Structured Notes According to

ANATOMY

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading notes

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(Author)

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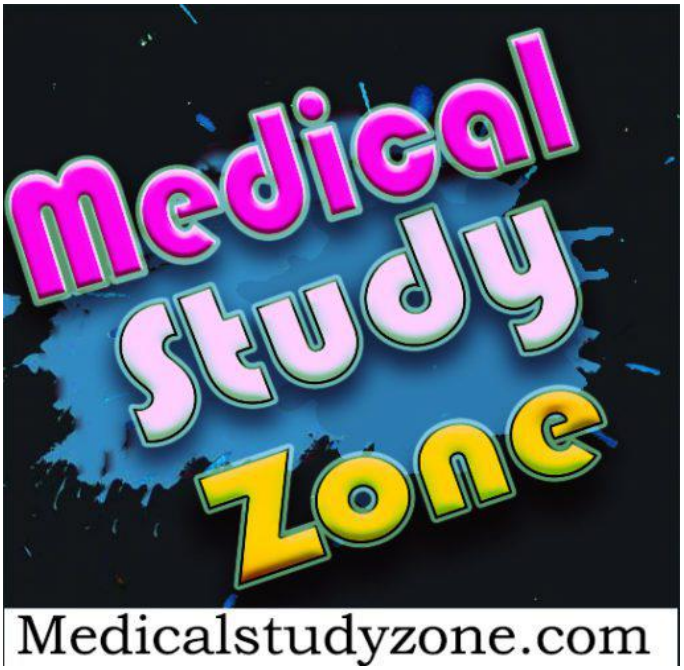


CONTENTS

ANATOMY VOLUME-I

LIST OF IMPORTANT TOPICS

👉 MUST DOS

- Cranial Nerves And Nuclei, esp. Optic nerve pathway- Most important for NIMHANS
- Brachia! Plexus: Branches and Palsies
- Root Values And Dermatomes of UL & LL
- Arteries and branches: Subclavian artery, Axillary artery, Internal iliac
- Nerve Supply of Perineum, Ear, Eye
- Relations of Lesser Sac, Parotid gland
- Peritoneal anatomy

👉 Embryology

- Derivatives Of Dierent Germ Layers, particularly Neural Crest
- Branchial Arch, CleG Derivatives
- Spermato/Oogenesis, Mitosis, Meiosis

👉 Osteology

- Types Of Joints With Examples
- Ossification Centers, particularly ones present at birth
- Knee Join Ligaments; learn with orthopedics (injuries)

👉 Neuroanatomy

- Cavernous Sinus Boundaries/Structures Passing through it, Tributaries
- Blood Supply
- Brainstem Sections
- Ventricle Boundaries

👉 Histology

- List Of Epithelium Lining Of Various Regions

LEARNING OBJECTIVES

UNIT 1

DEVELOPMENTAL TIME LINE

- Menstrual cycle
- Embryonic period

GAMETOGENESIS PART 1

- Germ Cell Tumour
- Cell Division: Mitosis And Meiosis
- Spermatogenesis
- Oogenesis

GAMETOGENESIS PART 2

- Oogenesis
- Menstrual cycle

DEVELOPMENTAL PERIOD: WEEK 1AND 2

- Development during week 1
- Implantation
- Blastocyst

WEEK 3 AND 4

- Gastrulation
- Ingression
- Primitive Streak And Notochord
- Primordial Germ Layer

GERM LAYER DERIVATIVES

- Folding of embryos; Transverse section of embryo
- Body tubes

ECTODERM AND NEURAL CREST CELL

- Longitudinal Section Of Embryo
- Neural Crest Cells
- Digeorge Syndrome
- Surface Ectoderm Derivatives
- Neural Plate Ectoderm Derivatives
- Salivary Glands

MESODERM DERIVATIVES

- Dorsal view of embryo

- Transverse section
- COMPONENTS OF MESODERM
- Lateral plate Mesoderm
- Somite Derivatives Components
- Skeleton Development

