



General anatomy

المرحلة الاولى

Lec (5)

م.د محمد نمر

The skull

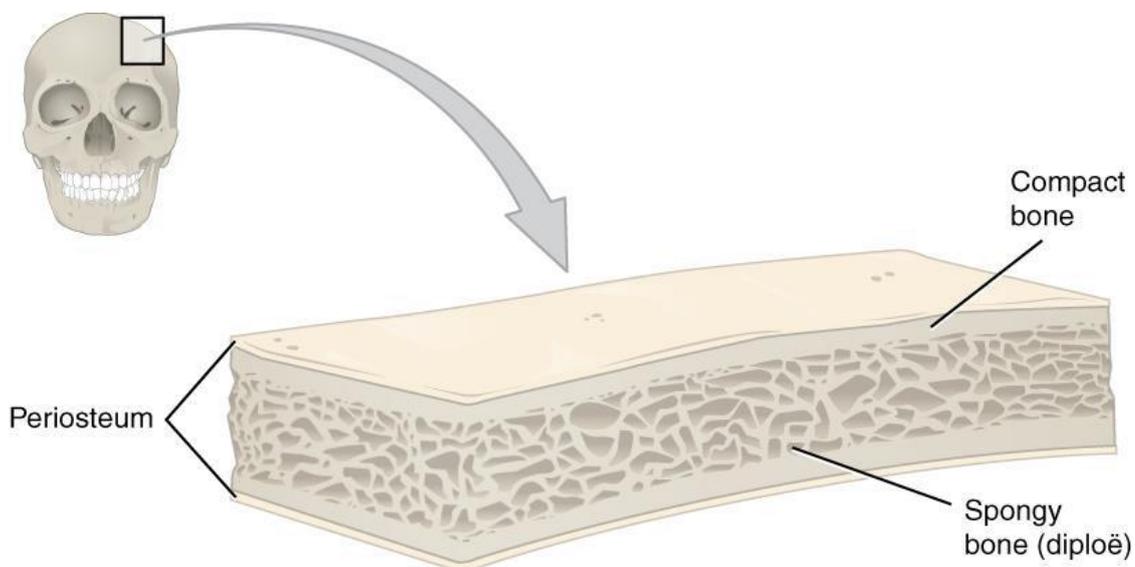
The skull is composed of several separate bones united at immobile joints called *sutures*.

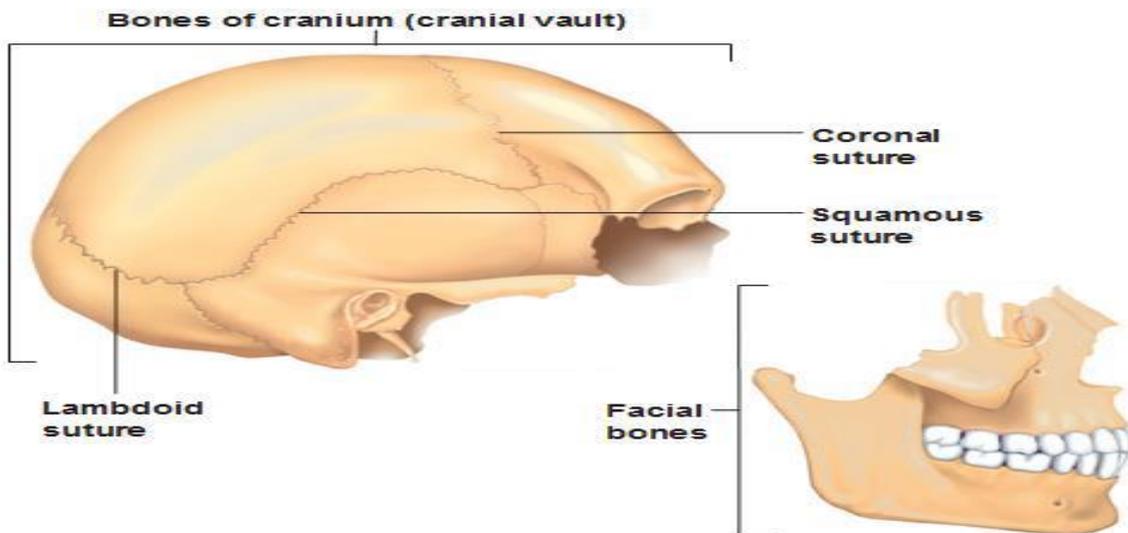
The mandible is an exception to this rule; it is united to the skull by the mobile *temporomandibular joint*.

The skull is composed of 22 bones and can be divided into those of the **cranium** which are 8 in number and those of the **face** which are 14 bones.

The *vault* is the upper part of the cranium, and the *base of the skull* is the lowest part of the cranium.

The skull bones are made up of *external* and *internal tables* of compact bone separated by a layer of spongy bone called the *diploë*. The internal table is thinner and more brittle than the external table. The bones are covered on the outer and inner surfaces with periosteum.



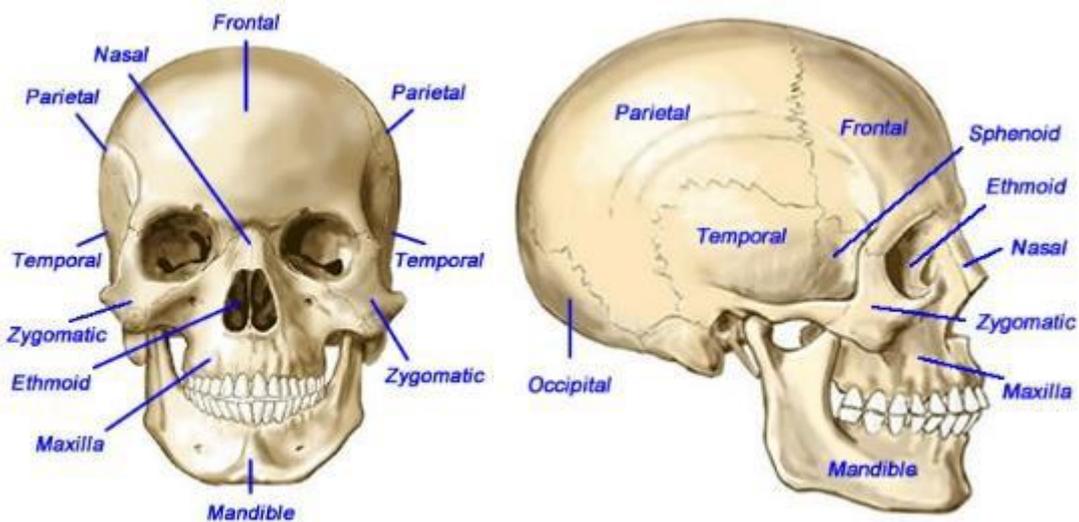


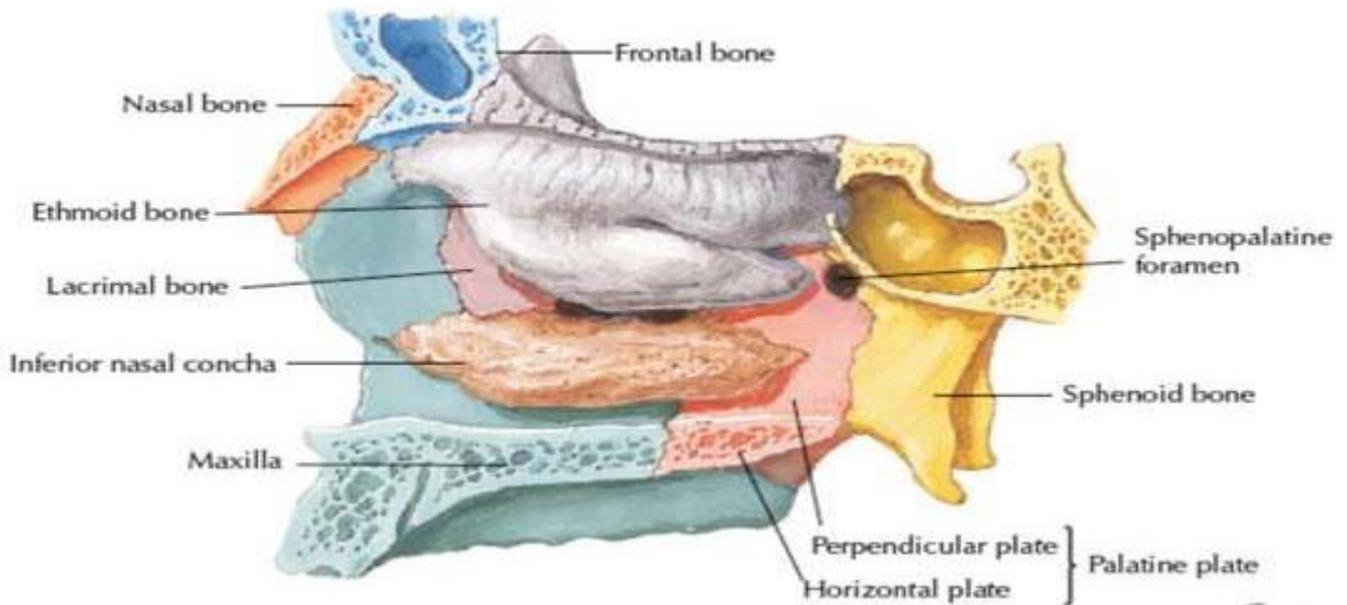
The **cranium** consists of the following bones, two of which are paired:

1. Frontal bone: 1
2. Parietal bones: 2
3. Occipital bone: 1
4. Temporal bones: 2
5. Sphenoid bone: 1
6. Ethmoid bone: 1

The **facial** bones consist of the following, two of which are single:

1. Zygomatic bones: 2
2. Maxillae: 2
3. Nasal bones: 2
4. Lacrimal bones: 2
5. Vomer: 1
6. Palatine bones: 2
7. Inferior conchae: 2
8. Mandible: 1





The Cranium

Frontal bone

Parts:

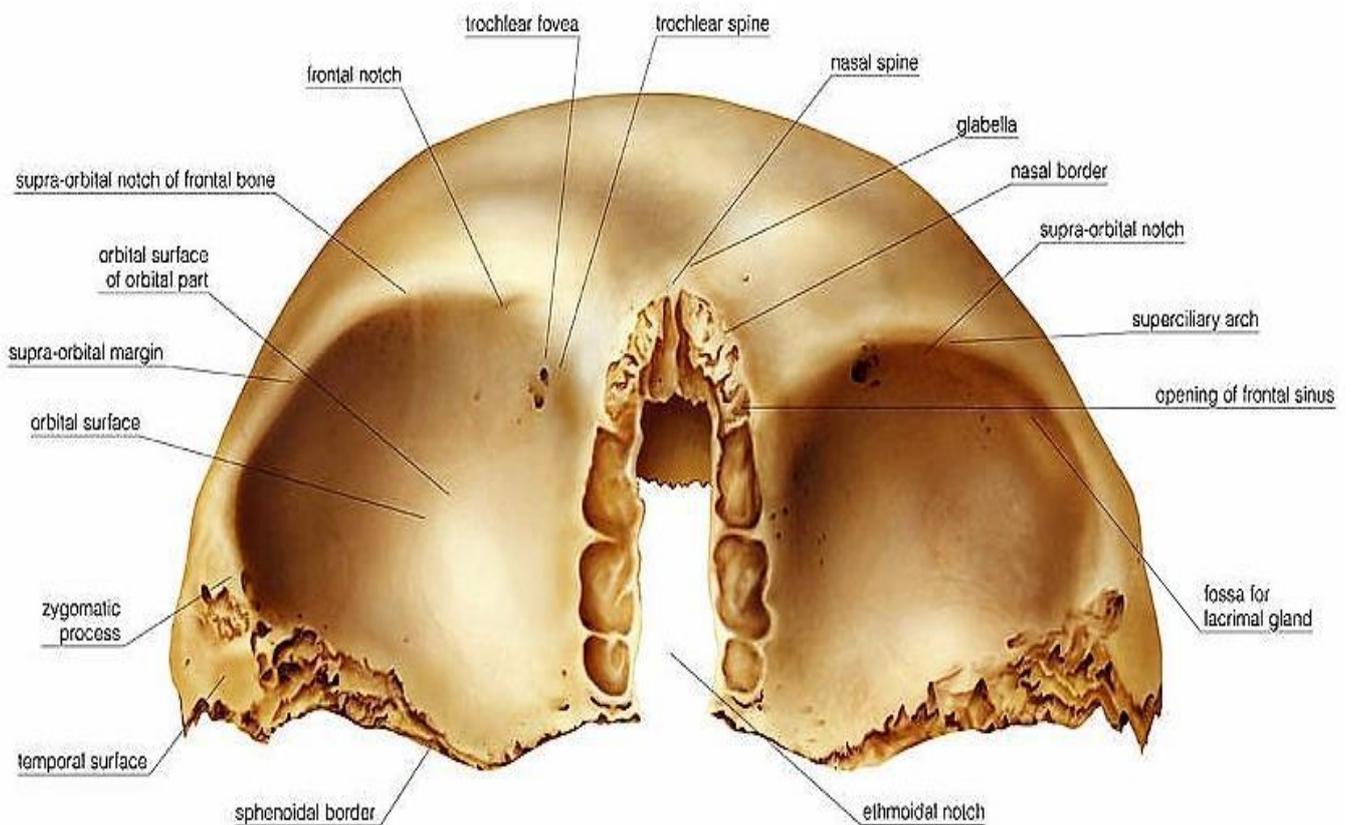
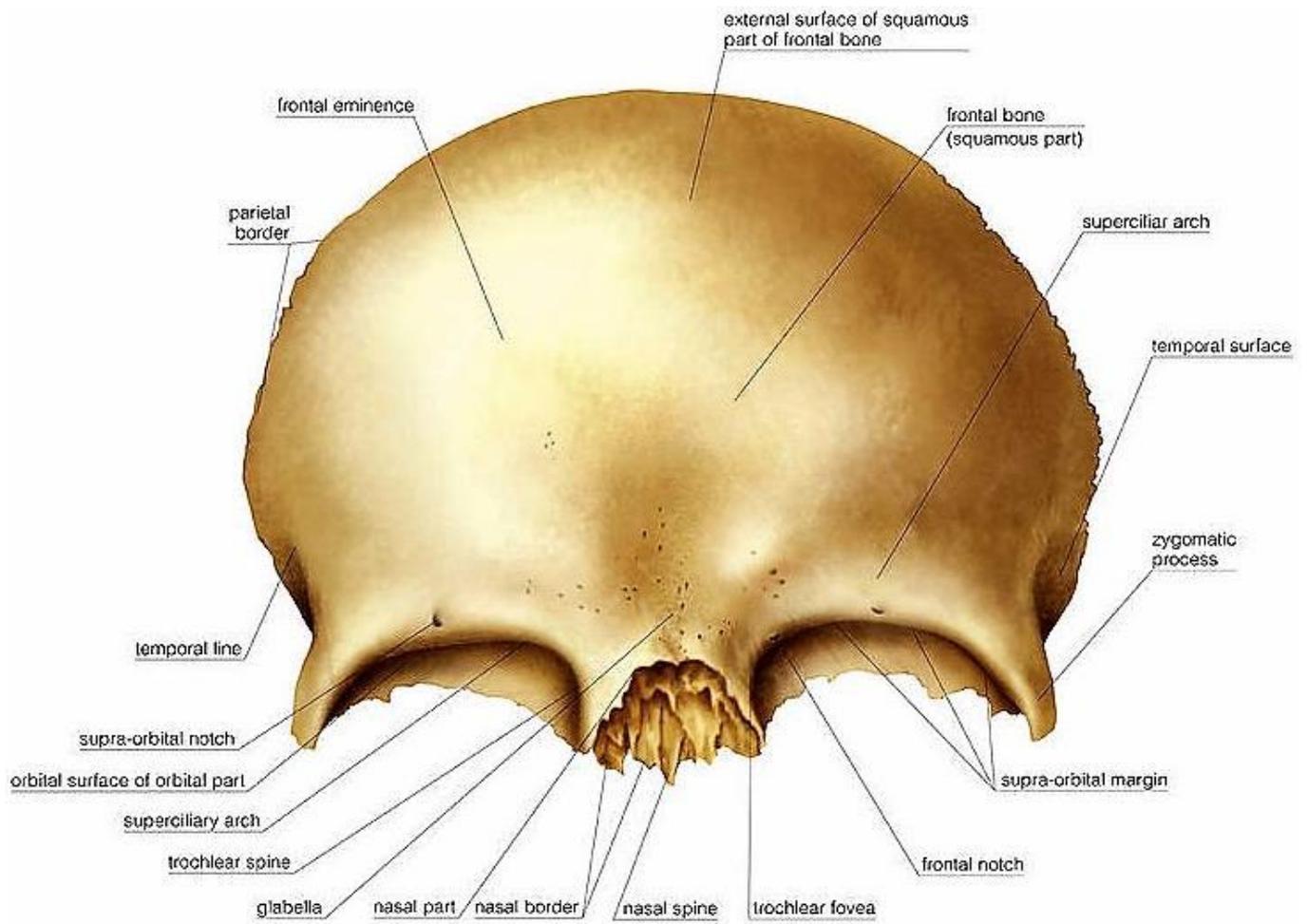
- Squamous portion
 - The largest part of the frontal bone.
 - Form the majority of the forehead
 - Form the supraorbital margin and the superciliary arch
 - The zygomatic process of the frontal bone extends from the lateral part of supraorbital margin.

- Orbital portion

Form the roof of the orbit and floor of the anterior cranial fossa.

- Nasal portion

Articulates with the nasal bones and frontal process of the maxilla to form the roof of the nose



Parietal bones

Characteristics

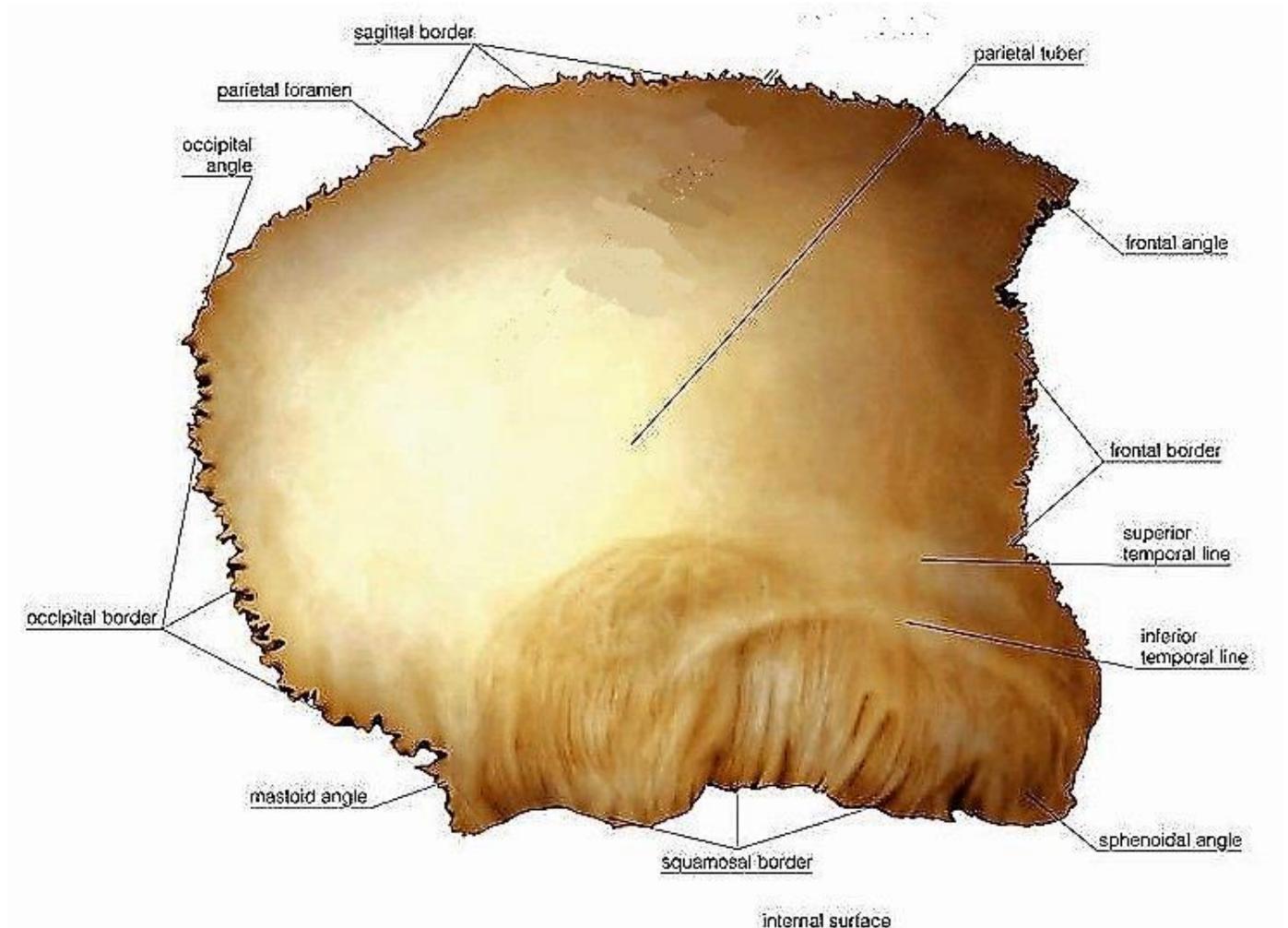
- Forms the majority of the cranial vault and provide attachment for the temporalis Muscle

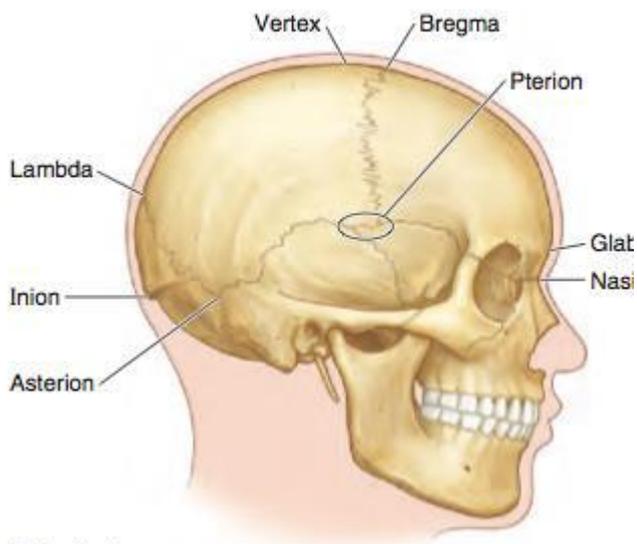
- The four corners of the parietal are not ossified at birth and give rise to the Fontanelles

- There are two parietal bones
- Relatively square in shape
- They form the roof and sides of the cranial vault.

It has 4 angles:

1. Frontal----located at bregma
(meeting of coronal and sagittal sutures)
2. Sphenoid---located at pterion
(area where parietal, temporal and sphenoid bones join)
3. Occipital---located at lambda
(meeting of sagittal and lambdoid sutures)
4. Mastoid-----located at asterion
(meeting of parietal bone, occipital bone and mastoid part of temporal bone)





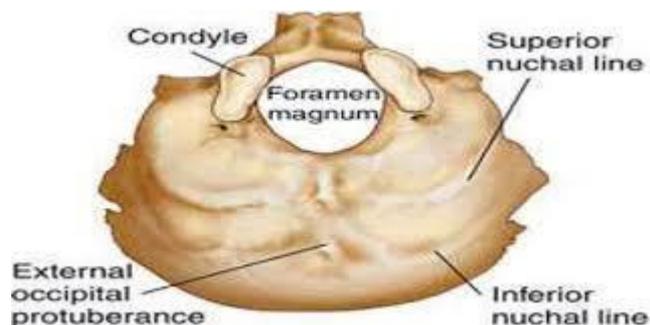
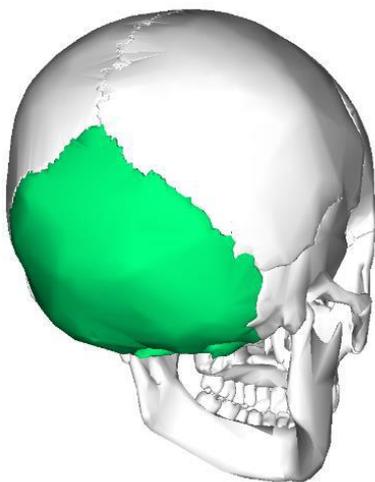
Occipital bone

Characteristics

1. Forms the posterior part of the cranial vault
2. Articulates with the atlas (first cervical vertebra)
3. there is 1 occipital bone

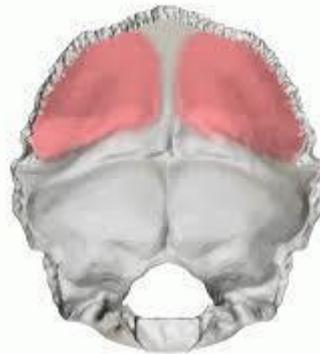
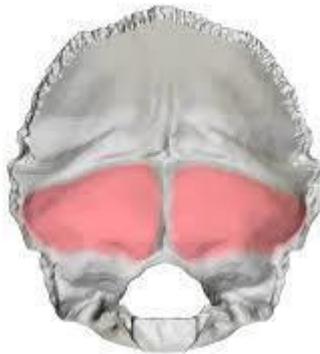
Parts:

- Squamous portion
 - Articulates with the temporal and parietal bone
 - The largest portion of the occipital bone
 - Located posterior and superior to the foramen magnum
 - Has the external occipital protuberance (more pronounced in males)
 - Has the superior and inferior nuchal lines
 - Has grooves on the internal surface for 3 of the sinuses forming the confluences of the sinuses (the superior sagittal and the right and left transverse sinuses)



- The depression superior to the transverse sinus is for the occipital lobes of the brain

- The depression inferior to the transverse sinus is for the cerebellum.



lateral (condylar) portion

○ articulates with temporal bone

○ it is located lateral to the foramen magnum

○ has the occipital condyles that articulate with the atlas

○ contain the hypoglossal canal

○ forms a portion of the jugular foramen.



• basilar portion

○ articulates with the petrous of the temporal and sphenoid bones

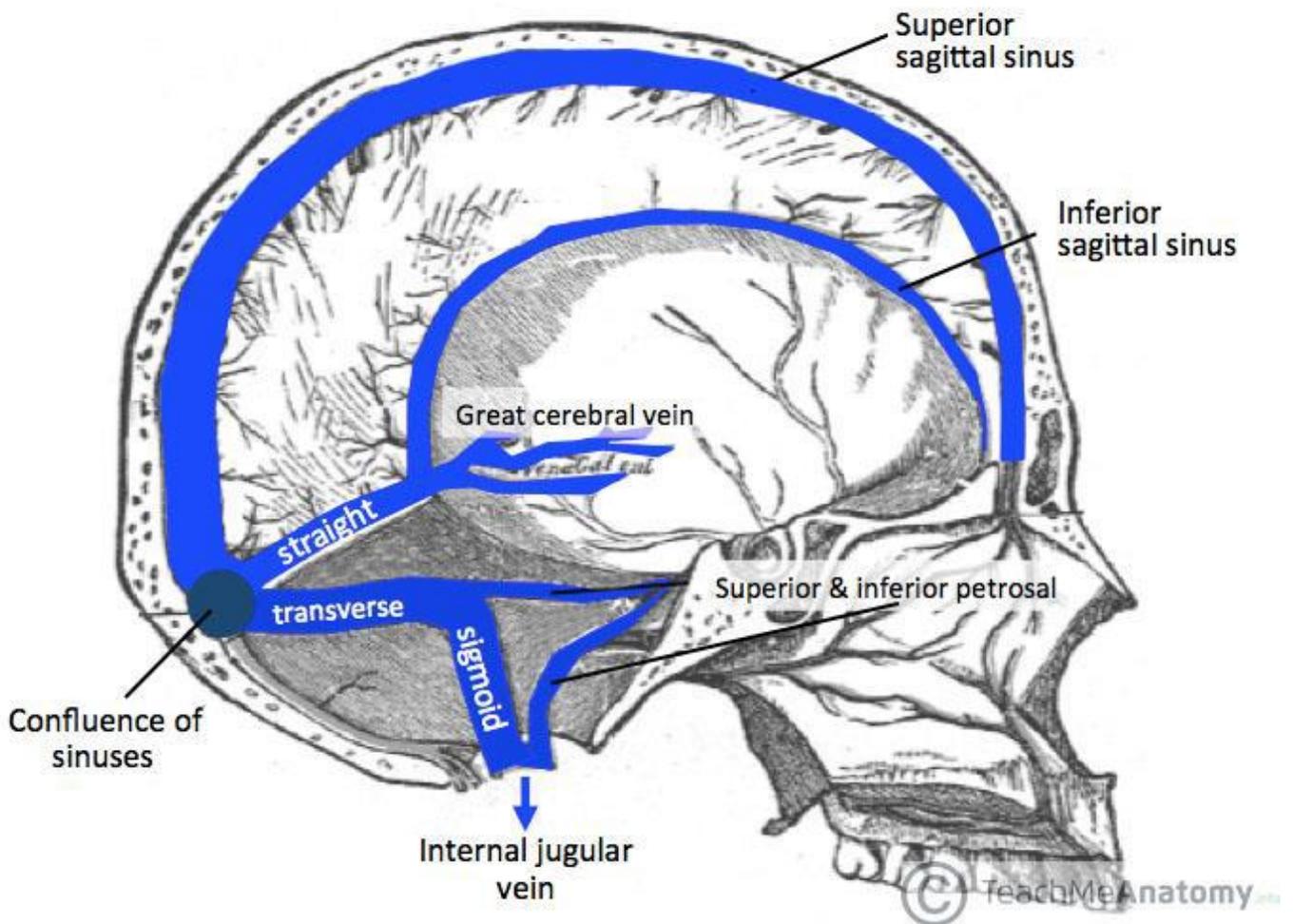
○ its located immediately anterior to the foramen

magnum

○ Internal surface of the basilar portion is called the



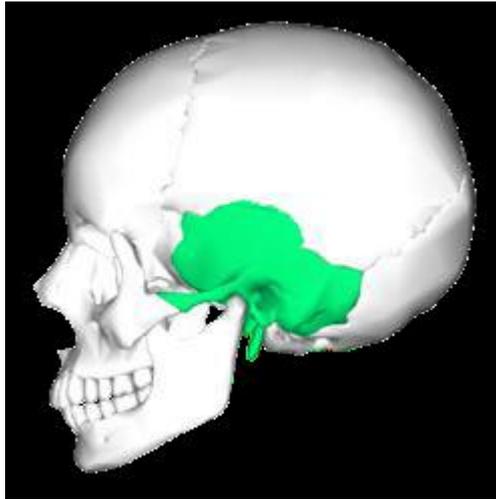
clivus; and part of the brain stem lies against it



Temporal bone

Characteristics

1. Helps form the base and the lateral wall of the skull
2. House the auditory and vestibular apparatuses
3. Contain mastoid air cells



4. There are 2 temporal bones

Parts:

- **Squamous portion**

- The largest portion of the bone
- Three portions to the squamous part:

1. Temporal

- Temporal portion is the thin large area on the squamous part of the temporal
- On the internal surface of the temporal portion lies a groove for the middle meningeal artery

2. Zygomatic process

- The Zygomatic process extends laterally and anteriorly from the Squamous portion; it articulates with the temporal process of the zygomatic bone to make the zygomatic arch

3. Glenoid fossa

- Glenoid fossa is inferior and medial to the zygomatic process; it articulates with the mandibular condyle forming the temporomandibular joint.

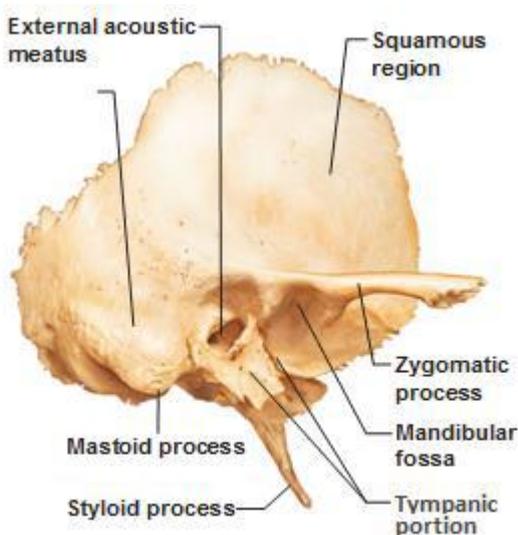
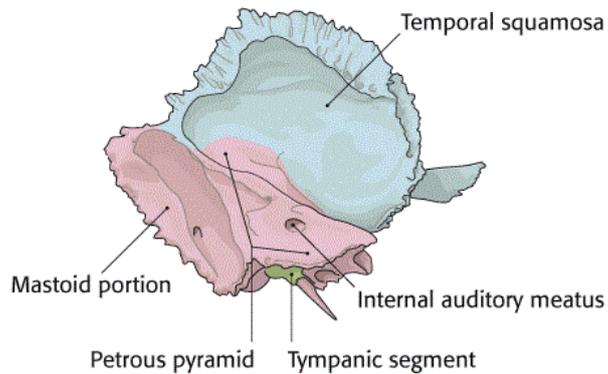
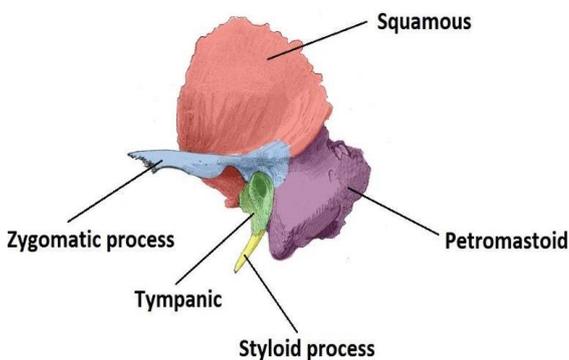
- **Petrous portion**

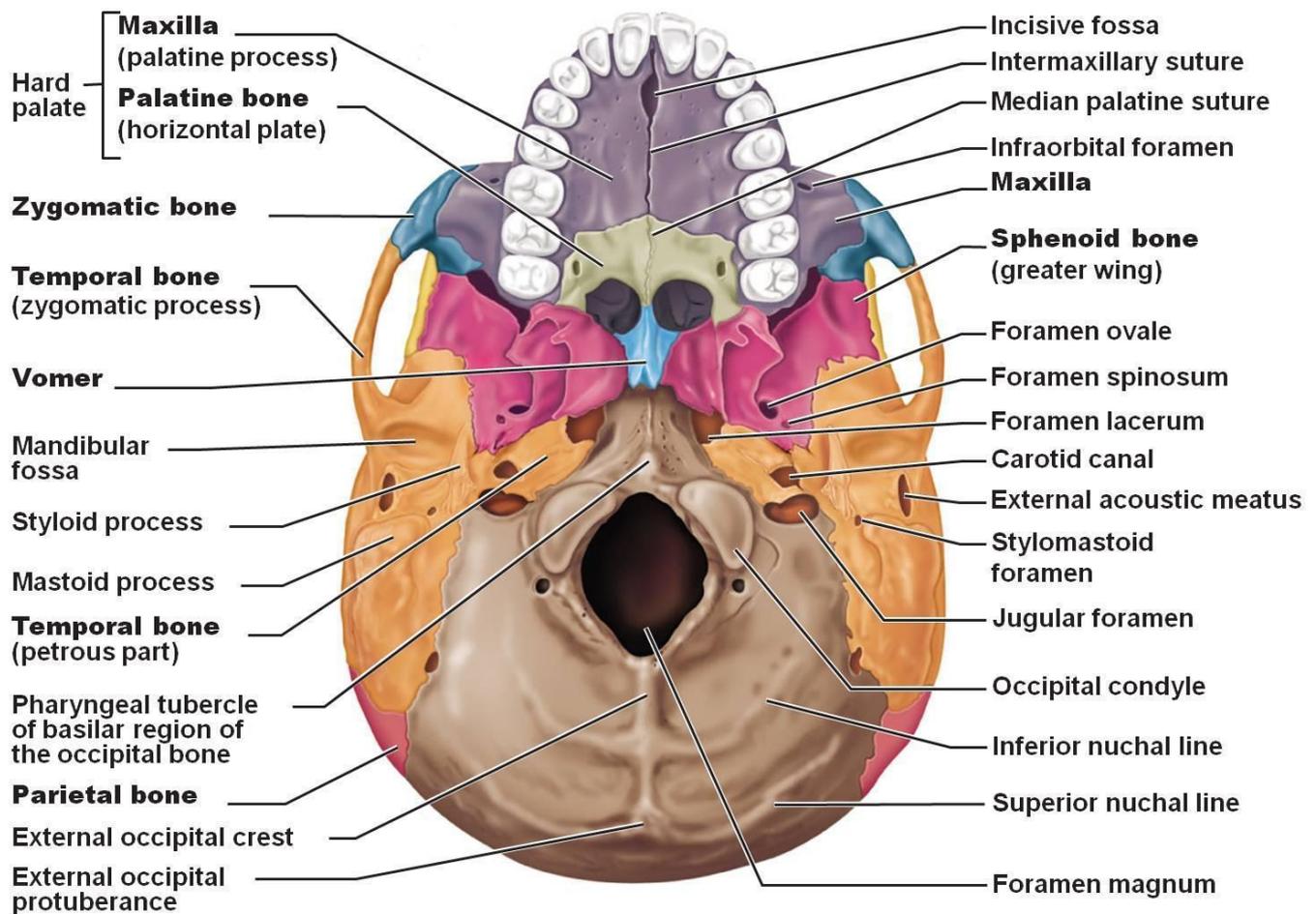
- Form the solid portion of the bone
- The auditory and vestibular apparatuses are located within the petrous part
- It extends anteriorly and medially
- The medial part articulates with the sphenoid to form the foramen lacerum
- Internal acoustic meatus is observed on the medial side of the petrous part
- Carotid canal lies on the inferior part of the petrous part
- Petrotympenic fissure lies between the petrous part of the temporal bone and the tympanic part of the temporal bone

- On the medial portion of the petrous part lie groove for the superior and inferior petrosal sinuses
- On the posterior inferior surface of the petrous part lies the jugular fossa.

Between the jugular fossa and the carotid canal is the tympanic canaliculus

- The mastoid process extends posteriorly and has large mastoid air cells
- **Tympanic portion**
 - a plate of bone forming the anterior, posterior and inferior portion of the external acoustic meatus
 - anterior part form the posterior portion of the glenoid fossa
- **Styloid process**
 - a project from the temporal bone
 - the stylomastoid foramen lies posterior to this process





(a) Inferior view of the skull (mandible removed)

Parts:

- **body:**
 - the center of the sphenoid bone
 - anterior portion of the body helps form part of the nasal cavity
 - superior part of the body, known as the sella turcica, is a saddle shaped and possesses the anterior and posterior clinoid processes
 - hypophyseal fossa, the deepest part of sella turcica, houses the pituitary gland
 - dorsum sellae is square shaped part of the bone that lies posterior to the sella turcica
 - body contains the sphenoid paranasal sinus
 - optic canal is found in the body of the sphenoid
- **greater wing:**
 - extends laterally and anteriorly from the posterior portion of the body of the

sphenoid

- forms a large part of the middle cranial fossa
- lateral portion is the infratemporal surface
- anterior portion lies in the orbit
- contain 3 foramina

4. foramen spinosum

5. foramen rotundum

6. foramen ovale

- **lesser wing:**

- extend laterally and anteriorly from the superior portion of the sphenoid body
- separated from the greater wing by the superior orbital fissure

- **pterygoid process:**

- arises from the inferior surface of the body
- there are 2 pterygoid process each has:

○ lateral pterygoid plate

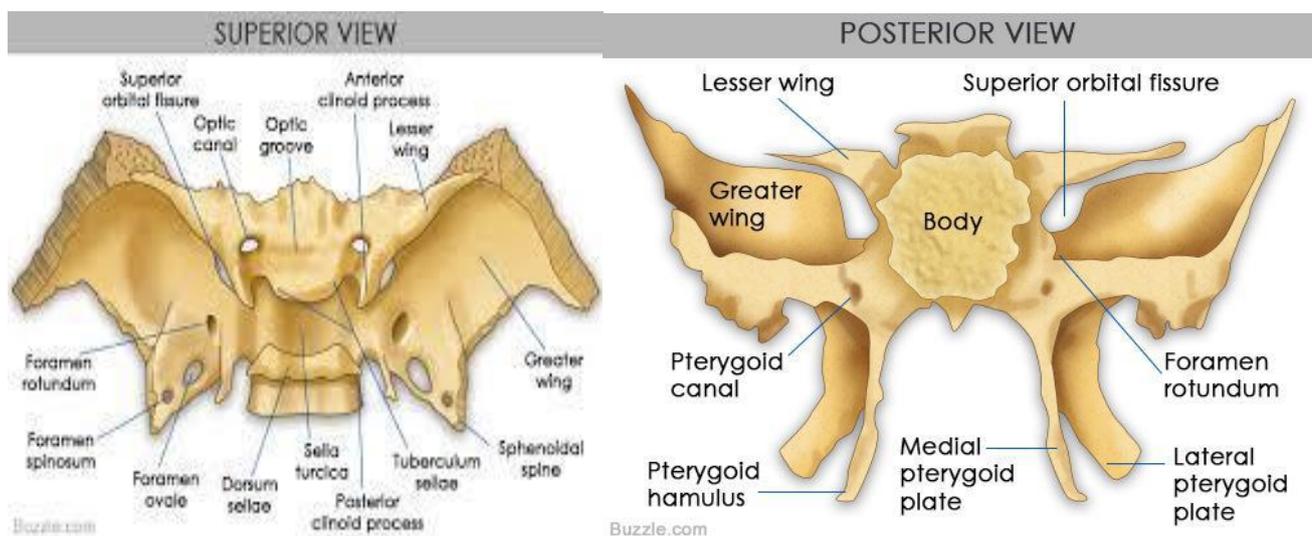
○ medial pterygoid plate

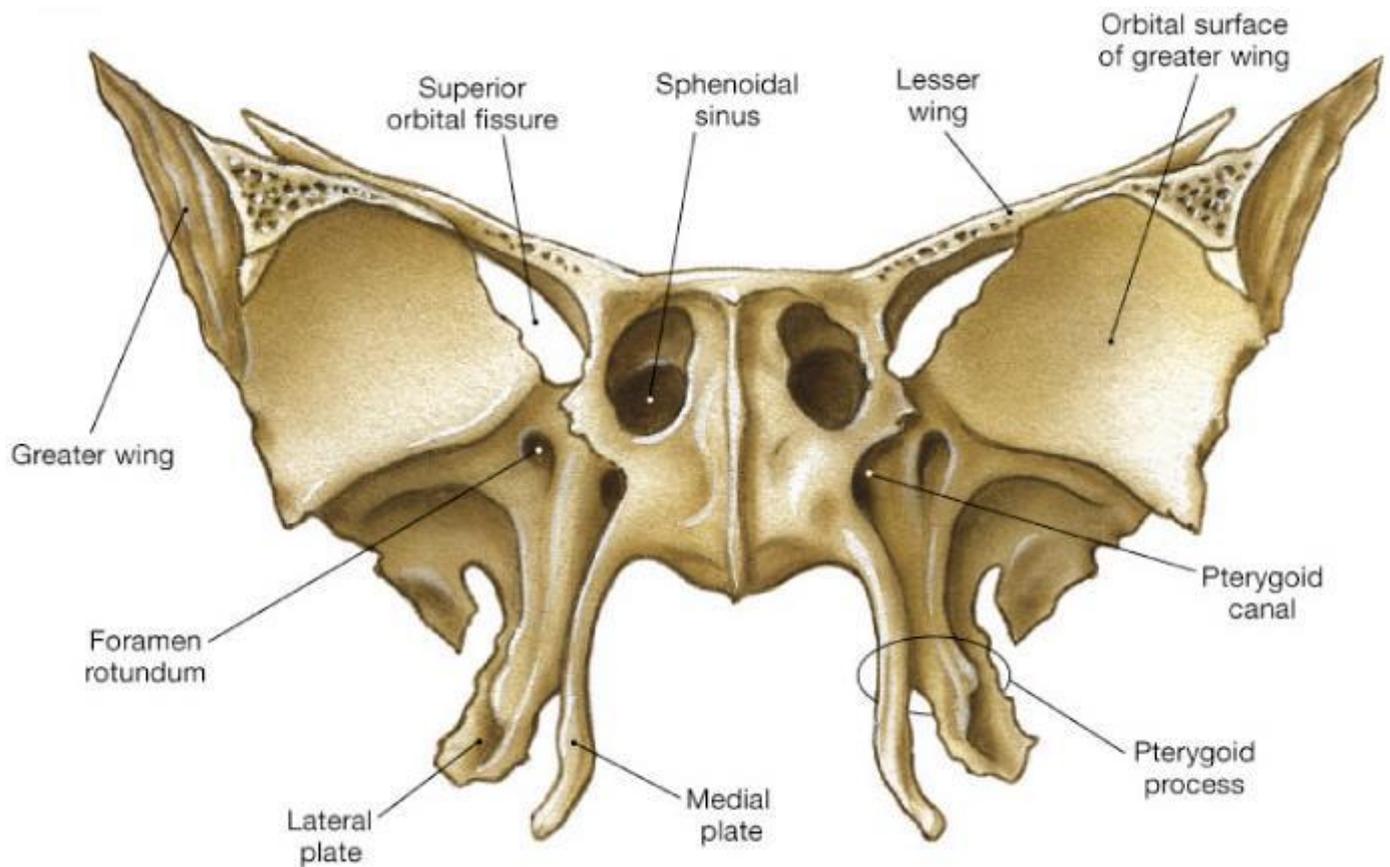
- pterygoid hamulus extends from the medial pterygoid plate

- two canals are associated with the pterygoid process:

○ pterygoid canal

○ pharyngeal canal





Ethmoid bone

Characteristics

- a porous bone that forms the major portion of the middle part of the face between the orbits
- helps form the orbit, nasal cavity, nasal septum and anterior cranial fossa
- there is 1 ethmoid bone

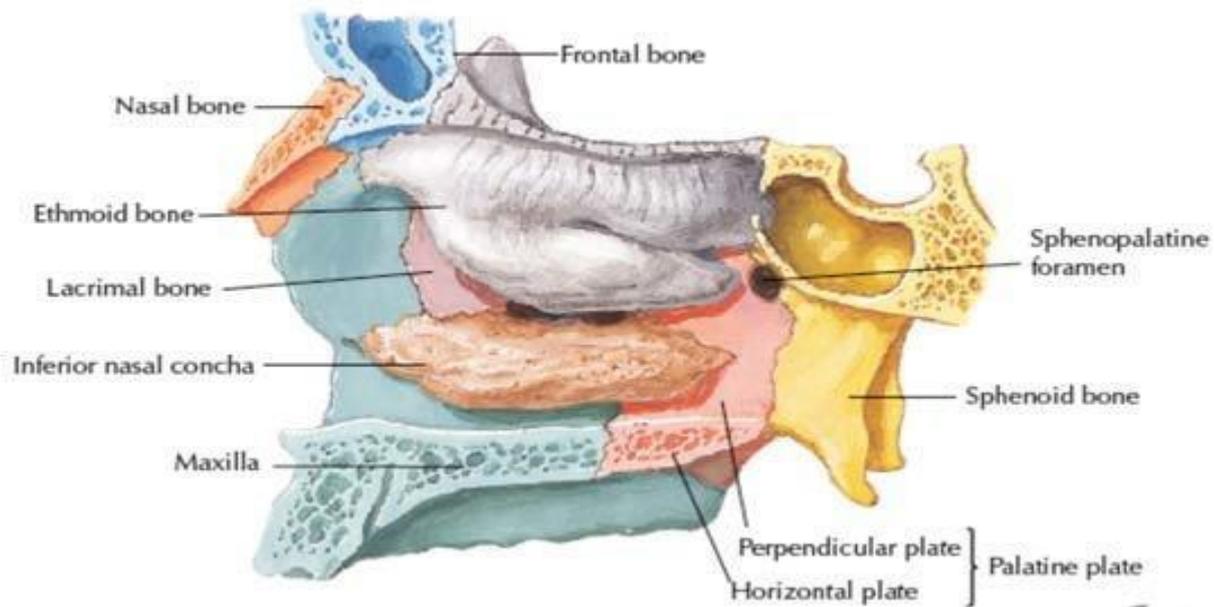
parts:

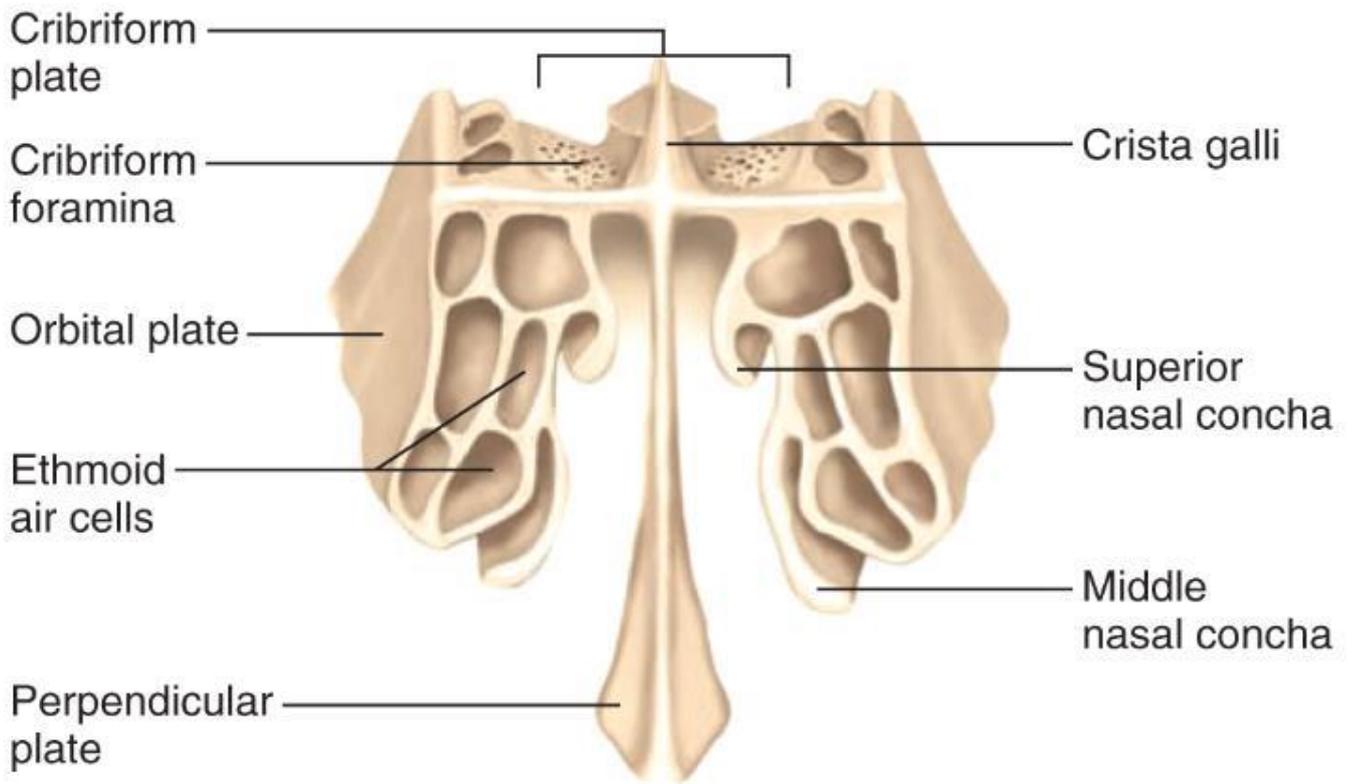
- **Perpendicular plate**
- A flat that descends from the cribriform plate to form part of the nasal septum
- Articulates with the vomer inferiorly

Cribriform plate

- A horizontal bone that forms the superior surface of the ethmoid and it contains numerous foramina for the olfactory nerve
- Crista galli is vertical plate that extends superiorly from the cribriform plate providing attachment for the falx cerebri of the meninges
- Associated with a small foramen cecum

- **Ethmoid labyrinth**
- The largest part of the ethmoid bone
- Descends inferiorly from the cribriform plate
- Ethmoid paranasal sinuses are located within the ethmoid labyrinth
- Ethmoid labyrinth forms 2 major structures within the nasal cavity:
 - Superior nasal concha
 - middle nasal concha







جامعة دجلة الأهلية

كلية طب الاسنان

GENERAL ANATOMY

LEC. 1

المرحلة الاولى



2018-2019

Human anatomy

Lec 1

Human body:

The human body is composed of a head, neck, trunk (which include thorax and abdomen, arms, hands, legs and feet). The study of human body involves anatomy, physiology, histology and embryology.

Anatomy:

Is the science that studies the structure, shape and function of human body. The body's shape is determined by a skeleton made of bones and cartilages, surrounded by fat, muscles, connective tissue, organs and other structures.

Clinical anatomy is the study of the macroscopic structure and function of the body as it relates to the practice of medicine and other health sciences.

Basic anatomy is the study of the minimal amount of anatomy consistent with the understanding of the overall structure and function of the body

Descriptive anatomic terms

It's important to medical health personnel to have a knowledge and understanding of the basic anatomic terms. Without anatomic terms, one cannot accurately discuss or record the abnormal function of the joints, the action of the muscles, the alteration in the position of the organs or the exact position of the swelling or the tumors.

Terms related to the position:

All descriptions of the human body are based on the assumption that the person is standing erect with the upper limbs by the sides, the face and palms of the hands are directed forward. This is called *Anatomic position*. The various parts of the body are then described in relation to certain imaginary planes.

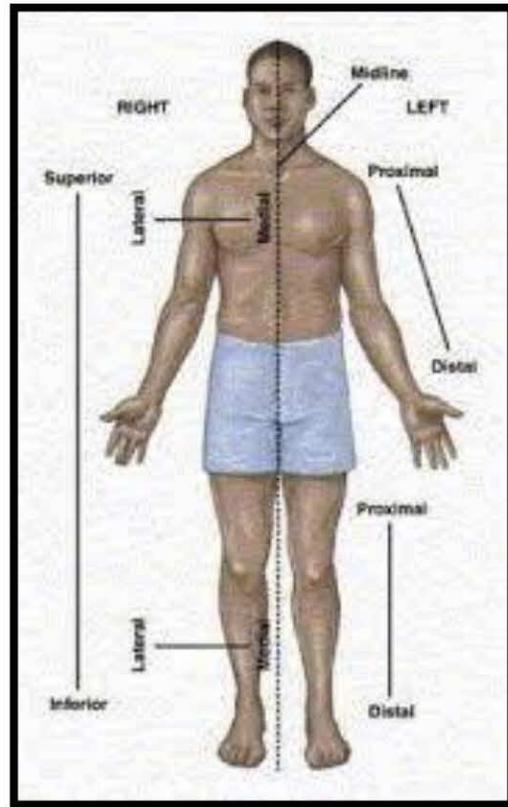
Anatomic Position

Standing erect, with palms and face directed forward, feet are flat on the floor. It is the standard reference point in which all positions, movements and planes are described.

Median Sagittal Plane:

This is a vertical plane passing through the center of the body, dividing it into equal right and left halves. Planes situated to one or the other side of the median plane and parallel to it are termed *paramedian*.

A structure situated nearer to the median plane of the body than another is said to be *medial* to the other. Similarly, structures that lies farther away from the median plane than another is said to be *lateral*.

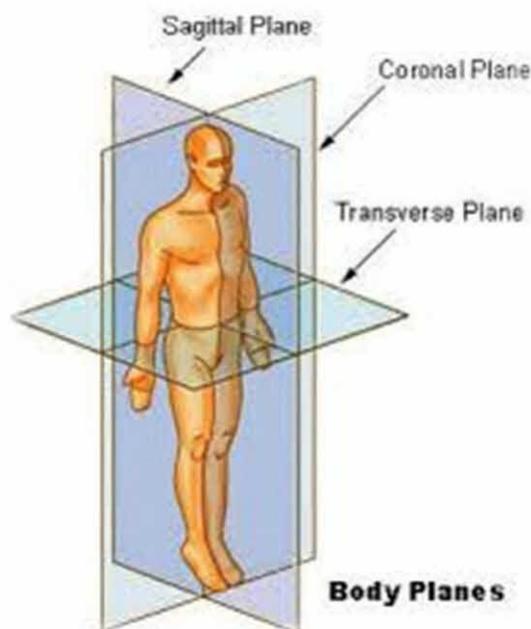


Coronal Planes:

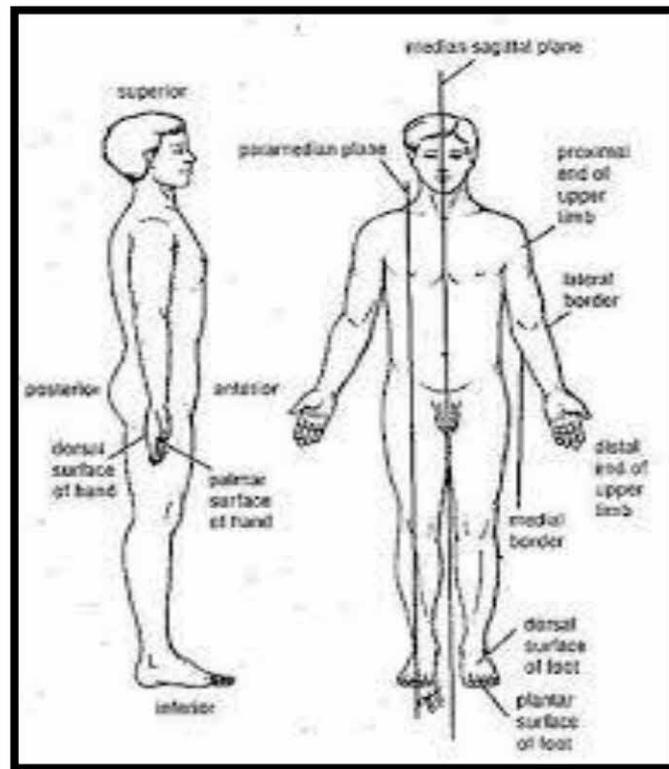
These planes are imaginary vertical planes at right angle to the median plane.

