The Meninges

The brain in the skull is surrounded by three protective membranes, or meninges: the dura mater, the arachnoid mater, and the pia mater. (The spinal cord in the vertebral column is also surrounded by three meninges)

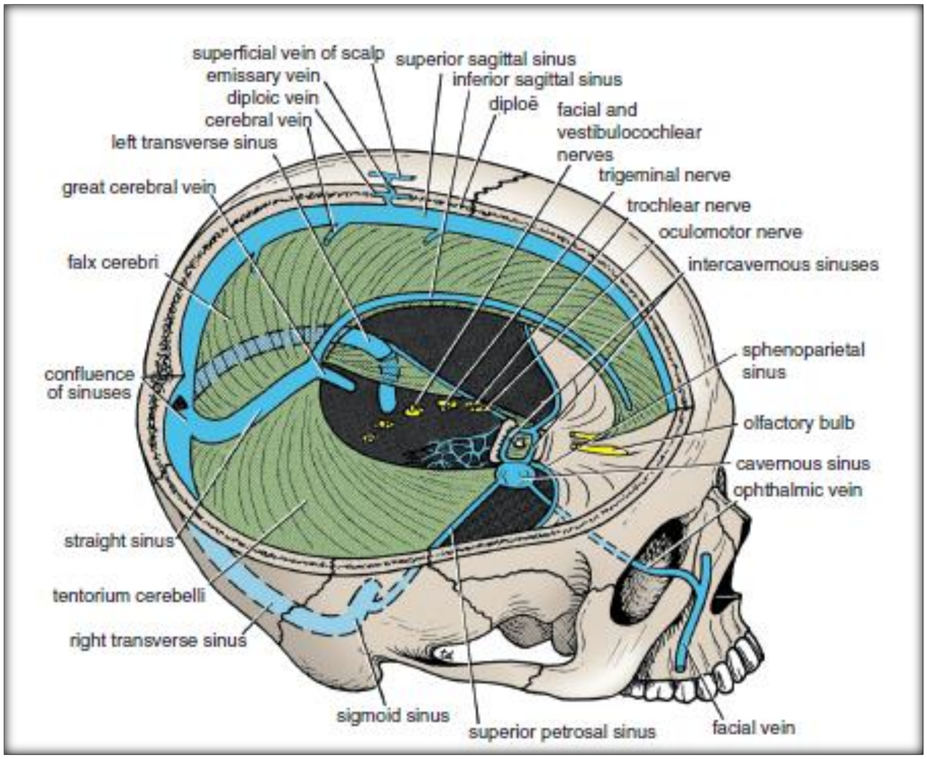
Dura Mater of the Brain

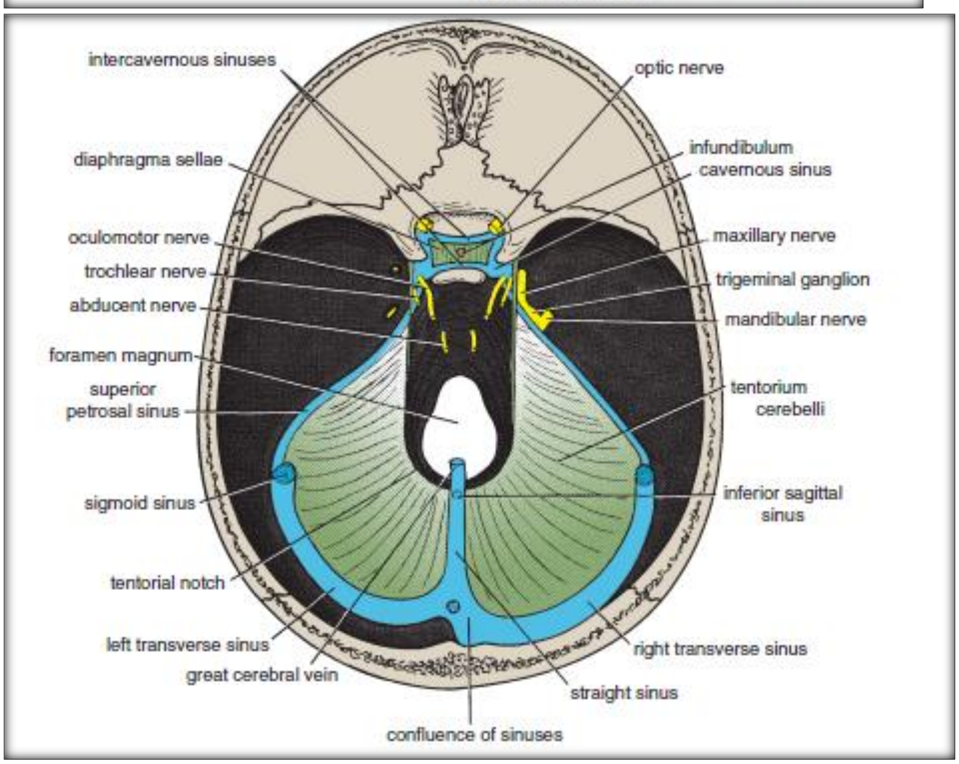
The dura mater is conventionally described as two layers: the endosteal layer and the meningeal layer. These are closely united except along certain lines, where they separate to form venous sinuses. The **endosteal layer** is nothing more than the ordinary periosteum covering the inner surface of the skull bones. **It does not extend** through the foramen magnum to become continuous with the dura mater of the spinal cord. Around the margins of all the foramina in the skull, it becomes continuous with the periosteum on the outside of the skull bones. At the sutures, it is continuous with the sutural ligaments. It is most strongly adherent to the bones over the base of the skull.

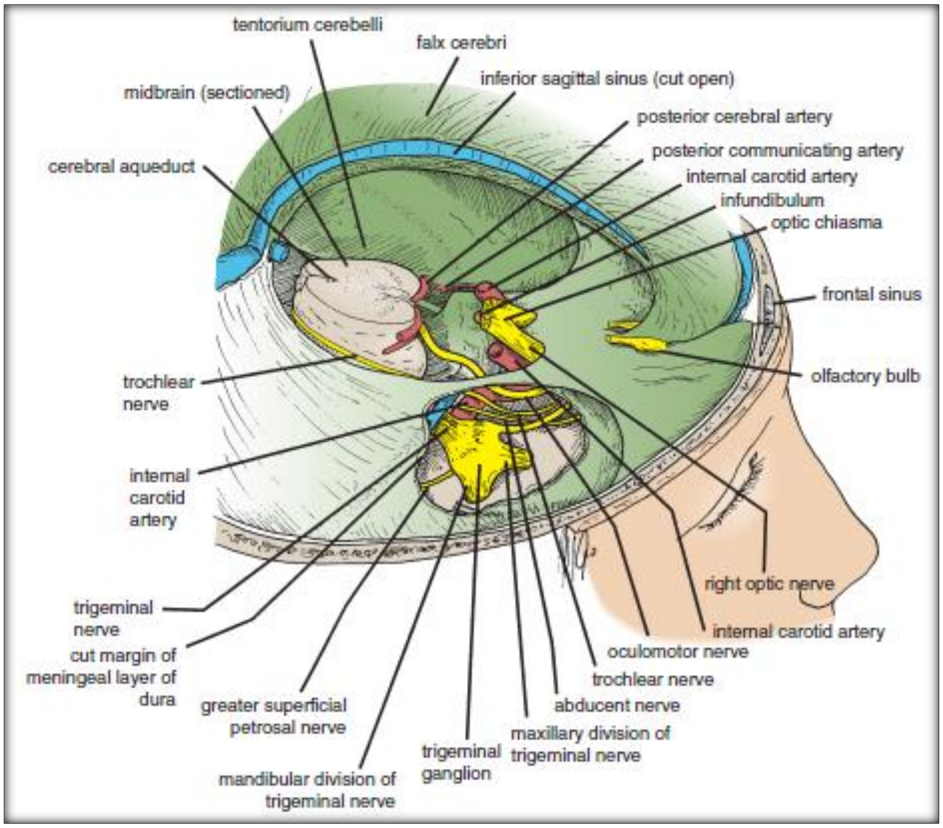
The **meningeal layer** is the dura mater proper. It is a dense, strong, fibrous membrane covering the brain and is continuous through the foramen magnum with the dura mater of the spinal cord. It provides tubular sheaths for the cranial nerves as the latter pass through the foramina in the skull. Outside the skull, the sheaths fuse with the epineurium of the nerves. The meningeal layer sends inward four septa that divide the cranial cavity into freely communicating spaces lodging the subdivisions of the brain. The function of these septa is to restrict the rotatory displacement of the brain.

The **falx cerebri** is a sickle-shaped fold of dura mater that lies in the midline between the two cerebral hemispheres. Its narrow end in front is attached to the internal frontal crest and the crista galli. Its broad posterior part blends in the midline with the upper surface of the tentorium cerebelli. The superior sagittal sinus runs in its upper fixed margin, the inferior sagittal sinus runs in its lower concave free margin, and the straight sinus runs along its attachment to the tentorium cerebelli.

The **tentorium cerebelli** is a crescent-shaped fold of dura mater that roofs over the posterior cranial fossa. It covers the upper surface of the cerebellum and supports the occipital lobes of the cerebral hemispheres. In front is a gap, the **tentorial notch,** for the passage of the midbrain, thus producing an inner free border and an outer attached or fixed border. The fixed border is attached to the posterior clinoid processes, the superior borders of the petrous bones, and the margins of the grooves for the transverse sinuses on the occipital bone. The free border runs forward at its two ends, crosses the attached border, and is affixed to the anterior clinoid process on each side. At the point where the two borders cross, the third and fourth cranial nerves pass forward to enter the lateral wall of the cavernous sinus







Close to the apex of the petrous part of the temporal bone, the lower layer of the tentorium is pouched forward beneath the superior petrosal sinus to form a recess for the trigeminal nerve and the trigeminal ganglion.

The falx cerebri and the falx cerebelli are attached to the upper and lower surfaces of the tentorium, respectively. The straight sinus runs along its attachment to the falx cerebri, the superior petrosal sinus along its attachment to the petrous bone, and the transverse sinus along its attachment to the occipital bone.

The **falx cerebelli** is a small, sickle-shaped fold of dura mater that is attached to the internal occipital crest and projects forward between the two cerebellar hemispheres. Its posterior fixed margin contains the occipital sinus.

The **diaphragma sellae** is a small circular fold of dura mater that forms the roof for the sella turcica. A small opening in its center allows passage of the stalk of the pituitary gland.

Dural Nerve Supply

Branches of the trigeminal, vagus, and first three cervical nerves and branches from the sympathetic system pass to the dura. Numerous sensory endings are in the dura. The dura is sensitive to stretching, which produces the sensation of headache. Stimulation of the sensory endings of the trigeminal nerve above the level of the tentorium cerebelli produces referred pain to an area of skin on the same side of the head. Stimulation of the dural endings below the level of the tentorium produces referred pain to the back of the neck and back of the scalp along the distribution of the greater occipital nerve.

Dural Arterial Supply

Numerous arteries supply the dura mater from the internal carotid, maxillary, ascending pharyngeal, occipital, and vertebral arteries. From a clinical standpoint, the most important is the middle meningeal artery, which is commonly damaged in head injuries.

The **middle meningeal artery** arises from the maxillary artery in the infratemporal fossa. It enters the cranial cavity and runs forward and laterally in a groove on the upper surface of the squamous part of the temporal bone. To enter the cranial cavity, it passes through the foramen spinosum to **lie between the meningeal and endosteal layers of dura.** The anterior (frontal) branch deeply grooves or tunnels the anteroinferior angle of the parietal bone, and its course corresponds roughly to the line of the underlying precentral gyrus of the brain. The posterior (parietal) branch curves backward and supplies the posterior part of the dura mater.

Dural Venous Drainage

The **meningeal veins** lie in the endosteal layer of dura. The middle meningeal vein follows the branches of the middle meningeal artery and drains into the pterygoid venous plexus or the sphenoparietal sinus. The veins lie lateral to the arteries.

Arachnoid Mater of the Brain

The arachnoid mater is a delicate, impermeable membrane covering the brain and lying between the pia mater internally and the dura mater externally. It is separated from the dura by a potential space, the **subdural space,** and from the pia by the **subarachnoid space,** which is filled with **cerebrospinal fluid.**

The arachnoid bridges over the sulci on the surface of the brain, and in certain situations the arachnoid and pia are widely separated to form the **subarachnoid cisternae.**

In certain areas, the arachnoid projects into the venous sinuses to form **arachnoid villi.** The arachnoid villi are most numerous along the superior sagittal sinus. Aggregations of arachnoid villi are referred to as **arachnoid granulations**. Arachnoid villi serve as sites where the cerebrospinal fluid diffuses into the bloodstream.

It is important to remember that structures passing to and from the brain to the skull or its foramina must pass

through the subarachnoid space. All the cerebral arteries and veins lie in the space, as do the cranial nerves. The arachnoid fuses with the epineurium of the nerves at their point of exit from the skull. In the case of the optic nerve, the arachnoid forms a sheath for the nerve that extends into the orbital cavity through the optic canal and fuses with the sclera of the eyeball. Thus, the subarachnoid space extends around the optic nerve as far as the eyeball.

The **cerebrospinal fluid** is produced by the **choroid plexuses** within the lateral, third, and fourth ventricles of the brain. It escapes from the ventricular system of the brain through the three foramina in the roof of the fourth ventricle and so enters the subarachnoid space. It now circulates both upward over the surfaces of the cerebral hemispheres and downward around the spinal cord. The spinal subarachnoid space extends down as far as the **second sacral vertebra**. Eventually, the fluid enters the bloodstream by passing into the arachnoid villi and diffusing through their walls.

In addition to removing waste products associated with neuronal activity, the cerebrospinal fluid provides a fluid medium in which the brain floats. This mechanism effectively protects the brain from trauma.

Pia Mater of the Brain

The pia mater is a vascular membrane that closely invests the brain, covering the gyri and descending into the deepest sulci. It extends over the cranial nerves and fuses with their epineurium. The cerebral arteries entering the substance of the brain carry a sheath of pia with them.

The Venous Blood Sinuses

The venous sinuses of the cranial cavity are blood-filled spaces situated between the layers of the dura mater; they are lined by endothelium. Their walls are thick and composed of fibrous tissue; they have no muscular tissue. The sinuses have no valves. They receive tributaries from the brain, the diploë of the skull, the orbit, and the internal ear.

The **superior sagittal sinus** lies in the upper fixed border of the falx cerebri. It runs backward and becomes continuous with the right transverse sinus. The sinus communicates on each side with the **venous lacunae.** Numerous arachnoid villi and granulations project into the lacunae. The superior sagittal sinus receives the **superior cerebral veins.**

The **inferior sagittal sinus** lies in the free lower margin of the falx cerebri. It runs backward and joins the great cerebral vein to form the straight sinus. It receives cerebral veins from the medial surface of the cerebral hemisphere.

The **straight sinus** lies at the junction of the falx cerebri with the tentorium cerebelli. Formed by the union of the inferior sagittal sinus with the great cerebral vein, it drains into the left transverse sinus.

The **right transverse sinus** begins as a continuation of the superior sagittal sinus; the **left transverse sinus** is usually a continuation of the straight sinus. Each sinus lies in the lateral attached margin of the tentorium cerebelli, and they end on each side by becoming the sigmoid sinus.

The **sigmoid sinuses** are a direct continuation of the transverse sinuses. Each sinus turns downward behind the mastoid antrum of the temporal bone and then leaves the skull through the jugular foramen to become the internal jugular vein.

The **occipital sinus** lies in the attached margin of the falx cerebelli. It communicates with the vertebral veins through the foramen magnum and the transverse sinuses.

Each **cavernous sinus** lies on the lateral side of the body of the sphenoid bone. Anteriorly, the sinus receives the inferior ophthalmic vein and the central vein of the retina. The sinus drains posteriorly into the transverse sinus through the superior petrosal sinus. Intercavernous sinuses connect the two cavernous sinuses through the sella turcica.(see figures above)

Important Structures Associated with the Cavernous Sinuses

- The internal carotid artery and the 6th cranial nerve, which travel through it
- In the lateral wall, the 3rd and 4th cranial nerves, and the ophthalmic and maxillary divisions of the 5th cranial nerve.
- The pituitary gland, which lies medially in the sella turcica
- The veins of the face, which are connected with the cavernous sinus via the facial vein and inferior ophthalmic vein, are an important route for the spread of infection from the face
- The **superior** and **inferior petrosal sinuses,** which run along the upper and lower borders of the petrous part of the temporal bone

Pituitary Gland (Hypophysis Cerebri)

The pituitary gland is a small, oval structure attached to the undersurface of the brain by the **infundibulum**. The gland is well protected by virtue of its location in the sella turcica of the sphenoid bone. The pituitary gland is vital to life and well described later.

References :

1- Snell, Richard S. Clinical anatomy by regions. Lippincott Williams & Wilkins, 2011.

2- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.

Lecture 5 **The Brain** **second stage**

د.أحمد جسام النقيب

The brain is that part of the central nervous system that lies inside the cranial cavity. It is continuous with the spinal cord through the foramen magnum.

Major Parts of the Brain		Cavities of the Brain
Forebrain	Cerebrum	Right and left lateral ventricles
	Diencephalon	Third ventricle
Midbrain		Cerebral aqueduct
Hindbrain	Pons Medullaoblongata Cerebellum	Fourth ventricle and central canal

Cerebrum

The **cerebrum** is the largest part of the brain and consists of two **cerebral hemispheres** connected by a mass of white matter called the **corpus callosum**.

Each hemisphere extends from the frontal to the occipital bones; above the anterior and middle cranial fossae; and, posteriorly, above the tentorium cerebelli. The hemispheres are separated by a deep cleft, the **longitudinal fissure**, into which projects the **falx cerebri**.

The surface layer of each hemisphere is called the **cortex** and is composed of **gray matter**. The cerebral cortex is thrown into folds, or **gyri,** separated by fissures, **or sulci.** By this means, the surface area of the cortex is greatly increased. Several of the large sulci conveniently subdivide the surface of each hemisphere into **lobes.** The lobes are named for the bones of the cranium under which they lie.

The **frontal lobe** is situated in front of the **central sulcus** and above the **lateral sulcus.** The **parietal lobe** is situated behind the central sulcus and above the lateral sulcus. The **occipital lobe** lies below the **parietooccipital sulcus.** Below the lateral sulcus is situated the **temporal lobe.**

The **precentral gyrus** lies immediately anterior to the central sulcus and is known as the **motor area**. The large motor nerve cells in this area control voluntary movements on the opposite side of the body. Most nerve fibers cross over to the opposite side in the medulla oblongata as they descend to the spinal cord.

In the motor area, the body is represented in an inverted position, with the nerve cells controlling the movements of the feet located in the upper part and those controlling the movements of the face and hands in the lower part.

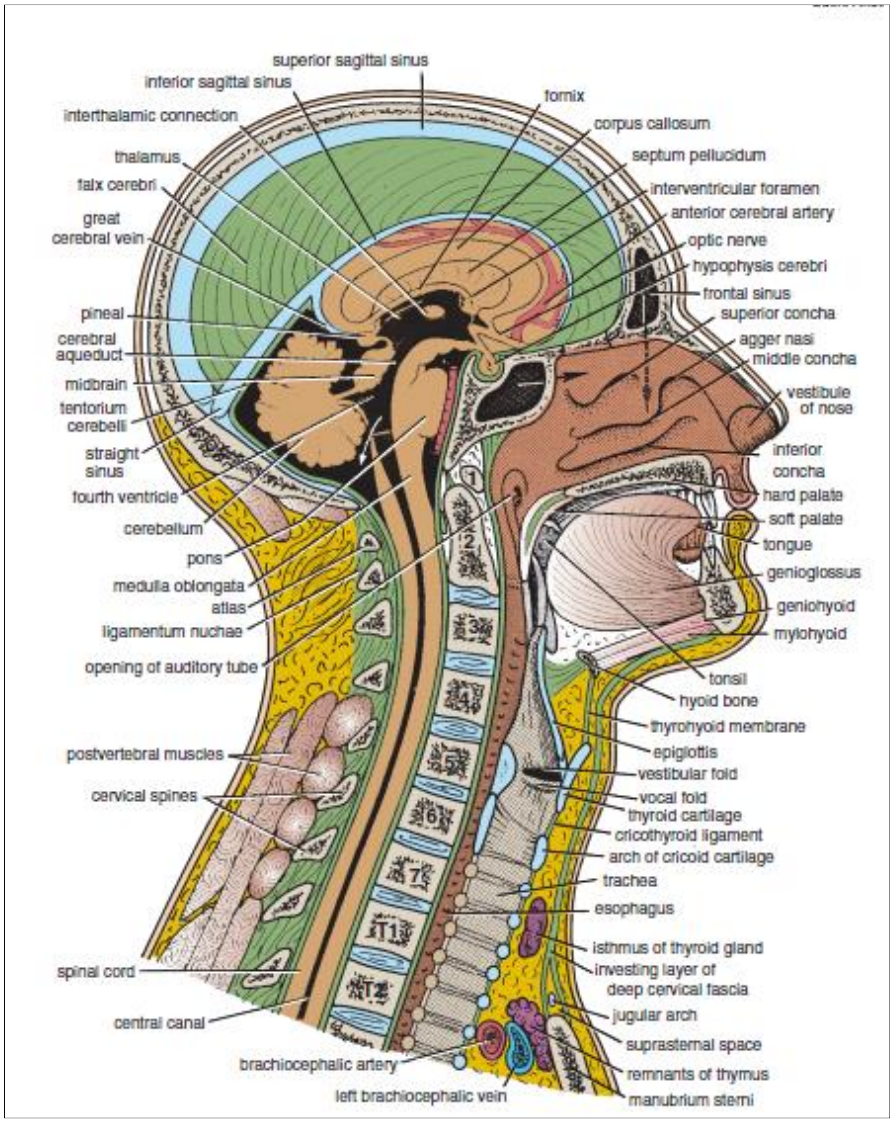
The **postcentral gyrus** lies immediately posterior to the central sulcus and is known as the **sensory area**. The small nerve cells in this area receive and interpret sensations of pain, temperature, touch, and pressure from the opposite side of the body.

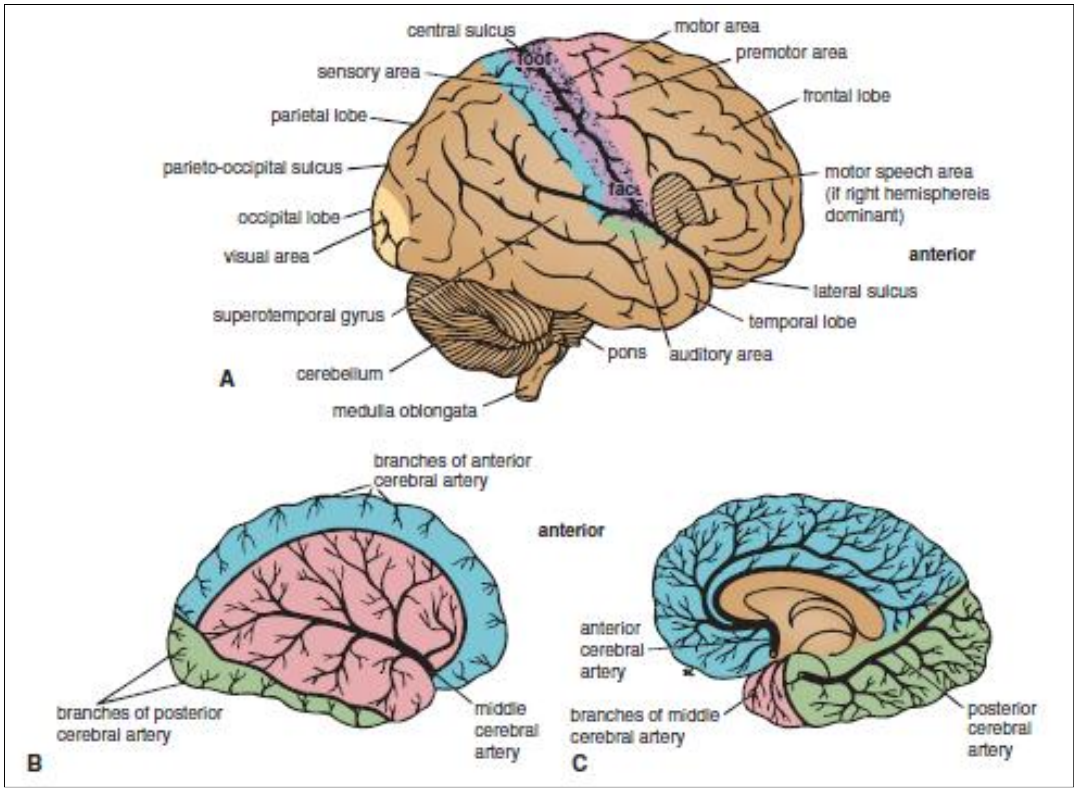
The **superior temporal gyrus** lies immediately below the lateral sulcus. The middle of this gyrus is concerned with the reception and interpretation of sound and is known as the **auditory area.**

Broca's area, or the **motor speech area,** lies just above the lateral sulcus. It controls the movements employed in speech. It is dominant in the left hemisphere in right-handed persons and in the right hemisphere in left-handed persons.

The **visual area** is situated on the posterior pole and medial aspect of the cerebral hemisphere in the region of the **calcarine sulcus**. It is the receiving area for visual impressions.

The cavity present within each cerebral hemisphere is called the **lateral ventricle.** The lateral ventricle communicate with the third ventricle through the **interventricular foramina.**





Diencephalon

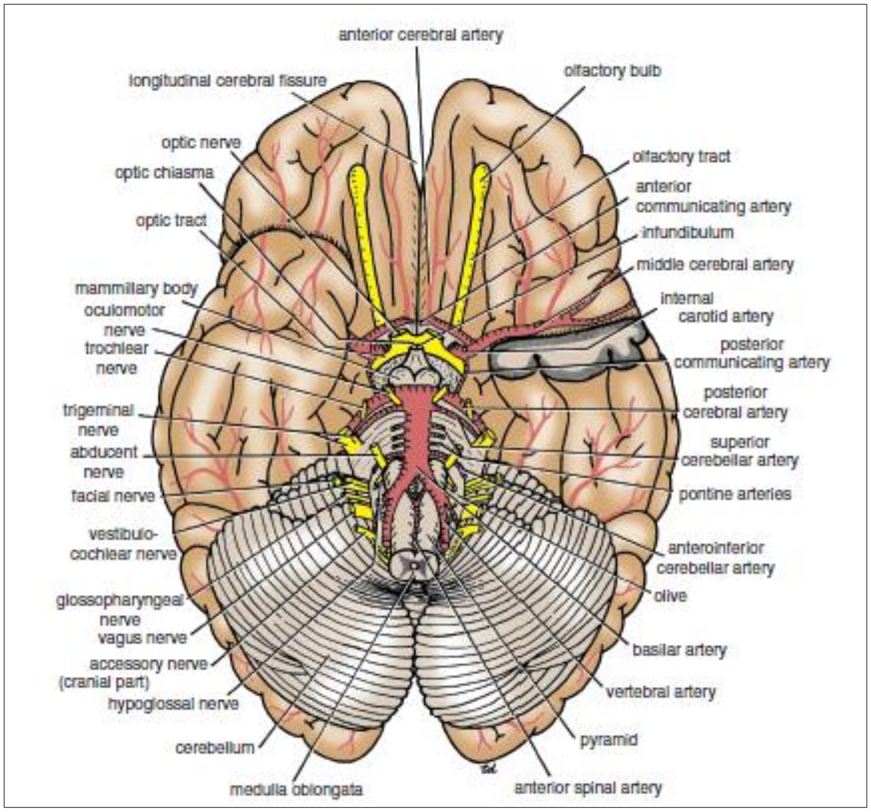
The diencephalon is almost completely hidden from the surface of the brain. It consists of a dorsal **thalamus** and a ventral **hypothalamus.** The thalamus is a large mass of gray matter that lies on either side of the third ventricle. It is the great relay station on the afferent sensory pathway to the cerebral cortex. The hypothalamus forms the lower part of the lateral wall and floor of the third ventricle. The following structures are found in the floor of the third ventricle from before backward: the **optic chiasma**, the **tuber cinereum** and the **infundibulum,** the **mammillary bodies,** and the **posterior perforated substance.**

Midbrain

The midbrain is the narrow part of the brain that passes through the tentorial notch and connects the forebrain to the hindbrain.

The midbrain comprises two lateral halves called the **cerebral peduncles;** each of these is divided into an anterior part, the **crus cerebri;** and a posterior part, the **tegmentum,** by a pigmented band of gray matter, the **substantia nigra**. The narrow cavity of the midbrain is the **cerebral aqueduct,** which connects the third and fourth ventricles. The **tectum** is the part of the midbrain posterior to the cerebral aqueduct; it has four small surface swellings, namely, the **two superior** and **two inferior colliculi.**

The colliculi are deeply placed between the cerebellum and the cerebral hemispheres. The **pineal body** is a small glandular structure that lies between the superior colliculi. It is attached by a stalk to the region of the posterior wall of the third ventricle. The pineal commonly calcifies in middle age, and thus it can be visualized on radiographs.



Hindbrain

The **pons** is situated on the anterior surface of the cerebellum below the midbrain and above the medulla oblongata. It is composed mainly of nerve fibers, which connect the two halves of the cerebellum. It also contains ascending and descending fibers connecting the forebrain, the midbrain, and the spinal cord. Some of the nerve cells within the pons serve as relay stations, whereas others form cranial nerve nuclei.

The **medulla oblongata** is conical in shape and connects the pons above to the spinal cord below. A **median fissure** is present on the anterior surface of the medulla, and on each side of this is a swelling called the **pyramid**. The pyramids are composed of bundles of nerve fibers that originate in large nerve cells in the precentral gyrus of the cerebral cortex. The pyramids taper below, and here most of the descending fibers cross over to the opposite side, forming the **decussation of the pyramids.**

Posterior to the pyramids are the **olives,** which are oval elevations produced by the underlying **olivary nuclei**. Behind the olives are the **inferior cerebellar peduncles,** which connect the medulla to the cerebellum.

On the posterior surface of the inferior part of the medulla oblongata are the **gracile** and **cuneate tubercles,** produced by the medially placed underlying **nucleus gracilis** and the laterally placed underlying **nucleus cuneatus.**

The **cerebellum** lies within the posterior cranial fossa beneath the tentorium cerebelli. It is situated posterior to the pons and the medulla oblongata. It consists of two hemispheres connected by a median portion, the **vermis.** The cerebellum is connected to the midbrain by the **superior cerebellar peduncles,** to the pons by the **middle cerebellar peduncles,** and to the medulla by the **inferior cerebellar peduncles.**

The surface layer of each cerebellar hemisphere, called the **cortex,** is composed of gray matter. The cerebellar cortex is thrown into folds, or **folia,** separated by closely set transverse fissures. Certain masses of gray matter are found in the interior of the cerebellum, embedded in the white matter; the largest of these is known as the **dentate nucleus.**

The cerebellum plays an important role in the control of muscle tone and the coordination of muscle movement on the same side of the body.

The cavity of the hindbrain is the fourth ventricle. This is bounded in front by the pons and the medulla oblongata and behind by the **superior** and **inferior medullary vela** and the cerebellum. The fourth ventricle is connected above to the third ventricle by the cerebral aqueduct, and below it is continuous with the central canal of the spinal cord. It communicates with the subarachnoid space through three openings in the lower part of the roof: a median and two lateral openings.

Ventricles of the Brain

The ventricles of the brain consist of the two lateral ventricles, the third ventricle, and the fourth ventricle. The two **lateral ventricles** communicate with the **third ventricle** through the **interventricular foramina**; the third ventricle communicates with the fourth ventricle by the **cerebral aqueduct.** The fourth ventricle, in turn, is continuous with the narrow **central canal** of the spinal cord and, through the three foramina in its roof, with the subarachnoid space. The ventricles are filled with cerebrospinal fluid, which is produced by the **choroid plexuses** of the two lateral ventricles, the third ventricle, and the fourth ventricle. The size and shape of the cerebral ventricles may be visualized clinically using computed tomography (CT) scans and magnetic resonance imaging (MRI).

Blood Supply of the Brain

Arteries of the Brain

The brain is supplied by the two internal carotid and the two vertebral arteries. The four arteries anastomose on the inferior surface of the brain and form the **circle of Willis** (circulus arteriosus).

Veins of the Brain

The veins of the brain have no muscular tissue in their thin walls, and they possess no valves. They emerge from the brain and drain into the cranial venous sinuses.
Cerebral and cerebellar veins and veins of the brainstem are present. The **great cerebral vein** is formed by the union of the two **internal cerebral veins** and drains into the straight sinus.

The Cranial Nerves in the Cranial Cavity

The 12 pairs of cranial nerves are named as follows:
I. Olfactory (sensory)
II. Optic (sensory)
III. Oculomotor (motor)
IV. Trochlear (motor)
V. Trigeminal (mixed)
VI. Abducent (motor)
VII. Facial (mixed)
VIII. Vestibulocochlear (sensory)
IX. Glossopharyngeal (mixed)
X. Vagus (mixed)
XI. Accessory (motor)
XII. Hypoglossal (motor)

The nerves emerge from the brain and are transmitted through foramina and fissures in the base of the skull. All the nerves are distributed in the head and neck except the vagus, which also supplies structures in the thorax and abdomen. The 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.

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1- Snell, Richard S. Clinical anatomy by regions. Lippincott Williams & Wilkins, 2011.
2- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.

Lecture 6 **The Orbit** **second stage**

د.أحمد جسام النقيب

The Orbital Region

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

Eyelids

The eyelids protect the eye from injury and excessive light by their closure. The upper eyelid is larger and more mobile than the lower, and they meet each other at the **medial** and **lateral angles.** The **palpebral fissure** is the elliptical opening between the eyelids and is the entrance into the conjunctival sac. When the eye is closed, the upper eyelid completely covers the cornea of the eye. When the eye is open and looking straight ahead, the upper lid just covers the upper margin of the cornea. The lower lid lies just below the cornea when the eye is open and rises only slightly when the eye is closed.

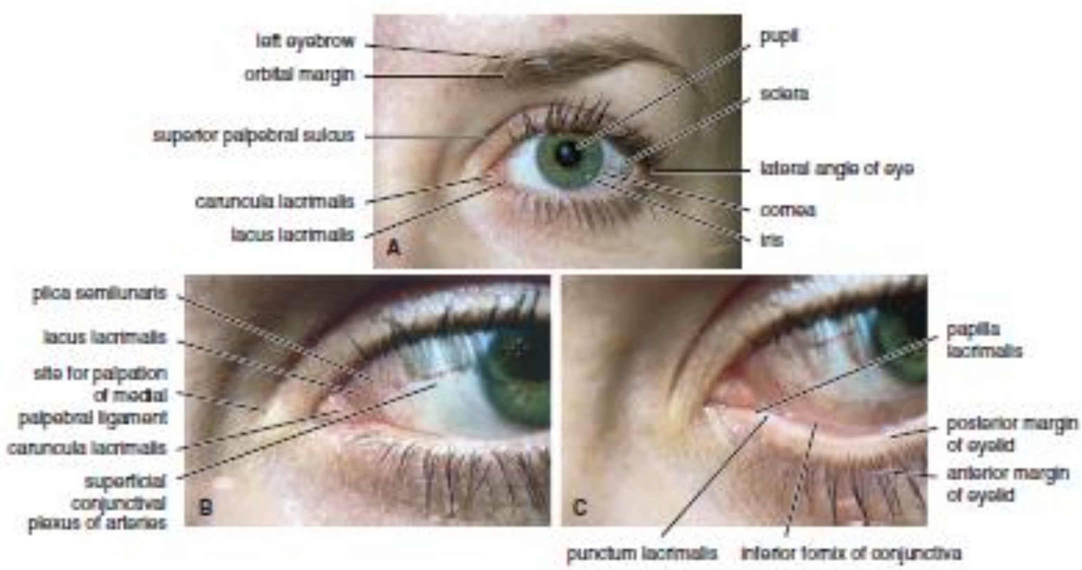
The superficial surface of the eyelids is covered by skin, and the deep surface is covered by a mucous membrane called the **conjunctiva.** The **eyelashes** are short, curved hairs on the free edges of the eyelids. They are arranged in double or triple rows at the mucocutaneous junction. The sebaceous glands (glands of Zeis) open directly into the eyelash follicles. The **ciliary glands** (glands of Moll) are modified sweat glands that open separately between adjacent lashes. The **tarsal glands** are long, modified sebaceous glands that pour their oily secretion onto the margin of the lid; their openings lie behind the eyelashes. This oily material prevents the overflow of tears and helps make the closed eyelids airtight.

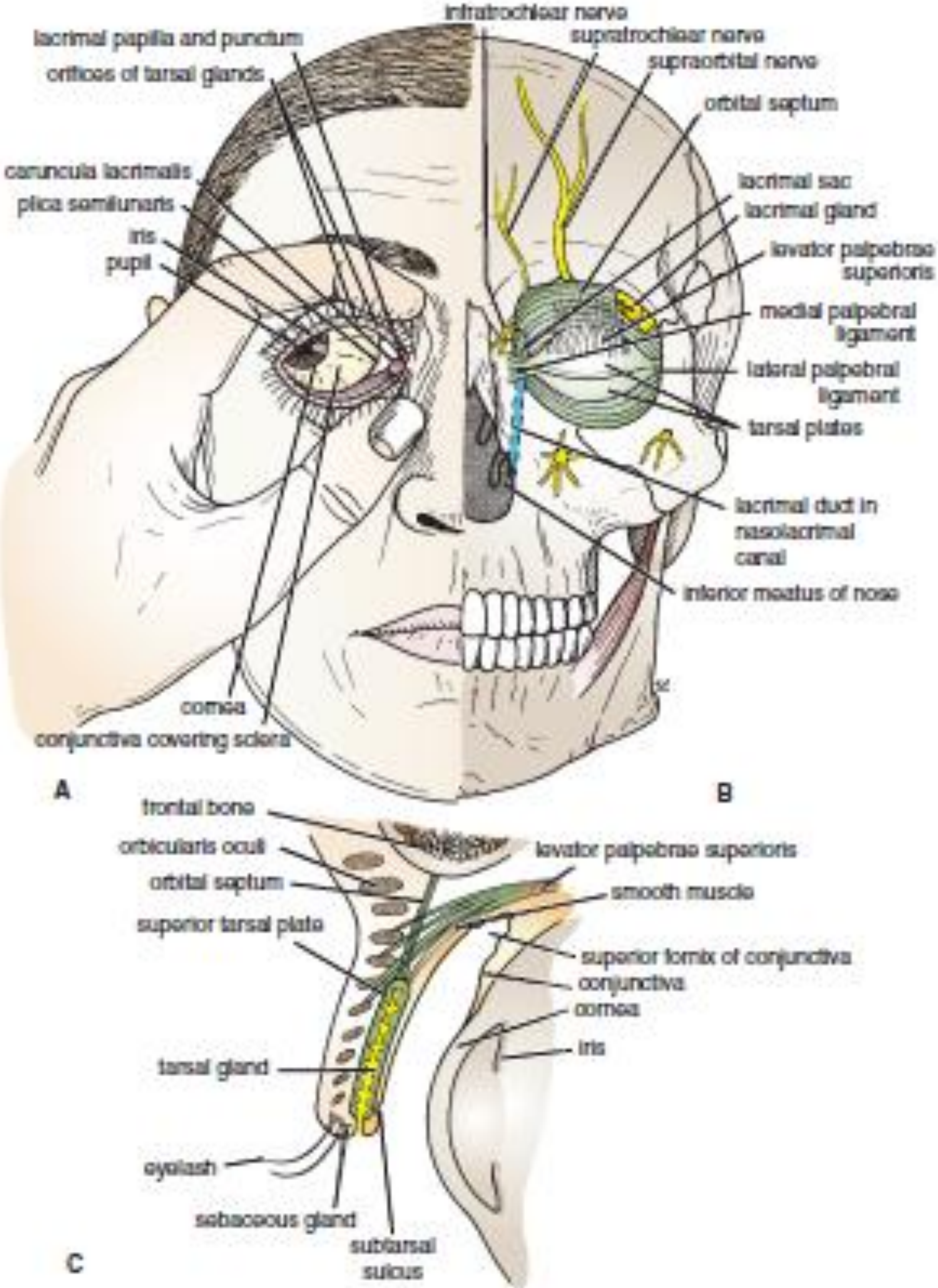
The more rounded medial angle is separated from the eyeball by a small space, the **lacus lacrimalis,** in the center of which is a small, reddish yellow elevation, the **caruncula lacrimalis**. A reddish semilunar fold, called the **plica semilunaris,** lies on the lateral side of the caruncle.

Near the medial angle of the eye a small elevation, the **papilla lacrimalis,** is present. On the summit of the papilla is a small hole, the **punctum lacrimale,** which leads into the **canaliculus lacrimalis**. The papilla lacrimalis projects into the lacus, and the punctum and canaliculus carry tears down into the nose.

The **conjunctiva** is a thin mucous membrane that lines the eyelids and is reflected at **the superior** and **inferior fornices** onto the anterior surface of the eyeball. Its epithelium is continuous with that of the cornea. The upper lateral part of the superior fornix is pierced by the ducts of the lacrimal gland. The conjunctiva thus forms a potential space, the **conjunctival sac,** which is open at the **palpebral fissure.** Beneath the eyelid is a groove, the **subtarsal sulcus,** which runs close to and parallel with the margin of the lid. The sulcus tends to trap small foreign particles introduced into the conjunctival sac and is thus clinically important.

The framework of the eyelids is formed by a fibrous sheet, the **orbital septum.** This is attached to the periosteum at the orbital margins. The orbital septum is thickened at the margins of the lids to form the superior and inferior **tarsal plates.** The lateral ends of the plates are attached by a band, the **lateral palpebral ligament,** to a bony tubercle just within the orbital margin. The medial ends of the plates are attached by a band, the **medial palpebral ligament,** to the crest of the lacrimal bone. The tarsal glands are embedded in the posterior surface of the tarsal plates. The superficial surface of the tarsal plates and the orbital septum are covered by the palpebral fibers of the **orbicularis oculi muscle**. The aponeurosis of insertion of the **levator palpebrae superioris muscle** pierces the orbital septum to reach the anterior surface of the superior tarsal plate and the skin.




infratrochlear nerve
lacrimal papilla and punctum
supratrochlear nerve
supraorbital nerve
orifices of tarsal glands
orbital septum
caruncula lacrimalis
plica semilunaris
iris
pupil
lacrimal sac
lacrimal gland
levator palpebrae superioris
medial palpebral ligament
lateral palpebral ligament
tarsal plates
lacrimal duct in nasolacrimal canal
inferior meatus of nose
cornea
conjunctiva covering sclera
A
B
frontal bone
orbicularis oculi
orbital septum
superior tarsal plate
levator palpebrae superioris
smooth muscle
superior fornix of conjunctiva
conjunctiva
cornea
iris
tarsal gland
eyelash
sebaceous gland
subtarsal sulcus
C

Movements of the Eyelids

The position of the eyelids at rest depends on the tone of the **orbicularis oculi** and the **levator palpebrae superioris muscles** and the position of the eyeball. The eyelids are closed by the contraction of the orbicularis oculi and the relaxation of the levator palpebrae superioris muscles. The eye is opened by the levator palpebrae superioris raising the upper lid. On looking upward, the levator palpebrae superioris contracts, and the upper lid moves with the eyeball. On looking downward, both lids move, the upper lid continues to cover the upper part of the cornea, and the lower lid is pulled downward slightly by the conjunctiva, which is attached to the sclera and the lower lid.

TABLE 11.2 Muscles of the Eyeball and Eyelids

Muscle	Origin	Insertion	Nerve Supply	Action
Extrinsic Muscles of Eyeball (Striated Skeletal Muscle)				
Superior rectus	Tendinous ring on posterior wall of orbital cavity	Superior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Raises cornea upward and medially
Inferior rectus	Tendinous ring on posterior wall of orbital cavity	Inferior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Depresses cornea downward and medially
Medial rectus	Tendinous ring on posterior wall of orbital cavity	Medial surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks medially
Lateral rectus	Tendinous ring on posterior wall of orbital cavity	Lateral surface of eyeball just posterior to corneoscleral junction	Abducent nerve (6th cranial nerve)	Rotates eyeball so that cornea looks laterally
Superior oblique	Posterior wall of orbital cavity	Passes through pulley and is attached to superior surface of eyeball beneath superior rectus	Trochlear nerve (4th cranial nerve)	Rotates eyeball so that cornea looks downward and laterally
Inferior oblique	Floor of orbital cavity	Lateral surface of eyeball deep to lateral rectus	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks upward and laterally
Intrinsic Muscles of Eyeball (Smooth Muscle)				
Sphincter pupillae of iris			Parasympathetic via oculomotor nerve	Constricts pupil
Dilator pupillae of iris			Sympathetic	Dilates pupil
Ciliary muscle			Parasympathetic via oculomotor nerve	Controls shape of lens; in accommodation, makes lens more globular
Muscles of Eyelids				
Orbicularis oculi (see Table 11.4)				
Levator palpebrae superioris	Back of orbital cavity	Anterior surface and upper margin of superior tarsal plate	Striated muscle oculomotor nerve, smooth muscle sympathetic	Raises upper lid

Lacrimal Apparatus

Lacrimal Gland

The lacrimal gland consists of a large **orbital part** and a small **palpebral part,** which are continuous with each other around the lateral edge of the aponeurosis of the levator palpebrae superioris. It is situated above the eyeball in the anterior and upper part of the orbit posterior to the orbital septum. The gland opens into the lateral part of the superior fornix of the conjunctiva by 12 ducts.

The **parasympathetic secretomotor nerve supply** is derived from the **lacrimal nucleus** of the facial nerve. The preganglionic fibers reach the pterygopalatine ganglion (sphenopalatine ganglion) via the nervus intermedius and its great petrosal branch and via the nerve of the pterygoid canal. The postganglionic fibers leave the ganglion and join the maxillary nerve. They then pass into its zygomatic branch and the zygomaticotemporal nerve. They reach the lacrimal gland within the lacrimal nerve.

The **sympathetic postganglionic nerve supply** is from the internal carotid plexus and travels in the deep petrosal nerve, the nerve of the pterygoid canal, the maxillary nerve, the zygomatic nerve, the zygomaticotemporal nerve, and finally the lacrimal nerve.

Lacrimal Ducts

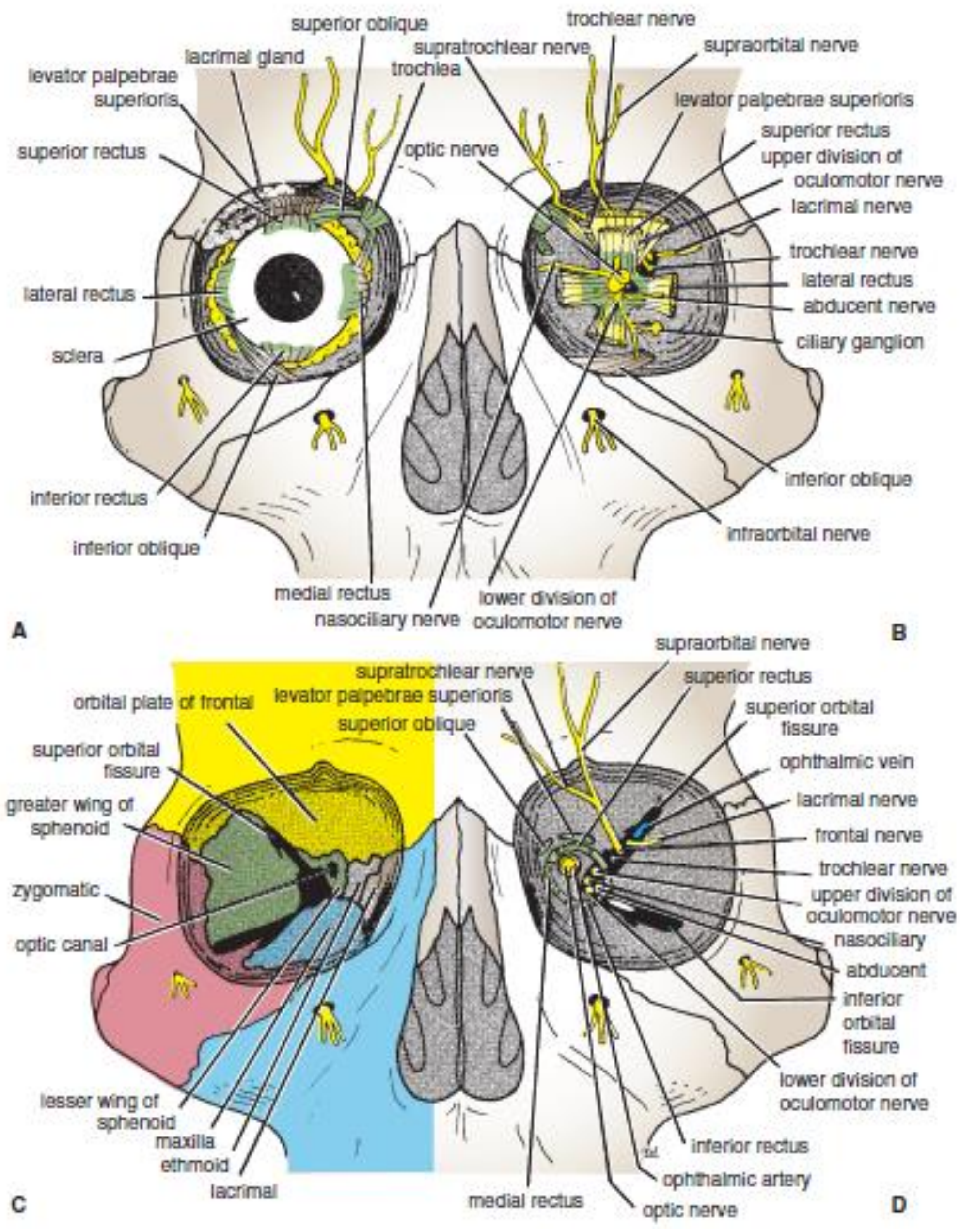
The tears circulate across the cornea and accumulate in the **lacus lacrimalis.** From here, the tears enter the **canaliculi lacrimales** through the **puncta lacrimalis.** The canaliculi lacrimales pass medially and open into the **lacrimal sac** which lies in the lacrimal groove behind the medial palpebral ligament and is the upper blind end of the nasolacrimal duct.

The **nasolacrimal duct** is about 0.5 in. (1.3 cm) long and emerges from the lower end of the lacrimal sac. The duct descends downward, backward, and laterally in a bony canal and opens into the inferior meatus of the nose. The opening is guarded by a fold of mucous membrane known as the **lacrimal fold.** This prevents air from being forced up the duct into the lacrimal sac on blowing the nose.

The Orbit

Description

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 plate of the frontal bone, which separates the orbital cavity from the anterior cranial fossa and the frontal lobe of the cerebral hemisphere. **Lateral wall:** Formed by the zygomatic bone and the greater wing of the sphenoid **Floor:** Formed by the orbital plate of the maxilla, which separates the orbital cavity from the maxillary sinus. **Medial wall:** Formed from before backward by the frontal process of the maxilla, the lacrimal bone, the orbital plate of the ethmoid (which separates the orbital cavity from the ethmoid sinuses), and the body of the sphenoid.

Openings into the Orbital Cavity

The openings into the orbital cavity are:

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

Supraorbital notch (Foramen): The supraorbital notch is situated on the superior orbital margin. It transmits the supraorbital nerve and blood vessels.

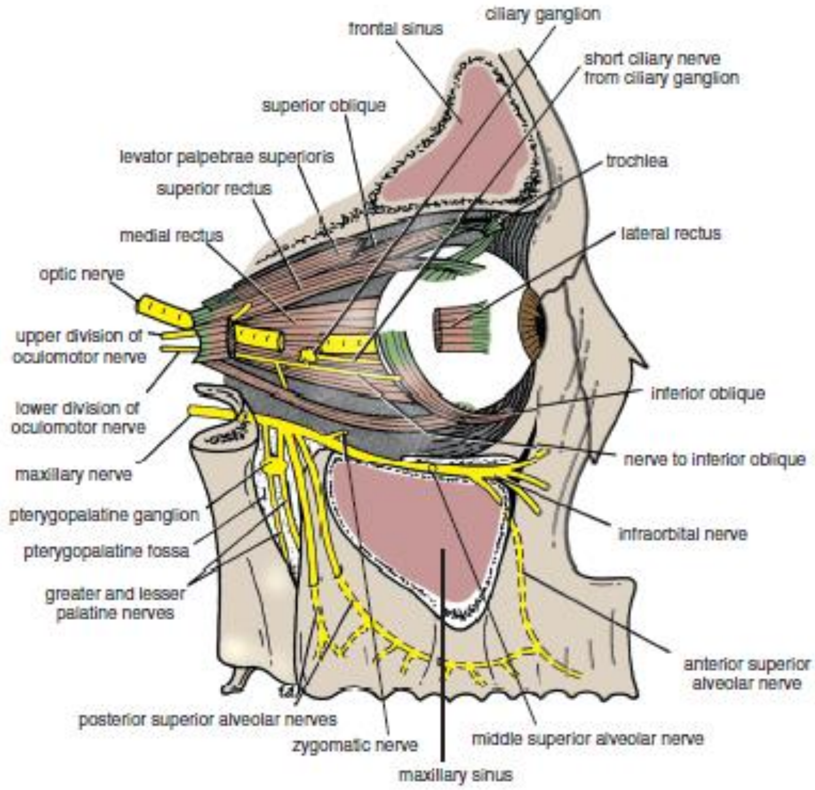
Infraorbital groove and canal: Situated on the floor of the orbit in the orbital plate of the maxilla; they transmit the infraorbital nerve (a continuation of the maxillary nerve) and blood vessels.

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

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.

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.

Optic canal: Located posteriorly in the lesser wing of the sphenoid; it communicates with the middle cranial fossa. It transmits the optic nerve and the ophthalmic artery.



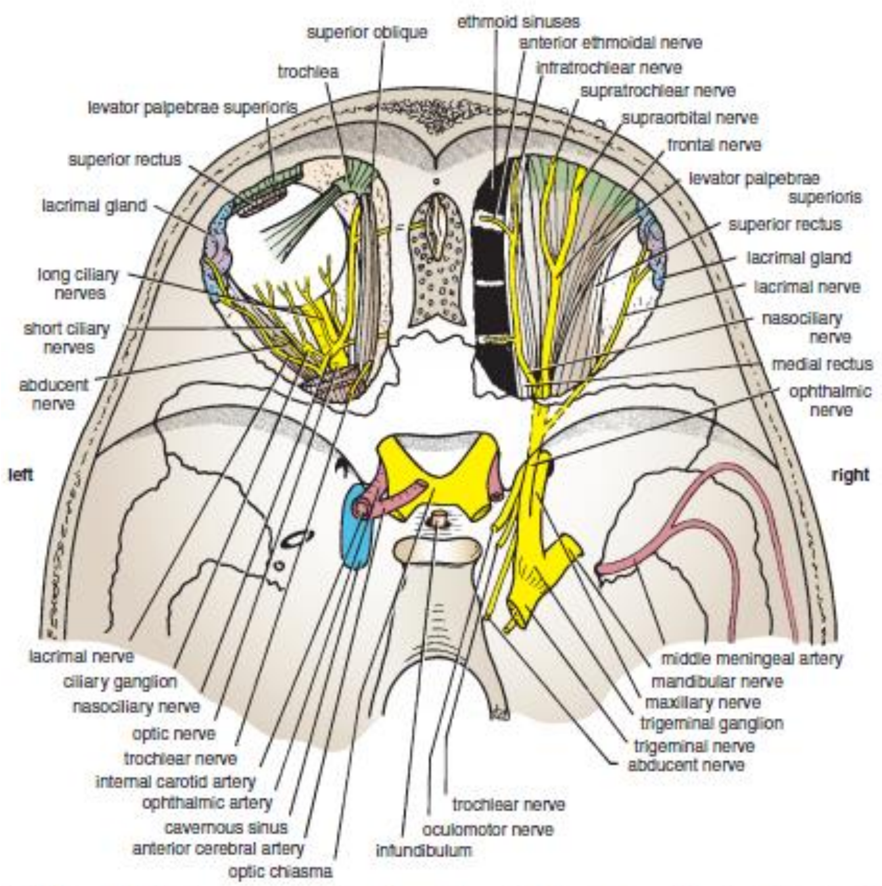
Orbital Fascia

The orbital fascia is the periosteum of the bones that form the walls of the orbit. It is loosely attached to the bones and is continuous through the foramina and fissures with the periosteum covering the outer surfaces of the bones. The **muscle of Müller,** or **orbitalis muscle,** is a thin layer of smooth muscle that bridges the inferior orbital fissure. It is supplied by sympathetic nerves, and its function is unknown.

Nerves of the Orbit

Optic Nerve

The optic nerve enters the orbit from the middle cranial fossa by passing through the optic canal. It is accompanied by the ophthalmic artery, which lies on its lower lateral side. The nerve is surrounded by sheaths of pia mater, arachnoid mater, and dura mater. It runs forward and laterally within the cone of the recti muscles and pierces the sclera at a point medial to the posterior pole of the eyeball. Here, the meninges fuse with the sclera so that the subarachnoid space with its contained cerebrospinal fluid extends forward from the middle cranial fossa, around the optic nerve, and through the optic canal, as far as the eyeball. A rise in pressure of the cerebrospinal fluid within the cranial cavity therefore is transmitted to the back of the eyeball.



Lacrimal Nerve

The lacrimal nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the upper part of the superior orbital fissure and passes forward along the upper border of the lateral rectus muscle. It is joined by a branch of the zygomaticotemporal nerve, which later leaves it to enter the lacrimal gland (parasympathetic secretomotor fibers). The lacrimal nerve ends by supplying the skin of the lateral part of the upper lid.

Frontal Nerve

The frontal nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the upper part of the superior orbital fissure and passes forward on the upper surface of the levator palpebrae superioris beneath the roof of the orbit. It divides into the **supratrochlear** and **supraorbital nerves** that wind around the upper margin of the orbital cavity to supply the skin of the forehead; the supraorbital nerve also supplies the mucous membrane of the frontal air sinus.

Trochlear Nerve

The trochlear nerve enters the orbit through the upper part of the superior orbital fissure. It runs forward and supplies the superior oblique muscle.

Oculomotor Nerve

The **superior ramus** of the oculomotor nerve enters the orbit through the lower part of the superior orbital fissure. It supplies the superior rectus muscle, then pierces it, and supplies the levator palpebrae superioris muscle. The **inferior ramus** of the oculomotor nerve enters the orbit in a similar manner and supplies the inferior rectus, the medial rectus, and the inferior oblique muscles. The nerve to the inferior oblique gives off a branch that passes to the ciliary ganglion and carries parasympathetic fibers to the sphincter pupillae and the ciliary muscle

Nasociliary Nerve

The nasociliary nerve arises from the ophthalmic division of the trigeminal nerve. It enters the orbit through the lower part of the superior orbital fissure. It crosses above the optic nerve, runs forward along the upper marginof the medial rectus muscle, and ends by dividing into the **anterior ethmoidal** and **infratrochlear nerves**.

Branches of the Nasociliary Nerve

■ The **communicating branch to the ciliary ganglion** is a sensory nerve. The sensory fibers from the eyeball pass to the ciliary ganglion via the short ciliary nerves, pass through the ganglion without interruption, and then join the nasociliary nerve by means of the communicating branch.

■The **long ciliary nerves,** two or three in number, arise from the nasociliary nerve as it crosses the optic nerve. They contain sympathetic fibers for the dilator pupillae muscle. The nerves pass forward with the short ciliary nerves and pierce the sclera of the eyeball. They continue forward between the sclera and the choroid to reach the iris.

■ The **posterior ethmoidal nerve** supplies the ethmoidal and sphenoidal air sinuses

■ The **infratrochlear nerve** passes forward below the pulley of the superior oblique muscle and supplies the skin of the medial part of the upper eyelid and the adjacent part of the nose.

■ The **anterior ethmoidal nerve** passes through the anterior ethmoidal foramen and enters the anterior cranial fossa on the upper surface of the cribriform plate of the ethmoid. It enters the nasal cavity through a slitlike opening alongside the crista galli. After supplying an area of mucous membrane, it appears on the face as the **external nasal branch** at the lower border of the nasal bone, and supplies the skin of the nose down as far as the tip.

Abducent Nerve

The abducent nerve enters the orbit through the lower part of the superior orbital fissure. It supplies the lateral rectus muscle.

Ciliary Ganglion

The ciliary ganglion is a parasympathetic ganglion about the size of a pinhead and situated in the posterior part of the orbit. It receives its preganglionic parasympathetic fibers from the oculomotor nerve via the nerve to the inferior oblique. The postganglionic fibers leave the ganglion in the **short ciliary nerves,** which enter the back of the eyeball and supply the sphincter pupillae and the ciliary muscle. A number of sympathetic fibers pass from the internal carotid plexus into the orbit and run through the ganglion without interruption.

Blood Vessels and Lymph Vessels of the Orbit

Ophthalmic Artery

The ophthalmic artery is a branch of the internal carotid artery after that vessel emerges from the cavernous sinus. It enters the orbit through the optic canal with the optic nerve. It runs forward and crosses the optic nerve to reach the medial wall of the orbit. It gives off numerous branches, which accompany the nerves in the orbital cavity.

Branches of the Ophthalmic Artery

■ The **central artery of the retina** is a small branch that pierces the meningeal sheaths of the optic nerve to gain entrance to the nerve. It runs in the substance of the optic nerve and enters the eyeball at the center of the **optic disc.** Here, it divides into branches, which may be studied in a patient through an ophthalmoscope. The branches are end arteries.

■ The **muscular branches**

■ The **ciliary arteries** can be divided into anterior and posterior groups. The former group enters the eyeball near the corneoscleral junction; the latter group enters near the optic nerve.

■ The **lacrimal artery** to the lacrimal gland

■ The **supratrochlear** and **supraorbital arteries** are distributed to the skin of the forehead.

Ophthalmic Veins

The **superior ophthalmic vein** communicates in front with the facial vein. The **inferior ophthalmic vein** communicates through the inferior orbital fissure with the pterygoid venous plexus. Both veins pass backward through the superior orbital fissure and drain into the cavernous sinus.

Lymph Vessels

No lymph vessels or nodes are present in the orbital cavity.

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1- Snell, Richard S. Clinical anatomy by regions. Lippincott Williams & Wilkins, 2011.

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Lecture 7 The Eye د.أحمد جسام النقيب

The Eye

Movements of the Eyeball

Terms Used in Describing Eye Movements

The center of the cornea or the center of the pupil is used as the anatomic “anterior pole” of the eye. All movements of the eye are then related to the direction of the movement of the anterior pole as it rotates on any one of the three axes (horizontal, vertical, and sagittal). The terminology then becomes as follows: **Elevation** is the rotation of the eye upward, **depression** is the rotation of the eye downward, **abduction** is the rotation of the eye laterally, and **adduction** is the rotation of the eye medially. Rotatory movements of the eyeball use the upper rim of the cornea (or pupil) as the marker. The eye rotates either medially or laterally.

Extrinsic Muscles Producing Movement of the Eye

There are six voluntary muscles that run from the posterior wall of the orbital cavity to the eyeball. These are the **superior rectus,** the **inferior rectus,** the **medial rectus,** the **lateral rectus,** and the **superior** and **inferior oblique muscles.** Because the superior and the inferior recti are inserted on the medial side of the vertical axis of the eyeball, they not only raise and depress the cornea, respectively, but also **rotate it medially**.

For the superior rectus muscle to raise the cornea directly upward, the inferior oblique muscle must assist; for the inferior rectus to depress the cornea directly downward, the superior oblique muscle must assist. Note that the tendon of the superior oblique muscle passes through a fibrocartilaginous pulley (trochlea) attached to the frontal bone. The tendon now turns backward and laterally and is inserted into the sclera beneath the superior rectus muscle.

TABLE 11.2 Muscles of the Eyeball and Eyelids

Muscle	Origin	Insertion	Nerve Supply	Action
Extrinsic Muscles of Eyeball (Striated Skeletal Muscle)				
Superior rectus	Tendinous ring on posterior wall of orbital cavity	Superior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Raises cornea upward and medially
Inferior rectus	Tendinous ring on posterior wall of orbital cavity	Inferior surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Depresses cornea downward and medially
Medial rectus	Tendinous ring on posterior wall of orbital cavity	Medial surface of eyeball just posterior to corneoscleral junction	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks medially
Lateral rectus	Tendinous ring on posterior wall of orbital cavity	Lateral surface of eyeball just posterior to corneoscleral junction	Abducent nerve (6th cranial nerve)	Rotates eyeball so that cornea looks laterally
Superior oblique	Posterior wall of orbital cavity	Passes through pulley and is attached to superior surface of eyeball beneath superior rectus	Trochlear nerve (4th cranial nerve)	Rotates eyeball so that cornea looks downward and laterally
Inferior oblique	Floor of orbital cavity	Lateral surface of eyeball deep to lateral rectus	Oculomotor nerve (3rd cranial nerve)	Rotates eyeball so that cornea looks upward and laterally
Intrinsic Muscles of Eyeball (Smooth Muscle)				
Sphincter pupillae of iris			Parasympathetic via oculomotor nerve	Constricts pupil
Dilator pupillae of iris			Sympathetic	Dilates pupil
Ciliary muscle			Parasympathetic via oculomotor nerve	Controls shape of lens; in accommodation, makes lens more globular

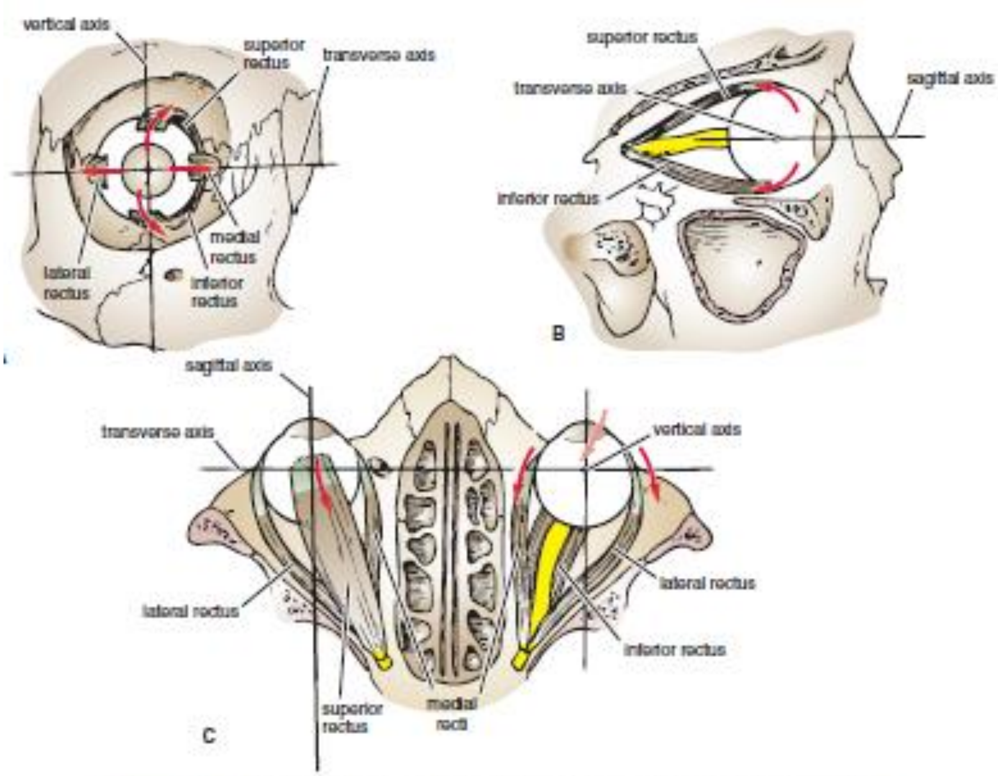


FIGURE 11.21 The actions of the four recti muscles in producing movements of the eyeball.

Clinical Testing for the Actions of the Superior and Inferior Recti and the Superior and Inferior Oblique Muscles

Because the actions of the superior and inferior recti and the superior and inferior oblique muscles are complicated when a patient is asked to look vertically upward or vertically downward, the physician tests the eye movements where the single action of each muscle predominates. The origins of the superior and inferior recti are situated about 23° medial to their insertions, and, therefore, when the patient is asked to turn the cornea laterally, these muscles are placed in the optimum position to raise (superior rectus) or lower (inferior rectus) the cornea. Using the same rationale, the superior and inferior oblique muscles can be tested. The pulley of the superior oblique and the origin of the inferior oblique muscles lie medial and anterior to their insertions. The physician tests the action of these muscles by asking the patient first to look medially, thus placing these muscles in the optimum position to lower (superior oblique) or raise (inferior oblique) the cornea. In other words, when you ask a patient to look medially and downward at the tip of his or her nose, you are testing the superior oblique at its best position. Conversely, by asking the patient to look medially and upward, you are testing the inferior oblique at its best position

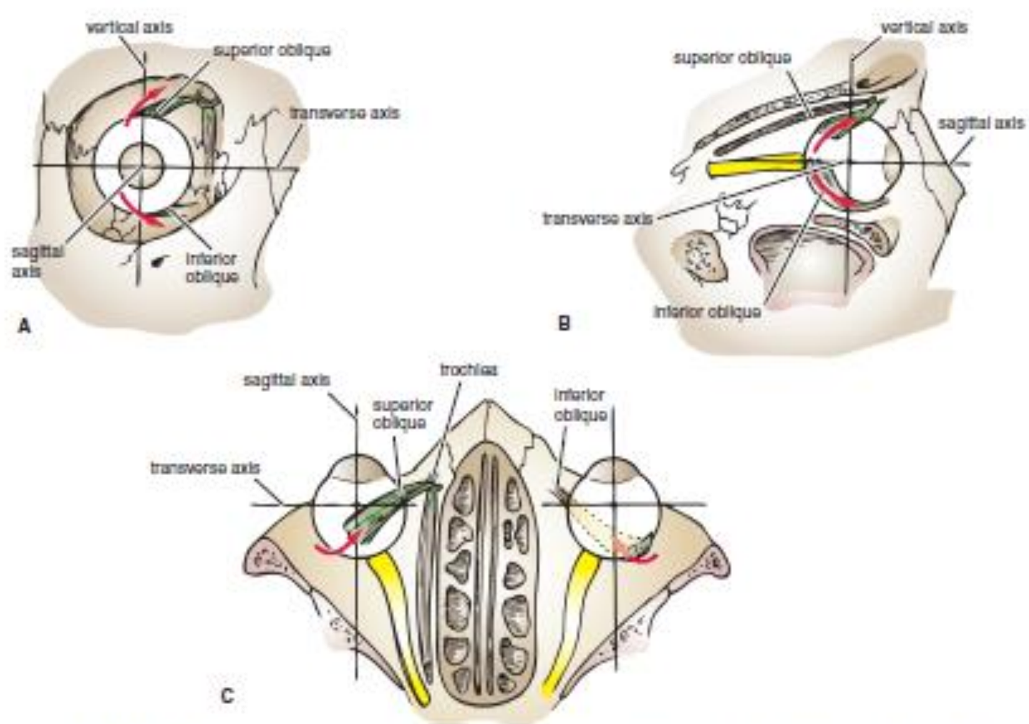


FIGURE 11.22 The actions of the superior and inferior oblique muscles in producing movements of the eyeball.

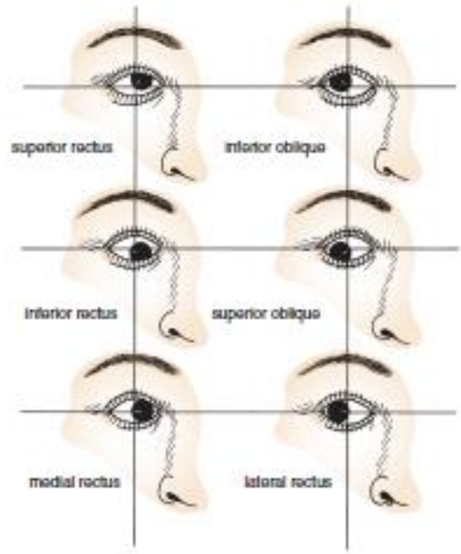


FIGURE 11.23 Actions of the four recti and two oblique muscles of the right orbit, assuming that each muscle is acting alone. The position of the pupil in relation to the vertical and horizontal planes should be noted in each case. The actions of the superior and inferior recti and the oblique muscles in the living intact eye are tested clinically, as described on page 557.

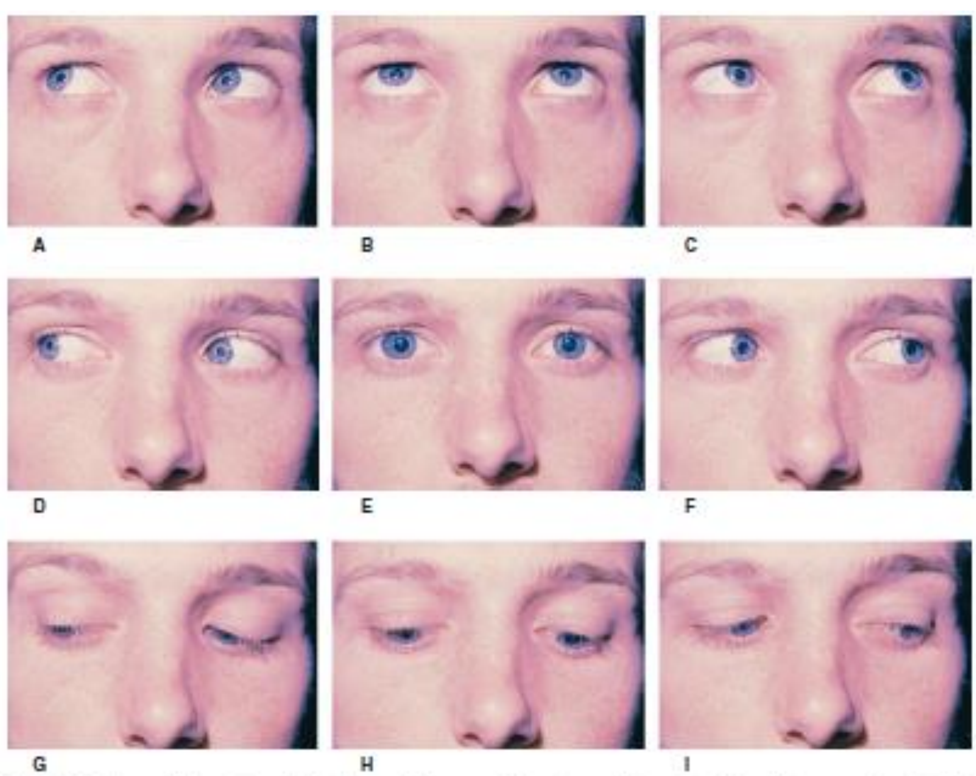


FIGURE 11.24 The cardinal positions of the right and left eyes and the actions of the recti and the oblique muscles principally responsible for the movements of the eyes. **A.** Right eye, superior rectus muscle; left eye, inferior oblique muscle. **B.** Both eyes, superior recti and inferior oblique muscles. **C.** Right eye, inferior oblique muscle; left eye, superior rectus muscle. **D.** Right eye, lateral rectus muscle; left eye, medial rectus muscle. **E.** Primary position, with the eyes fixed on a distant fixation point. **F.** Right eye, medial rectus muscle; left eye, lateral rectus muscle. **G.** Right eye, inferior rectus muscle; left eye, superior oblique muscle. **H.** Both eyes, inferior recti and superior oblique muscles. **I.** Right eye, superior oblique muscle; left eye, inferior rectus muscle.

Intrinsic Muscles

The involuntary intrinsic muscles are the **ciliary muscle** and the **constrictor,** and the **dilator pupillae of the iris** take no part in the movement of the eyeball and are discussed later.

Fascial Sheath of the Eyeball

The fascial sheath surrounds the eyeball from the optic nerve to the corneoscleral junction. It separates the eyeball from the orbital fat and provides it with a socket for free movement. It is perforated by the tendons of the orbital muscles and is reflected onto each of them as a tubular sheath. The sheaths for the tendons of the medial and lateral recti are attached to the medial and lateral walls of the orbit by triangular ligaments called the **medial** and **lateral check ligaments.** The lower part of the fascial sheath, which passes beneath the eyeball and connects the check ligaments, is thickened and serves to suspend the eyeball; it is called the **suspensory ligament of the eye.** By this means, the eye is suspended from the medial and lateral walls of the orbit, as if in a hammock.

Structure of the Eye

The eyeball is embedded in orbital fat but is separated from it by the fascial sheath of the eyeball. The eyeball consists of three coats, which, from without inward, are the fibrous coat, the vascular pigmented coat, and the nervous coat.

Coats of the Eyeball

Fibrous Coat

The fibrous coat is made up of a posterior opaque part, the sclera, and an anterior transparent part, the cornea. The Sclera The opaque sclera is composed of dense fibrous tissue and is white. Posteriorly, it is pierced by the optic nerve and is fused with the dural sheath of that nerve. The **lamina cribrosa** is the area of the sclera that is pierced by the nerve fibers of the optic nerve. The sclera is also pierced by the ciliary arteries and nerves and their associated veins, the venae vorticosae. The sclera is directly continuous in front with the cornea at the corneoscleral junction, or limbus.

The Cornea

The transparent **cornea** is largely responsible for the refraction of the light entering the eye. It is in contact posteriorly with the aqueous humor.

Blood Supply The cornea is avascular and devoid of lymphatic drainage. It is nourished by diffusion from the aqueous humor and from the capillaries at its edge.

Nerve Supply Long ciliary nerves from the ophthalmic division of the trigeminal nerve

Function of the Cornea

The cornea is the most important refractive medium of the eye. This refractive power occurs on the anterior surface of the cornea, where the refractive index of the cornea (1.38) differs greatly from that of the air. The importance of the tear film in maintaining the normal environment for the corneal epithelial cells should be stressed.

Vascular Pigmented Coat

The vascular pigmented coat consists, from behind forward, of the choroid, the ciliary body, and the iris.

The Choroid

The choroid is composed of an outer pigmented layer and an inner, highly vascular layer.

The Ciliary Body

The **ciliary body** is continuous posteriorly with the choroid, and anteriorly it lies behind the peripheral margin of the iris. It is composed of the ciliary ring, the ciliary processes, and the ciliary muscle.

The **ciliary ring** is the posterior part of the body, and its surface has shallow grooves, the **ciliary striae.**

The **ciliary processes** are radially arranged folds, or ridges, to the posterior surfaces of which are connected the suspensory ligaments of the lens.

The **ciliary muscle** is composed of meridianal and circular fibers of smooth muscle. The meridianal fibers run backward from the region of the corneoscleral junction to the ciliary processes. The circular fibers are fewer in number and lie internal to the meridianal fibers.

■ **Nerve supply:** The **ciliary muscle** is supplied by the parasympathetic fibers from the oculomotor nerve. After synapsing in the ciliary ganglion, the postganglionic fibers pass forward to the eyeball in the short ciliary nerves.

■ **Action:** Contraction of the ciliary muscle, especially the meridianal fibers, pulls the ciliary body forward. This relieves the tension in the suspensory ligament, and the elastic lens becomes more convex. This increases the refractive power of the lens.

The Iris and Pupil

The iris is a thin, contractile, pigmented diaphragm with a central aperture, the pupil. It is suspended in the aqueous humor between the cornea and the lens. The periphery of the iris is attached to the anterior surface of the ciliary body. It divides the space between the lens and the cornea into an **anterior** and a **posterior chamber.** The muscle fibers of the iris are involuntary and consist of circular and radiating fibers. The circular fibers form the **sphincter pupillae** and are arranged around the margin of the pupil. The radial fibers form the **dilator pupillae** and consist of a thin sheet of radial fibers that lie close to the posterior surface.

■ **Nerve supply:** The **sphincter pupillae** is supplied by parasympathetic fibers from the oculomotor nerve. After synapsing in the ciliary ganglion, the postganglionic fibers pass forward to the eyeball in the short ciliary nerves. The **dilator pupillae** is supplied by sympathetic fibers, which pass forward to the eyeball in the long ciliary nerves.

■ **Action:** The sphincter pupillae constricts the pupil in the presence of bright light and during accommodation.

The dilator pupillae dilates the pupil in the presence of light of low intensity or in the presence of excessive sympathetic activity such as occurs in fright.

Nervous Coat: The Retina

The retina consists of an **outer pigmented layer** and an **inner nervous layer.** Its outer surface is in contact with the choroid, and its inner surface is in contact with the vitreous body. The posterior three quarters of the retina is the receptor organ. Its anterior edge forms a wavy ring, the **ora serrata,** and the nervous tissues end here. The anterior part of the retina is nonreceptive and consists merely of pigment cells, with a deeper layer of columnar epithelium. This anterior part of the retina covers the ciliary processes and the back of the iris. At the center of the posterior part of the retina is an oval, yellowish area, the **macula lutea,** which is the area of the retina for the most distinct vision. It has a central depression, the **fovea centralis**.

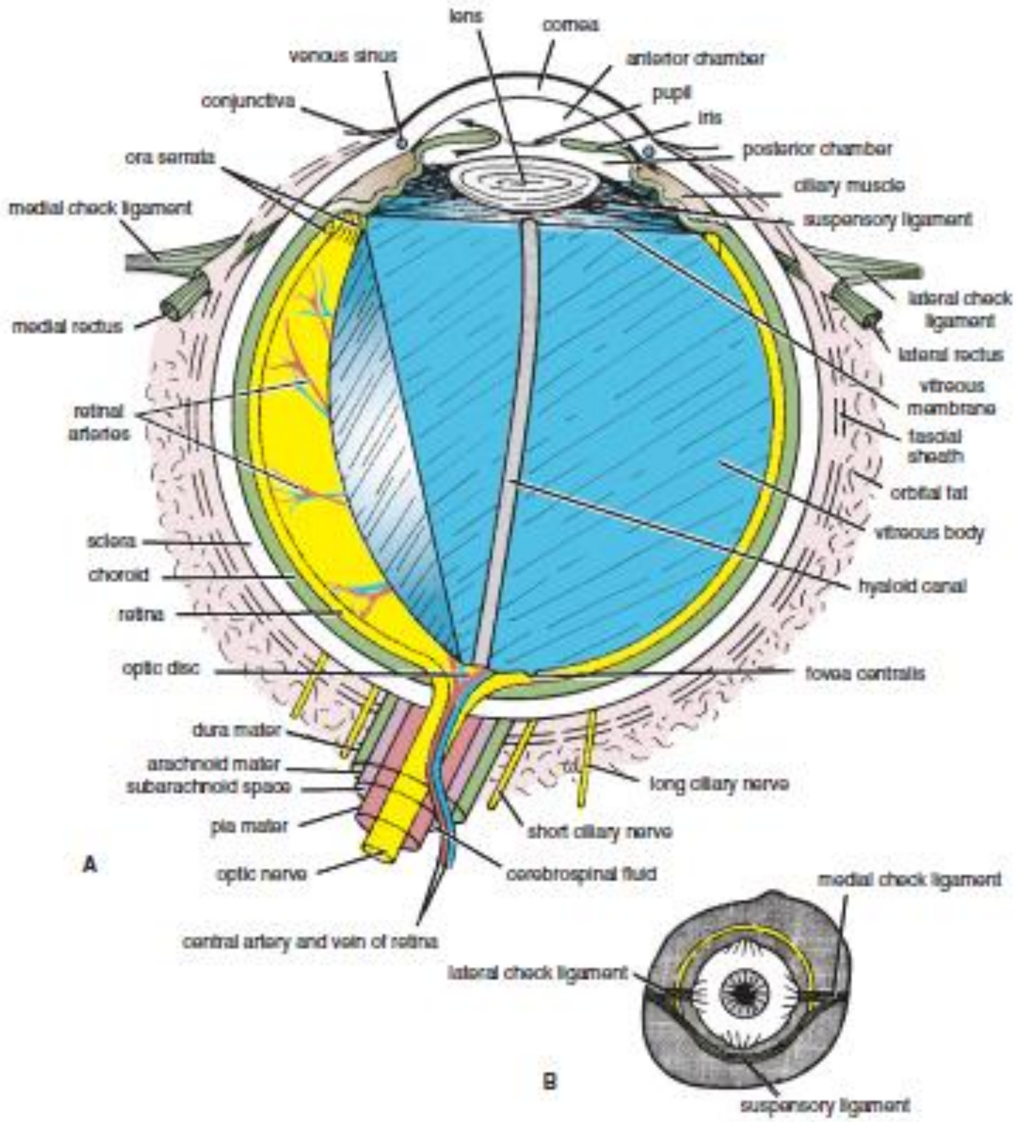
The optic nerve leaves the retina about 3 mm to the medial side of the macula lutea by the optic disc. The **optic disc** is slightly depressed at its center, where it is pierced by the **central artery of the retina.** At the optic disc is a complete absence of **rods** and **cones** so that it is insensitive to light and is referred to as the **"blind spot."** On ophthalmoscopic examination, the optic disc is seen to be pale pink in color, much paler than the surrounding retina.

Contents of the Eyeball

The contents of the eyeball consist of the refractive media, the aqueous humor, the vitreous body, and the lens.

Aqueous Humor

The aqueous humor is a clear fluid that fills the anterior and posterior chambers of the eyeball. It is believed to be a secretion from the ciliary processes, from which it enters the posterior chamber. It then flows into the anterior chamber through the pupil and is drained away through the spaces at the iridocorneal angle into the **canal of Schlemm.** Obstruction to the draining of the aqueous humor results in a rise in intraocular pressure called **glaucoma.** This can produce degenerative changes in the retina, with consequent blindness. The function of the aqueous humor is to support the wall of the eyeball by exerting internal pressure and thus maintaining its optical shape. It also nourishes the cornea and the lens and removes the products of metabolism; these functions are important because the cornea and the lens do not possess a blood supply.



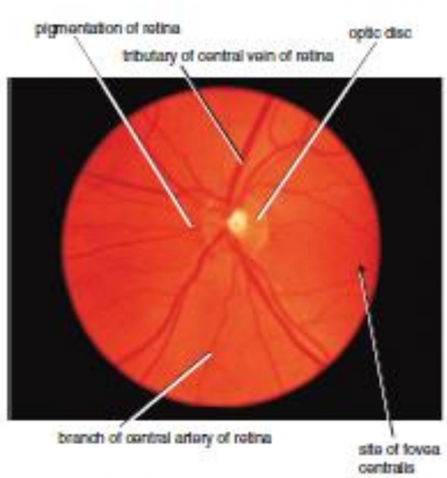


FIGURE 11.26 The left ocular fundus as seen with an ophthalmoscope.

Vitreous Body

The vitreous body fills the eyeball behind the lens and is a transparent gel. The **hyaloid canal** is a narrow channel that runs through the vitreous body from the optic disc to the posterior surface of the lens; in the fetus, it is filled by the hyaloid artery, which disappears before birth. The function of the vitreous body is to contribute slightly to the magnifying power of the eye. It supports the posterior surface of the lens and assists in holding the neural part of the retina against the pigmented part of the retina.

The Lens

The lens is a transparent, biconvex structure enclosed in a transparent capsule. It is situated behind the iris and in front of the vitreous body and is encircled by the ciliary processes. The lens consists of an elastic **capsule,** which envelops the structure; a **cuboidal epithelium,** which is confined to the anterior surface of the lens; and **lens fibers,** which are formed from the cuboidal epithelium at the equator of the lens. The lens fibers make up the bulk of the lens.

The elastic lens capsule is under tension, causing the lens constantly to endeavor to assume a globular rather than a disc shape. The equatorial region, or circumference, of the lens is attached to the ciliary processes of the ciliary body by the **suspensory ligament.** The pull of the radiating fibers of the suspensory ligament tends to keep the elastic lens flattened so that the eye can be focused on distant objects.

Accommodation of the Eye

To accommodate the eye for close objects, the ciliary muscle contracts and pulls the ciliary body forward and inward so that the radiating fibers of the suspensory ligament are relaxed. This allows the elastic lens to assume a more globular shape. With advancing age, the lens becomes denser and less elastic, and, as a result, the ability to accommodate is lessened (presbyopia). This disability can be overcome by the use of an additional lens in the form of glasses to assist the eye in focusing on nearby objects.

Constriction of the Pupil during Accommodation of the Eye

To ensure that the light rays pass through the central part of the lens so spherical aberration is diminished during accommodation for near objects, the sphincter pupillae muscle contracts so the pupil becomes smaller.

Convergence of the Eyes during Accommodation of the Lens

In humans, the retinae of both eyes focus on only one set of objects (single binocular vision). When an object moves from a distance toward an individual, the eyes converge so that a single object, not two, is seen. Convergence of the eyes results from the coordinated contraction of the medial rectus muscles.

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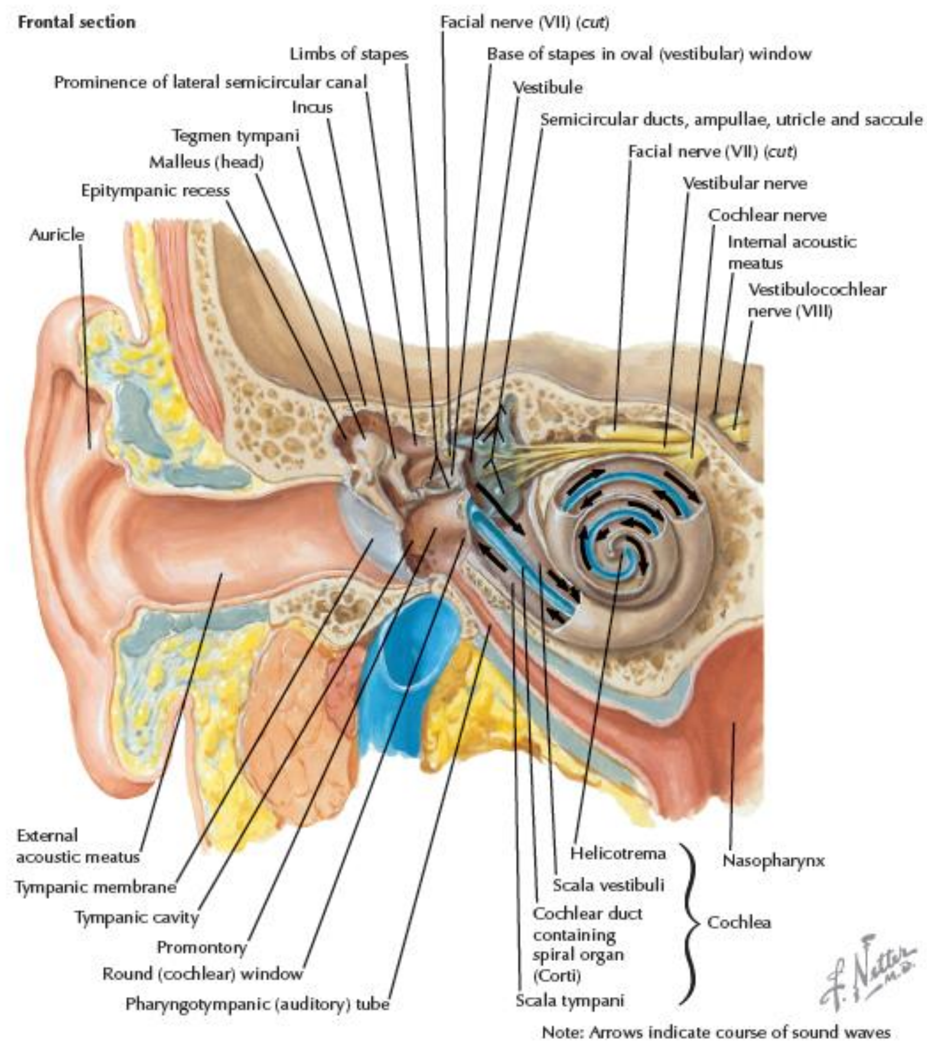
ANATOMY OF THE EAR

SECOND STAGE

DR. AHMED JASSAM ALNAQEEB
ORAL AND MAXILLOFACIAL SURGEON

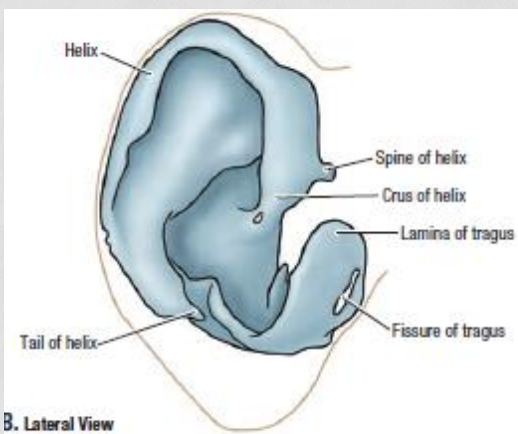
THE EAR

- The ear consists of
  - the external ear
  - the middle ear, or tympanic cavity
  - the internal ear, or labyrinth, contains the organs of hearing and balance.



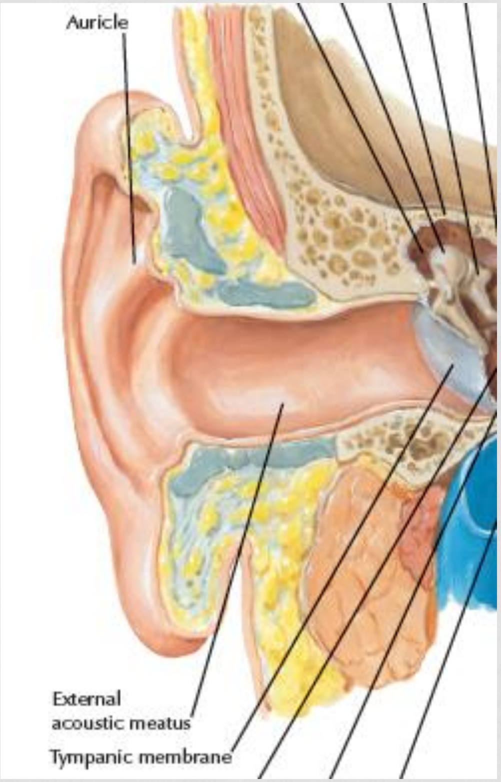
EXTERNAL EAR

- Consist of: auricle and an external auditory meatus.
- The auricle has a characteristic shape and collects air vibrations.
- thin plate of elastic cartilage covered by skin.
- It has extrinsic and intrinsic muscles, which are supplied by the facial nerve.



