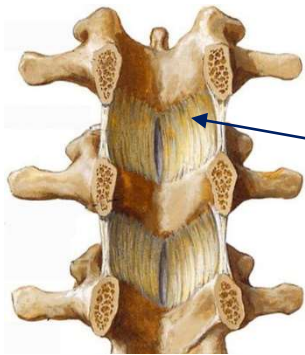
Prevents **hyperflexion** of the vertebral column and post.
protrusion of the discs

◆ Intervertebral disc.

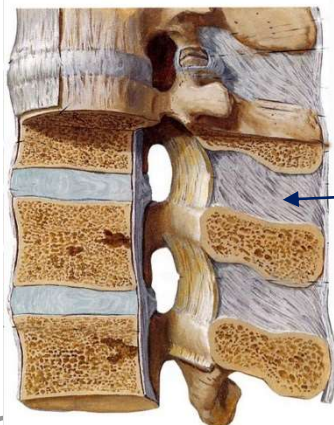
Make the movement of vertebral column **flexible**
and make the vertebral column with **elasticity**.

Lig. associated with vertebral arch & processes

1. Yellow lig.(ligamenta flava)
2. Intertransverse lig.
3. Interspinous lig.
4. Supraspinous lig.



Ant.view of vertebral canal
Vertebral bodies removed



Lat.view (half body removed)

Ligamentum flavum

Intertransverse ligament

Interspinous lig.

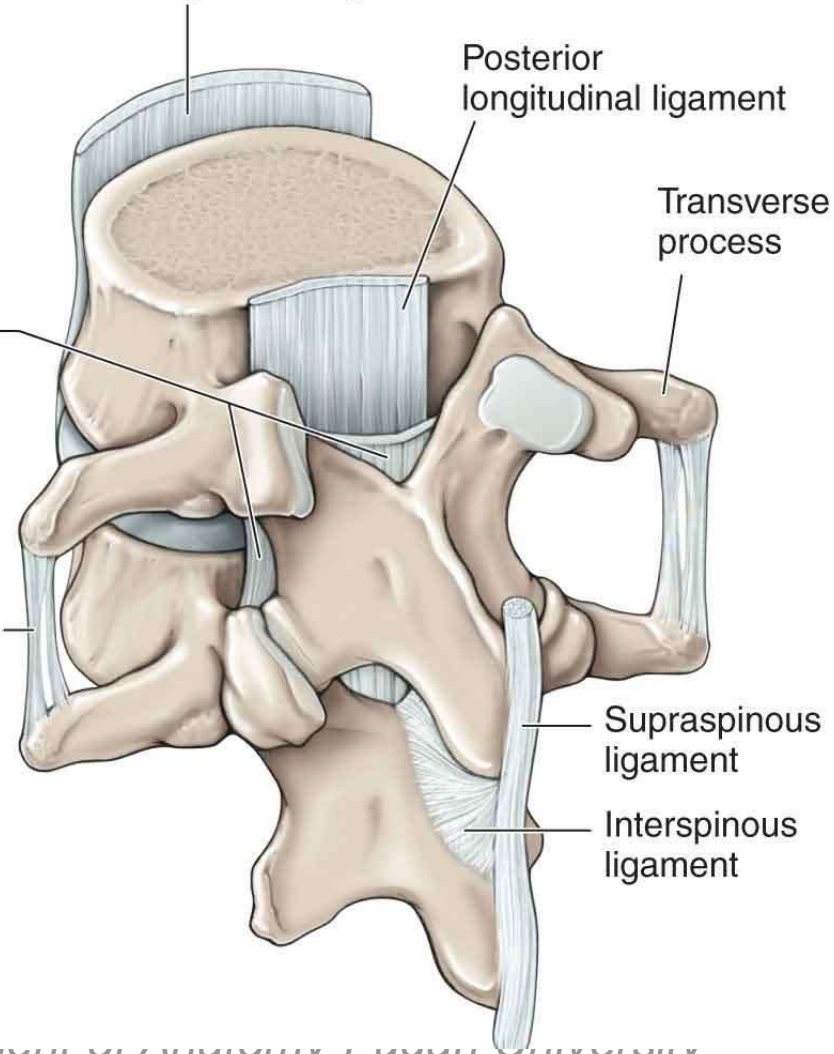
Anterior longitudinal ligament

Posterior longitudinal ligament

Transverse process

Supraspinous ligament

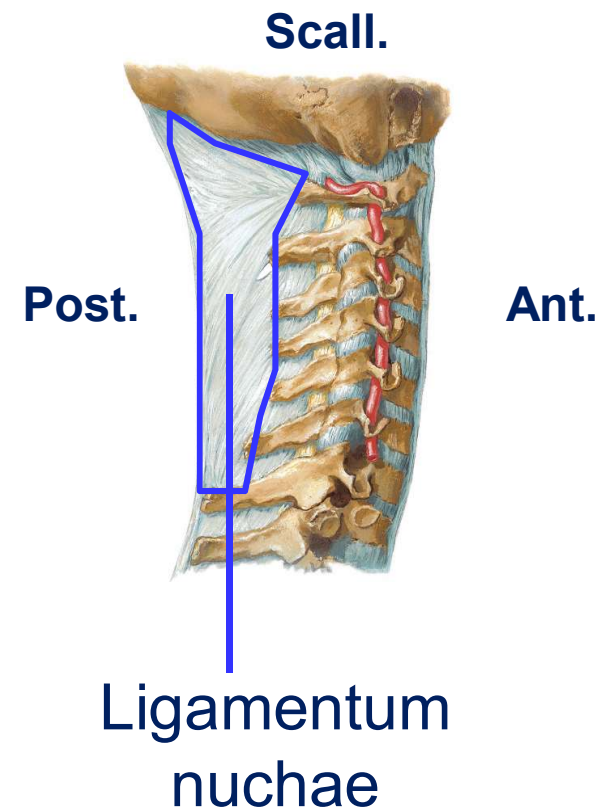
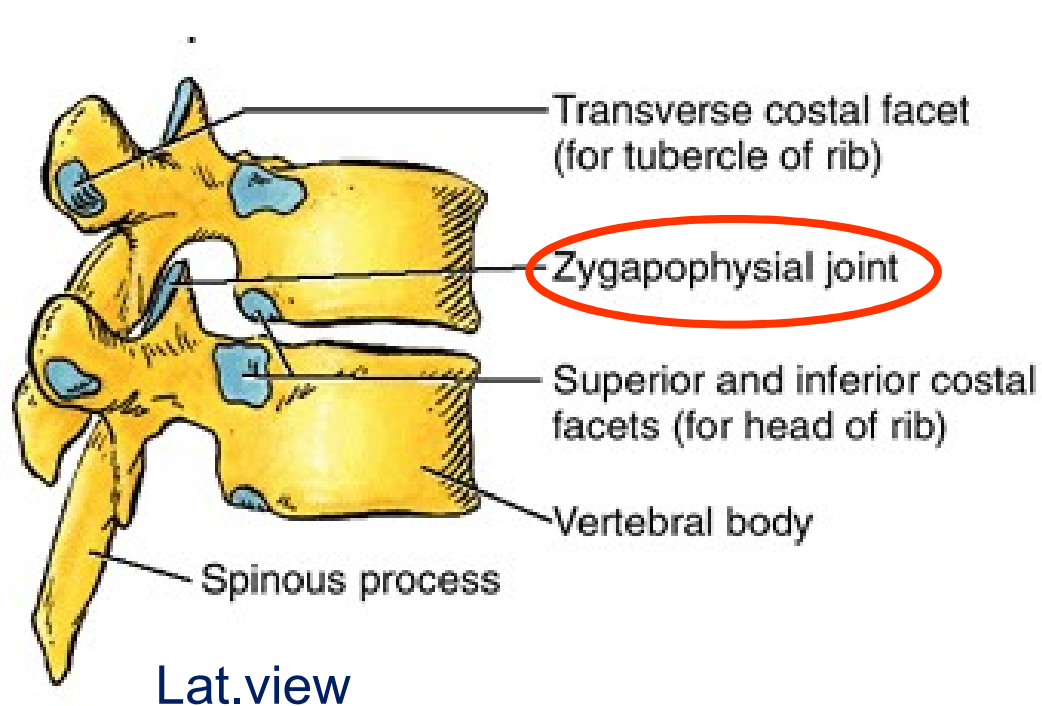
Interspinous ligament



Lig. & joints associated with vertebral arch

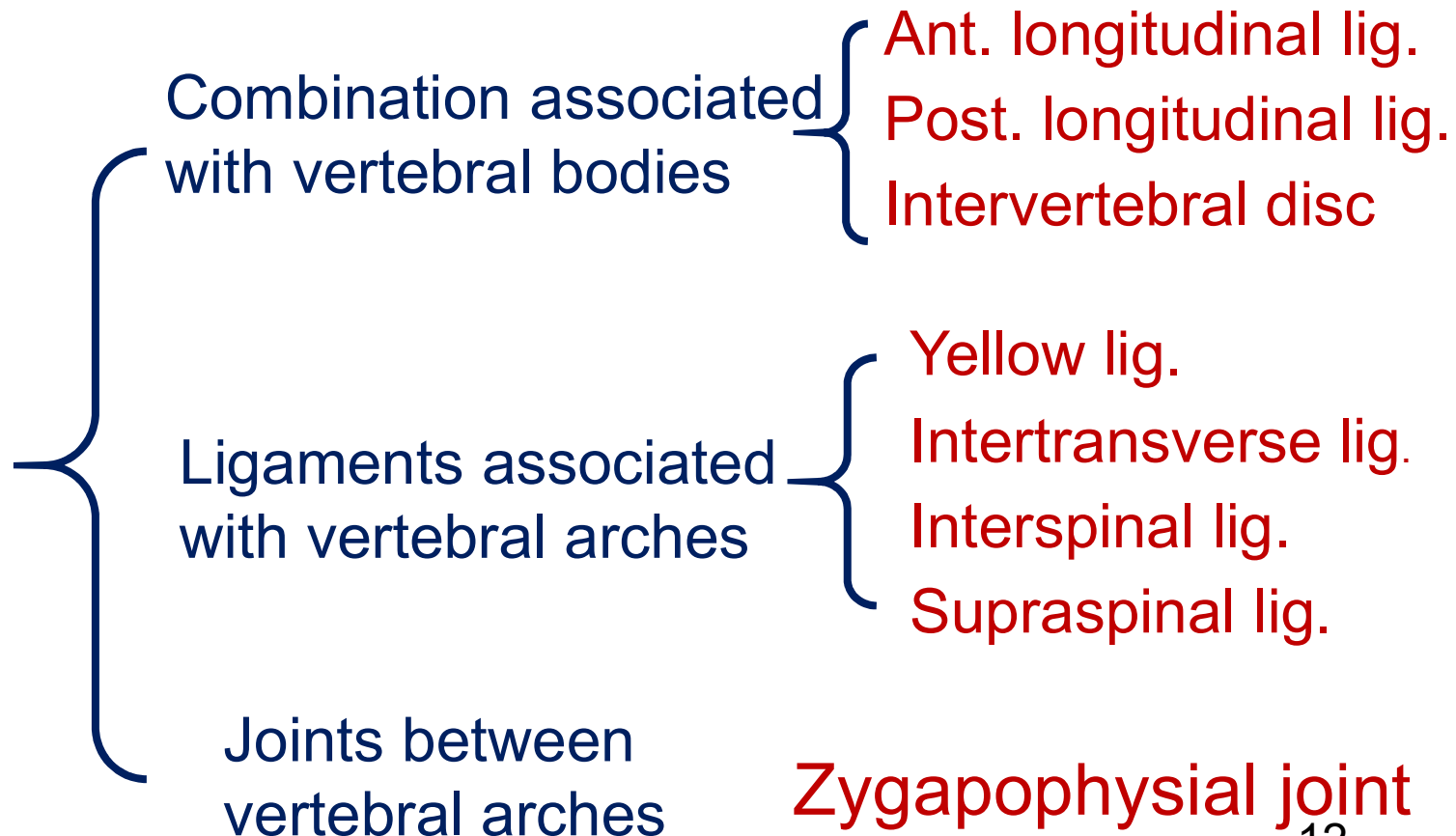
Ligamentum nuchae - Superspinous lig. in the neck

Zygapophysial joints - Between sup. & inf. articular process



Summary of Intervertebral combination

Ligaments, joints and intervertebral disc



The view of the spinal column as a whole



Bones + joints

Related bones are joined together by lig, disc & joint between intervertebral arch.

About 70cm in male adult, female (60cm) .
intervertebral discs = $\frac{1}{4}$ (column). After the adult, length of column become shorter (with age) .

Lat.view Post.view Ant.view

Ant. and post. view of the spinal column



Anterior view

The vertebral increase in size from top to bottom (because of increasing weight.)
At 2nd sacral vertebrae - become small.
Slightly **convex** backward

Posterior view

All the spinous process like a continuous crest, **cervical** spinous process is bifid.
Spinous process of **thoracic** vertebrae are pointing to posterior downward sloping.



Copy

Lateral view of the spinal column

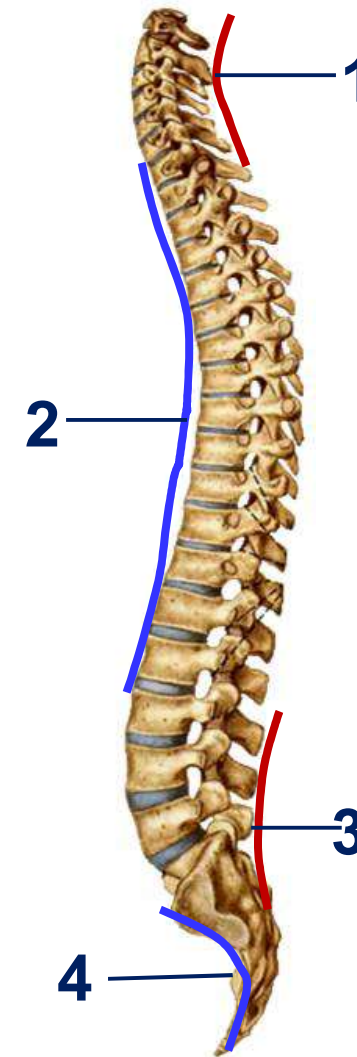
rsity

Four physiological curvature exist in adult

- 1 - Cervical curvature- convex forward
- 2 - Thoracic curvature-convex backward
- 3 - Lumbar curvature-convex forward
- 4 - Sacral curvature- convex backward

Movement of the vertebral column

1. Flexion
2. Extension
3. Lateral flexion
4. Rotation



15

Lat.view

Physical curvatures of the spinal column

At birth-two curvature only

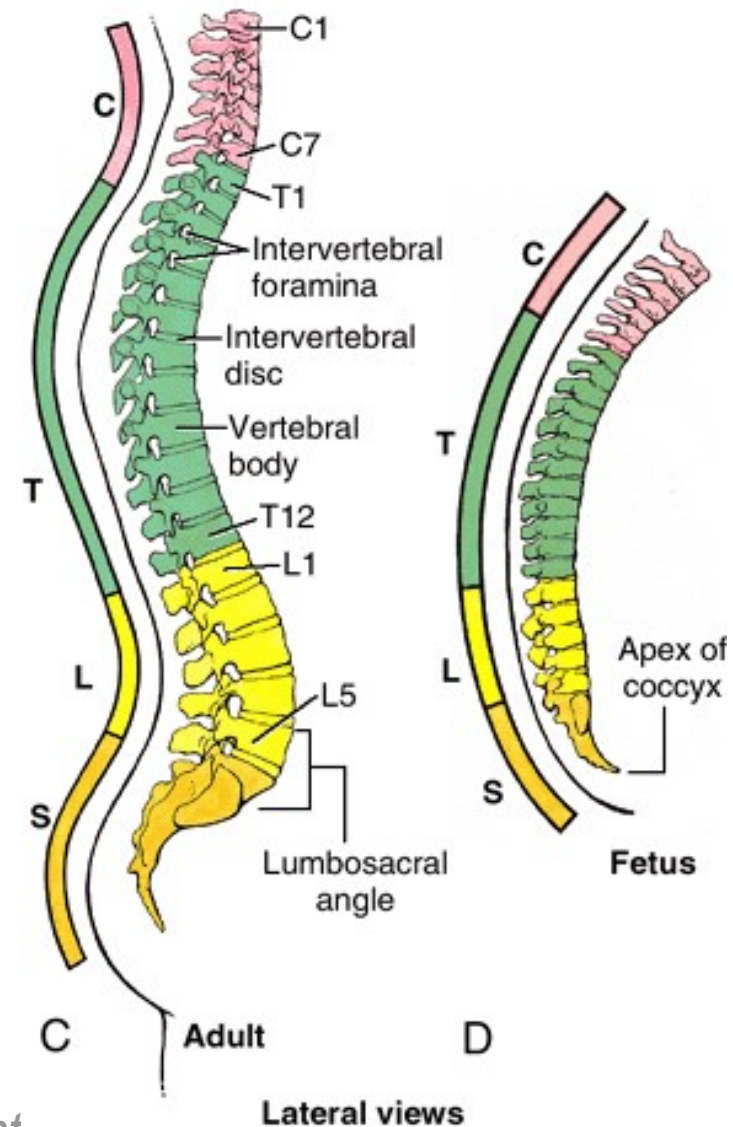
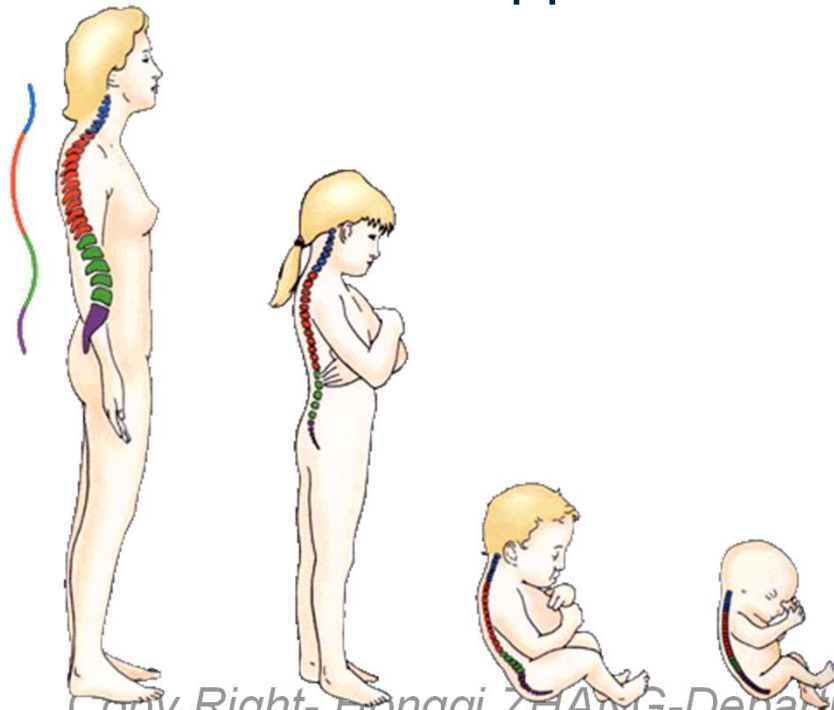
Thoracic curvature, Sacral curvature

When to begin to raise the head

Cervical curvature appear

When to begin to stand

Lumbar curvature appear



Thoracic cage

Composition

Bones + their articulations

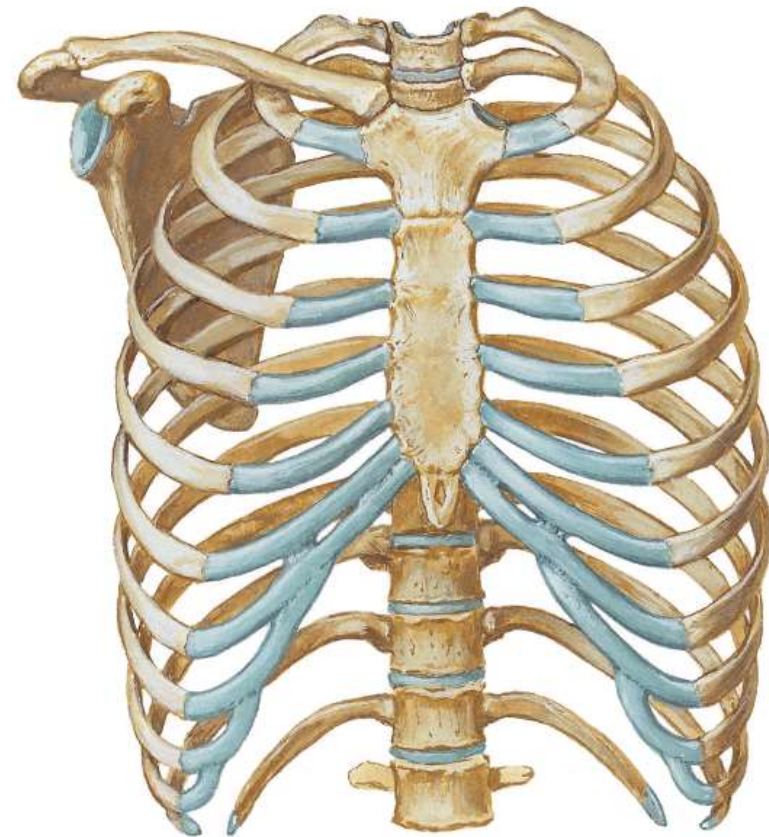
Bone:

- 12 Thoracic vertebrae,
- 12 Pairs of ribs
- 1 Sternum.