Horizontal or transverse planes:

These planes are at a right angle to both median and coronal planes.



The term *Anterior* and *Posterior* are used to indicate the front and back of the body.



Midline:

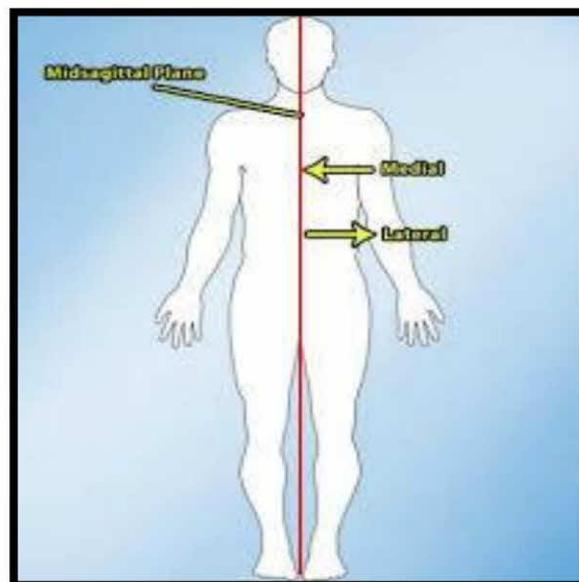
An imaginary vertical line that divides the body equally to right and left.

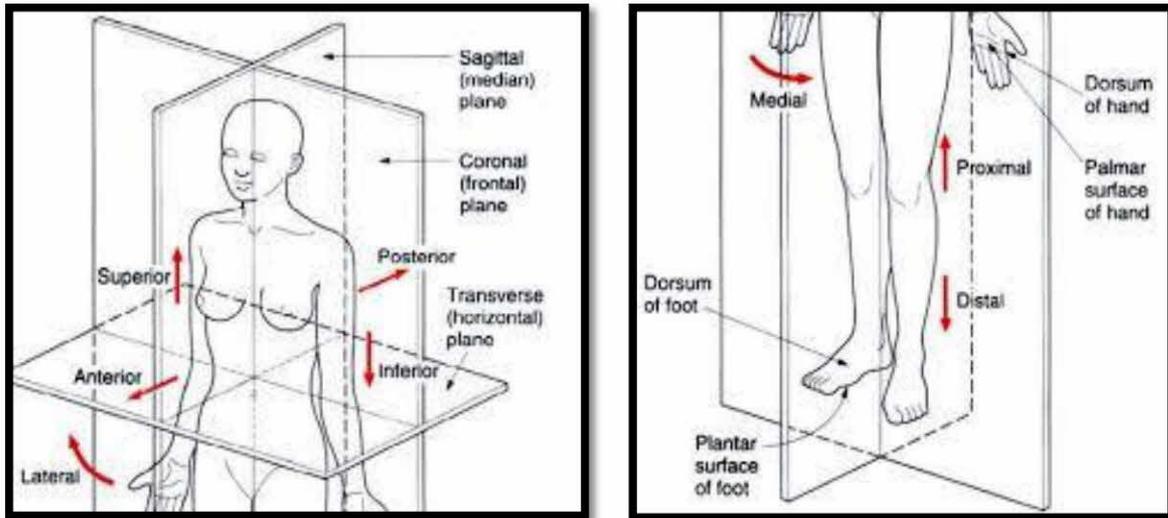
Medial:

Toward or at the midline of the body

Lateral:

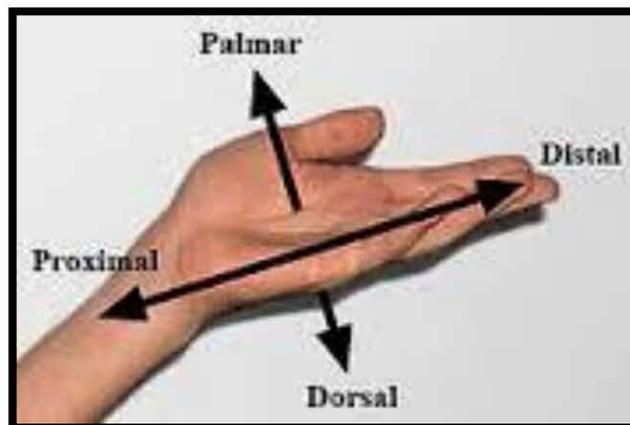
Away from the midline of the body.





In describing the **hand**, the terms **palmer** and **dorsal** surfaces are used in place of anterior and posterior.

In describing foot, the terms **planter** and **dorsal** surfaces are used instead of lower and upper surfaces.



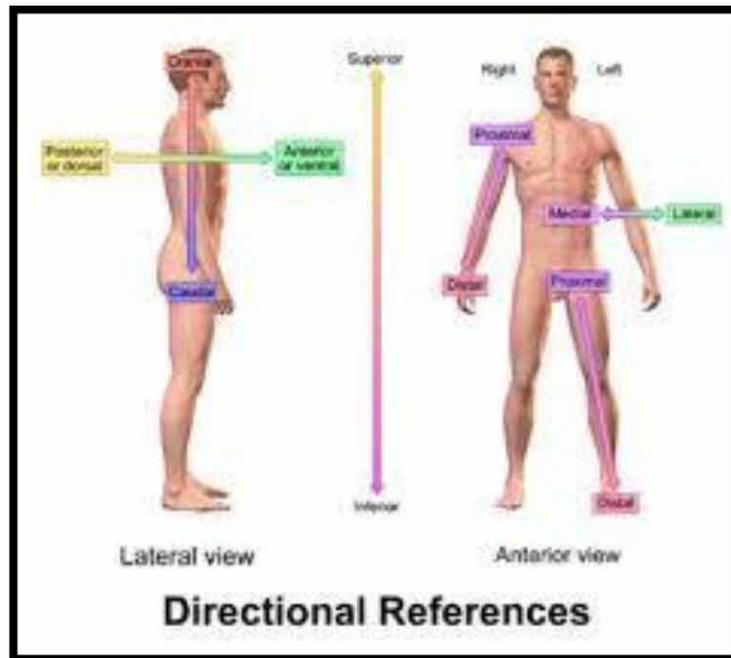
Proximal:

Closer to the origin of the body part or the point of attachment of a limb to the body trunk.

Distal:

Farther from the origin of a body part or the point of attachment of a limb to the body trunk.

- ✚ The term **proximal** and **distal** describe the relative distance from the root of the limbs, for example, the arm is proximal to the forearm and the hand is distal to the forearm.



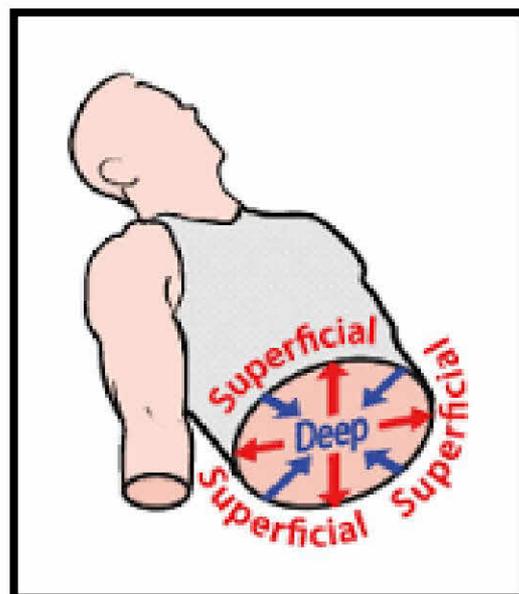
- ✚ The term **superficial** and **deep** denote the relative distances of structures from the surface of the body and the terms **superior** and **inferior** denote levels relatively high or low with reference to the upper and lower ends of the body.

Superficial

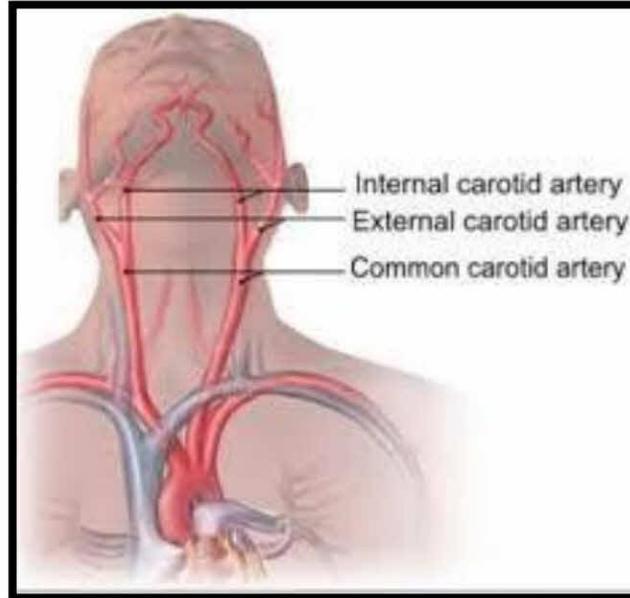
Refers to a structure being closer to the surface of the body than another structure

Deep

Refers to a structure being closer to the core of the body than another structure.



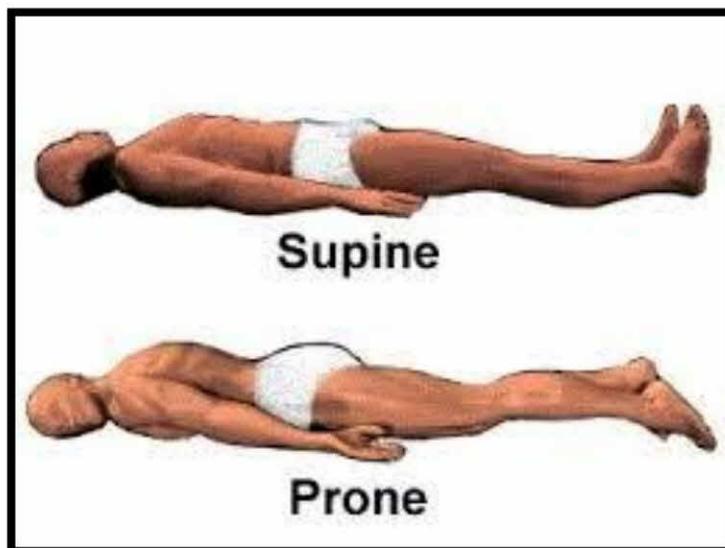
The terms ***internal*** and ***external*** are used to describe the relative distance of the structure from the centre of an organ or cavity; for example, the internal carotid artery is located inside the cranial cavity while the external carotid artery is located outside the cranial cavity.



The term ***ipsilateral*** refers to the same side of the body, for example, the left hand and the left foot are ***ipsilateral***. ***Contralateral*** refers to opposite sides of the body, for example, the left eye and the right ear are ***contralateral***

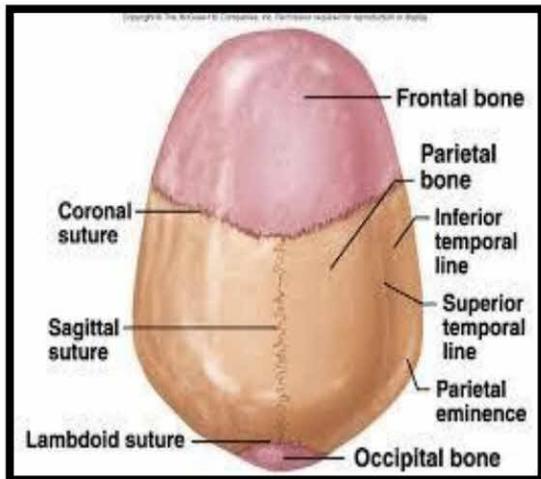
The ***supine position*** of the body is lying on the back.

The ***prone position*** is lying so that the face is directed downward.



Terms related to movement

A site where two or more bones come together is known as a **joint**. Some joints have no movements like the suture of the skull, some have movements like shoulder joint.



Flexion

Is bending a joint or decreasing the angle between two bones, this movement that takes place in a sagittal plane. For example, flexion of the elbow joint approximates the anterior surface of the forearm to the anterior surface of the arm. It is usually an anterior movement, but it is occasionally posterior as in the case of knee joint.

Extension

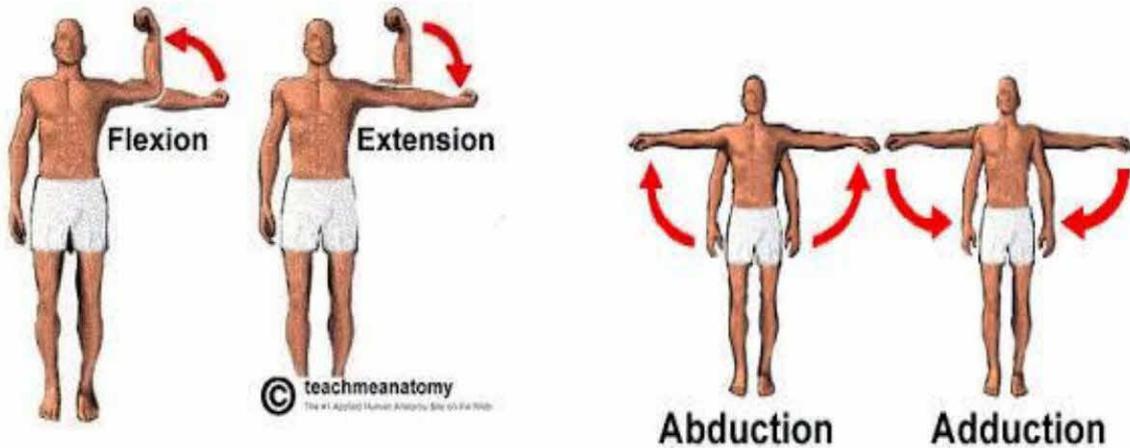
Means straightening the joint or increasing the angle between two bones and usually takes place in a posterior direction ■

Abduction

Is a movement of a body part away from the midline of the body in the coronal plane.

Adduction

Is a movement of a body part toward the midline of the body.



Rotation

is the term applied to the movement of a part of the body around its long axis.

✚ **Medial rotation**

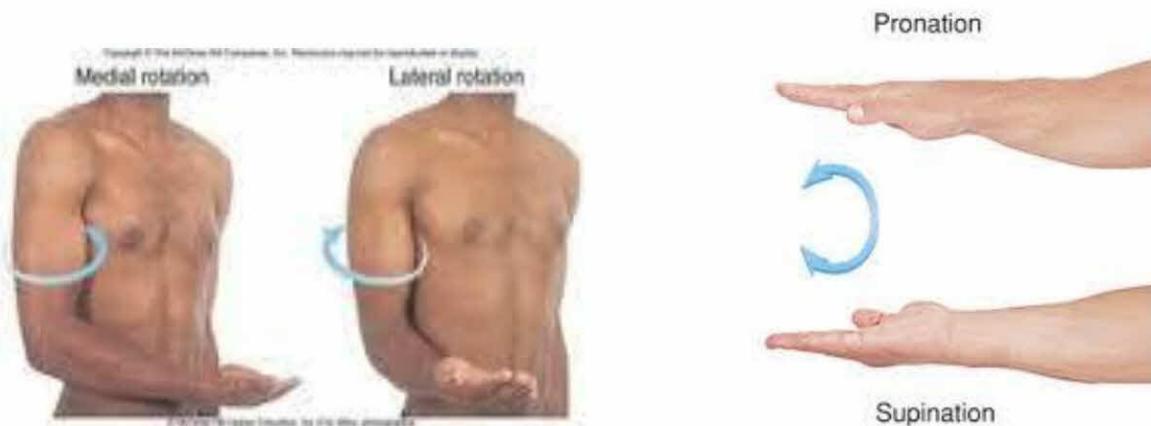
is the movement that results in the anterior surface of the part facing medially.

✚ **Lateral rotation**

is the movement that results in the anterior surface of the part facing laterally.

Pronation of the forearm is a medial rotation of the forearm in such a manner that the palm of the hand faces posteriorly.

Supination of the forearm is a lateral rotation of the forearm from the pronated position so that the palm of the hand comes to face anteriorly.



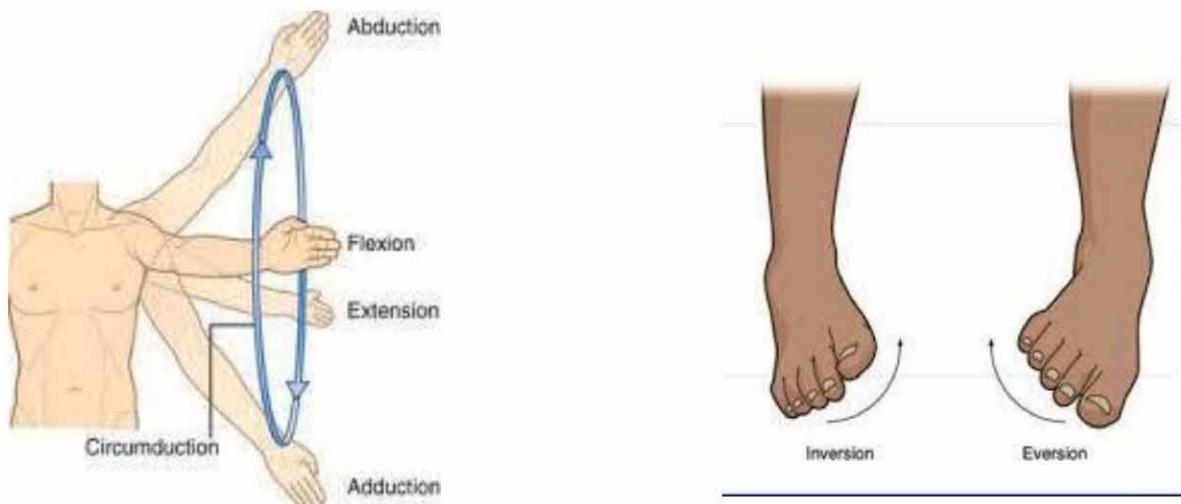
Circumduction is the combination in sequences of the movements of flexion, extension, abduction and adduction.

Inversion

is the movement of the foot so that the sole faces in a medial direction.

Eversion

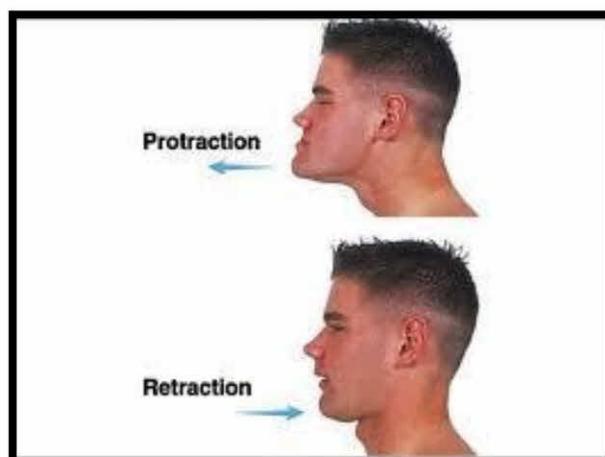
is the opposite movement of the foot so that the sole faces in a lateral direction.



Retraction Moving a part backward

Protraction Moving a part forward

Used to describe the forward and backward movement of the lower jaw at the temporomandibular joint).

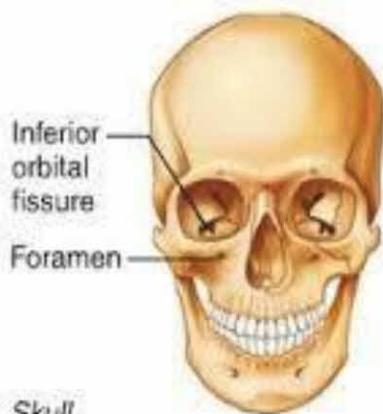


Foramen: Round hole through which blood vessels, nerves or ligaments pass

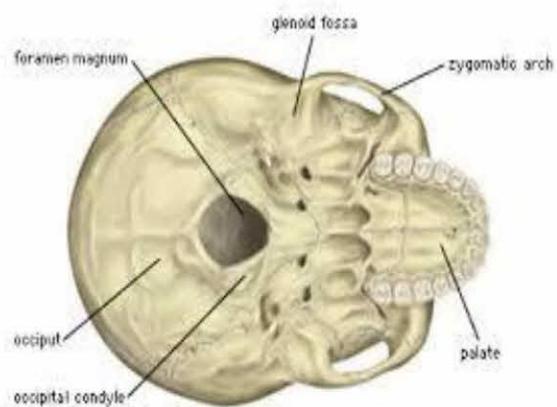
Fissure: Long, crack- line hole for blood vessels and nerves, Channel- like cleft or crack

Fossa: A shallow depression (the word suggests "ditch" or "trench"). Such depressions in the surface of bones often receive another articulating bone with which a joint is formed.

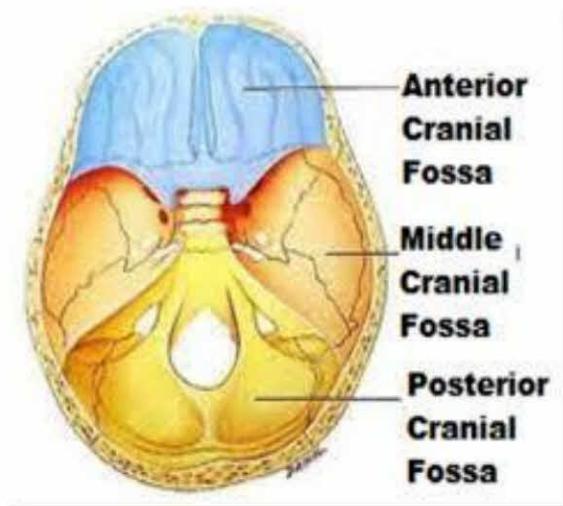
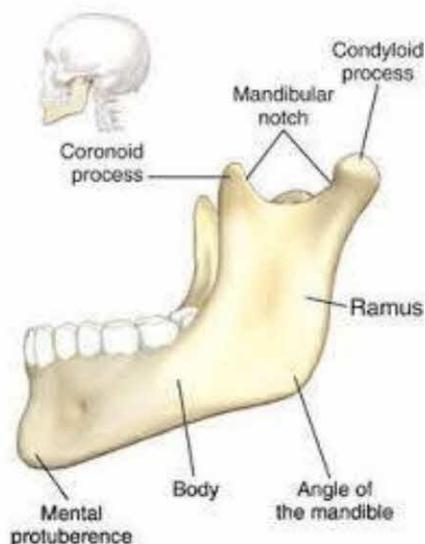
Notch: a V- like depression in the margin or edge of a flat area of bone .



Skull



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GENERAL ANATOMY

LEC. 2

المرحلة الاولى



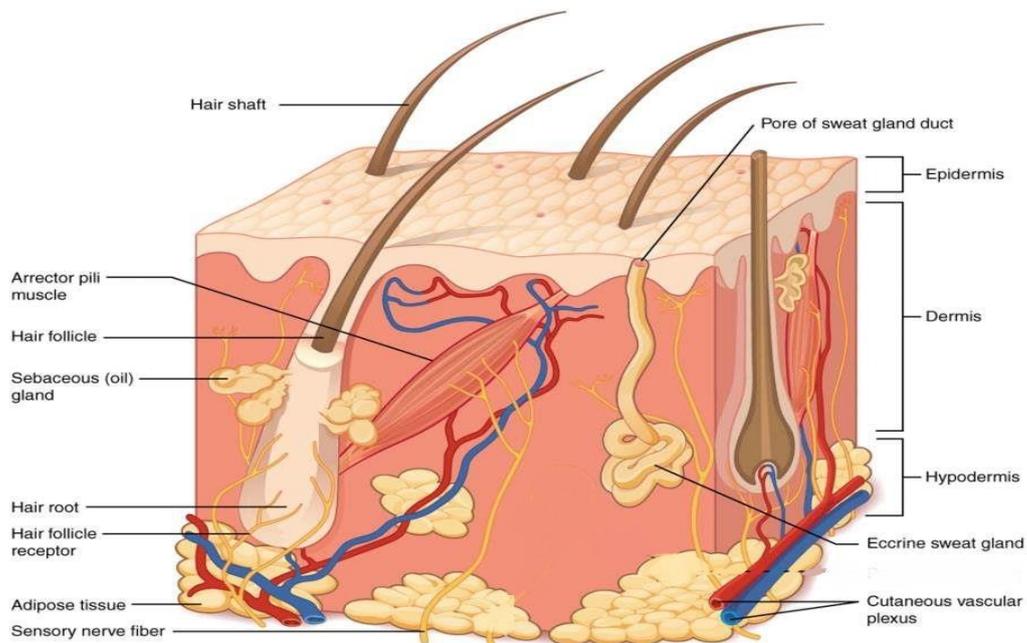
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Skin

The skin is divided into two parts: the superficial part, *the epidermis*; and the deep part, *the dermis*.

The epidermis

- stratified squamous epithelium (consist of squamous”flattened” epithelial cells arranged in layers).
- On the palms of the hands and the soles of the feet, the epidermis is extremely thick (to withstand the wear and tear that occurs in these regions).
- In other areas of the body, for example, on the anterior surface of the arm and forearm, it is thin.

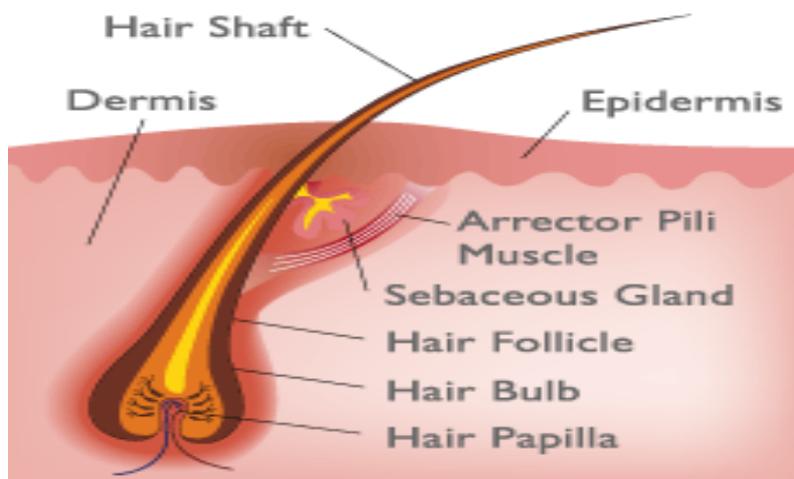
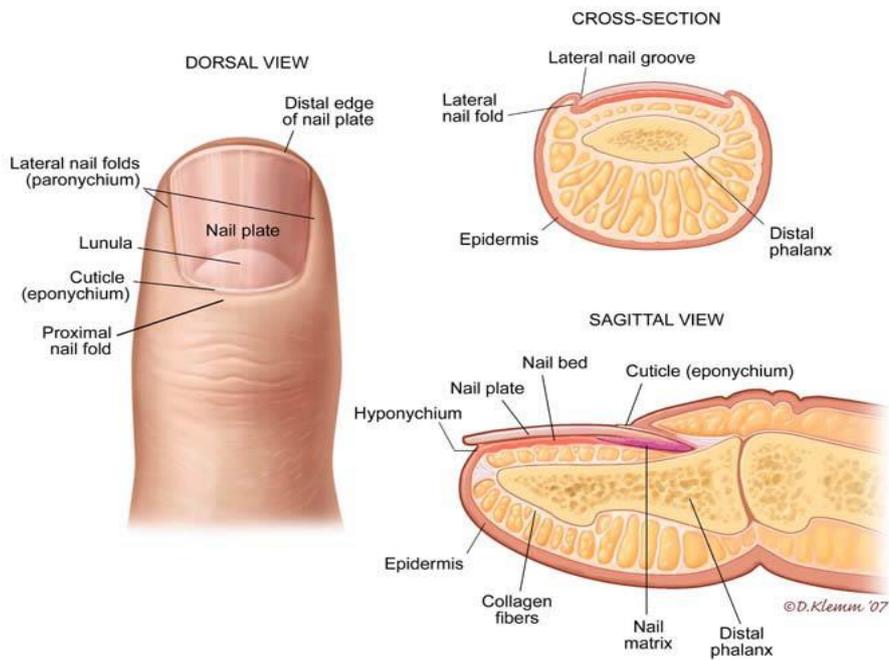


The dermis

- Composed of dense connective tissue containing many blood vessels, lymphatic vessels and nerves.
- It shows considerable variation in thickness in different parts of the body, tending to be thinner on the anterior than on the posterior surface.
- It is thinner in women than in men.
- The dermis of the skin is connected to the underlying deep fascia or bones by the superficial fascia (subcutaneous tissue).
- The skin over joints always folds in the same place, the SKIN CREASES.

The appendages of the skin are:

1. the nails
2. hair follicles
3. sebaceous glands
4. Sweat glands.

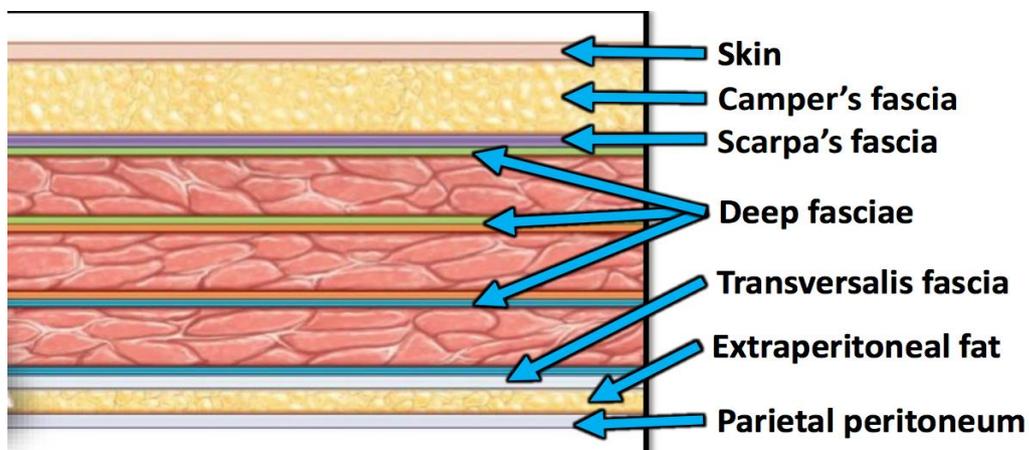


Fasciae

The fasciae of the body can be divided into two types *superficial* and *deep*; and lie between the skin and the underlying muscles and bones.

The superficial fascia, or subcutaneous tissue, is a mixture of loose areolar and adipose tissue that unites the dermis of the skin to the underlying deep fascia

The deep fascia is a membranous layer of connective tissue that invests the muscles and other deep structures.

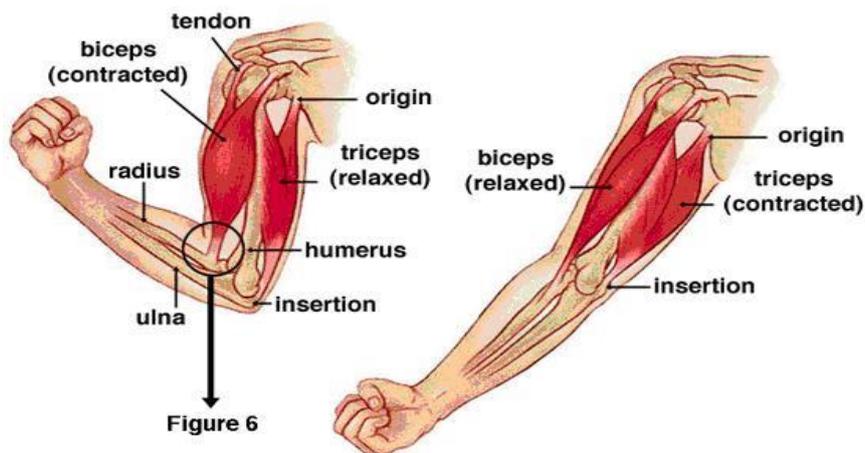


Muscles

The three types of muscles are *skeletal*, *smooth*, and *cardiac*.

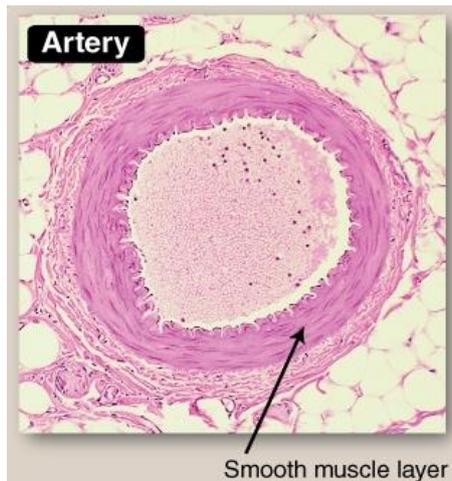
Skeletal Muscles

- Skeletal muscles produce the movements of the skeleton.
- Consist of striated muscle fibers
- They are sometimes called voluntary muscles
- A skeletal muscle has two or more attachments. The attachment that moves the least is referred to as *the origin*, and the one that moves the most, *the insertion*.
- The fleshy part of the muscle is referred to as its *belly*. The ends of a muscle are attached to bones, cartilage, or ligaments by cords of fibrous tissue called *tendons*.



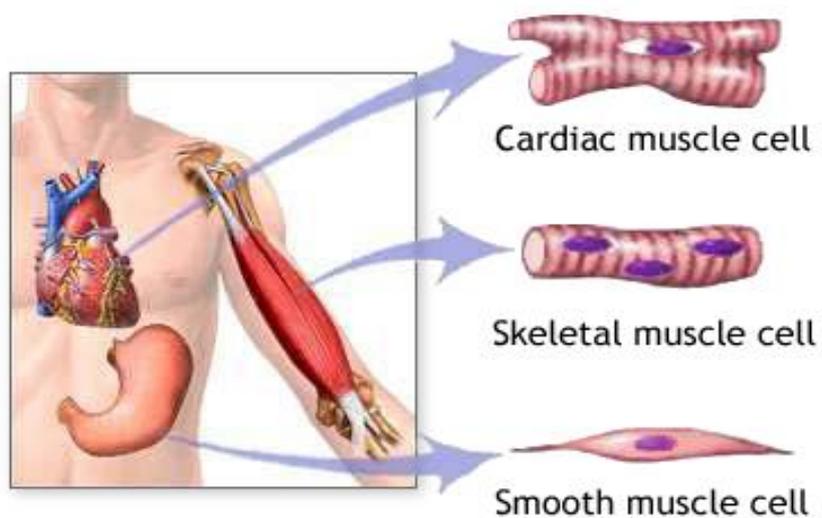
Smooth Muscle

- Consists of long, spindle-shaped cells closely arranged in bundles or sheets. In the tubes of the body
- In the digestive system, it provides the motive power for propelling the contents through the lumen, it also causes the ingested food to be thoroughly mixed with the digestive juices.
- In storage organs such as the urinary bladder and the uterus, the fibers are irregularly arranged and interlaced with one another. Their contraction is slow and sustained and brings about expulsion of the contents of the organs.
- In the walls of the blood vessels, the smooth muscle fibers are arranged circularly and serve to modify the caliber of the lumen.



Cardiac Muscle

- Cardiac muscle consists of striated muscle fibers.
- It also called myocardium.
- Its fibers tend to be arranged in whorls and spirals, and they have the property of spontaneous and rhythmic contraction.
- Specialized cardiac muscle fibers form the conducting system of the heart.



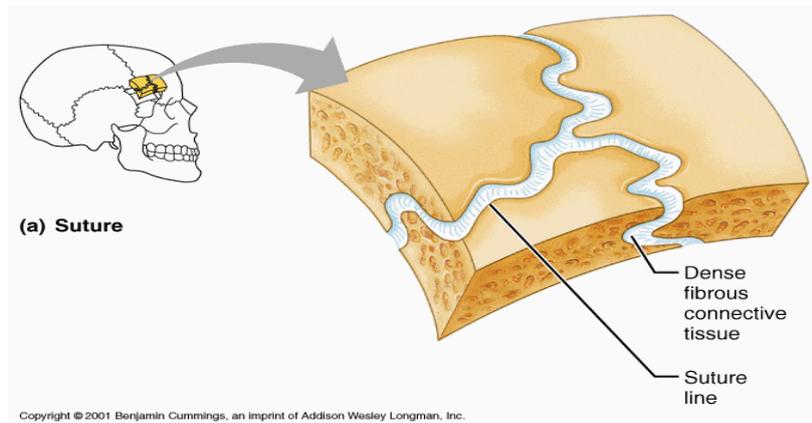
Joints

A site where two or more bones come together, whether or not movement occurs between them, is called a joint.

Joints are classified according to the tissues that lie between the bones: *fibrous joints*, *cartilaginous joints*, and *synovial joints*.

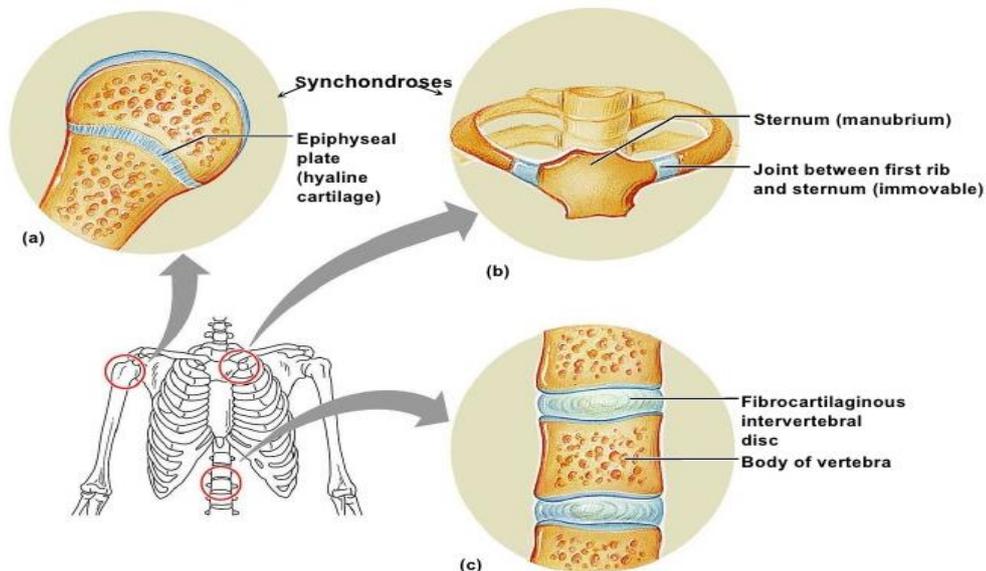
Fibrous Joints

The articulating surfaces of the bones are joined by fibrous tissue, and thus very little movement is possible. Like The sutures of the vault of the skull.



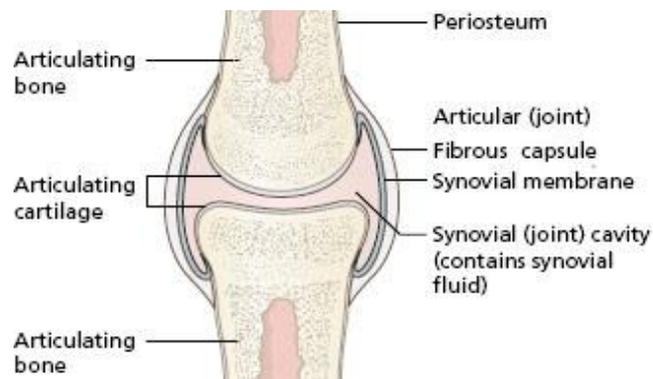
Cartilaginous Joints

- Are connected entirely by cartilage (fibrocartilage or hyaline).
- They allow more movement between bones than fibrous joints.
- Like joints between the ribs and sternum and joints between vertebrae



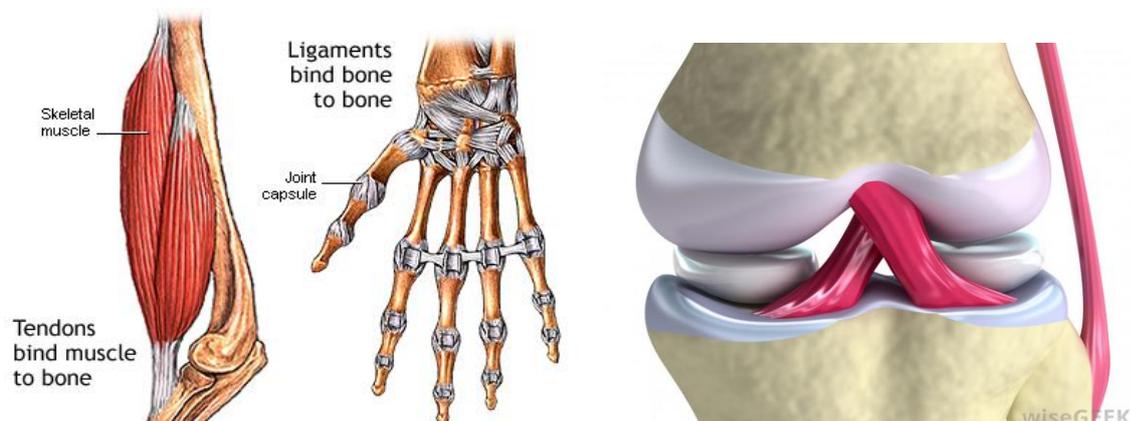
Synovial Joints

- The articular surfaces of the bones are covered by a thin layer of hyaline cartilage separated by a joint cavity.
- This arrangement permits a great degree of freedom of movement.
- The cavity of the joint is lined by synovial membrane.
- The synovial membrane is protected on the outside by a tough fibrous membrane referred to as the capsule of the joint.
- The articular surfaces are lubricated by a viscous fluid called synovial fluid, which is produced by the synovial membrane.



Ligaments

A ligament is a cord or band of connective tissue uniting two structures. Commonly found in association with joints.



Blood Vessels

Blood vessels are of three types: *arteries*, *veins*, and *capillaries*.

Arteries

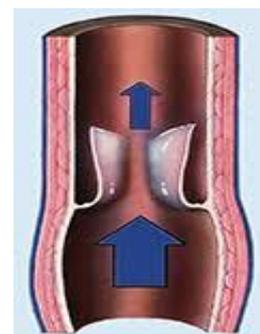
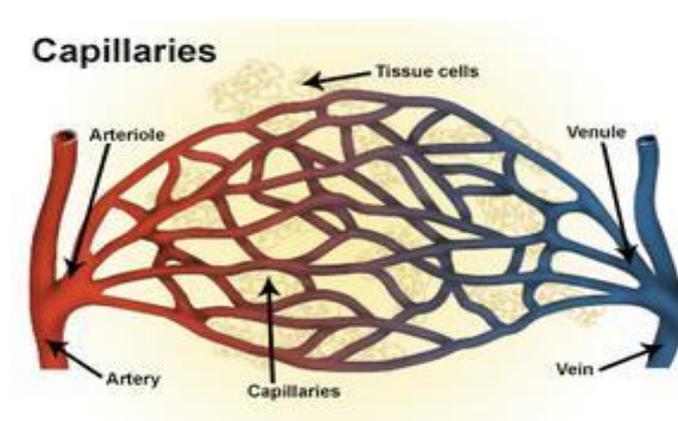
- Transport blood from the heart and distribute it to the various tissues of the body by means of their branches.
- The smallest arteries, <0.1mm in diameter, are referred to as arterioles.
- The joining of branches of arteries is called an anastomosis.
- Arteries do not have valves.

Veins

- Transport blood back to the heart.
- Many of them possess valves.
- The smallest veins are called venules.
- The smaller veins, or tributaries unite to form larger veins, which commonly join with one another to form venous plexuses.

Capillaries

Are microscopic vessels in the form of a network connecting the arterioles to the venules.



Lymphatic System

The lymphatic system consists of *lymphatic tissues* and *lymphatic vessels*

Lymphatic tissues

- Are a type of connective tissue that contains large numbers of lymphocytes.
- Lymphatic tissue is organized into the following organs or structures: *the thymus, the lymph nodes, the spleen, and the lymphatic nodules.*
- Lymphatic tissue is essential for the immunologic defenses of the body against bacteria and viruses.

Lymphatic vessels

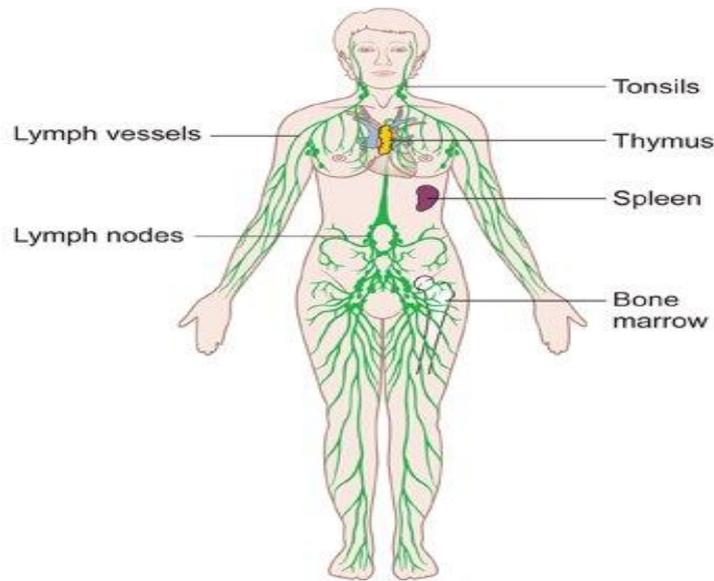
- Are thin tubes that assist the cardiovascular system in the removal of tissue fluid from the tissue spaces of the body; the vessels then return the fluid to the blood.

The lymphatic system is essentially a drainage system, and there is no circulation.

Lymphatic vessels are found in all tissues and organs of the body except the central nervous system, the eyeball, the internal ear, the epidermis of the skin, the cartilage, and the bone.

Lymph is the name given to tissue fluid once it has entered a lymphatic vessel.

Before lymph is returned to the bloodstream, it passes through at least one lymph node and often through several.



Bone

Bone is a living tissue like other connective tissues; bone consists of cells, fibers, and matrix. It is hard because of the calcification of its extracellular matrix.

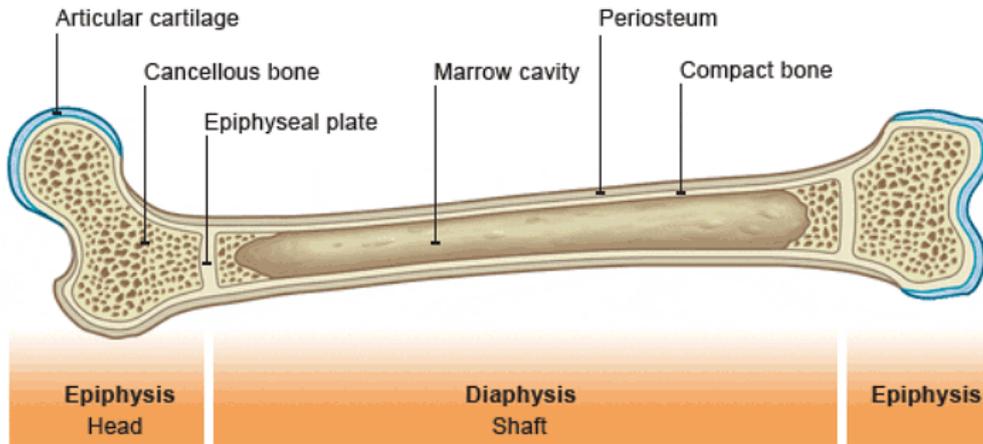
Bones do lots of important things:

- They support our bodies and the joints at the end of bones act as levers so we can move around.
- They protect various parts of our bodies from injury, for example the ribs protect the heart and lungs.
- They store important minerals that are used by our bodies, such as calcium.
- Some bones are filled with a soft, spongy material called bone marrow, which makes blood cells.

Bone exists in two forms: *Compact* and *cancellous*.

Compact bone appears as a solid mass

Cancellous bone consists of a branching network of trabeculae.

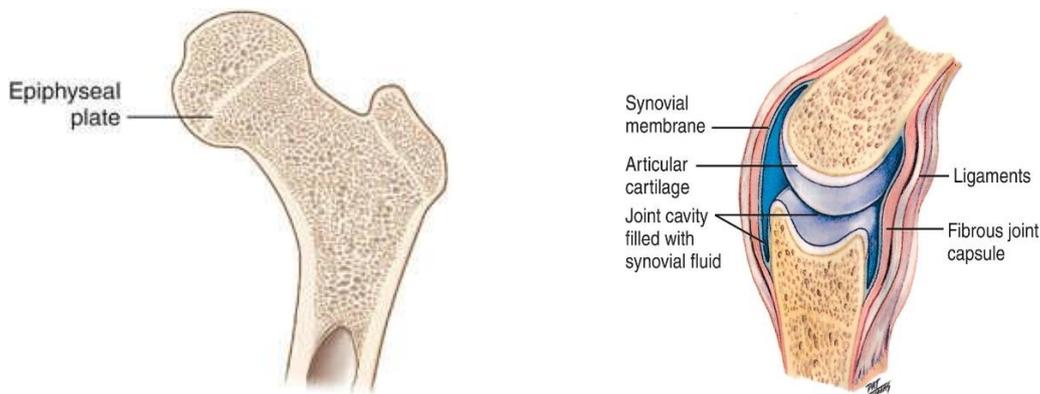


Cartilage

Cartilage is a form of connective tissue in which the cells and fibers are embedded in a gel-like matrix, the latter being responsible for its firmness and elasticity. Except on the exposed surfaces in joints, a fibrous membrane called the perichondrium covers the cartilage. There are three types of cartilage depending on their consistency:

1-Hyaline cartilage

Examples are the epiphyseal plates of growing long bones and the articular surfaces of nearly all synovial joints.

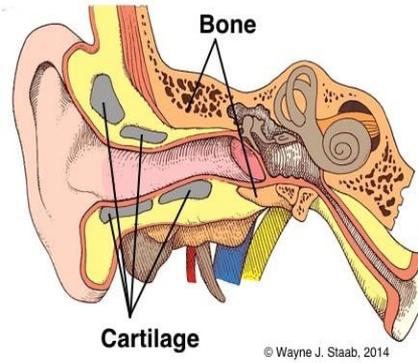
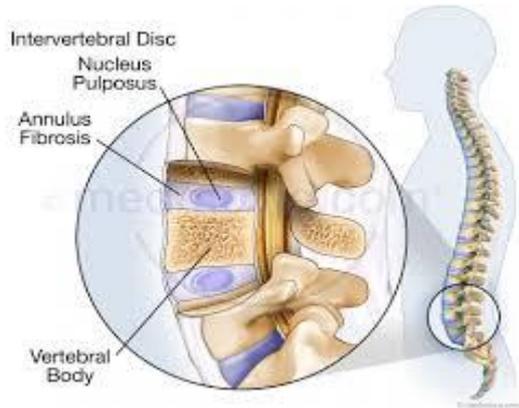


2-Fibrocartilage

Example is intervertebral discs

3-Elastic cartilage

Examples are external ear and larynx





جامعة دجلة الأهلية

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GENERAL ANATOMY

LEC. ٣

المرحلة الاولى

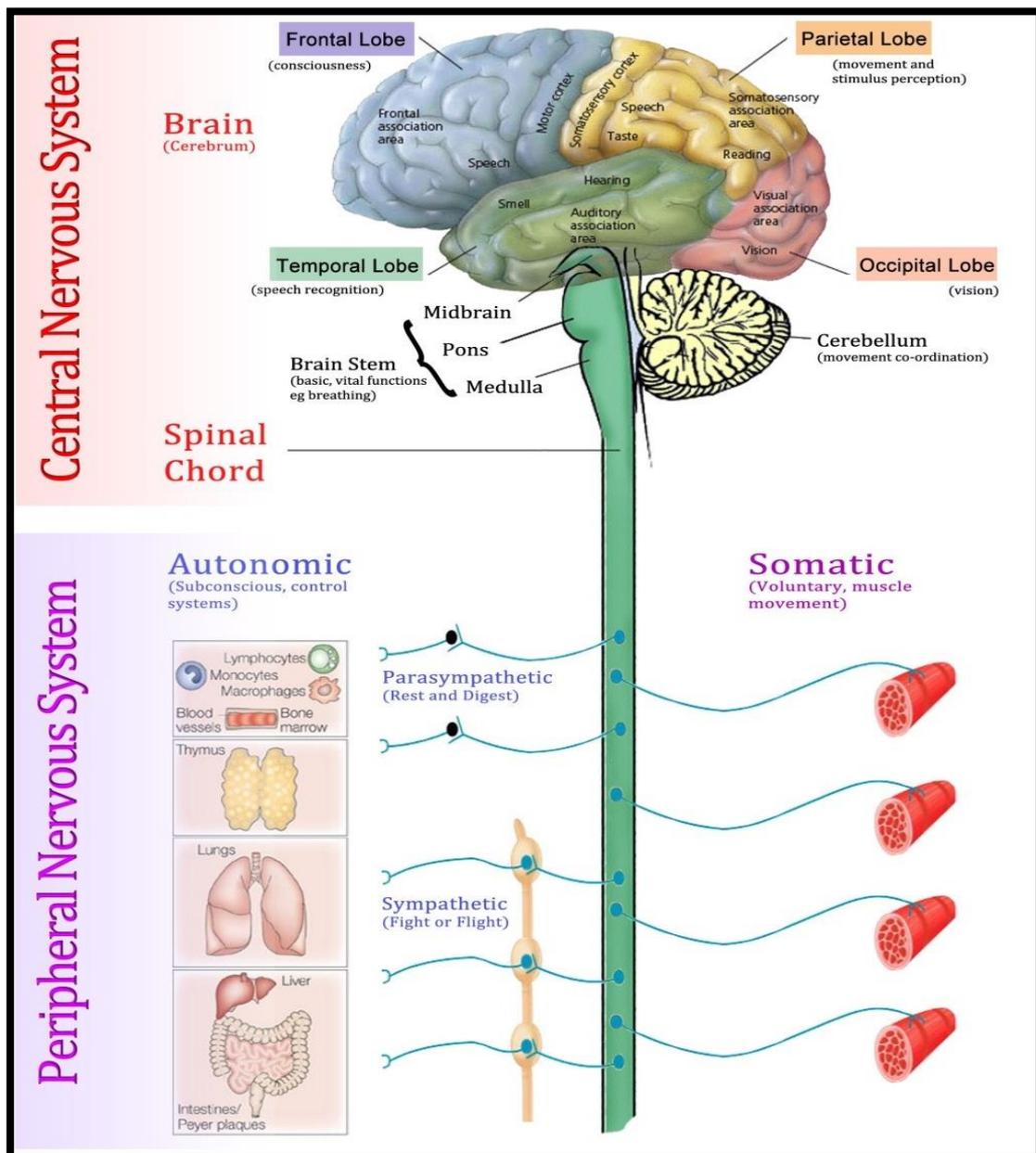


2018-2019

Nervous System

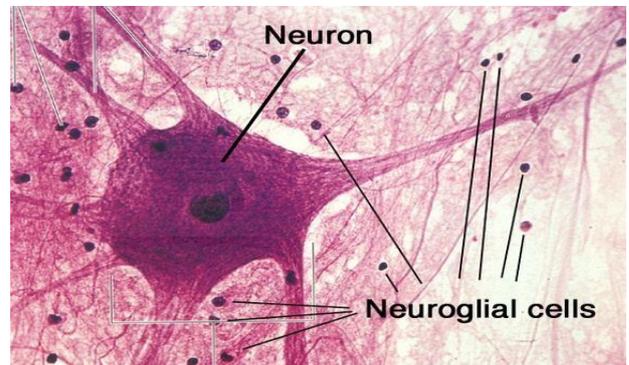
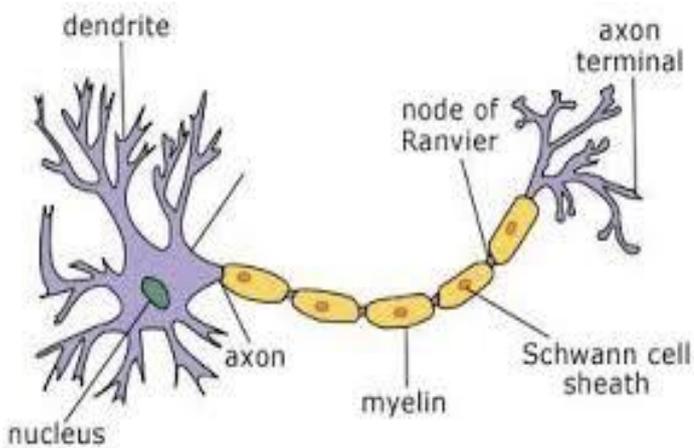
The nervous system is divided into two main parts: the *central nervous system*, which consists of the brain and spinal cord, and the *peripheral nervous system*, which consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves.