ENDODERM DERIVATIVES

- Gut Tube Derivatives
- Lung bud forming lungs
- Pharyngeal pouches
- Gut Tube

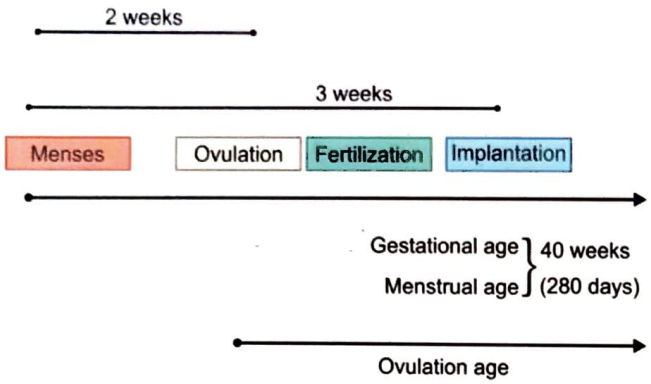
PLACENTA DEVELOPMENT

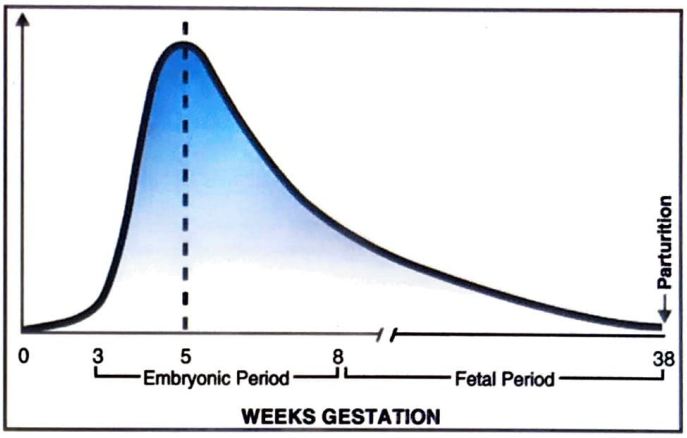
- Extra Embryonic Mesoderm
- Yolk Sac
- Uterus
- Chorionic Villi

1 DEVELOPMENTAL TIME LINE

MENSTRUAL CYCLE

00:00:44





Previous Year's Questions

Q. heart begins at week?

A. 4
B. 5
C. 6
D. 7

Previous Year's Questions

Q. All is true about the developmental timeline except?

A. Implantation occurs at day 20-22 in menstrual cycle
B. Implantation occurs 20-22days post fertilization
C. Embryo is till the 8th week of fertilization
D. Fetal stage is termed from 10th week of gestation

Embryonic period

00:07:24

- EMBRYONIC PERIOD :3-8 WKS
- PRE EMBRYONIC PERIOD :Before 3 WKS
- FETAL PERIOD :8 WKS - 38 WKS

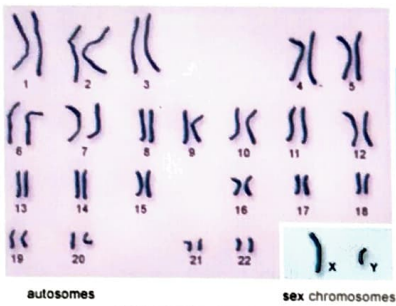
2 GAMETOGENESIS PART - 1

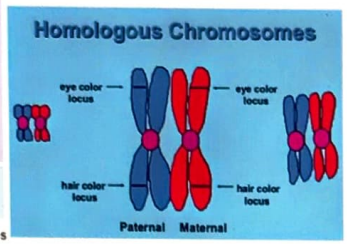
CHROMOSOMES

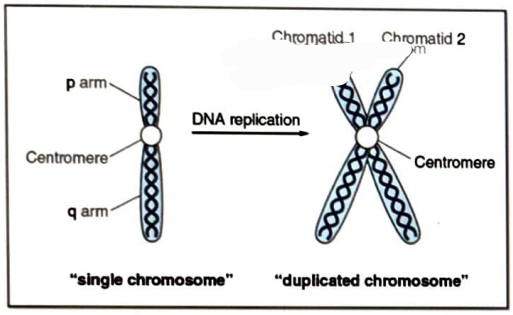
- Chromosomes are present in the nucleus of a cell
- 23 Pairs→22 pairs of Autosomes
- 1 pair of sex chromosome

HOMOLOGOUS CHROMOSOMES

- 2n 2N
  - n → No. of chromosomes
  - N → Amount of DNA
- DNA Replication done in 'S [synthetic] phase' Of interphase