EXTERNAL EAR

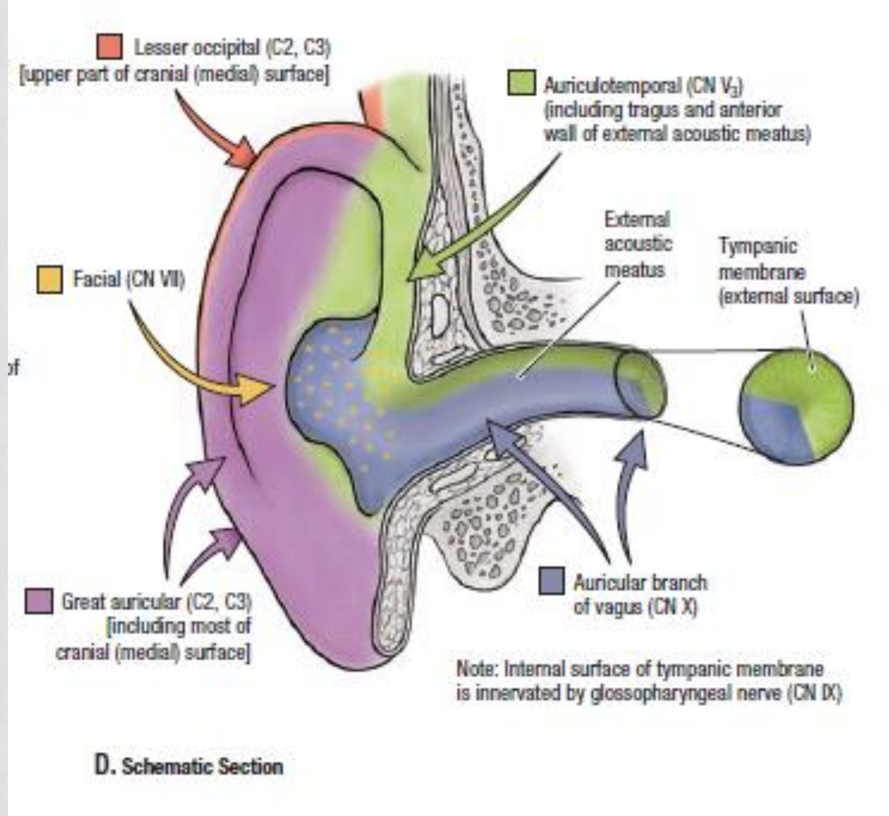
- The **external auditory meatus** is a curved tube from the auricle to the tympanic membrane
- It conducts sound waves
- framework of the meatus:
  1. outer 1/3: elastic cartilage
  2. inner 2/3: bone(tympanic plate)
- lined by skin
- outer 1/3 provided with **hairs**,
  sebaceous & **ceruminous glands.**
- hairs and wax provide sticky barrier .



EXTERNAL EAR

❖ **sensory nerve**

1. auriculotemporal nerve
2. the auricular branch of vagus
3. Greater auricular N.
4. Lesser occipital N.

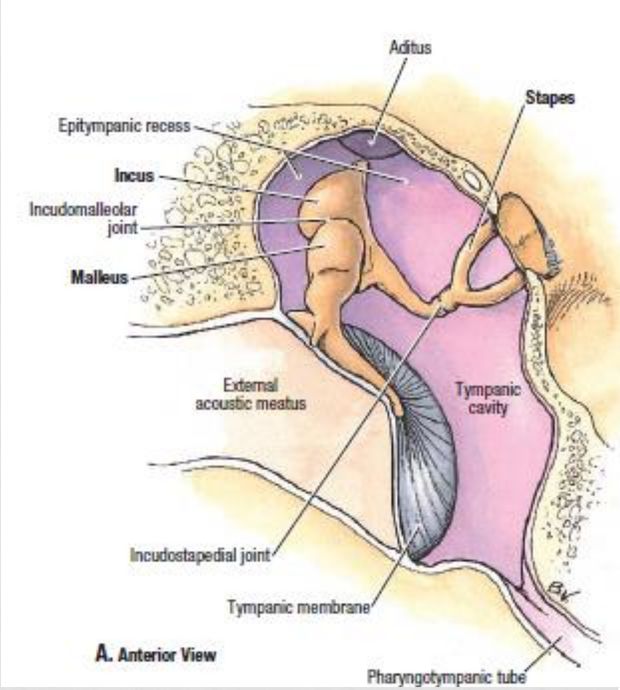


❖ **lymph drainage**

1. superficial parotid
2. mastoid
3. superficial cervical

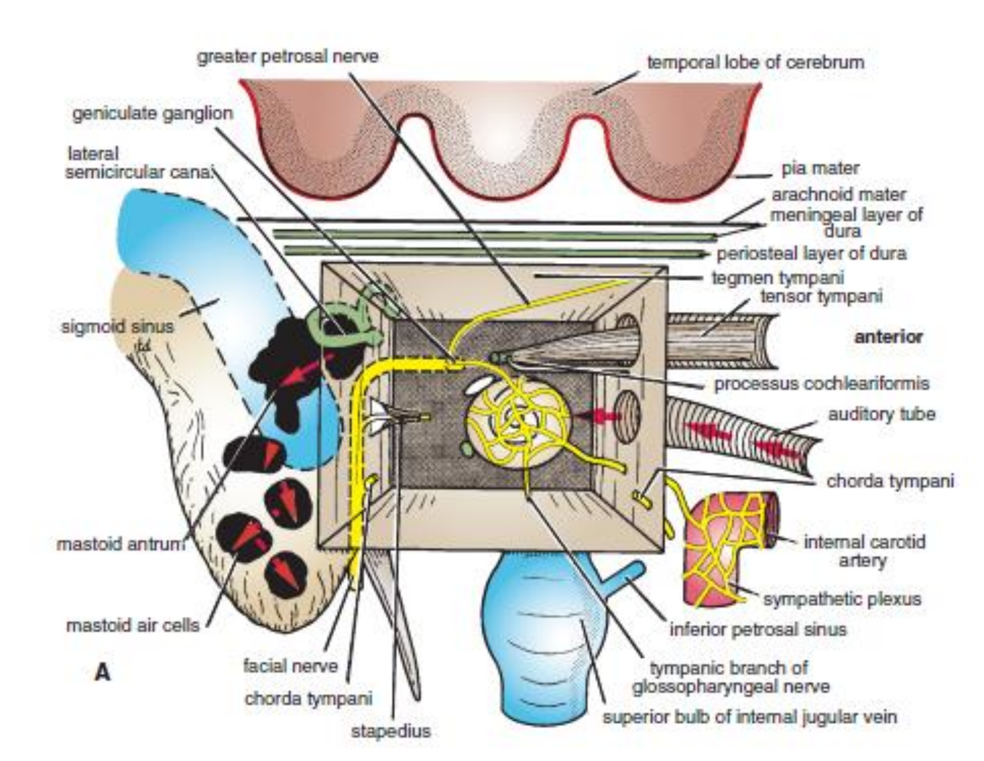
MIDDLE EAR (TYMPANIC CAVITY)

- An air-containing cavity in the petrous
- a narrow, oblique, slitlike long axis lies approximately parallel to the plane of the tympanic membrane
- lined with mucous membrane
- contains the auditory ossicles (transmit vibrations of eardrum to perilymph of the internal ear.
- . It communicates with the nasopharynx &with the mastoid antrum.



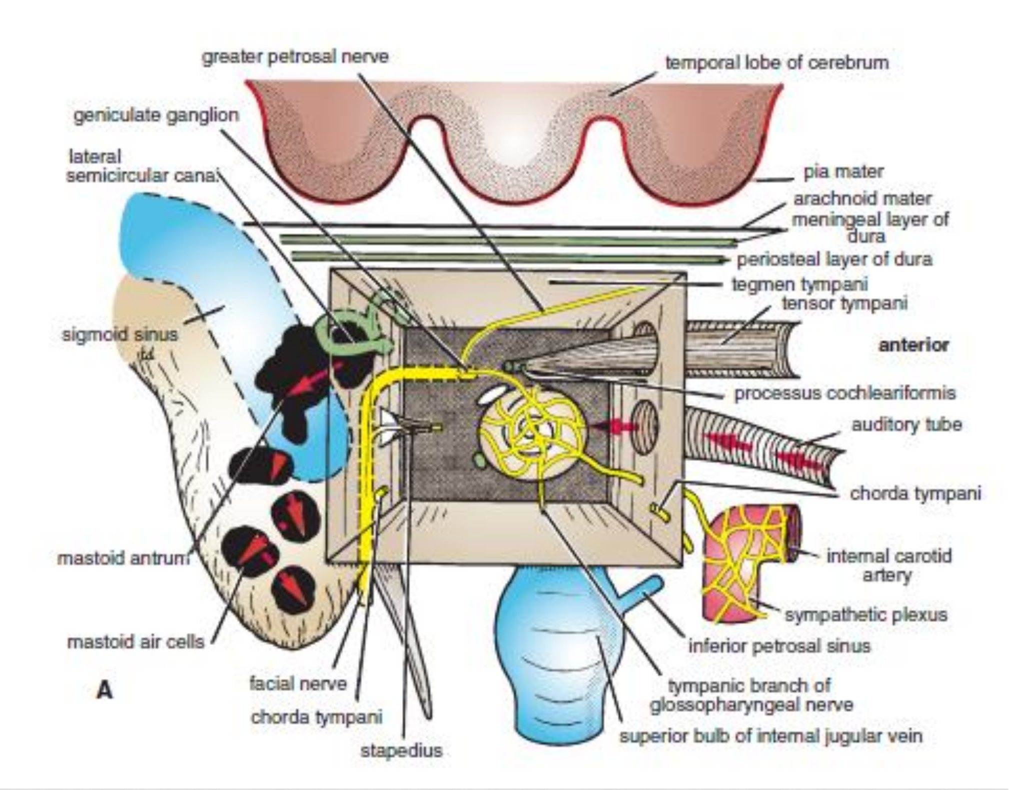
THE ROOF OF TYMPANIC CAVITY

- The **roof:** thin plate of bone, the **tegmen tympani**,
- separates the tympanic cavity from the meninges and the temporal lobe of the brain



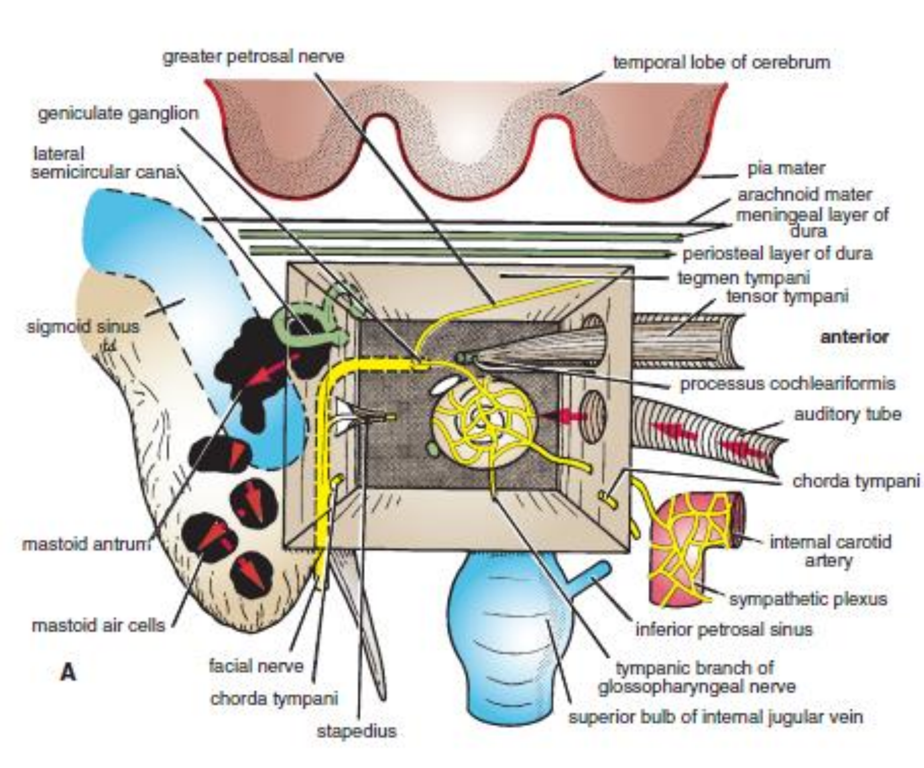
THE FLOOR OF TYMPANIC CAVITY

- The **floor**: thin plate of bone
- may be partly replaced by fibrous tissue
- separates the tympanic cavity from the superior bulb of the internal jugular vein



THE ANTERIOR WALL OF TYMPANIC CAVITY

- **anterior wall**
- From below: thin bone separates TC from ICA
- At upper part are the openings into two canals
- The thin, bony septum, which separates the canals, is prolonged backward on the medial wall, forming a shelflike projection.

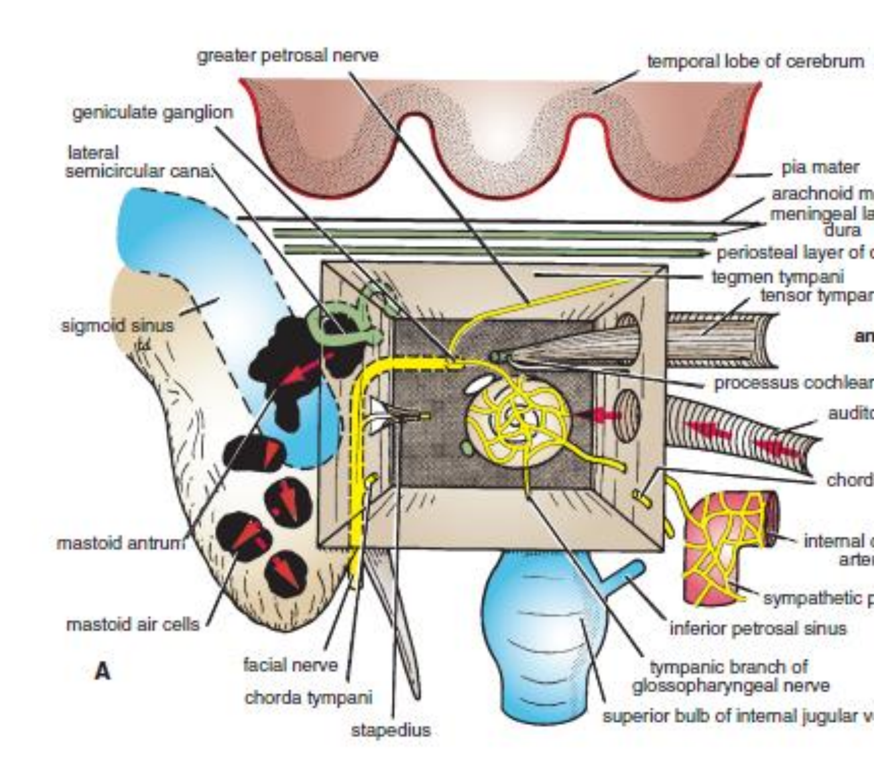


THE POSTERIOR WALL OF TYMPANIC CAVITY

❑The **posterior wall**

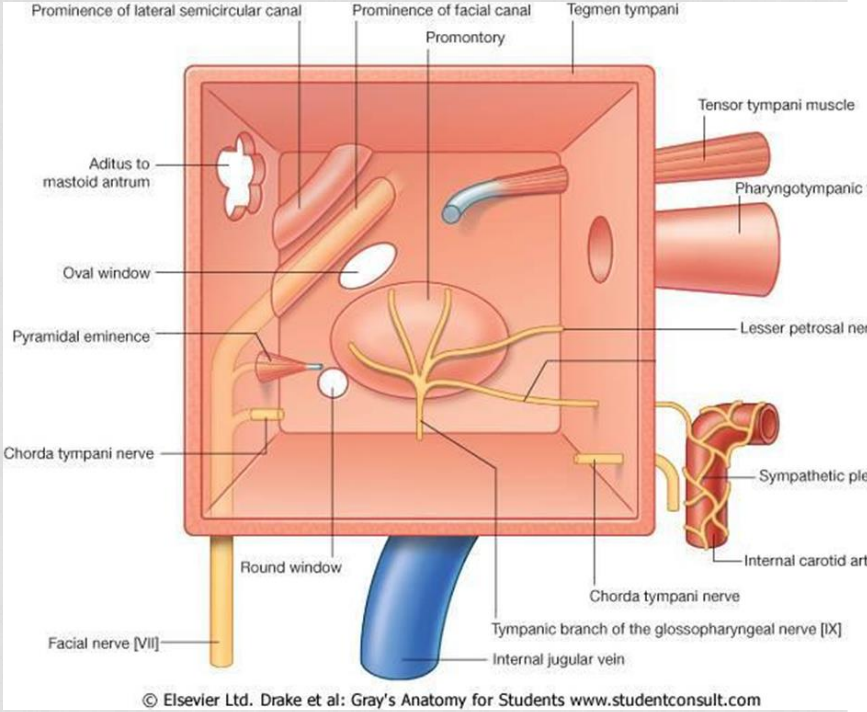
- upper part a large, irregular opening, the **aditus to the mastoid antrum**

- Below this is a small, conical projection, the **pyramid**, from whose apex emerges the tendon of the **stapedius muscle.**



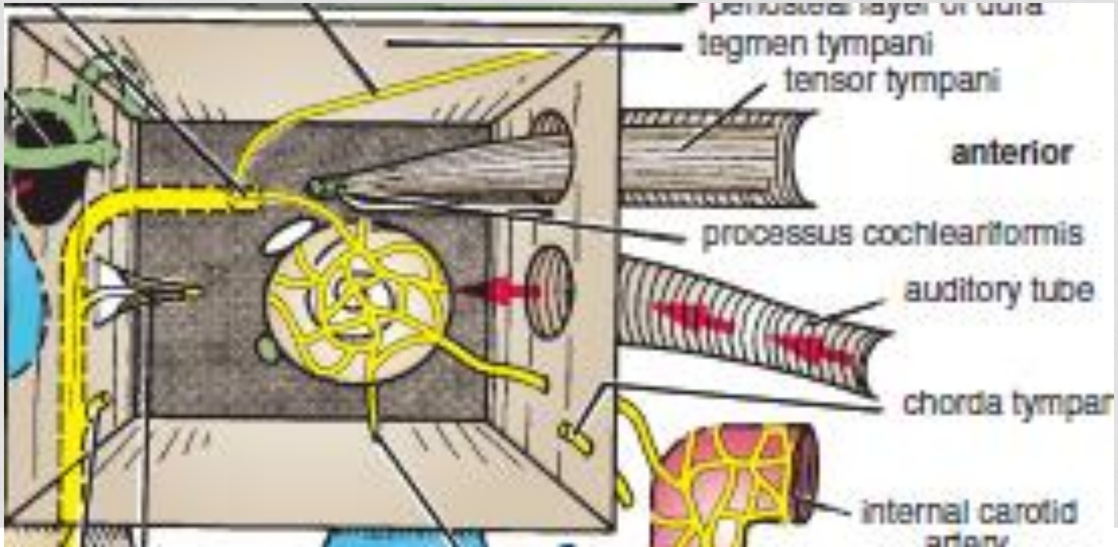
THE MEDIAL WALL OF TYMPANIC CAVITY

- formed by the lateral wall of the inner ear.
- **Promontory:** a rounded projection, which results from underlying first turn of the cochlea
- **Fenestra vestibuli (oval window):** above and behind promontory, closed by base of stapes. Medial to it there is perilymph of the scala vestibuli of the internal ear.
- **Fenestra cochleae (round window):** below promontory, its closed by the **secondary tympanic membrane.**
- medial to it, is perilymph of the blind end of the scala tympani



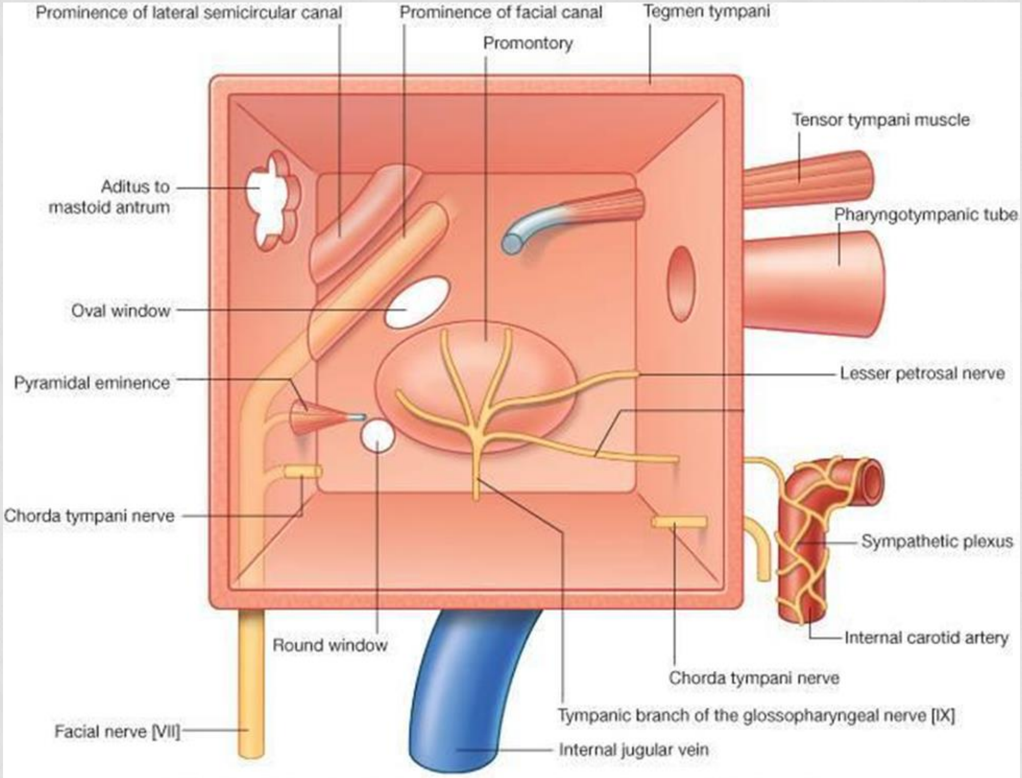
THE MEDIAL WALL OF TYMPANIC CAVITY

- bony shelf from anterior wall extends backward on medial wall above promontory and above fenestra vestibuli. It supports tensor tympani muscle.
- Its posterior end is curved upward and forms a pulley, the **processus cochleariformis,** around which the tendon of the tensor tympani bends laterally to reach its insertion on the handle of the malleus



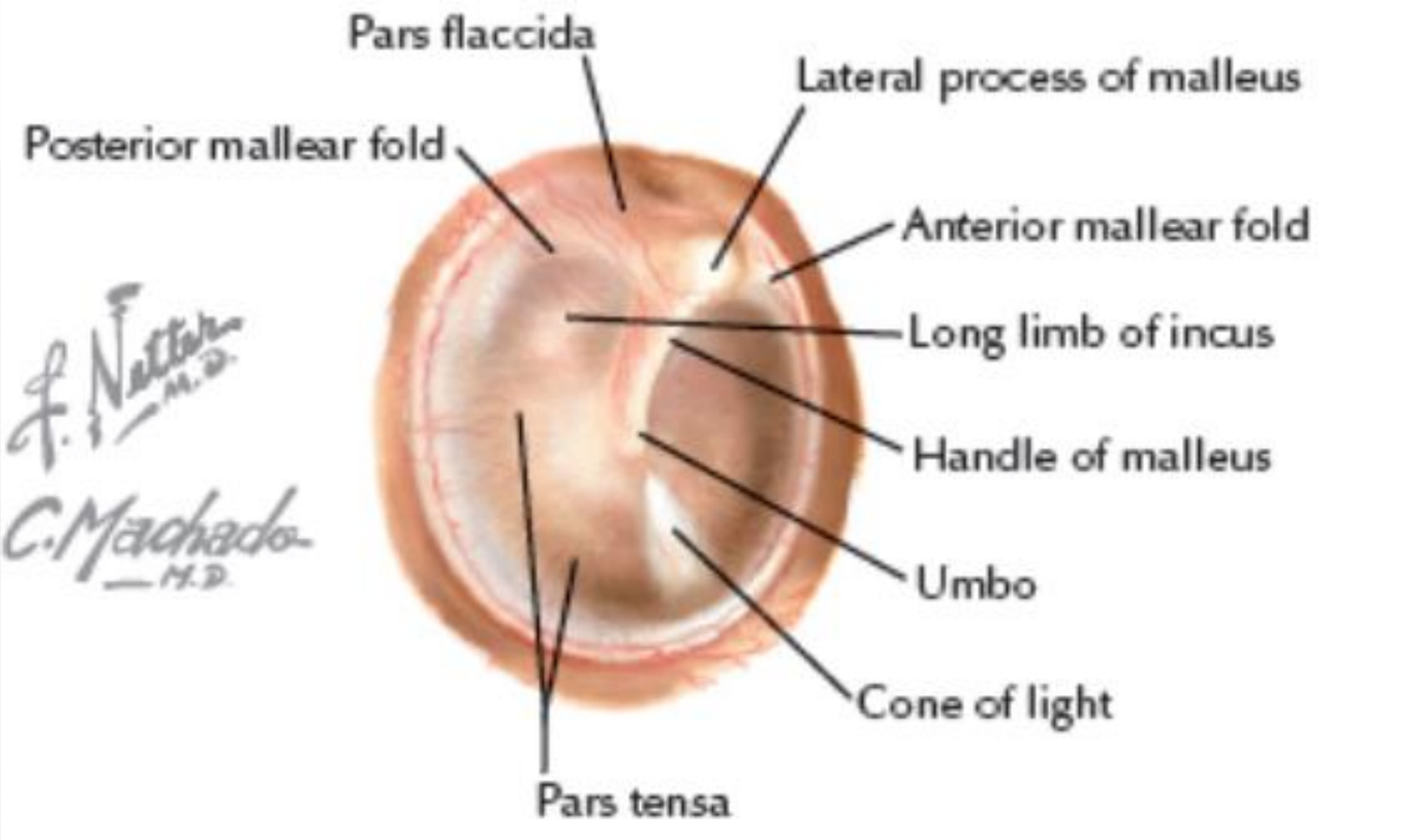
THE MEDIAL WALL OF TYMPANIC CAVITY

- A rounded ridge runs horizontally backward above P & FV known as the**prominence of the facial nerve canal.** On reaching the posterior wall, it curves downward behind the pyramid



THE LATERAL WALL OF TYMPANIC CAVITY

- Formed by tympanic membrane
- The **tympanic membrane** thin, fibrous membrane
- it is obliquely placed, facing downward, forward, and laterally
- It is concave laterally, and at the depth of the concavity is a small depression, the **umbo,** produced by the tip of the handle of the malleus
- The tympanic membrane is circular and measures about 1 cm in diameter
- The circumference is thickened and is slotted into a groove in the bone (**tympanic sulcus),** which is deficient superiorly forming a notch.
- From the sides of the notch, two bands, termed the **anterior** and **posterior malleolar folds,** pass to the lateral process of the malleus.


Pars flaccida
Lateral process of malleus
Posterior mallear fold
Anterior mallear fold
Long limb of incus
Handle of malleus
Umbo
Cone of light
Pars tensa
F. Netter M.D.
C. Machado M.D.

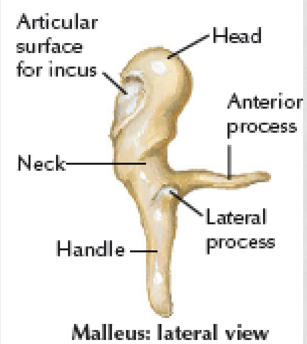
THE LATERAL WALL OF TYMPANIC CAVITY

- **pars flaccida:** small triangular area on the tympanic membrane bounded by the folds
- The remainder of the membrane is tense and is called the **pars tensa.**

- The tympanic membrane is extremely sensitive to pain and is innervated on its outer surface by the **auriculotemporal nerve** and the **auricular branch of the vagus**

AUDITORY OSSICLES

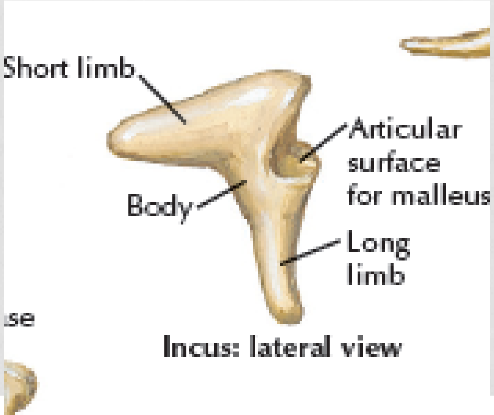
- **Malleus** is the largest ossicle which has
  - **Head:** rounded and articulates posteriorly with incus
  - **Neck:** constricted part below the head
  - **Handle:** passes downward and backward and is firmly attached to the medial surface of tympanic membrane
  - **anterior process:** connected to anterior wall of tympanic cavity by a ligament
  - **lateral process:** projects laterally and is attached to anterior and posterior malleolar folds



Malleus: lateral view

AUDITORY OSSICLES

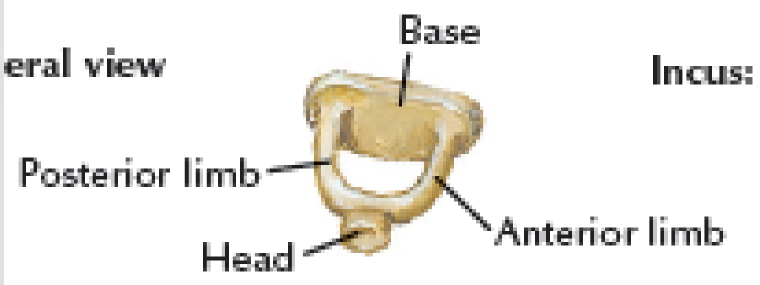
- **Incus:** it possesses:
  - **Body:** rounded and articulates anteriorly with head of malleus.
  - **long process** descends behind and parallel to handle of malleus. Its lower end bends medially and articulates with head of the stapes
  - **short process:** projects backward and is attached to posterior wall of tympanic cavity by a ligament.



AUDITORY OSSICLES

❑**Stapes:** it has:

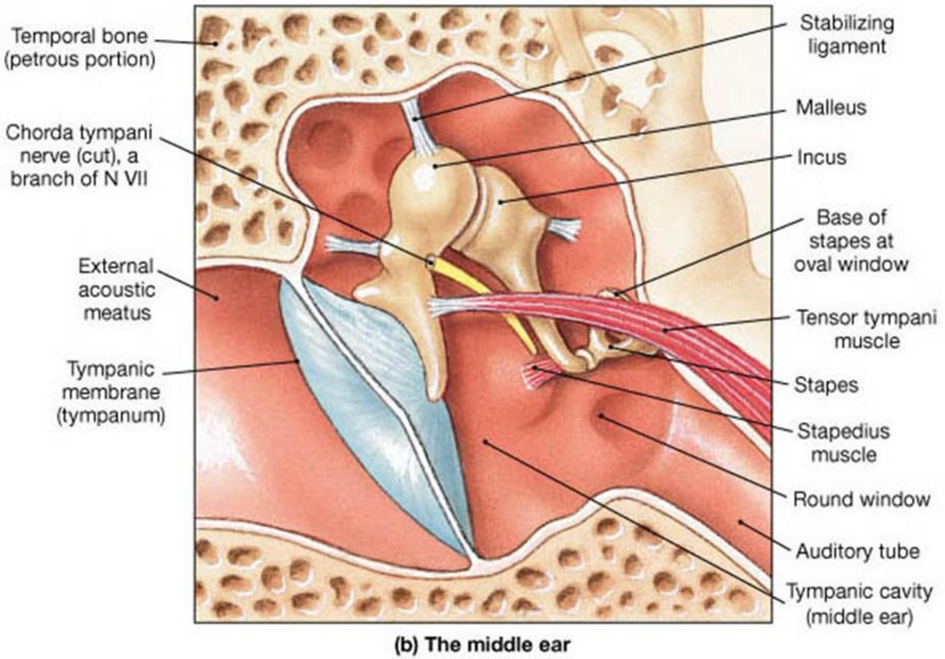
- **Head:** small and articulates with long process of incus
- **Neck:** narrow and receives insertion of stapedius muscle
- **two limbs:** diverge from neck and are attached to oval **base.**
- edge of base is attached to margin of fenestra vestibuli by a ring of fibrous tissue, **anular ligament.**



MUSCLES OF THE OSSICLES

TABLE 11.3 Muscles of the Middle Ear

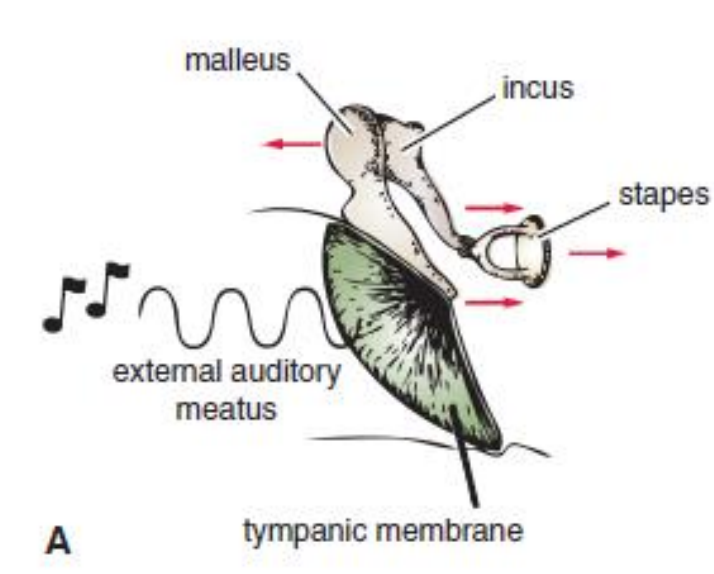
Muscle	Origin	Insertion	Nerve Supply	Action
Tensor tympani	Wall of auditory tube and wall of its own canal	Handle of malleus	Mandibular division of trigeminal nerve	Dampens down vibrations of tympanic membrane
Stapedius	Pyramid (bony projection on posterior wall of middle ear)	Neck of stapes	Facial nerve	Dampens down vibrations of stapes

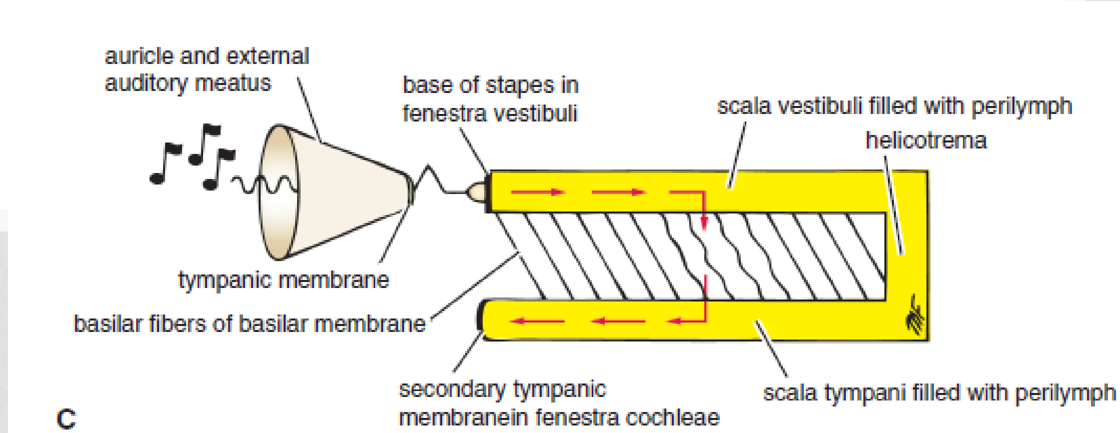


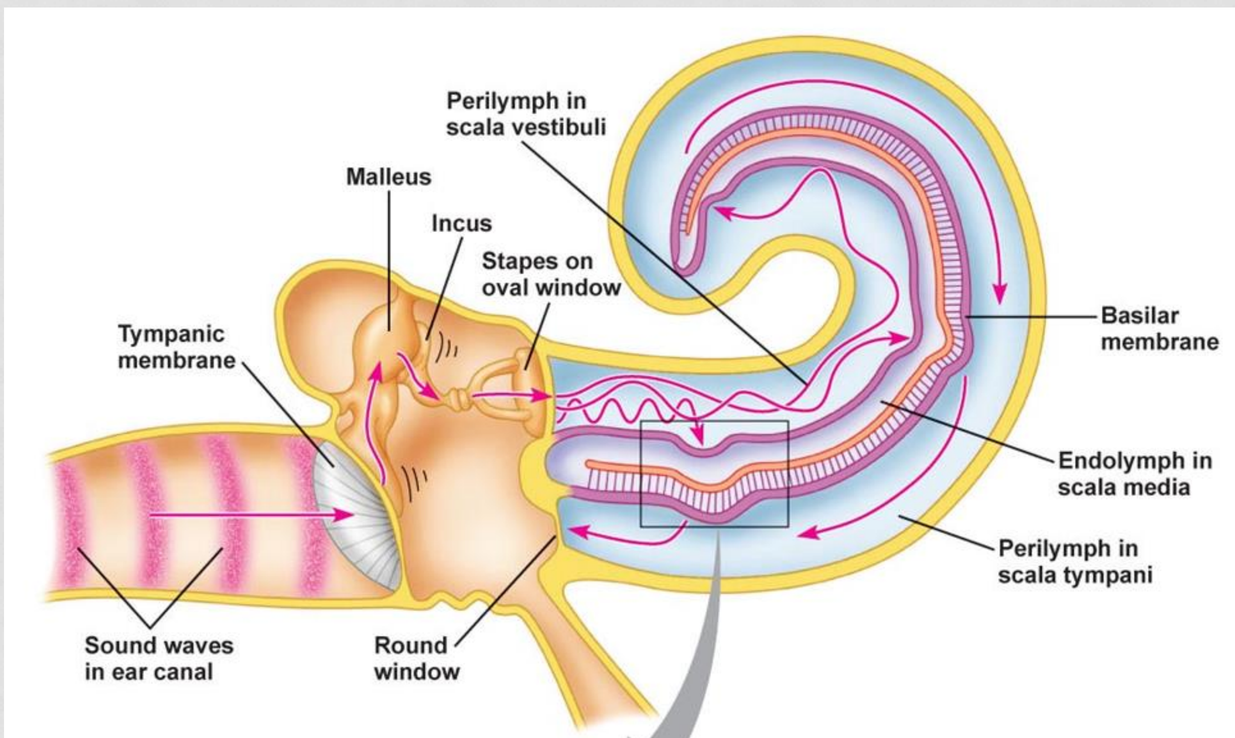
(b) The middle ear

MOVEMENTS OF THE AUDITORY OSSICLES

- ❖ The malleus and incus rotate on an anteroposterior axis
- ➢ When the tympanic membrane moves medially:
  1. handle of malleus moves medially
  2. head of malleus and body of incus move laterally
  3. long process of incus moves medially with stapes
  4. base of stapes is pushed medially in fenestra vestibuli, and the motion is communicated to the perilymph in the scala vestibuli
- ❑ Liquid being incompressible, the perilymph causes an outward bulging of the secondary tympanic membrane in the fenestra cochleae at the lower end of the scala tympani
- The above movements are reversed if the tympanic membrane moves laterally
- the effective pressure on the perilymph increase by a total of 22 to 1

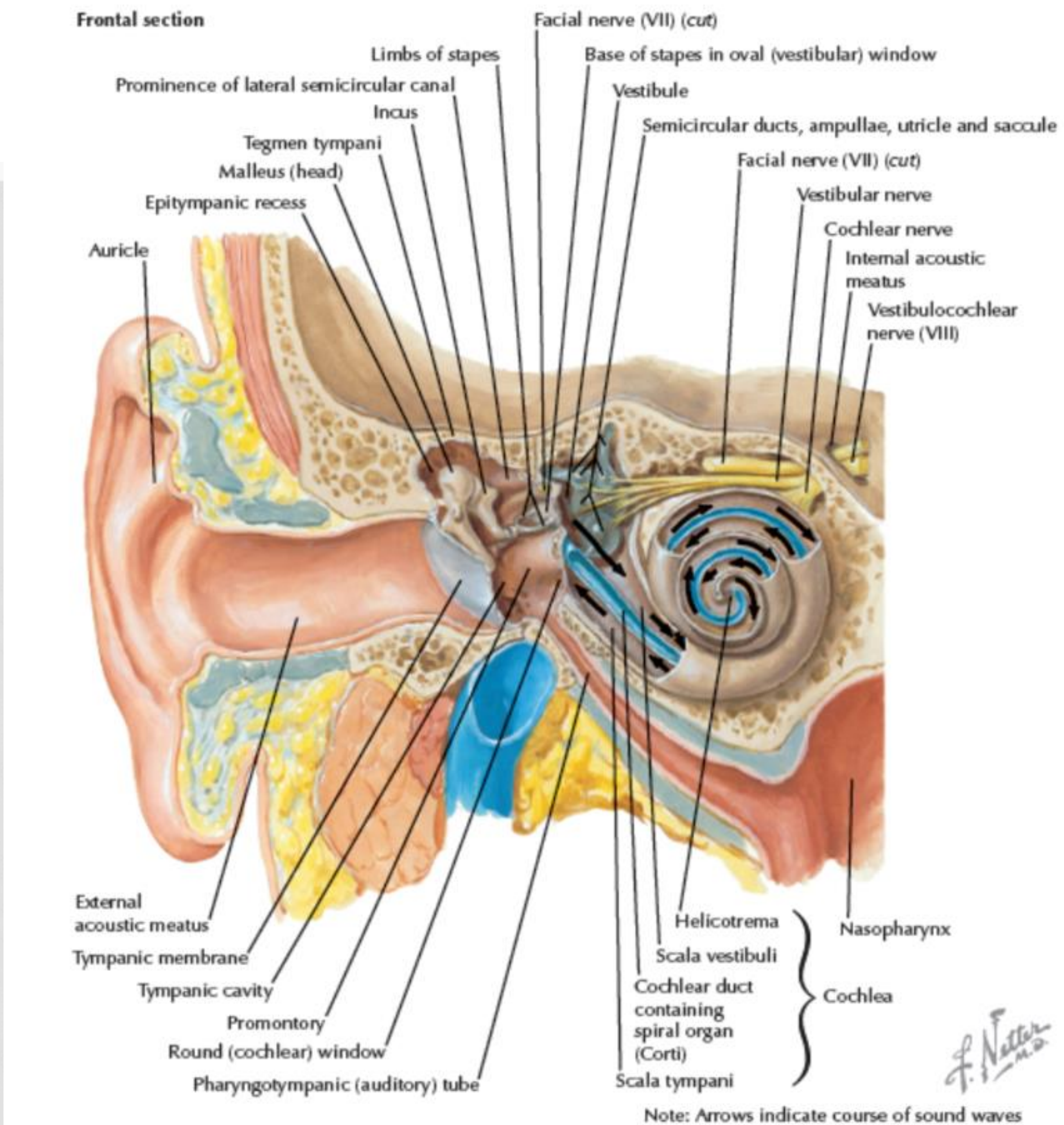

malleus
incus
stapes
external auditory meatus
tympanic membrane
A


auricle and external auditory meatus
base of stapes in fenestra vestibuli
scala vestibuli filled with perilymph
helicotrema
tympanic membrane
basilar fibers of basilar membrane
secondary tympanic membranein fenestra cochleae
scala tympani filled with perilymph
C


Perilymph in scala vestibuli
Malleus
Incus
Stapes on oval window
Tympanic membrane
Basilar membrane
Endolymph in scala media
Perilymph in scala tympani
Sound waves in ear canal
Round window

AUDITORY TUBE

- connects anterior wall of tympanic cavity to nasal pharynx
- posterior third is bony, and anterior two thirds is cartilaginous
- As the tube descends, it passes over the upper border of the superior constrictor muscle
- It serves to equalize air pressures in the tympanic cavity and the nasal pharynx



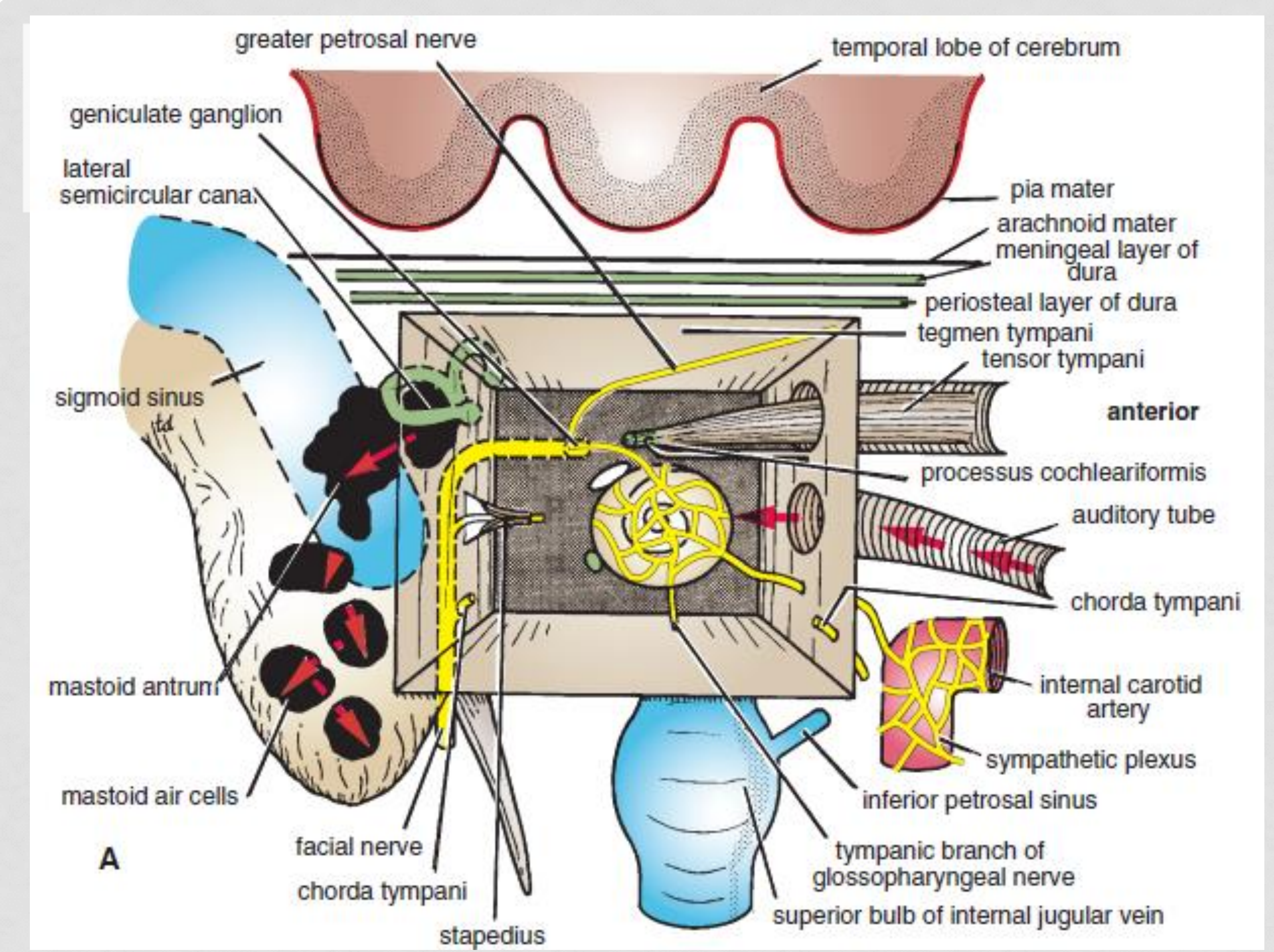
Frontal section
Facial nerve (VII) (cut)
Limbs of stapes
Base of stapes in oval (vestibular) window
Prominence of lateral semicircular canal
Vestibule
Incus
Semicircular ducts, ampullae, utricle and saccule
Tegmen tympani
Facial nerve (VII) (cut)
Malleus (head)
Vestibular nerve
Epitympanic recess
Cochlear nerve
Auricle
Internal acoustic meatus
Vestibulocochlear nerve (VIII)
External acoustic meatus
Tympanic membrane
Tympanic cavity
Promontory
Round (cochlear) window
Pharyngotympanic (auditory) tube
Helicotrema
Scala vestibuli
Cochlear duct containing spiral organ (Corti)
Scala tympani
Cochlea
Nasopharynx
F. Netter M.D.
Note: Arrows indicate course of sound waves

MASTOID ANTRUM

- The mastoid antrum lies behind the middle ear in the petrous bone
- It communicates with the middle ear by the aditus

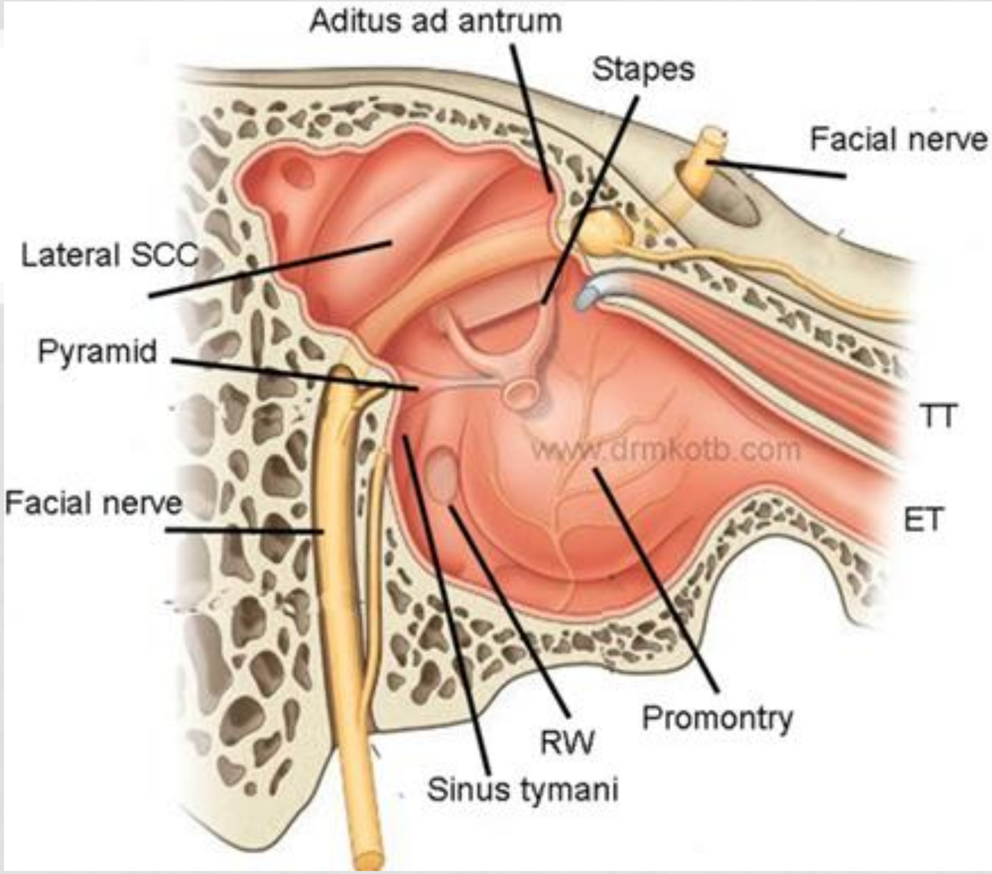
❑ **Relations**

- **Anterior wall :**the middle ear and contains the aditus
- **Posterior wall :** separates the antrum from the sigmoid venous sinus and the cerebellum
- **Lateral wall** forms the floor of the suprameatal triangle
- **Medial wall** : the posterior semicircular canal
- **Superior wall** is the thin plate of bone, the tegmen tympani, which is related to the meninges of the middle cranial fossa and the temporal lobe of the brain
- **Inferior wall** is perforated with holes, through which the antrum communicates with the mastoid air cells

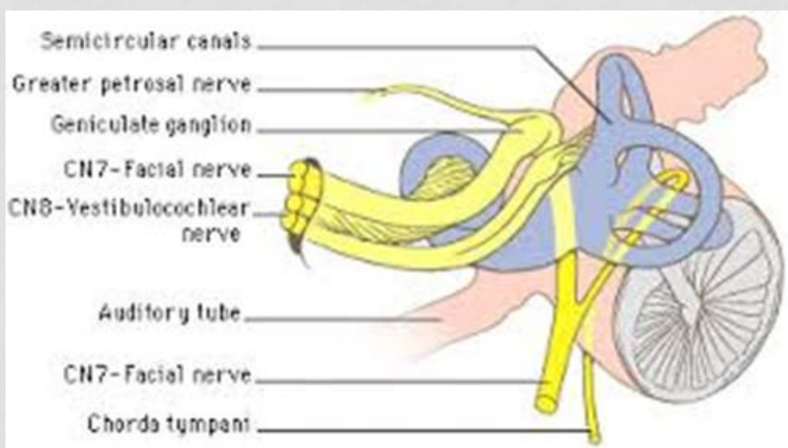

greater petrosal nerve
temporal lobe of cerebrum
geniculate ganglion
lateral
semicircular canal
pia mater
arachnoid mater
meningeal layer of
dura
periosteal layer of dura
tegmen tympani
tensor tympani
sigmoid sinus
anterior
processus cochleariformis
auditory tube
chorda tympani
mastoid antrum
internal carotid
artery
sympathetic plexus
mastoid air cells
inferior petrosal sinus
facial nerve
tympanic branch of
glossopharyngeal nerve
A
chorda tympani
superior bulb of internal jugular vein
stapedius

THE FACIAL NERVE

- Enters the internal acoustic meatus & then into facial canal
- nerve runs laterally above vestibule of the internal ear until it reaches the medial wall of the middle ear. Here, the nerve expands to form the sensory **geniculate ganglion**
- nerve then bends sharply backward above the promontory
- On arriving at posterior wall of middle ear, it curves downward on medial side of aditus
- It descends in posterior wall of middle ear, behind the pyramid, and finally emerges through the stylomastoid foramen into the neck



Aditus ad antrum
Stapes
Facial nerve
Lateral SCC
Pyramid
TT
www.drmkotb.com
Facial nerve
ET
Promontry
RW
Sinus tymani



Semicircular canals
Greater petrosal nerve
Geniculate ganglion
CN7-Facial nerve
CN8-Vestibulocochlear nerve
Auditory tube
CN7-Facial nerve
Chorda tympani

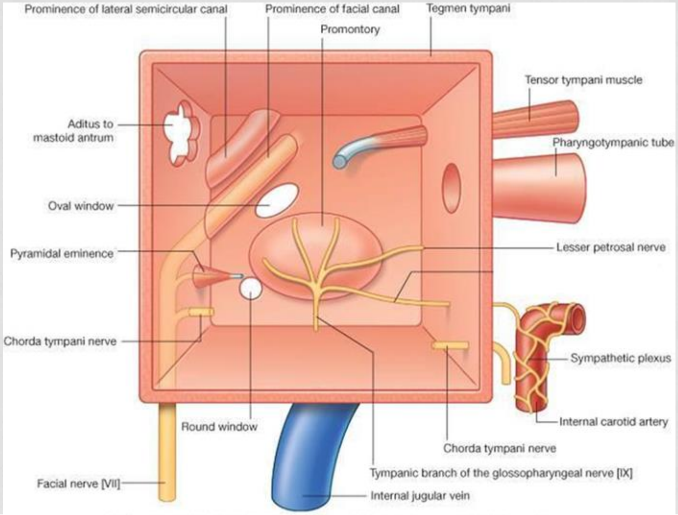
IMPORTANT BRANCHES OF THE INTRAPETROUS PART OF THE FACIAL NERVE

1. **Greater petrosal nerve** emerges on superior surface of petrous & joined by deep petrosal nerve to form **nerve of the pterygoid canal.**
2. **nerve to the stapedius** arises from facial nerve as it descends in its canal behind the pyramid
3. **chorda tympani** arises from facial nerve just above stylomastoid foramen. It enters the middle ear close to the posterior border of the tympanic membrane. It runs forward & leaves middle ear through petrotympanic fissure and enters infratemporal fossa, where it joins the lingual nerve

- It contain
  1. Taste fibers : ant. 2/3 of tongue & FOM
  2. Parasympathetic scretomotor fibers : to submand. & subling. glands

TYMPANIC NERVE

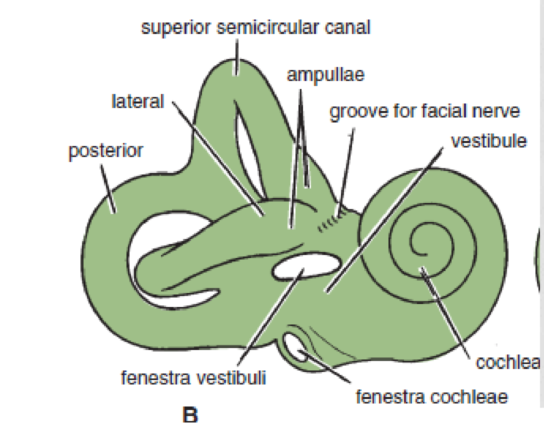
- arises from glossopharyngeal nerve, just below jugular foramen
- passes through the floor of the middle ear and onto promontory forming **tympanic plexus**.
- tympanic plexus supplies lining of middle ear and gives off lesser petrosal nerve, which sends secretomotor fibers to parotid gland via the otic ganglion. It leaves the skull through the foramen ovale.



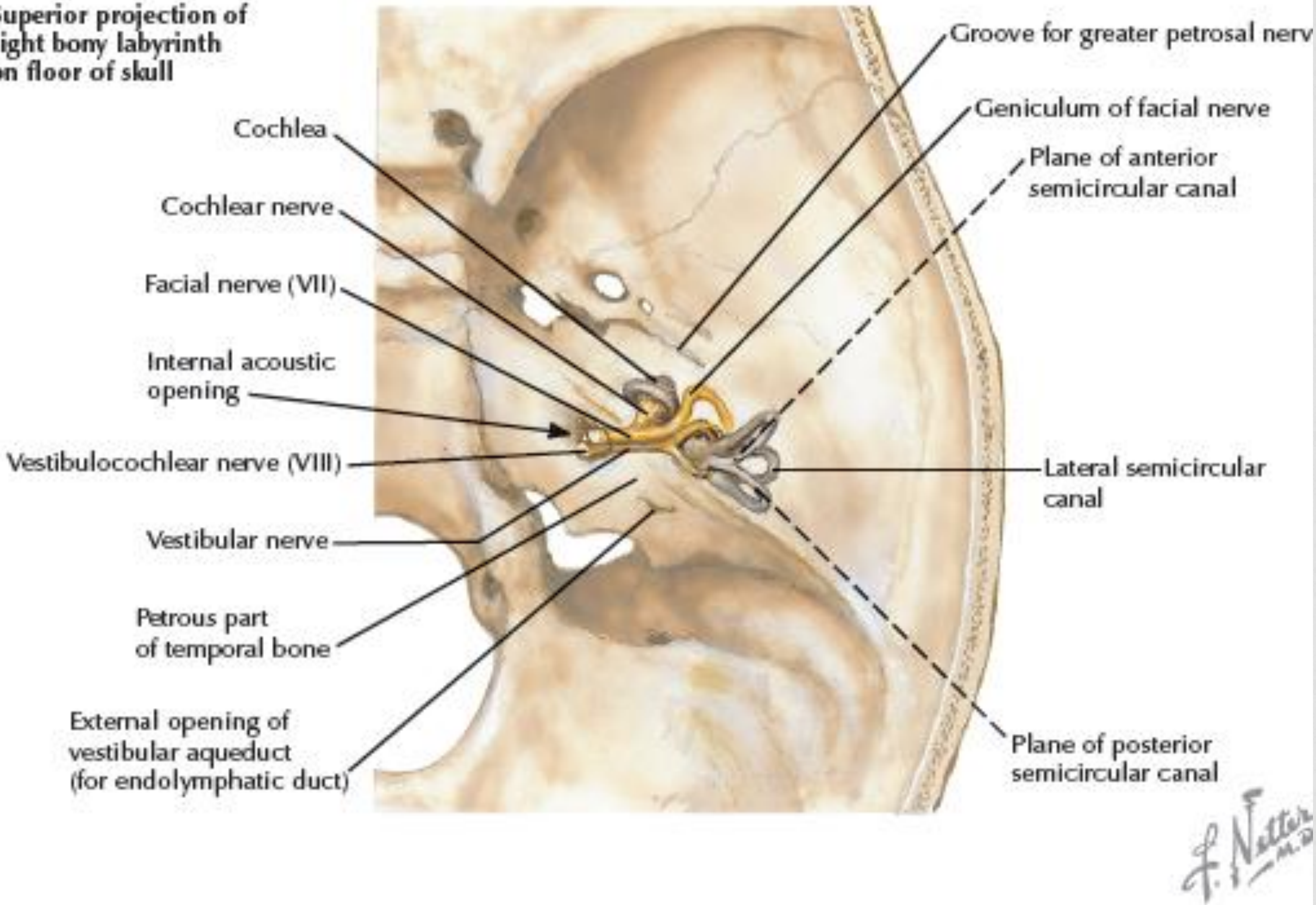
THE INTERNAL EAR, OR LABYRINTH

- situated in the petrous part of the temporal bone, medial to the middle ear
- It consists of

1. **bony labyrinth**, comprising a series of cavities within bone
2. **membranous labyrinth**, comprising a series of membranous sacs and ducts contained within bony labyrinth

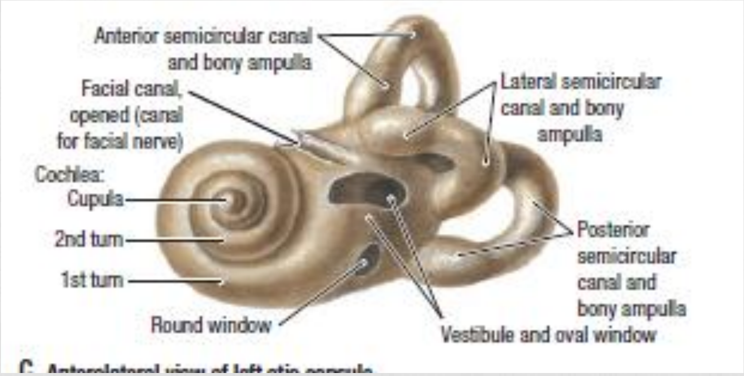


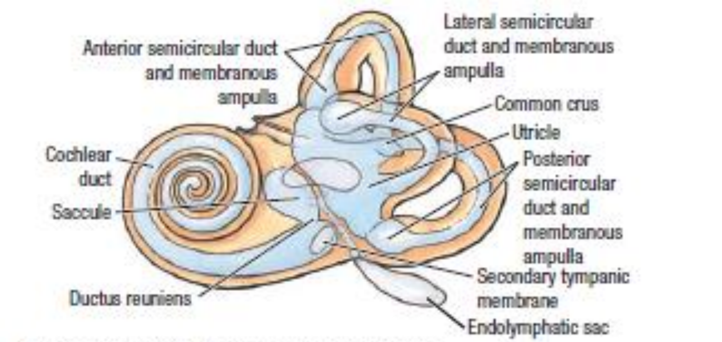
Superior projection of right bony labyrinth on floor of skull



BONY LABYRINTH

- The bony labyrinth consists of three parts: the vestibule, the semicircular canals, and the cochlea
- These are cavities situated in the substance of dense bone.
- They are lined by endosteum and contain a clear fluid, the perilymph, in which is suspended the membranous labyrinth.

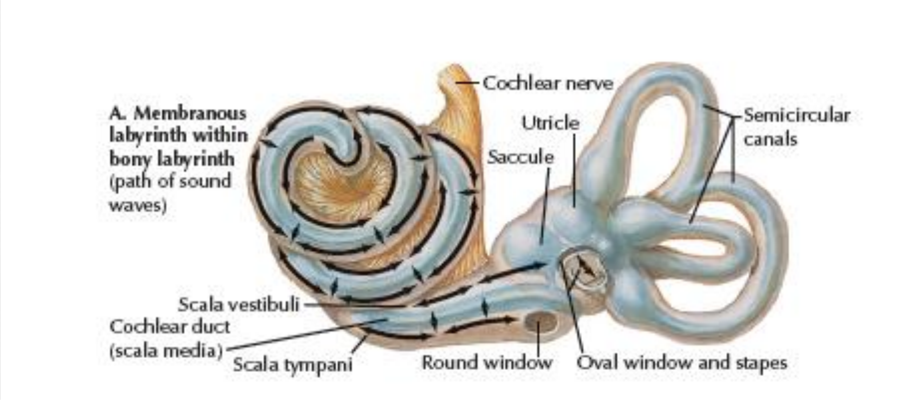




C. Anterolateral view of left membranous labyrinth

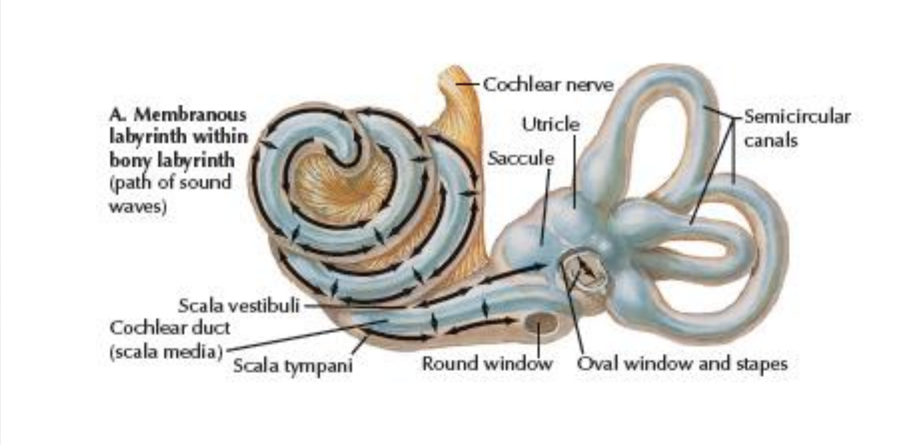
BONY LABYRINTH

- **The vestibule**
- central part
- Lies posterior to cochlea and anterior to semicircular canals
- In its lateral wall are the fenestra vestibuli, & fenestra cochleae
- within the vestibule are the saccule and utricle of the membranous labyrinth



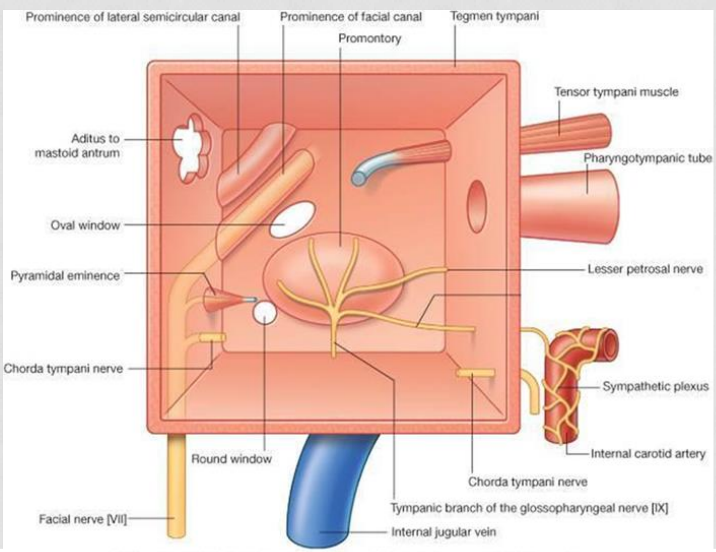
BONY LABYRINTH

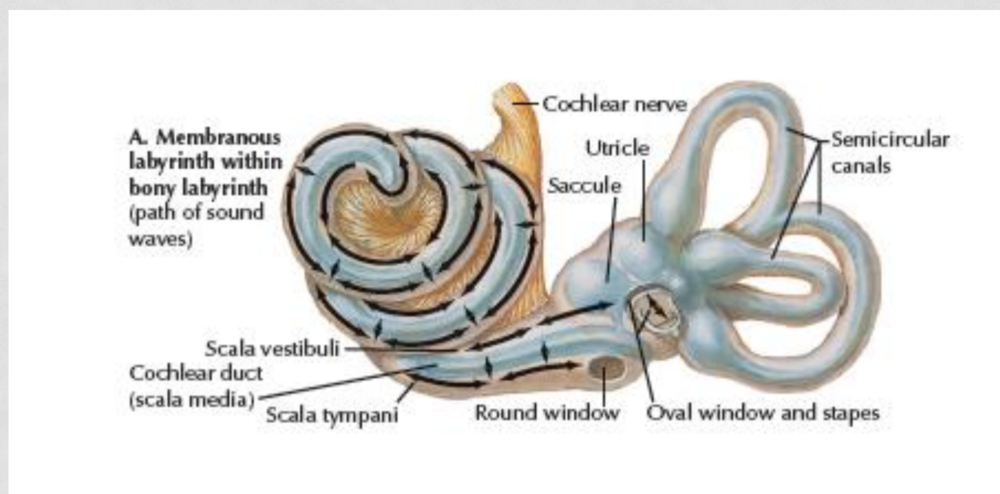
- **semicircular canals—superior**, **posterior**, and **lateral**
- open into posterior part of the vestibule.
- Each canal has a swelling at one end called the **ampulla.**
- The canals open into the vestibule by five orifices, one of which is common to two of the canals.
- Lodged within the canals are the **semicircular ducts**



BONY LABYRINTH

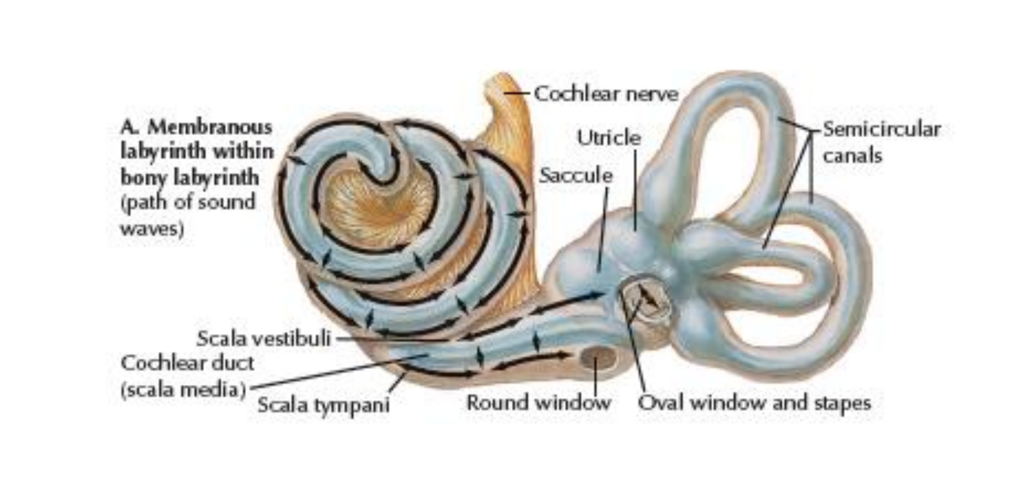
- The superior semicircular canal is vertical and at right angles to long axis of petrous bone.
- The posterior canal is also vertical but is parallel with long axis of petrous bone.
- The lateral canal is horizontal, and it lies in the medial wall of aditus above the facial nerve canal.

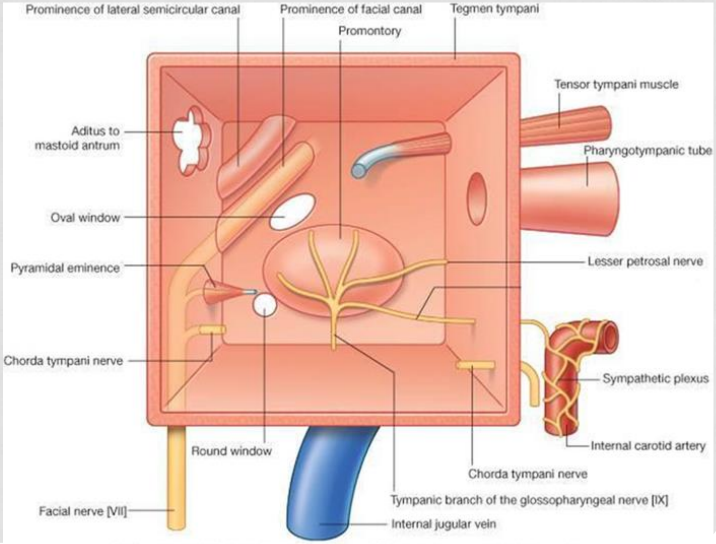


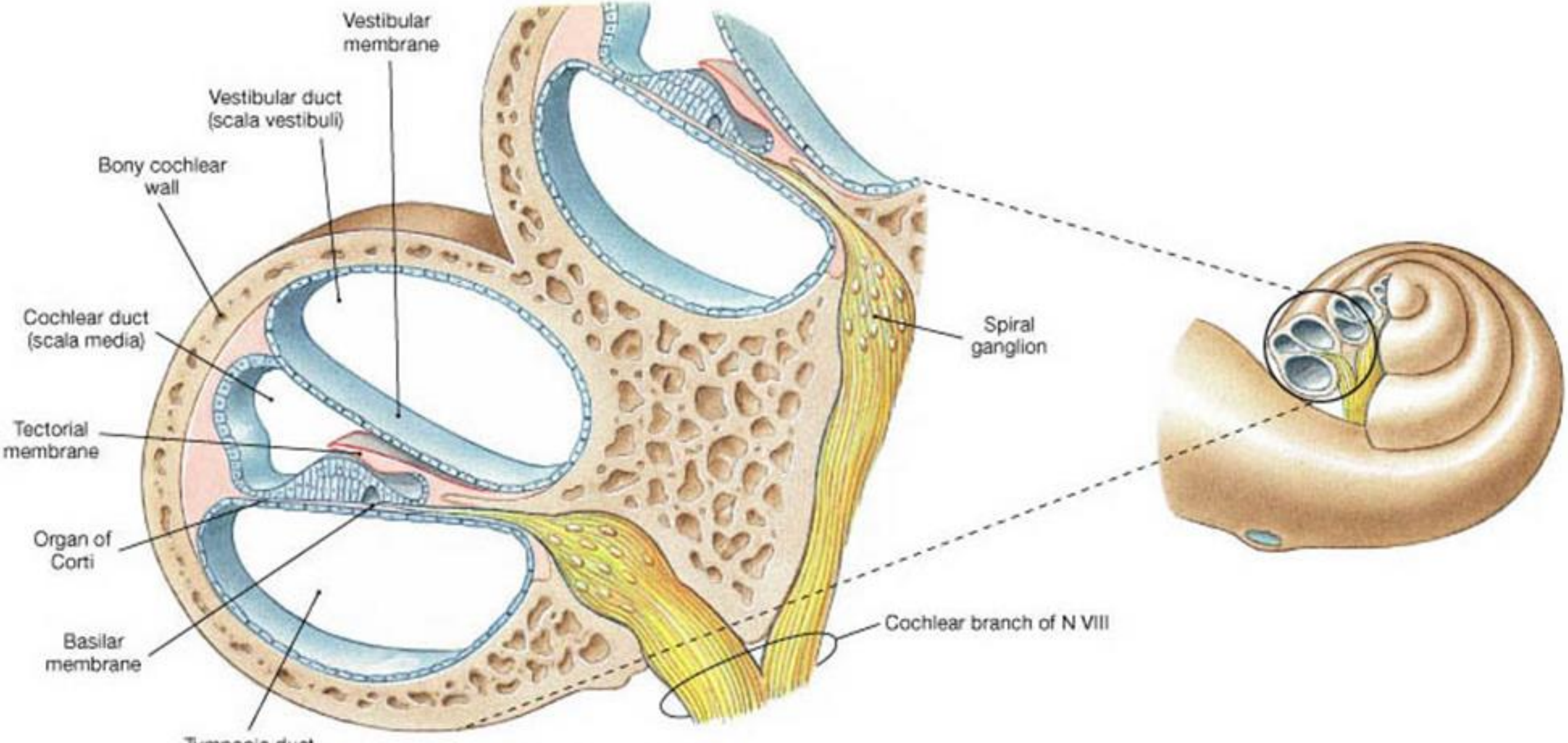


BONY LABYRINTH

- The **cochlea** resembles a snail shell.
- It opens into the anterior part of the vestibule
- it consists of a central pillar, the **modiolus**, around which a hollow bony tube makes two and one half spiral turns.
- The first basal turn of the cochlea is responsible for the promontory



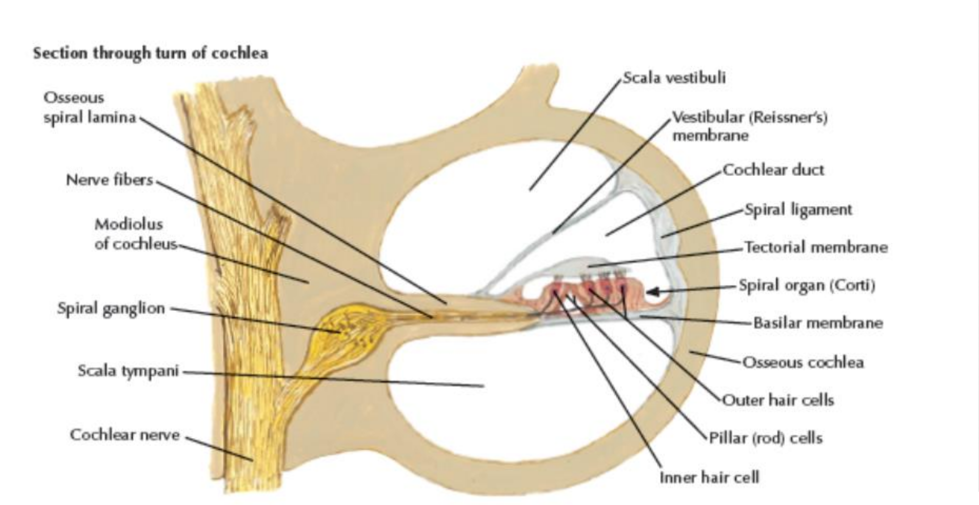




(d) Cochlear chambers

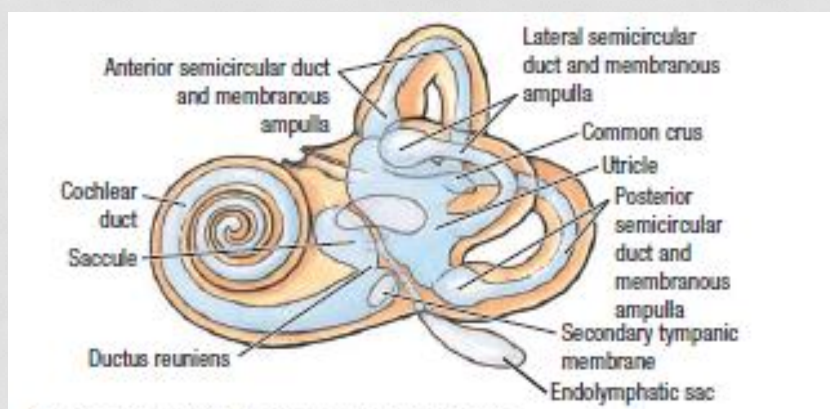
BONY LABYRINTH

- **Modiolus** is perforated by branches of the cochlear nerve.
- the **spiral lamina,** winds around the modiolus and projects into the interior of the canal and partially divides it.
- The **basilar membrane** stretches from the free edge of the spiral lamina to the outer bony wall, thus dividing the cochlear canal into the **scala vestibuli** above and the **scala tympani** below.



MEMBRANOUS LABYRINTH

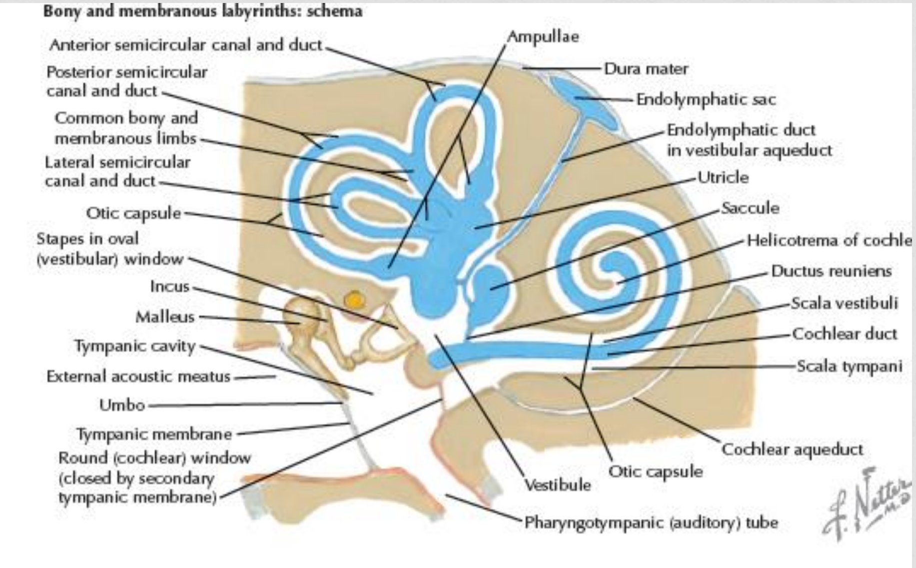
- lodged within bony labyrinth
- filled with endolymph and surrounded by perilymph.
- It consists of
- **utricle** and **saccule** (in the bony vestibule)
- three **semicircular ducts** (within bony semicircular canals)
- **duct of cochlea** (within the bony cochlea)
- All these structures freely communicate with one another.

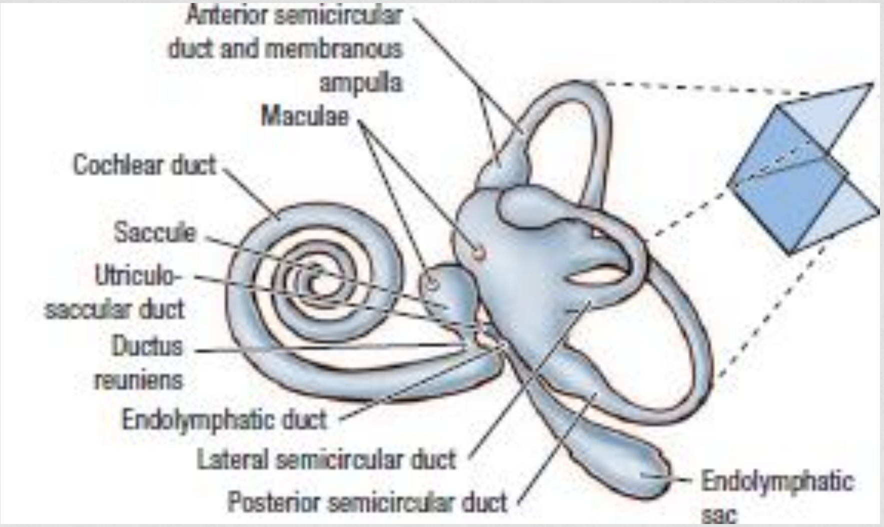


C. Anterolateral view of left membranous labyrinth

MEMBRANOUS LABYRINTH

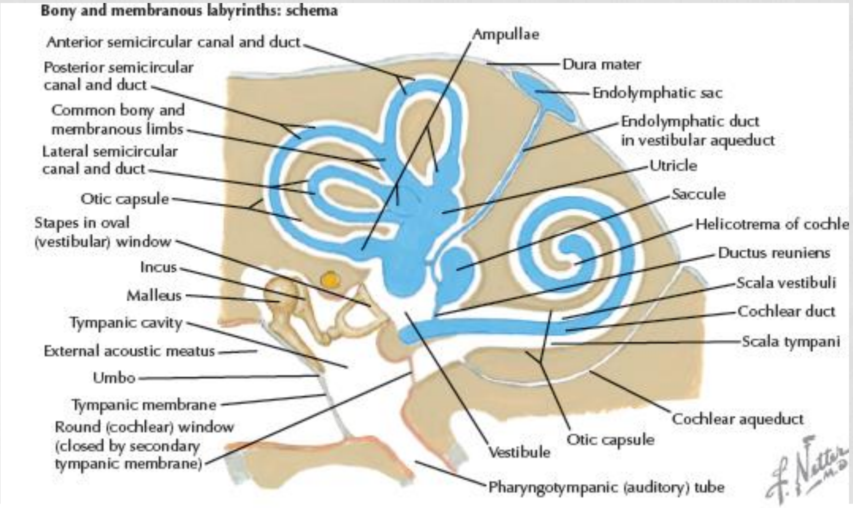
- The **utricle** is the larger of the two vestibular sacs
- indirectly connected to the saccule and the ductus endolymphaticus by the **ductus utriculosaccularis.**





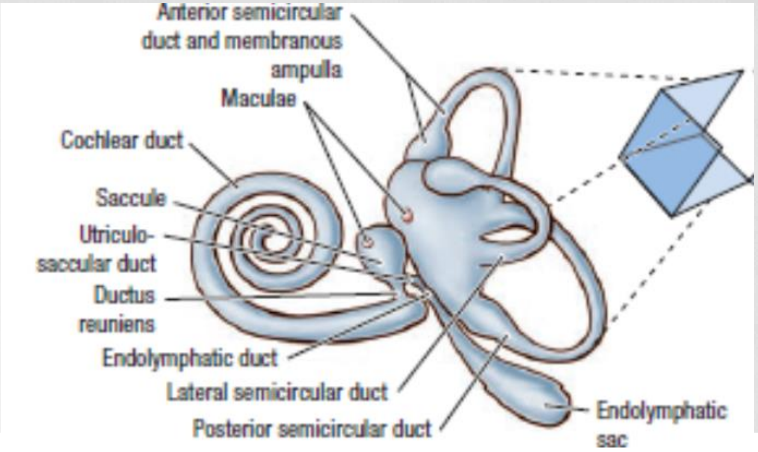
MEMBRANOUS LABYRINTH

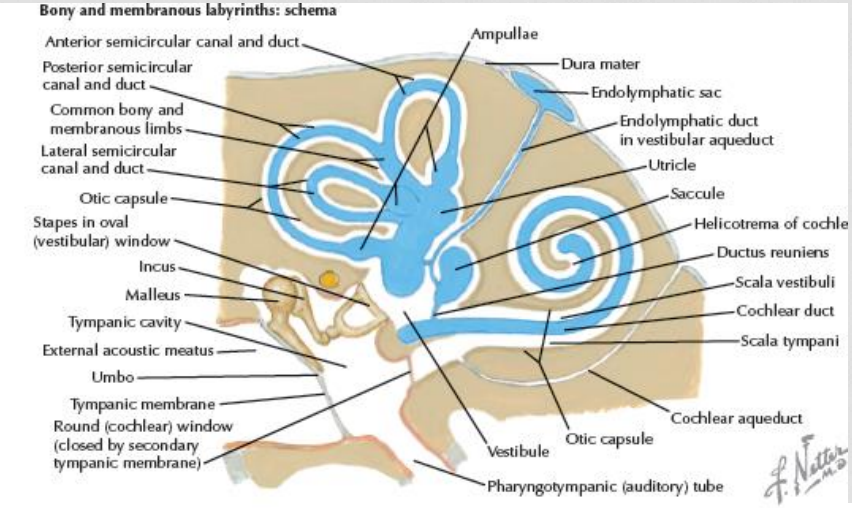
- **saccule** is globular and is connected to the utricle,
- **ductus endolymphaticus** end in a small blind pouch, the **saccus endolymphaticus**
- This lies beneath dura on posterior surface of petrous.
- Located on the walls of the utricle and saccule are specialized sensory receptors, which are sensitive to the orientation of the head to gravity or other acceleration forces.



MEMBRANOUS LABYRINTH

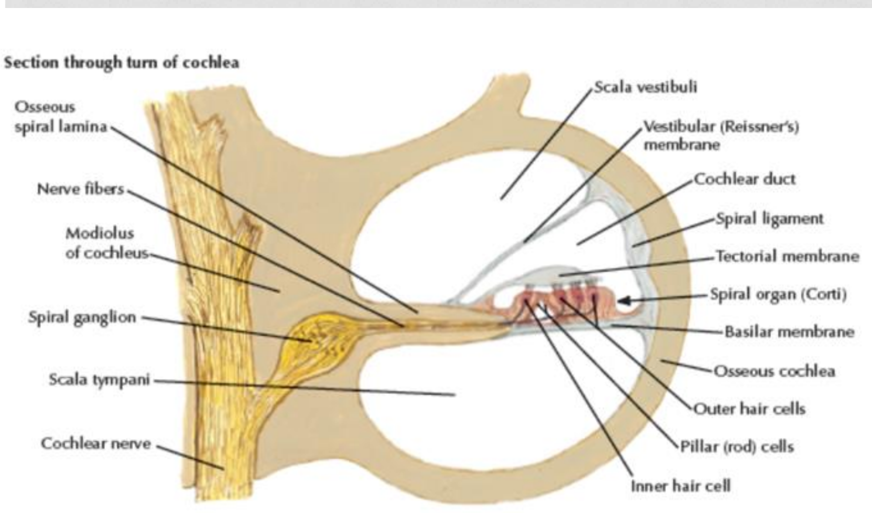
- **semicircular ducts** have smaller diameter than semicircular canals
- arranged at right angles to each other so that all three planes are represented
- Whenever the head begins or ceases to move, the endolymph in the semicircular ducts changes its speed of movement relative to that of the walls of the semicircular ducts. This change is detected in the sensory receptors in the ampullae of the semicircular ducts.

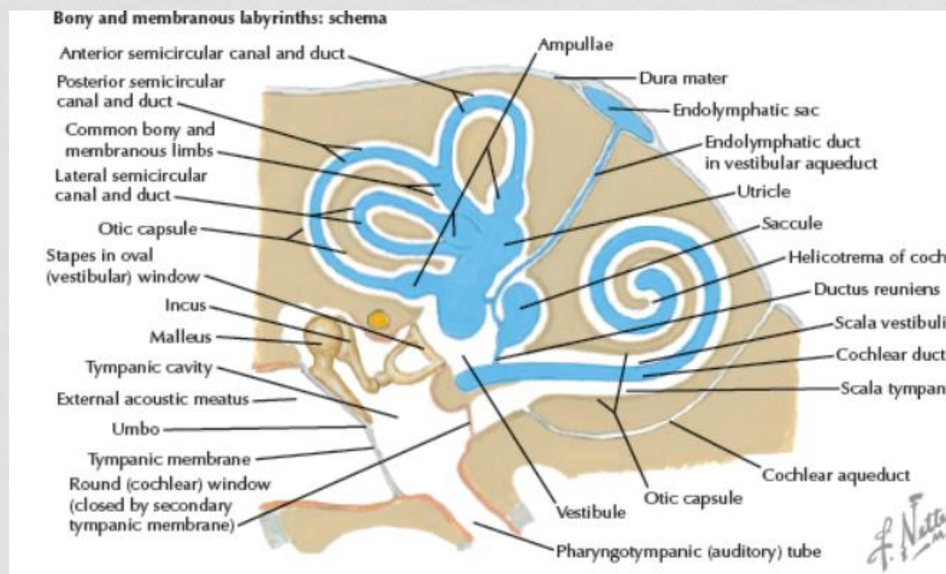




MEMBRANOUS LABYRINTH

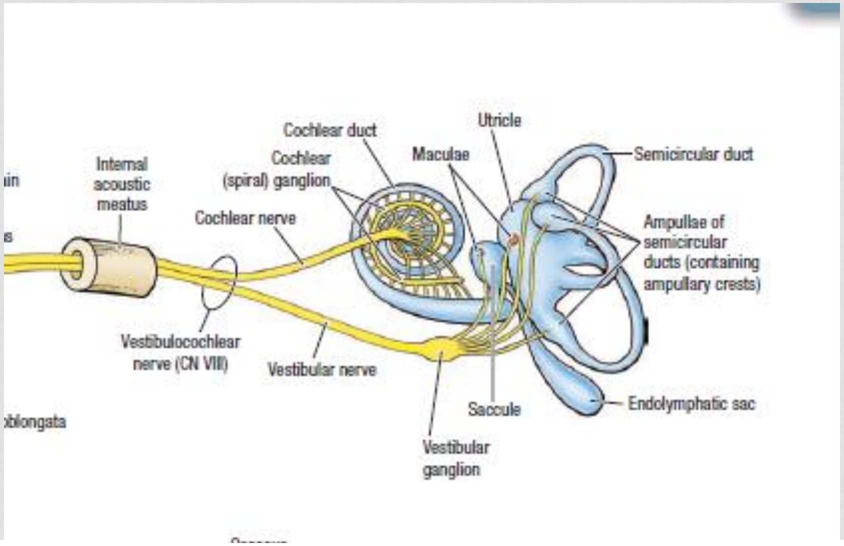
- **duct of the cochlea** is triangular in cross section
- connected to the saccule by the **ductus reuniens.**
- highly specialized epithelium that lies on the **basilar membrane** forms the **spiral organ of Corti** and contains the sensory receptors for hearing





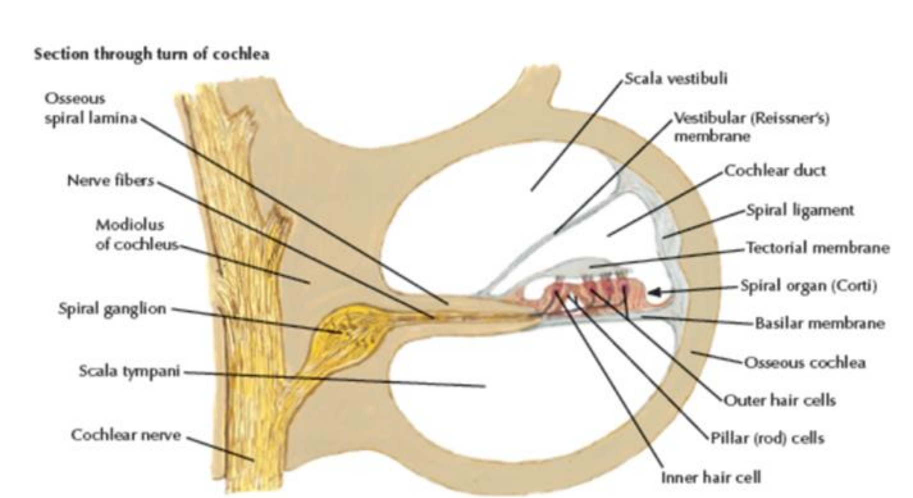
VESTIBULOCOCHLEAR NERVE

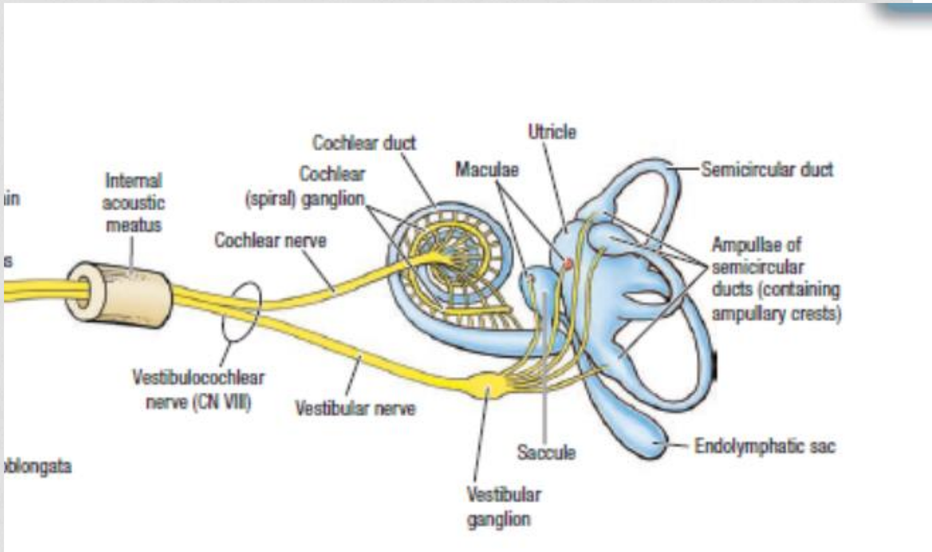
- At bottom of the internal acoustic meatus the nerve divides into vestibular and cochlear portions
- The **vestibular nerve**
- form the **vestibular ganglion.**
- Branches then enter to membranous labyrinth, supply utricle, saccule, and ampullae of semicircular ducts.