Functionally, the nervous system can be further divided into the *somatic nervous system*, which controls the voluntary activities, and the *autonomic nervous system*, which controls the involuntary activities.

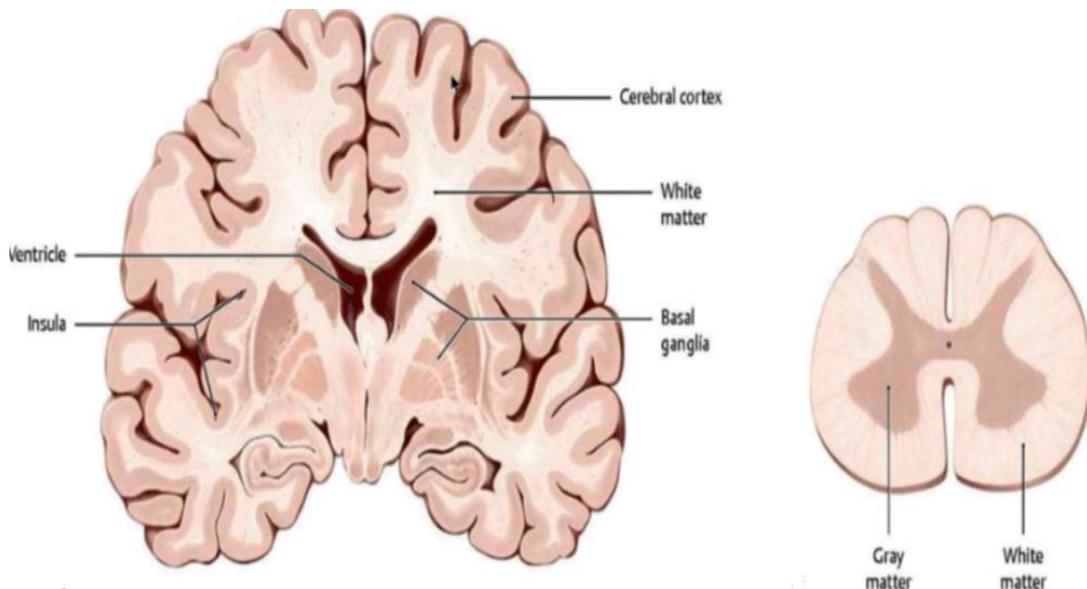


Central Nervous System

The central nervous system is composed of large numbers of nerve cells and their processes, supported by specialized tissue called *neuroglia*. *Neuron* is the term given to the nerve cell and all its processes. The nerve cell has two types of processes, called *dendrites* and an *axon*. *Dendrites* are the short processes of the cell body; the *axon* is the longest process of the cell body.



The interior of the central nervous system is organized into *gray* and *white matter*. *Gray matter* consists of nerve cells embedded in neuroglia. *White matter* consists of nerve fibers (axons) embedded in neuroglia.



Peripheral Nervous System

The peripheral nervous system consists of the cranial and spinal nerves and their associated ganglia. On dissection, the cranial and spinal nerves are seen as grayish white cords. They are made up of bundles of nerve fibers (axons) supported by delicate areolar tissue.

Cranial Nerves

There are 12 pairs of cranial nerves that leave the brain and pass through foramina in the skull. All the nerves are distributed in the head and neck except the X (vagus) nerve, which also supplies structures in the thorax and abdomen.

The 12 pairs of cranial nerves are named as follows:

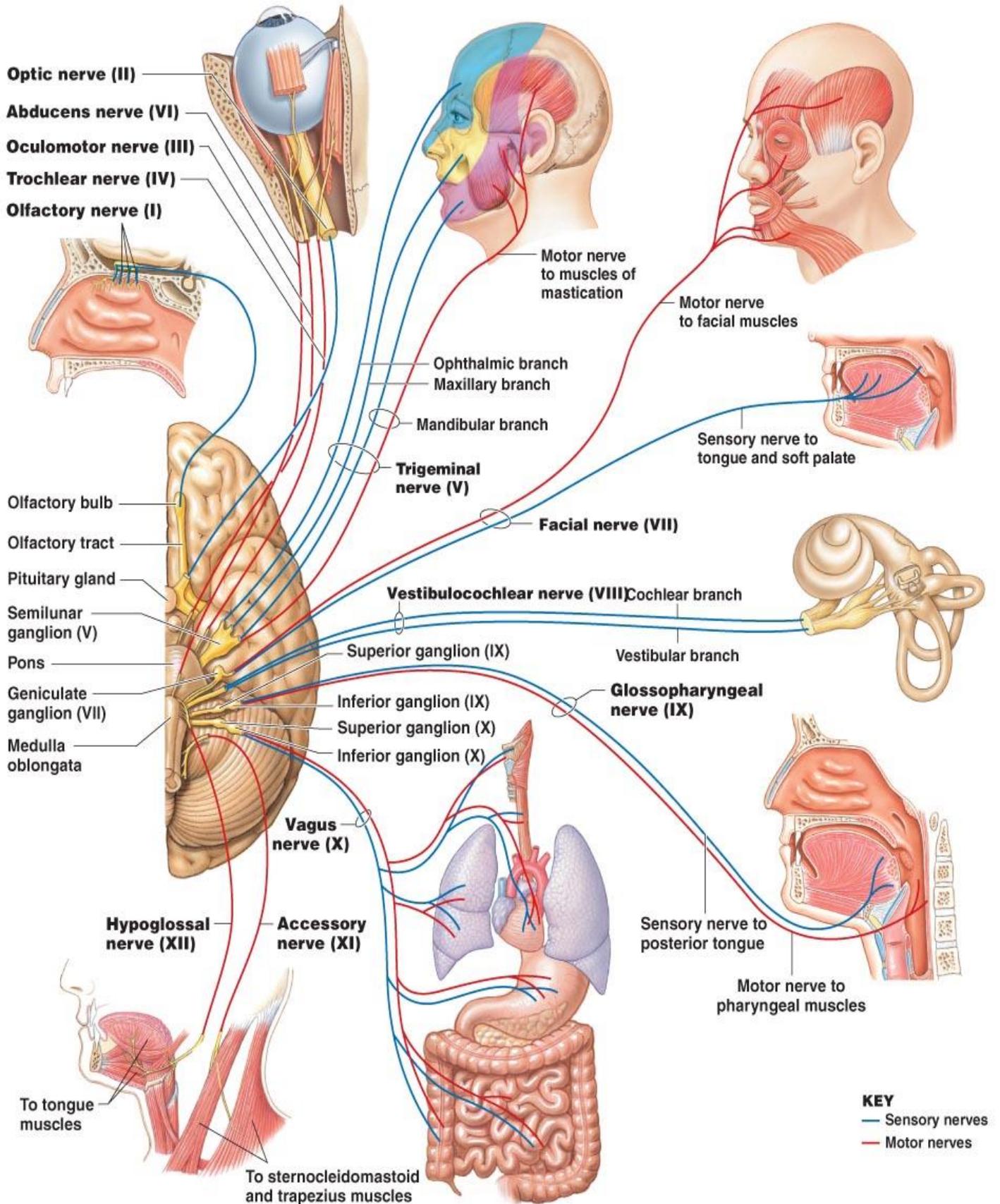
- I. Olfactory** (sensory for smell)
- II. Optic** (sensory for vision)
- III. Oculomotor** (motor fibers to eye muscles)
- IV. Trochlear** (motor fibers to trochlear muscle eye)
- V. Trigeminal** (mixed) sensory for the face; motor fibers to chewing muscles
- VI. Abducent** (motor fibers to abducent muscle)
- VII. Facial** (mixed) sensory for taste; motor fibers to the facial muscles
- VIII. Vestibulocochlear** (sensory for balance and hearing)
- IX. Glossopharyngeal** (mixed) sensory for taste; motor fibers to the pharynx
- X. Vagus** (mixed) sensory and motor fibers for pharynx, larynx and viscera
- XI. Accessory** (motor fibers to neck and upper back)
- XII. Hypoglossal** (motor fibers to tongue).

Olfactory, Optic and Vestibulocochlear nerves are entirely sensory; the Oculomotor, Trochlear, Abducent, Accessory and Hypoglossal nerves are entirely motor; and the remaining nerves are mixed

Note

Each cranial nerve has its specific number for example CN I is the olfactory nerve

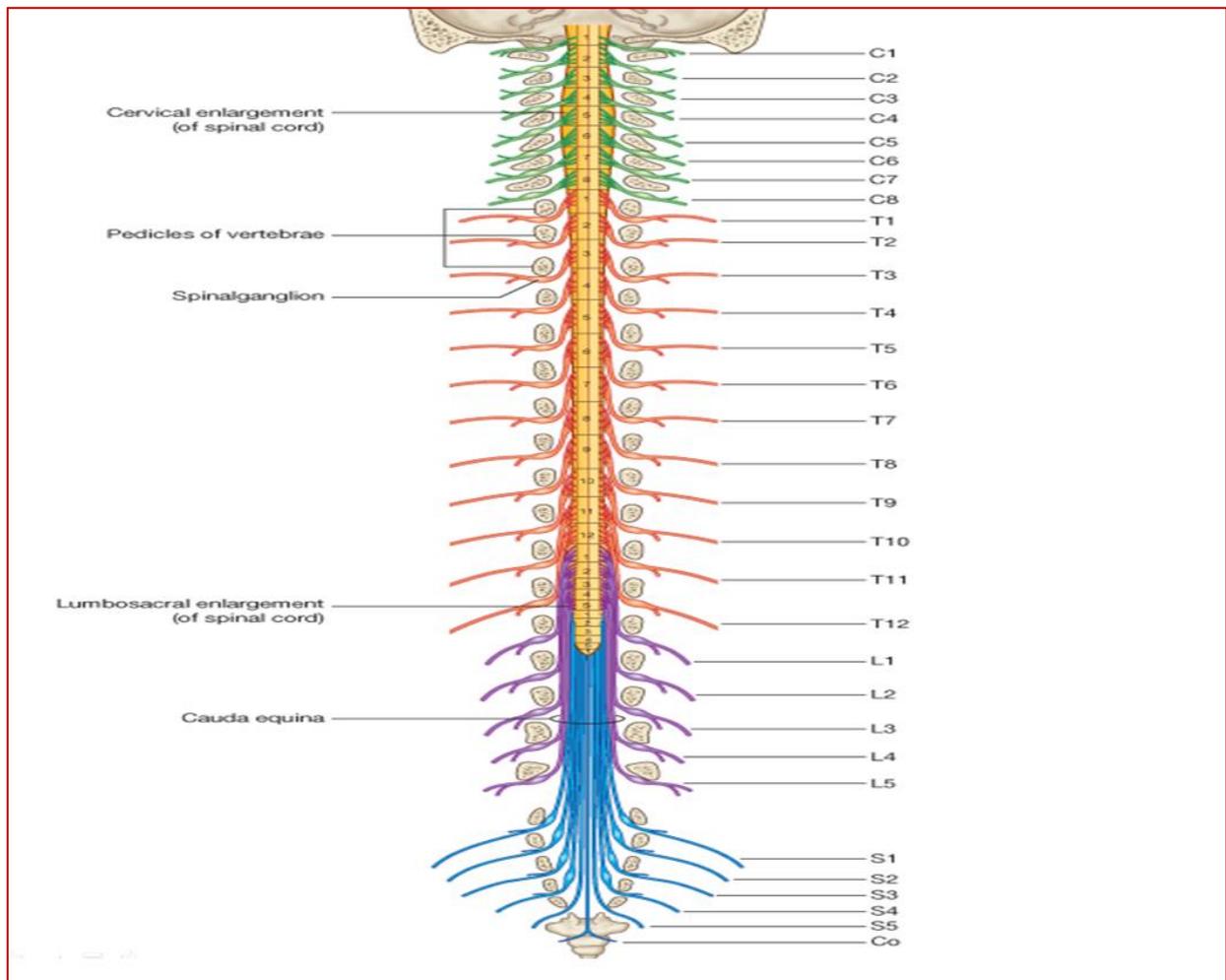
The branches of the 12 cranial nerves, their functions (motor, sensory, or mixed), and the structures they innervate



Spinal Nerves

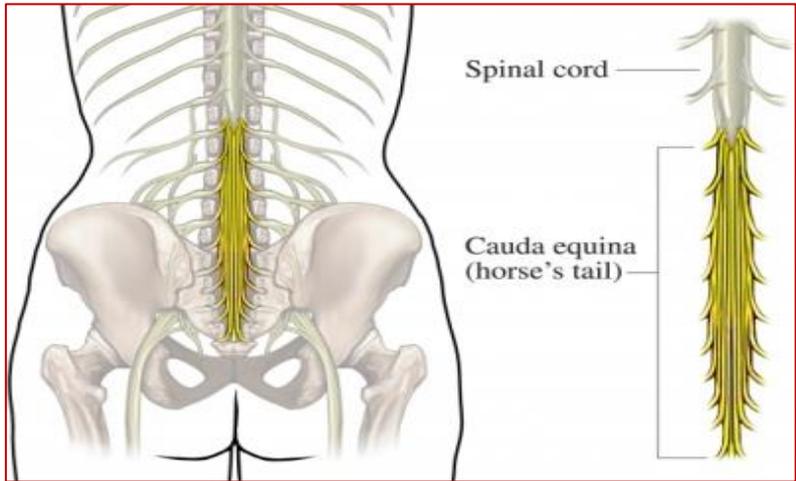
A total of 31 pairs of spinal nerves leave the spinal cord and pass through intervertebral foramina in the vertebral column. The spinal nerves are named according to the region of the vertebral column with which they are associated: **8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal.**

Note that there are **eight** cervical nerves and only **seven** cervical vertebrae and that there is one coccygeal nerve and four coccygeal vertebrae.

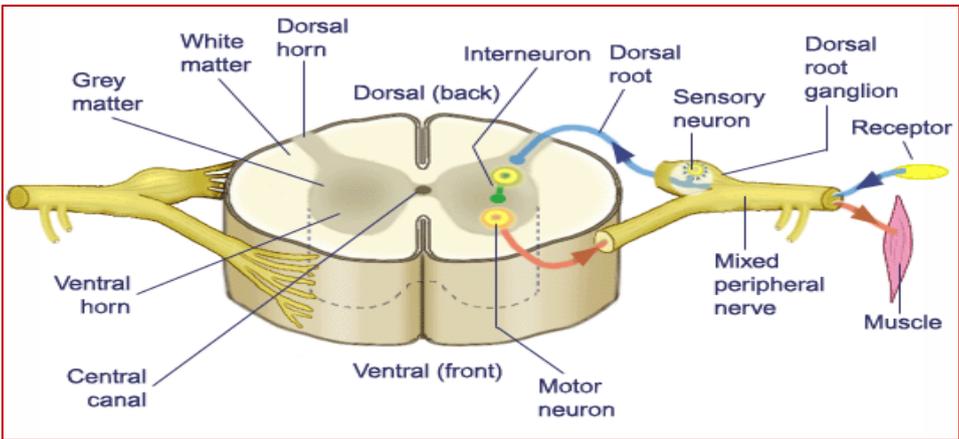


During development, the spinal cord grows in length more slowly than the vertebral column. In the adult, when growth ceases, the lower end of the spinal cord reaches inferiorly only as far as the lower border of the 1st lumbar vertebra. To accommodate for this disproportionate growth in length, the length of the roots increases progressively from above downward.

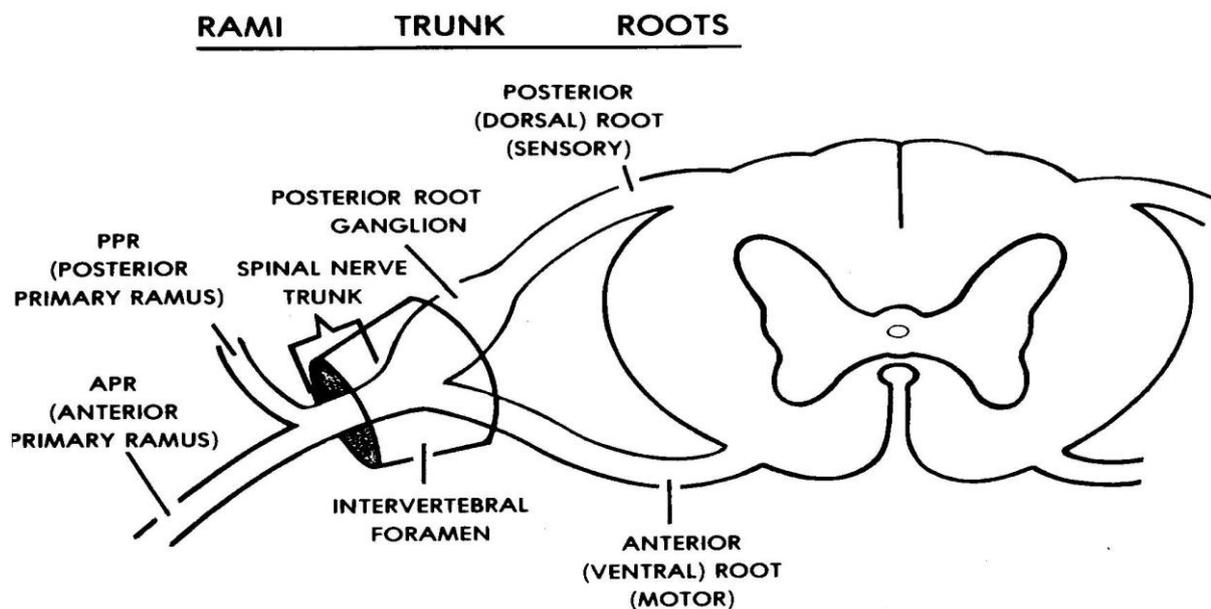
In the upper cervical region, the spinal nerve roots are short and run almost horizontally, but the roots of the lumbar and sacral nerves below the level of the termination of the cord form a vertical bundle of nerves that resembles a horse's tail and is called the *cauda equine*



Each spinal nerve is connected to the spinal cord by two roots: the *anterior root* and the *posterior root*. The *anterior root* consists of bundles of nerve fibers carrying nerve impulses away from the central nervous system. Such nerve fibers are called *efferent fibers*. Those efferent fibers that go to skeletal muscle and cause them to contract are called *motor fibers*. Their cells of origin lie in the anterior gray horn of the spinal cord. The posterior root consists of bundles of nerve fibers that carry impulses to the central nervous system and are called *afferent fibers*. Because these fibers are concerned with conveying information about sensations of touch, pain, temperature, and vibrations, they are called *sensory fibers*.



At each intervertebral foramen, the anterior and posterior roots unite to form a spinal nerve. Here, the motor and sensory fibers become mixed together, so that a spinal nerve is made up of a mixture of motor and sensory fibers. On emerging from the foramen, the spinal nerve divides into a large *anterior ramus* and a smaller *posterior ramus*. The ***posterior ramus*** passes posteriorly around the vertebral column to supply the muscles and skin of the back. The ***anterior ramus*** continues anteriorly to supply the muscles and skin over the anterolateral body wall and all the muscles and skin of the limbs.



Autonomic Nervous System

The autonomic nervous system is the part of the nervous system concerned with the innervations of involuntary structures such as the heart, smooth muscle, and glands throughout the body and is distributed throughout the central and peripheral nervous system. The autonomic system may be divided into two parts:

1. the *sympathetic*
2. the *parasympathetic*

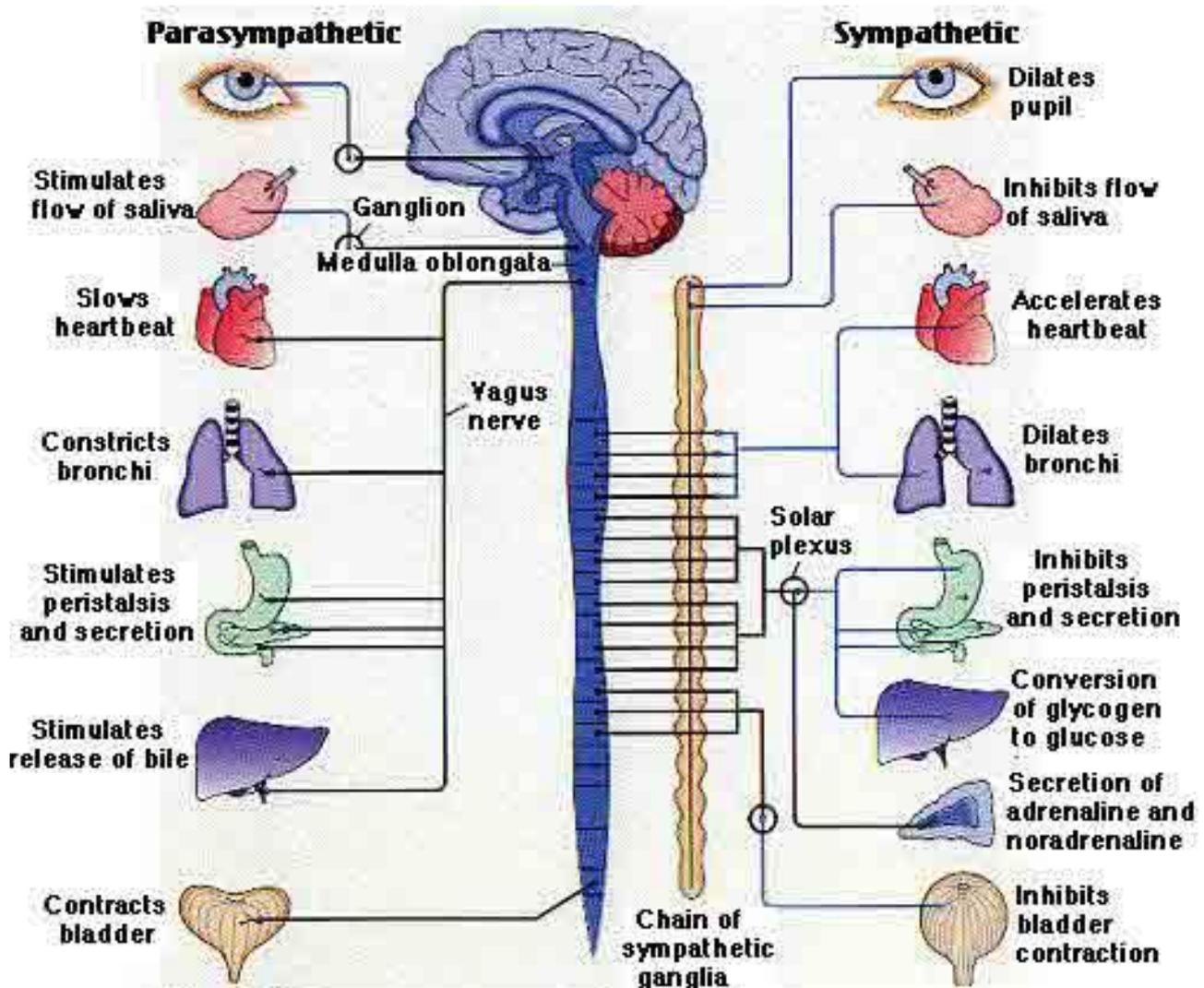
And both parts have afferent and efferent nerve fibers.

Sympathetic System

The activity of the Sympathetic part of the autonomic system is the preparation of the body for action and emergency as in the (fight or flight) response by increasing heart rate, respiration, blood pressure (by constriction of the peripheral blood vessels), and also increase the blood flow to the brain, heart, and skeletal muscles; dilating the pupils.

Parasympathetic system

The activity of the parasympathetic part of the autonomic system is aimed at conserving and restoring energy and functions to calm the body as in rest or digest by decreasing heart rate, respiration, blood pressure; constriction the pupils; and increase peristalsis of intestine (increasing visceral activity) and glandular activity and open the sphincters.





جامعة دجلة الأهلية

كلية طب الاسنان

GENERAL ANATOMY

LEC. 4

المرحلة الاولى



5018-5016

The Autonomic Nervous System

It is the part of the nervous system concerned with the innervations of **involuntary** structures such as the heart, smooth muscle, and glands throughout the body and is distributed throughout the central and peripheral nervous system. The autonomic system may be divided into two parts:

1-The Sympathetic

2-The Parasympathetic

And both parts have afferent and efferent nerve fibers.

The Sympathetic Nervous System

The activity of the Sympathetic part of the autonomic system is the preparation of the body for action and emergency as in the (fight or flight) response by increasing heart rate, respiration, blood pressure (by constriction of the peripheral blood vessels), and also increase the blood flow to the brain, heart, and skeletal muscles; dilating the pupils.

Efferent Fibers

The gray matter of the spinal cord, from the 1st thoracic segment to the 2nd lumbar segment, possesses a lateral horn, or column, in which are located the cell bodies of the sympathetic connector neurons

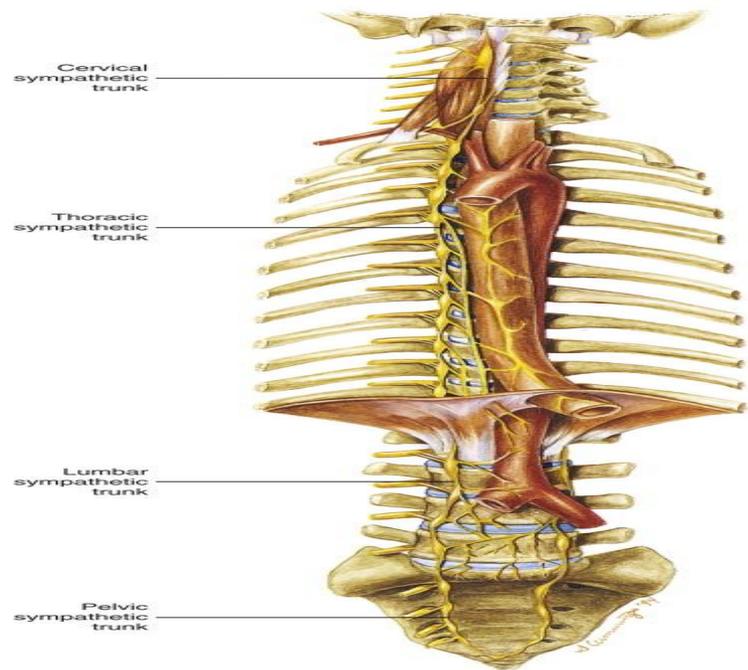
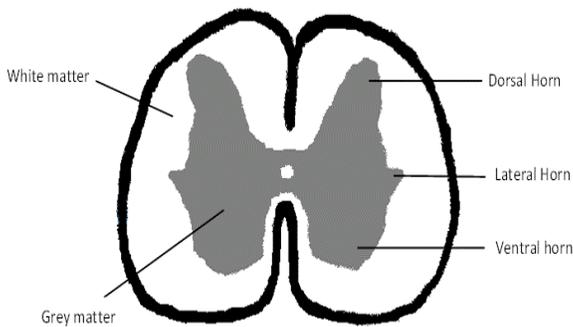
The myelinated axons of these cells leave the spinal cord in the anterior nerve roots and then pass to the **paravertebral ganglia** of the **sympathetic trunk**

Sympathetic trunks are two ganglionated nerve trunks that extend the whole length of the vertebral column. There are 3 ganglia in each trunk of the neck, 11 or 12 ganglia in the thorax, 4 or 5 ganglia in the lumbar region, and 4 or 5 ganglia in the pelvis.

The two trunks lie close to the vertebral column and end below by joining together to form a single ganglion, the **ganglion impar**.

Afferent Fibers

The afferent myelinated nerve fibers travel from the viscera through the sympathetic ganglia. They enter the spinal nerve and reach their cell bodies in the posterior root ganglion of the corresponding spinal nerve.



The Parasympathetic Nervous System

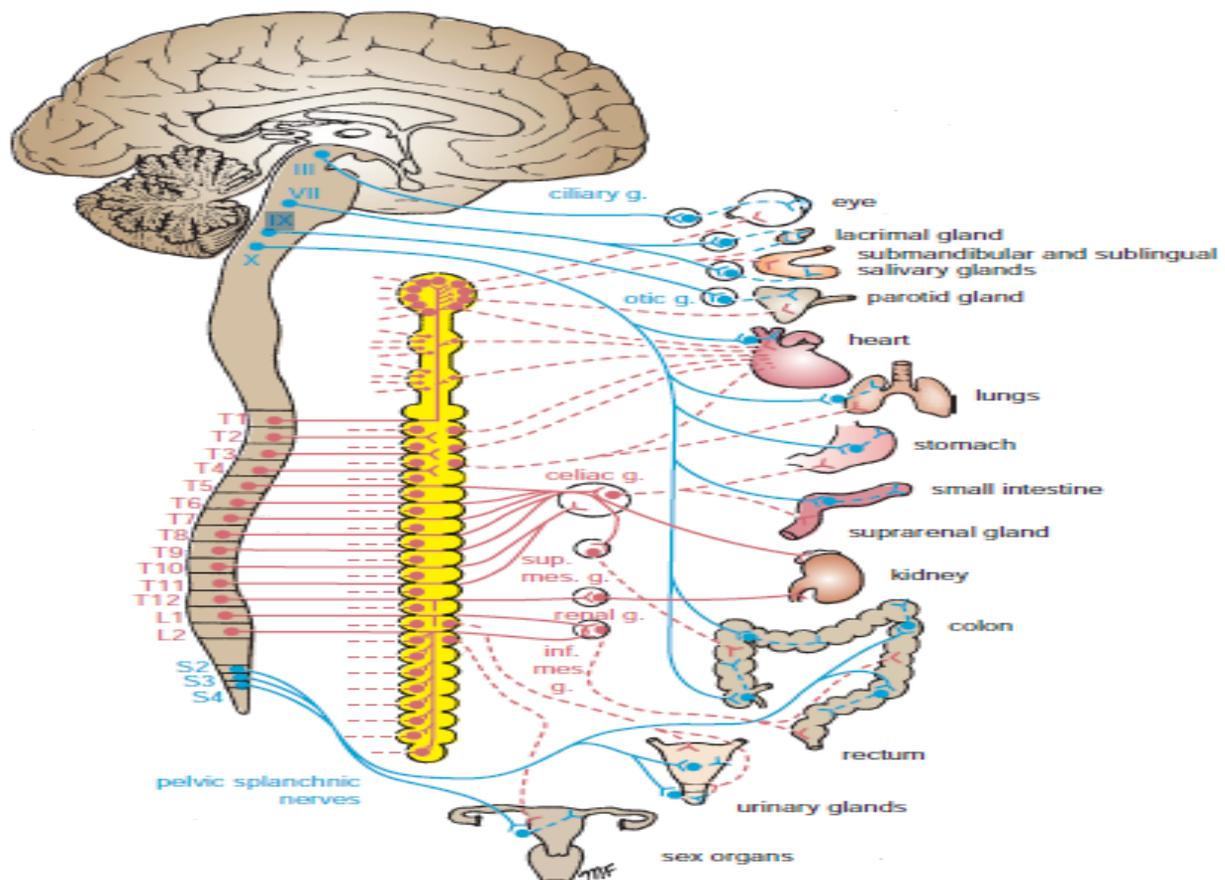
The activity of the parasympathetic part of the autonomic system is aimed at conserving and restoring energy and functions to calm the body as in rest or digest by decreasing heart rate, respiration, blood pressure; constriction the pupils; and increase peristalsis of intestine (increasing visceral activity) and glandular activity and open the sphincters

Efferent Fibers

The connector cells of this part of the system are located in the brain and the sacral segments of the spinal cord. Those in the brain form parts of the nuclei of origin of cranial nerves III, VII, IX, and X, and the axons emerge from the brain contained in the corresponding cranial nerves. The sacral connector cells are found in the gray matter of the 2nd, 3rd and 4th sacral segments of the cord. These cells are not sufficiently numerous to form a lateral gray horn, as do the sympathetic connector cells in the thoracolumbar region. The myelinated axons leave the spinal cord in the anterior nerve roots of the corresponding spinal nerves. They then leave the sacral nerves and form the **pelvic splanchnic nerves**.

Afferent Fibers

The afferent myelinated fibers travel from the viscera to their cell bodies located either in the sensory ganglia of the cranial nerves or in the posterior root ganglia of the sacrospinal nerves.





General Anatomy

المرحلة الاولى
Lec (6)

م.د محمد نمر

Facial bones

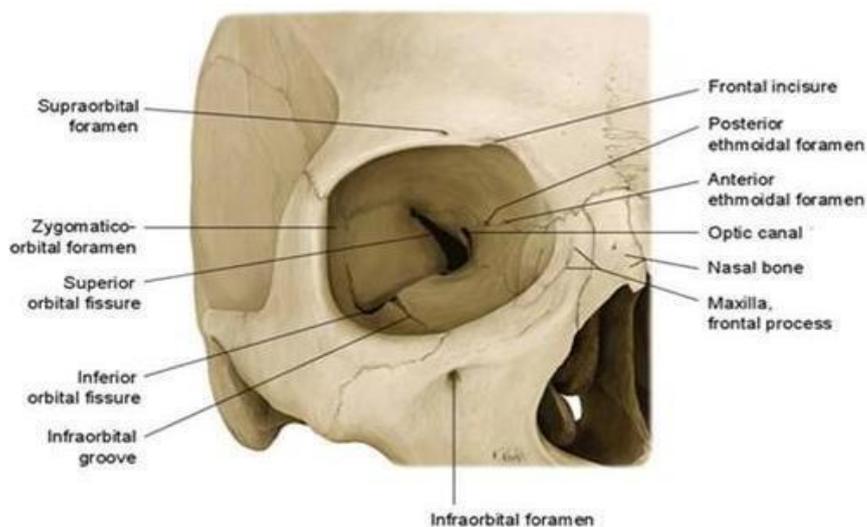
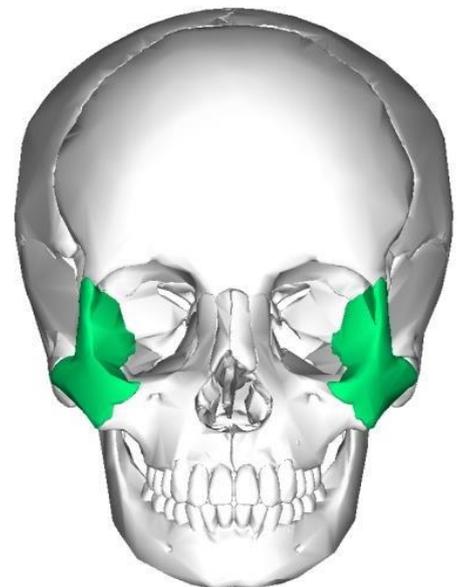
The **facial** bones consist of the following, two of which are single:

1. Zygomatic bones: 2
2. Maxillae: 2
3. Nasal bones: 2
4. Lacrimal bones: 2
5. Vomer: 1
6. Palatine bones: 2
7. Inferior conchae: 2
8. Mandible: 1

1. Zygomatic bone (Zygoma)

Characteristics

- Forms the majority of the skeleton of the cheek
- There are 2 zygomatic bones
- Provides attachment of the masseter muscle
- Three foramina in the zygoma:
 1. Zygomatico-orbital foramen
 2. Zygomatico-facial foramen
 3. Zygomatico-temporal foramen



Parts:

❖ Frontal process

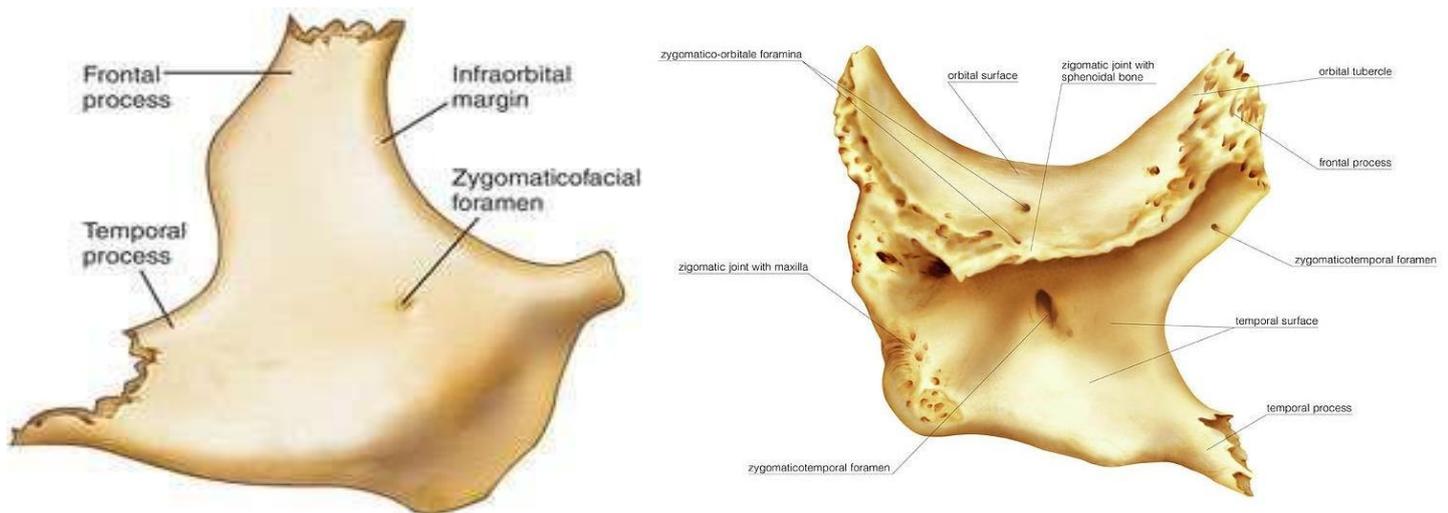
Articulates with the frontal bone to help in forming the lateral wall of the orbit

❖ Temporal process

Articulates with the zygomatic process of temporal bone to form the zygomatic arch

❖ Maxillary process

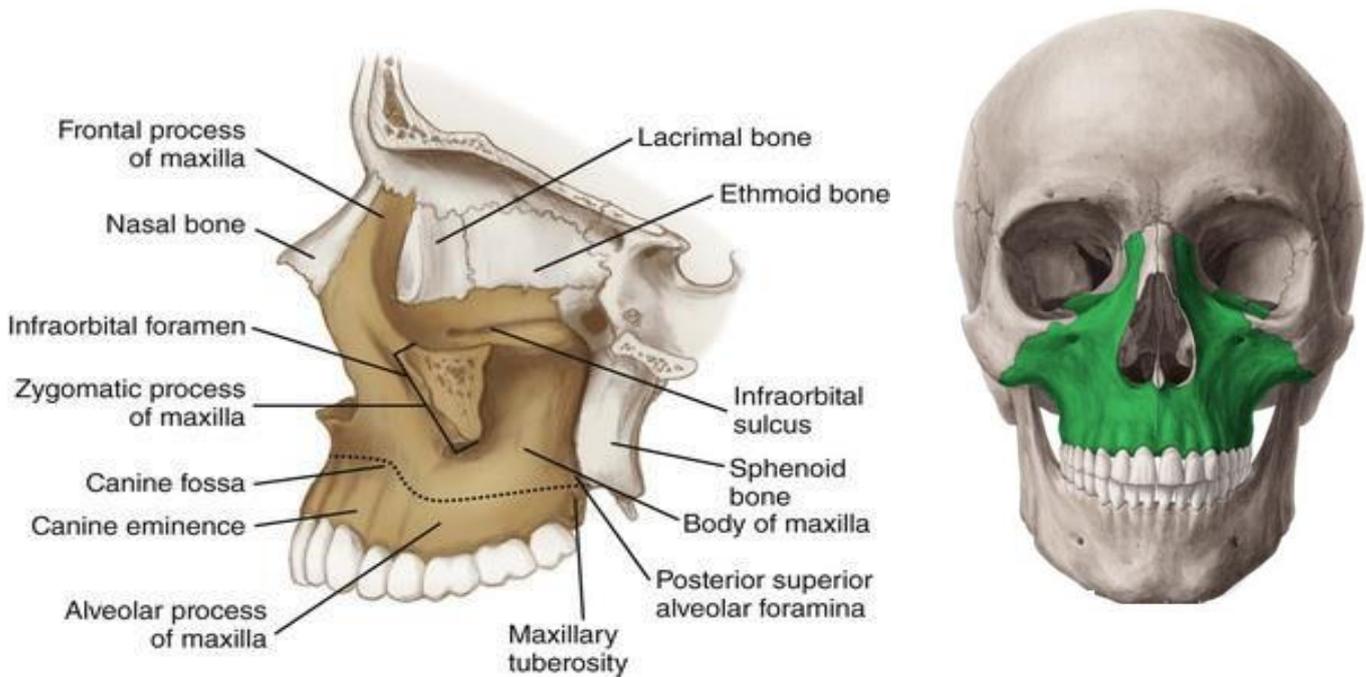
Articulates with the zygomatic process of the maxillary bone to help in forming the floor of the orbit



2. Maxillary bone (Maxilla)

Characteristics

- Forms the majority of the skeleton of the face and the upper jaw
- Contains the maxillary paranasal sinus
- Articulates with the opposite maxilla and the frontal, sphenoid, nasal, vomer and ethmoid bones; inferior nasal concha, palatine, lacrimal, zygomatic bone and the nasal cartilages
- There are 2 maxillary bone (maxillae)



Parts:

❖ **Body**

- Major part of the bone
- Has pyramidal shape
- Contains the maxillary paranasal sinus
- Give rise to 4 different regions:
 - ✓ Orbit
 - ✓ Nasal cavity
 - ✓ Infratemporal fossa
 - ✓ Face
- Infraorbital canal and foramen pass from the orbit region to the face region

❖ **Frontal process**

- Extends superiorly to articulate with the nasal, frontal, ethmoid and lacrimal bones
- Forms the anterior boundary of the lacrimal fossa

❖ **Zygomatic process**

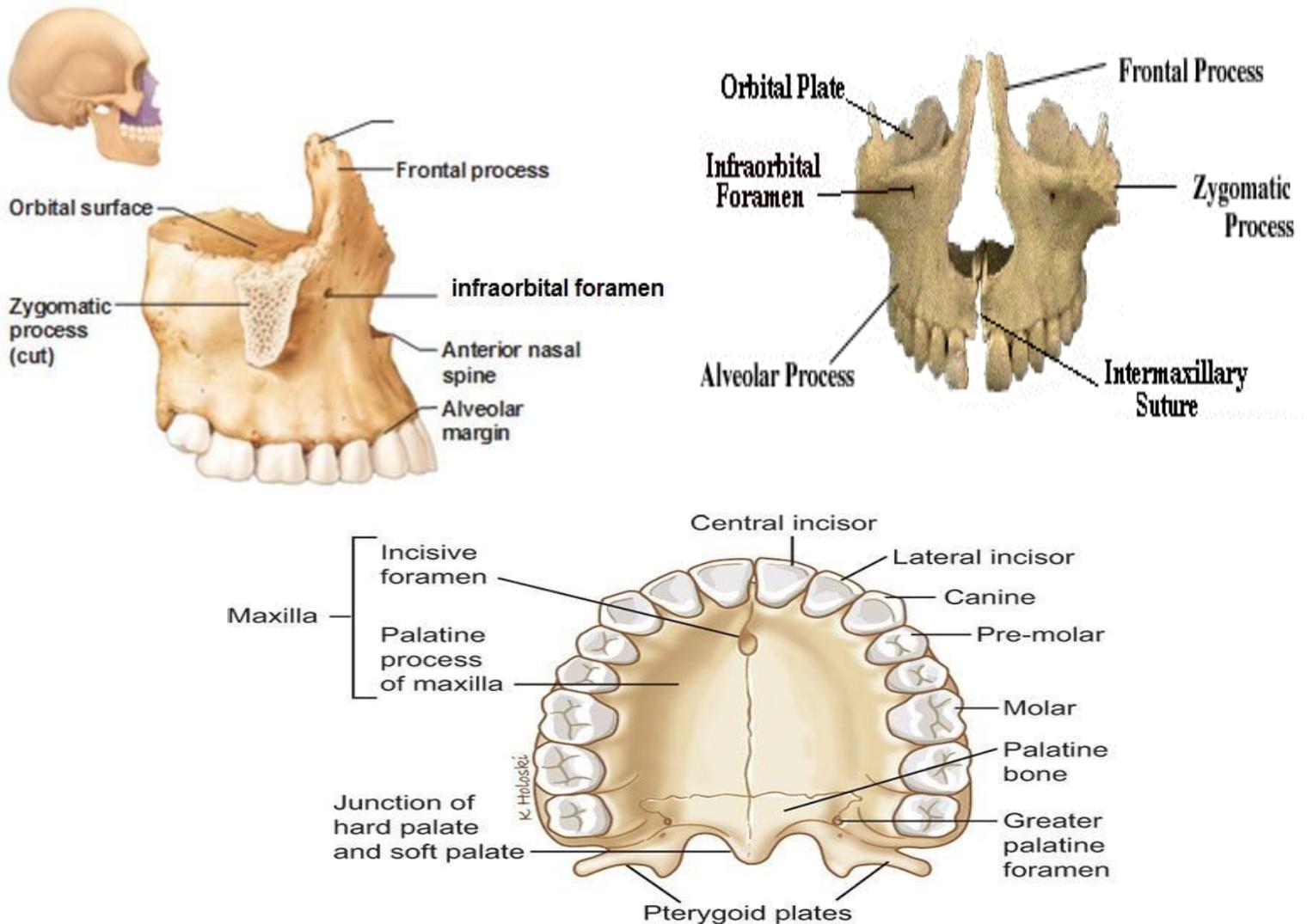
- Extends laterally to articulate with the maxillary process of the zygomatic bone

❖ **Palatine process**

- Extends medially to form the majority of the hard palate
- Articulates with the palatine process of the opposite side and the horizontal plate of the palatine bone
- Incisive foramen is located in the anterior portion

❖ Alveolar process

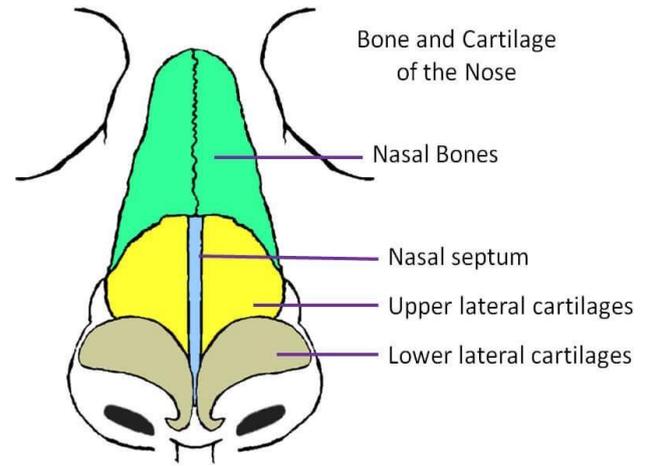
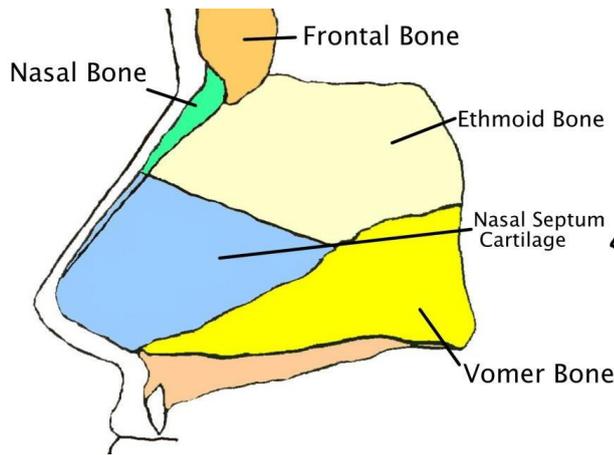
- The part of the maxilla that supports all the maxillary teeth
- Each maxilla contains 5 primary and 8 permanent teeth
- Alveolar bone is resorbed when the tooth is lost



3. Nasal bone

Characteristics

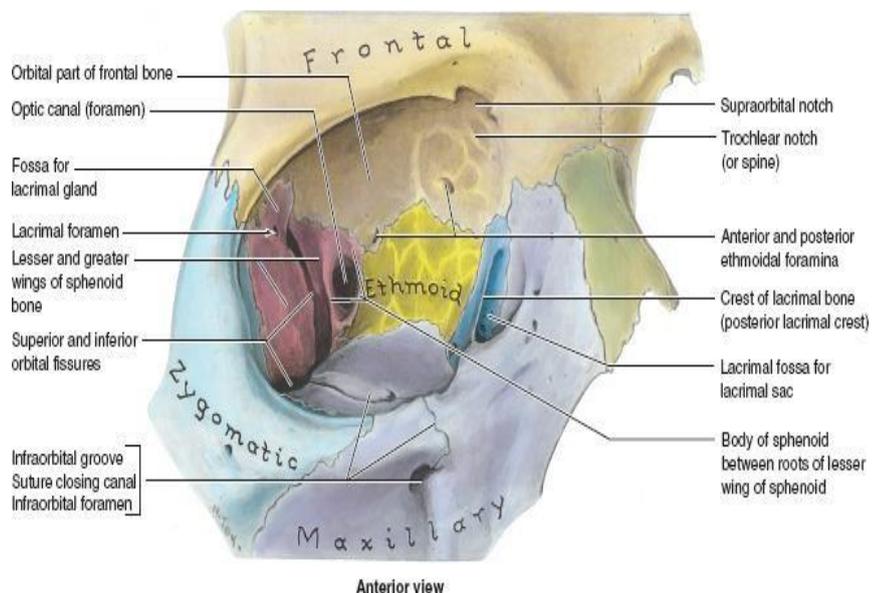
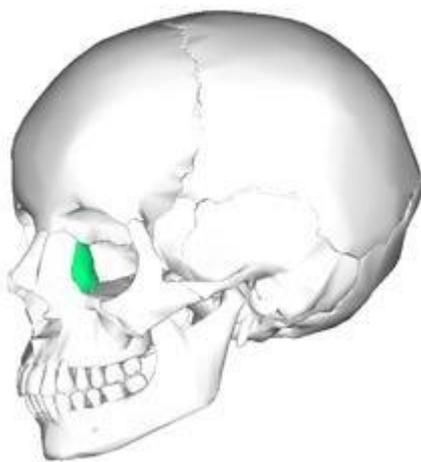
- Inferior portion forms the superior margin of the nasal aperture
- Forms the bridge of the nose
- There are 2 nasal bones
- Articulates with the nasal bone of the opposite side, the nasal portion of the frontal bone, the frontal process of the maxilla, and the perpendicular plate of the ethmoid bone
- Inferior portion of the nasal bone attaches with the upper lateral nasal cartilages and septal nasal cartilages



4. Lacrimal bone

Characteristics

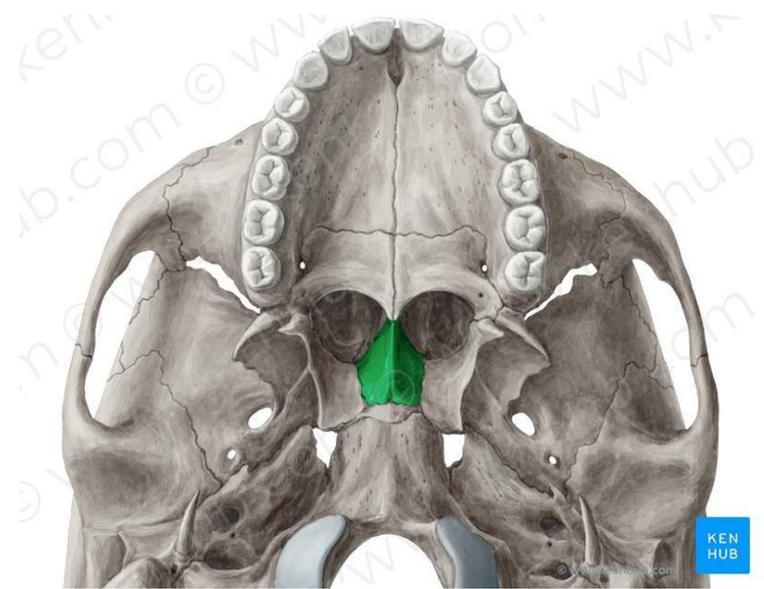
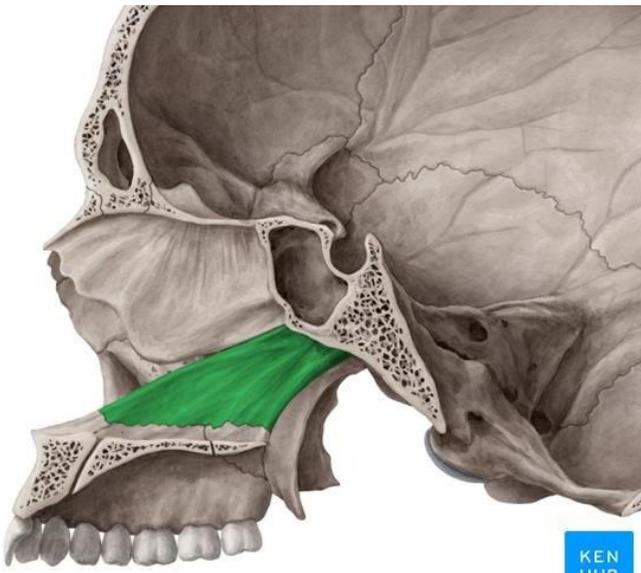
- Lacrimal bone is small, rectangular in shape, very thin and fragile
- There are 2 lacrimal bones
- Forms a small portion of the medial wall of the orbit
- Articulates with the frontal process of maxilla, orbital plate of the ethmoid bone, the frontal bone and the inferior nasal concha
- The region that articulates with the frontal process of the maxilla forms the lacrimal fossa; the location of lacrimal sac.
- The inferior part of the lacrimal bone forms a small portion of the lateral wall of the nasal cavity



5. **vomer**

Characteristics

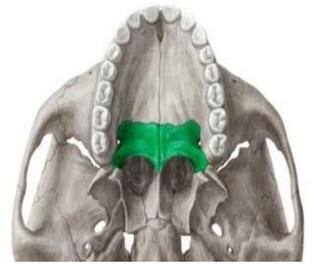
- shaped like a 'plough'
- forms the posterior inferior part of the nasal septum
- there is 1 vomer bone
- articulates with the perpendicular plate of the ethmoid, maxilla, palatine bone, sphenoid bone and the septal cartilage
- posterior border does not articulate with any other bone
- Intramembranous ossification



6. Palatine bone

Characteristics

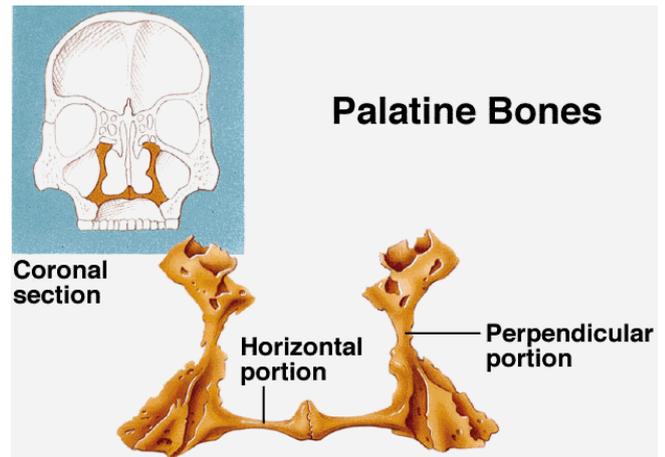
- There are two palatine bones.
- Every palatine bone is lodged between the **pterygoid process** of **sphenoid bone** posteriorly, and the **maxilla** anteriorly.
- 2 palatine bones create the posterior one-third of the **hard palate** that is why it is called palatine bone.



