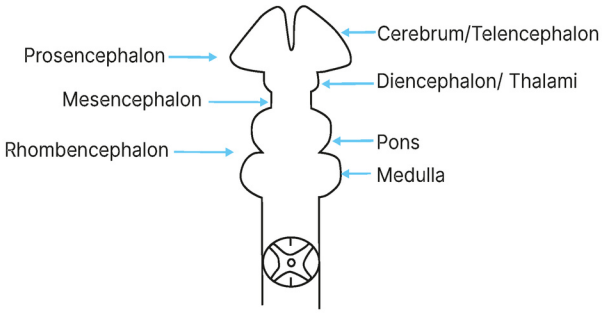
1. NEUROANATOMY

00:00:48

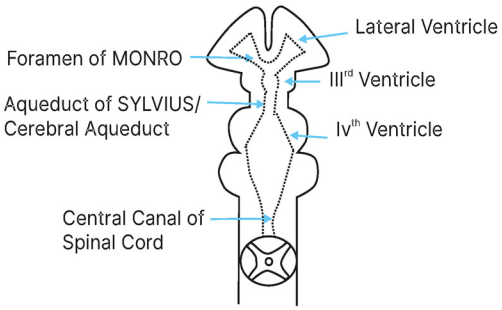
BRAIN/ENCEPHALON

- Prosencephalon → Forebrain
  - Cerebrum/Telencephalon
  - Thalami/Diencephalon
- Mesencephalon → Midbrain
- Rhombencephalon → Hindbrain
  - Cerebellum + pons → Metencephalon
  - Medulla → Myelencephalon



VENTRICLES OF BRAIN

- Lateral Ventricle - Present in Cerebrum/Telencephalon
- IIIrd Ventricle - Present in Thalamus/Diencephalon
- IVth Ventricle - Present in Hindbrain/Rhombencephalon



CSF FLOW DIRECTION

Lateral Ventricles (CSF is produced here by the choroid plexus)

↓

Foramen of Monro (Interventricular Foramen)

↓

Third Ventricle

↓

Cerebral Aqueduct/Aqueduct of SYLVIUS (located in midbrain)

↓

Fourth Ventricle

↓

Foramen of LUSCHKA (2 Lateral Foramen)
Foramen of MAGENDIE (1 Mid Line Foramen)

↓

Subarachnoid Space

↓

Dural Venous Sinuses (Majority into Superior Sagittal Sinuses)

FMGE 2025

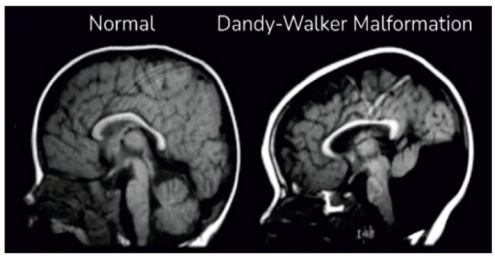
AQUEDUCTAL STENOSIS

- Block in the Aqueduct of Sylvius/ Cerebral aqueduct leads to dilatation of IIIrd ventricle
- M/c cause of congenital hydrocephalus: Congenital Aqueductal stenosis

Yourwish

DANDY WALKER SYNDROME

- Atresia of foramina of Luschka and Magendie leads to dilatation of the IVth ventricle.



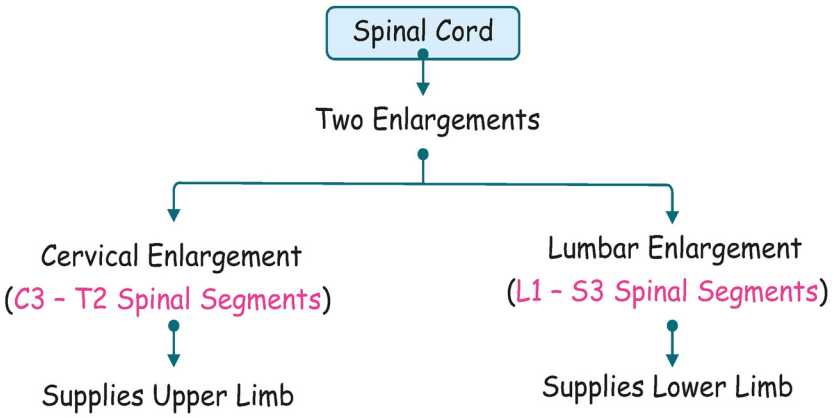
SPINAL CORD

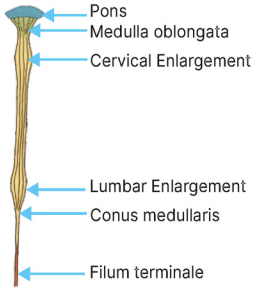
00:12:22

Extent

- Adults - C1 to lower border of L1 vertebrae
- Neonates - C1 to upper border of L3 vertebrae
- In the adult, the spinal cord terminates on average at the level of the middle third of the body of the first lumbar vertebra.

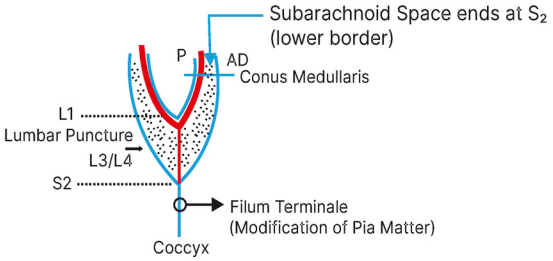
SPINAL CORD ENLARGEMENTS



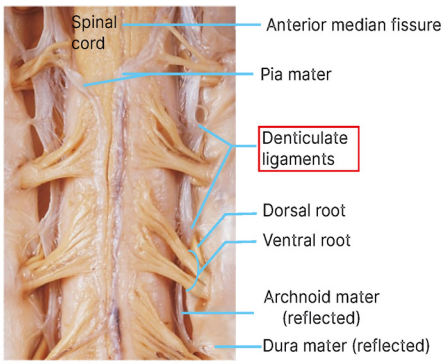


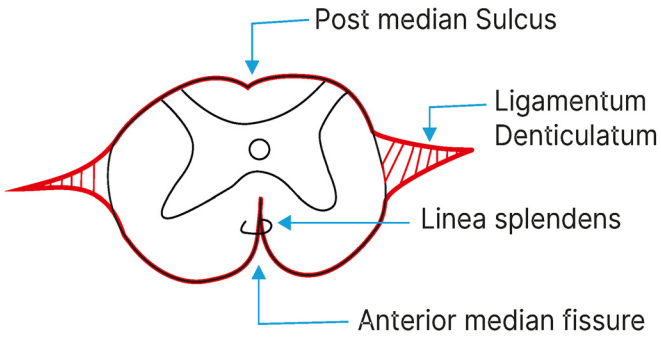
Terminal Part of Spinal Cord

- Spinal cord ends in a cone-shaped structure → conus medullaris
- From conus medullaris, a fine thread-like structure extends upto level of the coccyx → Filum terminale.
- Bundle of nerve roots located at the base of the spinal cord → Cauda equina



Modifications of Pia Matter





Filum Terminale	• Modification of the Pia mater. • Arachnoid and dura mater descend and merge with the pia mater at the lower border of S2. • The subarachnoid space ends at the level of the lower border of S2.

	• Site of lumbar puncture: L3-L4.
	• Filum terminale:
	  ○ Internus - Made of only pia matter
	  ○ Externus - Made of all three meninges

Linea Splendens	• Extension of the pia mater into the anterior median fissure.
Ligamentum Denticulatum	• Tooth-like projections on either side. • Total 2 in number with 21 projections on each side.

GREY MATTER AND WHITE MATTER

00:27:46

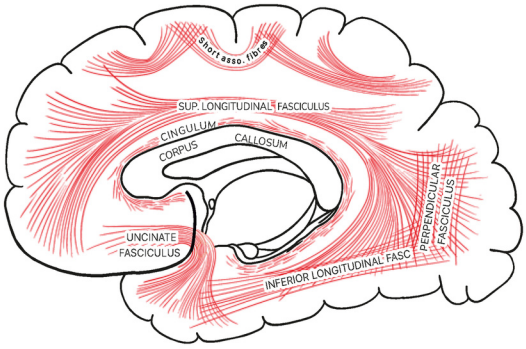
WHITE MATTER INICET 2024	GRAY MATTER INICET 2019
1. Association Fibres 2. Commissural Fibres 3. Projection Fibres • Corona Radiata • Internal Capsule • Tracts	1. Cerebral Cortex 2. Basal Ganglia

White Matter

Association Fibres

FMGE 2020, FMGE 2021,

- Bundle of axons connecting the brain anteroposteriorly.
- Types of association fibres: Short and long association fibres.
  - Gyri → Elevations
  - Sulcus→ Depressions
- Short association fibres/arcuate fasciculus → Connecting the two adjacent gyri.
- Long association fibres :
  - Superior Longitudinal fasciculus: Connects the frontal lobe with the occipital lobe.
  - Inferior Longitudinal fasciculus: Connecting the temporal lobe with the occipital lobe.

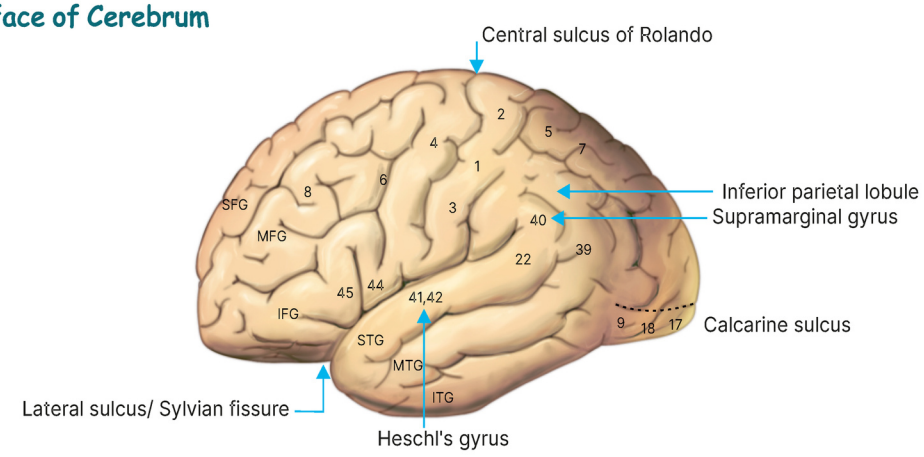


- Cingulum → Long association fiber
- Broca's speech area (44,45) and auditory area (41.42) are connected by Uncinate fasciculus.
- Broca's speech area (44,45) and Wernicke's speech area (22,39,40) are connected by the Arcuate Fasciculus.

CEREBRAL CORTEX (BRODMANN AREAS)

00:35:35

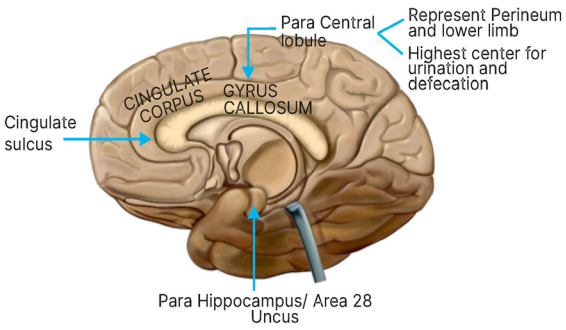
Superolateral Surface of Cerebrum



Lobe / Landmark	Structure	Brodmann Area(s)	Function / Description
Temporal Lobe	Superior temporal gyrus	Heschel's gyrus→ Area 41 and 42	Primary auditory area
		Area 22 (Posteriorly)	Auditory association area (Wernicke's speech area- 22,39,40)
	Middle temporal gyrus	-	-
	Inferior temporal gyrus	-	-
Frontal Lobe	Superior frontal gyrus	Area 6 (posterior)	Premotor area
	Middle frontal gyrus	Area 8	Frontal eyefield area → horizontal gaze
		Area 6 (posterior)	Premotor area
	Inferior frontal gyrus	Area 6 (posterior)	Premotor area
		Area 44,45	Broca's motor speech area
Central Sulcus of Rolando	Pre-central gyrus	Area 4	Primary motor area
	Post central gyrus	Area 3, 1, 2	Primary sensory area
Parietal Lobe	Superior parietal lobule	Area 5, 7	Sensory association area
	Inferior parietal lobule	-	Associated with hand and eye coordination
Calcarine Sulcus- Concentric circles	Central area	Area 17	Primary visual area
	Peripheral areas	Area 18 and 19	Visual association area
Lateral Sulcus	Sylvian fissure	-	Present between the frontal and temporal lobes

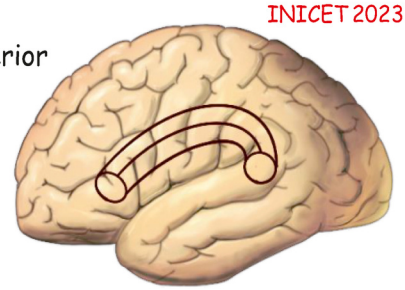
MEDIAL SURFACE OF CEREBRUM

- Cingulate sulcus :
  - Present anterior to corpus callosum.
  - Splits into two sulcus creating a lobule called the paracentral lobule
    → Represents perineum and lower limb
    → The highest centre which controls urination and defecation.
- Uncus :
  - Area 28 → Primary olfactory area.
- Parahippocampus



Aphasia

INICET 2023



- Wernicke's Sensory speech area (22) is present posteriorly on the superior temporal gyrus.
  - Wernicke's Aphasia/Receptive Aphasia/Fluent Aphasia: The patient is not able to understand the spoken or written language.
- Broca's Motor Speech area (44,45) is present on the inferior frontal gyrus.
  - Broca's Aphasia/Expressive Aphasia/Non Fluent Aphasia/ Agrammatic Aphasia: Speech becomes difficult, but the patient understands the spoken language.
- Conduction Aphasia:
  - Lesion in the Arcuate Fasciculus connecting Broca's and Wernicke's Speech Area.
- Global Aphasia:
  - Severe form of non-fluent aphasia, caused by damage to the left side of the brain that effects receptive and expressive language skills (needed for both written and oral language) as well as auditory and visual comprehension.

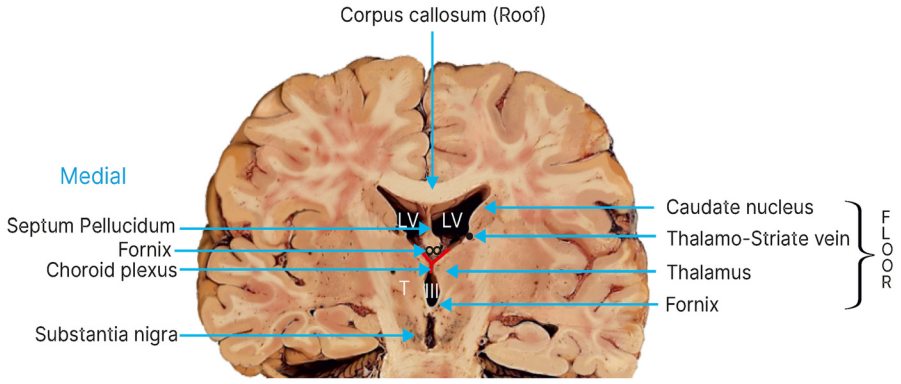
SECTIONS OF BRAIN

00:53:22

Coronal Section (lateral Ventricles)

INICET 2022

Boundaries of Lateral Ventricle



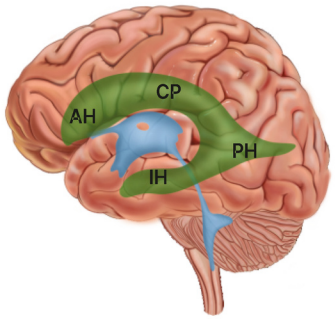
Roof	• Formed by the corpus callosum (largest commissural fiber) ○ Connecting the right and left halves of the brain.
Floor	• Caudate nucleus • Thalamo striate veins • Choroid plexus • Thalamus • Fornix: The lower margin of the septum pellucidum is attached with the fornix
Medial wall	• Formed by the septum pellucidum.

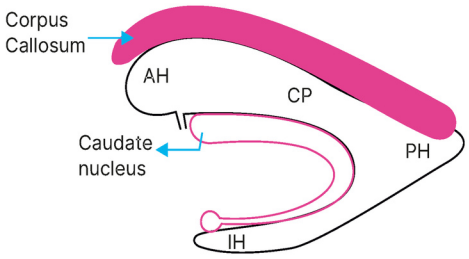
- Substantia nigra:
  - Present in the midbrain
  - Consists of melanin → Precursor of dopamine
- Lentiform nucleus
  - Lens shaped
  - Lateral to the internal capsule

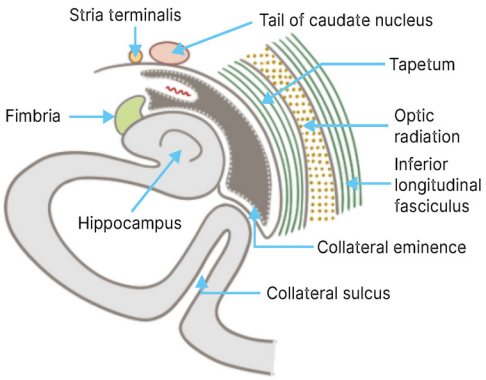
Yourwish

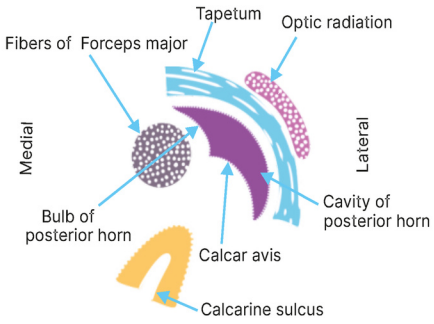
Lateral Ventricles

FMGE 2021









Horns of Lateral Ventricles

Anterior horn	• Present in the frontal lobe. • Roof is formed by corpus callosum • Floor is formed by the head of caudate nucleus

Posterior horn	• Present in the occipital lobe.
	• Roof and lateral wall is formed by tapetum fibres.
	• Medial wall has two depressions
	  ○ Bulb of posterior horn → by fibers of forceps major
	  ○ Calcar avis → By calcarine sulcus

Central horn	• Present in the parietal lobe
Inferior horn	• Present in the temporal lobe • Roof is formed by the tail of caudate nucleus • Floor is formed by the hippocampus

Fornix

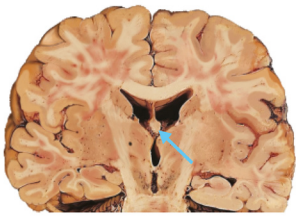
Q. The structure indicated in the image originates from:

a. Mamillary body

b. Hippocampus

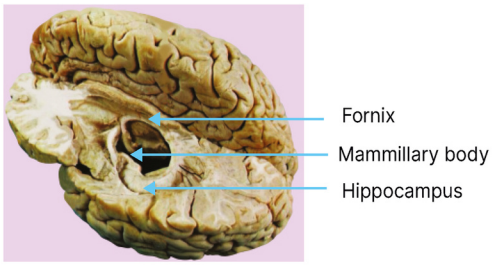
c. Thalamus

d. Amygdala

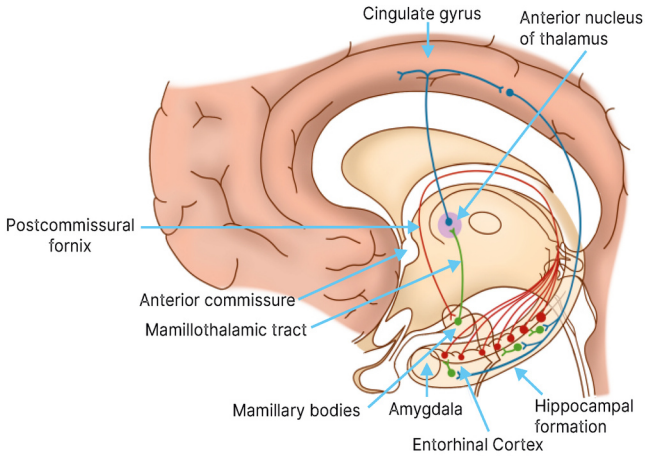


Answer - b. Hippocampus

- The structure marked is fornix
- Fornix begins from the hippocampus and joins the mammillary body
- Hippocampal commissure connects fronix



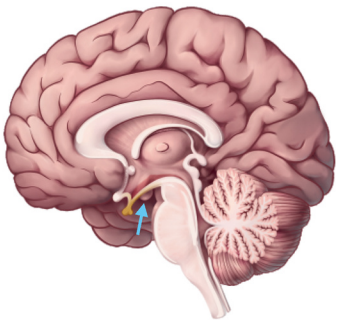
Hippocampus
↓
(fornix)
↓
Mammillary body
↓
(mammillothalamic tract)
↓
Anterior nucleus of the thalamus



Q. Which pathway provides afferent fibres to the mamillary body, a structure located beneath the brain surface?
a. Fornix
b. Thalamus
c. Pituitary gland
d. Corpus callosum

Answer - a. Fornix

Q. The marked structure sends efferents to which nucleus of the thalamus?
a. Pulvinar nucleus
b. Posterior lateral nucleus
c. Anterior nucleus
d. Lateral nucleus



Answer - c. Anterior nucleus

Q. Fornix consists of which type of fibres?
a. Association and Commissural fibres
b. Association and Projection fibres
c. Commissural and Projection fibres
d. Association fibres

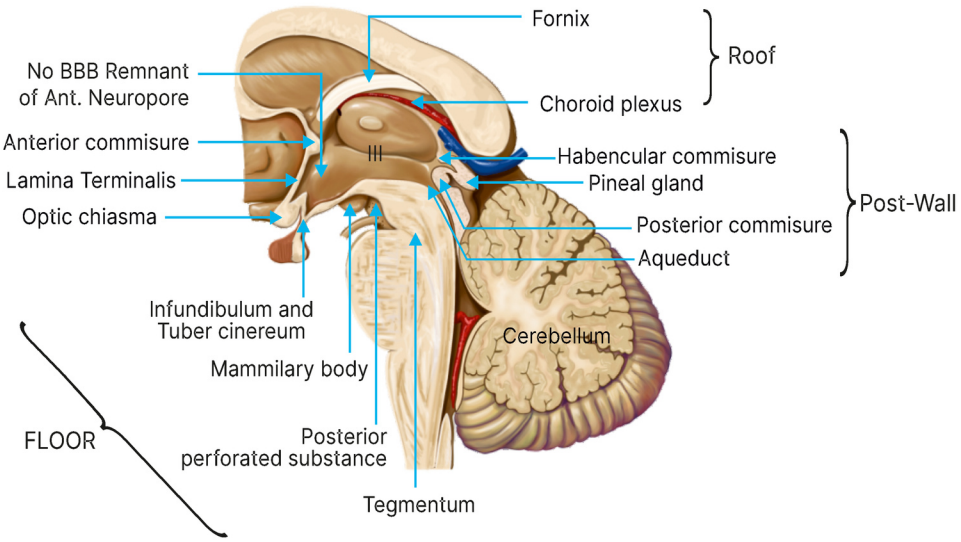
Answer - a. Association and commissural fibres

- Fornix consist of association, commissural, and projection fibres
  - Association > commissural > projection

Sagittal Section (III Ventricle)

01:17:19

NEET PG 2022

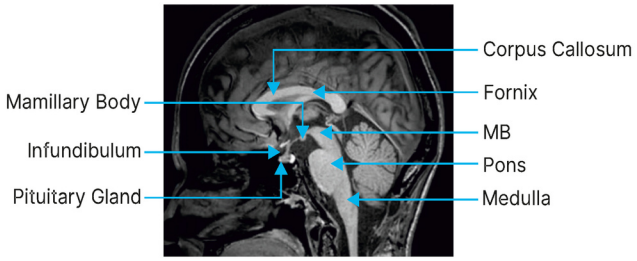


Boundaries of the III ventricle	
Roof	• Fornix • Choroid Plexus

Anterior Wall	• Anterior Commissure
	• Lamina terminalis
	  ○ Remnant of the anterior neuropore
	  ○ No blood-brain barrier

Posterior Wall	• Habenular commissure • Pineal gland • Posterior commissure • Cerebral aqueduct
Floor	• Optic chiasma • Infundibulum • Mamillary body • Posterior perforating substance • Tegmentum of mid brain

- Parts of Corpus callosum (largest commissural fiber)
  - Rostrum
  - Genu (Anterior-most part)
  - Body
  - Splenium

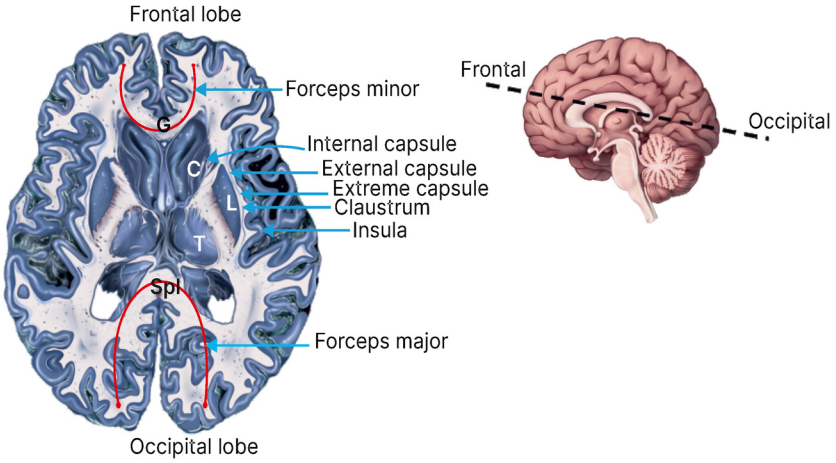


Transverse Section of Cerebrum

01:25:00

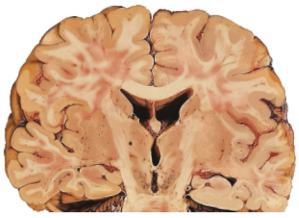
- Genu is connected to the frontal lobe via the forceps minor.
- Splenium is connected to the occipital lobe via the forceps major.
- The genu and splenium are connected to each other by the body
  - Fibres arising from them are called tapetum fibres.

- Internal capsule:
  - Between the thalamus, caudate nucleus, and the lentiform nucleus
- External capsule: Outer to the lentiform nucleus
- Extreme capsule: Outer to external capsule
- The sheath of gray matter between the external capsule and the extreme capsule is called the claustrum.
- Insula → Hidden lobe of cerebrum



Basal Ganglia

FMGE 2021-2023



- Corpus striatum- Located in Telencephalon
  - Comprising the caudate nucleus and the lentiform nucleus
  - Lentiform nucleus: Putamen and Globus Pallidus
- Subthalamic nucleus - Located in Diencephalon
- Substantia nigra - Located in Mesencephalon

Site of Lesion	Movement Disorder
Globus Pallidus	Athetosis
Putamen and Caudate	Chorea
Substantia Nigra	Parkinson's Disease
Subthalamic Nucleus	Hemibalismus

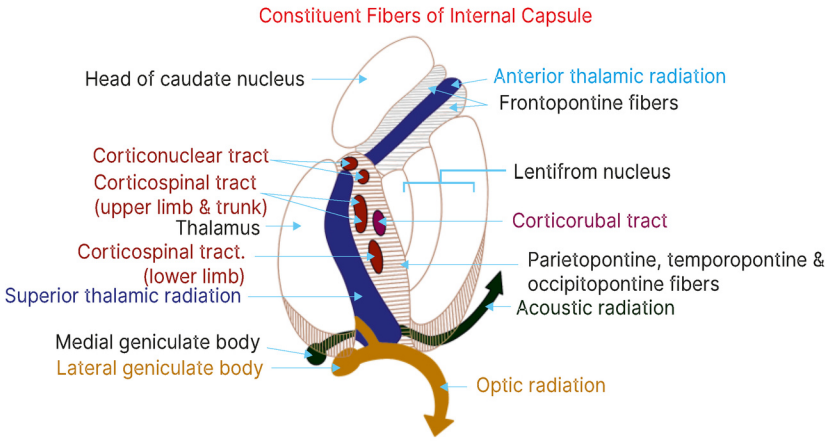
Q. Neostriatum consists of?
a. Caudate nucleus and globus pallidus
b. Globus pallidus and putamen
c. Globus pallidus and lentiform nucleus
d. Caudate nucleus and putamen

Answer - d. Caudate nucleus and putamen

Internal Capsule

01:32:36

FMGE 2024, Neet PG 2024



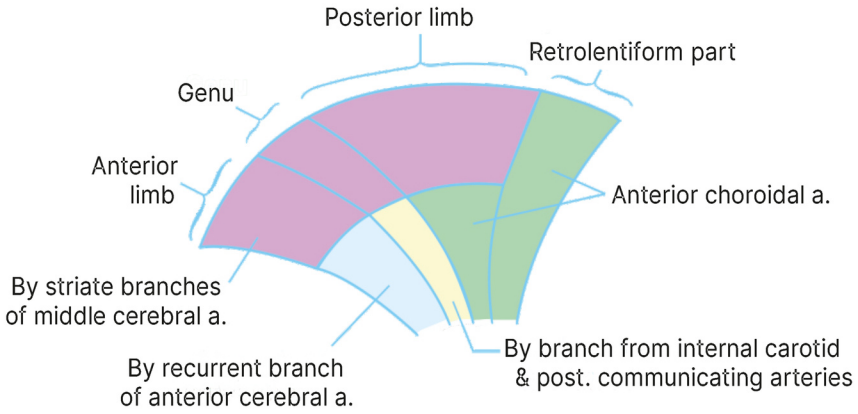
- Thalamus and caudate nucleus medially and the lentiform nucleus laterally

Yourwish

Parts of Internal Capsule

- Anterior limb
- Genu → Corticonuclear tract passes through the genu
- Posterior limb → Corticospinal tract passes through anterior 2/3rd of the posterior limb
- Retrolentifrom
- Sublentiform

Blood Supply Of Internal Capsule



Segment	Specific Part	Arterial Supply
Anterior Limb	Superior part	Striate branches of middle cerebral artery
	Inferior part	Recurrent branch of anterior cerebral artery (Heubner artery)
Genu	Superior part	Striate branches of middle cerebral artery
	Inferior part	Branches from internal carotid and posterior communicating arteries
Posterior Limb	Superior part	Striate branches of middle cerebral artery
	Inferior part	Anterior choroidal artery
Retrolentiform Part	Anterior choroidal artery	

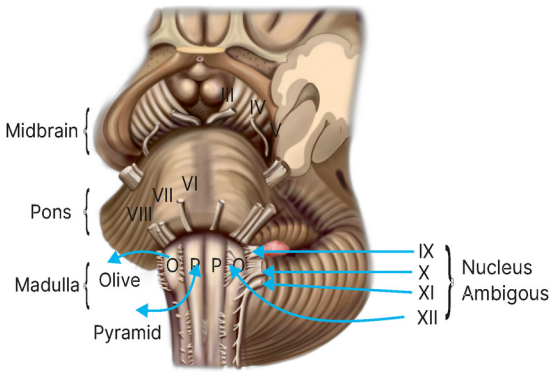
BRAIN STEM

01:37:05

Ventral Aspect of Brainstem

Midbrain

- Cranial nerve III
- Cranial nerve IV
  - Dorsal origin
  - Longest intracranial course
  - Internal decussation
  - The smallest and thinnest cranial nerve

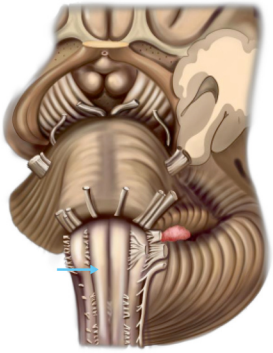


Pons

- Cranial nerve V
  - Exit between the pons and the middle cerebellar peduncle

- Cranial nerves VI, VII ,VIII
  - Present in ponto-medullary junction
- Cranial nerve IX, X, XI
  - Present lateral to the olive.
  - Has a common nucleus called the nucleus ambigous
- Cranial nerve XII
  - Present between the pyramid and the olive
    → Olive is elevated due to the olivary nucleus
    → Pyramid is elevated due to the pyramidal tracts
- The interpeduncular fossa is present between the two cerebral peduncle
- Contents of the interpeduncular fossa
  - Infundibulum
  - Tuber cinereum
  - Mammillary body
  - Posterior perforated substance
  - Cranial nerve III

Q. Injury at the arrow-marked structure leads to:
a. C/L Hemiplegia
b. I/L Hemiplegia

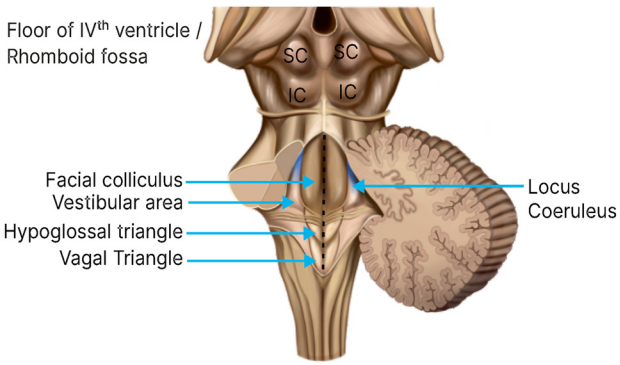


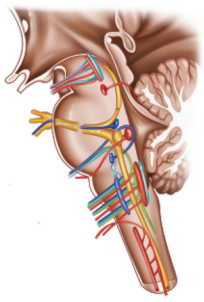
Ans. C/L Hemiplegia

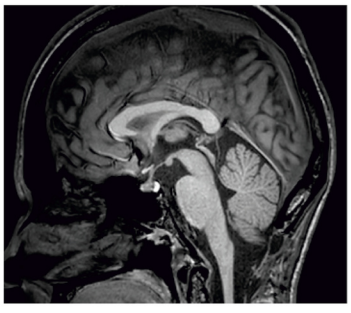
- Arrow-marked structure is the pyramid → Pyramidal/ Corticospinal tract (descending)

Dorsal Aspect of Brainstem

- Corpora quadrigemina: Formed by superior and inferior colliculi (Total 4 in number)
  - Superior colliculi → Vision
  - Inferior colliculi → Auditory pathway
- Superior fovea contains bluish grey pigmented area (Locus cerleus)
  - Secretes dopamine
- Floor of the fourth ventricle / Rhomboid fossa
  - Facial colliculus → Formed due to Abducens nucleus
    → Facial nerve takes turn around the Abducens nucleus
  - Vestibular area → Formed due to the vestibulocochlear nucleus
  - Hypoglossal triangle → Formed due to the hypoglossal nucleus
  - Vagal triangle → Formed due to the vagal nucleus
- Roof of the fourth ventricle
  - Superior medullary velum (nervous structure)
  - Inferior medullary velum (non-nervous structure)







Important Information

- Cranial nerve seen behind the midbrain → IV Nerve
- Cranial nerve seen behind pons → VII Nerve

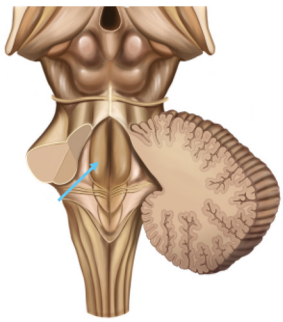
Injury to the facial colliculus

↓

Damage of facial nerve > Abducens Nuclei

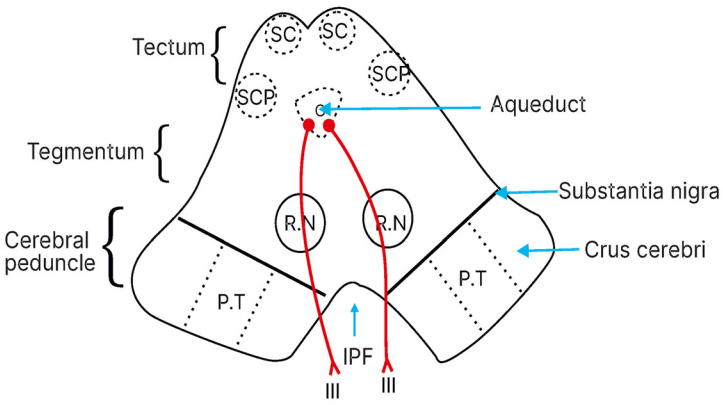
↓

Facial muscles > Lateral Rectus (Risorius muscle)



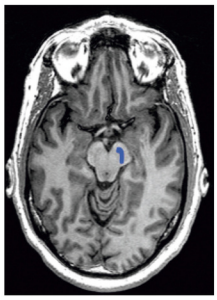
Transverse Section of the Midbrain

- Tectum: Present behind the aqueduct
- Tegmentum: Red nucleus is located here
- Cerebral Peduncle: Present in front of the aqueduct
  - Grey matter → Substantia nigra
  - In middle → Interpeduncular fossa
- Crus cerebri → White matter
  - In front of Substantia nigra
  - Divided into 3 parts
  - Middle part of the crus cerebri has pyramidal tracts.
- IIIrd nerve is present in the midbrain at the level of the superior colliculus.
- IVth nerve is present in the midbrain at the level of ithe nferior colliculus.
- Superior cerebellar peduncle connects the midbrain with the cerebellum behind.