GAMETOGENESIS

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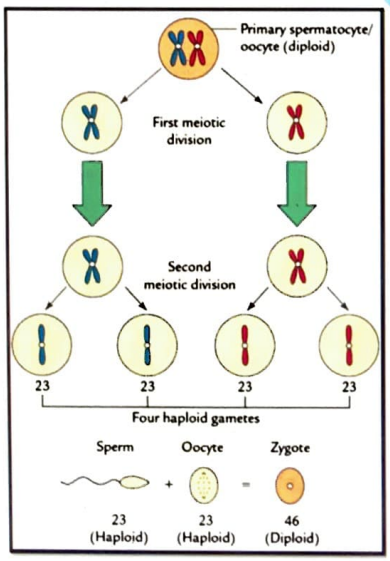
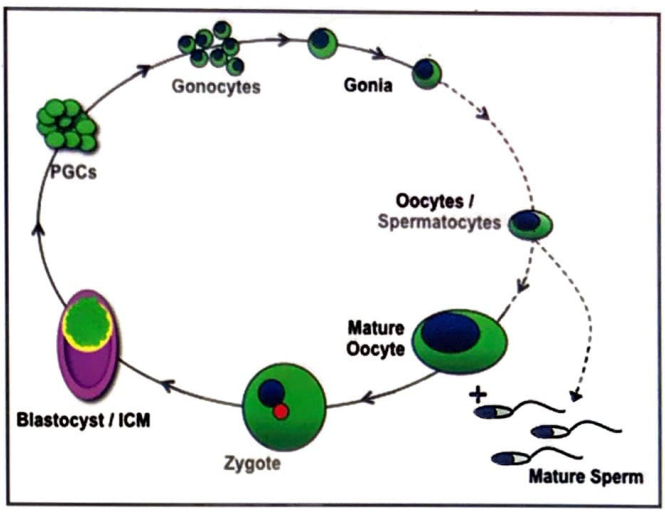




- ICM → Inner cell mass
- PGCs → Primordial Germ cells
- PGC → First sex cell of the body
- Chromosomes separate during meiosis 1
- Chromatid separates at meiosis 2

GERM CELL TUMOUR

00:14:46

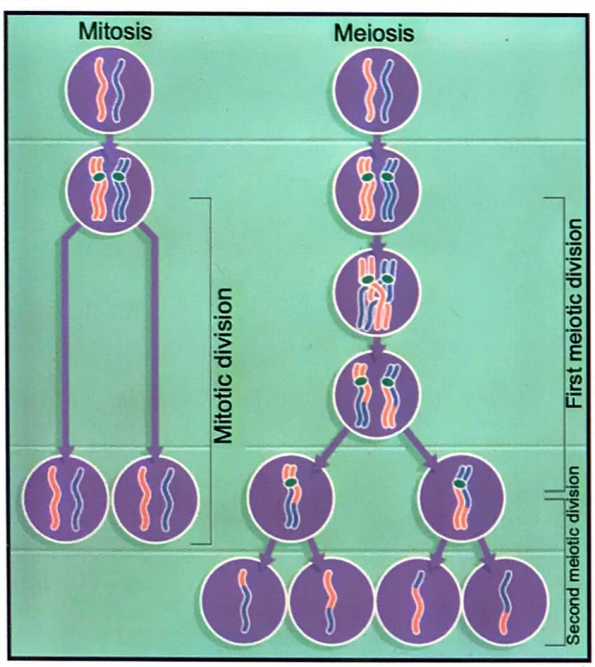
OROPHARYNGEAL TERATOMA

Sacrococcygeal Teratoma

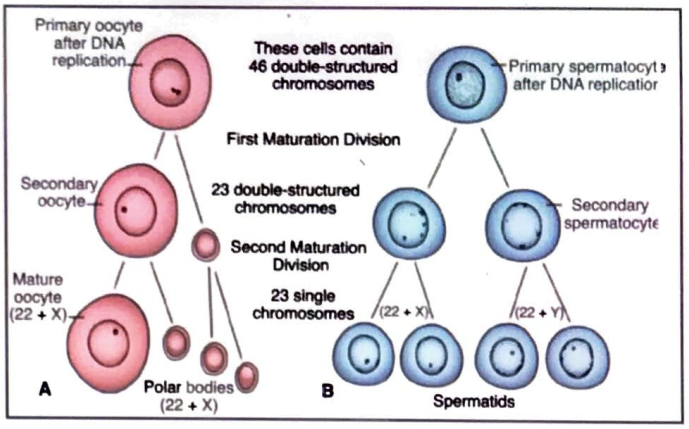
CELL DIVISION: MITOSIS AND MEIOSIS

00:17:43

Mitosis	Meiosis
• Takes place in somatic cells completes in one sequence	• Takes place in germ cells completes in 2 sequences; • Meiosis I & meiosis II
• Crossing over of chromatids doesn't takes place	• Crossing over of chromatids takes place
• Daughter cells have same • Chromosomes as parent cells	• Daughter cells have half the • no. of chromosomes as parent cells
• Daughter cells are identical • to each other and to parent	• Daughter cells are not identical • to each other & to parent cell
• Equational division	• Reductional division