Parts:

❖ perpendicular plate

- is the thin vertical part of the palatine bone.
- On the superior border there is a notch that articulates with the sphenoid bone forming the sphenopalatine foramen
- A small orbital process helps forms part of the orbit
- Forms part of the wall of the pterygopalatine fossa and the lateral wall of the nasal cavity
- Lateral wall articulates with the maxilla to form the palatine canal

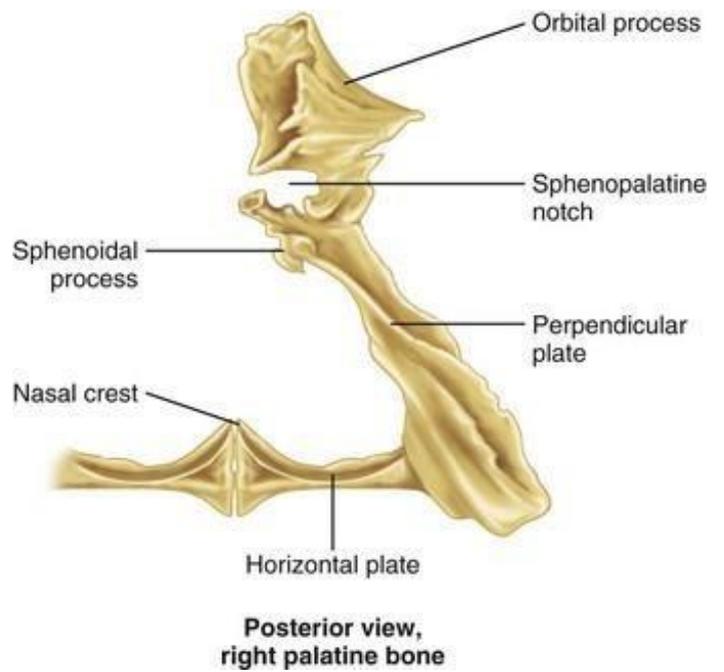
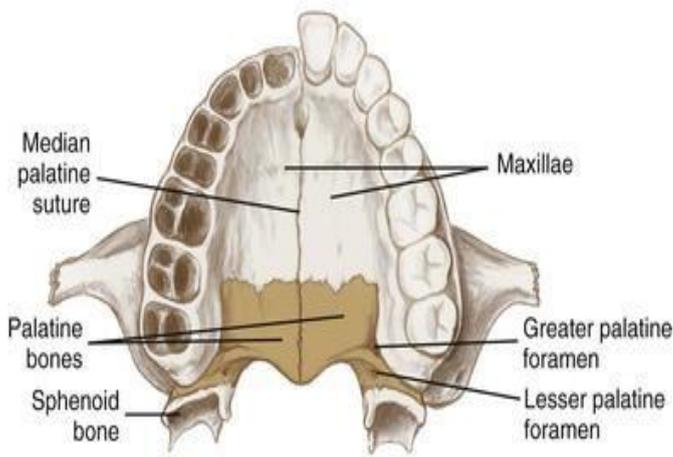


❖ Horizontal plate

- articulate with palatine process of the maxillae and forms the posterior portion of the hard palate
- Superior to the horizontal plate is the nasal cavity
- On the medial part (formed by both of the horizontal plates) is the nasal spine
- Greater palatine foramen is in the horizontal plate

❖ Pyramidal process

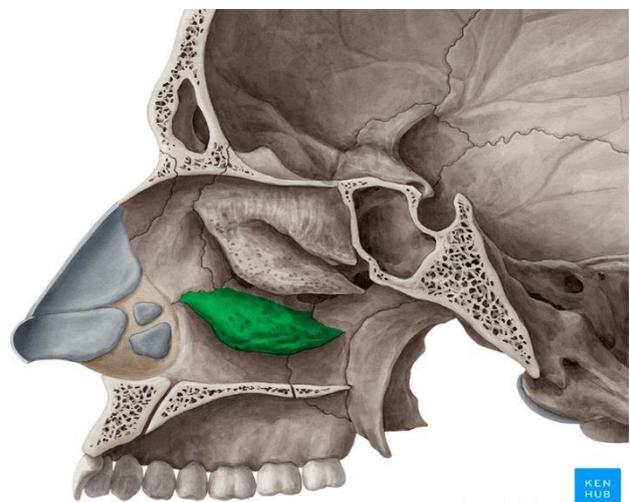
- Extends posteriorly and inferiorly from the junction of the perpendicular and horizontal plates of the palatine bone
- Lesser palatine foramen is located here



7. Inferior nasal conchae

Characteristics

- Is described as a curved bone that forms part of the lateral wall of the nasal cavity
- There are 2 inferior nasal conchae
- Articulates with the maxilla, perpendicular plate of the palatine bone, lacrimal and ethmoid bones



8. Mandible

Characteristics

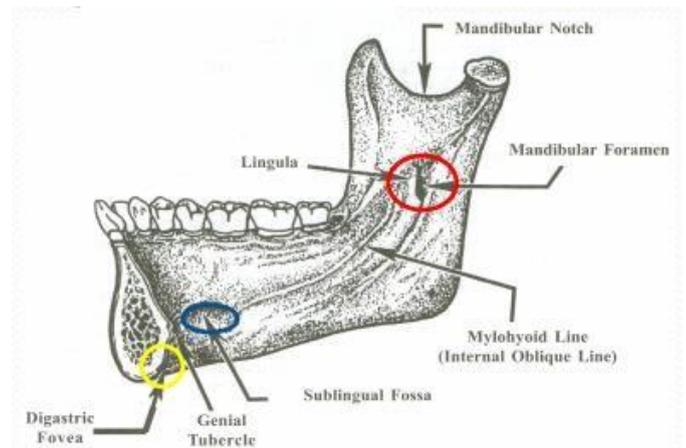
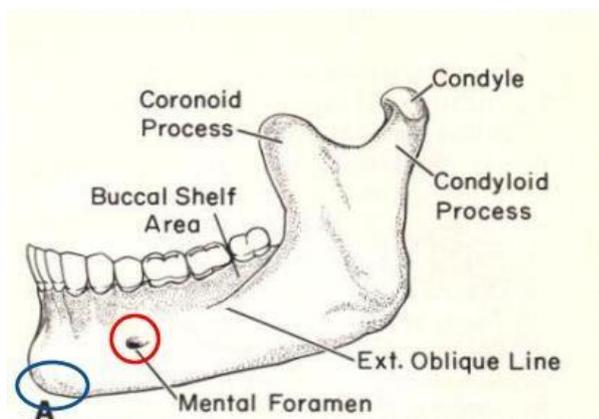
- Forms the lower jaw
- Described as a horse shoe shaped
- All muscles of mastication attached to the mandible
- There is 1 mandible



Parts:

❖ Body

- Mental foramen lies on the anterior part of the lateral surface of the body
- External oblique line is observed on the lateral side of the mandible
- On the medial side of the body lies the mylohyoid line (internal oblique line)
- mylohyoid line helps divide a sublingual from submanibular fossa
- posterior border of the mylohyoid line provides for attachments of the pterygomandibular raphe
- at the midline on the medial side are the superior and inferior genial tubercles as well as the digastric fossa



❖ Ramus

- meets the body of the mandible at the angle of the mandible on each side
- mandibular foramen is located on the medial side of the ramus
- superior part is divided into a coronoid process anteriorly and a condylar process posteriorly; separated by a mandibular notch

❖ **coronoid process**

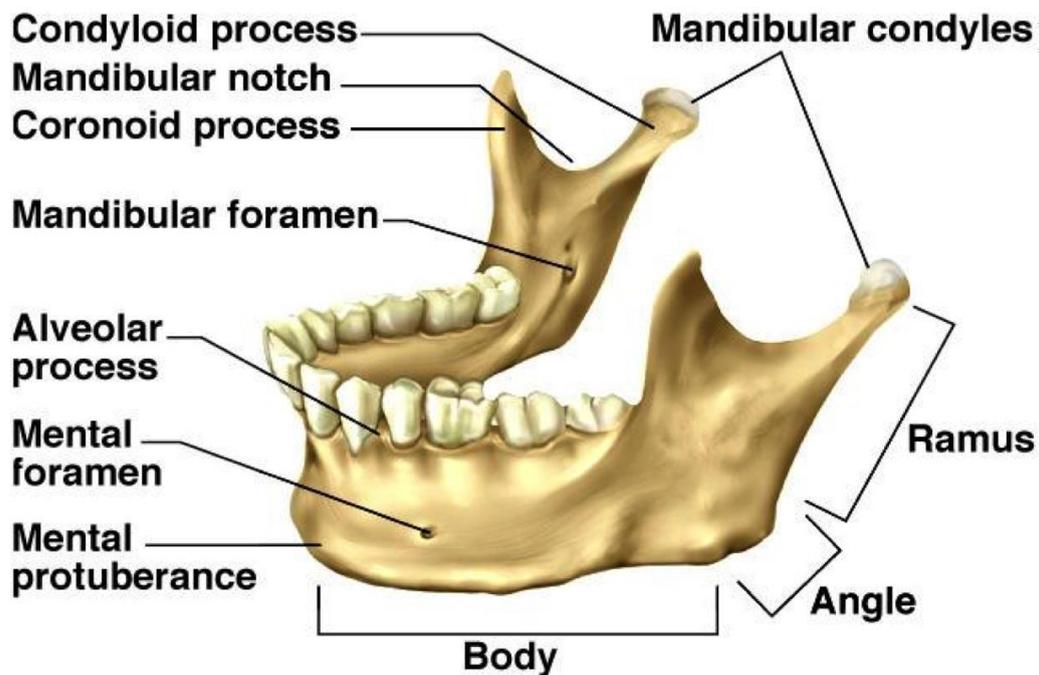
- the anterior most superior extension of each ramus
- temporalis muscle attaches to the coronoid process

❖ **condylar process**

- articulates with the temporal bone in the temporomandibular joint
- has a neck that forms a condyle superiorly

❖ **alveolar process**

- extends superiorly from the body
- created by a thick buccal and thin lingual plate of bone
- the part of the mandible that supports the mandibular teeth
- each side of the mandible contains 5 primary and 8 permanent teeth
- alveolar bone is resorbed when a tooth is lost





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GENERAL ANATOMY

Lec. 7

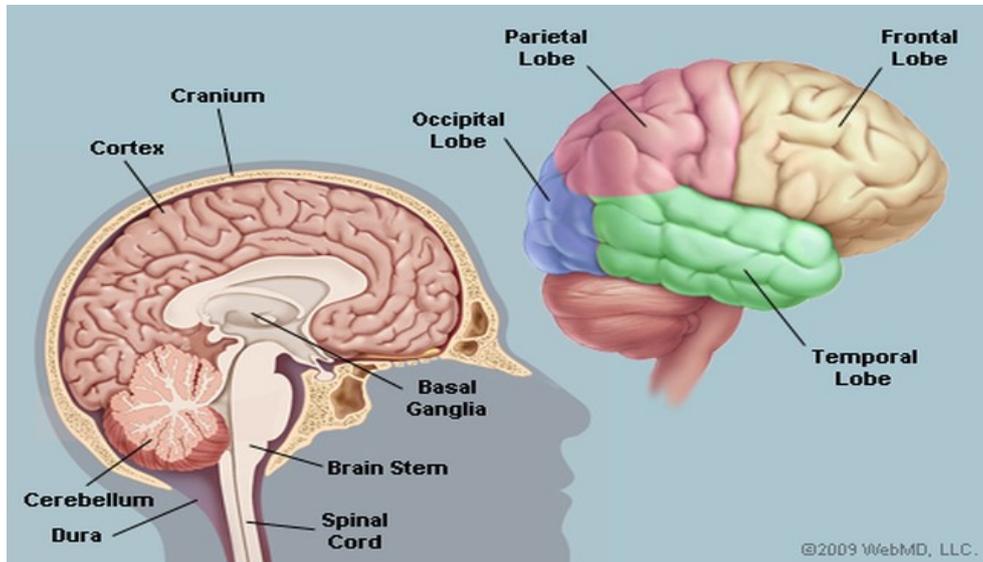
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2018-2019

The Cranial Cavity

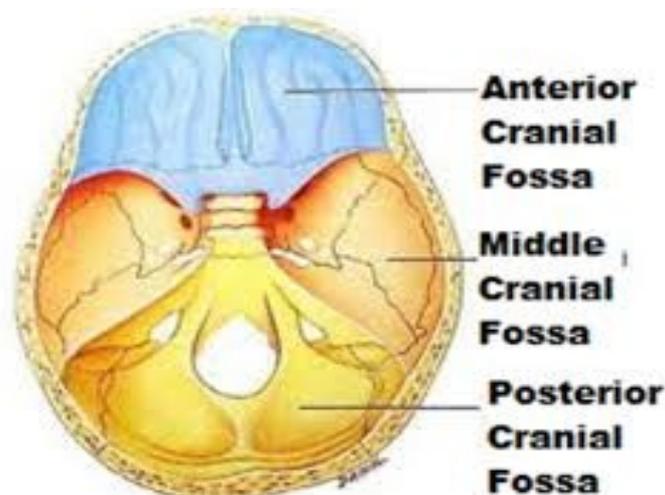
The cranial cavity contains the brain and its surrounding meninges, portions of the cranial nerves, arteries, veins, and venous sinuses.

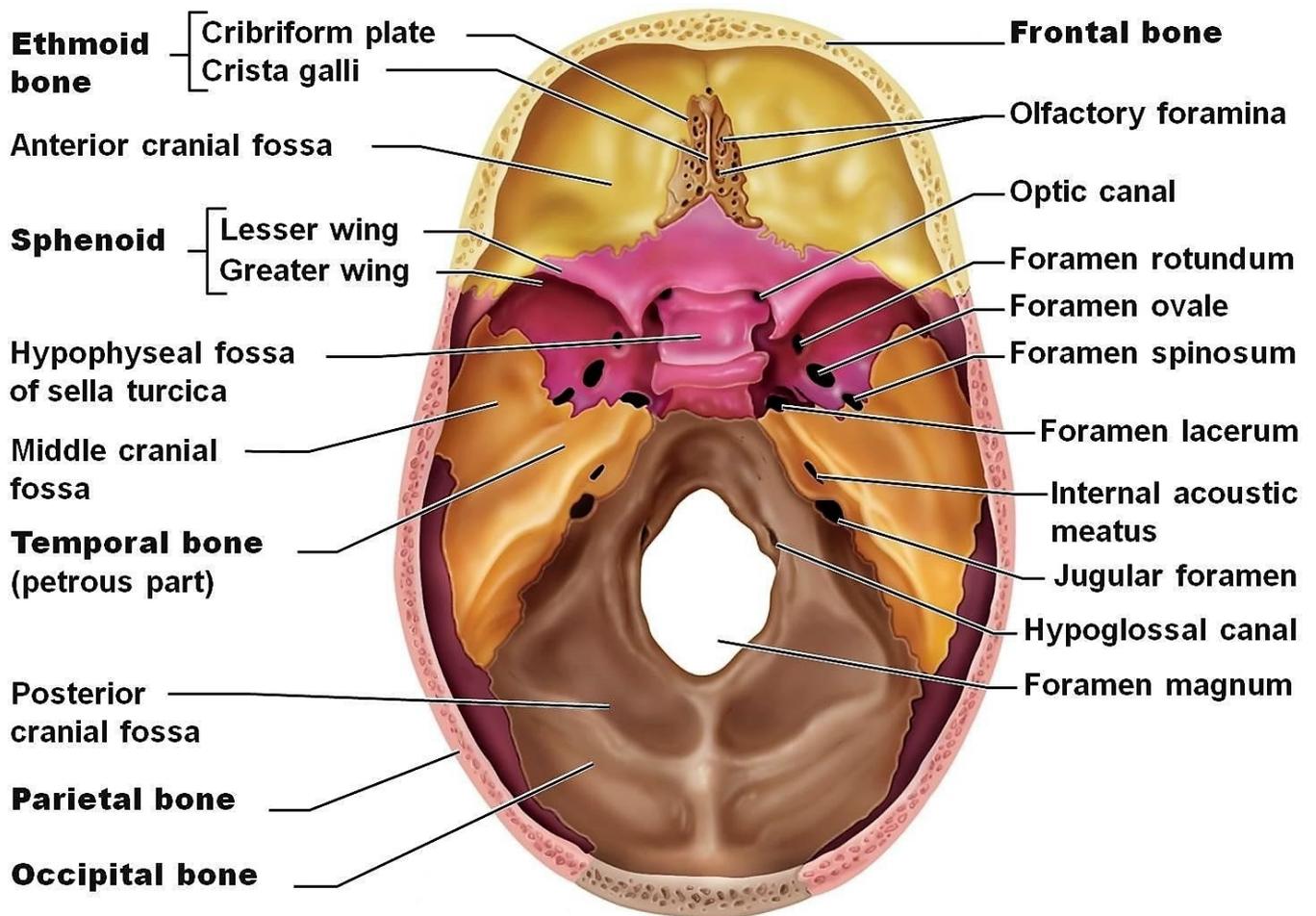


Base of the Skull

The interior surface of the base of the skull is divided into three cranial fossae: *anterior*, *middle*, and *posterior*.

The anterior cranial fossa is separated from the middle cranial fossa by *the lesser wing of the sphenoid*, and the middle cranial fossa is separated from the posterior cranial fossa by the *petrous part of the temporal bone*.



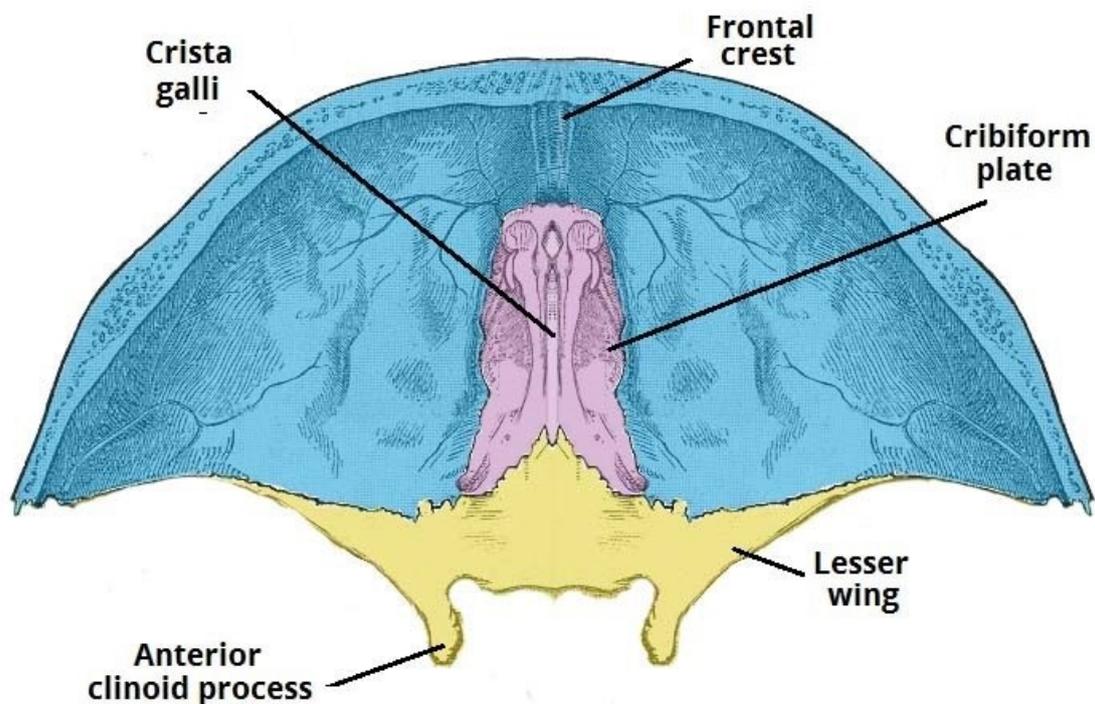


Anterior Cranial Fossa

The anterior cranial fossa lodges the frontal lobes of the brain. It is bounded anteriorly by the inner surface of the frontal bone, and in the midline is a crista galli for the attachment of the **falx cerebri**.

Its posterior boundary is the sharp lesser wing of the sphenoid, which articulates laterally with the frontal bone and meets the anteroinferior angle of the parietal bone, or the pterion. The medial end of the lesser wing of the sphenoid forms the **anterior clinoid process** on each side, which gives attachment to the **tentorium cerebelli**.

The floor of the fossa is formed by the ridged **orbital plates of the frontal bone** laterally and by the **cribriform plate** of the ethmoid medially. The **crista galli** is a sharp upward projection of the ethmoid bone in the midline for the attachment of the falx cerebri. Alongside the crista galli is a narrow slit in the cribriform plate for the passage of the **anterior ethmoidal nerve** into the nasal cavity. The upper surface of the cribriform plate supports the olfactory bulbs, and the small perforations in the cribriform plate are for the **olfactory nerves**.



Middle Cranial Fossa

The middle cranial fossa consists of a small median part and expanded lateral parts. The median part is formed by the body of the sphenoid, and the expanded lateral parts form concavities on either side, which lodge the **temporal lobes** of the brain.

It is bounded anteriorly by the lesser wings of the sphenoid and posteriorly by the superior borders of the petrous parts of the temporal bones. Laterally lie the squamous parts of the temporal bones, the greater wings of the sphenoid, and the parietal bones.

The floor of each lateral part of the middle cranial fossa is formed by the greater wing of the sphenoid and the squamous and petrous parts of the temporal bone.

The median part of the middle cranial fossa is formed by the body of the sphenoid bone. Anteriorly, the **optic canal** transmits the optic nerve and the ophthalmic artery, a branch of the internal carotid artery, to the orbit. Posterior to the optic canal is the **sella turcica**. The sella turcica is bounded anteriorly by an elevation, the **tuberculum sellae**. Behind the elevation is a deep depression, the **hypophyseal fossa**, which lodges the **pituitary gland**. The sella turcica is bounded posteriorly by a square plate of bone called the **dorsum sellae**. The superior angles of the dorsum sellae have two tubercles, called the **posterior clinoid processes**.

The sphenoid air sinus is found inside of the body of the sphenoid. The **superior orbital fissure**, which is a slit like opening between the lesser and the greater wings of the sphenoid, transmits the lacrimal, frontal, trochlear, oculomotor, nasociliary, and abducent nerves, together with the superior ophthalmic vein.

The **foramen rotundum** perforates the greater wing of the sphenoid and transmits the maxillary nerve from the trigeminal ganglion to the pterygopalatine fossa.

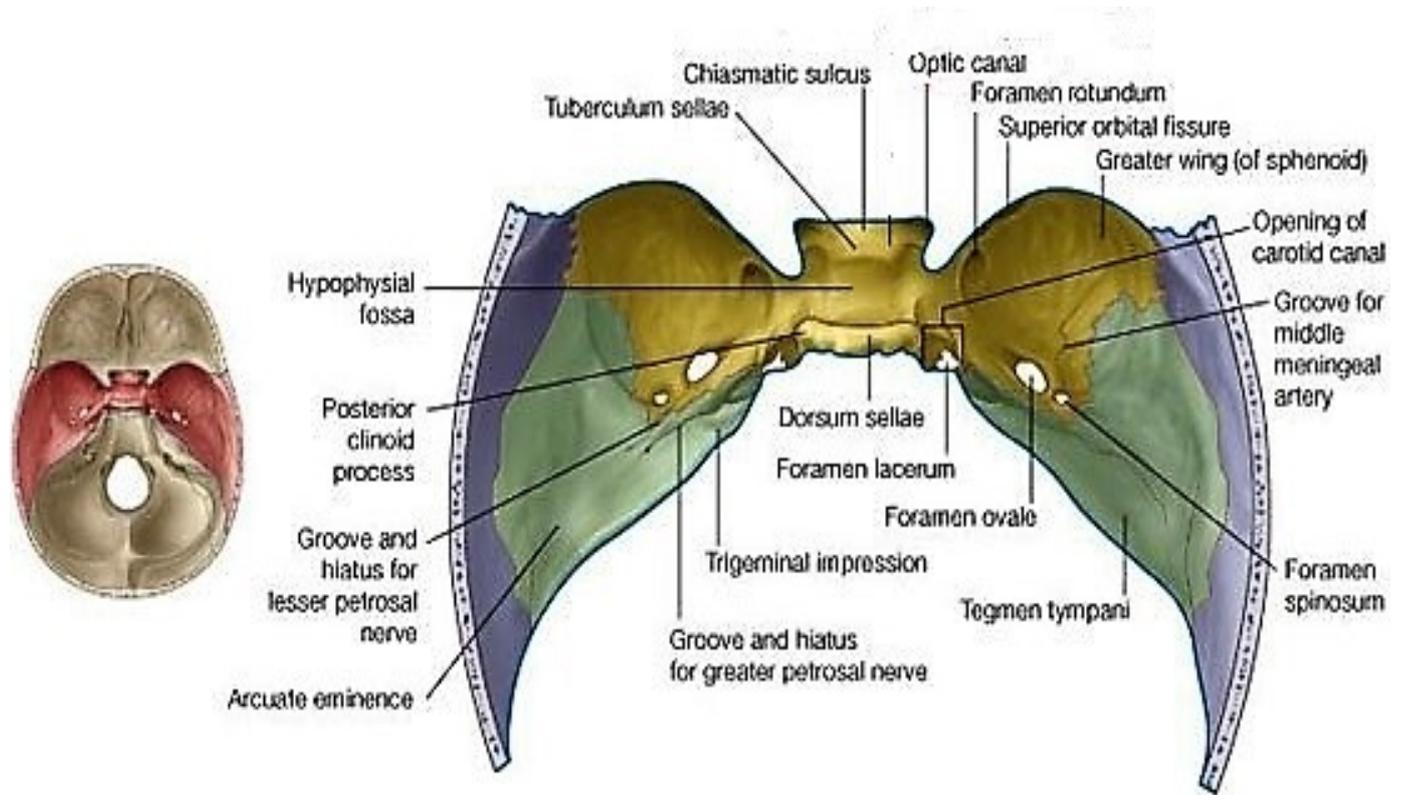
The **foramen ovale** lies posterolateral to the foramen rotundum. It perforates the greater wing of the sphenoid and transmits the large sensory root and small motor root of the mandibular nerve to the infratemporal fossa; the lesser petrosal nerve also passes through it.

The small **foramen spinosum** lies posterolateral to the foramen ovale and also perforates the greater wing of the sphenoid. The foramen transmits the middle meningeal artery from the infratemporal fossa into the cranial cavity.

The large and irregularly shaped **foramen lacerum** lies between the apex of the petrous part of the temporal bone and the sphenoid bone. The inferior opening of the foramen lacerum in

life is filled by cartilage and fibrous tissue, and only small blood vessels pass through this tissue from the cranial cavity to the neck.

The **carotid canal** opens into the side of the foramen lacerum above. The internal carotid artery enters the foramen through the carotid canal.



Posterior Cranial Fossa

The posterior cranial fossa is deep and lodges the **cerebellum**, **pons**, and **medulla oblongata**. Anteriorly, the fossa is bounded by the superior border of the petrous part of the temporal bone, and posteriorly it is bounded by the internal surface of the squamous part of the occipital bone. The floor of the posterior fossa is formed by the basilar, condylar, and squamous parts of the occipital bone and the mastoid part of the temporal bone.

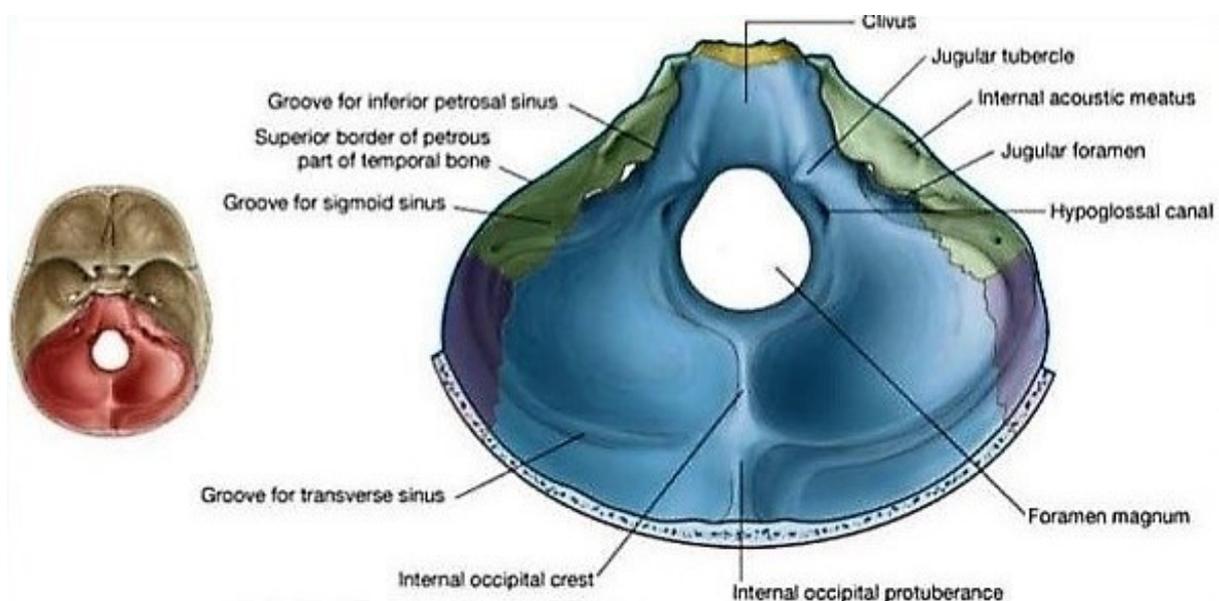
The **foramen magnum** occupies the central area of the floor and transmits the medulla oblongata and its surrounding meninges, the ascending spinal parts of the accessory nerves, and the two vertebral arteries. The **hypoglossal canal** is situated above the anterolateral boundary of the foramen magnum and transmits the **hypoglossal nerve**.

The **jugular foramen** lies between the lower border of the petrous part of the temporal bone and the condylar part of the occipital bone. It transmits the following structures:

1. The **inferior petrosal sinus**
2. The **9th, 10th, and 11th cranial nerves**
3. The large **sigmoid sinus**.

The **internal acoustic meatus** pierces the posterior surface of the petrous part of the temporal bone. It transmits the vestibulocochlear nerve and the motor and sensory roots of the facial nerve.

The **internal occipital crest** runs upward in the midline posteriorly from the foramen magnum to the **internal occipital protuberance**; to it is attached the small **falx cerebella** over the **occipital sinus**. On each side of the internal occipital protuberance is a wide groove for the **transverse sinus**





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GENERAL ANATOMY

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2018-2019

External Views of the Skull

Anterior View of the Skull

The **frontal bone**, or forehead bone, curves downward to make the upper margins of the orbits. The **superciliary arches** can be seen on both side, and the **supraorbital notch**, or **foramen**, can be recognized. Medially, the frontal bone articulates with the frontal processes of the maxillae and with the nasal bones. Laterally, the frontal bone articulates with the zygomatic bone.

The **orbital margins** are bounded by the frontal bone superiorly, the zygomatic bone laterally, the maxilla inferiorly, and the frontal process of the maxilla and nasal process of frontal bone medially.

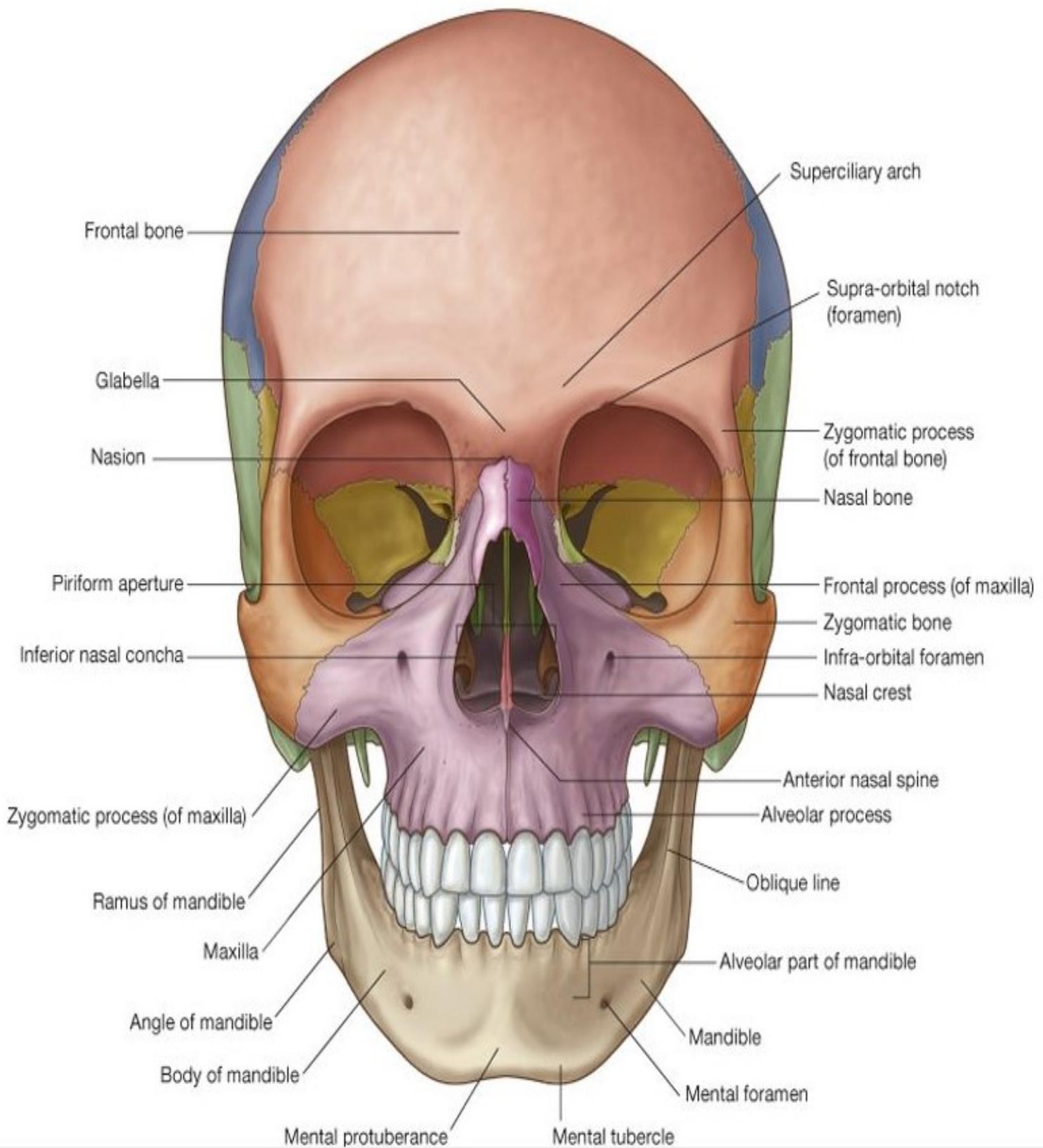
Within the **frontal bone**, just above the orbital margins, there are two hollow spaces lined with mucous membrane called the **frontal air sinuses**. These communicate with the nose and serve as voice resonators.

The **two nasal bones** form the bridge of the nose. Their lower borders, with the maxillae make the **anterior nasal aperture**. The nasal cavity is divided into two by the bony nasal septum, which is largely formed by the **vomer**. The **superior** and **middle conchae** are shelves of bone that project into the nasal cavity from the **ethmoid** on each side; the **inferior conchae** are separate bones.

The two **maxillae** form the upper jaw, the anterior part of the hard palate, part of the lateral walls of the nasal cavities, and part of the floors of the orbital cavities. The two bones meet in the midline at the **intermaxillary suture** and form the lower margin of the nasal aperture. Below the orbit, the maxilla is perforated by the **infraorbital foramen**. The **alveolar process** projects downward and, together with the fellow of the opposite side, forms the **alveolar arch**, which carries the upper teeth. Within each maxilla, there is a large, pyramid-shaped cavity lined with mucous membrane called the **maxillary sinus**. This communicates with the nasal cavity and serves as a voice resonator.

The zygomatic bone is perforated by two foramina for the zygomatico-facial and zygomatico-temporal nerves. Medially, it articulates with the maxilla and laterally it articulates with the zygomatic process of the temporal bone to form the zygomatic arch.

The **mandible**, or lower jaw, consists of a horizontal body and two vertical rami.



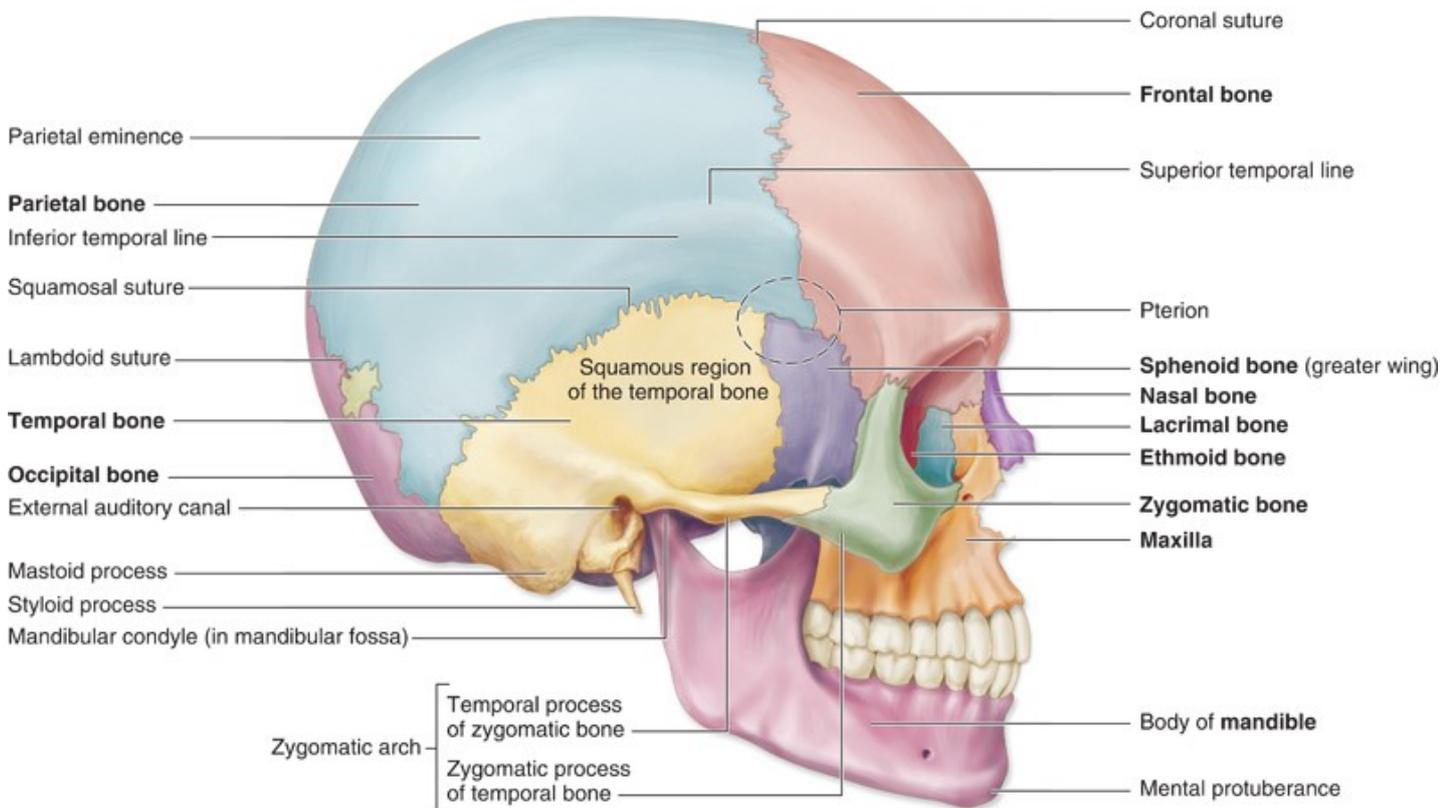
Lateral View of the Skull

The **frontal bone** forms the anterior part of the side of the skull and articulates with the parietal bone at the **coronal suture**. The **parietal bones** form the sides and roof of the cranium and articulate with each other in the midline at the **sagittal suture**. They articulate with the occipital bone behind, at the **lambdoid suture**.

The skull is completed at the side by the squamous part of the **occipital bone**; parts of the **temporal bone**, namely, the **squamous, tympanic, mastoid process, styloid process, and zygomatic process**; and the **greater wing of the sphenoid**.

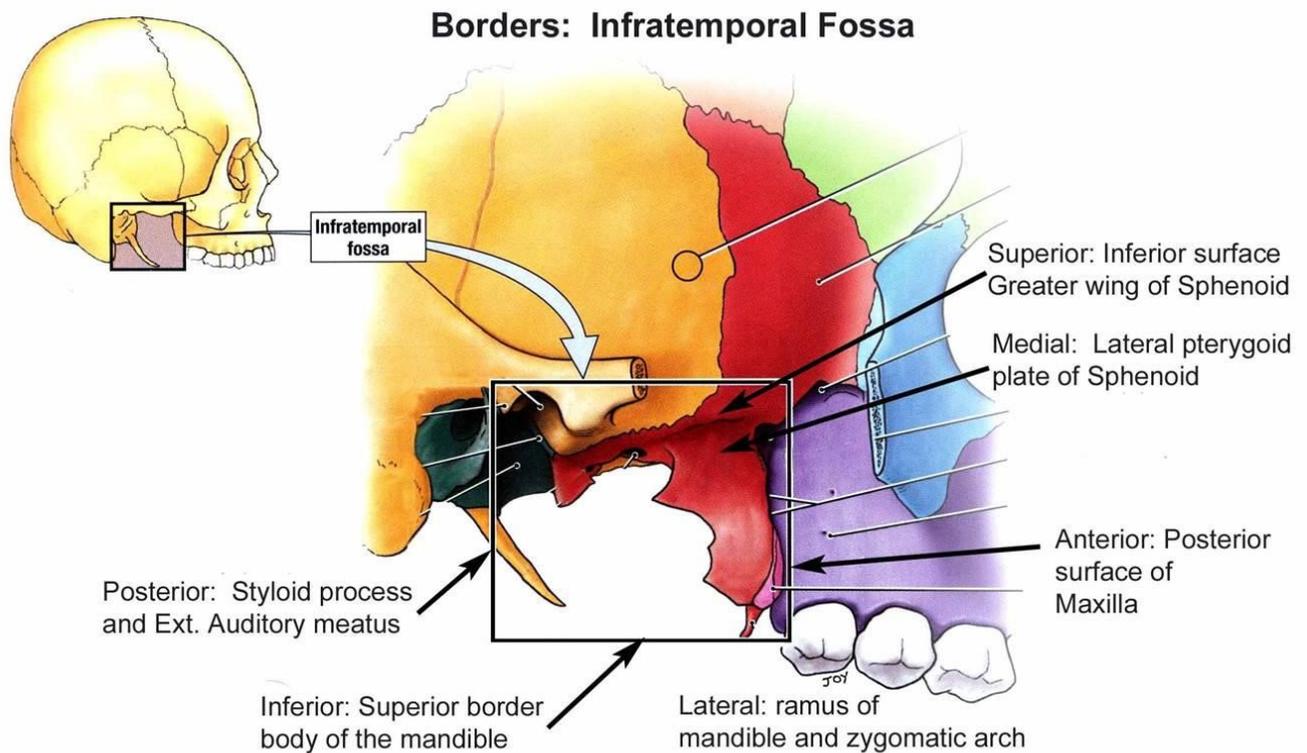
We can see the position of the external auditory meatus and the ramus and body of the mandible lie inferiorly. The thinnest part of the lateral wall of the skull is found where the antero-inferior corner of the parietal bone articulates with the greater wing of the sphenoid; this point is referred to as the **pterion**.

*Clinically, the pterion is an important area because it overlies the anterior division of the **middle meningeal artery and vein**. Identify the **superior and inferior temporal lines**, which begin as a single line from the posterior margin of the zygomatic process of the frontal bone and diverge as they arch backward.*



The **temporal fossa** lies below the inferior temporal line. The **infratemporal fossa** lies below the **infratemporal crest** on the greater wing of the sphenoid. Its boundaries are:

- ✓ Anteriorly by maxilla
- ✓ Superiorly by greater wings of sphenoid
- ✓ Medially by lateral pterygoid plate
- ✓ Laterally by coronoid process and ramus of mandible
- ✓ Posteriorly by TMJ and styloid process of temporal bone.

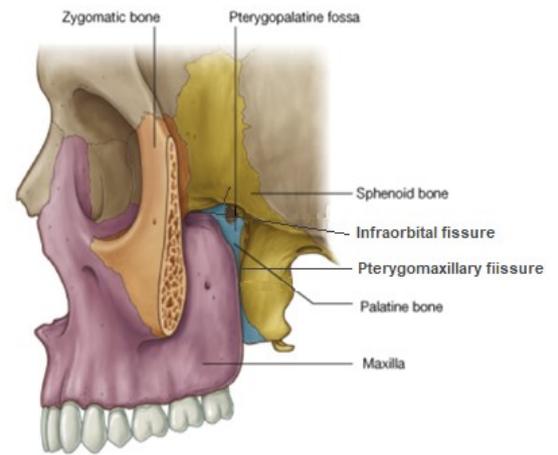
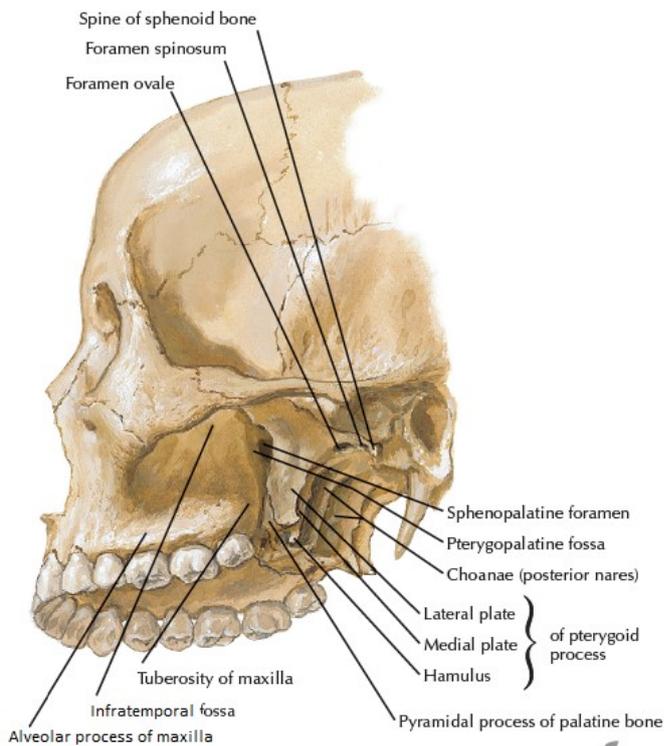


It communicates with the orbit by inferior orbital fissure and with pterygo-palatine fossa via pterygo-maxillary fissure.

The **pterygo-maxillary fissure** is a vertical fissure that lies within the fossa between the pterygoid process of the sphenoid bone and back of the maxilla. It leads medially into the **pterygopalatine fossa**.

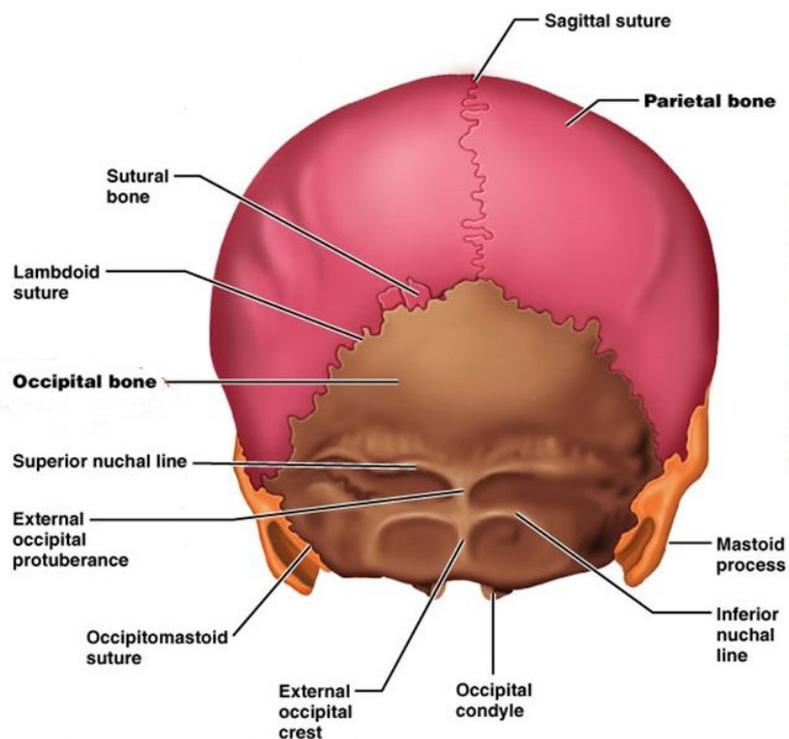
The **inferior orbital fissure** is a horizontal fissure between the greater wing of the sphenoid bone and the maxilla. It leads forward into the orbit.

The **pterygopalatine fossa** is a small space behind and below the orbital cavity. It communicates laterally with the infratemporal fossa through the pterygo-maxillary fissure, medially with the nasal cavity through the **sphenopalatine foramen**, superiorly with the skull through the foramen rotundum, and anteriorly with the orbit through the **inferior orbital fissure**.



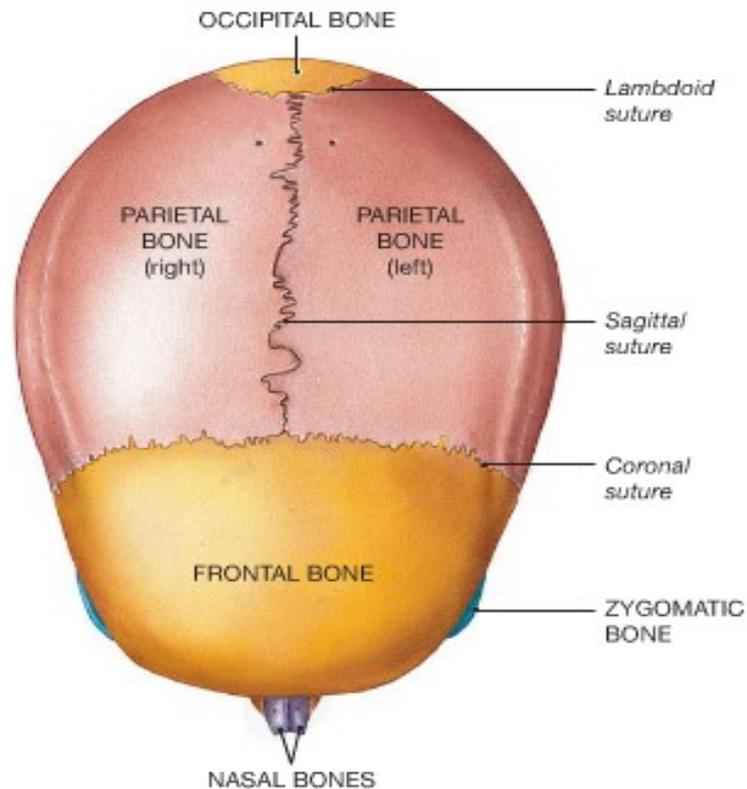
Posterior View of the Skull

The posterior parts of the two parietal bones with the **sagittal suture** are seen above. Below, the parietal bones articulate with the squamous part of the occipital bone at the **lambdoid suture**. On each side the occipital bone articulates with the temporal bone. In the midline of the occipital bone is a roughened elevation called the **external occipital protuberance**, which gives attachment to muscles and the ligamentum nuchae. On either side of the protuberance the **superior nuchal lines** extend laterally toward the temporal bone.



Superior View of the Skull

Anteriorly, the frontal bone articulates with the two parietal bones at the **coronal suture**. Occasionally, the two halves of the frontal bone fail to fuse, leaving a midline **metopic suture**. Behind, the two parietal bones articulate in the midline at the **sagittal suture**.



Inferior View of the Skull

If the mandible is discarded, the anterior part of this aspect of the skull is seen to be formed by the **hard palate**. The **palatal processes of the maxillae** and the **horizontal plates of the palatine bones** can be identified.

In the midline anteriorly is the **incisive fossa and foramen**. Posterolaterally are the **greater and lesser palatine foramina**. The inferior end of the **medial pterygoid plate of sphenoid bone** is prolonged as a curved spike of bone, the **pterygoid hamulus**.

Posterolateral to the **lateral pterygoid plate**, the greater wing of the sphenoid is pierced by the large **foramen ovale** and the small **foramen spinosum**. The **mandibular fossa** of the temporal bone and the **articular tubercle** form the upper articular surfaces for the temporomandibular joint.

The **squamotympanic fissure** is separating the mandibular fossa from the tympanic plate posteriorly. The **styloid process** of the temporal bone projects downward and forward from its inferior aspect.

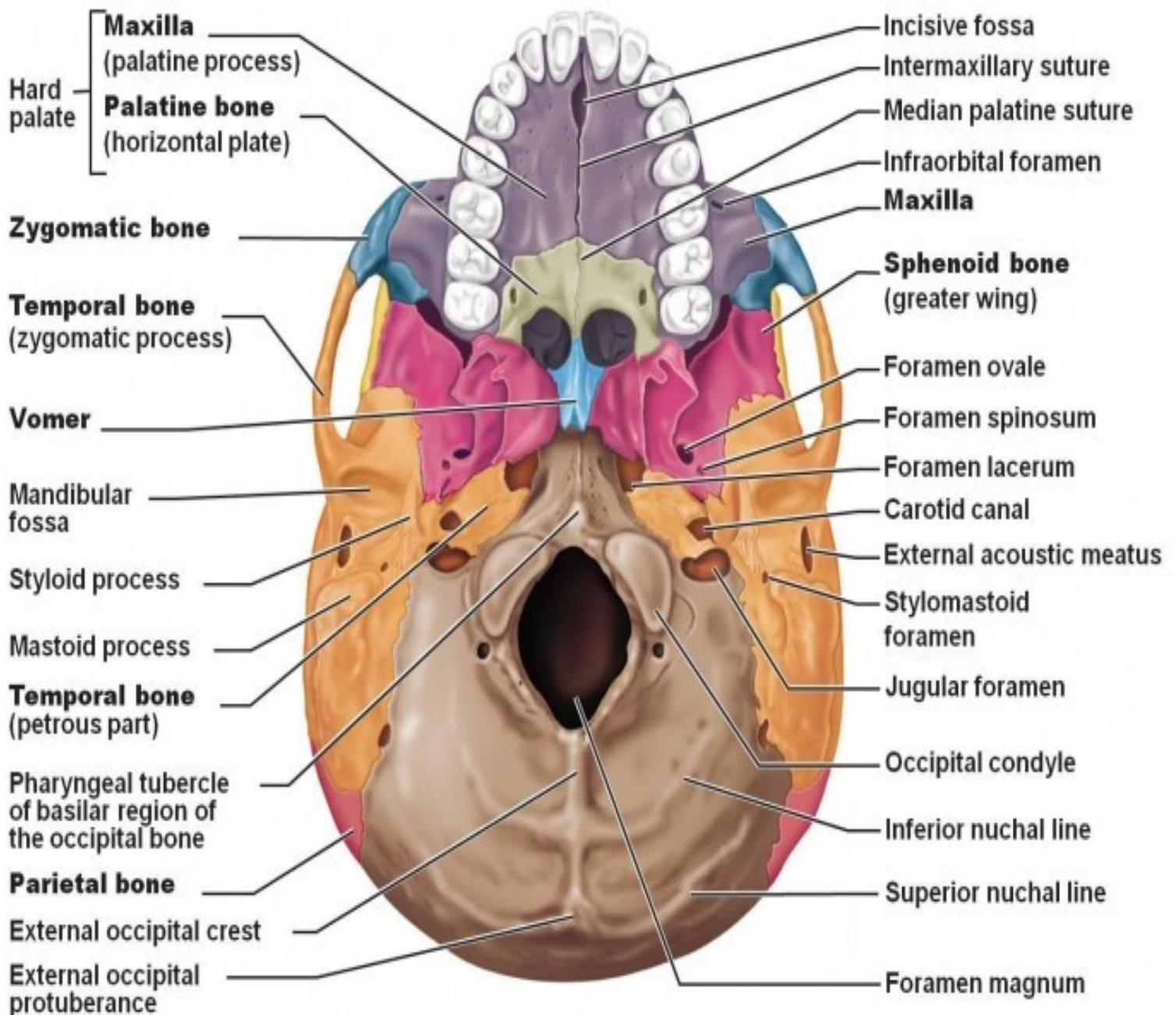
The opening of the **carotid canal** can be seen on the inferior surface of the petrous part of the temporal bone. The medial end of the petrous part of the temporal bone is irregular and together with the basilar part of the occipital bone and the greater wing of the sphenoid, forms the **foramen lacerum**.

During life, the foramen lacerum is closed with fibrous tissue, and only a few small vessels pass through this foramen from the cavity of the skull to the exterior. The **tympanic plate**, which forms part of the temporal bone, is C shaped on section and forms the bony part of the **external auditory meatus**.

In the interval between the styloid and mastoid processes, the **stylomastoid foramen** can be seen. Medial to the styloid process, the petrous part of the temporal bone has a deep notch, which, together with a shallower notch on the occipital bone, forms the **jugular foramen**.

The **occipital condyles** should be identified; they articulate with the superior aspect of the lateral mass of the first cervical vertebra, the atlas. Superior to the occipital condyle is the **hypoglossal canal** for transmission of the hypoglossal nerve.

Posterior to the foramen magnum in the midline is the external occipital protuberance. The superior nuchal lines should be identified as they curve laterally on each side.