VESTIBULOCOCHLEAR NERVE

- **cochlear nerve** divides into branches, which enter foramina at the base of the modiolus.
- Has **spiral ganglion** that is lodged in a canal winding around the modiolus in the base of the spiral lamina.
- The peripheral branches of this nerve pass from the ganglion to the **spiral organ of Corti.**





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- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.

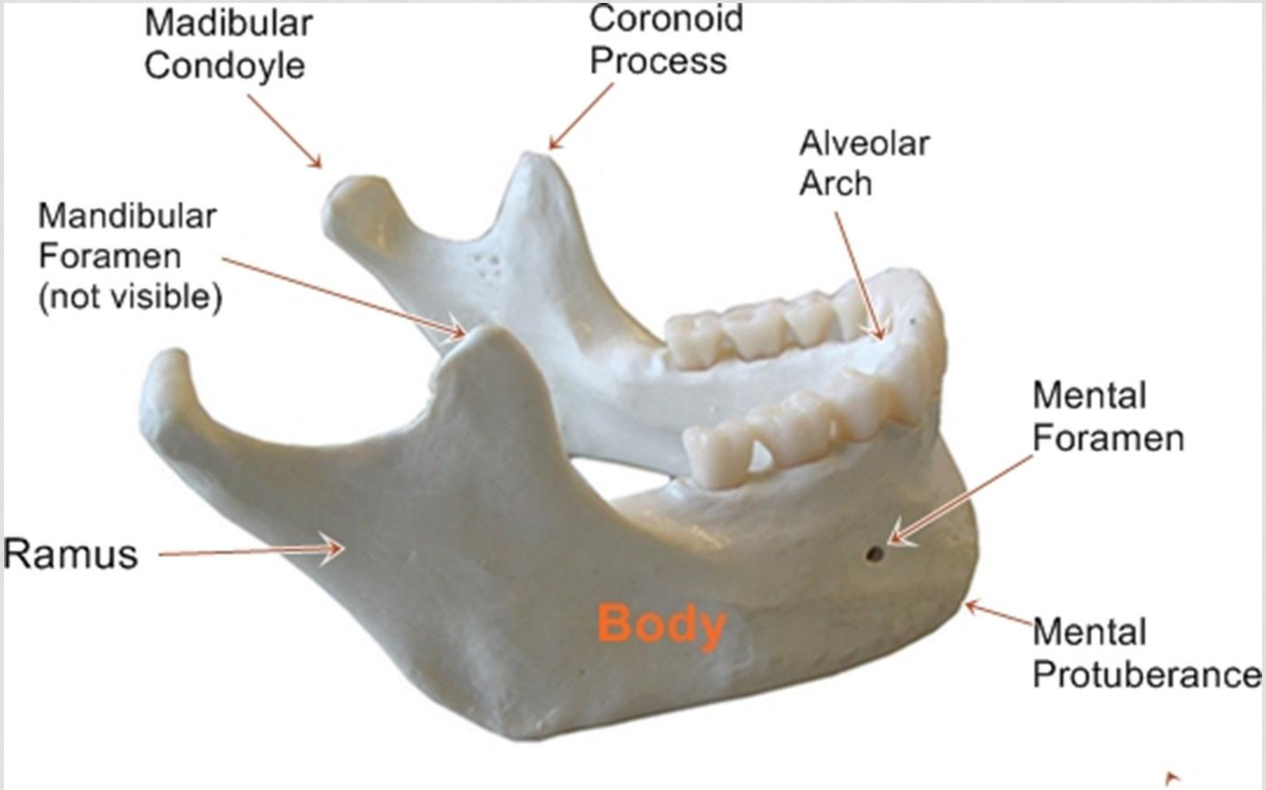
ANATOMY OF THE MANDIBLE

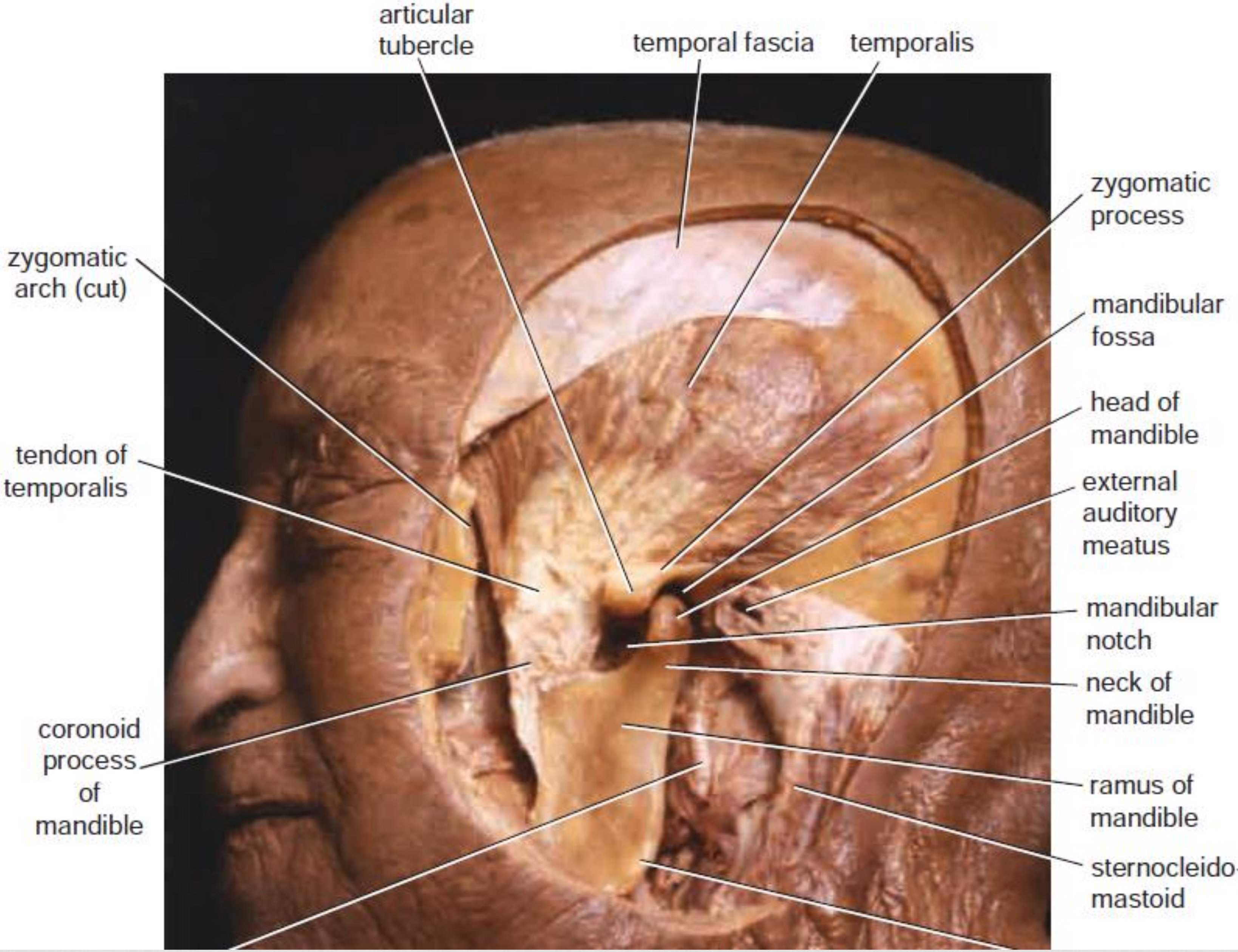
SECOND STAGE

DR. AHMED JASSSAM ALNAQEEB
ORAL AND MAXILLOFACIAL SURGEON

THE MANDIBLE

The mandible or lower jaw is *the largest and strongest bone of the face*, and it articulates with the skull at the temporomandibular joint.

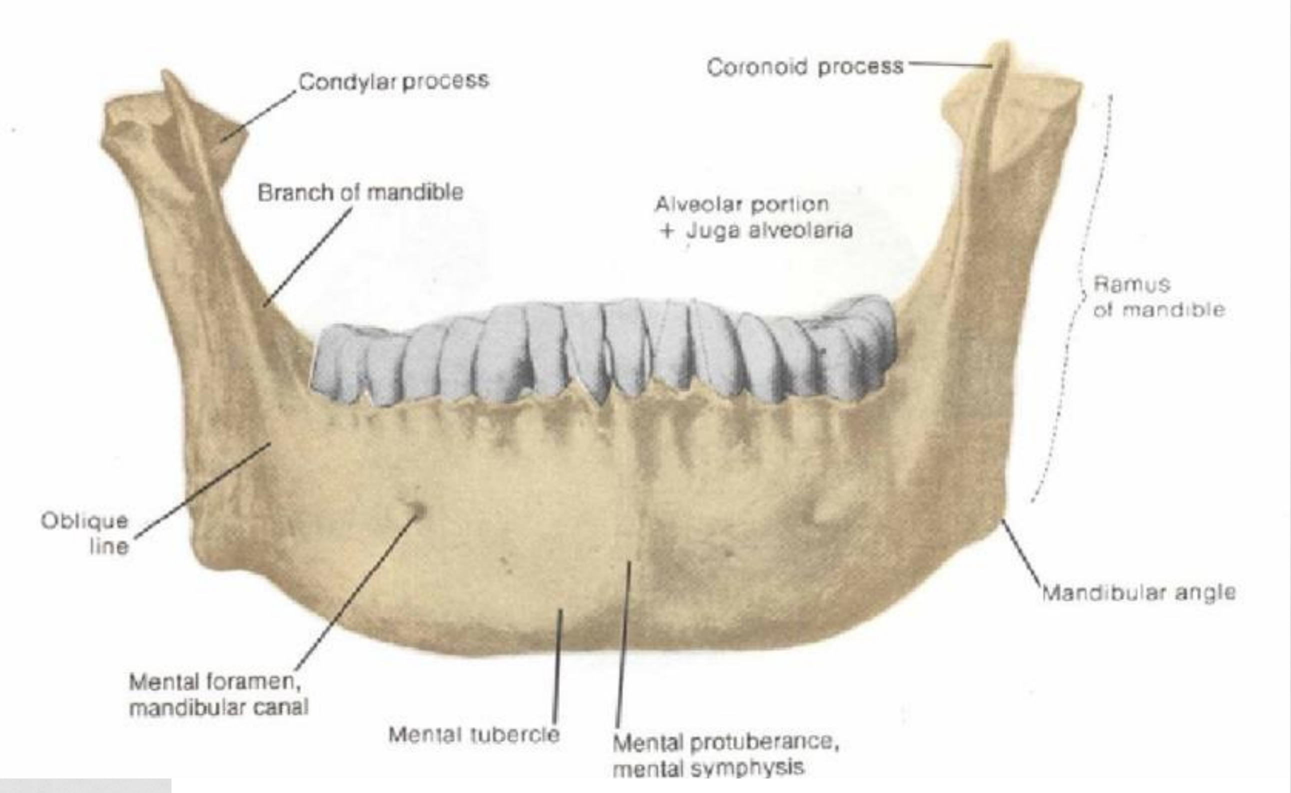




articular tubercle
temporal fascia
temporalis
zygomatic process
mandibular fossa
head of mandible
external auditory meatus
mandibular notch
neck of mandible
ramus of mandible
sternocleido-mastoid
zygomatic arch (cut)
tendon of temporalis
coronoid process of mandible

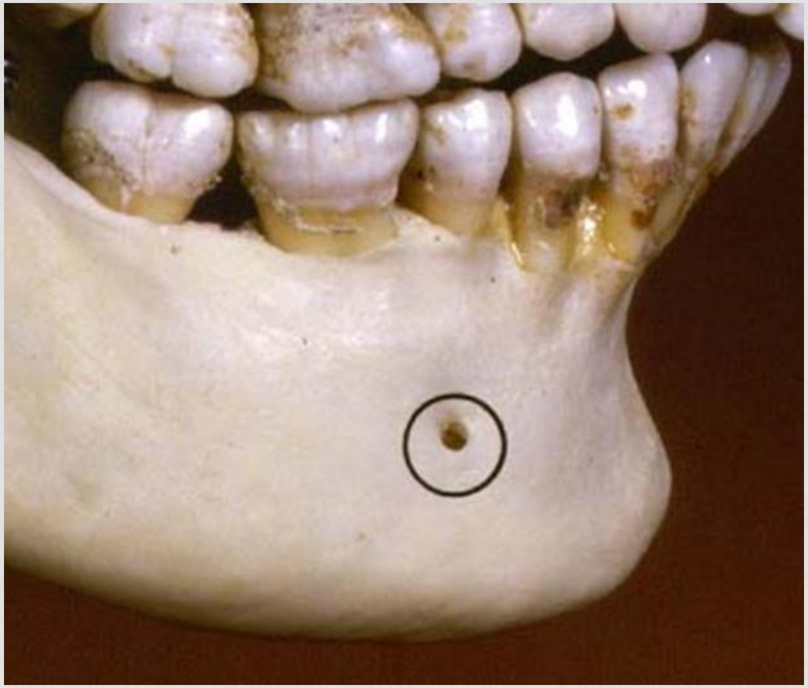
THE MANDIBLE

The body of the mandible, on its external surface in the midline, has a faint ridge, the ***symphysis menti.***



THE MANDIBLE

- The *mental foramen* can be seen below the second premolar tooth; it transmits the terminal branches of the inferior alveolar nerve and vessels.

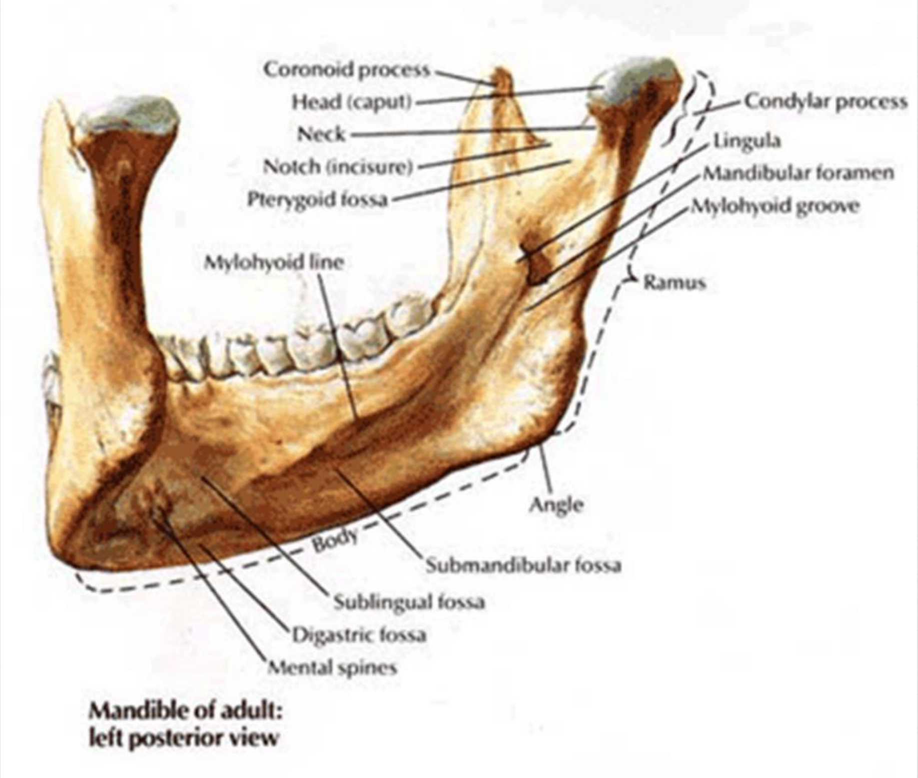


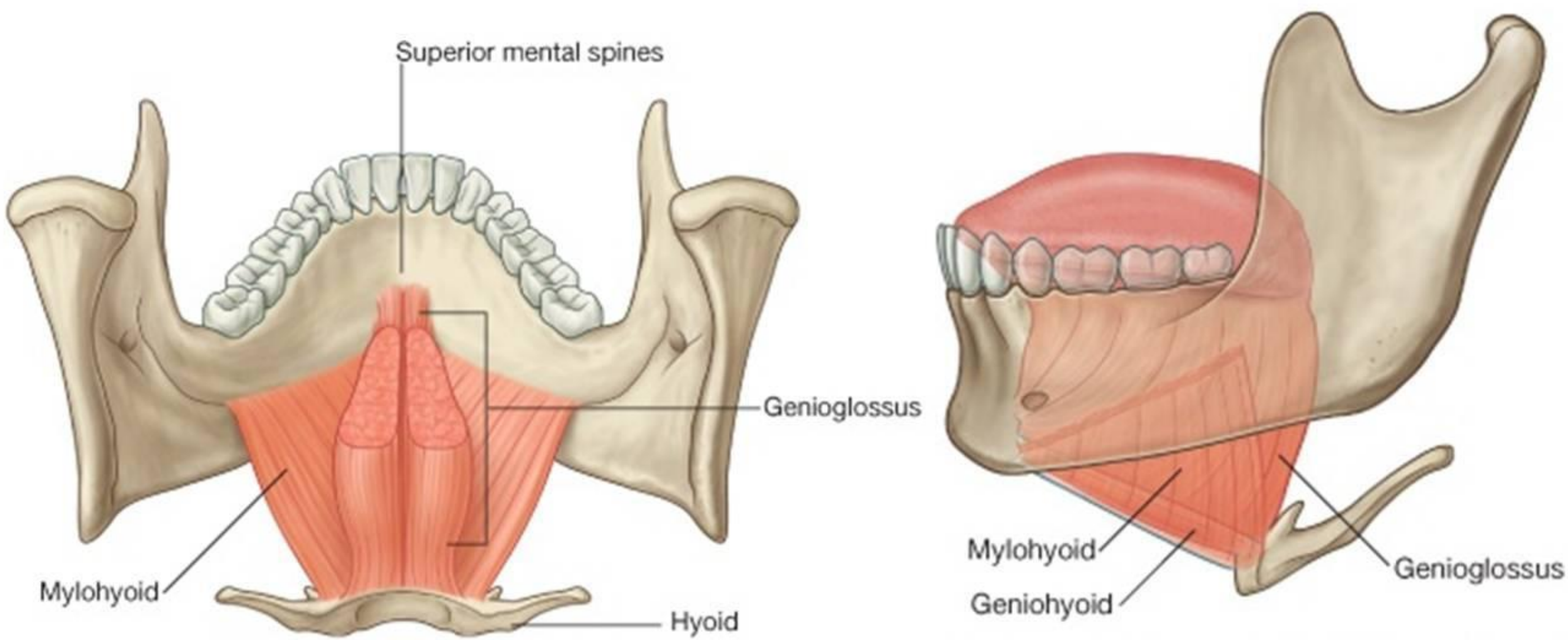
THE MANDIBLE

On the medial surface of the body of the mandible in the median plane are seen the *mental spines*; these give origin to the genioglossus muscles above and the geniohyoid muscles below .

THE MANDIBLE

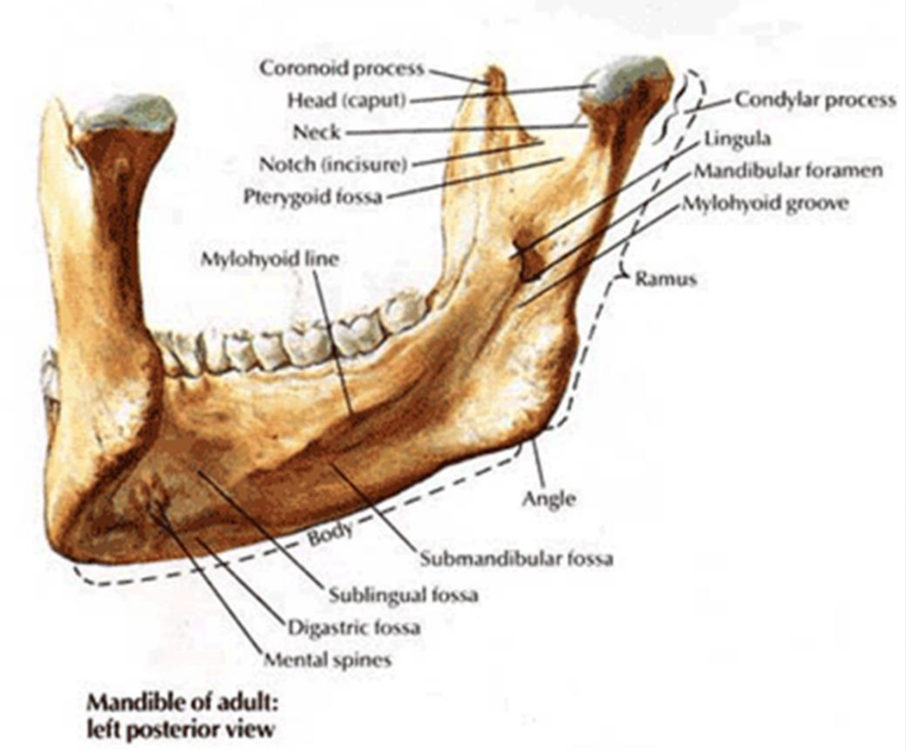
- The *mylohyoid line* can be seen as an oblique ridge that runs backward and laterally from the area of the mental spines to an area below and behind the third molar tooth.




Superior mental spines
Genioglossus
Mylohyoid
Hyoid
Mylohyoid
Geniohyoid
Genioglossus

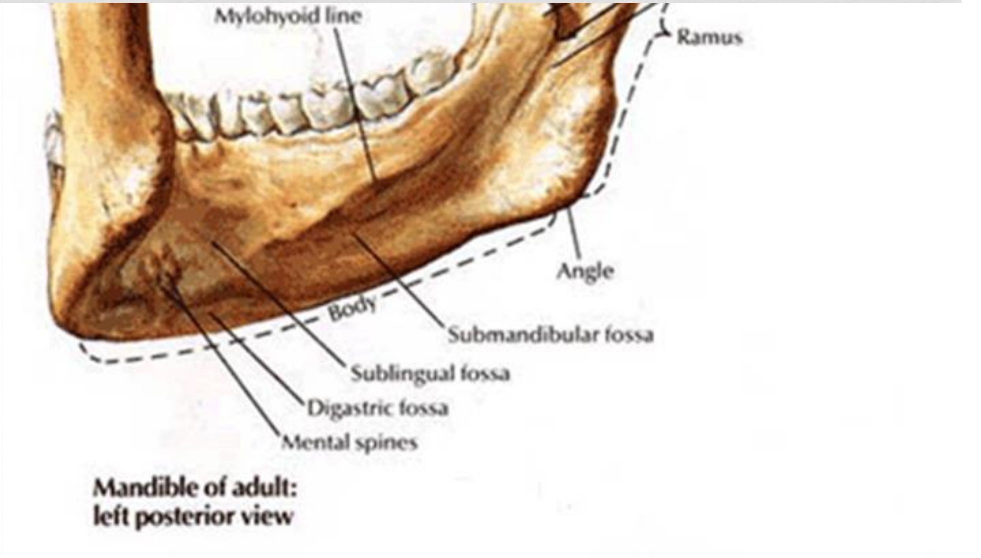
THE MANDIBLE

- The ***submandibular fossa***, for the superficial part of the submandibular salivary gland
- The ***sublingual fossa***, for the sublingual gland



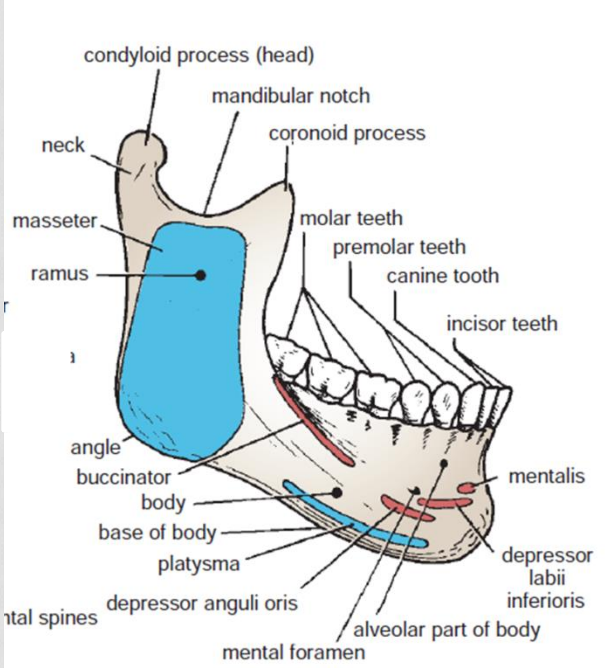
THE MANDIBLE

- The upper border of the body of the mandible is called the ***alveolar part***
- The lower border of the body of the mandible is called *the* ***base***.
- The ***digastric fossa*** is a small, roughened depression on the base, on either side of the symphysis menti .

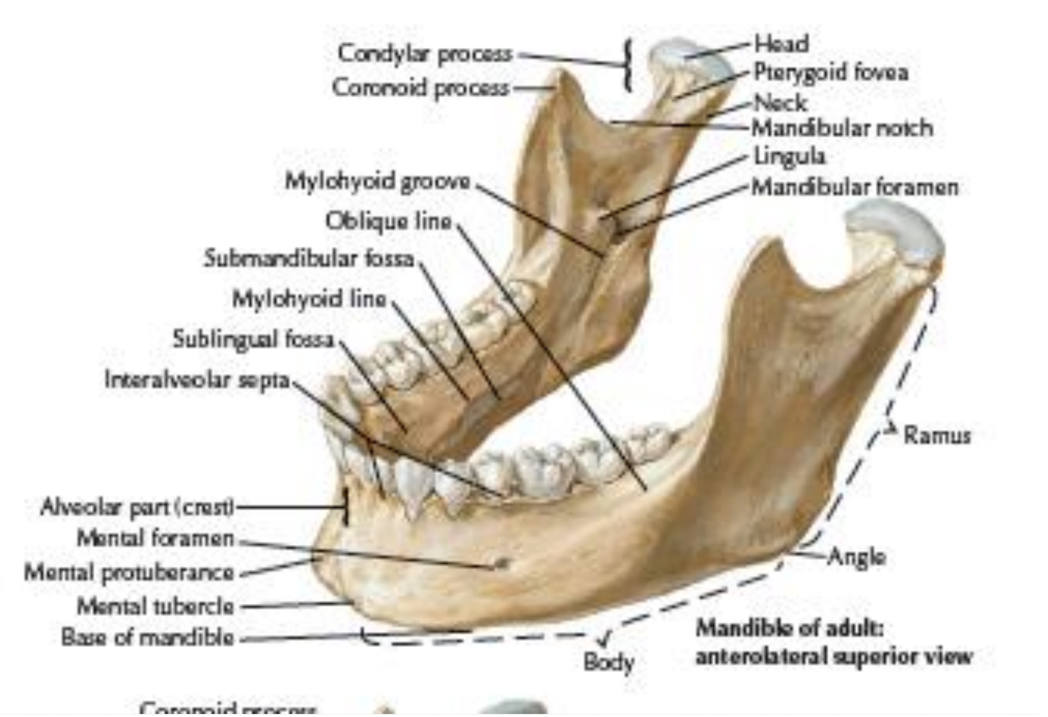


THE MANDIBLE

The *ramus* of the mandible is vertically placed and has an anterior ***coronoid*** process and a posterior ***condyloid*** process, or head; the two processes are separated by the ***mandibular notch***.

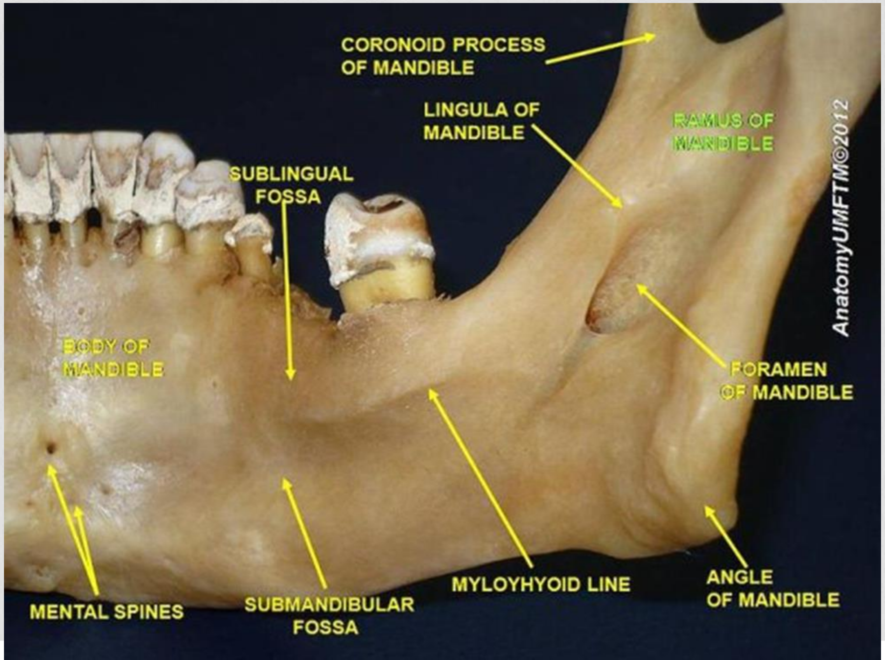


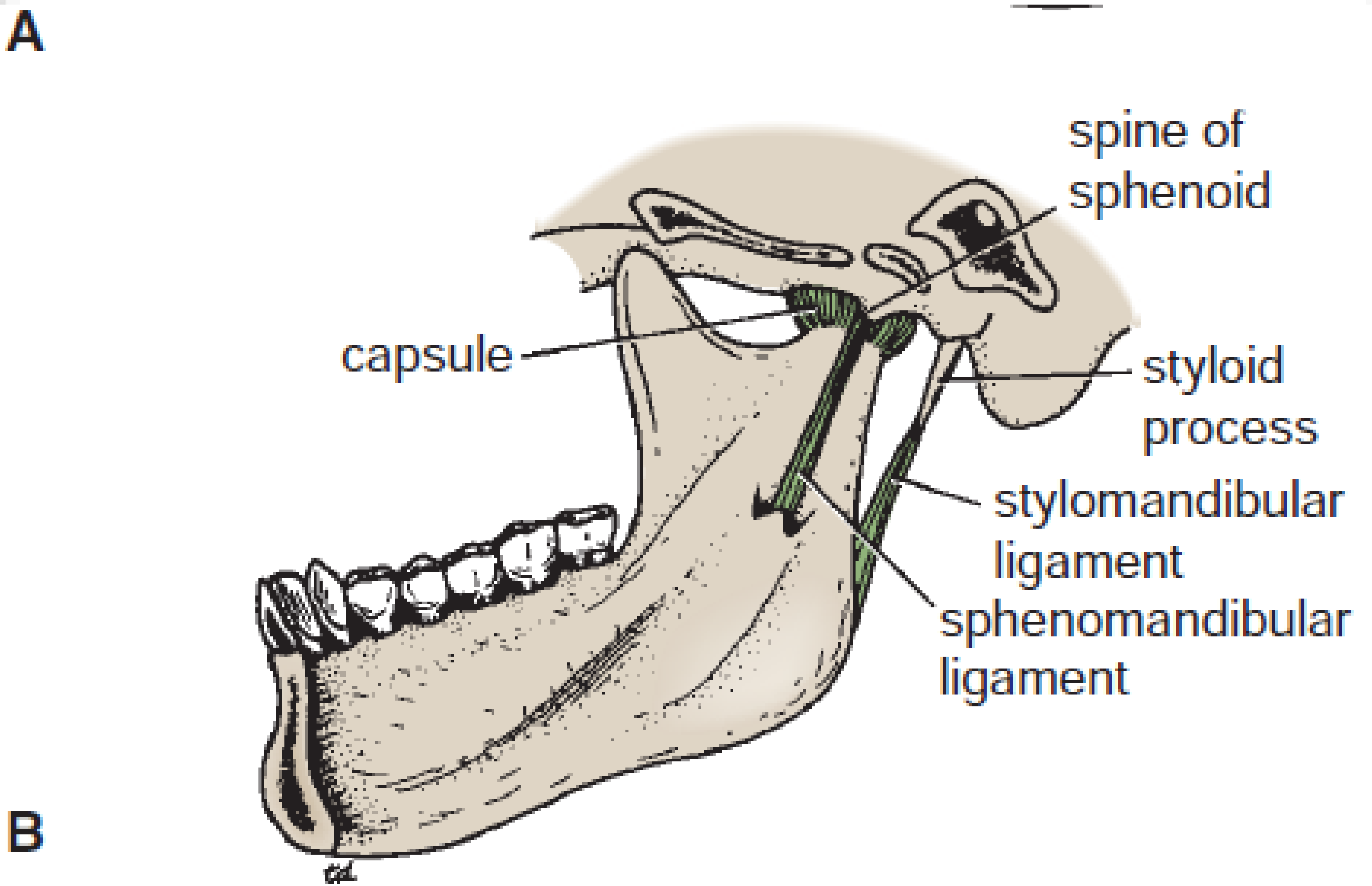
lateral aspect (right side)



THE MANDIBLE

- On the medial surface is the ***mandibular foramen*** for the inferior alveolar nerve and vessels
- In front of the foramen is a projection of bone, called the ***lingula***, for the attachment of the **sphenomandibular ligament**

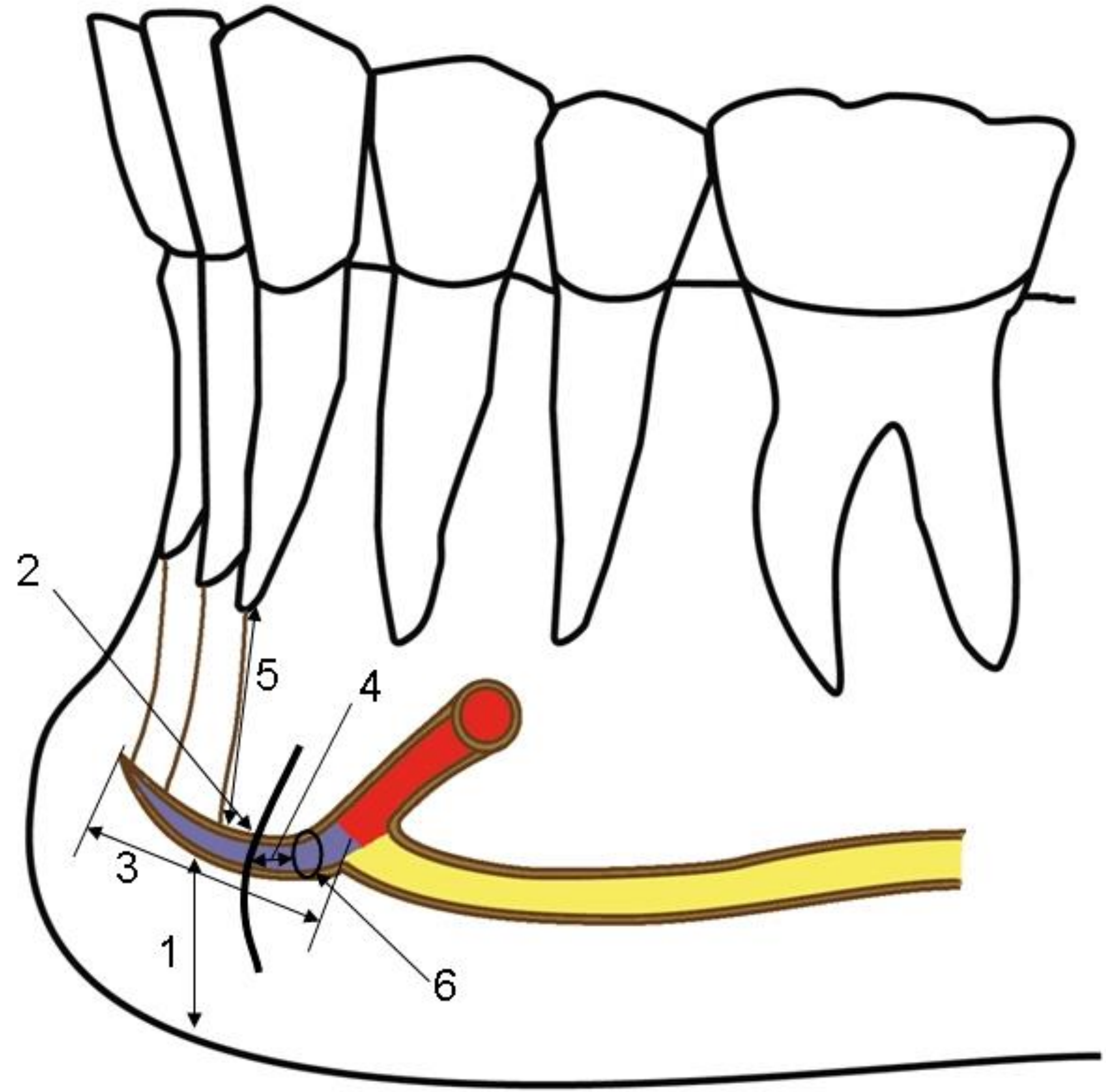



A
spine of sphenoid
capsule
styloid process
stylomandibular ligament
sphenomandibular ligament
B

THE MANDIBLE

The foramen leads into the *mandibular canal*, which opens on the lateral surface of the body of the mandible at the mental foramen

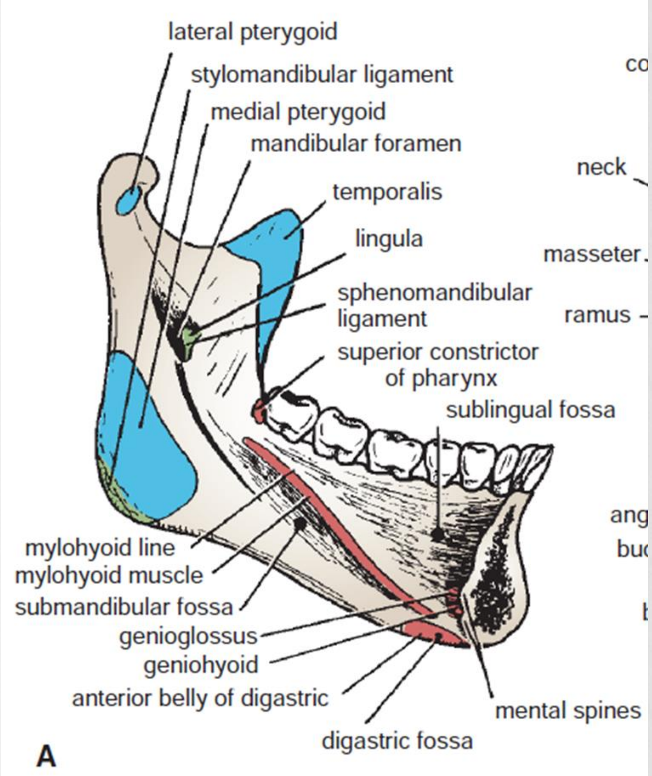
The *incisive canal* is a continuation forward of the mandibular canal beyond the mental foramen and below the incisor teeth



2
5
4
3
1
6

THE MANDIBLE

The coronoid process receives on its medial surface the attachment of the temporalis muscle.



medial aspect (left side)

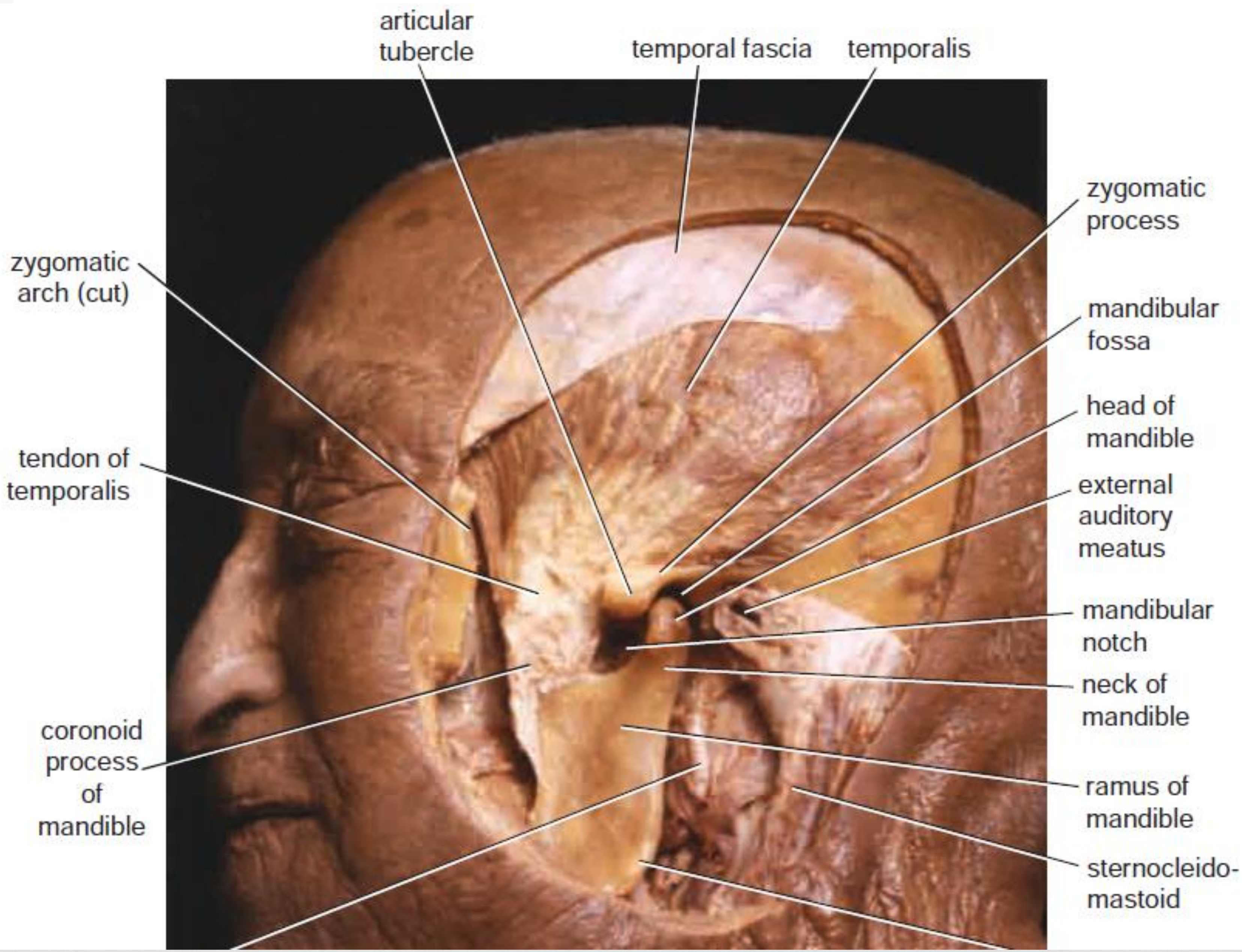
TEMPOROMANDIBULAR JOINT

TEMPOROMANDIBULAR JOINT

Articulation

Occurs between the **articular tubercle** and the anterior portion of the **mandibular fossa** of the temporal bone above and the head (condyloid process) of the mandible below.

The articular surfaces are covered with fibrocartilage.

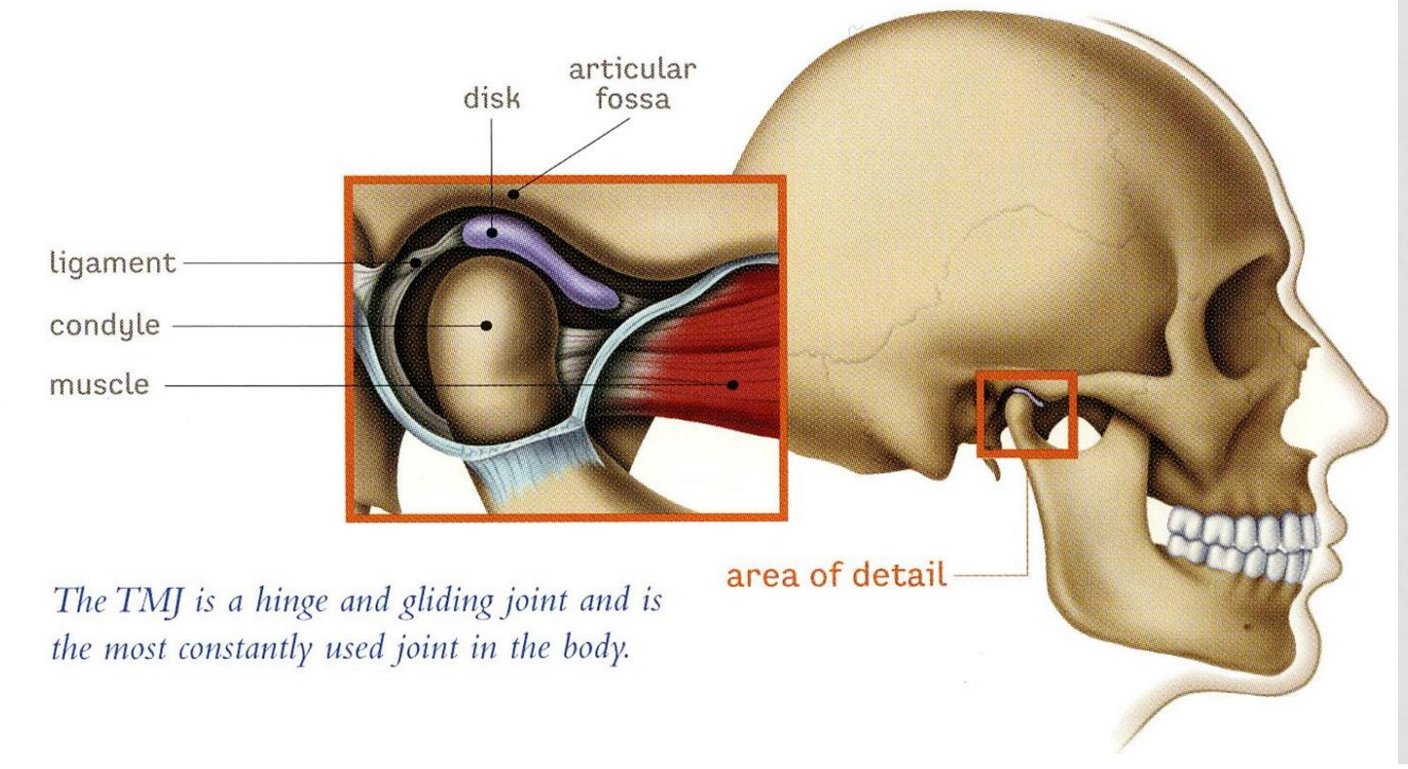


articular tubercle
temporal fascia
temporalis
zygomatic process
zygomatic arch (cut)
mandibular fossa
head of mandible
tendon of temporalis
external auditory meatus
mandibular notch
neck of mandible
coronoid process of mandible
ramus of mandible
sternocleido-mastoid

TEMPOROMANDIBULAR JOINT

Type of Joint

The temporomandibular joint is synovial. The articular disc divides the joint into upper and lower cavities.

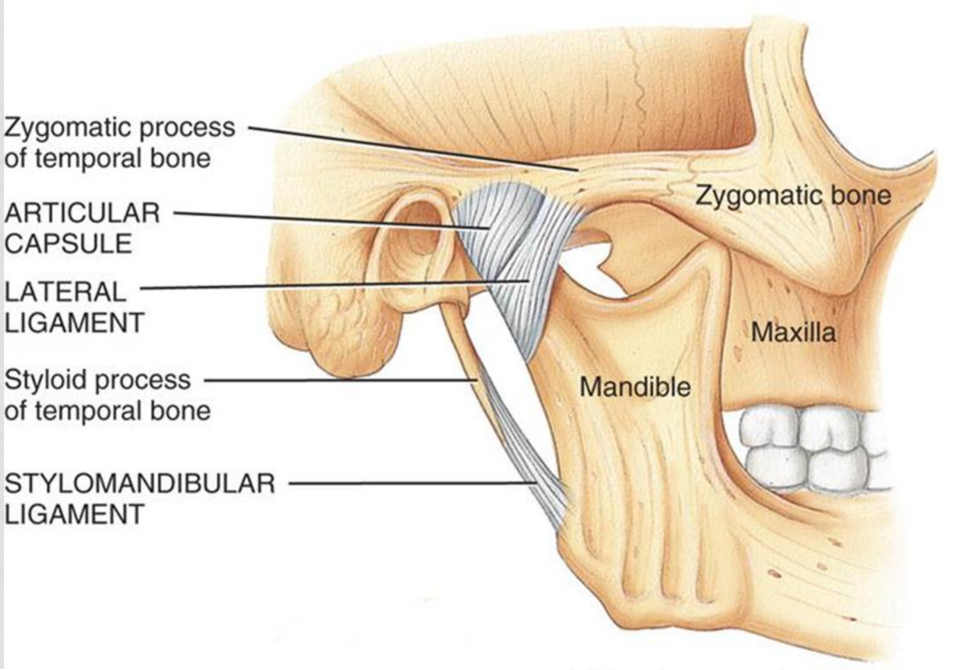


The TMJ is a hinge and gliding joint and is the most constantly used joint in the body.

TEMPOROMANDIBULAR JOINT

Capsule

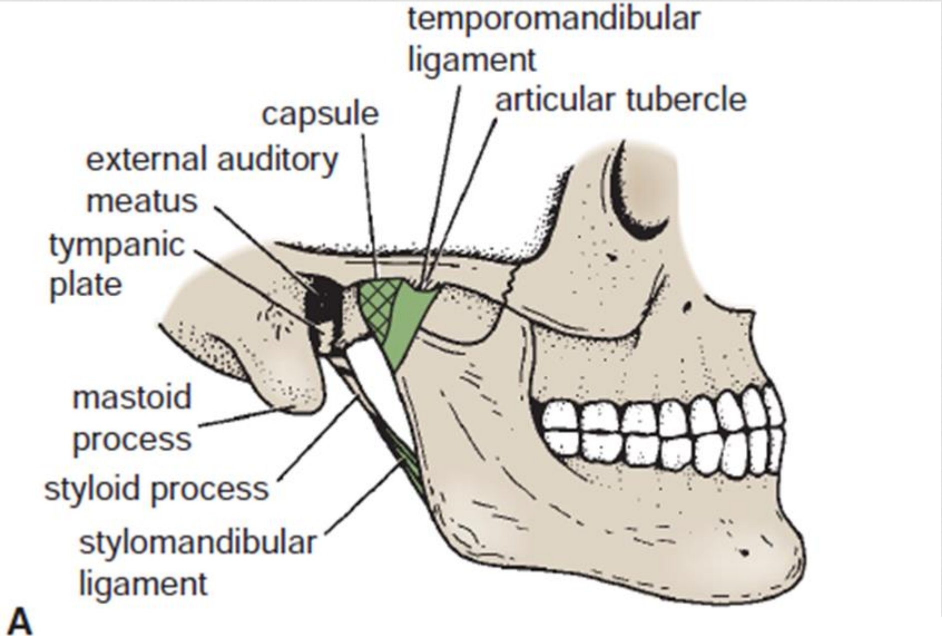
The capsule surrounds the joint and is attached above to the articular tubercle and the margins of the mandibular fossa and below to the neck of the mandible.



TEMPOROMANDIBULAR JOINT

Ligaments

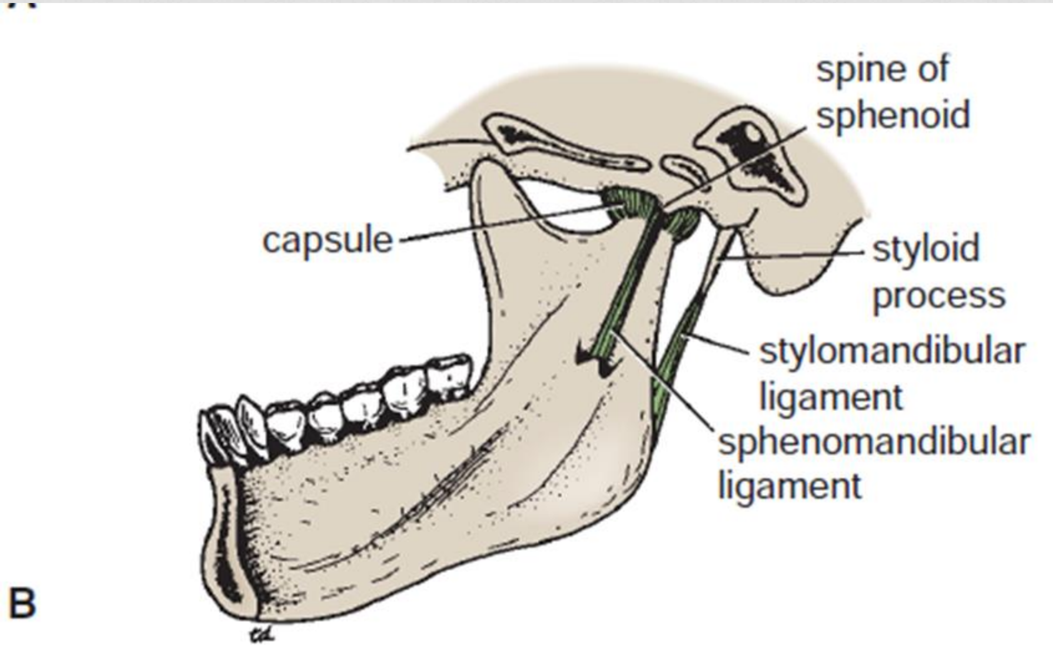
- **lateral temporomandibular ligament** strengthens the lateral aspect of the capsule
- This ligament limits the movement of the mandible in a posterior direction



TEMPOROMANDIBULAR JOINT

Ligaments

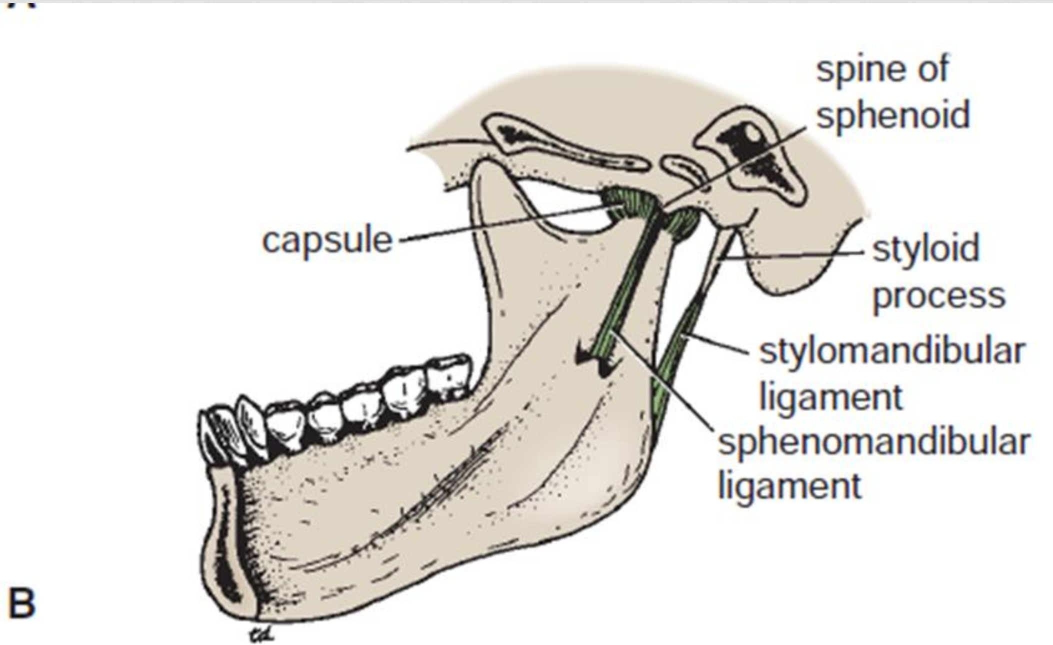
- The **sphenomandibular ligament** a thin band lies on the medial side of the joint
- attached above to the spine of the sphenoid bone and below to the lingula of the mandibular foramen



TEMPOROMANDIBULAR JOINT

Ligaments

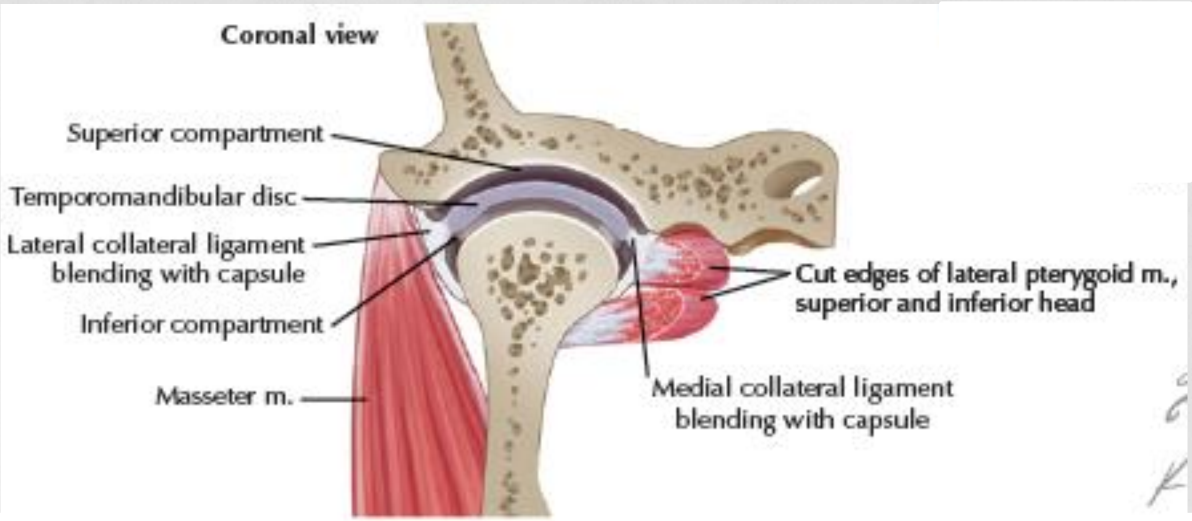
- The **stylomandibular ligament** lies behind and medial to the joint and some distance from it.
- It is a band of thickened deep cervical fascia extends from apex of the styloid process to angle of the mandible



TEMPOROMANDIBULAR JOINT

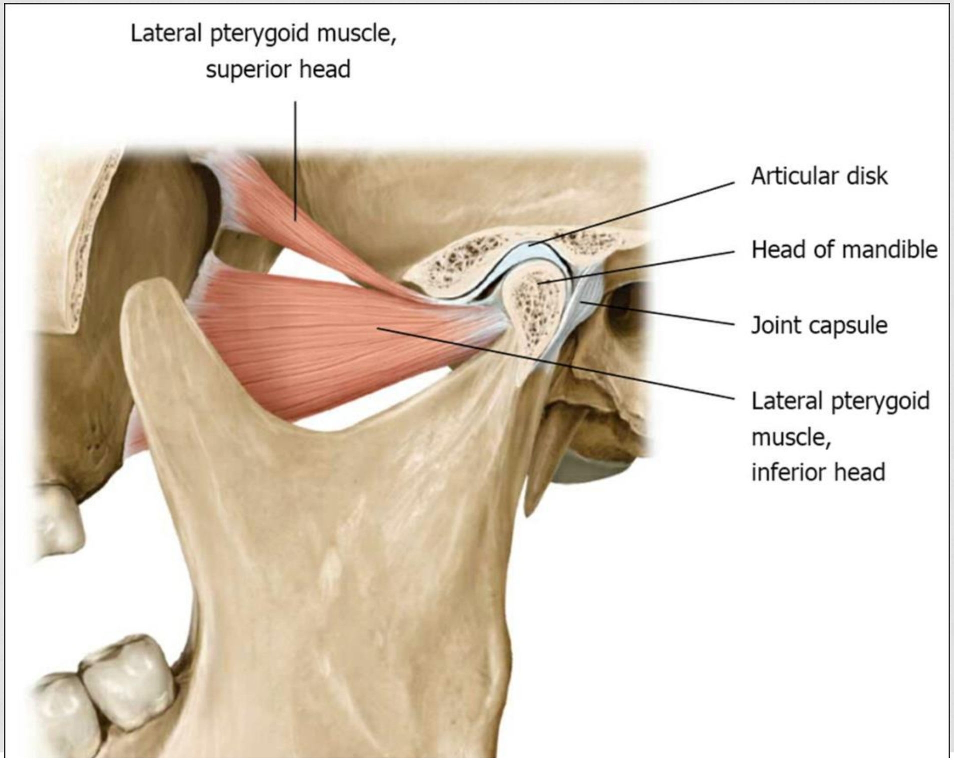
The **articular disc** divides the joint into upper and lower cavities . It is an oval plate of fibrocartilage that is attached circumferentially to the capsule.

It is also attached in front to the tendon of the lateral pterygoid muscle and by fibrous bands to the head of the mandible.



TEMPOROMANDIBULAR JOINT

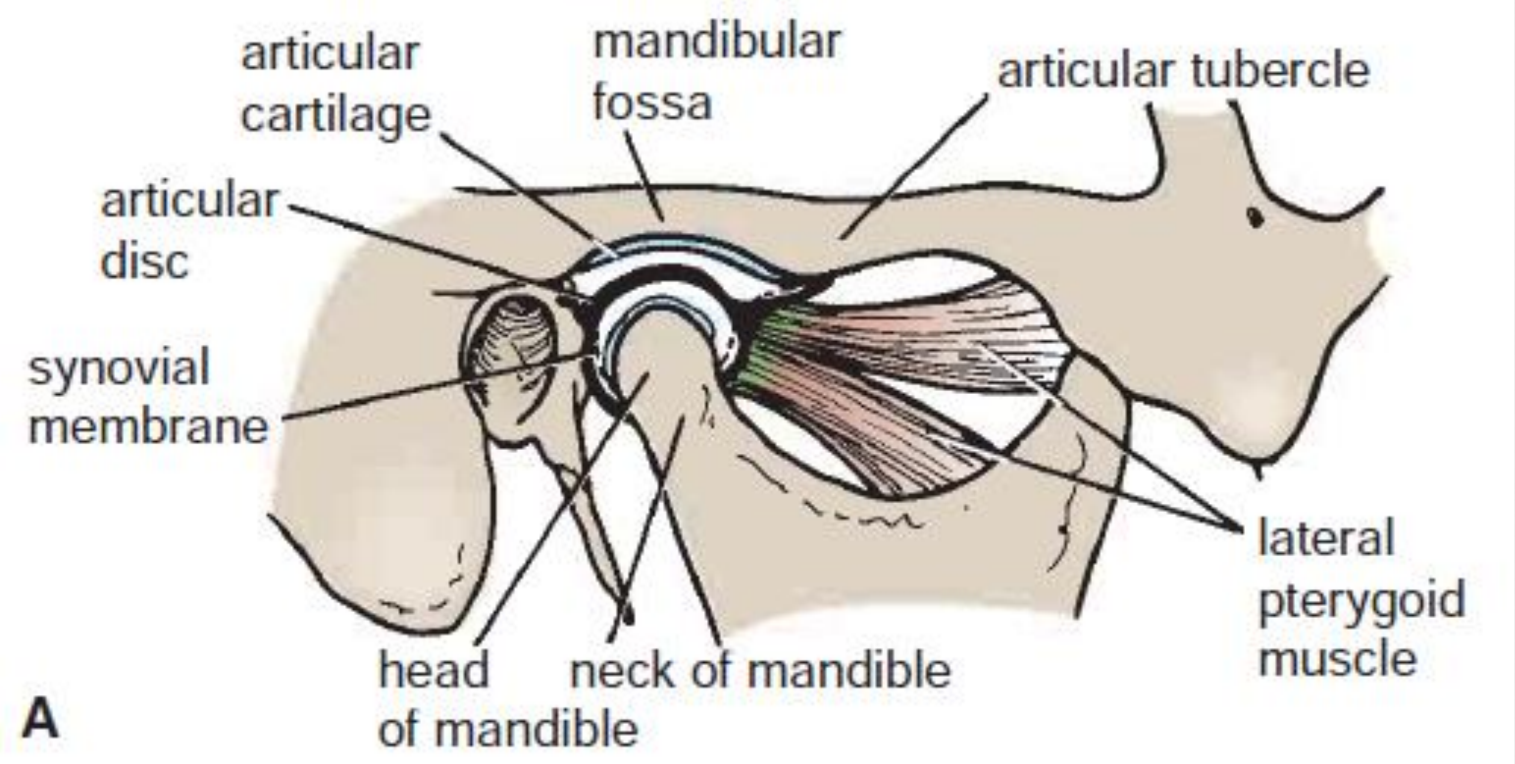
The upper surface of the disc is concavoconvex from before backward to fit the shape of the articular tubercle and the mandibular fossa; the lower surface is concave to fit the head of the mandible.



TEMPOROMANDIBULAR JOINT

Synovial Membrane

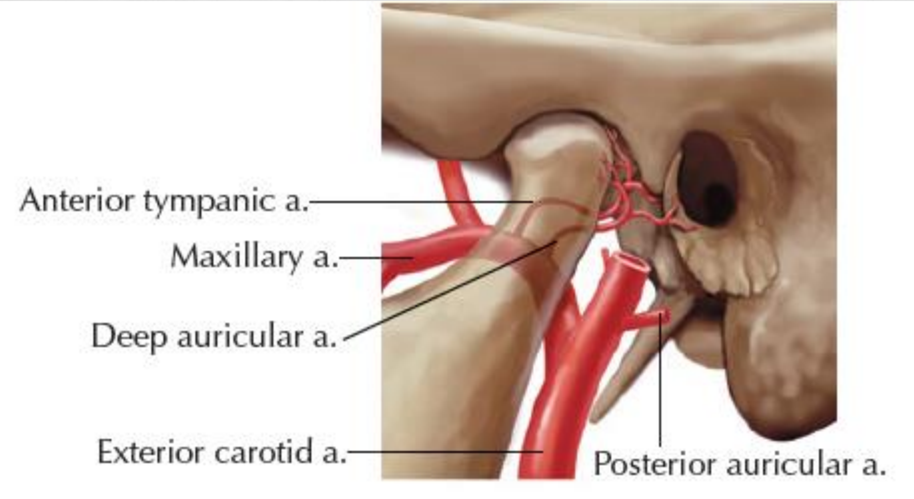
This lines the capsule in the upper and lower cavities of the joint.

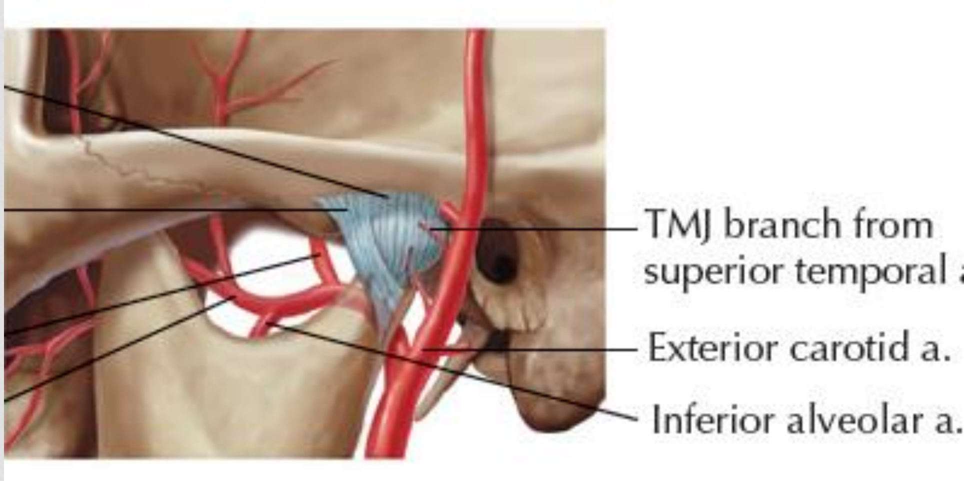


TEMPOROMANDIBULAR JOINT

- **Blood supply**

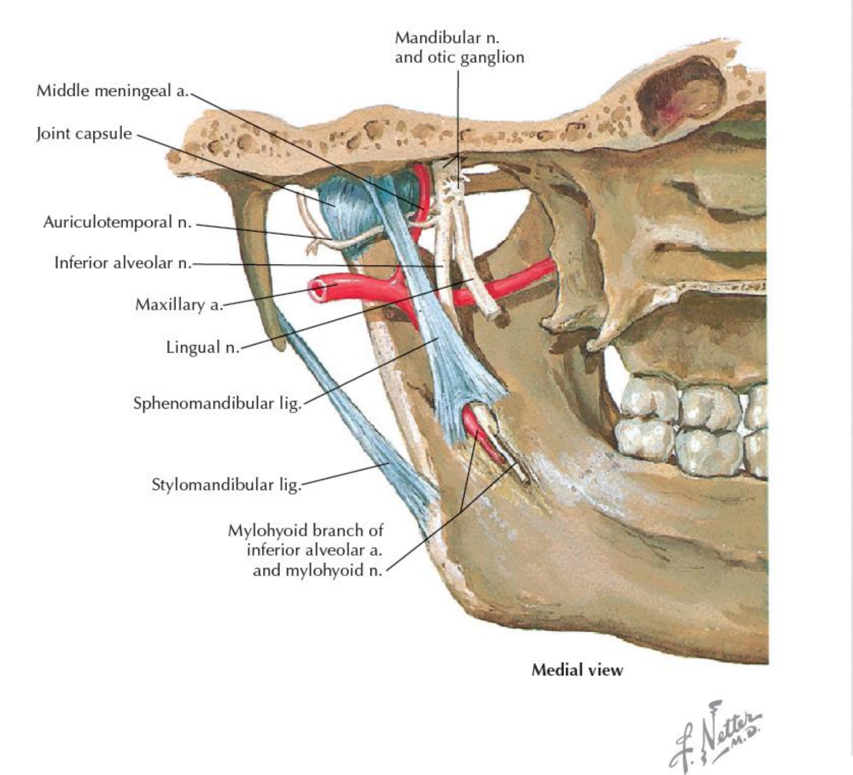
1. Superficial temporal a.
2. Anterior tympanic a.
3. Deep auricular a.



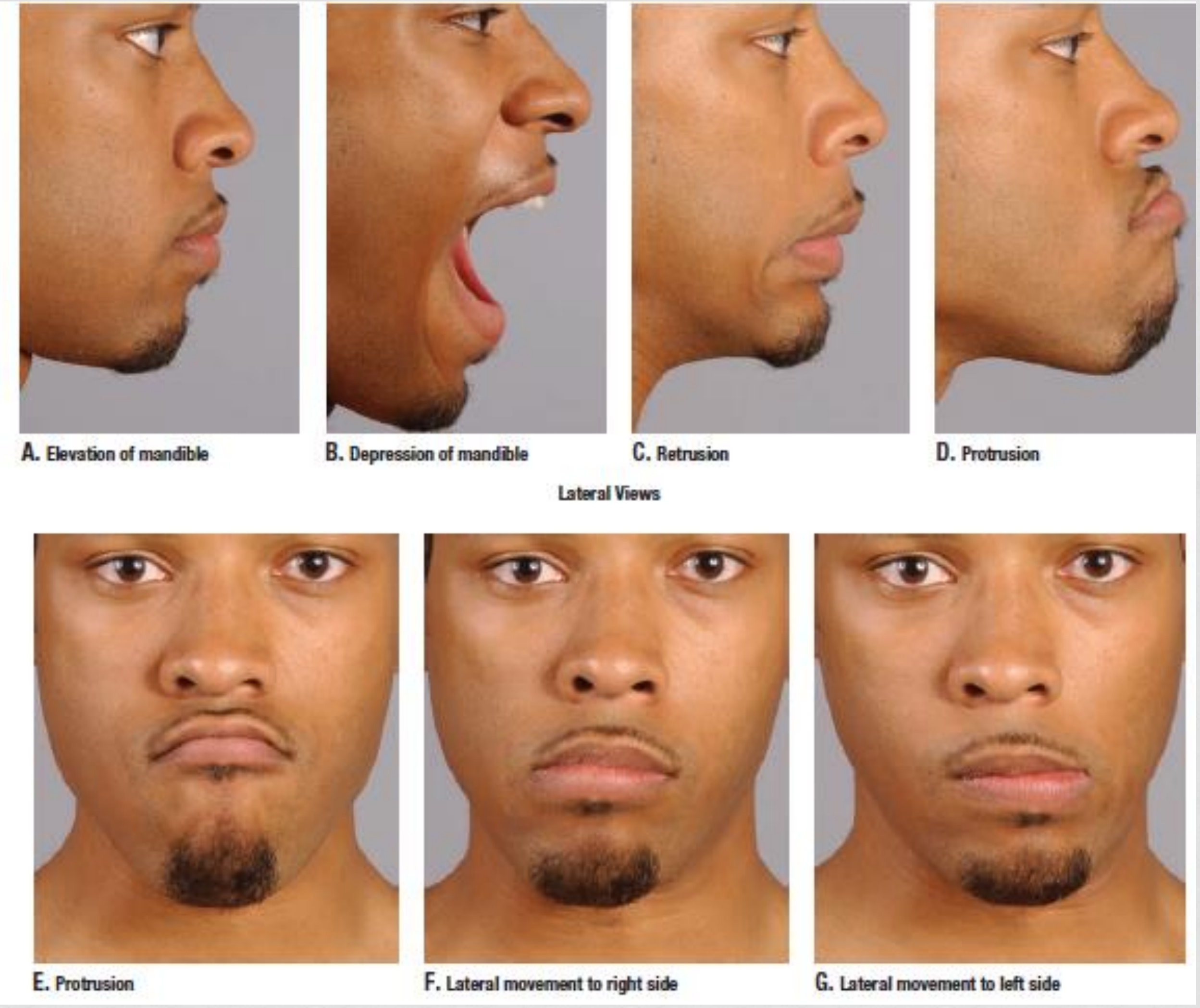


TEMPOROMANDIBULAR JOINT

- **Nerve Supply**
- Auriculotemporal n.
- Masseteric branch of mandibular nerve



MOVEMENTS OF TMJ



A. Elevation of mandible
B. Depression of mandible
C. Retrusion
D. Protrusion

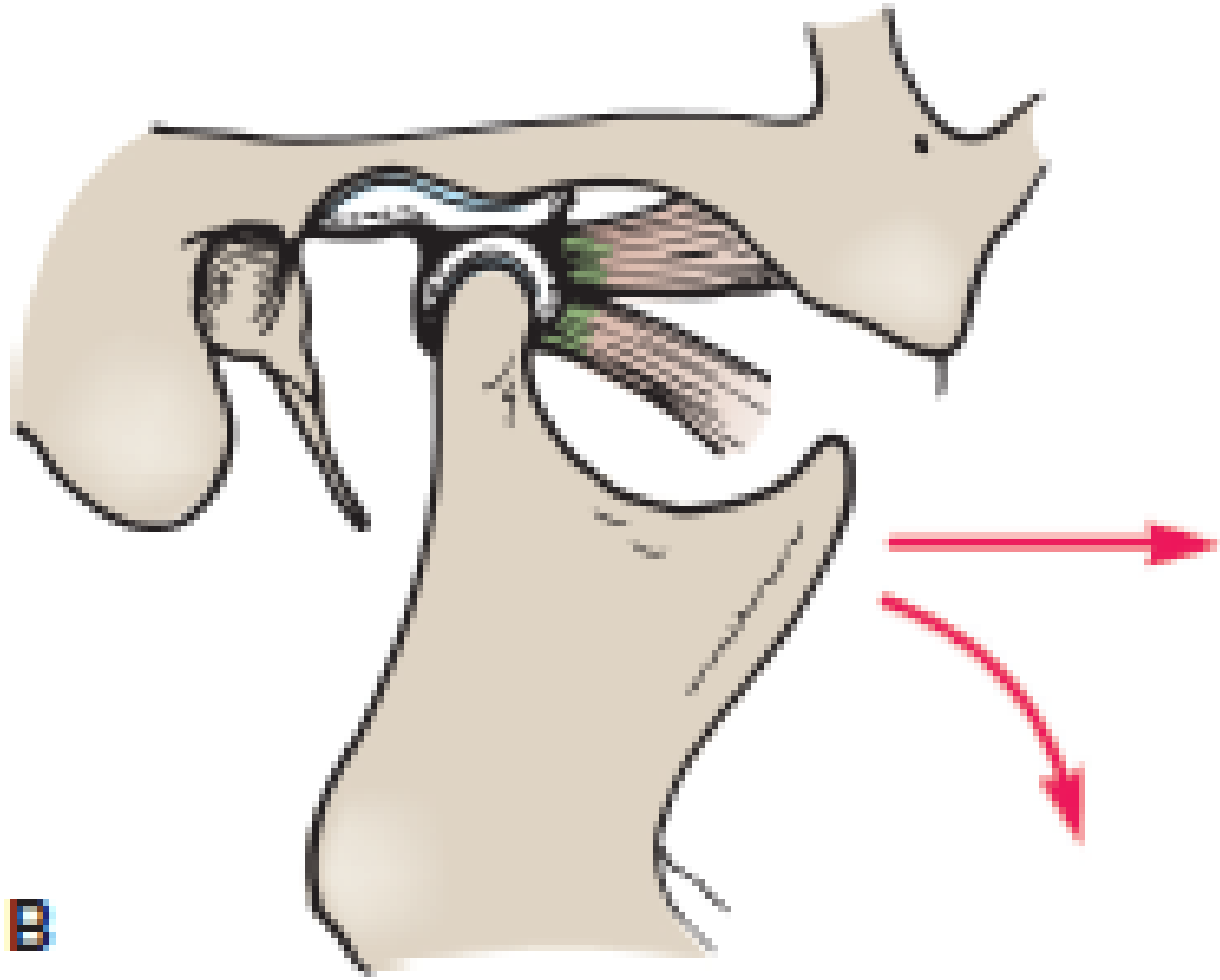
Lateral Views

E. Protrusion
F. Lateral movement to right side
G. Lateral movement to left side

MOVEMENTS OF TMJ

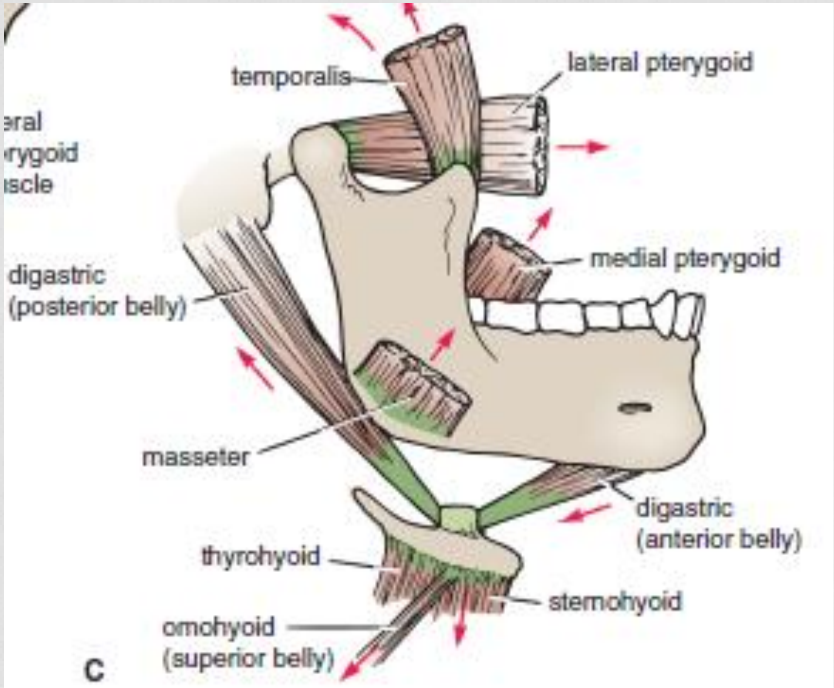
❑ **Depression of the Mandible**

- As the mouth is opened, the head of the mandible rotates on the undersurface of the articular disc around a horizontal axis. To prevent the angle of the jaw impinging unnecessarily on the parotid gland and the sternocleidomastoid muscle, the mandible is pulled forward.


B

MOVEMENTS OF TMJ

- Depression is brought about by contraction of the digastrics, the geniohyoids, and the mylohyoids; the lateral pterygoids play an important role by pulling the mandible forward



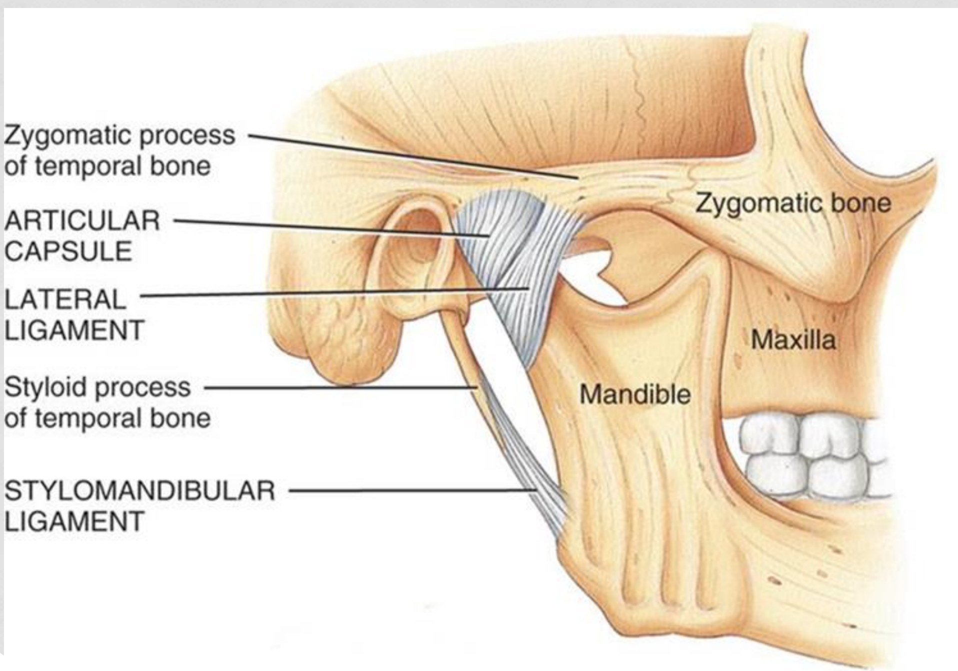
MOVEMENTS OF TMJ

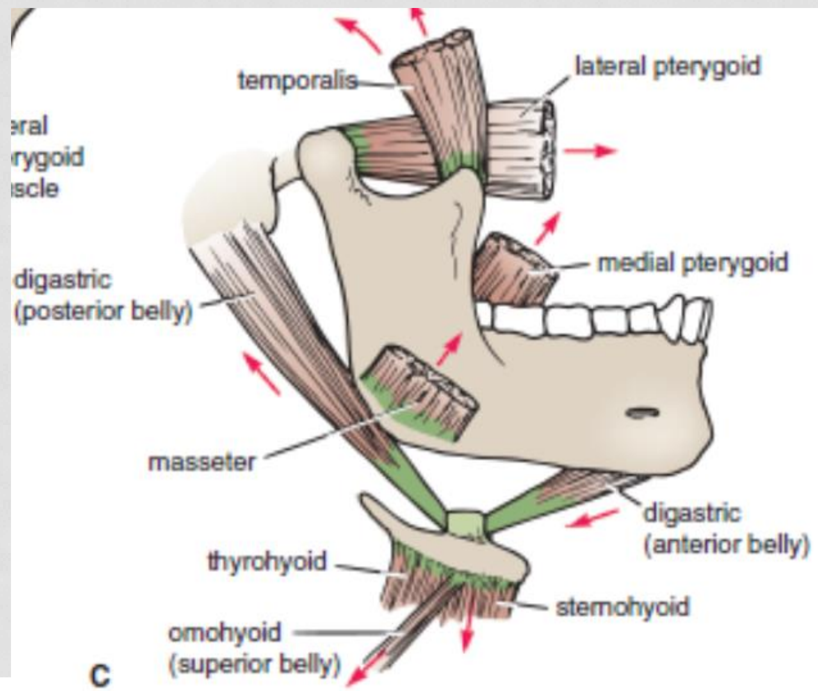
❑ **Elevation of the Mandible**

- The movements in depression of the mandible are reversed.
- First, the head of the mandible and the disc move backward
- then the head rotates on the lower surface of the disc

MOVEMENTS OF TMJ

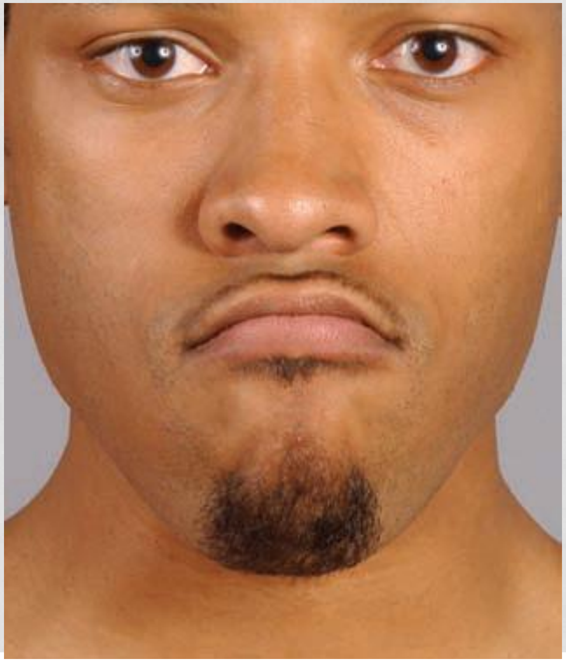
- Elevation of the mandible is brought about by contraction of the temporalis, the masseter, and the medial pterygoids.
- The articular disc is pulled backward by the fibroelastic tissue





MOVEMENTS OF TMJ

- **Protrusion of the Mandible**
  - The articular disc is pulled forward onto the anterior tubercle, carrying the head of the mandible with it. All movement thus takes place in the upper cavity of the joint.



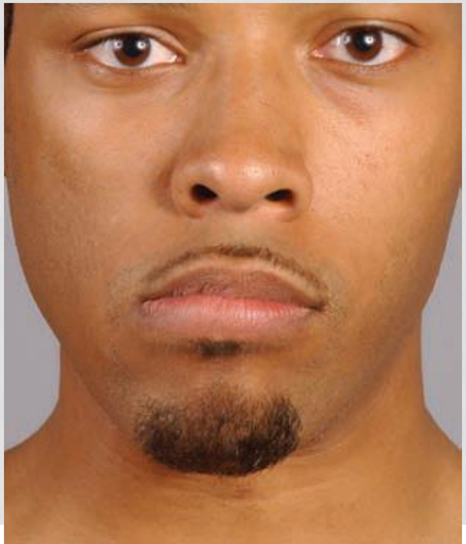
MOVEMENTS OF TMJ

- **Retraction of the Mandible**
  - The articular disc and the head of the mandible are pulled backward into the mandibular fossa.
  - Retraction is brought about by contraction of the posterior fibers of the temporalis

MOVEMENTS OF TMJ

❑Lateral Chewing Movements

- These are accomplished by alternately protruding and retracting the mandible on each side.
- For this to take place, a certain amount of rotation occurs, and the muscles responsible on both sides work alternately



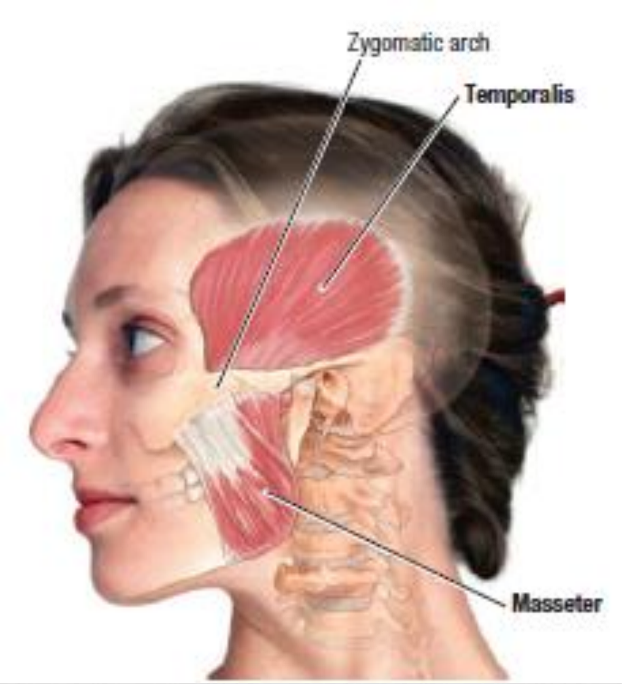
IMPORTANT RELATIONS OF THE TEMPOROMANDIBULAR JOINT

- **Anteriorly:** The mandibular notch and the masseteric nerve and artery
- **Posteriorly:** The tympanic plate of the external auditory meatus and the glenoid process of the parotid gland
- **Laterally:** The parotid gland, fascia, and skin
- **Medially:** The maxillary artery and vein and the auriculotemporal nerve

MUSCLES OF MASTICATION

Masseter

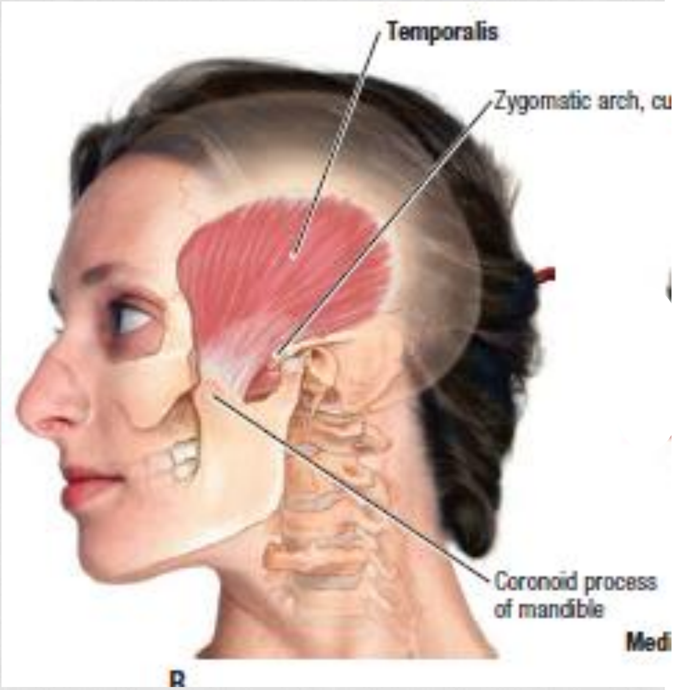
- **Origin:** Zygomatic arch
- **Insertion:** Lateral surface ramus of mandible
- **Nerve supply:** Mandibular division of trigeminal nerve
- **Action:** Elevates mandible to occlude teeth



MUSCLES OF MASTICATION

❑Temporalis

- **Origin:** Floor of temporal fossa
- **Insertion:** Coronoid process of Mandible
- **Nerve supply:** Mandibular division of trigeminal nerve
- **Action:** Anterior and superior fibers elevate mandible;
  posterior fibers retract mandible



MUSCLES OF MASTICATION

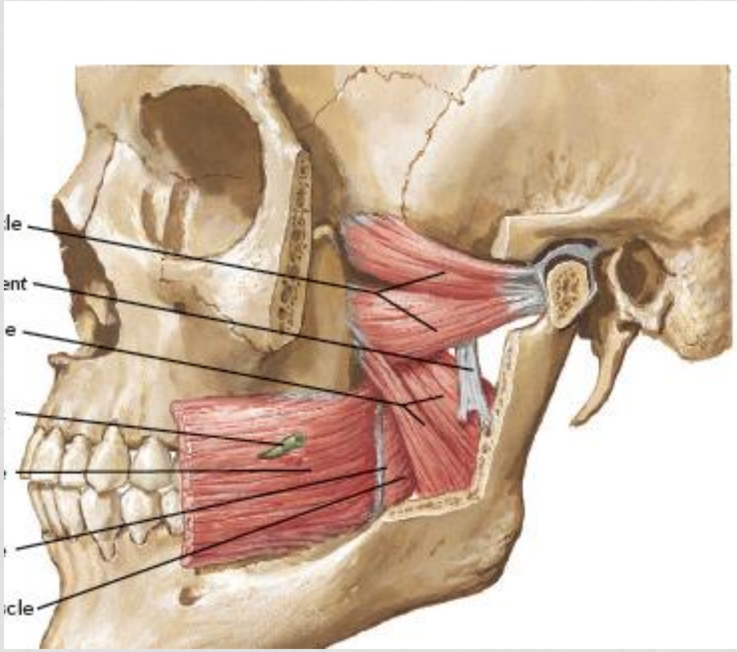
❑**Lateral pterygoid (twoheads)**

- **Origin:**

❖Superior head: greater wing of sphenoid

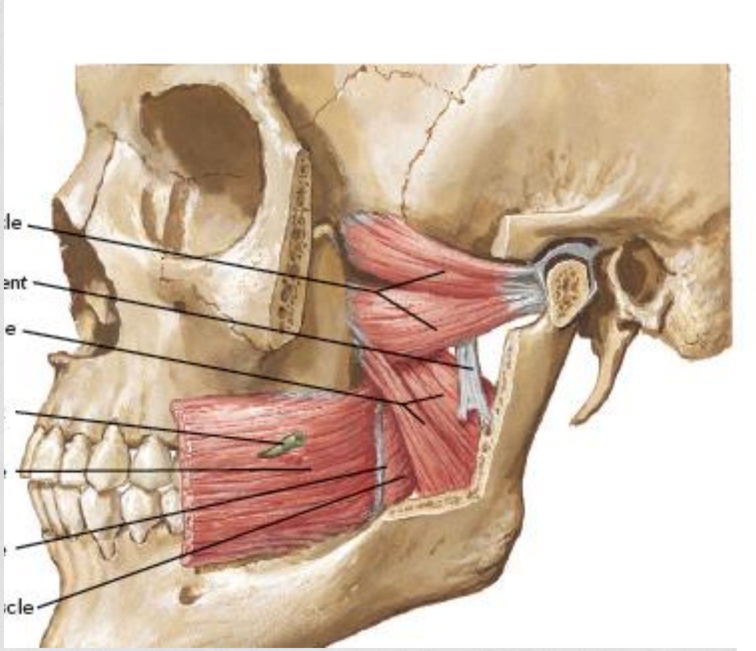
❖Inferior head: lateral aspect of lateral pterygoid plate

- **Insertion:** Neck of mandible and articular disc
- **Nerve supply:** Mandibular division of trigeminal nerve
- **Action:** depress mandible; protrude mandible



MUSCLES OF MASTICATION

- **medial pterygoid (twoheads)**
- **Origin:**
  - Superficial head: maxillary tuberosity
  - deep head: medial aspect of lateral pterygoid plate
- **Insertion:** Medial surface of angle of mandible
- **Nerve supply:** Mandibular division of trigeminal nerve
- **Action:** elevate mandible



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- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.