Joint:

- 1-Sternocostal joints
- 2-Costotransverse joints
- 3-Costal head joint

Bony Framework of Thorax
Anterior view



Ant.view of thoracic cage

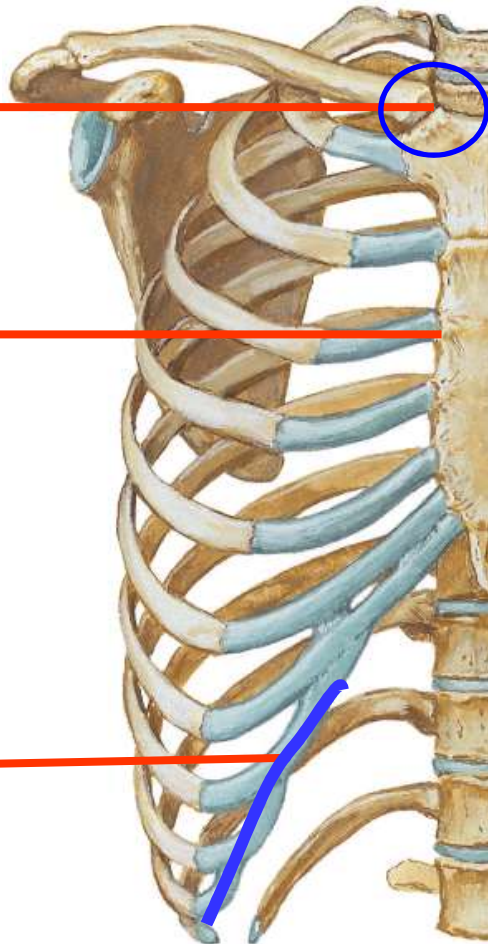
Thoracic cage

Sternoclavicular joint

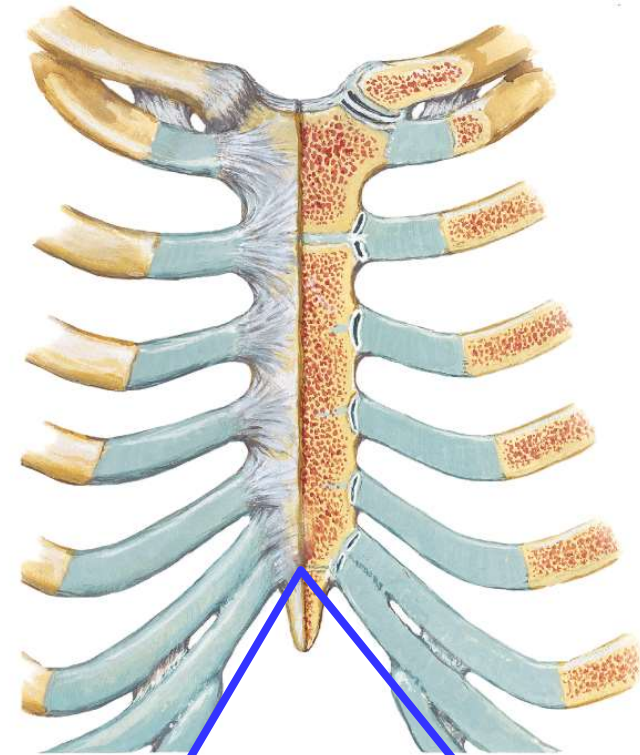
Sterncostal articulations

Costal arch

between costal cartilages 8, 9, and 10 to form the costal arch

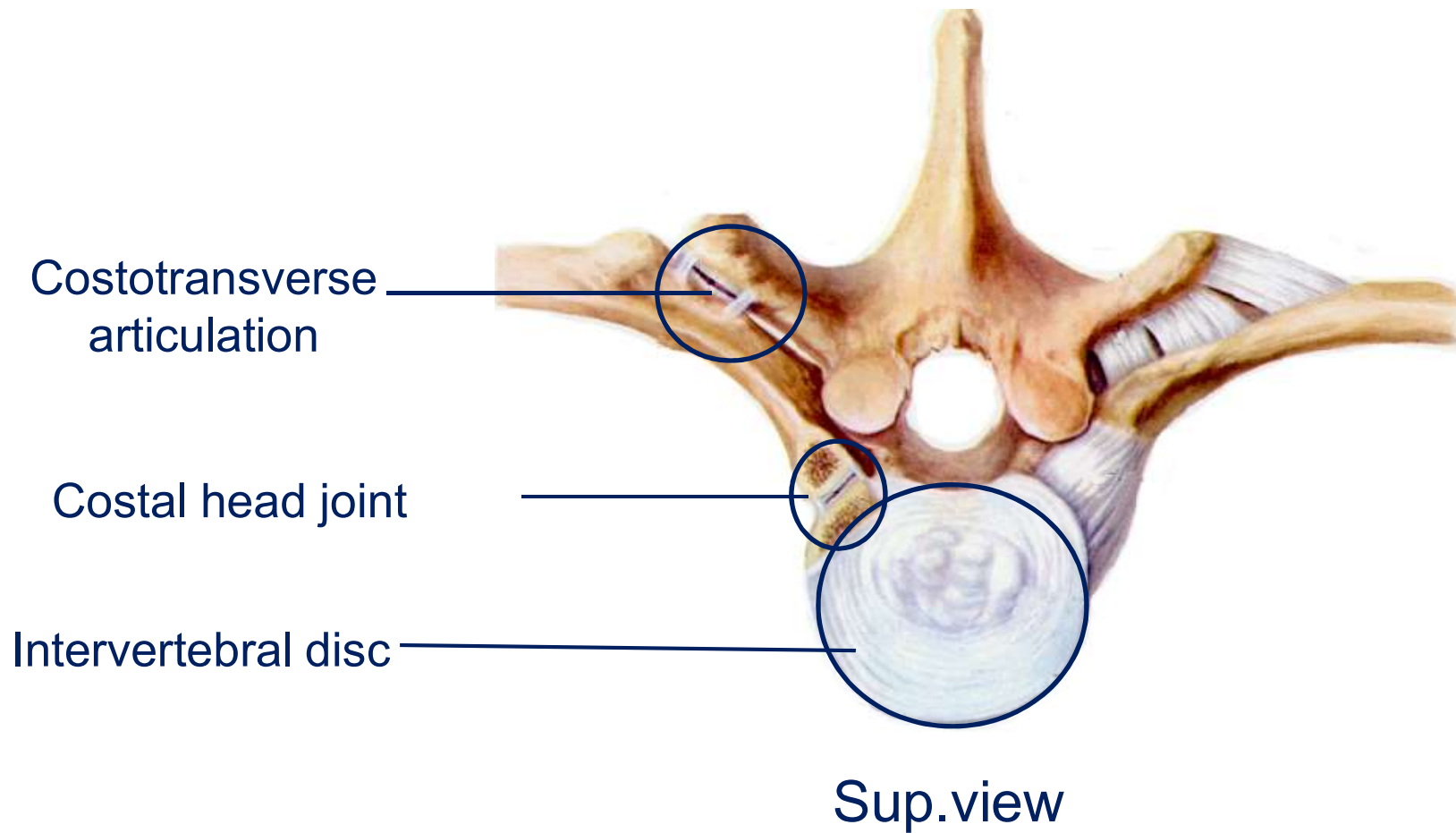


Sterncostal Articulations
Anterior View



infrasternal angle

Costovertebral joint



General features of thoracic cage

Roughly cone-shape,
Narrow **above** and broad **below**,
Flattened from **front-backward**,
Inlet of thorax

Bounded by upper border of manubrium,
first rib, and vertebra T₁

Outlet of thorax

Bounded by T₁₂, 12th & 11th ribs,
costal arch and xiphoid process

Infrasternal angle

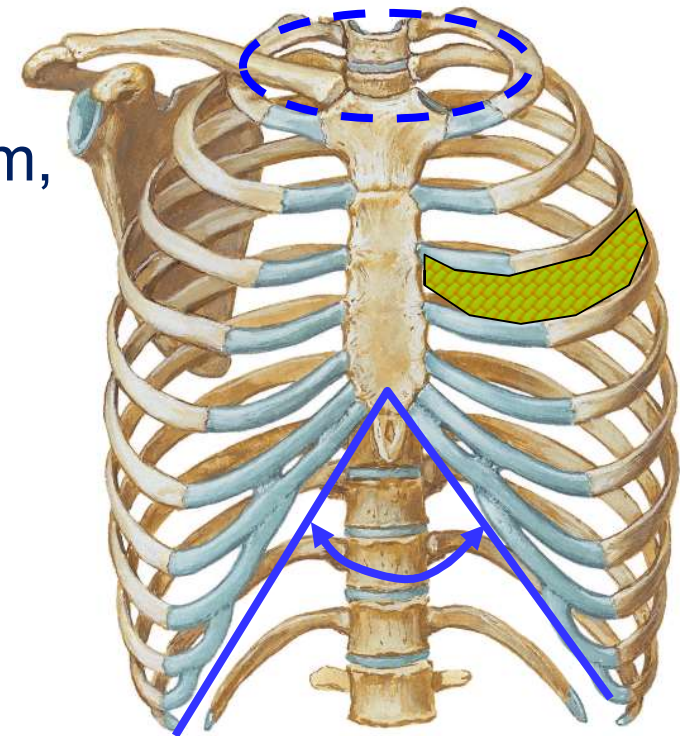
Formed by the costal arch of both side

Intercostal spaces

Lie between two ribs

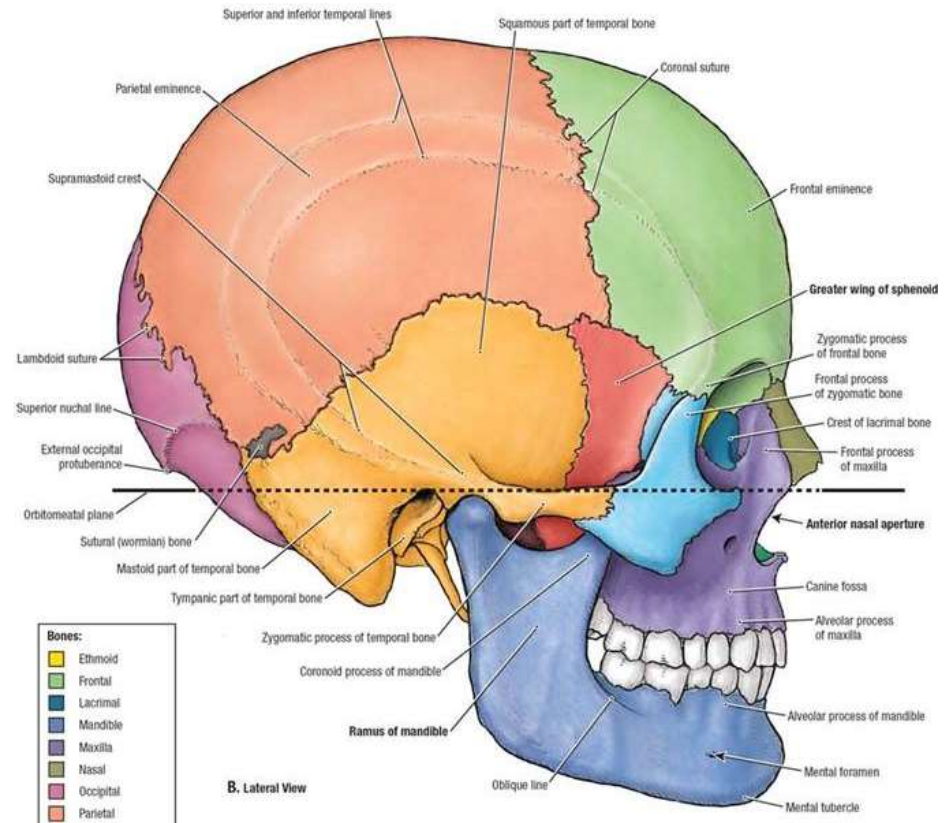
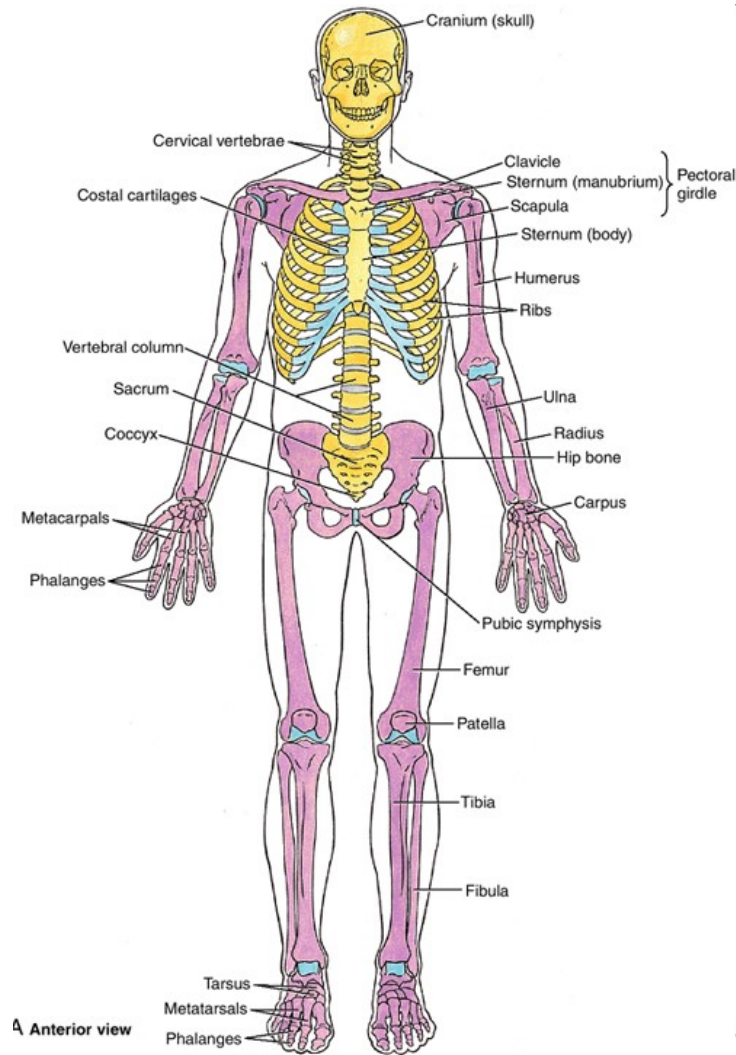
Function: protect the viscera and breathing

Bony Framework of Thorax
Anterior view



infrasternal
angle

Cranial bones and their articulations



Skull (cranial bones+ their articulations)

Skull consist of cranial bones and their articulations.

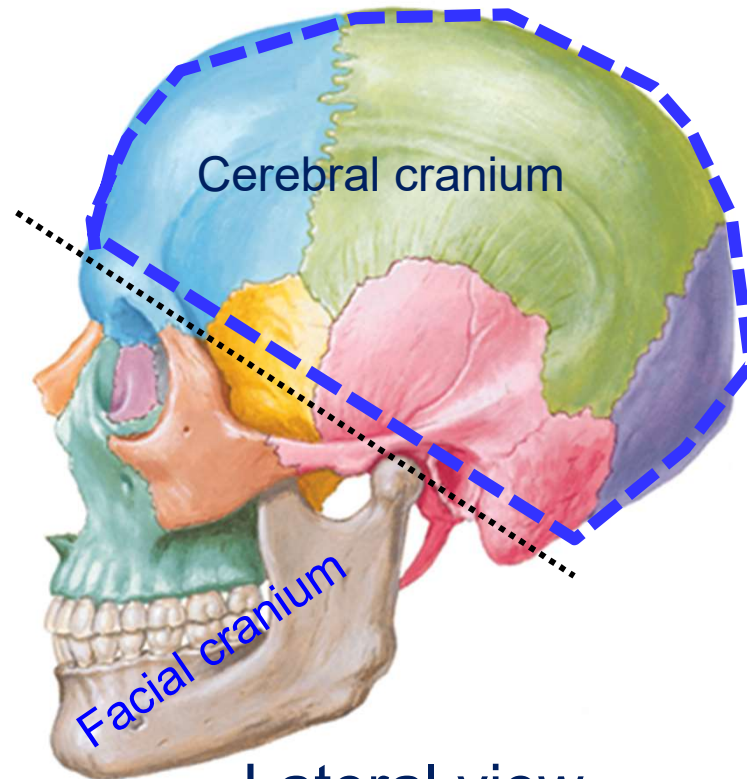
23 (don't including 6 auditory bones) bones

29 (including 6 auditory bones) bones

Cerebral cranium and facial cranium

15 bones

Facial
cranium



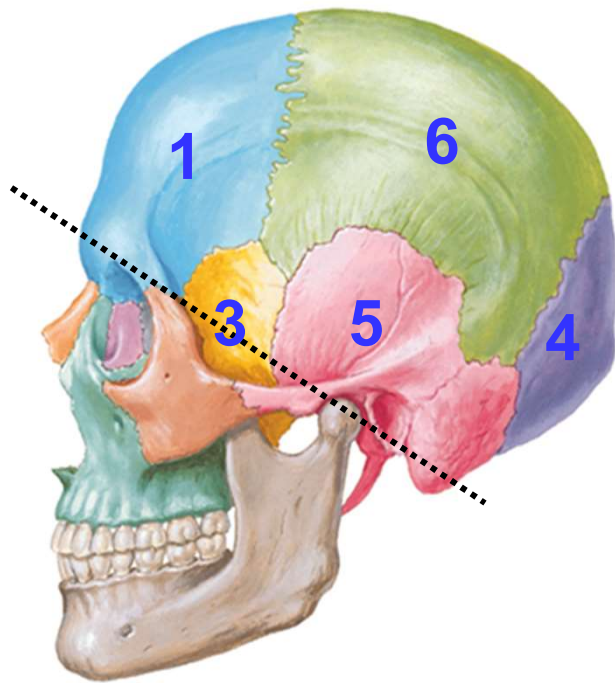
8 bones

Cerebral
cranium

Lateral view

Skull -Cerebral cranium

- **Cerebral cranium** (8) —larger, upper and posterior part, houses and protects the brain