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GENERAL ANATOMY

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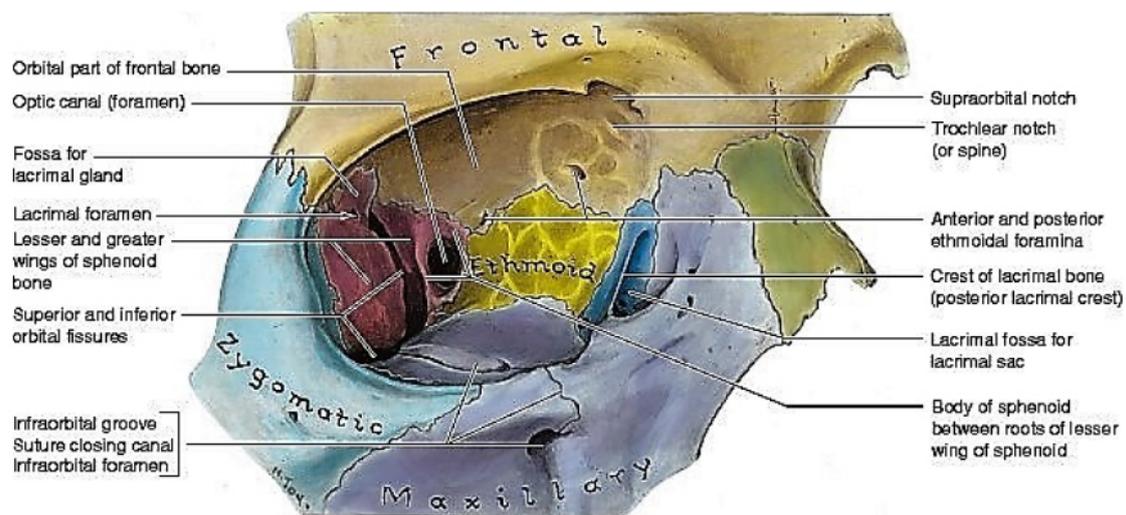
2018-2019

The Orbital Region

The orbits are a pair of bony cavities that contain the eyeballs; their associated muscles, nerves, vessels, and fat as well as the most of the lacrimal apparatus. The orbital opening is guarded by two thin, movable folds, *the eyelids*.

The Orbit

The orbit is a pyramidal cavity with its base anterior and its apex posterior. The **orbital margin** is formed above by the frontal bone; the lateral margin is formed by the processes of the frontal and zygomatic bones, the inferior margin is formed by the zygomatic bone and the maxilla, and the medial margin is formed by the processes of the maxilla and the frontal bone.



- ✚ **Roof:** Formed by the orbital part of the frontal bone, which separates the orbital cavity from the anterior cranial fossa.
- ✚ **Lateral wall:** Formed by the zygomatic bone and the greater wing of the sphenoid.
- ✚ **Floor:** Formed by the orbital plate of the maxilla (body of maxilla), which separates the orbital cavity from the maxillary sinus.
- ✚ **Medial wall:** Formed from before to backward by the frontal process of the maxilla, the lacrimal bone, the orbital plate of the ethmoid (labyrinth part) and the body of the sphenoid.

Openings into the Orbital Cavity

The openings into the orbital cavity are:

1. Orbital opening:

Lies anteriorly. About one sixth of the eye is exposed; the remainder is protected by the walls of the orbit.

2. **Supraorbital notch (Foramen):**

The supraorbital notch is situated on the superior orbital margin. It transmits the supraorbital nerve and blood vessels.

3. **Infraorbital groove and canal:**

Situated on the floor of the orbit in the orbital plate of the maxilla; they transmit the infraorbital nerve (a continuation of the maxillary nerve) and blood vessels.

4. **Nasolacrimal canal:**

Located anteriorly on the medial wall; it communicates with the inferior meatus of the nose. It transmits the nasolacrimal duct.

5. **Inferior orbital fissure:**

Located posteriorly between the **maxilla** and the **greater wing** of the sphenoid; it communicates with the pterygopalatine fossa. It transmits the maxillary nerve and its zygomatic branch, the inferior ophthalmic vein, and sympathetic nerves.

6. **Superior orbital fissure:**

Located posteriorly between the greater and lesser wings of the sphenoid; it communicates with the middle cranial fossa. It transmits the lacrimal nerve, the frontal nerve, the trochlear nerve, the oculomotor nerve (upper and lower divisions), the abducent nerve, the nasociliary nerve, and the superior ophthalmic vein.

7. **Optic canal:**

Located posteriorly in the body of the sphenoid; it communicates with the middle cranial fossa. It transmits the optic nerve and the ophthalmic artery.

8. **Anterior ethmoidal foramen:**

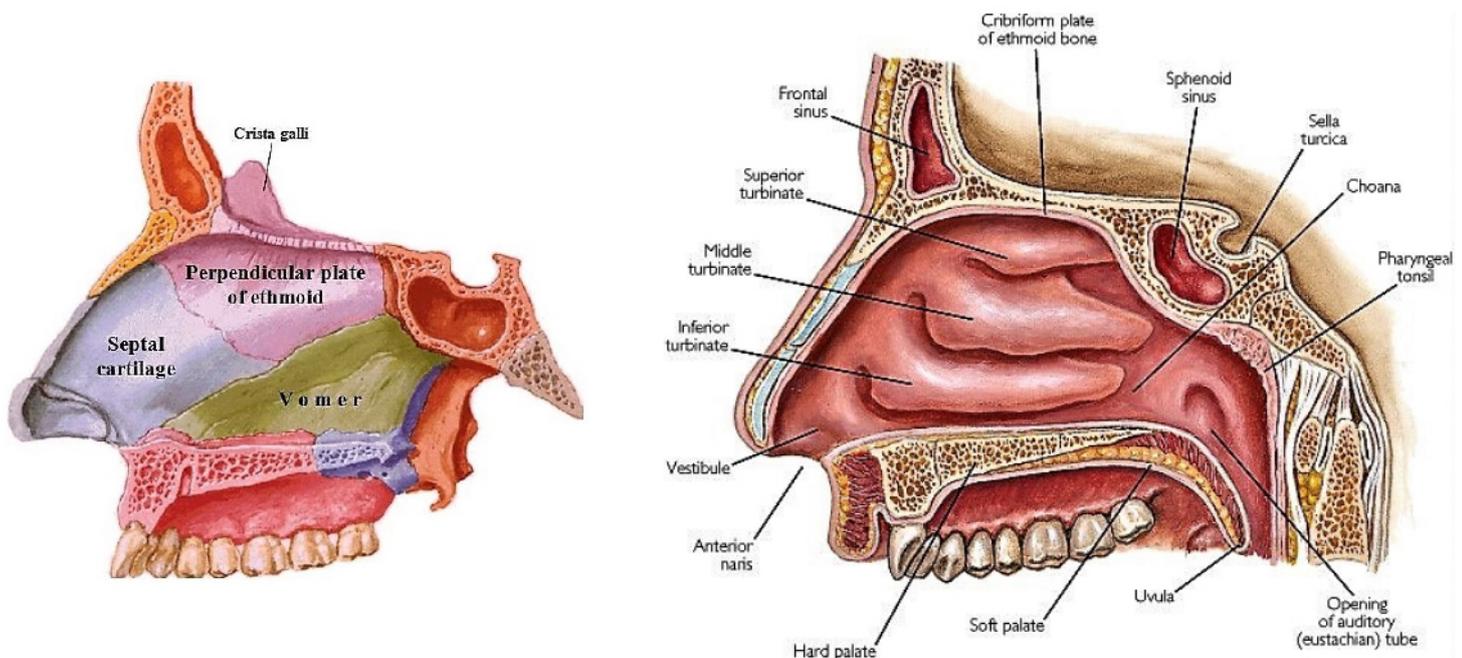
Located between the frontal and ethmoidal bone and transmit the anterior ethmoidal nerve and vessel.

9. **Posterior ethmoidal foramen:**

Located between the frontal and ethmoidal bone and transmit the posterior ethmoidal nerve and vessel.

Nasal cavity

The nasal cavity extends from the nostrils in front to the posterior nasal apertures behind, where the nose opens into the nasopharynx. The nasal vestibule is the area of the nasal cavity lying just inside the nostril. The nasal cavity is divided into right and left halves by the nasal septum. The septum is made up of septal cartilage, the perpendicular plate of ethmoid and the vomer bone.



Walls of the nasal cavity

Each half of the nasal cavity has a floor, a roof, a lateral wall and a medial wall

❖ Floor:

The palatine process of the maxilla and the horizontal plate of the palatine bone

❖ Roof:

The roof is narrow and is formed anteriorly beneath the bridge of the nose by the nasal and frontal bones, in the middle by the cribriform plate of ethmoid bone, and posteriorly by the downward sloping body of sphenoid.

❖ Medial wall:

The medial wall is formed by the nasal septum. The upper part is formed by the perpendicular plate of ethmoid bone. The inferior part is formed by the vomer. The anterior part is formed by the nasal septal cartilage.

The septum rarely lies in the midline, thus increasing the size of one half of the nasal cavity and decreasing the size of the other.

❖ **Lateral wall:**

The lateral wall has 3 projections of bones called superior, middle and inferior nasal conchae. The space below each concha is called meatus.

✚ **Spheno-ethmoidal recess:**

It's a small area above the superior concha. It receives the opening of sphenoid air sinus

✚ **Superior meatus:**

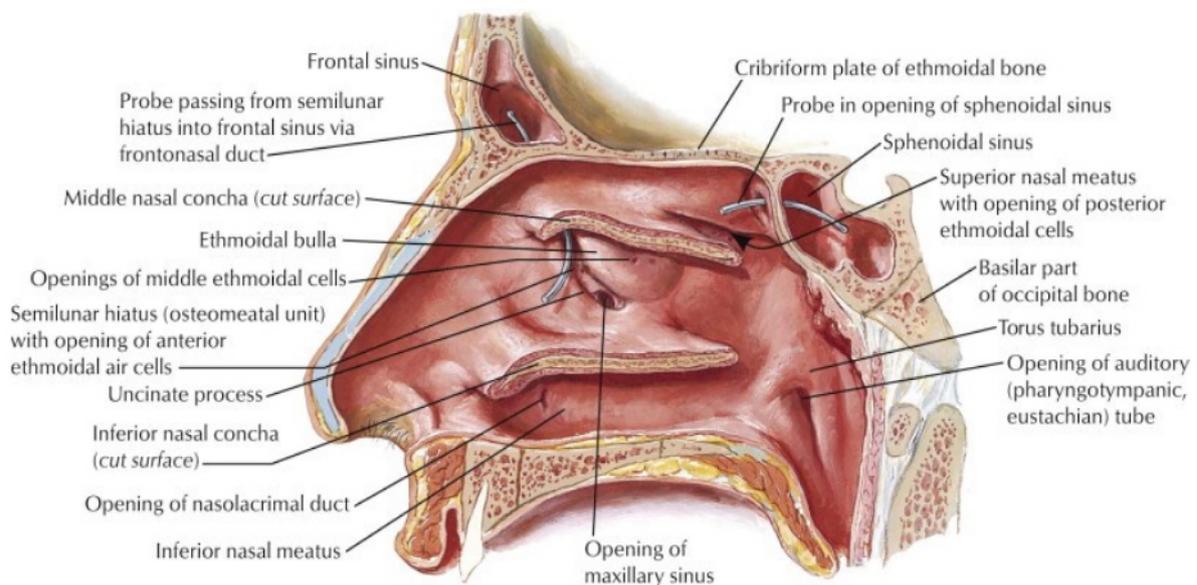
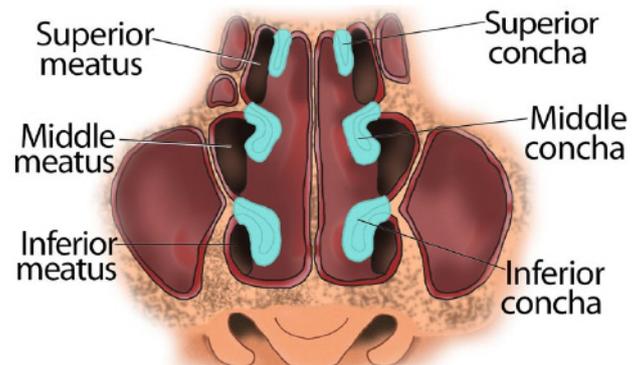
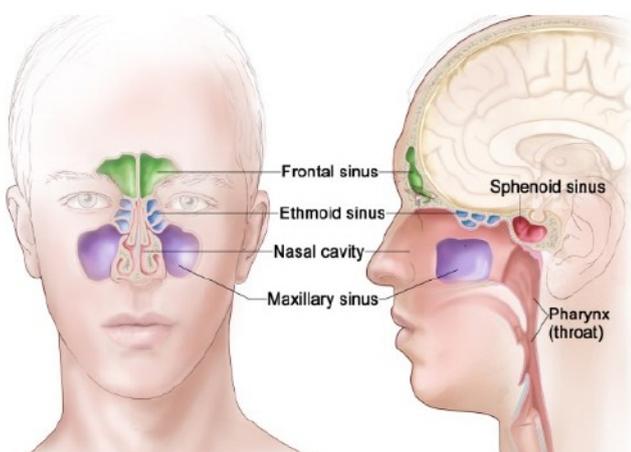
It lies below the superior concha. It receives the openings of posterior ethmoidal sinus

✚ **Middle meatus:**

It lies below the middle concha. It has round swelling called **bullae ethmoidalis** that is formed by the middle ethmoidal air sinuses. The maxillary sinus opens into the middle meatus through the hiatus semilunaris

✚ **Inferior meatus:**

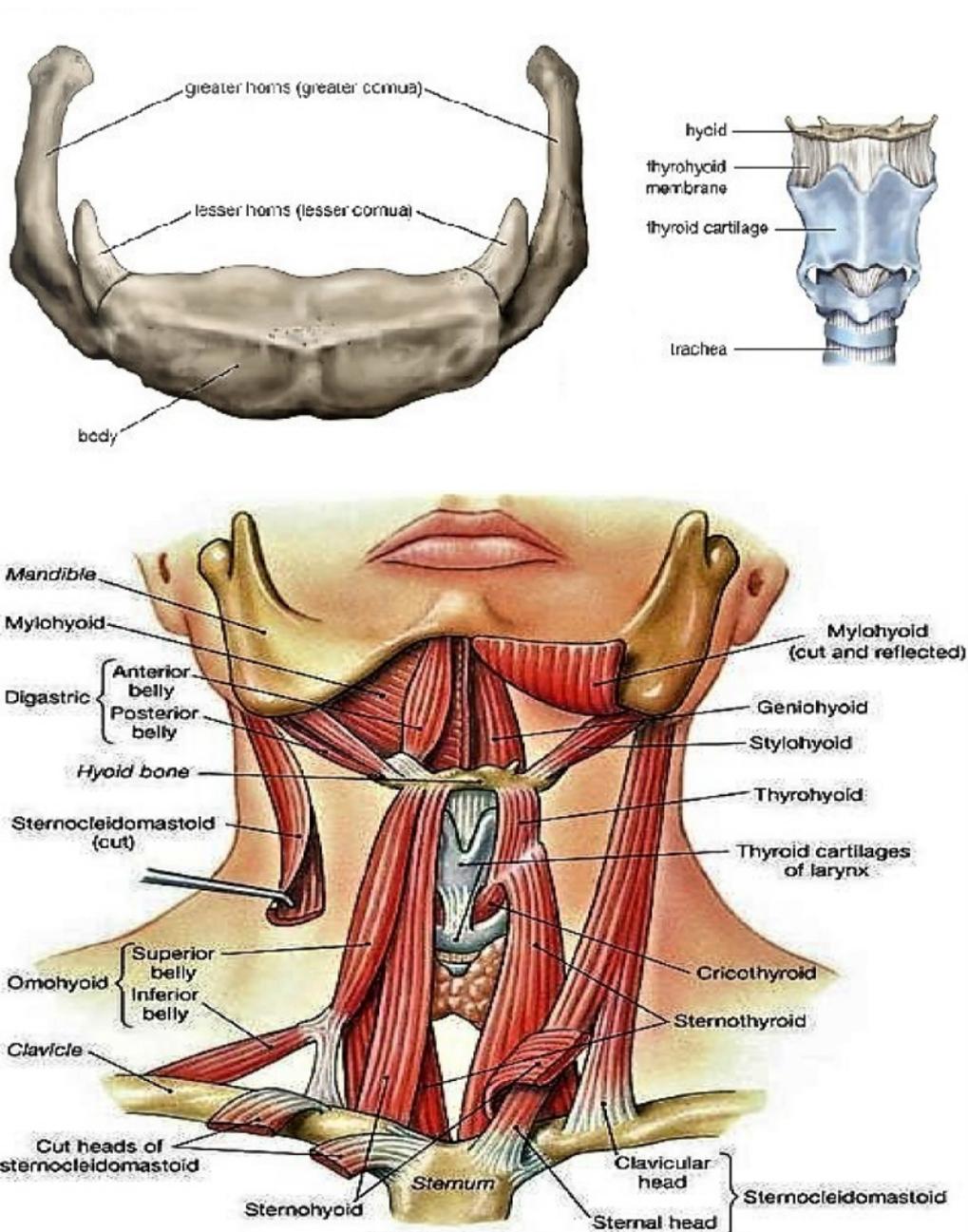
It lies below the inferior concha and receives the opening of the lower end of nasolacrimal duct, which is guarded by a fold of mucous membrane.



Hyoid bone

The hyoid bone is a mobile single bone found in the midline of the neck below the mandible and above the larynx. It does not articulate with any other bones.

The hyoid bone is U shaped and consists of a body and two greater and two lesser cornua. It is attached to the skull by the stylohyoid ligament and to the thyroid cartilage by the thyrohyoid membrane. The hyoid bone forms a base for the tongue and is suspended in position by muscles that connect it to the mandible (by digastrics, geniohyoid and mylohyoid muscles), to the styloid process of the temporal bone (by stylohyoid muscle), to the thyroid cartilage (by thyrohyoid muscle), to the sternum (by sternohyoid muscle), and to the scapula (by omohyoid muscle).





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Lec. 10

المرحلة الاولى



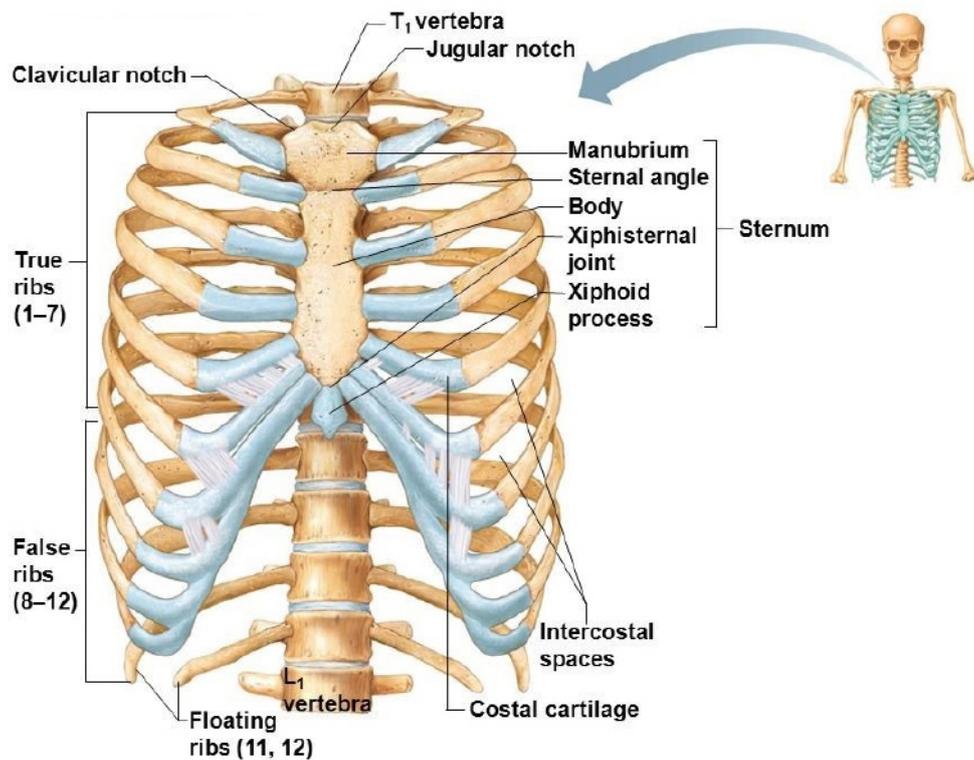
2018-2019

Thorax

The thorax (or chest) is the region of the body between the neck and the abdomen. It is flattened in front and behind but rounded at the sides.

The framework of the walls of the thorax, which is referred to as the **thoracic cage**, is formed by

1. the vertebral column behind
2. the ribs and intercostals spaces on either side
3. The sternum and costal cartilages in front.
4. Superiorly, the thorax communicates with the neck
5. Inferiorly it is separated from the abdomen by the diaphragm.

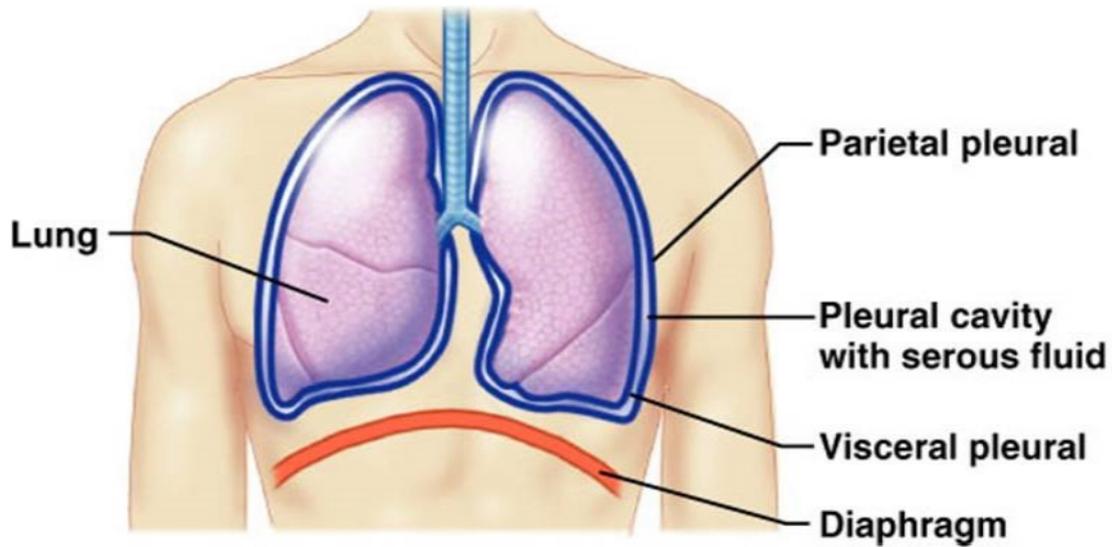


The thoracic cage protects the lungs and heart and affords attachment for the muscles of the thorax, upper extremity, abdomen, and back.

The cavity of the thorax (chest cavity) can be divided into a median partition, called the **mediastinum**, and the laterally placed pleurae and lungs.

The Pleurae

The lungs are covered by a thin membrane called the **visceral pleura**, which passes from each lung at its root (i.e., where the main air passages and blood vessels enter) to the inner surface of the chest wall, where it is called the **parietal pleura**. In this manner, two membranous sacs called the **pleural cavities** are formed, one on each side of the thorax, between the lungs and the thoracic walls.



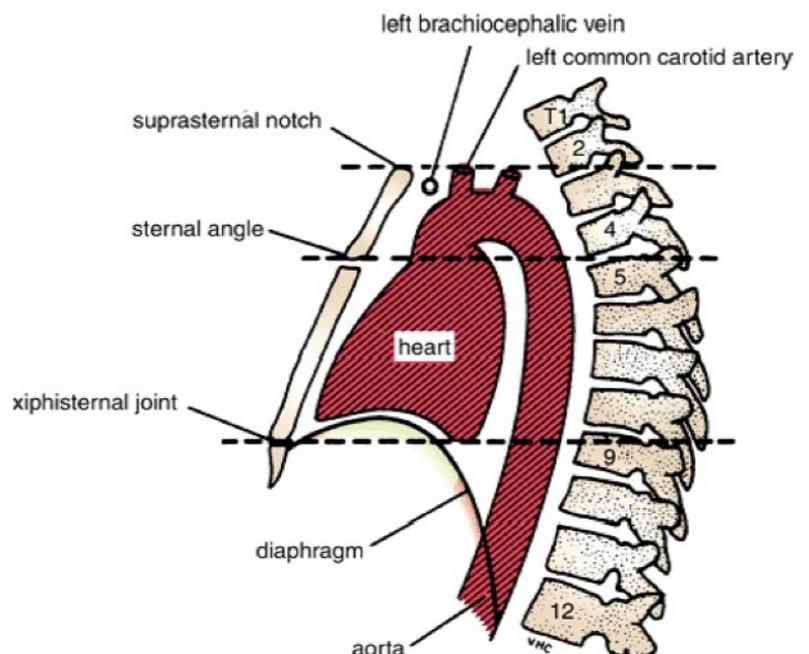
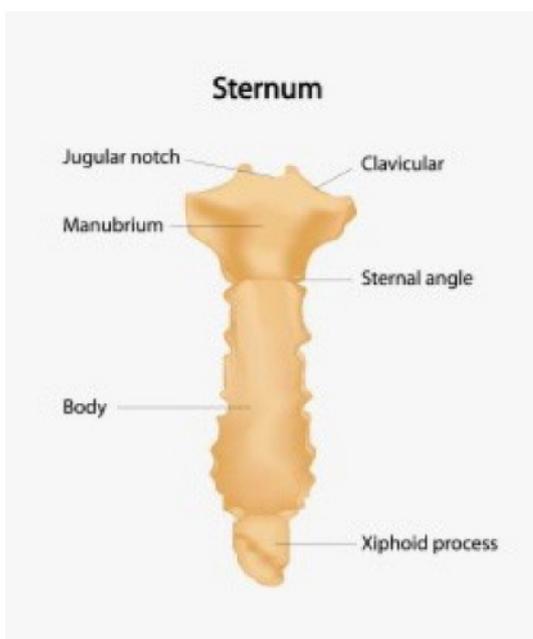
Sternum

The sternum lies in the midline of the anterior chest wall. It is a flat bone that can be divided into three parts:

1. manubrium sterni
2. body of the sternum
3. Xiphoid process.

- ❖ The **manubrium** is the upper part of the sternum. It articulates with the body of the sternum at the manubriosternal joint, and it also articulates with the clavicles and with the 1st costal cartilage and the upper part of the 2nd costal cartilages on each side. It lies opposite the 3rd and 4th thoracic vertebrae.
- ❖ The **body of the sternum** articulates above with the manubrium at the **manubriosternal joint** and below with the xiphoid process at the **xiphisternal joint**. On each side, it articulates with the 2nd to the 7th costal cartilages.
- ❖ The **xiphoid process** is a thin plate of cartilage that becomes ossified at its proximal end during adult life. No ribs or costal cartilages are attached to it.

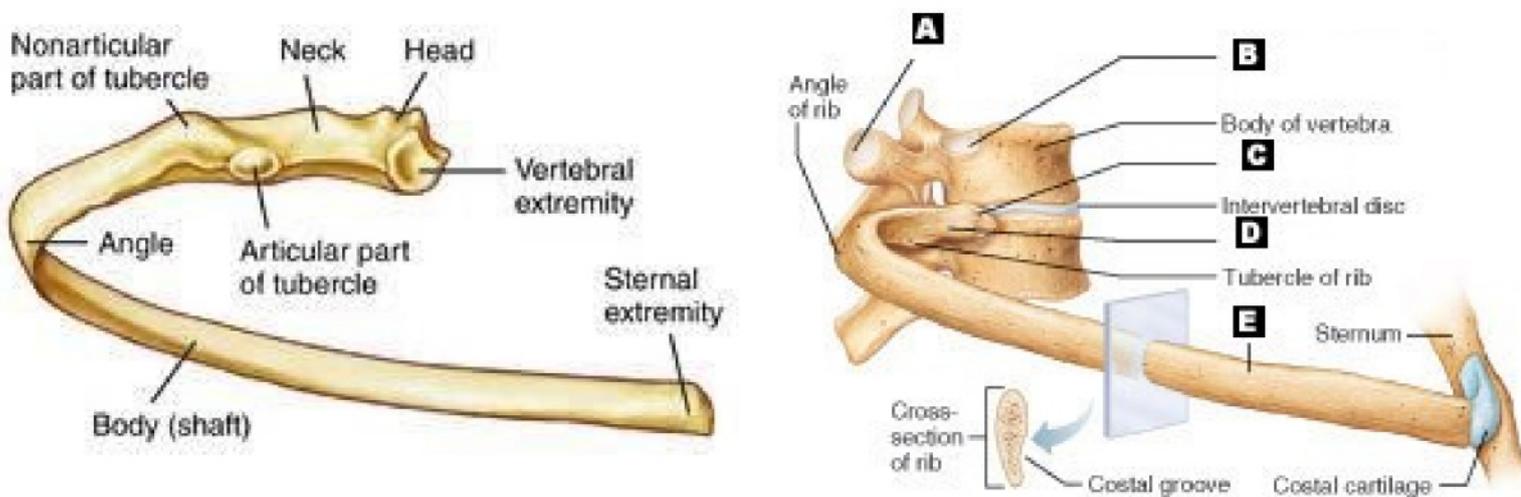
The **sternal angle** (angle of Louis), formed by the articulation of the manubrium with the body of the sternum, can be recognized by the presence of a transverse ridge on the anterior aspect of the sternum. The transverse ridge lies at the level of the 2nd costal cartilage, the point from which all costal cartilages and ribs are counted. The **xiphisternal joint** lies opposite the body of the ninth thoracic vertebra.



Ribs

There are 12 pairs of ribs, all of which are attached posteriorly to the thoracic vertebrae. The ribs are divided into three categories:

- **True ribs:** The upper seven pairs are attached anteriorly to the sternum by their costal cartilages.
- **False ribs:** The 8th, 9th, and 10th pairs of ribs are attached anteriorly to each other and to the 7th rib by means of their costal cartilages and small synovial joints.
- **Floating ribs:** The 11th and 12th pairs have no anterior attachment.



Typical Rib

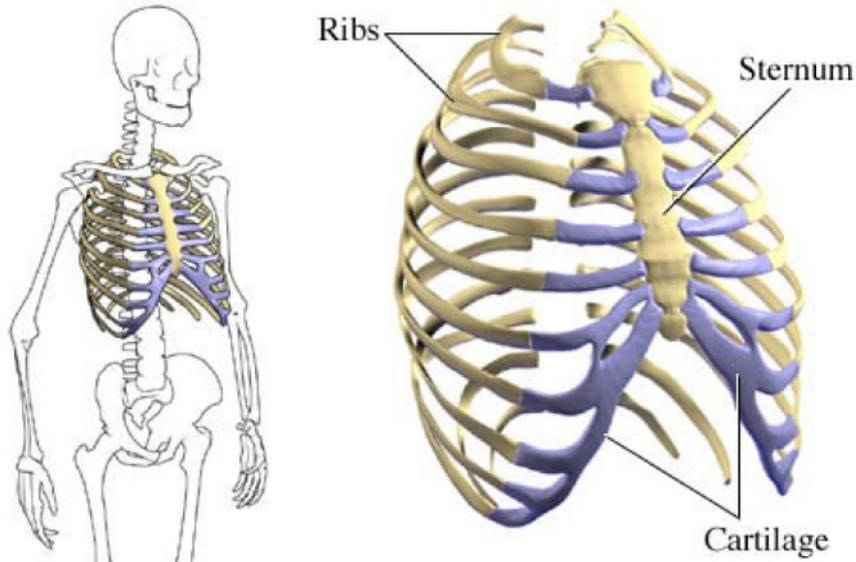
A typical rib is a long, twisted, flat bone having a rounded, smooth superior border and a sharp, thin inferior border. The inferior border overhangs and forms the **costal groove**, which accommodates the intercostals vessels and nerve. The anterior end of each rib is attached to the corresponding costal cartilage.

A rib has a **head, neck, tubercle, shaft, and angle**.

- ✓ The **head** has two facets for articulation with the numerically corresponding vertebral body and that of the vertebra immediately above.
- ✓ The **neck** is a constricted portion situated between the head and the tubercle.
- ✓ The **tubercle** is a prominence on the outer surface of the rib at the junction of the neck with the shaft. It has a facet for articulation with the transverse process of the numerically corresponding vertebra.
- ✓ The **shaft** is thin and flattened and twisted on its long axis. Its inferior border has the costal groove.
- ✓ The **angle** is where the shaft of the rib bends sharply forward.

Costal Cartilages

Costal cartilages are bars of cartilage connecting the upper seven ribs to the lateral edge of the sternum and the 8th, 9th, and 10th ribs to the cartilage immediately above. The cartilages of the 11th and 12th ribs end in the abdominal musculature. The costal cartilages contribute significantly to the elasticity and mobility of the thoracic walls. In old age, the costal cartilages tend to lose some of their flexibility as the result of superficial calcification.



Joints of the Chest Wall

❖ Joints of the Sternum

1. The **manubriosternal joint** is a cartilaginous joint between the manubrium and the body of the sternum. A small amount of angular movement is possible during respiration.
2. The **xiphisternal joint** is a cartilaginous joint between the xiphoid process (cartilage) and the body of the sternum. The xiphoid process usually fuses with the body of the sternum during middle age.

❖ Joints of the Ribs

1. Joints of the Heads of the Ribs

Called **Costovertebral joints**. The 1st rib and the three lowest ribs have a single synovial joint with their corresponding vertebral body. For the 2nd to 9th ribs, the head articulates by means of a synovial joint with the corresponding vertebral body and that of the vertebra above it. There is a strong **intra-articular ligament** that connects the head to the intervertebral disc.

2. Joints of the Tubercles of the Ribs

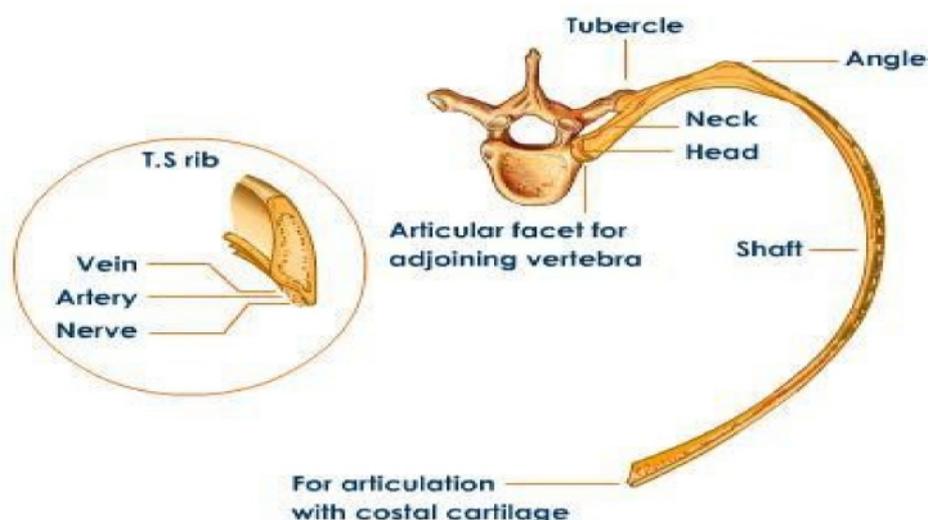
The tubercle of a rib articulates by means of a synovial joint with the transverse process of the corresponding vertebra (**Costotransverse joint**). This joint is absent on the 11th and 12th ribs.

3. Joints of the Ribs and Costal Cartilages

These joints are cartilaginous joints.

4. Joints of the Costal Cartilages with the Sternum

The 1st costal cartilages articulate with the manubrium, by cartilaginous joints. The 2nd to 7th costal cartilages articulate with the lateral border of the sternum by synovial joints. In addition, the 6th, 7th, 8th, 9th, and 10th costal cartilages articulate with one another along their borders by small synovial joints. The cartilages of the 11th and 12th ribs are embedded in the abdominal musculature.



Supra-pleural Membrane

Superiorly, the thorax opens into the root of the neck by a narrow aperture, the **thoracic outlet**. The outlet transmits structures that pass between the thorax and the neck (esophagus, trachea, blood vessels, etc.) and for the most part lie close to the midline. On either side of these structures, the outlet is closed by a dense facial layer called the **suprapleural membrane** which is tent-shaped fibrous sheet





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GENERAL ANATOMY

LEC. 11

المرحلة الاولى



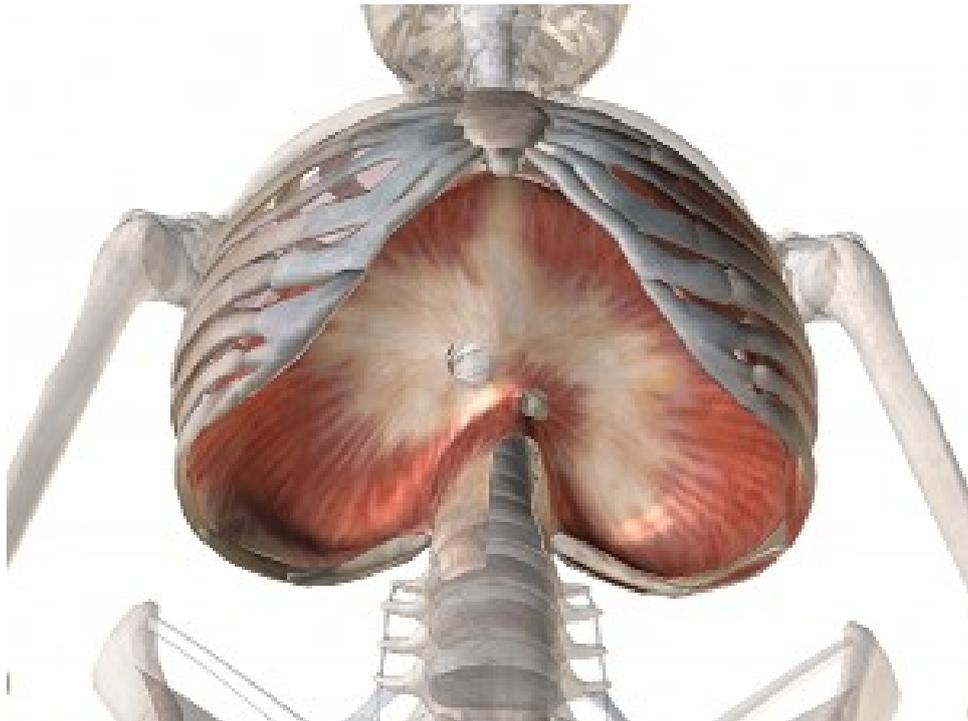
2018-2019

Diaphragm

The diaphragm is a thin muscular and tendinous septum that separates the chest cavity above from the abdominal cavity below. It is pierced by the structures that pass between the chest and the abdomen.

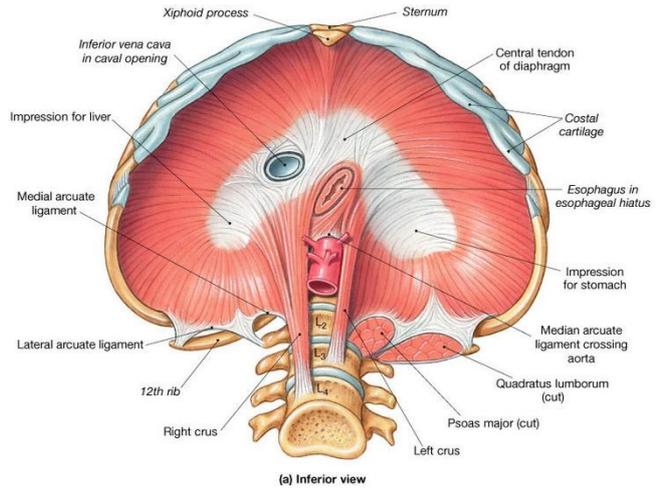
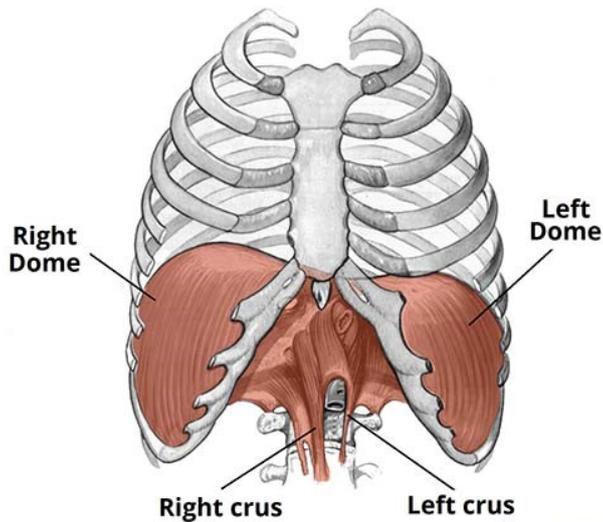
The diaphragm is the most important muscle of respiration. It is dome shaped and consists of a peripheral muscular part, which arises from the margins of the thoracic opening, and a centrally placed tendon. The origin of the diaphragm can be divided into three parts:

- ✚ A **sternal part** arising from the posterior surface of the xiphoid process.
- ✚ A **costal part** arising from the deep surfaces of the lower six ribs and their costal cartilages.
- ✚ A **vertebral part** arising by vertical columns and from the arcuate ligaments.

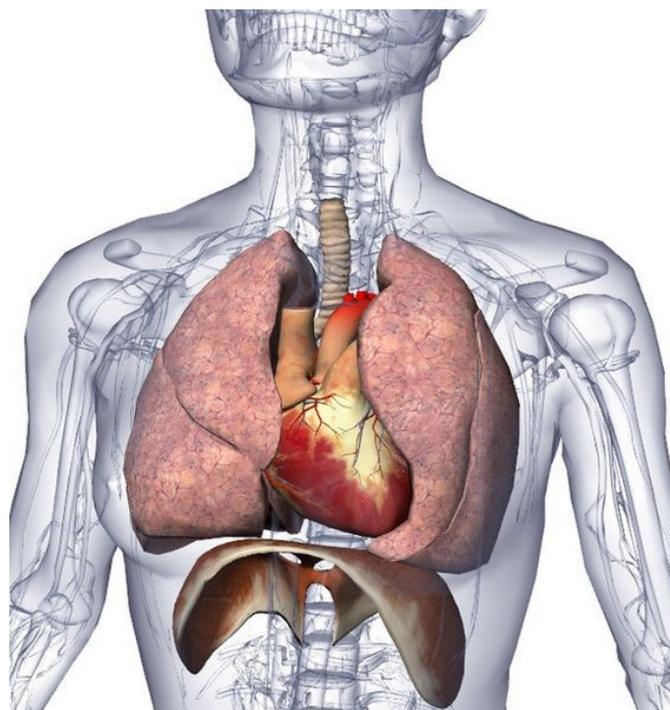


Shape of the Diaphragm

As seen from in front, the diaphragm curves up into *right and left domes*. The right dome reaches as high as the upper border of the 5th rib, and the left dome may reach the lower border of the 5th rib. (The right dome lies at a higher level, because of the large size of the right lobe of the liver.) The central tendon lies at the level of the xiphisternal joint.



The domes support the right and left lungs, whereas the central tendon supports the heart. The levels of the diaphragm vary with the phase of respiration, the posture, and the degree of distention of the abdominal viscera. The diaphragm is lower when a person is sitting or standing; it is higher in the supine position and after a large meal.



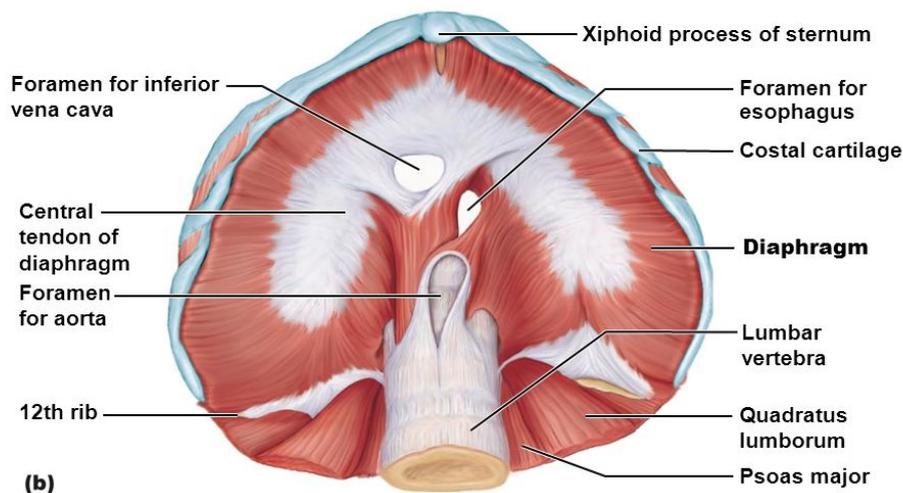
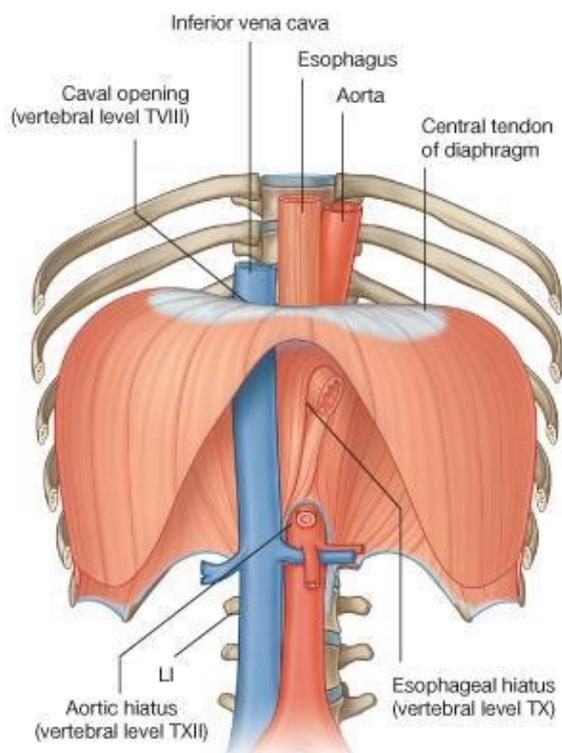
Action of the Diaphragm

On contraction, the diaphragm pulls down its central tendon and increases the vertical diameter of the thorax.

Openings of the diaphragm

The diaphragm has three main openings:

1. The **aortic opening** lies anterior to the body of the 12th thoracic vertebra. It transmits the *aorta*, *the thoracic duct*, and *the azygos vein*.
2. The **esophageal opening** lies at the level of the 10th thoracic vertebra. It transmits *the esophagus*, *the right and left vagus nerves*, *the esophageal branches of the left gastric vessels*, and *the lymphatics from the lower third of the esophagus*.
3. The **caval opening** lies at the level of the 8th thoracic vertebra in the central tendon. It transmits the *inferior vena cava* and *terminal branches of the right phrenic nerve*.



Openings of the Thorax

The chest cavity communicates with the root of the neck through an opening called the **thoracic outlet**. It is called an **outlet** because important vessels and nerves emerge from the thorax here to enter the neck and upper limbs.

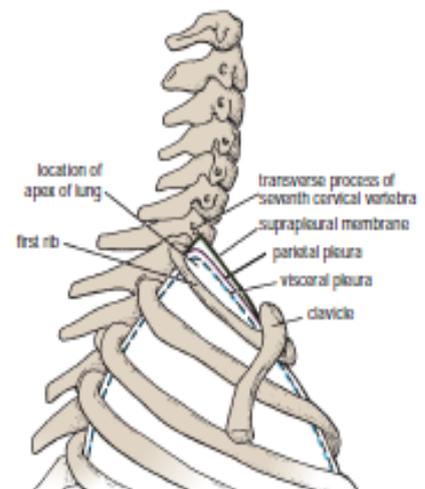
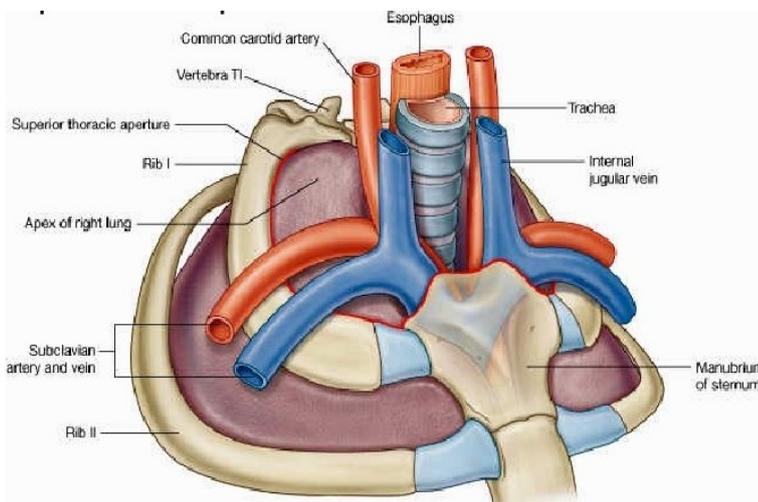
The opening is bounded:

Posteriorly by the 1st thoracic vertebra.

Laterally by the medial borders of the 1st ribs and their costal cartilages.

Anteriorly by the superior border of the manubrium sterni.

The opening is obliquely placed facing upward and forward. Through this small opening pass the esophagus and trachea and many vessels and nerves. Because of the obliquity of the opening, the apices of the lung and pleurae project upward into the neck.



The thoracic cavity communicates with the abdomen through a large opening. The opening is bounded:

posteriorly by the 12th thoracic vertebra.

Laterally by the curving costal margin.

anteriorly by the xiphisternal joint.

Through this large opening, which is closed by the diaphragm, pass the esophagus and many large vessels and nerves, all of which pierce the diaphragm.

Mediastinum

The mediastinum is the median partition of the thoracic cavity, it is bounded
Superiorly to the thoracic outlet and the root of the neck
Inferiorly to the diaphragm
Anteriorly to the sternum
Posteriorly to the vertebral column.

It contains the remains of the *thymus, the heart and large blood vessels, the trachea and esophagus, the thoracic duct and lymph nodes, the vagus and phrenic nerves, and the sympathetic trunks.*

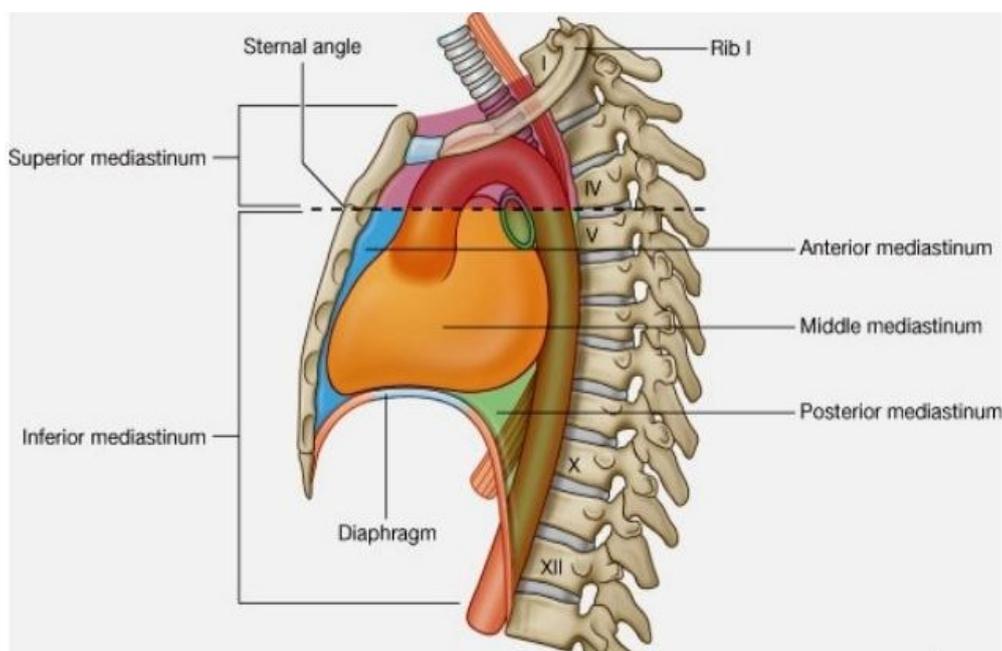
The mediastinum is divided into **superior** and **inferior mediastinum** by an imaginary plane passing from the sternal angle anteriorly to the lower border of the body of the 4th thoracic vertebra posteriorly.

The **superior mediastinum** is bounded in front by the manubrium and behind by the first four thoracic vertebrae.

The **inferior mediastinum** is bounded in front by the body of the sternum and behind by the lower eight thoracic vertebrae.

The inferior mediastinum is further subdivided into

- ✓ The **middle mediastinum**, which consists of the pericardium and heart.
- ✓ The **anterior mediastinum**, which is a space between the pericardium and the sternum.
- ✓ The **posterior mediastinum**, which lies between the pericardium and the vertebral column.



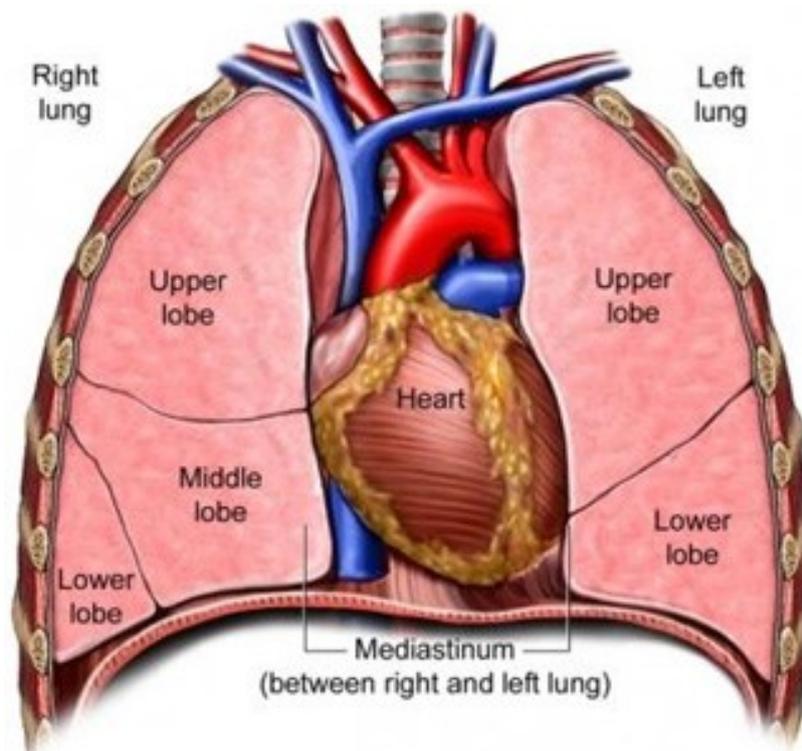
The major mediastinal structures are arranged in the following order from anterior to posterior:

Superior Mediastinum:

- (a) Thymus
- (b) Large veins
- (c) Large arteries
- (d) Trachea,
- (e) Esophagus and thoracic duct
- (f) Sympathetic trunks.
- (g) vagus nerve
- (h) phrenic nerve

Inferior Mediastinum:

- (a) Thymus
- (b) Heart within the pericardium with the phrenic nerves on each side
- (c) Esophagus and thoracic duct
- (d) Descending aorta
- (e) Sympathetic trunks.





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GENERAL ANATOMY

Lec. 12

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2018-2019

Heart

The heart is a hollow muscular organ that is somewhat pyramid shaped and lies within the pericardium in the mediastinum. It is connected at its base to the great blood vessels but otherwise lies free within the pericardium.

Surfaces of the Heart

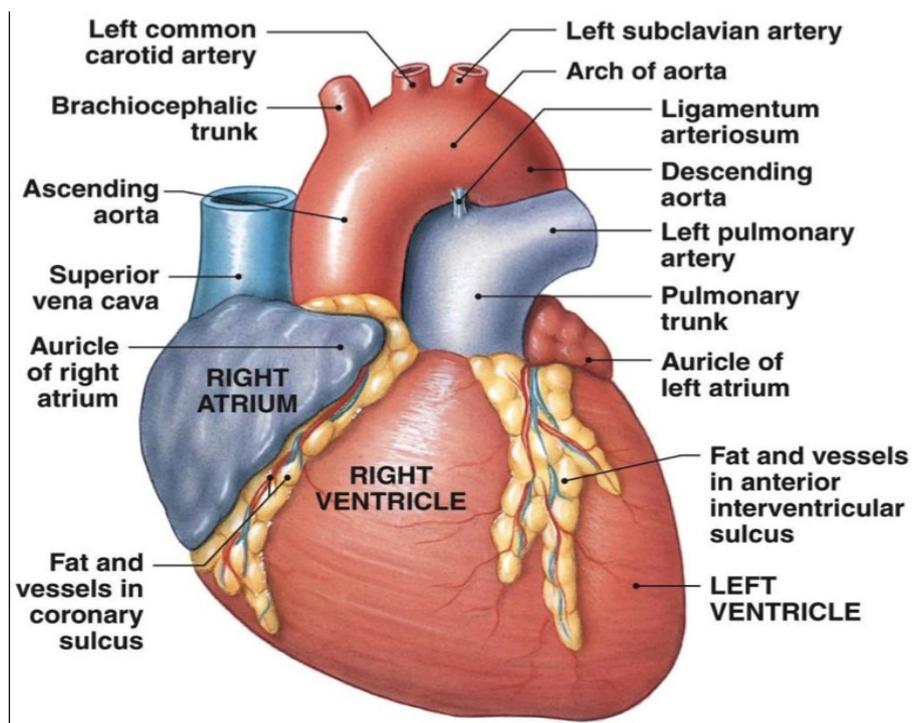
The heart has three surfaces: sterno-costal (anterior), diaphragmatic (inferior), and a base (posterior). It also has an apex, which is directed downward, forward, and to the left.