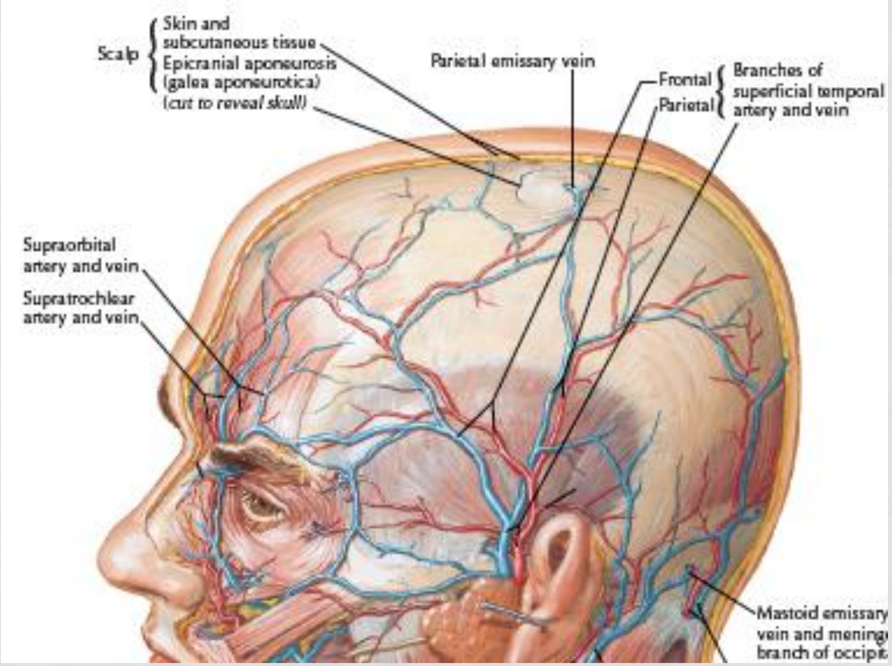
ANATOMY OF THE SCALP

SECOND STAGE

DR. AHMED JASSAM ALNAQEEB
ORAL AND MAXILLOFACIAL SURGEON

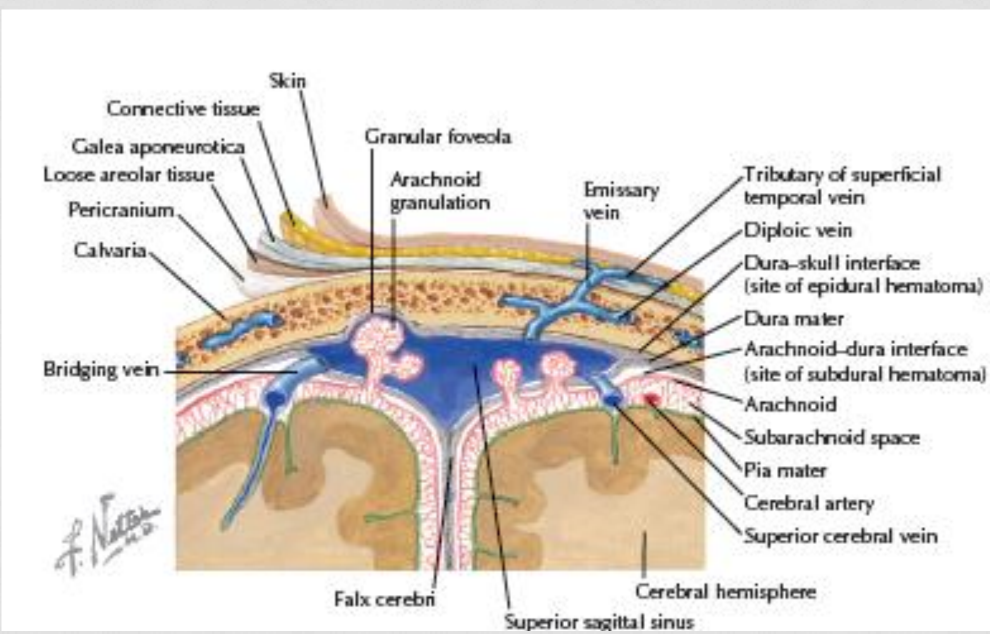
THE SCALP

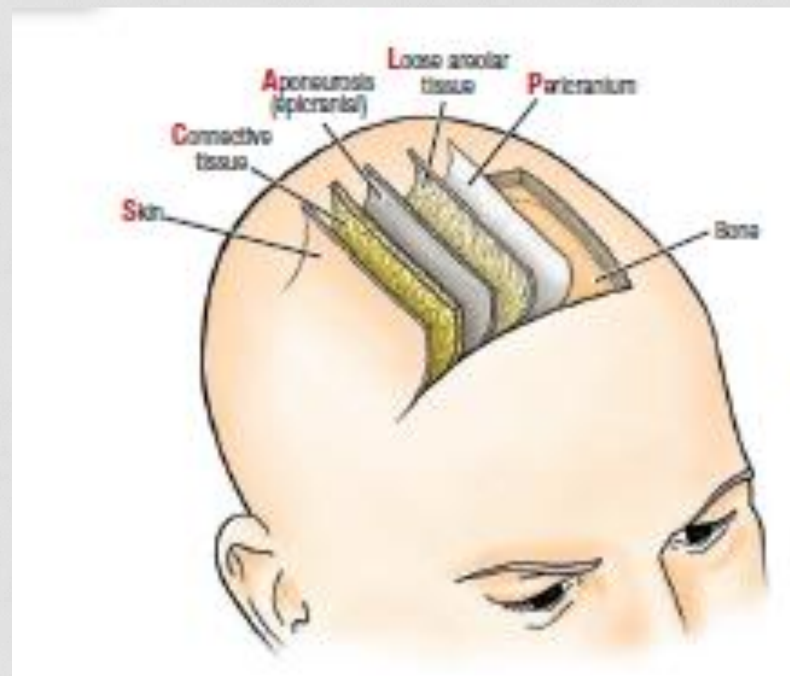
- **Structure**
- The scalp consists of five layers, the first three of which are intimately bound together and move as a unit



THE SCALP

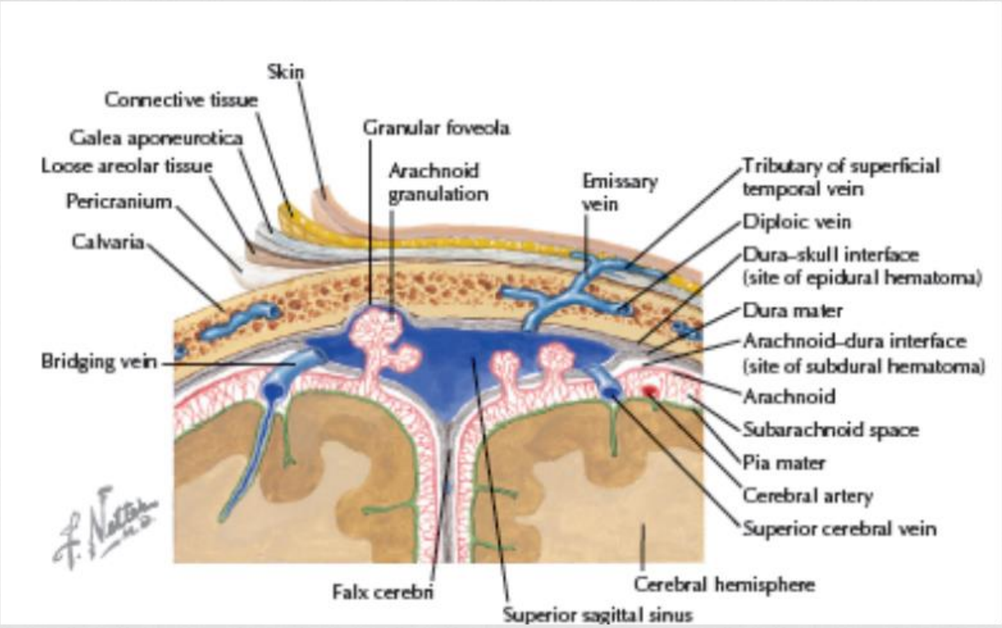
- **S**kin: which is thick and hair bearing and contains numerous sebaceous glands

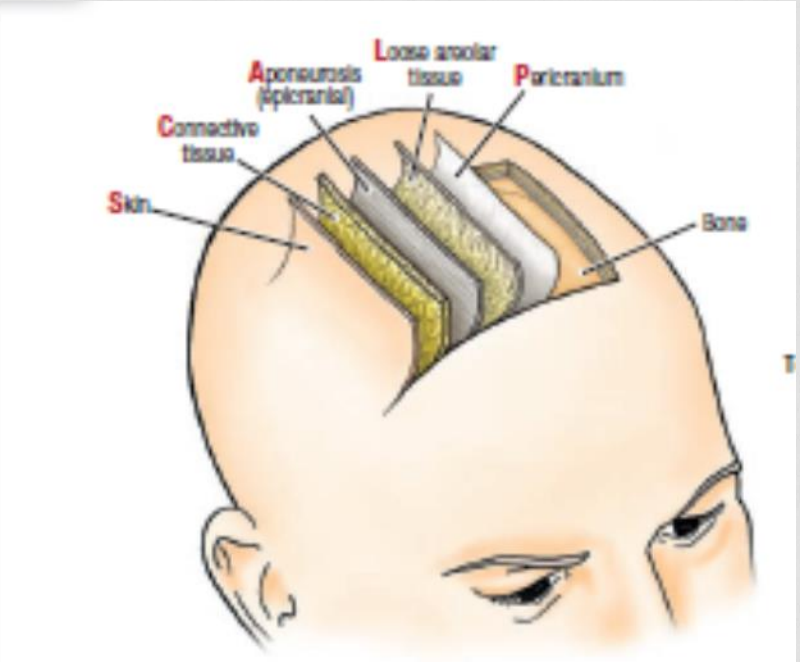




THE SCALP

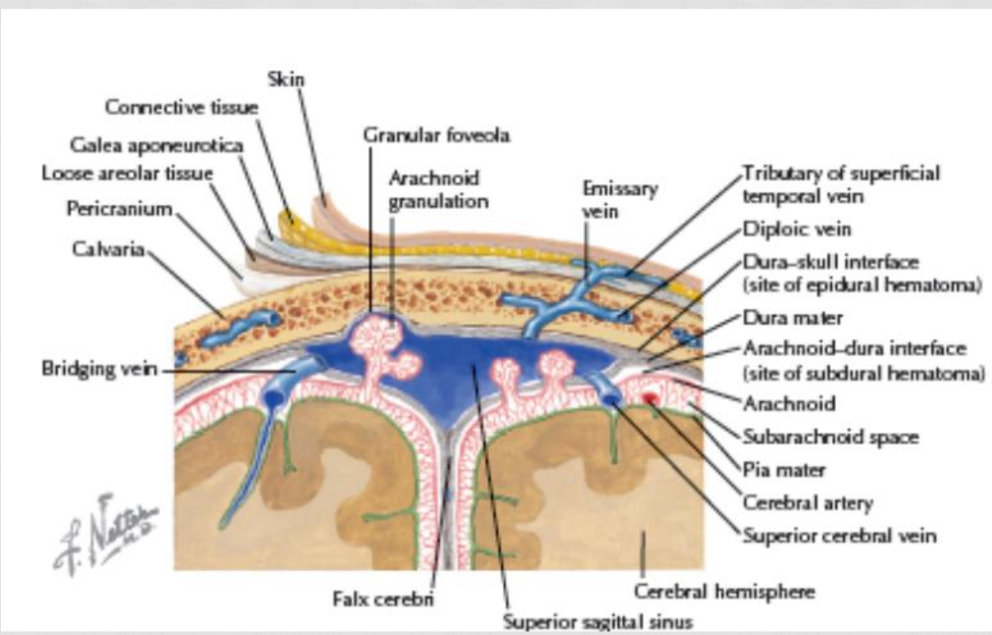
- **C**onnective tissue beneath the skin, which is fibrofatty, the fibrous septa uniting the skin to the underlying aponeurosis of the occipitofrontalis muscle

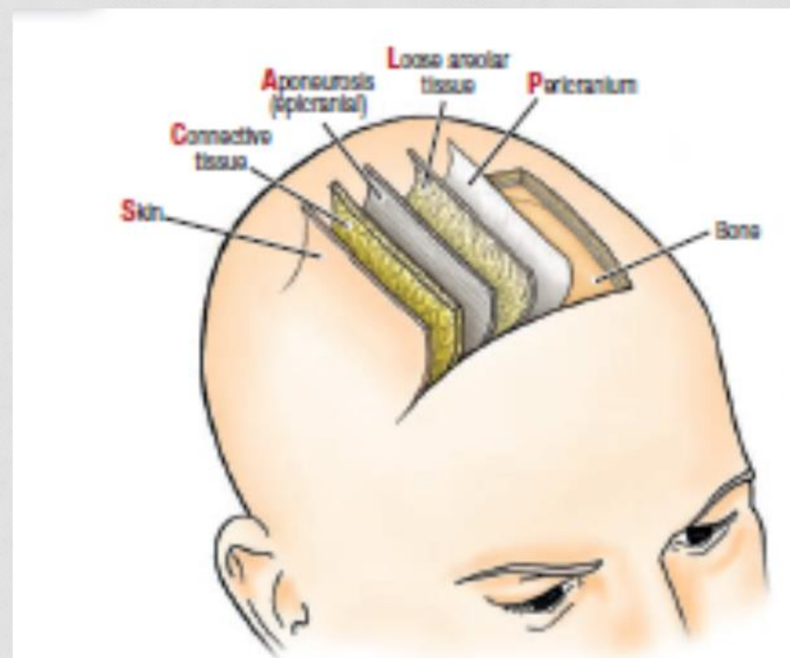




THE SCALP

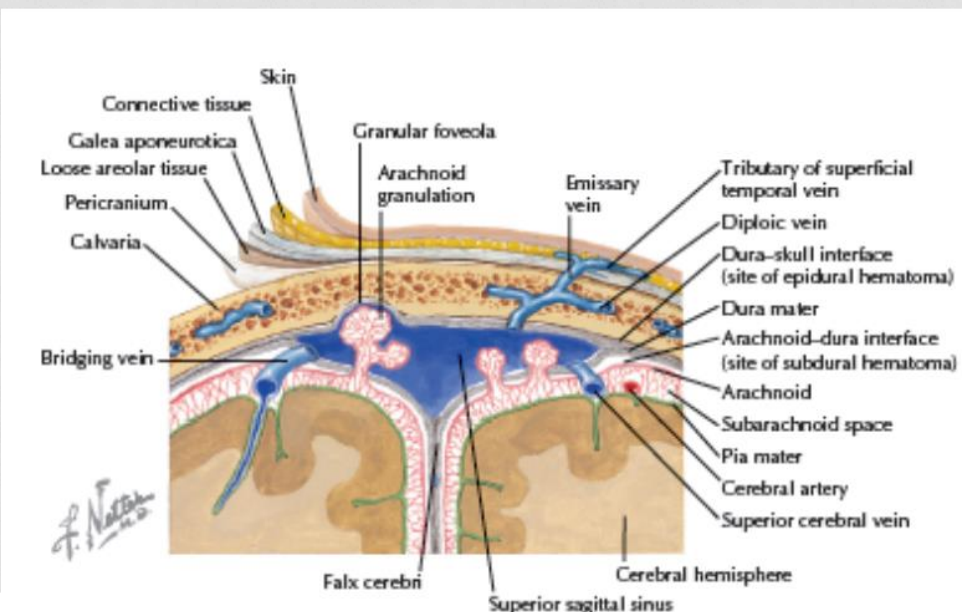
- **A**poneurosis (epicranial), which is a thin, tendinous sheet that unites the occipital and frontal bellies of the occipitofrontalis muscle
- The lateral margins of the aponeurosis are attached to the temporal fascia.

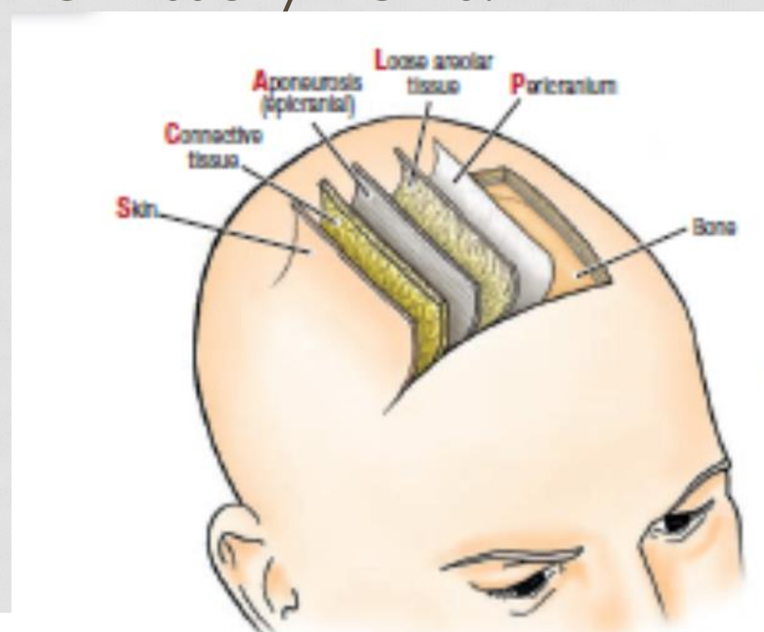




THE SCALP

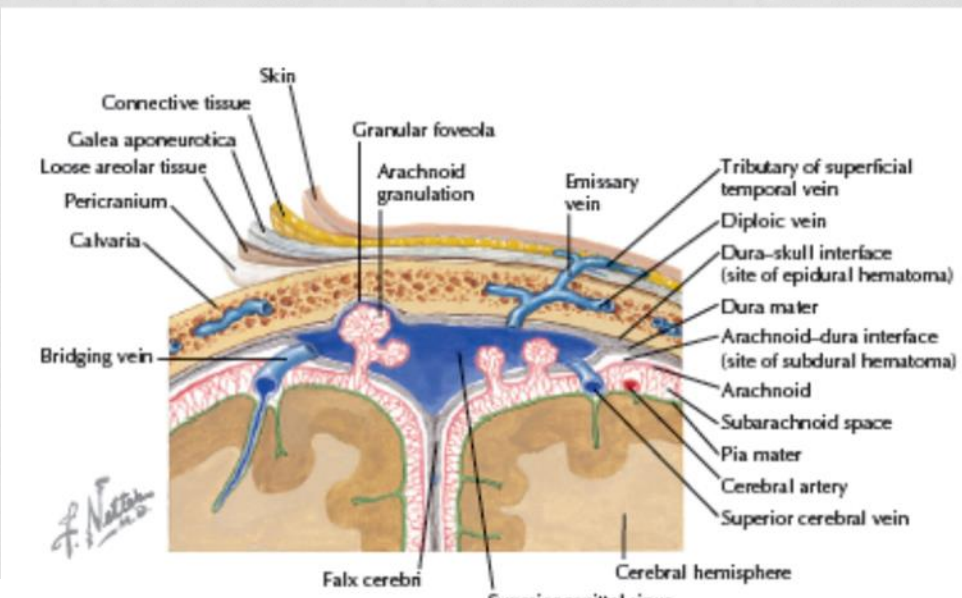
- **L**oose areolar tissue, which occupies the subaponeurotic space and loosely connects the epicranial aponeurosis to the periosteum of the skull (the pericranium).
- The areolar tissue contains a few small arteries, but it also contains some important emissary veins.

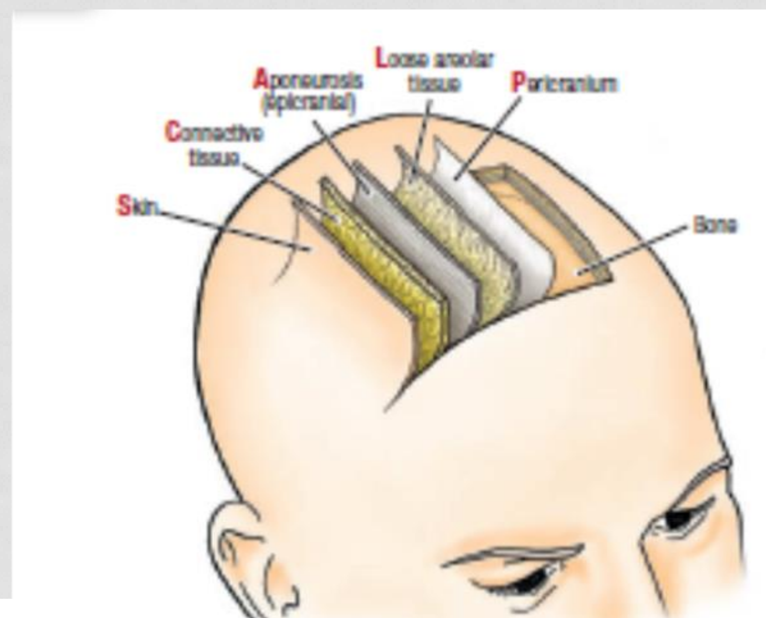




THE SCALP

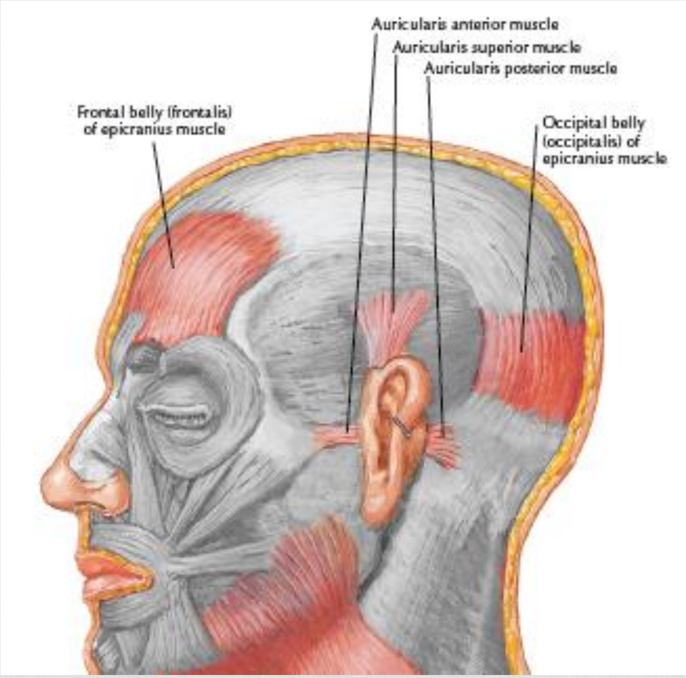
- **P**ericranium, which is the periosteum covering the outer surface of the skull bones.
- at the sutures between skull bones, the periosteum on the outer surface of the bones becomes continuous with the periosteum on the inner surface of the skull bones





MUSCLES OF THE SCALP

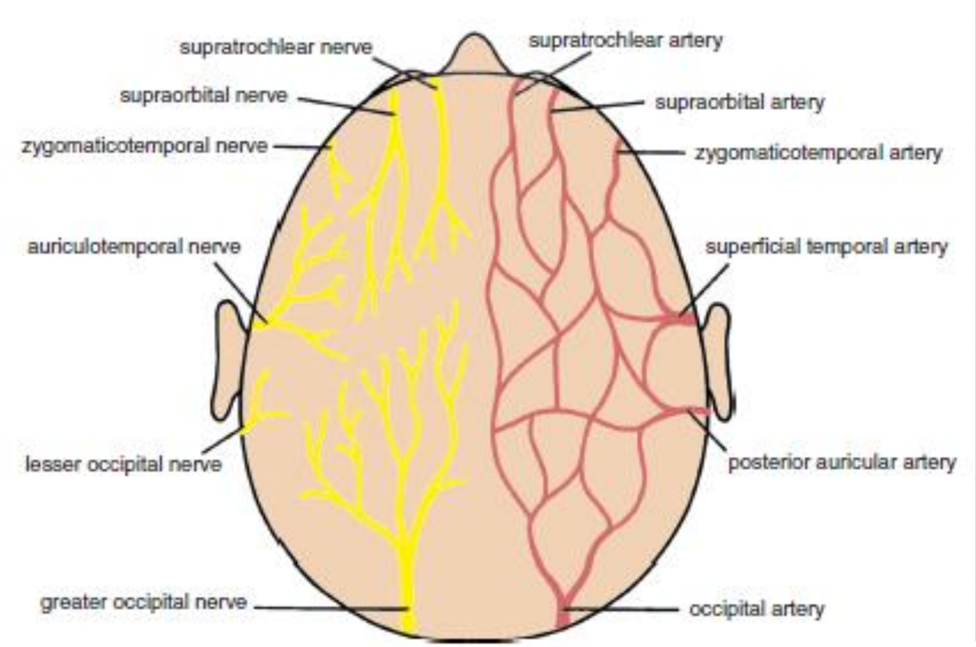
- **Occipitofrontalis**
- **Origin**
  - Occipital belly: Highest nuchal line of occipital bone
  - Frontal belly: Skin and superficial fascia of eyebrows
- **Insertion:** Epicranial aponeurosis
- **Nerve supply**: Facial nerve
- **Action:** Moves scalp on skull and raises eyebrows



SENSORY NERVE SUPPLY OF THE SCALP

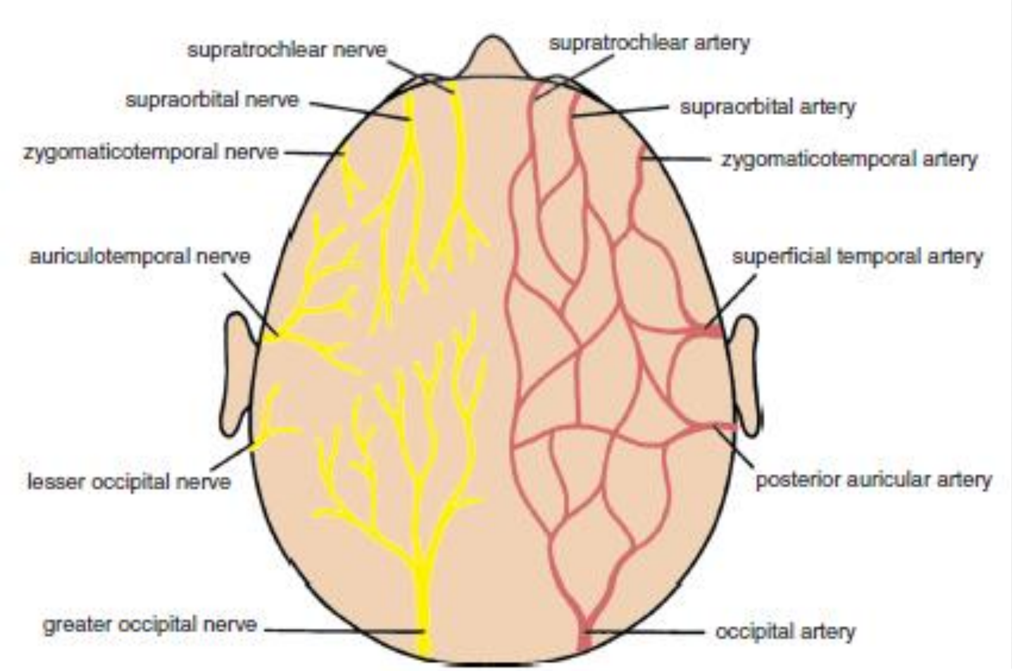
- The main trunks of the sensory nerves lie in the superficial fascia

- **supratrochlear nerve,** a branch of the ophthalmic division of the trigeminal nerve, winds around the superior orbital margin and supplies the scalp



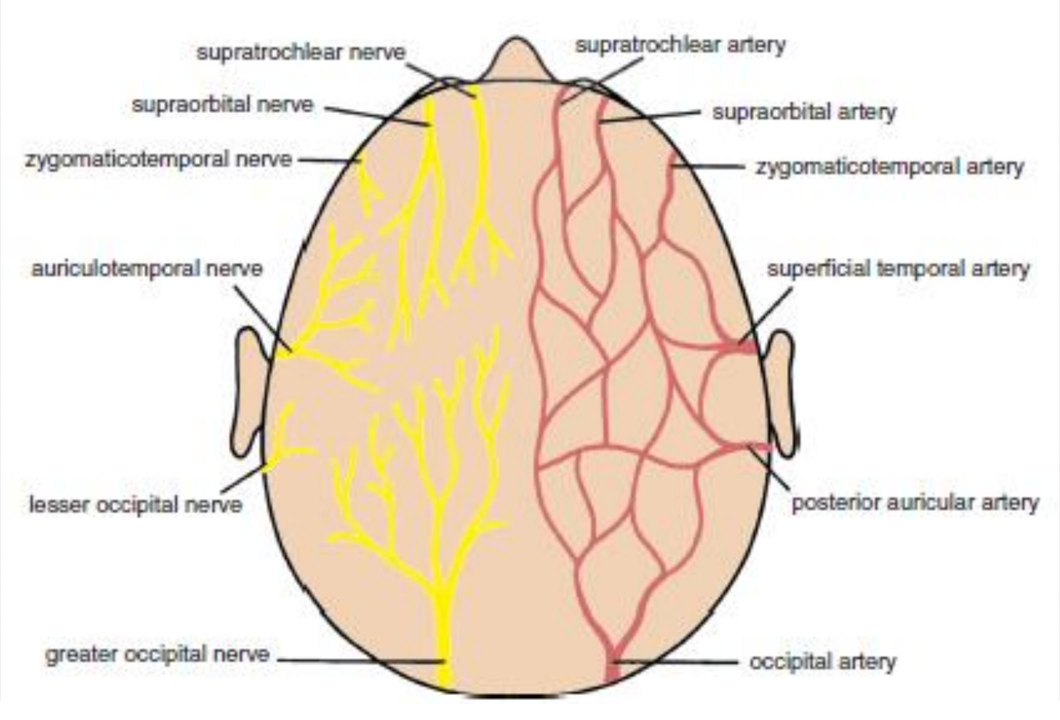
SENSORY NERVE SUPPLY OF THE SCALP

- **supraorbital nerve,** a branch of the ophthalmic division of the trigeminal nerve, winds around the superior orbital margin and ascends over the forehead



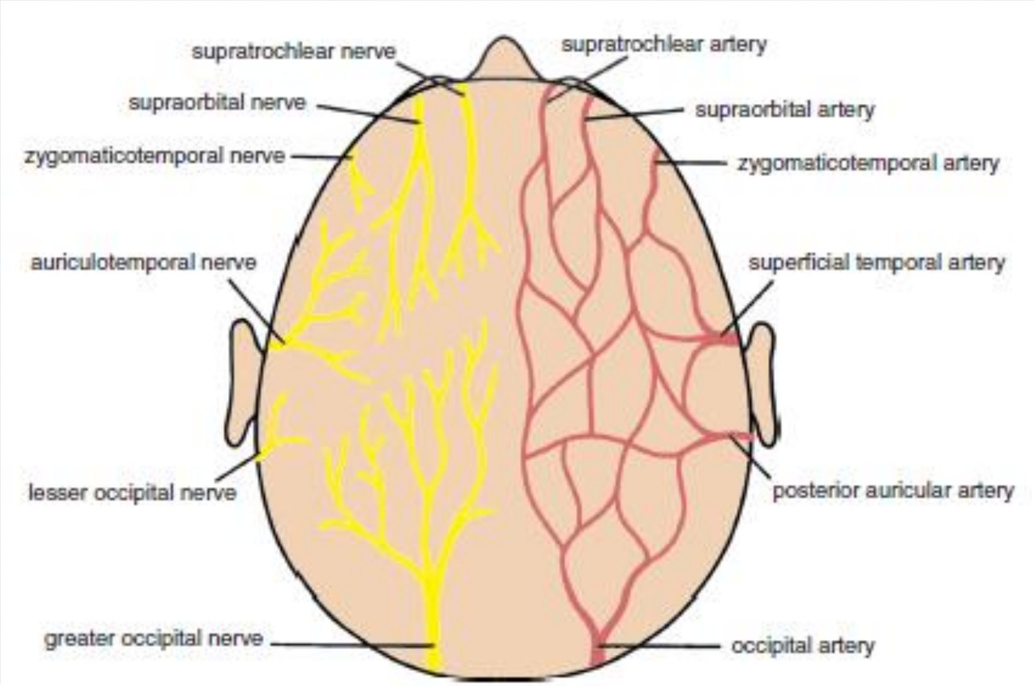
SENSORY NERVE SUPPLY OF THE SCALP

- **zygomaticotemporal nerve**, a branch of the maxillary division of the trigeminal nerve, supplies the scalp over the temple



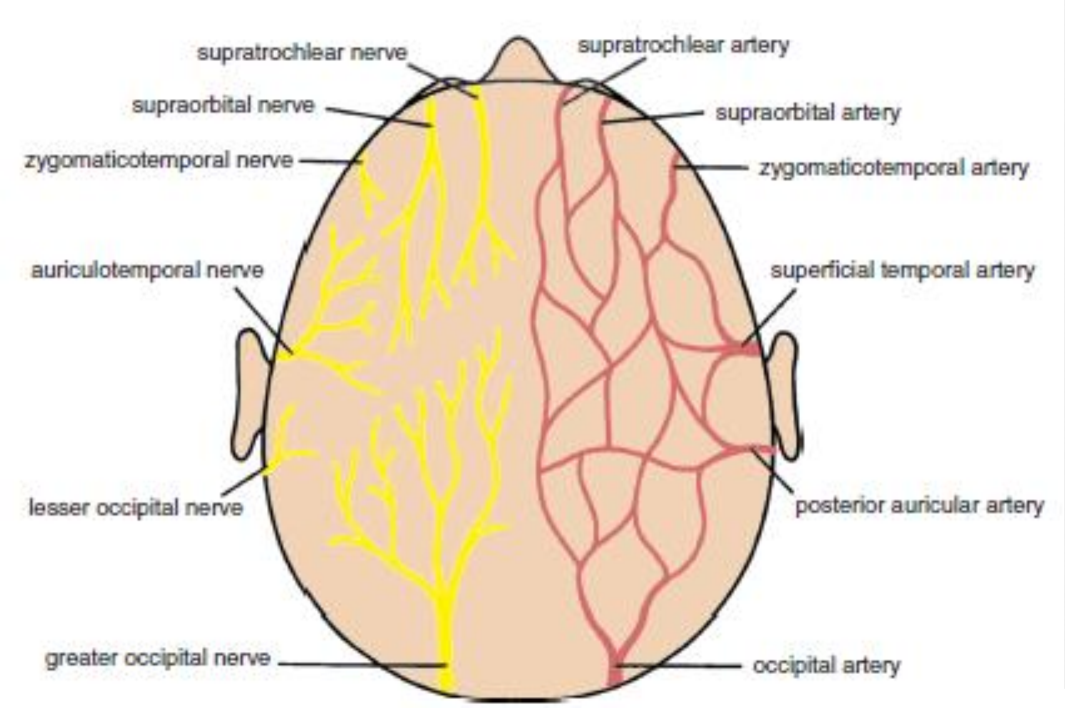
SENSORY NERVE SUPPLY OF THE SCALP

- **auriculotemporal nerve,** a branch of the mandibular division of the trigeminal nerve, ascends over the side of the head from in front of the auricle Its terminal branches supply the skin over the temporal region.



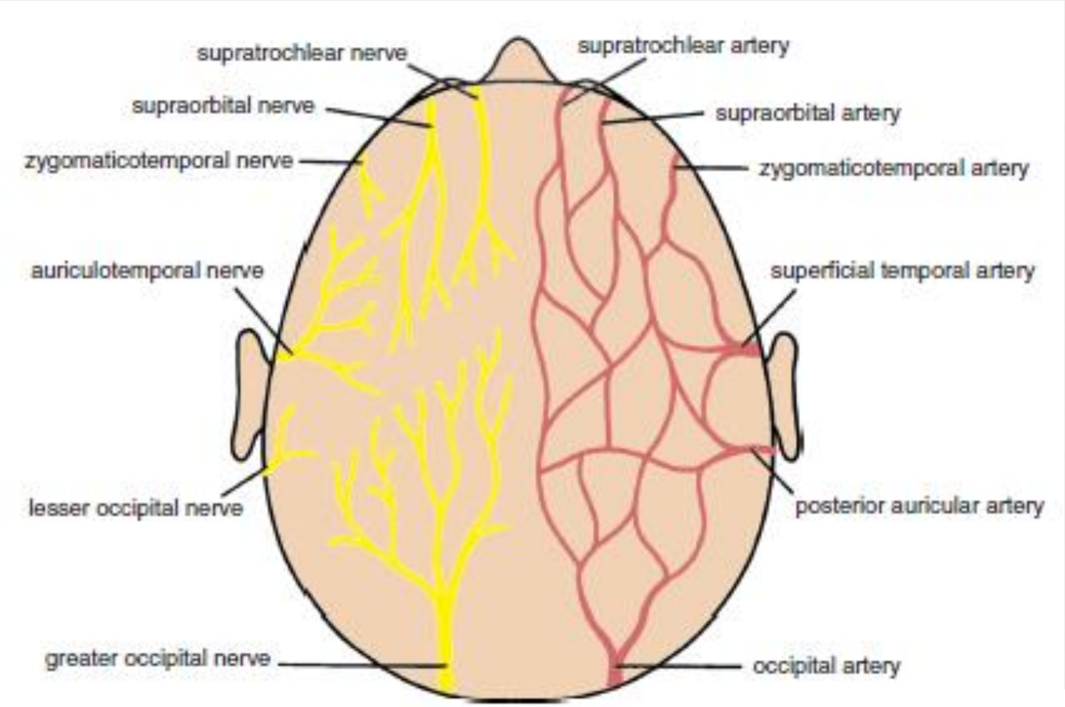
SENSORY NERVE SUPPLY OF THE SCALP

- **lesser occipital nerve,** a branch of the cervical plexus (C2), supplies the scalp over the lateral part of the occipital region and the skin over the medial surface of the auricle



SENSORY NERVE SUPPLY OF THE SCALP

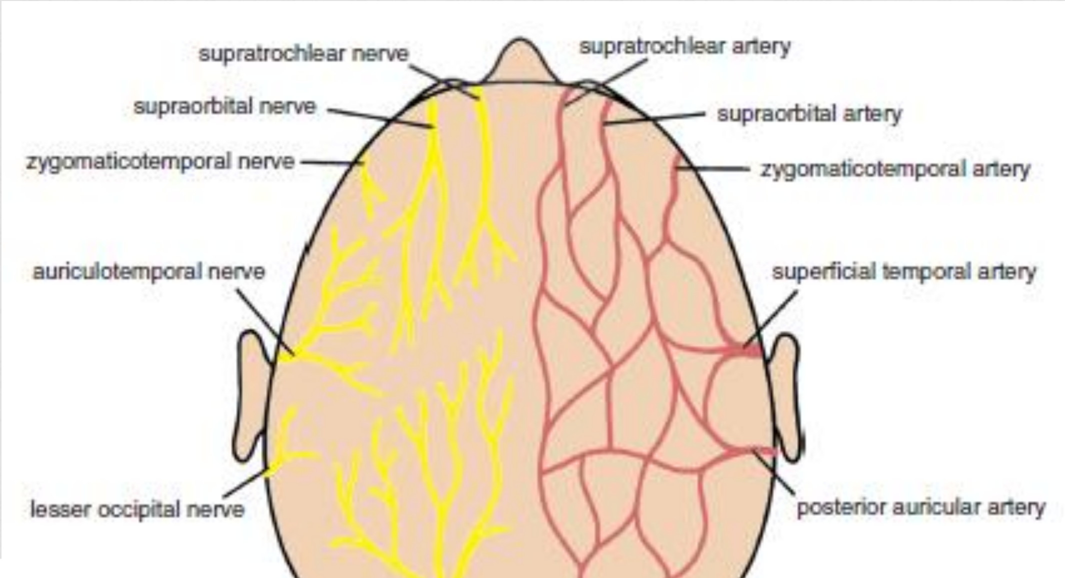
- **greater occipital nerve**, a branch of the posterior ramus of the 2nd cervical nerve, ascends over the back of the scalp and supplies the skin as far forward as the vertex of the skull



ARTERIAL SUPPLY OF THE SCALP

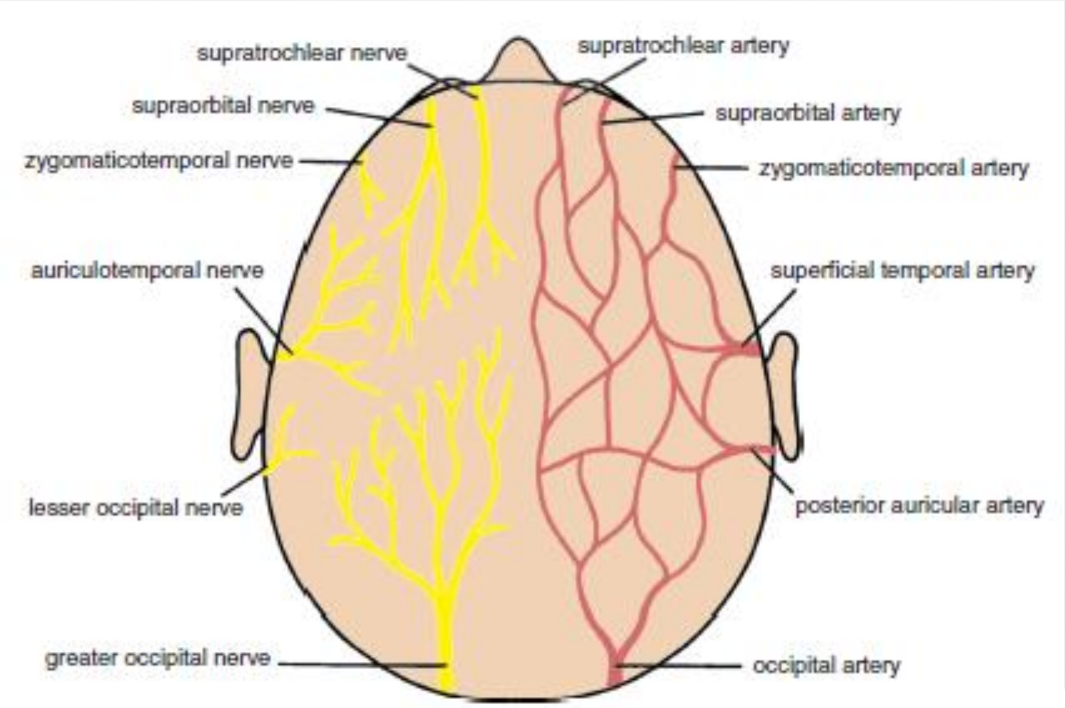
- The scalp has a rich supply of blood to nourish the hair follicles
- The arteries lie in the superficial fascia.

❑ **supratrochlear** and the **supraorbital arteries,** branches of the ophthalmic artery, ascend over the forehead in company with the supratrochlear and supraorbital nerves



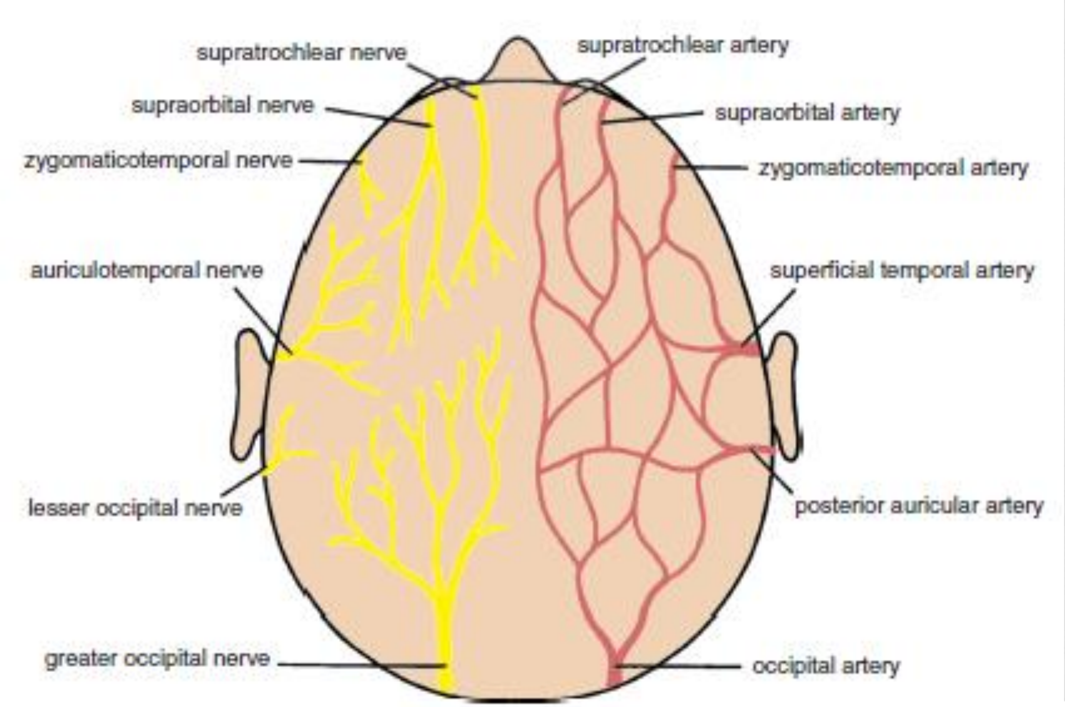
ARTERIAL SUPPLY OF THE SCALP

- **superficial temporal artery,** the smaller terminal branch of the external carotid artery, ascends in front of the auricle in company with the auriculotemporal nerve.



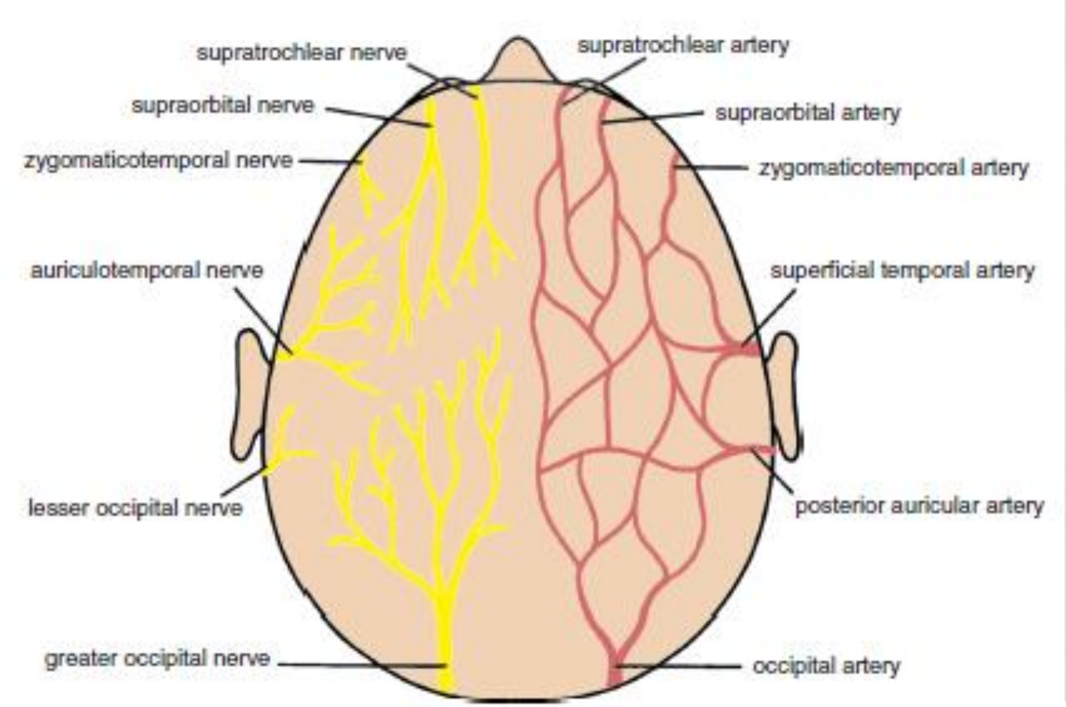
ARTERIAL SUPPLY OF THE SCALP

- **posterior auricular artery**, a branch of the external carotid artery, ascends behind the auricle to supply the scalp above and behind the auricle



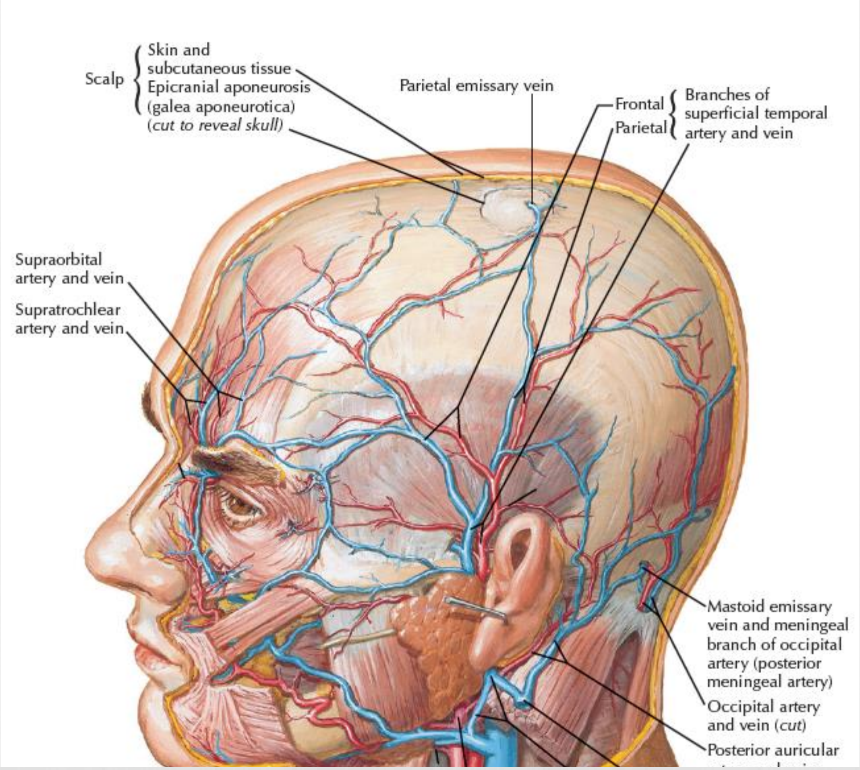
ARTERIAL SUPPLY OF THE SCALP

- **occipital artery**, a branch of the external carotid artery, ascends from the apex of the posterior triangle, in company with the greater occipital nerve.



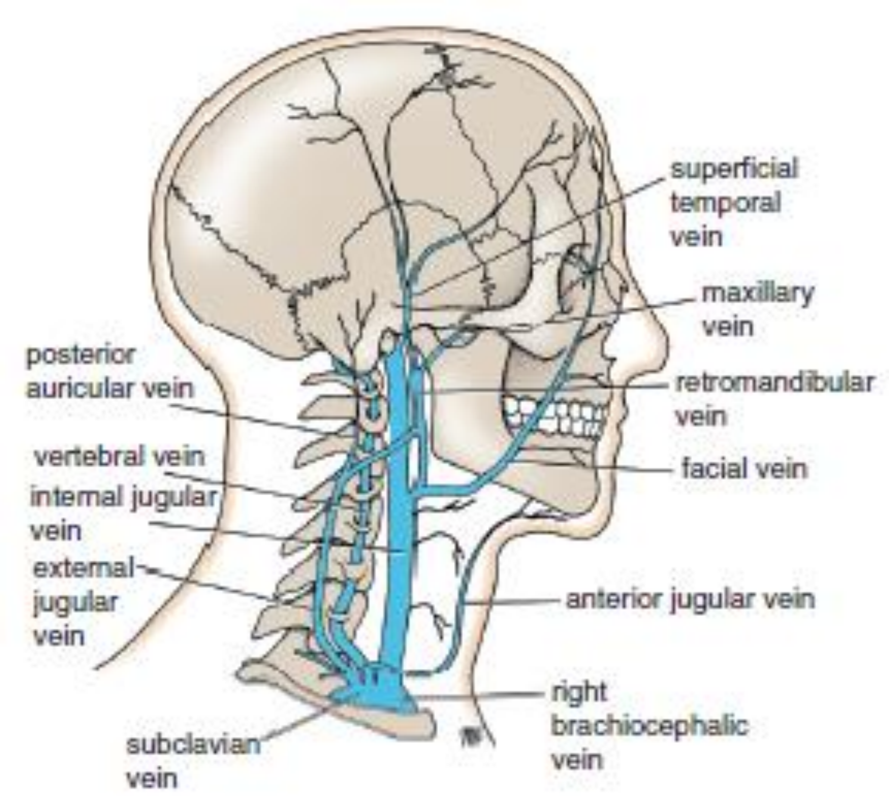
VENOUS DRAINAGE OF THE SCALP

- **supratrochlear** and **supraorbital veins** unite at the medial margin of the orbit to form the facial vein.



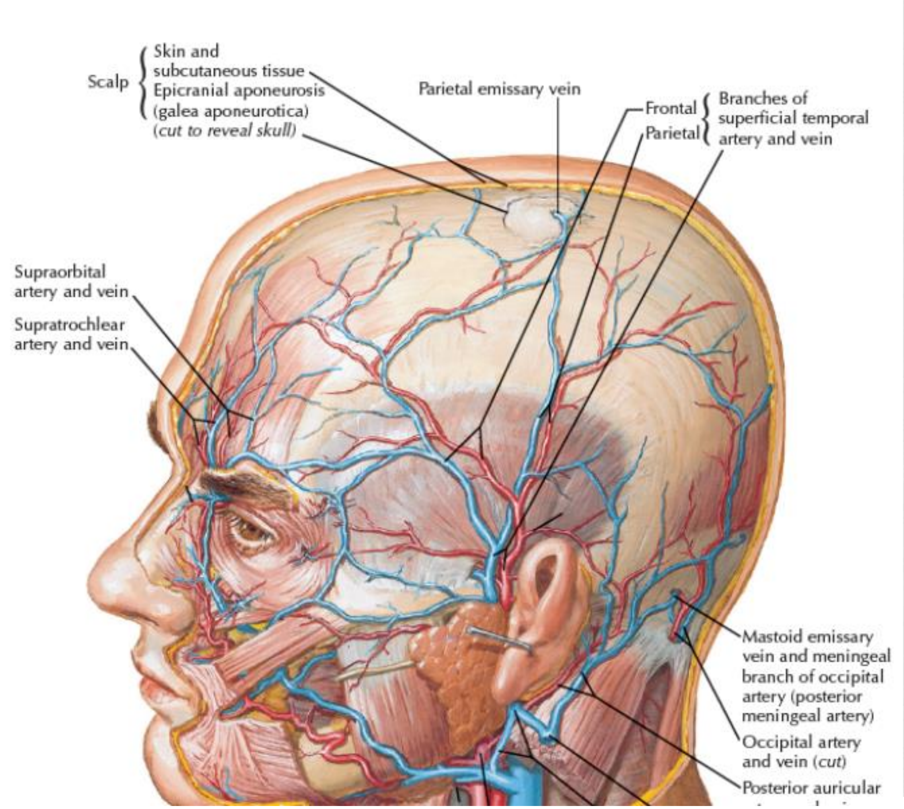
VENOUS DRAINAGE OF THE SCALP

- **superficial temporal vein** unites with the maxillary vein in the substance of the parotid gland to form the retromandibular vein



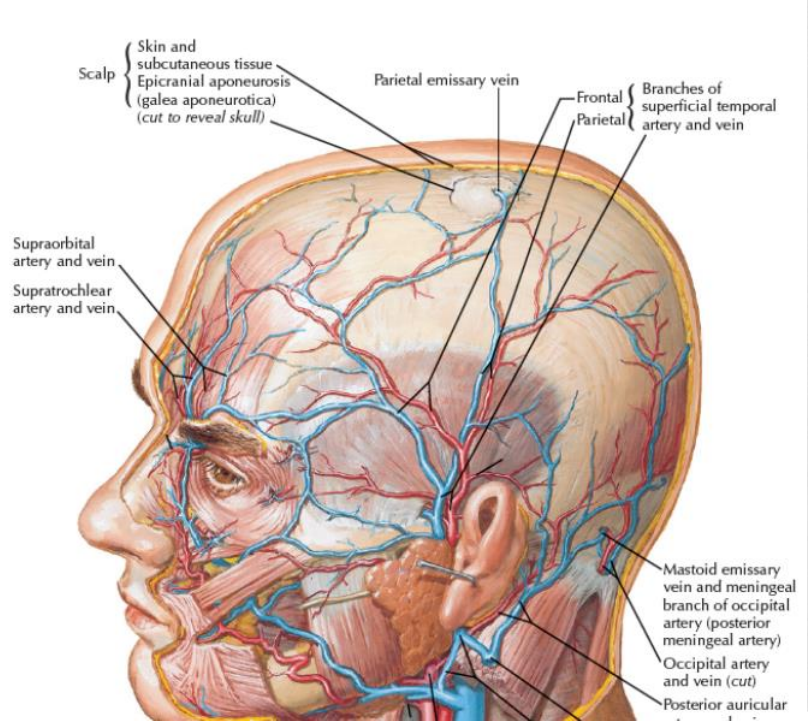
VENOUS DRAINAGE OF THE SCALP

- **posterior auricular vein** unites with the posterior division of the retromandibular vein, just below the parotid gland, to form the external jugular vein



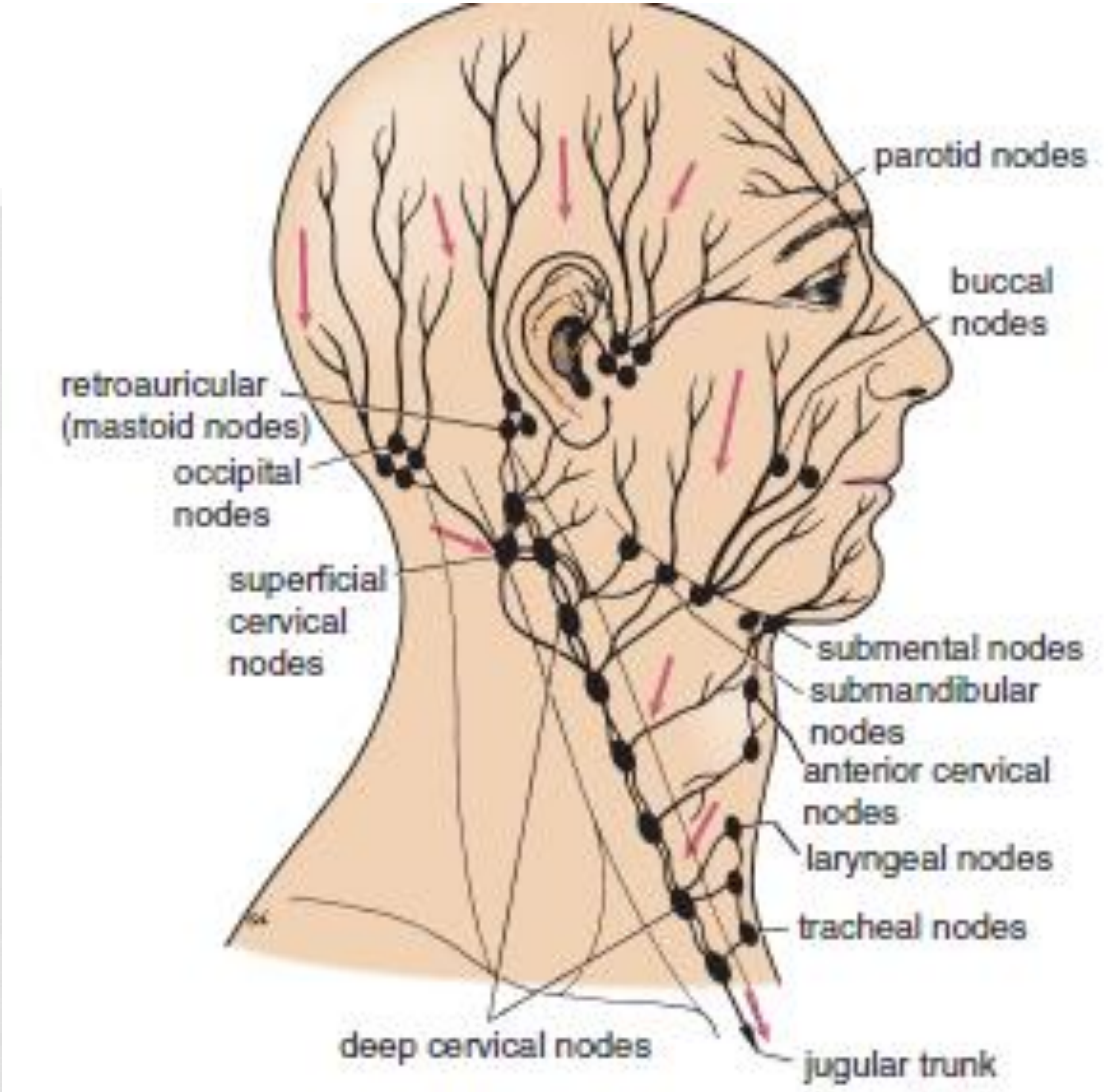
VENOUS DRAINAGE OF THE SCALP

- **occipital vein** drains into the suboccipital venous plexus, which lies beneath the floor of the upper part of the posterior triangle; the plexus in turn drains into the vertebral veins or the internal jugular vein



LYMPH DRAINAGE OF THE SCALP

- Lymph vessels in the **anterior** part of the scalp and forehead drain into the **submandibular** lymph nodes
- Drainage from the **lateral part** of the scalp above the ear is into the **superficial parotid** (**preauricular**) nodes;
- lymph vessels in the part of the scalp **above** and **behind** the ear drain into the **mastoid** nodes.
- Vessels in the **back** of the scalp drain into the **occipital** nodes.


parotid nodes
buccal nodes
retroauricular (mastoid nodes)
occipital nodes
superficial cervical nodes
submental nodes
submandibular nodes
anterior cervical nodes
laryngeal nodes
tracheal nodes
deep cervical nodes
jugular trunk

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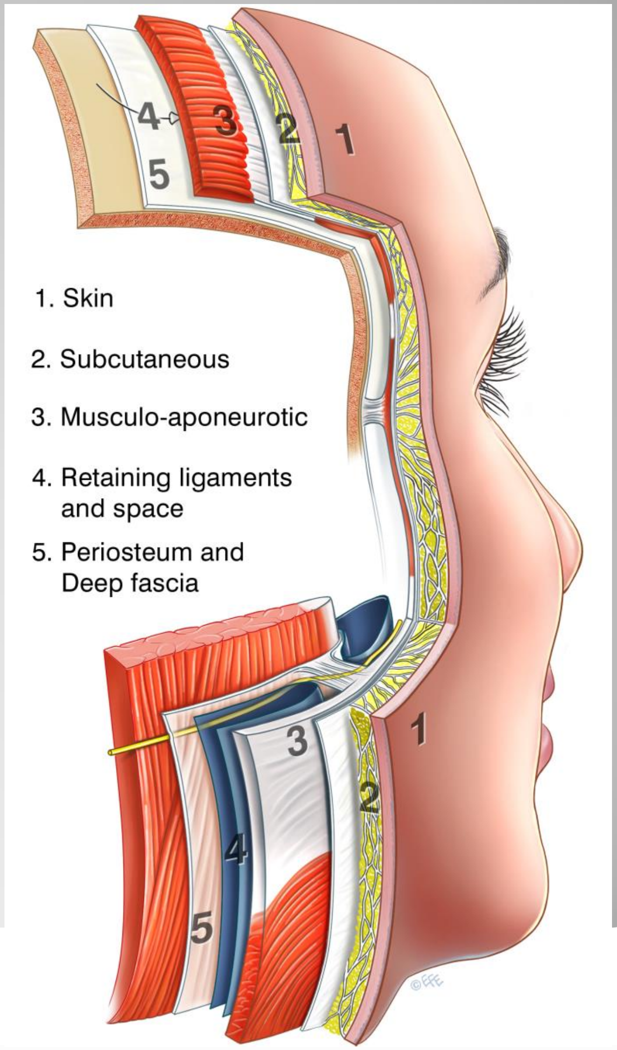
The Face

Dr. Ahmed Jassam Alnaqeeb
Oral and maxillofacial surgeon

The Face

- **Skin of the Face**
- possesses numerous sweat and sebaceous glands.
- connected to underlying bones by loose connective tissue, in which are embedded the muscles of facial expression.
- **No deep fascia is present in the face.**

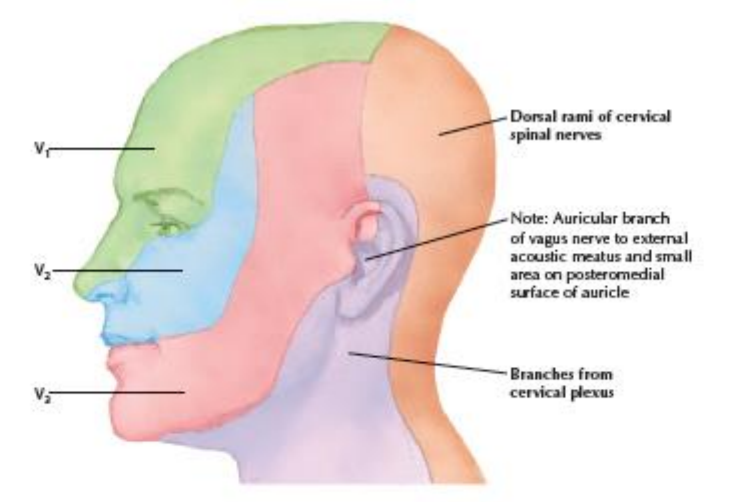


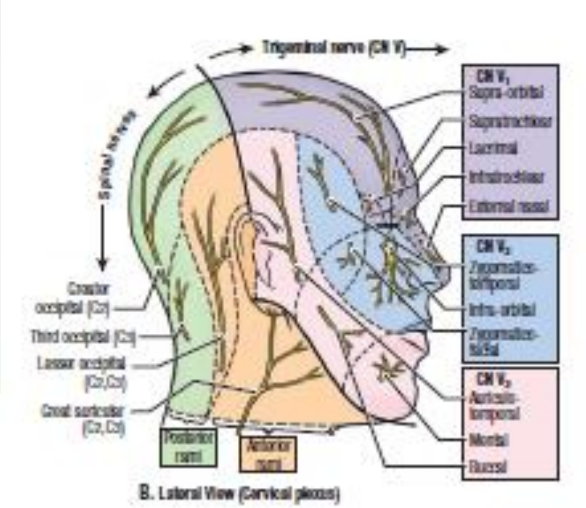
- Wrinkle lines of the face result from the repeated folding of the skin perpendicular to the long axis of the underlying contracting muscles, coupled with the loss of youthful skin elasticity.

- Surgical scars of the face are less conspicuous if they follow the wrinkle lines.

Sensory Nerves of the Face

- The skin of the face is supplied by branches of the three divisions of the trigeminal nerve
- except for the small area over the angle of the mandible and the parotid gland which is supplied by the great auricular nerve (C2 and 3).
- There is overlap of the three divisions of the trigeminal nerve

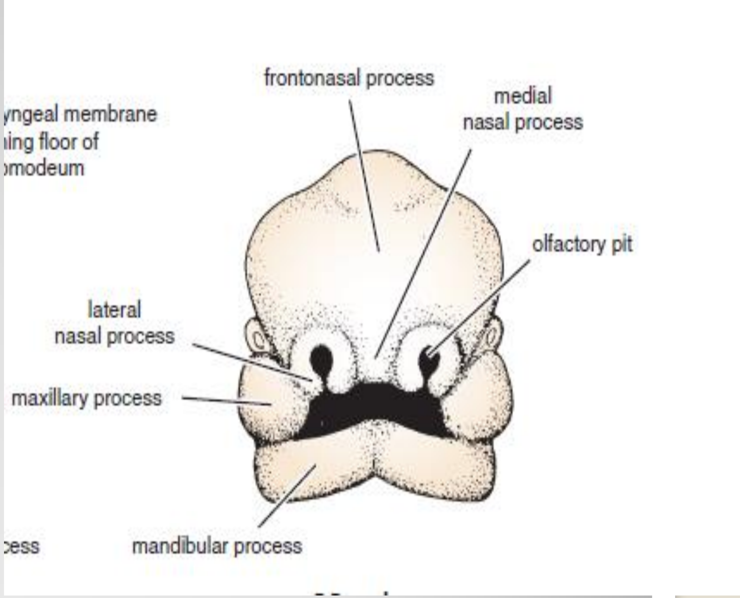




B. Lateral View (Cervical plexus)

Sensory Nerves of the Face

- The ophthalmic nerve supplies the region developed from the frontonasal process
- the maxillary nerve serves the region developed from the maxillary process of the first pharyngeal arch
- the mandibular nerve serves the region developed from the mandibular process of the first pharyngeal arch.

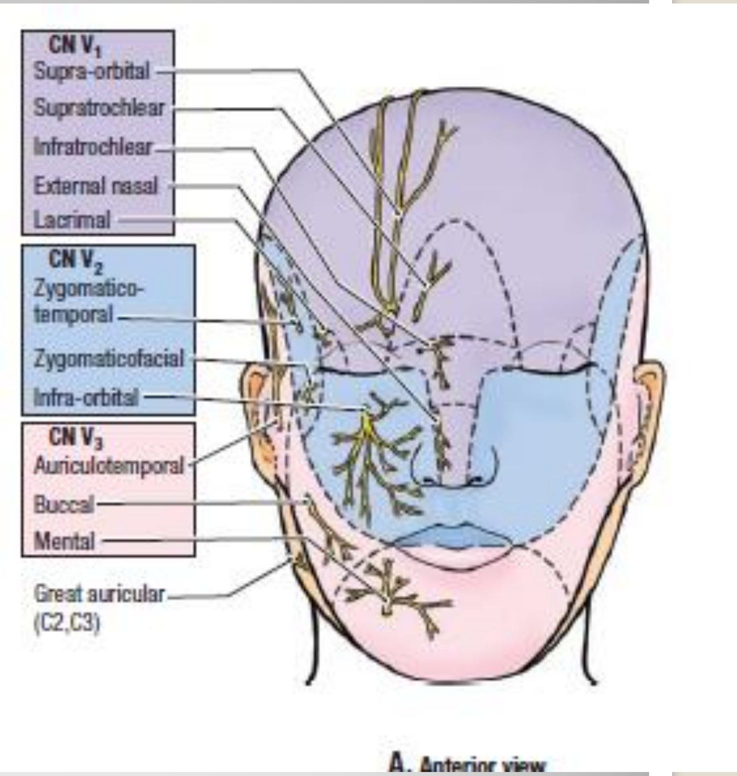


Sensory Nerves of the Face

- These nerves not only supply the skin of the face, but also supply proprioceptive fibers to the underlying muscles of facial expression.
- They are, in addition, the sensory nerve supply to the mouth, teeth, nasal cavities, and paranasal air sinuses.

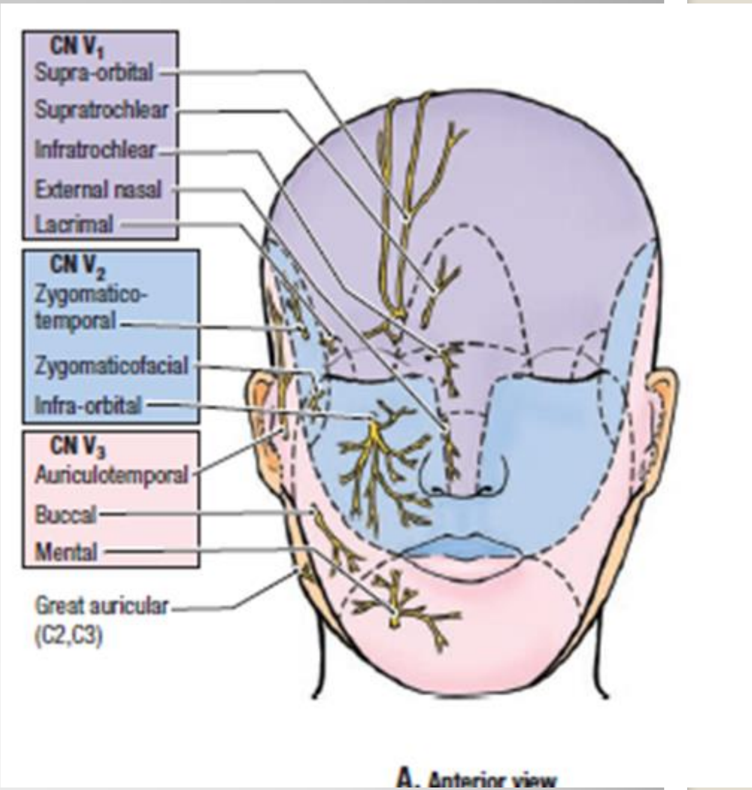
Ophthalmic Nerve

- Five branches of the nerve pass to the skin.
- **lacrimal nerve** supplies the skin and conjunctiva of the lateral part of the upper eyelid
- **supraorbital nerve** winds around the upper margin of the orbit at the supraorbital notch.



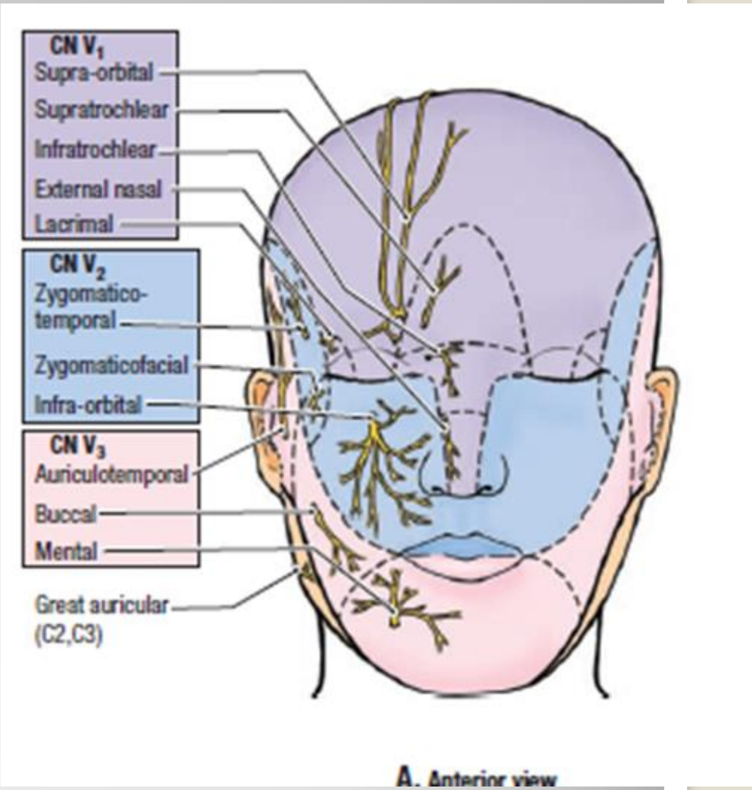
Ophthalmic Nerve

- **supratrochlear nerve** winds around upper margin of orbit medial to supraorbital nerve.
- **infratrochlear nerve** leaves the orbit below pulley of superior oblique muscle.
- **external nasal nerve** leaves the nose by emerging between nasal bone and upper nasal cartilage.



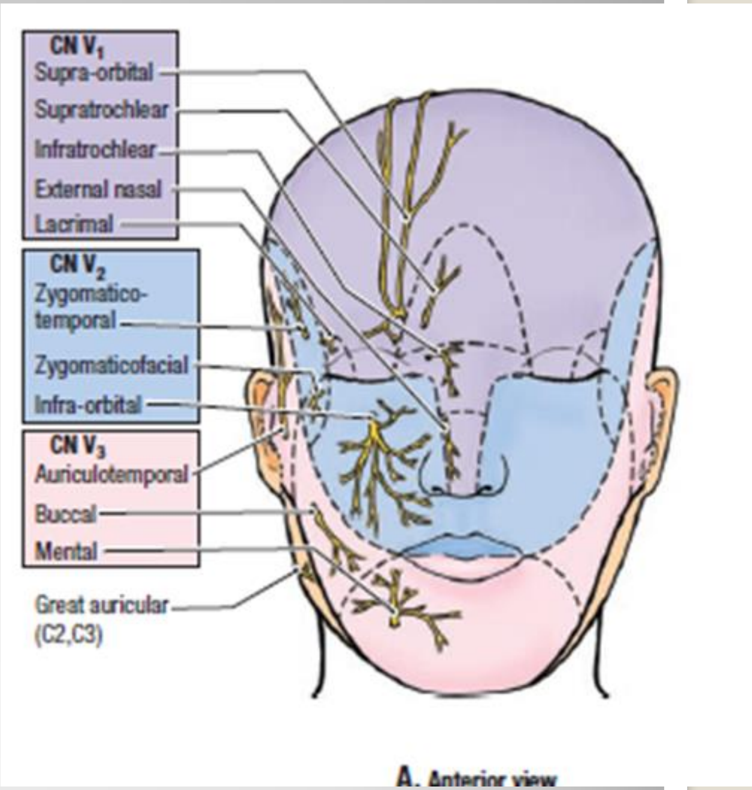
Maxillary Nerve

- Three branches of the nerve pass to the skin.
- **infraorbital nerve** is a direct continuation of maxillary nerve. It enters the orbit and appears on face through infraorbital foramen.
- **zygomaticofacial nerve** passes onto the face through a small foramen on the lateral side of the zygomatic bone.
- **zygomaticotemporal nerve** emerges in the temporal fossa through a small foramen on the posterior surface of the zygomatic bone.



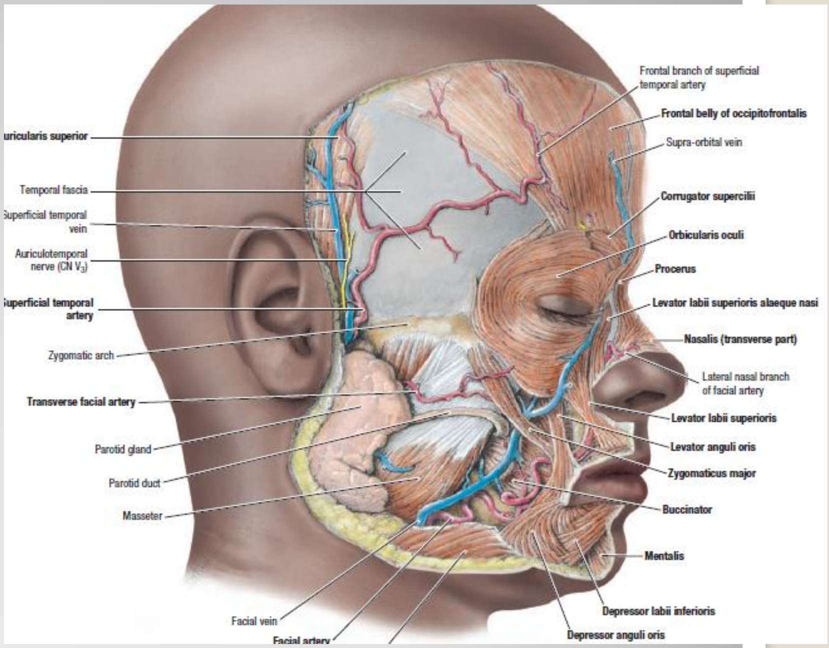
Mandibular Nerve

- Three branches of the nerve pass to the skin.
- **mental nerve** emerges from the mental foramen of the mandible
- **buccal nerve** emerges from beneath the anterior border of the masseter muscle
- **auriculotemporal nerve** ascends from upper border of parotid gland between the superficial temporal vessels and auricle.



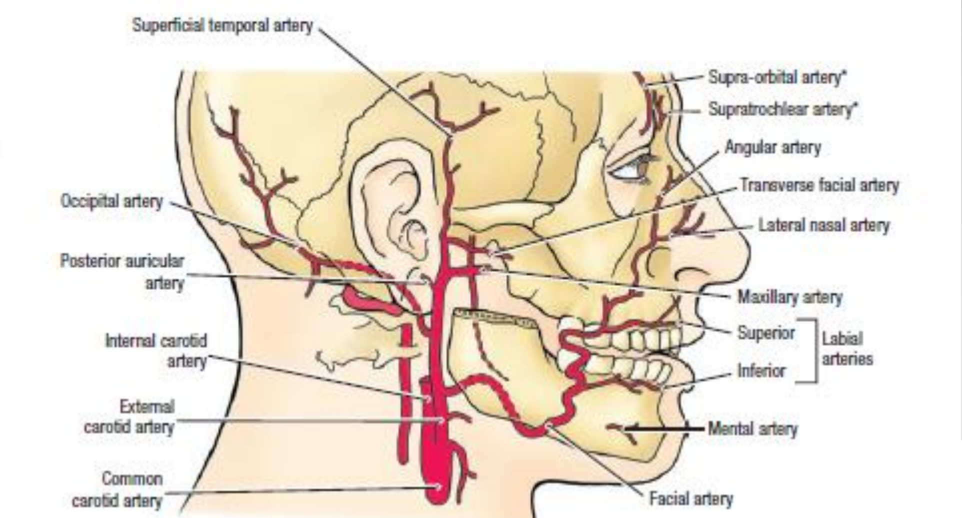
Arterial Supply of the Face

- The face receives a rich blood supply from two main vessels: the **facial** and **superficial temporal** arteries, which are supplemented by several small arteries that accompany the sensory nerves of the face.



The facial artery

- arises from the external carotid artery
- Having arched upward and over submandibular salivary gland, it curves around the inferior margin of the body of the mandible at the anterior border of the masseter muscle.

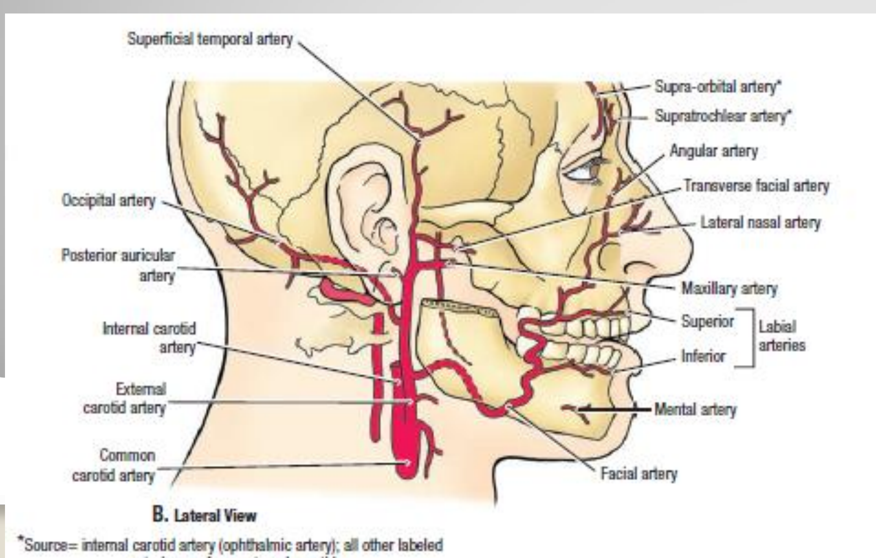


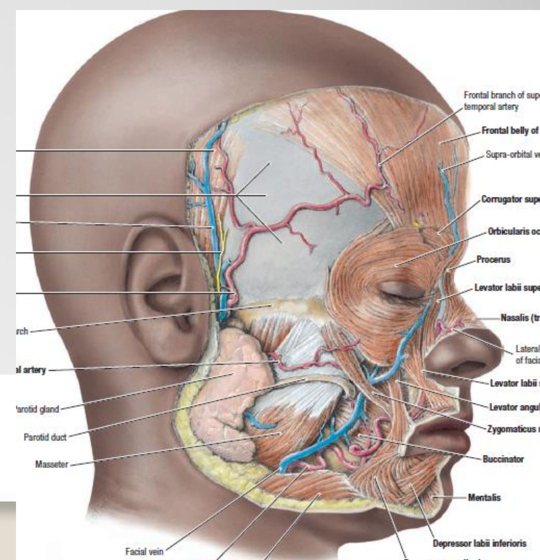
B. Lateral View

*Source= internal carotid artery (ophthalmic artery); all other labeled arteries are from external carotid

The facial artery

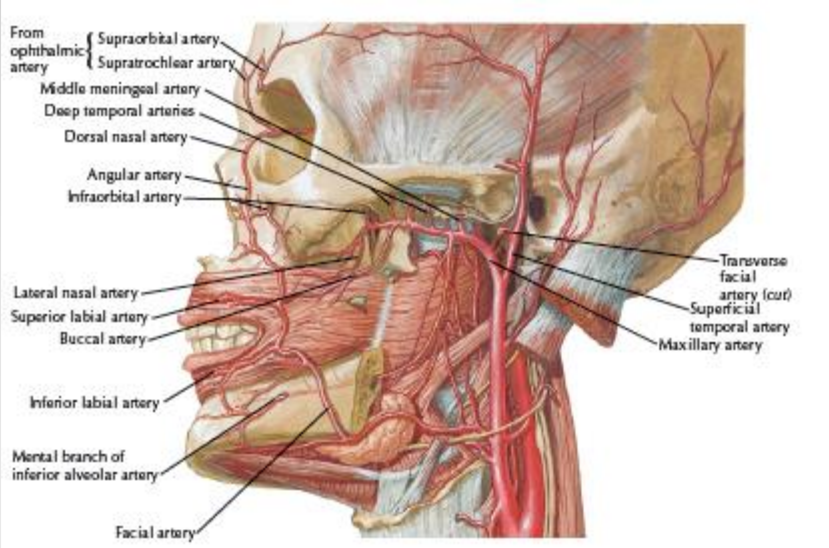
- It runs upward in a tortuous course toward angle of the mouth and is covered by platysma and risorius muscles.
- It then ascends deep to zygomaticus muscles and levator labii superioris muscle and runs along side of nose to medial angle of eye, where it anastomoses with terminal branches of ophthalmic artery





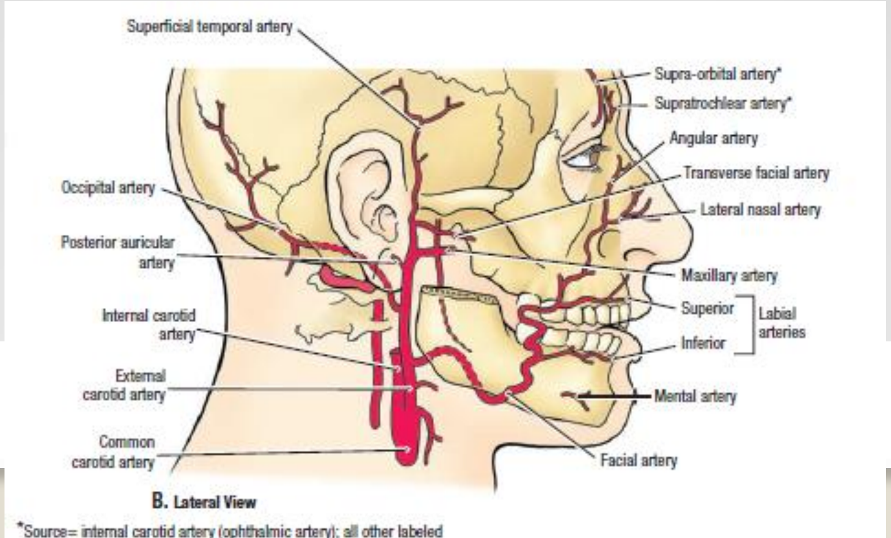
Branches of facial artery

- **submental artery** arises from the facial artery at the lower border of the body of the mandible.
- **inferior labial artery** arises near the angle of the mouth.
- **superior labial artery** arises near the angle of the mouth.
- **lateral nasal artery** arises from facial artery alongside nose.



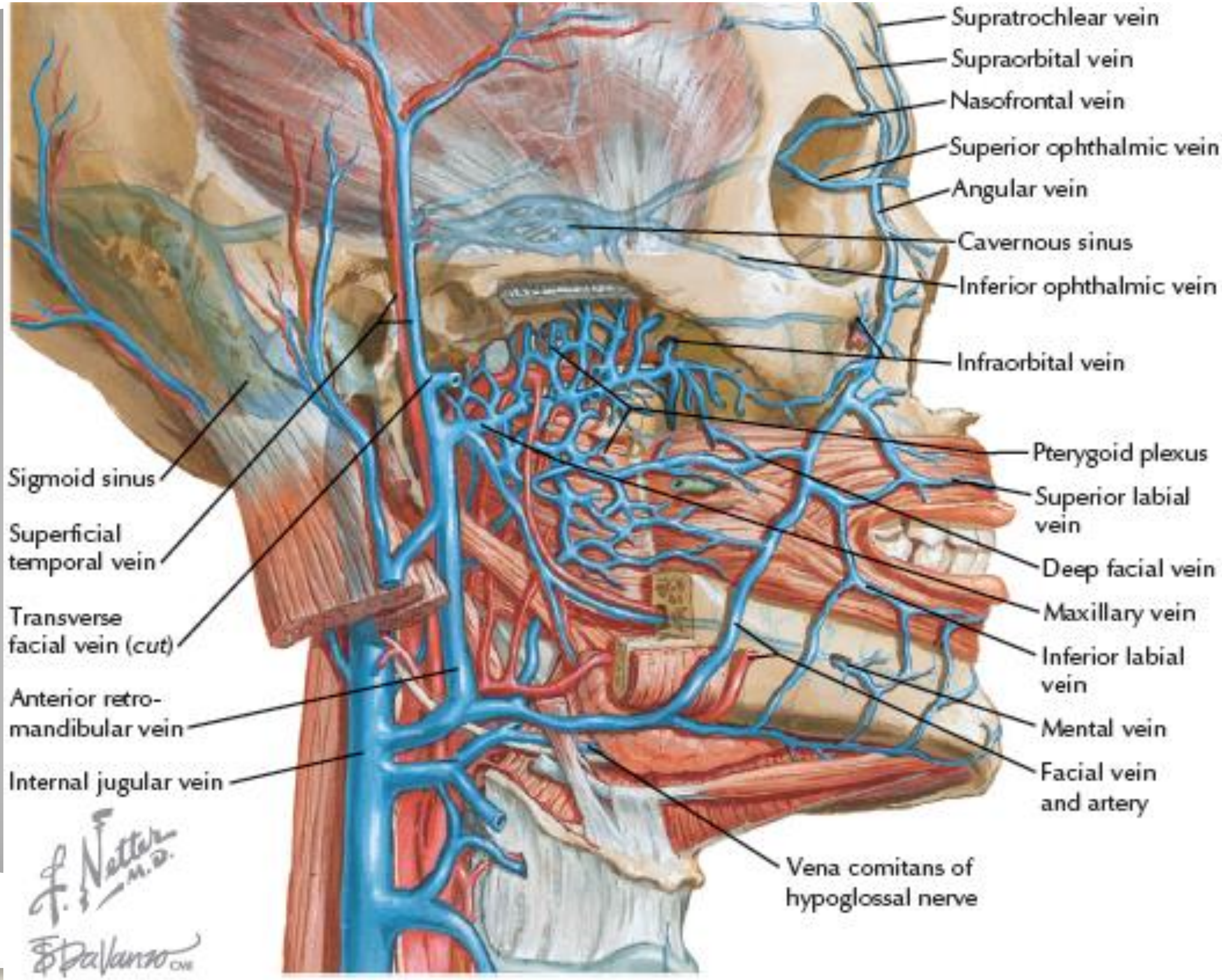
Other arteries of face

- **superficial temporal artery:** smaller terminal branch of external carotid artery, commences in the parotid gland. It ascends in front of the auricle to supply the scalp
- **transverse facial artery:** a branch of the superficial temporal artery, arises within the parotid gland. It runs forward across the cheek just above the parotid duct
- **supraorbital** and **supratrochlear** arteries, branches of the ophthalmic artery, supply the skin of the forehead



Venous Drainage of the Face

- **facial vein** is formed at medial angle of eye by union of supraorbital and supratrochlear veins
- It is connected to superior ophthalmic vein directly through supraorbital vein.
- By means of superior ophthalmic vein, facial vein is connected to cavernous sinus
- facial vein descends behind facial artery to lower margin of body of the mandible.
- It crosses superficial to submandibular gland and is joined by anterior division of retromandibular vein.
- facial vein ends by draining into the internal jugular vein.