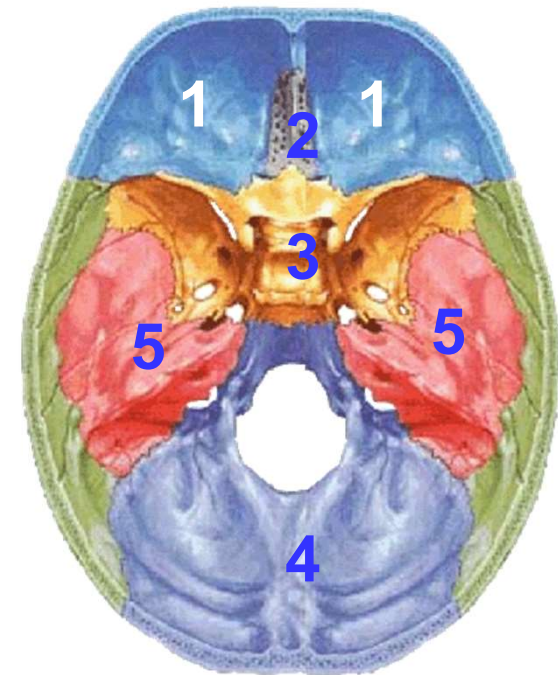
Lat.view

Unpaired bones

- 1-Frontal bones
- 2-Ethmoid bones
- 3-Sphenoid bones
- 4-Occipital bones

Paired bones

- 5-Temporal bone
- 6-Parietal bone



Sup.view of
the base

Skull-Facial cranium

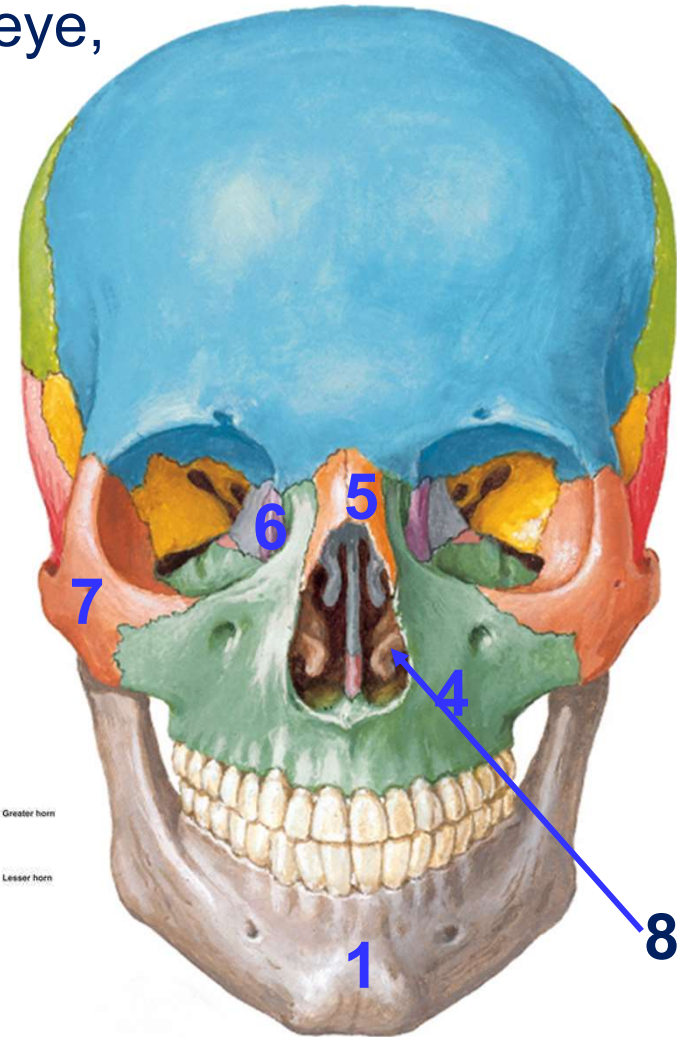
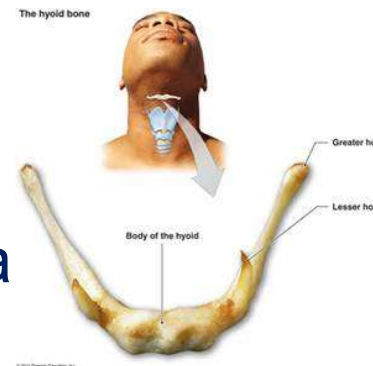
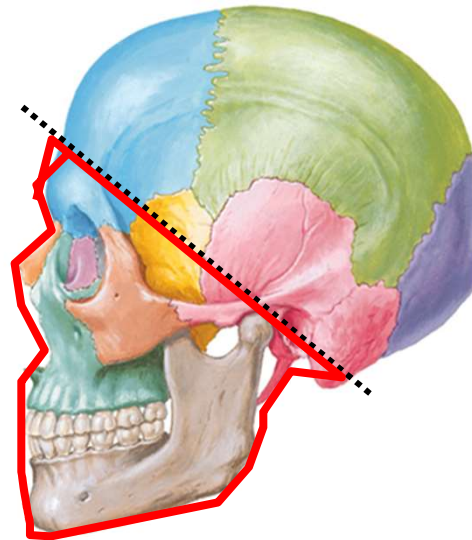
Bones of **facial cranium** (15) —smaller, lower, and ant. part, contains bones that surrounded the eye, nose and mouth

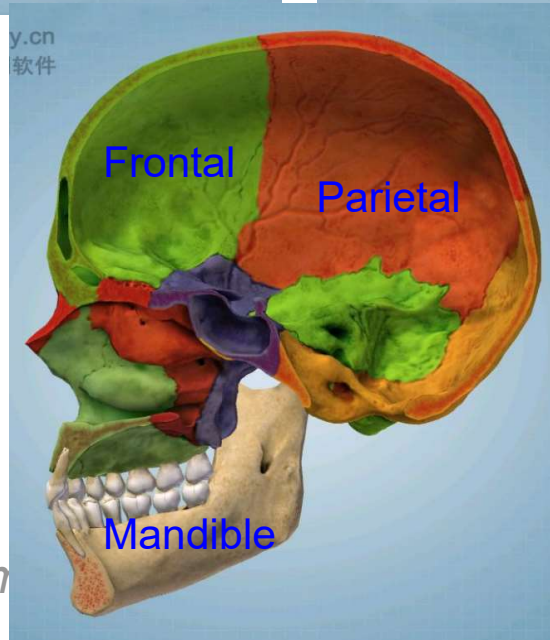
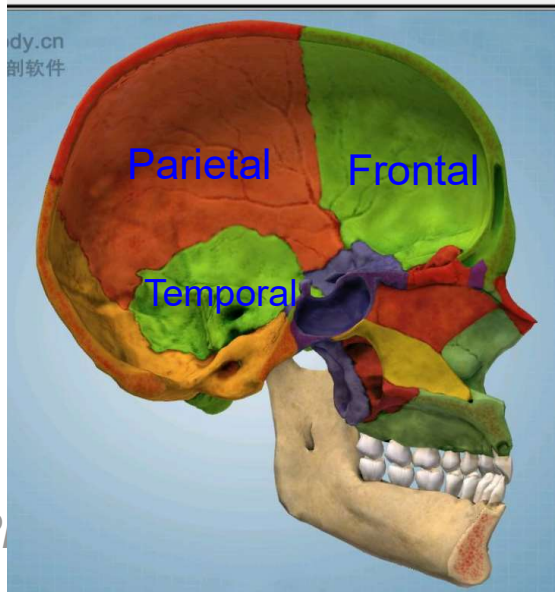
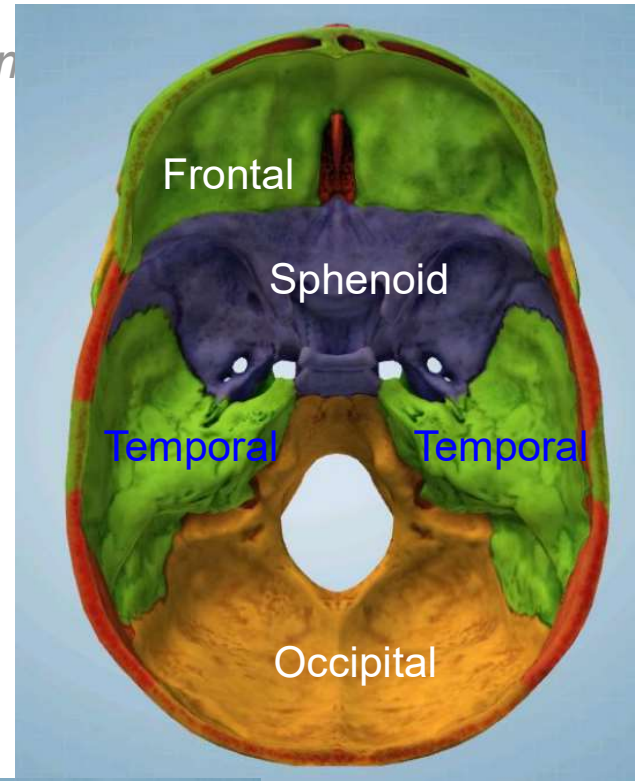
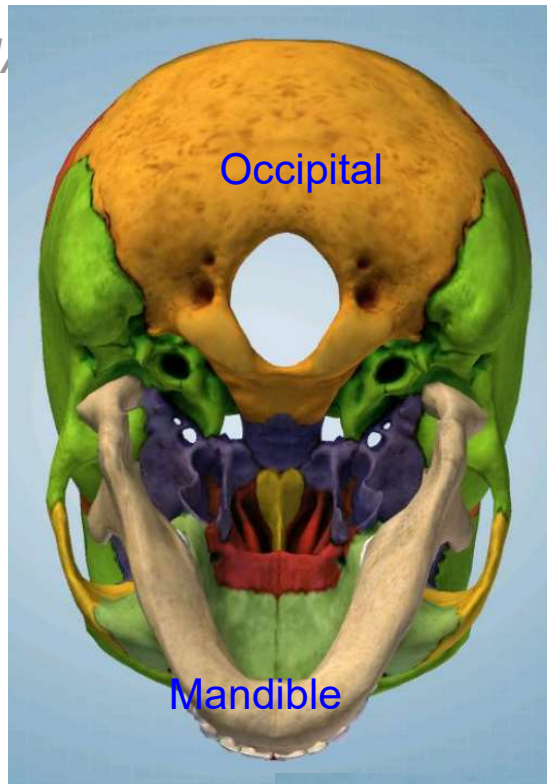
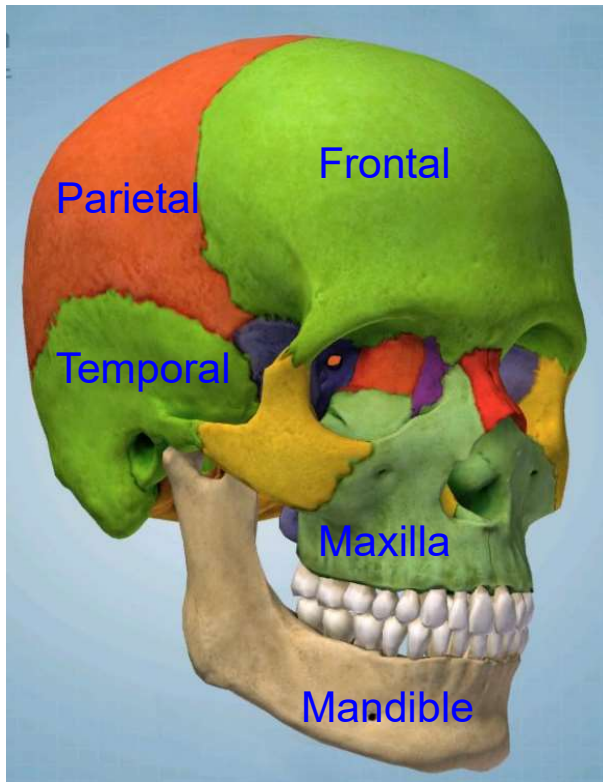
Single bones

- 1- Mandible
- 2- Vomer
- 3- Hyoid bone

Paired bones

- 4- Maxilla
- 5- Nasal bone
- 6- Lacrimal bone
- 7- Zygomatic bone
- 8- Inferior nasal concha
- 9- Palatine bone





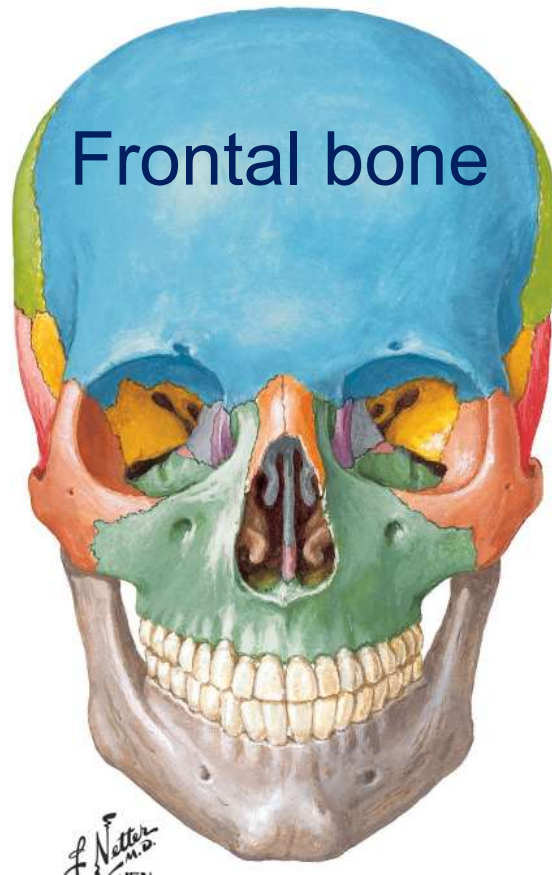
Copy R

artm

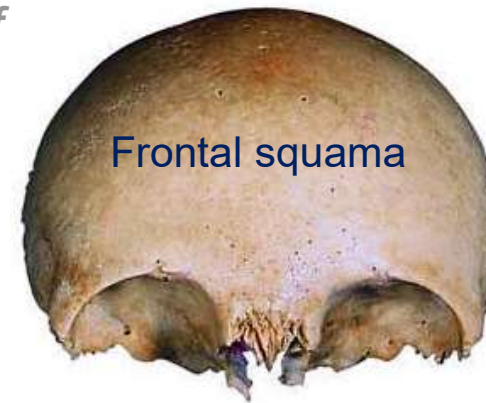
iversity

C Frontal bone -1 Department of

sity



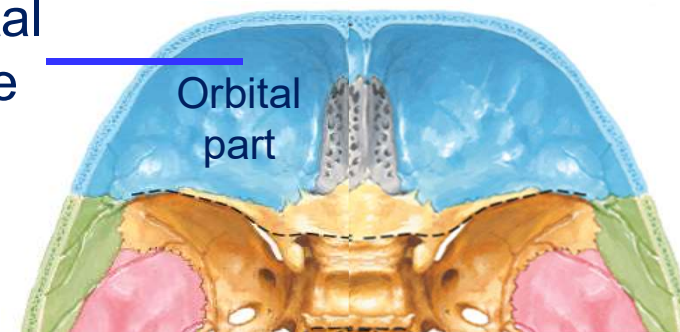
1. Frontal squama
2. Orbital part
3. Roof of nasal cavity
4. Frontal sinus



Ant. aspect

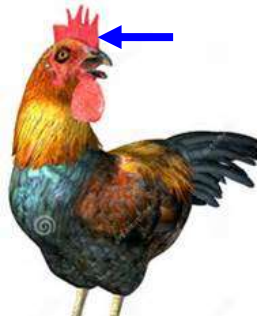


Frontal bone

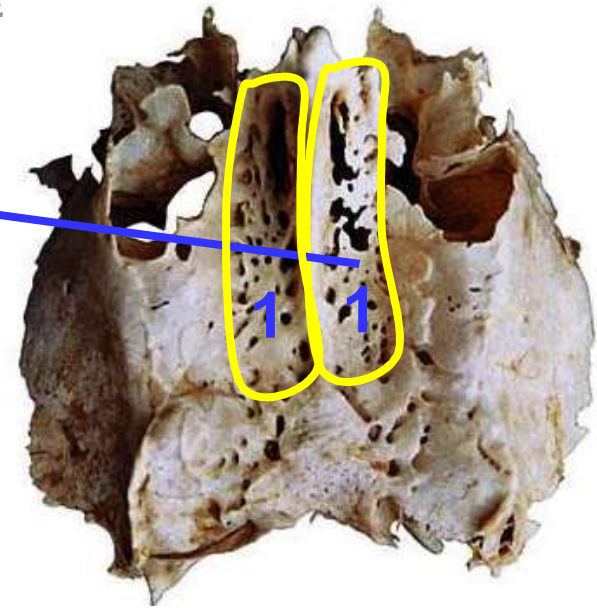
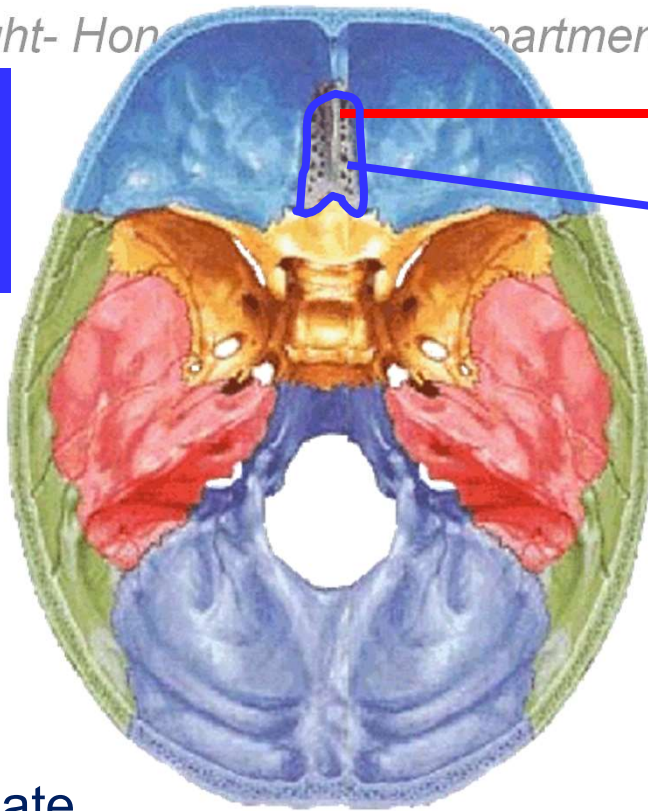