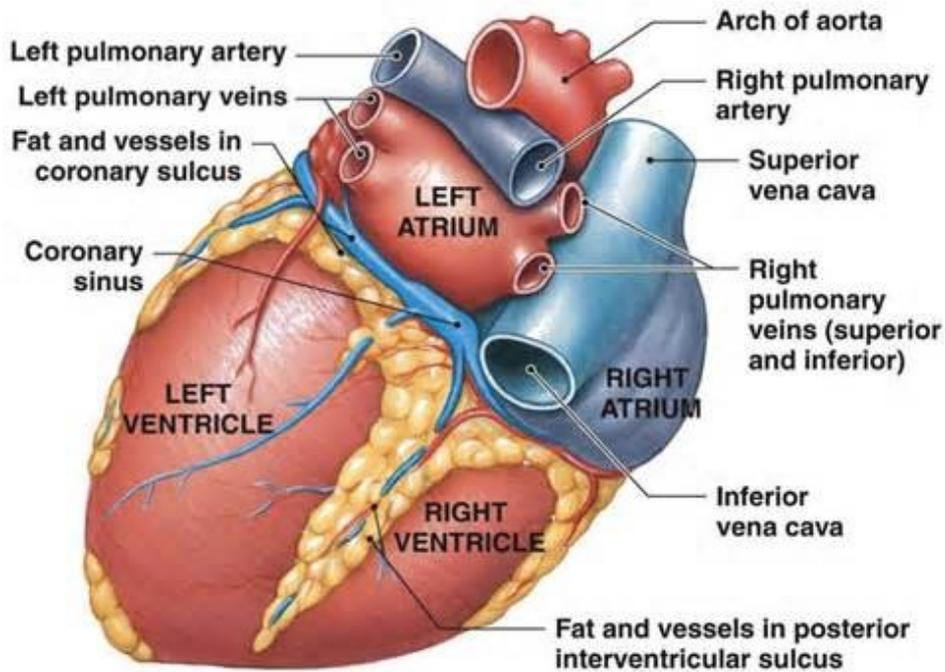
The **sterno-costal surface** is formed mainly by the right atrium and the right ventricle, which are separated from each other by the vertical atrioventricular groove. The right border is formed by the right atrium; the left border, by the left ventricle and part of the left auricle. The right ventricle is separated from the left ventricle by the anterior interventricular groove.

The **diaphragmatic surface** of the heart is formed mainly by the right and left ventricles separated by the posterior interventricular groove. The inferior surface of the right atrium, into which the inferior vena cava opens, also forms part of this surface.

The **base of the heart**, or the posterior surface, is formed mainly by the left atrium, into which open the four pulmonary veins. The base of the heart lies opposite the apex.

The **apex of the heart**, formed by the left ventricle, is directed downward, forward, and to the left. It lies at the level of the fifth left intercostal space, (9 cm) from the midline.



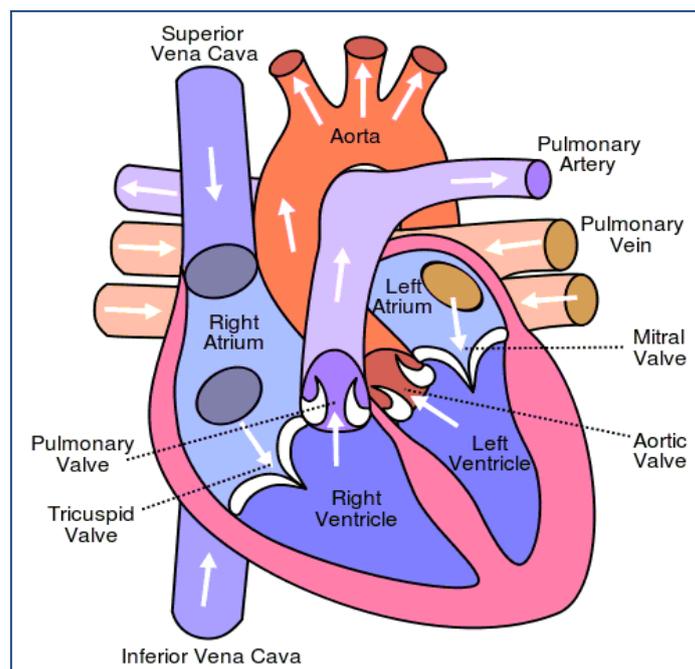


Chambers of the Heart

The heart is divided into four chambers: the right and left atria and the right and left ventricles. The right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle.

The right side of the heart is composed of the right atrium and the right ventricle; these chambers receive blood from the systemic circulation and pump it to the pulmonary circulation for gas exchange.

The left atrium and the left ventricle receive the blood from the pulmonary circulation and pump it to the systemic circulation.



Right Atrium

The right atrium consists of a main cavity and a small out pouching, the auricle.

Openings into the Right Atrium

- 1) The **superior vena cava** opens into the upper part of the right atrium; it has no valve. It returns the blood to the heart from the upper half of the body.
- 2) The **inferior vena cava** (larger than the superior vena cava) opens into the lower part of the right atrium; it is guarded by a rudimentary, nonfunctioning valve. It returns the blood to the heart from the lower half of the body.
- 3) The **coronary sinus**, which drains most of the blood from the heart wall, opens into the right atrium between the inferior vena cava and the atrioventricular orifice. It is guarded by a rudimentary, nonfunctioning valve.
- 4) The **right atrioventricular orifice** lies anterior to the inferior vena caval opening and is guarded by the tricuspid valve

Right Ventricle

The right ventricle communicates with the right atrium through the atrioventricular orifice and with the pulmonary trunk through the pulmonary orifice. The walls of the right ventricle are much thicker than those of the right atrium.

The tricuspid valve guards the atrioventricular orifice and consists of three cusps formed by a fold of endocardium with some connective tissue enclosed:

The pulmonary valve guards the pulmonary orifice and consists of three semilunar cusps.

Left Atrium

Similar to the right atrium, the left atrium consists of a main cavity and a left auricle. The left atrium is situated behind the right atrium and forms the greater part of the base or the posterior surface of the heart.

Openings into the Left Atrium

- 1) The four pulmonary veins, two from each lung, open through the posterior wall and have no valves.
- 2) The left atrioventricular orifice is guarded by the mitral valve.

Left Ventricle

The left ventricle communicates with the left atrium through the atrioventricular orifice and with the aorta through the aortic orifice. The walls of the left ventricle are three times thicker than those of the right ventricle. (The left intraventricular blood pressure is six times higher than that inside the right ventricle.)

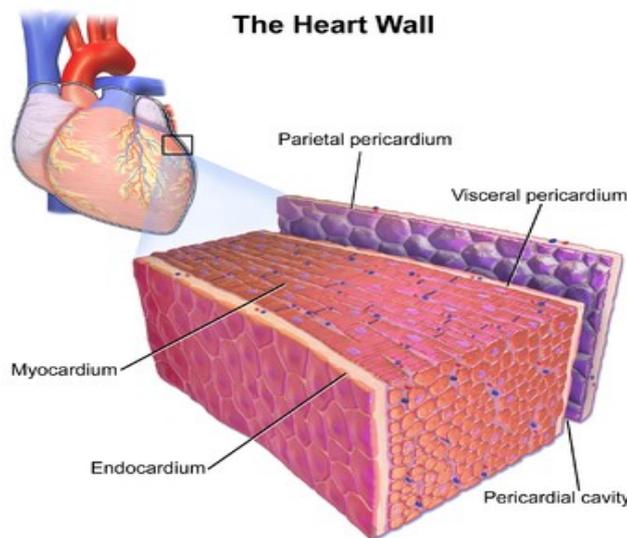
The **mitral valve** guards the atrioventricular orifice. It consists of two cusps, one anterior and one posterior. The **aortic valve** guards the aortic orifice with right, left and posterior cusps.

Behind the cusps, the aortic wall bulges to form an **aortic sinus**. The anterior aortic sinus gives origin to the right coronary artery, and the left posterior sinus gives origin to the left coronary artery.

Structure of the Heart

The walls of the heart are composed of a thick layer of cardiac muscle, the **myocardium**, covered externally by the epicardium and lined internally by the endocardium. The atrial portion of the heart has relatively thin walls and is divided by the **atrial septum** into the right and left atria.

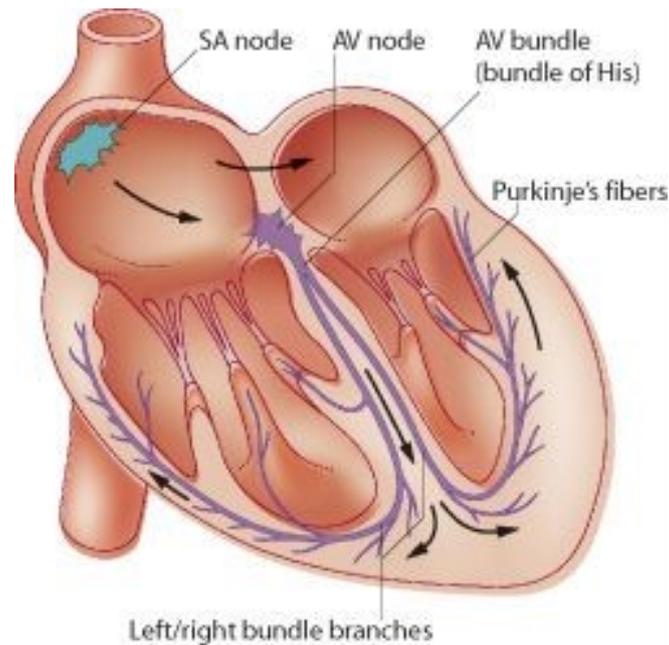
The ventricular portion of the heart has thick walls and is divided by the **ventricular septum** into the right and left ventricles.



Conducting System of the Heart

The normal heart contracts rhythmically at about 70 to 90 beats per minute in the resting adult. The rhythmic contractile process originates spontaneously in the conducting system and the impulse travels to different regions of the heart, so the atria contract first and together, to be followed later by the contractions of both ventricles together. The slight delay in the passage of the impulse from the atria to the ventricles allows time for the atria to empty their blood into the ventricles before the ventricles contract.

The conducting system of the heart consists of specialized cardiac muscle present in the **sinuatrial node**, the **atrioventricular node**, the **atrioventricular bundle** and its right and left bundle branches, and the subendocardial plexus of **Purkinje fibers** (specialized cardiac muscle fibers that form the conducting system of the heart).



Arterial Supply of the Heart

The arterial supply of the heart is provided by the right and left coronary arteries, which arise from the ascending aorta immediately above the aortic valve. The **right coronary artery** arises from the anterior aortic sinus of the ascending aorta. The **left coronary artery**, which is usually larger than the right coronary artery, it arises from the left posterior aortic sinus of the ascending aorta.

Venous Drainage of the Heart

Most blood from the heart wall drains into the right atrium through the coronary sinus. The remainder of the blood is returned to the right atrium by the **anterior cardiac vein** and by small veins that open directly into the heart chambers.

Nerve Supply of the Heart

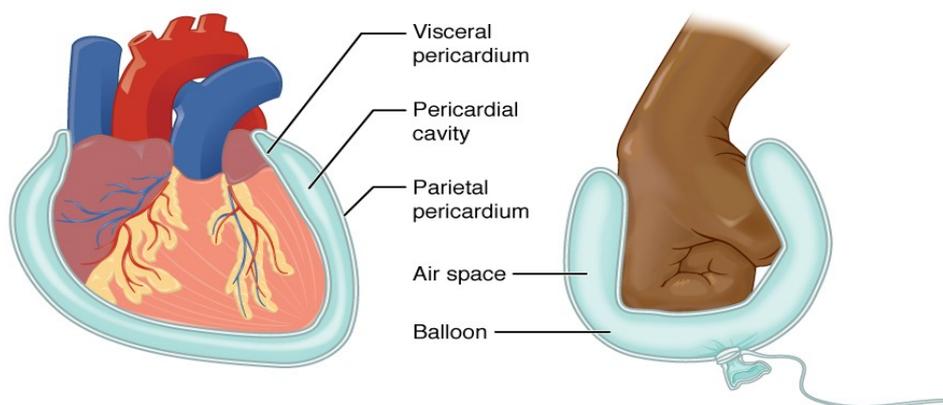
The heart is innervated by sympathetic and parasympathetic fibers of the autonomic nervous system via the **cardiac plexuses**. The sympathetic supply arises from the cervical and upper thoracic portions of the sympathetic trunks, and the parasympathetic supply comes from the vagus nerves. Activation of sympathetic nerves results in cardiac acceleration, increased force of contraction of the cardiac muscle, and dilatation of the coronary arteries. Activation of the parasympathetic nerves results in a reduction in the rate and force of contraction of the heart and a constriction of the coronary arteries.

Pericardium

The pericardium is a fibro-serous sac that encloses the heart and the roots of the great vessels. Its functions are:

- 1) To restrict excessive movements of the heart as a whole.
- 2) To serve as a lubricated container in which the different parts of the heart can contract.

The pericardium lies within the middle mediastinum, posterior to the body of the sternum.



Fibrous Pericardium

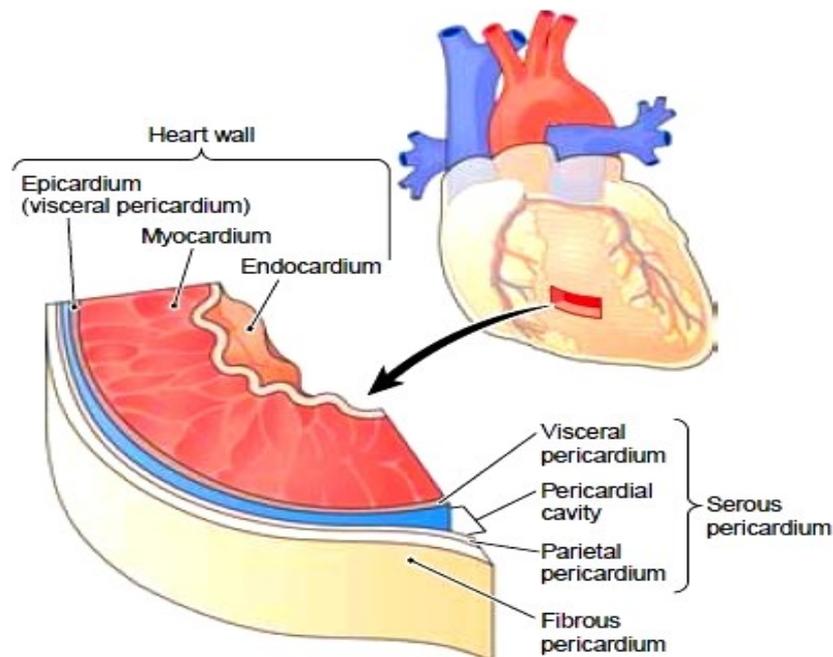
The fibrous pericardium is the strong fibrous part of the sac. It is firmly attached below to the central tendon of the diaphragm. It fuses with the outer coats of the great blood vessels passing through it—namely, the aorta, the pulmonary trunk, the superior and inferior venae cavae, and the pulmonary veins. The fibrous pericardium is attached in front to the sternum by the **sternopericardial ligaments**.

Serous Pericardium

The serous pericardium lines the fibrous pericardium and coats the heart. It is divided into parietal and visceral layers.

1. The **parietal layer** lines the fibrous pericardium and is reflected around the roots of the great vessels to become continuous with the visceral layer of serous pericardium that closely covers the heart.
2. The **visceral layer** is closely applied to the heart and is often called the **epicardium**.

The slit like space between the parietal and visceral layers is referred to as the **pericardial cavity**. Normally, the cavity contains a small amount of tissue fluid (about 50 mL), the **pericardial fluid**, which acts as a lubricant to facilitate movements of the heart.



Nerve Supply of the Pericardium

1. *The fibrous pericardium and the parietal layer of the serous pericardium are supplied by the phrenic nerves.*
2. *The visceral layer of the serous pericardium is innervated by branches of the sympathetic trunks and the vagus nerves.*



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GENERAL ANATOMY

LEC. 13

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2018-2019

Large Veins of the Thorax

Brachiocephalic Veins

The **right brachiocephalic vein** is formed at the root of the neck by the union of the right subclavian and the right internal jugular veins. The **left brachiocephalic vein** has a similar origin as it formed at the root of the neck by the union of the left subclavian and the left internal jugular veins. The joining of them forms the **superior vena cava**.

Superior Vena Cava

The superior vena cava contains all the venous blood from the head and neck and both upper limbs and is formed by the union of the two brachiocephalic veins. It passes downward to end in the right atrium of the heart.

Azygos Veins

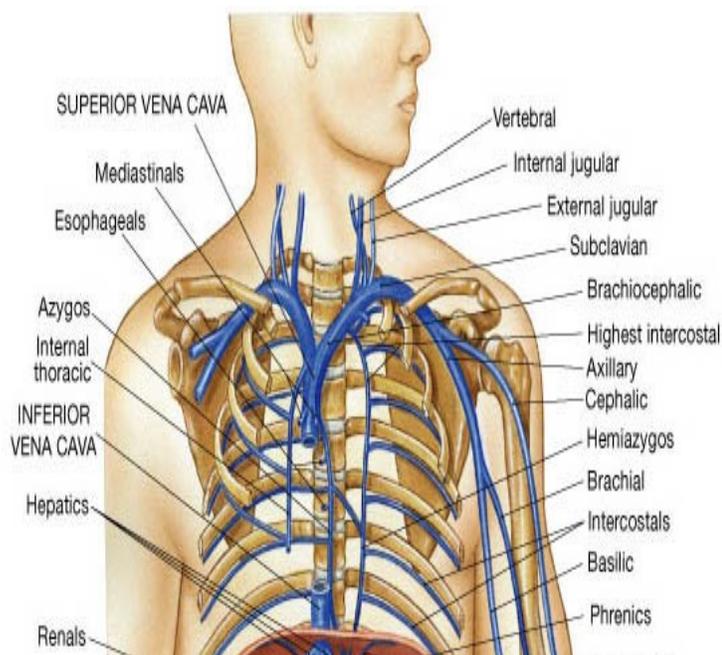
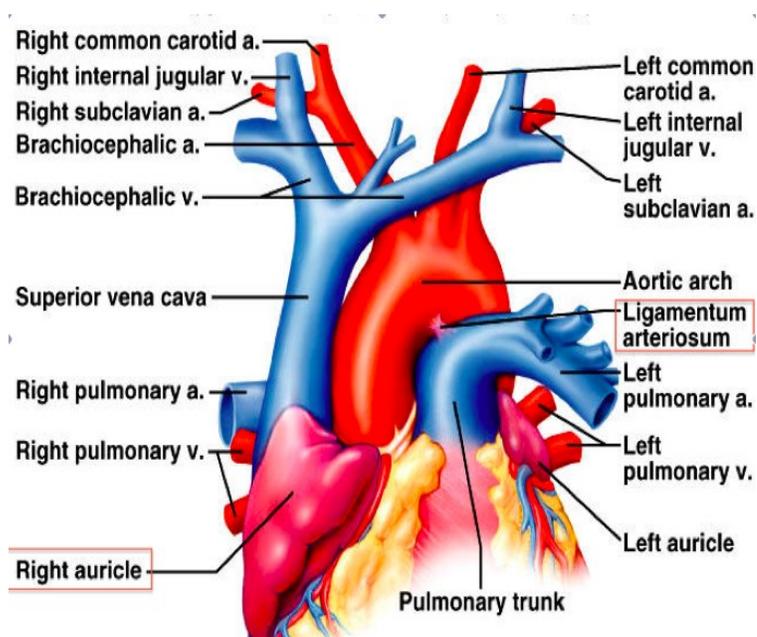
Consist of the main azygos vein, superior and inferior Hemiazygos veins. the main azygos vein begins in the abdominal cavity and ascends through the aortic opening of diaphragm and runs on the right side of aorta till it join the superior vena cava

Inferior Vena Cava

The inferior vena cava pierces the central tendon of the diaphragm opposite the eighth thoracic vertebra and almost immediately enters the lowest part of the right atrium.

Pulmonary Veins

Two pulmonary veins leave each lung carrying oxygenated blood to the left atrium of the heart.

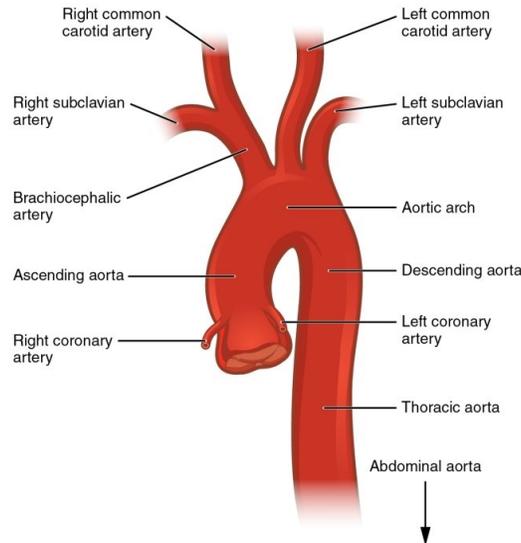


Large Arteries of the Thorax

Aorta

The aorta is the main arterial trunk that delivers oxygenated blood from the left ventricle of the heart to the tissues of the body. It is divided for purposes of description into the following parts:

- 1) Ascending aorta
- 2) Arch of the aorta
- 3) Descending thoracic aorta
- 4) Abdominal aorta.



Ascending Aorta

The ascending aorta begins at the base of the left ventricle and runs upward and forward to become continuous with the arch of the aorta. At its root, it possesses three bulges, the **sinuses of the aorta**, one behind each aortic valve cusp.

Branches:

- 1) **The right coronary artery** arises from the anterior aortic sinus
- 2) **The left coronary artery** arises from the left posterior aortic sinus.

Arch of the Aorta

The arch of the aorta is a continuation of the ascending Aorta. It arches upward, backward, and to the left to become continuous with the descending aorta.

Branches:

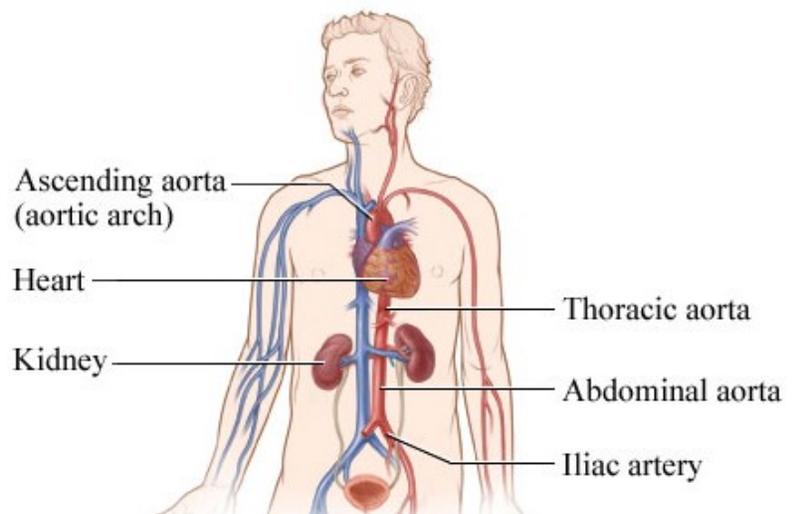
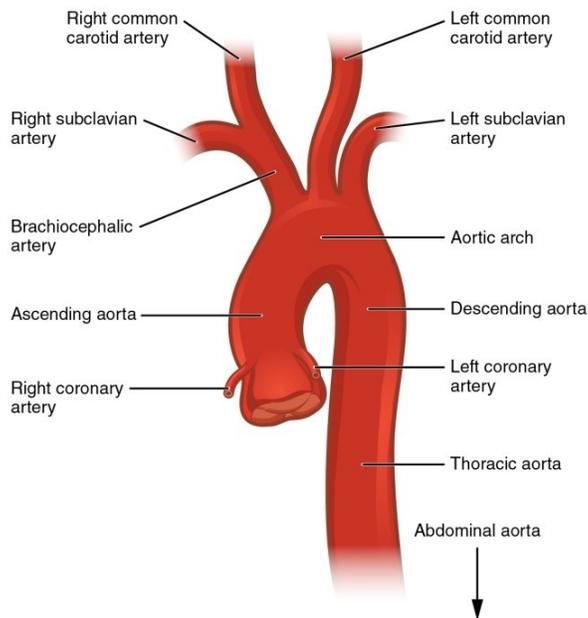
- 1) The **brachiocephalic artery** it divides into the right subclavian and right common carotid arteries.
- 2) The **left common carotid artery**
- 3) The **left subclavian artery**.

Descending Thoracic Aorta

The descending thoracic aorta lies in the posterior mediastinum and begins as a continuation of the arch of the aorta it passes behind the diaphragm (through the aortic opening) in the midline and becomes continuous with the abdominal aorta.

Branches:

- 1) **Posterior intercostal arteries**
- 2) **Subcostal arteries**
- 3) **Pericardial, esophageal, and bronchial arteries**



Pulmonary Trunk

The pulmonary trunk conveys deoxygenated blood from the right ventricle of the heart to the lungs. It leaves the upper part of the right ventricle and terminates by dividing into right and left pulmonary arteries.

Branches:

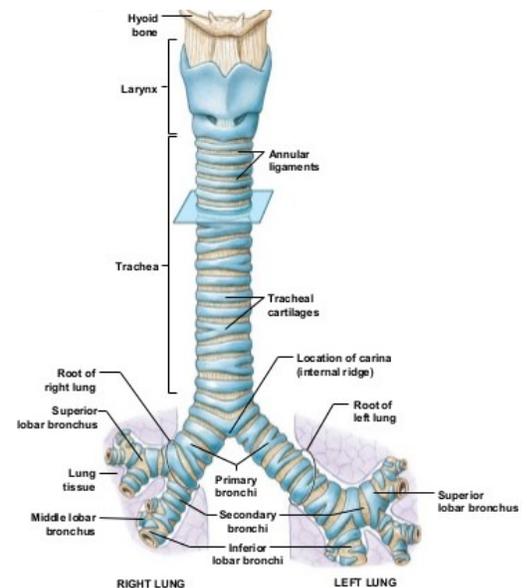
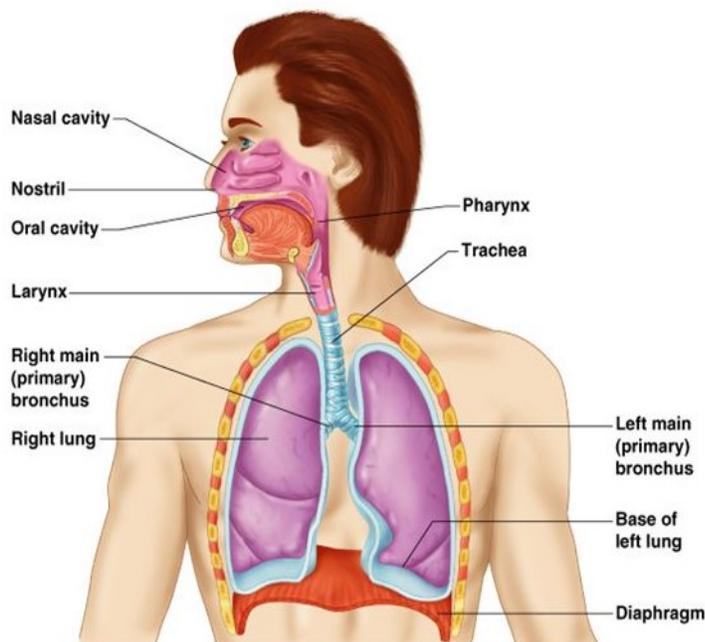
- 1) **Right pulmonary artery** runs to the right lung.
- 2) **Left pulmonary artery** runs to the left lung.

Nerves of the Thorax

- 1) Vagus Nerves
- 2) Phrenic Nerves
- 3) Thoracic Part of the Sympathetic Trunk

Trachea

The trachea is a mobile cartilaginous and membranous tube. It begins in the neck as a continuation of the larynx at the level of the 6th cervical vertebra. It descends in the midline of the neck. In the thorax, the trachea ends below at the **carina** by dividing into right and left principal (main) bronchi at the level of the sternal angle (opposite the disc between the 4th and 5th thoracic vertebrae). In adults, the trachea is about (11.25 cm) long and (2.5 cm) in diameter. The fibroelastic tube is kept patent by the presence of U-shaped bars (rings) of hyaline cartilage embedded in its wall. The posterior free ends of the cartilage are connected by smooth muscle, the **trachealis muscle**.



Blood Supply of the Trachea

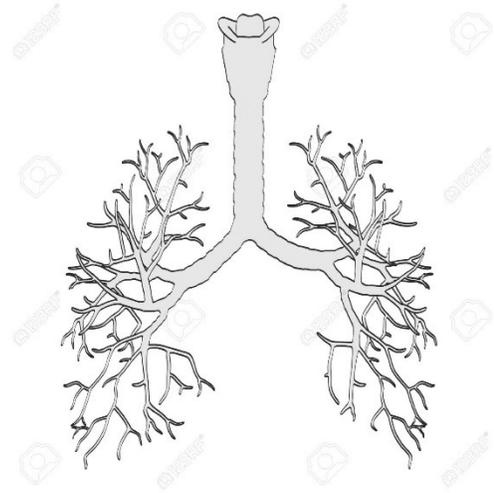
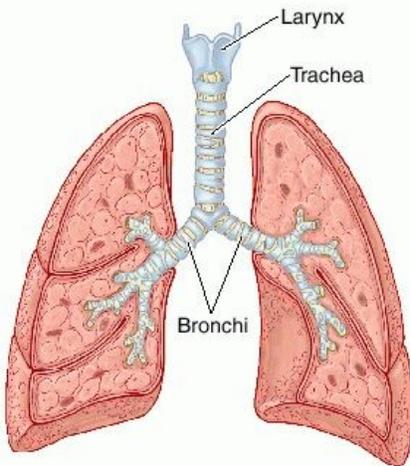
- ✓ The upper two thirds are supplied by the inferior thyroid arteries
- ✓ The lower third is supplied by the bronchial arteries.

Nerve Supply of the Trachea

- ✓ The sensory nerve supply → → from the vagus and the recurrent laryngeal nerves.
- ✓ Sympathetic nerves supply → → the trachealis muscle.

The Bronchi

The trachea bifurcates behind the arch of the aorta into the **right and left principal (primary or main) bronchi**. The bronchi divide dichotomously, giving rise to several million terminal bronchioles that terminate in one or more respiratory bronchioles.



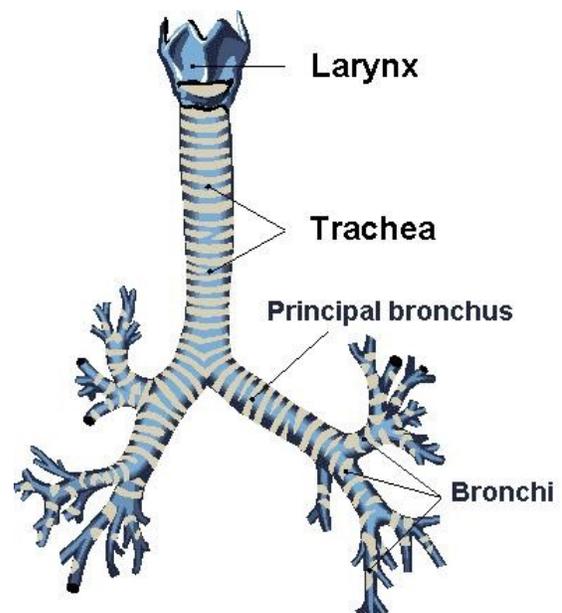
Principal Bronchi

❖ *The right principal (main) bronchus* is wider, shorter, and more vertical than the left and is about (2.5 cm) long. The right principal bronchus gives off:

1. **The superior lobar bronchus**
2. **Middle lobar bronchus**
3. **An inferior lobar bronchus.**

❖ *The left principal (main) bronchus* is narrower, longer, and more horizontal than the right and is about (5 cm) long. The left principal bronchus divides into:

1. **Superior lobar bronchus**
2. **Inferior lobar bronchus.**



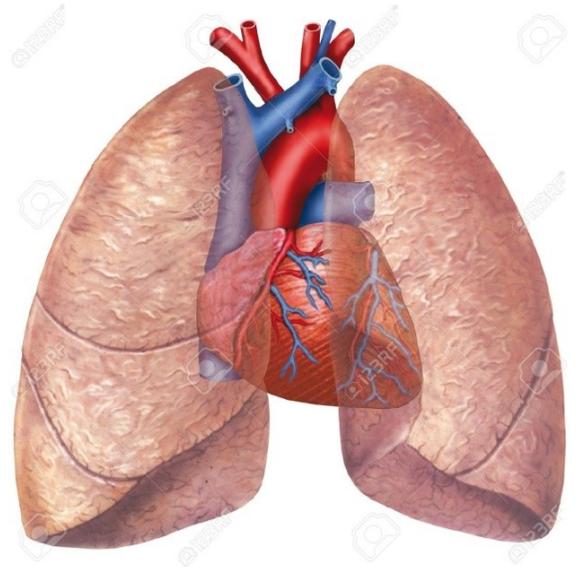
The Lung

The lungs are situated on each side of the mediastinum. They are therefore separated from each other by the heart and great vessels and other structures in the mediastinum. Each lung has:

1. A **blunt apex**, which projects upward into the neck for about (2.5 cm) above the clavicle
2. a **concave base** that sits on the diaphragm
3. a **convex costal surface**, which corresponds to the concave chest wall
4. A **concave mediastinal surface**, which is molded to the pericardium and other mediastinal structures.

At about the middle of the mediastinal surface is the **hilum**, a depression in which the bronchi, vessels, and nerves that form the **root** enter and leave the lung. The **root** is formed by structures that are entering or leaving the lung. It is made up of bronchi, pulmonary artery and veins, lymph vessels, bronchial vessels and nerves.

The **anterior border** is thin and overlaps the heart; the posterior border is thick and lies beside the vertebral column.



Lobes and Fissures

✓ Right Lung

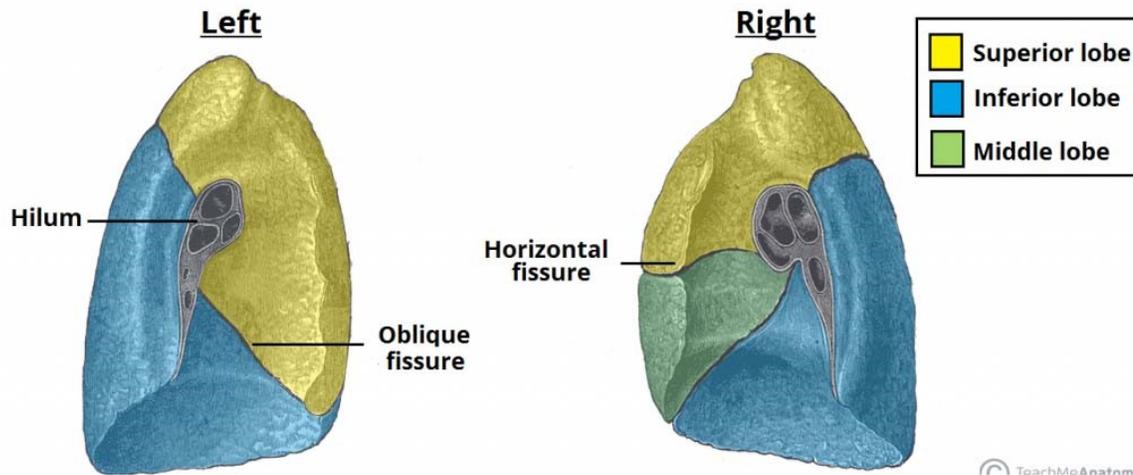
The right lung is slightly larger than the left and is divided by the oblique and horizontal fissures into three lobes:

1. The upper lobe
2. The middle lobe
3. The lower lobe.

The **oblique fissure** runs from the inferior border upward and backward. The **horizontal fissure** runs horizontally at the level of the 4th costal cartilage to meet the oblique fissure in the midaxillary line. The middle lobe is a small triangular lobe bounded by the horizontal and oblique fissures.

✓ Left Lung

The left lung is divided by a similar oblique fissure into two lobes: the **upper** and **lower lobes**. There is no horizontal fissure in the left lung.



Blood Supply of the Lungs

The bronchi, the connective tissue of the lung, and the visceral pleura receive their blood supply from:

1. **The bronchial arteries**, which are branches of the descending aorta.
2. **The bronchial veins** (which communicate with the pulmonary veins) drain into the azygos and hemiazygos veins.

The alveoli receive deoxygenated blood from the terminal branches of the pulmonary arteries. The oxygenated blood leaving the alveolar capillaries drains into the tributaries of the pulmonary veins, which follow the intersegmental connective tissue septa to the lung root. Two pulmonary veins leave each lung root to empty into the left atrium of the heart

Nerve Supply of the Lungs

At the root of each lung is a **pulmonary plexus** composed of efferent and afferent autonomic nerve fibers. The plexus is formed from branches of the sympathetic trunk and receives parasympathetic fibers from the vagus nerve.

- ✓ The sympathetic efferent fibers produce bronchodilatation and vasoconstriction.
- ✓ The parasympathetic efferent fibers produce bronchoconstriction, vasodilatation, and increased glandular secretion.

Anatomy Of Pharynx

Boundaries –

- a. **Superiorly-Base of skull** including posterior part of body of sphenoid and the basilar part of the occipital bone.
- b. **Inferiorly**-pharynx continues with **oesophagus** at the level of 6th cervical vertebra/ lower border of cricoid cartilage.
- c. **Posteriorly-Prevertebral fascia** separating it from cervical spine
- d. **Anteriorly**-Communication with **Nasal cavity, Oral cavity, and Larynx.**

e. On each side

i) It is attached to the

medial **p**terygoid plate

pterygo **m**andibular raphe

mandible

tongue

hyoid bone

thyroid and cricoid cartilages

ii) Communication with middle ear through

eustachian tube

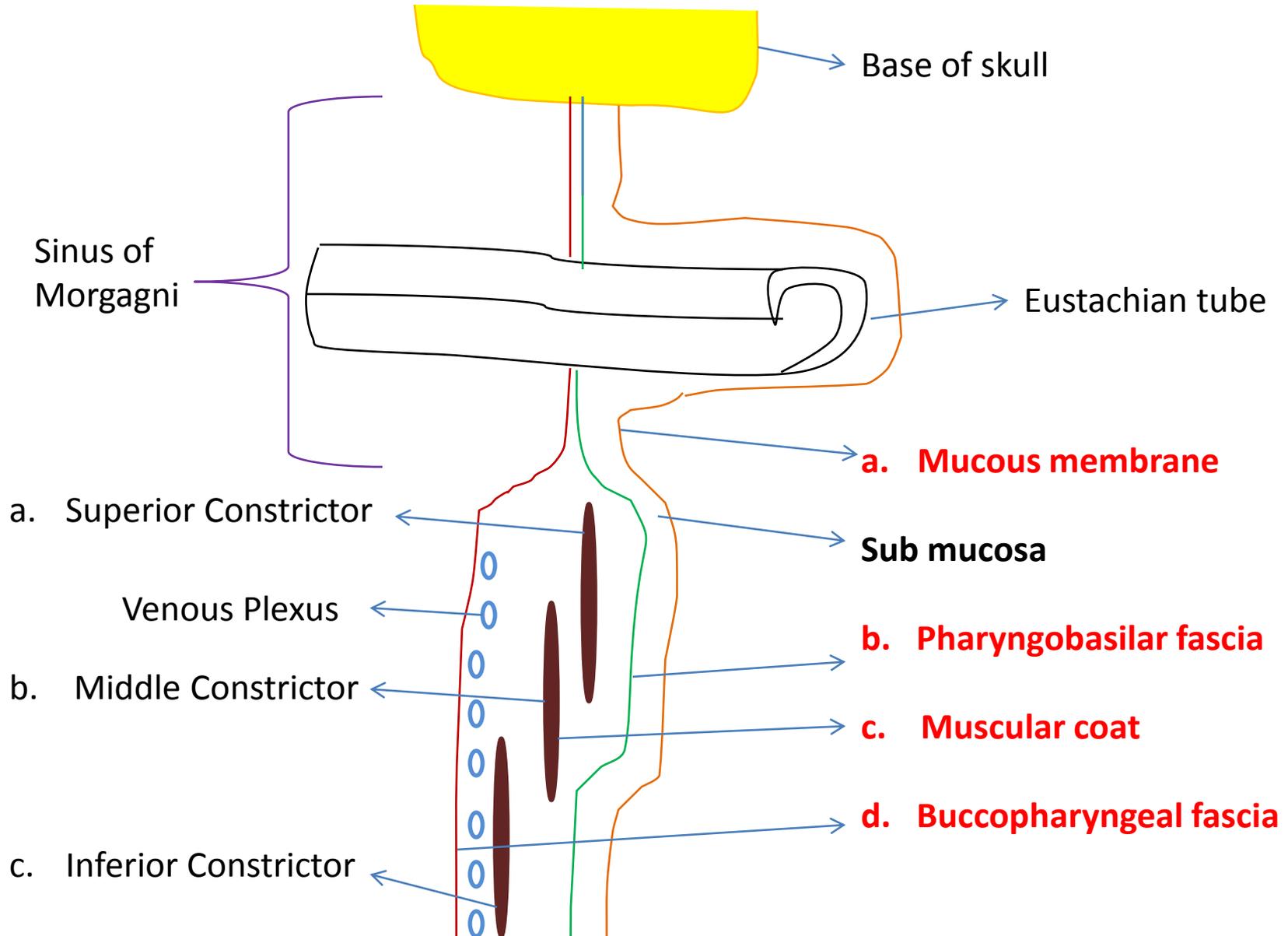
iii) **Styloid process** and muscles attached to it

iv) Common, Internal and External **Carotid Artery**

Structure of Pharyngeal wall from within outwards

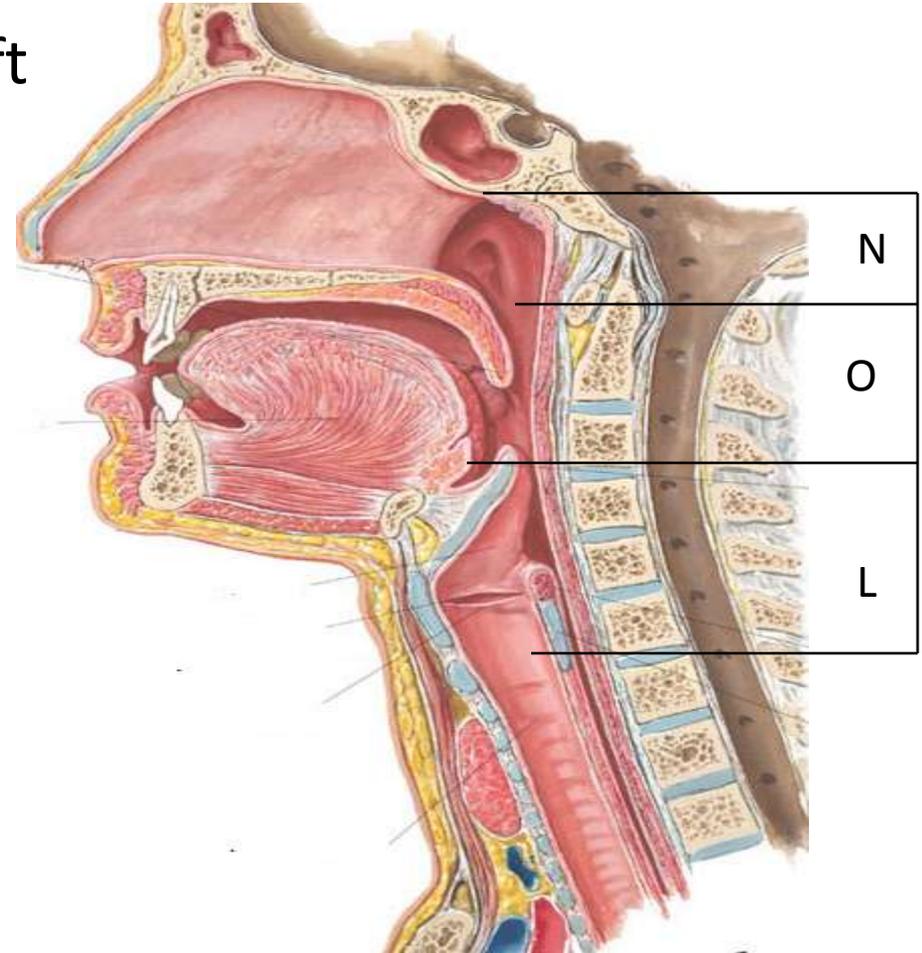
1. **Mucous membrane**-lined by Stratified Squamous epithelium.
2. **Pharyngeal aponeurosis/ Pharyngobasilar fascia**-it is a fibrous layer lining the muscular coat.
3. **Muscular coat**-consist of-
 - a. **Outer Circular Layer** consist of 3 muscles-
 - > **Superior constrictor** > **Middle constrictor** > **Inferior constrictor**
 - b. **Inner Longitudinal Layer** consist of 3 muscles-
 - > **Stylopharyngeus** > **Salpingopharyngeus** > **Palatopharyngeus**
4. **Buccopharyngeal fascia**-covers the outer surface of constrictor muscles.

STRUCTURE OF PHARYNX-



Division of Pharynx

- The nasal part – **NASOPHARYNX/ EPIPHARYNX**
(extends from base of skull to soft palate)
- The oral part – **OROPHARYNX**
(extends from hard palate to hyoid bone)
- The laryngeal part – **LARYNGOPHARYNX/ HYPOPHARYNX**
(extends from upper border of epiglottis to lower border of cricoid cartilage)



NASOPHARYNX

- It is the upper most part.
- It lies behind the nasal cavity

Roof- Basisphenoid and Basiocciput.

Posterior wall- Arch of Atlas vertebrae covered by prevertebral muscles and fascia.

Anterior wall- Posterior nasal apertures (Choanae).

Lateral wall on both sides

- Opening of **Eustachian Tube**
- **Tubal opening** bounded by Tubal elevation/Torus tubarius
- **Salpingopharyngeal fold** raised by Salpingopharyngeus muscle
- **Fossa of Rosenmuller** or Lateral/Pharyngeal Recess

Inferiorly- It communicates with **oropharynx**

1. **Pharyngeal/ Nasopharyngeal Tonsil**-it is a subepithelial collection of lymphoid tissue opposite the basiocciput.
2. **Pharyngeal Bursa**-it is the small median recess in the mucosa covering the tonsil.
3. **Rathke's pouch**-it is reminiscent of buccal mucosal invagination, to form anterior lobe of pituitary.
4. **Tubal tonsil**-collection of subepithelial lymphoid tissue situated at the tubal elevation.

5. **Sinus of Morgagni**-space between skull and upper free border of superior constrictor muscle.

Structures passing through this gap-

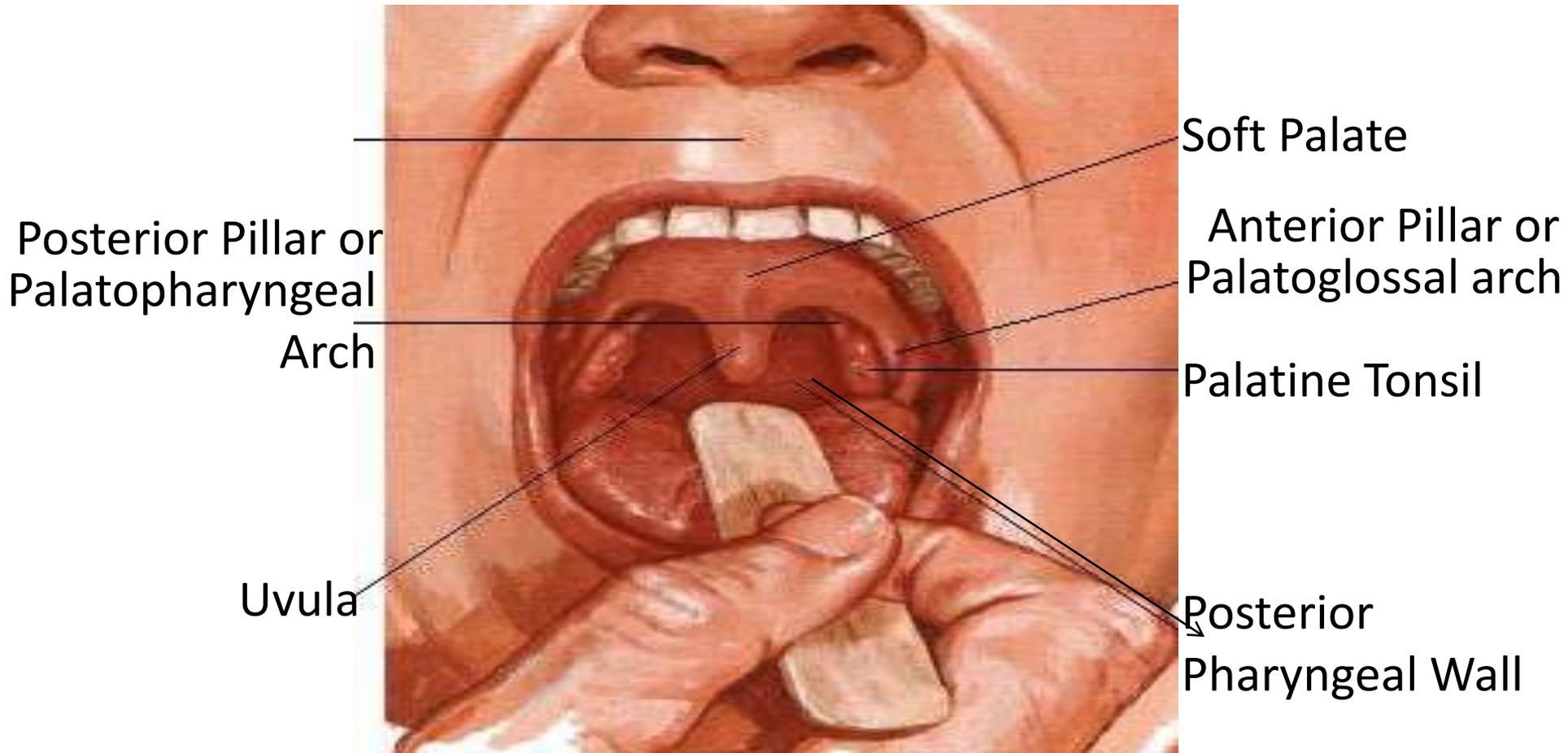
- L**evator veli palatini
- A**scending palatine artery
- T**ensor veli palatini
- E**ustachian tube

6. **Passavant's Ridge**-mucosal ridge raised by fibres of **Palatopharyngeus**. It encircles posterior and lateral walls of nasopharyngeal isthmus. Soft palate during its contraction makes firm contact with this ridge to cut off nasopharynx from oropharynx during deglutition or speech

- Nasopharynx is lined by **Pseudostratified Ciliated Columnar** epithelium.
- Lymphatic drainage-
 - Deep cervical nodes
 - Spinal accessory chain of nodes
 - Contralateral lymph nodes

OROPHARYNX

It is the middle part of the pharynx situated behind the oral cavity.



Boundaries

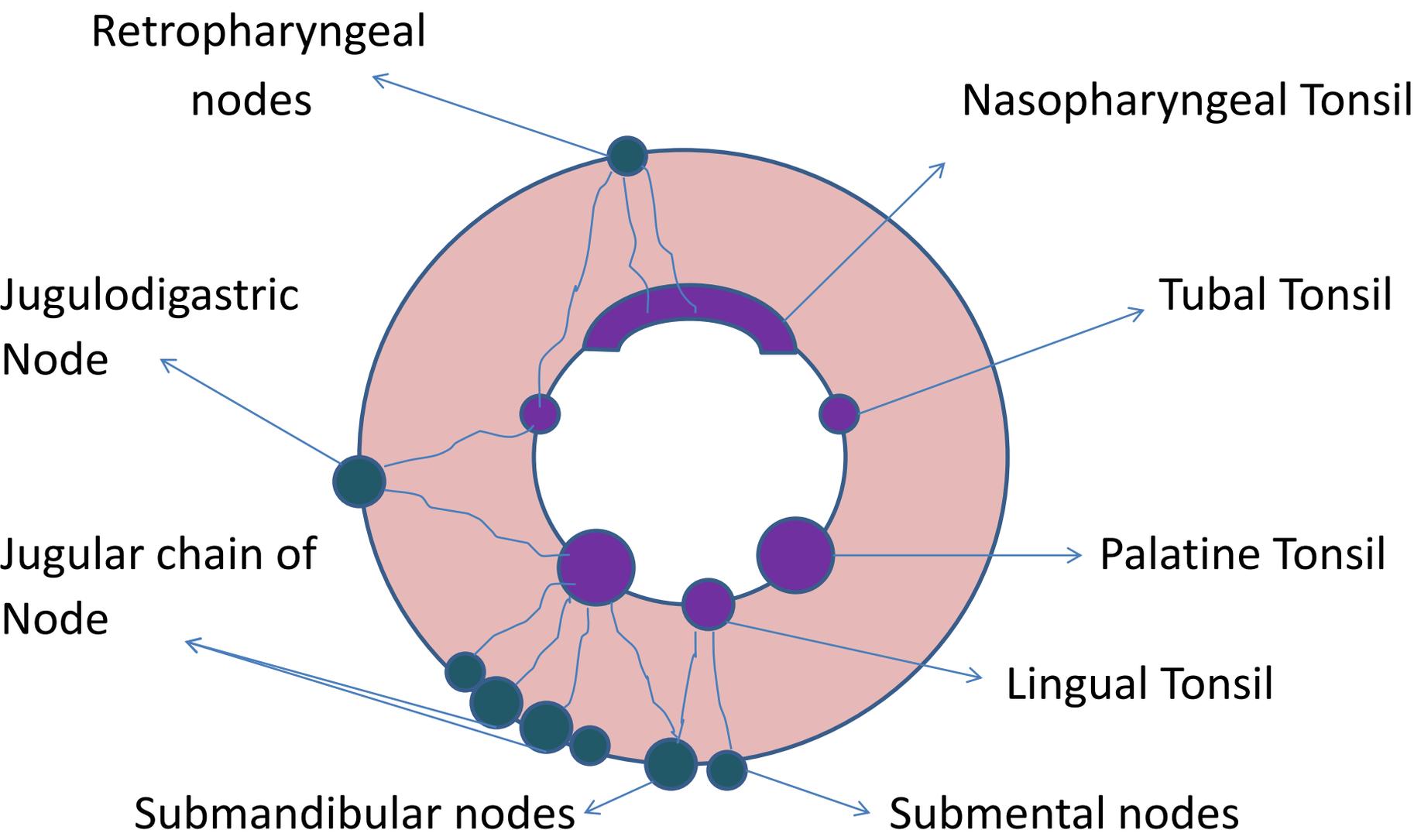
- **Above**- communicates with nasopharynx through nasopharyngeal isthmus.
- **Below**- opens into laryngopharynx.
- **Anterior wall**-
 - upper part- deficient, oropharynx communicates with oral cavity through Oropharyngeal isthmus/ Isthmus of Fauces.
 - lower part- base of tongue
 - lingual tonsils
 - valleculae
- **Posterior wall**- Third cervical vertebrae.
- **Lateral wall**- Palatine/Faucial tonsil
 - Anterior pillar (Palatoglossus muscle)
 - Posterior pillar (Palatopharyngeus muscle)

Lymphatic drainage

Oropharynx- Into Upper Jugular chain particularly Jugulodigastric (tonsillar) node.

Soft palate, Lateral and Posterior pharyngeal walls and base of Tongue- into retropharyngeal and parapharyngeal nodes.

In relation to Oropharyngeal Isthmus there are several aggregations of Lymphoid Tissue that constitute **WALDEYER'S LYMPHATIC RING**.



Laryngopharynx

Lower part of pharynx situated behind and partly on sides of the larynx.

Hypopharynx lies opposite to 3rd, 4th, 5th, 6th cervical vertebrae.

Clinically it is divided into 3 regions-

1. Pyriform Sinus (fossa)
2. Post-cricoid region
3. Posterior Pharyngeal wall

Pyriiform Sinus

- Lies on either side of larynx.
- Extends from Pharyngoepiglottic fold to upper end of Oesophagus.
- Internal Laryngeal Nerve runs submucosally in the lateral wall of sinus (local anaesthesia)
- Bounded by-
Laterally-thyrohyoid membrane and thyroid cartilage
Medially-Aryepiglottic fold, posterolateral surfaces of arytenoid and cricoid.