Q. The neurotransmitter secreted by the area marked in the given image is:

a. Dopamine
b. Acetylcholine
c. Glutamine
d. Nor adrenaline



Answer - a. Dopamine

- Area marked is substantia nigra

Q. At which level does the nerve supply for the marked structure arise?

a. Red nucleus
b. Subthalamic nuclei
c. Decussation of pthe yramidal tract
d. Olivary nucleus

Answer - a. Red nucleus

- The marked structure is medial rectus muscle

Q. Decussation of the superior cerebellar peduncle occurs at which level?

a. Midbrain

b. Medulla

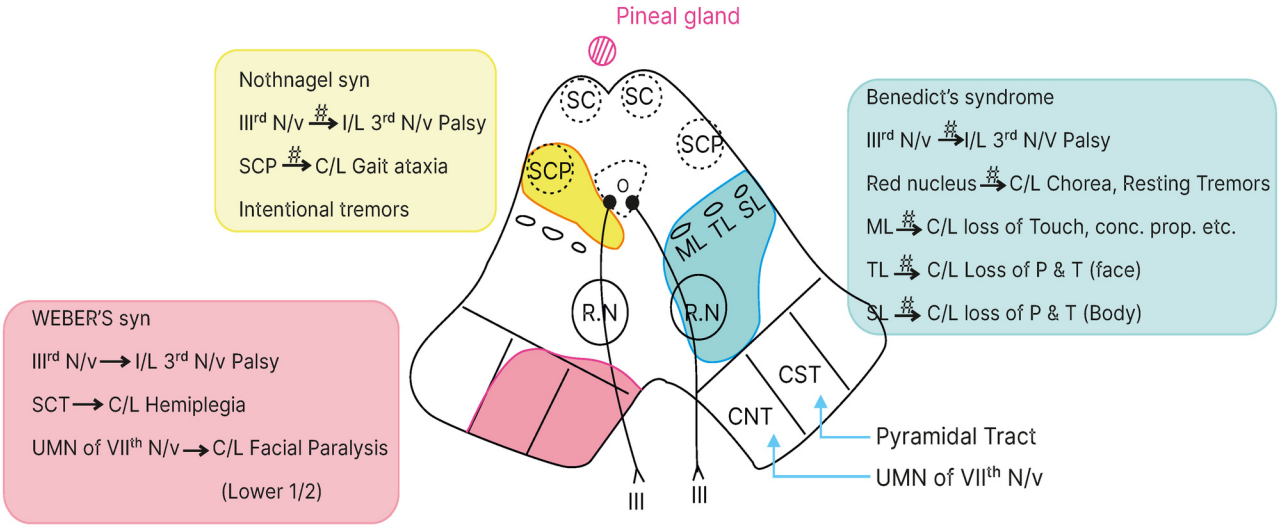
c. Pons

d. Diencephalon

Answer - a. Midbrain

MIDBRAIN SYNDROMES

02:00:33



- Cause: Stroke of Posterior Cerebral Artery (PCA)
- Segment involved: P1 of PCA

Weber Syndrome (medial Midbrain)

Structures Involved

- Oculomotor nerve (CN III)
- Crus cerebri
  - Corticospinal tract
  - Corticobulbar fibers (UMN fibers of the facial nerve)

Clinical Features

- Ipsilateral CN III palsy
  - Down & out eye
  - Loss of pupillary reflex
- Contralateral hemiplegia
  - Due to corticospinal tract involvement
- Contralateral lower facial paralysis
  - UMN type (lower half of face)

Yourwish

Benedict Syndrome (Tegmentum of Midbrain)

Structures Involved

- Oculomotor nerve (CN III)
- Red nucleus
- Medial lemniscus
- Trigeminal lemniscus
- Spinal lemniscus (spinothalamic tract)

Clinical Features

- Ipsilateral CN III palsy
- Contralateral involuntary movements
  - Chorea
  - Resting tremors (red nucleus involvement)
- Contralateral loss of sensations:
  - Fine touch, vibration, proprioception (medial lemniscus)
  - Pain & temperature from the face (trigeminal lemniscus)
  - Pain & temperature from the body (spinal lemniscus)

Lemnisci At Midbrain Level

- Seen at level of superior colliculus:
  - Medial lemniscus
  - Trigeminal lemniscus
  - Spinal lemniscus
- Not seen at superior colliculus:
  - Lateral lemniscus

Nothnagel Syndrome (dorsal Midbrain)

Structures Involved

- Oculomotor nerve (CN III)
- Superior cerebellar peduncle

Clinical Feature

- Contralateral gait ataxia and intentional tremors

Parinaud Syndrome

- Tumor of the pineal gland (Pinealoma) → compresses the superior colliculi
- Vertical gaze affected→ Sun setting sign.

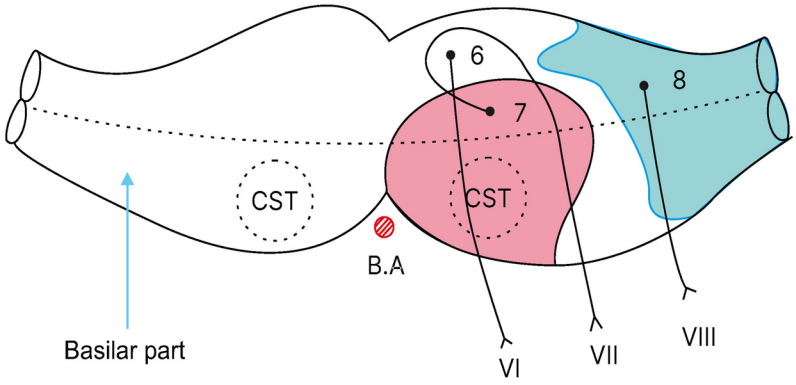
Claude's Syndrome

- Benedict + Nothnagel syndromes

PONTINE SYNDROMES

02:09:14

INICET 2020



Ponto Cerbellar Angle Syn
d/t Acoustic Neuroma
VIIth N/v ⟶ I/L Facial Paralysis
VIIIth N/v ⟶ I/L Progressive deafness
CP ⟶ I/L Ataxia

MILARD GUBLER Syn
VIth N/v #⟶ I/L Convergent Squint
VIIth N/v #⟶ I/L Facial Paralysis
CST #⟶ C/L Hemiplegia

- Cause: Basilar artery stroke
- The basilar artery lies in the basilar sulcus on the ventral pons

Transverse Section of Pons

- Ventral (Basilar) part of the pons contains:
  - Corticospinal (pyramidal) tract
  - CN VI
  - CN VII
  - CN VIII
- Facial colliculus
  - Elevation on the dorsal pons
  - Formed by the CN VI nucleus

Millard-gubler Syndrome (Ventral Pontine Syndrome)

Structures Involved

- Abducens nerve (CN VI)
- Facial nerve (CN VII)
- Corticospinal tract

Clinical Features

- Ipsilateral lateral rectus palsy - Ipsilateral convergent squint
- Ipsilateral LMN facial paralysis
- Contralateral hemiplegia

Pontocerebellar Angle (CPA) Syndrome

- Due to Acoustic neuroma (Vestibular schwannoma)

Structures Involved

- Facial nerve (CN VII)

- Vestibulocochlear nerve (CN VIII)
- Cerebellar peduncles

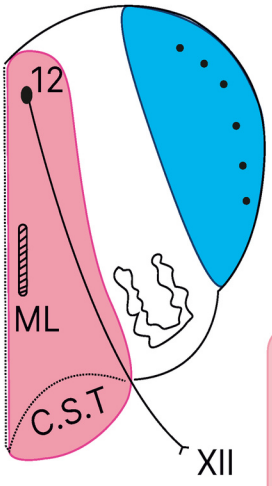
Clinical Features

- Ipsilateral LMN facial paralysis
- Ipsilateral progressive deafness
- Ipsilateral cerebellar ataxia

MEDULLARY SYNDROME

02:13:00

- IVth ventricle posteriorly
- Pyramid and olive anteriorly



LATERAL MEDULLARY Syn./ WALLENBURG Syn.
Restiform Body $\xrightarrow{\#}$ I/L Ataxia, I/L Intentional Tremors, I/L Hypotonia
Descending Sym. Pathway $\xrightarrow{\#}$ Horner's Syndrome
V_s (Spinal Nucleus) $\xrightarrow{\#}$ I/L Loss of Pain & Temp (face)
Spinal Lemniscus (Lat. STT) $\xrightarrow{\#}$ C/L Loss of pain & temp (Body)
NTS $\xrightarrow{\#}$ loss of Taste
N. Ambigus $\xrightarrow{\#}$ Bulbar paralysis, gag reflex, cough reflex

Medial Medullary Syndrome/ Dejerine syndrome
XIIth N/v $\xrightarrow{\#}$ I/L Tongue deviation
ML $\xrightarrow{\#}$ C/L loss of Touch, Conc. Prop etc.
CST $\xrightarrow{\#}$ C/L Hemiplegia

Dejerine Syndrome/medial Medullary Syndrome

Site Of Lesion

- Medial part of the medulla

Structures Involved

- Hypoglossal nerve (CN XII)
- Pyramidal (corticospinal) tract
- Medial lemniscus

Clinical Features

- Ipsilateral hypoglossal nerve palsy
  - Tongue deviates towards the side of the lesion

- Contralateral hemiplegia
  - Due to pyramidal tract involvement
- Contralateral loss of sensations
  - Fine touch
  - Proprioception
  - Vibration

Wallenberg Syndrome/lateral Medullary Syndrome

- Posterior Inferior Cerebellar Artery (PICA) stroke

Structures Involved

- Nucleus tractus soliatrius
- Restiform body
- Nucleus ambigus
- Spinal nucleus of the trigeminal nerve
- Lateral spinothalamic tract
- Descending sympathetic fibers

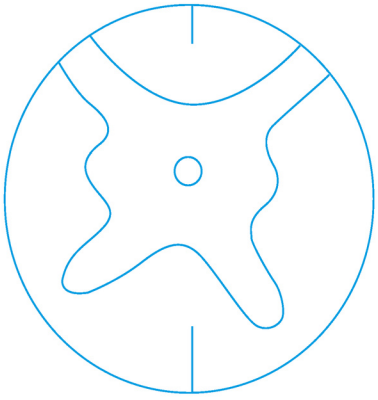
Clinical Features

- Loss of taste
  - Due to nucleus tractus solitarius involvement
- Ipsilateral cerebellar ataxia, intentional tremors, hypotonia
  - Due to restiform body involvement
- Bulbar paralysis, loss of gag reflex, loss of cough reflex
  - Due to the nucleus ambiguus involvement
- Ipsilateral loss of pain and temperature from the face
  - Due to spinal nucleus of the trigeminal nerve involvement
- Contralateral loss of pain and temperature from the body → Crossed hemianesthesia
  - Due to lateral spinothalamic tract involvement
- Ipsilateral Horner syndrome
  - Due to the involvement of descending sympathetic fibers

SPINAL CORD TRACTS

02:17:45

- White matter is present in the periphery of the spinal cord
- White matter is divided into:
  - Dorsal column → Only ascending tracts
  - Lateral column → Both ascending and descending tracts
  - Ventral column → Both ascending and descending tracts



Yourwish

Descending tracts	Ascending tracts
• Lateral corticospinal tract • Anterior corticospinal tract • Rubrospinal tract • Vestibulo spinal tract • Tectospinal tract	• Fasciculus Gracilis • Fasciculus Cuneatus • Lateral Spinothalamic Tract • Anterior Spinothalamic Tract • Dorsal spinocerebellar tract • Ventral spinocerebellar tract

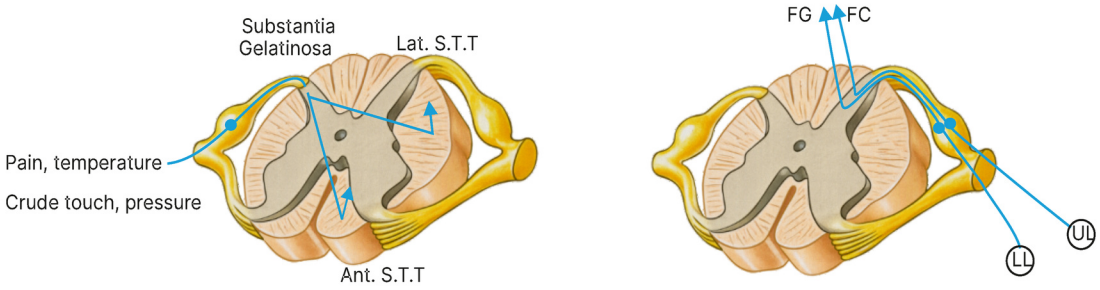
Descending Tracts

- Corticospinal Tract (Pyramidal Tract)
  - Origin: Cerebral cortex
  - Types:
    - → Lateral corticospinal tract (lateral column)
    - → Anterior corticospinal tract (ventral column)
  - Function: Controls voluntary movements
- Rubrospinal Tract
  - Location: Lateral column
  - Origin: Red nucleus
  - Function:
    - → Facilitates flexors
    - → Inhibits extensors
- Vestibulospinal Tract/ Postural tracts
  - Facilitates extensors
  - Inhibits flexors
  - Maintains posture
- Tectospinal Tract
  - Coordinates: Head, Neck. Eyes, Upper limbs

Ascending Tracts

- Dorsal column tracts
  - Fasciculus Gracilis: Medial part of the dorsal column
  - Fasciculus Cuneatus: Lateral part of the dorsal column
  - Functions
    - → Fine touch
    - → Vibration
    - → Stereognosis
    - → Conscious proprioception
- Spinothalamic Tracts
  - Lateral Spinothalamic Tract
    - → Location: Lateral column
    - → Function: Pain, Temperature
  - Anterior Spinothalamic Tract
    - → Location: Anterior column
    - → Function: Crude touch, Pressure
- Spinocerebellar Tracts

- Dorsal spinocerebellar tract
- Ventral spinocerebellar tract
- Function: Unconscious proprioception



Spinothalamic & Dorsal Column Pathways

Entry Of Sensory Fibers

- All sensory modalities enter the spinal cord through the dorsal root ganglion
  - Pain
  - Temperature
  - Crude touch
  - Pressure
- Sensory fibers enter via the dorsal root
- Motor fibers exit via the ventral root

Spinothalamic Tract Pathway

- First-Order Neuron:
  - Cell body located in dorsal root ganglion
  - Central process enters spinal cord
- Nucleus Involved:
  - Fibers terminate in the substantia gelatinosa
    → Located in the spinal cord
- Second-Order Neuron:
  - Originates from substantia gelatinosa
  - Crosses to the opposite side in the spinal cord at the same spinal segment
- Formation of Tracts
  - After crossing:
    → Fibers entering lateral column form lateral spinothalamic tract
    → Fibers entering anterior column form anterior spinothalamic tract
  - Functions
    → Lateral spinothalamic tract: Pain, Temperature
    → Anterior spinothalamic tract: Crude touch, Pressure
- Lemniscal Continuation
  - In the brainstem (medulla, pons, midbrain):
    → Lateral spinothalamic tract → forms spinal lemniscus
    → Anterior spinothalamic tract → joins medial lemniscus

DORSAL COLUMN PATHWAY

- Entry of Fibers
  - Sensory fibers enter through the dorsal root ganglion

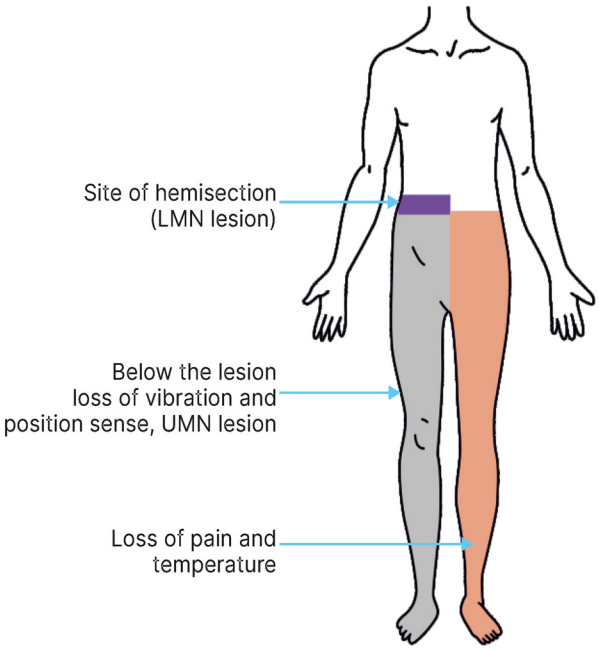
- Enter the dorsal column of the spinal cord
- Fasciculus Gracilis
  → Carries fibers from the lower limb
  → Located medially in the dorsal column
- Fasciculus Cuneatus
  → Carries fibers from the upper limb
  → Located laterally in the dorsal column

- Features of Dorsal Column Tracts
  - Do not cross the spinal cord
  - Do not terminate inthe spinal cord
  - Ascend ipsilaterally
- Termination
  - Fibers terminate in the medulla oblongata:
- Fasciculus gracilis → gracile nucleus
- Fasciculus cuneatus → cuneate nucleus
- Lemniscal Formation
  - From the gracile and cuneate nuclei → Forms the medial lemniscus

Brown Sequard Syndrome

NEET PG 2019

- Hemisection of the spinal cord
- Involves damage to one half of the spinal cord
- Leads to asymmetrical sensory and motor deficits

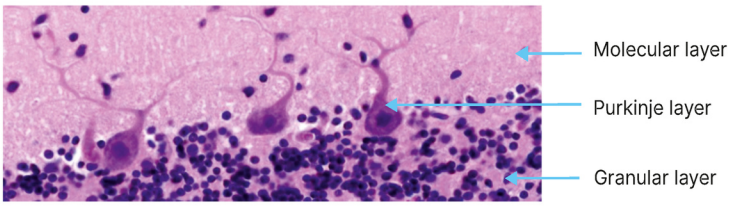


- Effect on Spinothalamic Tracts:
  - Pain, Temperature, Crude touch, Pressure
  - Side of Loss:
    → Contralateral loss because the spinothalamic tracts cross in the spinal cord
- Effect on Dorsal Column Tracts:
  - Fine touch, Vibration, Stereognosis, Conscious proprioception
  - Side of Loss:
    → Ipsilateral to the lesion because the dorsal column tracts do not cross in the spinal cord

CEREBELLAR CORTEX

02:38:50

- The outer gray matter of the cerebellum is called the cerebellar cortex
- Layers of Cerebellar Cortex
  - Molecular layer - Outer
  - Purkinje layer - Middle
  - Granular layer - Innermost
- Cells of Cerebellar Cortex
  - Molecular Layer: Stellate cells, Basket cells
  - Purkinje Layer: Purkinje cells

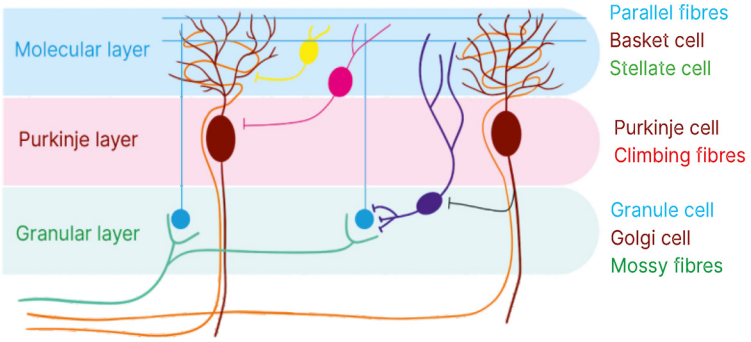


→ Largest cells in cerebellar cortex
→ Flask-shaped
- Granular Layer: Granular cells, Golgi cells

- Nature of Cerebellar Cortex Cells
  - Inhibitory Cells
    → Stellate cells, Basket cells, Purkinje cells, Golgi cells
  - Excitatory Cells: Granular cells

Cerebellar Afferents

- Types of Afferent Fibers
  - Climbing fibers:
    → Ascend to the molecular layer
    → Directly climb over Purkinje cell dendrites
    → Tracts Included: Olivocerebellar tract and Para-olivocerebellar tract
  - Mossy fibers:
    → End in the granular layer
    → Synapse with granular cells
    → Tracts Included: Rest all tracts except climbing fibres
    → Granular cells are excitatory; they transmit information to the molecular layer



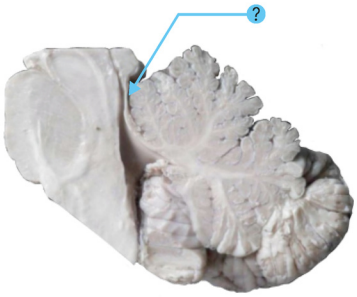
Cerebellar Efferents

- From Cerebellar Cortex: Purkinje cells
  - Purkinje cells inhibit the deep nuclei of the cerebellum via GABA
  - This inhibition fine-tunes cerebellar output, regulating timing, force, and coordination of movements
- From Cerebellum: Deep nuclei

Cerebellar Peduncle

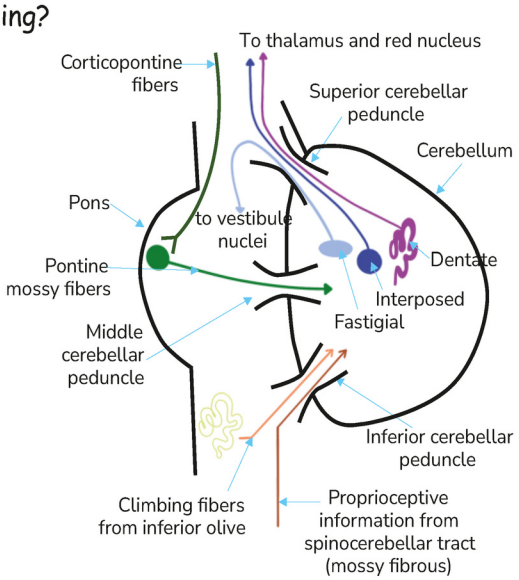
- Superior cerebellar peduncle: Midbrain to cerebellum
- Middle cerebellar peduncle: Pons to cerebellum
- Inferior cerebellar peduncle: Medulla to cerebellum

Q. Fibers from the marked structure terminate at which of the following?
a. Fastigial nucleus
b. Inferior olivary nucleus
c. Red nucleus
d. Subthalamus



Ans - c. Red nucleus

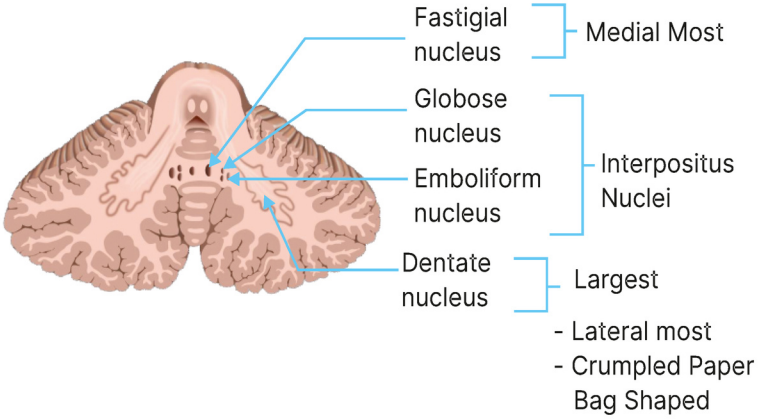
- The marked structure is the superior cerebellar peduncle



Yourwish

Deep Nuclei of Cerebellum

- Mnemonic: Doctors Eat Good Food (Lateral to medial)
  - Dentate nucleus
    → Largest, Crumpled paper bag-shaped
  - Interpositus nuclei:
    → Emboliform nucleus
    → Globose nucleus
  - Fastigial nucleus



Important Information

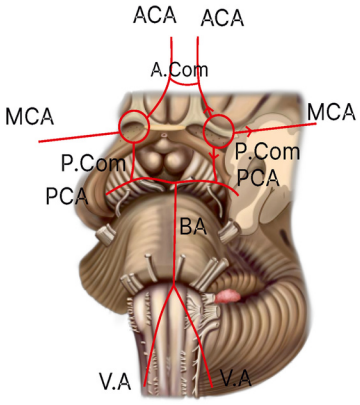
- Crumpled paper bag-shape:
  - Dentate nucleus
  - Inferior olivary nucleus in the medulla

BLOOD SUPPLY OF BRAIN

02:49:14

Circle of Willis

- The brain has two main arterial systems:
  - Anterior circulation: Formed by the internal carotid arteries
  - Posterior circulation: Formed by vertebral arteries
- These two systems join to form the Circle of Willis.



Posterior Circulation

- Two vertebral arteries.
  - Enter the skull through the foramen magnum.
  - Both vertebral arteries unite to form the basilar artery.
- Basilar artery:
  - Lies on the pons
  - Terminates by dividing into right and left posterior cerebral arteries (PCA).

Anterior Circulation

- Each internal carotid artery (ICA) gives:
  - Anterior cerebral artery (ACA)
  - Middle cerebral artery (MCA)
  - Posterior communicating artery (PCOM)
- Anterior communicating artery connects
  - Anterior cerebral arteries on either side
  - Branch of the Anterior Cerebral Artery
- Posterior communicating artery connects:
  - Internal carotid artery to the posterior cerebral artery on either side

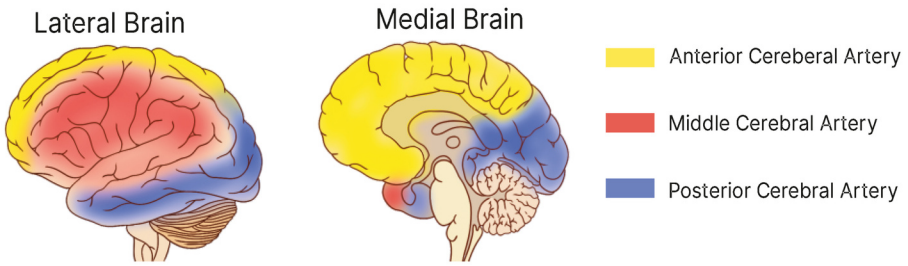
Formation of Circle of Willis

- Arteries forming the circle:
  - Anterior communicating artery

- Right & left anterior cerebral arteries
- Right & left internal carotid arteries
- Right & left posterior communicating arteries
- Right & left posterior cerebral arteries

- Middle cerebral artery does not form the circle of willis

Parent Artery	Branches
Internal Carotid Artery	• Anterior cerebral artery (ACA) • Middle cerebral artery (MCA) • Posterior communicating artery • Ophthalmic artery → 1st branch • Anterior choroidal artery
Vertebral Artery	• Anterior spinal artery - 1 • Posterior spinal artery -2 • Medullary branches • Posterior inferior cerebellar artery (PICA) • Meningeal branches
Basilar Artery	• Anterior inferior cerebellar artery (AICA) • (Labyrinthine artery is a branch of AICA) • Superior cerebellar artery • Pontine branches • Posterior cerebral artery

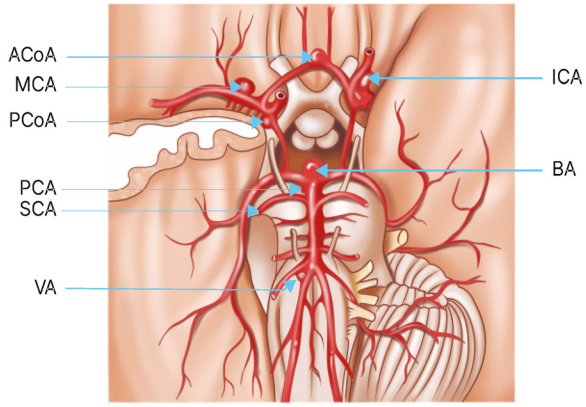


INICET 2025

- Chief artery of cerebrum:
  - Anterior cerebral artery → Medial surface
  - Middle cerebral artery → Superolateral surface
  - Posterior cerebral artery → Inferior surface

Clinical Correlation

- Anterior communicating artery aneurysm compresses the optic chiasma
- Posterior communicating artery compresses the oculomotor nerve
- Rupture of Saccular aneurysm leads to subarachnoid haemorrhage



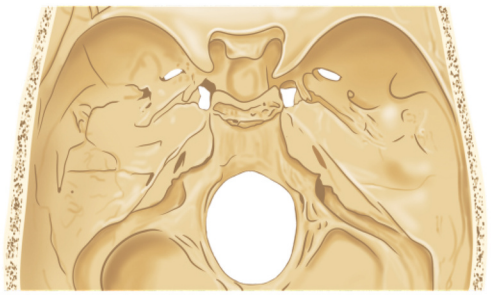
2. HEAD AND NECK

CRANIAL FORAMEN

00:00:40

NEET PG 2022
FMGE 2019
INICET 2022, 2024

- Three foramina in sequence:
  - R - Foramen Rotundum
  - O - Foramen Ovale
  - S - Foramen Spinosum



Superior orbital fissure (sof)

- Located between:
  - Lesser wing of the sphenoid
  - Greater wing of the sphenoid

Structures passing through sof

Cranial nerves	• CN IV - Trochlear nerve → Superior oblique
	• CN VI - Abducens nerve → Lateral rectus
	• CN III - Oculomotor nerve → Other extraocular muscles
	• Branches of CN V1 (Ophthalmic nerve)
	  ○ Frontal nerve
	  ○ Nasociliary nerve
	  ○ Lacrimal nerve

Veins	• Superior ophthalmic vein • Inferior ophthalmic vein

Foramen rotundum

- Structure passing → CN V2 (Maxillary nerve)

Foramen ovale

- Structures passing (MALE)
  - M - Mandibular nerve (CN V3)
  - A - Accessory meningeal artery
  - L - Lesser petrosal nerve
  - E - Emissary vein

Foramen spinosum

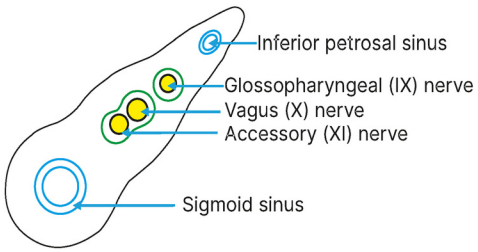
- Structures passing:
  - Nervus spinosus
  - Middle meningeal artery

- Rupture of the middle meningeal artery → Epidural (Extradural) hemorrhage
  - Biconvex (lens-shaped) hematoma
  - Lucid interval

Internal acoustic meatus

- Structures passing:
  - CN VII - Facial nerve
  - CN VIII - Vestibulocochlear nerve
  - Labyrinthine vessels

Jugular foramen



- Structures Passing:
  - Inferior petrosal sinus
  - Glossopharyngeal nerve (CN IX)
  - Vagus nerve (CN X)
  - Accessory nerve (CN XI)
  - Sigmoid sinus
- Internal Jugular Vein:
  - Sigmoid and Inferior petrosal sinus exit through the jugular foramen
  - Both unite after crossing the foramen and form the Internal Jugular Vein
- Sheath Arrangement:
  - CN IX → Separate sheath
  - CN X + CN XI → Common sheath
    → Vago-Accessory Complex (VAC)

Foramen lacerum

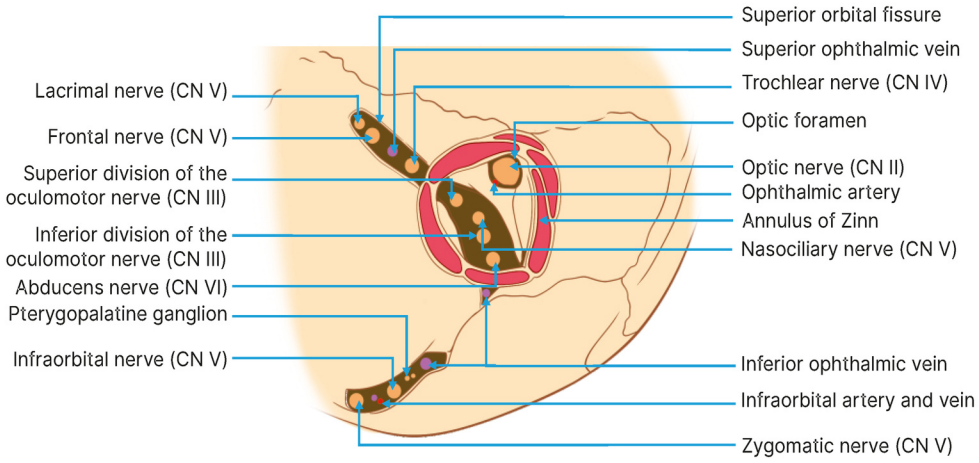
- Located behind ROSS
- Space between:
  - Sphenoid bone
  - Apex of the petrous part of the temporal bone
  - Basilar part of the occipital bone

Annulus of zinn

00:07:23

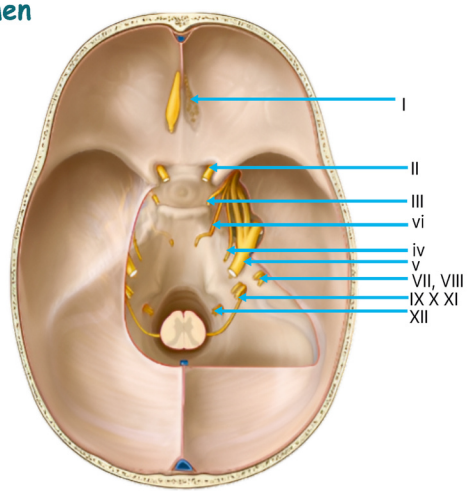
- Common Tendinous Ring
- Structures passing outside the ring:
  - L - Lacrimal nerve
  - F - Frontal nerve
  - T- Trochlear nerve
  - Superior ophthalmic vein above
  - Inferior ophthalmic vein below

Yourwish



Nerves passing through cranial foramen

00:11:59



Structure	Cranial Nerve	Clinical Correlation
Cribriform Plate	CN I (Olfactory nerve)	SARS-CoV-2 spreads from the nasal cavity to the cranial cavity via the cribriform plate.
Optic Canal	CN II (Optic nerve)	Located medial to the anterior clinoid process.
Superior Orbital Fissure	CN III (Oculomotor) CN IV (Trochlear) CN VI (Abducens)	CN IV → Only CN with a dorsal origin CN VI → Ascends upward
Trigeminal Nerve	CN V	Largest and thickest
Internal Acoustic Meatus	CN VII (Facial) CN VIII (Vestibulocochlear)	—
Jugular Foramen	CN IX (Glossopharyngeal) CN X (Vagus) CN XI (Accessory)	—
Hypoglossal Canal	CN XII (Hypoglossal nerve)	—

SPHENOID BONE

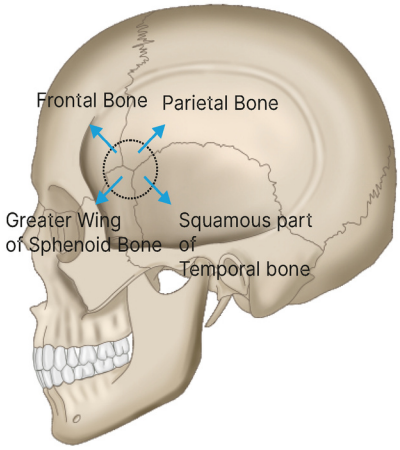
00:15:16

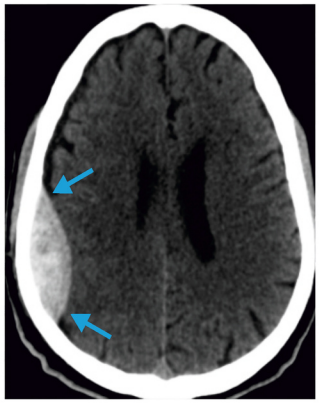
- The sphenoid bone is divided into four parts
  - Body
  - Lesser wing
  - Greater wing
  - Pterygoid plates
    - → Medial pterygoid plate
    - → Lateral pterygoid plate

Superior Orbital Fissure	• Located between the lesser wing and the greater wing
Foramen Rotundum	• Transmits → CN V2 (Maxillary nerve)
Pterygoid Canal	• Transmits - Nerve to the pterygoid canal ○ AKA: Vidian nerve ○ Formed by two nerves → Greater petrosal nerve → Deep petrosal nerve ○ Vidian neurectomy is done in vasomotor rhinitis

PTERION

00:18:11



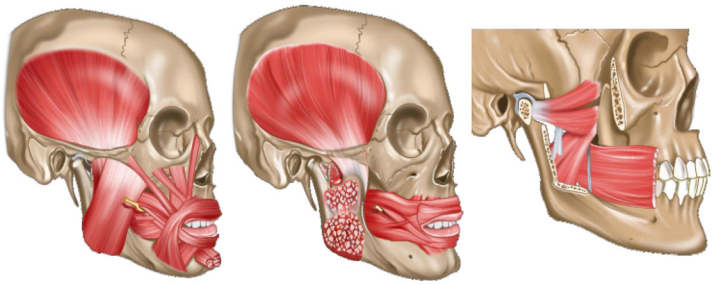


- Pterion → H-shaped suture
- Formed by four bones
  - Frontal bone
  - Parietal bone
  - Squamous part of the temporal bone
  - Greater wing of the sphenoid
- Fetal Correlation
  - Corresponds to the anterolateral fontanelle of fetal skull
- Relations of Pterion
  - Anterior/Frontal division of Middle meningeal vessels
  - Middle cerebral vessels
  - Sylvian fissure/ lateral sulcus
  - Lesser wing of the sphenoid

- If trauma occurs at the pterion
  - Middle meningeal artery may rupture
  - Leads to Epidural hemorrhage (Extradural hemorrhage)
    → Biconvex / "Idli-shaped" hemorrhage on imaging
    → Lucid interval pattern

MUSCLES OF MASTICATION

00:22:54



Masseter	• Attached to the angle of ramus of the mandible on outer surface
Temporalis	• Fan-shaped muscle • Attached to the temporalis fossa • Posterior horizontal fibers - Retraction of mandible • Vertical fibers - Elevation of mandible
Lateral pterygoid	• Attached to the capsule of the temporomandibular joint • Depression of the mandible/ opening the jaw • Lockjaw while yawning
Medial pterygoid	• Attached to inner surface of ramus of the mandible • M/c in Trismus (lockjaw)

- Buccinator → Accessory muscle of mastication
- Nerve supply: Mandibular nerve (V3)
  - Trunk of V3 → Medial pterygoid
  - Anterior division of V3 → Masseter, Temporalis, Lateral pterygoid
- Elevation of the mandible:
  - Masseter
  - Temporalis
  - Medial pterygoid

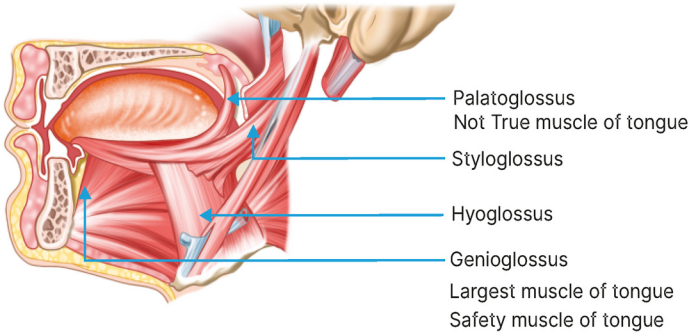
Q. A student had his jaw locked while yawning. Which of the following muscles attached to the articular disc of TMJ is under spasmodic contraction?