Sup. view sity

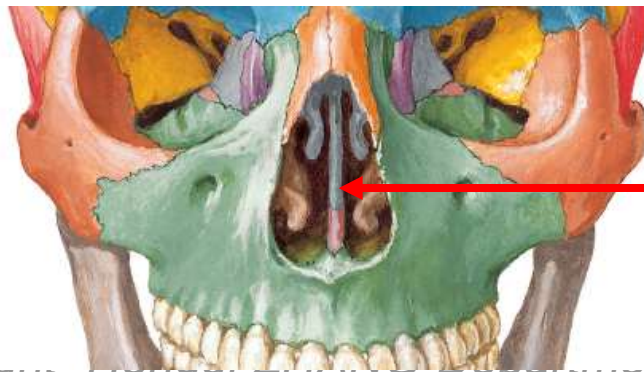
Ethmoid Bone -1



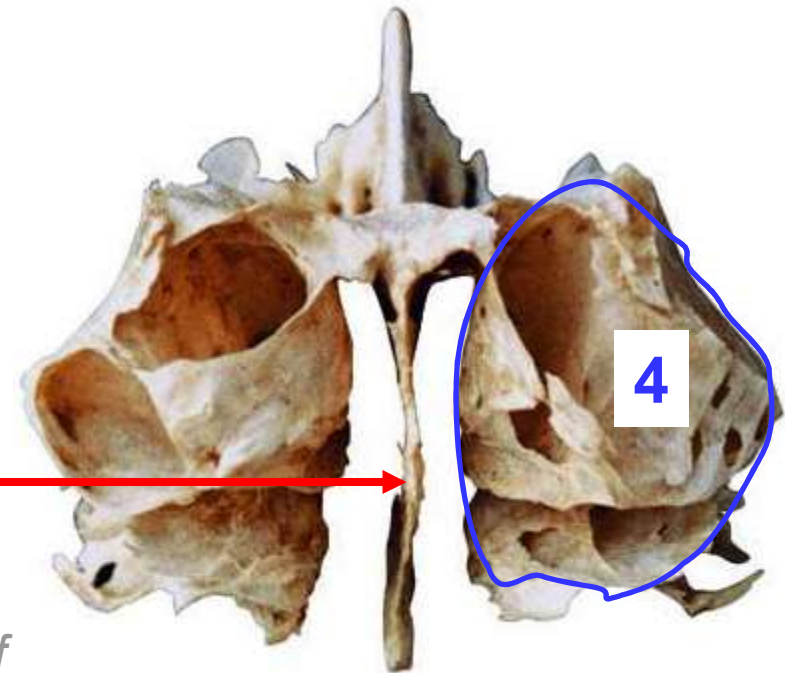
3-Crista galli



- 1-Cribriform plate
- 2-Perpendicular plate
- 4-Ethmoidal labyrinth

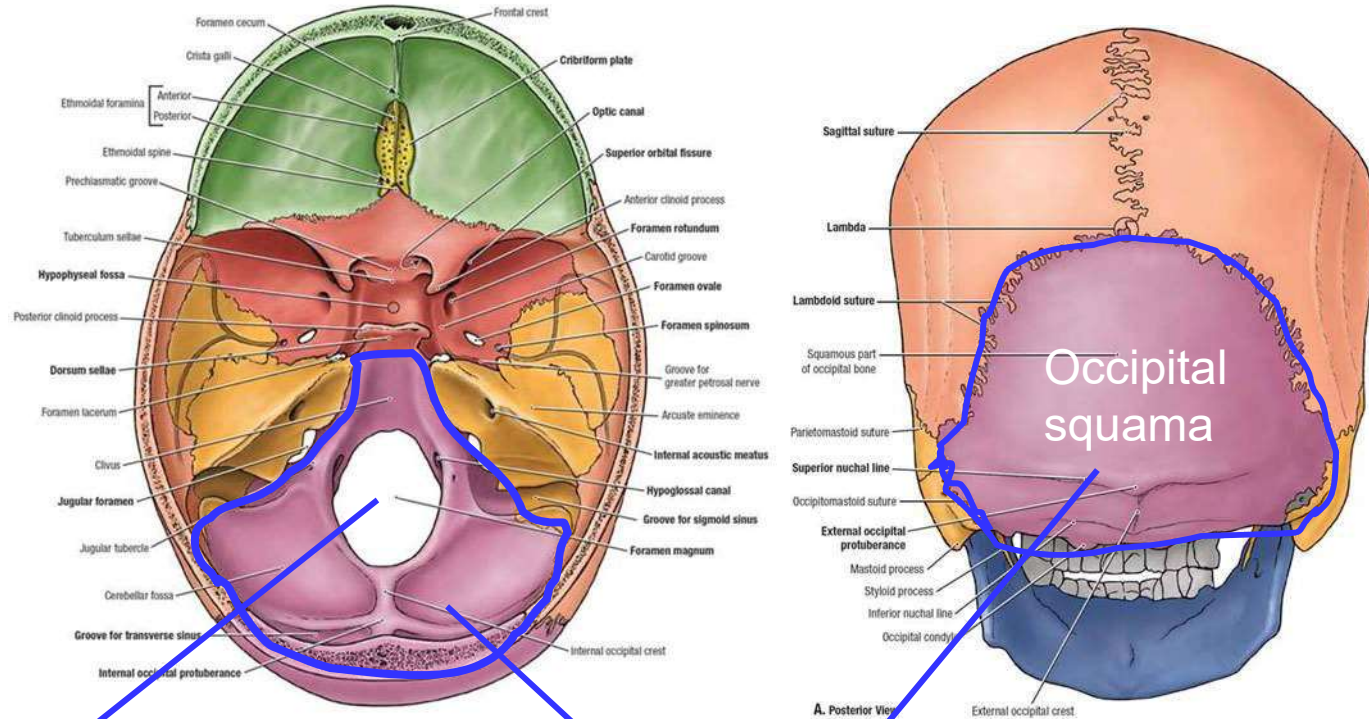


2



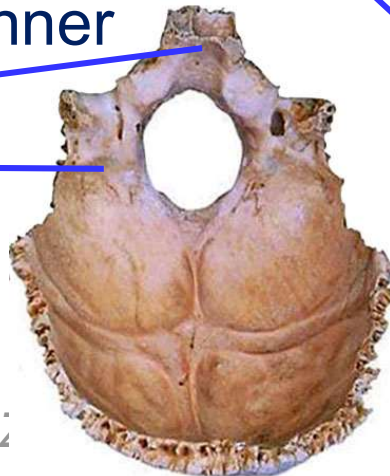
4

Occipital bone -1



Foramen magnum
Basilar part
Lateral parts
Occipital squama

Inner

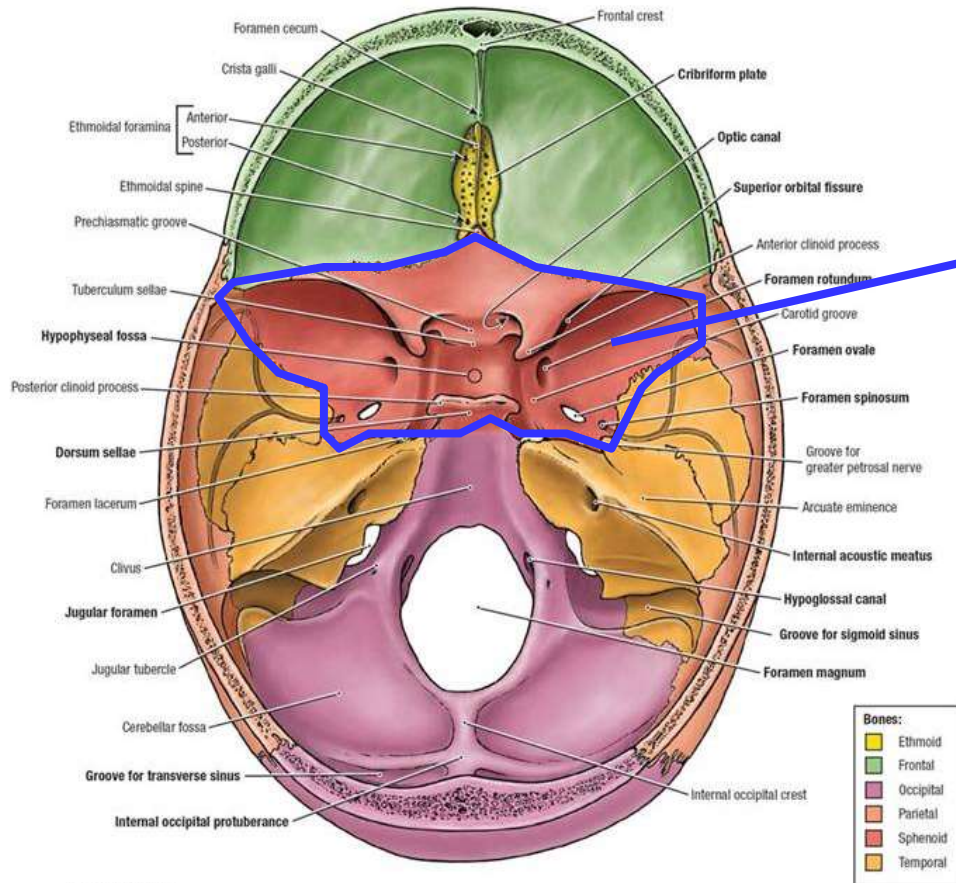


Occipital bone

Outer



Sphenoid bone -1



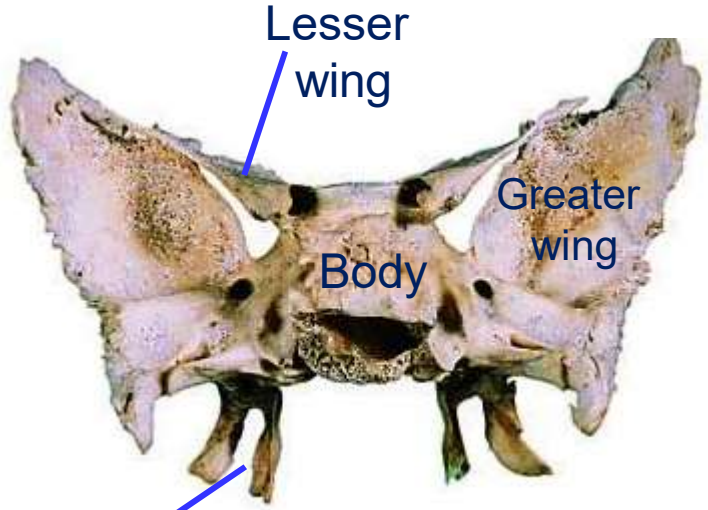
B. Superior View

Sup.view
Of cranial base

Body
Greater wing
Lesser wing
Pterygoid process



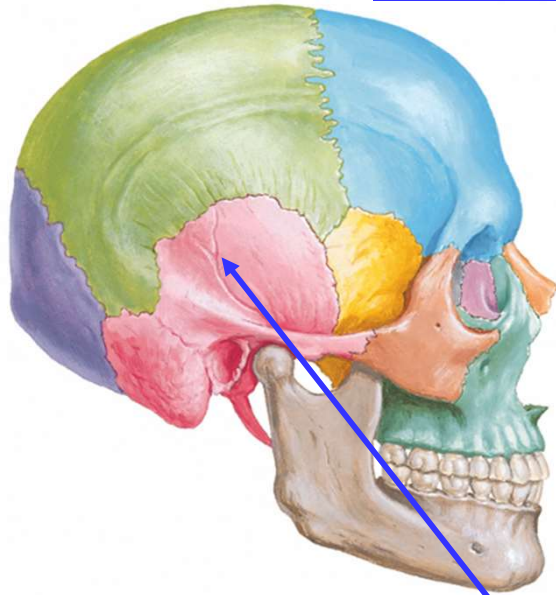
Sup.view



From ant. to post.

Copy Right- I

Temporal bone

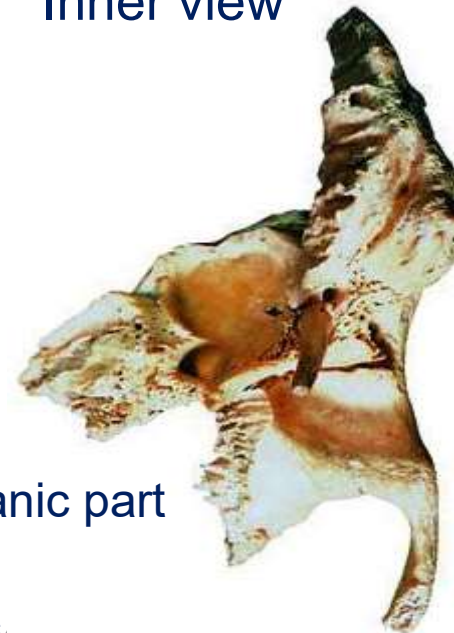
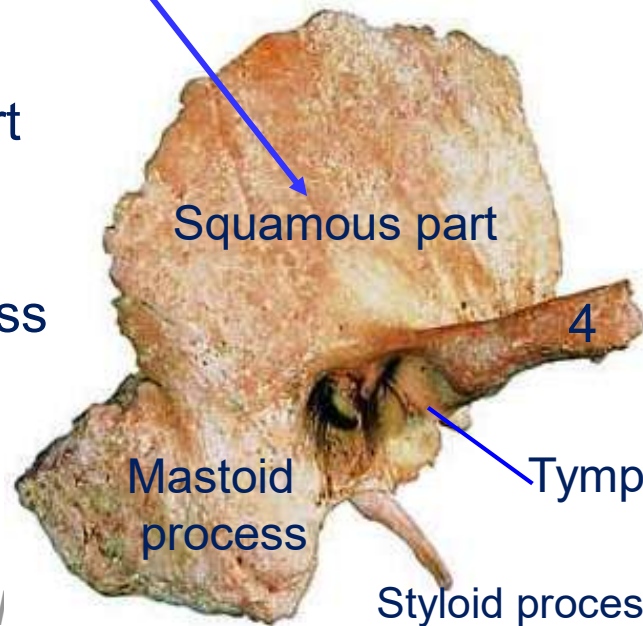


Four parts

1. Squamous part
2. Petrous part
3. Tympanic part
4. Mastoid process



Inner view



P

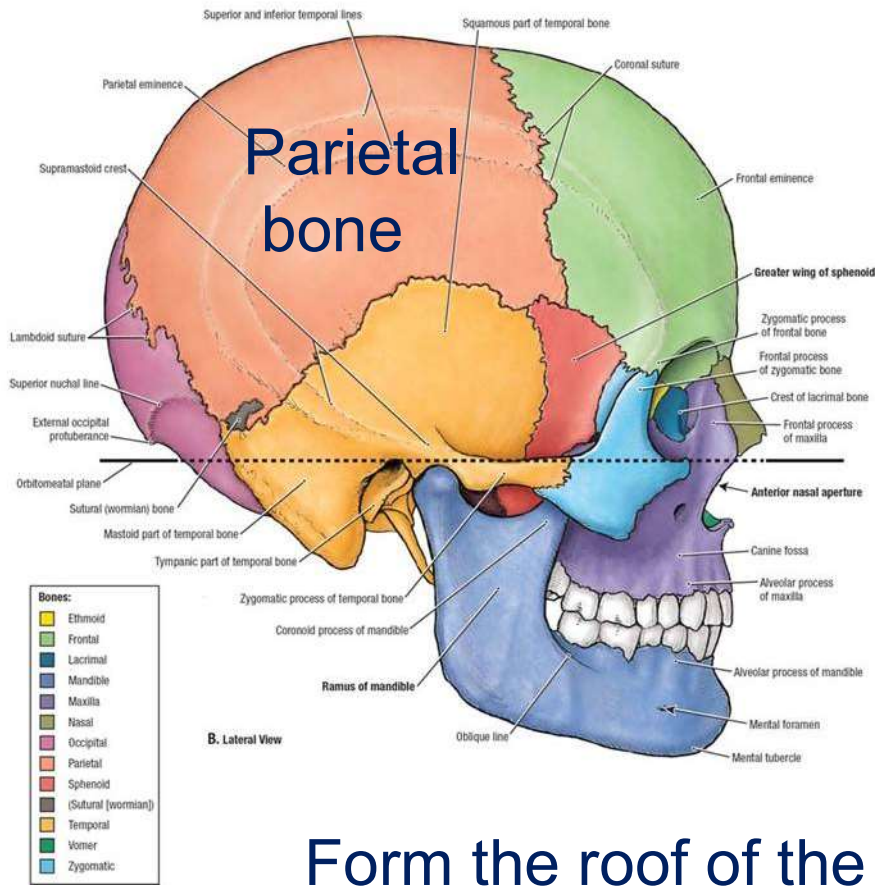
A

Copy Right- I

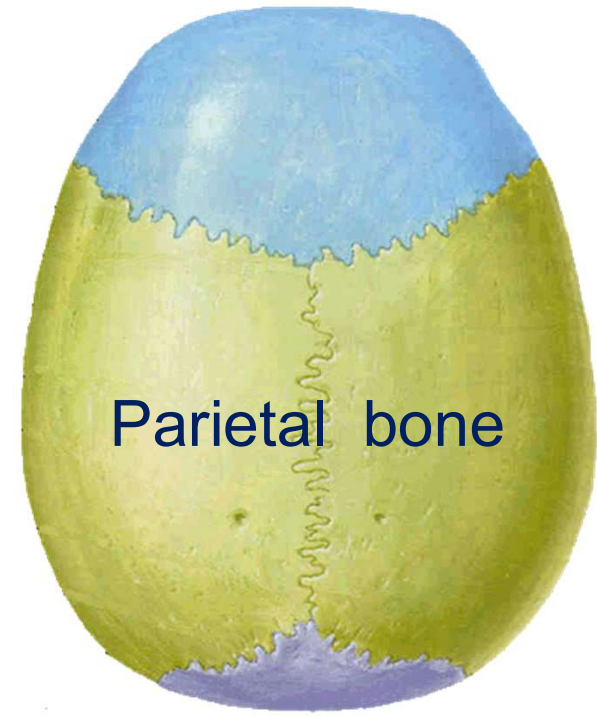
Styloid process

Anatomy - Ugan University

Parietal bones-2



Parietal bone



Parietal bone

Form the roof of the cranium
Sagittal suture

Mandible



mandible

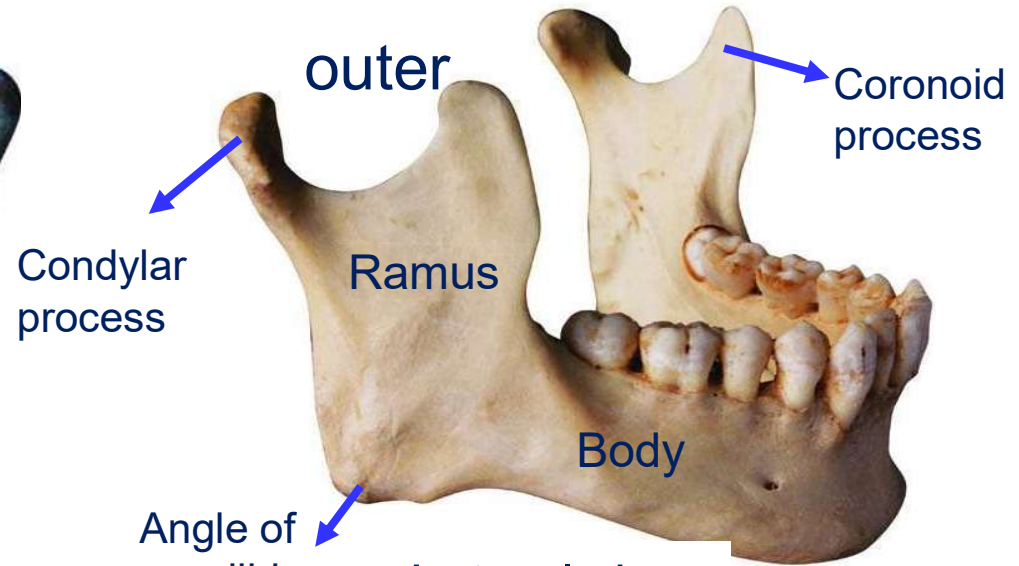


Posterior view



Inner

Medial view



outer

Coronoid process

Condylar process

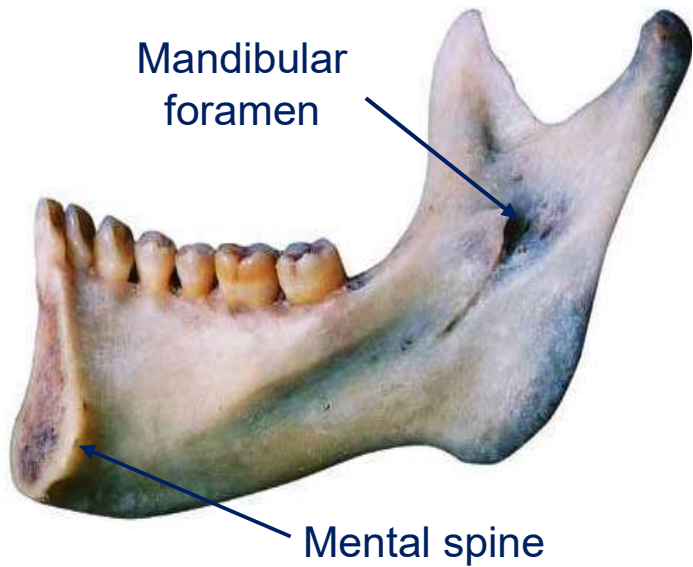
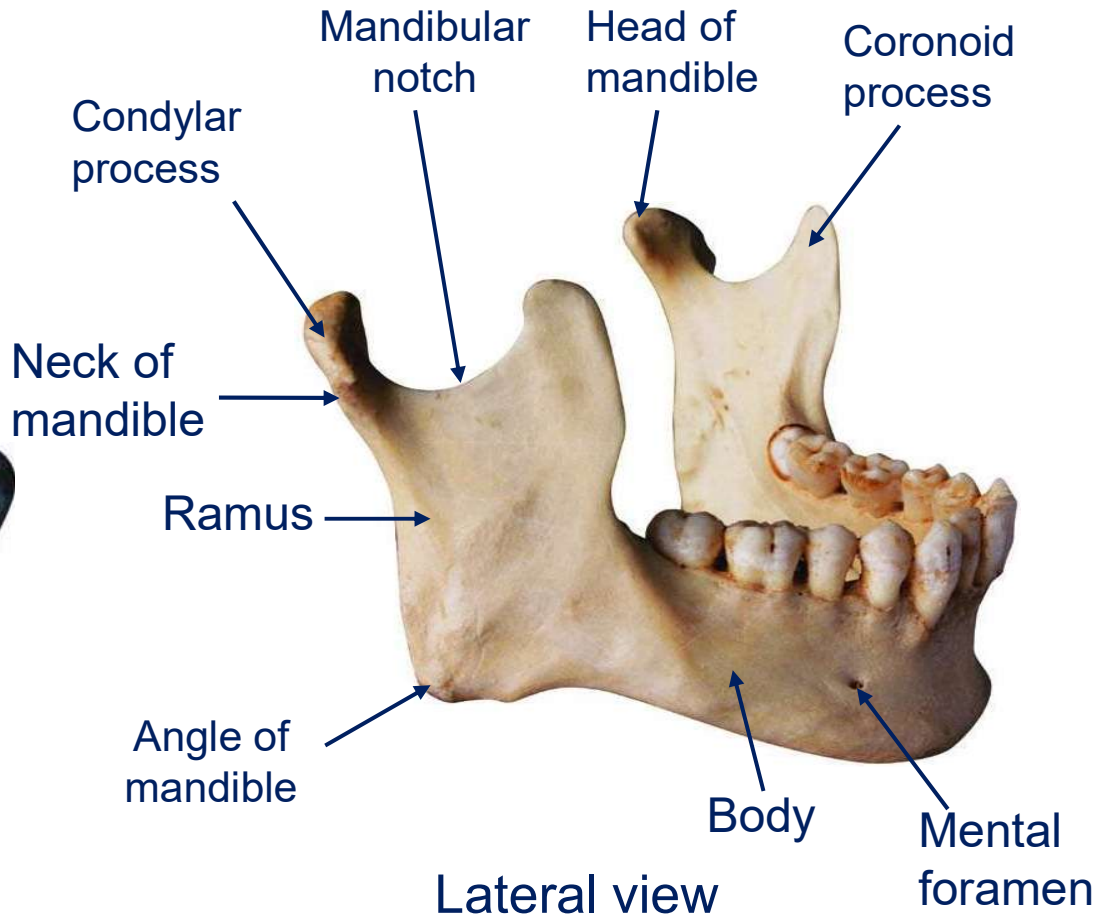
Ramus