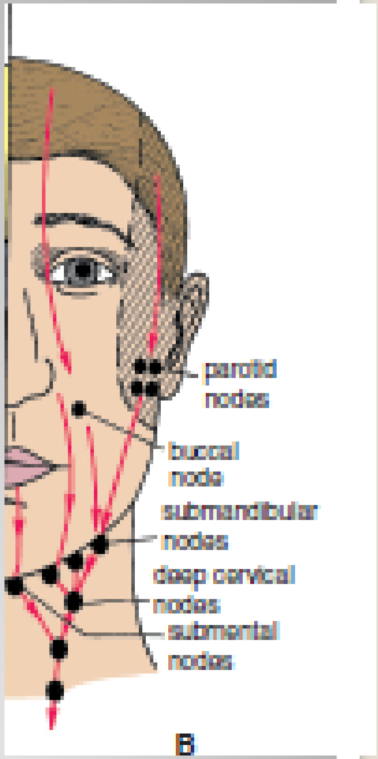

Supratrochlear vein
Supraorbital vein
Nasofrontal vein
Superior ophthalmic vein
Angular vein
Cavernous sinus
Inferior ophthalmic vein
Infraorbital vein
Pterygoid plexus
Superior labial vein
Deep facial vein
Maxillary vein
Inferior labial vein
Mental vein
Facial vein and artery
Vena comitans of hypoglossal nerve
Sigmoid sinus
Superficial temporal vein
Transverse facial vein (cut)
Anterior retro-mandibular vein
Internal jugular vein
F. Netter M.D.
DaVanzo

Tributaries of facial vein

- The facial vein receives tributaries that correspond to the branches of the facial artery.
- It is joined to the pterygoid venous plexus by the **deep facial vein** and to the cavernous sinus by the superior ophthalmic vein.
- The **transverse facial vein** joins the superficial temporal vein within the parotid gland.

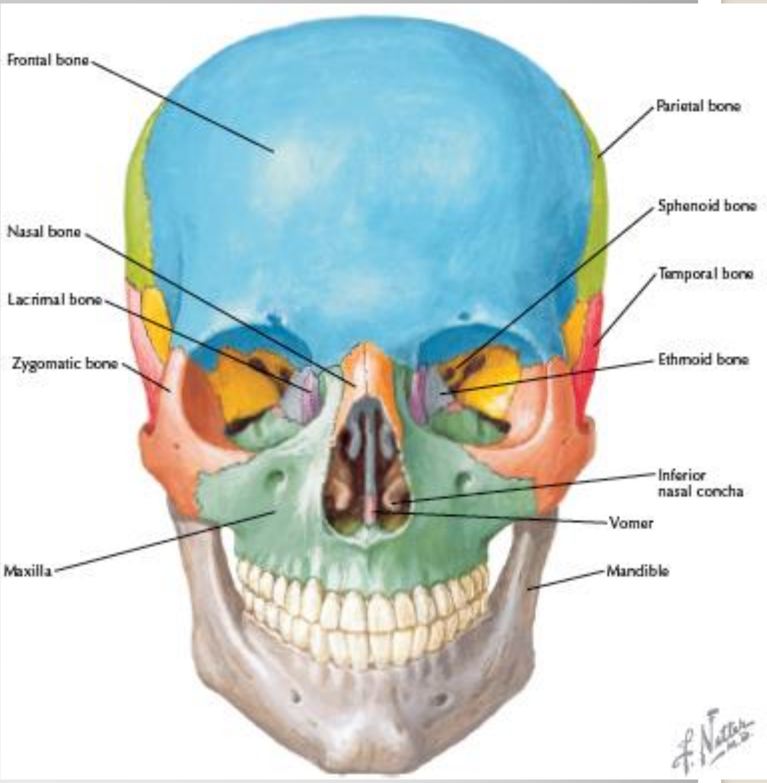
Lymph Drainage of the Face

- Lymph from the forehead and the anterior part of the face drains into the submandibular lymph nodes
- A few buccal lymph nodes may be present along the course of these lymph vessels.
- The lateral part of the face, including the lateral parts of the eyelids, is drained by lymph vessels that end in the parotid lymph nodes.
- The central part of the lower lip and the skin of the chin are drained into the submental lymph nodes.



Bones of the Face

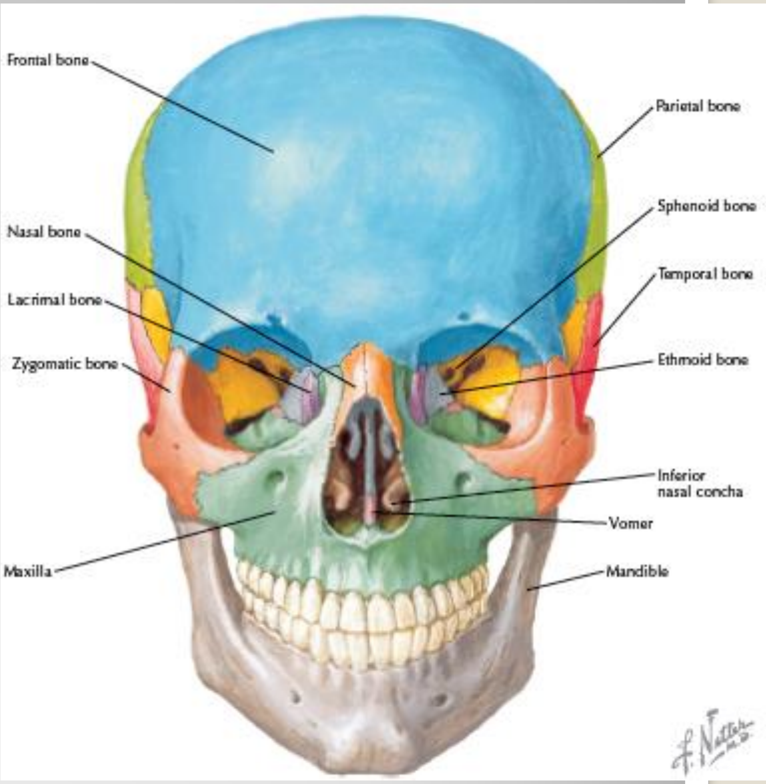
- The superior orbital margins and the area above them are formed by the **frontal bone,** which contains the **frontal air sinuses.**
- The lateral orbital margin is formed by the **zygomatic bone**
- the inferior orbital margin is formed by the **zygomatic bone** and the **maxilla.**
- The medial orbital margin is formed above the maxillary process of the frontal bone and below by the frontal process of the **maxilla.**



- The root of the nose is formed by the **nasal bones,** which articulate below with the maxilla and above with the frontal bones.

- The important central bone of the middle third of the face is the maxilla, containing its teeth and the maxillary air sinus.

- The bone of the lower third of the face is the mandible, with its teeth.



Muscles of the Face (Muscles of Facial Expression)

- The muscles of the face are embedded in the superficial fascia, and most arise from the bones of the skull and are inserted into the skin
- The orifices of the face, namely, the orbit, nose, and mouth, are guarded by the eyelids, nostrils, and lips, respectively.
- It is the function of the facial muscles to serve as sphincters or dilators of these structures.
- A secondary function of the facial muscles is to modify the expression of the face.
- All the muscles of the face are developed from the second pharyngeal arch and are supplied by the facial nerve.

Muscles of the Eyelids

- The sphincter muscle orbicularis oculi
- dilator muscles are the levator palpebrae superioris and the occipitofrontalis

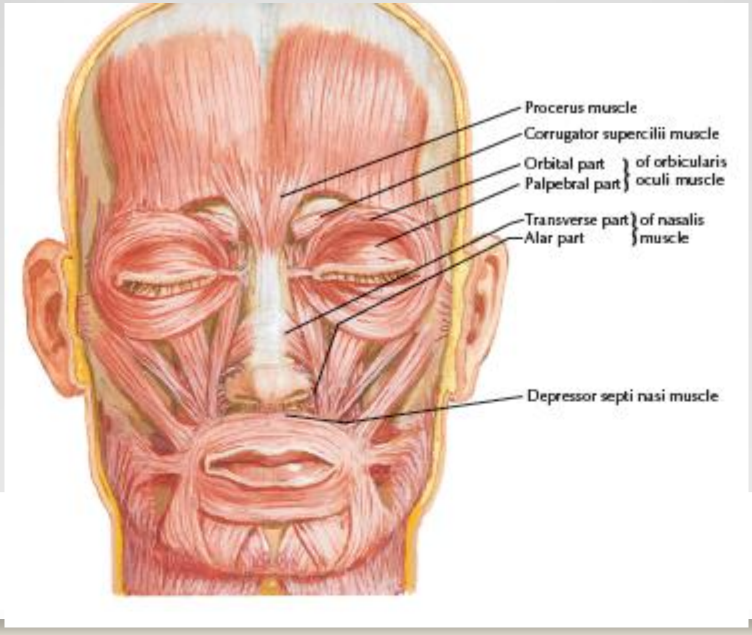
TABLE 11.4 Muscles of the Head

Muscle	Origin	Insertion	Nerve Supply	Action
Orbicularis oculi				
Palpebral part	Medial palpebral ligament	Lateral palpebral raphe	Facial nerve	Closes eyelids and dilates lacrimal sac
Orbital part	Medial palpebral ligament and adjoining bone	Loops return to origin	Facial nerve	Throws skin around orbit into folds to protect eyeball
Corrugator supercilii	Superciliary arch	Skin of eyebrow	Facial nerve	Vertical wrinkles of forehead, as in frowning


Occipitofrontalis


Corrugator supercilii


Orbicularis oculi



Muscles of the Nostrils

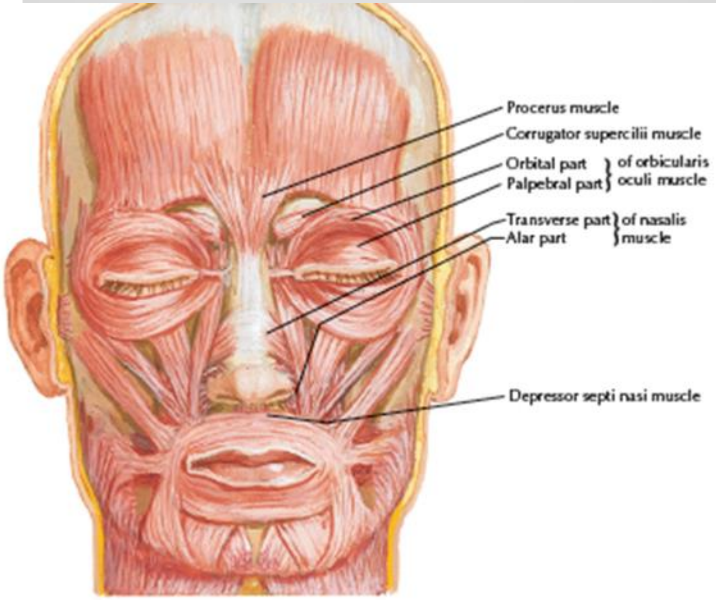
- The sphincter muscle is the compressor naris and the dilator muscle is the dilator naris

TABLE 11.4 Muscles of the Head

Muscle	Origin	Insertion	Nerve Supply	Action
Compressor nasi	Frontal process of maxilla	Aponeurosis of bridge of nose	Facial nerve	Compresses mobile nasal cartilages
Dilator naris	Maxilla	Ala of nose	Facial nerve	Widens nasal aperture
Procerus	Nasal bone	Skin between eyebrows	Facial nerve	Wrinkles skin of nose

Procerus + transverse part of nasalis

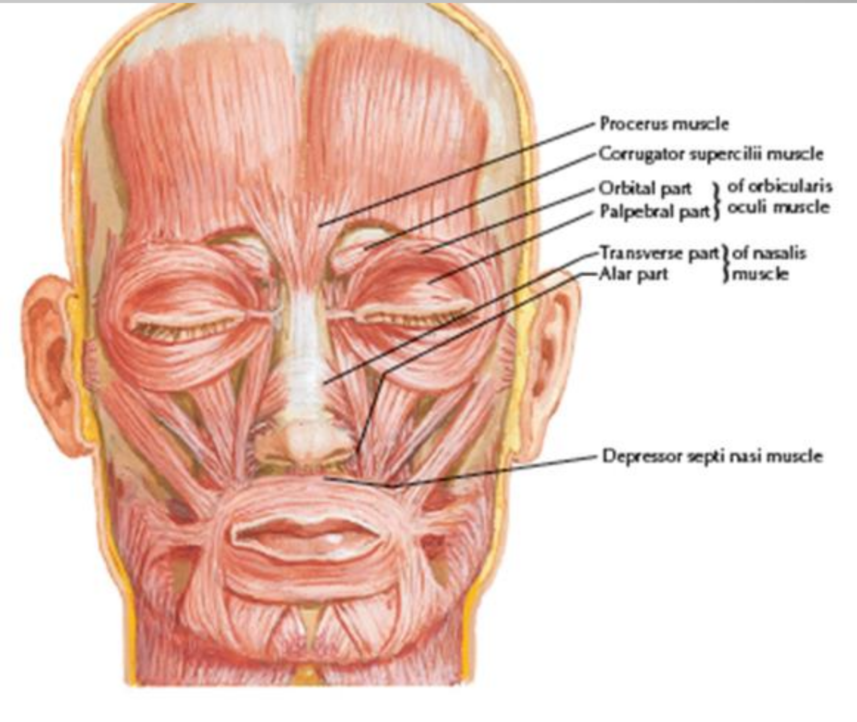
Lev. labii sup. alaeque nasi + alar part of nasalis



Sphincter Muscle of the Lips: Orbicularis Oris

- Origin and insertion: The fibers encircle the oral orifice within the substance of the lips
- Some of the fibers arise near the midline from the maxilla above and the mandible below
- Other fibers arise from the deep surface of the skin and pass obliquely to the mucous membrane lining the inner surface of the lips.
- Many of the fibers are derived from the buccinator muscle.
- Nerve supply: Buccal and mandibular branches of the facial nerve
- Action: Compresses the lips together

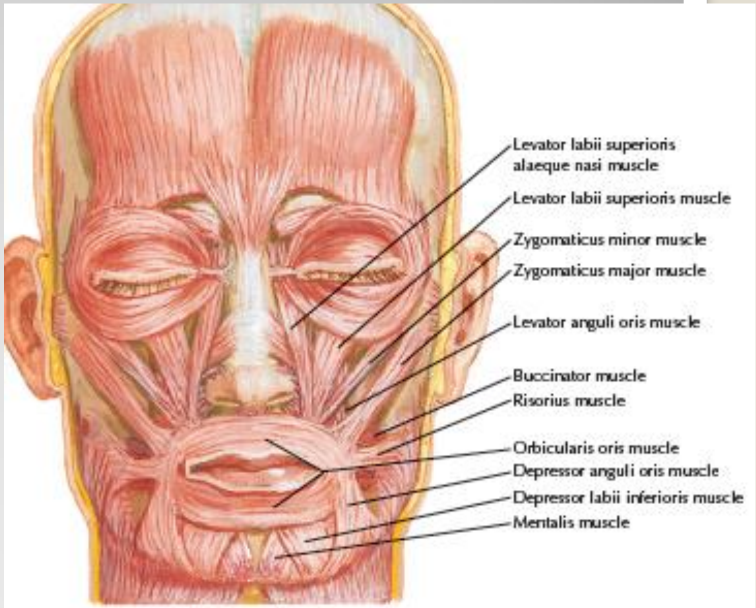
Orbicularis oris



Dilator Muscles of the Lips

- The dilator muscles radiate out from the lips, and their action is to separate the lips
- The muscles arise from the bones and fascia around the oral aperture and converge to be inserted into the substance of the lips.
- the muscles are named as follows:

1. Levator labii superioris alaeque nasi
2. Levator labii superioris
3. Zygomaticus minor
4. Zygomaticus major
5. Levator anguli oris
6. Risorius
7. Depressor anguli oris
8. Depressor labii inferioris
9. Mentalis



- Nerve Supply Buccal and mandibular branches of the facial nerve

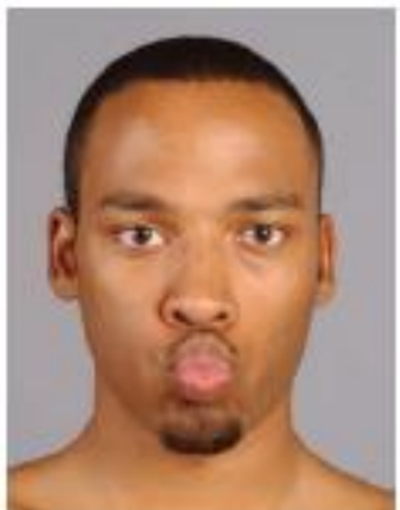
Zygomaticus major + minor

Risorius

Risorius + depressor labii inferioris

Levator labii sup. + depressor labii

Dilators of mouth:
Risorious plus levator labii superioris



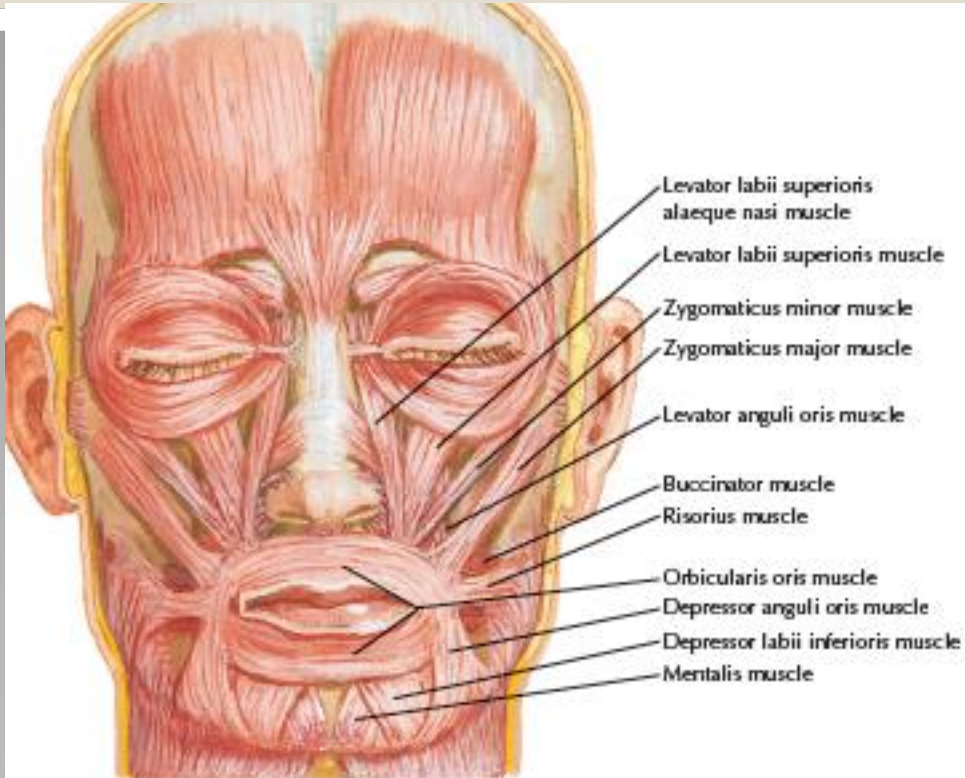
Orbicularis oris

Depressor anguli oris

Mentalis

Muscle of the Cheek (Buccinator)

- **Origin:** From the outer surface of the alveolar margins of the maxilla and mandible opposite the molar teeth and from the pterygomandibular ligament
- **Insertion:** The muscle fibers pass forward, forming the muscle layer of the cheek. The muscle is pierced by the parotid duct. At the angle of the mouth the central fibers decussate, those from below entering the upper lip and those from above entering the lower lip; the highest and lowest fibers continue into the upper and lower lips, respectively, without intersecting. The buccinator muscle thus blends and forms part of the orbicularis oris muscle.
- **Nerve supply:** Buccal branch of the facial nerve
- **Action:** Compresses the cheeks and lips against the teeth



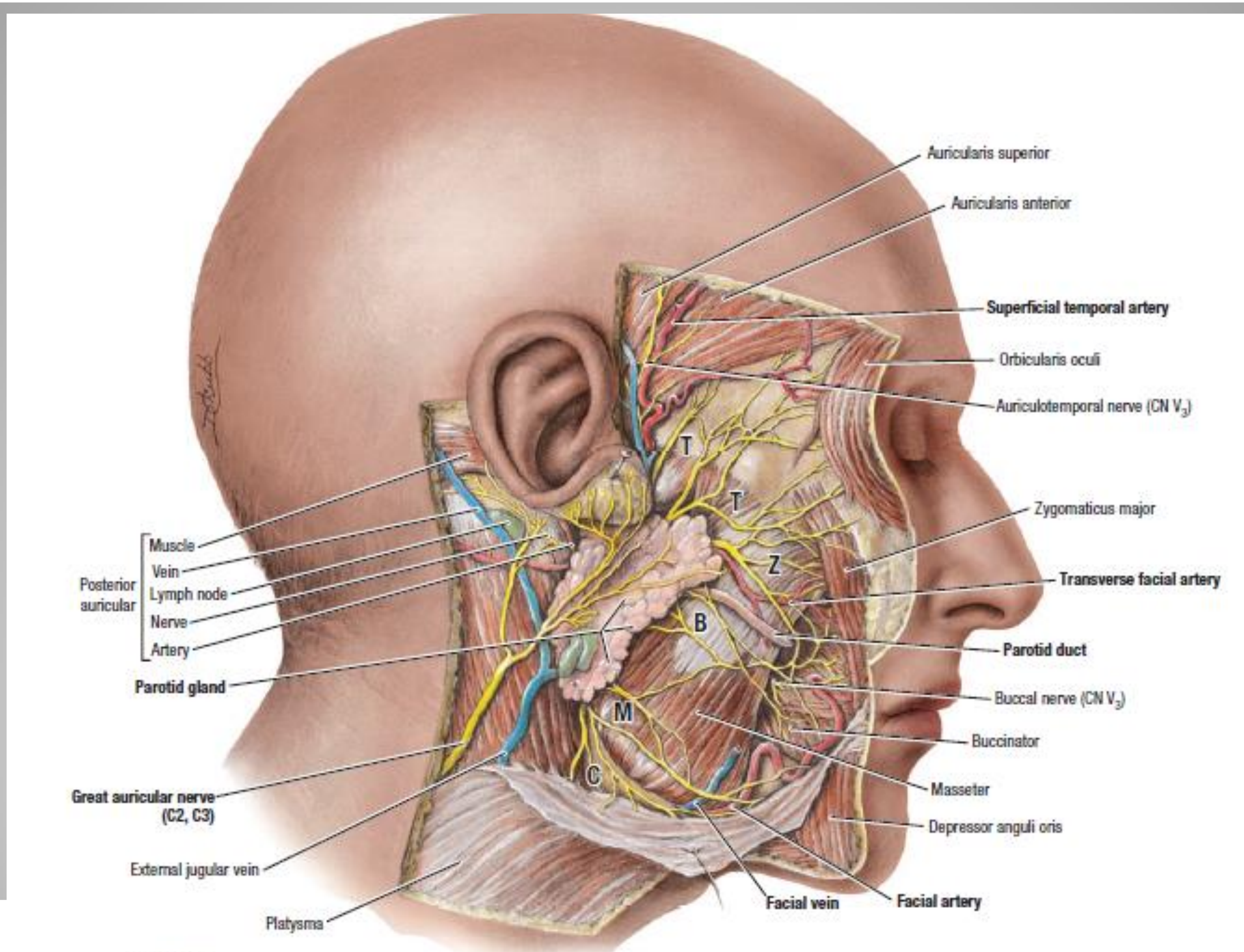
Buccinator + orbicularis oris

Facial Nerve

- As the facial nerve runs forward within the substance of the parotid salivary gland, it divides into its five terminal branches

- **temporal branch** emerges from the upper border of the gland and supplies the anterior and superior auricular muscles, the frontal belly of the occipitofrontalis, the orbicularis oculi, and the corrugator supercilii.

- The **zygomatic branch** emerges from the anterior border of the gland and supplies the orbicularis oculi.

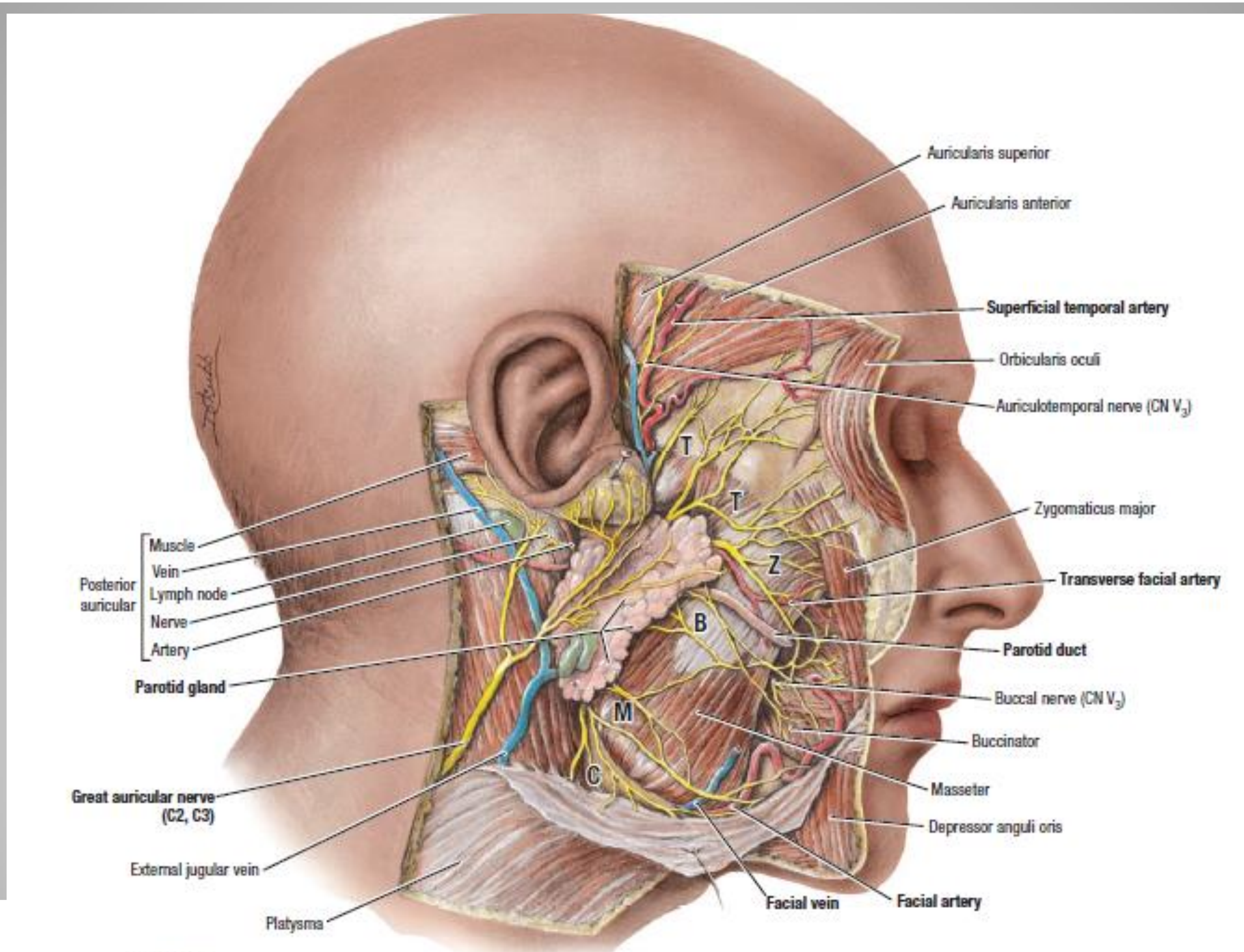


Lateral View

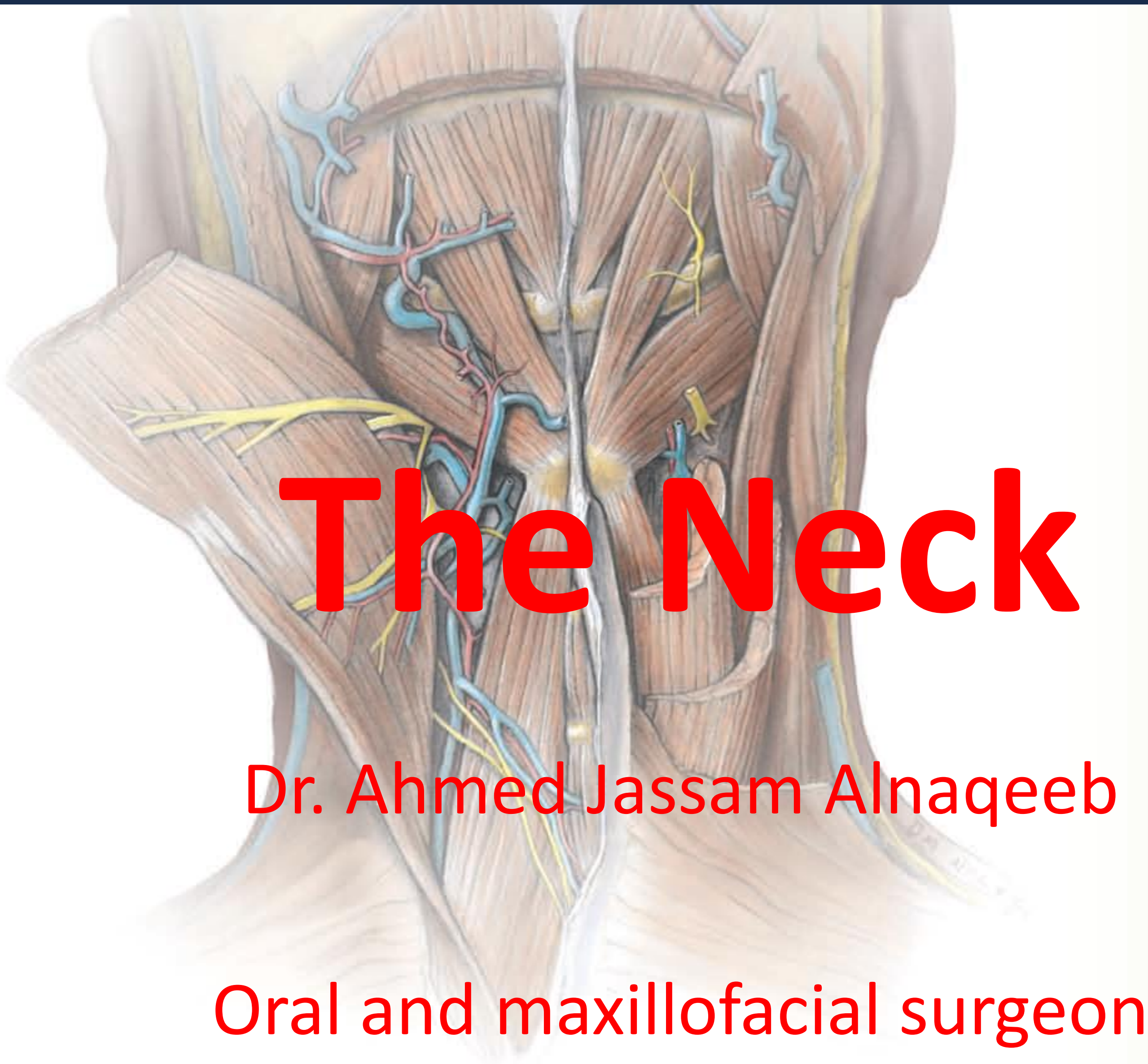
- **buccal branch** emerges from the anterior border of the gland below the parotid duct and supplies the buccinator muscle and the muscles of the upper lip and nostril.

- **mandibular branch** emerges from the anterior border of the gland and supplies the muscles of the lower lip.

- **cervical branch** emerges from the lower border of the gland and passes forward in the neck below the mandible to supply the platysma muscle; it may cross the lower margin of the body of the mandible to supply the depressor anguli oris muscle.



Lateral View

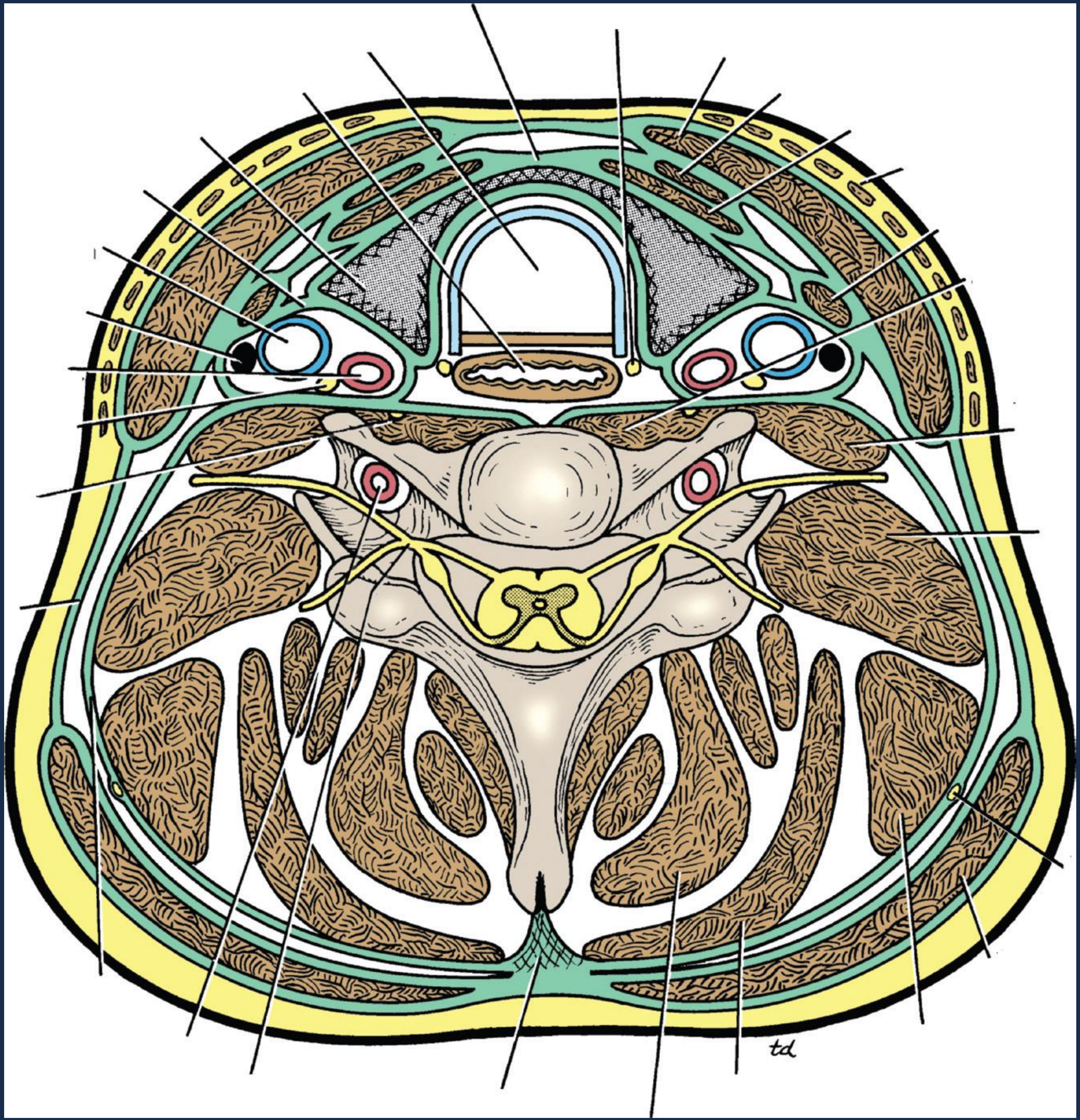


The Neck

Dr. Ahmed Jassam Alnaqeeb

Oral and maxillofacial surgeon

- The neck is the region of the body that lies between the lower margin of the mandible above and the suprasternal notch and the upper border of the clavicle below.
- It is strengthened by the cervical part of the vertebral column



Skin of the Neck

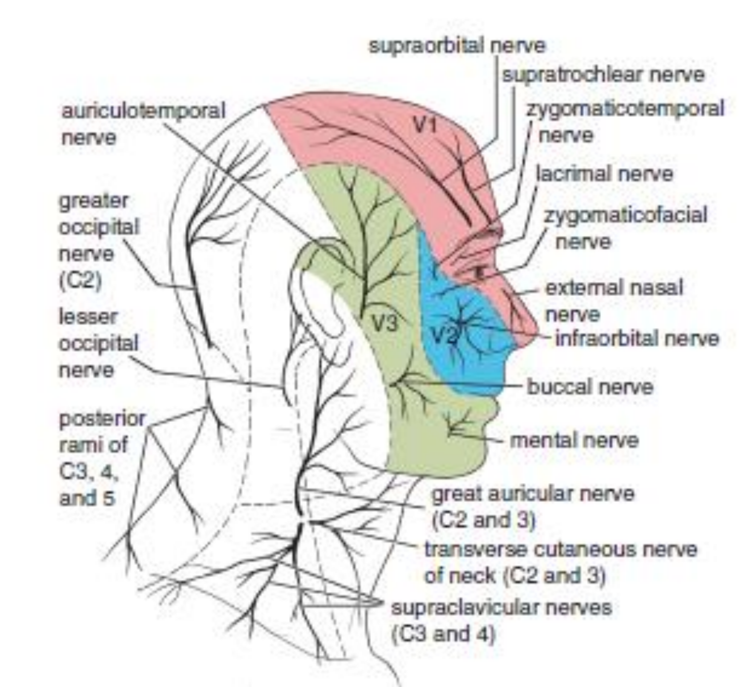
- The natural lines of cleavage of the skin are constant and run almost horizontally around the neck.

Superficial Fascia

- The superficial fascia of the neck forms a thin layer that encloses the platysma muscle.
- Also embedded in it are the cutaneous nerves, the superficial veins, and the superficial lymph nodes.

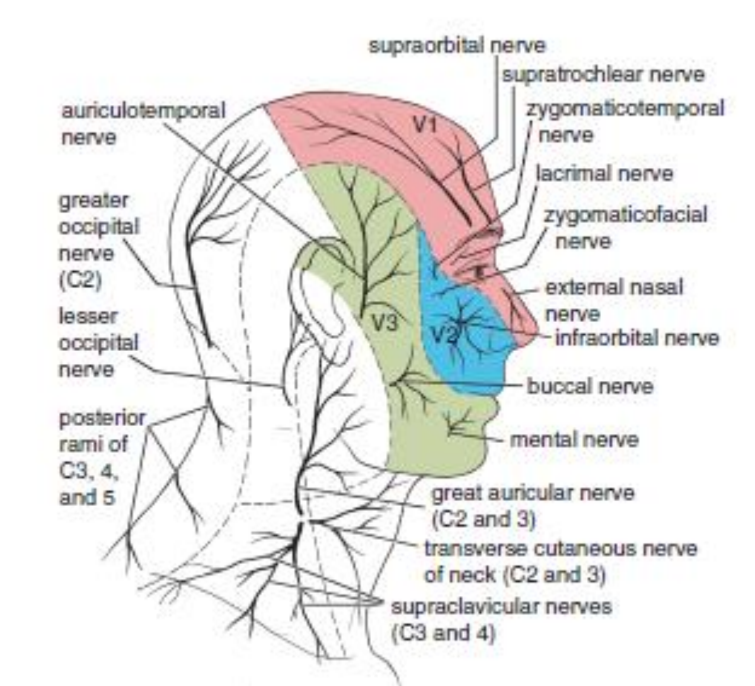
Cutaneous Nerves

- The skin overlying the trapezius muscle on the back of the neck and on the back of the scalp as high as the vertex is supplied by posterior rami of cervical nerves 2 to 5
- The **greater occipital nerve** is a branch of the posterior ramus of the 2nd cervical nerve.
- The 1st cervical nerve has no cutaneous branch.

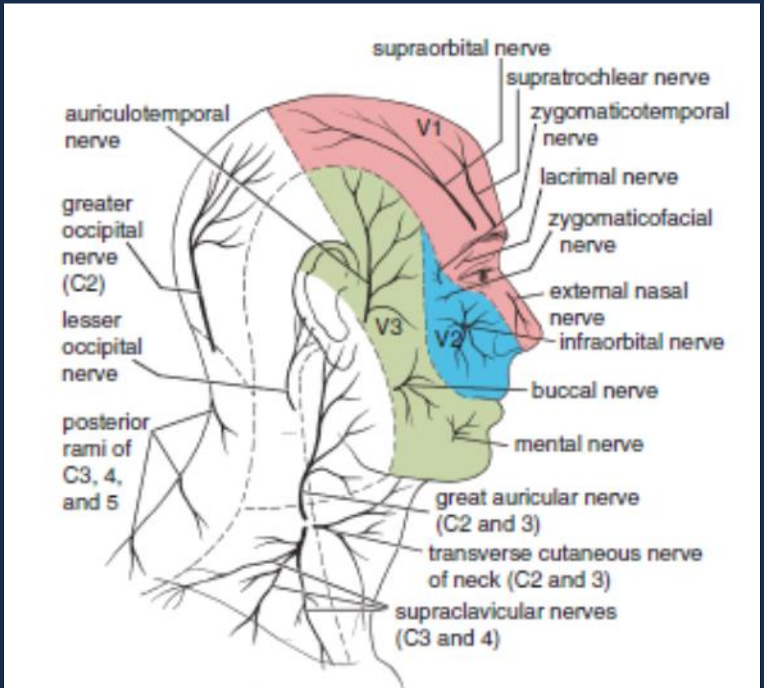


Cutaneous Nerves

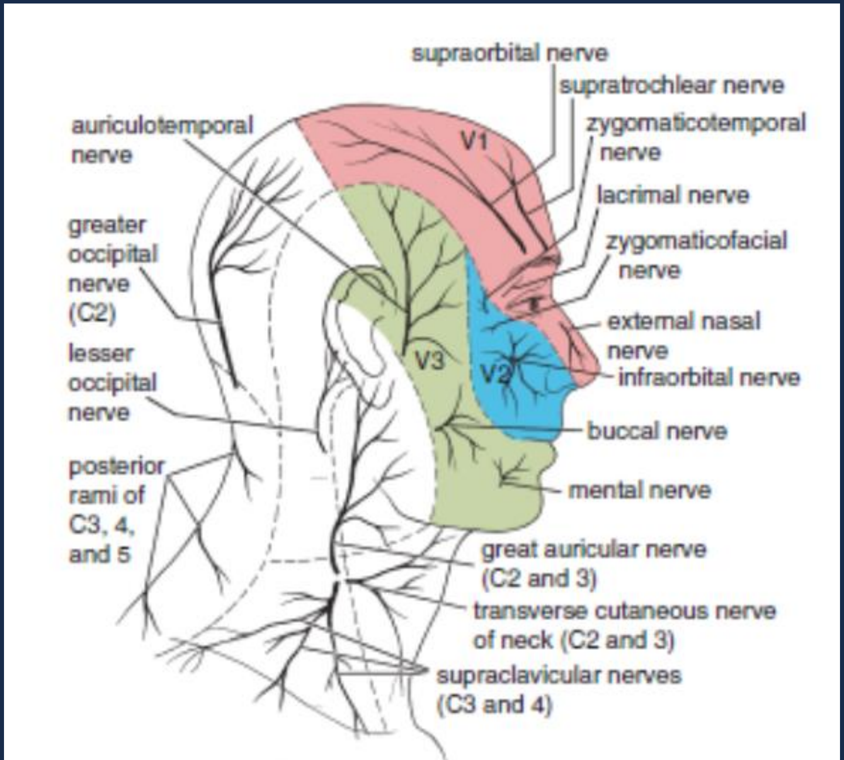
- The skin of the front and sides of the neck is supplied by anterior rami of cervical nerves 2 to 4 through branches of the cervical plexus. The branches emerge from beneath the posterior border of the sternocleidomastoid muscle



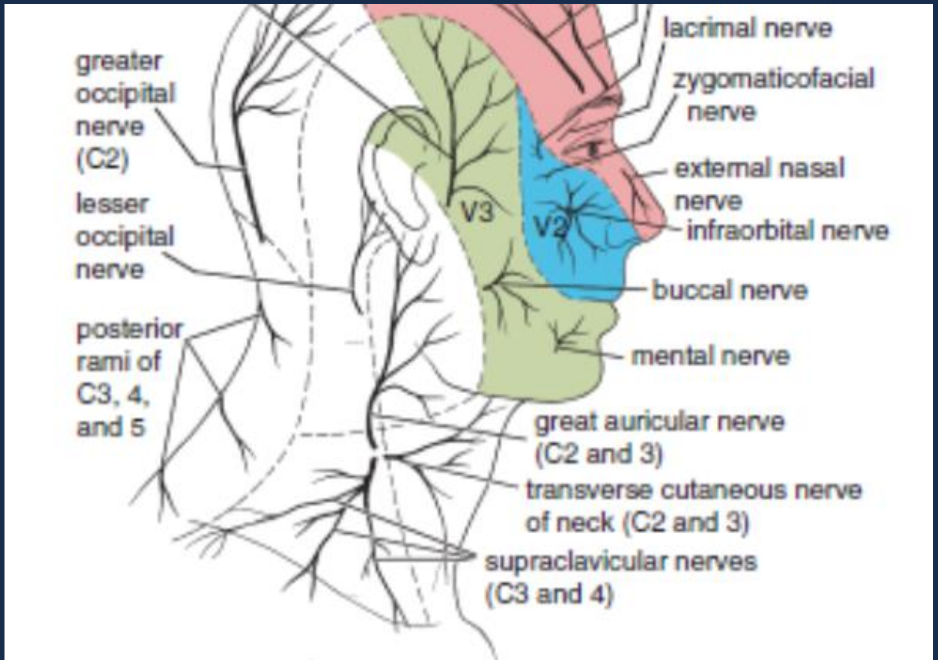
- The **lesser occipital nerve** (C2) hooks around the accessory nerve and ascends along the posterior border of the sternocleidomastoid muscle to supply the skin over the lateral part of the occipital region and the medial surface of the auricle
- The **great auricular nerve** (C2 and 3) ascends across the sternocleidomastoid muscle and divides into branches that supply the skin over the angle of the mandible, the parotid gland, and on both surfaces of the auricle



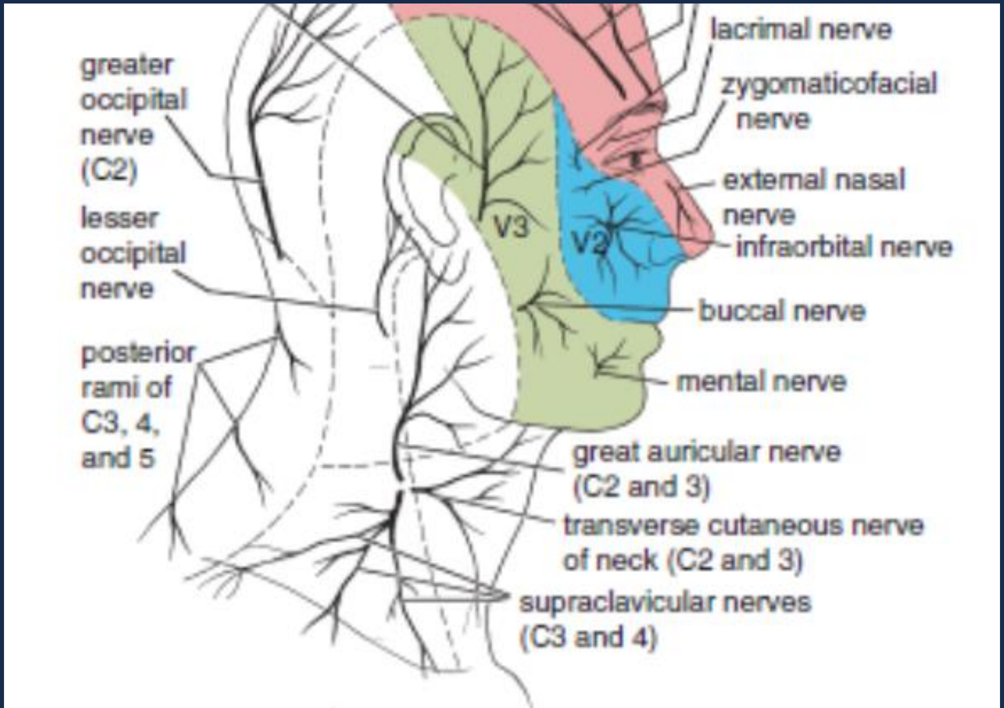
- The **transverse cutaneous nerve** (C2 and 3) emerges from behind the middle of the posterior border of the sternocleidomastoid muscle. It divides into branches that supply the skin on the anterior and lateral surfaces of the neck, from the body of the mandible to the sternum



- The **supraclavicular nerves** (C3 and 4) emerge from beneath the posterior border of the sternocleidomastoid muscle and descend across the side of the neck.
- The **medial supraclavicular nerve** crosses the medial end of the clavicle and supplies the skin as far as the median plane.
- The **intermediate supraclavicular nerve** crosses the middle of the clavicle and supplies the skin of the chest wall.



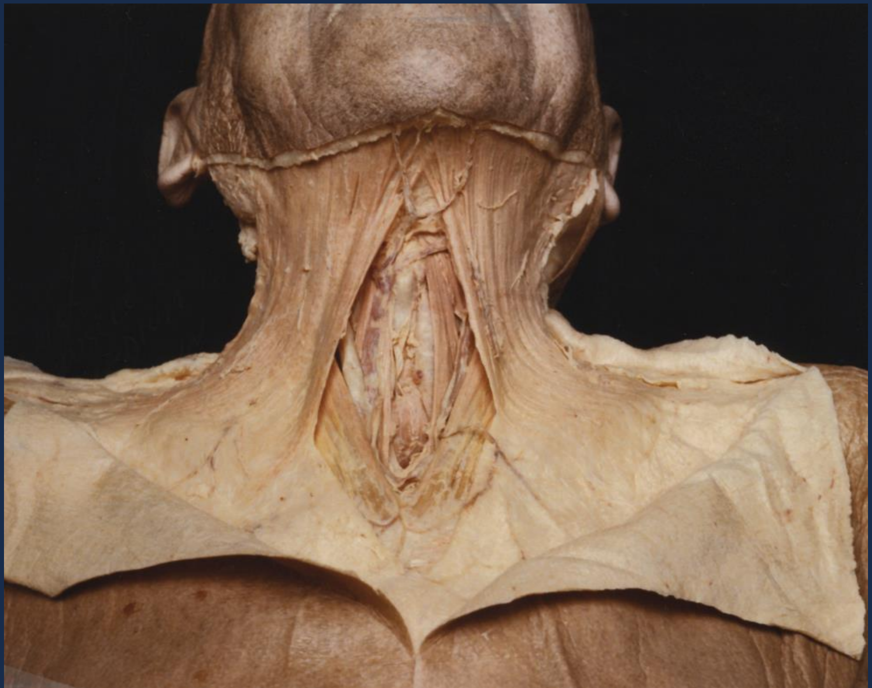
- The **lateral supraclavicular nerve** crosses the lateral end of the clavicle and supplies the skin over the shoulder and the upper half of the deltoid muscle; this nerve also supplies the posterior aspect of the shoulder as far down as the spine of the scapula.



Platysma

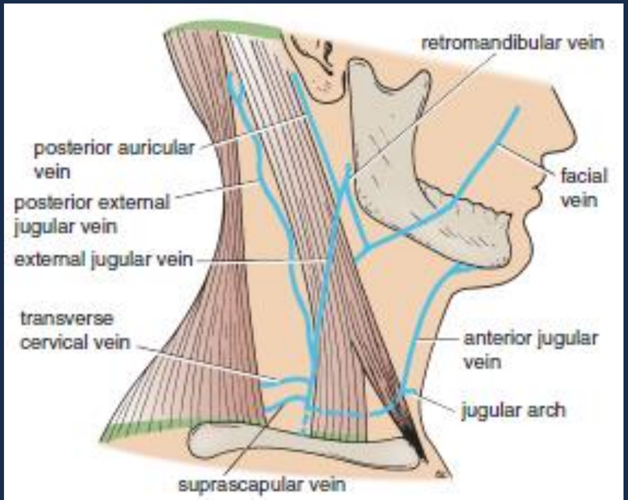
- The platysma muscle is a thin but clinically important muscular sheet embedded in the superficial fascia

Muscle	Origin	Insertion	Nerve Supply	Action
Platysma	Deep fascia over pectoralis major and deltoid	Body of mandible and angle of mouth	Facial nerve cervical branch	Depresses mandible and angle of mouth

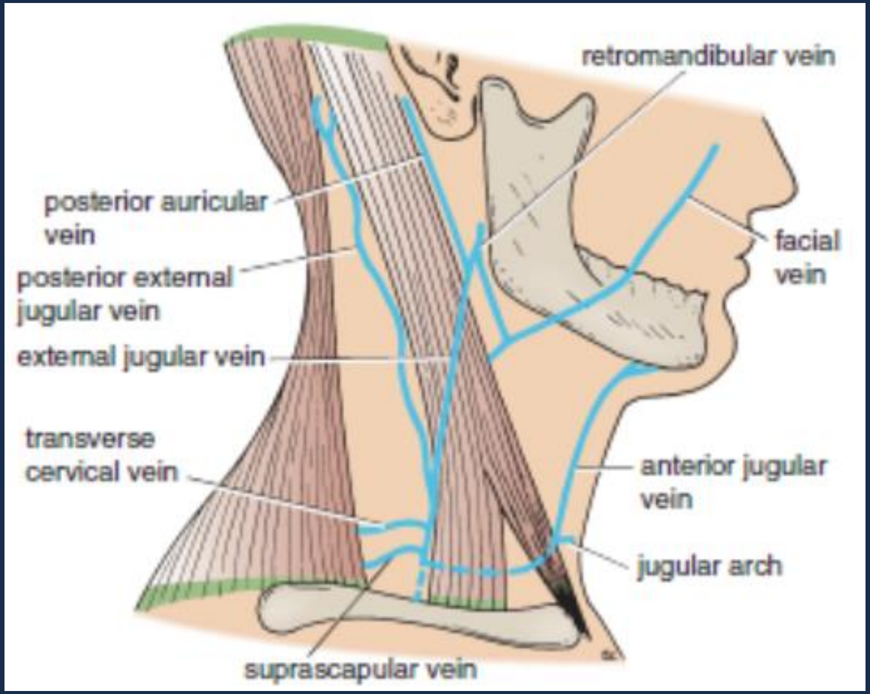


Superficial Veins

- External Jugular Vein
- The external jugular vein begins just behind the angle of the mandible by the union of the posterior auricular vein with the posterior division of the retromandibular vein
- It descends obliquely across the sternocleidomastoid muscle and, just above the clavicle in the posterior triangle, pierces the deep fascia and drains into the subclavian vein
- It varies considerably in size, and its course extends from the angle of the mandible to the middle of the clavicle.

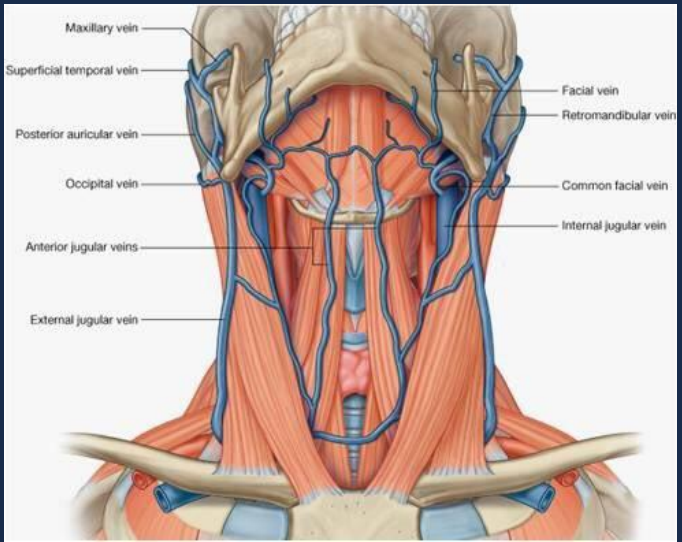


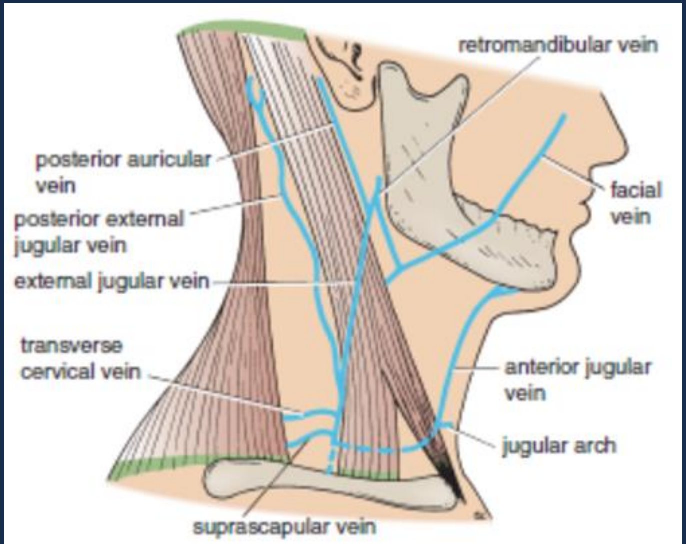
- The external jugular vein has the following tributaries:
- Posterior auricular vein
- Posterior division of the retromandibular vein
- Posterior external jugular vein, a small vein that drains the posterior part of the scalp and neck and joins the external jugular vein about halfway along its course
- Transverse cervical vein
- Suprascapular vein
- Anterior jugular vein



Anterior Jugular Vein

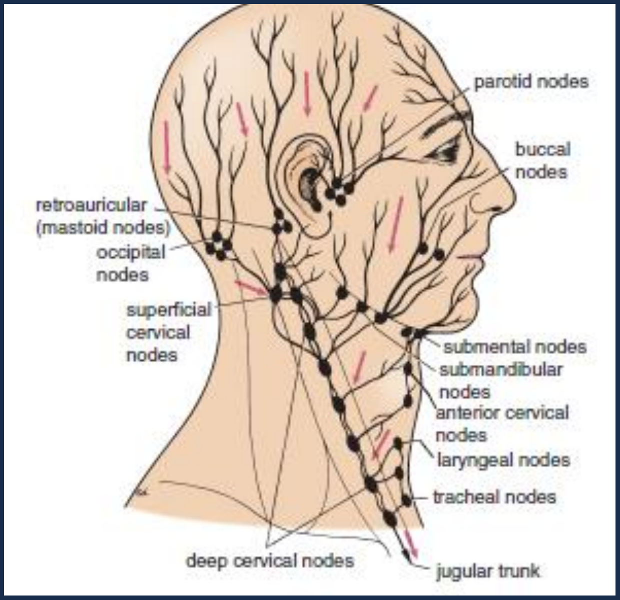
- The anterior jugular vein begins just below the chin, by the union of several small veins
- It runs down the neck close to the midline. Just above the suprasternal notch, the veins of the two sides are united by a transverse trunk called the **jugular arch**.
- The vein then turns sharply laterally and passes deep to the sternocleidomastoid muscle to drain into the external jugular vein.





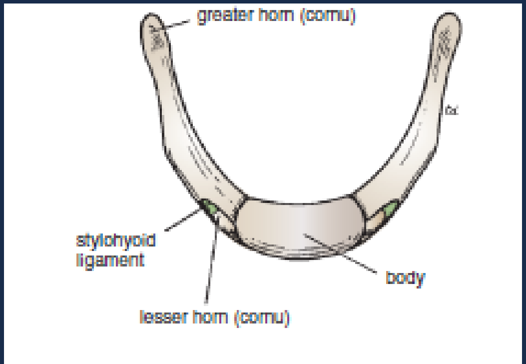
Superficial Lymph Nodes

- The superficial cervical lymph nodes lie along the external jugular vein superficial to the sternocleidomastoid muscle
- They receive lymph vessels from the occipital and mastoid lymph nodes and drain into the deep cervical lymph nodes

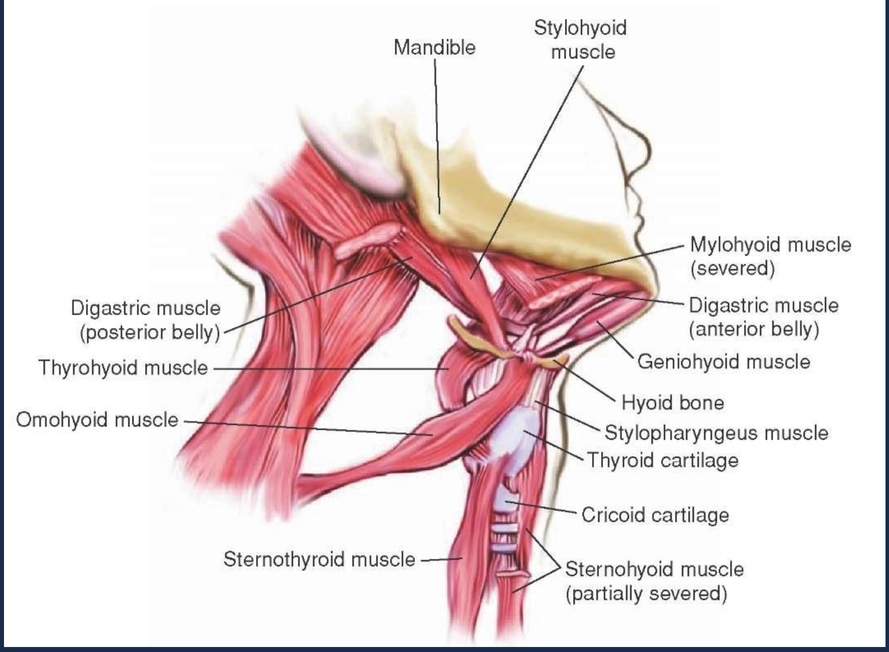


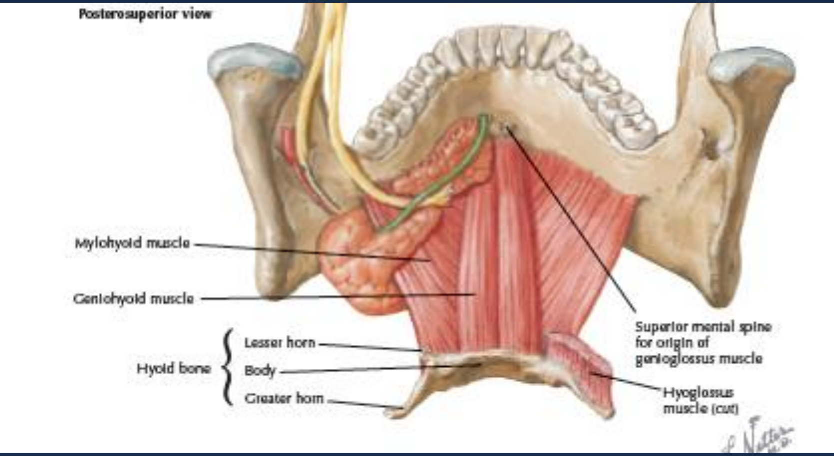
Bones of the Neck

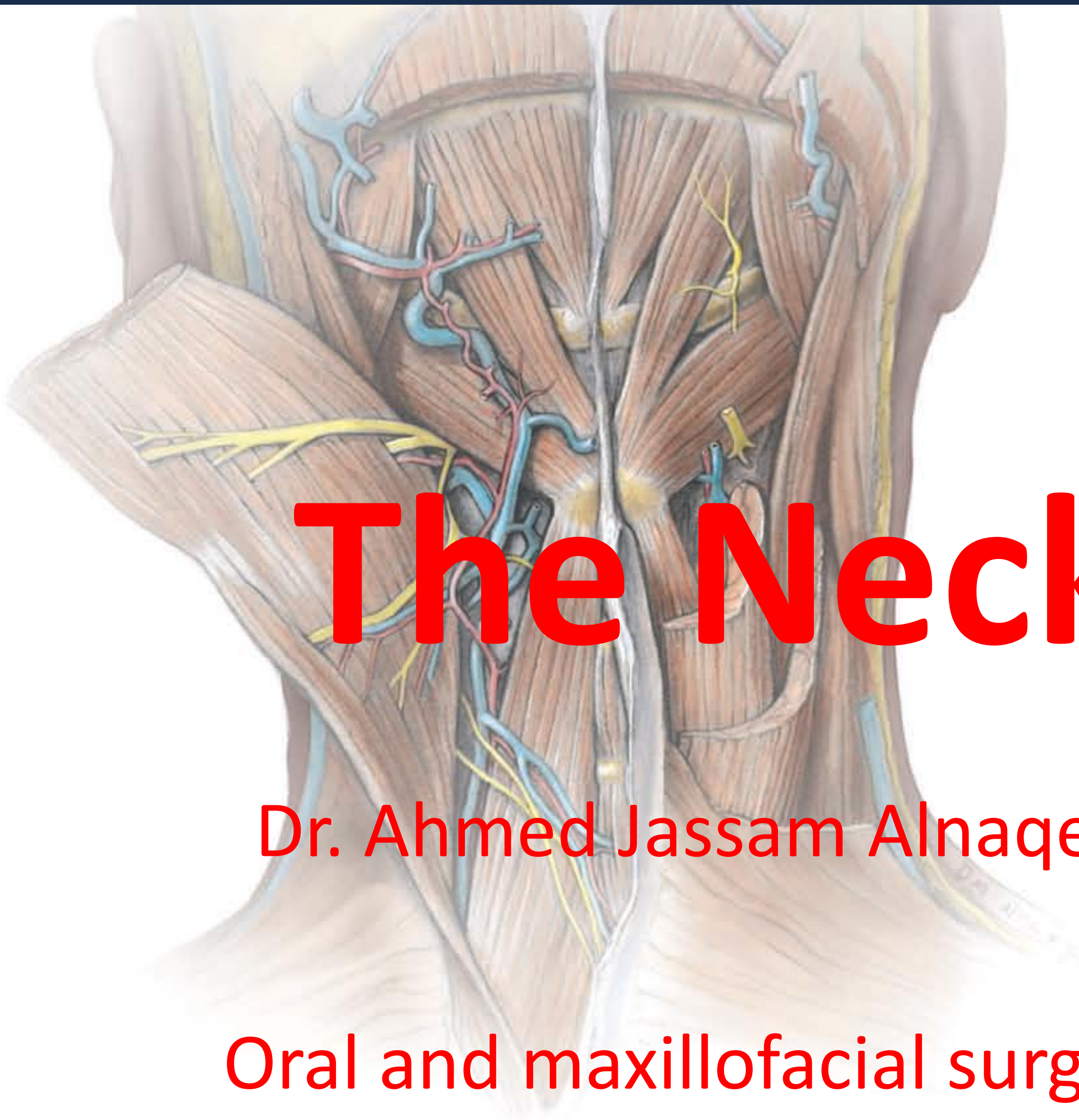
- **Hyoid Bone**
- The hyoid bone is a mobile single bone found in the midline of the neck below the mandible and abides the larynx.
- It does not articulate with any other bones.
- The hyoid bone is U shaped and consists of a body and two greater and two lesser cornua
- It is attached to the skull by 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, to the styloid process of the temporal bone, to the thyroid cartilage, to the sternum, and to the scapula.







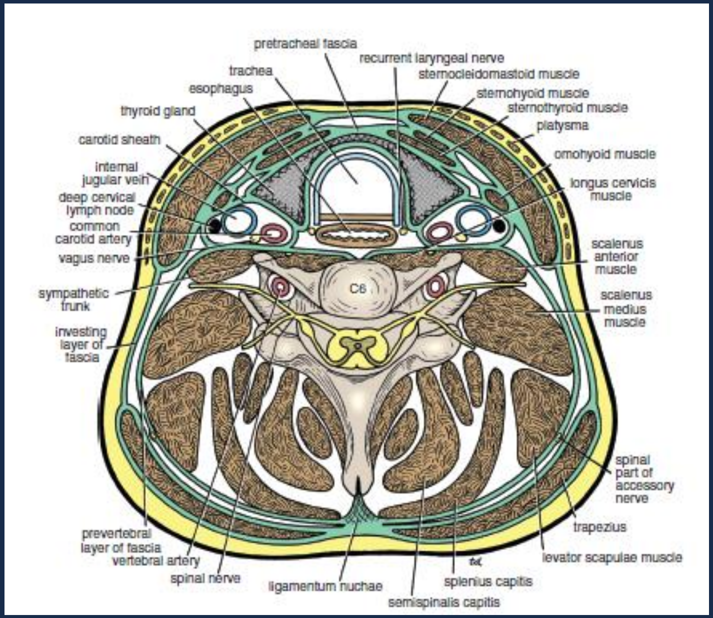
The Neck

Dr. Ahmed Jassam Alnaqeeb

Oral and maxillofacial surgeon

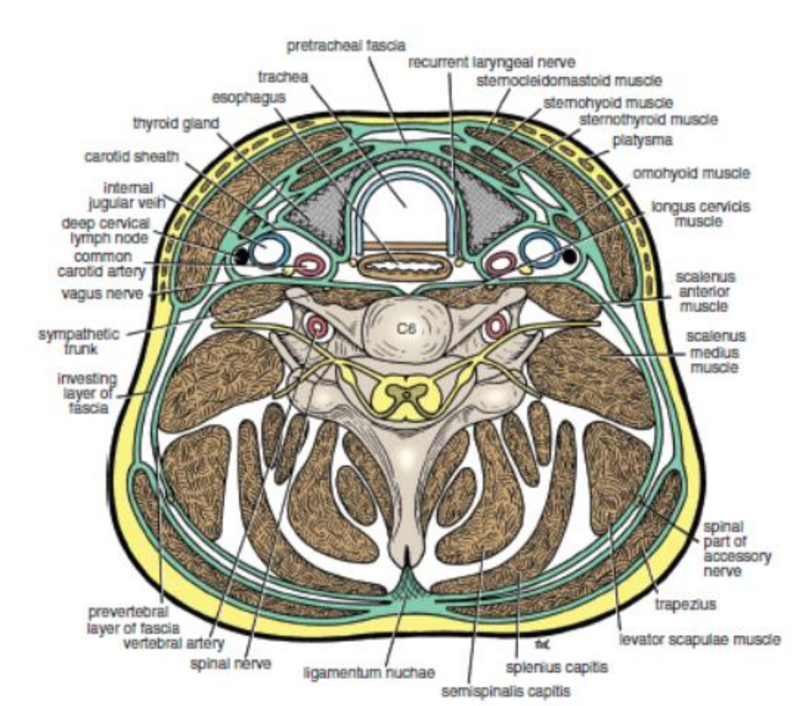
Deep Cervical Fascia

- The deep cervical fascia supports the muscles, the vessels, and the viscera of the neck
- In certain areas, it is condensed to form well-defined, fibrous sheets called the **investing layer,** the **pretracheal layer,** and the **prevertebral layer.**
- It is also condensed to form the carotid sheath



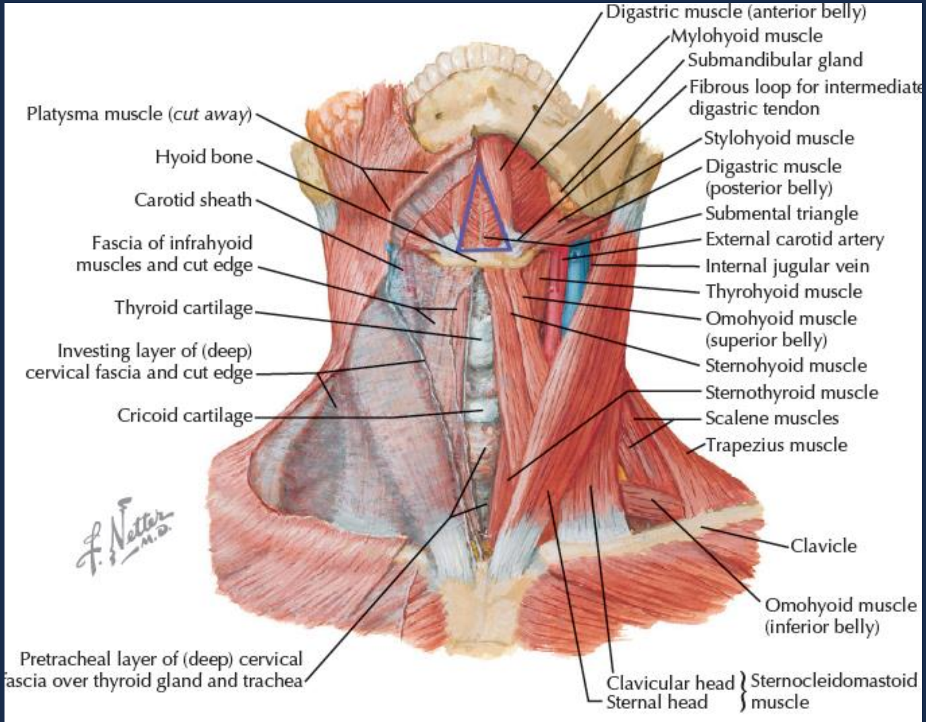
Investing Layer

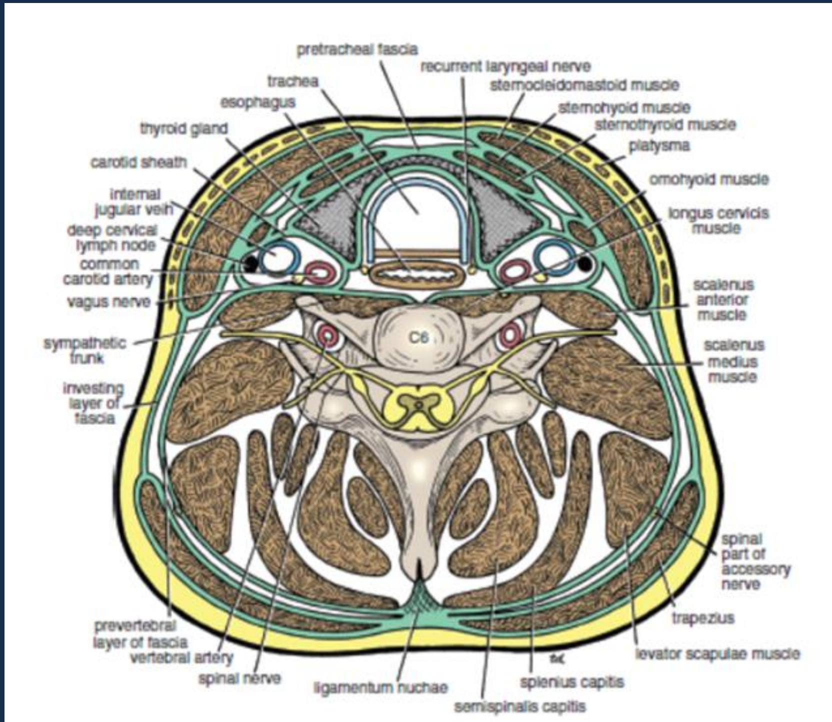
- The investing layer is a thick layer that encircles the neck.
- It splits to enclose the trapezius and the sternocleidomastoid muscles



Pretracheal Layer

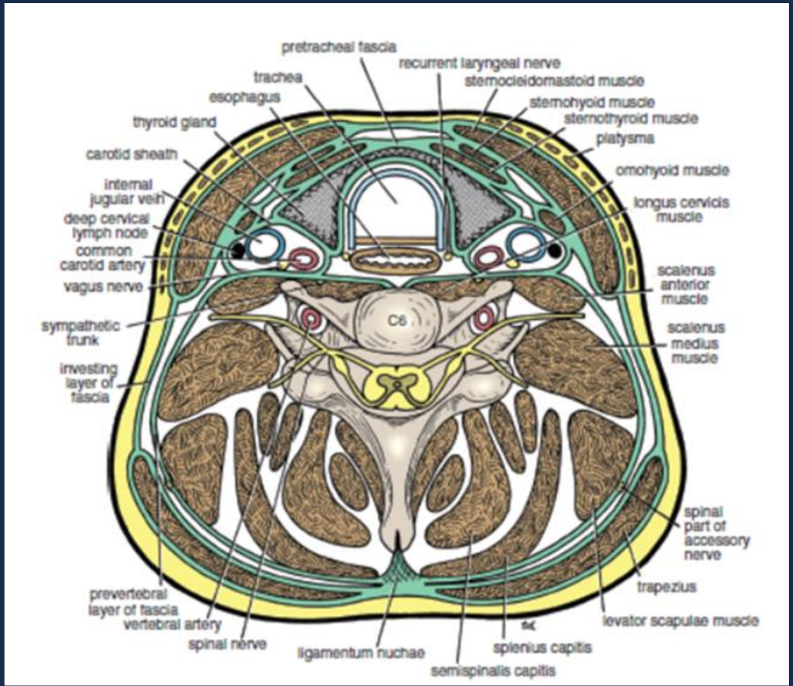
- thin layer that is attached above to the laryngeal cartilages
- It surrounds the thyroid and the parathyroid glands, forming a sheath for them, and encloses the infrahyoid muscles





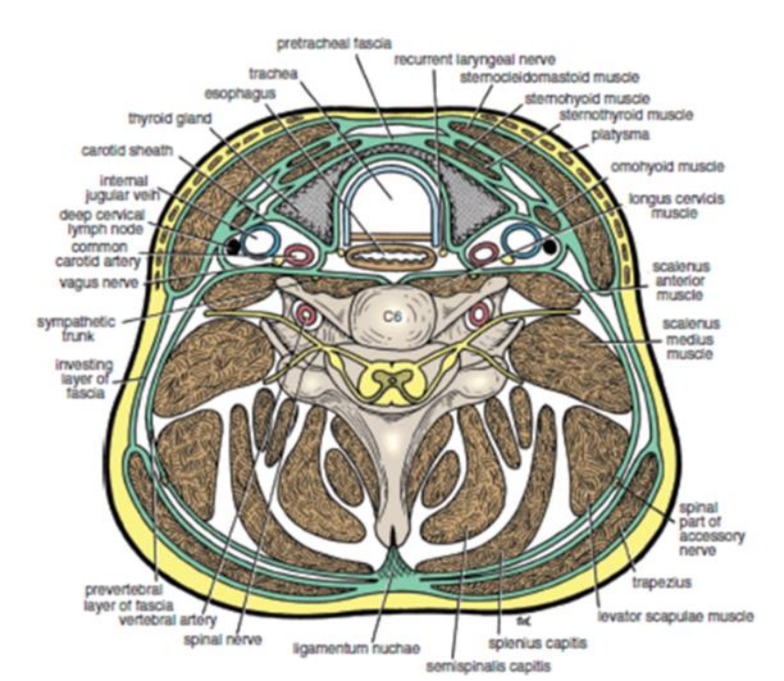
Prevertebral Layer

- thick layer that passes like a septum across the neck behind the pharynx and the esophagus and in front of the prevertebral muscles and the vertebral column
- It forms the fascial floor of the posterior triangle, and it extends laterally over the first rib into the axilla to form the important axillary sheath



Carotid Sheath

- A local condensation of the prevertebral, the pretracheal, and the investing layers of the deep fascia
- surround the common and internal carotid arteries, the internal jugular vein, the vagus nerve, and the deep cervical lymph nodes

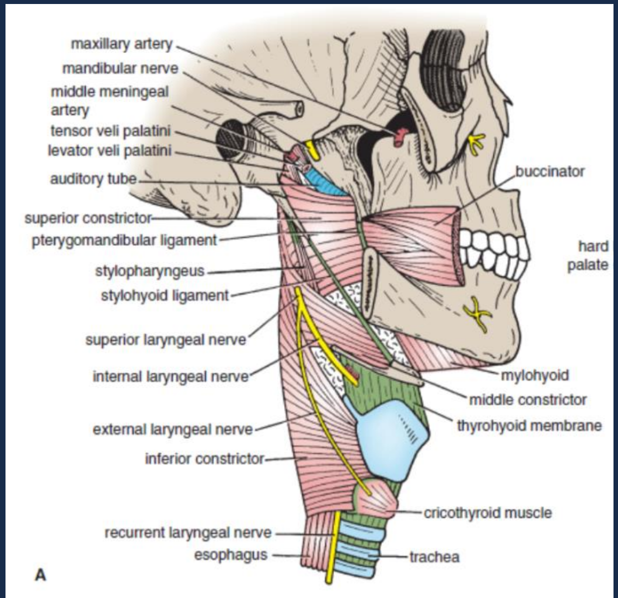


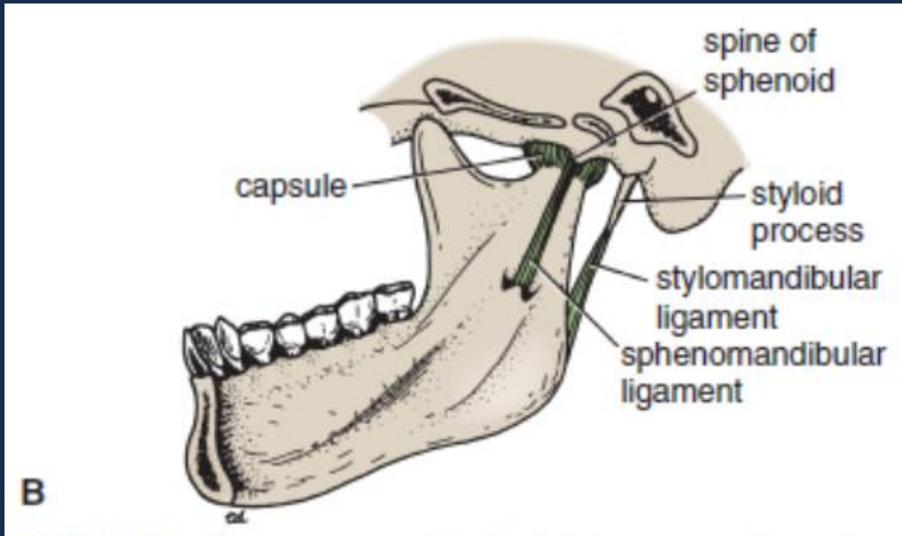
Axillary Sheath

- As the subclavian artery and the brachial plexus emerge in the interval between the scalenus anterior and the scalenus medius muscles, they carry with them a sheath of the prevertebral fascia, which extends into the axilla and is called the **axillary sheath**

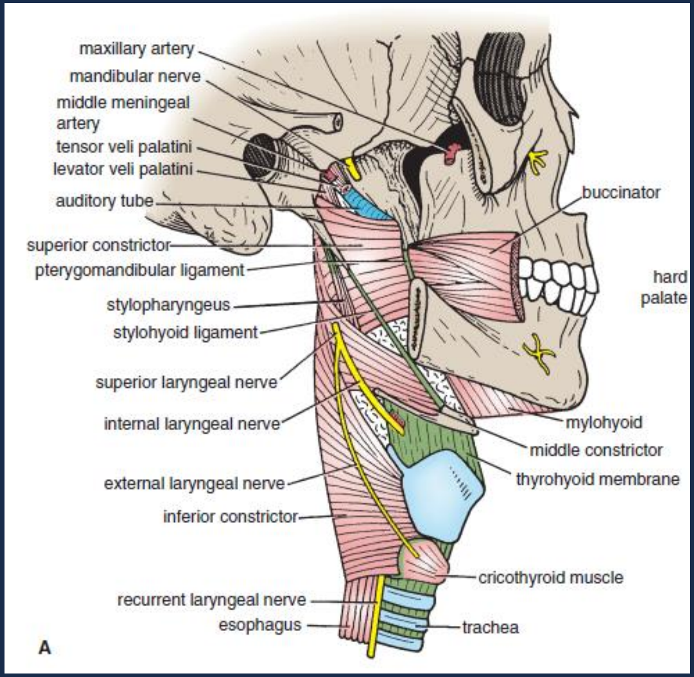
Cervical Ligaments

- **Stylohyoid ligament:** Connects the styloid process to the lesser cornu of the hyoid bone
- **Stylomandibular ligament:** Connects the styloid process to the angle of the mandible
- **Sphenomandibular ligament:** Connects the spine of the sphenoid bone to the lingula of the mandible





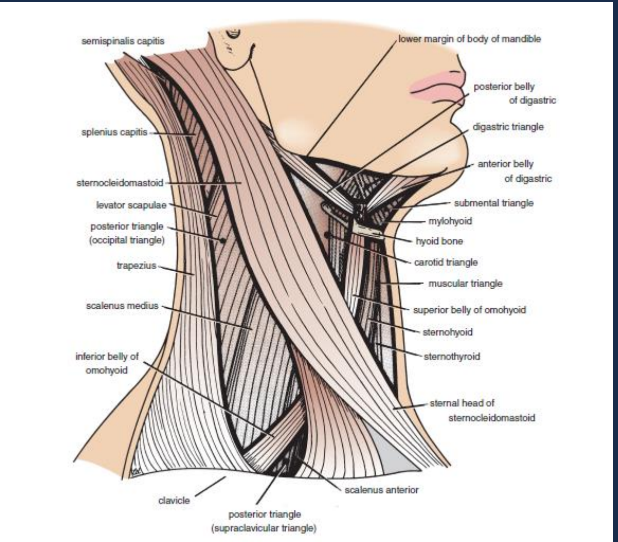
- **Pterygomandibular ligament:** Connects the hamular process of the medial pterygoid plate to the posterior end of the mylohyoid line of the mandible. It gives attachment to the superior constrictor and the buccinator muscles



Muscles of the Neck

❑ **Sternocleidomastoid Muscle**

- When the sternocleidomastoid muscle contracts, it appears as an oblique band crossing the side of the neck from the sternoclavicular joint to the mastoid process of the skull.
- It divides the neck into anterior and posterior triangles
- The anterior border covers the carotid arteries, the internal jugular vein, and the deep cervical lymph nodes; it also overlaps the thyroid gland.