Post-cricoid Region

It is a part of anterior wall of laryngopharynx.

Posterior Pharyngeal Wall

It extends from level of Hyoid bone to the level of cricoarytenoid joint.

Lymphatics

- Pyriform Sinus → upper Jugular chain.
- Posterior wall → Lateral nodes → deep cervical lymph nodes.
- Post-cricoid region → Parapharyngeal nodes → nodes of supraclavicular and paratracheal chain.

Nerve supply of Pharynx

Pharyngeal plexus of nerves formed by-

- pharyngeal branch of vagus nerve
 - pharyngeal branches of glossopharyngeal nerve.
 - pharyngeal branches of superior cervical sympathetic ganglion
-
- Motor fibres-Vagus N. – supply all muscles of pharynx except Stylopharyngeus (glossopharyngeal N.)
 - Sensory fibres-Glossopharyngeal N. and Vagus N.

Killian's Dehiscence

Inferior constrictor muscle has 2 parts:

1. Thyropharyngeus: has oblique fibres
2. Cricopharyngeus: has transverse fibres

Potential gap between these 2 parts is **KILLIAN'S DEHISCENCE** or **Gateway of Tears**.

This is the site for herniation of pharyngeal mucosa in cases of pharyngeal pouch.

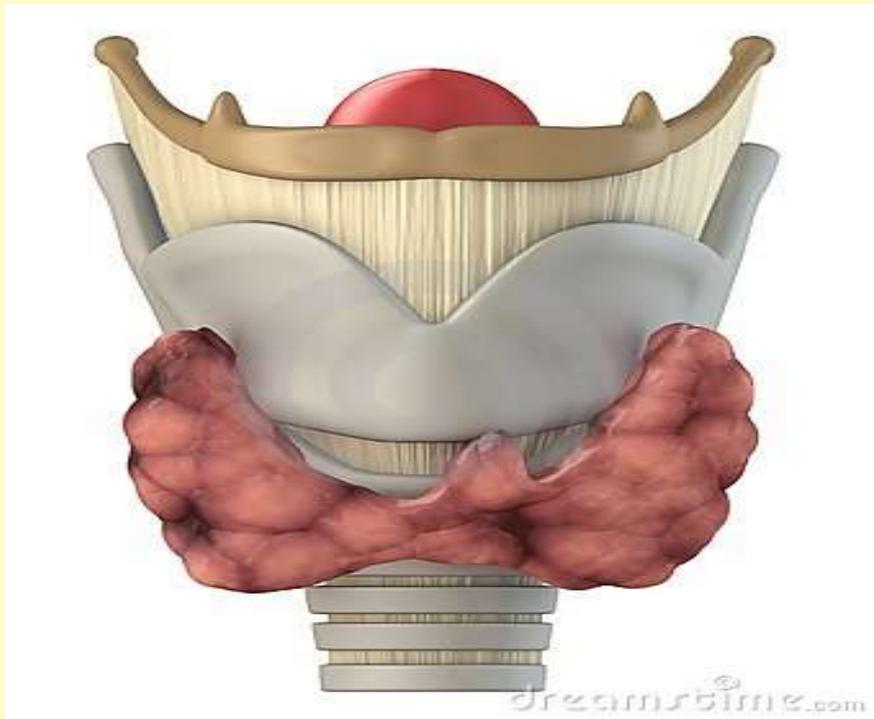
Pharyngeal Spaces

Potential spaces in relation to pharynx where abscess can form-

1. **Retropharyngeal space**- lies behind pharynx, extend from base of skull to bifurcation of trachea.
2. **Parapharyngeal space**- present on one side of pharynx, contains (a) Carotid vessels, (b) Jugular vein, (c) last 4 Cranial Nerves (d) Sympathetic chain

THANK YOU

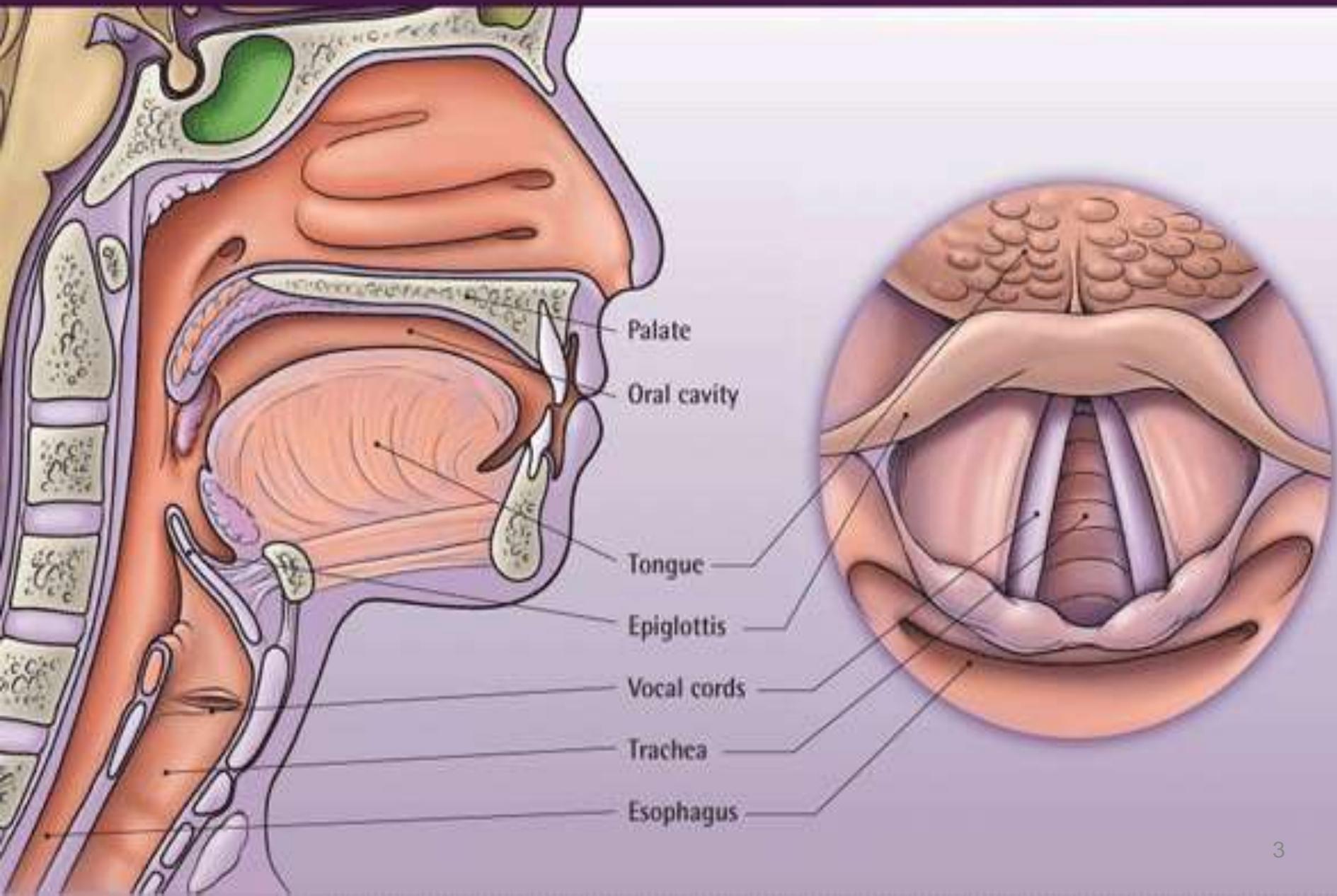
PRESENTATION ON ANATOMY AND PHYSIOLOGY OF LARYNX



OBJECTIVES

- To discuss the basic anatomy of the larynx
 - To enumerate the main functions of the larynx

Larynx



LARYNX

Commonly called- voice box

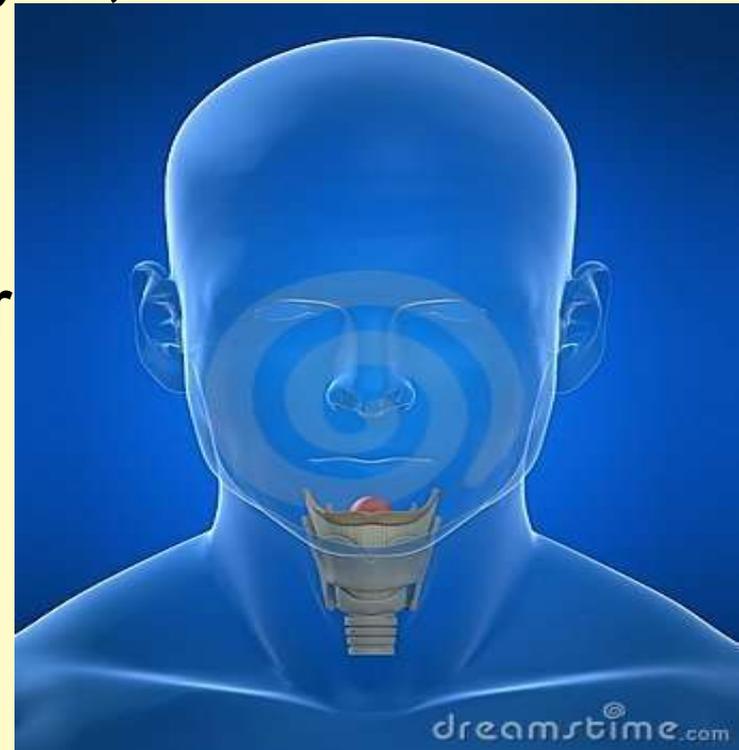
Shape- tube shaped.

Composed- muscles, cartilages, connective tissue.

Bony part- hyoid bone.

Location- 4-6 cervical vertebrae

Lies- midline of the neck.



SHAPE AND SIZE

- the shape of the larynx in lower side is circular and from the upper it is tringular in shape.
- Its length is 4.3 cm,
- transverse diameter is 4.2 cm and anterior posterior diameter 3.6 cm.

LARYNX

The larynx is composed of nine pieces of cartilage.

PAIRED

Arytenoid cartilage

Corniculate cartilage

Cuneiform cartilage

,

UNPAIRED:

Thyroid cartilage

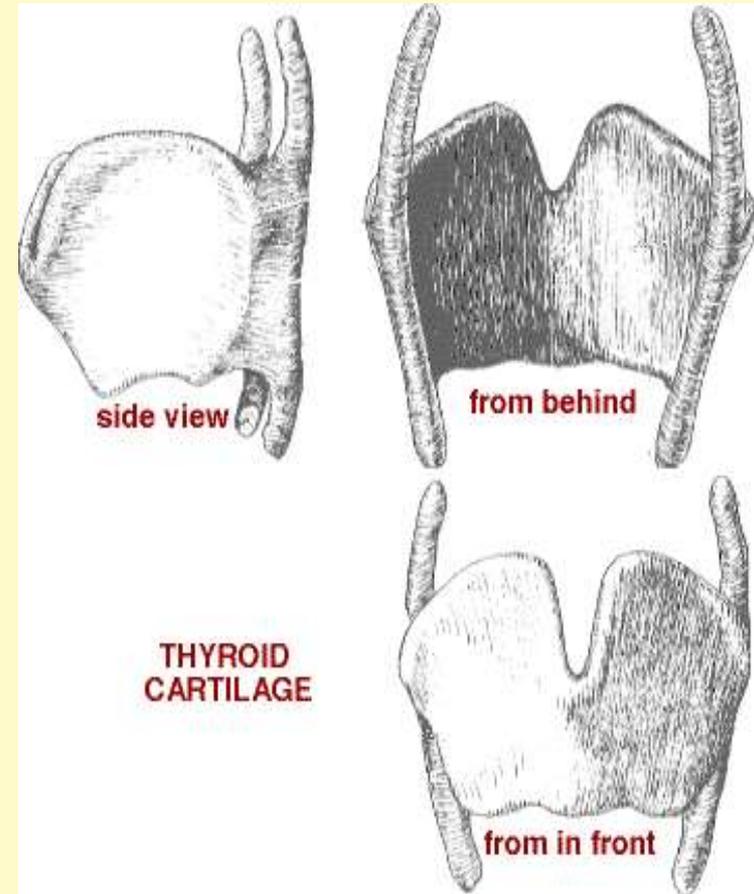
Cricoid cartilage

Epiglottis

THYROID CARTILAGE

Largest cartilage.

consist of two laminae the anterior border of which are fused with each other at an angle in the middle line of the neck and form a subcutaneous projection named as ADAM'S APPLE OR laryngeal prominence.



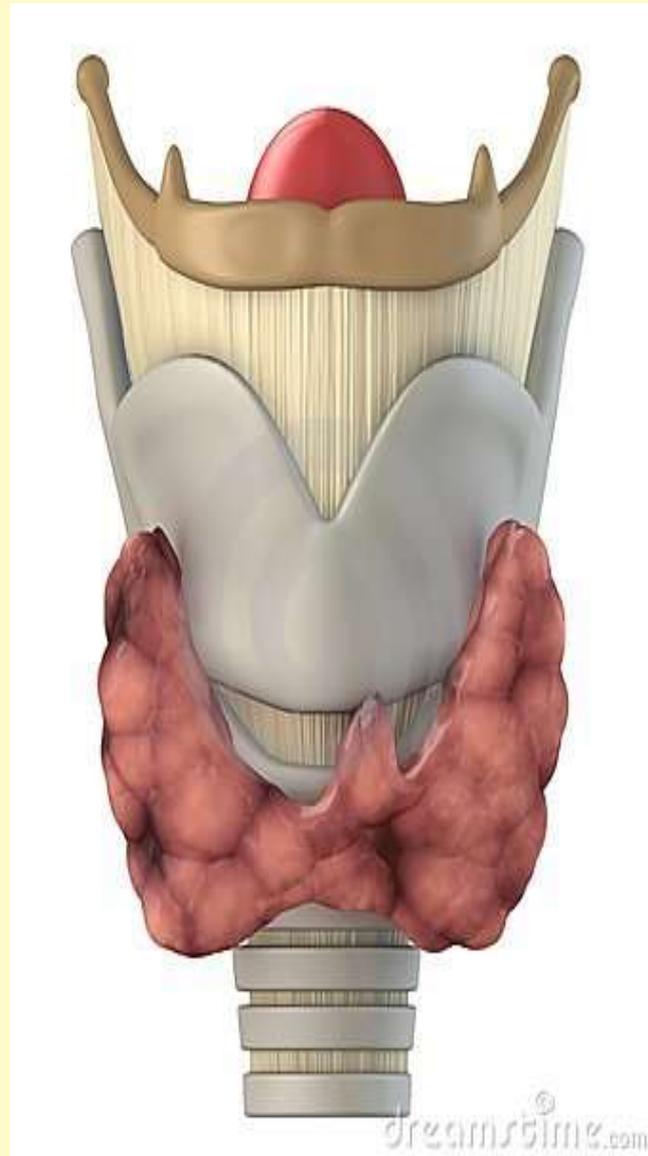
LINNING OF THE LARYNX

superior of the vocal fold is
non karatinized stratified squamous epithelium,
inferior to the vocal fold is **pseudo stratified
columnar epithelium.**

THYROID CARTILAGE

larger in males than females
due to the influence of male sex hormones on its growth during puberty.

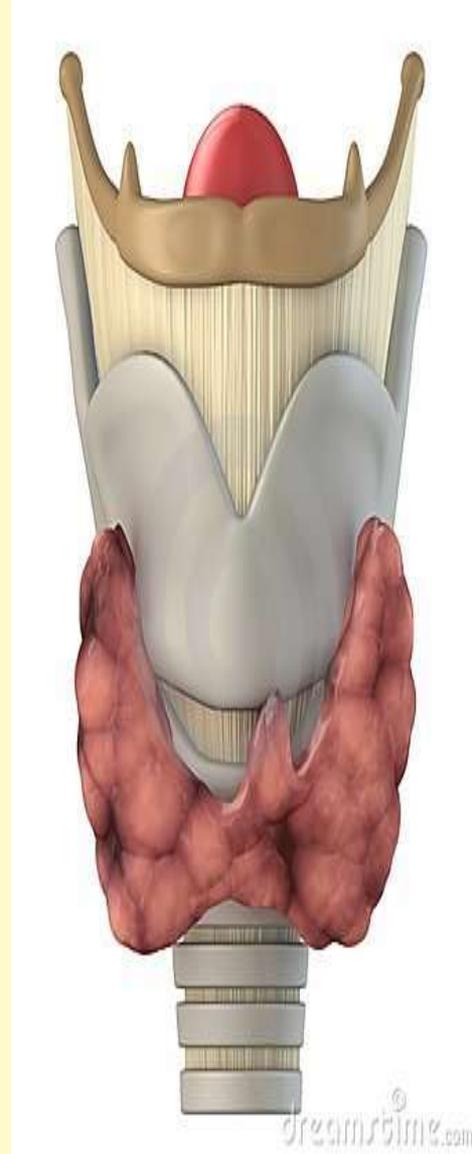
Immediately above it is the lamina are separated by a V shape notch, the superior thyroid notch. The laminae are irregularly



THYROID CARTILAGE

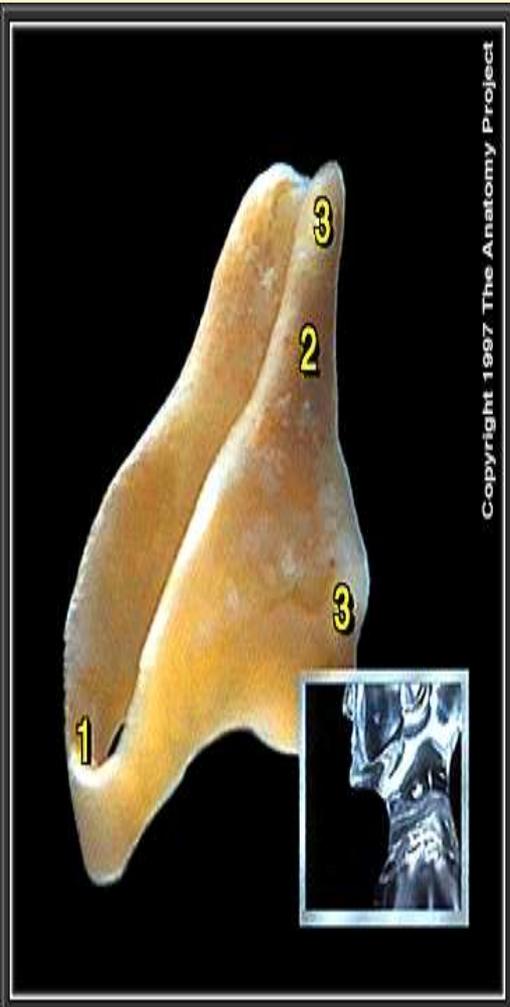
The laminae are irregularly quadrilateral in the shape and their posterior angles are prolonged into processes termed the superior and inferior cornu.

- The superior cornu is long, and narrow, directed upward, backward, and medialward which gives attachment to the lateral hypothyroid ligament.
- The inferior cornu is short and thick, it is directed downward with a slight inclination forward and medialward, and present on the medial side of its tip, a small oval articular facet for articulation



CRICOID CARTILAGE

- A ring of hyaline cartilage known as **SIGNET RING**.
- form the inferior wall of the larynx. smaller, thicker and smaller than the thyroid and forms the lower and posterior parts of the wall of the larynx.
- attached to the first ring of cartilage of the trachea by the **cricotracheal ligament**
- the thyroid cartilage is connected to the cricoid cartilage by **the cricothyroid ligament** . It is the landmark.

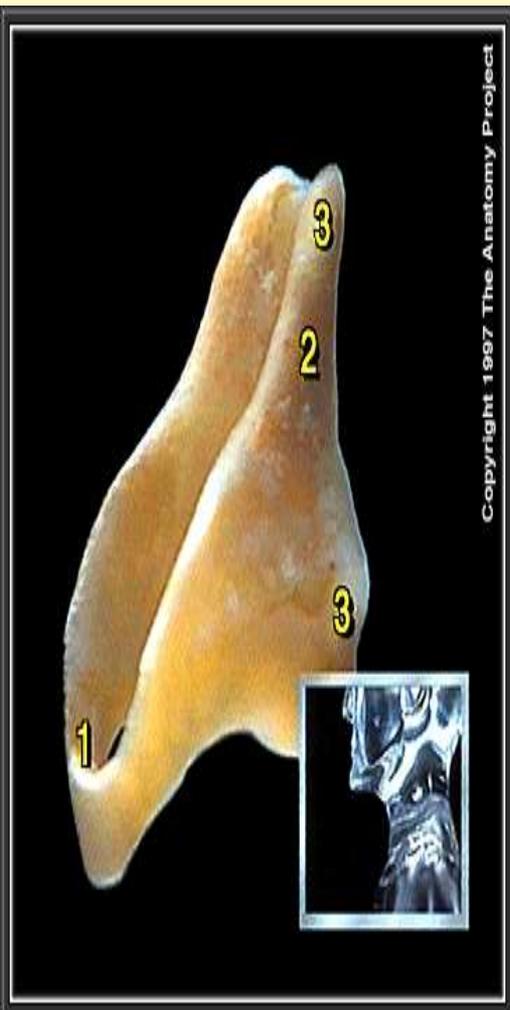


CRICOID CARTILAGE

□ It consists of two parts: a posterior quadrangle lamina and anterior quadrangle lamina.

□ The lamina (posterior portion) is deep, and broad and measures from above downward about 2 or 3 cm, on its posterior surface, in the middle line, is the vertical ridge to the lower part of which are attached to the longitudinal fibres of the oesophagus.

□ The arch (anterior portion) is narrow and convex, and measures vertically from 5 to 7 mm.



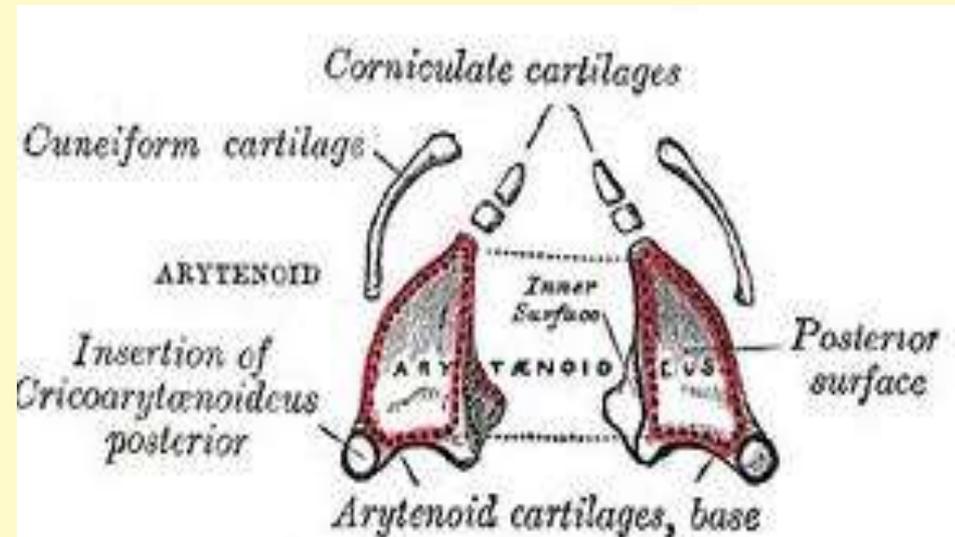
EPIGLOTTIS

- It is a large leaf-shaped piece of elastic cartilage that is covered with epithelium.
- stem of the epiglottis is attached to the anterior rim of the thyroid cartilage and hyoid bone .
- the broad superior leaf portion of epiglottis is unattached and free to move up and down like a trap door.
- The free extremity is connected by the thyroepiglottic



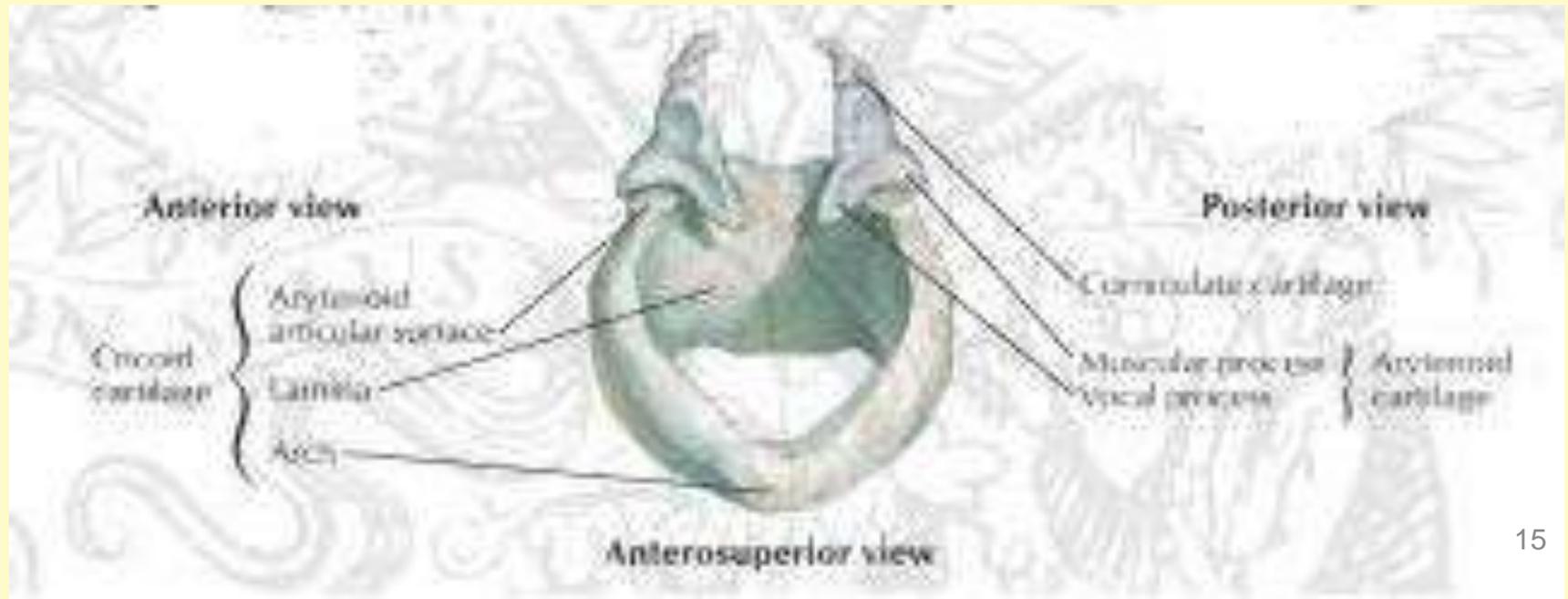
ARYTENOID CARTILAGE

- Triangular pieces, hyaline cartilage located at the posterior, superior border of the cricoid cartilage at the back of the larynx.
- Each is pyramidal in form and has three surface, a base and a apex.
- Posterior surface is triangular, smooth and concave.
- Anterolateral surface is convex and rough.
- Attached to the vocal folds and intrinsic pharyngeal muscles. Supported by the arytenoid cartilage,



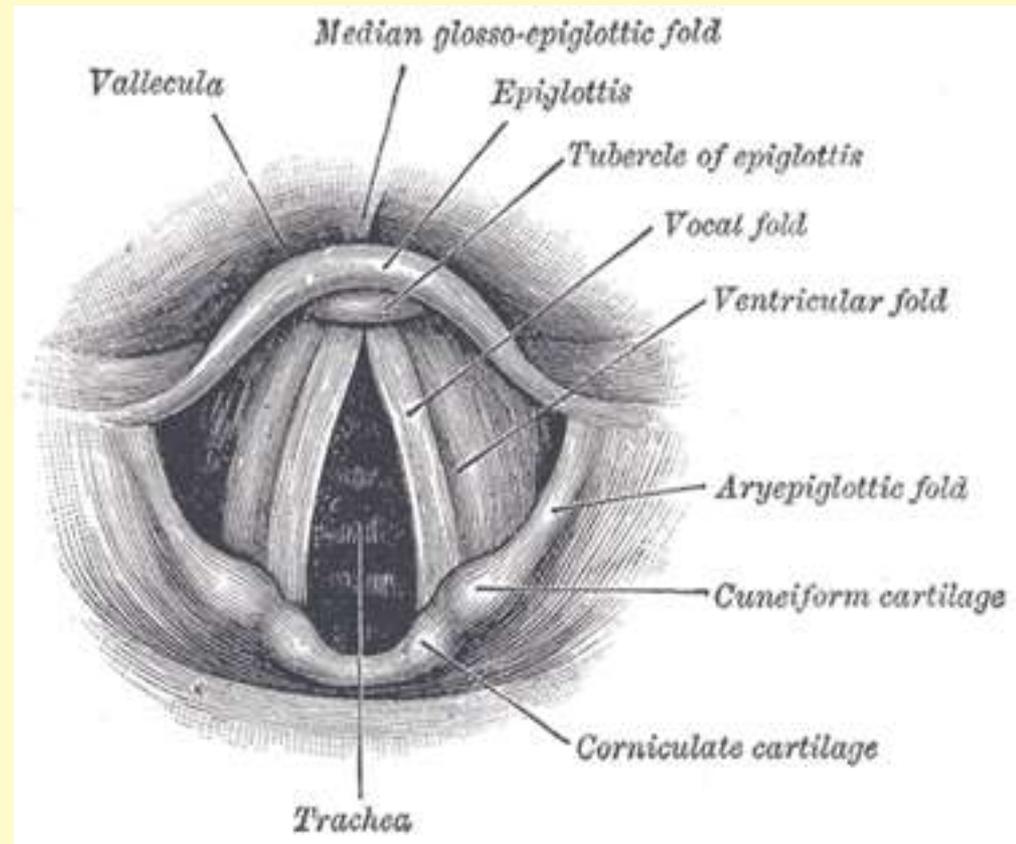
CORNICULATE CARTILAGES

- Two small conical nodules
- Shape-horn shaped , elastic cartilage.
- Located apex of the each arytenoid cartilage. Situated in the posterior part of the aryepiglottic.



CUNEIFORM CARTILAGES

- club shaped
- placed one on either side, in the aryepiglottic fold
- just in front of the arytenoids ligament and gives the support the vocal folds and the lateral aspects of the epiglottis.



LARYNGEAL LIGAMENTS

- **EXTRINSIC**

- Thyrohyoid membrane and ligaments
- Cricothyroid membrane and ligaments
- Cricotracheal ligament
- Epiglottis

- **INTRINSIC**

- Elastic membrane
- Quadrangular membrane
- Conus elasticus (cricovocal membrane)
- Median cricothyroid ligament
- Vocal Ligament
- Thyroepiglottic ligament

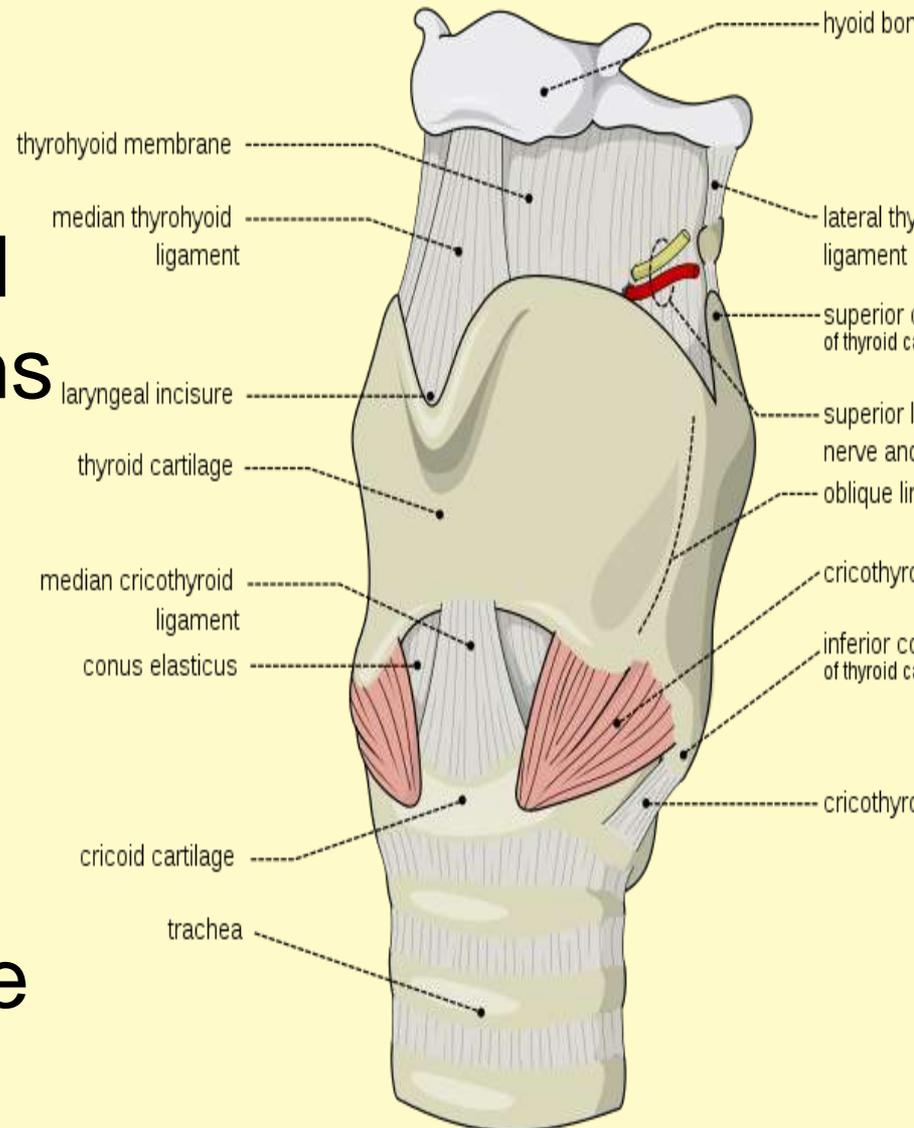
EXTRINSIC LIGAMENTS

The thyroid membrane---

a broad, fibroelastic layer, attached below to the upper border of the thyroid cartilage and to the front of its superior cornu.

EXTRINSIC LIGAMENTS

The thyrohyoid ligament – is the round elastic cord, which forms the posterior border of the thyrohyoid membrane and passes between the tip of the superior cornu of the thyroid cartilage and the extremity of the greater cornu of the hyoid bone.

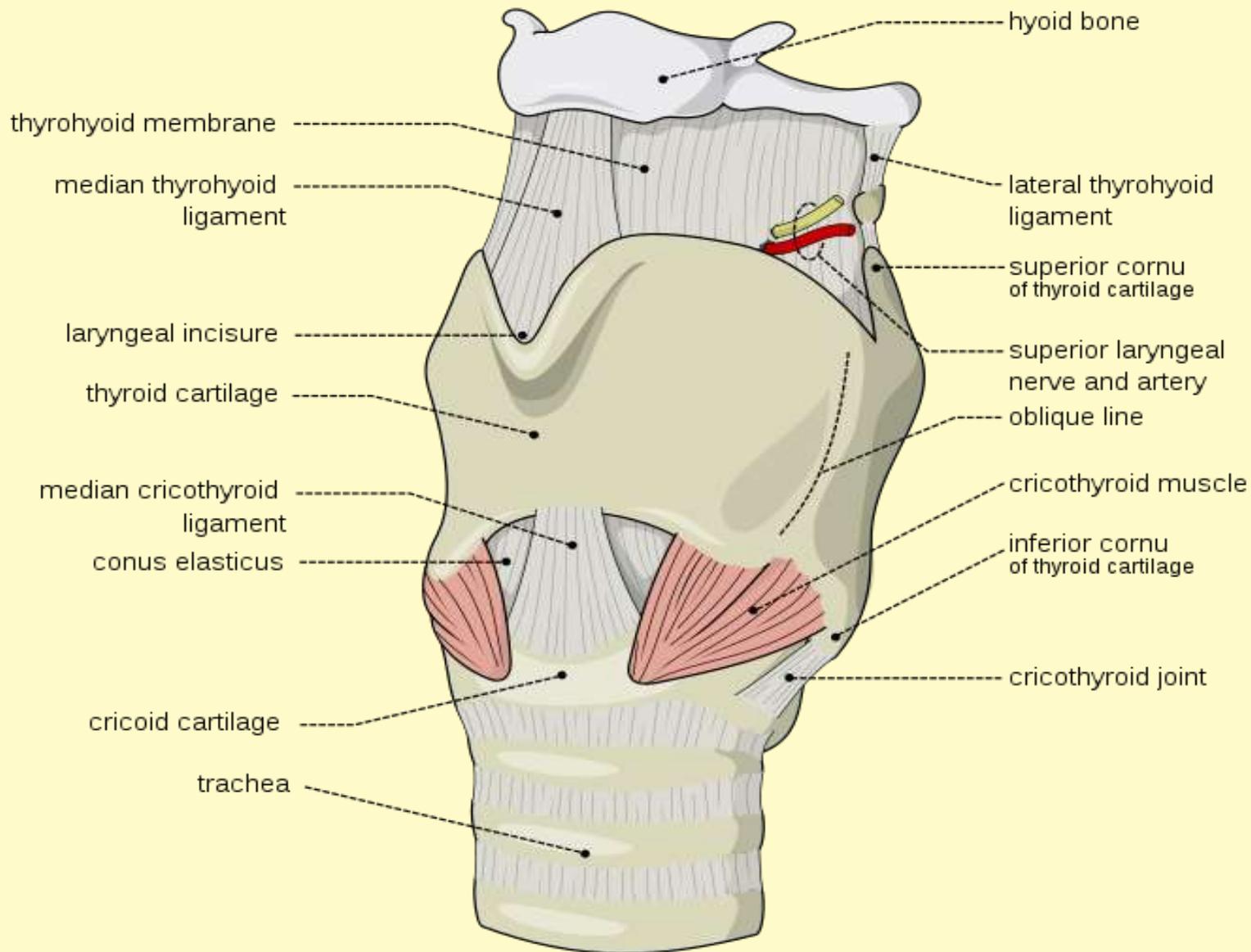


EXTRINSIC LIGAMENTS

Epiglottis -- is connected with the hyoid bone by an elastic band the hyoepiglottic ligament.

Cricotracheal ligament –

Connects the cricoid cartilage with the first ring of the trachea. It resembles the fibrous membrane which connects the cartilaginous rings of the trachea to the each other.



INTRINSIC LIGAMENTS

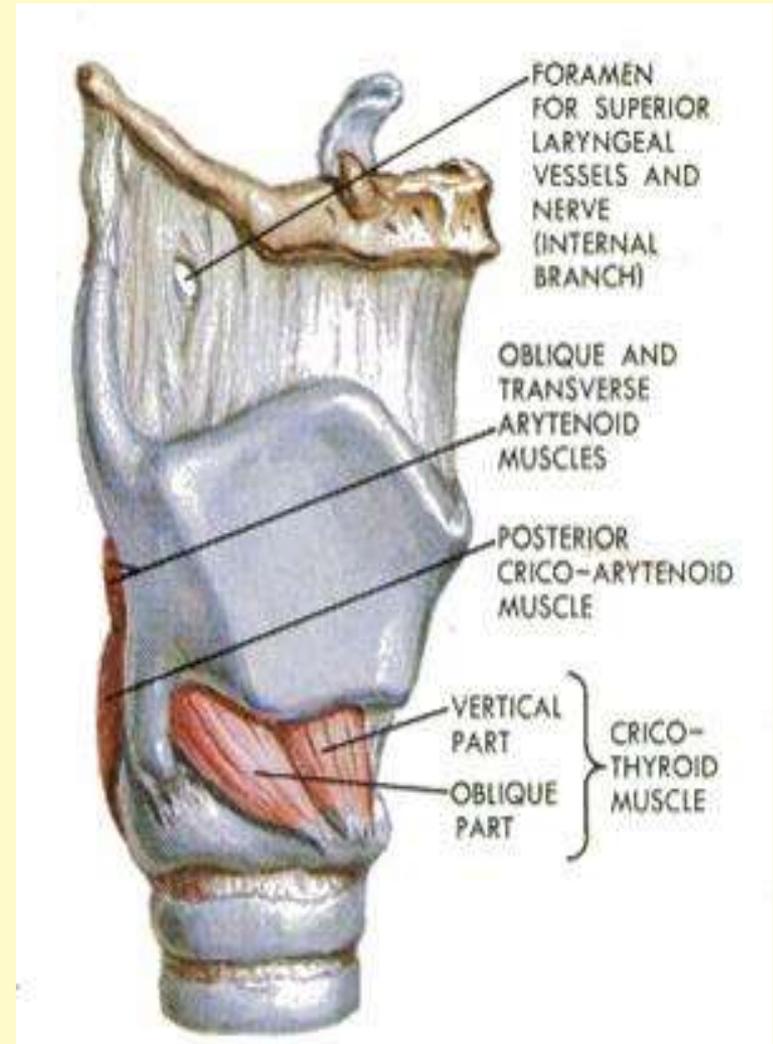
THE CORNUS ELASTICUS-- is composed mainly of yellow elastic tissue. It connects the thyroid, cricoid, arytenoid cartilage to one another .

THYROEPIGLOTTIC LIGAMENT---- is a long, slender, elastic cord which connects the stem of the epiglottis with the angle of thyroid cartilage.

MUSCLES OF LARYNX

Extrinsic muscles

- The Mylohyoid Muscle
- Geniohyoid Muscle
- The Stylohyoid Muscle
- Cricothyroid



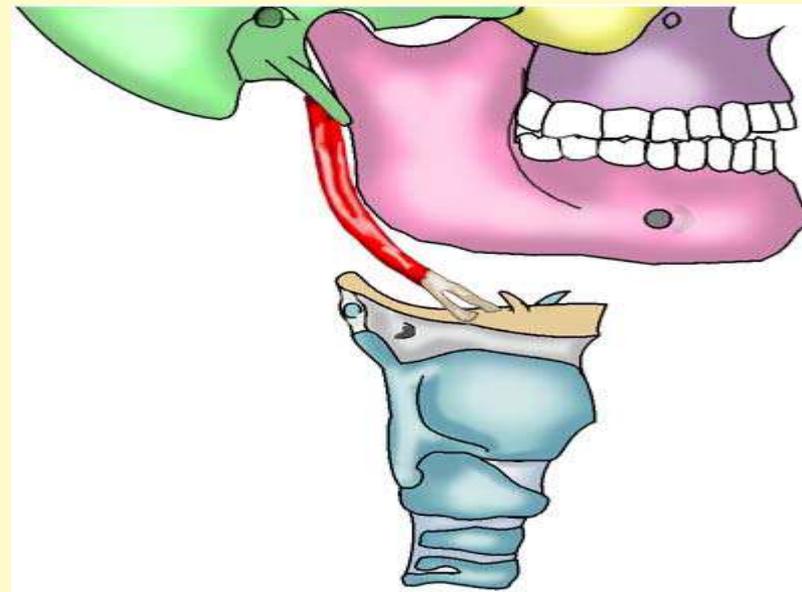
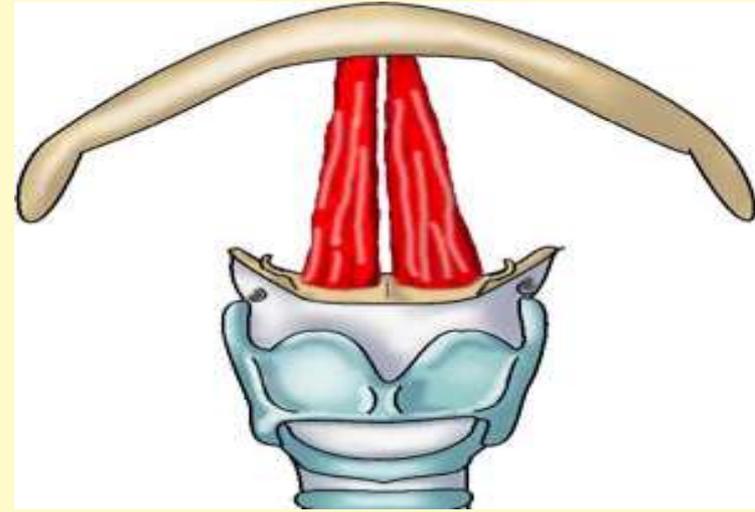
EXTRINSIC MUSCLES

The Geniohyoid Muscle

They lie superior to the mylohyoid muscle to body of the hyoid bone

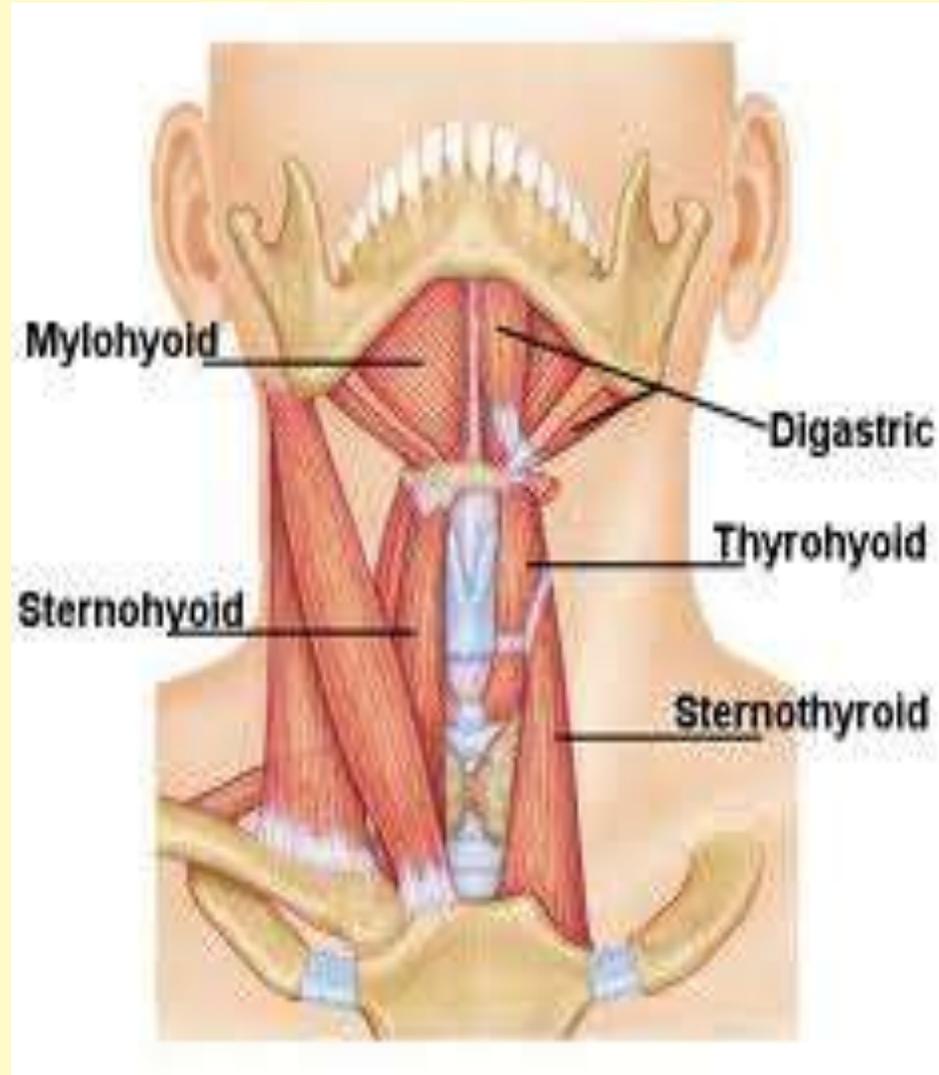
The Stylohyoid Muscle

Insertion: the body of the hyoid bone



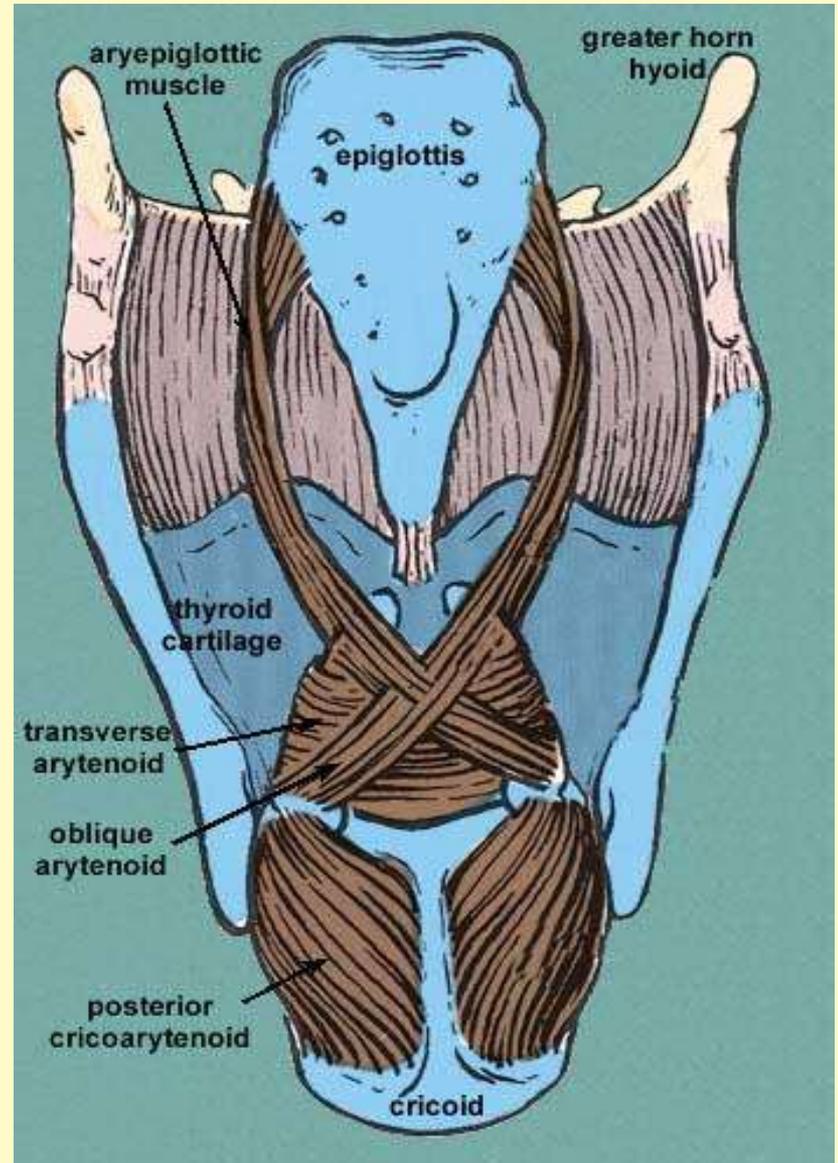
Cont.....

The thyrohyoid muscle - It arises from the oblique line on the lamina of the thyroid cartilage, and to the greater cornu of the hyoid bone.