GAMETOGENESIS: MALE AND FEMALE



SPERMATOGENESIS

00:21:38

Previous Year's Questions

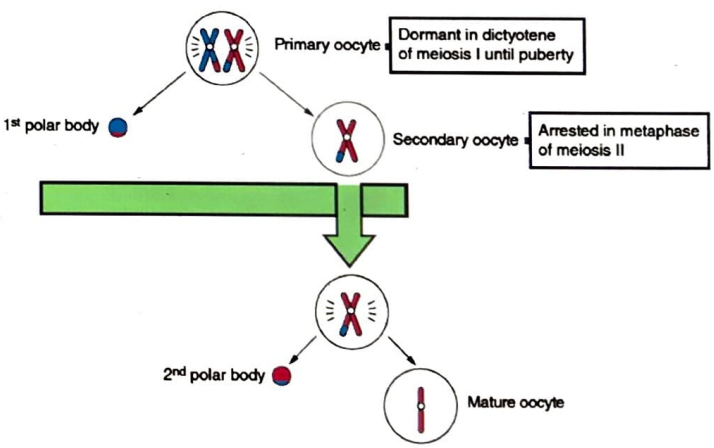
Q. FALSE ABOUT SPERMATOGENESIS IS
- Spermatozoa are formed from spermatogonium
- Takes 74 days to complete
- Largest cell is primary spermatocyte
- Meiosis occurs after secondary spermatocyte stage

OOGENESIS

00:23:33

Previous Year's Questions

Q. which cell undergoing fertilization
- Primary oocyte in prophase arrest
- Primary oocyte in metaphase arrest
- Secondary oocyte in prophase arrest
- Secondary oocyte in metaphase arrest



PRIMARY OOCYTE
- arrested in diplotene stage of Meiosis I
- after LH surge, it will form secondary oocyte
- INDEPENDENT ASSORTMENT

- separation of maternal or paternal chromosomes depending on probability factor [50% chances of having either paternal or maternal chromosomes in daughter cells]

- P→Primary oocyte
- P →Arrested in prophase
- P→Until puberty achieved

  - Arrested at Diplotene of Prophase I d/t OMI (oocyte maturation Inhibitor)
  - ↑cAMP
  - LH surge at puberty reduce cAMP TESTIS AT BIRTH
- 5th month of IUL:7 7million
- At birth:1-2 million
- Undergoes ovulation:400-500

SECONDARY OOCYTE

- Secondary oocyte is arrested in metaphase 2 of meiosis II

Testis at birth:

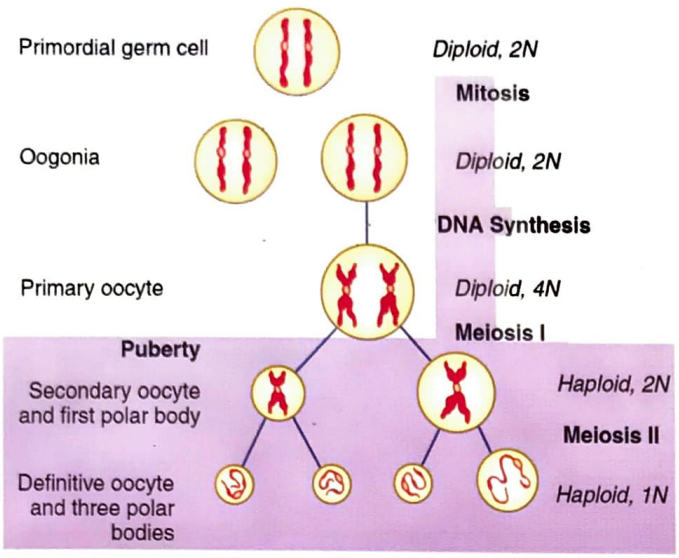
Dormant → Till puberty

- PGC [Primordial germ cell] are present in Testis (at birth)
- Spermatogenesis takes 74 days for completion oogenesis takes years for completion