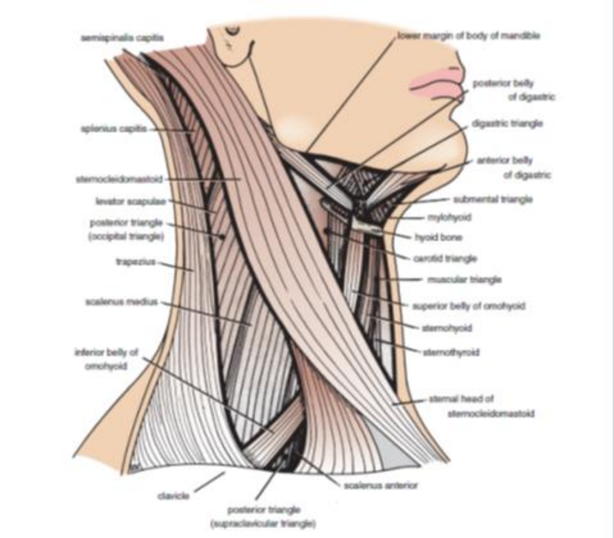
- The muscle is covered superficially by skin, fascia, the platysma muscle, and the external jugular vein.
- The deep surface of the posterior border is related to the cervical plexus of nerves, the phrenic nerve, and the upper part of the brachial plexus

TABLE 11.5 Muscles of the Neck

Muscle	Origin	Insertion	Nerve Supply	Action
Sternocleidomastoid	Manubrium sterni and medial third of clavicle	Mastoid process of temporal bone and occipital bone	Spinal part of accessory nerve and C2 and 3	Two muscles acting together extend head and flex neck; one muscle rotates head to opposite side

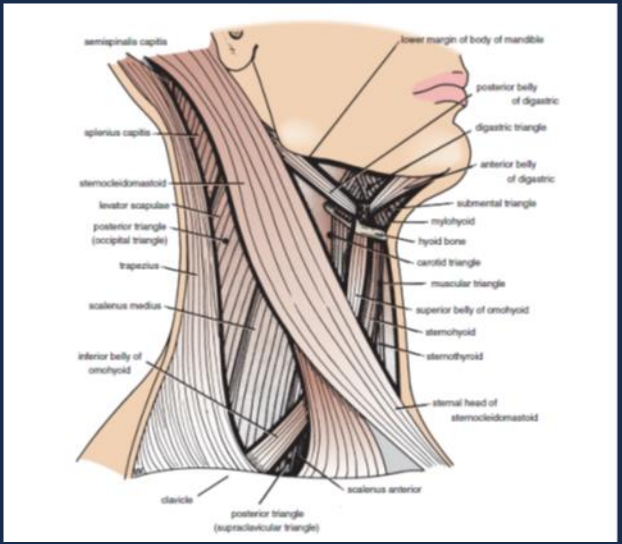
Muscular Triangles of the Neck

- The sternocleidomastoid muscle divides the neck into the anterior and the posterior triangles
- **Anterior Triangle**
- The anterior triangle is bounded above by the body of the mandible, posteriorly by the sternocleidomastoid muscle, and anteriorly by the midline.
- It is further subdivided into the **carotid triangle,** the **digastric triangle,** the **submental triangle,** and the **muscular triangle**



Muscular Triangles of the Neck

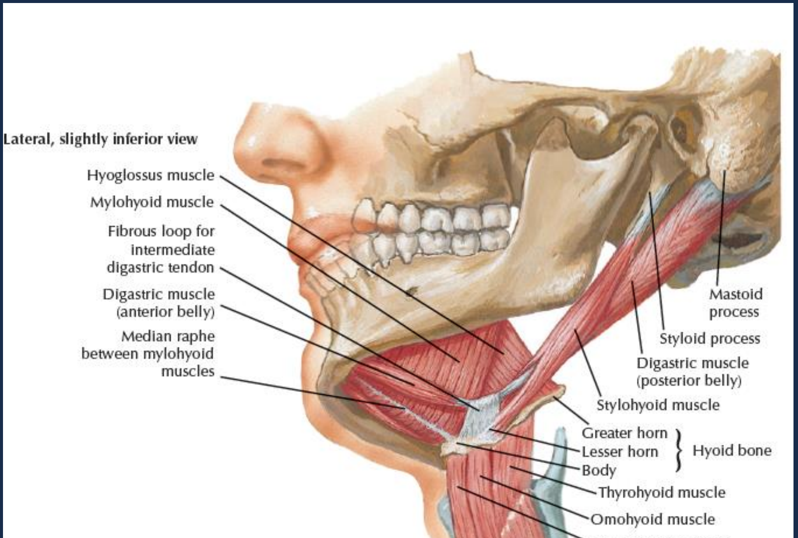
- **Posterior Triangle**
- The posterior triangle is bounded posteriorly by the trapezius muscle, anteriorly by the SCM muscle, and inferiorly by the clavicle
- The posterior triangle of the neck is further subdivided by the **inferior belly of the omohyoid muscle** into a large **occipital triangle** above and a small **supraclavicular triangle** below



Muscles of the Neck

❑ Digastric muscle

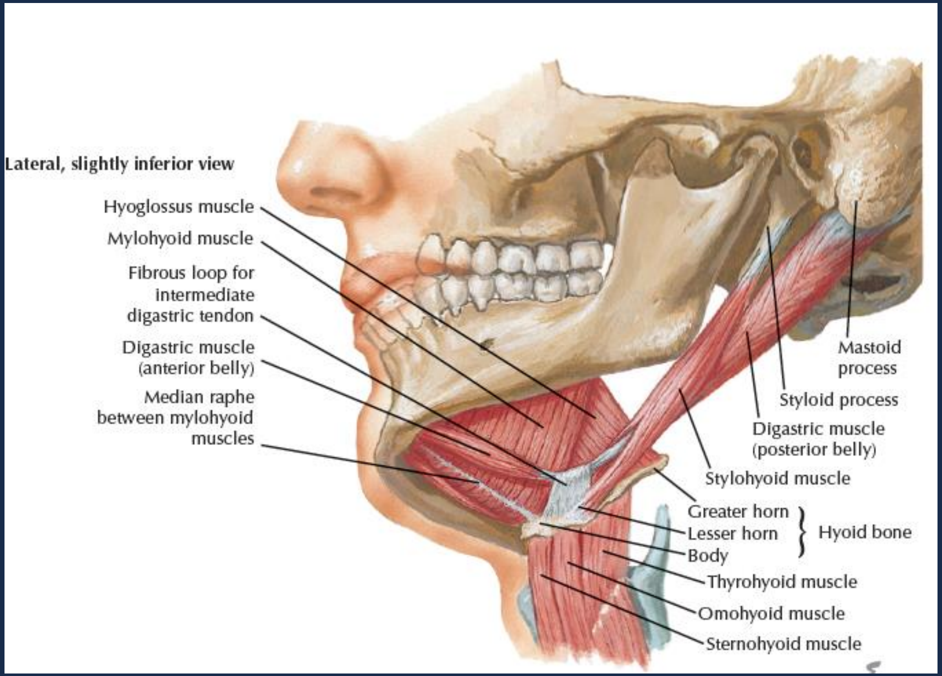
- Origin: Posterior belly Mastoid process of temporal bone
  Anterior belly Body of mandible
- Insertion: Intermediate tendon is held to hyoid by fascial sling
- Nerve supply : post. Belly by facial nerve, ant. Belly by nerve to mylohyoid
- Action: Depresses mandible or elevates hyoid bone



Muscles of the Neck

❑ Stylohyoid muscle

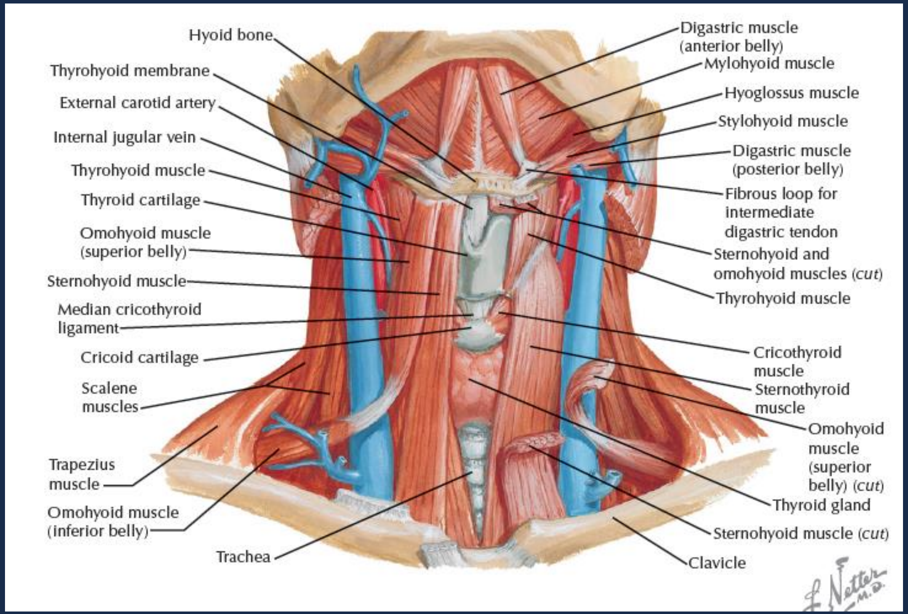
- Origin: Styloid process
- Insertion: Body of hyoid bone
- Nerve supply : facial nerve
- Action: elevates hyoid bone

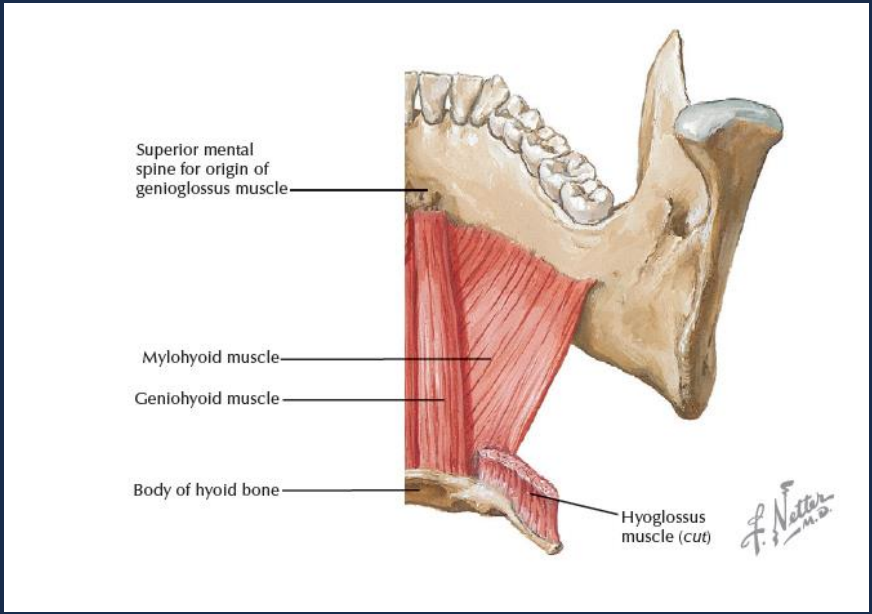


Muscles of the Neck

❑ Mylohyoid muscle

- Origin: Mylohyoid line of body of mandible
- Insertion: Body of hyoid bone and fibrous raphe
- Nerve supply : mylohyoid nerve (Inferior alveolar Nerve)
- Action: Elevates floor of mouth and hyoid bone or depresses mandible

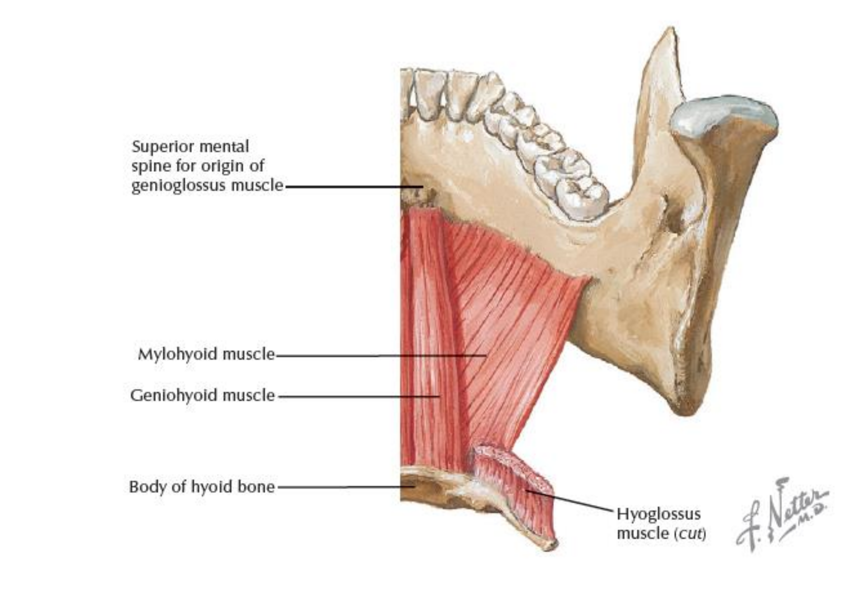




Muscles of the Neck

❑ Geniohyoid muscle

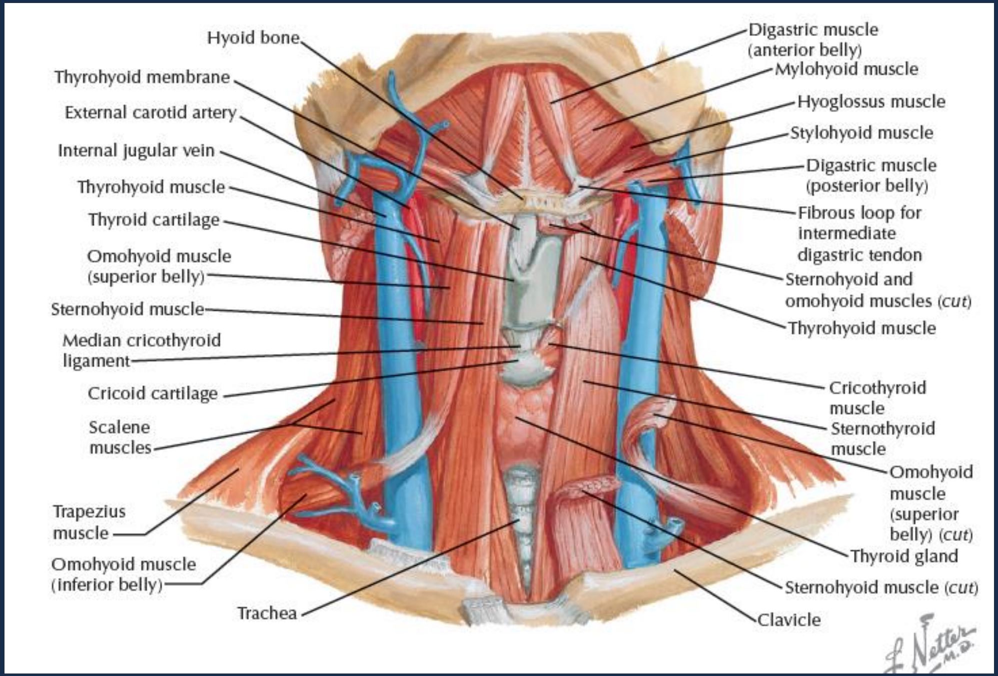
- Origin: Inferior mental spine of mandible
- Insertion: Body of hyoid bone
- Nerve supply : C 1
- Action: Elevates hyoid bone or depresses mandible



Muscles of the Neck

❑ Sternohyoid muscle

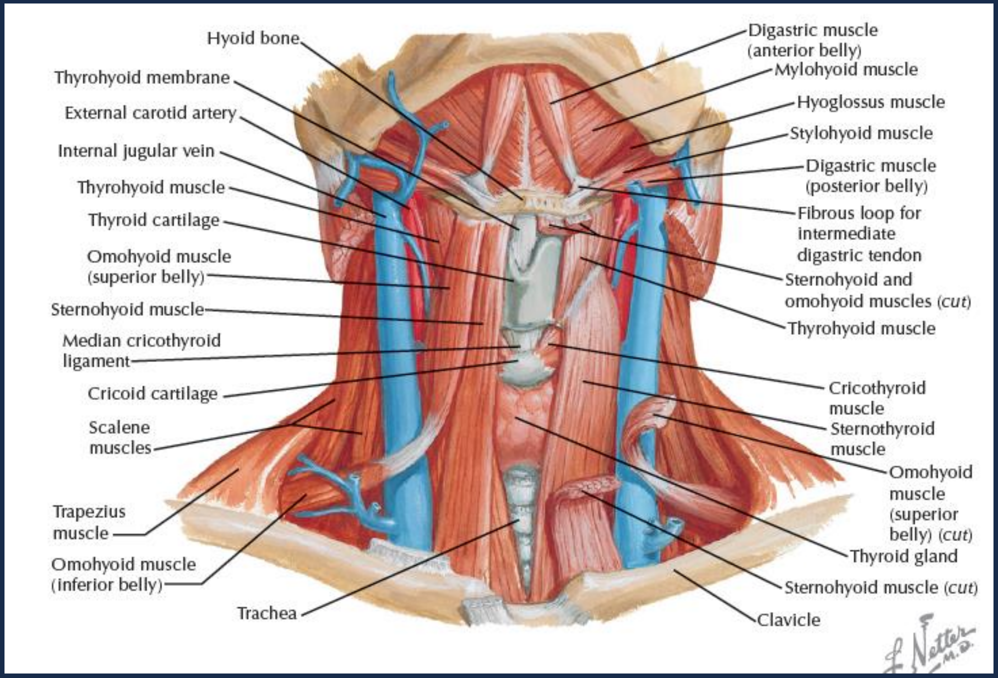
- Origin: Manubrium sterni and clavicle
- Insertion: Body of hyoid bone
- Nerve supply :Ansa cervicalis; C1, 2, and 3
- Action: Depresses hyoid bone



Muscles of the Neck

❑ **Sternothyroid muscle**

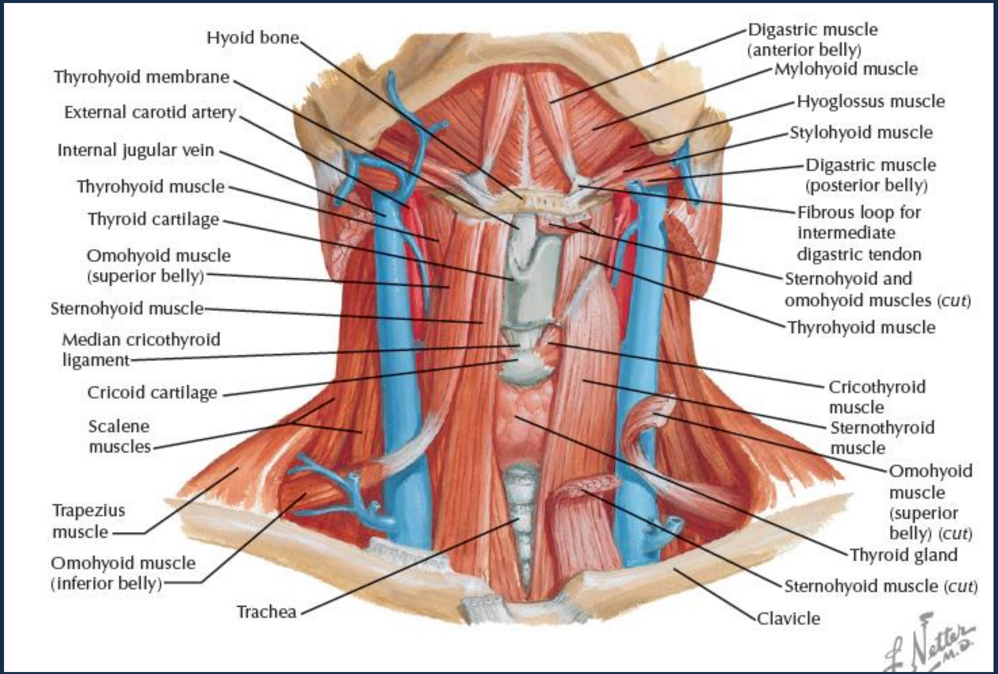
- Origin: Manubrium sterni
- Insertion: Oblique line on lamina of thyroid cartilage
- Nerve supply :Ansa cervicalis; C1, 2, and 3
- Action: Depresses larynx



Muscles of the Neck

❑ **Thyrohyoid muscle**

- Origin: Oblique line on lamina of thyroid cartilage
- Insertion:Lower border of body of hyoid bone
- Nerve supply :C1
- Action: Depresses hyoid bone or elevates larynx

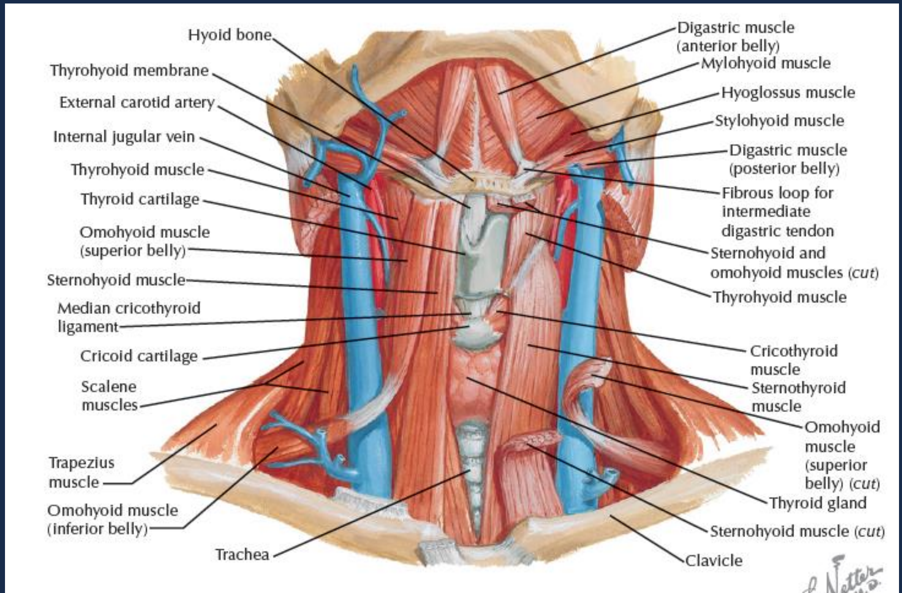


Muscles of the Neck

❑ Omohyoid muscle

- Origin: **Inferior belly** Upper margin of scapula and suprascapular ligament……. **Superior belly** Lower border of body of hyoid bone
- Insertion: Intermediate tendon is held to clavicle and first rib by fascial sling
- Nerve supply : Ansa cervicalis; C1, 2, and 3
- Action: Depresses hyoid bone

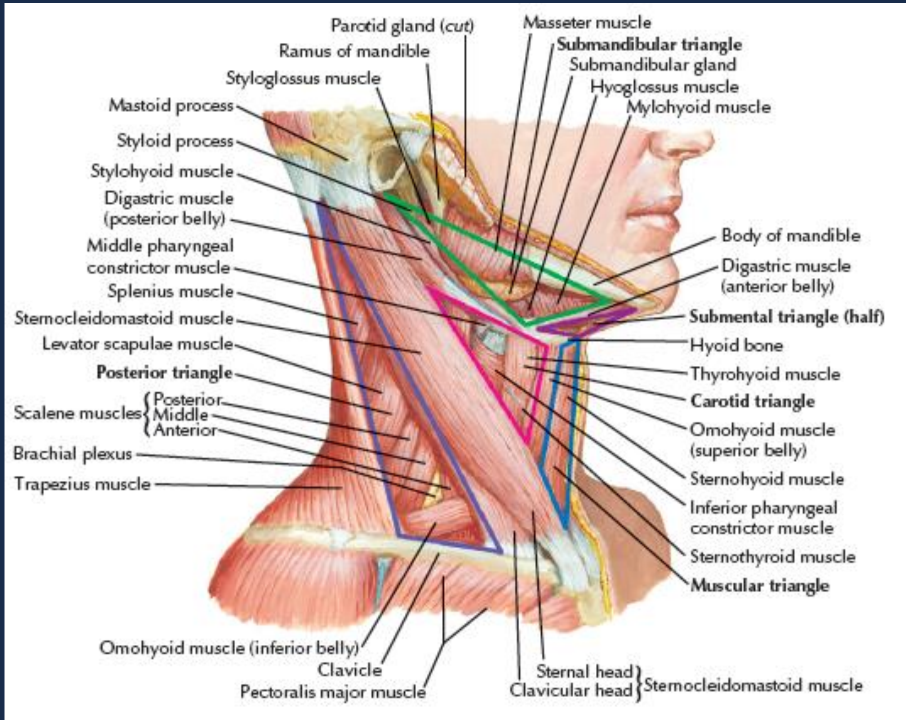
  or elevates scapula



Muscles of the Neck

❑ **Scalenus anterior muscle**

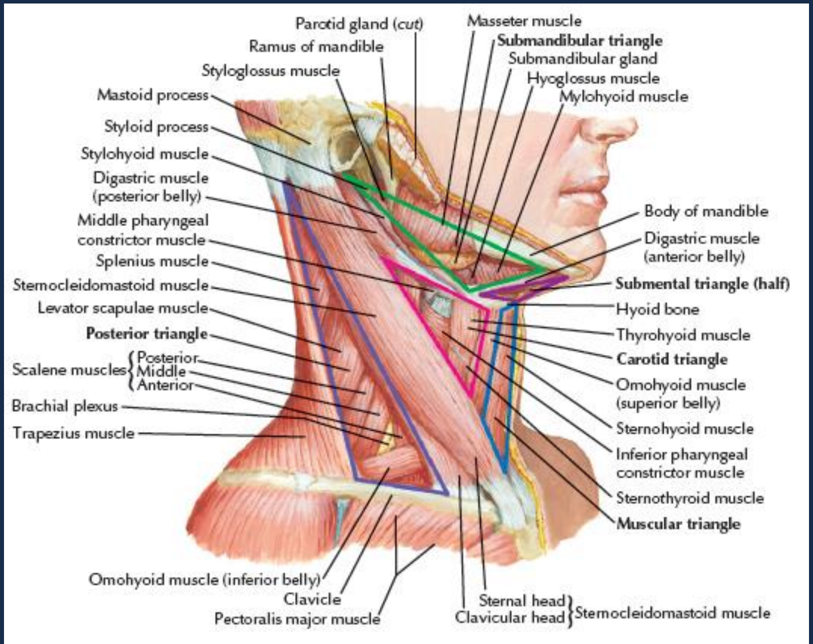
- The scalenus anterior muscle is a key muscle in understanding the root of the neck. It is deeply placed and it descends almost vertically from the vertebral column to the 1st rib



Muscles of the Neck

❑ Scalenus anterior muscle

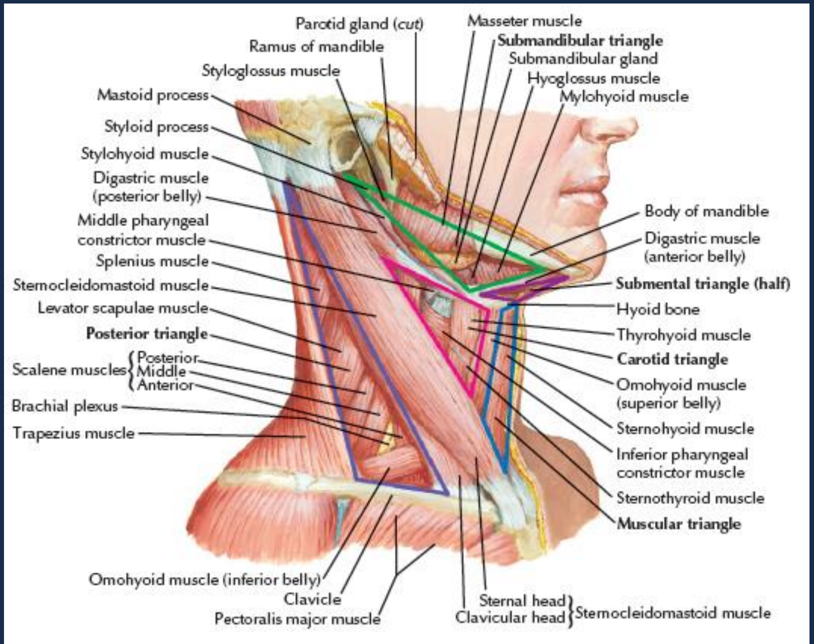
- Origin: Transverse processes of 3rd , 4th , 5th , and 6th vertebrae
- Insertion: 1st rib
- Nerve supply : C4, 5, and 6
- Action: Elevates 1st rib; laterally flexes and rotates cervical part of vertebral column



Muscles of the Neck

❑ Scalenus medius muscle

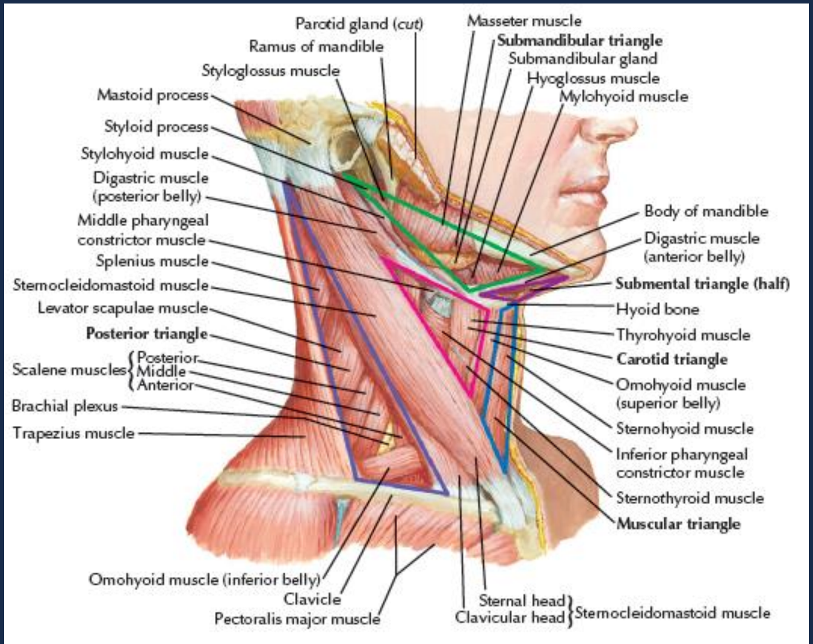
- Origin: Transverse processes upper six cervical vertebrae
- Insertion: 1st rib
- Nerve supply : Anterior rami of cervical nerves
- Action: Elevates 1st rib; laterally flexes and rotates cervical part of vertebral column



Muscles of the Neck

❑ Scalenus posterior muscle

- Origin: Transverse processes lower cervical vertebrae
- Insertion: 2nd rib
- Nerve supply : Anterior rami of cervical nerves
- Action: Elevates 2nd rib; laterally flexes and rotates cervical part of vertebral column



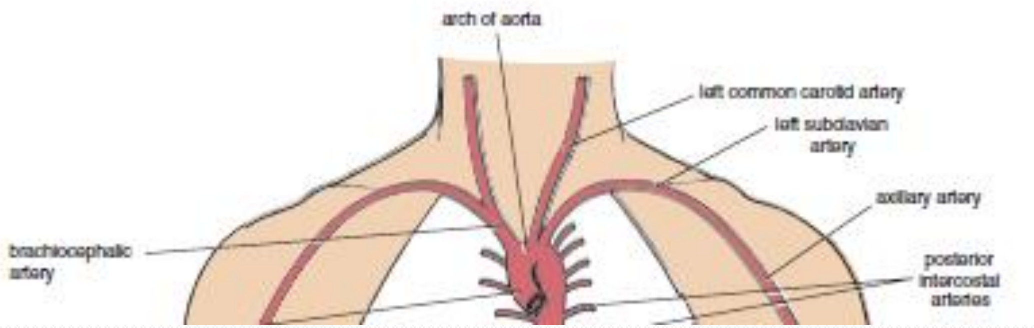
Arteries of the Head and Neck

Dr. Ahmed Jassam Alnaqeeb

Oral and maxillofacial surgeon

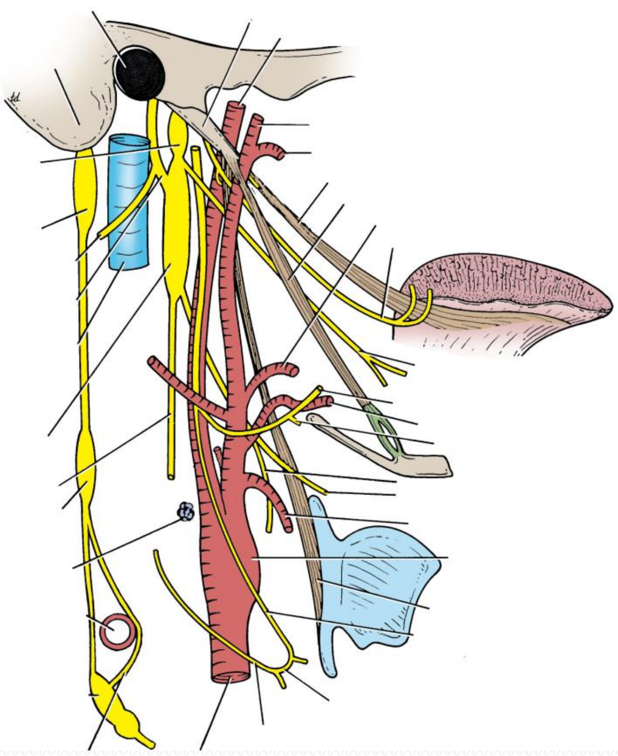
Common Carotid Artery

- The right common carotid artery arises from the brachiocephalic artery behind the right sternoclavicular joint
- The left artery arises from the arch of the aorta in the superior mediastinum
- is embedded in the carotid sheath, throughout its course and is closely related to the internal jugular vein and vagus nerve
- The common carotid artery runs upward through the neck under cover of the anterior border of the sternocleidomastoid muscle, from the sternoclavicular joint to the upper border of the thyroid cartilage. Here, it divides into the external and internal carotid arteries



Carotid Sinus

- At its point of division, the terminal part of the common carotid artery or the beginning of the internal carotid artery shows a localized dilatation, called the carotid sinus

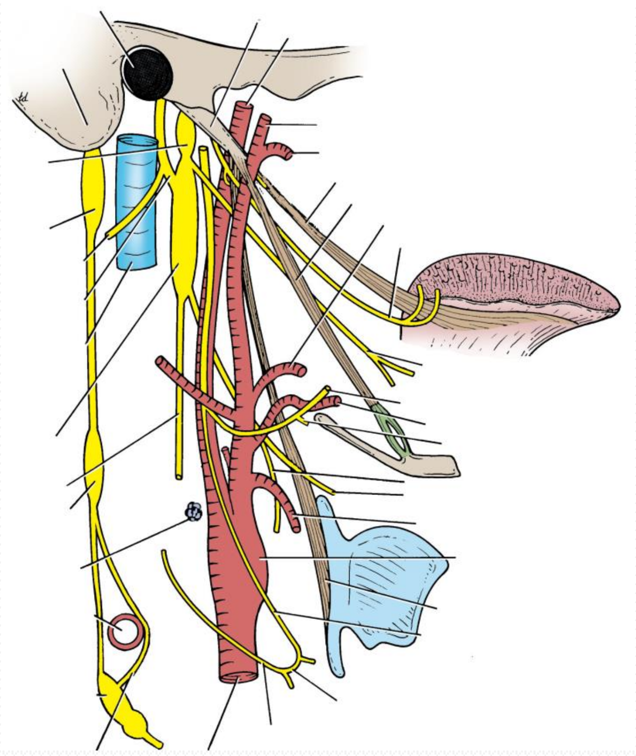


- The tunica media of the sinus is thinner than elsewhere, but the adventitia is relatively thick and contains numerous nerve endings derived from the glossopharyngeal nerve.

- The carotid sinus serves as a reflex pressoreceptor mechanism: A rise in blood pressure causes a slowing of the heart rate and vasodilatation of the arterioles.

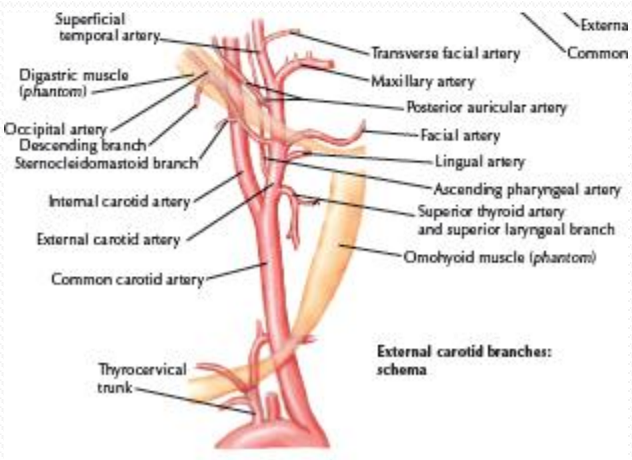
Carotid Body

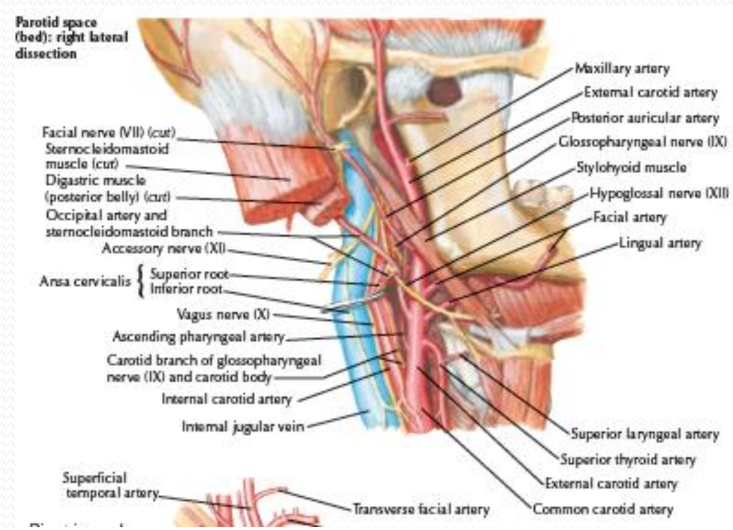
- a small structure that lies posterior to the point of bifurcation of the common carotid artery
- It is innervated by the glossopharyngeal nerve.
- The carotid body is a chemoreceptor, being sensitive to excess CO_2 and reduced O_2 tension in the blood.
- Such a stimulus reflexly produces a rise in blood pressure and heart rate and an increase in respiratory movements.



External Carotid Artery

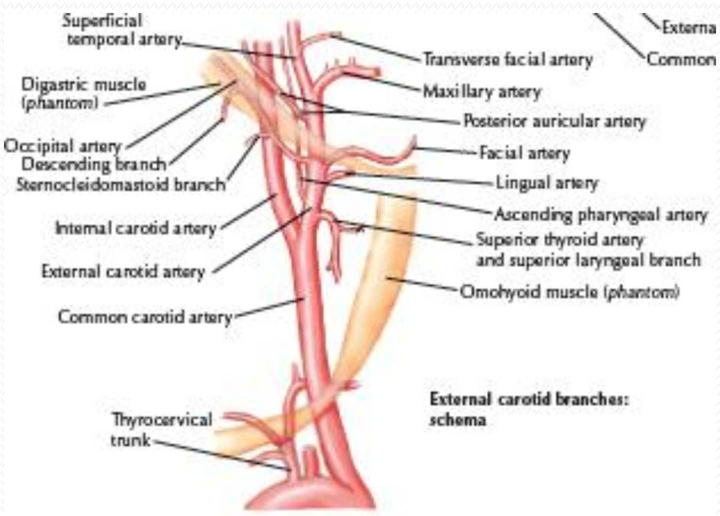
- one of the terminal branches of the common carotid artery
- supplies structures in the neck, face, scalp, tongue and maxilla.
- The artery begins at the level of the upper border of the thyroid cartilage and terminates in the substance of the parotid gland behind the neck of the mandible by dividing into the superficial temporal and maxillary arteries.

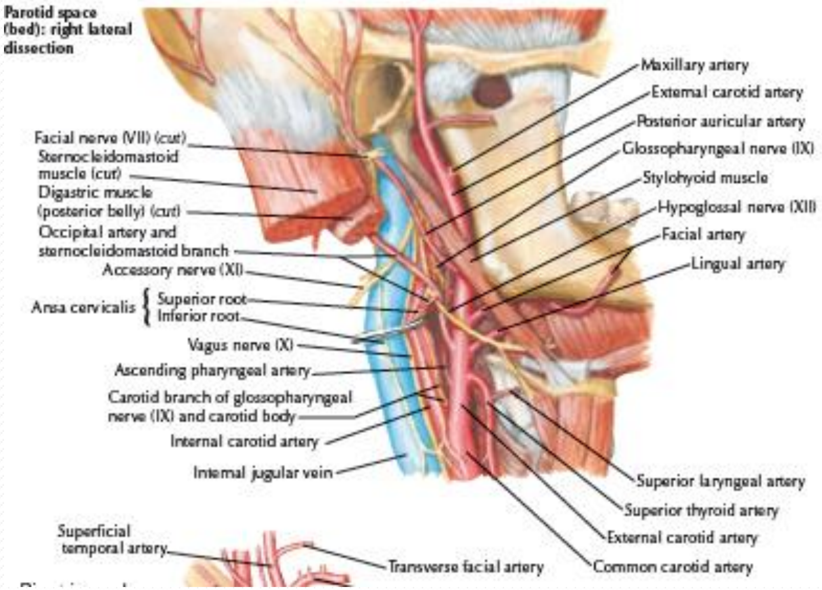




External Carotid Artery

- Close to its origin, the artery emerges from undercover of the sternocleidomastoid muscle, where its pulsations can be felt.
- At first, it lies medial to the internal carotid artery, but as it ascends in the neck, it passes backward and lateral to it. It is crossed by the posterior belly of the digastric and the stylohyoid

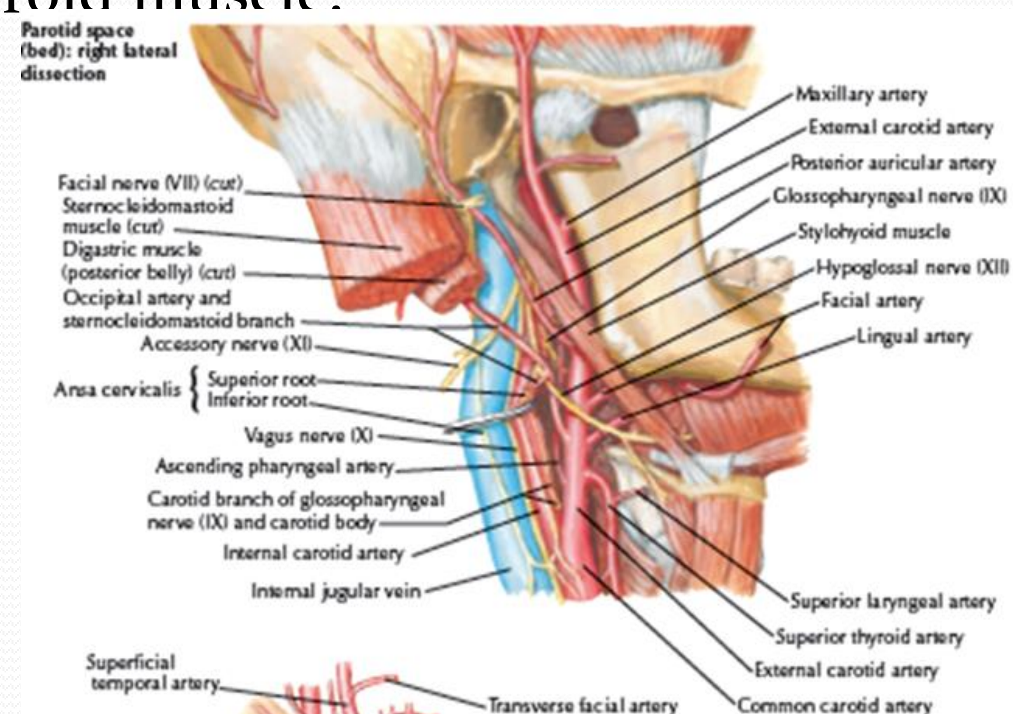




Branches of the External Carotid Artery

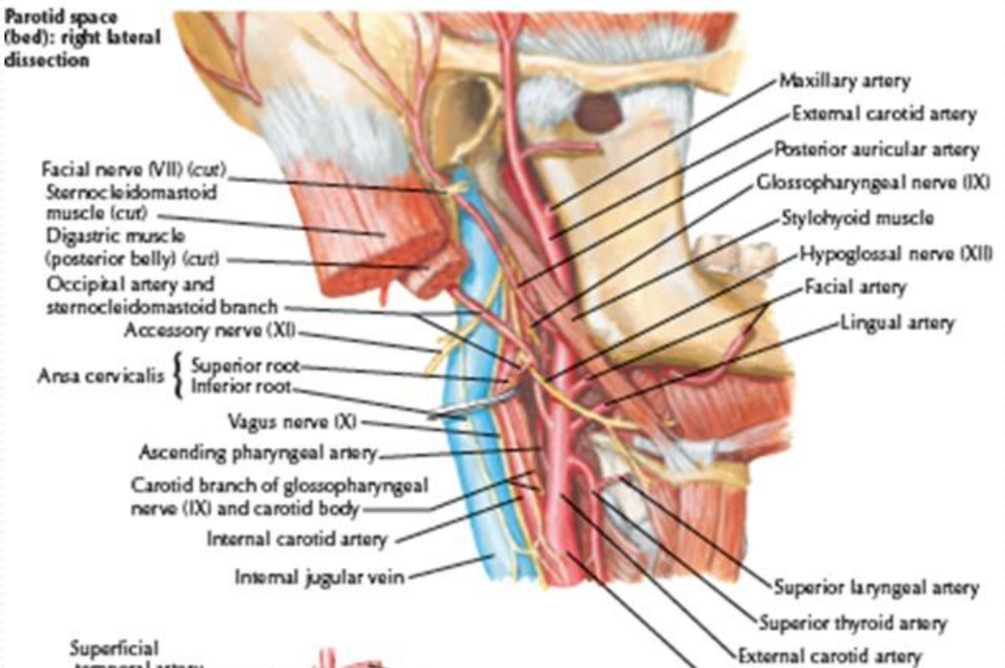
❑Superior Thyroid Artery

- The superior thyroid artery curves downward to the upper pole of the thyroid gland
- It is accompanied by the external laryngeal nerve, which supplies the cricothyroid muscle.



Branches of the External Carotid Artery

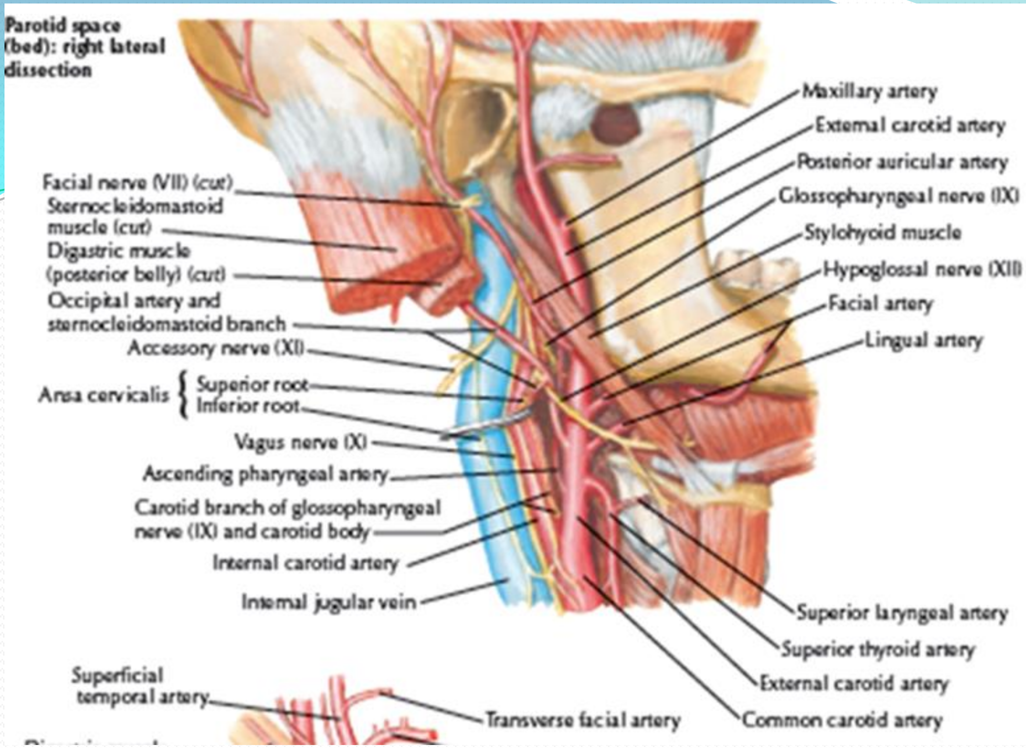
- **Ascending Pharyngeal Artery**
- The ascending pharyngeal artery ascends along and supplies the pharyngeal wall.
- **Lingual Artery**
- The lingual artery loops upward and forward and supplies the tongue.

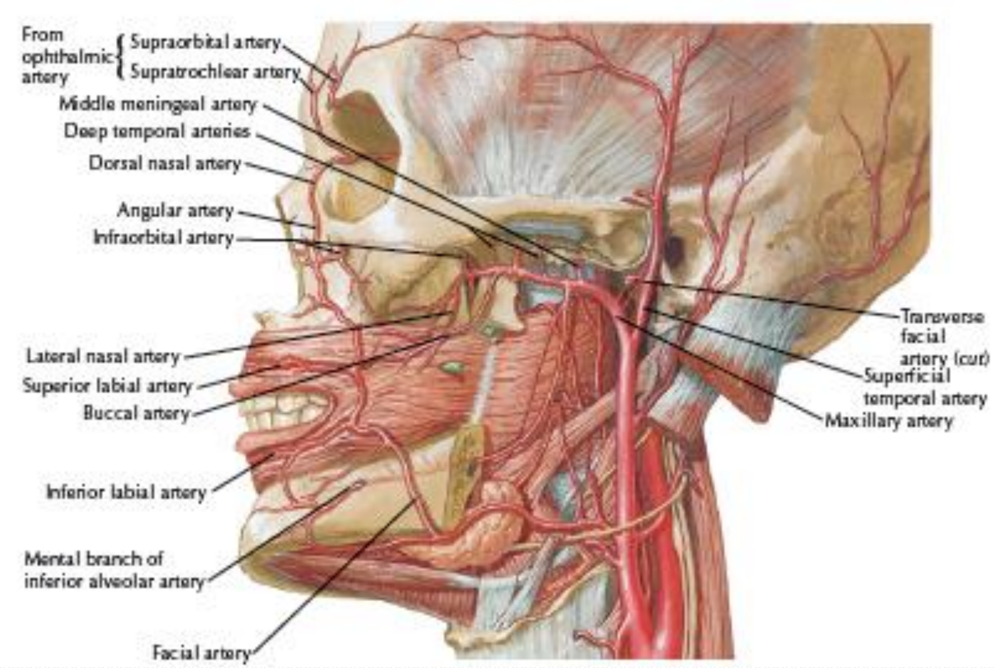


Branches of the External Carotid Artery

❑ Facial Artery

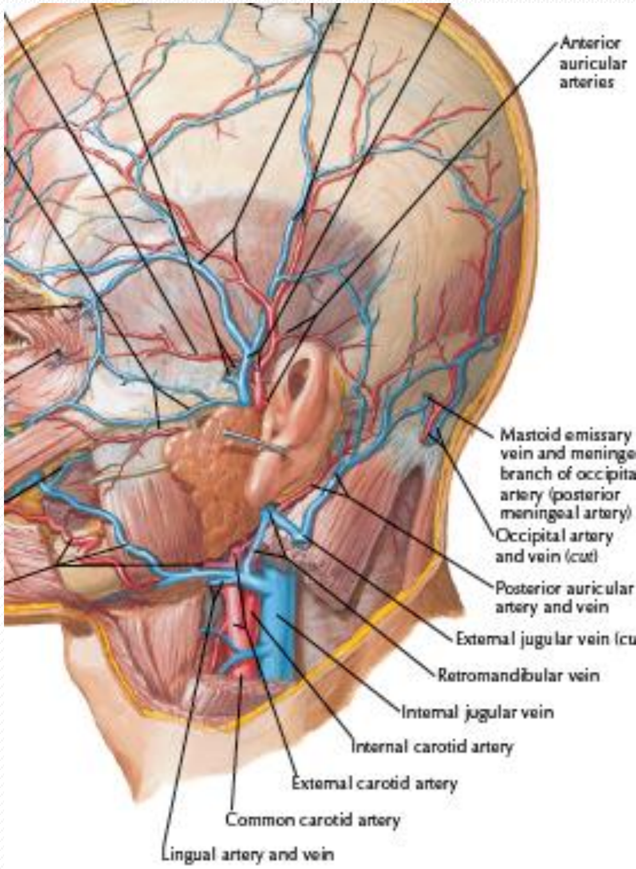
- The facial artery loops upward close to the outer surface of the pharynx and the tonsil, deep to the submandibular salivary gland and emerges and bends around the lower border of the mandible.
- It then ascends over the face close to the anterior border of the masseter muscle. The artery then ascends around the lateral margin of the mouth and terminates at the medial angle of the eye
- **Branches of the facial artery** supply the tonsil, the submandibular salivary gland, and the muscles and the skin of the face.


Parotid space (bed): right lateral dissection
Maxillary artery
External carotid artery
Posterior auricular artery
Glossopharyngeal nerve (IX)
Stylohyoid muscle
Hypoglossal nerve (XII)
Facial artery
Lingual artery
Facial nerve (VII) (cut)
Sternocleidomastoid muscle (cut)
Digastric muscle (posterior belly) (cut)
Occipital artery and sternocleidomastoid branch
Accessory nerve (XI)
Ansa cervicalis
Superior root
Inferior root
Vagus nerve (X)
Ascending pharyngeal artery
Carotid branch of glossopharyngeal nerve (IX) and carotid body
Internal carotid artery
Internal jugular vein
Superior laryngeal artery
Superior thyroid artery
External carotid artery
Common carotid artery
Superficial temporal artery
Transverse facial artery


From ophthalmic artery
Supraorbital artery
Supratrochlear artery
Middle meningeal artery
Deep temporal arteries
Dorsal nasal artery
Angular artery
Infraorbital artery
Lateral nasal artery
Superior labial artery
Buccal artery
Inferior labial artery
Mental branch of inferior alveolar artery
Facial artery
Transverse facial artery (cut)
Superficial temporal artery
Maxillary artery

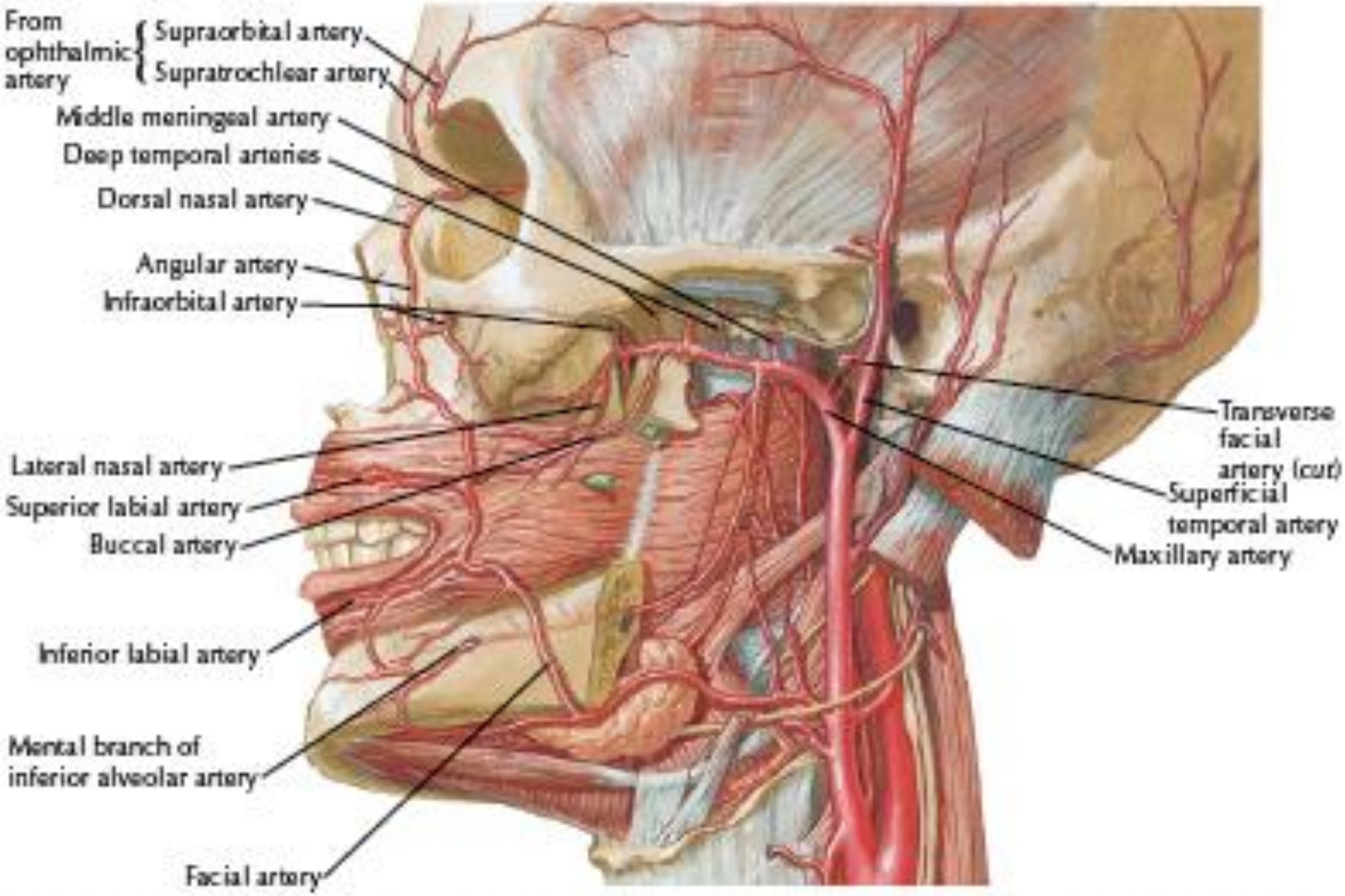
Branches of the External Carotid Artery

- **Occipital Artery**
- The artery supplies the back of the scalp
- **Posterior Auricular Artery**
- The posterior auricular artery supplies the auricle and the scalp
- **Superficial Temporal Artery**
- The superficial temporal artery ascends over the zygomatic arch, where it may be palpated just in front of the auricle
- It is accompanied by the auriculotemporal nerve, and it supplies the scalp.



Branches of the External Carotid Artery

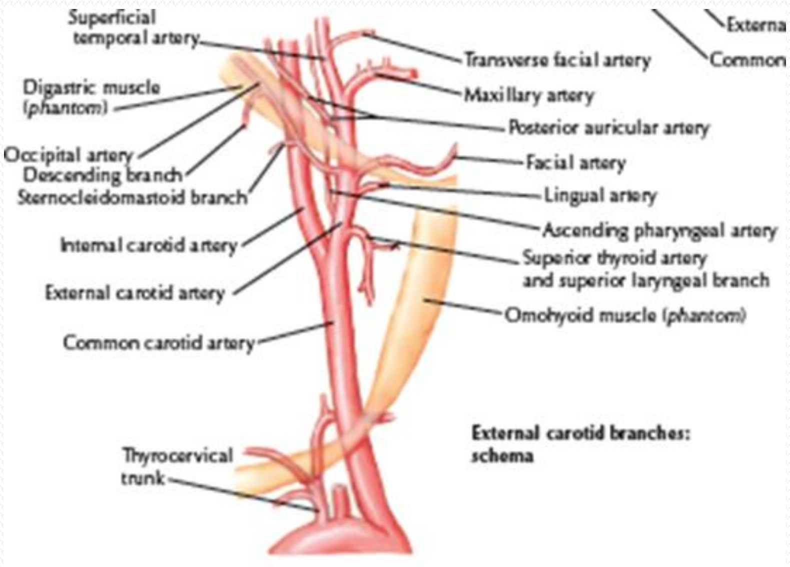
- **Maxillary Artery**
- The maxillary artery runs forward medial to the neck of the mandible and enters the pterygopalatine fossa of the skull.
- Its Branches supply the upper and the lower jaws, the muscles of mastication, the nose, the palate, and the meninges inside the skull.
- **Middle Meningeal Artery**
- enters the skull through the foramen spinosum
- It runs laterally within the skull and divides into anterior and posterior branches
- The anterior branch is important because it lies close to the motor area of the cerebral cortex of the brain.
- Accompanied by its vein, it grooves (or tunnels) through the pterion, where it is prone to damage after a blow to the head.



From ophthalmic artery
Supraorbital artery
Supratrochlear artery
Middle meningeal artery
Deep temporal arteries
Dorsal nasal artery
Angular artery
Infraorbital artery
Lateral nasal artery
Superior labial artery
Buccal artery
Inferior labial artery
Mental branch of inferior alveolar artery
Facial artery
Transverse facial artery (cut)
Superficial temporal artery
Maxillary artery

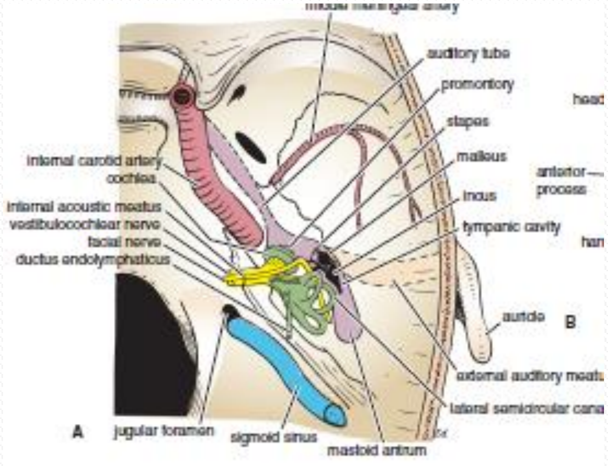
Internal Carotid Artery

- begins at the bifurcation of the common carotid artery at the level of the upper border of the thyroid cartilage
- It supplies the brain, the eye, the forehead, and part of the nose.
- The artery ascends in the neck embedded in the carotid sheath
- At first it lies superficially; it then passes deep to the parotid salivary gland



Internal Carotid Artery

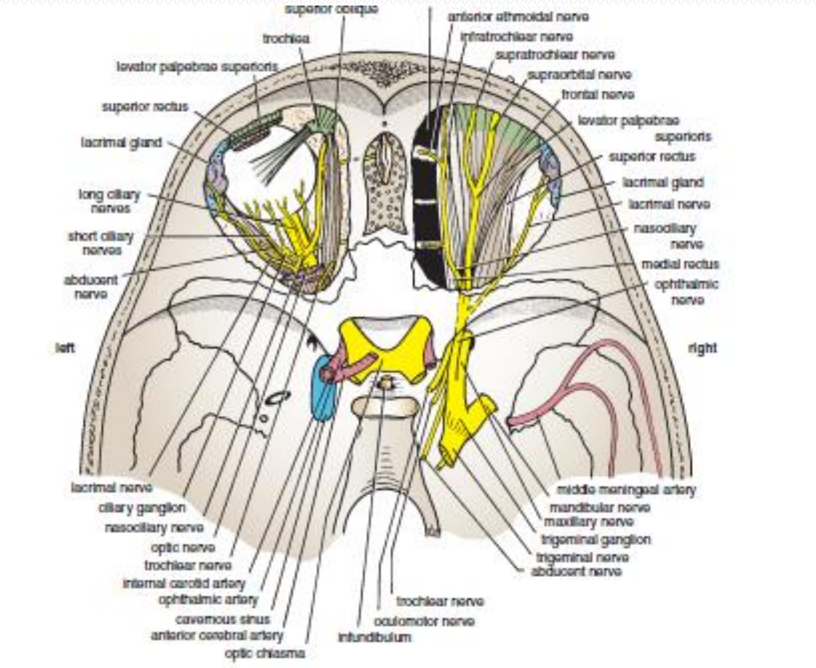
- The artery leaves the neck by passing into the cranial cavity through the carotid canal in the petrous part of the temporal bone. It then passes upward and forward in the cavernous venous sinus (without communicating with it).
- The artery then leaves the sinus and passes upward again medial to the anterior clinoid process of the sphenoid bone.
- The artery then inclines backward, lateral to the optic chiasma, and terminates
- By dividing into the anterior and the middle cerebral arteries.



Branches of the Internal Carotid Artery

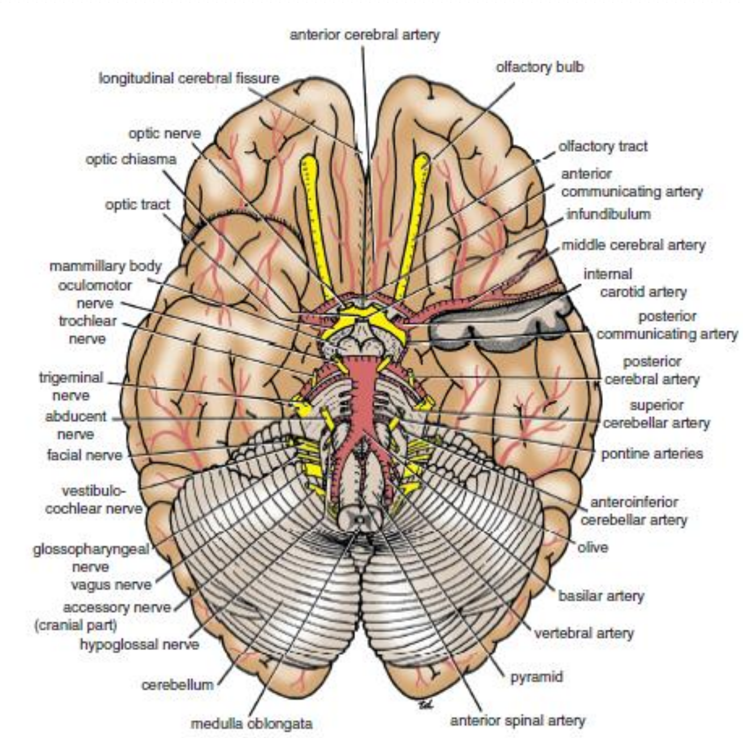
❑ Ophthalmic Artery

- arises from the internal carotid artery as it emerges from the cavernous sinus
- It passes forward into the orbital cavity through the optic canal, and it gives off the central artery of the retina, which enters the optic nerve and runs forward to enter the eyeball



Branches of the Internal Carotid Artery

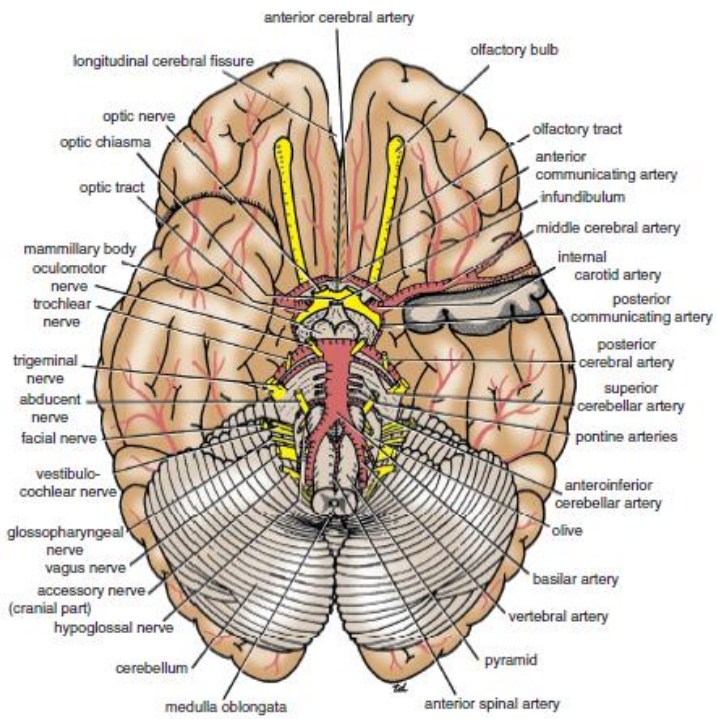
- **Posterior Communicating Artery**
- runs backward to join the posterior cerebral artery
- **Anterior Cerebral Artery**
- is a terminal branch of the internal carotid artery
- It passes forward between the cerebral hemispheres and supply the medial and the superolateral surfaces of the cerebral hemisphere.
- It is joined to the artery of the opposite side by the **anterior communicating artery.**



Branches of the Internal Carotid Artery

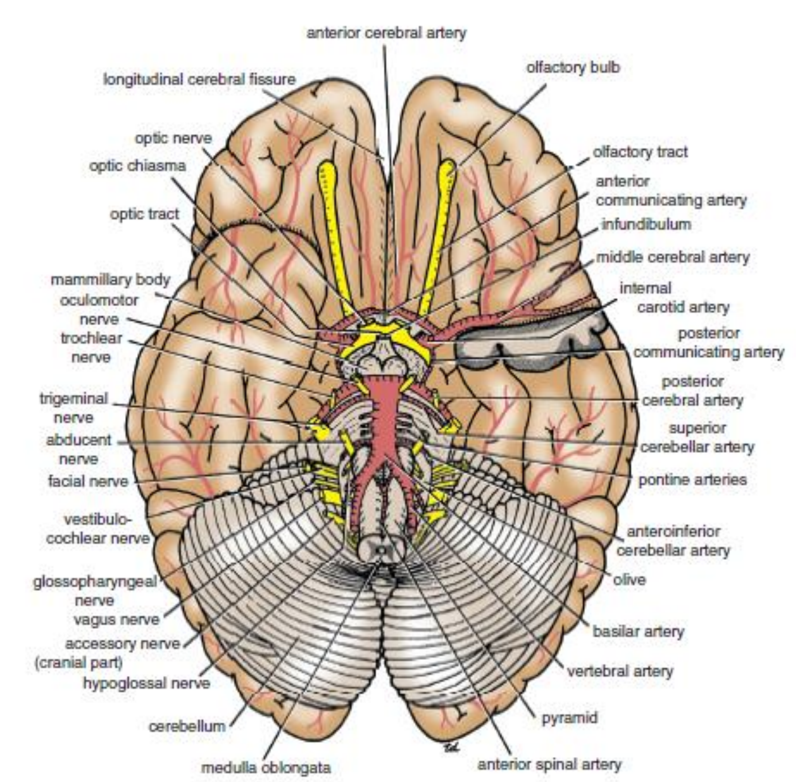
Middle Cerebral Artery

- is the largest terminal branch of the internal carotid artery
- it runs laterally. It supplies the lateral surface of the cerebral hemisphere
- The middle cerebral artery thus supplies all the motor area of the cerebral cortex except the leg area.
- It also gives off central branches that supply central masses of gray matter and the internal capsule of the brain.



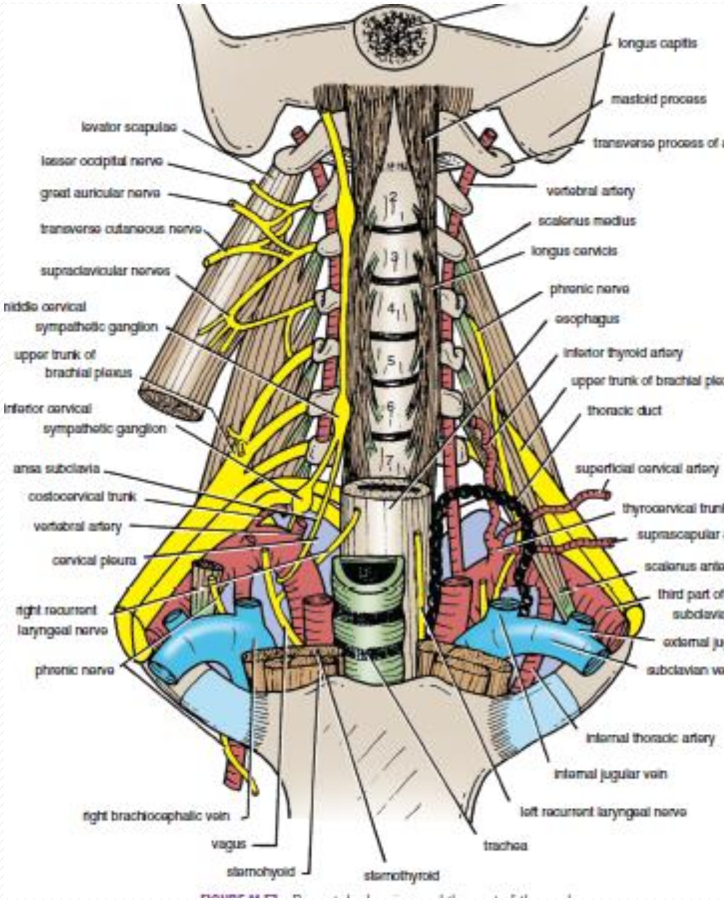
Circle of Willis

- The circle of Willis lies in the subarachnoid space at the base of the brain.
- It is formed by the anastomosis between the branches of the two internal carotid arteries and the two vertebral arteries
- The anterior communicating, posterior cerebral, and basilar (formed by the junction of the two vertebral arteries
- Cortical and central branches arise from the circle and supply the brain.



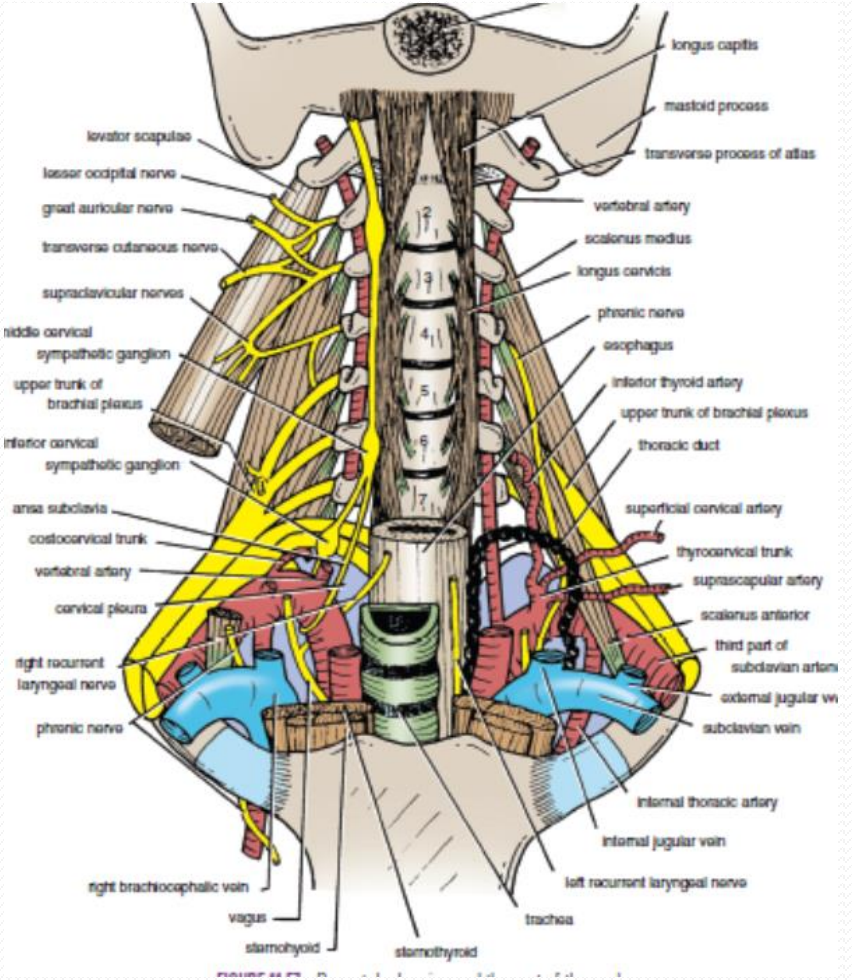
Subclavian Arteries

- The right subclavian artery arises from the brachiocephalic artery, behind the right sternoclavicular joint
- The left subclavian artery arises from the arch of the aorta in the thorax
- It arches upward and laterally over the pleura and between the scalenus anterior and medius muscles.
- At the outer border of the 1st rib, it becomes the axillary artery.
- The scalenus anterior muscle passes anterior to the artery on each side and divides it into three parts.



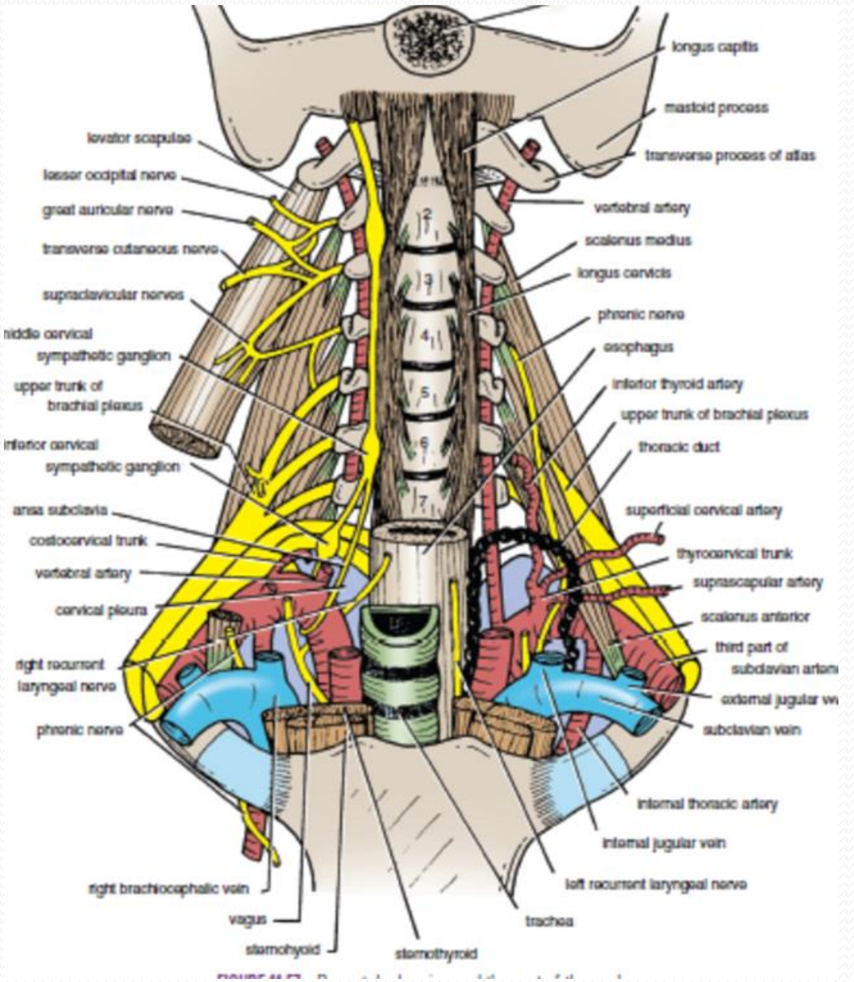
First Part of the Subclavian Artery

- The first part extends from the origin of the subclavian artery to the medial border of the scalenus anterior muscle
- This part gives off the **vertebral artery**, the **thyrocervical trunk**, and the **internal thoracic artery**



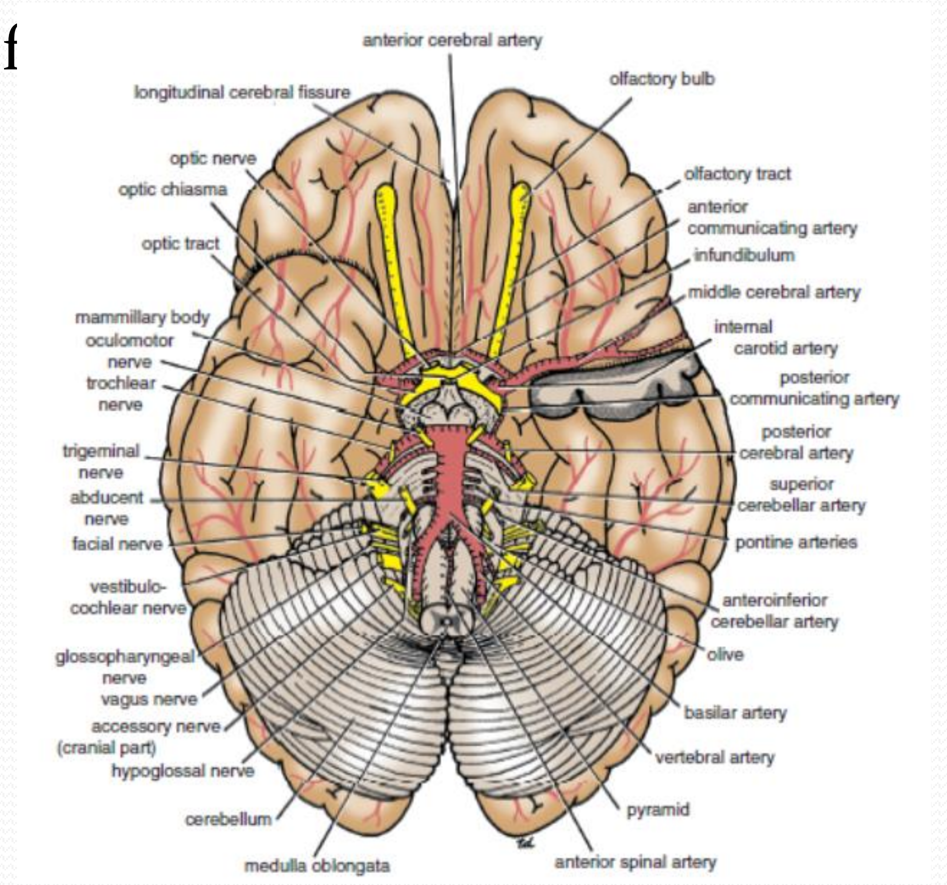
The vertebral artery

- ascends in the neck through the foramina in the transverse processes of the upper six cervical vertebrae
- It passes medially above the posterior arch of the atlas and then ascends through the foramen magnum into the skull.
- On reaching the anterior surface of the medulla oblongata of the brain at the level of the lower border of the pons, it joins the vessel of the opposite side to form the basilar artery.



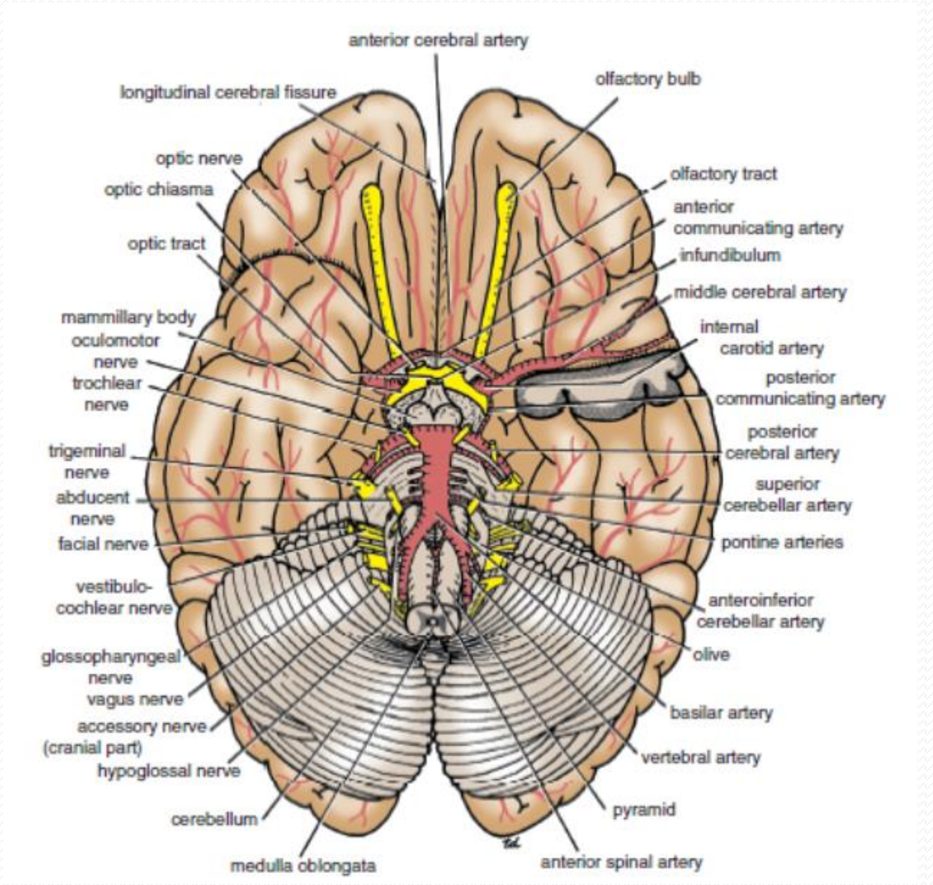
The vertebral artery

- The **basilar artery** ascends in a groove on the anterior surface of the pons.
- It gives off branches to the pons, the cerebellum, and the internal ear.
- It finally divides into the two posterior cerebral arteries.



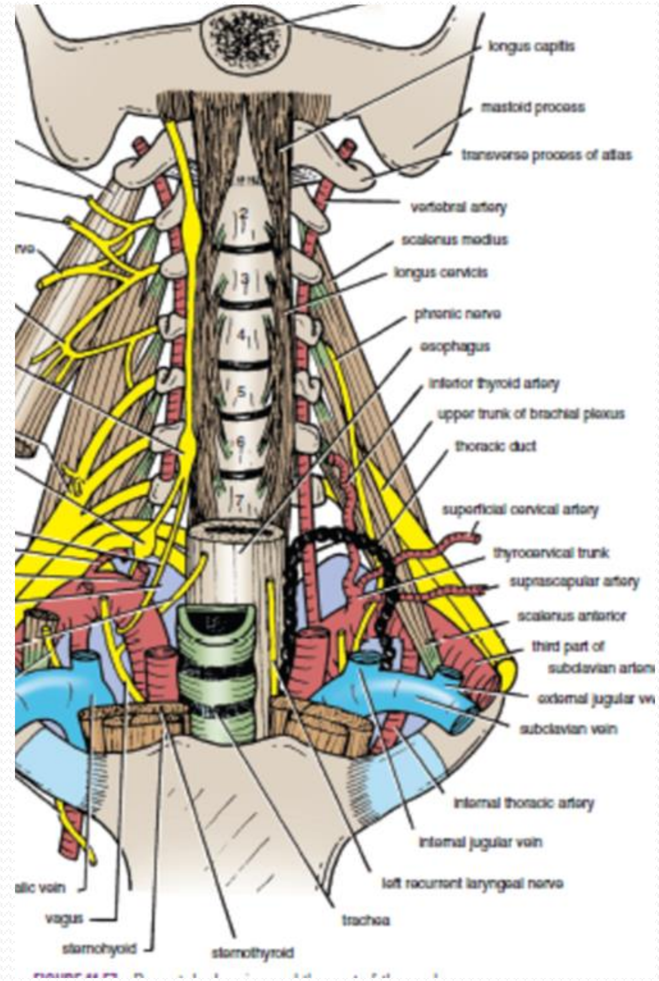
The vertebral artery

- On each side, the **posterior cerebral artery** curves laterally and backward around the midbrain.
- Cortical branches supply the inferolateral surfaces of the temporal lobe and the visual cortex on the occipital lobe



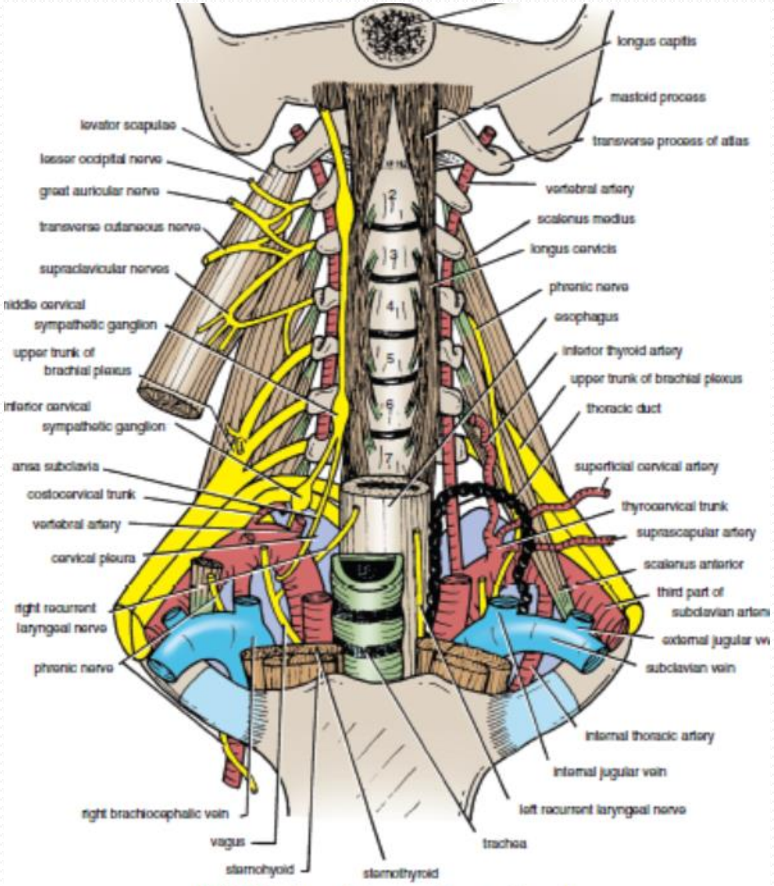
The **thyrocervical trunk**

- is a short trunk that gives off three terminal branches
- **inferior thyroid artery** ascends to the posterior surface of the thyroid gland, where it is closely related to the recurrent laryngeal nerve. It supplies the thyroid and the inferior parathyroid glands.
- **superficial cervical artery** is a small branch that crosses the brachial plexus
- **suprascapular artery** runs laterally over the brachial plexus and follows the suprascapular nerve onto the back of the scapula



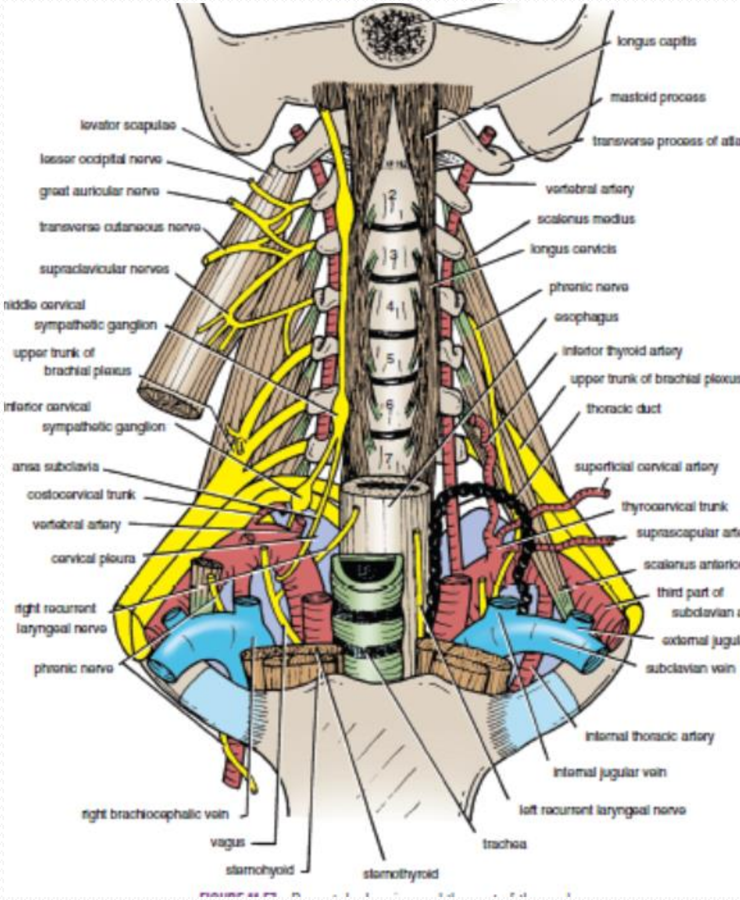
The internal thoracic artery

- descends into the thorax behind the 1st costal cartilage and in front of the pleura
- It descends vertically one fingerbreadth lateral to the sternum; in the 6th intercostal space, it divides into the superior epigastric and the musculophrenic arteries.



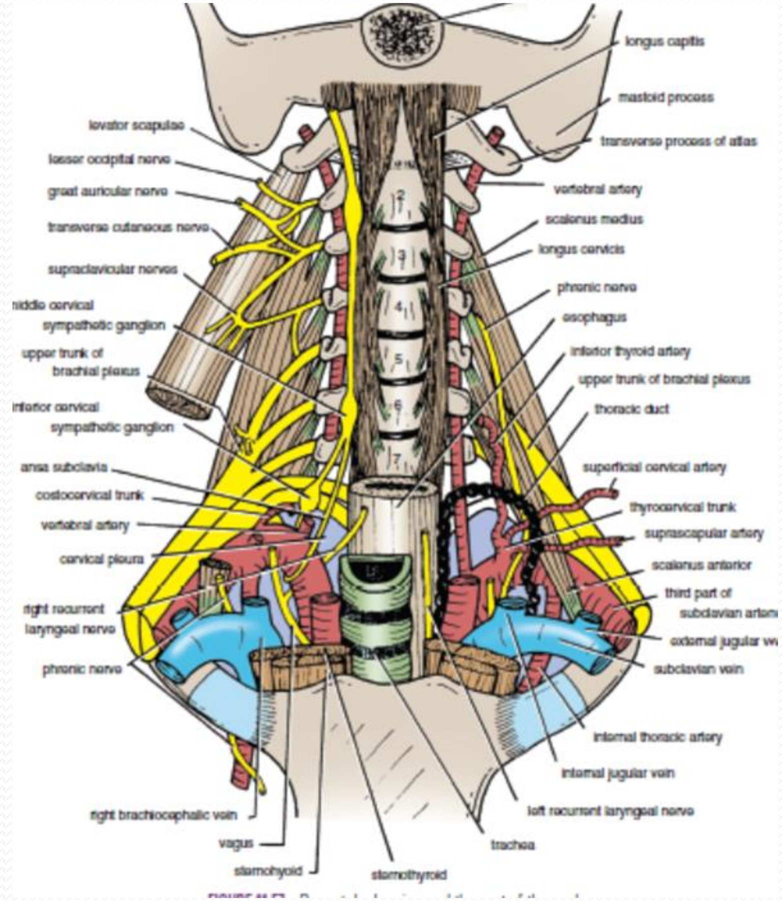
Second Part of the Subclavian Artery

- lies behind the scalenus anterior muscle
- **Branches**
- The **costocervical trunk** runs backward over the dome of the pleura and divides into
- the **superior intercostal artery,** which supplies the 1st and the 2nd intercostal spaces
- the **deep cervical artery,** which supplies the deep muscles of the neck.



Third Part of the Subclavian Artery

- extends from the lateral border of the scalenus anterior muscle across the posterior triangle of the neck to the lateral border of the 1st rib, where it becomes the axillary artery.
- Here,in the root of the neck, it is closely related to the nerves of the brachial plexus.
- **Branches** The third part of the subclavian artery usually
- has no branches. Occasionally, however, the superficial cervical arteries, the suprascapular arteries, or both arise from this part



Veins and lymphatics of the Head and Neck

Dr. Ahmed Jassam Alnaqeeb

Oral and maxillofacial surgeon

Veins of the Head and Neck

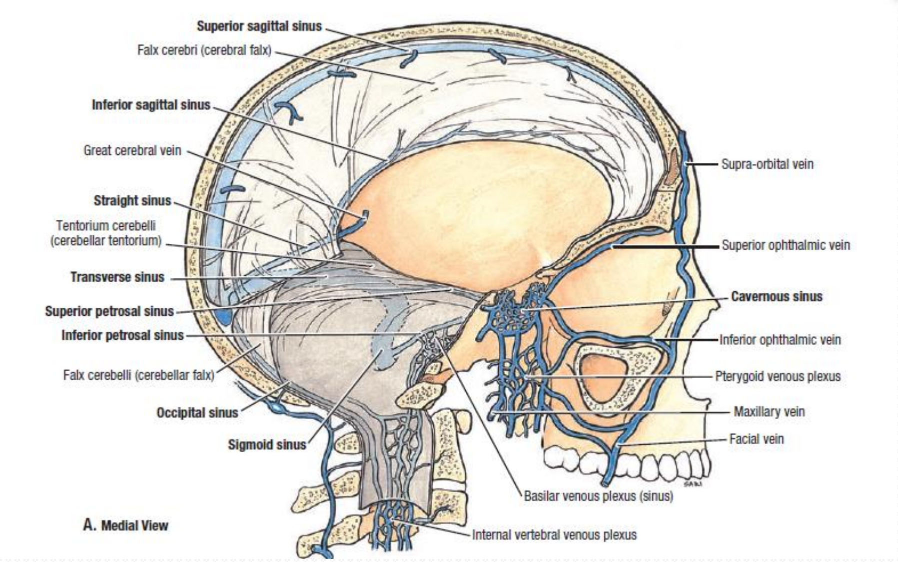
- The veins of the head and neck may be divided into

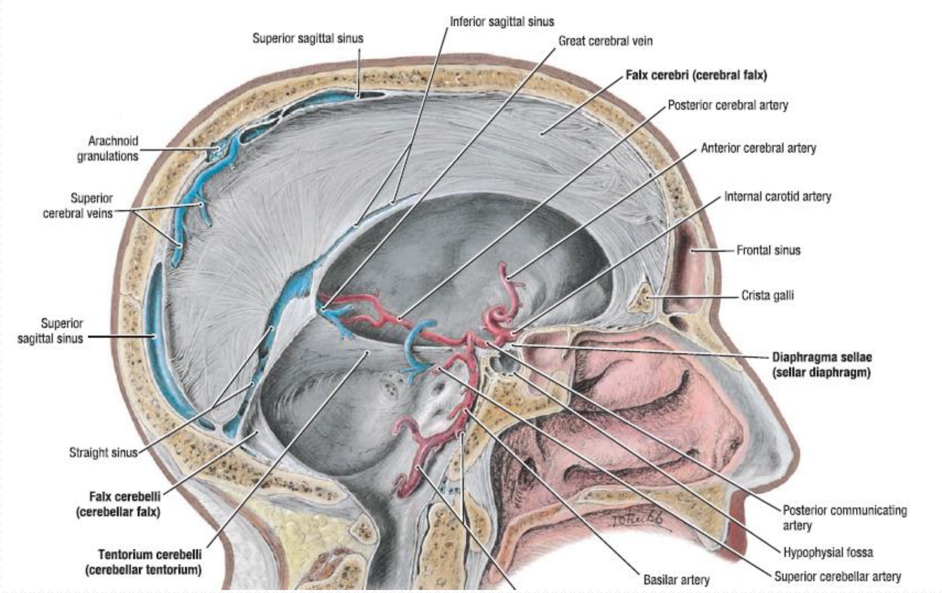
■■ The veins of the brain, venous sinuses, diploic veins, and emissary veins

■■ The veins of the scalp, face, and neck

Veins of the Brain

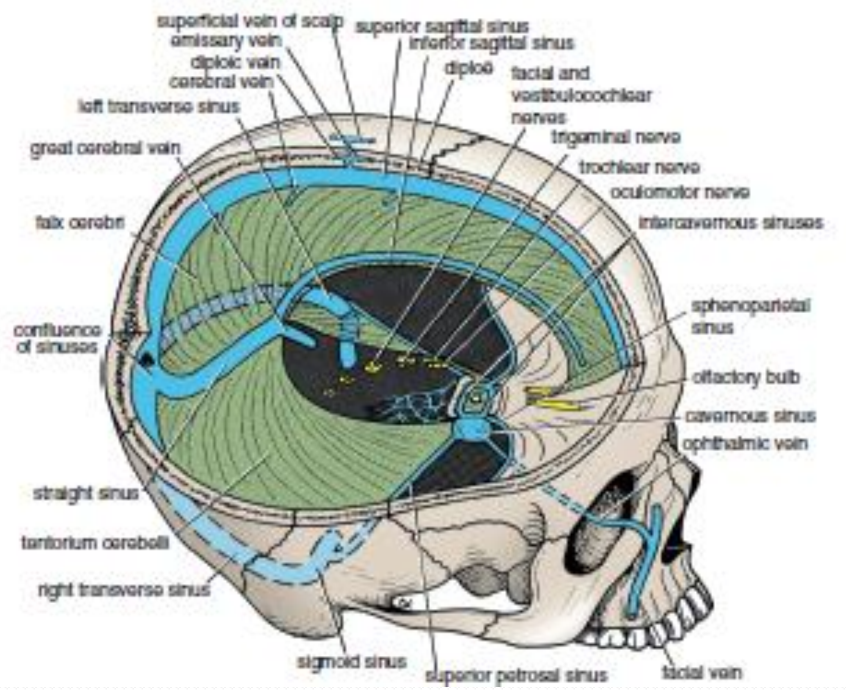
- The veins of the brain are thin walled and have no valves.
- They consist of the cerebral veins, the cerebellar veins, and the veins of the brainstem,
- all of which drain into the neighboring venous sinuses.