Body

Angle of mandible

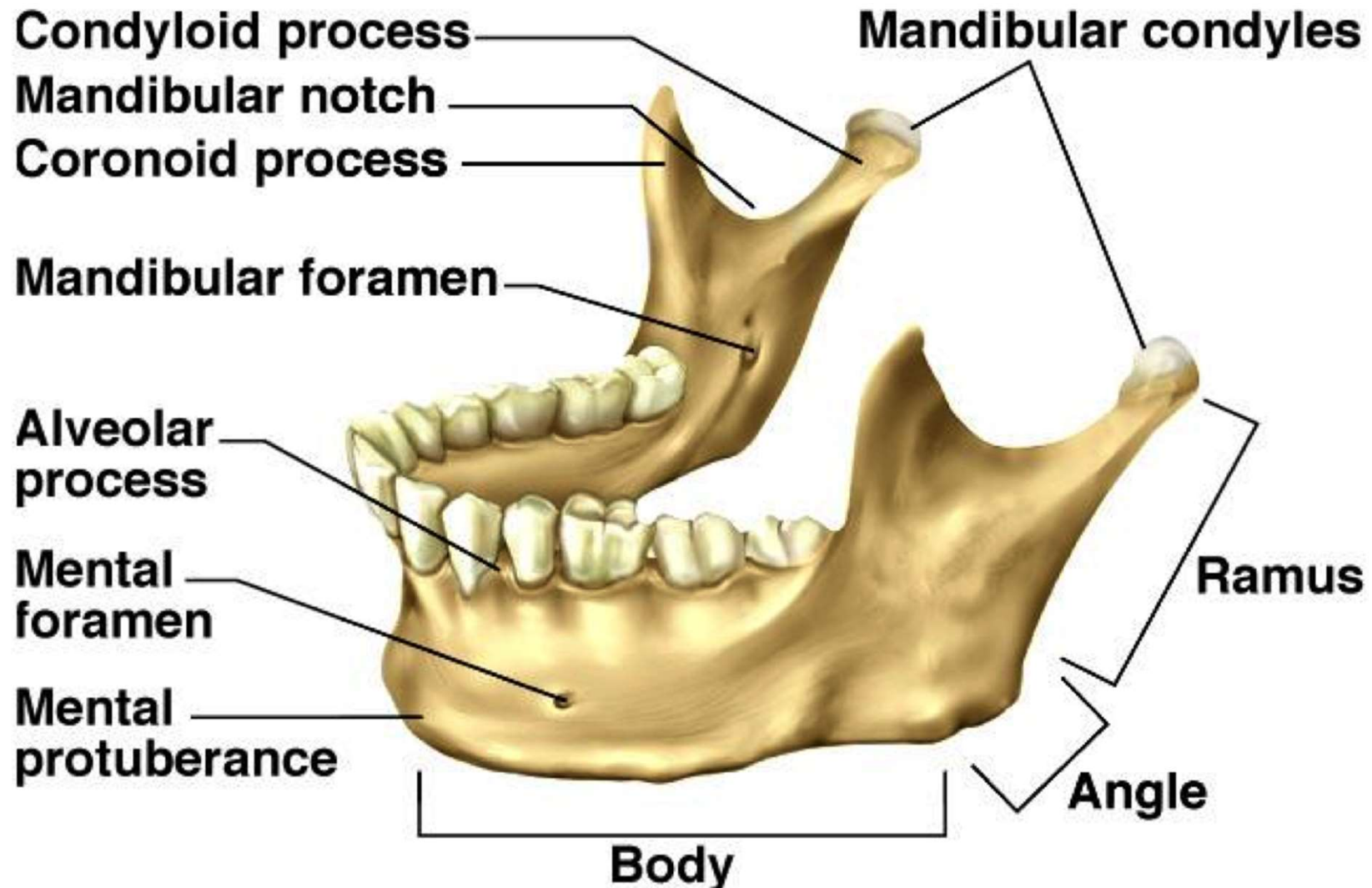
Lateral view

Mandible

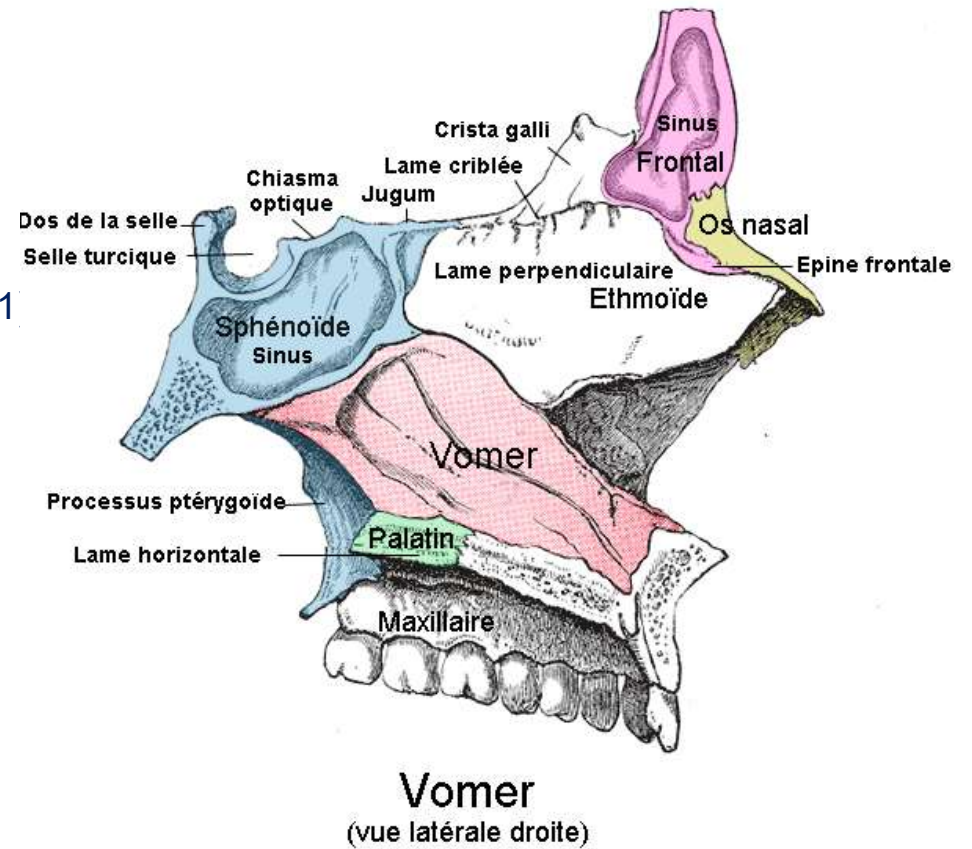
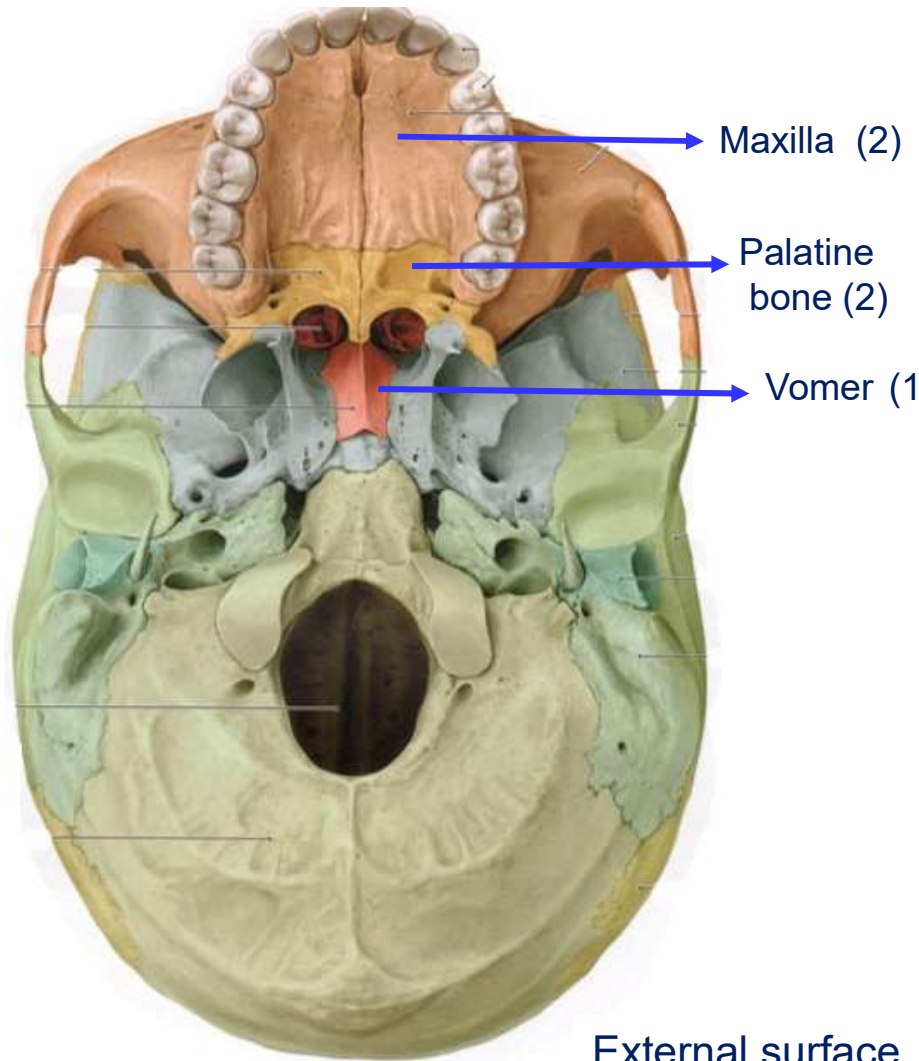


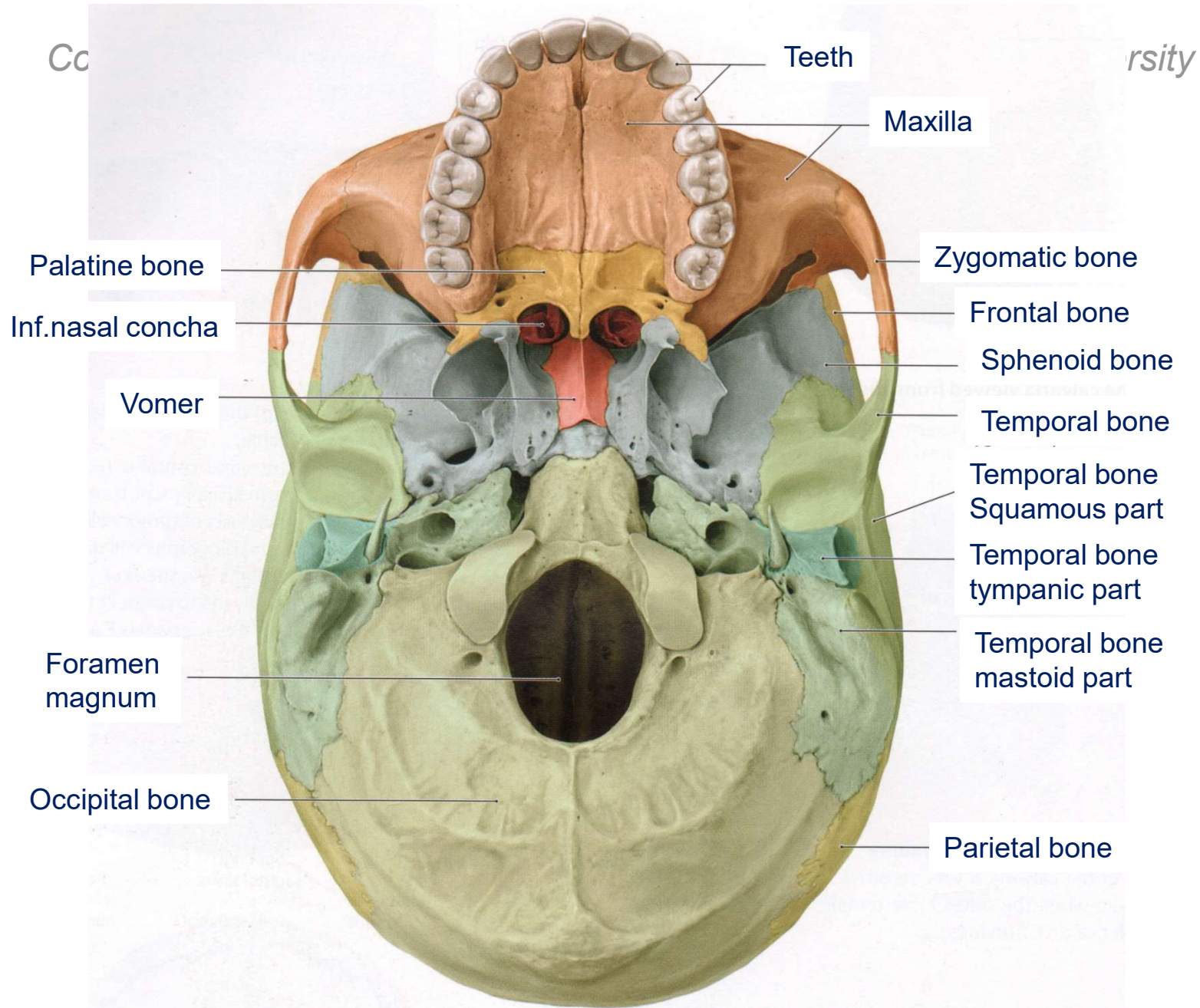
Outer view

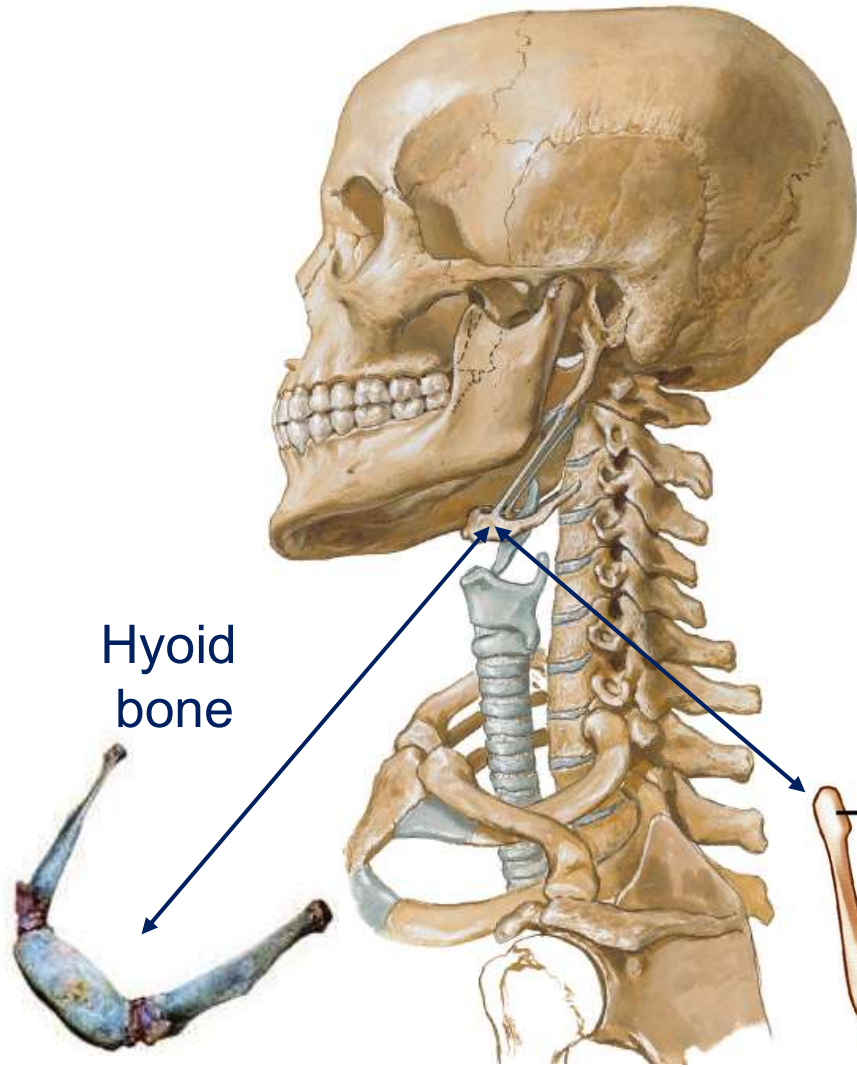
The mandibular without the teeth in the old



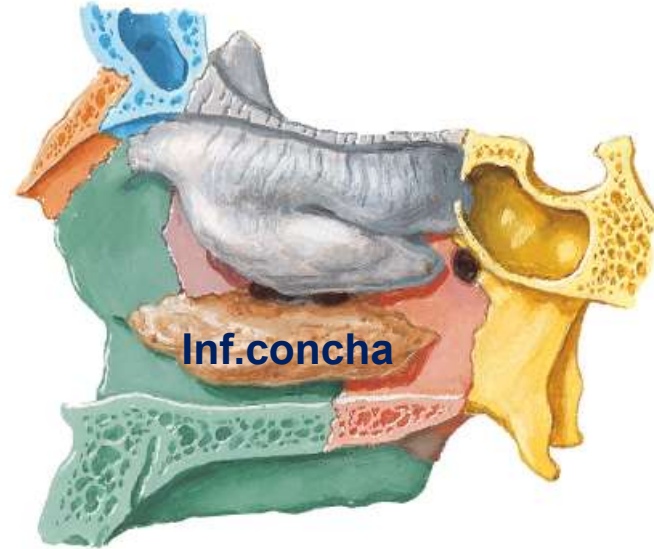
Palatine bone and Vomer bone





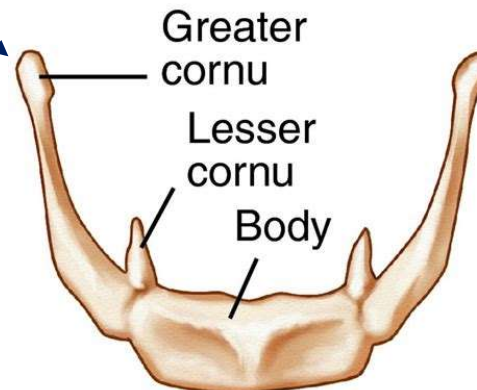


Hyoid bone



Inf.concha

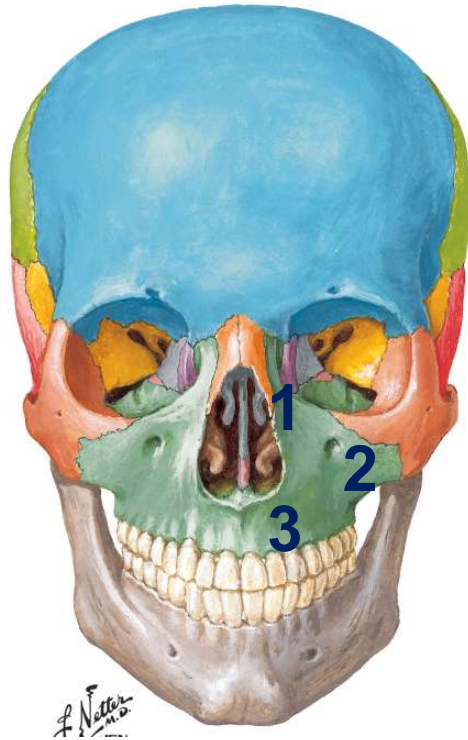
Nasal conchae exposed
Sagittal section (skull)