A. Lateral pterygoid
B. Temporalis
C. Medial pterygoid
D. Masseter

Answer- A. Lateral pterygoid

MUSCLES OF TONGUE

00:30:12



- The muscles of the tongue are divided into
  - Intrinsic
  - Extrinsic

Extrinsic muscles

- Genioglossus
  - From the genial tubercle of the mandible to the tongue
  - Largest muscle of the tongue
  - Safety muscle of the tongue
  - Prevents the tongue from falling back and obstructing the airway
- Styloglossus - From the styloid process to the tongue
- Palatoglossus- From the palate to the tongue
  - Not the true muscle of the tongue
- Hyoglossus- From the hyoid bone to the tongue

Motor supply

- Motor supply to tongue, except Palatoglossus → Hypoglossal nerve
  - Palatoglossus is supplied by Vago-accessory complex
- If one hypoglossal nerve is injured
  - Tongue deviates to the paralyzed side
    → To the side of hypoglossal nerve injury (ipsilateral)

Sensory supply

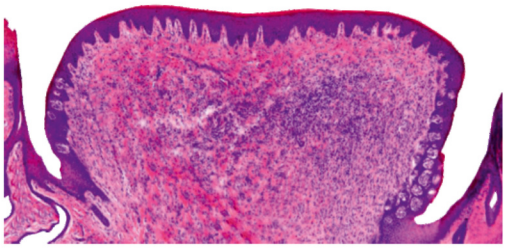
- Sensory supply is divided into:
  - General sensation
  - Special sensation (taste)
- Tongue divided into
  - Anterior 2/3
    → Taste - chorda tympani branch of the facial nerve (7th nerve)
    → General sensation - Lingual nerve (branch of V3 of the trigeminal nerve)
  - Posterior 1/3
    → General sensation → Glossopharyngeal nerve (9th nerve)
    → Taste → Glossopharyngeal nerve (9th nerve)
  - Posterior-most part
    → General sensation → Vagus nerve (10th nerve)
    → Taste → Vagus nerve (10th nerve)

Tongue papillae

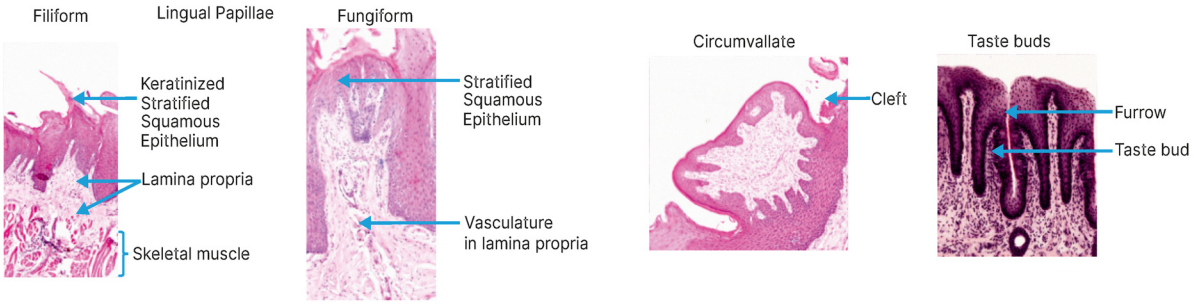
- Circumvallate papillae are located at the junction of anterior 2/3 and posterior 1/3
- Taste from circumvallate papillae → Glossopharyngeal nerve (9th nerve)

Q. Identify the papillae from the given histological section?

a. Fungiform
b. Circumvallate
c. Filiform
d. Foliate

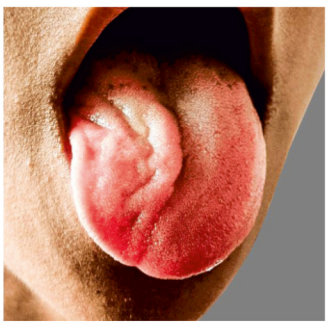


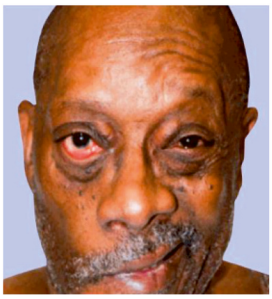
Ans. b) Circumvallate



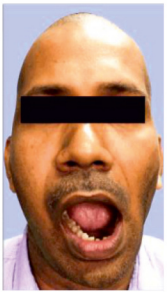
Papillae Type	Important Points
Fungiform	Mushroom-shaped; contains taste buds
Circumvallate	Large, circular papillae with a circular groove (trench)
Filiform	Slender, thread-like papillae; no taste buds Keratinized stratified squamous epithelium
Foliate	Vertical folds or ridges; well-developed in early childhood

Rule of 17

Contralateral deviation (X+VII)	Ipsilateral deviation (XII + V)
Deviation of the uvula - X nerve 	Deviation of the tongue - XII nerve 



Deviation of the angle of mouth - VII nerve



Deviation of the jaw - V nerve

MANDIBULAR NERVE

00:44:48

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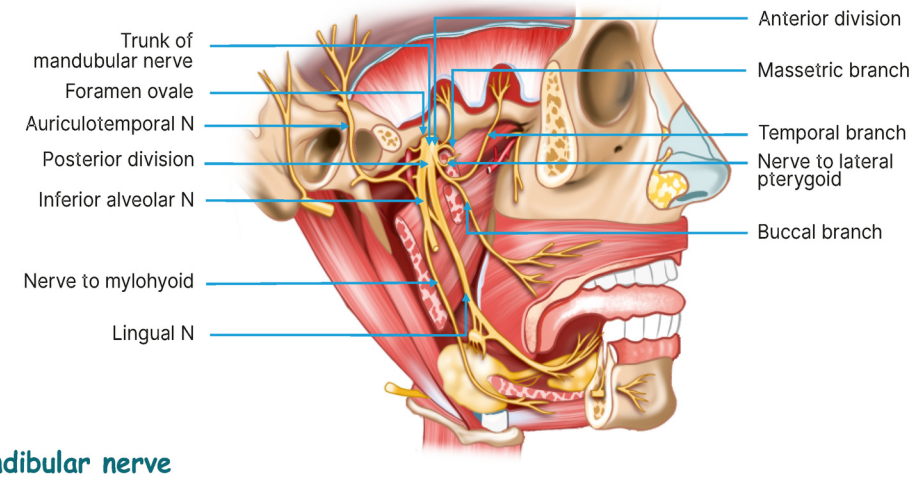
INICET 2019, 2022, 2025



Trunk of the mandibular nerve

- Passes through otic ganglion
- Supplies
  - Medial pterygoid
  - Tensor tympani
  - Tensor veli palatini

Anterior division of the mandibular nerve

- Masseter
- Temporalis
- Lateral pterygoid

Posterior division of the mandibular nerve

- Posterior division gives 3 branches:
  - A → Auriculotemporal nerve
  - L → Lingual nerve
  - I → Inferior alveolar nerve

Auriculotemporal nerve

- Supplies:
  - Skin over upper 2/3 of auricle

- Skin over temporal region
- Temporomandibular joint
- Parotid gland

Frey's syndrome

Injury to the Auriculotemporal Nerve
↓
Regeneration of Nerve Fibers
↓
Joins the Great Auricular Nerve
↓
Leads to Gustatory Sweating
↓
Redness and Sweating over the Angle of the Mandible while eating

Lingual nerve

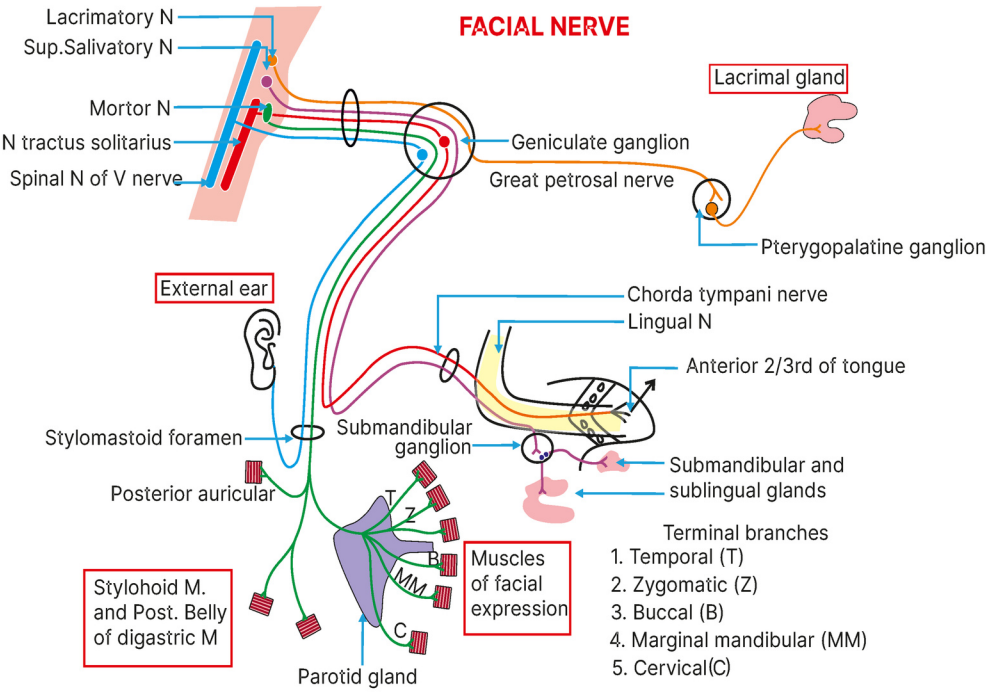
- Passes through the submandibular ganglion
- Carries general sensation from the anterior 2/3 of the tongue
- Submandibular duct winds around the lingual nerve
  - Submandibular gland resection → Lingual nerve injury (M/c)

Inferior alveolar nerve

- Enters mandible through mandibular foramen
  - Supplies the lower jaw region

FACIAL NERVE

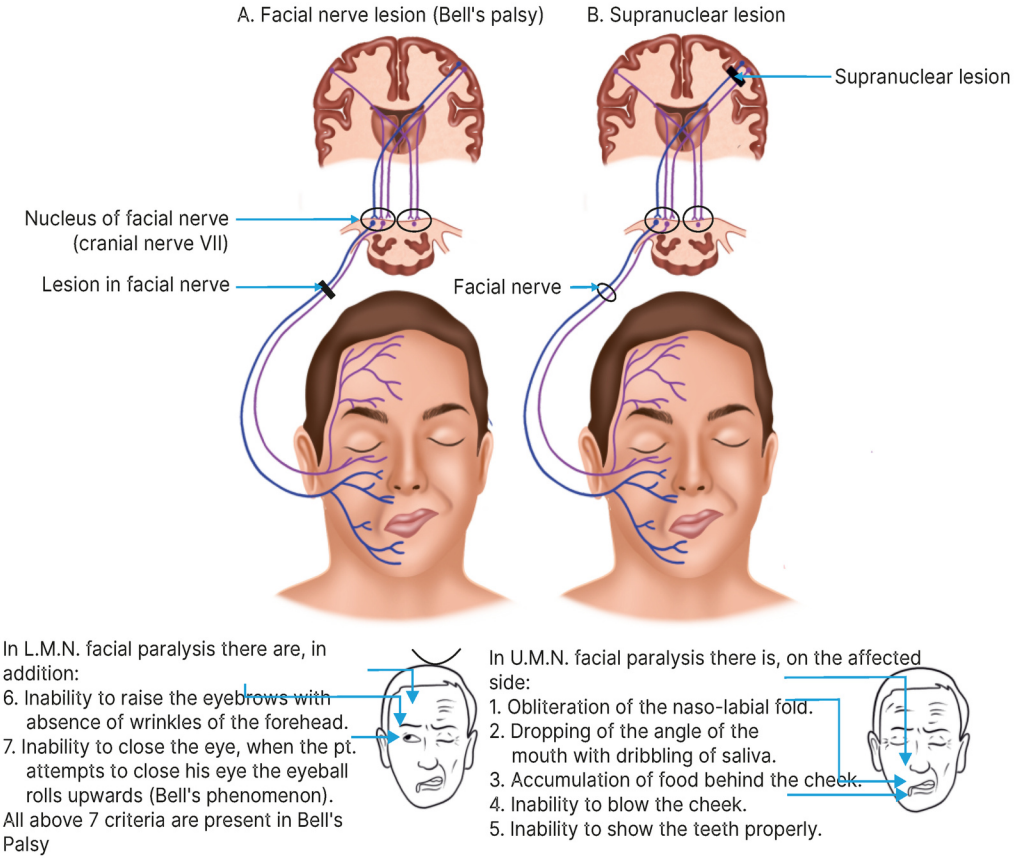
00:53:35



Branches

- Greater petrosal nerve
  - Ends in the pterygopalatine ganglion
  - Postganglionic fibers supply the lacrimal gland
  - Lacrimal gland parasympathetic supply → 7th nerve
- Chorda tympani
  - Taste from the anterior 2/3 of the tongue
  - Supplies the submandibular gland and the sublingual gland
- The 7th nerve supplies the glands of the head & neck
  - Exception → Parotid gland, which is supplied by IX th nerve
  - Facial nerve passes through the parotid gland
    → Divides into 5 terminal branches and supplies the muscles of facial expression

Umn v/s lmn lesions of the facial nerve



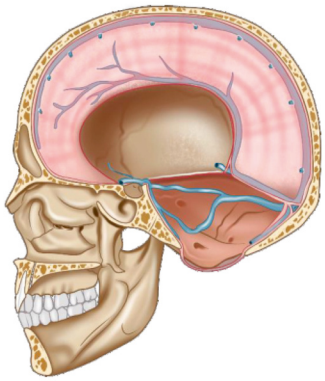
UMN lesion	LMN lesion

• Supranuclear lesion
• UMN lesion features
  ○ Lower half of the face is paralyzed → Contralateral side
  → Angle of mouth drooping
  → Dribbling of saliva
  → Food accumulation in the cheek
	• Lesion of the facial nerve after the nucleus
	• LMN lesion features
	  ○ The entire half of the face is paralyzed → Ipsilateral side
	  → Drooping of the mouth
	  → Dribbling of saliva
	  → Food accumulation in the cheek
	  → Cannot raise eyebrow
	  → No forehead wrinkles

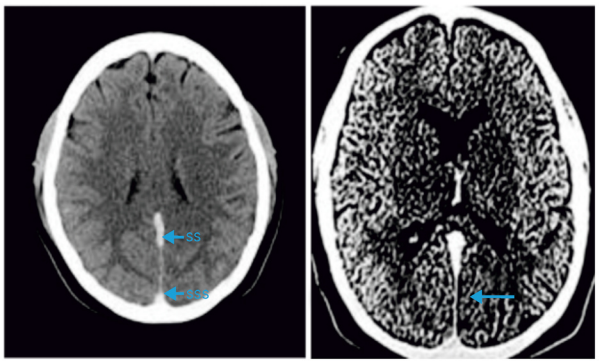
Yourwish

DURAL VENOUS SINUSES

01:01:25



- Total 23 sinus
  - 8 paired
  - 7 unpaired
- Formed between
  - Endosteal layer of dura mater
  - Meningeal layer of dura mater
- Exceptions (present only in meningeal layer):
  - Inferior sagittal sinus
  - Straight sinus

Superior sagittal sinus	• In midline • Drains into the confluence of sinuses
Inferior sagittal sinus	• Below the superior sagittal sinus • Present only in the meningeal layer • Joins the straight sinus
Straight sinus	• Drains into confluence • Present only in meningeal layer • The great cerebral vein (vein of Galen) continues as the straight sinus 
Occipital sinus	• Drains into the confluence of sinuses

Drainage pathway

Confluence of sinuses

↓

Transverse sinus

↓

Sigmoid sinus

↓

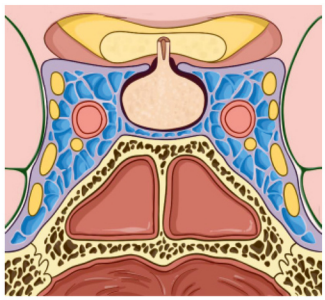
Inferior petrosal sinus

↓

Internal jugular vein

- The internal jugular vein is formed by the sigmoid sinus and the inferior petrosal sinus

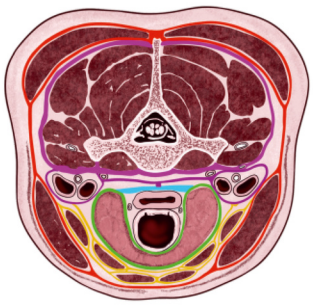
Cavernous sinus



- Cavernous sinus
  - Paired sinus
  - Located on either side of the body of sphenoid bone
- Structures in the lateral wall
  - CN III (oculomotor)
  - CN IV (trochlear)
  - CN V1 (ophthalmic)
- Structures inside the cavernous sinus
  - Internal carotid artery
  - CN VI (abducens)
- Maxillary nerve (CN V2) does not pass through lateral wall of cavernous sinus

DEEP CERVICAL FASCIA (POLICE FASCIA)

01:08:22



- Layers in neck
  - Skin
  - Superficial fascia
  - Deep cervical fascia
- Deep cervical fascia modifications
  - Investing layer
  - Pretracheal fascia
  - Prevertebral fascia
  - Carotid sheath

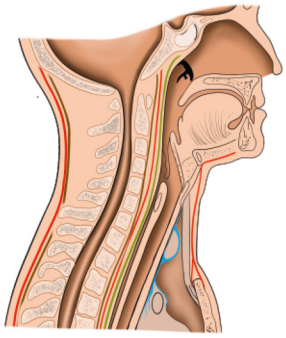
Prevertebral fascia	• Surrounds cervical vertebrae and associated muscles • Axillary sheath is the extension of the prevertebral fascia • Brachial plexus carries the prevertebral fascia into the axilla and forms the axillary sheath
Pretracheal fascia	• Located in front of the trachea • Content – Thyroid gland • Forms false capsule of the thyroid gland • True capsule is formed by gland parenchyma

Investing layer	• Most superficial layer of deep cervical fascia
	• Encloses entire neck → Splits to enclose structures (Rule of two)
	• Two muscles
	  ○ Sternocleidomastoid
	  ○ Trapezius
	• Two glands
	  ○ Parotid
	  ○ Submandibular
	• Two spaces
	  ○ Suprasternal space
	  ○ Supraclavicular space
	• Two ligaments
	  ○ Stylomandibular
	  ○ Sphenomandibular
	• Two pulleys

	○ Digastric ○ Omohyoid • Mumps is painful because of the unyielding investing layer around the parotid gland
Carotid sheath	• True contents ○ Common carotid artery ○ Internal carotid artery ○ Internal jugular vein ○ Vagus nerve • False contents ○ CN IX ○ CN XI ○ CN XII

- Berry's ligament
  - Modification of pretracheal fascia
  - Connects the thyroid gland to the cricoid cartilage
  - Thyroid swelling moves with deglutition due to Berry's ligament

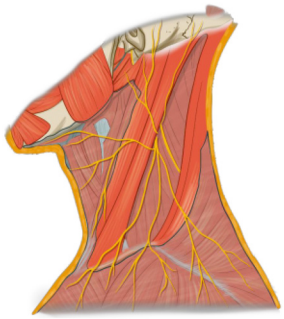
Sagittal section deep cervical fascia



- Three fascia
  - Buccopharyngeal fascia
  - Alar fascia
  - Prevertebral fascia
- Spaces
  - Retropharyngeal space
    → Between buccopharyngeal fascia and alar fascia
    → Closed space
  - Danger space
    → Between the alar fascia and the prevertebral fascia
    → Extends into the mediastinum
    → Infection spreads to the mediastinum
    → Compression of trachea → dyspnea
    → Compression of the esophagus → dysphagia

GREAT AURICULAR NERVE

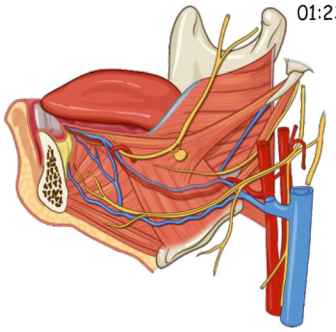
01:19:20



- Posterior triangle boundaries
  - Sternocleidomastoid
  - Trapezius
  - Clavicle
- Roof of posterior triangle contains 4 cutaneous nerves
  - Lesser occipital nerve
  - Great auricular nerve
  - Transverse cervical nerve
  - Supraclavicular nerve
- All four nerves emerge from the nerve point → Erb's point

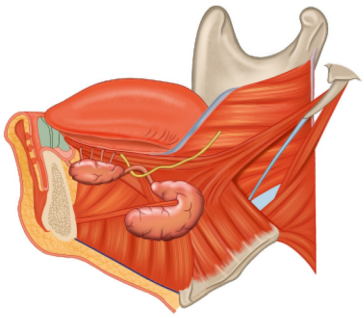
- The external jugular vein is also present in roof
- The great auricular nerve runs along with the external jugular vein and supplies
  - Skin over the angle of mandible
  - Lobule (lower 1/3) of the auricle
    → Upper 2/3 of auricle → Auriculotemporal nerve
- Clinical correlations:
  - Post-parotidectomy loss of sensation in shaving area → Great auricular nerve injury
  - Frey's syndrome

HYOGLOSSUS MUSCLE



Superficial relations of the hyoglossus muscle

- Hyoglossus muscle → From the hyoid bone to the tongue
- Structures superficial to the hyoglossus
  - Lingual nerve
    → Pass through Submandibular ganglion
  - Styloglossus muscle
  - Hypoglossal nerve (12th nerve)
  - Deep part of the submandibular gland

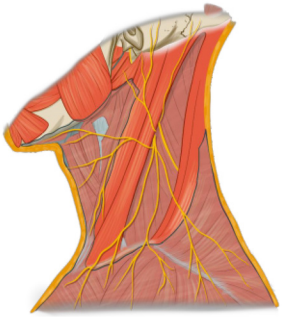


Submandibular gland

- Submandibular gland is divided into
  - Superficial part
  - Deep part
- Division occurs around the mylohyoid muscle

Q. A patient presented with jaw swelling and weight loss. Suspecting a malignancy, the submandibular gland was resected. Which is the most likely nerve to be damaged during submandibular gland resection?

A. Nerve to mylohyoid
B. Inferior alveolar nerve
C. Lingual nerve
D. Hypoglossal nerve

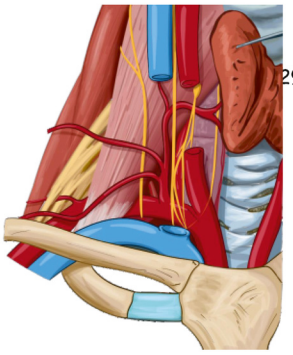


Answer. C. Lingual nerve

Deep relations of the hyoglossus muscle

- Stylohyoid muscle
- Cranial nerve IX

SCALENUS ANTERIOR MUSCLE



Relations of the scalenus anterior muscle

- Posterior Relations
  - Subclavian artery: divided into 3 parts by the scalenus anterior
    → 1st part → Medial to muscle
    → 2nd part → Behind muscle
    → 3rd part → Lateral to muscle

- Brachial plexus is present between the scalenus anterior and the scalenus medius
- Anterior Relations
  - Subclavian vein
  - Thyrocervical trunk branches (Mnemonic: SIT)
    - → Suprascapular artery
    - → Inferior thyroid artery
    - → Transverse cervical artery
- Carotid sheath contents
  - Common carotid artery
  - Internal jugular vein
  - Vagus nerve
- Sympathetic trunk (posterior to carotid sheath)
- Recurrent laryngeal nerve
  - Present in the tracheoesophageal groove
  - On the right side loops around the right subclavian artery
- Phrenic nerve
  - Origin → C3, C4, C5
  - Descends on the anterior surface of the scalenus anterior and then supplies the diaphragm

SUBCLAVIAN ARTERY

01:36:25

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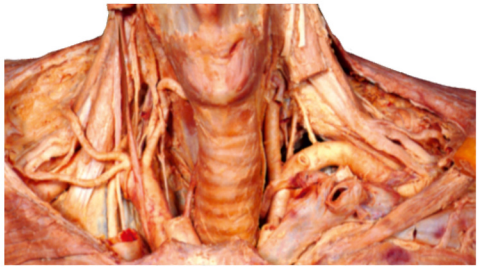
- Divided into 3 parts by the scalenus anterior muscle
- Branches of 1st Part
  - Vertebral artery
  - Internal thoracic artery
  - Thyrocervical Trunk - Branches:
    - → Suprascapular artery
    - → Inferior thyroid artery
    - → Transverse cervical artery
- Branches of the 2nd Part
  - Costocervical trunk
- Branches of the 3rd Part
  - Dorsal scapular artery



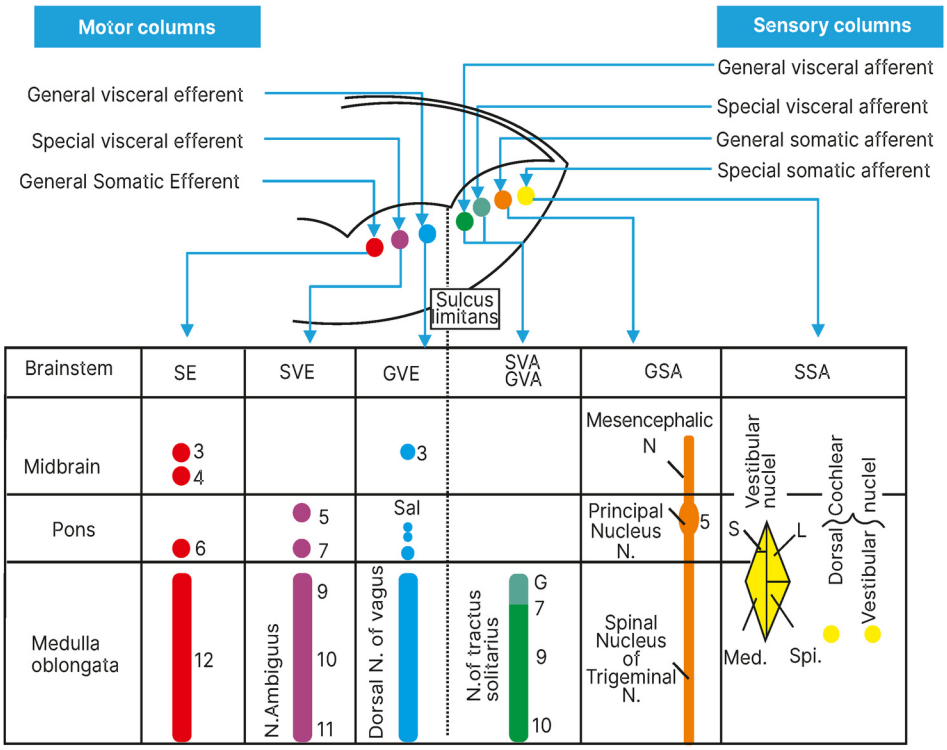
Q. Inferior thyroid artery supplies which of the following structures?

A. Thyroid
B. Parathyroid
C. Oesophagus
D. Thymus
E. All of the above

Answer. E. All of the above

CRANIAL NERVE NUCLEI AND COLUMNS

01:38:38



- Each cranial nerve has its own nuclei
- Nuclei with similar functions are arranged in one column
- Cranial nerve nuclei are located in:
  - Midbrain
  - Pons
  - Medulla
- CN I and CN II → No cranial nerve nuclei
- CN III to CN XII → Nuclei located in brainstem

Motor columns

Special visceral efferent (sve)

- Supplies muscles derived from pharyngeal arches
- Nerve supply of Pharyngeal arch → 5, 7, 9, 10
  - Arch 1 → Muscles of mastication → V3
  - Arch 2 → Muscles of facial expression → VII
  - Arch 3 → Muscles of palate, larynx, pharynx → IX
  - Arch 4 & 6 → Muscles of palate, larynx, pharynx → X
- Location of Nuclei
  - Motor nucleus of V → pons
  - Facial nucleus → pons
  - Nucleus ambiguus (IX, X, XI) → medulla

General somatic efferent (gse)

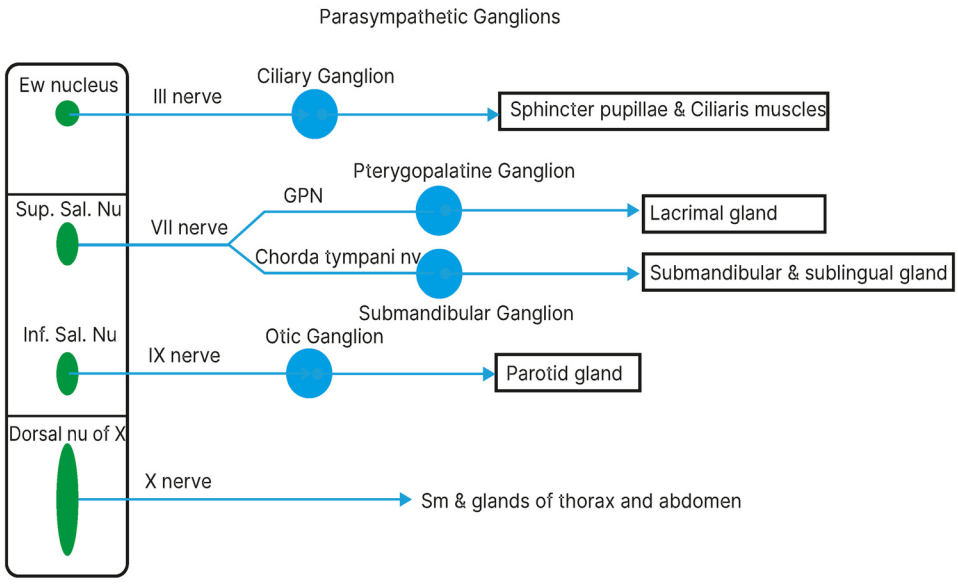
- Supplies muscles derived from somites
  - Extraocular muscles → CN III, IV, VI

- Tongue muscles → CN XII
- Location of Nuclei
  - Oculomotor nucleus (III) → Midbrain
  - Trochlear nucleus (IV) → Midbrain
  - Abducens nucleus (VI) → Pons
  - Hypoglossal nucleus (XII) → Medulla

General visceral efferent (gve)

- GVE column → Cranial nerves 3, 7, 9, 10 → Parasympathetic column
  - Supplies glands and smooth muscles
- Salivatory nucleus → Pons
  - Superior salivatory nucleus (CN VII)
    → Submandibular gland
    → Sublingual gland
    → Lacrimal gland (lacrimatory nucleus is part of the superior salivatory nucleus)
  - Inferior salivatory nucleus (CN IX)
    → Parotid gland
- Smooth Muscle Nuclei
  - Edinger-Westphal nucleus (CN III) → Midbrain
    → Ciliary muscle
    → Sphincter pupillae
  - Dorsal nucleus of vagus (CN X) → Medulla oblongata
    → Smooth muscle of the respiratory tract
    → Smooth muscle of the GIT

PARASYMPATHETIC GANGLION



Sensory columns

Special visceral afferent and general visceral afferent

- Nucleus of tractus solitarius → carries:
  - Special sensation (taste)
  - General visceral sensation from the tongue

General somatic afferent

- Supplies body wall sensation of head & neck
- Sensory nucleus of the trigeminal (large nucleus)
  - Extends from
    → Midbrain
    → Pons
    → Medulla
    → Up to the C2 spinal segment
- Three Parts
  - Mesencephalic nucleus → Midbrain
  - Chief (Principal) sensory nucleus → Pons
  - Spinal nucleus → Medulla
- Functional Division
  - Pain & temperature → Spinal nucleus
  - Touch & pressure → Chief sensory nucleus
  - Proprioception → Mesencephalic nucleus (Center of Jaw reflex)

Special somatic afferent

- Special sensation from the internal ear
- Carried by CN VIII
- Vestibular nuclei and Cochlear nuclei are present in the ponto-medullary junction

EXTERNAL CAROTID ARTERY

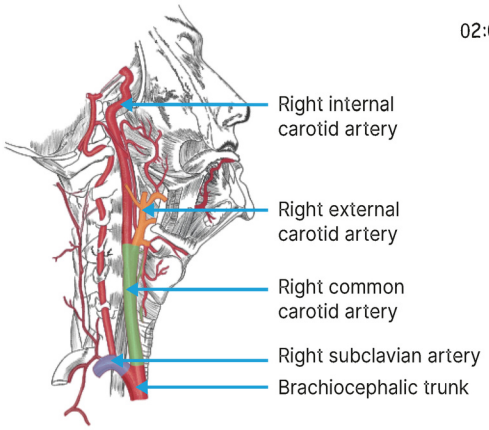
01:58:51

Ventral Branches	• Superior thyroid artery • Lingual artery • Facial artery
Medial Branch	• Ascending pharyngeal artery ○ First and Smallest branch
Dorsal Branches	• Occipital artery • Posterior auricular artery
Terminal branches	• Maxillary artery → Largest Branch • Superficial temporal artery

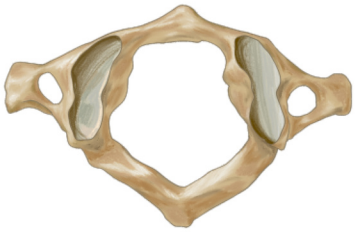
VERTEBRAL ARTERY

02:01:46

- Origin
  - First part of the subclavian artery (VIT branches)
- Course
  - Enters foramen transversarium at C6
  - Ascends through C6-C1
  - Enters the skull via the foramen magnum
- Parts
  - 1st part → Origin to C6



- 2nd part → Within foramen transversarium (C6-C1)
- 3rd part → From C1 to foramen magnum
- 4th part → Intracranial part

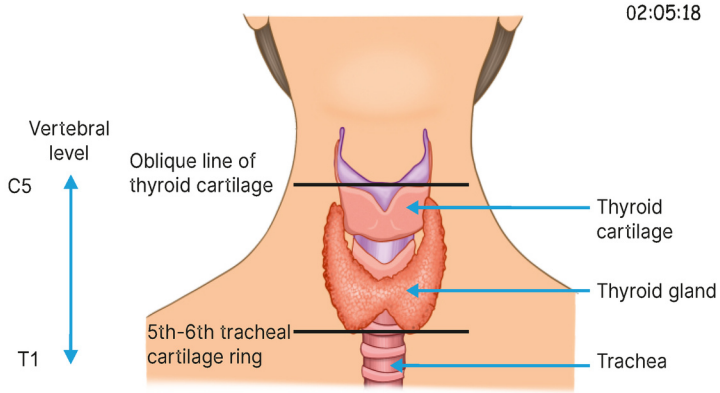


- At C1:
  - Arrow at foramen transversarium → 2nd part
  - Arrow on posterior arch of C1 → 3rd part
  - Groove on the posterior arch of C1 → Accommodates the 3rd part

THYROID GLAND

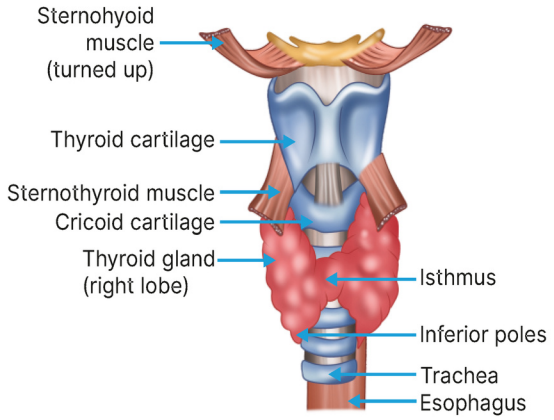
02:05:18

- Extent
  - Vertebral level → C5 to T1
  - Cartilage reference
    - → From oblique line of the thyroid cartilage
    - → To 5th or 6th tracheal ring
- The thyroid gland lies beneath the oblique line of the thyroid cartilage
- The sternothyroid muscle is attached to the oblique line



Q. Which of the following structures prevents the upward extension of thyroid swelling through its attachment to the thyroid cartilage?