Venous Sinuses

- situated between the periosteal and the meningeal layer of the dura mater
- have thick, fibrous walls, but they possess no valves.
- receive tributaries from the brain, the skull bones, the orbit, and the internal ear.
- They include:
  - superior and inferior sagittal sinuses
  - straight sinus
  - transverse sinuses
  - sigmoid sinuses
  - occipital sinus
  - cavernous sinuses
  - Superior and inferior petrosal sinuses

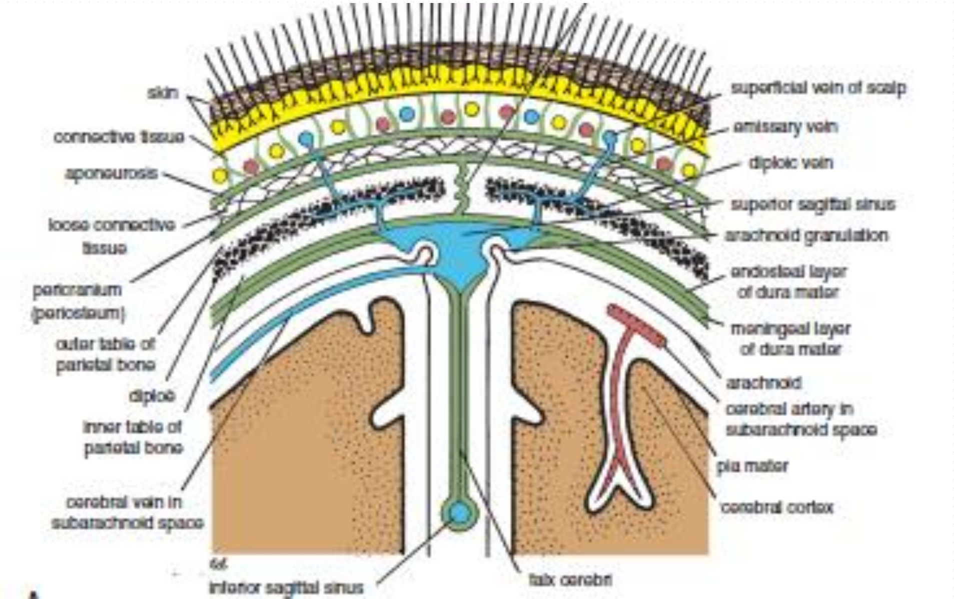


❑ **Diploic Veins**

- occupy channels within the bones of the vault of the skull

❑ **Emissary Veins**

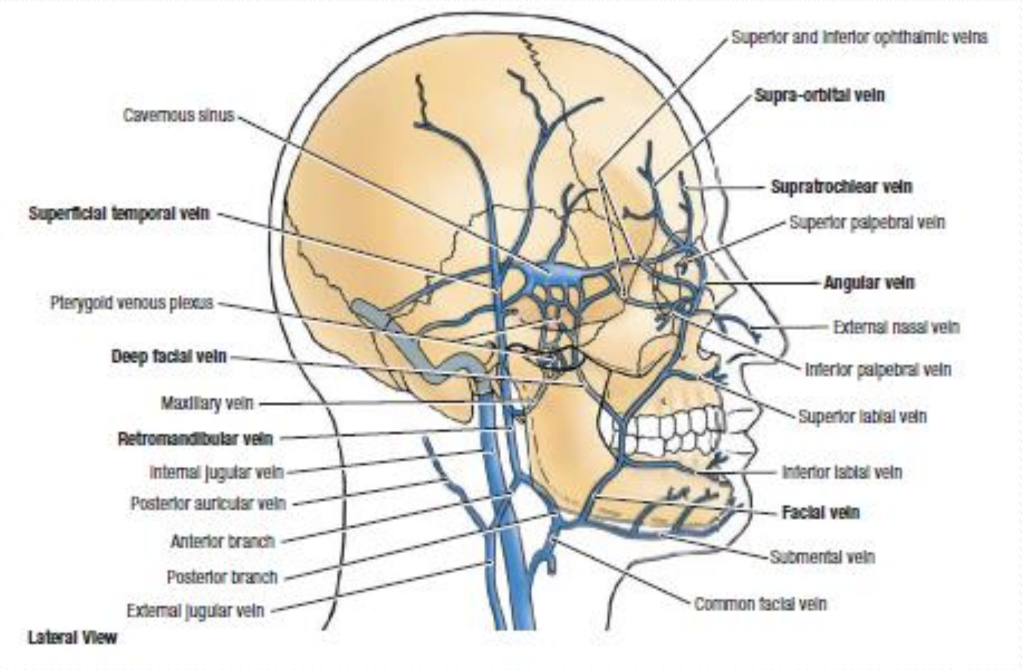
- are valveless veins that pass through the skull bones
- connect the veins of the scalp to the venous sinuses (and are an important route for the spread of infection).



Veins of the Face and the Neck

Facial Vein

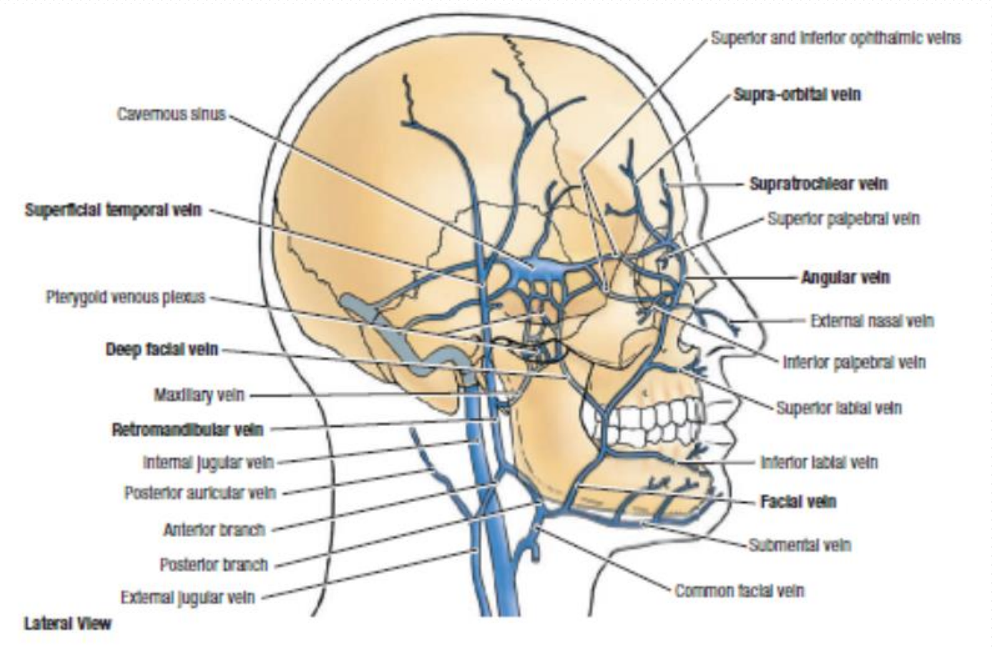
- formed by the union of the **supraorbital** and **supratrochlear veins**
- connected through the ophthalmic veins with the cavernous sinus.
- The facial vein descends down the face with the facial artery and passes around the lateral side of the mouth. It then crosses the mandible,
- is joined by the anterior division of the retromandibular vein, and drains into the internal jugular vein.



Veins of the Face and the Neck

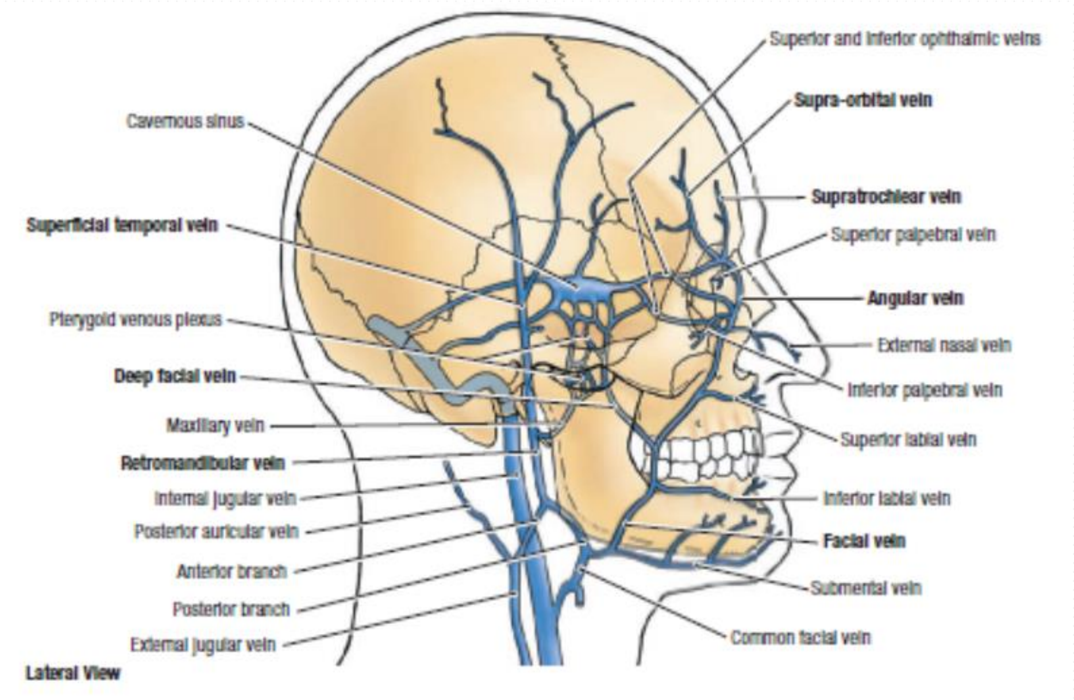
Superficial Temporal Vein

- formed on the side of the scalp
- It follows the superficial temporal artery and the auriculotemporal nerve and then enters the parotid salivary gland, where it joins the maxillary vein to form the retromandibular vein.



Veins of the Face and the Neck

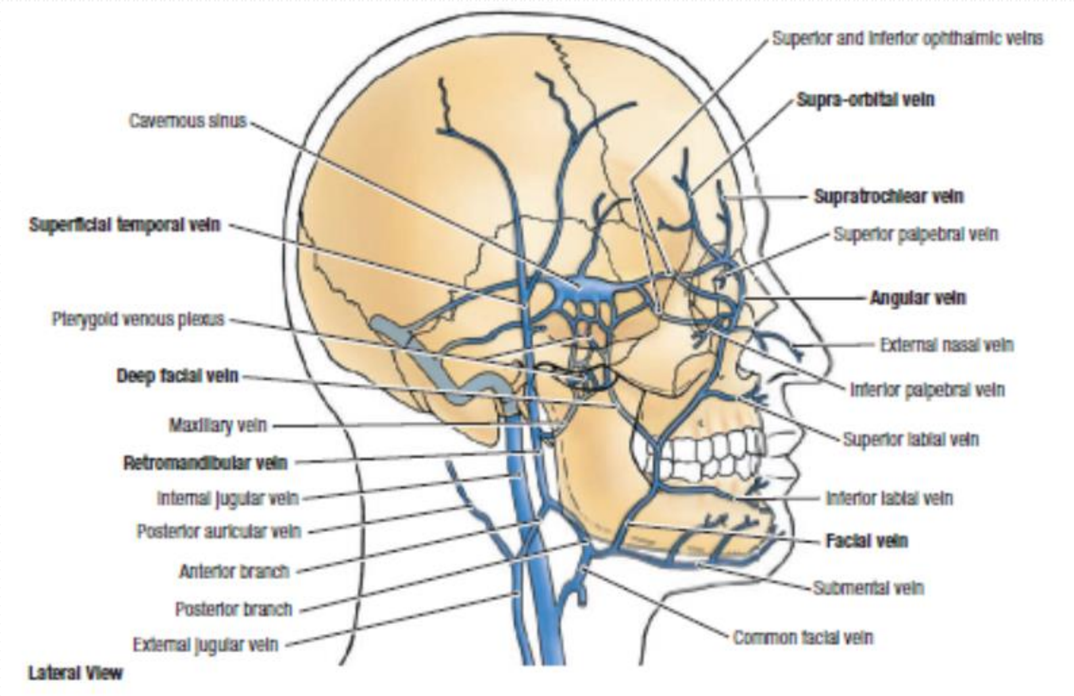
- **Maxillary Vein**
- formed in the infratemporal fossa from the pterygoid venous plexus
- It joins the superficial temporal vein to form the retromandibular vein.



Veins of the Face and the Neck

❑ Retromandibular Vein

- formed by the union of superficial temporal and maxillary veins
- On leaving the parotid salivary gland, it divides into an anterior branch, which joins the facial vein, and a posterior branch, which joins the posterior auricular vein to form the external jugular vein.



Veins of the Face and the Neck

❑ External Jugular Vein

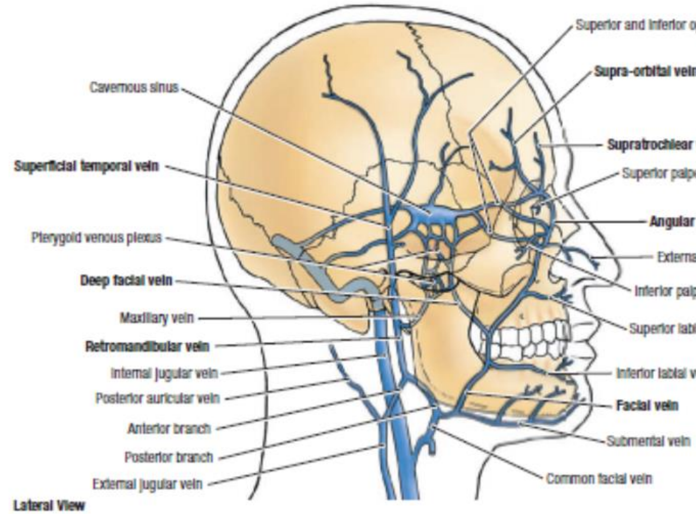
- formed behind the angle of the jaw by the union of the posterior auricular vein with the posterior division of the retromandibular vein
- It descends across the sternocleidomastoid muscle and beneath the platysma muscle, and it drains into the subclavian vein behind the middle of the clavicle.
- **Tributaries**

➢ **Posterior external jugular vein** from the back of the scalp

➢ **Transverse cervical vein** from the skin and the fascia over the posterior triangle

➢ **Suprascapular vein** from the back of the scapula

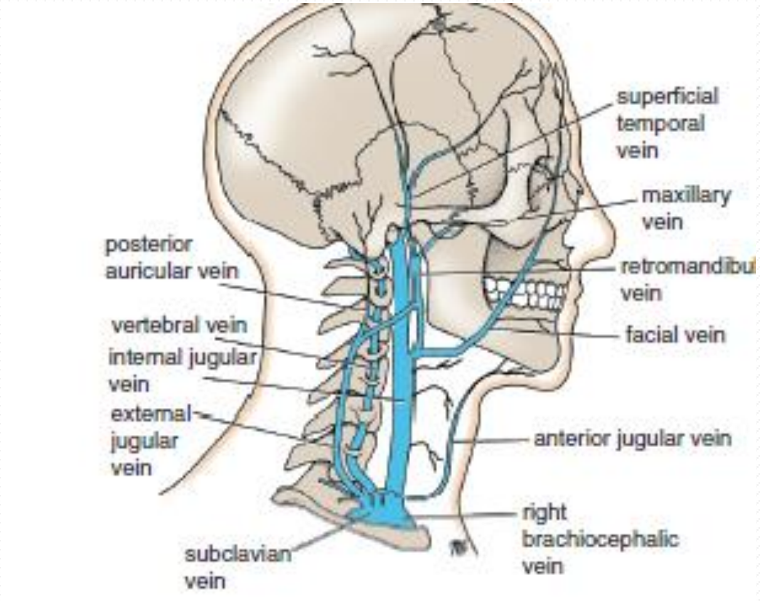
➢ **Anterior jugular vein**.



Veins of the Face and the Neck

❑ Anterior Jugular Vein

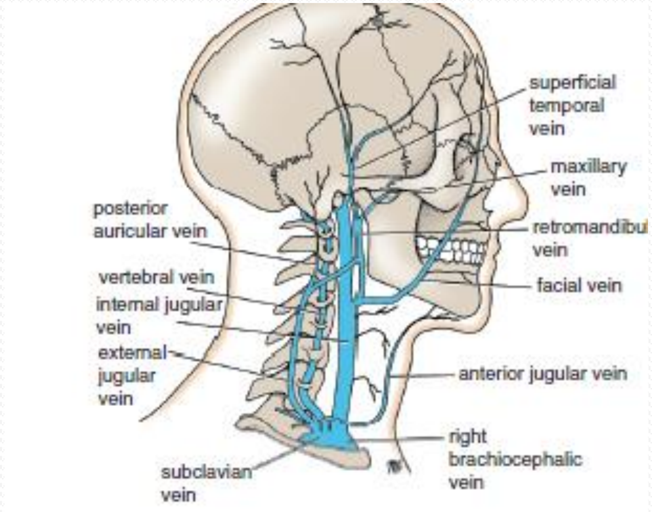
- The anterior jugular vein descends in the front of the neck close to the midline
- Just above the sternum, it is joined to the opposite vein by the jugular arch.
- The anterior jugular vein joins the external jugular vein deep to the sternocleidomastoid muscle.



Veins of the Face and the Neck

Internal Jugular Vein

- is a large vein that receives blood from the brain, face, and neck
- It starts as a continuation of the sigmoid sinus and leaves the skull through the jugular foramen.
- It then descends through the neck in the carotid sheath lateral to the vagus nerve and the internal and common carotid arteries.
- It ends by joining the subclavian vein behind the medial end of the clavicle to form the brachiocephalic vein

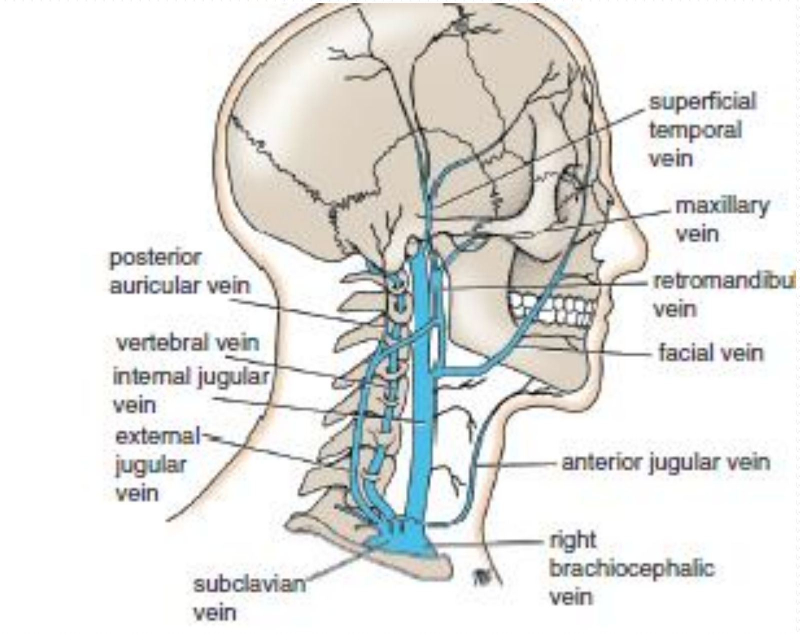


Veins of the Face and the Neck

- Throughout its course, it is closely related to the **deep cervical lymph nodes.**
- The vein has a dilatation at its upper end called the **superior bulb** and another near its termination called the **inferior bulb.** Directly above the inferior bulb is a bicuspid valve.

❑ Tributaries of the Internal Jugular Vein

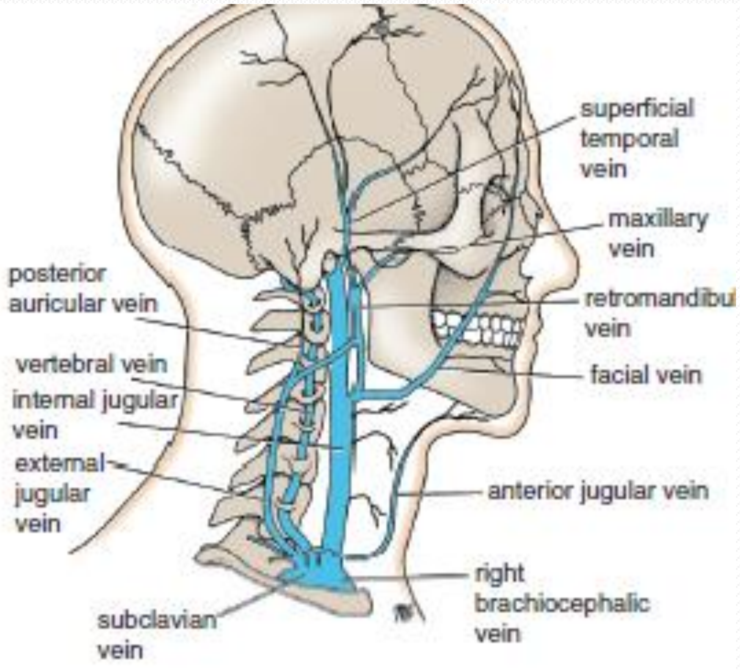
- **Inferior petrosal sinus**
- **Facial vein**
- **Pharyngeal veins**
- **Lingual vein**
- **Superior thyroid vein**
- **Middle thyroid vein**



Veins of the Face and the Neck

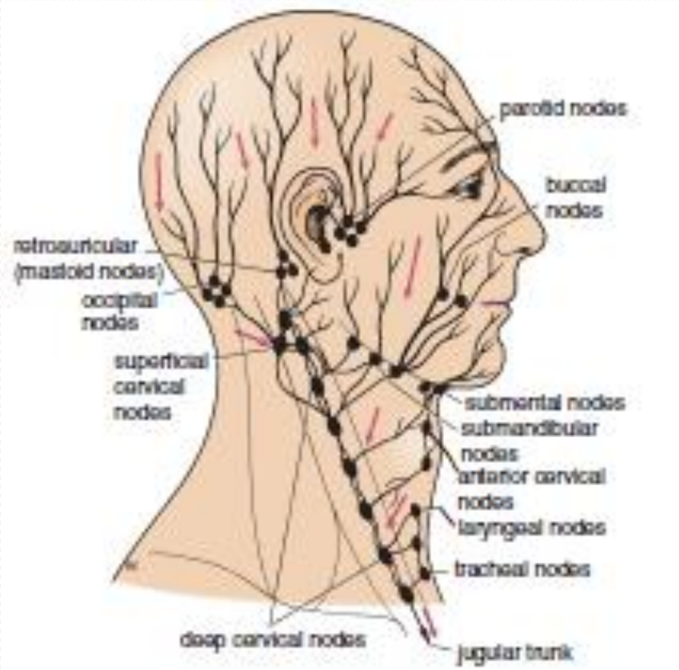
Subclavian Vein

- is a continuation of the axillary vein at the outer border of the 1st rib
- It joins the internal jugular vein to form the brachiocephalic vein, and it receives the external jugular vein. In addition, it often receives the thoracic duct on the left side and the right lymphatic duct on the right



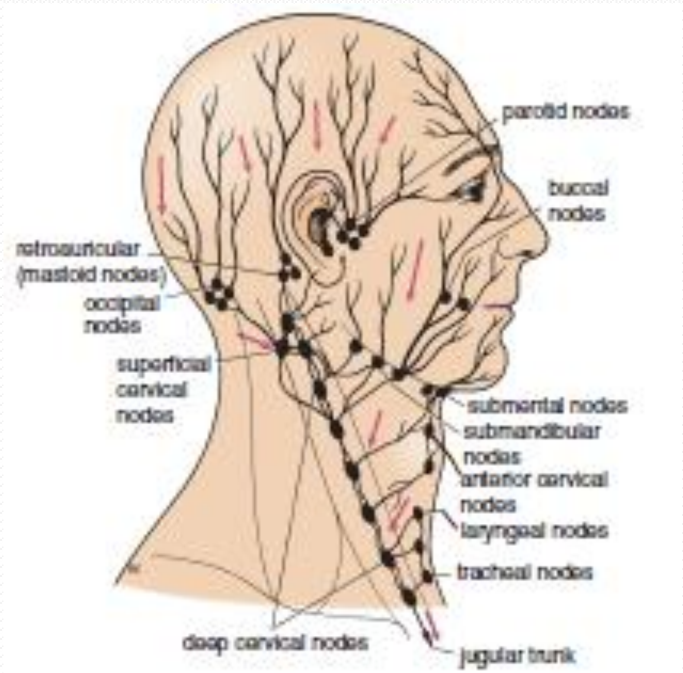
Lymph Drainage of the Head and Neck

- The lymph nodes of the head and neck are arranged as:
- ➢ regional collar that extends from below the chin to the back of the head
- ➢ deep vertical terminal group that is embedded in the carotid sheath in the neck



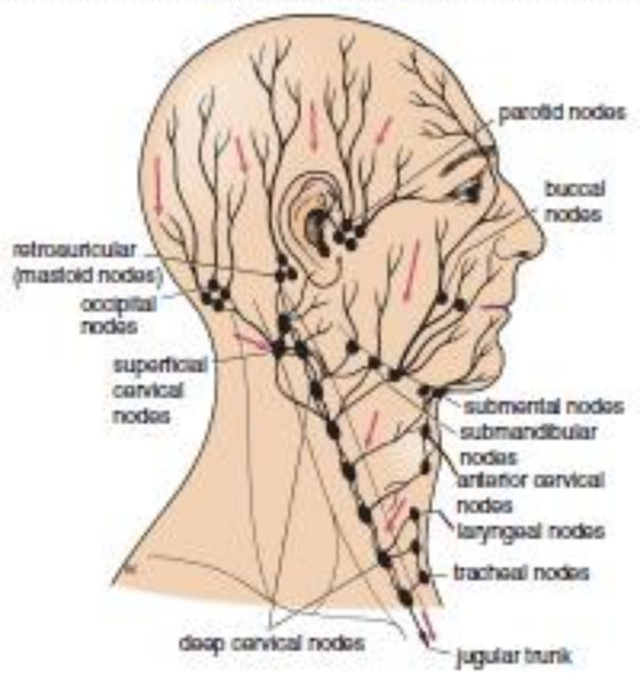
Regional Nodes

- **Occipital nodes:** situated over the occipital bone on the back of the skull. They receive lymph from the back of the scalp.
- **Retroauricular (mastoid) nodes:** lie behind the ear over the mastoid process. They receive lymph from the scalp above the ear, the auricle, and the external auditory meatus.
- **Parotid nodes:** situated on or within the parotid gland. They receive lymph from the scalp above the parotid gland, the eyelids, the parotid gland, the auricle, and the external auditory meatus



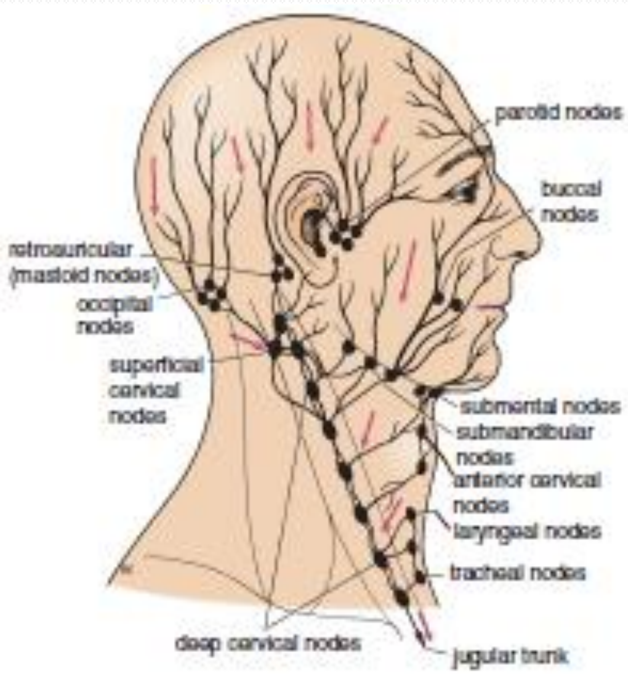
Regional Nodes

- **Buccal (facial) nodes:** One or two nodes lie in the cheek over the buccinator muscle. They drain lymph that ultimately passes into the submandibular nodes.
- **Submandibular nodes:** lie superficial to the submandibular gland just below the lower margin of the jaw. They receive lymph from the front of the scalp; the nose; the cheek; the upper lip and the lower lip (except the central part); the frontal, maxillary, and ethmoid sinuses; the upper and lower teeth (except the lower incisors); the anterior two thirds of the tongue (except the tip); the floor of the mouth and vestibule; and the gums.



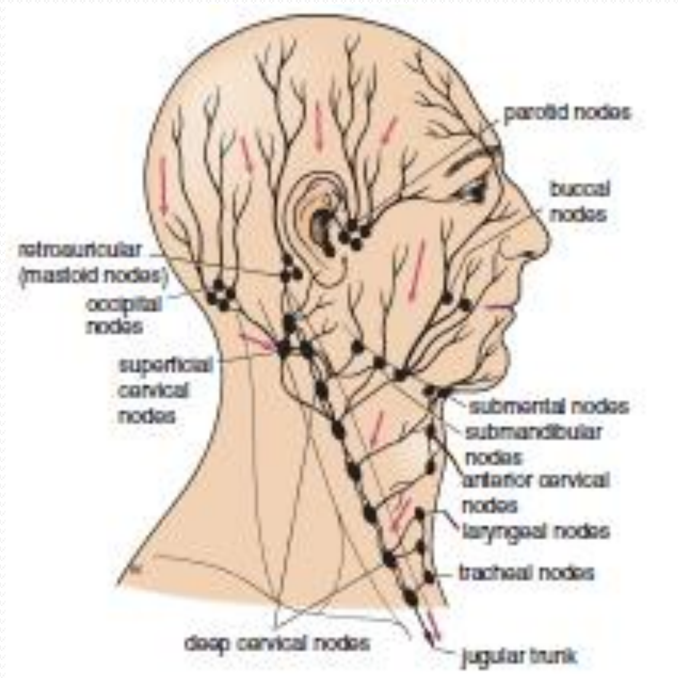
Regional Nodes

- **Submental nodes:** lie in the submental triangle just below the chin. They drain lymph from the tip of the tongue, the floor of the anterior part of the mouth, the incisor teeth, the center part of the lower lip, and the skin over the chin.
- **Anterior cervical nodes:** lie along the course of the anterior jugular veins in the front of the neck. They receive lymph from the skin and superficial tissues of the front of the neck.
- **Superficial cervical nodes:** These lie along the course of the external jugular vein on the side of the neck. They drain lymph from the skin over the angle of the jaw, the skin over the lower part of the parotid gland, and the lobe of the ear.



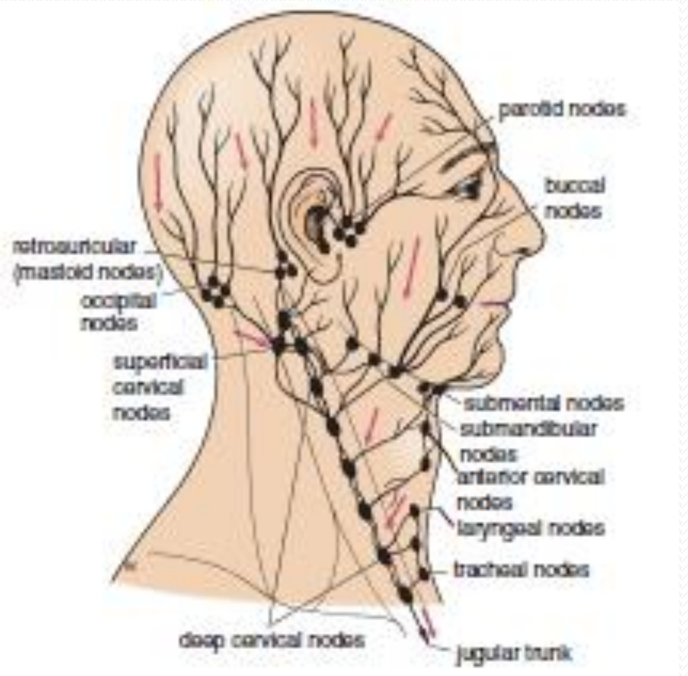
Regional Nodes

- **Retropharyngeal nodes:** lie behind the pharynx and in front of the vertebral column. They receive lymph from the nasal pharynx, the auditory tube, and the vertebral column.
- **Laryngeal nodes:** lie in front of the larynx. They receive lymph from the larynx.
- **Tracheal (paratracheal) nodes:** These lie alongside the trachea. They receive lymph from neighboring structures, including the thyroid gland



Deep Cervical Nodes

- form a vertical chain along the course of IJV within the carotid sheath
- They receive lymph from all the groups of regional nodes.
- The **jugulodigastric node:** located below and behind the angle of the jaw, is mainly concerned with drainage of the tonsil and the tongue.
- The **juguloomohyoid node:** situated close to the omohyoid muscle, is mainly associated with drainage of the tongue.
- The efferent lymph vessels from the deep cervical lymph nodes join to form the jugular trunk, which drains into the thoracic duct or the right lymphatic duct



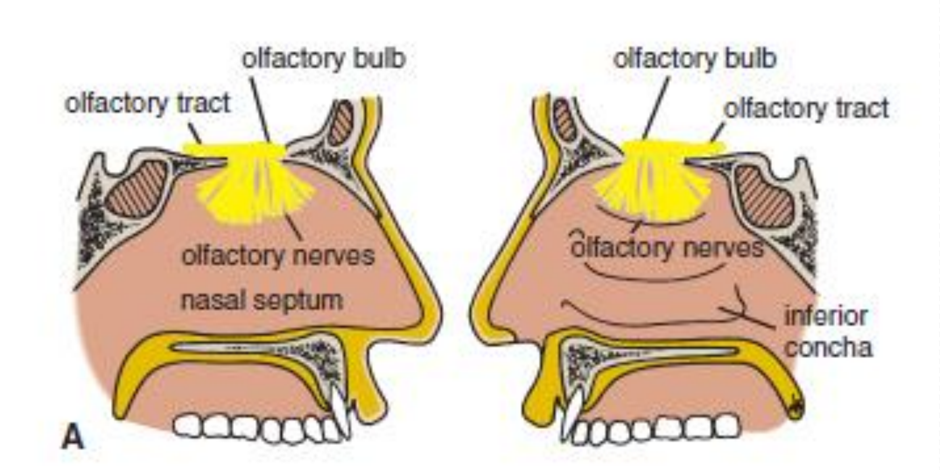
Cranial Nerves

Dr Ahmed Jassam Alnaqeeb

Cranial nerves

I. **Olfactory Nerves**

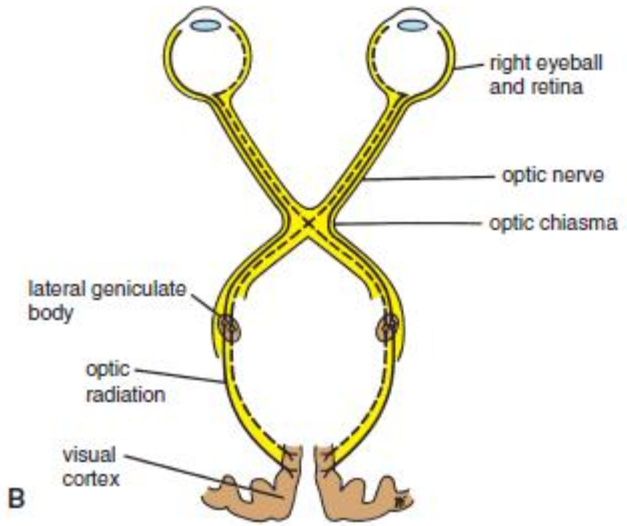
- arise from **olfactory receptor nerve cells** in the olfactory mucous membrane which situated in the upper part of the nasal cavity above the level of the superior concha
- Bundles of olfactory nerve fibers pass through the cribriform plate to enter the **olfactory bulb** in the cranial cavity
- The olfactory bulb is connected to the olfactory area of the cerebral cortex by the **olfactory tract**.



Cranial nerves

II. **Optic Nerve**

- composed of the axons of the cells of the**ganglionic layer** of the retina
- emerges from the back of the eyeball and enter the cranial cavity through the optic canal
- then unites with the optic nerve of the opposite side to form the optic chiasma
- In the chiasma, the fibers from the medial half of each retina cross the midline and enter the **optic tract** of the opposite side, whereas the fibers from the lateral half of each retina pass posteriorly in the optic tract of the same side.
- Most of the fibers of the optic tract terminate by synapsing with nerve cells in the **lateral geniculate body**
- The axons of the nerve cells of the lateral geniculate body pass posteriorly as the **optic radiation** and terminate in the **visual cortex** of the cerebral hemisphere

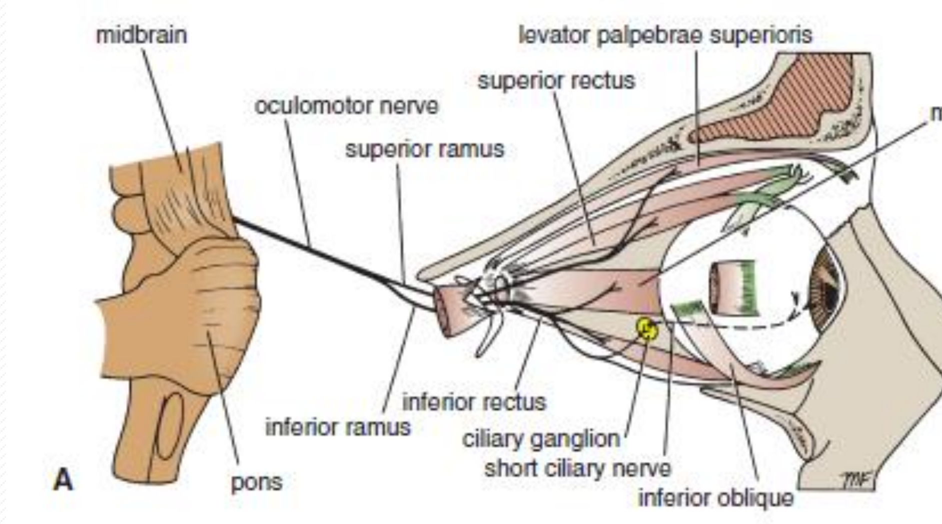


Cranial nerves

III. **Oculomotor Nerve**

- emerges on the anterior surface of the midbrain
- Pass forward to the middle cranial fossa where it run in the lateral wall of the cavernous sinus. Here, it divides into a **superior** and an **inferior ramus,** which enter the orbital cavity through the superior orbital fissure
- The oculomotor nerve supplies the following
- **The extrinsic muscles of the eye:**
- **The intrinsic muscles of the eye:** constrictor pupillae, ciliary muscles supplied by the parasympathetic component of the oculomotor nerve.

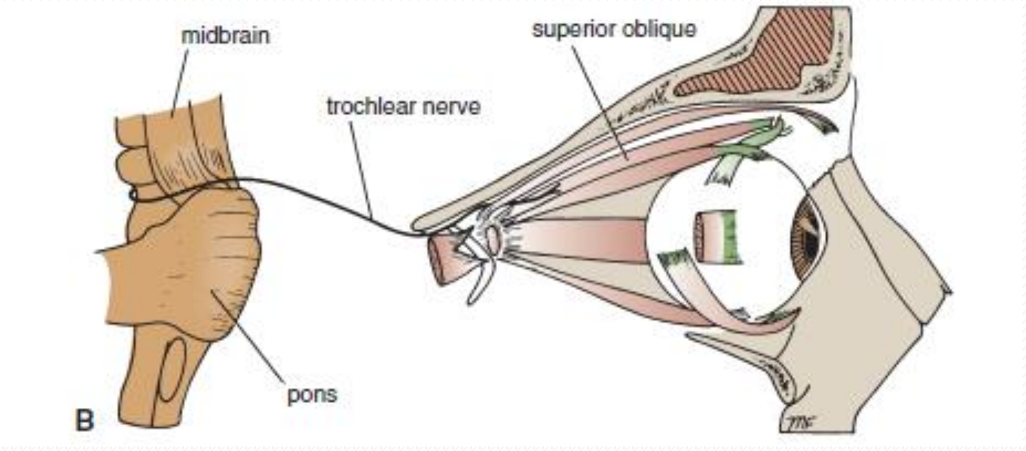
These fibers synapse in the **ciliary ganglion** and reach the eyeball in the **short ciliary nerves**



Cranial nerves

IV. **Trochlear Nerve**

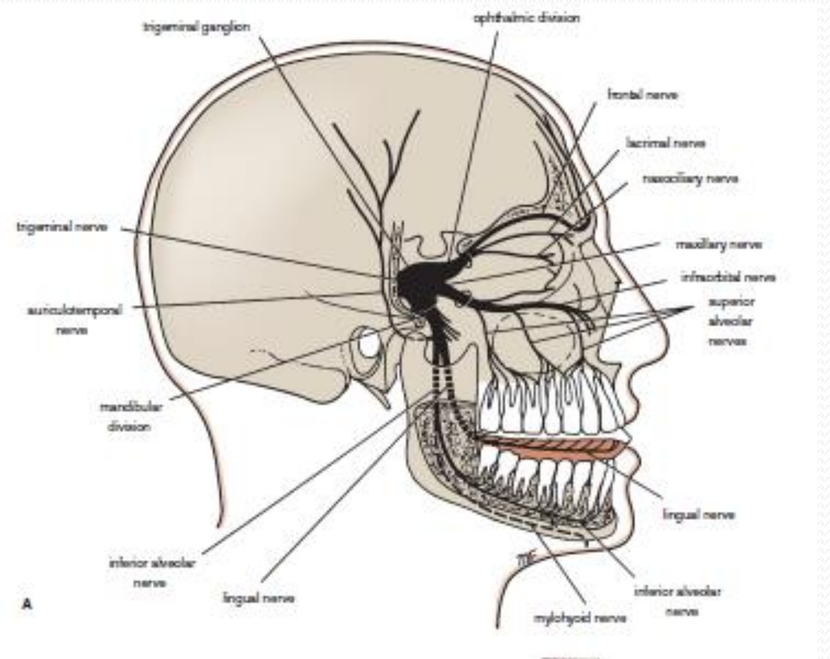
- It leaves the posterior surface of the midbrain
- It then passes forward through the middle cranial fossa in the lateral wall of the cavernous sinus and enters the orbit through the superior orbital fissure
- It supplies: The superior oblique muscle of the eyeball



Cranial nerves

V. Trigeminal Nerve

- the largest cranial nerve. It leaves the anterior aspect of the pons as a small **motor root** and a large **sensory root**
- it passes forward to reach the apex of petrous part in the middle cranial fossa. Here, the large sensory root expands to form the **trigeminal ganglion**
- The trigeminal ganglion lies within a pouch of dura mater called the **trigeminal cave.**
- The motor root of the trigeminal nerve is situated below the sensory ganglion and is completely separate from it.
- The ophthalmic (V1), maxillary (V2), and mandibular (V3) nerves arise from the anterior border of the ganglion



Cranial nerves

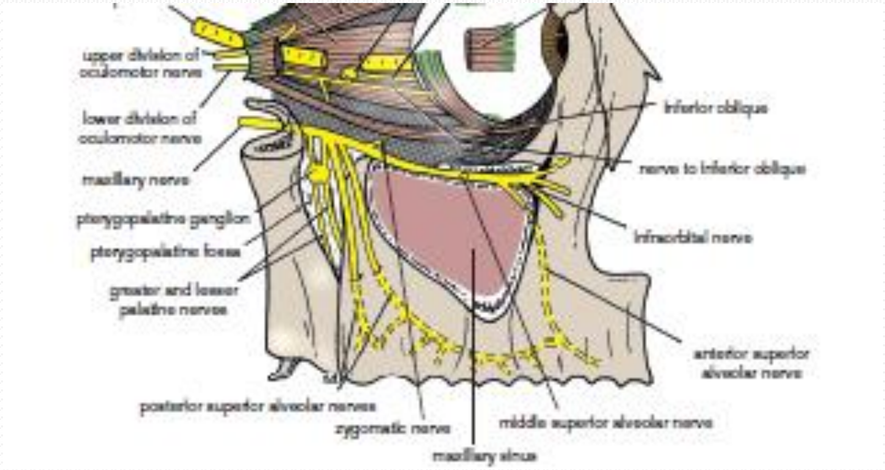
- **Ophthalmic Nerve (V1)**
- purely sensory. It runs forward in the lateral wall of the cavernous sinus and divides into three branches, the lacrimal, frontal, and nasociliary nerves, which enter the orbital cavity
- Branches
- **lacrimal nerve** runs forward and joined by the zygomaticotemporal branch of the maxillary nerve, The lacrimal nerve then enters the lacrimal gland and gives branches to the conjunctiva and the skin of the upper eyelid.
- **frontal nerve** runs forward and divides into the **supraorbital** and **supratrochlear nerves**
- **nasociliary nerve** crosses the optic nerve,
- Branches:
- **anterior ethmoid nerve:** It gives off two **internal nasal branches** and **external nasal nerve.**
- **Sensory fibers** to the ciliary ganglion
- **Long ciliary nerves** (sympathetic fibers to the dilator pupillae muscle and sensory fibers to the cornea)
- **Infratrochlear nerve**
- **Posterior ethmoidal nerve**

Cranial nerves

- **Maxillary Nerve (V2)**
- arises from the trigeminal ganglion → lateral wall of the cavernous sinus → foramen rotundum → pterygopalatine fossa → the orbit → inferior orbital fissure → infraorbital nerve → infraorbital groove → infraorbital foramen → face and side of the nose.
- Branches
- **Meningeal**
- **Zygomatic**
- **Ganglionic**
- **Posterior, middle and anterior superior alveolar nerves**

Cranial nerves

- **Pterygopalatine Ganglion**
- is a parasympathetic ganglion, which is suspended from the maxillary nerve in the pterygopalatine fossa
- It is secretomotor to the lacrimal and nasal glands
- Branches
- **Orbital branches,** which enter the orbit through theinferior orbital fissure
- **Greater and lesser palatine nerves** which supply the palate, the tonsil, and the nasal cavity
- **Pharyngeal branch,** which
  supplies the roof of the
  nasopharynx



Cranial nerves

- **Mandibular Nerve (V3)**
- both motor and sensory
- leaves the skull through foramen ovale to enter the infratemporal fossa
- the 2 roots join together to form the trunk of the mandibular nerve, and then divides into a small anterior and a large posterior division

❑ Branches from the Main Trunk of the Mandibular Nerve

- **Meningeal branch**
- **Nerve to the medial pterygoid muscle,** which supplies not only the medial pterygoid, but also the tensor veli palatini muscle

Cranial nerves

- Branches from the Anterior Division of the Mandibular Nerve
- **Masseteric nerve**
- **Deep temporal nerves**
- **Nerve to the lateral pterygoid muscle**
- **Buccal nerve** to the skin and the mucous membrane of the cheek (sensory)
- Branches from the Posterior Division of the Mandibular Nerve
- **Auriculotemporal nerve,** sensory & secretomotor
- **Lingual nerve**, it is joined by the **chorda tympani nerve** and it supplies the mucous membrane of the anterior two thirds of the tongue and the floor of the mouth. It also gives off **preganglionic parasympathetic secretomotor fibers** to the submandibular ganglion
- **Inferior alveolar nerve** Before entering the inf. Alv. canal, it gives off the **mylohyoid nerve** (which supplies the mylohyoid muscle and the anterior belly of the digastric muscle)
- **Communicating branch,** which frequently runs from the inferior alveolar nerve to the lingual nerve

Cranial nerves

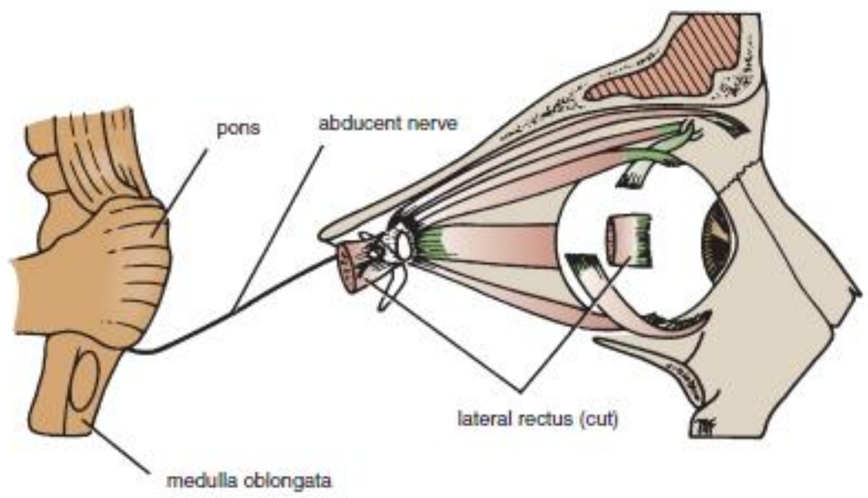
- **Otic Ganglion**
- parasympathetic ganglion
- located medial to the mandibular nerve just below the skull
- preganglionic fibers (glossopharyngeal) via lesser petrosal nerve
- Postganglionic secretomotor fibers reach the parotid salivary gland via the auriculotemporal nerve.

- **Submandibular Ganglion**
- parasympathetic ganglion
- lies deep to the submandibular salivary gland
- attached to the lingual nerve by small nerves
- Preganglionic parasympathetic fibers (facial nerve) via the chorda tympani and the lingual nerves.
- Postganglionic secretomotor fibers pass to the submandibular and the sublingual salivary glands.

Cranial nerves

VI. Abducent Nerve

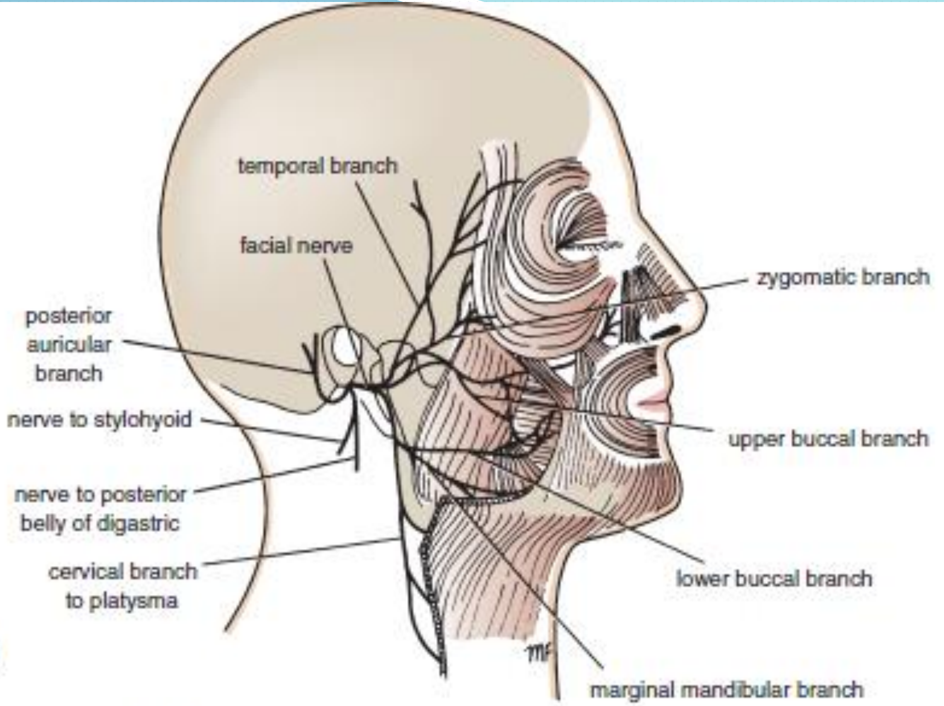
- emerges from anterior surface of hindbrain between pons and medulla oblongata
- It passes forward with the internal carotid artery through the cavernous sinus in the middle cranial fossa and enters the orbit through the superior orbital fissure
- supplies the lateral rectus muscle



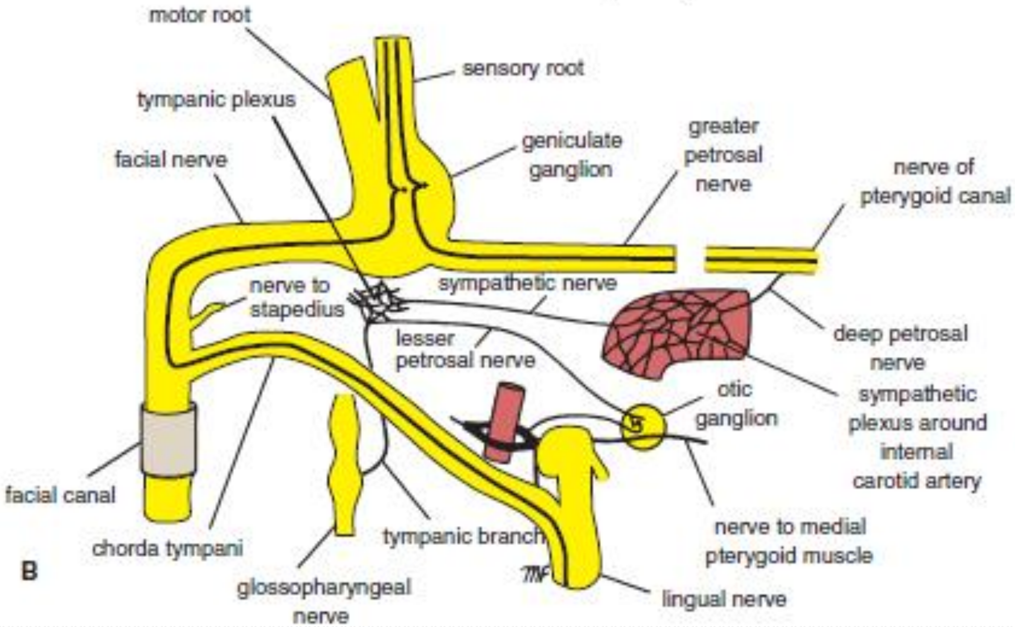
Cranial nerves

VII. **Facial Nerve**

- Has motor root and a sensory root **(nervus intermedius)**
- emerges on anterior surface of hindbrain between pons and medulla oblongata.
- The roots pass laterally in posterior cranial fossa with vestibulocochlear nerve and enter internal acoustic meatus
- At the bottom of the meatus, the nerve enters the facial canal that runs laterally through the inner ear. On reaching the medial wall of the middle ear (tympanic cavity), the nerve swells to form the sensory **geniculate ganglion**
- it emerges from the temporal bone through the stylomastoid foramen.
- The facial nerve now passes forward through the parotid gland to its distribution


temporal branch
facial nerve
posterior auricular branch
nerve to stylohyoid
nerve to posterior belly of digastric
cervical branch to platysma
zygomatic branch
upper buccal branch
lower buccal branch
marginal mandibular branch

A


motor root
sensory root
tympanic plexus
facial nerve
geniculate ganglion
greater petrosal nerve
nerve of pterygoid canal
nerve to stapedius
sympathetic nerve
lesser petrosal nerve
deep petrosal nerve
sympathetic plexus around internal carotid artery
otic ganglion
facial canal
chorda tympani
glossopharyngeal nerve
tympanic branch
nerve to medial pterygoid muscle
lingual nerve

B

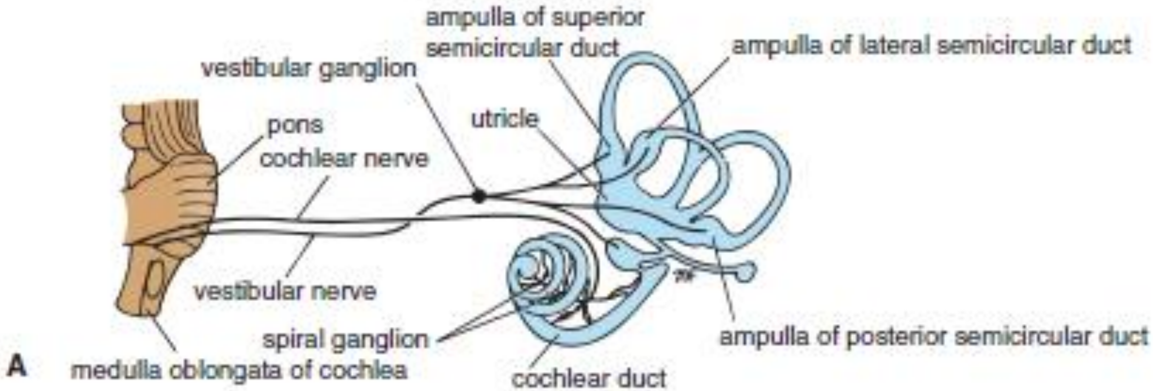
Cranial nerves

- Important Branches of the Facial Nerve
- **Greater petrosal nerve** arises at the geniculate ganglion. It contains preganglionic parasympathetic fibers that synapse in the pterygopalatine ganglion. The greater petrosal nerve also contains taste fibers from the palate.
- **Nerve to stapedius** supplies the stapedius muscle in the middle ear
- **Chorda tympani** arises in the facial canal in the posterior wall of the middle ear. leaves the middle ear through the **petrotympanic fissure,** thus entering the infratemporal fossa and joining the lingual nerve. contains preganglionic parasympathetic fibers to the submandibular and the sublingual salivary glands. also contains taste fibers from the anterior two thirds of the tongue and floor of the mouth.
- **Posterior auricular,** the posterior belly of the digastric, and the stylohyoid nerves
- The 5 terminal branches within the parotid gland

Cranial nerves

VIII. Vestibulocochlear Nerve

- sensory nerve that consists **vestibular** and **cochlear** fibers
- Leave anterior surface of brain between pons and medulla oblongata
- They cross the posterior cranial fossa and enter the internal acoustic meatus with the facial nerve
- vestibular fibers originate from vestibule and semicircular canals; therefore, they are concerned with sense of position and with movement of the head.
- cochlear fibers originate in **spiral organ of Corti** and are therefore concerned with hearing.

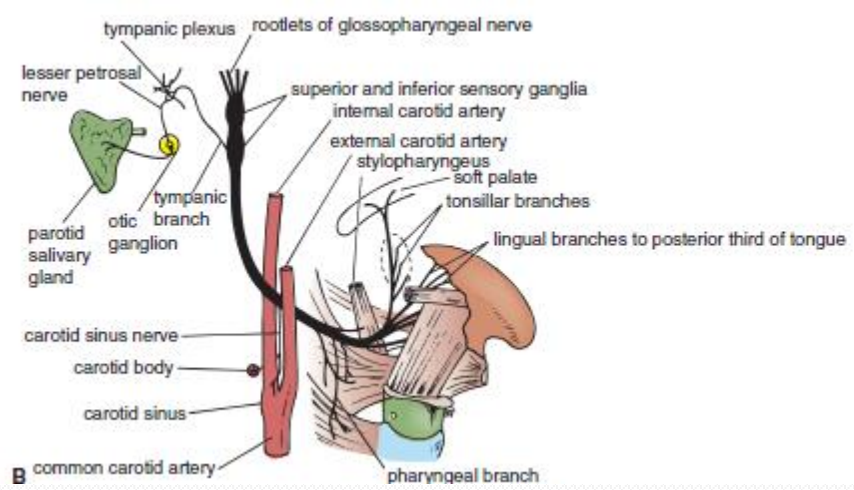


Cranial nerves

IX. Glossopharyngeal Nerve

- motor and sensory nerve
- It emerges from anterior surface of medulla oblongata
- It passes laterally in the posterior cranial fossa and leaves the skull through the jugular foramen.
- The **superior** and **inferior sensory ganglia** are located on the nerve as it passes through the foramen.
- The glossopharyngeal nerve then descends through the upper part of the neck to the back of

  the tongue



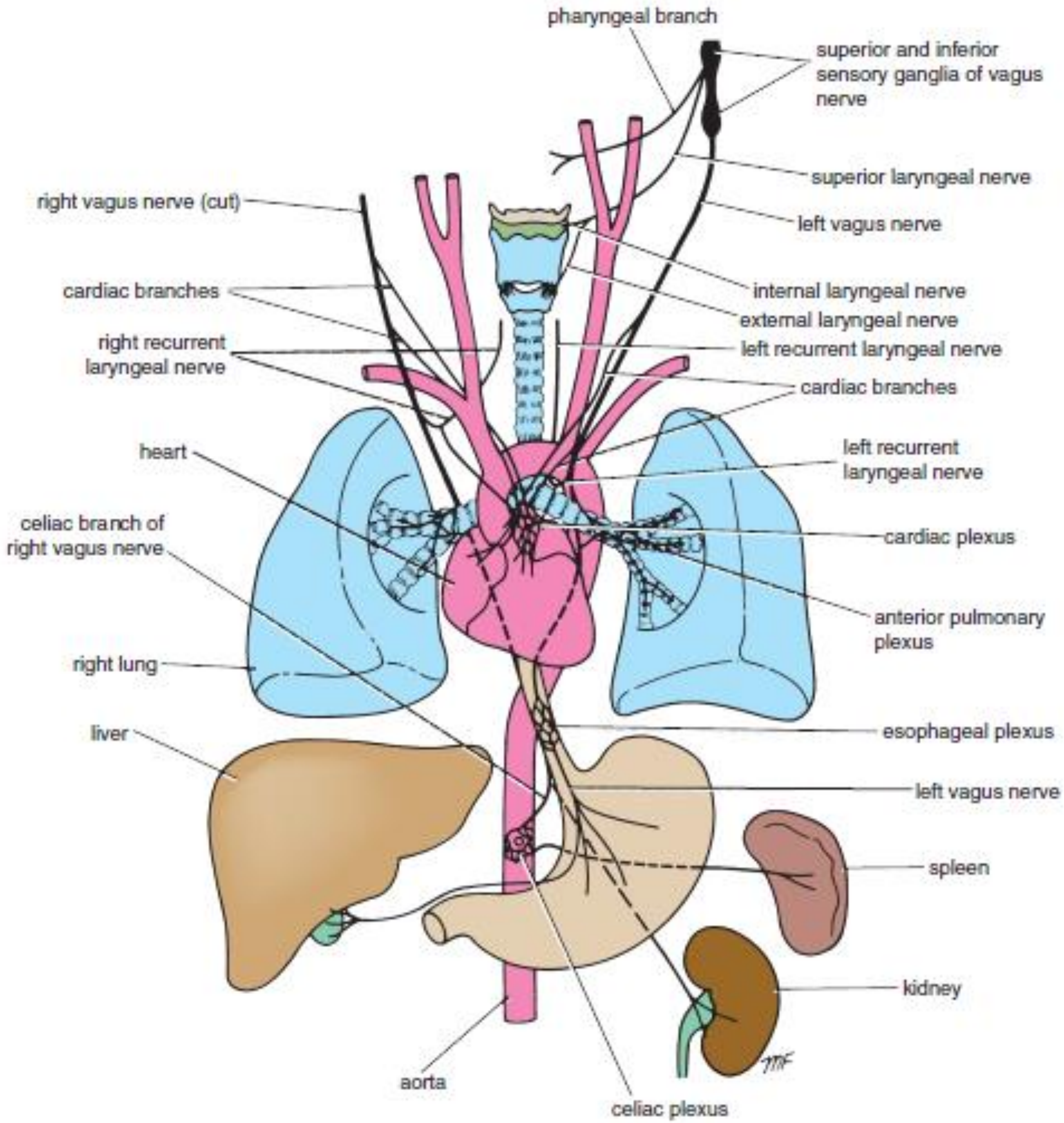
Cranial nerves

- Important Branches of the Glossopharyngeal Nerve
- **Tympanic branch** passes to the tympanic plexus in the middle ear that give **lesser petrosal nerve,**
- **Carotid branch** contains sensory fibers from the carotid sinus and the carotid body
- **Nerve to the stylopharyngeus muscle**
- **Pharyngeal branches** run to the **pharyngeal plexus** and also receive branches from the vagus nerve and the sympathetic trunk.
- **Lingual branch** passes to the mucous membrane of the posterior third of the tongue (including the vallate papillae).

Cranial nerves

X. **Vagus Nerve**

- composed of motor and sensory fibers
- emerges from the anterior surface of the medulla oblongata
- The nerve passes laterally through the posterior cranial fossa and leaves the skull through the jugular foramen.
- has both **superior and inferior sensory ganglia.**
- Below the inferior ganglion, the **cranial root of the accessory nerve** joins the vagus nerve and is distributed mainly in its pharyngeal and recurrent laryngeal branches.
- The vagus nerve descends through the neck within the
- carotid sheath
- It passes through the mediastinum of the thorax and enters the abdomen through the esophageal opening in the diaphragm.



pharyngeal branch
superior and inferior sensory ganglia of vagus nerve
superior laryngeal nerve
right vagus nerve (cut)
left vagus nerve
internal laryngeal nerve
cardiac branches
external laryngeal nerve
right recurrent laryngeal nerve
left recurrent laryngeal nerve
cardiac branches
heart
left recurrent laryngeal nerve
celiac branch of right vagus nerve
cardiac plexus
anterior pulmonary plexus
right lung
liver
esophageal plexus
left vagus nerve
spleen
kidney
aorta
celiac plexus

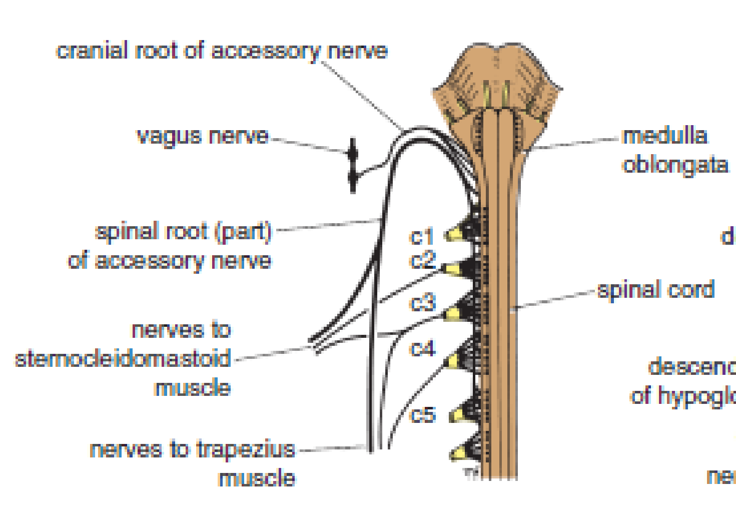
Cranial nerves

- **Important Branches of the Vagus Nerve in the Neck**
- **Meningeal and auricular branches**
- **Pharyngeal branch** joins the pharyngeal plexus and supplies all the muscles of the pharynx (except the stylopharyngeus) and of the soft palate (except the tensor veli palatini).
- **Superior laryngeal nerve** divides into the internal and the external laryngeal nerves. The **internal laryngeal nerve** is sensory to the mucous membrane of the piriform fossa and the larynx down as far as the vocal cords. The **external laryngeal nerve** is motor and is located close to the superior thyroid artery; it supplies the cricothyroid muscle.
- **Recurrent laryngeal nerve :** On the right side, the nerve hooks around the **first part of the subclavian artery.** On the left side, the nerve hooks around the **arch of the aorta.** and then ascends into the neck between the trachea and the esophagus. The nerve is closely related to the inferior thyroid artery, and it supplies all the muscles of the larynx, except the cricothyroid muscle, the mucous membrane of the larynx below the vocal cords, and the mucous membrane of the upper part of the trachea.
- **Cardiac branches** (two or three) arise in the neck, descend into the thorax, and end in the cardiac plexus

Cranial nerves

XI. Accessory Nerve

- motor nerve. It consists of a cranial root and a spinal root
- The cranial root emerges from the anterior surface of the medulla oblongata. The nerve runs laterally in the posterior cranial fossa and joins the spinal root.
- The spinal root arises from nerve cells in the anterior gray column (horn) of the upper five segments of the cervical part of the spinal cord. The nerve ascends alongside the spinal cord and enters the skull through the foramen magnum. It then turns laterally to join the cranial root



Cranial nerves

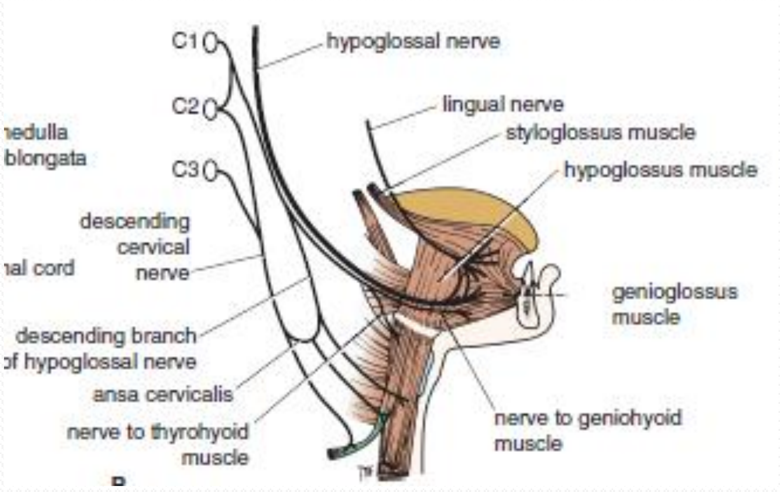
- The two roots unite and leave the skull through the jugular foramen.
- The roots then separate: The cranial root joins the vagus nerves and is distributed in its branches to the muscles of the soft palate and pharynx (via the pharyngeal plexus) and to the muscles of the larynx (except the cricothyroid muscle)

- The spinal root runs downward and laterally and enters the deep surface of the sternocleidomastoid muscle, which it supplies, and then crosses the posterior triangle of the neck to supply the trapezius muscle

Cranial nerves

XII. **Hypoglossal Nerve**

- motor nerve.
- It emerges on anterior surface of the medulla oblongata
- crosses the posterior cranial fossa, and leaves the skull through the hypoglossal canal.
- then passes downward and forward in the neck and crosses the internal and external carotid arteries to reach the tongue
- In the upper part of its course, it is joined by C1 fibers from the cervical plexus.



Cranial nerves

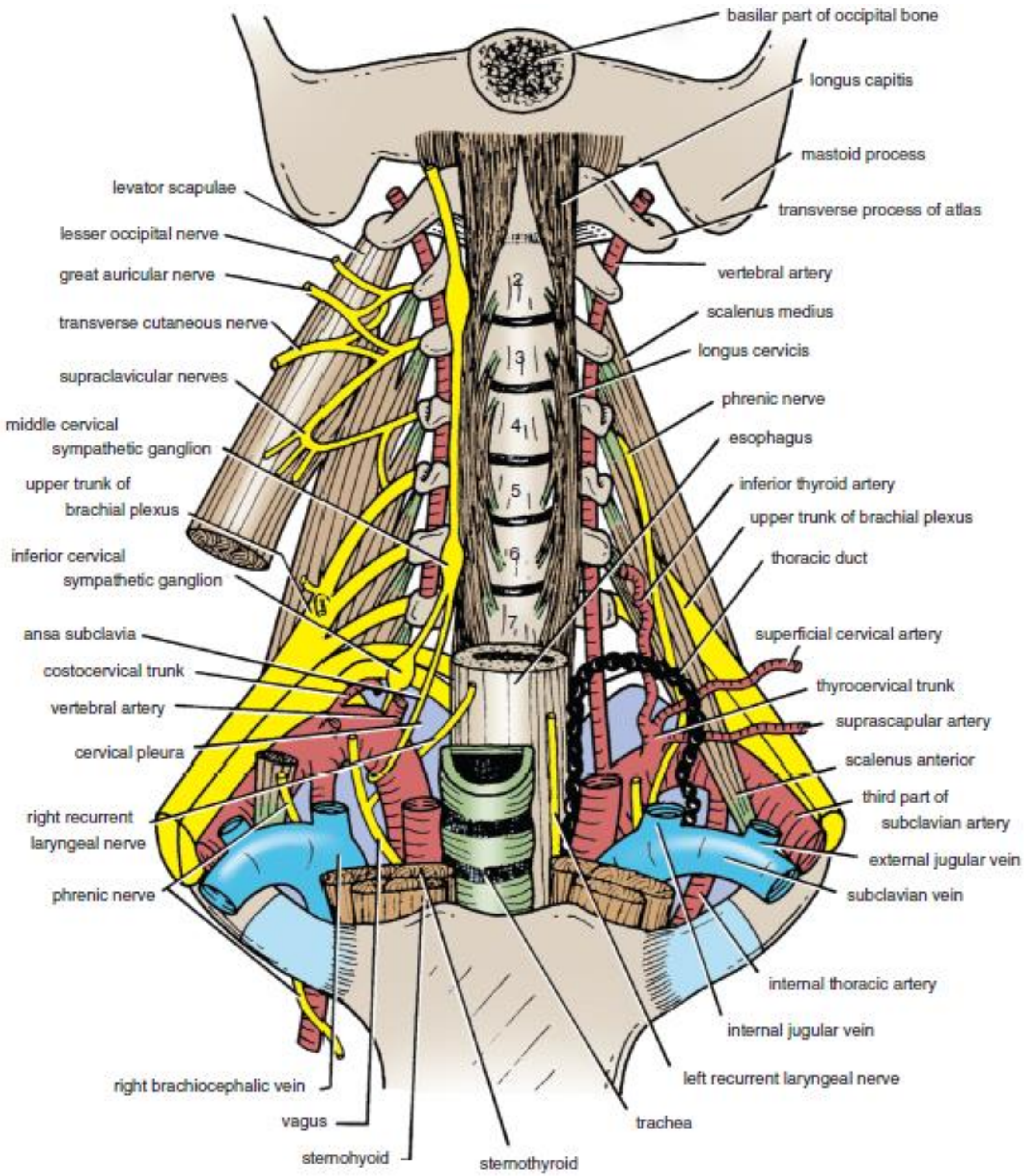
- Important Branches of the Hypoglossal Nerve
- **Meningeal branch**
- **Descending branch** (C1 fibers) passes downward and joins the **descending cervical nerve** (C2 and 3) to form the **ansa cervicalis.** Branches from this loop supply the omohyoid, the sternohyoid, and the sternothyroid muscles.
- **Nerve to the thyrohyoid muscle (C1)**
- **Muscular branches to all the muscles of the tongue** except the palatoglossus (pharyngeal plexus)
- **Nerve to the geniohyoid muscle (C1).**

Main Nerves of the Neck

Dr. Ahmed Alnaqeeb

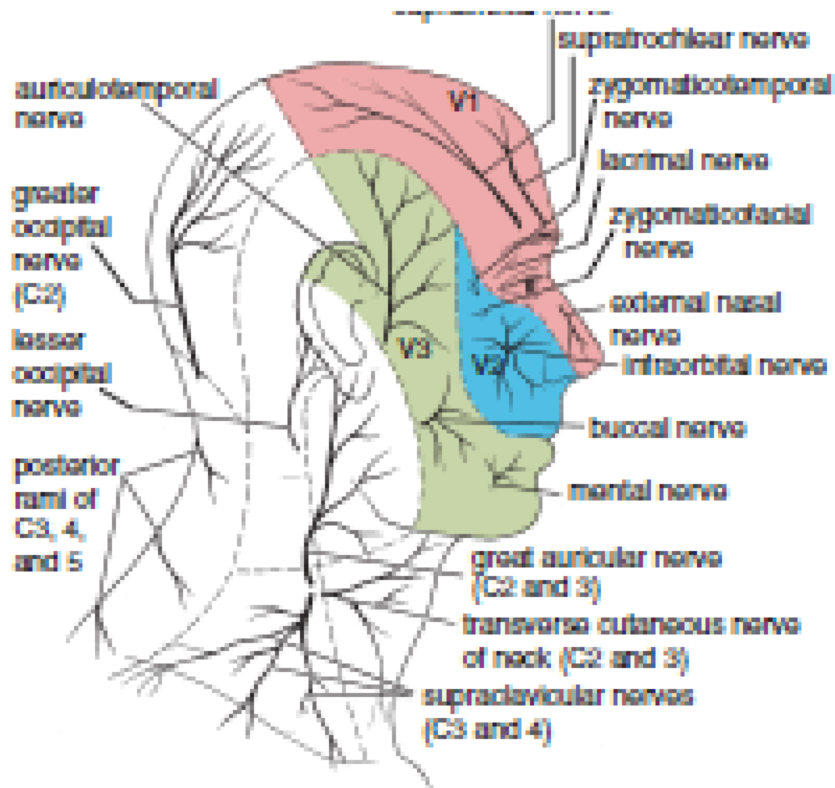
Cervical Plexus

- formed by the anterior rami of C1–C4
- rami are joined by connecting branches, which form loops that lie in front of the origins of the levator scapulae and the scalenus medius muscles
- plexus is covered in front by the prevertebral layer of deep cervical fascia and is related to the internal jugular vein within the carotid sheath


basilar part of occipital bone
longus capitis
mastoid process
transverse process of atlas
vertebral artery
scalenus medius
longus cervicis
phrenic nerve
esophagus
inferior thyroid artery
upper trunk of brachial plexus
thoracic duct
superficial cervical artery
thyrocervical trunk
suprascapular artery
scalenus anterior
third part of subclavian artery
external jugular vein
subclavian vein
internal thoracic artery
internal jugular vein
left recurrent laryngeal nerve
trachea
sternothyroid
sternohyoid
vagus
right brachiocephalic vein
phrenic nerve
right recurrent laryngeal nerve
cervical pleura
vertebral artery
costocervical trunk
ansa subclavia
inferior cervical sympathetic ganglion
upper trunk of brachial plexus
middle cervical sympathetic ganglion
supraclavicular nerves
transverse cutaneous nerve
great auricular nerve
lesser occipital nerve
levator scapulae
2
3
4
5
6
7

Branches of cervical plexus

- **Cutaneous branches**
- The **lesser occipital nerve** (C2
- The **greater auricular nerve** (C2 and 3),
- The **transverse cervical nerve** (C2 and 3)
- The **supraclavicular nerves** (C3 and 4).



Branches of cervical plexus

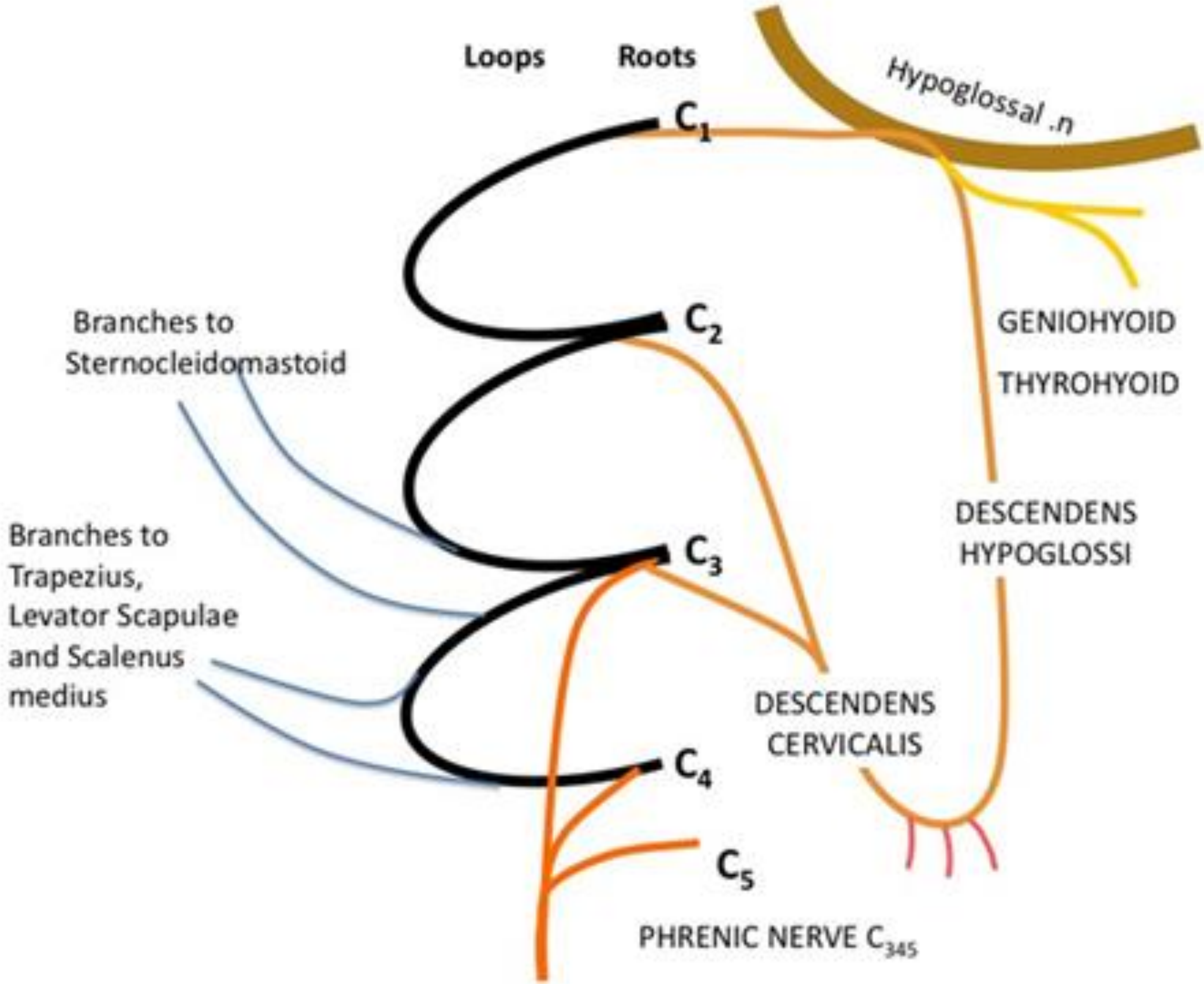
- **Muscular branches to the neck muscles.**
- Prevertebral muscles, sternocleidomastoid (proprioceptive, C2 and 3), levator scapulae (C3 and 4), and trapezius (proprioceptive, C3 and 4).

- A branch from C1 joins the hypoglossal nerve.

- Some of these C1 fibers later leave the hypoglossal as the descending branch, which unites with the **descending cervical nerve** (C2 and 3), to form the **ansa cervicalis** supply the omohyoid, sternohyoid, and sternothyroid muscles.

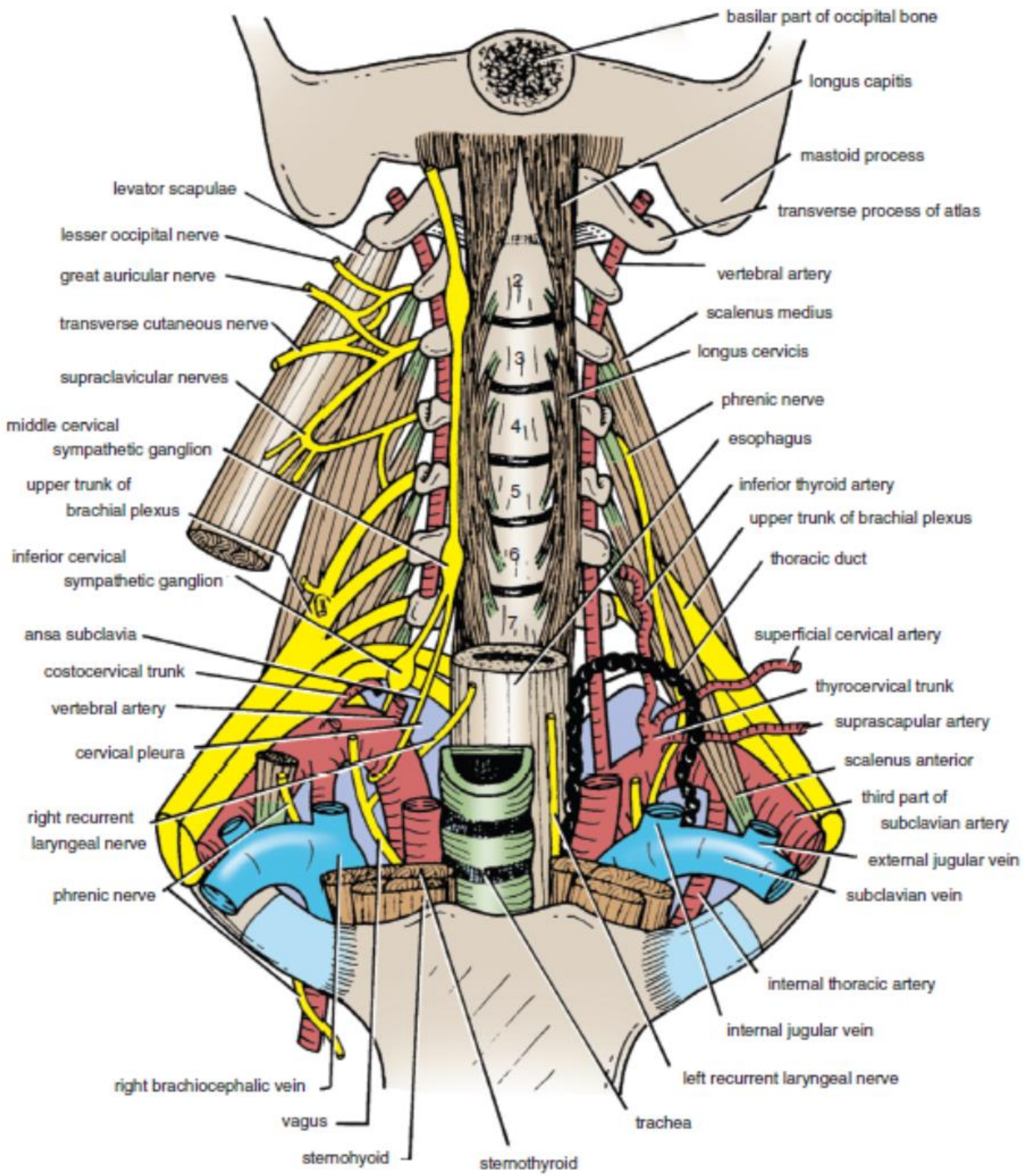
- Other C1 fibers within the hypoglossal nerve leave it as the nerve to the thyrohyoid and geniohyoid.

- **Muscular branch to the diaphragm.** Phrenic nerve


Loops
Roots
Hypoglossal .n
C1
C2
C3
C4
C5
Branches to Sternocleidomastoid
GENIOHYOID
THYROHYOID
DESCENDENS HYPOGLOSSI
Branches to Trapezius, Levator Scapulae and Scalenus medius
DESCENDENS CERVICALIS
PHRENIC NERVE C345

Phrenic Nerve

- arises in the neck from the C3, C4,C5
- runs vertically downward across the front of the scalenus anterior muscle
- enters the thorax by passing in front of the subclavian artery.
- The phrenic nerve is the only motor nerve supply to diaphragm.
- also sends sensory branches to the pericardium, the mediastinal parietal pleura, and the pleura and peritoneum covering the upper and lower surfaces of the central part of the diaphragm.


basilar part of occipital bone
longus capitis
mastoid process
transverse process of atlas
vertebral artery
scalenus medius
longus cervicis
phrenic nerve
esophagus
inferior thyroid artery
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thoracic duct
superficial cervical artery
thyrocervical trunk
suprascapular artery
scalenus anterior
third part of subclavian artery
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internal thoracic artery
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left recurrent laryngeal nerve
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sternothyroid
sternohyoid
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right recurrent laryngeal nerve
cervical pleura
vertebral artery
costocervical trunk
ansa subclavia
inferior cervical sympathetic ganglion
upper trunk of brachial plexus
middle cervical sympathetic ganglion
supraclavicular nerves
transverse cutaneous nerve
great auricular nerve
lesser occipital nerve
levator scapulae
2
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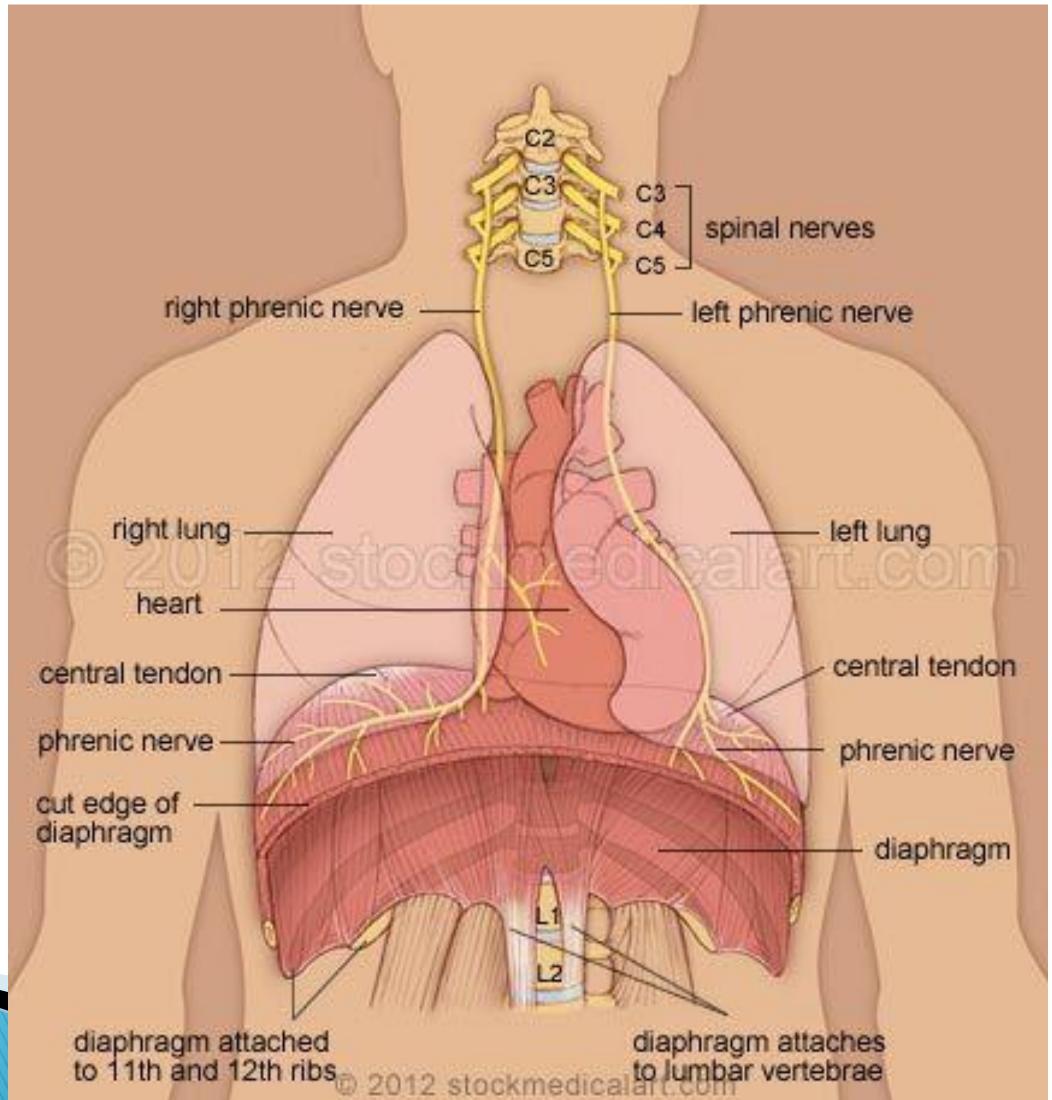
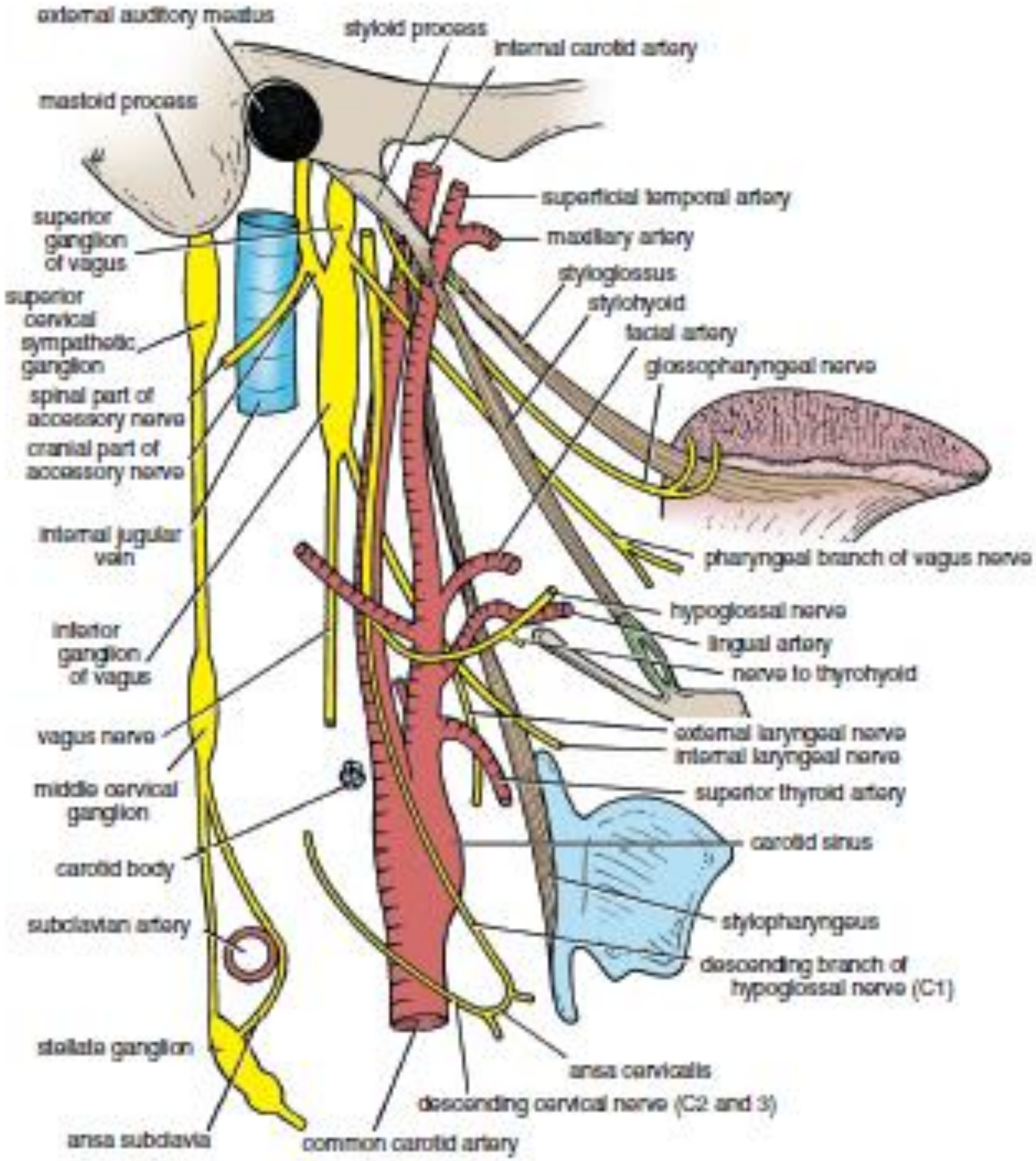
C3 4 5 keep my diaphram alive



The Autonomic Nervous System in the Head and Neck

Sympathetic Part

- **Cervical Part of the Sympathetic Trunk**
- The cervical part extends upward to the base of the skull and below to the neck of the 1st rib
- It lies directly behind the internal and common carotid arteries (i.e., medial to the vagus)
- and is embedded in deep fascia between the carotid sheath and the prevertebral layer
- The sympathetic trunk possesses three ganglia: the superior, middle, and inferior cervical ganglia.



external auditory meatus
styloid process
internal carotid artery
mastoid process
superficial temporal artery
superior ganglion of vagus
maxillary artery
styloglossus
stylohyoid
superior cervical sympathetic ganglion
facial artery
glossopharyngeal nerve
spinal part of accessory nerve
cranial part of accessory nerve
internal jugular vein
pharyngeal branch of vagus nerve
hypoglossal nerve
inferior ganglion of vagus
lingual artery
nerve to thyrohyoid
vagus nerve
external laryngeal nerve
internal laryngeal nerve
middle cervical ganglion
superior thyroid artery
carotid sinus
carotid body
stylopharyngeus
subclavian artery
descending branch of hypoglossal nerve (C1)
stellate ganglion
ansa cervicalis
descending cervical nerve (C2 and 3)
ansa subclavia
common carotid artery

Superior Cervical Ganglion

- lies immediately below the skull
- **Branches**
- **internal carotid nerve,** postganglionic fibers, accompanies the internal carotid artery, form the internal carotid plexus.
- **Gray rami communicantes** to anterior rami C1-4
- **Arterial branches** to the common and external carotid arteries. form a plexus around the arteries
- **Cranial nerve branches,** which join the 9th, 10th, and 12th cranial nerves
- **Pharyngeal branches,** which unite with the pharyngeal branches of the glossopharyngeal and vagus nerves to form the pharyngeal plexus
- **superior cardiac branch,** which descends in the neck and ends in the cardiac plexus in the thorax

Middle Cervical Ganglion

- lies at the level of the cricoid cartilage
- **Branches**
- **Gray rami communicantes** to the anterior rami of C5,6
- **Thyroid branches,** pass along the inferior thyroid artery to the thyroid gland
- **The middle cardiac branch,** which descends in the neck and ends in the cardiac plexus in the thorax

Inferior Cervical Ganglion

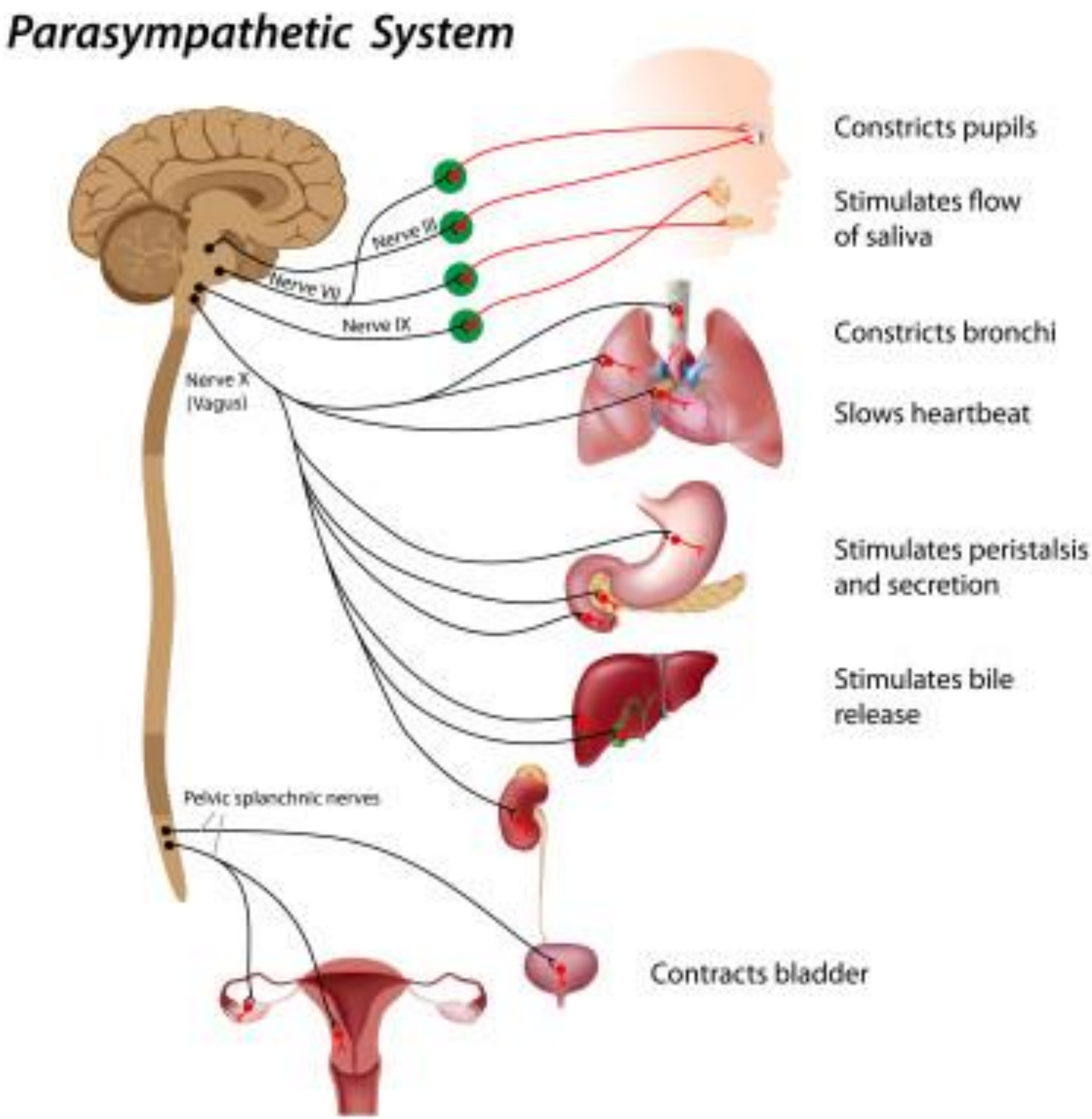
- in most people fused with the first thoracic ganglion to form the **stellate ganglion.**

- It lies in the interval between the transverse process of the 7th cervical vertebra and the neck of the 1st rib, behind the vertebral artery

- **Branches**
- **Gray rami communicantes** to the anterior rami of C7,8
- **Arterial branches** to the subclavian and vertebral arteries
- **inferior cardiac branch,** which descends to join the cardiac plexus in the thorax

Parasympathetic Part

- The cranial portion of the craniosacral outflow of the parasympathetic part of the autonomic nervous system is located in the nuclei of
- **oculomotor (3rd)**
- **facial (7th),**
- **glossopharyngeal (9th)**
- **vagus (10th) cranial nerves**


Parasympathetic System
Nerve III
Nerve VII
Nerve IX
Nerve X (Vagus)
Pelvic splanchnic nerves
Constricts pupils
Stimulates flow of saliva
Constricts bronchi
Slows heartbeat
Stimulates peristalsis and secretion
Stimulates bile release
Contracts bladder

Parasympathetic nuclei

- The parasympathetic nucleus of the oculomotor nerve is called the **Edinger–Westphal nucleus**
- those of the facial nerve the **lacrimatory** and the **superior salivary nuclei**;
- that of the glossopharyngeal nerve the **inferior salivary nucleus**
- of the vagus nerve the **dorsal nucleus of the vagus.**
- The axons of these connector nerve cells are myelinated preganglionic fibers

- The cranial parasympathetic ganglia are the **ciliary,** the **pterygopalatine,** the **submandibular,** and the **otic.**

- In certain locations, the ganglion cells are placed in nerve plexuses, such as the **cardiac plexus,** the **pulmonary plexus,** the **myenteric plexus (Auerbach's plexus),** and the **mucosal plexus (Meissner's plexus).**

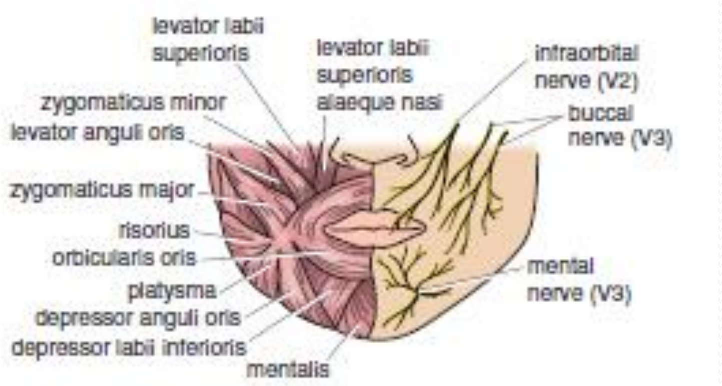
- The last two plexuses are found in the gastrointestinal tract.
-
- The postganglionic fibers are nonmyelinated, and they are short in length.