Greater cornu

Lesser cornu

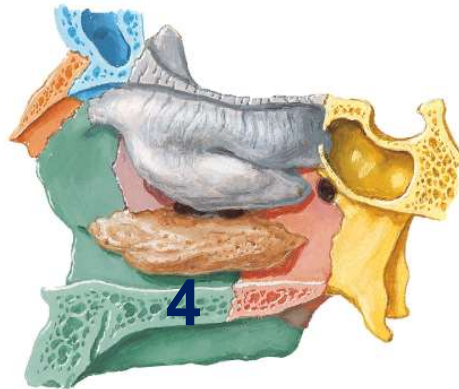
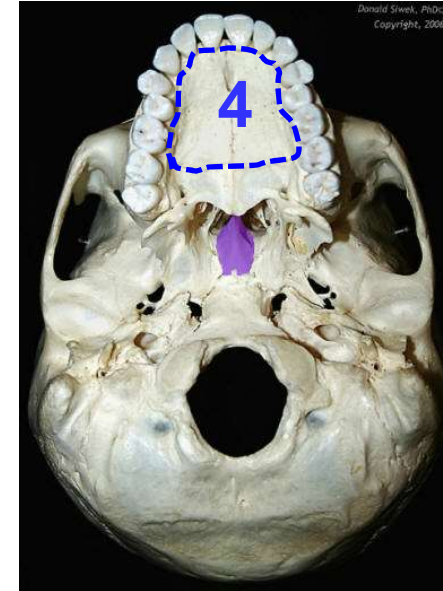
Body



Lat. aspect



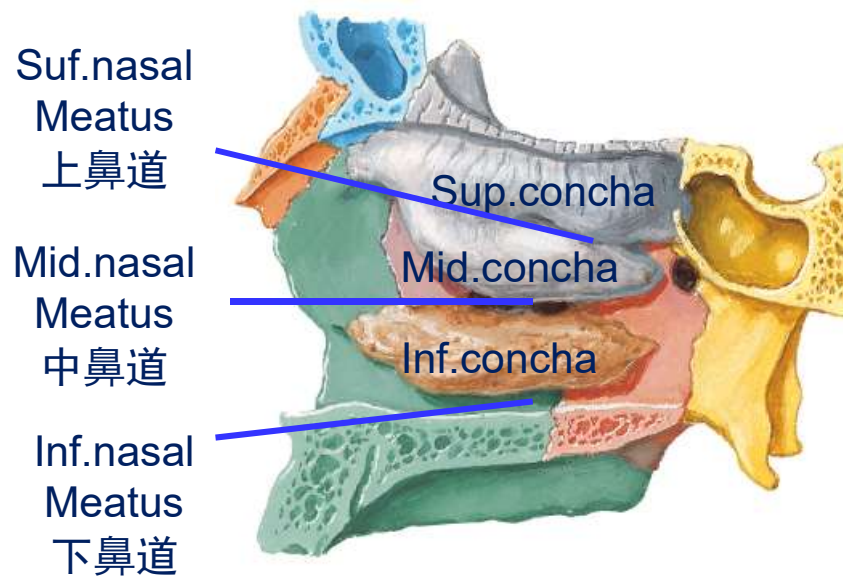
Med. aspect



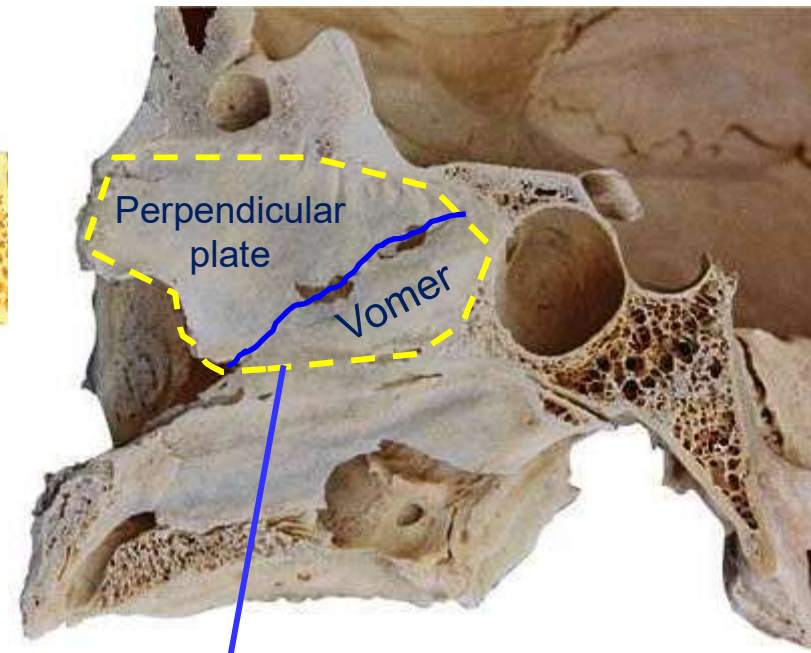
One body
Four processes
Sinus of maxilla

- 1- Frontal process
- 2- Zygomatic process
- 3- Alveolar process
- 4- Palatine process

Nasal septum 鼻中隔 & nasal meatus 鼻道



Nasal conchae exposed
Sagittal section (skull)

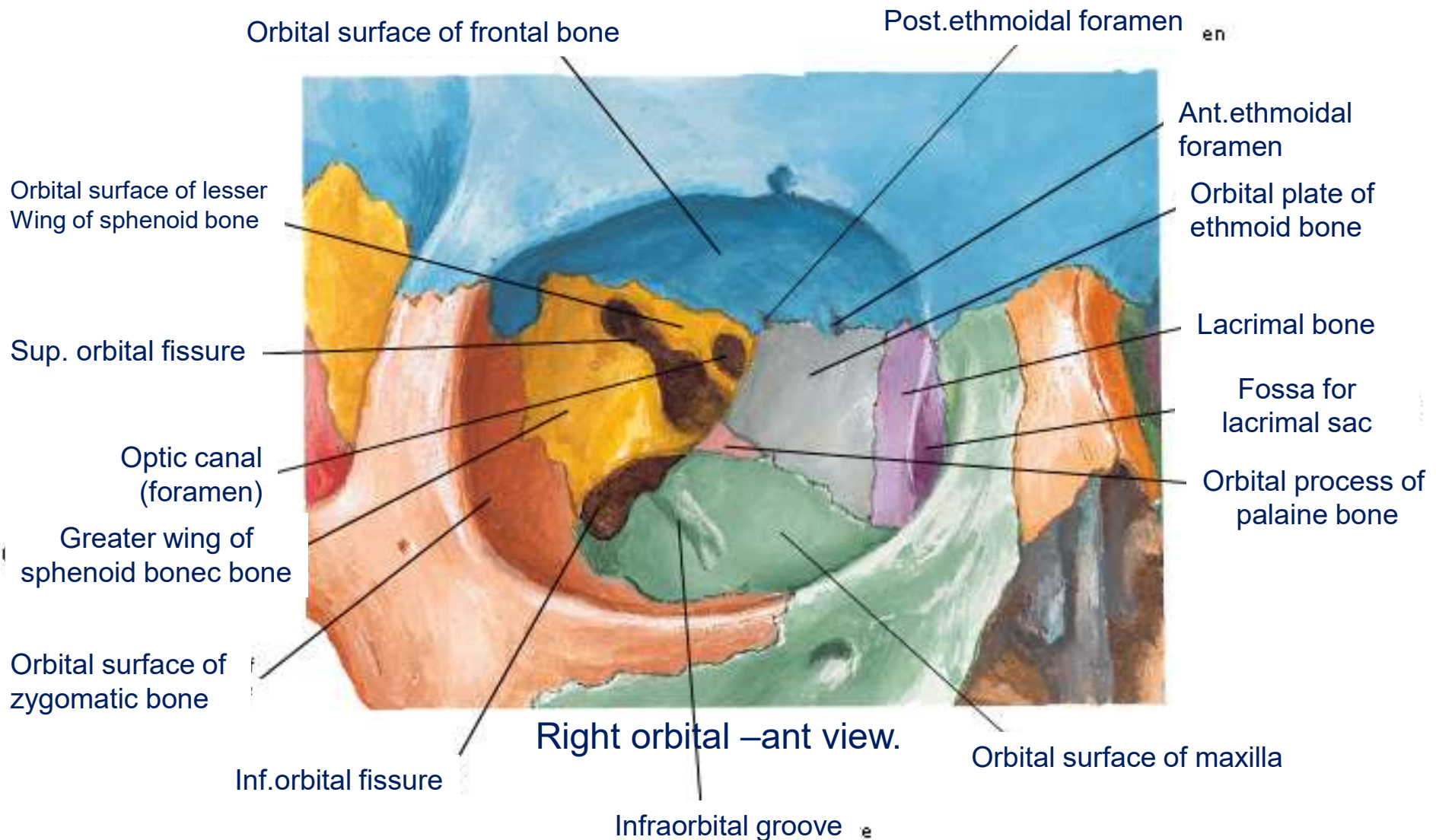


Bony nasal septum

Perpendicular plate of sphenoid bone
Vomer bone

Skull: ant.view-Right orbit

Learn it by yourself



The skull as a whole

Bones:

Frontal-1

Parietal-2

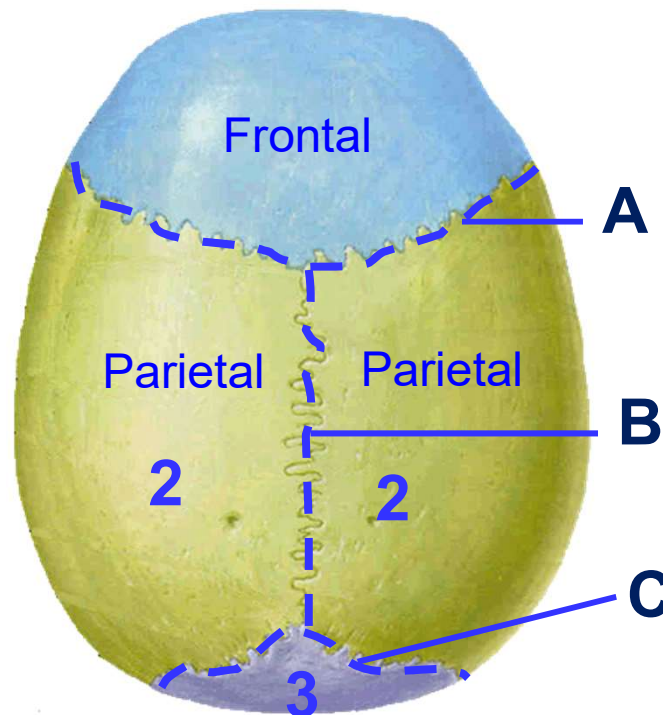
Occipital-3

Sutures:

A - Coronal

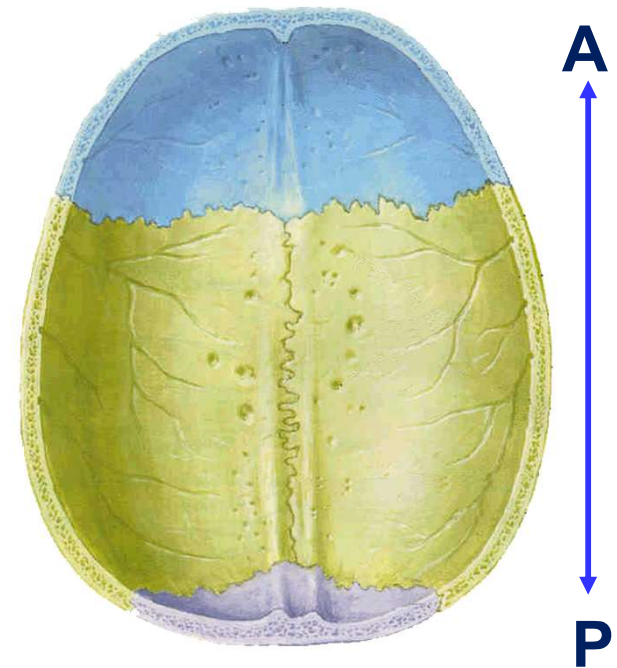
B - Sagittal

C - Lambdoid



superior view

Internal view



Sulcus for superior sagittal sinus
Granular foveola
Arterial grooves

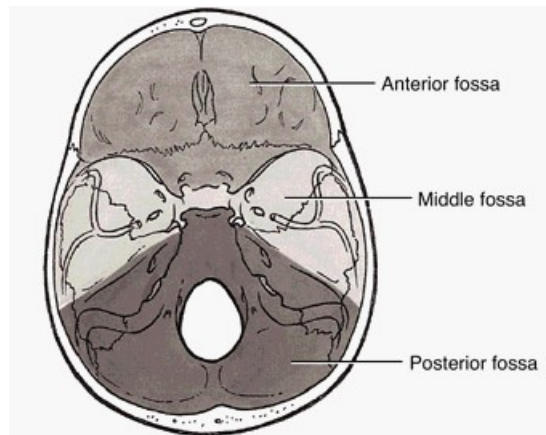
At Base of skull

Forms three fossae

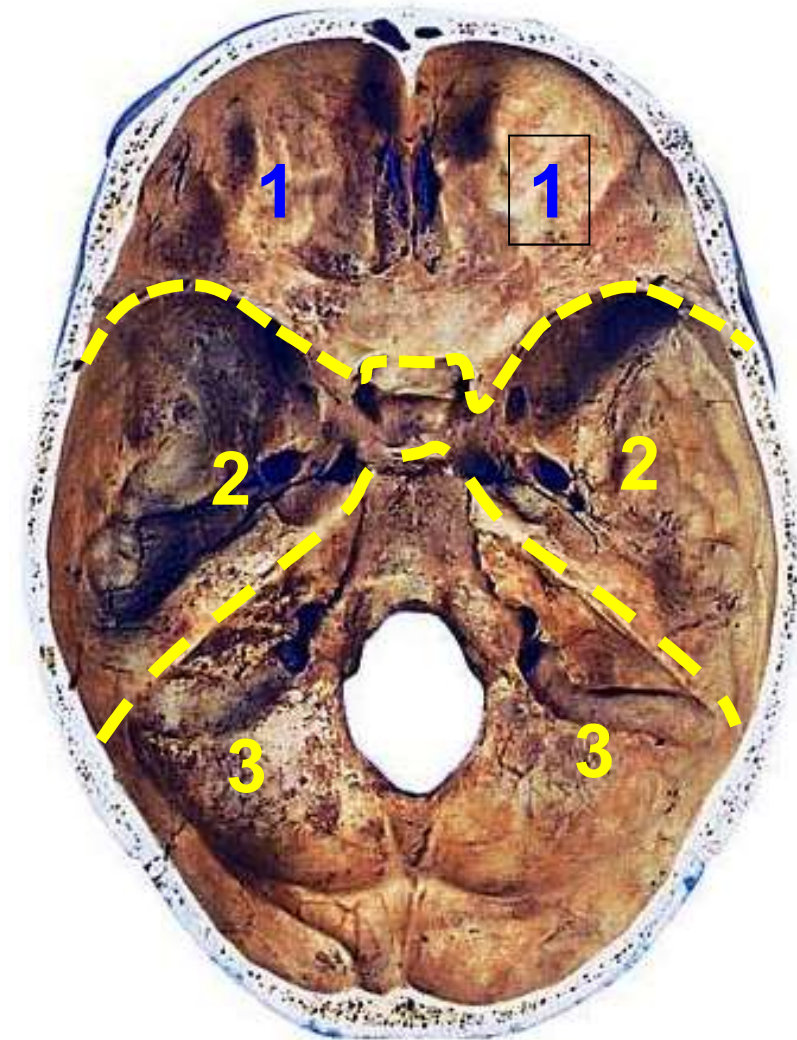
1-Anterior cranial fossa

2-Middle cranial fossa

3-Posterior cranial fossa



A Superior view, cranial fossae



Sup.view of cranial base

Lateral view of the skull

- 1- External acoustic pore
- 2- Mastoid process
- 3- Zygomatic arch
- 4- Temporal fossa

Pterion

It is a “H” shape area where four bone united.

Features

Bone thin

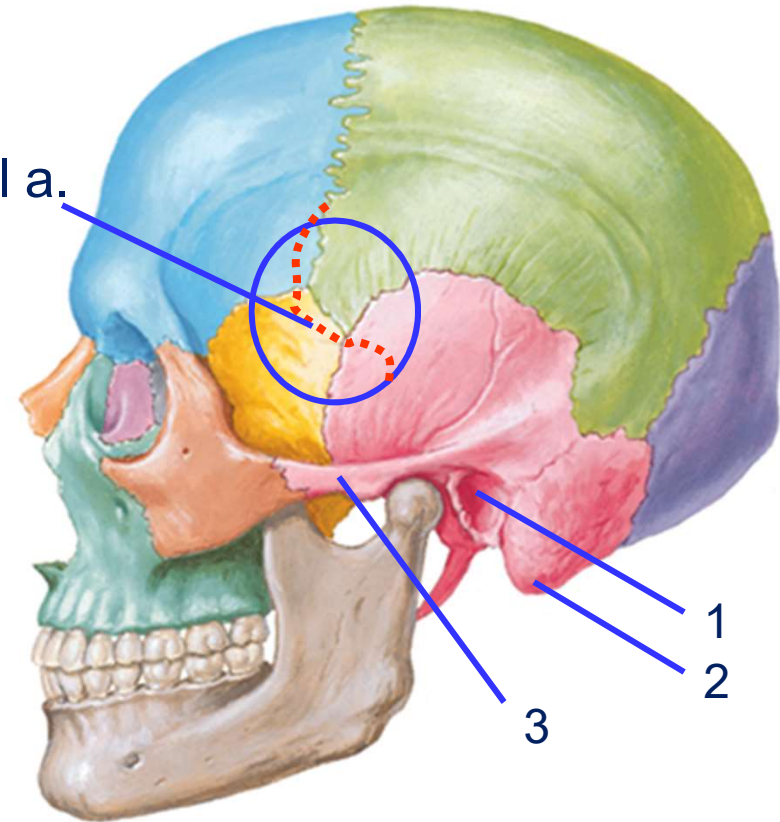
Artery in deep (mid,meningeal a.)

After fracture,

Bleeding – hematoma

(Violence hit)

Mid meningeal a.