A. Pretracheal fascia
B. Sternothyroid
C. Thyrohyoid membrane
D. Ligament of Berry



Answer. B. Sternothyroid

PHARYNX

02:08:02

- Muscles
  - 3 longitudinal muscles
  - 3 circular muscles (constrictors)
    - → Superior constrictor
    - → Middle constrictor
    - → Inferior constrictor
    - → Inferior constrictor is formed by:
      1. Thyropharyngeus (thyroid cartilage → pharyngeal raphe)
      2. Cricopharyngeus (cricoid cartilage → pharyngeal raphe)
- Killian's Dehiscence:
  - A weak triangular area between-
    - → Thyropharyngeus
    - → Cricopharyngeus
  - Outpouching through this area → Zenker's diverticulum

NEET PG 2020, 2024
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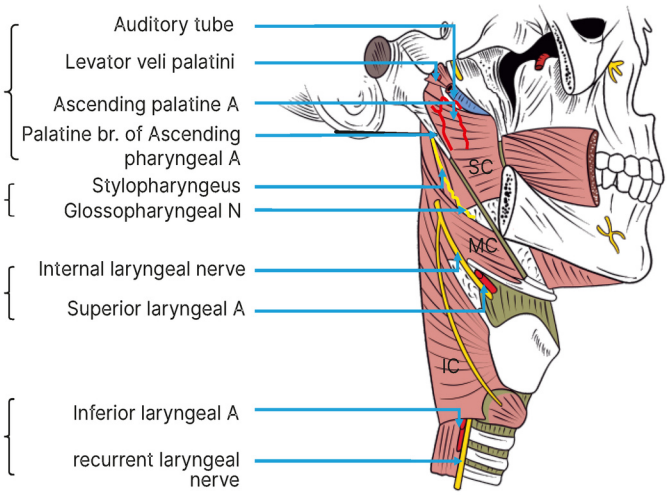
INICET 2019

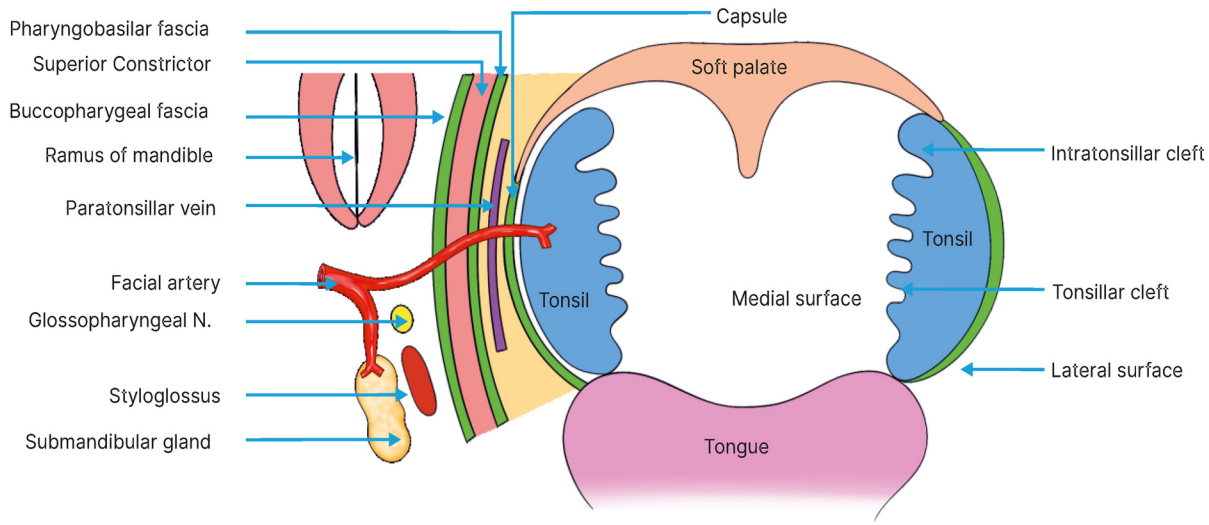
Structures passing between constrictors

- Between the Superior & Middle Constrictor
  - Stylopharyngeus muscle
  - Glossopharyngeal nerve
- Between the Middle & Inferior Constrictor
  - Internal laryngeal nerve
  - Superior laryngeal artery
- Below Inferior Constrictor
  - Recurrent laryngeal nerve
  - Inferior laryngeal artery
- Above Superior Constrictor
  - Auditory (Eustachian) tube
  - Levator veli palatini
  - Ascending palatine artery
  - Palatine branches of the ascending pharyngeal artery



TONSILAR BED

02:12:53



- Tonsils are located inside the superior constrictor muscle
- Layers (inside → outside):
  - Capsule
  - Paratonsillar space → contains Paratonsillar vein
    → Bleeding during tonsillectomy → Paratonsillar vein
  - Pharyngobasilar fascia (inner fascia)
  - Buccopharyngeal fascia (outer fascia)
- Tonsillitis pain referred to the ear → Via glossopharyngeal nerve (Jacobson's nerve)

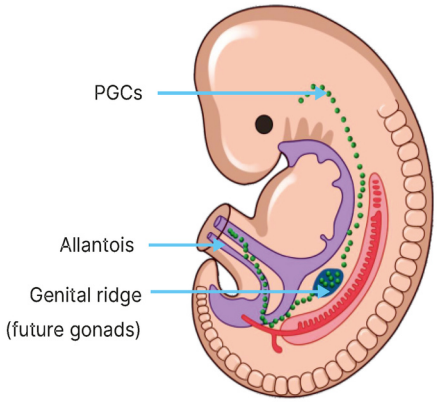
3. EMBRYOLOGY

GENERAL EMBRYOLOGY

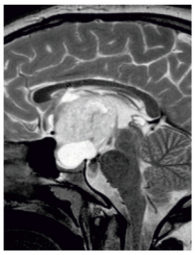
00:00:35

Primordial Germ Cells (PGC)

- PGC give rise to male and female gametes
- PGC are produced from the epiblast during the 2nd week
- Migrates to the yolk sac by the 4th week
- Migrates to the genital ridge by the 5th week
- Genital ridge gives rise to the testes and ovaries



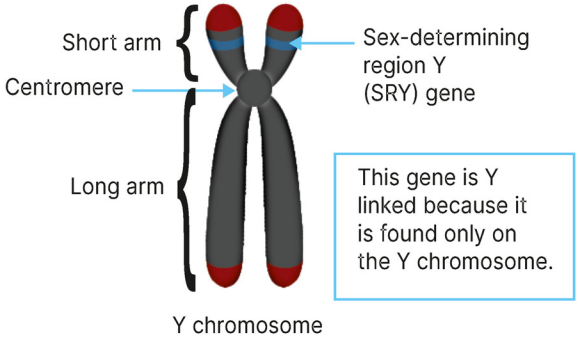
Clinical Correlation

Craniopharyngeal teratoma	• Due to the abnormal migration of PGC to the neck 
Sacrococcygeal teratoma	• Due to abnormal migration of PGC to the sacrum & coccyx, and even persistence of the primitive streak FMGE 2023 

Location of the Sry Gene

NEET PG 2023

- Distal end of the short arm of the Y chromosome



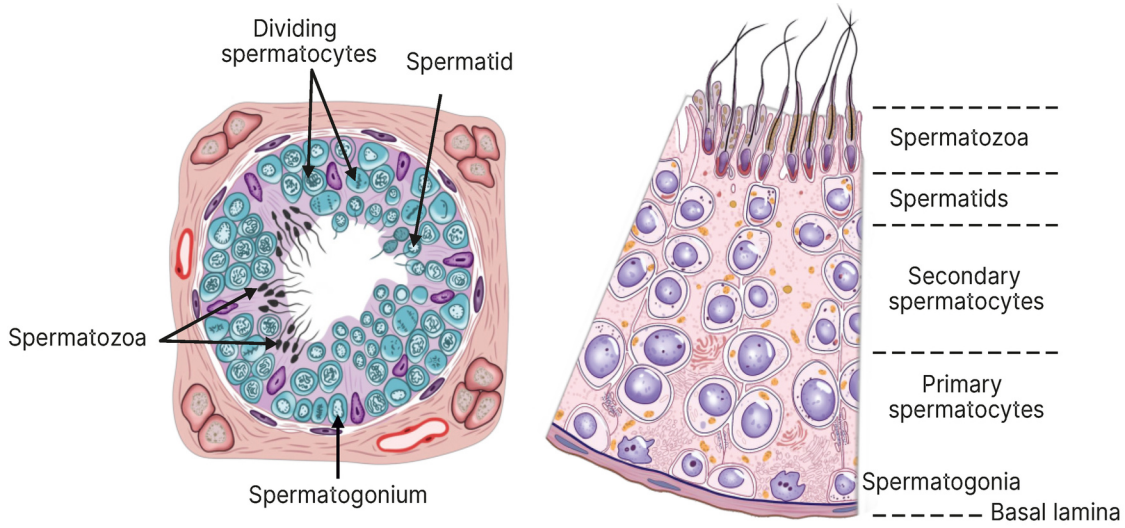
Spermatogenesis

00:03:34

FMGE 2021

- Location: Seminiferous tubule
- Duration: 72-74 days
- Process: Occurs in the membrane of Sertoli cells

Sertoli Cells



- Spermatogonia (Basal membrane) → Primary spermatocyte (diploid in nature, formed after 5-7 cycles of mitosis) → Secondary spermatocyte (haploid in nature) → Spermatids (undergo spermiogenesis) → Spermatozoa (present at the tip of the Sertoli cells) → Spermiation (released from Sertoli cells) → Migrates to the Epididymis
- Location, maturation, and gaining of motility of Spermatozoa all happen inthe Epididymis
- Capacitation (final maturation) takes place in the fallopian tube just before fertilization

Important Information

- The middle piece of a spermatozoa will have the most no.of mitochondria

Oogenesis

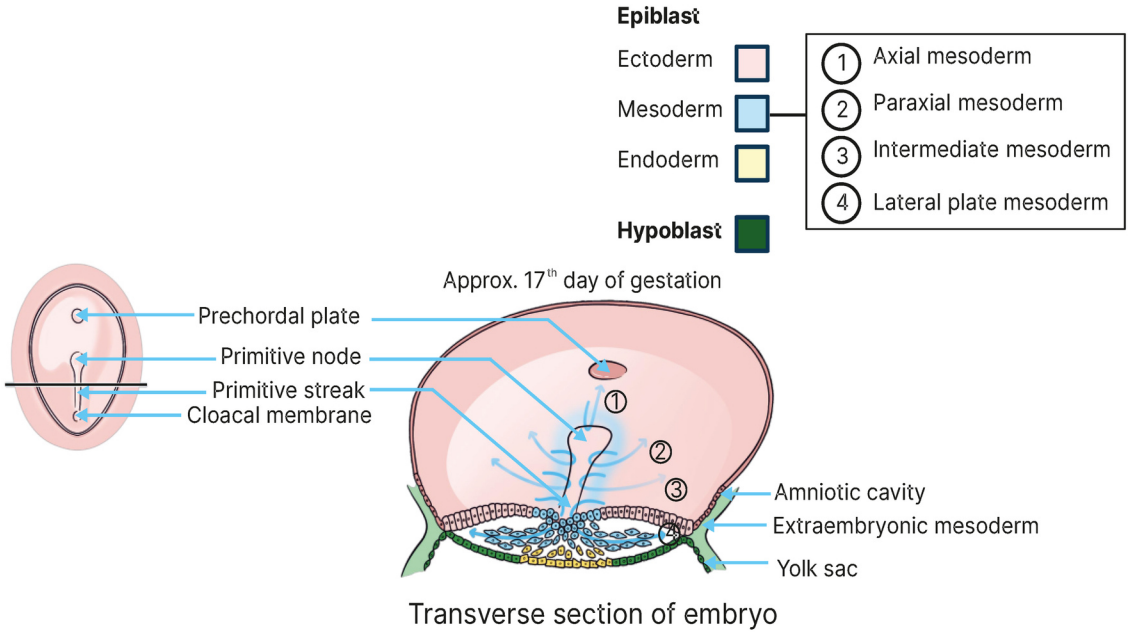
00:08:07

FMGE 2023

- Primary oocyte is arrested in Prophase-1 (Diplotene stage) of meiosis-1
- Secondary oocyte is arrested in Metaphase-2 of meiosis-2

Gastrulation

00:09:35

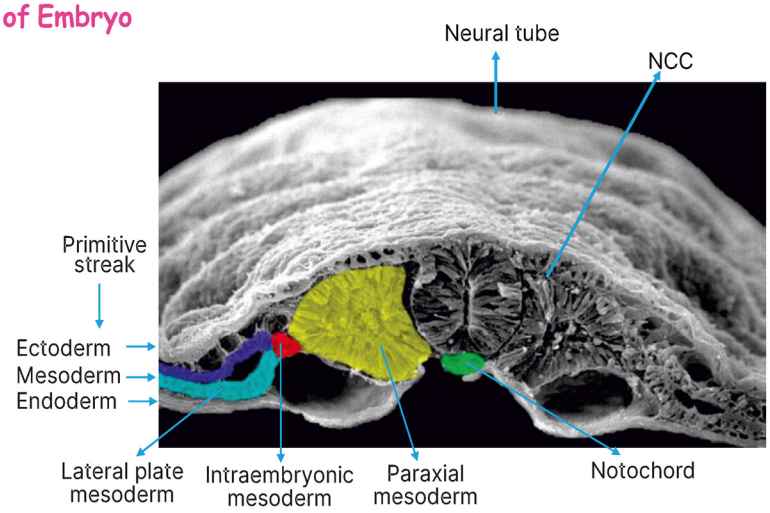


Transverse section of embryo

Yourwish

- Takes place in the 3rd week
- Formation of all the 3 germ layers- Ectoderm, Endoderm, and Mesoderm
  - All 3 formed from the primitive streak
  - Sequence of formation of germ layers- Endoderm → Mesoderm → Ectoderm
- Primitive node (Hensen's node) forms the notochord

Transverse Section of Embryo

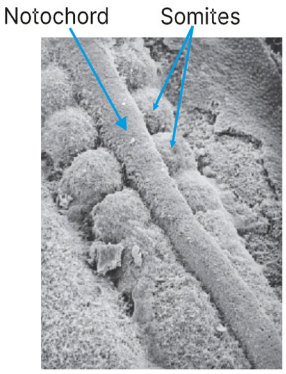


- Notochord stimulates the overlying ectoderm to form the neural tube
- Intraembryonic mesoderm (present inside the embryo)- Paraxial, intermediate, and lateral plate mesoderm

Intermediate Mesoderm

- Forms the nephrogenic cord and genital ridge
- Helps in forming the urogenital system

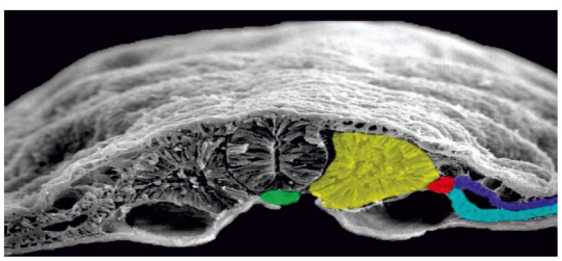
Paraxial Mesoderm



- Forms somites (spherical ball-like structures)
- Somites have 3 parts
  - Dermatome- Forms the dermis of the back
  - Sclerotome- Forms the skeleton
    (only the axial skeleton- sternum, ribs, vertebrae)
  - Myotome- Forms the muscles
    → Epiaxial myotome- Forms the true back muscles
    (e.g., Erector spinae)
    → Hypoaxial Myotome- Forms the limb muscles, abdominal muscles,
    and intercostal muscles

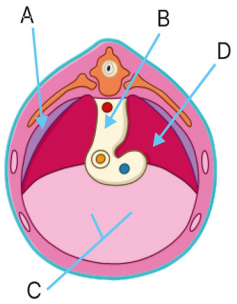
Lateral Plate Mesoderm

00:19:40



- Lateral plate mesoderm- Forms the dermis of the front, appendicular skeleton, smooth and cardiac muscles
- Intraembryonic coelom divides the lateral plate mesoderm into
  - Somatopleuric Lateral plate mesoderm- Along the ectoderm
    → Forms the parietal layers of the cavities- the dermis of the front, and the appendicular skeleton
  - Splanchnopleuric Lateral plate mesoderm- Along the endoderm
    → Forms visceral layers- the smooth and cardiac muscles
- Intraembryonic coelom- Forms the pericardial cavity, pleural cavity, and peritoneal cavity
- Septum transversum
  - Undifferentiated lateral plate mesoderm
  - Cranial most part of the embryo before folding
  - Forms the central tendon of the diaphragm, fibrous pericardium, stroma of the liver, and ventral mesogastrium

00:26:38



Development of Diaphragm

- A- Body wall mesoderm/Cervical somites
  - Forms the muscles of the diaphragm
- B- Dorsal meso-oesophagus
- C- Septum tranversum
  - Forms the central tendon
- D- Pleuro-peritoneal membrane

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00:29:45

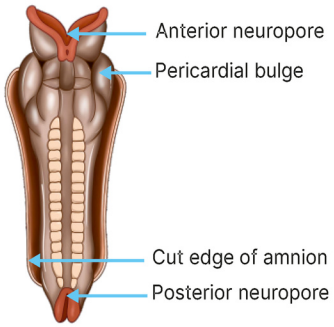
Congenital Diaphragmatic Hernia

- Absence of the pleuro-peritoneal membrane
- During development, due to high pressure in the abdomen, the loops of intestines herniate into the thorax, compressing the lungs, leading to lung hypoplasia

CNS EMBRYOLOGY

Neural Tube

- Neuralation- Formation of the neural tube
- Occurs in the 3rd week of Intrauterine life
- Forms the central nervous system: Brain, Spinal cord, Glial cells (except the Schwann cells), Retina
- Two openings:



Anterior neuropore	Posterior neuropore
• AKA cranial neuropore/Rostral neuropore • Closes on the 25th day • Fails to close- Anencephaly	• AKA caudal neuropore • Closes on the 27/28th day • Fails to close- Spina bifida

- Craniorachischisis- Anencephaly + Defect of the spinous process of the vertebrae

Types of Spina Bifida

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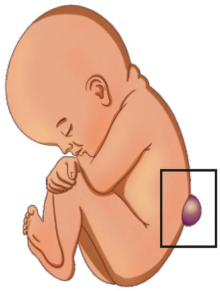

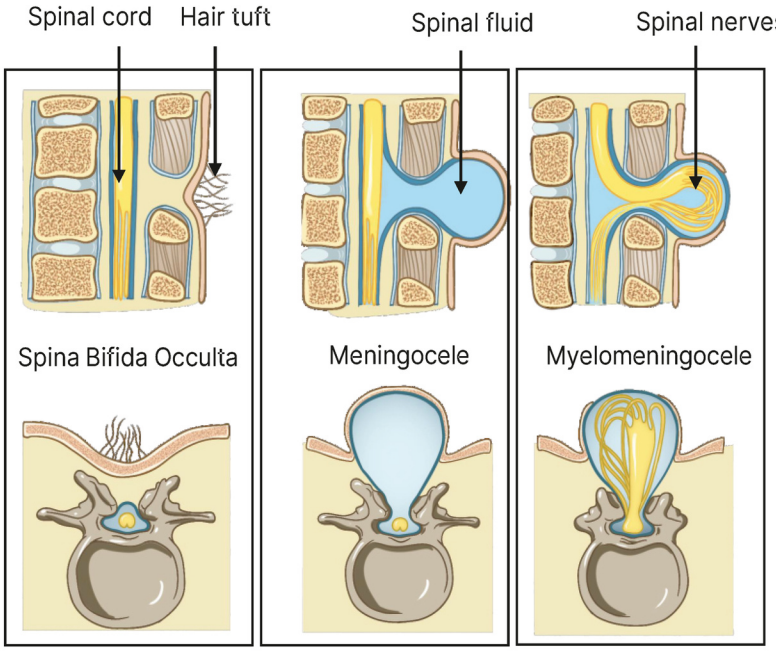

- Spina bifida occulta- Defect of the vertebrae with a tuft of hair on the outside
- Meningocele- Defect of the vertebrae with meninges protruding outside with CSF
- Myelomeningocele- Defect of the vertebrae with meninges protruding outside with nervous tissue

Neural Crest Cells (NCC) Derivatives

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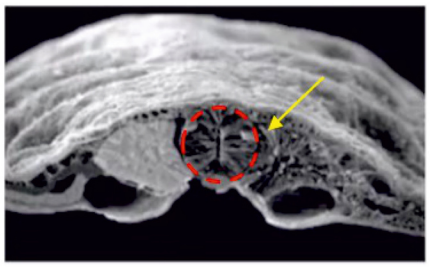
- Forms the peripheral nervous system
  - All ganglions
  - Enteric plexus
  - Schwann cells
  - Adrenal medulla
  - Parafollicular cells / C cells (found in thyroid cells)
  - Melanocytes
  - Most of the skull bones
  - Dentine
  - Pharyngeal arch cartilage
  - Dermis of the head and neck
  - Conotruncal septum (spiral and bulbar septum)



Important Information

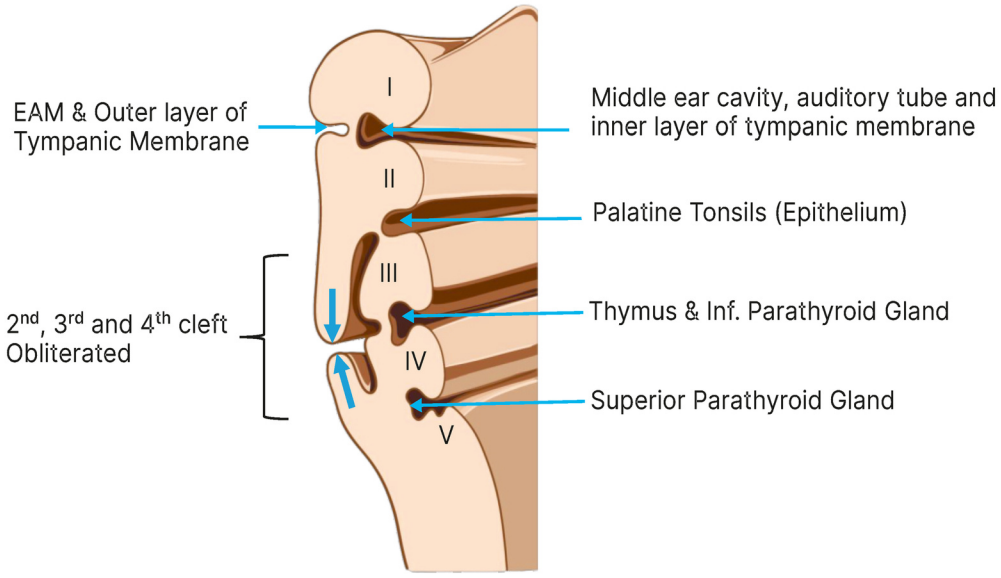
- Ultimobranchial body acts like a platform for the formation of Parafollicular cells
- Neural crest cells migrate and sit on the ultimobranchial body to form Parafollicular cells

HEAD & NECK EMBRYOLOGY

00:38:08

ECTODERMAL CLEFTS	ENDODERMAL POUCHES
• Ectodermal invaginates to form clefts • 4 ectodermal clefts	• Endodermal invaginates out to form pouches • 4 Endodermal pouches

Derivatives



- The thymus migrates to the mediastinum, hence the 3rd pouch forms the inferior parathyroid gland, and the 4th pouch forms the superior parathyroid gland

Clinical Correlation

00:42:35

Cervical Sinus

- Formed due to the overlapping of the 2nd arch
- Normally, it's obliterated
- If it persists, it forms a branchial cyst/fistula

Digeorge Syndrome

- 3rd > 4th pouch involvement
- Non-formation of 3rd pouch → No thymus & parathyroid gland → Thymic hypoplasia & Hypocalcemia

Pharyngeal Arch Derivatives

00:44:43

- Nerve supply **(Mnemonic- 5, 7, 9, 10)**
  - 1st- Mandibular nerve (CN 5_3)
  - 2nd- Facial nerve (CN 7)
  - 3rd- Glossopharyngeal nerve (CN 9)
  - 4th- Superior laryngeal nerve (branch of CN 10)
  - 6th- Recurrent laryngeal nerve (branch of CN 10)
- Pharyngeal arches are derived from the mesoderm

Yourwish

Bones and Cartilages Derived from the Pharyngeal Arches

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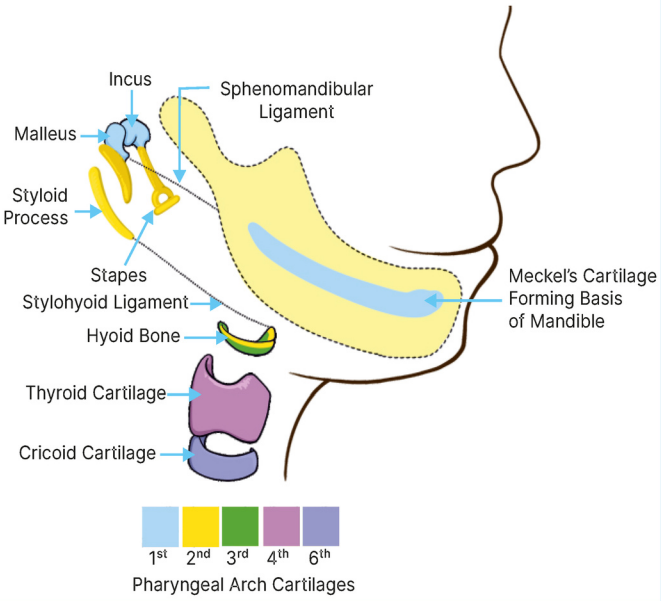
1st arch- Malleus, Incus, Anterior ligament of Malleus, Sphenomandibular ligament, Mandible, maxilla

2nd arch- Stapes, Styloid process, Stylohyoid ligament, lesser horn, and upper part of the body of the hyoid bone

3rd arch- Greater horn and lower part of the body of the hyoid bone

4th & 6th arch- All the cartilages of the larynx

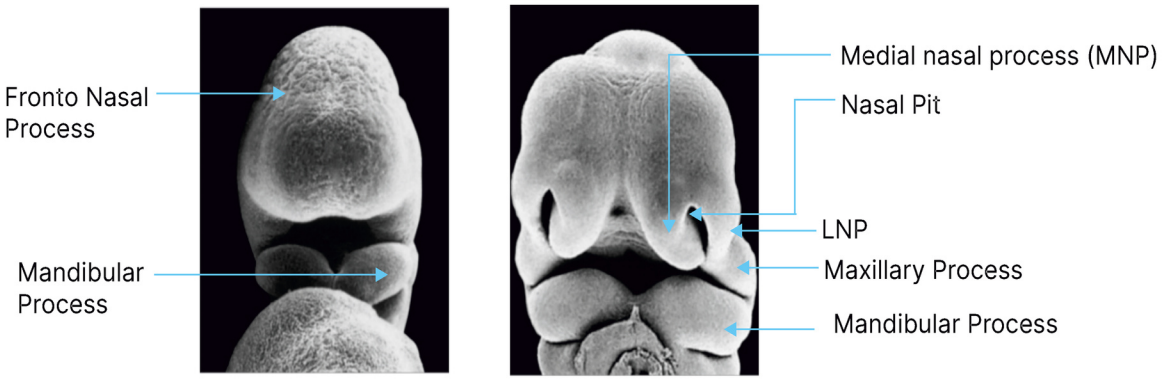


Muscles Derived from the Pharyngeal Arches

Pharyngeal arch (nerve supply)	Muscles derived
1st arch (CN 5_3)	• Muscles of mastication • Tensor tympani • Tensor veli palatini • Anterior belly of digastric • Mylohyoid
2nd arch (CN 7)	• Muscles of facial expression • Stapedius • Posterior belly of the digastric • Stylohyoid
3rd arch (CN 9)	• Stylopharyngeus
4th & 6th arch (CN 10)	• Muscles of the pharynx, larynx, and palate

Development of Face

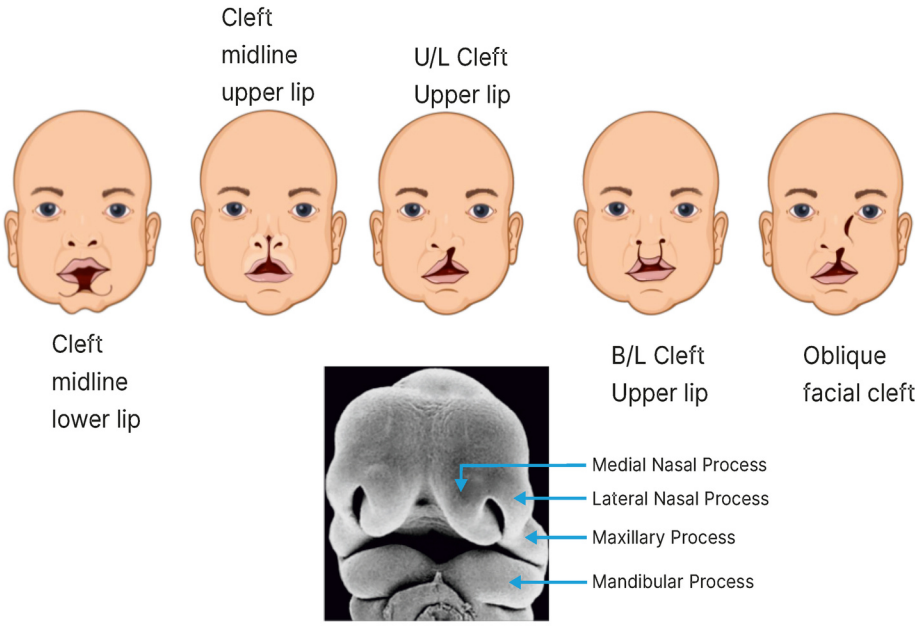
00:51:10



- The lower part of the face is formed from the mandibular process, and the mandibular process itself forms the maxillary process
- The upper part of the face (frontal and nasal) is derived from the frontonasal process
  - Medial nasal process
  - Lateral nasal process
  - Maxillary nasal process

Facial Anomalies

00:53:00



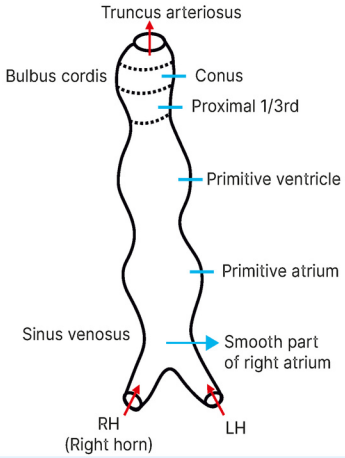
	Normal embryology	Anamoly
Lower lip	• Forms by fusion of the madubular process	• **Cleft midline lower lip-** Due to non-fusion of the mandibular process
Upper lip	• Philtrum- Forms by the fusion of the medial nasal process • Entire upper lip- Maxillary process fuses with the medial nasal process	• **Cleft midline upper lip-** Due to non-fusion of the medial process • **U/L cleft upper lip-** Due to non-fusion of the maxillary process with the medial nasal process • **B/L cleft upper lip-** Due to non-fusion of both the maxillary process and the medial nasal process • **Oblique facial cleft-** Due to non-fusion of the maxillary process with the medial nasal process and the lateral nasal process

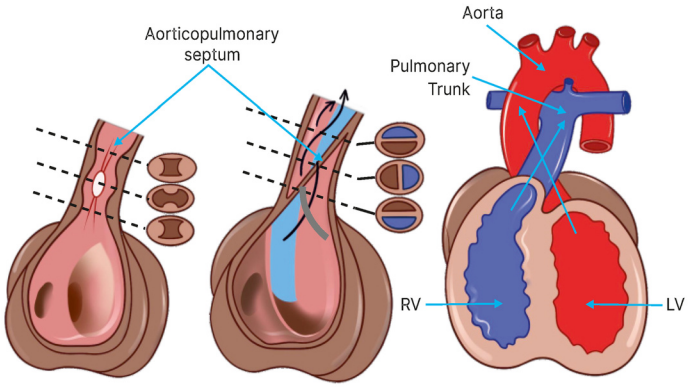
CVS EMBRYOLOGY

00:56:54

Development of the Heart

- Forms from the Splanchnopleuric Lateral plate mesoderm
- Formation of 2 heart tubes → Fusion of the heart tubes cranially, but free caudally



Cranial end	• Called Truncus arteriosus
	• Blood goes out (outflow of blood)
	• Forms the ascending aorta and the pulmonary trunk
	• Aortico-pulmonary septum/Spiral septum separates the ascending aorta and the pulmonary trunk
	• Initially Ascending aorta comes from the right ventricle, and the pulmonary trunk comes from the left ventricle
	  ○ During development, the Spiral septum takes a turn
	  ○ Leading to the ascending aorta coming from the left ventricle and the pulmonary trunk coming from the right ventricle
	• Transposition of great arteries- Failure of the spiral septum to spiral
	• Patent truncus arteriosus- Failure of formation of the spiral septum
	 

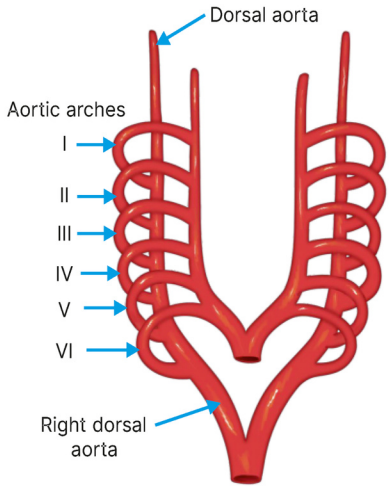
Caudal end	• Called the Sinus venosus (right and left horn) • Drains the blood (inflow of the blood) • Left horn- Forms the coronary sinus ○ Coronary sinus is the largest vein into which all the cardiac veins drain, returning the blood to the right atrium

Middle part	• Forms the chamber (atria and ventricles)
	• Dilatation 1- Bulbus cordis- Divided into 3 parts
	  ○ Carnial most part- Truncus arteriosus
	  ○ Conus part- Has to form the smooth outflowing part
	  ○ Proximal 1/3rd
	• Dilatation 2- Primitive ventricle
	• Dilatation 3- Primitive atrium

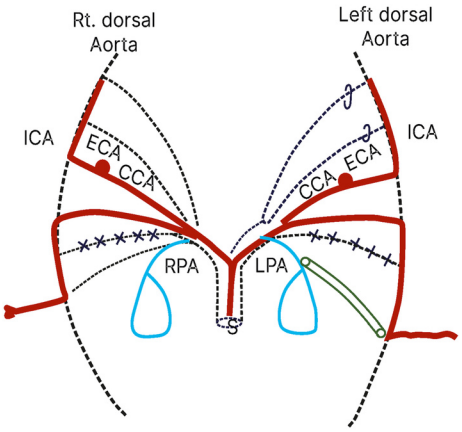
Development of Arterial System

01:03:45

- Right and left dorsal aorta- Present dorsally
- Aortic sac with 2 horns- Present ventrally
- Aortic arches- Connect the aortic sac and dorsal aorta with 6 arch arteries



Arch Arteries

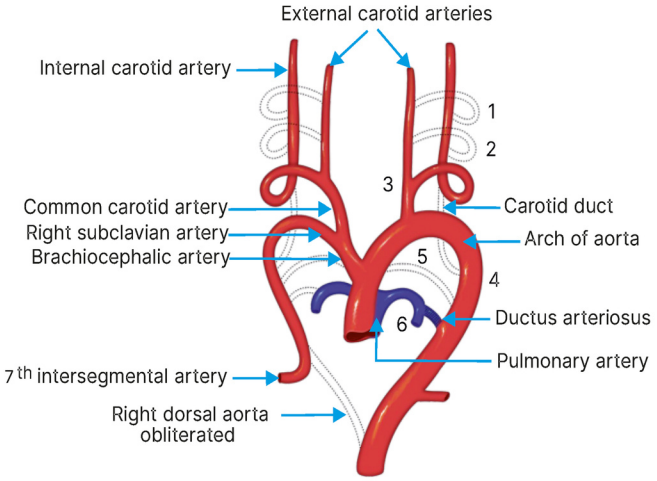


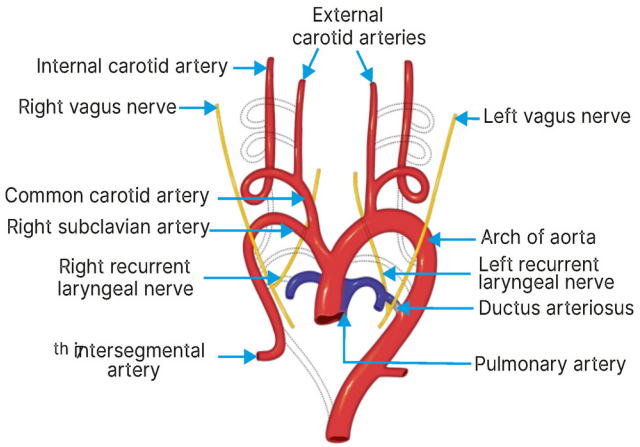
Arch aorta	• Left horn of the aortic sac, left 4th arch artery, left dorsal aorta
Brachiocephalic Trunk	• Right horn of the aortic sac
Common Carotid Artery	• Proximal part of the 3rd arch artery • Gives rise to a bud-like structure – External carotid artery
Internal Carotid Artery	• Distal part of the 3rd arch artery and the dorsal aorta
Left Subclavian Artery	• Left 7th cervical intersegmental artery
Right Subclavian Artery	• Right 4th arch artery, right dorsal aorta, and right 7th cervical intersegmental artery
Pulmonary Artery	• Proximal part of the 6th arch artery
Ductus Arteriosus	• Distal part of the left 6th arch artery

- Nothing is derived from the 5th arch artery, as it is obliterated during development
- Remnant of the 1st arch artery- Maxillary artery
- Remnant of the 2nd arch artery- Stapedial artery and Hyoid artery

Yourwish

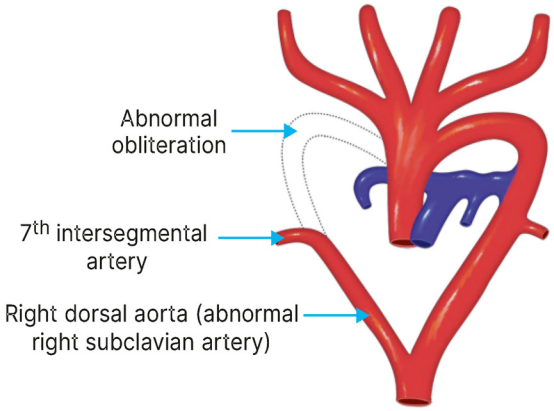
- Left recurrent laryngeal nerve is longer than the right RLN due to the 6th arch artery
  - On the right side, as nothing is derived from the distal part and the 5th arch artery
    → The right RLN ascends and takes a turn around the right subclavian artery
  - On the left side, the distal part forms the ductus arteriosus, and after birth, the ductus arteriosus closes to form the ligamentum arteriosum/
    → The left RLN does not have a chance to ascend, hence it takes a turn at the distal part, making it longer