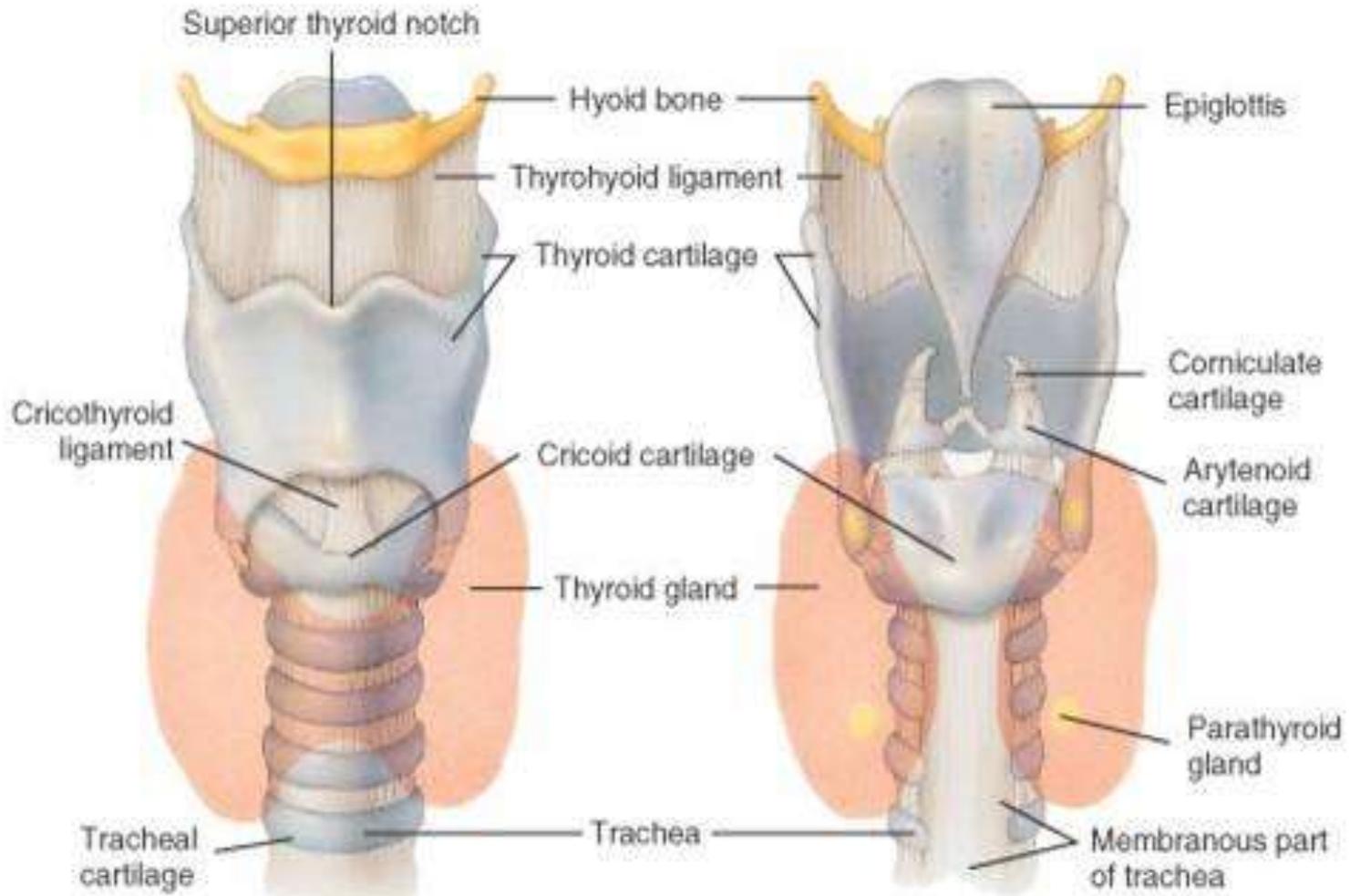


INTRINSIC MUSCLES OF LARYNX

- Thyroaryatenoid
- Oblique Arytaenoid
- Transverse Arytaenoid
- Posterior Cric arytenoid
- Lateral Cric arytenoid

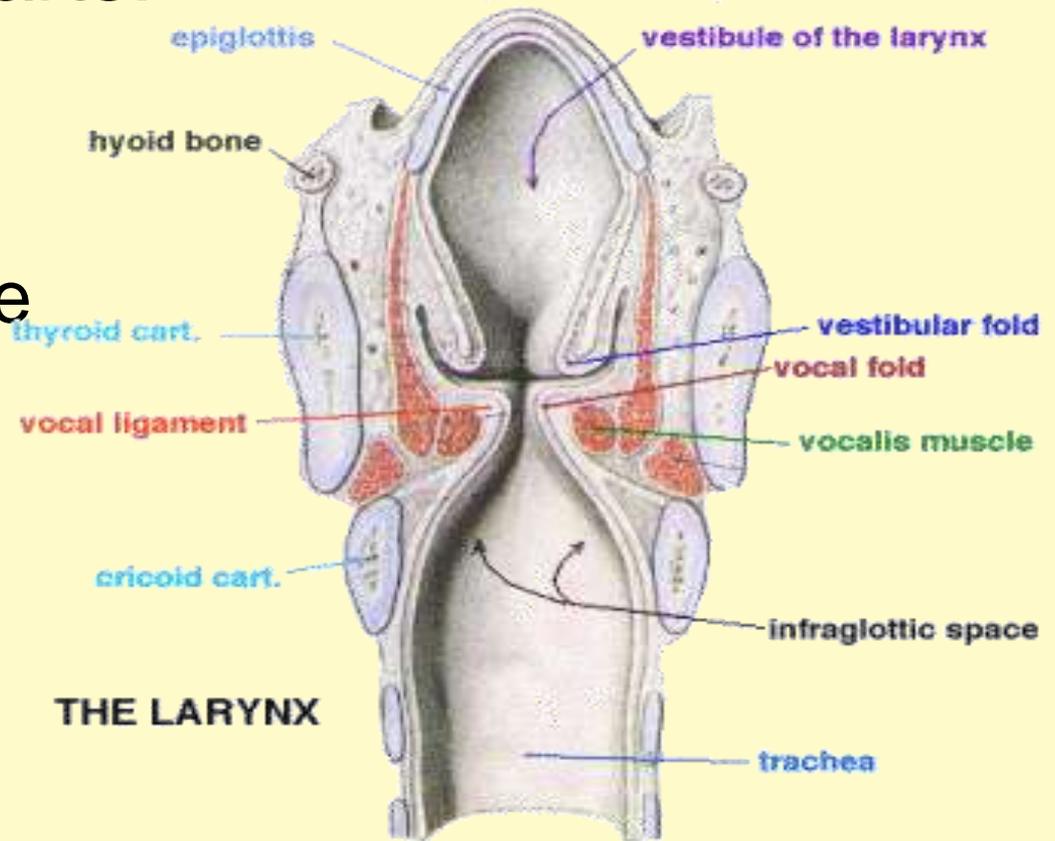


ANTERIOR AND POSTERIOR LARYNGEAL VIEW



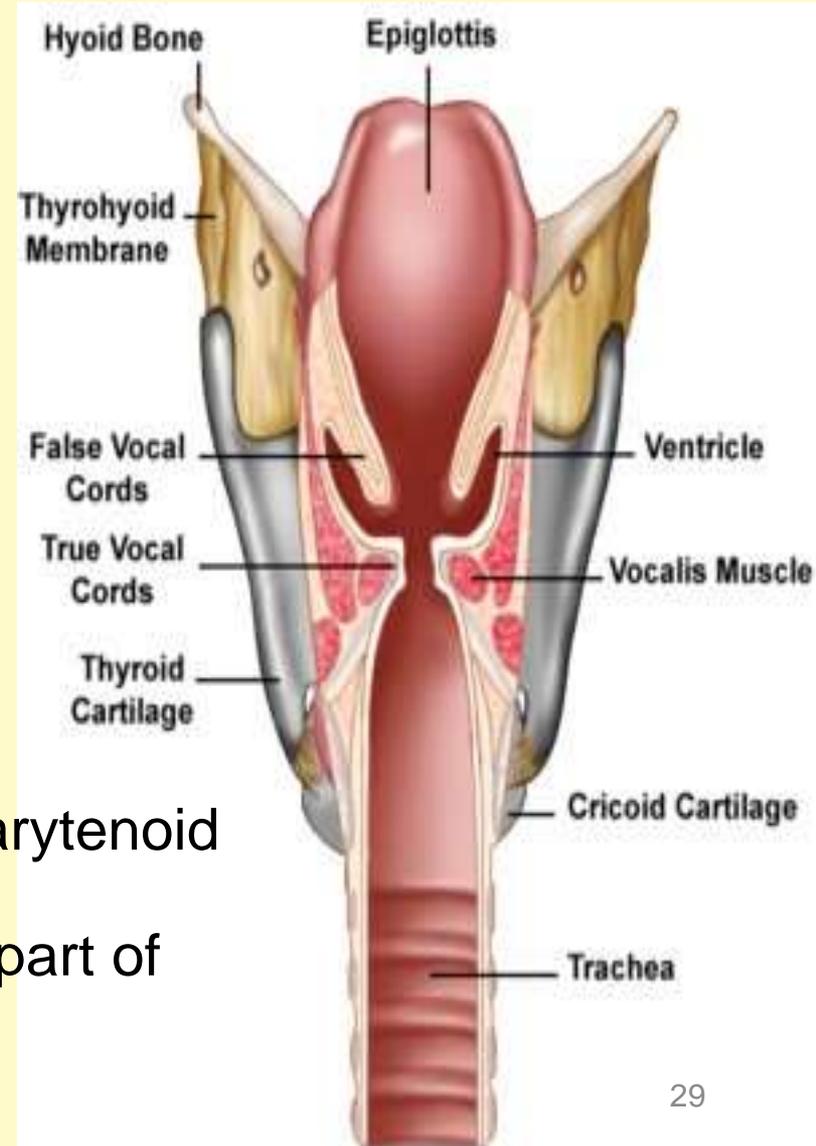
CAVITY OF THE LARYNX

- Divided into 3 parts:
 - Vestibule
 - Ventricle
 - Subglottic space



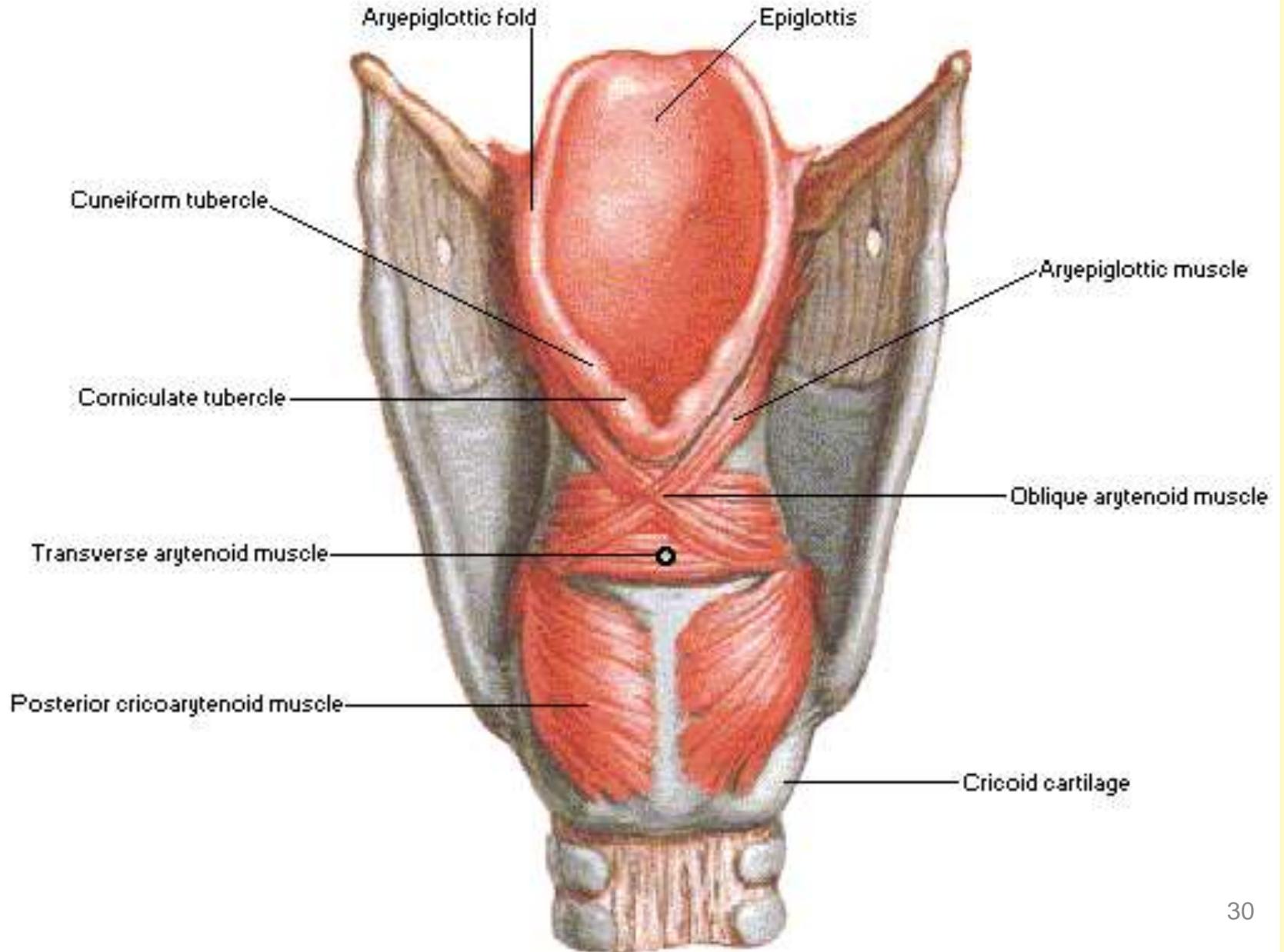
CAVITY OF THE LARYNX

- False Cords (ventricular bands)
 - Anteriorly: angle of the thyroid cartilage
 - Posteriorly: bodies of the arytenoid cartilage
- True cords
 - Voice production
 - Protection of lower respiratory tract
 - Anteriorly, : angle of thyroid cartilage
 - Posteriorly: vocal processes of the arytenoid cartilages
 - Enclose vocal ligament and a major part of the vocalis muscle



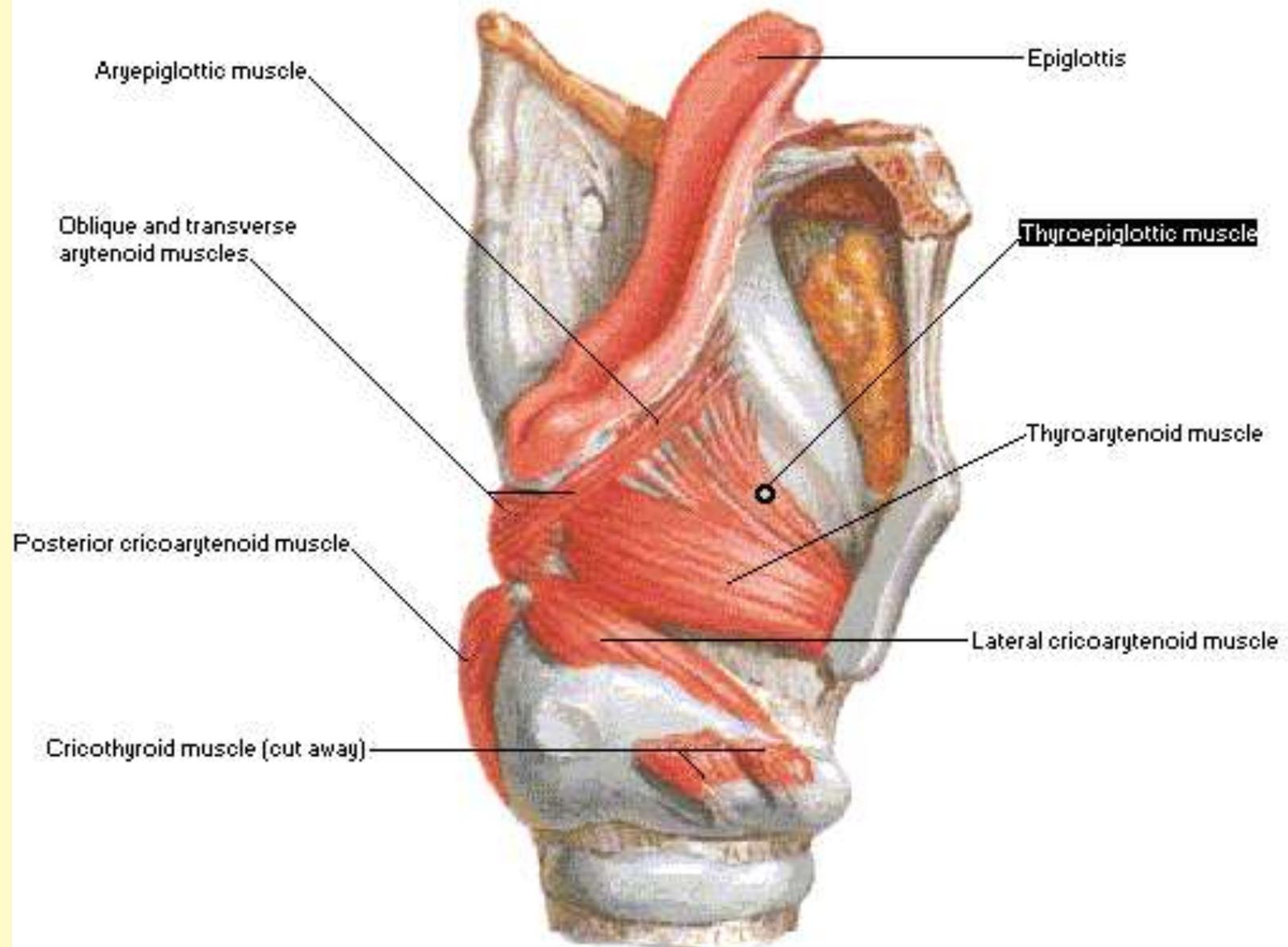
Intrinsic Muscles of Larynx

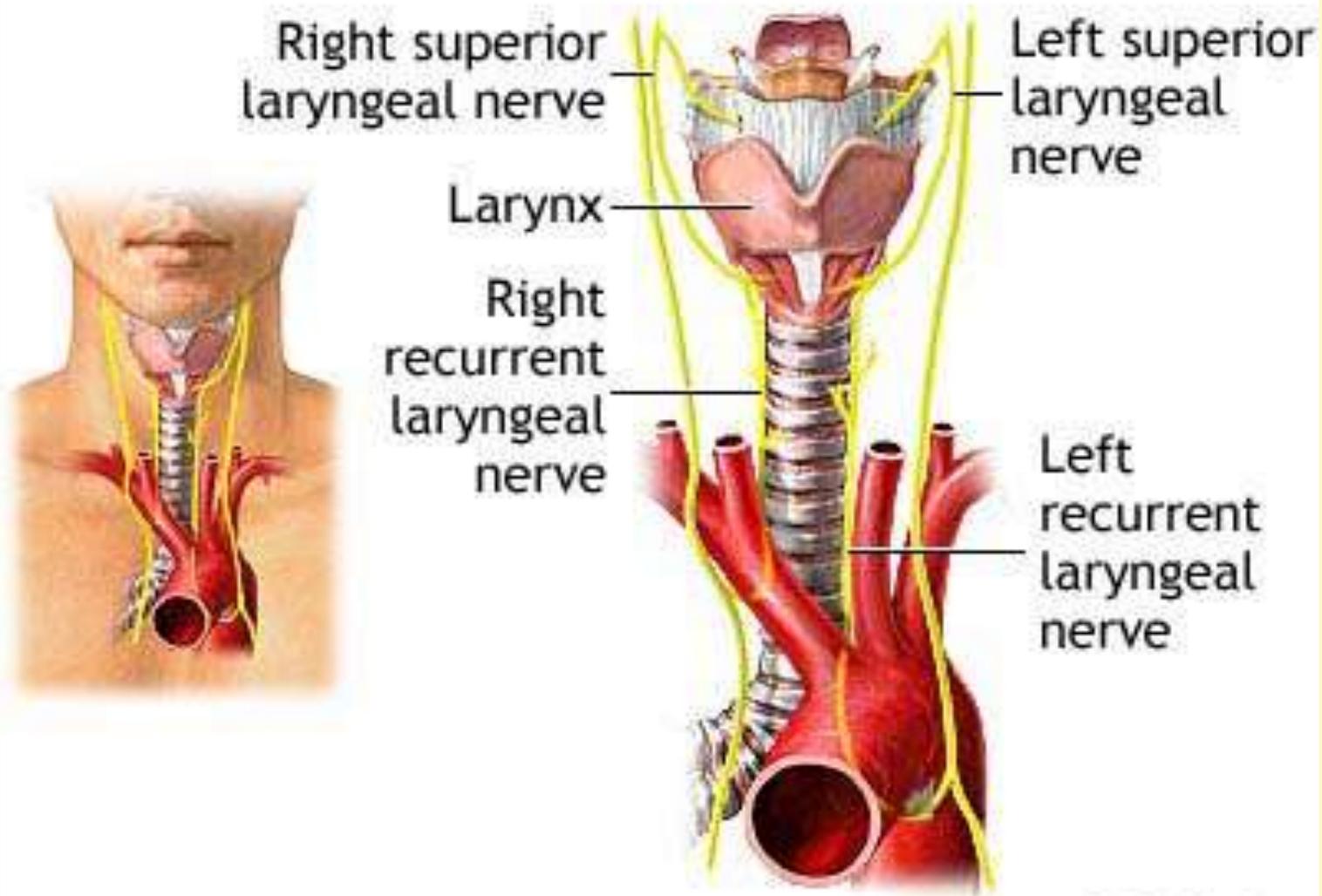
Posterior View



Intrinsic Muscles of Larynx

Lateral Dissection



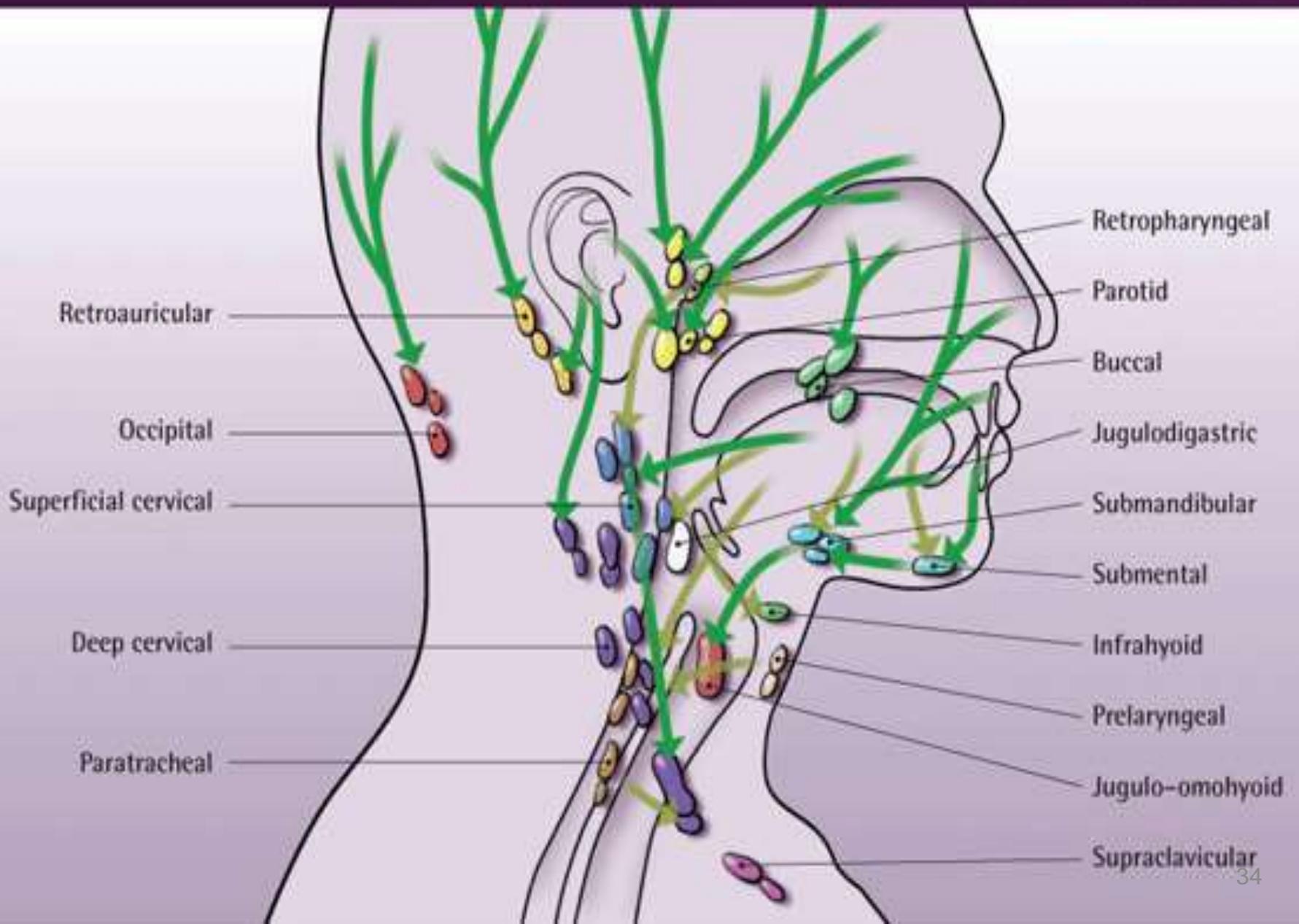


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BLOOD SUPPLY

- **Upper Larynx**
 - External carotid artery
 - Superior thyroid artery
 - Superior laryngeal artery
- **Lower Larynx**
 - Subclavian artery
 - Thyrocervical artery
 - Inferior thyroid artery
 - Inferior laryngeal artery

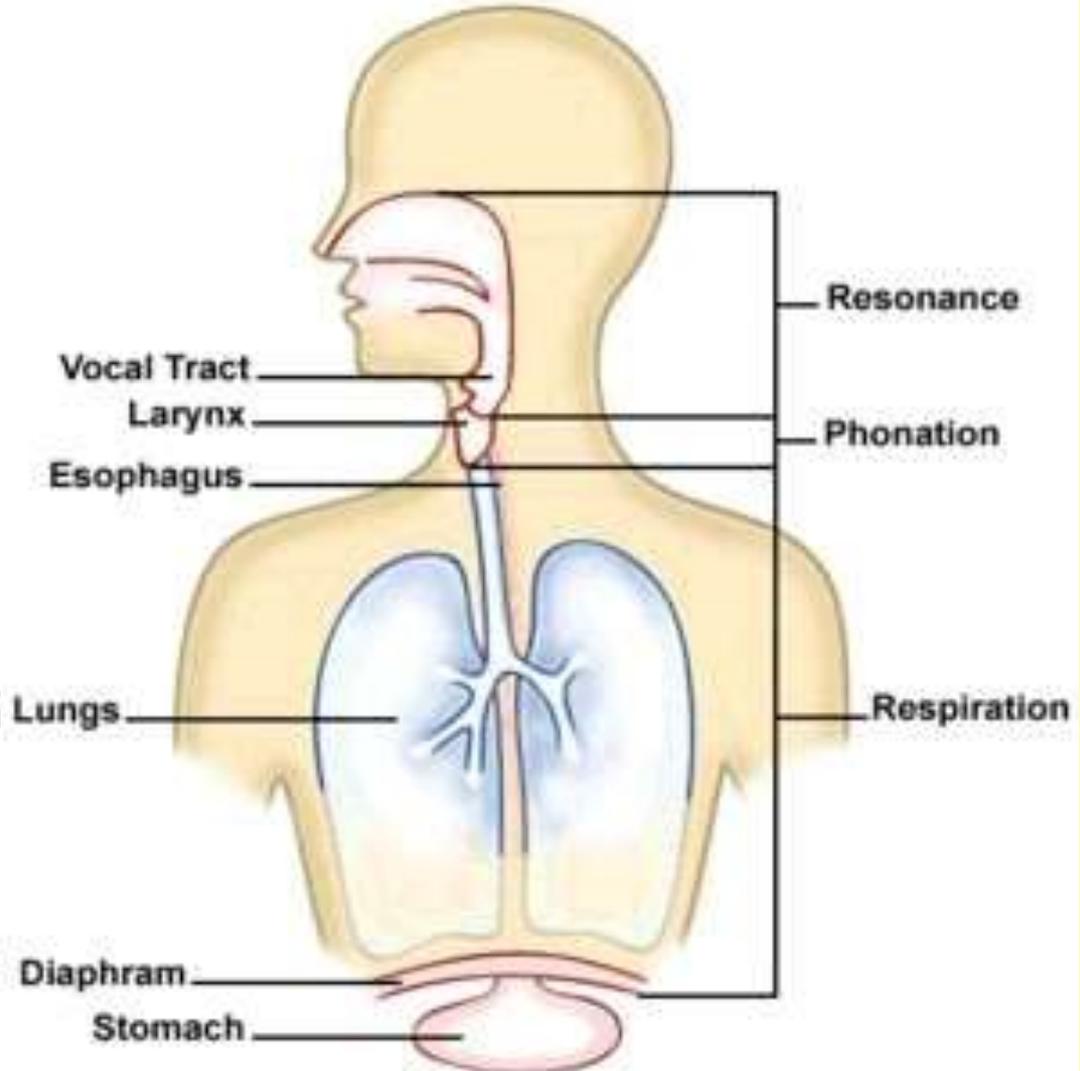
Lymph Nodes



PHYSIOLOGY

BASIC FUNCTIONS

- Protection
- Respiration
- Phonation
- Fixation of chest
- Closure of glottis



THE EAR

- Outer Ear
- Middle Ear
- Inner Ear

OUTER EAR

- **1. OUTER EAR** consists of the **PINNA** and the **EXTERNAL AUDITORY CANAL**.
- The pinna is the cartilage of the ear; it acts as a funnel to capture the sound.
- If you cup your hands to your ears (do it now), you'll notice the sound of my voice is louder.
- The transmission of sound vibrations through the outer ear occurs chiefly through air.

The Outer (External) Ear

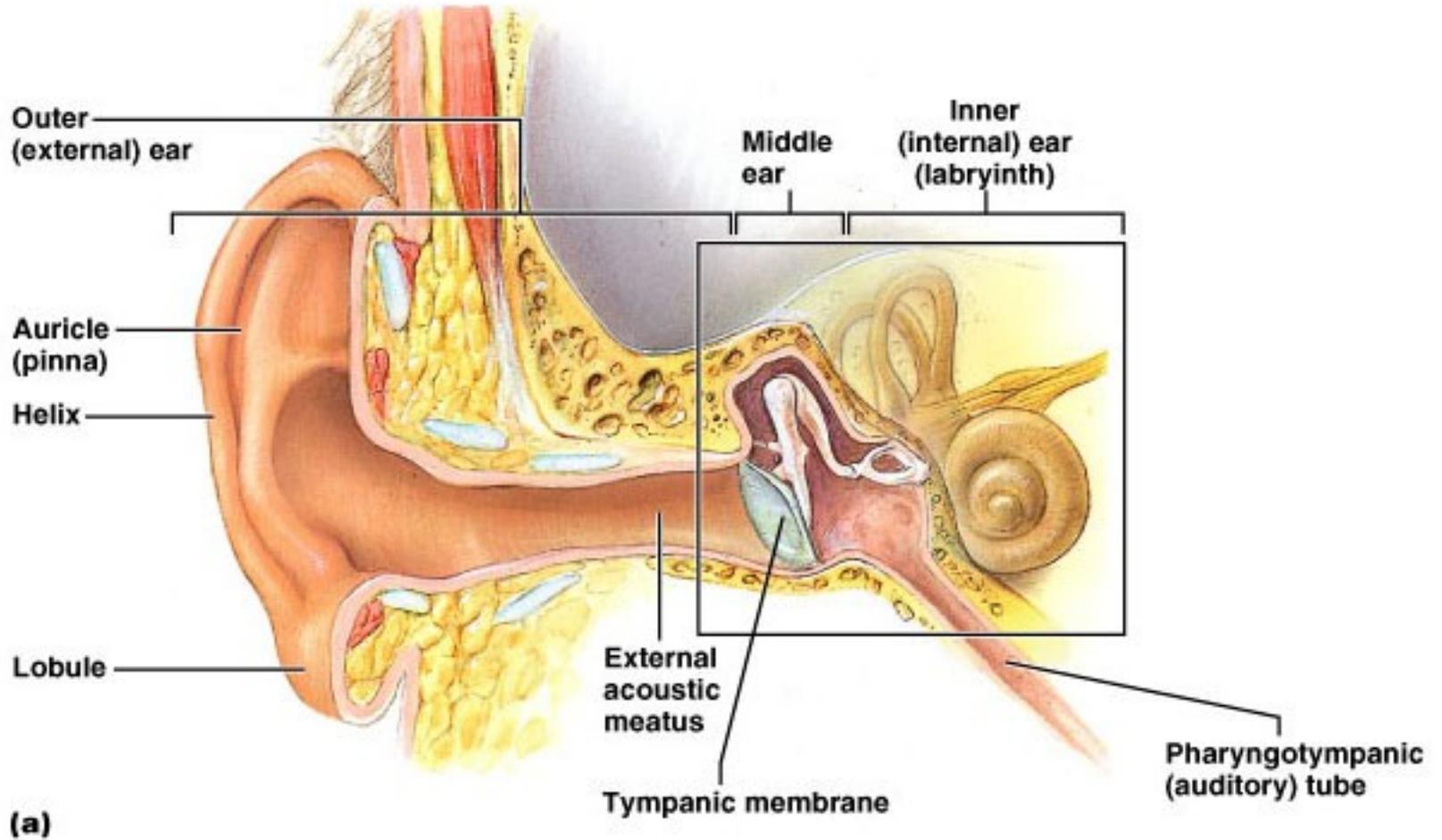
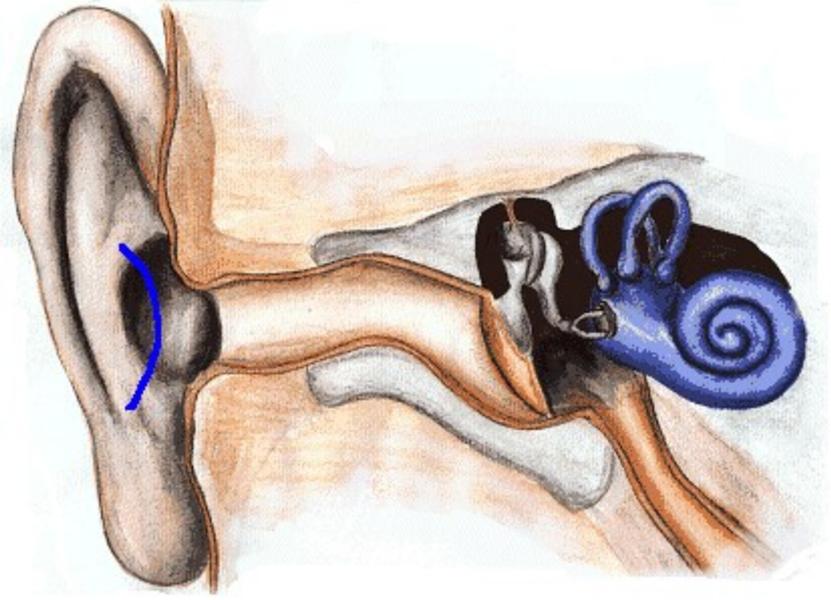


Figure 16.17a

MIDDLE EAR

- **2. MIDDLE EAR** is an **AIR** filled space with structures.
- The **TYMPANIC MEMBRANE** (ear drum) vibrates in response to sound.
- Attached to it are 3 bones: The **MALLEUS** (hammer), **INCUS** (anvil), and the **STAPES** (stirrup) are the smallest bones in the body. Together, they are only one inch long.
- Their function is to amplify sound vibrations. The malleus vibrates the incus, which vibrates the stapes.



Structures of the Middle Ear

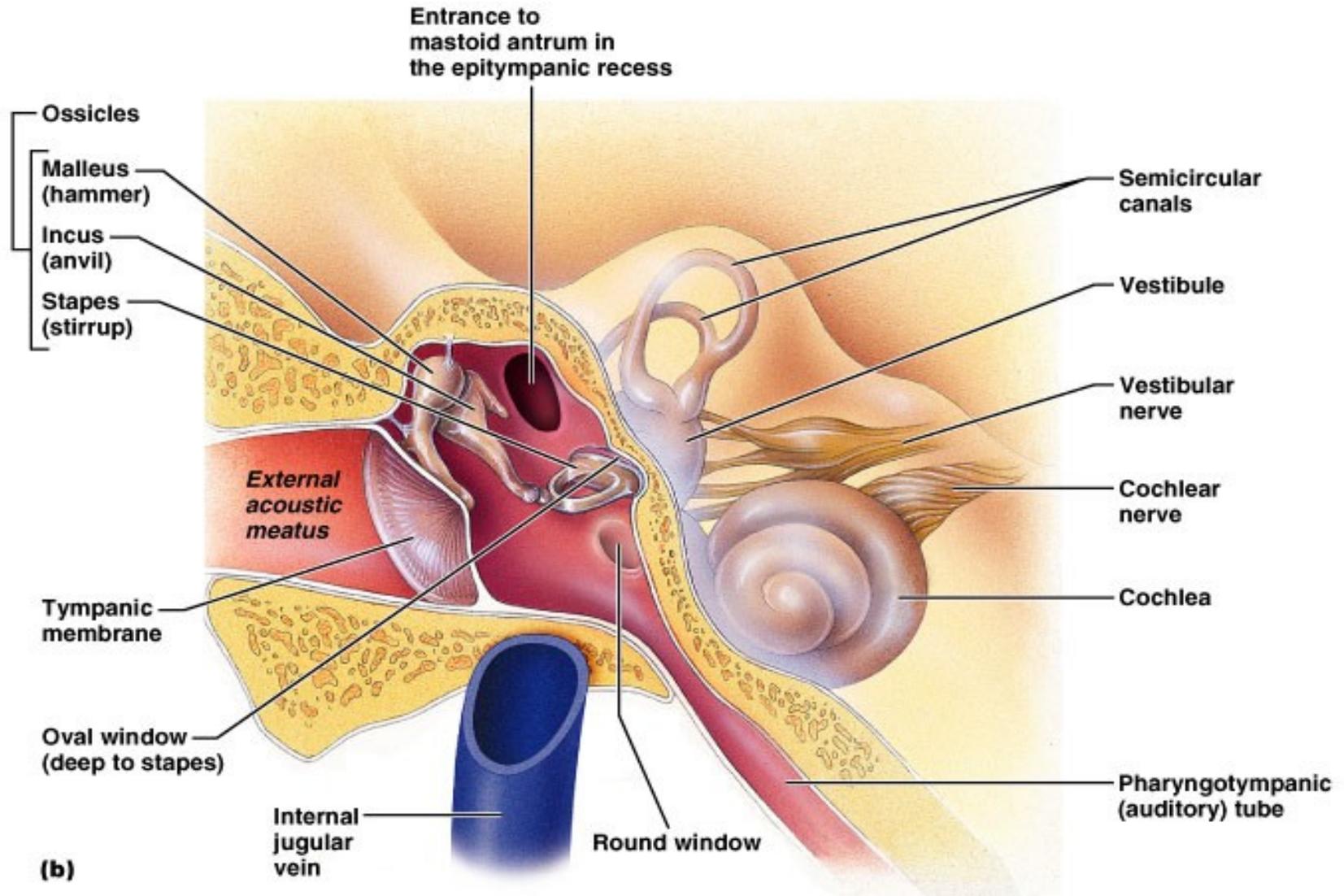


Figure 16.17b

MIDDLE EAR

- The middle ear is open to the nasopharynx by way of the **AUDITORY TUBE**, which is only the thickness of a pencil lead.
- If this tube is closed, the ears feel plugged up.
- The function of the auditory tube is to equalize the pressure of the middle ear and the outside air so the ear bones can vibrate.
- Tubes are put in the tympanic membrane to drain fluids in kids with frequent ear infections.

Structures of the Middle Ear

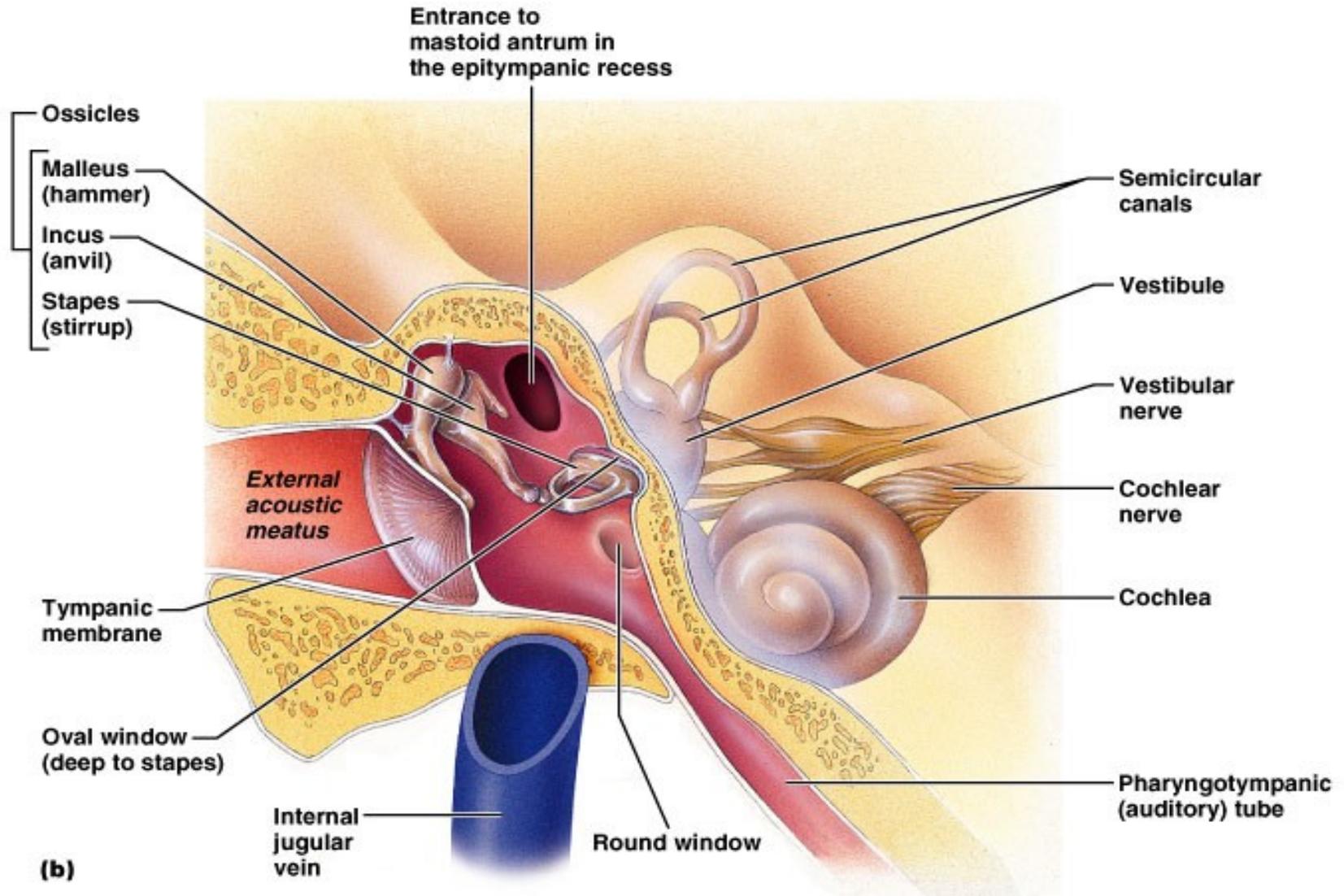


Figure 16.17b

INNER EAR

- **3. INNER EAR** exists within the temporal bone (petrious portion).
- It is a complex structure. It is located in a bony cavity called the **BONY LABYRINTH** (“maze”).
- It is filled with a fluid called **PERILYMPH**, which is similar to CSF.

The Inner (Internal) Ear

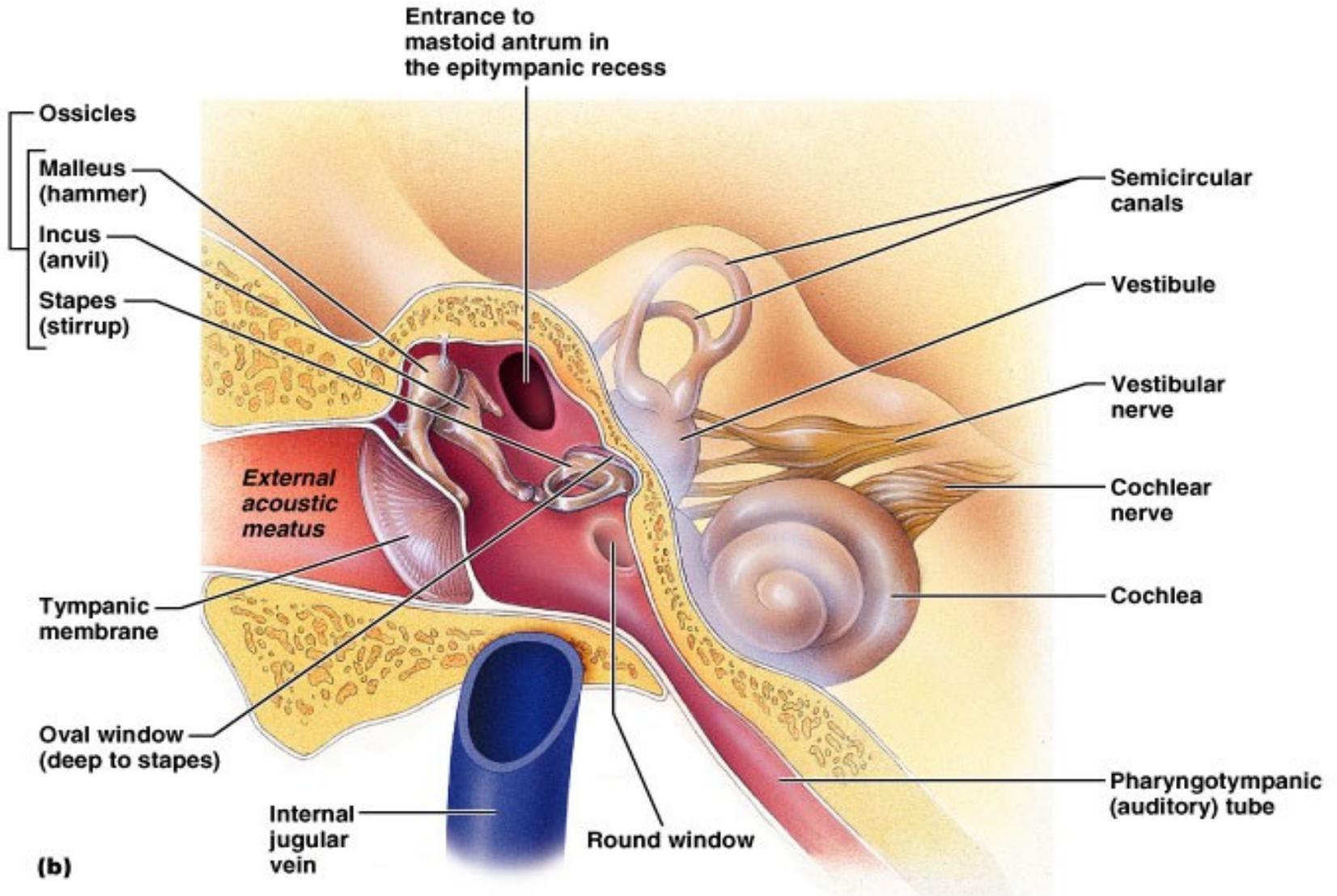
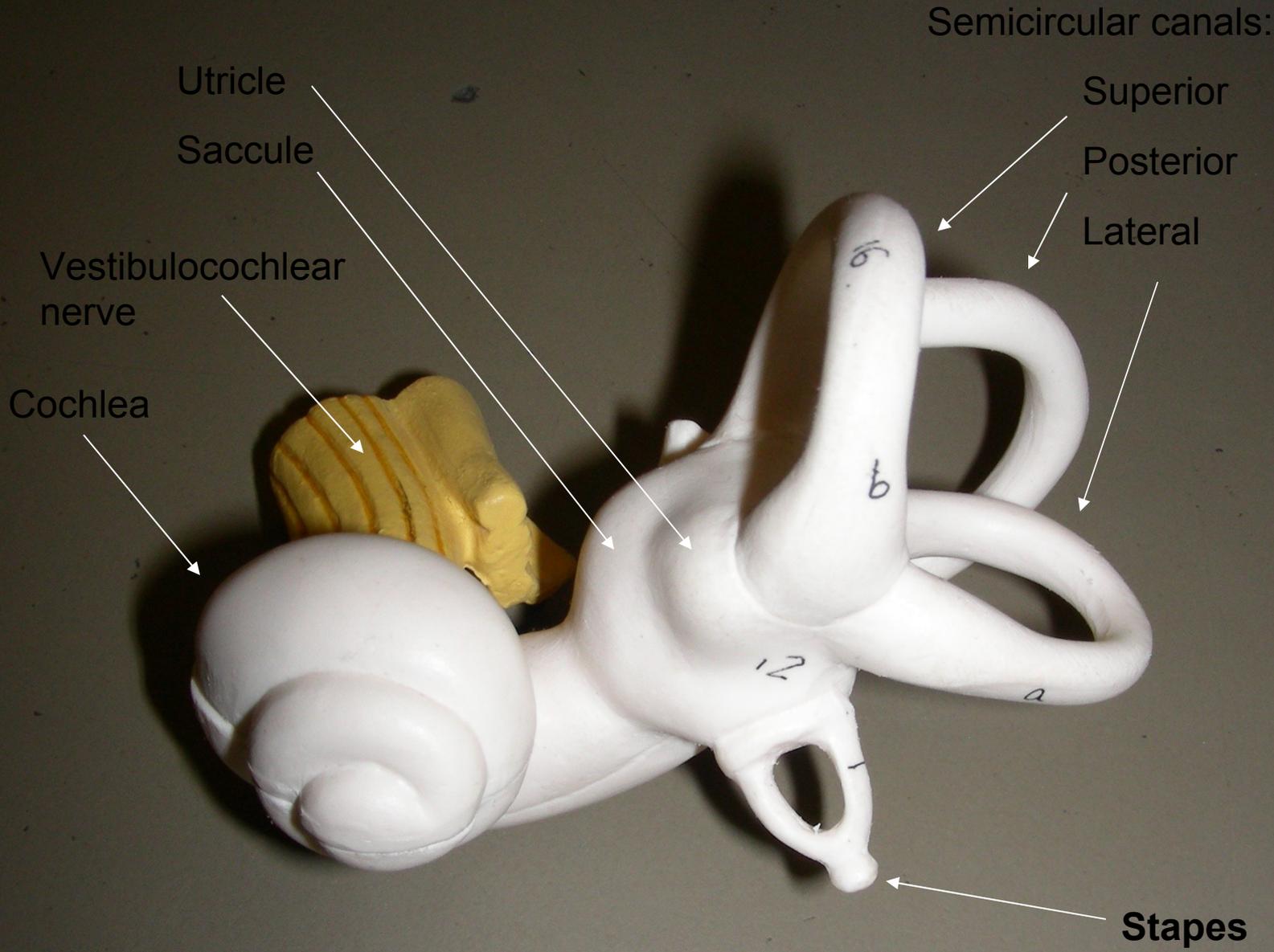


Figure 16.17b

Inner Ear

- Within the bony labyrinth is the **MEMBRANOUS LABYRINTH**, filled with **ENDOLYMPH**.
- One of the membranous structures is the **COCHLEA** (“snail shell”). This is responsible for hearing.
- The other structure is responsible for balance and consists of three parts:
 - Semicircular Canals
 - Utricle
 - Sacculle



Utricle

Saccule

Vestibulocochlear
nerve

Cochlea

Semicircular canals:

Superior

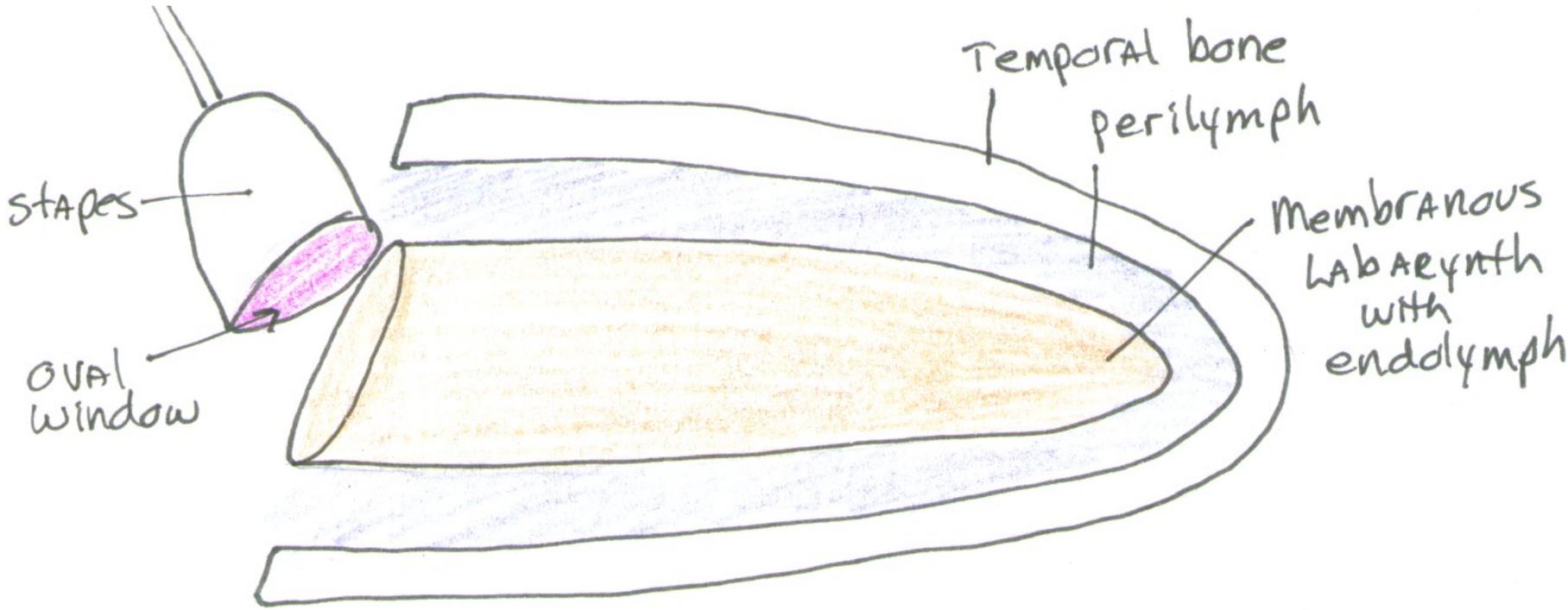
Posterior

Lateral

Stapes

Inner Ear

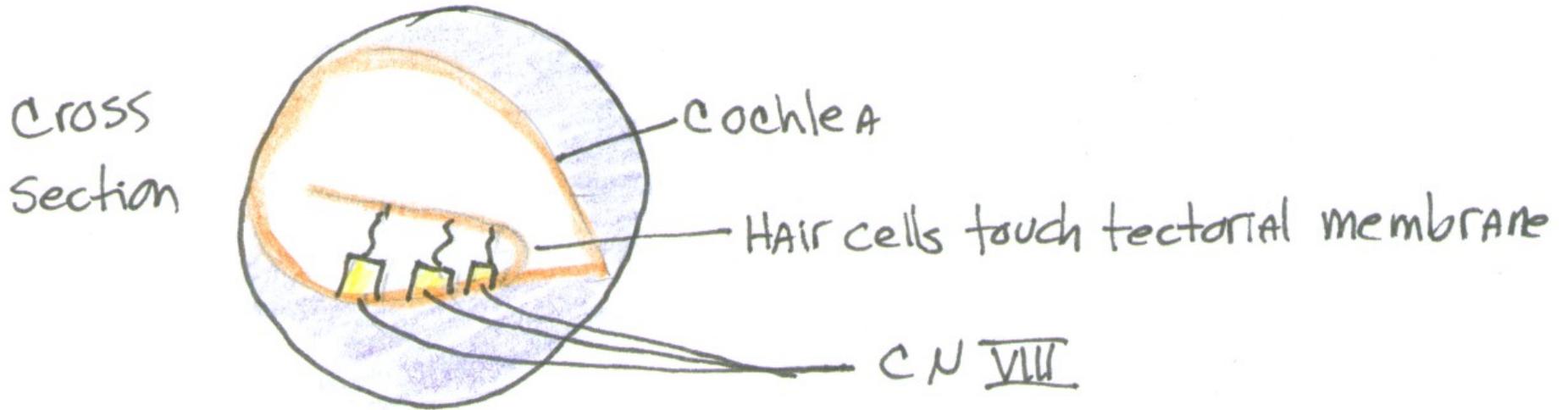
Instead of drawing the cochlea curled up, I've drawn it laying out straight.



Inner Ear: Cochlea

- Inside the cochlea are special neurons called **HAIR CELLS**; their axons form CN VIII.
- The stapes is attached to the **OVAL WINDOW**, and vibrations cause the perilymph to vibrate; the hair cells here transmit this vibration.
- Therefore the **HAIR CELLS** in this region are receptors for **HEARING**.

COCHLEA



Cochlea

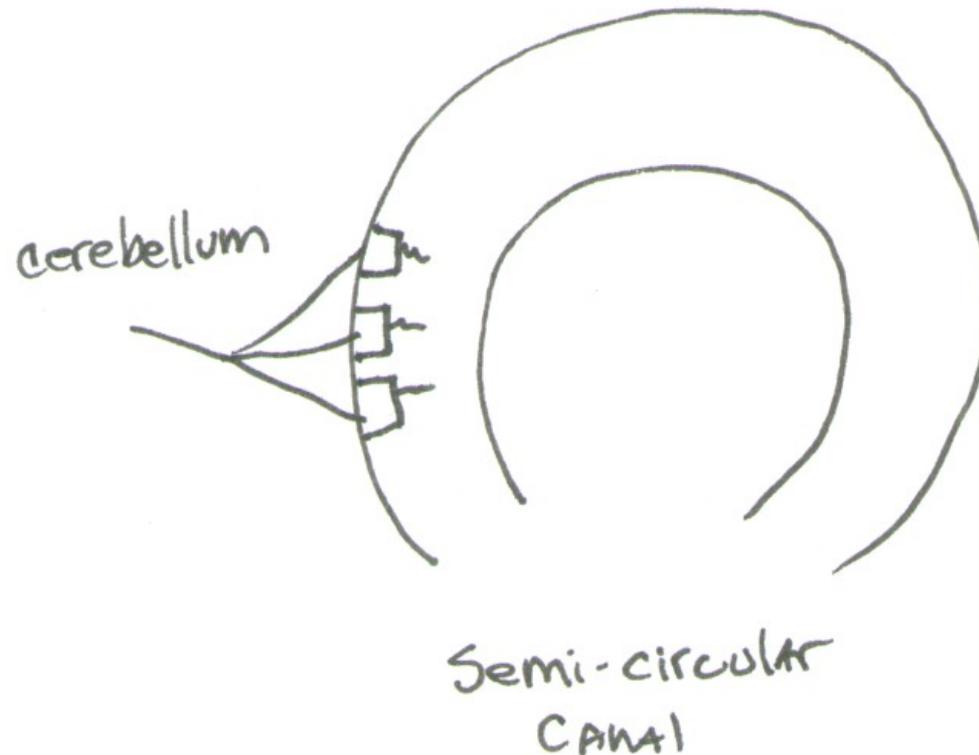
- Low frequencies (like the longer strings of a piano) cause a response in the tip of the cochlea.
- High frequencies cause a response at the larger end of the cochlea.

- The hair cells are connected to CN VIII, the **VESTIBULAR COCHLEAR NERVE**, which takes the signals to the brain.
- Therefore, the cochlea is where the hearing receptors are located, so the cochlea is responsible for all of the hearing of sounds.
- However, the ear does more than just hear; it is also responsible for balance and equilibrium.

VESTIBULAR SYSTEM

- This system regulates balance.
- It is also within the inner ear.
- **SEMI-CIRCULAR CANALS** (Three of them, all in different planes) determine movement in three planes.
- Within each semi-circular canal is endolymph and hair cells, which connect to nerves that go to the cerebellum.

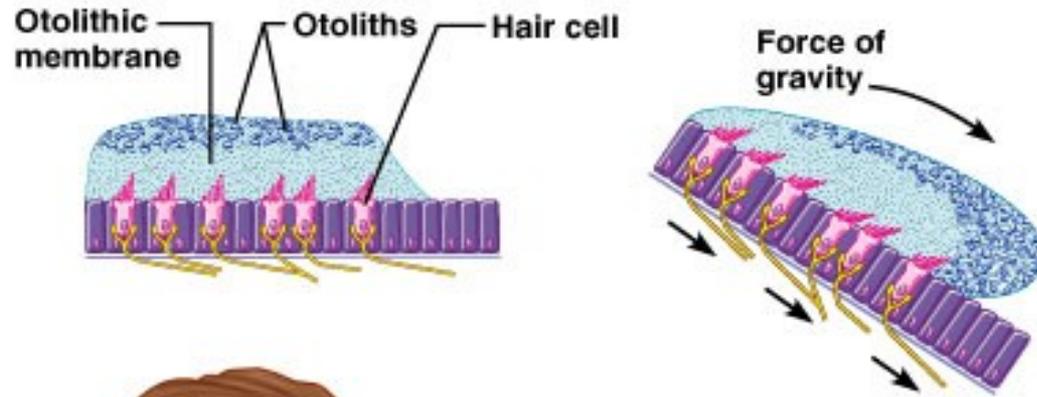
- When you move in one direction, like sliding across the room, the fluid sloshes like a cup of coffee, and it makes the hair cells move.



Utricle and Sacculle

- Attached to the semi-circular canals are two joined structures called the **UTRICLE** and the **SACCULE**.
- These also contain **HAIR CELLS** and **ENDOLYMPH**.
- Within the endolymph here are **OTOLITHS** (“ear rocks”) which are calcium deposits.
- When you stand perfectly upright, these otoliths fall directly down and bend the **HAIR CELLS** (a special type of neuron) on the lower cells. When you tip your head to the side, they will stimulate the hairs on that side.
- The otoliths stimulate the hair cells to tell you what position your head is in and give you a sense of equilibrium.
- Therefore, the **HAIR CELLS** in this region are receptors for equilibrium and the **OTOLITHS** are an essential component of this process.

Anatomy and Function of the Otoliths



Head upright



Head tilted

(b)

Ear Problems

- Inflammation of the semi-circular canals give you a sense of motion when you're not moving = **VERTIGO** (dizziness) or **LABYRINTHITIS**.
- This can be debilitating.
- Sometimes only one canal is affected, so you only get dizzy if you turn your head one way.