3 GAMETOGENESIS PART 2

Oogenesis

00:00:10



MEIOSIS I

- Reductional [illegible]
- Maternal & paternal chromosomes are separated
  - 2nd polar body released after fertilization
  - 1st polar body released after LH surge [before ovulation]
    - → LH surge occurs 36 hrs before ovulation
    - → LH speak occurs 12 hrs before ovulation [1st polar body released

Previous Year's Questions

Q. wrong statement about oogenesis is?

A. 1st polar body is released at ovulation

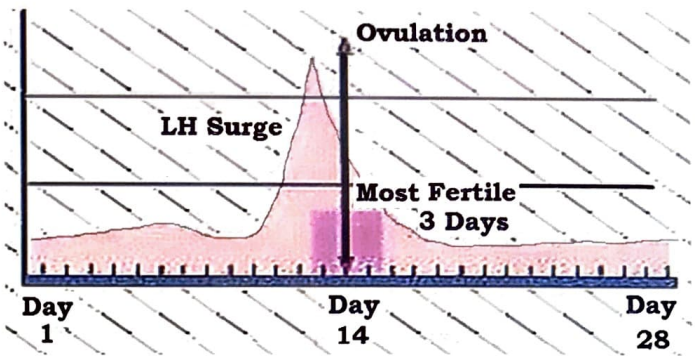
B. 2nd polar body is released at ovulation

C. Primary oocyte is 46XX

D Cell which undergoes ovulation is secondary ovum

Menstrual cycle

00:13:54



- LH surge occurs 36 hrs before ovulation
- LH peak occurs 12 hrs before ovulation [1st Polar Body released]
- Fertilization should occur within 24 hrs of ovulation
- degeneration occurs if fertilization do not occur
  - MENSTRUATION

WINDOW PERIOD FOR FERTILIZATION

- For female → 24 Hrs
- For male→48 Hrs
  - Sperms are capable of fertilization for 48 hrs after ejaculation
  - Sperms survival time in female 5-10 Days
  - FERTILE PERIOD → 12th to 15th Day [3 days]

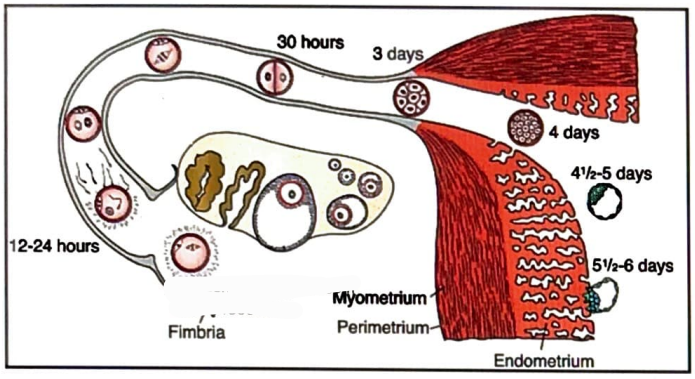
4 DEVELOPMENTAL PERIOD: WEEK 1&2

Previous Year's Questions

Q. false regarding I[st] week of development
Spermatozoon fertilizes ovum
Zona pellucida is acellular
Morula is 16 staged cell
Blastocyst attaches to endometrium at day 4

Development during week 1

00:00:45



- Fertilization Should Occur Within 24 Hrs Of Ovulation.
- Ovaryund ergoesov ulationand secon daryoocy teisovulatedcoveredby zonapellucida which prevent spolyspermy.
- Day 1:1 cell structure
- Day 2:2 cell structure
- Day3:Morula[canbe12/16/32/54 cells]

Zona pellucida
- Glycoprotein
- attracts sperm
- also covers zygote & prevents
  - Polyspermy
  - Implantation