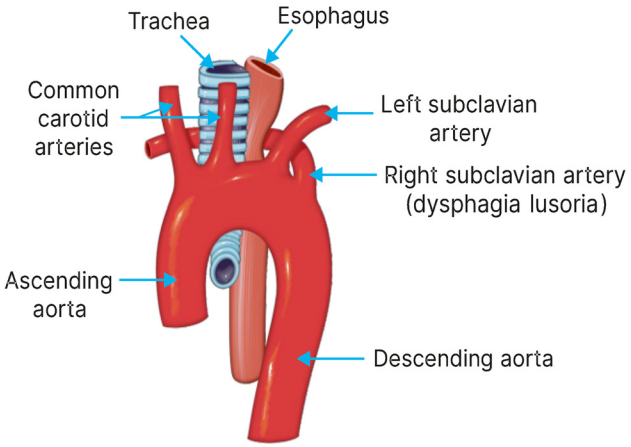




Dysphagia Lusoria (aberrant Right Subclavian Artery)

01:14:05

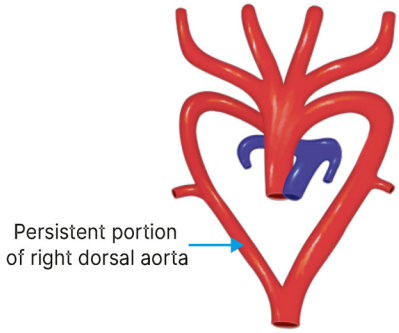


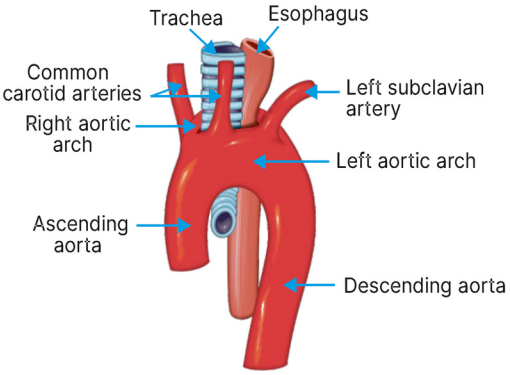


- **Cause**: Right 4th arch artery obliterates
- **Persistence of**: Caudal part of right dorsal aorta and right 7th cervical intersegmental artery

Double Arch of Aorta

01:15:18



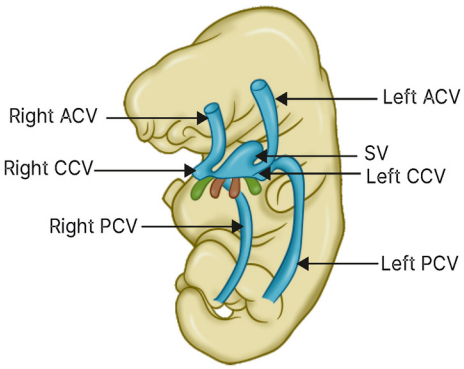


- Persistence of both 4th arch arteries and the caudal part of the dorsal aorta

Development of Venous System

01:15:55

- During development- Cardinal vein, the Vitelline vein, and Umblical vein



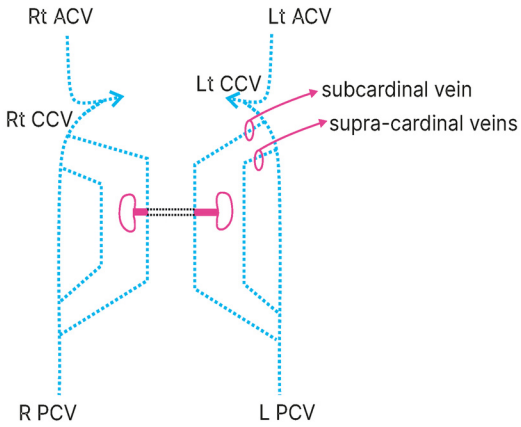
Umbilical Vein

- Right Umblical vein- Regresses
- Left Umbilical vein- Carries oxygenated blood from the mother to the fetus; obliterates after the birth and presents as ligamentum teres in the body

Vitelline Vein

- Collects the blood from the yolk sac
- Yolk sac will be the future gut, and from the gut, the blood is collected by the portal vein.
- Forms portal vein, right and left branches of the portal vein, sinusoids of the liver, central vein of the liver, and hepatic veins

Cardinal Vein



- Right and left anterior cardinal vein and the right and left posterior cardinal vein join to form the right and left common cardinal vein
- Inferior vena cava- Derived from 6 sources
  - Right posterior cardinal vein
  - Right supracardinal vein
  - Anastomosis between the right subcardinal and supracardinal vein
  - Right subcardinal vein
  - Anastomosis between the right subcardinal vein and the hepato-cardiac channel
  - Right hepato-cardiac channel
- Right and left renal veins drain into the IVC
- Right suprareal vein drains into the IVC, and the left suprarenal vein drains into the left renal vein
- Right gonadal vein drains into the IVC, and the left gonadal vein drains into the left renal vein

Suprarenal veins	• Cranial part of the subcardinal vein
Gonadal veins	• Caudal part of the subcardinal vein
Right renal vein	• Right mesonephric vein
Left renal vein	• Left mesonephric vein, left subcardinal vein, and inter-subcardinal anastomosis

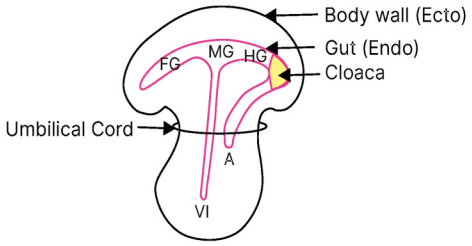
GUT EMBRYOLOGY

01:23:05

Umbilical Cord

- Body wall of the embryo- Derived from the ectoderm
- Foregut, midgut, and hindgut- Derived from the Endoderm
- Midgut gives rise to the vitellointestinal duct, and the hindgut gives rise to the allantois
- Content of the umbilical cord

- Vitellointestinal duct
- Allantois
- Warton's jelly
- Umbilical artery (right and left)
- Umbilical vein (left)



Developmental Anomalies Of The Midgut

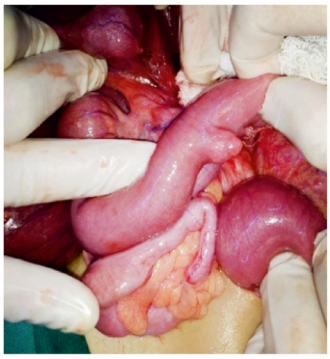
INICET 2022

Leakage Of Meconium From The Umbilicus

- Normally, the vitellointestinal duct obliterates
- Persistence of the vitellointestinal duct leads to meconium leakage from the umbilicus

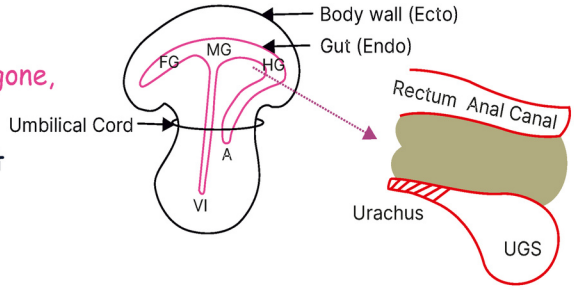
Meckel's Diverticulum

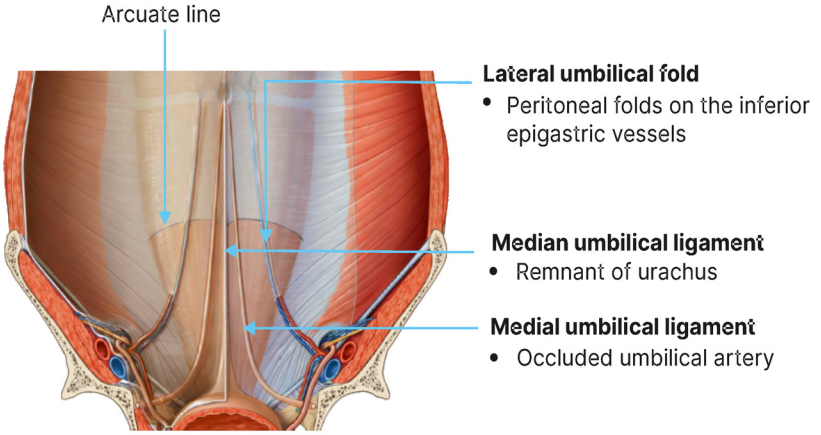
- Due to the persistence of the proximal part of the vitellointestinal duct, which is attached to the midgut (specifically to the ileum)



Development of Hindgut

- Mesoderm (present between the ectoderm and endoderm) separates the hindgut from the Allantois
- Hindgut forms the rectum and anal canal
- Allantois forms the urogenital sinus
- Cranial part of the urogenital sinus is called the urachus
- Urogenital sinus forms the entire urinary bladder, except the trigone, which is derived from the Wolffian duct
- Urachus is obliterated, which forms the median umbilical ligament
- Weeping umbilicus:
  - Persistence of the urachus
  - Leads to leakage of urine from the urinary bladder
- Medial umbilical ligament- Occluded umbilical artery
- Lateral umbilical fold- Peritoneal fold on the inferior epigastric vessels

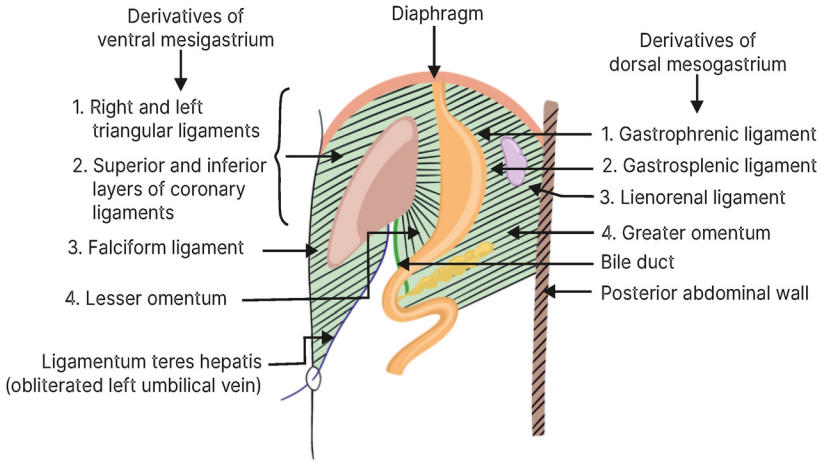




Mesentery

- A general term used for the double layer of the peritoneum
- Ventral mesentery- In front of the stomach
- Dorsal mesentery- Behind the stomach
- Mesogastrium- Mesentery attached to the stomach

Derivatives of the ventral mesentery	Derivatives of the dorsal mesentery
• Liver (develops as hepatic gut from the foregut) forms in the ventral mesentery • Falciform ligament- in front of the liver; lesser omentum- behind the liver • Right and left triangular ligaments and superior and inferior layers of the coronary ligaments enclose the liver	• Spleen is derived from the dorsal mesentery itself • Gastrosplenic ligament- Ligament between the stomach and the spleen • Lienorenal ligament- Ligament between the kidney and the spleen • Greater omentum- Omentum attached to the greater curvature of the stomach • Gastrophrenic ligament- Ligament between the stomach and the diaphragm



Rotation of the Gut

- Foregut rotates 90° in a clockwise direction
  - The liver in the front comes to the right and the spleen to the left
- Midgut rotates 270° in an anticlockwise direction
  - Takes place during the 6th week of pregnancy
  - Physiological hernia- As the rotation is early, the size of the embryo is small, and a lack of space to accommodate the long coils of the ileum and jejunum leads to the herniation of the midgut through the umbilical opening. It rotates and moves back in
  - Physiological hernia reduces back into the abdomen in the 10th week of development
- Hindguts does not rotate

Developmental Anomalies

INICET 2024

	Omphalocele	Gastroschisis
Definition	Failure of the reduction of physiological hernia	Herniation at the weak point of the abdomen

Yourwish

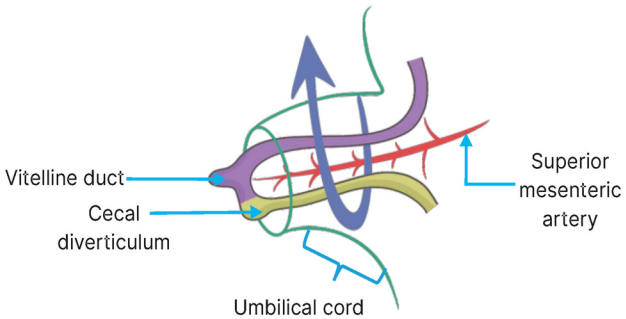
Sac	Present	Absent
Intestinal obstruction	-	Most common
Image		

Rotation of the Midgut

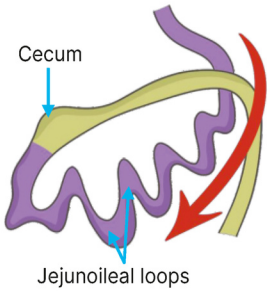
- Midgut rotates 270° in an anticlockwise direction around the superior mesenteric artery
- Prearterial segment- Forms the small intestine
- Postarterial segment- Forms the large intestine

1st 90° anti-clockwise rotation	• Prearterial segment comes to the right, and the postarterial segment to the left
2nd 90° anti-clockwise rotation	• The midgut reduces back into the abdomen ○ First, the Prearterial segment, followed by the Postarterial segment
3rd 90° anti-clockwise rotation	• The cecum, present in the midline, moves below the liver (subhepatic) and then moves into the right iliac fossa

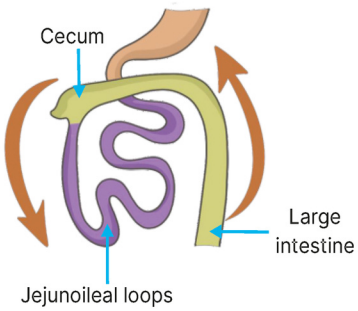
1. Herniation & 90° rotation



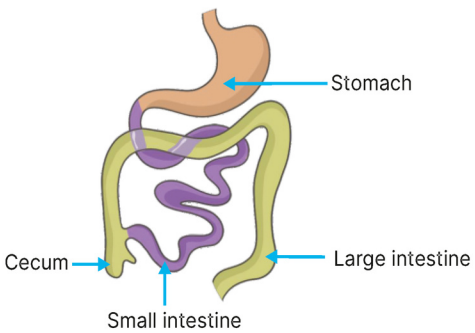
2. Elongation & formation of jejunoileal loops



3. Retraction & 180° rotation

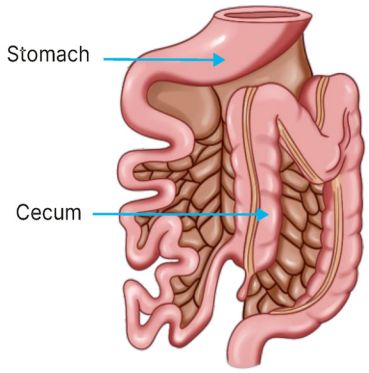
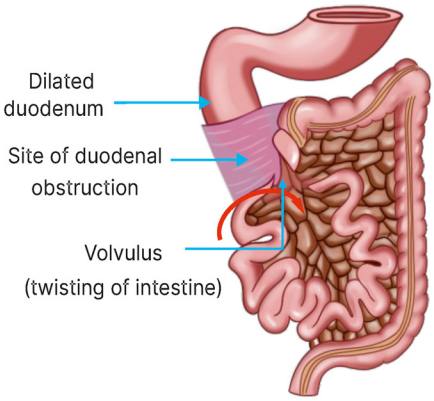
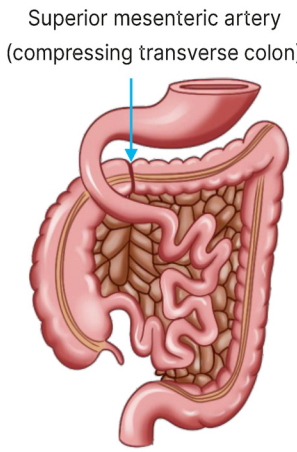


4. Final Positions



Developmental Anomalies of Midgut Rotation

01:41:15

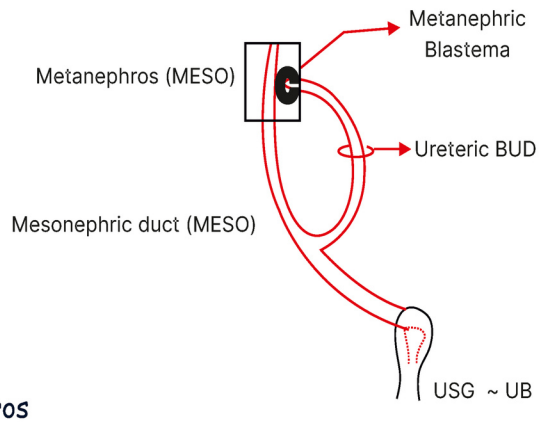
Non-rotation	Incomplete and volvulus	Reversed rotation
• 1st rotation is normal • 2nd and 3rd rotation is absent • Prearterial segment is on the right, and the postarterial segment is on the left	• AKA malrotation • 1st and 2nd rotation is normal, but 3rd rotation is absent • Cecum in the midline	• 1st rotation is normal • 2nd and 3rd rotations also occur, but in a clockwise direction • Postarterial segment reduces first, followed by the prearterial segment
		

UROGENITAL EMBRYOLOGY

01:44:20

Development of the Urinary System

- The kidney is derived from the nephrogenic cord
- 3 parts of the nephrogenic cord: Pronephros, mesonephros, and metanephros
  - Pronephros and mesonephros are obliterated in humans
  - Mesonephric duct passes from the metanephros, referred to as the Wolffian duct
  - Wolffian duct attaches to the urogenital sinus
- Ureteric bud
  - Formed from the Mesonephric duct
  - Ureteric bud goes behind, and the tip attaches to the metanephros
  - Forms Collecting ducts, minor and major calyces, renal pelvis, and ureter



- Metanephric blastema
  - Proliferation of the cells at the site at which ureteric bud attaches to the metanephros
  - Forms Bowman's capsule, Proximal convoluted tubule, Loop of Henle, Distal convoluted tubule, connecting tubules are
- Urethra is derived from the urogenital sinus

GENITAL SYSTEM

01:48:40

NEET PG 2020

Derivatives Of Wolffian Duct/mesonephric Duct

Male	Female
• Epididymis • Vas deferens/Ductus deferens • Seminal vesicles • Ejaculatory duct	• Gartner's duct- Located in the Broad ligament

Derivatives Of Mullerian Duct/paramesonephric Duct

Male	Female
• Prostatic utricle • Appendix of testes	• Fallopian tube • Uterus • Upper part of vagina

5. LOWER LIMB

NERVE SUPPLY

00:00:50

- The organization of the lower limb is similar to that of the upper limb.

Upper Limb	Lower Limb
Brachial plexus	Lumbosacral plexus
Muscles of the arm, forearm, and hand	Muscles of the thigh, leg, and foot
5 major nerves	5 major nerves

Golden Rule – Upper Limb

Compartment	Nerve Supply
Anterior compartment of the arm	Musculocutaneous nerve
Posterior compartment of the arm	Radial nerve
Posterior compartment of the forearm	Radial nerve
Anterior compartment of the forearm	Median + Ulnar nerve
Hand muscles	Median + Ulnar nerve
Deltoid, Teres minor	Axillary nerve

Golden Rule – Lower Limb

Thigh Compartments

Compartment	Nerve Supply
Anterior compartment	Femoral nerve
Medial compartment (Adductor compartment)	Obturator nerve
Posterior compartment	Tibial nerve

Leg Compartments

Compartment	Nerve Supply
Anterior compartment	Deep peroneal nerve
Lateral compartment	Superficial peroneal nerve
Posterior compartment	Tibial nerve

Foot Muscles

- Muscles arranged in 4 layers

- Nerve supply from the tibial nerve branches
  - Medial plantar nerve
  - Lateral plantar nerve

Sciatic Nerve

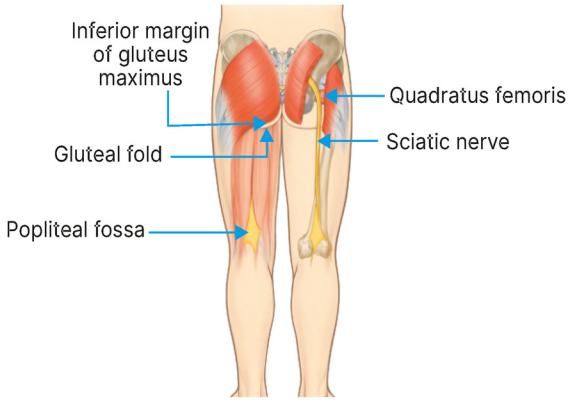
00:03:36

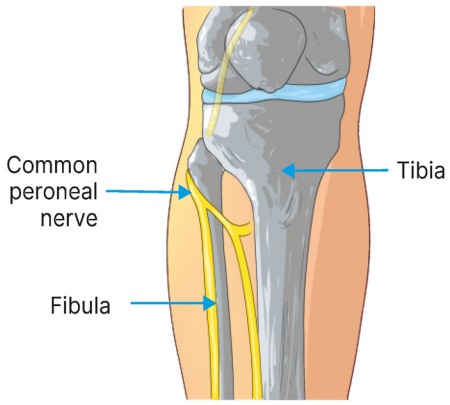
FMGE 2021

- The sciatic nerve is formed by two nerves:
  - Tibial nerve
  - Common peroneal nerve
- Origin- L4, L5, S1, S2, S3

Course Of The Sciatic Nerve

1. Originates from the lumbosacral plexus
2. Exits pelvis through the greater sciatic foramen below the piriformis muscle
3. Enters the gluteal region
4. Descends into the posterior compartment of the thigh
5. Reaches the popliteal fossa
   - Divides into the tibial nerve and the Common Peroneal nerve in the Popliteal fossa
   - The common peroneal nerve descends and divides into the deep and superficial peroneal nerves near the neck of the fibula





Relation With Piriformis

- Sciatic nerve exits: Below the piriformis muscle
- Clinical Importance
  - Compression of the sciatic nerve below the piriformis leads to: Piriformis syndrome

Sciatic Nerve In Gluteal Region

- Sciatic nerve supplies no muscles in the gluteal region

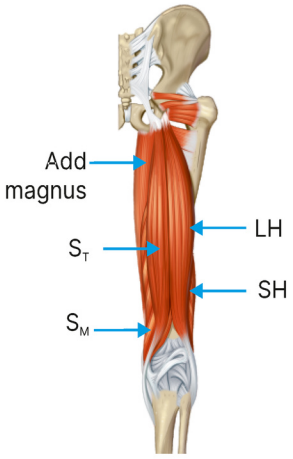
Sciatic Nerve In The Thigh

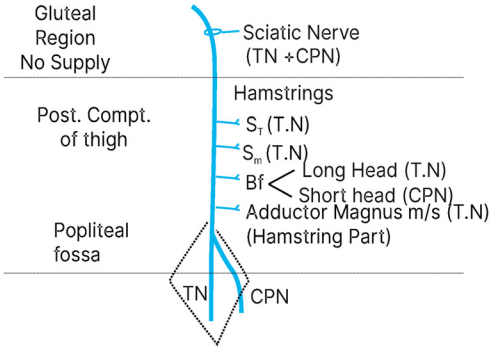
- Sciatic nerve supplies the posterior compartment muscles of the thigh.
- These muscles are known as Hamstrings.

Hamstring Muscles

Muscle	Nerve Supply
Semitendinosus	Tibial component of the sciatic nerve

Semimembranosus	Tibial component
Biceps femoris (long head)	Tibial component
Biceps femoris (short head)	Common peroneal nerve
Hamstring part of the adductor magnus	Tibial component





Important Information

- **HAMSTRING CRITERIA**
  - To be classified as a hamstring muscle, the muscle must originate from the ischial tuberosity

Popliteal Fossa

- At the apex of the popliteal fossa, the sciatic nerve divides into:
  - Tibial nerve
  - Common peroneal nerve

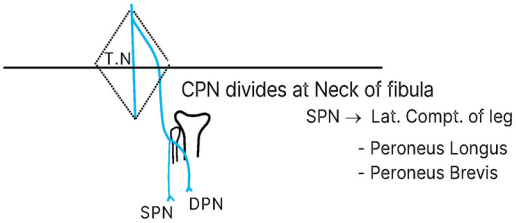
Common Peroneal Nerve

- Divides near the neck of the fibula into:
  - Deep peroneal nerve
  - Superficial peroneal nerve

Muscles of the lateral compartment of the leg	Function
Peroneus longus	Foot eversion
Peroneus brevis	Foot eversion

1. Superficial Peroneal Nerve

- Supplies the muscles of the lateral compartment of the legs
- Muscles Supplied:



2. Deep Peroneal Nerve

- Deep peroneal nerve supplies all muscles of the anterior compartment of the leg
- Muscles of the Anterior compartment of the leg

Muscle	Function
Tibialis anterior	Dorsiflexion
Extensor hallucis longus	Extension of the great toe
Extensor digitorum longus	Extension of digits
Peroneus tertius	Dorsiflexion

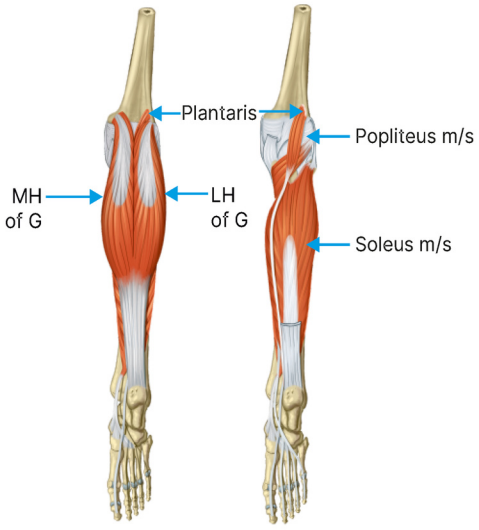
Tibial Nerve

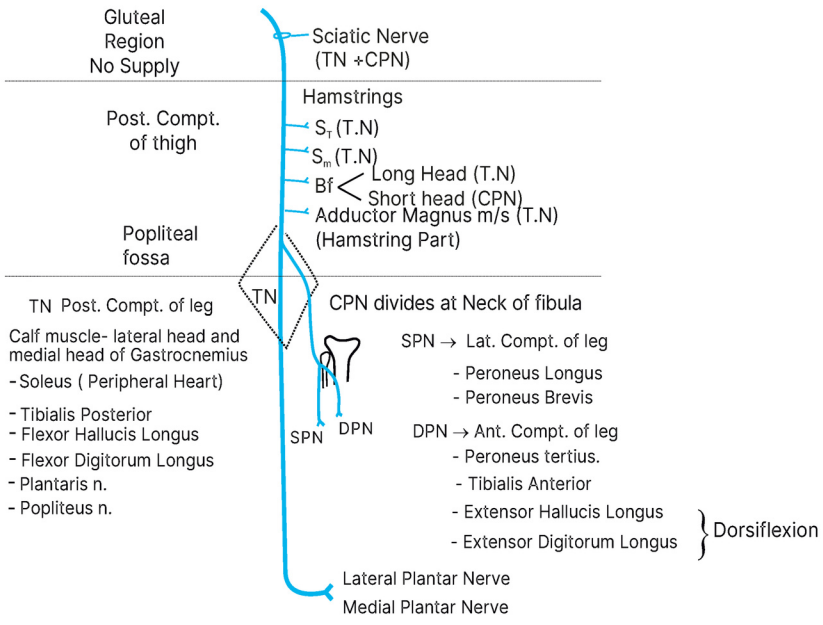
- Tibial nerve continues into the posterior compartment of the leg
- Later divides into:
  Medial plantar nerve
  Lateral plantar nerve
- These nerves supply the muscles of the foot.

Posterior Compartment Of The Leg- Calf Muscles

- Supplied by the tibial nerve

Muscle	Notes
Gastrocnemius	• Medial head • Lateral head
Soleus	• Lies beneath the gastrocnemius
Plantaris	• Location: Near the lateral head of the gastrocnemius
Popliteus	• Small muscle present in: Popliteal fossa
Tibialis posterior	• Plantar flexion
Flexor hallucis longus	• Flexion of the great toe
Flexor digitorum longus	• Flexion of digits





Achilles Tendon

- Also called: **Calcaneal tendon**
- Formed by the tendons of the Gastrocnemius & Soleus

Triceps Surae

- Group of muscles- Gastrocnemius (medial head), Gastrocnemius (lateral head), & Soleus group of muscles together are called **Triceps surae**

Soleus

- AKA Peripheral Heart Of The Body
- Soleus muscle contraction: Pumps venous blood upward
- Occurs due to **muscle pump action** during walking.
- Prevents venous pooling and varicose veins

FOOT

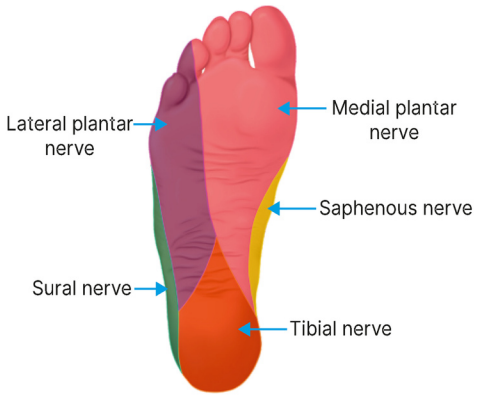
Sensory supply of foot

00:23:45

Plantar surface

Tibial Nerve Distribution

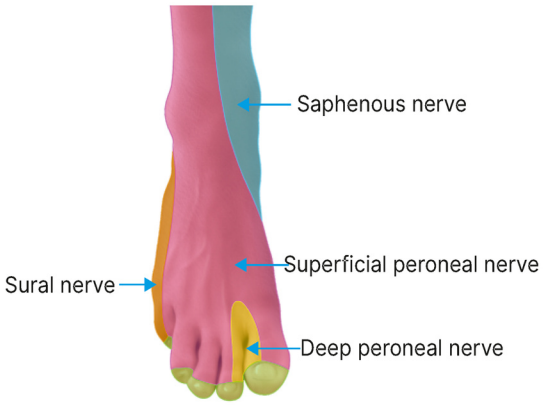
Area	Nerve Supply
Heel region	Tibial nerve
Medial $3\frac{1}{2}$ digits	Medial plantar nerve
Lateral $1\frac{1}{2}$ digits	Lateral plantar nerve



Comparison with Hand

Hand	Foot
Median nerve → lateral $3\frac{1}{2}$ digits	Medial plantar nerve → medial $3\frac{1}{2}$ digits
Ulnar nerve → medial $1\frac{1}{2}$ digits	Lateral plantar nerve → lateral $1\frac{1}{2}$ digits

Dorsum Of Foot



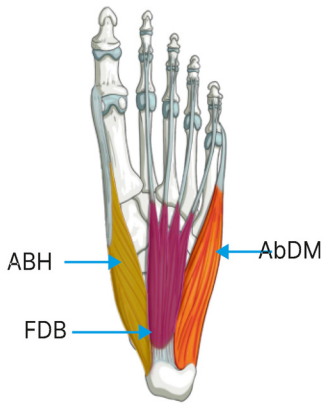
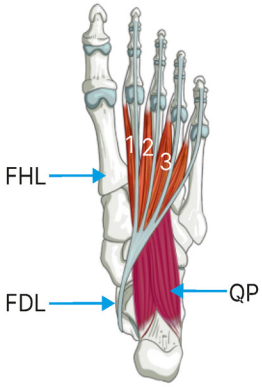
Yourwish

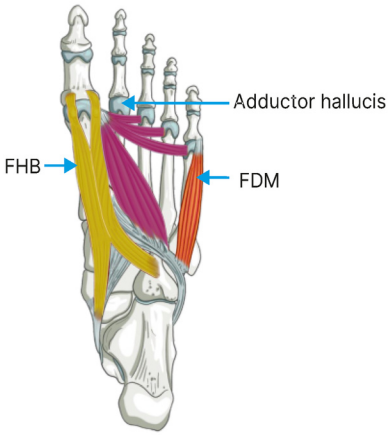
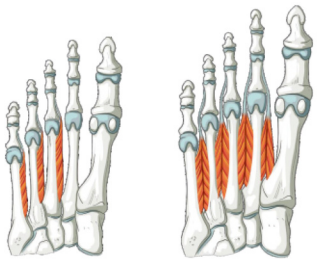
Deep Peroneal Nerve	• Supplies the skin between the first and second toes (1st web space)
Superficial Peroneal Nerve	• Supplies the skin of most of the dorsum of the foot
Sural Nerve	• Branch of the tibial nerve • Supplies the skin of the lateral side of the leg and the foot
Saphenous Nerve	• Branch of the femoral nerve • Supplies the skin of the medial side of the leg and foot up to the ball of the great toe • The saphenous nerve could be damaged while harvesting the great saphenous vein (used in CABG), as it travels adjacent to it.