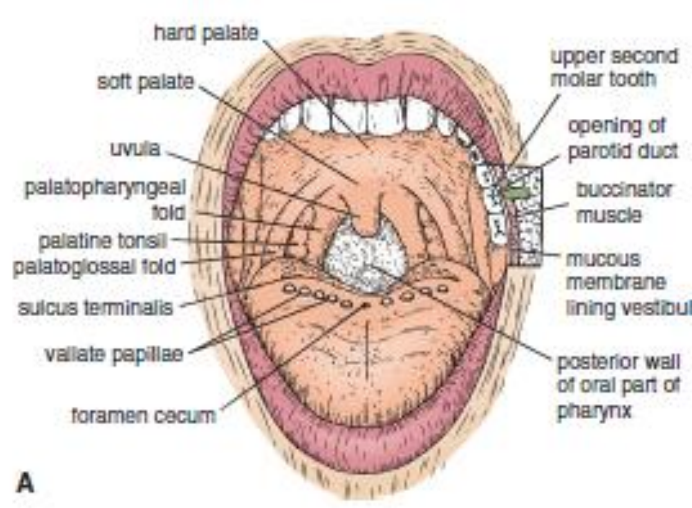
The Digestive System in theHead and Neck

Dr. Ahmed Jassam Alnaqeeb

The Mouth

- **The Lips**
- The lips are two fleshy folds that surround the oral orifice
- They are covered on the outside by skin and are lined on the inside by mucous membrane.
- The substance of the lips is made up by the orbicularis oris muscle and the muscles that radiate from the lips into the face

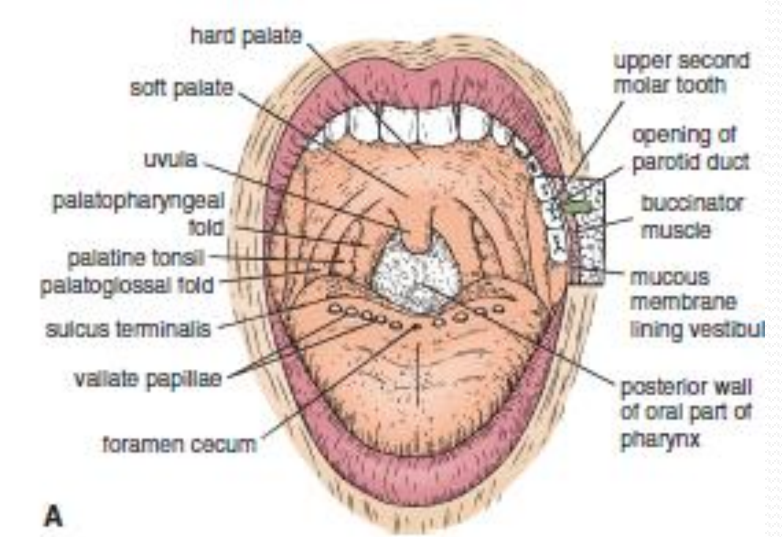




- Also included are the labial blood vessels and nerves, connective tissue, and many small salivary glands.
- The **philtrum** is the shallow vertical groove seen in the midline on the outer surface of the upper lip.
- Median folds of mucous membrane—the **labial frenulae**—connect the inner surface of the lips to the gums.

The Mouth Cavity

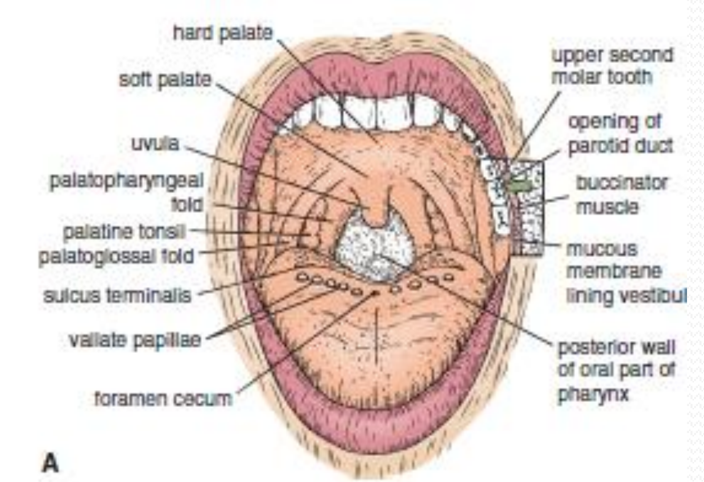
- The mouth extends from the lips to the pharynx.
- The entrance into the pharynx, the **oropharyngeal isthmus**, is formed on each side by the palatoglossal fold
- The mouth is divided into the vestibule and the mouth cavity proper



Vestibule

- The vestibule lies between the lips and the cheeks externally and the gums and the teeth internally.
- This slitlike space communicates with the exterior through the oral fissure between the lips.
- When the jaws are closed, it communicates with the mouth proper behind the third molar tooth on each side.
- The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums.

- The lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle and is lined with mucous membrane.
- The tone of the buccinator muscle and that of the muscles of the lips keeps the walls of the vestibule in contact with one another.
- The **duct of the parotid salivary gland** opens on a small papilla into the vestibule opposite the upper second molar tooth



Mouth Proper

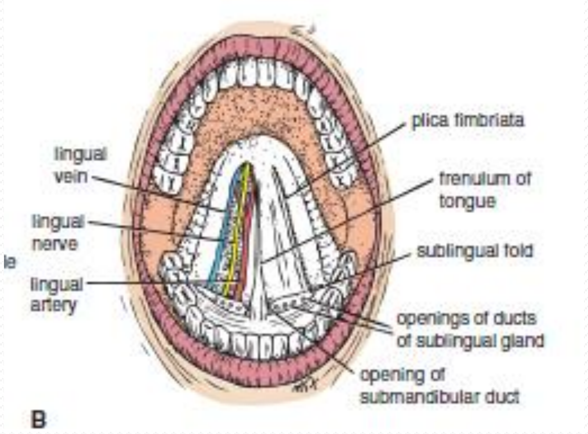
- The mouth proper has a roof and a floor.

❑ Roof of Mouth

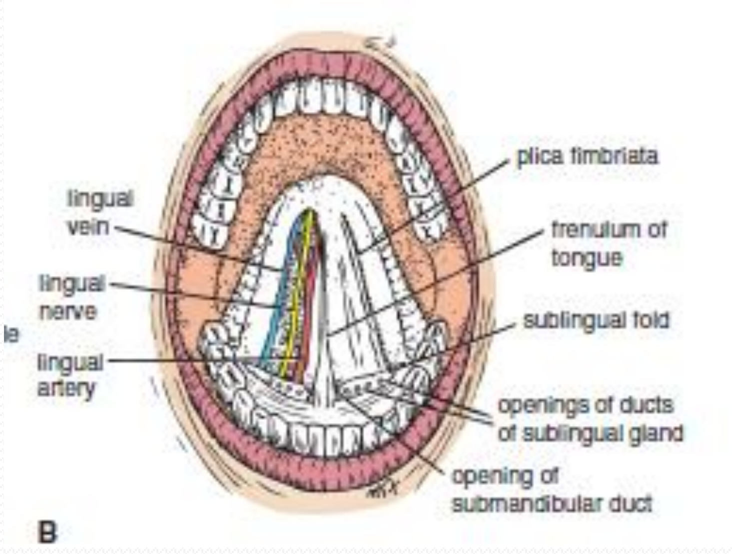
- The roof of the mouth is formed by the hard palate in front and the soft palate behind

❑ Floor of Mouth

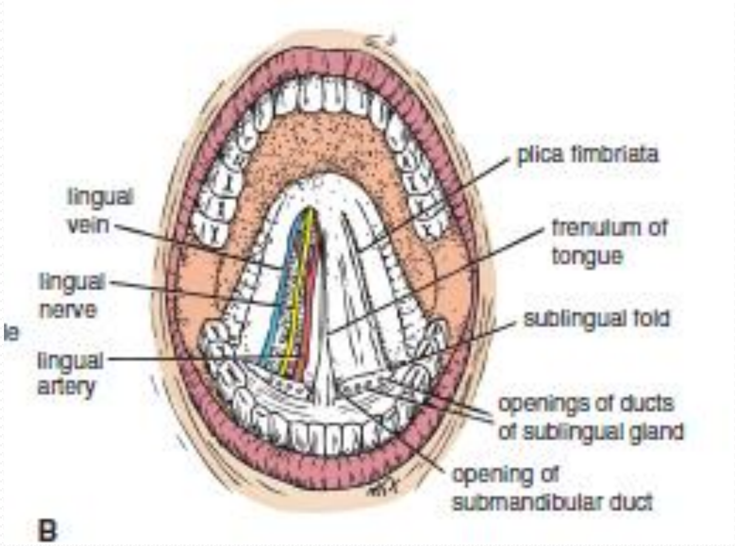
- The floor is formed largely by the anterior two thirds of the tongue and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible



- A fold of mucous membrane called the **frenulum of the tongue** connects the undersurface of the tongue in the midline to the floor of the mouth
- Lateral to the frenulum, the mucous membrane forms a fringed fold, the **plica fimbriata**



- The submandibular duct of the submandibular gland opens onto the floor of the mouth on the summit of a small papilla on either side of the frenulum of the tongue
- The sublingual gland projects up into the mouth, producing a low fold of mucous membrane, the **sublingual fold.**
- Numerous ducts of the gland open on the summit of the fold.

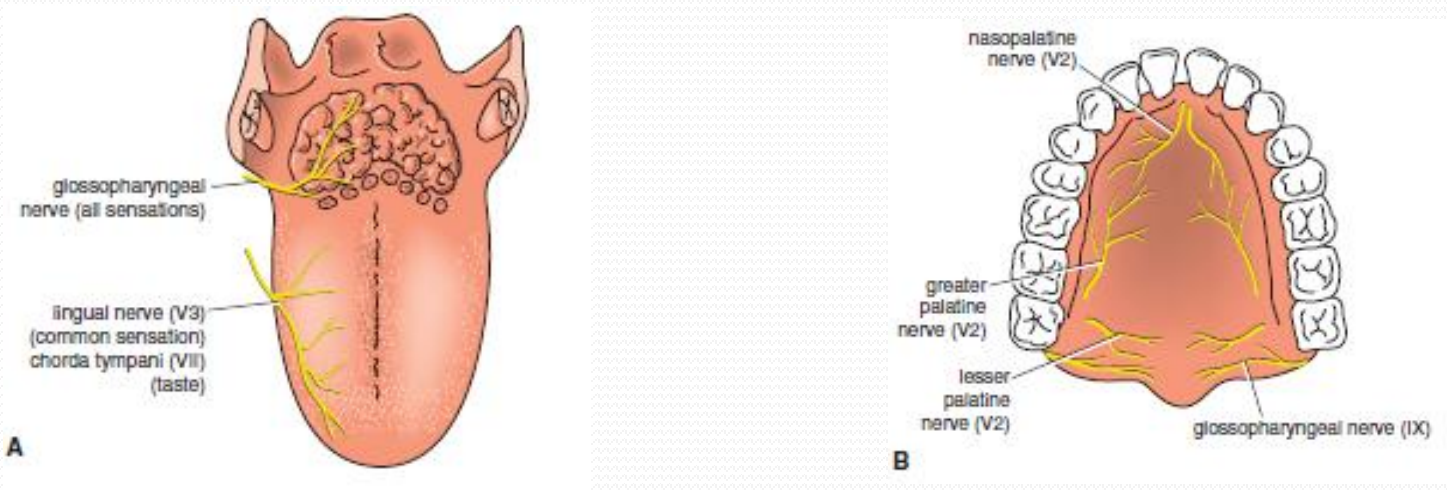


Mucous Membrane of the Mouth

- In the vestibule, the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa that prevent redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed.
- The mucous membrane of the gingiva, or gum, is strongly attached to the alveolar periosteum

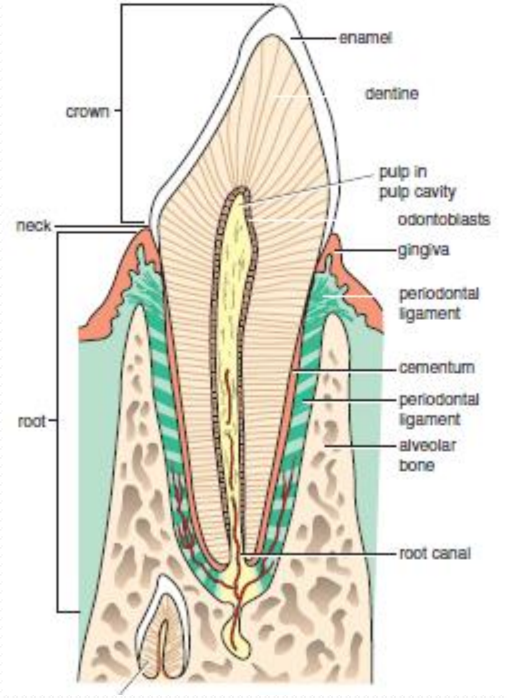
Sensory Innervation of the Mouth

- **Roof:** The greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve
- **Floor:** The lingual nerve (common sensation), a branch of the mandibular division of the trigeminal nerve. Then taste fibers travel in the chorda tympani nerve, a branch of the facial nerve.
- **Cheek:** The buccal nerve, a branch of the mandibular division of the trigeminal nerve (the buccinator muscle is innervated by the buccal branch of the facial nerve)



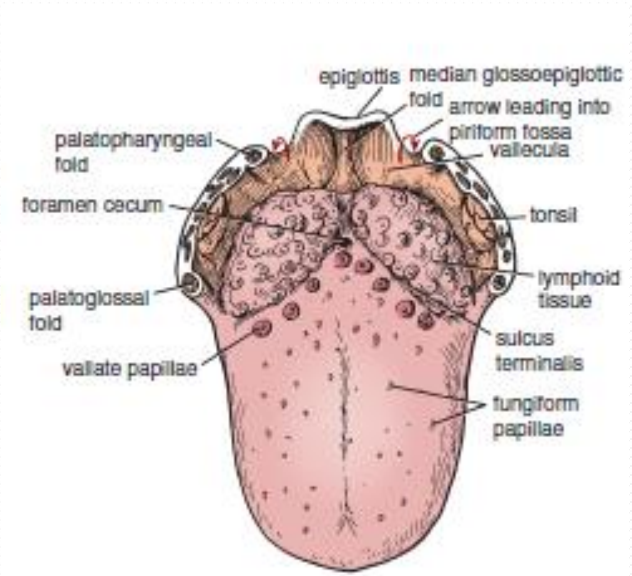
The Teeth

- **Deciduous Teeth**
- There are 20 deciduous teeth: four incisors, two canines, and four molars in each jaw.
- They begin to erupt about 6 months after birth and have all erupted by the end of 2 years. The teeth of the lower jaw usually appear before those of the upper jaw.
- **Permanent Teeth**
- There are 32 permanent teeth: 4 incisors, 2 canines, 4 premolars, and 6 molars in each jaw. They begin to erupt at 6 years of age. The last tooth to erupt is the third molar, which may happen between the ages of 17 and 30. The teeth of the lower jaw appear before those of the upper jaw.



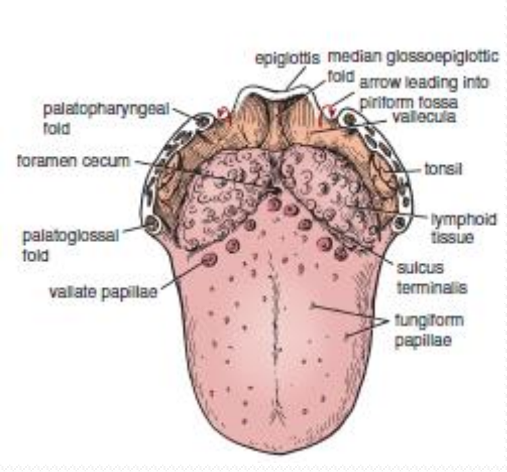
The Tongue

- The tongue is a mass of striated muscle covered with mucous membrane
- The muscles attach the tongue to the styloid process and the soft palate above and to the mandible and the hyoid bone below.
- The tongue is divided into right and left halves by a median **fibrous septum.**

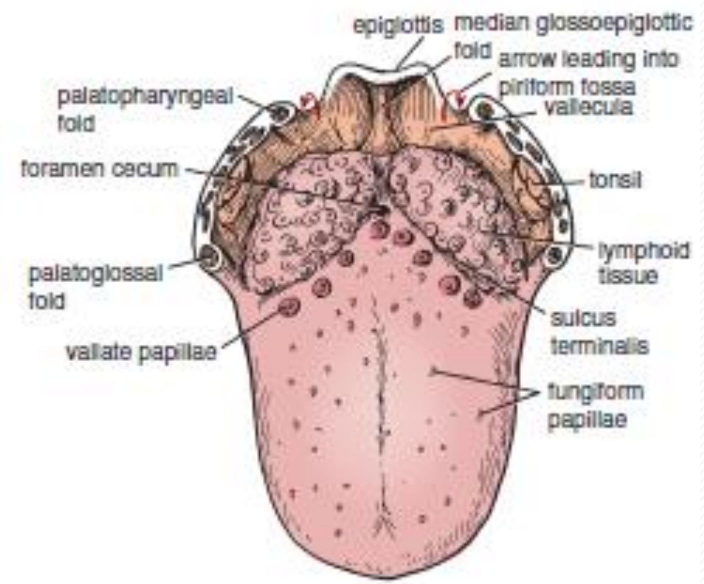


Mucous Membrane of the Tongue

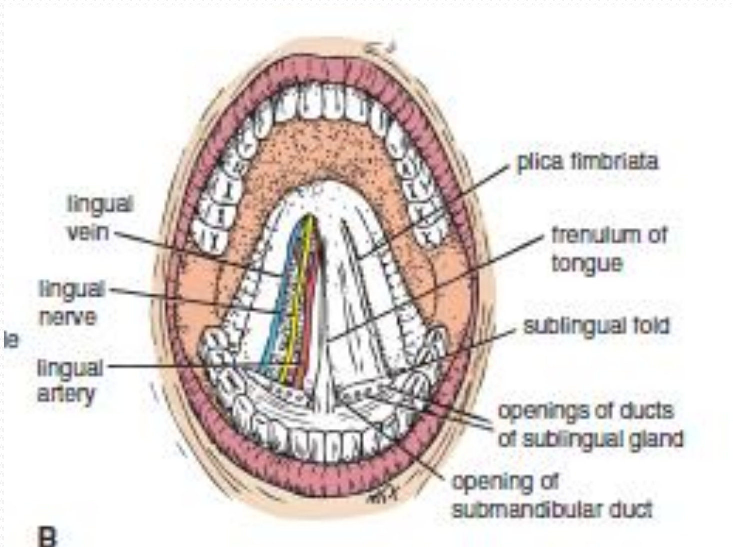
- The mucous membrane of the upper surface of the tongue can be divided into anterior and posterior parts by a V-shaped sulcus, the **sulcus terminalis**
- The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum.
- The sulcus serves to divide the tongue into the anterior two thirds, or oral part, and the posterior third, or pharyngeal part.
- The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct



- Three types of papillae are present on the upper surface of the anterior two thirds of the tongue: the **filiform papillae**, the **fungiform papillae**, and the **vallate papillae.**
- The mucous membrane covering the posterior third of the tongue is devoid of papillae but has an irregular surface caused by the presence of underlying lymph nodules, the **lingual tonsil.**



- The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth.
- In the midline anteriorly, the undersurface of the tongue is connected to the floor of the mouth by a fold of mucous membrane, the **frenulum of the tongue.**
- On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane. Lateral to the lingual vein, the mucous membrane forms a fringed fold called the **plica fimbriata**



Muscles of the Tongue

- The muscles of the tongue are divided into two types: intrinsic and extrinsic.
- Intrinsic Muscles
- These muscles are confined to the tongue and are not attached to bone. They consist of longitudinal, transverse, and vertical fibers.
- **Nerve supply:** Hypoglossal nerve
- **Action:** Alter the shape of the tongue

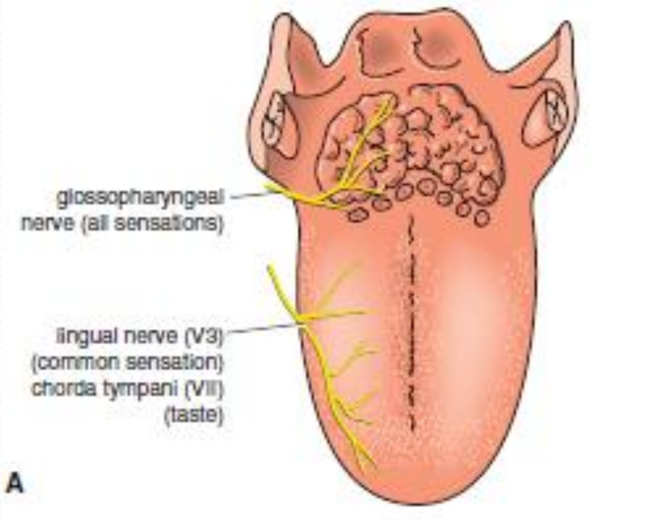
Extrinsic Muscles				
Genioglossus	Superior genial spine of mandible	Blends with other muscles of tongue	Hypoglossal nerve	Protrudes apex of tongue through mouth
Hyoglossus	Body and greater cornu of hyoid bone	Blends with other muscles of tongue	Hypoglossal nerve	Depresses tongue
Styloglossus	Styloid process of temporal bone	Blends with other muscles of tongue	Hypoglossal nerve	Draws tongue upward and backward
Palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus

- **Blood Supply**
- The lingual artery, the tonsillar branch of the facial artery, and the ascending pharyngeal artery supply the tongue.
- The veins drain into the internal jugular vein.

- **Lymph Drainage**
- **Tip:** Submental lymph nodes
- **Sides of the anterior two thirds:** Submandibular and deep cervical lymph nodes
- **Posterior third:** Deep cervical lymph nodes

Sensory Innervation

- **Anterior two thirds:** Lingual nerve branch of mandibular division of trigeminal nerve (general sensation) and chorda tympani branch of the facial nerve (taste)
- **Posterior third:** Glossopharyngeal nerve (general sensation and taste)



Movements of the Tongue

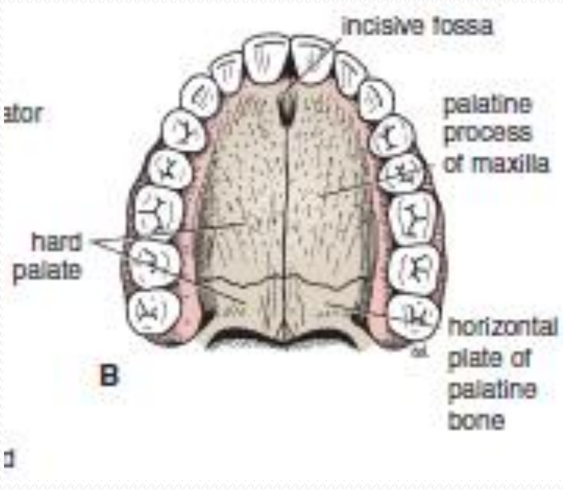
- **Protrusion:** The genioglossus muscles on both sides acting together
- **Retraction:** Styloglossus and hyoglossus muscles on both sides acting together
- **Depression:** Hyoglossus muscles on both sides acting
- together
- **Retraction and elevation of the posterior third:** Styloglossus and palatoglossus muscles on both sides acting together
- **Shape changes:** Intrinsic muscles

The Palate

- The palate forms the roof of the mouth and the floor of the nasal cavity. It is divided into two parts: the hard palate in front and the soft palate behind.

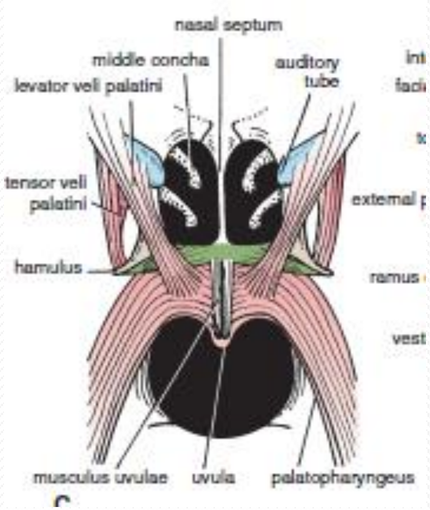
❑ Hard Palate

- The hard palate is formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones
- It is continuous behind with the soft palate.



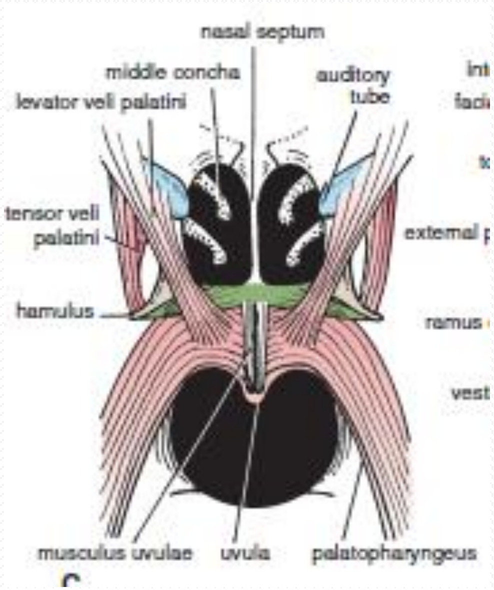
Soft Palate

- The soft palate is a mobile fold attached to the posterior
- border of the hard palate
- Its free posterior border presents in the midline a conical projection called the **uvula.**
- The soft palate is continuous at the sides with the lateral wall of the pharynx.
- The soft palate is composed of mucous membrane, palatine aponeurosis, and muscles.



Mucous Membrane

- The mucous membrane covers the upper and lower surfaces of the soft palate.
- **Palatine Aponeurosis**
- The palatine aponeurosis is a fibrous sheet attached to the posterior border of the hard palate. It is the expanded tendon of the tensor veli palatini muscle.



Muscles of the Soft Palate

- The muscles of the soft palate are the tensor veli palatini, the levator veli palatini, the palatoglossus, the palatopharyngeus, and the musculus uvulae
- The muscle fibers of the tensor veli palatini converge as they descend from their origin to form a narrow tendon, which turns medially around the pterygoid hamulus.
- The tendon, together with the tendon of the opposite side, expands to form the palatine aponeurosis.
- When the muscles of the two sides contract, the soft palate is tightened so that the soft palate may be moved upward or downward as a tense sheet.

Nerve Supply of the Palate

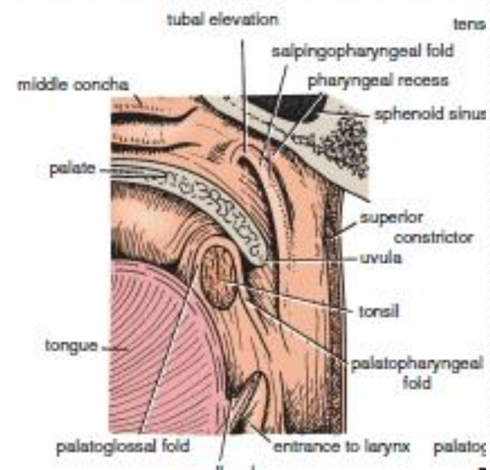
- The greater and lesser palatine nerves from the maxillary division of the trigeminal nerve enter the palate through the greater and lesser palatine foramina
- The nasopalatine nerve, also a branch of the maxillary nerve, enters the front of the hard palate through the incisive foramen.
- The glossopharyngeal nerve also supplies the soft palate.

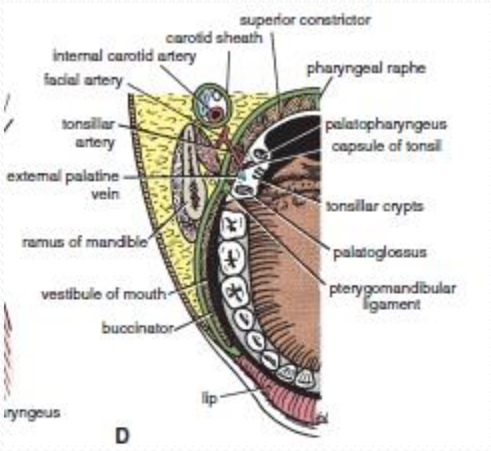
Blood Supply of the Palate

- The greater palatine branch of the maxillary artery, the
- ascending palatine branch of the facial artery, and the
- ascending pharyngeal artery

- **Lymph Drainage of the Palate**
- Deep Cervical Lymph Nodes

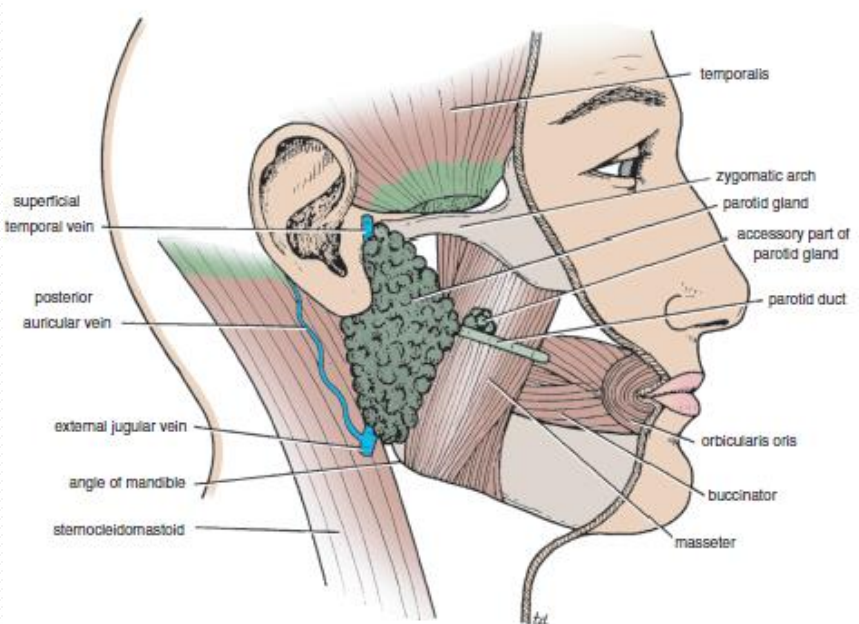
- **Palatoglossal Arch** The palatoglossal arch is a fold of mucous membrane containing the **palatoglossus muscle**, which extends from the soft palate to the side of the tongue. **The palatoglossal arch marks where the mouth becomes the pharynx.**
- **Palatopharyngeal Arch** The palatopharyngeal arch is a fold of mucous membrane behind the palatoglossal arch that runs downward and laterally to join the pharyngeal wall. The muscle contained within the fold is the **palatopharyngeus muscle.**
- The **palatine tonsils**, which are masses of lymphoid tissue, are located between the palatoglossal and palatopharyngeal arches



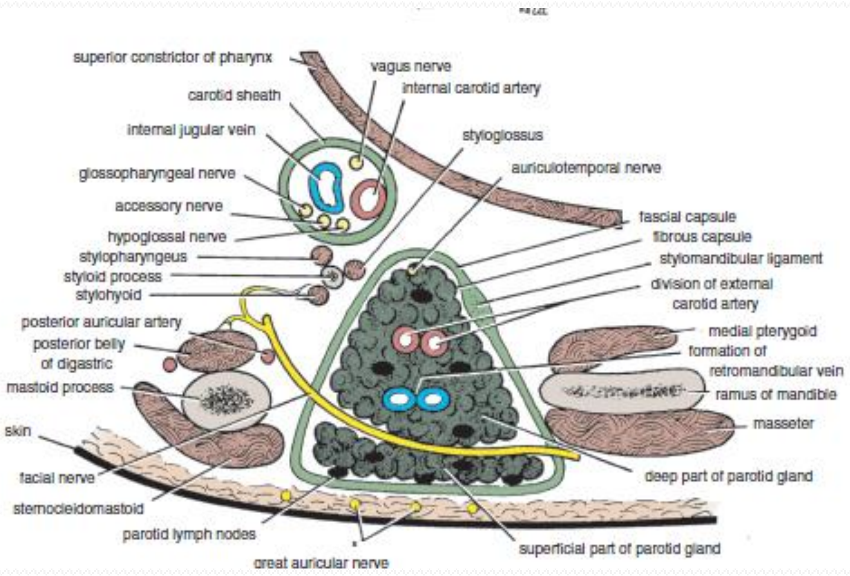


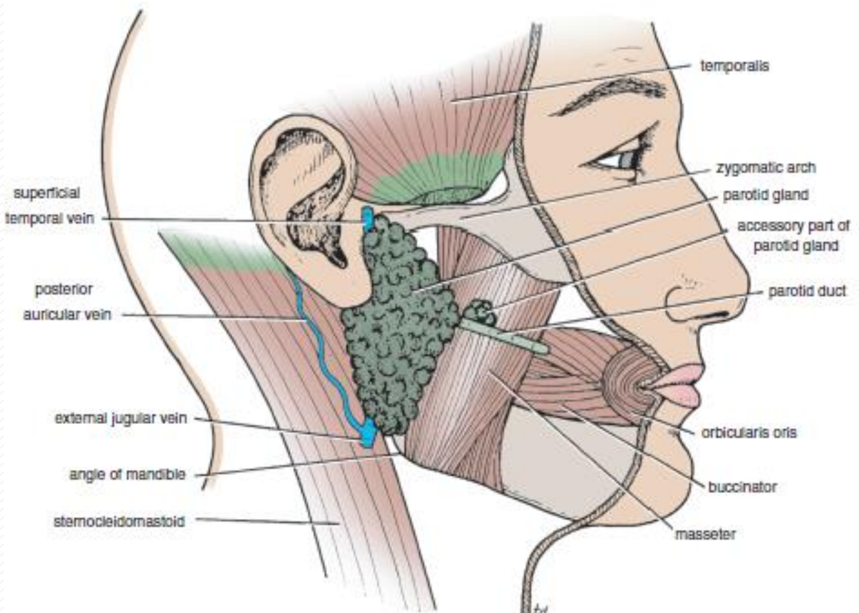
The Salivary Glands

- **Parotid Gland**
- The parotid gland is the largest salivary gland and is composed mostly of serous acini.
- It lies in a deep hollow below the external auditory meatus, behind the ramus of the mandible and in front of the sternocleidomastoid muscle.
-



- The facial nerve divides the gland into **superficial** and **deep lobes.**
- The parotid duct emerges from the anterior border of the gland and passes forward over the lateral surface of the masseter. It enters the vestibule of the mouth upon a small papilla opposite the upper second molar tooth

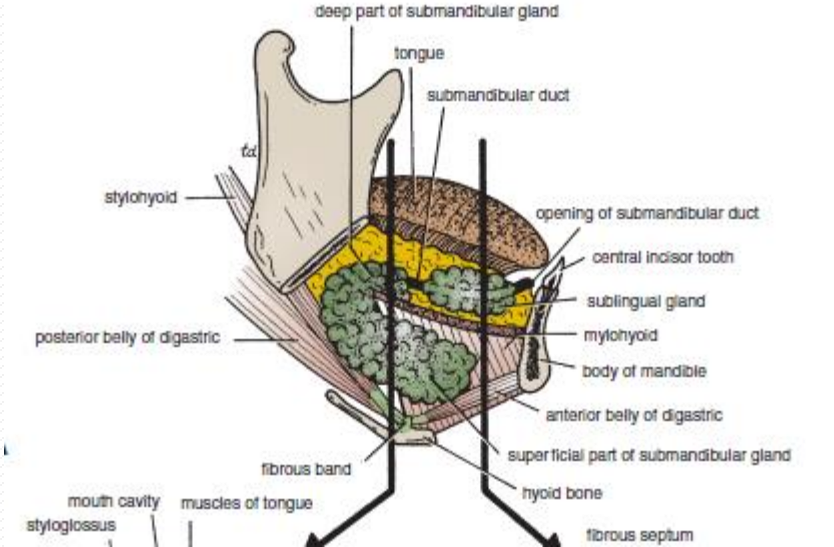




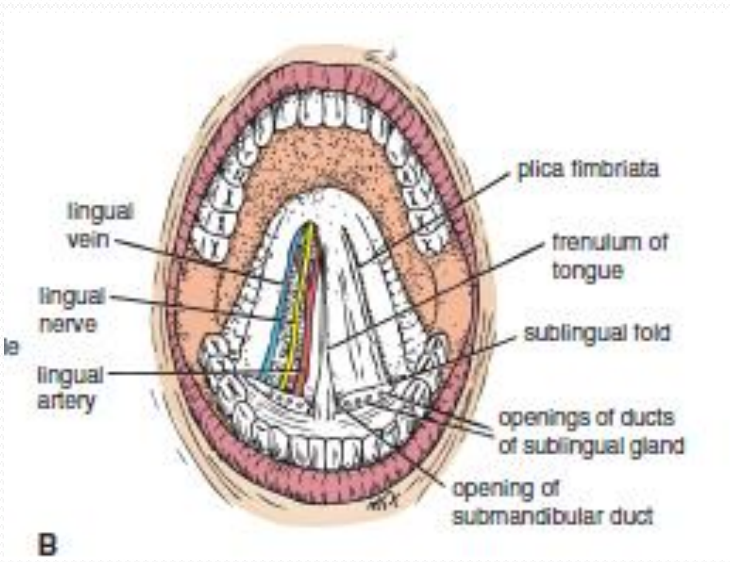
- **Nerve Supply**
- Parasympathetic secretomotor supply arises from the glossopharyngeal nerve.
- The nerves reach the gland via the tympanic branch, the lesser petrosal nerve, the otic ganglion, and the auriculotemporal nerve.

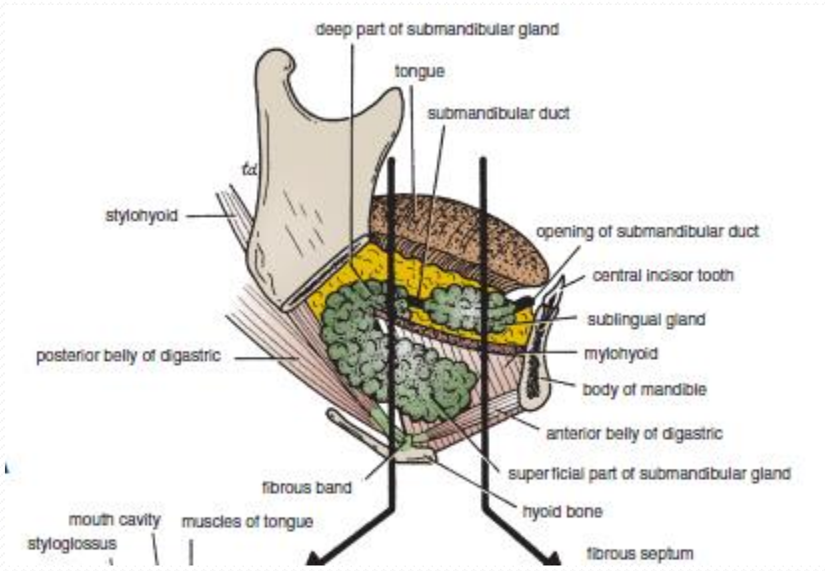
Submandibular Gland

- The submandibular gland consists of a mixture of serous and mucous acini.
- It lies beneath the lower border of the body of the mandible and is divided into superficial and deep parts by the mylohyoid muscle.
- The deep part of the gland lies beneath the mucous membrane of the mouth on the side of the tongue.



- The submandibular duct emerges from the anterior end of the deep part of the gland and runs forward beneath the mucous membrane of the mouth.
- It opens into the mouth on a small papilla, which is situated at the side of the frenulum of the tongue





- **Nerve Supply**
- Parasympathetic secretomotor supply is from the facial nerve via the chorda tympani, and the submandibular ganglion.
- The postganglionic fibers pass directly to the gland.

Sublingual Gland

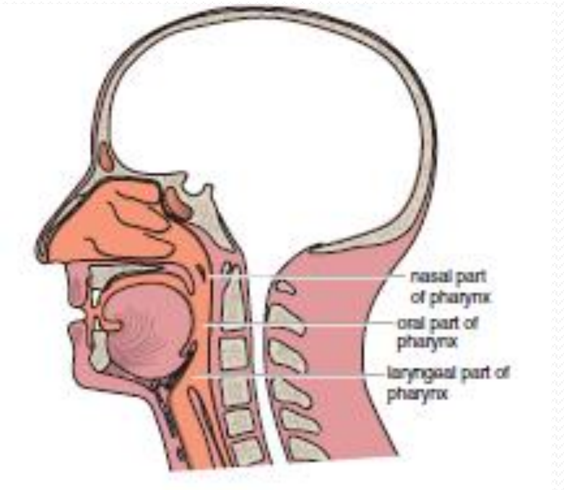
- The sublingual gland lies beneath the mucous membrane (sublingual fold) of the floor of the mouth, close to the frenulum of the tongue
- It has both serous and mucous acini, with the latter predominating.
- The **sublingual ducts** (8 to 20 in number) open into the mouth on the summit of the sublingual fold
- **Nerve Supply**
- Parasympathetic secretomotor supply is from the facial nerve via the chorda tympani, and the submandibular ganglion.
- Postganglionic fibers pass directly to the gland

The Pharynx

Dr Ahmed Jassam Alnaqeeb

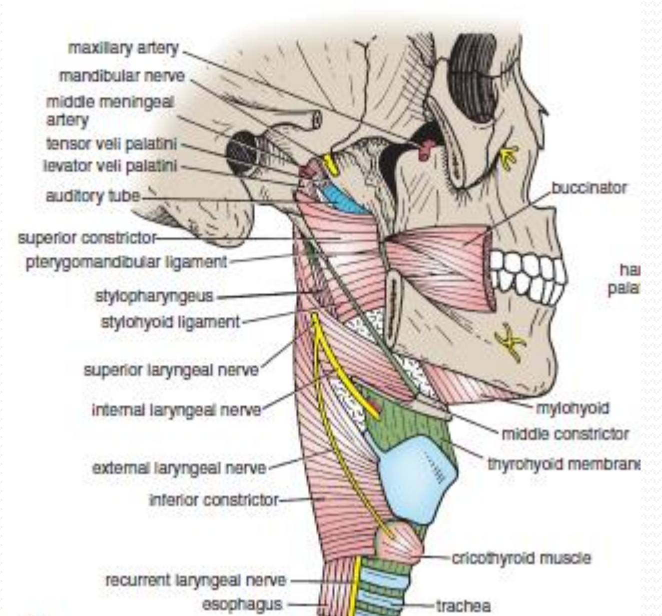
The Pharynx

- The pharynx is funnel shaped, its upper, wider end lying under the skull and its lower, narrow end becoming continuous with the esophagus
- divided into **nasal**, **oral**, and **laryngeal parts.**
- The pharynx has a musculomembranous wall
- By means of the auditory tube, the mucous membrane is also continuous with that of the tympanic cavity.



Muscles of the Pharynx

- The muscles in the wall of the pharynx consist of
- **superior, middle, and inferior constrictor muscles** whose fibers run in a somewhat circular direction
- **stylopharyngeus** and **salpingopharyngeus muscles**, whose fibers run in a somewhat longitudinal direction.



- The three constrictor muscles extend around the pharyngeal wall to be inserted into a fibrous band or raphe that extends from the pharyngeal tubercle on the basilar part of the occipital bone of the skull down to the esophagus.
- The three constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor

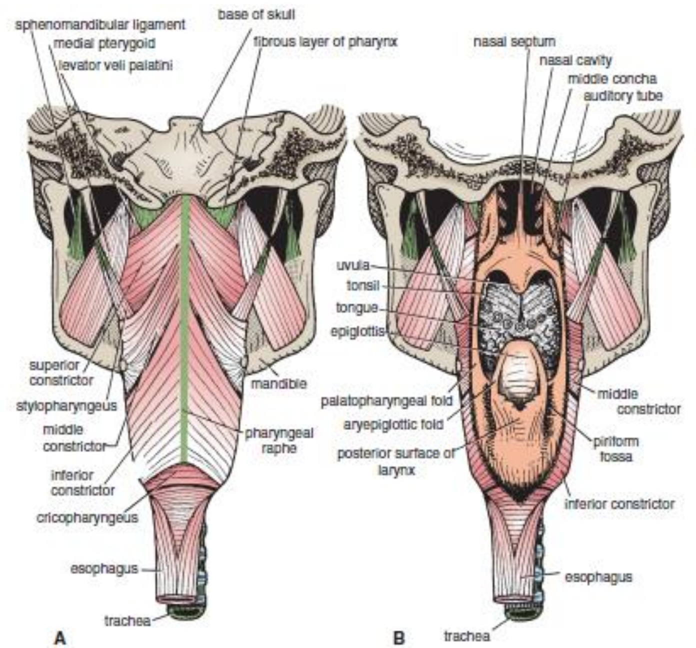
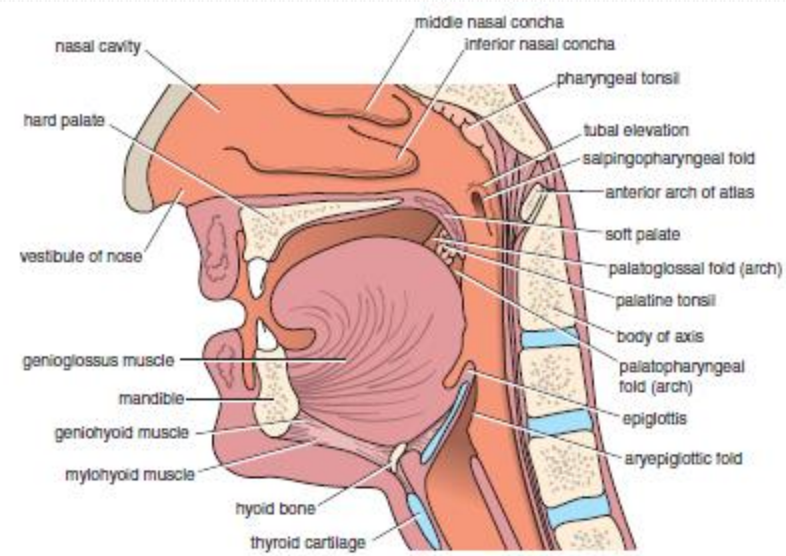


TABLE 11.10 Muscles of the Pharynx

Muscle	Origin	Insertion	Nerve Supply	Action
Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible	Pharyngeal tubercle of occipital bone, raphe in midline posteriorly	Pharyngeal plexus	Aids soft palate in closing off nasal pharynx, propels bolus downward
Middle constrictor	Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Inferior constrictor	Lamina of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Cricopharyngeus	Lowest fibers of inferior constrictor muscle			Sphincter at lower end of pharynx
Stylopharyngeus	Styloid process of temporal bone	Posterior border of thyroid cartilage	Glossopharyngeal nerve	Elevates larynx during swallowing
Salpingopharyngeus	Auditory tube	Blends with palatopharyngeus	Pharyngeal plexus	Elevates pharynx
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Pharyngeal plexus	Elevates wall of pharynx, pulls palatopharyngeal arch medially

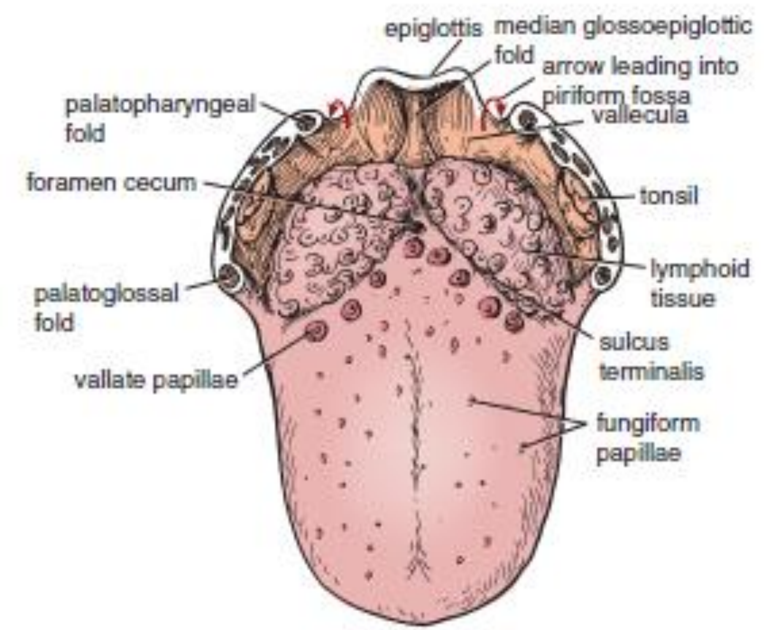
Interior of the Pharynx

- **Nasal Pharynx**
- This lies above the soft palate and behind the nasal cavities
- In the submucosa of the roof is a collection of lymphoid tissue called the **pharyngeal tonsil**
- The pharyngeal isthmus is the opening in the floor between the soft palate and the posterior pharyngeal wall.
- On the lateral wall is the opening of the **auditory tube,** the elevated ridge of which is called the **tubal elevation**
- The **pharyngeal recess** is a depression behind the tubal elevation.
- The **salpingopharyngeal fold** is a vertical fold of mucous membrane covering the salpingopharyngeus muscle.

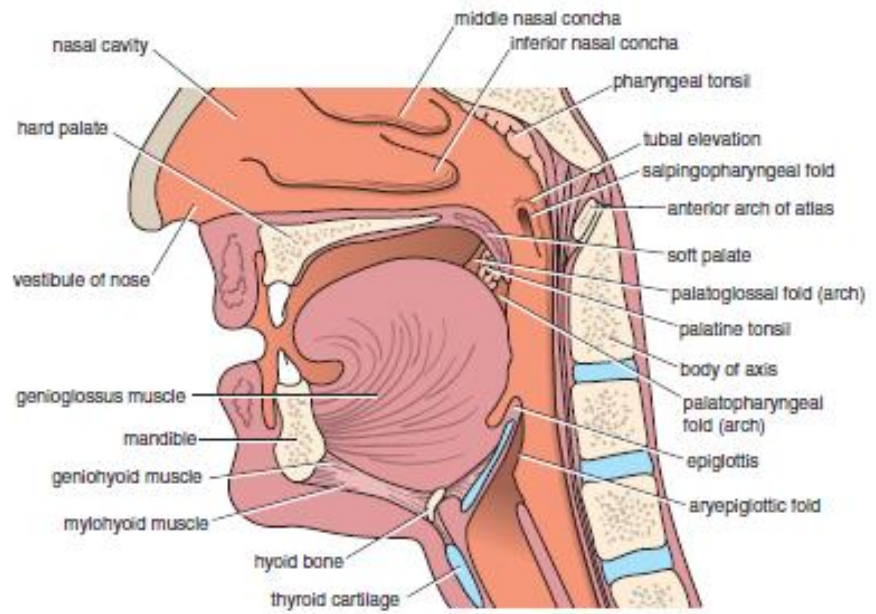


Oral Pharynx

- This lies behind the oral cavity
- The floor is formed by the posterior one third of the tongue and the interval between the tongue and epiglottis.
- In the midline is the **median glossoepiglottic fold** and on each side the **lateral glossoepiglottic fold.**
- The depression on each side of the median glossoepiglottic fold is called the **vallecula**

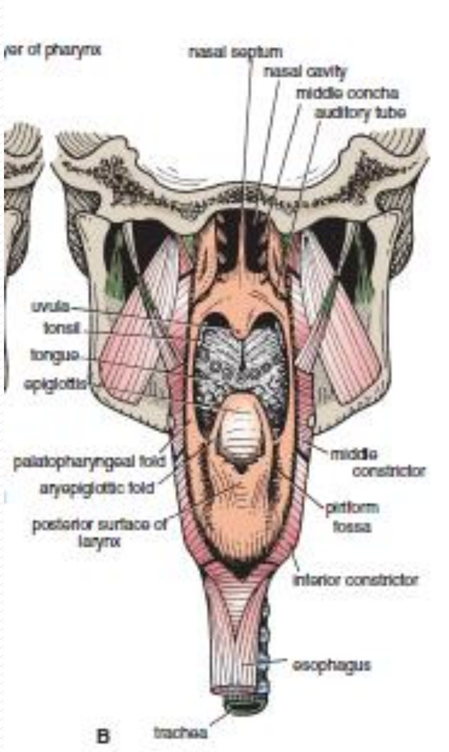


- On the lateral wall on each side are the **palatoglossal** and the **palatopharyngeal arches or folds** and the **palatine tonsils** between them
- The interval between the two palatoglossal arches is called the **oropharyngeal isthmus** and marks the boundary between the mouth and pharynx.
- The recess between the palatoglossal and palatopharyngeal arches is occupied by the **palatine tonsil.**



Laryngeal Pharynx

- This lies behind the opening into the larynx
- The lateral wall is formed by the thyroid cartilage and the thyrohyoid membrane.
- The **piriform fossa** is a depression in the mucous membrane on each side of the laryngeal inlet



❑ Sensory Nerve Supply of the Pharyngeal Mucous Membrane

- **Nasal pharynx:** The maxillary nerve (V2)
- **Oral pharynx:** The glossopharyngeal nerve
- **Laryngeal pharynx** (around the entrance into the larynx):
- The internal laryngeal branch of the vagus nerve

❑ Blood Supply of the Pharynx

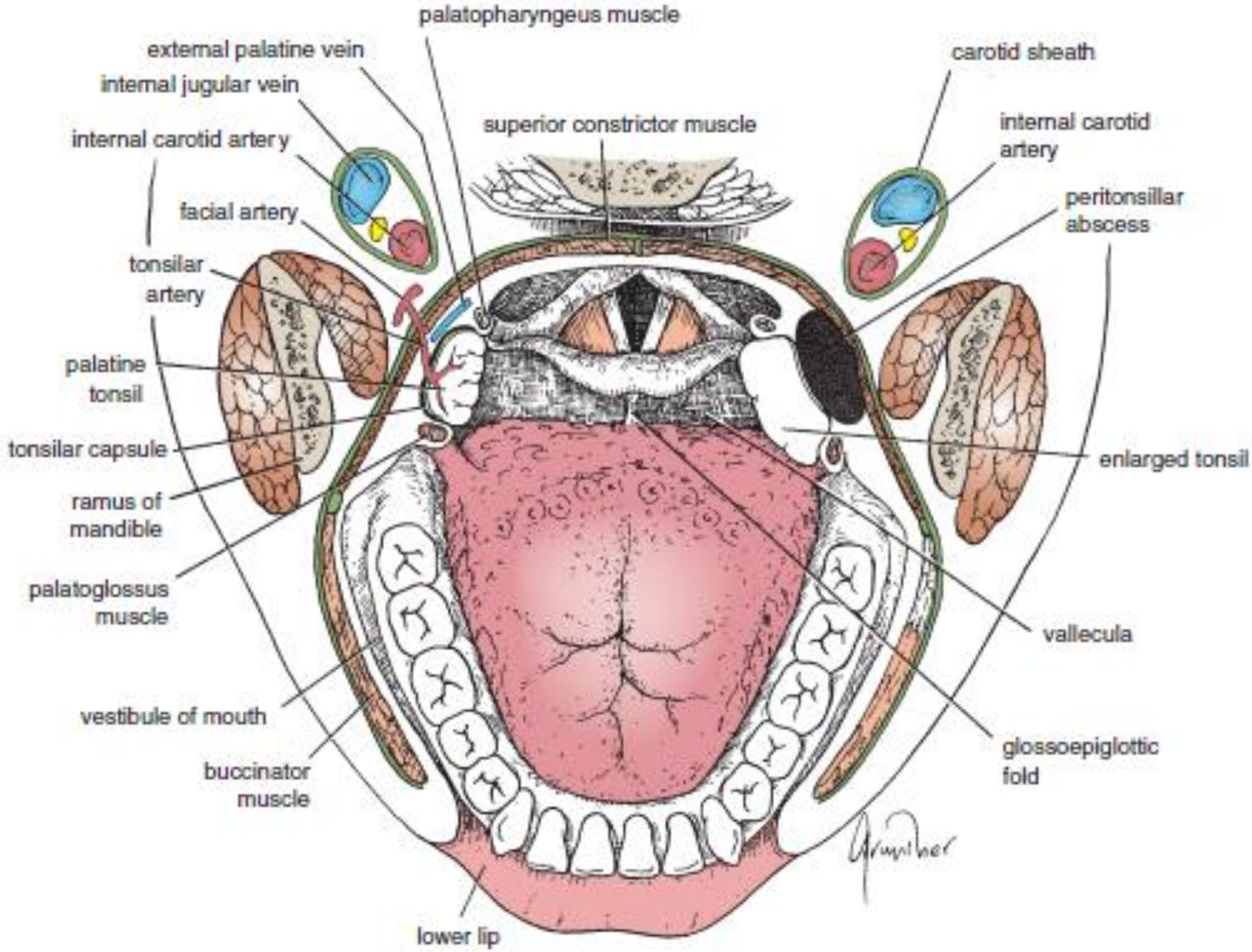
- Ascending pharyngeal, tonsillar branches of facial arteries and branches of maxillary and lingual arteries

❑ Lymph Drainage of the Pharynx

- Directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes into the deep cervical nodes

Palatine Tonsils

- The palatine tonsils are two masses of lymphoid tissue, each located in the depression on the lateral wall of the oral part of the pharynx between the palatoglossal and palatopharyngeal arches
- Each tonsil is covered by mucous membrane, and its free medial surface projects into the pharynx.
- The surface is pitted by numerous small openings that lead into the **tonsillar crypts.**
- The tonsil is covered on its lateral surface by a **fibrous capsule** which is separated from the superior constrictor muscle by loose areolar tissue and the external palatine vein descends from the soft palate in this tissue to join the pharyngeal venous plexus.
- Lateral to the superior constrictor muscle lie the styloglossus muscle, the loop of the facial artery, and the internal carotid artery.


palatopharyngeus muscle
external palatine vein
internal jugular vein
internal carotid artery
facial artery
tonsilar artery
palatine tonsil
tonsilar capsule
ramus of mandible
palatoglossus muscle
vestibule of mouth
buccinator muscle
lower lip
superior constrictor muscle
carotid sheath
internal carotid artery
peritonsillar abscess
enlarged tonsil
vallecula
glossoepiglottic fold

- **Blood Supply**
- The tonsillar branch of the facial artery.
- The veins pierce the superior constrictor muscle and join the external palatine, the pharyngeal, or the facial veins.
- **Lymph Drainage of the Tonsil**
- The upper deep cervical lymph nodes, just below and behind the angle of the mandible.

Waldeyer's Ring of Lymphoid Tissue

- The lymphoid tissue that surrounds the opening into the respiratory and digestive systems forms a ring.
- The lateral part of the ring is formed by the palatine tonsils and tubal tonsils (lymphoid tissue around the opening of the auditory tube in the lateral wall of the nasopharynx).
- The pharyngeal tonsil in the roof of the nasopharynx forms the upper part,
- the lingual tonsil on the posterior third of the tongue forms the lower part

The Esophagus

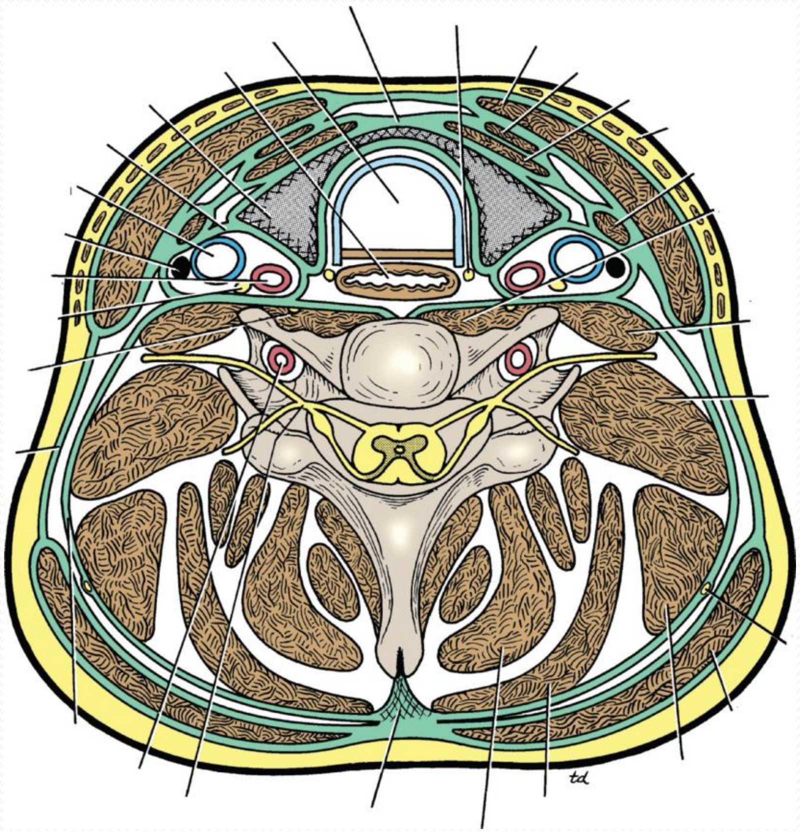
- The esophagus is a muscular tube about 10 in. (25 cm) long, extending from the pharynx to the stomach.
- It begins at the level of the cricoid cartilage, opposite the body of the sixth cervical vertebra.
- It commences in the midline, but as it descends through the neck, it inclines to the left side

Relations in the Neck

- **Anteriorly:** The trachea; the recurrent laryngeal nerves ascend one on each side, in the groove between the trachea and the esophagus

- **Posteriorly:** The prevertebral layer of deep cervical fascia, the longus colli and the vertebral column

- **Laterally:** On each side lie the lobe of the thyroid gland and the carotid sheath



- ## Blood Supply in the Neck
- The **arteries** of the esophagus in the neck are derived from the inferior thyroid arteries. The **veins** drain into the inferior thyroid veins.

- ## Lymph Drainage in the Neck
- The lymph vessels drain into the deep cervical lymph nodes.

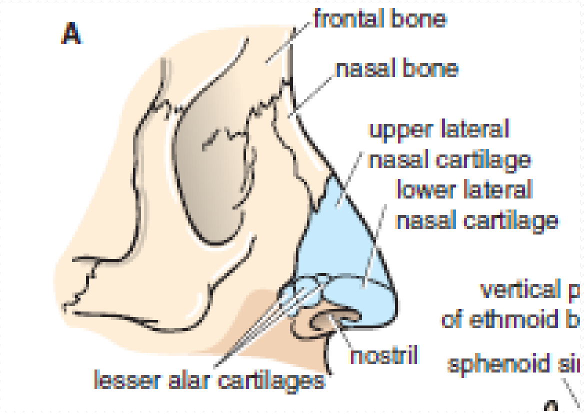
- ## Nerve Supply in the Neck
- The nerves are derived from the recurrent laryngeal nerves and from the sympathetic trunks

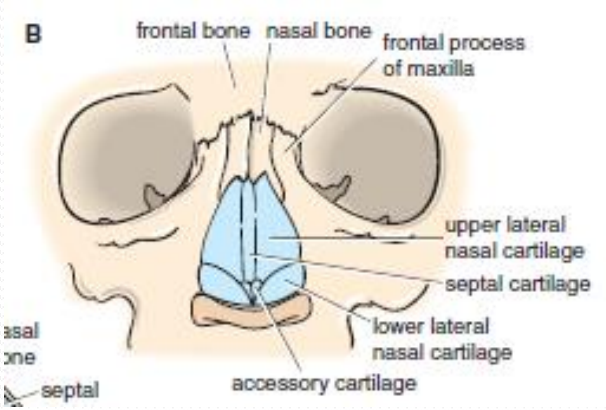
The Respiratory System in the Head and Neck

Dr. Ahmed Jassam Alnaqeeb

The Nose

- **External Nose**
- The external nose has two elliptical orifices called the **nostrils**, which are separated from each other by the **nasal septum**
- The lateral margin, the **ala nasi,** is rounded and mobile.
- The framework of the external nose is made up above by the nasal bones, the frontal processes of the maxillae, and the nasal part of the frontal bone. Below, the framework is formed of plates of hyaline cartilage





Blood Supply of the External Nose

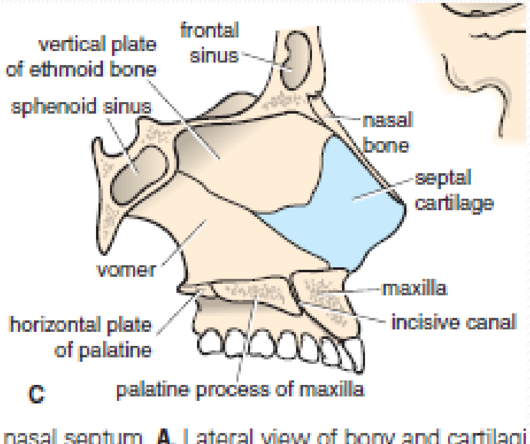
- The skin of the external nose is supplied by branches of the **ophthalmic** and the **maxillary** arteries
- The skin of the ala and the lower part of the septum are supplied by branches from the **facial artery**

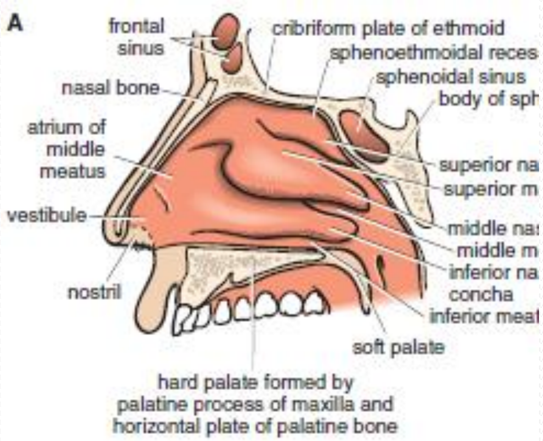
Nerve Supply of the External Nose

- **infratrochlear** and **external nasal** branches of the ophthalmic nerve (CN V)
- **infraorbital** branch of the maxillary nerve (CN V)

Nasal Cavity

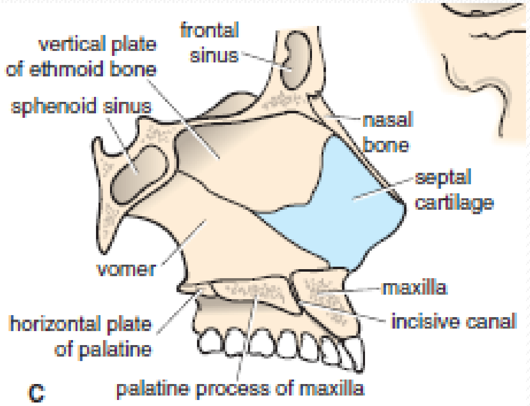
- The nasal cavity extends from the nostrils in front to the **posterior nasal apertures** or **choanae** behind
- The **nasal vestibule** is the area of the nasal cavity lying just inside the nostril
- The nasal cavity is divided into right and left halves by the **nasal septum**
- The septum is made up of the **septal cartilage**, the **vertical plate of the ethmoid**, and the **vomer.**



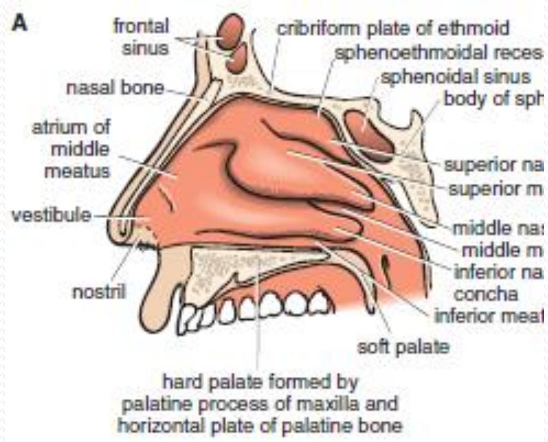


Walls of the Nasal Cavity

- **Floor**
- The palatine process of the maxilla and the horizontal plate of the palatine bone
- **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 the ethmoid, located beneath the anterior cranial fossa
- posteriorly by the downward sloping body of the sphenoid

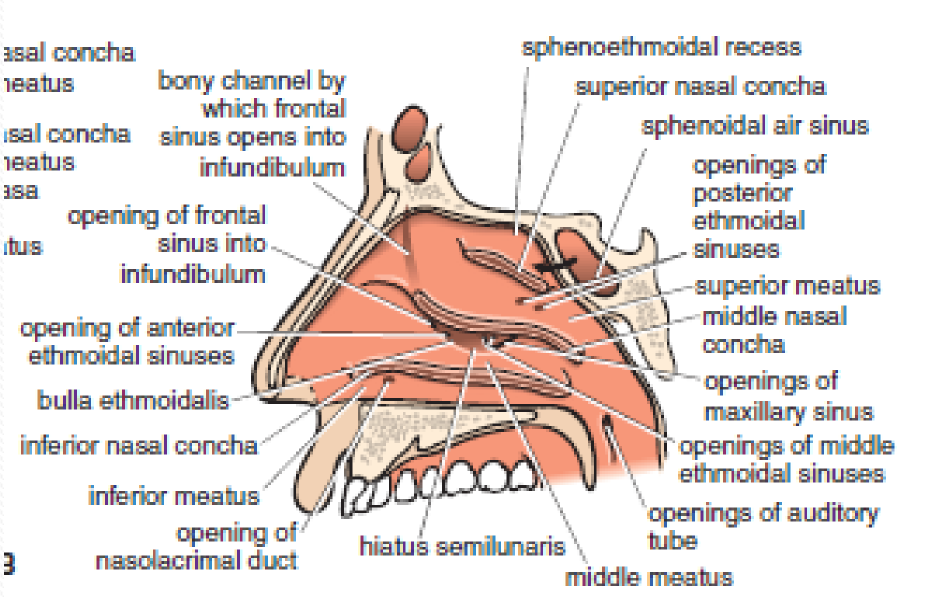


nasal septum. **A.** Lateral view of bony and cartilagi



Lateral Wall

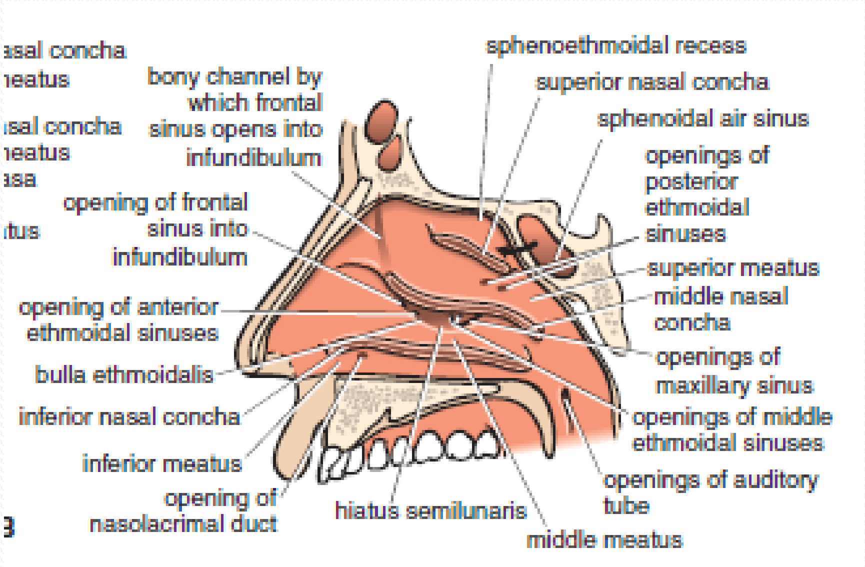
- The lateral wall has three projections of bone called the **superior, middle,** and **inferior nasal conchae**
- The space below each concha is called a **meatus.**
- **Sphenoethmoidal Recess** : is a small area above the superior concha. It receives the opening of the **sphenoid air sinus**
- **Superior Meatus** The superior meatus lies below the superior concha. It receives the openings of the **posterior ethmoid sinuses.**



Lateral Wall

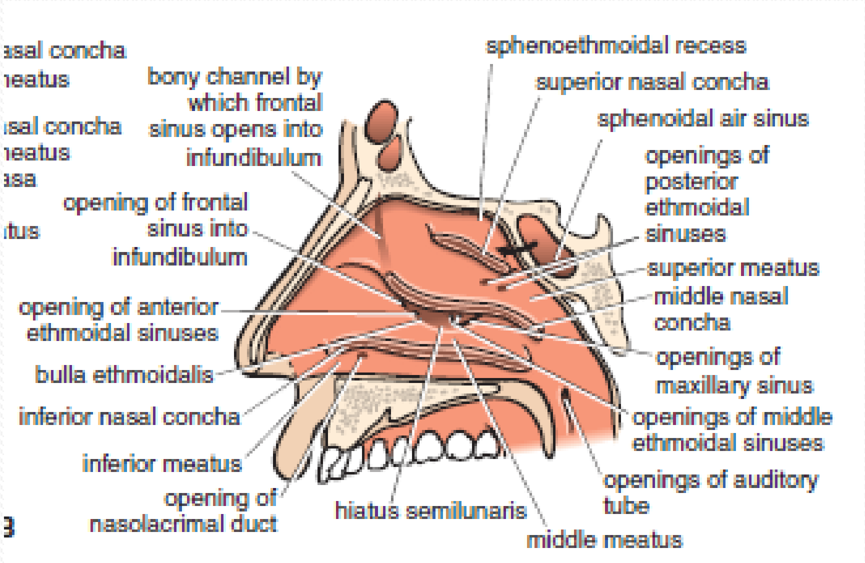
- **Middle Meatus** The middle meatus lies below the middle concha. It has a rounded swelling called the **bulla ethmoidalis** that is formed by the **middle ethmoidal air sinuses**, which open on its upper border.
- A curved opening, the **hiatus semilunaris,** lies just below the bulla. The anterior end of the hiatus leads into a funnel-shaped channel called the **infundibulum**, which is continuous with the
- **frontal sinus.** The **maxillary sinus** opens into the middle meatus through the

  hiatus semilunaris.



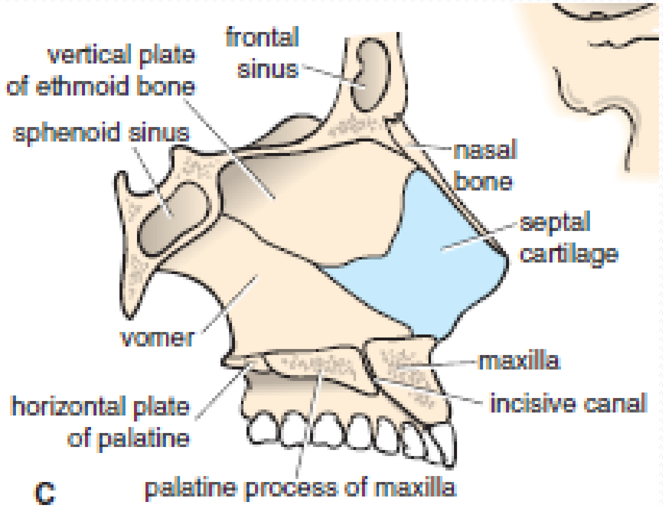
Lateral Wall

- **Inferior Meatus**
- The inferior meatus lies below the inferior concha and receives the opening of the lower end of the **nasolacrimal duct**, which is guarded by a fold of mucous membrane



Medial Wall

- The medial wall is formed by the nasal septum.
- The upper part is formed by the vertical plate of the ethmoid and the vomer
- The anterior part is formed by the 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.



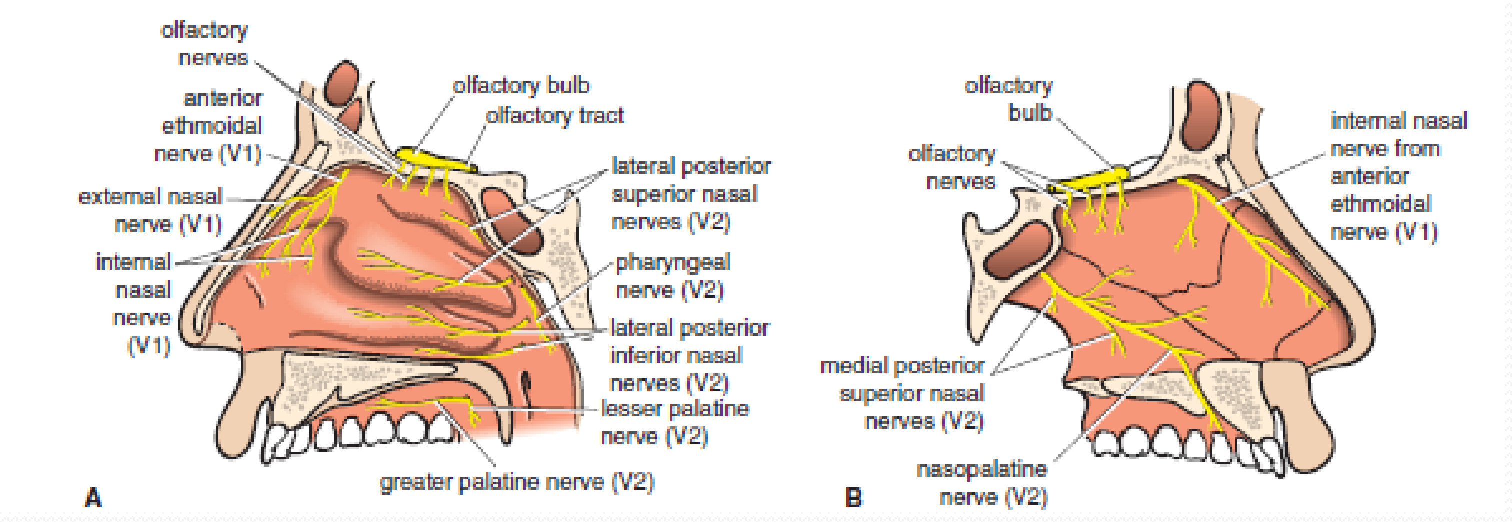
nasal septum. A. Lateral view of bony and cartilagi

Mucous Membrane of the Nasal Cavity

- The vestibule is lined with modified skin and has coarse hairs.
- The area above the superior concha is lined with olfactory mucous membrane and contains nerve endings sensitive to the reception of smell.
- The lower part of the nasal cavity is lined with respiratory mucous membrane.
- A large plexus of veins in the submucous connective tissue is present in the respiratory region which serves to heat up the inspired air
- presence of mucus on the surfaces of the conchae traps foreign particles and organisms in the inspired air

Nerve Supply of the Nasal Cavity

- The olfactory nerves from the olfactory mucous membrane ascend through the cribriform plate of the ethmoid bone to the olfactory bulbs
- The nerves of ordinary sensation are branches of the ophthalmic division (V1) and the maxillary division (V2) of the trigeminal nerve

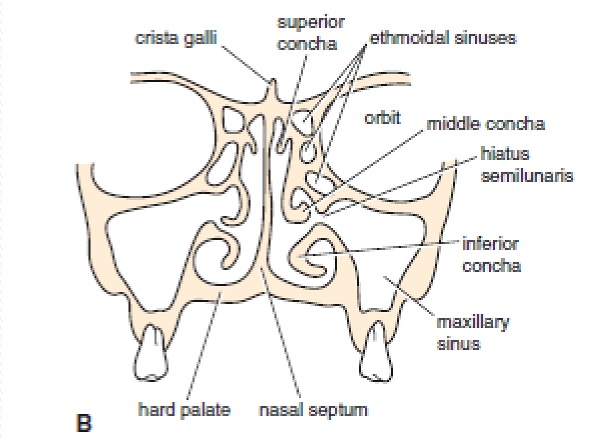


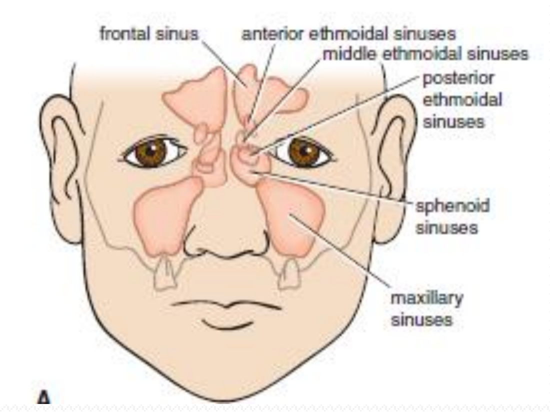
- **Blood Supply to the Nasal Cavity**
- The arterial supply to the nasal cavity is from branches of the **maxillary** artery.
- The most important branch is the **sphenopalatine** artery which anastomoses with the **septal** branch of the superior labial branch of the facial artery in the region of the vestibule.
- The submucous venous plexus is drained by veins that accompany the arteries.

- **Lymph Drainage of the Nasal Cavity**
- The lymph vessels draining the vestibule end in the submandibular nodes.
- The remainder of the nasal cavity is drained by vessels that pass to the upper deep cervical nodes.

The Paranasal Sinuses

- The paranasal sinuses are cavities found in the interior of the maxilla, frontal, sphenoid, and ethmoid bones
- They are lined with mucoperiosteum and filled with air; they communicate with the nasal cavity through relatively small apertures.
- The maxillary and sphenoidal sinuses are present in a rudimentary form at birth; they enlarge appreciably after the eighth year and become fully formed in adolescence.



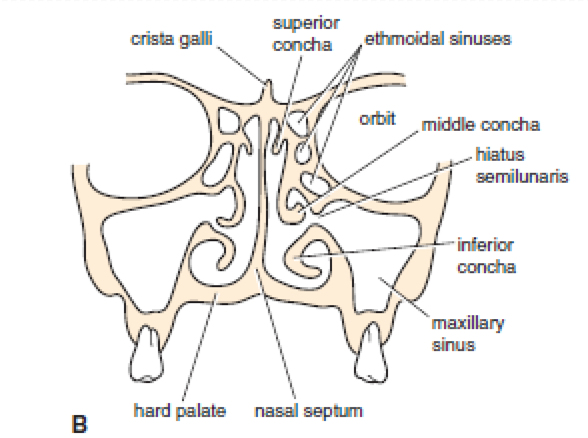


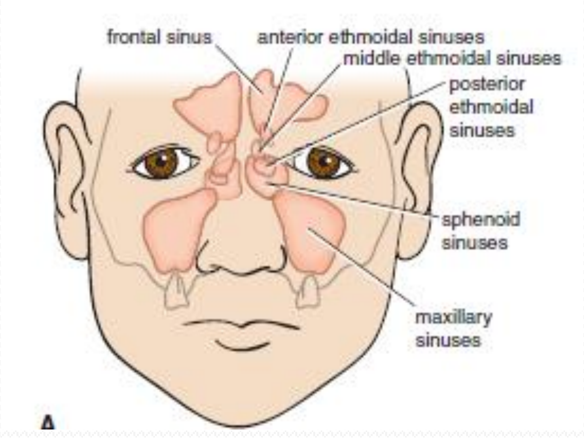
Drainage of Mucus and Function of Paranasal Sinuses

- The mucus produced by the mucous membrane is moved into the nose by ciliary action of the columnar cells.
- Drainage is also achieved by the siphon action created during the blowing of the nose.
- The function of the sinuses is to act as resonators to the voice; they also reduce the weight of the skull.

Maxillary Sinus

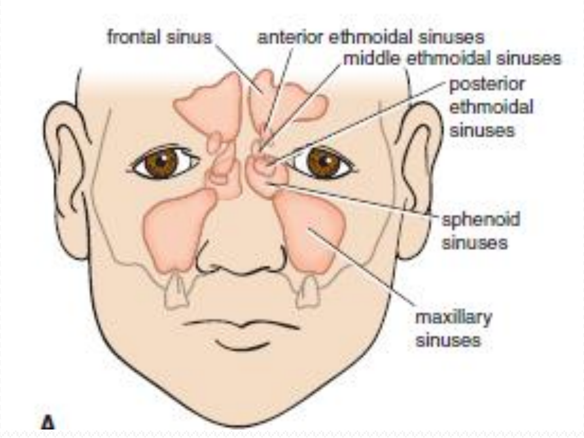
- The maxillary sinus is pyramidal in shape and located within the body of the maxilla behind the skin of the cheek
- The roof is formed by the floor of the orbit
- the floor is related to the roots of the premolars and molar teeth.
- The maxillary sinus opens into the middle meatus of the nose through the hiatus semilunaris





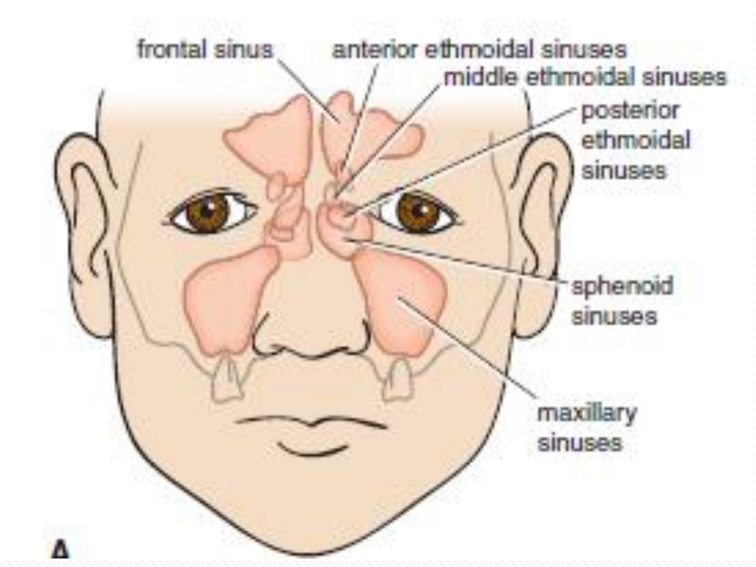
Frontal Sinuses

- The two frontal sinuses are contained within the frontal bone
- They are separated from each other by a bony septum.
- Each sinus is roughly triangular, extending upward above the medial end of the eyebrow and backward into the medial part of the roof of the orbit.
- Each frontal sinus opens into the middle meatus of the nose through the infundibulum



Sphenoidal Sinuses

- The two sphenoidal sinuses lie within the body of the sphenoid bone
- Each sinus opens into the sphenoethmoidal recess above the superior concha.



Ethmoid Sinuses

- The ethmoidal sinuses are anterior, middle, and posterior and they are contained within the ethmoid bone
- The anterior sinuses open into the infundibulum
- the middle sinuses open into the middle meatus, on or above the bulla ethmoidalis
- the posterior sinuses open into the superior meatus.