Lateral view

Identify them in the specimen

The cavities within the bones around the nasal cavity

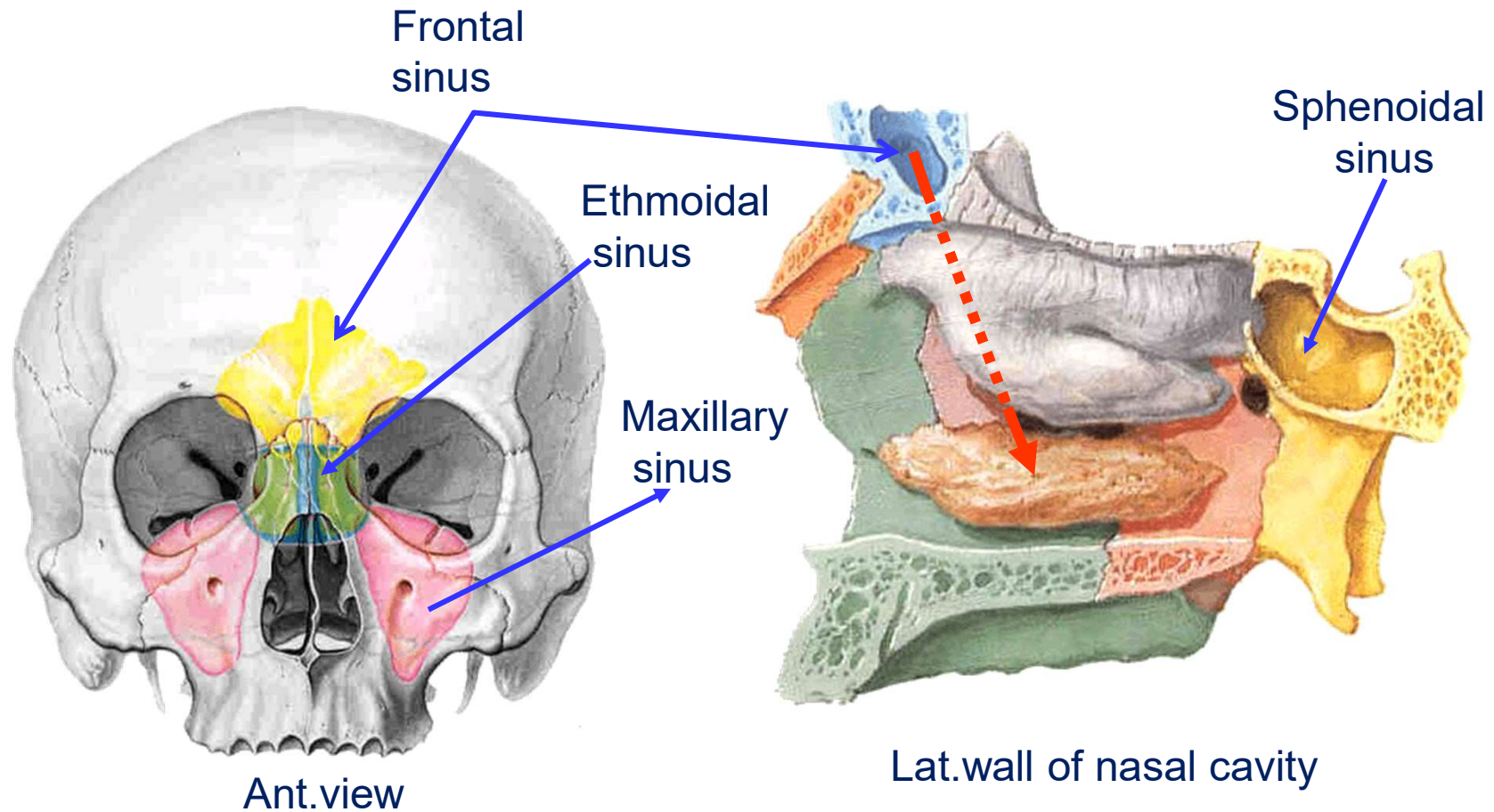
1. Frontal sinus
2. Ethmoidal sinus
3. Maxillary sinus
4. Sphenoidal sinus

Opening of four paired paranasal sinuses drain to nasal cavity

Function:

- ◆ Lighten the weight of the skull
- ◆ Enhance the resonance of the voice
- ◆ Increase the temperature & humidity of the air of nasal cavity.

Paranasal sinuses



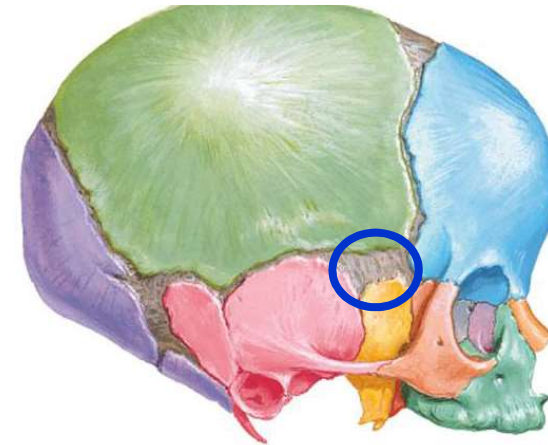
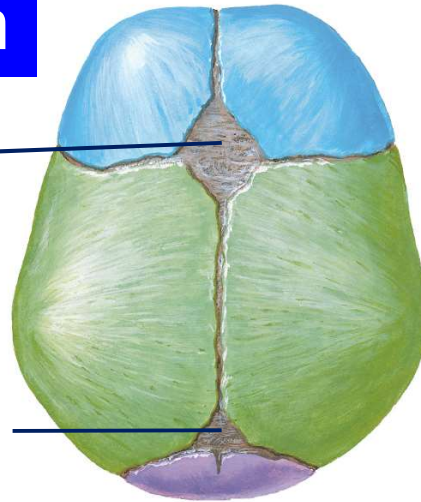
Superior view

Lateral view

Skull of newborn

Ant. fontanelle

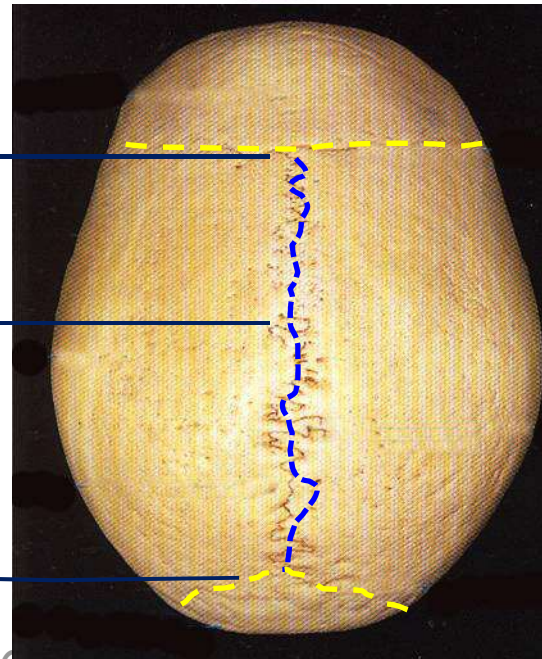
Post. fontanelle



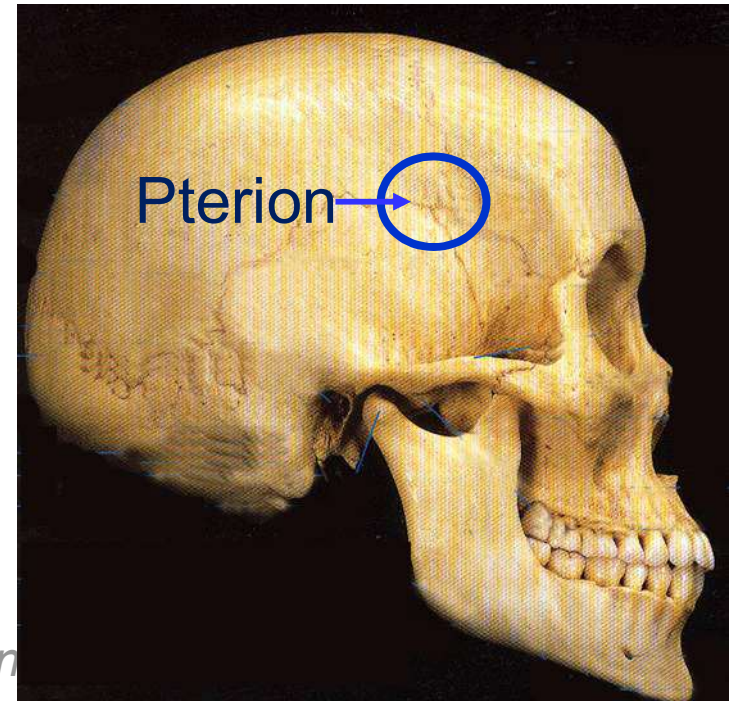
Coronal suture

Sagittal suture

Lamboid suture



Pterion



General characters of the skull at birth

Facial cranium/the whole skull

1/8 at birth. 1/4 in adult

Cranial fontanelles

unossified membrane between the bones at the angles of parietal bones

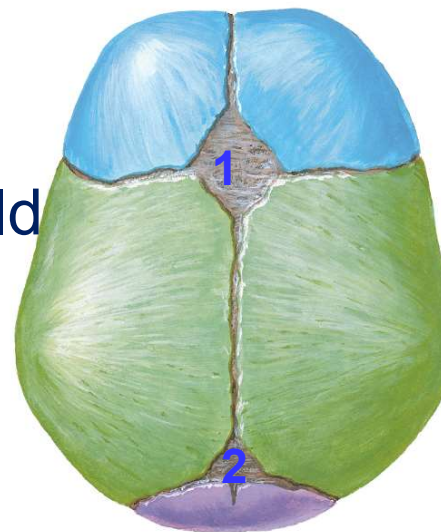
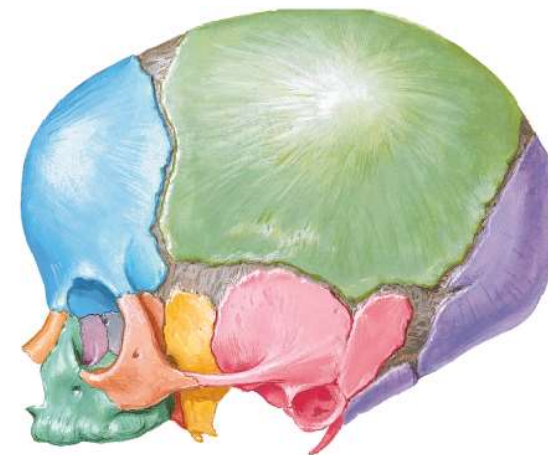
1-Anterior fontanelle

Close time: 1~2 years old

2-Posterior fontanelle

Closes at 2~3 months after birth

Skull of newborn
Lateral view



Skull of newborn
superior view

Different view of the full-term fetus skull



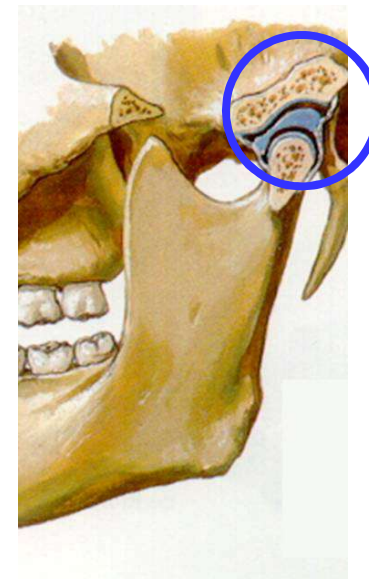
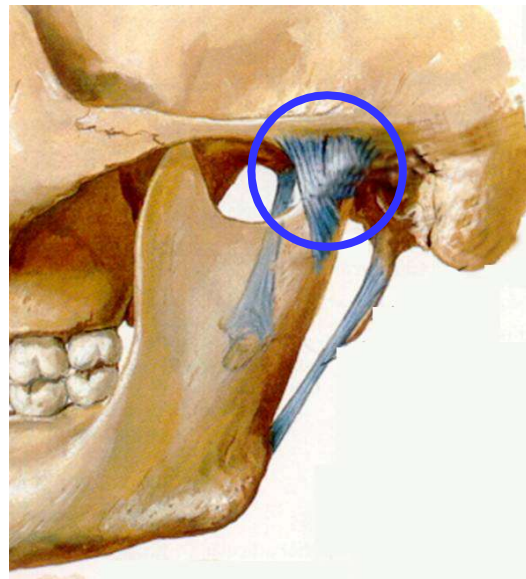
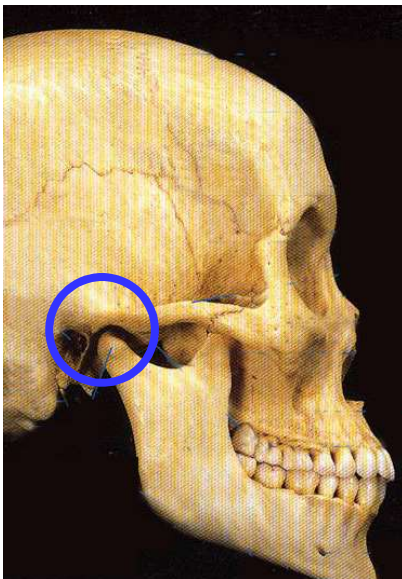
The joints of the skull are divided into three type:

Sutures: Coronal suture, sagittal suture and lambdoid

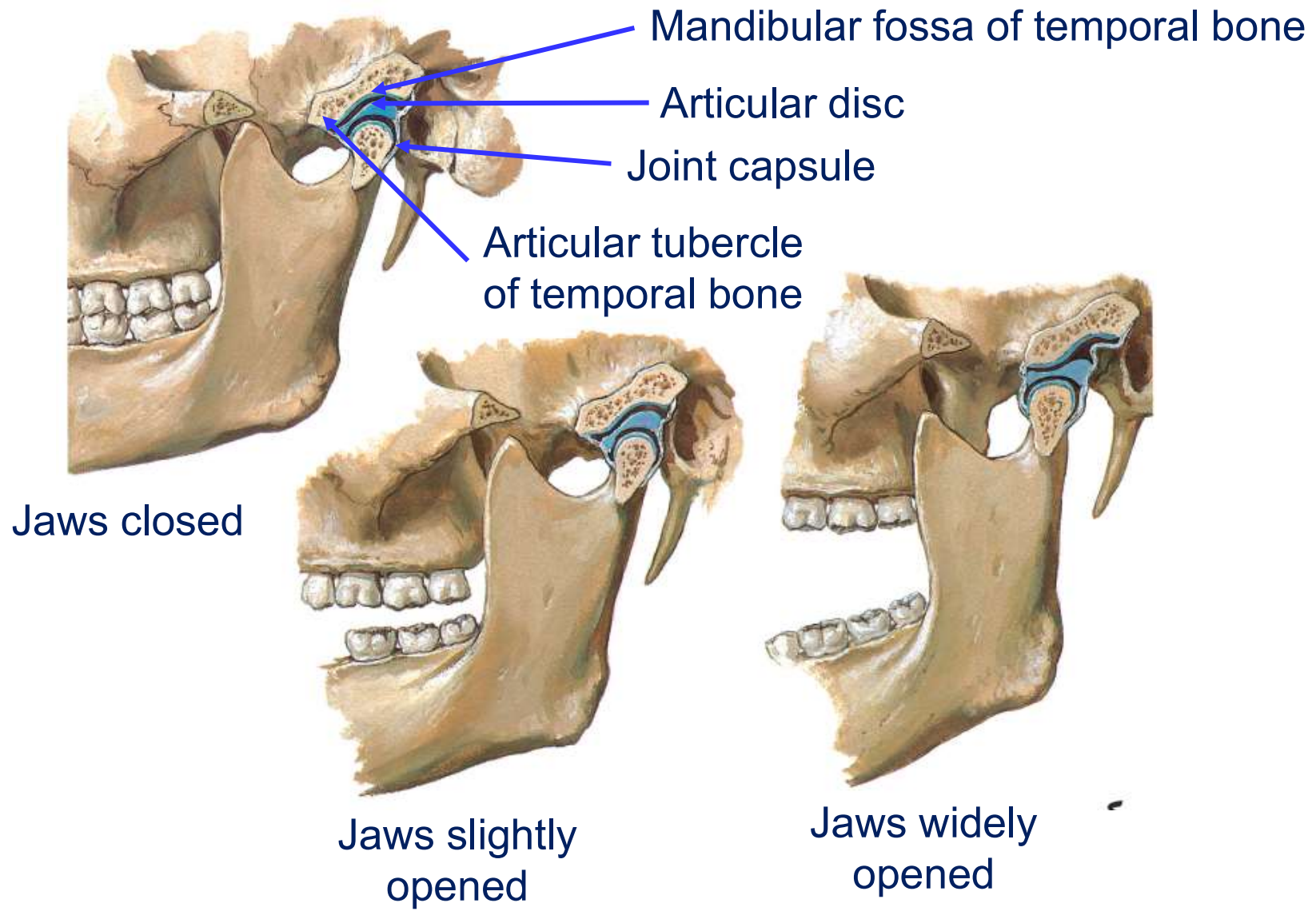
Cartilagenous: Occipitospheroid, petrosphenod etc.

Synovial joint: Temporomandibular joint- **important**

Mandibular fossa and condylar process of the mandible



United joints, open large & intake, dislocation (lock jaw)



**The following content will be learned
by observing the specimen and model.**

Orbit of eyes

Pyramid-shaped cavities

Base: supraorbital notch

Infraorbital foramen

Apex: optic canal

Superior Wall

Fossa for lacrimal gland

Medial wall

Fossa for lacrimal sac

Inferior wall

Infraorbital fissure

Infraorbital groove

Infraorbital canal



Identify them in the specimen

Bony nasal cavity

Roof:

Cribriform plate of ethmoid

Floor:

Bony palate

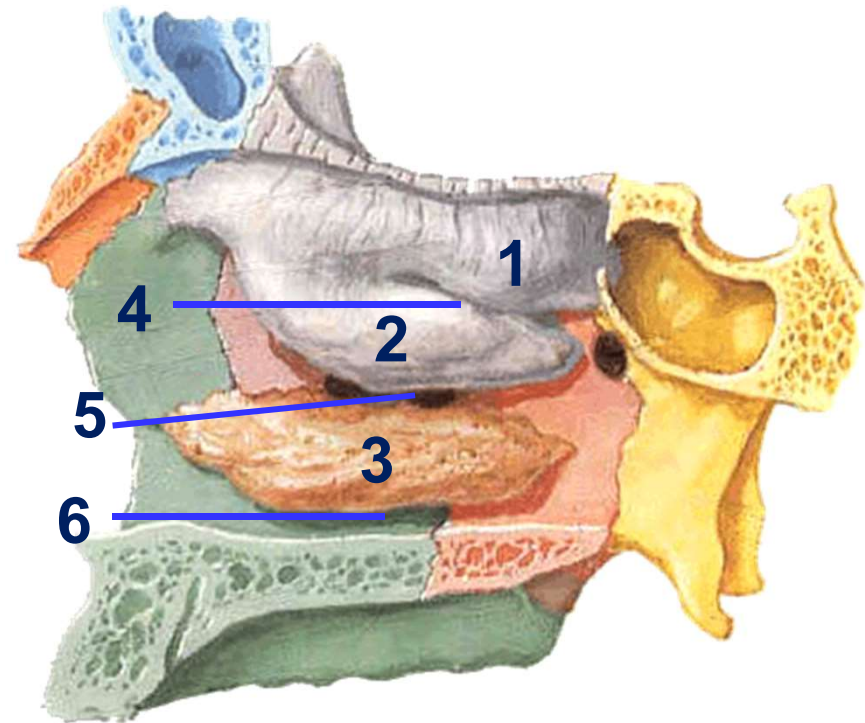
Lateral wall

Three nasal conchae(1-3)

Nasal meatus underlying
each concha (4-6)