Muscles of The Foot

00:28:05

- The muscles of the foot are not arranged in compartments
- They are arranged in four layers
- Sequence:
  1. First layer
  2. Second layer
  3. Third layer
  4. Fourth layer

Layer	Components	Muscles/Tendons	Nerve Supply
1st Layer	3 muscles	Abductor hallucis	Medial plantar nerve
		Flexor digitorum brevis • Flexion of digits • Contraction pulls four tendons	Medial plantar nerve
		Abductor digiti minimi	Lateral plantar nerve
2nd Layer	2 tendons & 2 muscles	Flexor hallucis longus tendon	-
		Flexor digitorum longus tendon	-
		Quadratus plantae, AKA Flexor digitorum accessorius)	Lateral plantar nerve
		Lumbricals (4) • 1st: Unipennate • 2nd-4th: Bipennate	1st: Medial plantar 2nd-4th: Lateral plantar

3rd Layer	3 muscles	Flexor hallucis brevis	Medial plantar nerve
		Adductor hallucis • Adduction of the great toe	Lateral plantar nerve
		Flexor digiti minimi	Lateral plantar nerve
4th Layer	Interossei	Plantar interossei (3 muscles)	Lateral plantar nerve
		Dorsal interossei (4 muscles)	Lateral plantar nerve

FEMORAL NERVE

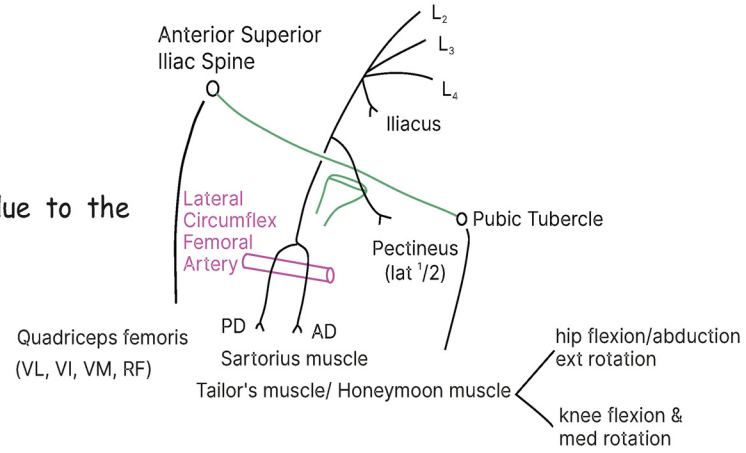
00:33:40

Origin

- Femoral nerve originates from: Posterior divisions of L2, L3, L4

Course

1. Originates from the lumbar plexus
2. Passes behind the inguinal ligament
3. Enters the anterior compartment of the thigh
4. Divides into anterior and posterior divisions due to the lateral circumflex femoral artery
   a. Anterior division in front of the artery
   b. Posterior division behind the artery



Early Muscle Supply

- Before division, the femoral nerve supplies:
  - Iliacus- Direct branch
  - Pectineus- Lateral half only

Important Information

- **Nerve supply of the Pectineus**
  - Femoral nerve (lateral half)
  - Obturator nerve (medial half)
- Classification: Hybrid / composite muscle - Muscle supplied by two nerves

Anterior division of femoral nerve

Motor supply

- Sartorius muscle

Aspect	Details
Also called	Tailor's muscle Honeymoon muscle
Feature	Longest muscle in the body
Origin	ASIS
Insertion	Tibia
Crosses	Hip joint Knee joint
Actions at the hip joint	Flexion Abduction External rotation **Mnemonic: FABER**
Actions at the knee joint	Flexion

Cutaneous Branches – Anterior Division

Nerve	Supply
Medial cutaneous nerve of the thigh	Skin of the medial side of the thigh
Intermediate cutaneous nerve of the thigh	Skin of the intermediate part of the thigh

Posterior Division of Femoral Nerve

Motor Supply

- **Quadriceps femoris- 4 heads**
  - Rectus femoris
  - Vastus lateralis
  - Vastus medialis
  - Vastus intermedius

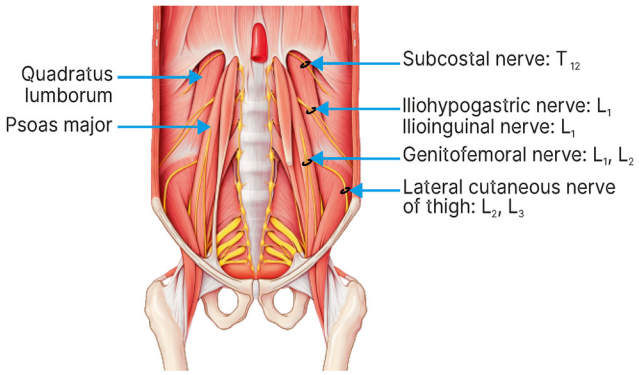
Cutaneous Branch- Posterior Division

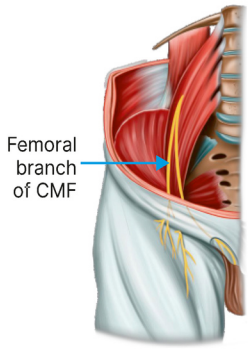
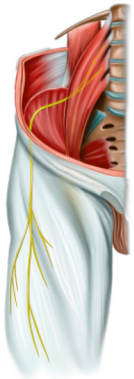
- **Saphenous nerve**
  - Course: Travels along the Great saphenous vein
  - Sensory Supply: Supplies the skin of
    → Medial side of the leg
    → Medial side of the foot
    → Up to the ball of the great toe
  - Clinical relevance
    → Great saphenous vein is used for graft in CABG
    → During vein harvesting: possible injury -Saphenous nerve
    → Result in loss of sensation over: Medial leg & Medial foot

MINOR NERVES OF LUMBAR PLEXUS

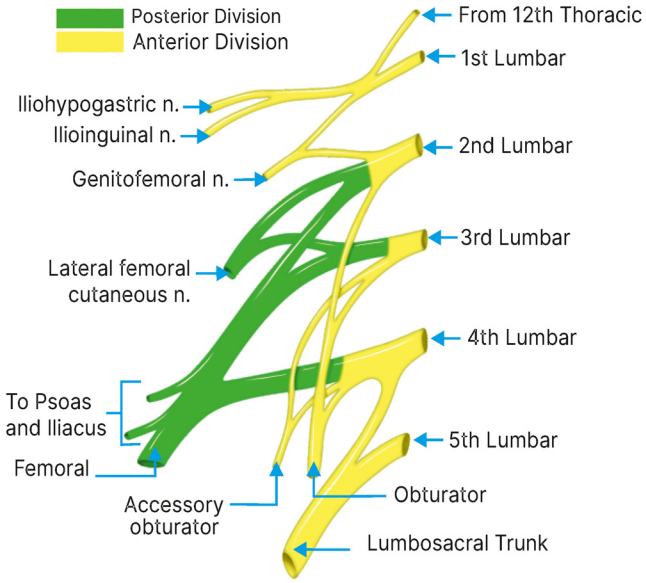
00:40:55

Muscle	Location
Quadratus lumborum	Posterior abdominal wall
Psoas major	Lumbar region



Nerve	Origin	Identification	Branches/Function
Iliohypogastric	L1	Emerges between the Quadratus lumborum & the Psoas major	-
Ilioinguinal	L1	Emerges between the Quadratus lumborum & the Psoas major	-
Genitofemoral 	L1 & L2	Pierces the psoas major muscle (most important feature)	Femoral branch: Skin over the femoral triangle Genital branch: Cremaster muscle
Lateral cutaneous nerve of the thigh 	L2 & L3	Comes from the inner aspect of the ileum and goes towards the lateral side ofthe thigh	Supplies skin on the lateral side of the thigh

Yourwish



Cremasteric Reflex

Component	Nerve
Stimulus	Stroking of the skin of the inner part of the thigh causes the cremasteric muscle to contract and pull up the ipsilateral testicles toward the inguinal canal
Afferent limb	**Femoral branch** of the genitofemoral nerve supplies the skin of the upper and medial aspect of the thigh
Efferent limb	**Genital branch** of the genitofemoral nerve supplies the cremasteric muscle
Result	**Cremaster muscle contracts** **Ipsilateral testis elevates**

Note: The femoral branch of GFN is anesthetized during femoral vein cannulation

Meralgia Paresthetica

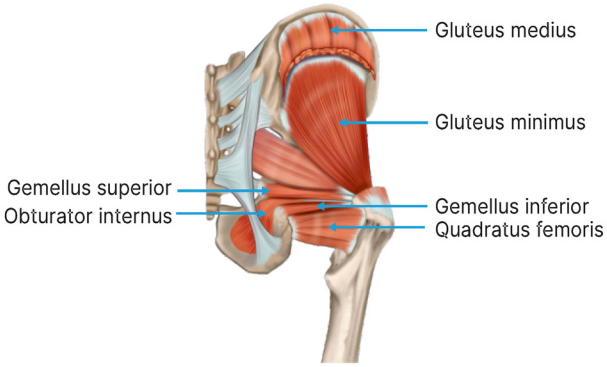
Aspect	Details
Cause	Compression of the Lateral cutaneous nerve of the thigh
Clinical Symptoms	Numbness Tingling Burning sensation Stabbing pain Location: Lateral side of thigh
Common Causes	Obesity Pregnancy Tight clothing

GLUTEAL REGION

00:48:49

Feature	Gluteus Maximus	Gluteus Medius	Gluteus Minimus
Position	Most superficial	Beneath the gluteus maximus	Beneath the gluteus medius
Size	Largest muscle in the body	-	Smallest

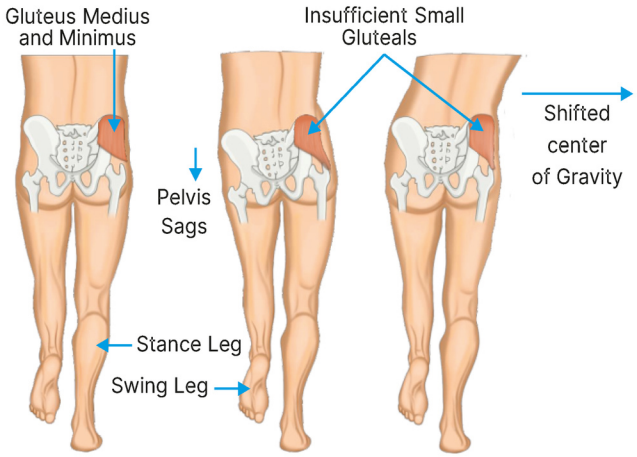
Nerve Supply	Inferior gluteal nerve (L5,S1,S2)	Superior gluteal nerve (L4,L5,S1)	Superior gluteal nerve (L4,L5,S1)
Actions	Hip extension External rotation Standing from sitting Climbing stairs	Hip abduction Internal rotation Pelvis stabilization (walking)	Hip abduction Internal rotation Pelvis stabilization (walking)



Trendelenburg Sign

FMGE 2025

Aspect	Details
Normal Situation	Right leg on the ground, left leg lifted Pelvis does NOT drop Gluteus medius/minimus of the opposite side stabilizes the pelvis
Superior Gluteal Nerve Damage	Gluteus medius/minimus is paralyzed Pelvis drops on the unsupported side Positive Trendelenburg sign
Compensation (Lurching Gait)	Patient walks with a lurching gait Body leans toward the affected side Occurs when: Superior gluteal nerve is damaged
Waddling Gait	Both superior gluteal nerves were damaged Lurches to both sides Penguin-like gait

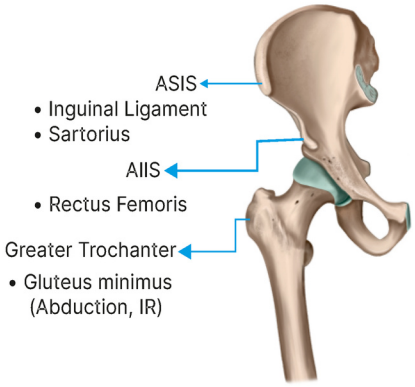


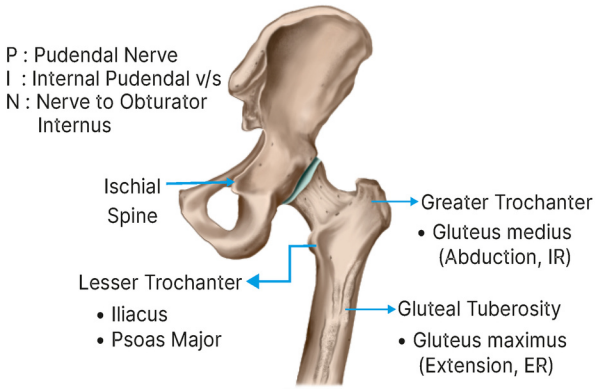
Deep Gluteal Muscles – Nerve Supply

Muscle	Nerve Supply	Action
Gemellus superior	Nerve to the obturator internus	Lateral rotation of the hip
Obturator internus	Nerve to the obturator internus	
Gemellus inferior	Nerve to the quadratus femoris	
Quadratus femoris	Nerve to the quadratus femoris	

ATTACHMENTS ON FEMUR

00:56:15



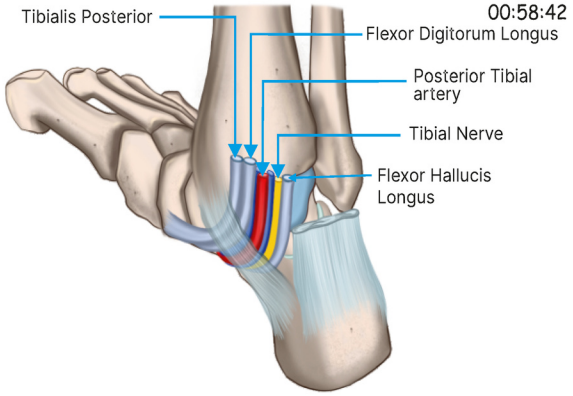


Structure	Attachment
ASIS	Sartorius Inguinal ligament
AIIS	Rectus femoris
Gluteus maximus	Gluteal tuberosity
Gluteus medius	Greater trochanter (posterior)
Gluteus minimus	Greater trochanter (anterior)
Lesser trochanter	Iliacus + Psoas major (form Iliopsoas tendon)
Ischial spine (PIN)	Pudendal nerve Internal pudendal artery & vein Nerve to the obturator internus

Tarsal Tunnel

- **Structures Passing**
  - Tibialis posterior tendon
  - Flexor digitorum longus tendon
  - Posterior tibial artery
  - Tibial nerve
  - Flexor hallucis longus tendon

00:58:42

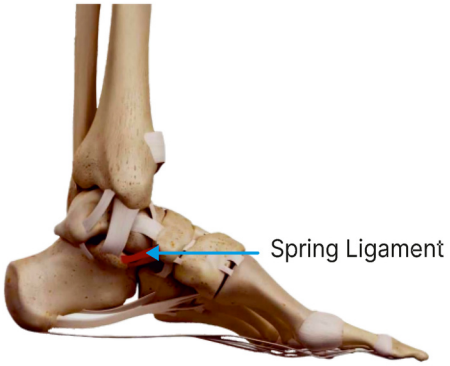


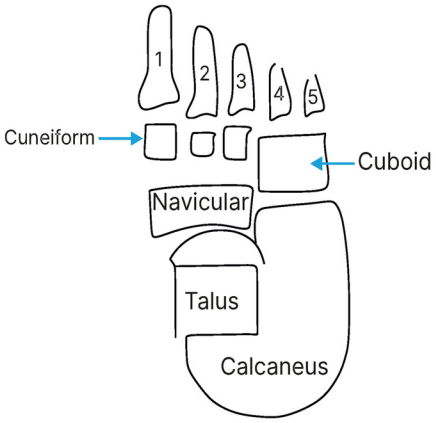
Mnemonic: Tom, Dick And Very Nervous Harry

- **Clinical Point-** The peripheral pulse here is palpated from the **posterior tibial artery**

ARCHES OF FOOT COMPARISON

01:01:00

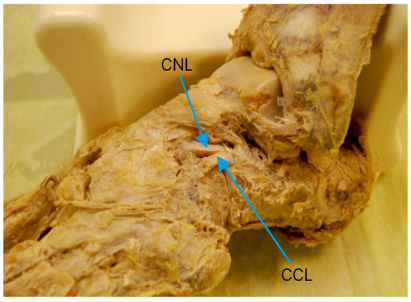
Feature	Medial Longitudinal Arch	Lateral Longitudinal Arch
Bones	Calcaneum, Talus, Navicular 3 cuneiforms, 1st-3rd metatarsals	Calcaneum, Cuboid 4th-5th metatarsals
Summit	Talus	Calcaneum
Joint	Talocalcaneonavicular (Ball & socket)	Calcaneocuboid (Saddle)
Supporting Ligaments	Spring ligament (Plantar calcaneonavicular) 	Long plantar ligament Short plantar ligament
Tie Beam	Plantar aponeurosis Flexor hallucis brevis tendon Flexor digitorum brevis tendon	Plantar aponeurosis Lateral part flexor digitorum brevis
Slings (Main Muscles)	Tibialis posterior Tibialis anterior Flexor hallucis longus Flexor digitorum longus	Peroneus longus Peroneus brevis



Yourwish

Bifurcate Ligament

- Formed by two ligaments:
  - Calcaneonavicular ligament
  - Calcaneocuboid ligament



DERMATOMES OF LOWER LIMB

01:07:00

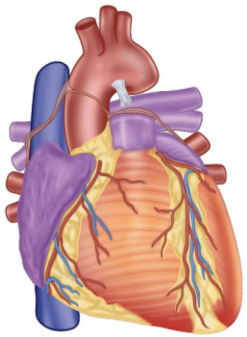
NEET PG 2021, 2022

Dermatome	Area
C5	Lateral arm
C6	Thumb
C7	Middle three fingers
C8	Little finger
T1	Medial forearm
L2	Mid anterior thigh
L3	Knees
L4	Medial aspect of the calf
L5	Dorsum of foot, lateral calf
S1	Sole, lateral foot

6. THORAX

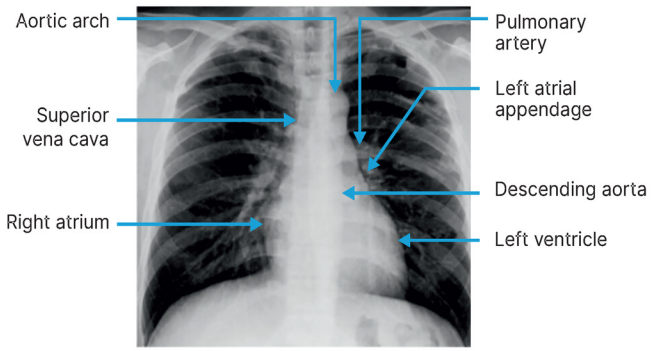
POSITION OF HEART

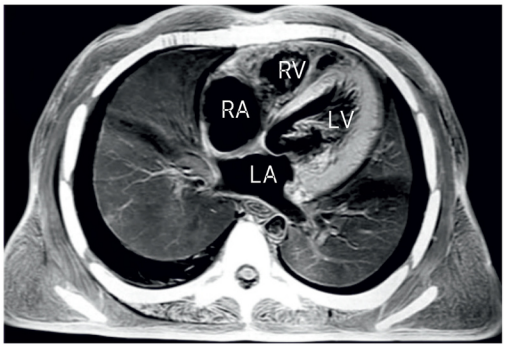
00:00:18



Apex	• Formed by the left ventricle • In the left 5th intercostal space ○ 9 cm away from the midline
Base	• Right (1/3rd) atrium + Left atrium (2/3rd)
Inferior surface	• Right atrium + Right ventricle + Left ventricle
Lateral surface	• Left ventricle + Left auricle
Right border	• Right atrium
Right cardiac shadow	• SVC + IVC + Right atrium

FMGE 2021
NEET PG 2019

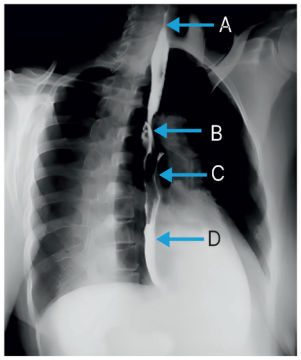




Indentation of aorta

00:08:00

Q. Where would the indentation of the aorta be pressing on the oesophagus in the given image?

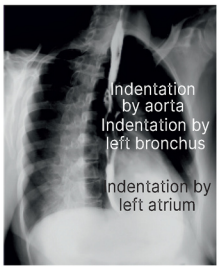


a. D
b. B
c. A
d. C

Answer: b. B

FMGE 2019

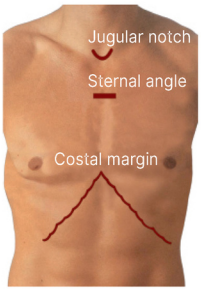
- The normal anatomical structures that press against the esophagus create visible indentations.
  - Indentation by the aorta
  - Indentation by the left bronchus
  - Indentation by the left atrium

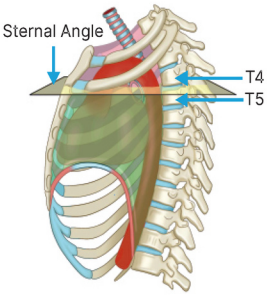


00:08:58

STERNAL ANGLE/ ANGLE OF LOUIS

- It is located between the manubrium and the body of the sternum (Manubriosternal Joint).
- It is at the level of the lower border of the T4 vertebra.
- 2nd rib articulates at the sternal angle.





Structures at sternal angle

- Beginning and end of the Arch of Aorta.
- SVC (Superior Vena Cava) pierces the pericardium.
- Junction of the Superior and Inferior mediastinum.

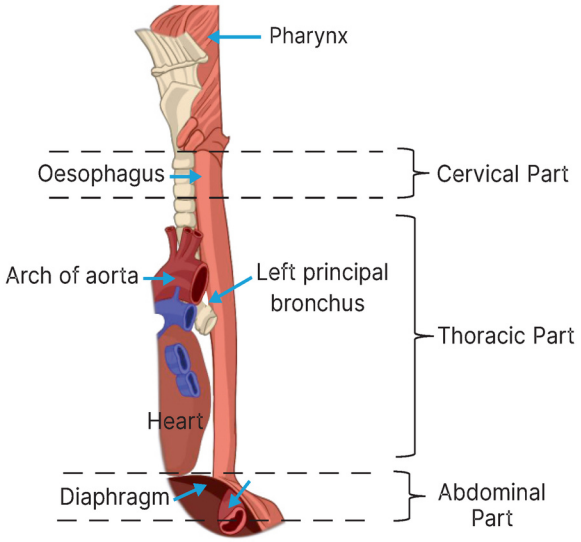
Important Information

- The thoracic duct deviates at T5.
- The arch of Azygous terminates into the SVC 2 cm below the sternal angle

OESOPHAGEAL CONSTRICTIONS

00:13:05

FMGE 2021
NEET PG 2020



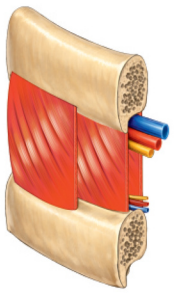
Constriction Point	Anatomical Cause	Distance from Incisor Teeth
Origin	Surrounded by the cricopharyngeus muscle	15 cm
Thoracic (Upper)	Crossed anteriorly by the aortic arch	23 cm
Thoracic (Lower)	Crossed by the left main bronchus	28 cm
Diaphragmatic	Passing through the respiratory diaphragm	40 cm

INTERCOSTAL SPACE

00:15:33

INICET 2023
NEET PG 2023

Intercostal muscles



- External Intercostal Muscle
- Internal Intercostal Muscle
- Innermost Intercostal Muscle
  - Sternocostalis muscle
  - Intercostalis Intimi muscle
  - Subcostalis muscle

Neurovascular bundle

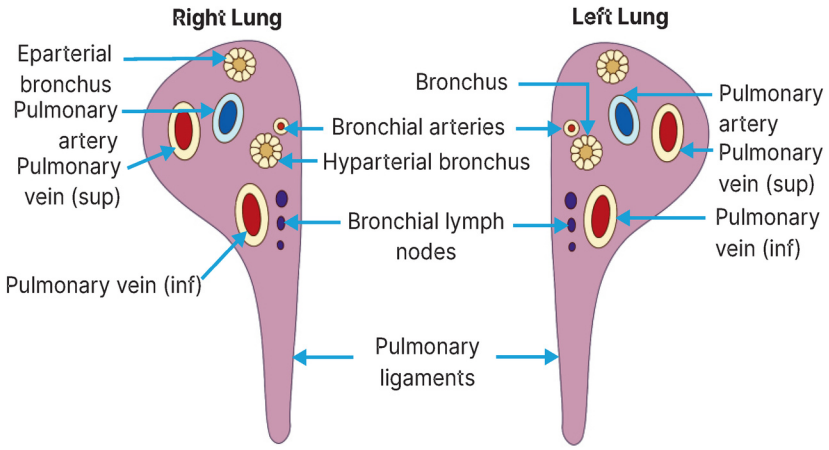
- Located in the plane between the Internal Intercostal muscle and the Innermost Intercostal muscle.
- Arrangement (Above downwards):
  - Vein, Artery, Nerve
  - Exception (1st Intercostal Space): Arranged as Nerve, Artery, Vein
- In performing thoracocentesis for pleural effusion, the needle is inserted specifically above the superior border of the lower rib to avoid damaging the neurovascular bundle, which runs along the costal groove of the upper rib.

ROOT OF LUNG

00:19:49

- The hilum is the opening on the mediastinal surface of the lung through which structures enter and exit.
  - All of these structures collectively form the root of the lung

Arrangement of structures



- Above downwards:

Right lung	Left lung
• Eparterial Bronchus • Pulmonary Artery • Hyparterial Bronchus • Pulmonary Vein	• Pulmonary Artery • Bronchus • Pulmonary Vein

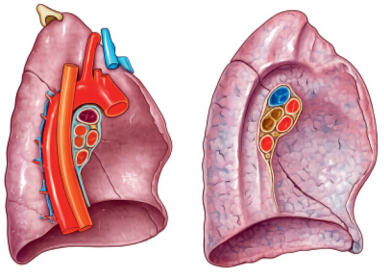
- Anterior - Posteriorly (same in both lungs):
  - Pulmonary Vein
  - Pulmonary Artery
  - Bronchus
  - Bronchial arteries

MEDIASTINAL SURFACE

00:25:47

Left lung

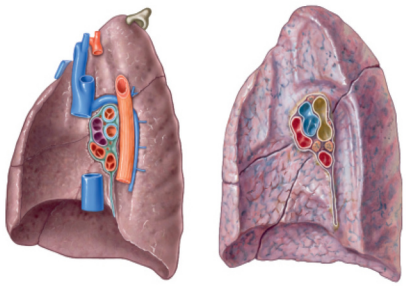
Mediastinal Surface- Left Lung



- Oesophagus
  - Vagus nerve
- Cardiac Notch - Heart
  - Phrenic nerve
- Ascending aorta
- Arch of aorta
- Descending aorta
- Left Subclavian Artery

Right lung

Mediastinal Surface- Right Lung



- Oesophagus
  - Vagus nerve
- Azygous vein
- Arch of Azygous vein
- SVC
- Right brachiocephalic vein
- Heart
  - Phrenic nerve

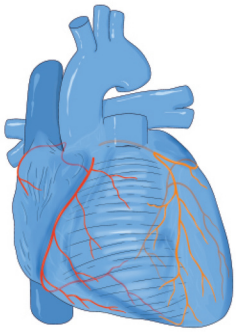
CORONARY CIRCULATION

00:33:32

FMGE 2024
INICET 2024

- Coronary arteries begin from the aortic sinuses
  - At the beginning of the aorta
- Aortic sinuses:
  - Anterior → Right coronary artery
  - Posterior:
    → Right (non-coronary sinus)
    → Left → Left coronary artery (Shorter and wider than RCA)

Branches of rca



- Right conus artery → First branch of RCA
  - Sometimes, the right conus artery directly comes from the anterior aortic sinus
    → Referred to as the 3rd coronary artery
- Posterior interventricular artery (PIVA)
- Right marginal artery/acute marginal artery
- SA nodal branch
  - Only in 65% of the population

Branches of Ica

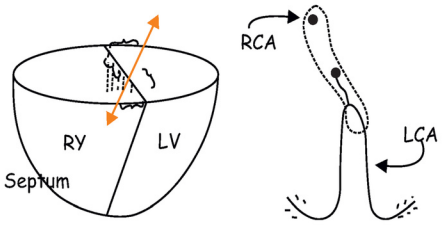
- Circumflex artery
  - Left marginal artery (obtuse marginal artery) is a branch of the circumflex artery
- Anterior interventricular artery (AIVA) / left anterior descending artery (LAD)
  - Diagonal artery is a branch of the LAD- Supplies the left ventricle

Blood supply

00:43:22

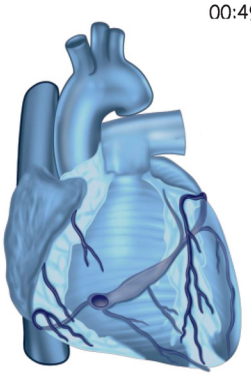
Right coronary artery	Left coronary artery

• Right atrium
• Right ventricle
• Posterior part of the left ventricle
• Posterior part of the interventricular septum
• Conduction system:
  ○ SA node (65%)
  ○ AV node
  ○ Bundle of His
  ○ Left bundle branch (minor)
	• Left atrium
	• Left ventricle
	• Anterior part of the right ventricle
	• Anterior part of the interventricular septum
	• Conduction system:
	  ○ Right bundle branch
	  ○ Left bundle branch (major)



Veins of heart

00:49:04



- Coronary sinus (~3cm)
  - Located in the atrioventricular groove
  - On the posterior surface of the heart
  - Drains blood from:
    - → Great cardiac vein
    - → Small cardiac vein
    - → Middle cardiac vein
- Coronary sinus drains blood into the right atrium
- Anterior cardiac veins drain blood directly into the right atrium

INTERNAL THORACIC ARTERY

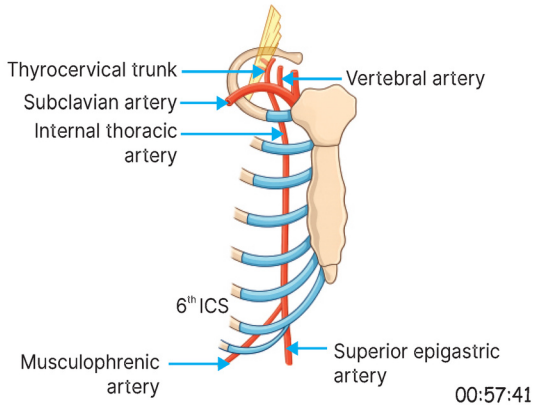
00:52:54

- Subclavian artery is divided into 3 parts by the scalenus anterior muscle
  - 1st part: Before the muscle
    - → Vertebral artery
    - → Internal thoracic artery
    - → Thyrocervical trunk
  - 2nd part: Behind the muscle
  - 3rd part: After the muscle
- Internal thoracic artery

- AKA: Internal mammary artery
- Passes adjacent to the sternum upto 6th intercostal space
- Gives branches to the intercostal space → Upper 6 Anterior intercostal arteries
- Terminates by dividing into:
  → Superior epigastric artery → Continues as the content of the rectus sheath
  → Musculophrenic artery→ 7th, 8th and 9th Anterior intercostal arteries
- Also gives rise to branches of the mammary gland

Branches of internal thoracic artery

- Musculophrenic Artery.
- Superior Epigastric Artery.
- Upper 6 Anterior Intercostal arteries.
- Perforating Arteries (branches 2-4 supply the mammary gland/breast).
- Mediastinal Branch (the principal artery of the Thymus).
- Pericardiophrenic Artery



AZYGOUS SYSTEM

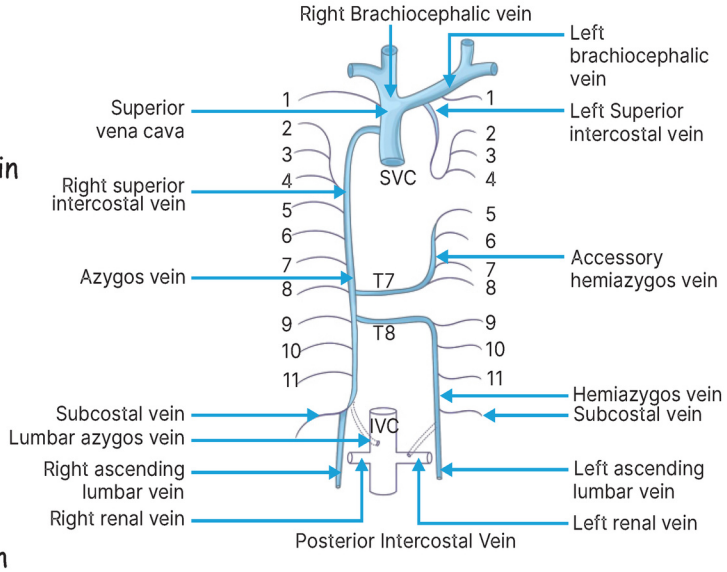
- Azygous vein: Single vein → right side

Right side

- 1st posterior intercostal vein:
  - Drains blood into the Right brachiocephalic vein
- 2nd, 3rd, and 4th intercostal veins:
  - Combine to form the Right superior intercostal vein
  - Drain into the Azygous vein
- 5th to 11th intercostal veins:
  - Drains directly into the Azygous vein

Left side

- 1st posterior intercostal vein:
  - Drains blood into the Left brachiocephalic vein
- 2nd, 3rd, and 4th intercostal veins:
  - Combine to form the Left superior intercostal vein
  - Drains blood into the left brachiocephalic vein
- 5th, 6th, 7th, and 8th intercostal veins:
  - Drain into Accessory hemiazygous vein (T7) → Azygous vein
- 8th, 10th and 11th intercostal veins:
  - Drains into the Hemiazygous vein (T8) → Azygous vein



Important Information

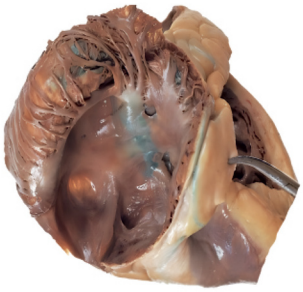
- Azygous vein drains blood from:
  - Right superior intercostal vein
  - 5th to 11th intercostal veins
  - Accessory hemiazygous vein
  - Hemiazygous vein

RIGHT ATRIUM

01:02:53

- Crista terminalis
  - Separates rough and smooth parts
- Musculi pectinati
  - Muscles of the rough part
  - Comb-like arrangement
- Fossa ovalis
  - Saucer-shaped depression in the interatrial septum
  - Limbus- Margin of fossa ovalis (above)
    → Derived from the Septum secundum
  - Floor of the fossa ovalis
    → Derived from the Septum primum
- Tricuspid valve
  - Between the right atrium and ventricle
  - Anterior, posterior, and septal cusps

Right atrium

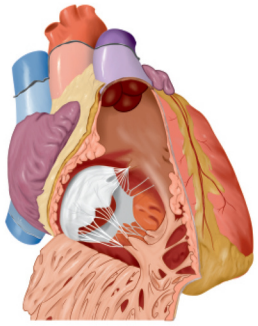


Triangle of koch

- Boundaries:
  - Opening of the coronary sinus
  - Tendon of Todaro
  - Septal cusp of the tricuspid valve
- The AV node is located in the triangle of Koch

RIGHT VENTRICLE

01:07:30



- Trabeculae carnea: Muscles in the wall of the right ventricle
  - Ridges → Elevated
  - Bridges
  - Pillars → Papillary muscles
    → Anterior (largest)
    → Posterior
    → Septal
- Chordae tendineae
  - From the tip of the papillary muscles
  - Attaches to the free margin of the cusp
- Right bundle branch passes through the moderator band

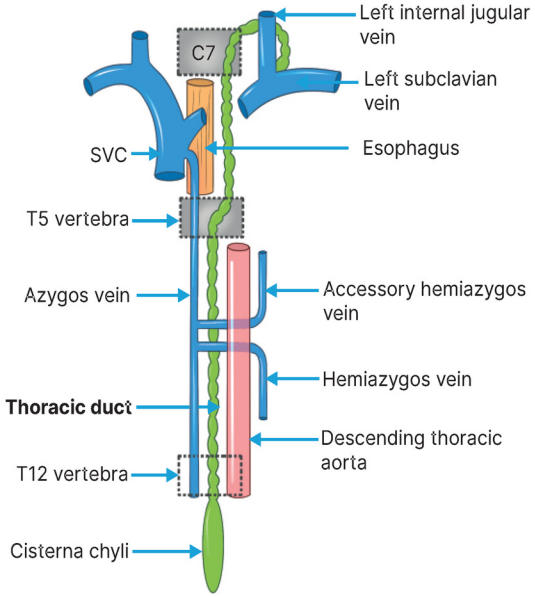
THORACIC DUCT

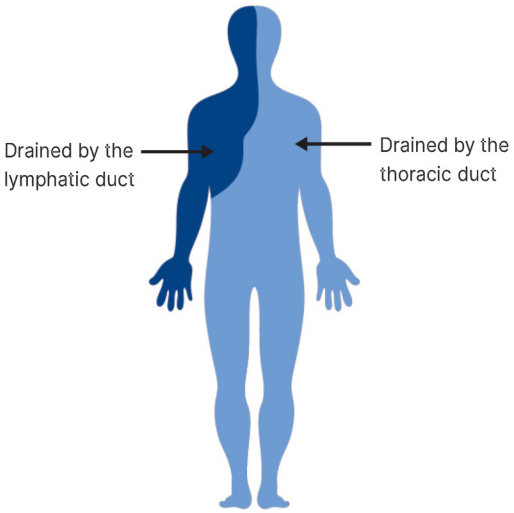
01:10:35

- Largest lymphatic vessel
- Ascends from the Cisterna chylii in the abdomen
  - Via the aortic opening of the diaphragm → At T12
- Deviate to the left at the level of T5
- Drains at the junction of the left subclavian vein and the left internal jugular vein

Yourwish

NEET PG 2025



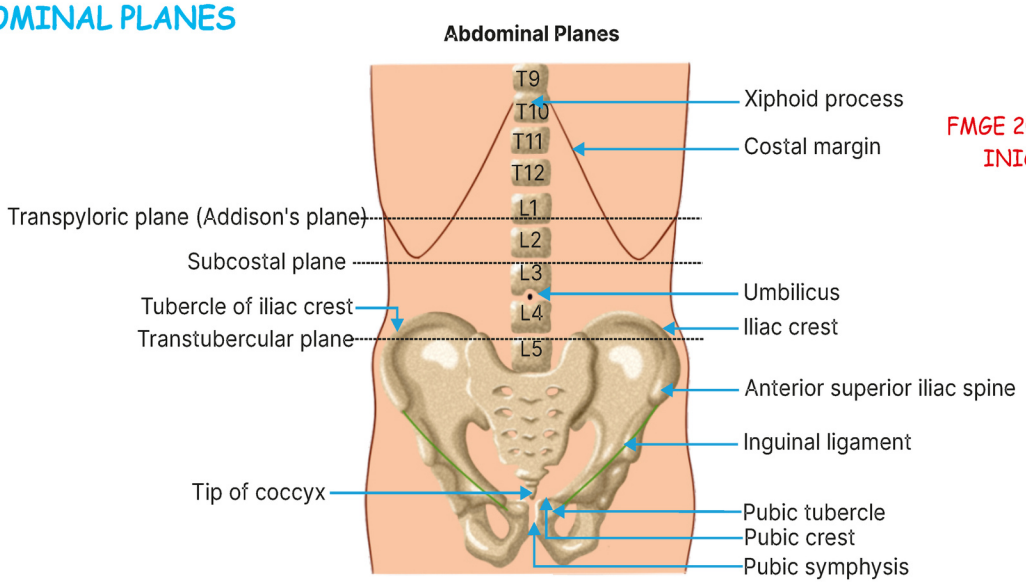


- Areas not drained by the Thoracic Duct:
  - Right side of the head and neck
  - Right side of the thoracic wall
  - Right lung
  - Right half of the heart
  - Convex surface of the liver
  - Right upper limb
- These areas are typically drained by the Right Lymphatic Duct

7. ABDOMEN

ABDOMINAL PLANES

00:00.18



Transpyloric plane: Pylorus of stomach, origin of superior mesenteric artery and hilum of kidney

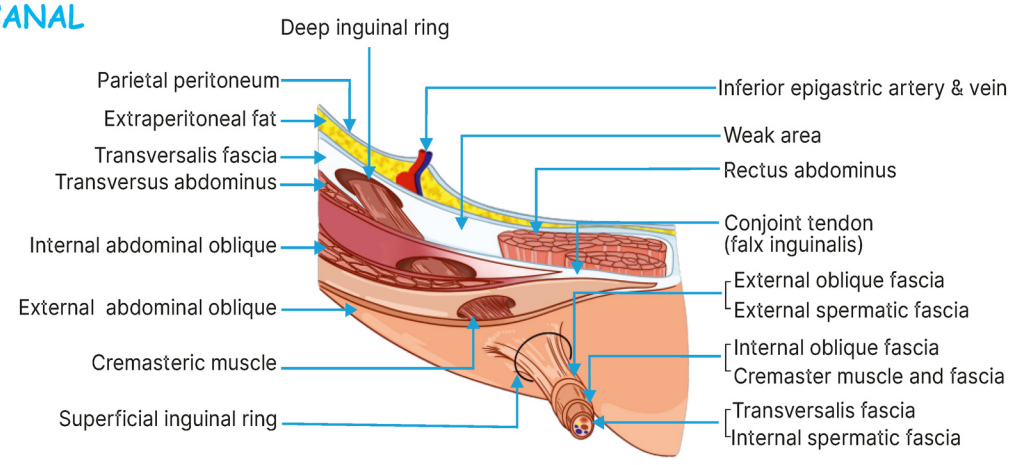
NEET PG 2019, 2021, 2022,
FMGE 2020, 2021, 2022, 2023, 2024
INICET 2019, 2022, 2024, 2025,
AIIMS 2020