Post fertilization

DAY 1 → Single cell stage

DAY 2 → 2 cell stage

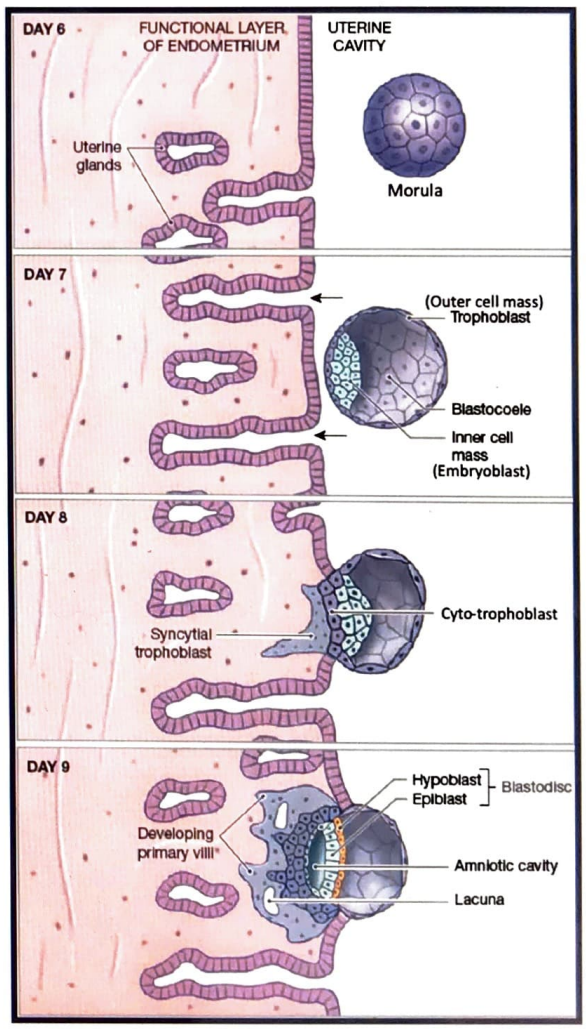
DAY 3 → Multicellular stage → MORULA
→ 12,16,32 & >32 cell stage (MORULA is 16 cell stage)
→ > 32 cell → advanced morula
→ advanced morula enters uterine cavity on day 4

DAY 4 → BLASTOCYST [by the end of day 4]
→ covered by zona pellucida [preventing implantation]

DAY 5 → Blastocyst hatches out of zona pellucida [important begins]

DAY 6 → Implantation occurs
→ Implantation-week long process [D5- D12]

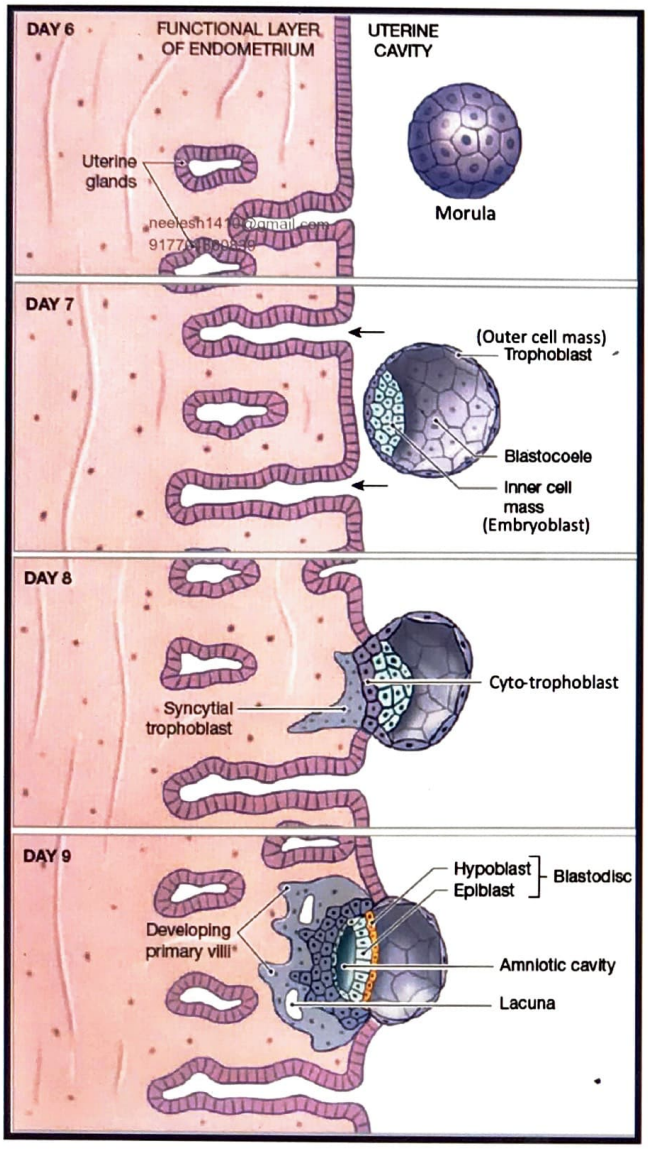
DAY 12 → UTERINE PLACENTATION Established