Medial wall

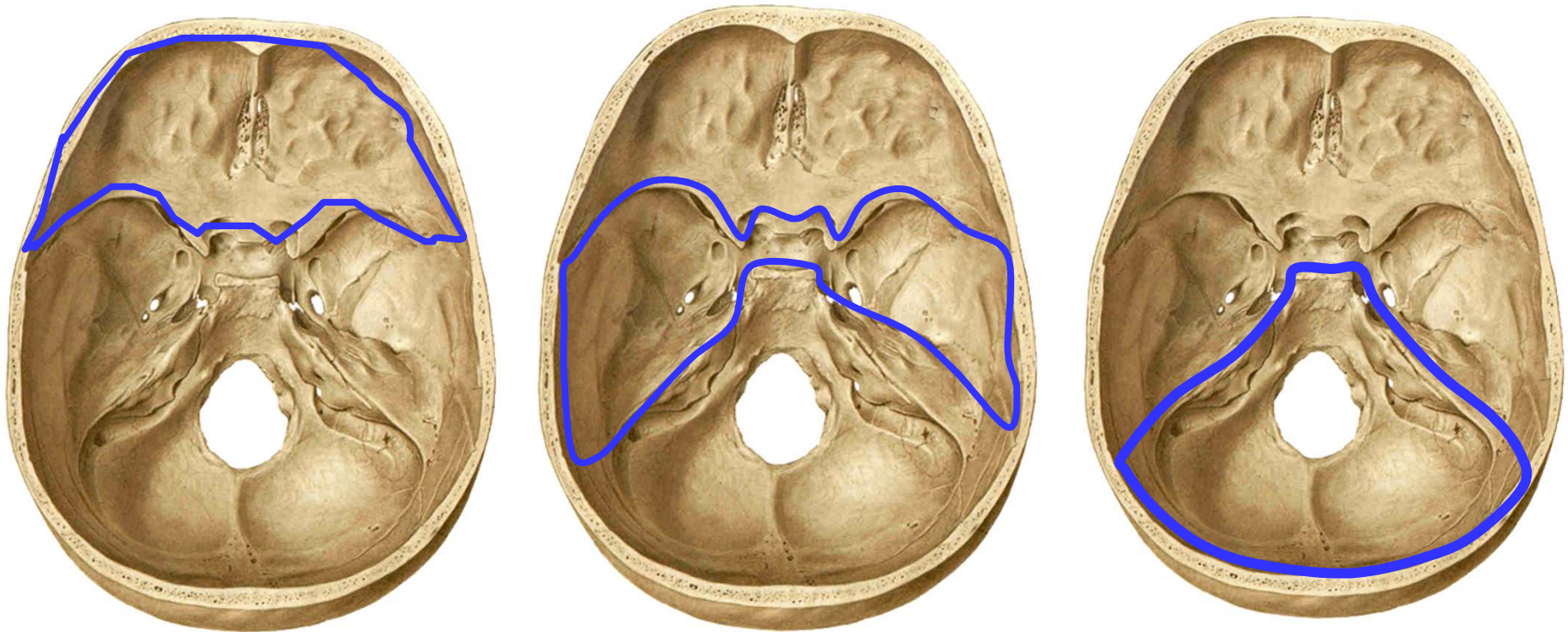
Nasal septum



Lateral wall of nasal cavity

cranial fossa

Ant.mid.post.cranial fossas

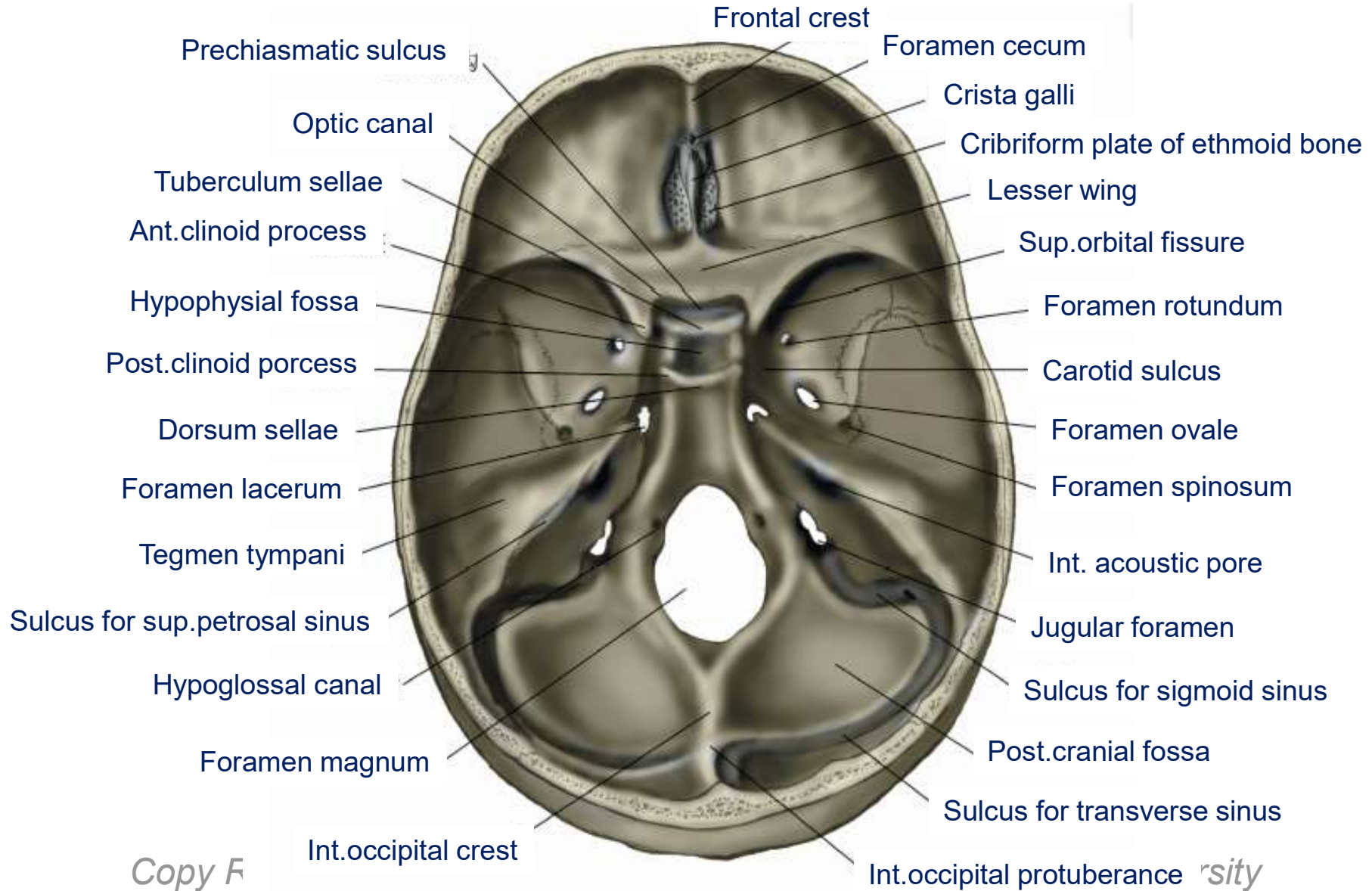


Sup.view of cranial base

Copy

Base of the skull (internal view)

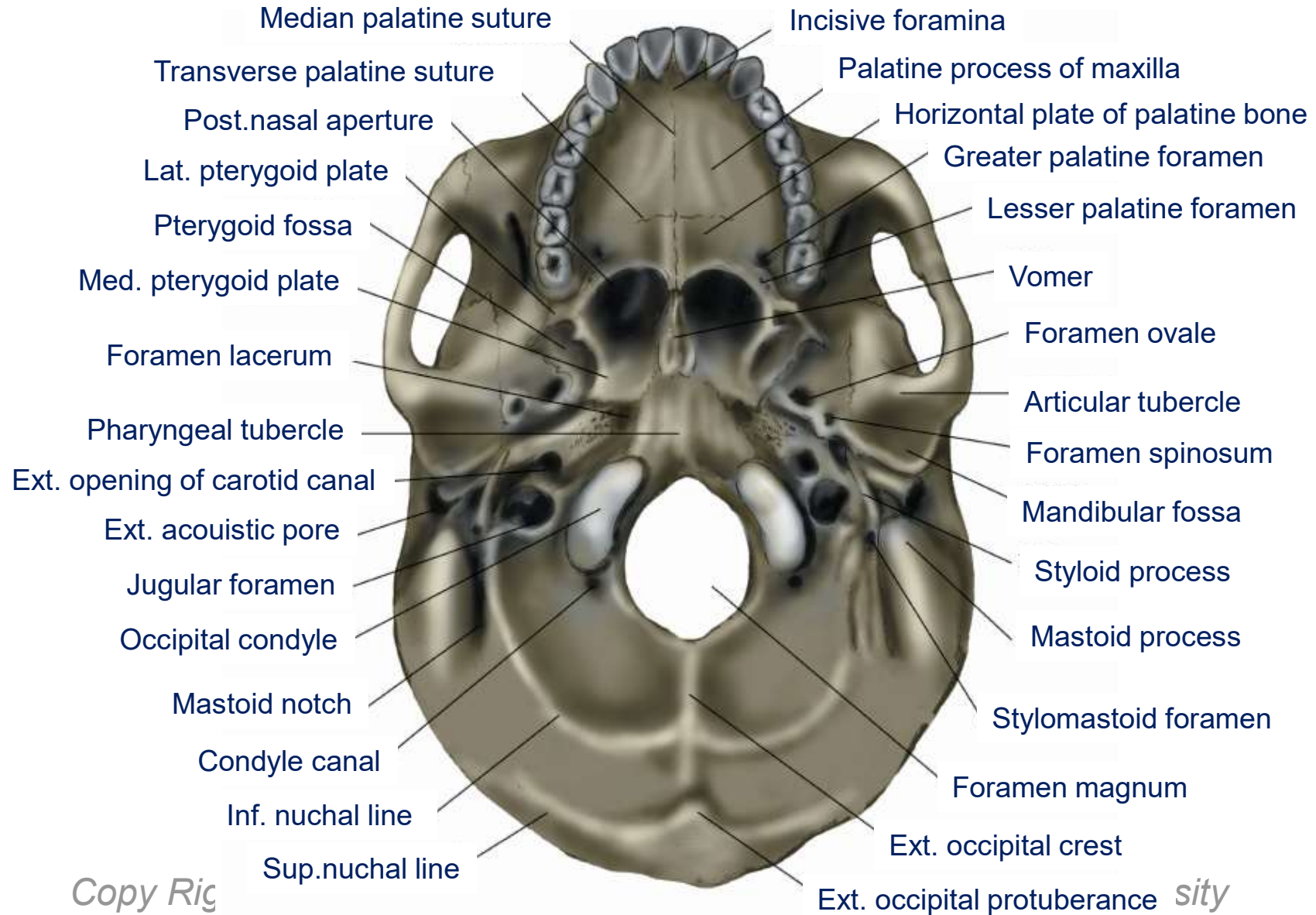
ty



Copy F

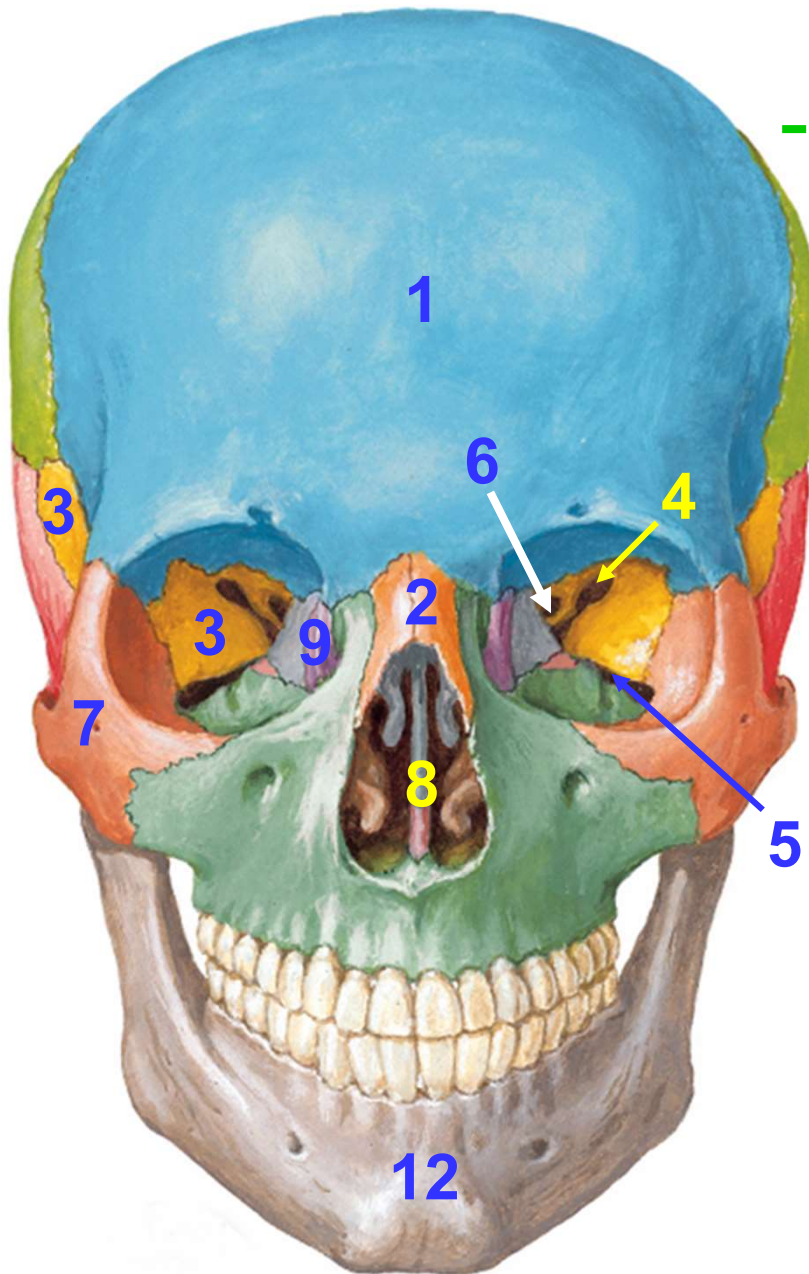
rsity

Base of the skull (external view) sity



Copy Rig

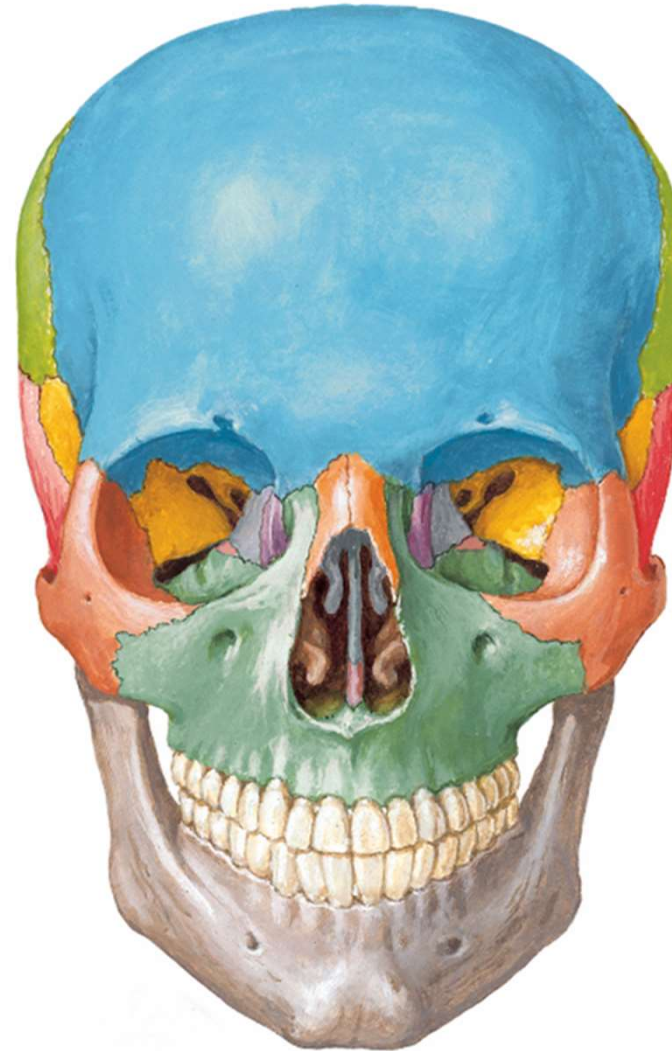
Skull-ant.view



- 1-Frontal bone
- 2-Nasal bone
- 3-Lesser wing of sphenoid bone
- 4-Sup. orbital fissure
- 5-Inf. orbital fissure
- 6-optic canal (foramen)
- 7-Zygomatic bone
- 8-Ethmoid bone
- 9-Lacrimal bone
- 10-Orbital process of palatine bone
- 11-Infraorbital groove
- 12-Maxilla

Skull viewed from the front (ant. view)

Frontal region:
frontal squama
frontal tuber
superciliary arch
glabella



The structures passing the opening or fissure of cranial base

Opening or fissure	Passing structure
Cribriform foramina	Olfactory nerve.
Sup.orbital fissure	Optic nerve.
	Oculomotor nerve.
	Trochlear nerve.
	1st branch of trigeminal nerve
Foramen rotundum	Maxillary nerve
Foramen ovale	Mandibular nerve
Foramen spinosum	Mid. Meningeal artery.
Foramen lacerum	Internal carotid artery.
Internal. acoustic pore	Facial nerve
	Vestibulocochlear nerve
Jugular foramen	Internal carotid vein, vagus nerve
	Glossopharyngeal nerve
	Accessory nerve
Hypoglossal canal	Hypoglossal nerve

Bone	Part	Description
Frontal	<ul style="list-style-type: none"> • Frontal sinus • Coronal suture 	<ul style="list-style-type: none"> • Air cavity that opens into nasal cavity • Joint between frontal and parietal bones
Parietal (2)	<ul style="list-style-type: none"> • Sagittal suture 	<ul style="list-style-type: none"> • Joint between the 2 parietal bones
Temporal (2)	<ul style="list-style-type: none"> • Squamosal suture • External auditory meatus • Mastoid process • Mastoid sinus • Mandibular fossa • Zygomatic process 	<ul style="list-style-type: none"> • Joint between temporal and parietal bone • The tunnel-like ear canal • Oval projection behind the ear canal • Air cavity that opens into middle ear • Oval depression anterior to the ear canal; articulates with mandible • Anterior projection that articulates with the zygomatic bone

Bone	Part	Description
Occipital	<ul style="list-style-type: none"> • Foramen magnum • Condyles • Lambdoid suture 	<ul style="list-style-type: none"> • Large opening for the spinal cord • Oval projections on either side of the foramen magnum; articulate with the atlas • Joint between occipital and parietal bones
Sphenoid	<ul style="list-style-type: none"> • Greater wing • Sella turcica • Sphenoid sinus 	<ul style="list-style-type: none"> • Flat, lateral portion between the frontal and temporal bones • Central depression that encloses the pituitary gland • Air cavity that opens into nasal cavity

Bone	Part	Description
Ethmoid	<ul style="list-style-type: none"> • Ethmoid sinus • Crista galli • Cribriform plate and olfactory foramina • Perpendicular plate • Conchae (4 are part of ethmoid; 2 inferior are separate bones) 	<ul style="list-style-type: none"> • Air cavity that opens into nasal cavity • Superior projection for attachment of meninges • On either side of base of crista galli; olfactory nerves pass through foramina • Upper part of nasal septum • Shelf-like projections into nasal cavities that increase surface area of nasal mucosa
Mandible	<ul style="list-style-type: none"> • Body • Condyles • socket 	<ul style="list-style-type: none"> • U-shaped portion with lower teeth • Oval projections that articulate with the temporal bones • Conical depressions that hold roots of lower teeth

Description of cranial Bones

Bone	Part	Description
Maxilla (2)	<ul style="list-style-type: none"> • Maxillary sinus • Palatine process • Sockets 	<ul style="list-style-type: none"> • Air cavity that opens into nasal cavity • Projection that forms anterior part of hard palate • Conical depressions that hold roots of upper teeth
Nasal (2)		<ul style="list-style-type: none"> • Form the bridge of the nose
Lacrimal (2)	<ul style="list-style-type: none"> • Lacrimal canal 	<ul style="list-style-type: none"> • Opening for nasolacrimal duct to take tears to nasal cavity
Zygomatic (2)		<ul style="list-style-type: none"> • Form point of cheek; articulate with frontal, temporal, and maxillae
Palatine (2)		<ul style="list-style-type: none"> • Form the posterior part of hard palate
Vomer		<ul style="list-style-type: none"> • Lower part of nasal septum

-
1. Lig. & joints related to the bones of trunk.
 2. Function, location & structure of Intervertebral disc.
 3. Number, name, location of the cranial bone.
 4. Identify the shape and location of each cranial bones.
 5. What are bones to form the orbit?
 6. Name, location and function of paranasal sinuses.
 7. Where is pterion and what is its feature?
 8. Where are ant. & post. fontanelle & when they close?
 9. Master the shape structure of the mandible.
 10. Master the structure of temporomandibular joint.

The end !

Good luck to you!

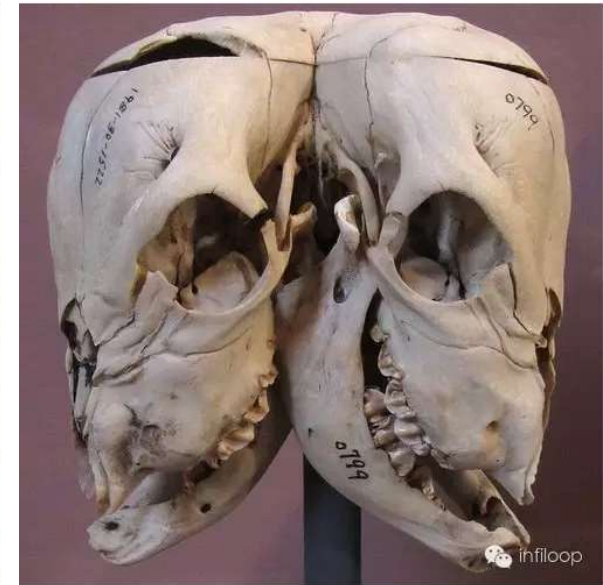


The content of next lecture

Upper limb bones and their joints

Copy Right- Hongqi ZHANG-Department of Anatomy-Fudan University

被上帝遗弃的孩子 Abandoned Children by God



Copy Right- Hongqi ZHANG-Department of Anatomy-Fudan University

Copy Right- Hongqi ZHANG-Department of Anatomy-Fudan University



Copy Right- Hongqi ZHANG-Department of Anatomy-Fudan University

丹霞地貌 Danxia landform in Gansu province



Copy Right- Hongqi ZHANG-Department of Anatomy-Fudan University