Plane	Vertebral level
Transpyloric (Addison's plane)	Lower border of L1
Subcostal	Lower border of L2
Umbilicus	L3-L4 (Dermatome T10)
Supracristal	Body of L4
Transtubercular	Upper border of L5

- Transpyloric plane: This plane passes through the pylorus of the stomach, the origin of the superior mesenteric artery, and the hilum of the kidney
- Supracristal plane: This plane passes at the level of the highest point of the iliac crest of the hip bone

INGUINAL CANAL

00.04.52



Layers of the anterior abdomen

- Skin
- Superficial fascia
  - Outer fatty layer- Camper's fascia
  - Inner fibrous layer- Scarpa's fascia
- External abdominal oblique, followed by the External oblique aponeurosis
- Internal abdominal oblique, followed by the internal abdominal aponeurosis
- Transversus abdominis muscle, followed by the Transversus abdominis aponeurosis
- Transversalis fascia
- Extraperitoneal layer (stores fat)
- Parietal peritoneum
- Deep inguinal ring: Oval opening in transversalis fascia
- Superficial inguinal ring: Triangular opening in the external oblique muscle
- Inguinal canal runs between the superficial and deep inguinal ring
- Conjoint Tendon, Aka Falx inguinalis
  - Formed by the joining of the internal oblique and the transverse abdominis aponeurosis

Boundaries of inguinal canal

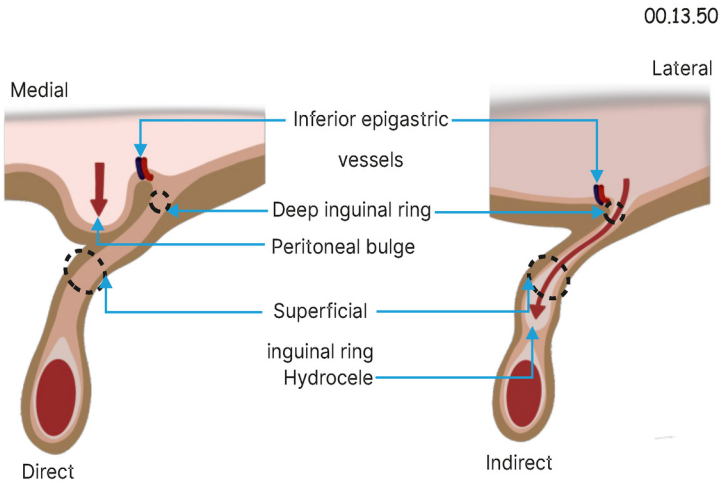
- Anterior:
  - External oblique muscle (throughout)
  - Internal oblique muscle (laterally)
- Superior:
  - Internal oblique muscle
  - Transverse abdominis muscle
- Posterior
  - Transversalis fascia (throughout)
  - Conjoint tendon (medially)
- Inferior
  - Inguinal ligament

Contents of inguinal canal

- Female: Ilioinguinal nerve and the round ligament of the uterus
- Male: Ilioinguinal nerve and spermatic cord

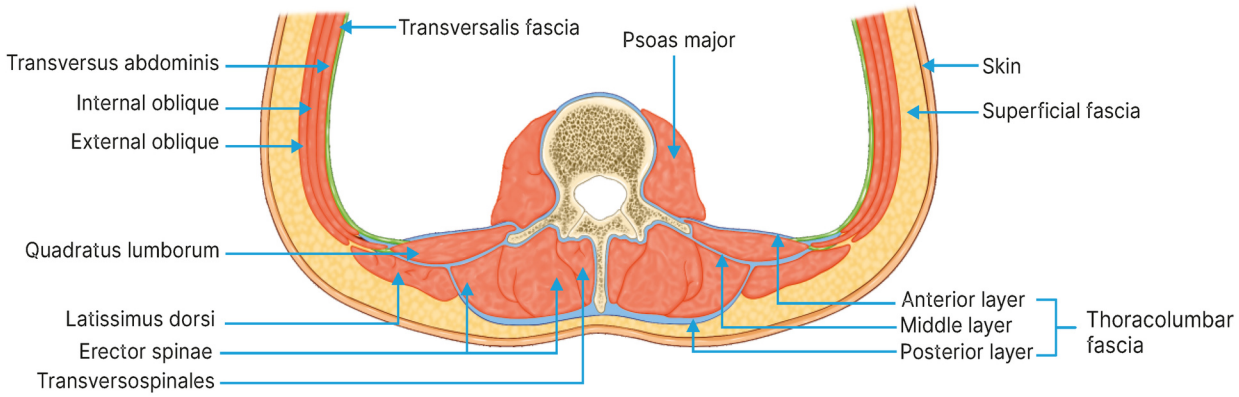
INGUINAL HERNIA

- Direct inguinal hernia
  - Herniates through Hesselbach's Triangle
  - Boundaries of Hesselbach's Triangle:
    - → Base- Inguinal ligament
    - → Medial- Rectus Abdominis
    - → Lateral- Inferior Epigastric vessels
- Indirect inguinal hernia
  - Herniates via the deep inguinal ring



THORACOLUMBAR FASCIA

00.15.14

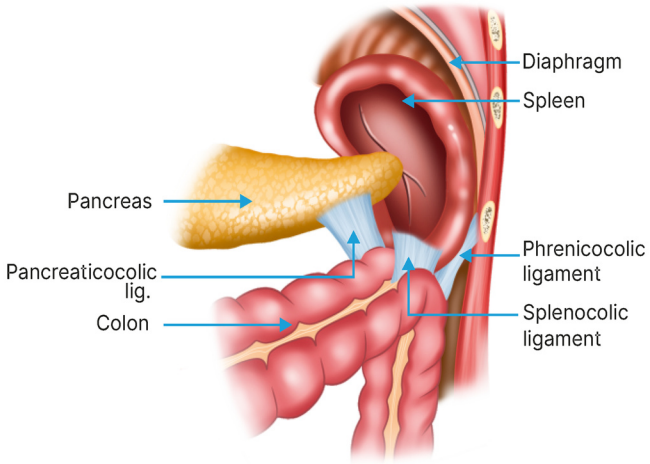


- The fascia is divided into three distinct layers on the back side:
  - Anterior layer
  - Middle layer
  - Posterior layer
- Muscles enclosed
  - Between the anterior and middle layer- Quadratus lumborum
  - Between the posterior and middle layer- Erector spinae and transversospinalis
- Psoas major muscle is adjacent to the body of the vertebra, covered by the psoas fascia

SPLEEN

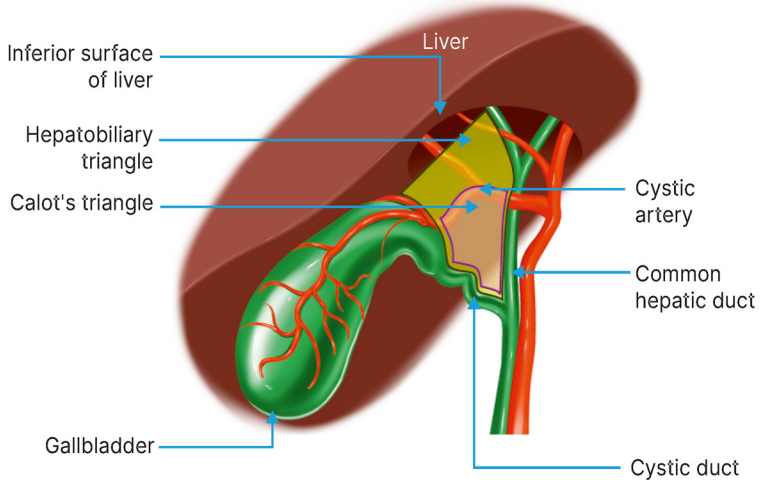
00.17.39

- Phrenicocolic ligament prevents the downward displacement of the spleen in splenomegaly



LIVER

- Calot's triangle boundaries
  - Superiorly - Cystic artery
  - Laterally- Cystic duct
  - Medially- Common hepatic duct
- Hepatobiliary triangle boundaries
  - Superiorly - Inferior surface of the liver
  - Laterally- Cystic duct and gall bladder
  - Medially- Common hepatic duct

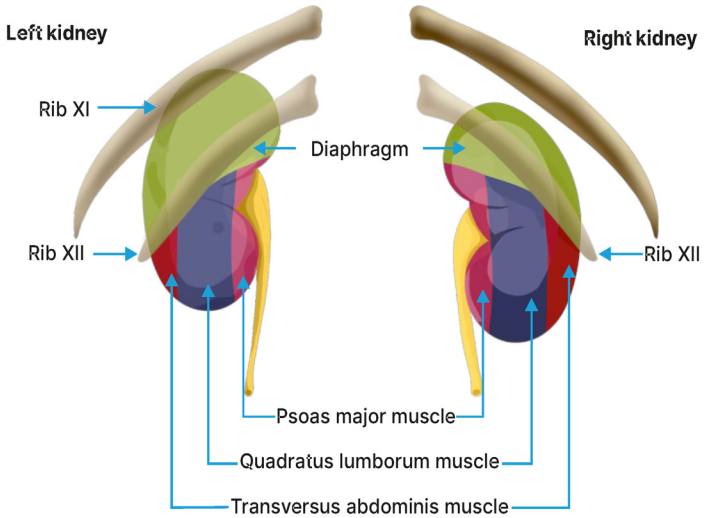


KIDNEY

00.21.11

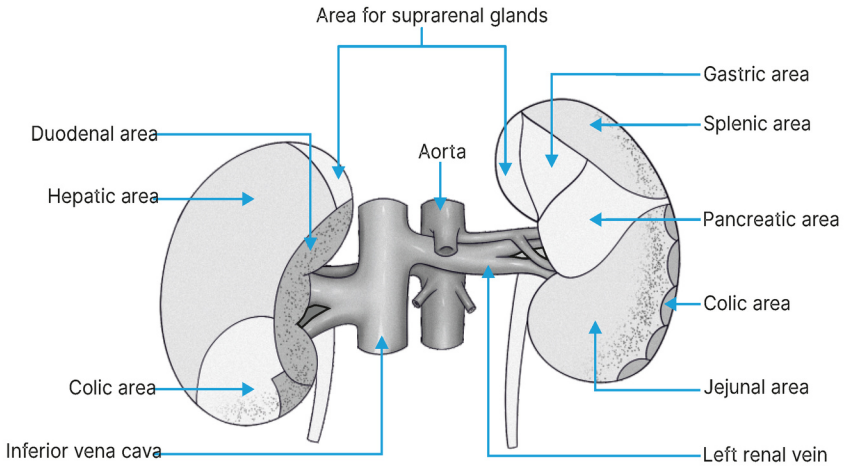
Posterior surface relations of the kidney

Right kidney	Left kidney
Upper half	
Diaphragm and 12th rib	Diaphragm, 11th and 12th rib
Lower half	
Medial to lateral- Psoas major, quadratus lumborum, transversus abdominis	



Anterior surface relations of the kidney

Right kidney	Left kidney
Upper pole Suprarenal gland	
Lower pole Colon and jejunum	
In the middle part	
Liver and duodenum	Stomach, spleen, and pancreas

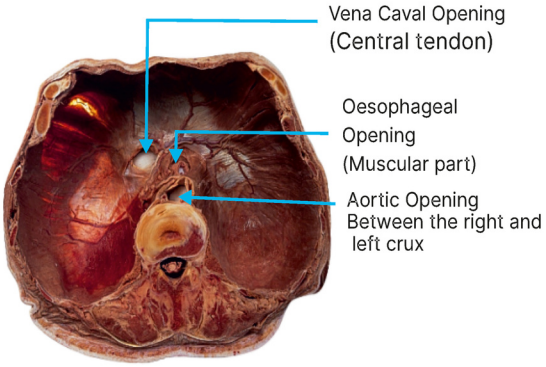


DIAPHRAGM

00.26.00

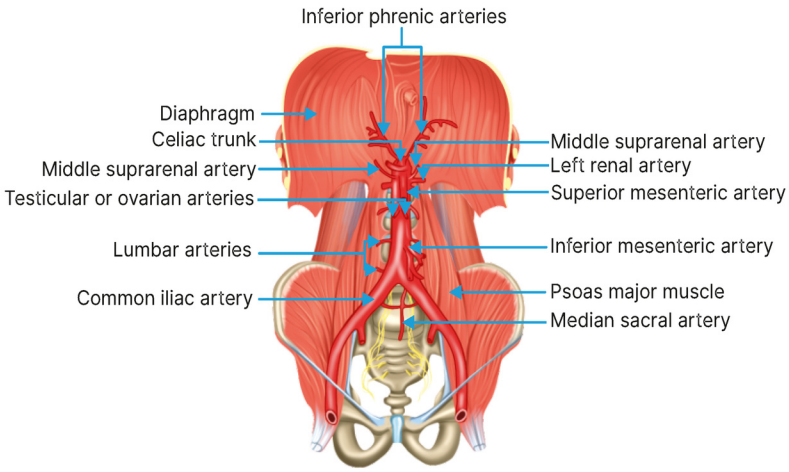
Mnemonic-VOA (Voice of America) - T 8, 10, 12

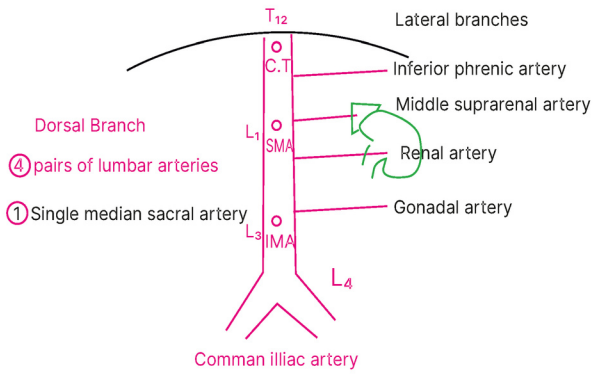
Opening	Present in	Vertebral level	Structures passing through
Vena Caval Opening	Central tendon	T8	Inferior Vena Cava Right Phrenic Nerve
Esophageal Opening	Muscular part	T10	Esophagus Vagus Nerve Esophageal branch of Left Gastric Artery
Aortic Opening	Between the right and left crux	T12	Aorta Thoracic duct Azygos Vein



ABDOMINAL AORTA

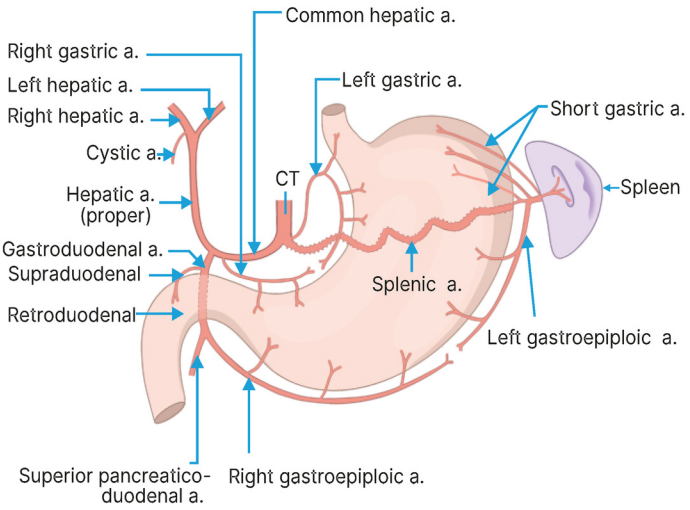
- At L4 divides in to common iliac arteries
- Ventral branches
  - Celiac trunk at T12- artery to the foregut
  - Superior mesenteric artery at L1- artery to midgut
  - Inferior mesenteric artery at L3- artery to hindgutL
- Lateral branches
  - Inferior phrenic artery
  - Artery to the suprarenal gland
  - Renal artery
  - Gonadal artery
- Dorsal branches
  - 4 pairs of lumbar arteries
  - Median sacral artery





Celiac trunk

- Artery of foregut
- Gives three branches
  - Left gastric artery
  - Splenic artery
  - Common hepatic artery



Left Gastric Artery

- Runs along the lesser curvature of the stomach
- Gives oesophageal branches to the lower end of the esophagus

Splenic Artery

- Tortuous artery
- Passes behind the stomach all the way to the spleen
- Branches
  - Pancreatic branches
  - Hilar branches to the splenic hilum
  - Short gastric arteries near the fundus of the stomach
  - Left gastroepiploic artery along the greater curvature

Common Hepatic Artery

- Divides into 2 main branches
  - Proper hepatic artery
  - Gastroduodenal artery

Proper Hepatic Artery

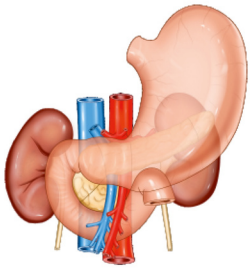
- Branches-
  - Right gastric artery
  - Right and left hepatic artery
  - Right hepatic artery gives a cystic artery branch

Gastroduodenal Artery

- Clinical anatomy- Peptic ulcer perforates the duodenum and causes bleeding. Gastrodudenla artery is the one that bleeds as passes behind the duudenum
- Divides into the right gastric epiploic artery along the greater curvature of the stomach and the superior pancreaticoduodenal artery

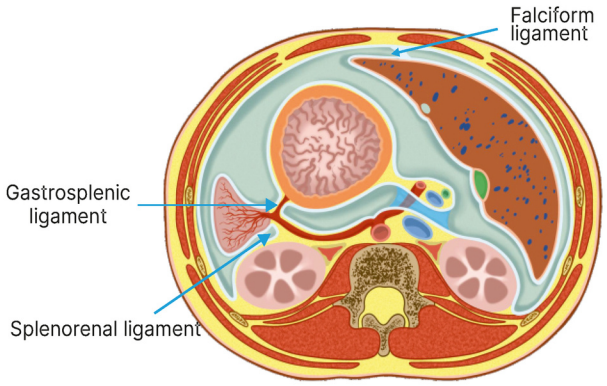
Superior mesenteric artery

- Branch of the abdominal aorta and originates at L1
- Passes behind the head and neck of the pancreas (compressed by the carcinoma head of the pancreas)
- Later comes in front of the uncinate process and runs anterior to the left renal vein



PERITONEAL FOLDS

00.48.42

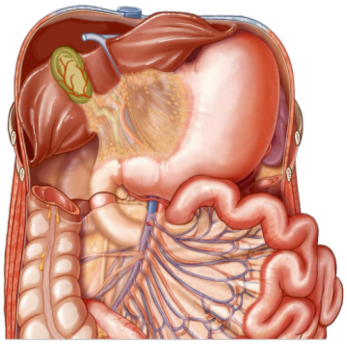


- Falciparum ligament
  - Between the anterior abdominal wall and the liver
  - Contains ligamentum teres, which is a remnant of the left umbilical vein
- Lesser omentum
  - Between the stomach and the liver
  - Free margin of this has the portal triad of the proper hepatic artery, portal vein, and bile duct
- Gastrosplenic ligament
  - Between the stomach and the spleen
  - Contains short gastric arteries and the gastroepiploic artery
- Leinorenal or splenorenal ligament
  - Between the kidney and spleen
  - Contains splenic vessels and the tail of the pancreas
- 90° rotation of the foregut forms the lesser sac and the greater sac
  - Greater sac is in front of the stomach
  - Lesser sac is behind the stomach

Lesser sac

- Also called the omental bursa
- The greater sac and the lesser sac are connected through the epiploic foramen/foramen of Winslow/omental foramen

Epiploic foramen



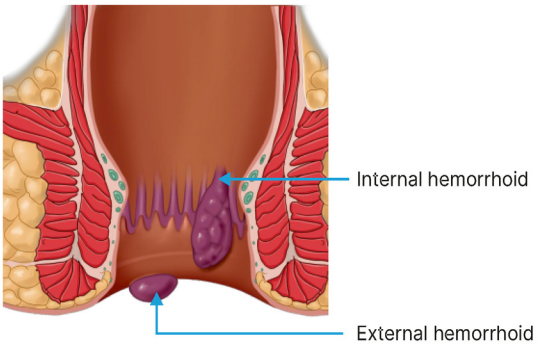
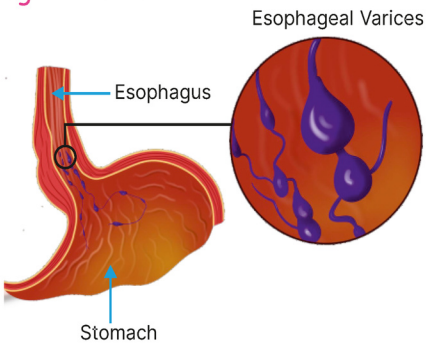
- Boundaries
  - Anterior: Free margin of the lesser omentum
    → Portal Vein (Posterior)
    → Proper Hepatic artery (anterior and left)
    → Bile Duct (anterior and right)
  - Posterior: IVC and Right suprarenal gland
  - Superior: Liver (Caudate lobe)
  - Inferior: First part of the duodenum

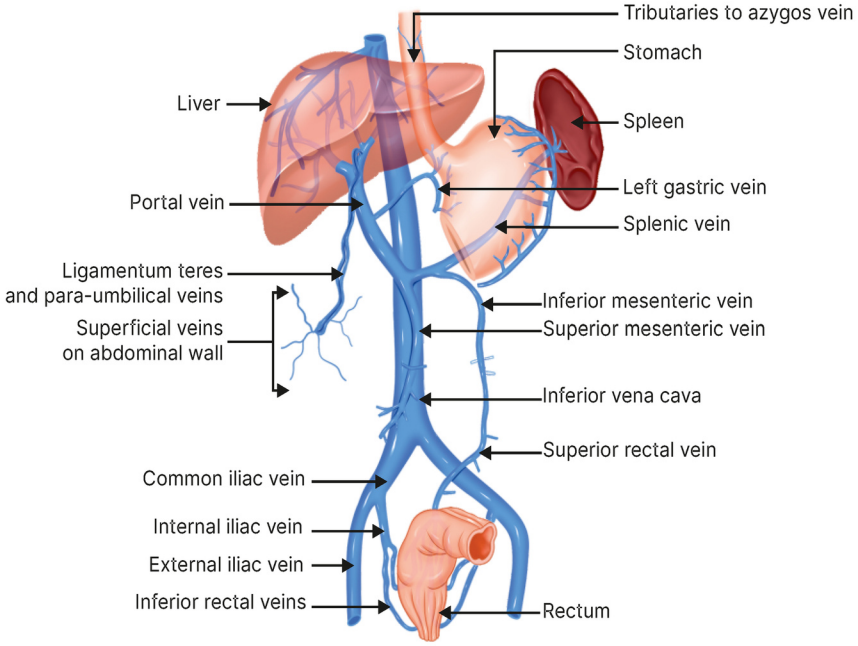
PORTOCAVAL ANASTOMOSES

01.02.27

- Portal vein- Drains from the gut
- IVC- Drains from kidneys, gonads, suprarenal glands, liver
- Portocaval anastomoses- contact between the portal vein and the IVC
- Clinical anatomy
  - Normally, blood gets drained from the rectum to the liver via the rectal veins and the portal vein. Blood moves from the high-pressure to the low-pressure
  - In the case of alcoholics, the portal vein is unable to drain in to liver casuing Portal HTN. D/t back pressure, the blood accumulates in the rectal veins, leading to hemorrhoids
  - Same concept applies to the oesophageal varices and caput medusa

Yourwish

Site	Portal system	Caval system	Clinical significance of portal hypertension
Rectum	Superior Rectal Vein	Middle & Inferior Rectal Vein	Hemorrhoids 
Lower head of the oesophagus	Oesophageal branches of Left Gastric Vein	Oesophageal branches of Accessory Hemiazygos Vein	Oesophageal varices 
Umbilicus	Para-Umbilical Vein	Superficial veins of the Anterior Abdominal Wall	Caput medusea 



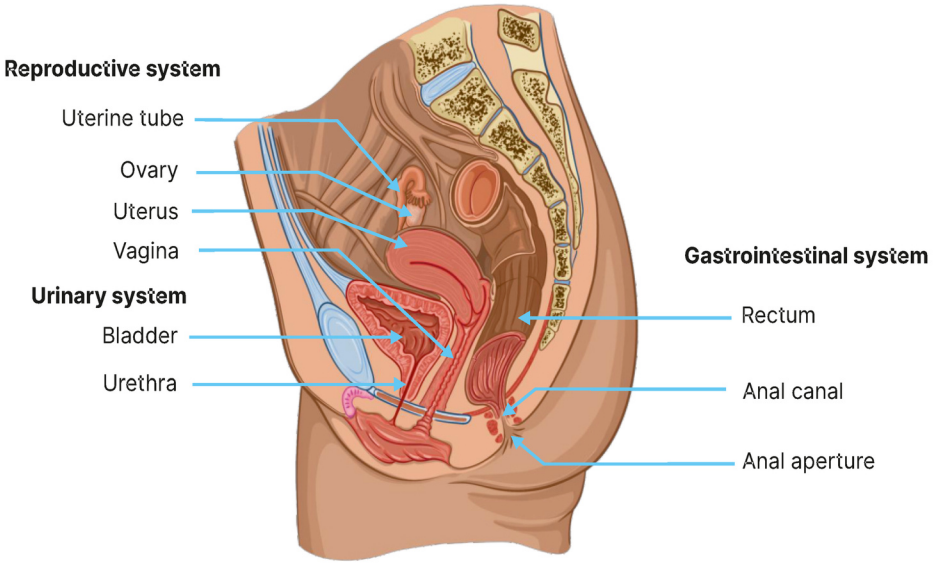
8. PELVIS & PERINEUM

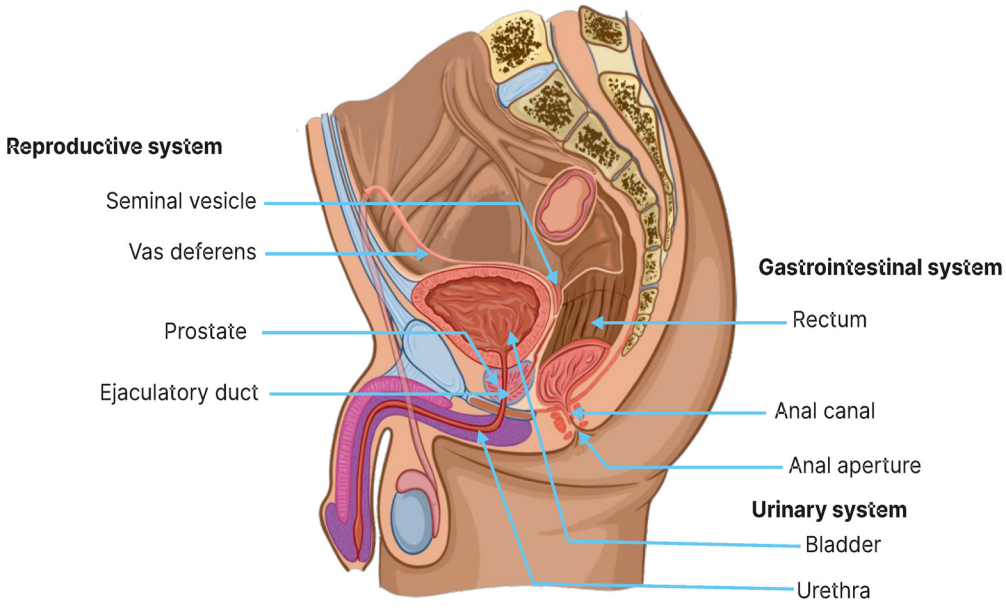
PELVIC DIAPHRAGM VS UROGENITAL DIAPHRAGM

00:00:58

Feature	Pelvic Diaphragm	Urogenital Diaphragm
Structure	Muscles sloping downward, forms the floor of the pelvis	Located below the pelvic diaphragm
Opening	Anal canal (anus)	Female: Urethra + Vagina Male: Urethra only (carries urine + semen)
Present in	Both males and females	Both males and females

FMGE 2020





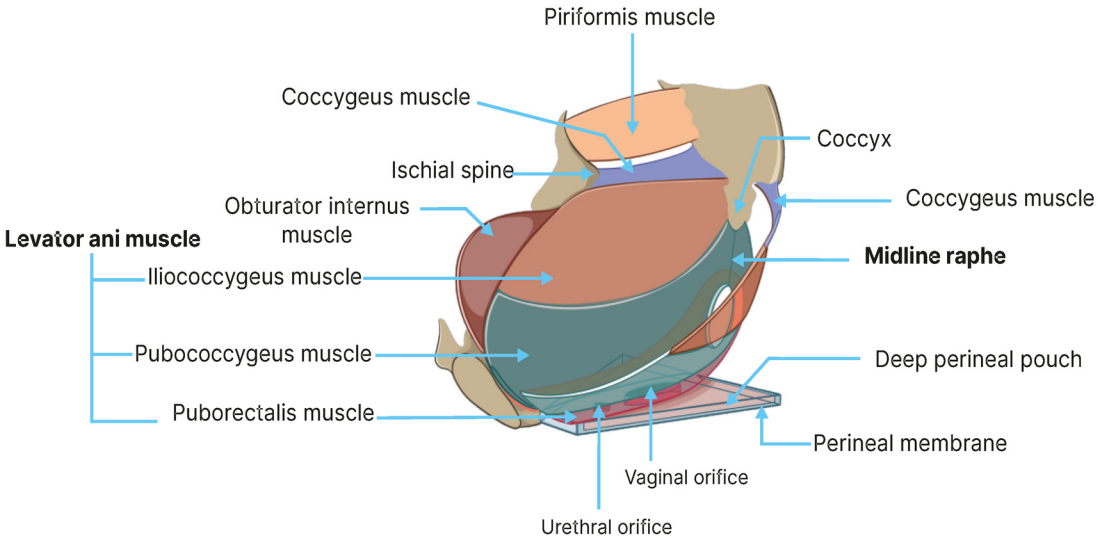
Pelvic Diaphragm

NEET PG 2020

Structure	Muscles
Pelvic diaphragm	• Levator ani + Coccygeus
Levator ani	• Pubococcygeus + Iliococcygeus + Puborectalis

Coccygeus	• Ischiococcygeus
	  ○ Origin: Ischial spine
	  ○ Insertion: Coccyx

Puborectalis	• Modification of pubococcygeus • Maintains anorectal angle • Muscle of continence



Urogenital Diaphragm

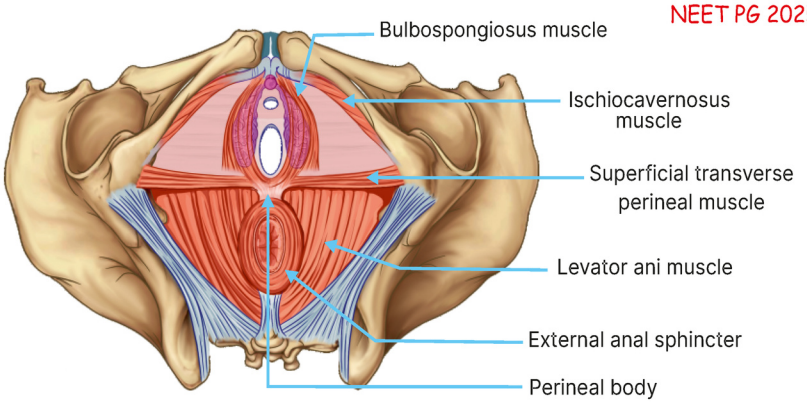
- Formed by **two muscles**.
  - External urethral sphincter
  - Deep transverse perineal muscle

PERINEAL BODY

00:06:35

Location

NEET PG 2025



- Situated between:
  - Vaginal opening
  - Anal canal
- Structure: Dense fibrous body
- Acts as: Support for pelvic organs

Clinical Relevance

- During normal vaginal delivery:
  - Perineal body may rupture
  - Loss of support
  - Pelvic organ prolapse
- Therefore, the perineal body must be protected

Muscles Attaching To The Perineal Body

NEET PG 2023

Type	Number	Muscles
Paired muscles	4 pairs (8 muscles)	• Bulbospongiosus • Superficial transverse perineal (STP) • Deep transverse perineal (DTP) • Levator ani
Unpaired muscles	2	• External anal sphincter • Longitudinal muscle of the anal canal

Perineal Pouches

- Two pouches present
  - Superficial perineal pouch
  - Deep perineal pouch

Fasciae in Perineum

Fascia (from inside-outside)	Details
Superior Fascia of Urogenital Diaphragm	Location: Above the urogenital diaphragm
Inferior Fascia of Urogenital Diaphragm	Also called: Perineal membrane
Superficial Fascia of the Perineum	Also called: Colles fascia

Formation of Perineal Pouches

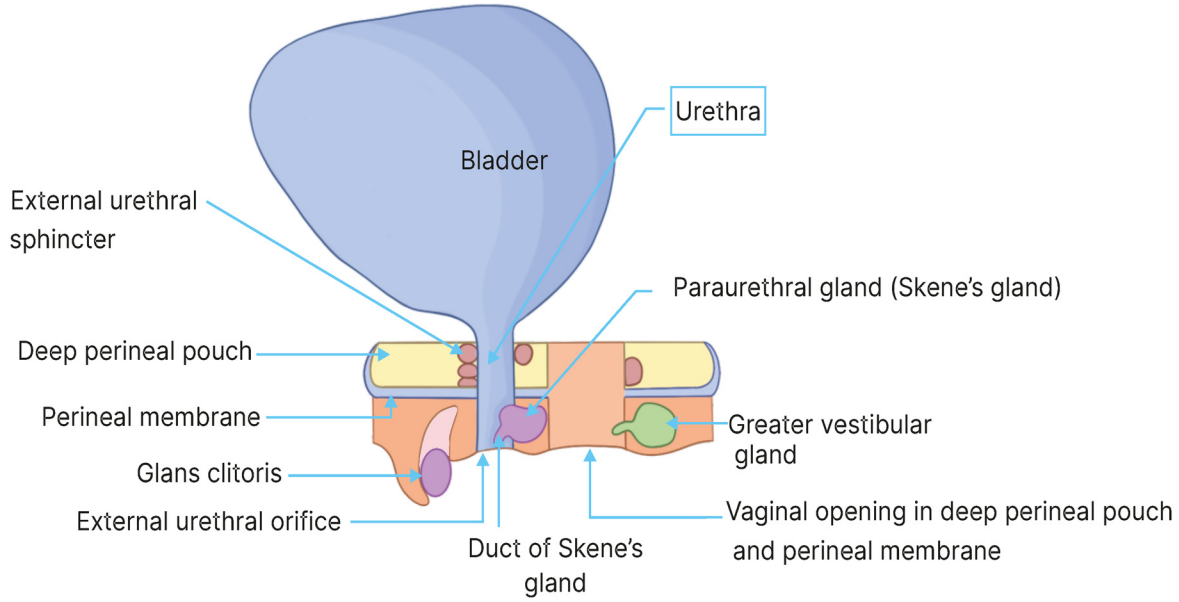
Fasciae	Pouch Formed
Superior fascia & inferior fascia	Deep perineal pouch
Inferior fascia & superficial fascia	Superficial perineal pouch

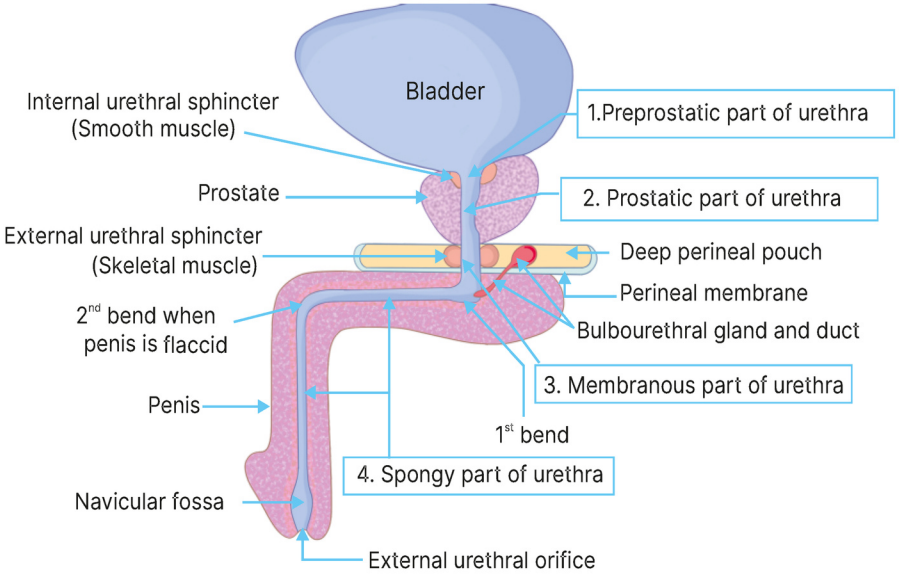
Contents of Perineal Pouches

- Key structure separating the pouches: **Perineal membrane**

Deep Perineal Pouch	Superficial Perineal Pouch
• External urethral sphincter • Deep transverse perineal (DTP) • (Form urogenital diaphragm) • Female: Urethra & Vagina • Males: Membranous urethra & Bulbourethral gland of Cowper • Dorsal nerve of the penis/clitoris • Dorsal artery of the penis/clitoris	• Superficial transverse perineal (STP) • Bulb of the penis/clitoris (Bulbospongiosus) • Crus of the penis/clitoris (Ischiocavernosus) • Male: Spongy urethra • Female: Urethral opening, vaginal opening, & Bartholin gland (Greater vestibular gland)