IMPLANTATION

00:09:13

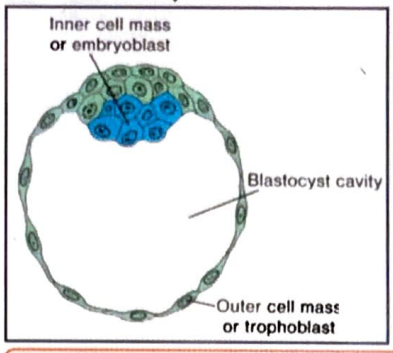
- Advanced morula enters uterine cavity on Day 4
- At the end of Day 4, advanced morula changed to BLASTOCYST
- contains Blast cells & cyst like cavity
- Contains
- Outer cell mass-Trophoblast [helps in placental formation]
- Inner cell mass - Embryoblast
- TROPHOBLAST divides into
  - Cytotrophoblast
  - Syncytiotrophoblast
    - → helps in implantation
    - → forms on D6-8
- EMBRYOBLAST form
  - Hypoblast [Dorsal]
  - Epiblast [ventral]
    - → Dorsal amniotic cavity
    - → Ventral yolk salk cavity

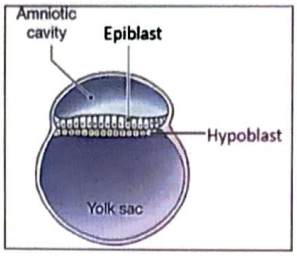


Blastocyst

00:11:23

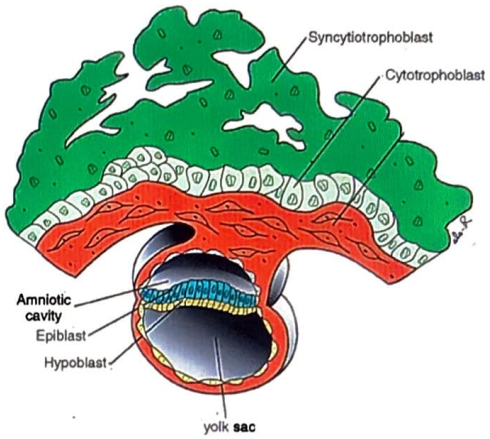
Epiblast forms 3 germs layers in 3rd week – Gastrulation





Important Information

2ndweakisknown asweakof2
2cells:Syncytiotrophoblast,cytotrophoblast
2cells:Epiblast,Hypoblast
2 cavities: Amniotic cavity (Dorsal), yolk sac cavity [VentralCavity]

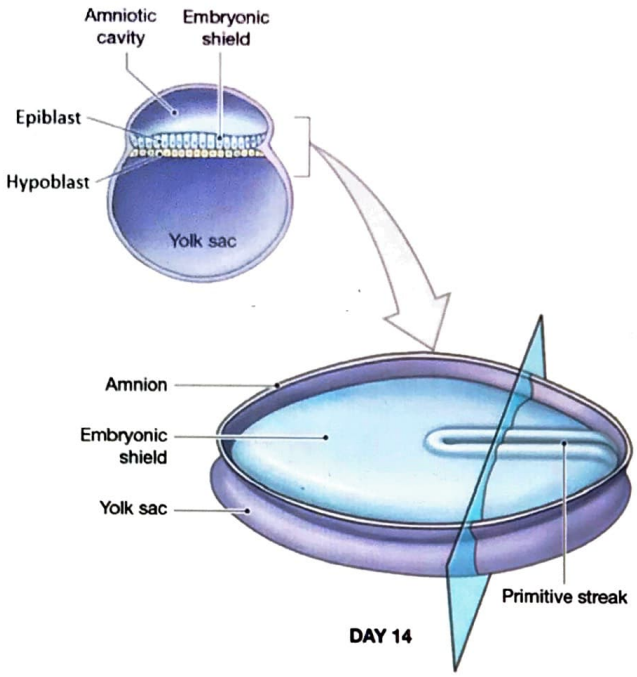


Double Bleb

DOUBLE BLEB SIGN ON USG

- d/t amniotic & yolk sac cavities
- seen in Normal Intrauterine pregnancy in week 2