Yourwish

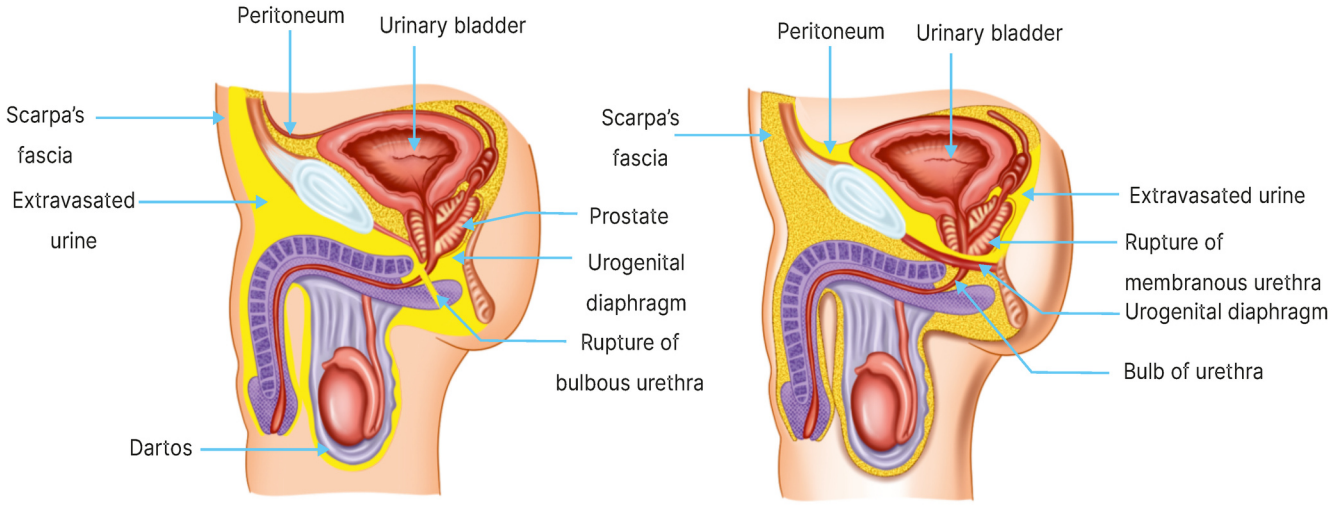




Extravasation of Urine

00:19:30

Injury Type	Example	Urethra Ruptured	Urine Spread
Straddle Injury	Riding a bicycle on a bumpy road	Bulbar urethra	Superficial perineal pouch Scrotum Penile shaft Anterior abdominal wall May extend to the axilla
Pelvic Fracture	Fall into a manhole	Membranous urethra	Deep perineal pouch If the superior fascia of the urogenital diaphragm ruptures → Space of Retzius **Location of Space of Retzius:** • Behind the pubic symphysis • Around the neck of the urinary bladder



Where Urine Cannot Spread

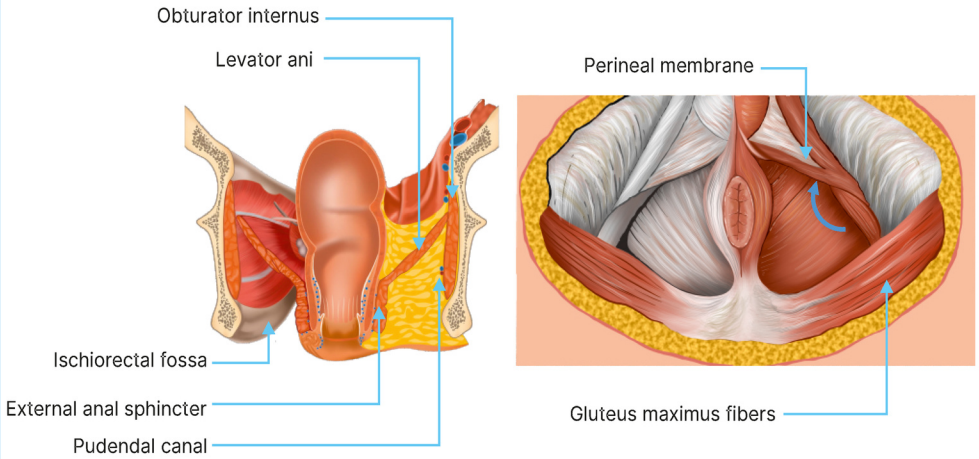
In a **Bulbar urethral rupture**, urine cannot spread to:

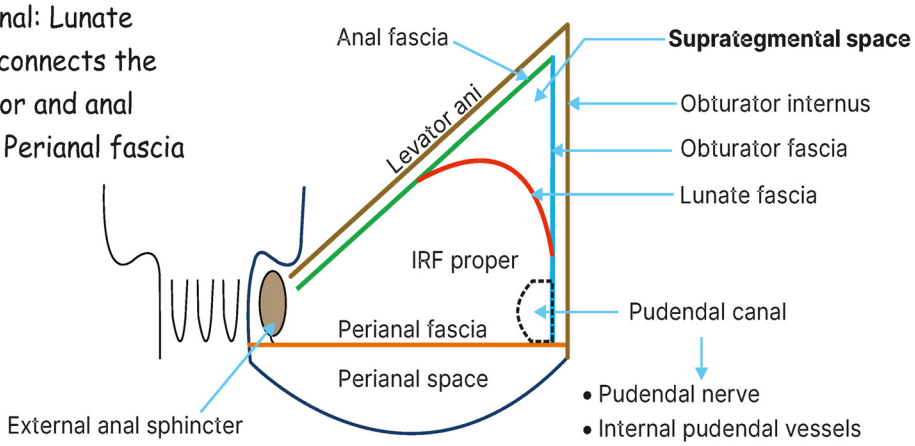
Area	Reason
Thigh	Fascia lata
Deep perineal pouch	Perineal membrane
Ischiorectal fossa	Colle's fascia

Ischiorectal/Ischioanal Fossa

00:24:15

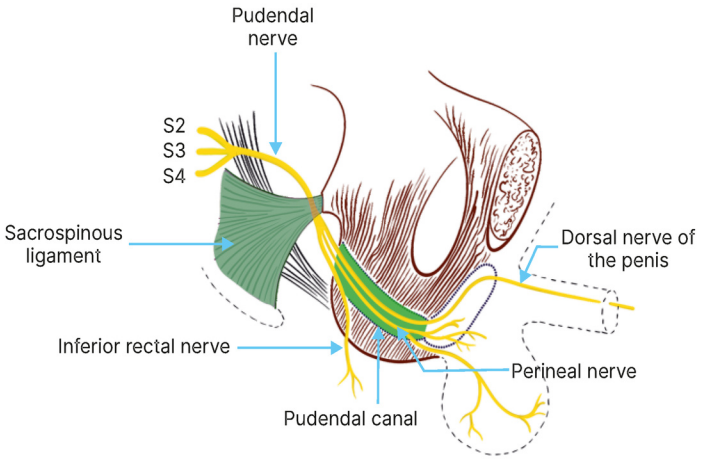
Feature	Details
Location/Shape	• Between the ischium & anal canal/rectum • Horseshoe-shaped, extends around the anal canal
Boundaries	• Lateral: Obturator internus • Medial: Levator ani + External anal sphincter • Anterior: Perineal membrane • Posterior: Sacrotuberous ligament + Gluteus maximus fibers • (Nearby: Sacrum, coccyx, ischial tuberosity)



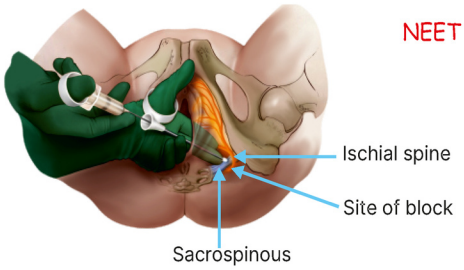
Contents	• Fat (major) • Pudendal canal (Alcock's canal): Pudendal nerve, Internal pudendal artery/vein • Inferior rectal nerve/vessels • Posterior scrotal/labial nerve
Fasciae	• Lateral: Obturator fascia • Medial: Anal fascia • Additional: Lunate fascia (connects the obturator and anal fascia), Perianal fascia 
Spaces	• Suprategmental space • Ischiorectal fossa proper • Perianal space

Pudendal Canal (Alcock's Canal)

Feature	Details
Names	• Alcock's canal
Formation	• Splitting of the obturator/lunate/perianal fascia
Location	• Lateral wall of the ischiorectal fossa, 2.5 cm above the ischial tuberosity
Contents	• Pudendal nerve (S2,S3,S4), Internal pudendal artery/vein
Pudendal Nerve Course	1. Origin from S2, S3, S4 2. Leaves pelvis through the greater sciatic foramen 3. Turns around the ischial spine 4. Re-enters via the lesser sciatic foramen 5. Enters the pudendal canal 6. Divides into terminal branches Branches • Perineal nerve • Dorsal nerve of the penis ○ Homologous structure in females: Dorsal nerve of the clitoris



Clinical	• Pudendal nerve block at the ischial spine (perineal surgeries, obstetrics)

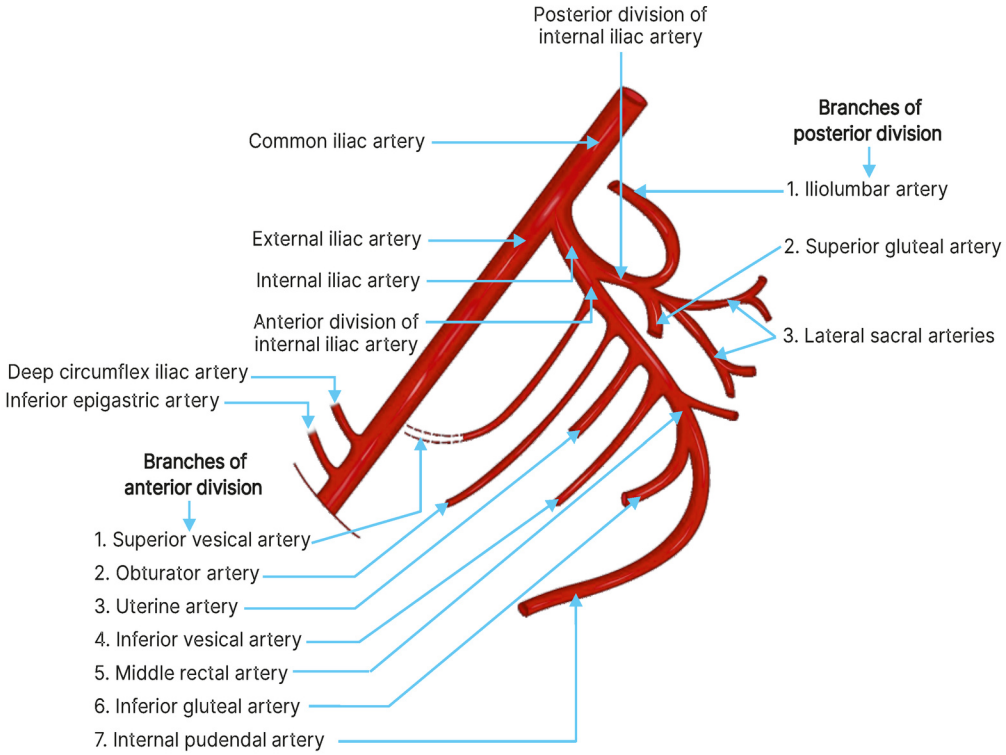


NEET PG 2020

INTERNAL ILIAC ARTERY

FMGE 2020 00:34:52

Feature	Details
Origin	The common iliac artery divides into the external iliac artery + Internal iliac artery
Divisions	Posterior division + Anterior division
Posterior Division Branches (Mnemonic: SIL)	**S** - Superior gluteal artery **I** - Iliolumbar artery **L** - Lateral sacral artery



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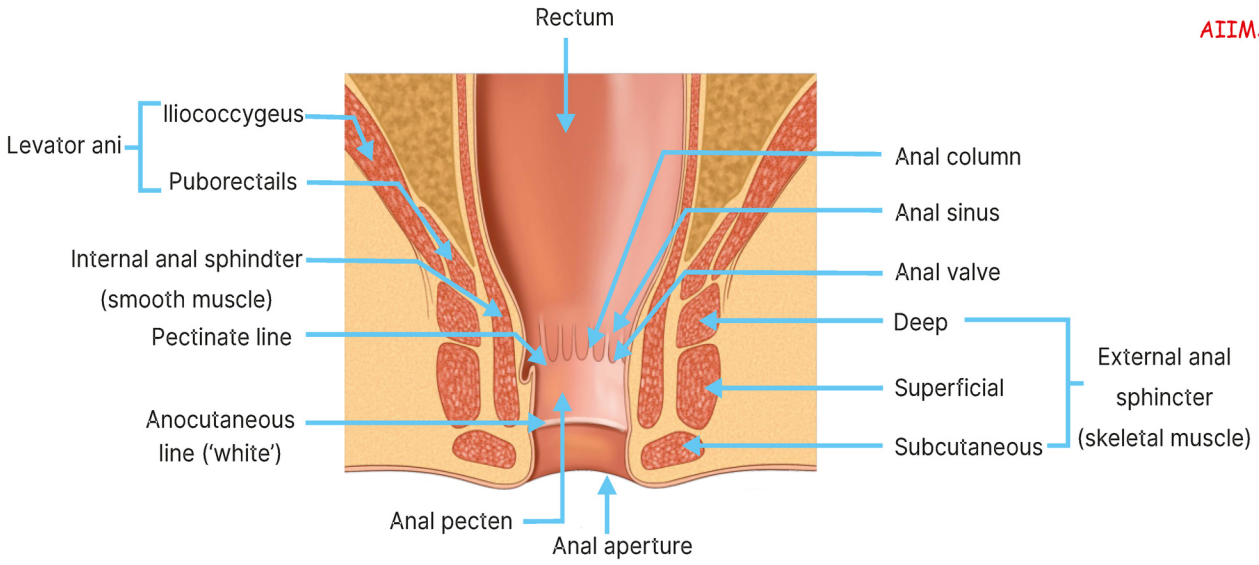
ANAL CANAL

00:37:08

AIIMS 2019



Structure	Description
Anal columns	Longitudinal mucosal folds
Anal valves	Crescent-shaped mucosal folds
Anal sinuses	Space between anal columns
Pectinate line	Formed by anal valves

Differences Above & Below Pectinate Line

Feature	Above Pectinate Line	Below Pectinate Line
Embryological origin	Endoderm	Ectoderm
Epithelium	Simple columnar	Stratified squamous non-keratinized/keratinized
Artery	Superior rectal artery	Inferior rectal artery
Vein	Superior rectal vein → portal system	Inferior rectal vein → caval system
Nerve supply	Autonomic	Pudendal nerve
Lymph drainage	Internal iliac nodes	Superficial inguinal nodes
Hemorrhoids	Internal hemorrhoids (painless)	External hemorrhoids (painful)

White Line (Anocutaneous Line)

- Also called: **Hilton's line**
- Function: Separates
  - Non-keratinized epithelium (above)
  - Keratinized skin (below)

9. TYPES OF JOINTS AND GENERAL HISTOLOGY

TYPES OF JOINTS

00:00:30

FMGE 2020, 2021, 2024,
NEET PG 2023, INICET 2024

TYPES OF JOINTS

Fibrous joints	Cartilaginous joints	Synovial joints
Sutures	Primary cartilaginous joint (Synchondrosis)	Ball & socket joint
Gomphosis	Secondary cartilaginous joint (Symphysis)	Hinge joint
Syndesmosis		Saddle joint
		Ellipsoid joint
		Condylar joint
		Plane joint
		Pivot joint

- Fibrous joints- Immovable joints
- Cartilaginous joints- Partially movable joints
- Synovial joints- Completely movable joints

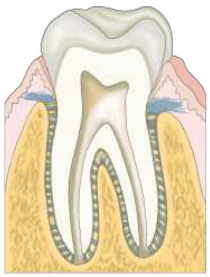
Fibrous Joints

00:00:58

FIBROUS JOINTS

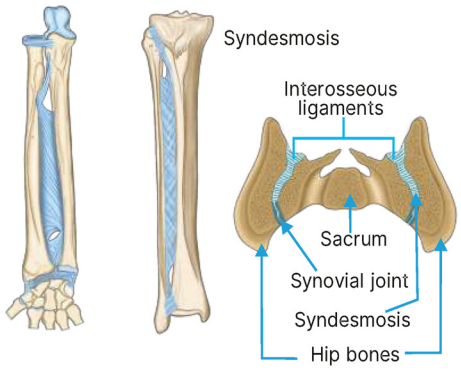
Sutures
Between the cranial bones

Gomphosis
Between tooth and the socket (Dentoalveolar joint)

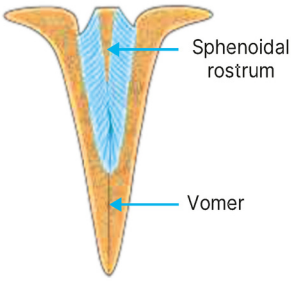


Syndesmosis
The joint between the two bones is held together with the help of the interosseous membrane

E.g.
Middle Radioulnar joint
Inferior Tibiofibular joint
Sacroiliac joint



- **Schindylesis (Ridge and groove)-** Special type of suture between the rostrum of the sphenoid bone and the alae of the vomer

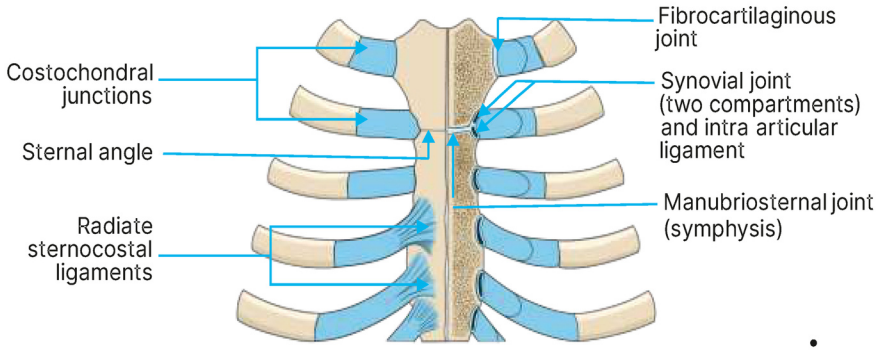


Cartilaginous Joints

00:04:00

Primary Cartilaginous Joint

- AKA Synchondrosis
- Between the epiphysis and the diaphysis of long bone (Eg. growth plate)
- Costochondral joint
- Spheno-occipital joint



Secondary Cartilaginous Joint

- AKA Symphysis
- All the midline joints
  - Manubriosternal joint
  - Xiphisternal joint
  - Intervertebral disc
  - Pubic symphysis
  - Sacro-coccygeal joint

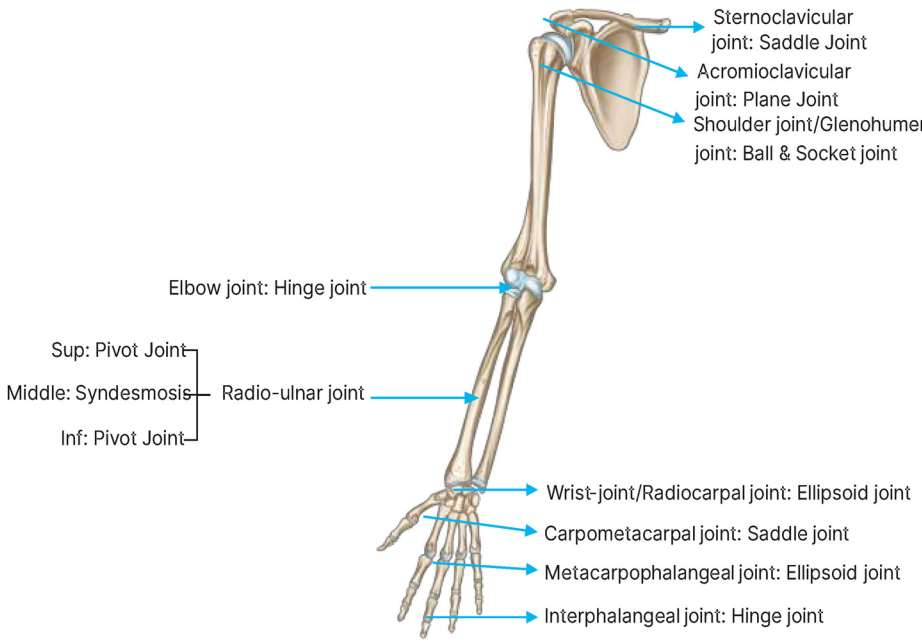
Important Information

- Symphysis menti, although present in the midline, is not a Secondary cartilaginous joint

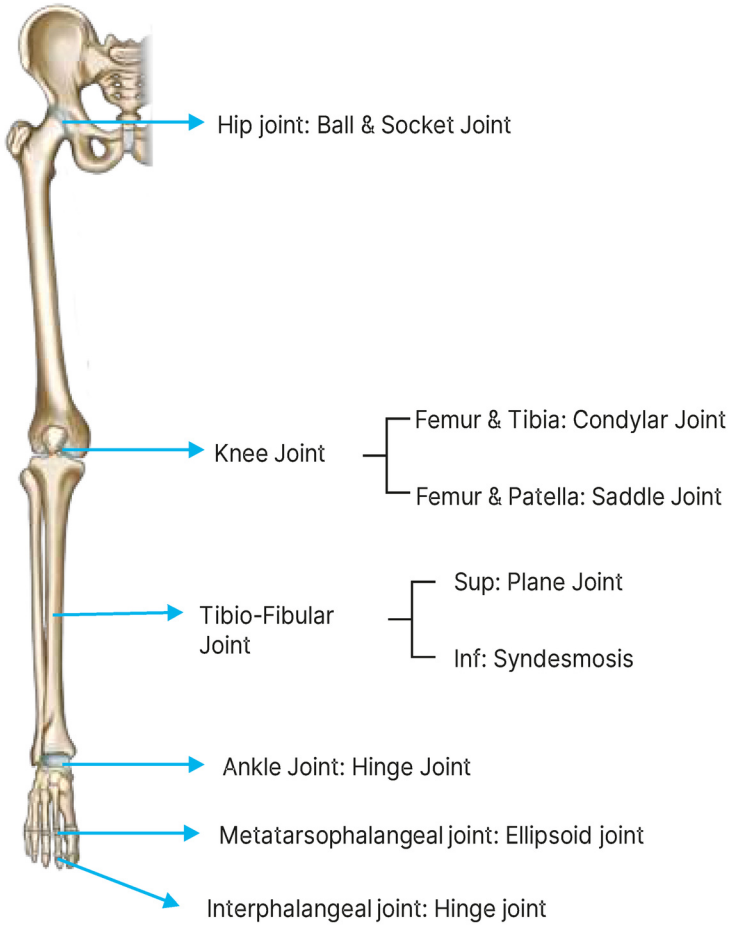
Synovial Joints

00:07:56

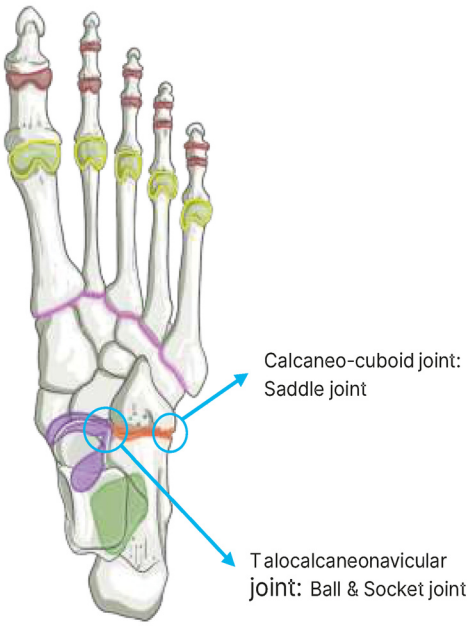
Upper Limb



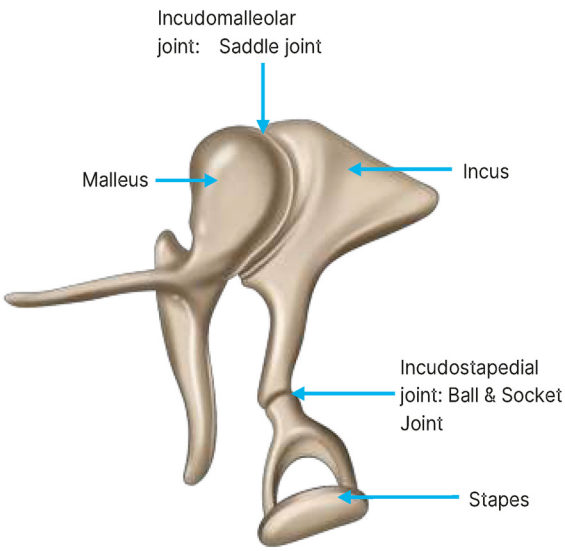
Lower Limb



FOOT



EAR OSSICLES



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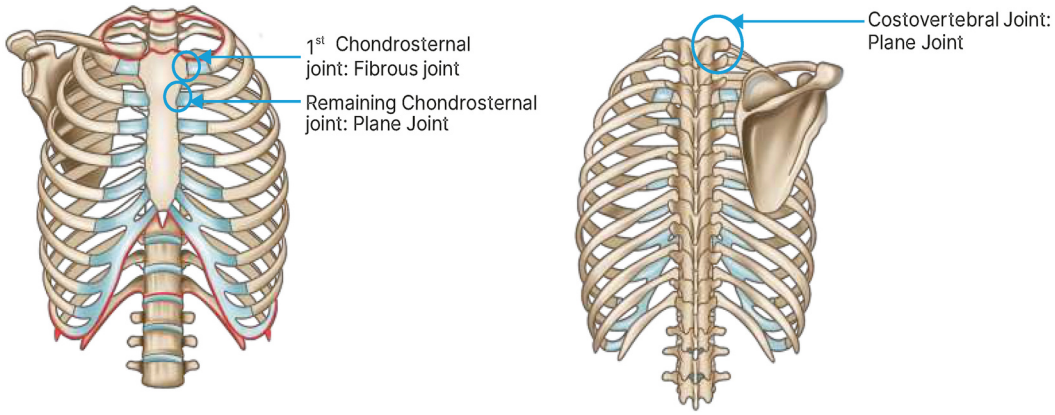
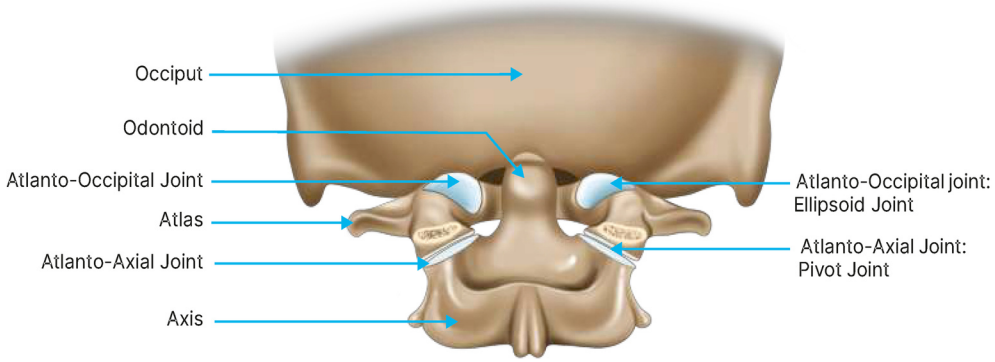
THORACIC CAGE



- All chondrosternal joints are plane synovial joints, except the first chondrosternal joint, which is a fibrous joint

Yes and No Joints



- No movement: Atlanto-axial joint (C1-C2)
  - Odontoid process goes and fits into the C1, helping the head move left and right
- Yes movement: Atlanto-occipital joint (C1-Occipital)

HISTOLOGY

00:18:50

AIIMS 2020, FMGE 2020, 2021, 2022, 2025, INICET 2019, 2021, 2022, NEET PG 2022, 2024

TYPES OF EPITHELIUM

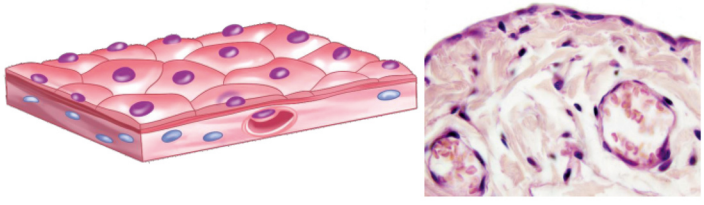
Simple (one layer)	Stratified (multiple layer)
Squamous	Squamous
Cuboidal	Cuboidal
Columnar	Columnar

Simple epithelium

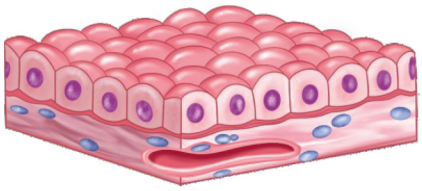
00:20:22

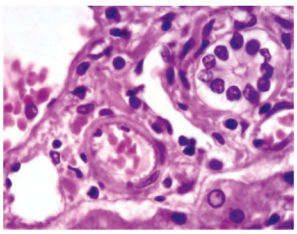
Simple Squamous

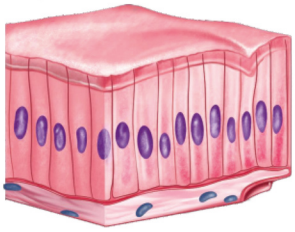
- Length < Breadth
- Nucleus: Flat
- Function: Exchange
- Examples:
  - Bowman's capsule

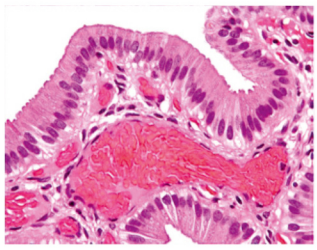


	○ Blood vessels (endothelium) ○ Body cavities ○ Alveoli
Simple Cuboidal	• Cube-shaped cells • Length = Breadth • Nucleus: Round and central • Function: Secretion • Examples: ○ Thyroid follicles ○ Ducts of glands ○ Germinal epithelium of the ovary ○ Tubules of the kidney ○ Choroid plexus
Simple Columnar	• Length > Breadth • Nucleus: Elongated and present more towards the basal membrane • Function: Secretion • Examples: ○ Stomach ○ Large intestine









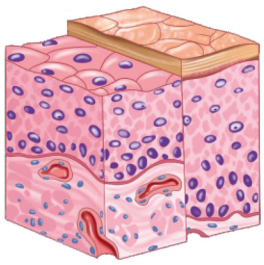
Stratified Epithelium

00:23:10

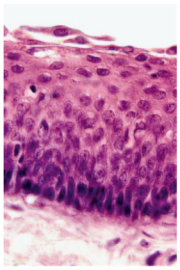
- Each variant is named based on the epithelium present on the topmost layer

Stratified Squamous Epithelium

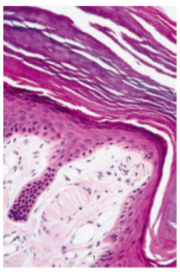
Features	Stratified Squamous
Apical layer	Squamous
Intermediate layer	Polygonal
Basal layer	Columnar
Examples (Wear and tear areas)	Skin, Tongue, Tonsils, Esophagus, Lower part of the anal canal, Vagina



Stratified squamous epithelium



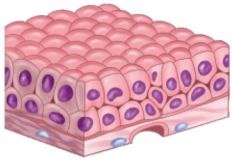
Stratified squamous (Non-keratinized)

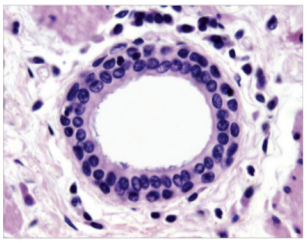


Stratified squamous (keratinized)

Stratified Cuboidal Epithelium

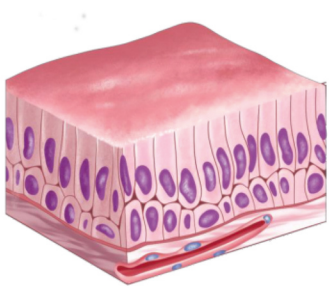
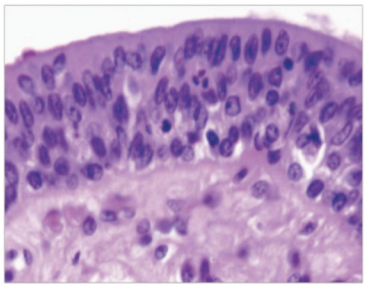
Features	Stratified Cuboidal
Apical layer	Cuboidal
Intermediate layer	Polygonal
Basal layer	Columnar
Examples	Ducts of Exocrine glands and sweat glands





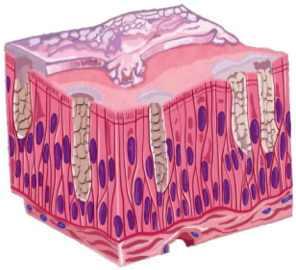
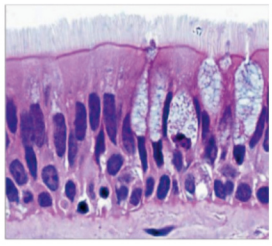
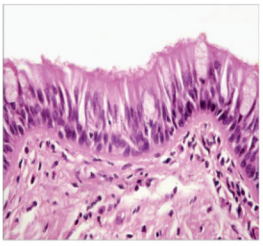
Stratified Columnar Epithelium

Features	Stratified Columnar
Apical layer	Columnar
Intermediate layer	Polygonal
Basal layer	Columnar
Examples	Membranous and penile urethra

Pseudostratified Epithelium

- A simple layer of cells with nuclei arranged at different levels, and it appears stratified (Pseudostratified)

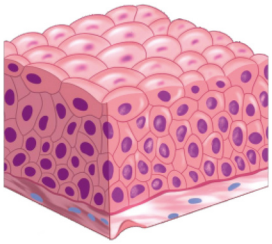
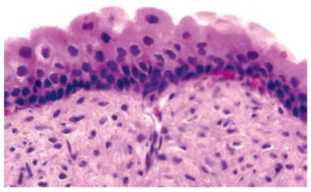
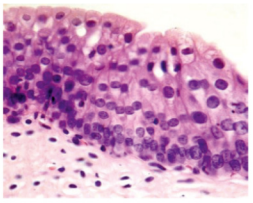
Pseudostratified Ciliated Columnar

- Examples: Trachea, Bronchus

Transitional Epithelium/Uroepithelium

00:26:30

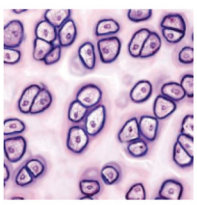
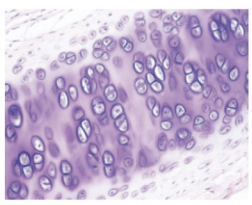
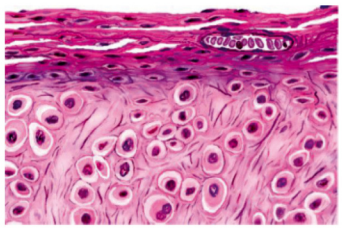
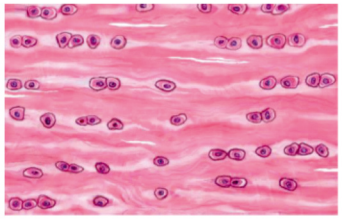
Features	Transitional/Uroepithelium cells
Apical layer	Umbrella/inverted 'U' shaped cells
Intermediate layer	Polygonal cells
Basal layer	Columnar cells
Examples	Ureter, Urinary bladder, Prostatic urethra

CARTILAGE

00:27:52

	Hyaline	Elastic	Fibrocartilage
Chodrocytes arrangement	In groups	In rows	
Matric	• Shiny/glossy (refractive index of type-II collagen fiber similar to that of ground substance)	• Elastic fibers • Type-II collagen	• Type-II collagen (long, wavy bundles)

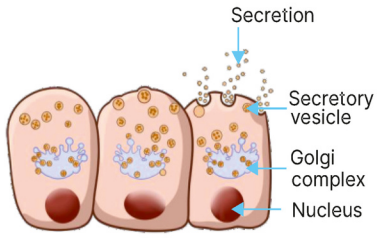
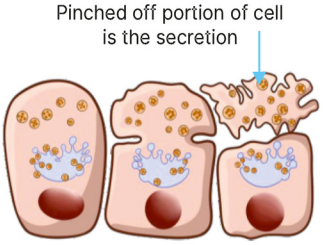
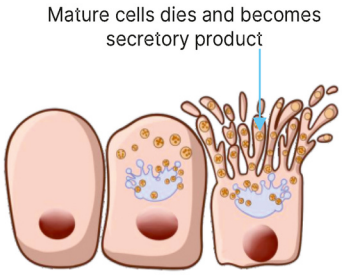





Peri-chondrium	+	+	-
Examples	• Articular cartilages • Costal cartilages • Embryonic cartilages • Epiphyseal cartilages • Respiratory cartilages	• Epiglottis • Ear lobe • Eustachian tube • Corniculate cartilage • Cuneiform cartilage • Apex of the arytenoid	• Meniscus • Articular disc • Glenoidal labrum • Intervertebral disc

- Paired cartilage:
  - Corniculate - Elastic cartilage
  - Cuneiform - Elastic cartilage
  - Arytenoid:
    → Base - Hyaline cartilage
    → Apex - Elastic cartilage
- Unpaired cartilage
  - Thyroid - Hyaline cartilage
  - Cricoid - Hyaline cartilage
  - Epiglottis- - Elastic cartilage

GLANDS BASED ON MODE OF SECRETION

00:32:30

	Merocrine	**Apocrine**	**Holocrine**
Mechanism of secretion	 Exocytosis		
Cells	Intact	Not intact	Not intact
Examples	Exocrine glands Sweat glands	Mammary glands Atypical sweat glands of the axilla, pubis	Sebaceous glands