5 DEVELOPMENTAL PERIOD: WEEK 3 & 4



GASTRULATION

00:03:30

Refer Image 5.1

Dorsal amniotic cavity
↓
Floor
↓
Epiblast proliferate
↓
Form primitive streak D14
↓
Epiblast migrate ventrally to form 3 germ layers
↓
Primitive streak (epiblast cells) go downwards towards roof of yolk sac to replace hypoblast cells
↓
Form Endoderm – 1st germ layer to form
↓
Then mesoderm is formed in the middle & the last to form is (Ectoderm)

3 germ layers

- Dorsal ectoderm – forms neural tube
- Middle mesoderm – forms cardiovascular
- Tube ventral endoderm – forms gut tube

3 germ layers are first formed at cephalic end, later at caudal end

Refer Image 5.2

- Primitive streak
  - formed from epiblast proliferation at end of 2nd week [day 14]
  - formed on the floor of amniotic cavity
  - appear at caudal end & migrates to cephalic end

INGRESSION

00:09:40

- Ventral migration of Epiblasts
- replaces hypoblast & forms Endoderm
- some epiblasts form mesoderm
- some epiblasts form ectoderm
- Epiblast proliferates to form a primary streak.
- Primitive streak appears at the caudal end of the baby and migrates towards the cephalic end of the baby. But gastrulation is reversed [Itiscephalo-caudal].
- The three germ layers are first formed near the head then towards the tail[In gastrulation].
- All the germ layers come from epiblast cells [illegible] is process is called gastrulation and this will happen in the 3rd week of post ovulation/postfertilization.

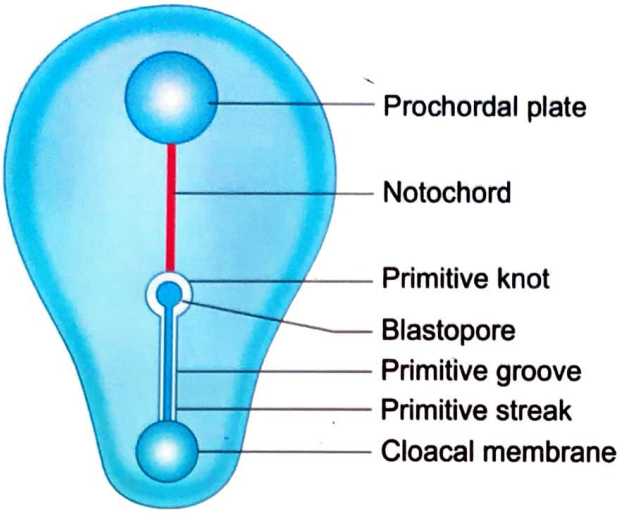
Previous Year's Questions

Q. FALSE STATEMENT ABOUT 2ND AND 3RD WEEK OF DEVELOPMENT IS?

a. Hypoblast form extraembryonic endoderm
b. Germ cells develop from yolk sac
c. 1st germ layer to form is ectoderm
d. Notochord is formed by epiblast

PRIMITIVE STREAK AND NOTOCHORD

00:16:40



- Epiblast Cells which are lying at floor of amniotic cavity undergo proliferation to form primitive streak.
- Primitive streak has 3 parts
  - Primitive groove
  - Primitive Knot
  - Primitive Pit
- As epiblast cells proliferate to form primitive streak some epiblastjumpsintoprimitivepitandgoesventrallytoreplace hypoblastcellintoendoderm.
- Endoderm is more ventral,If we go dorsal layer in middle known as mesoderm[formed by epiblast cell]
- Epiblast in the dorsal form will form an ectoderm .
- The floor of the amniotic cavity willhaven all 3 germ layers.
- Ectoderm and endoderm fuse at some level towards the cephalic end forming buccopharyngeal membrane and caudal end forming cloacal membrane. Both membranes don't have mesoderm because of fusion of dorsal ectoderm with ventral endoderm.
- Some of epiblast cells migrate towards the pit and go towards the buccopharyngeal membrane and they are going to form a notochord .
- So,a notochord is formed by epiplasts lying between the primitive pit and the bucco-pharyngeal membrane.
- This notochord is known as Axial mesoderm.
- Axial mesoderm stimulates dorsal epiblast or dorsal ectoderm to form the nervous system there.

PRIMORDIAL GERM LAYER

00:25:00

- isolated from Epiblasts at end of week 2
- migrated to endodermal wall of yolk sac
- at week 4, they migrates towards genital ridge
- reach genital ridge at the end of week 5
- forms gametes
- aberrant migration leads to teratomas
- sacro coccygeal teratoma
- oropharyngeal teratoma

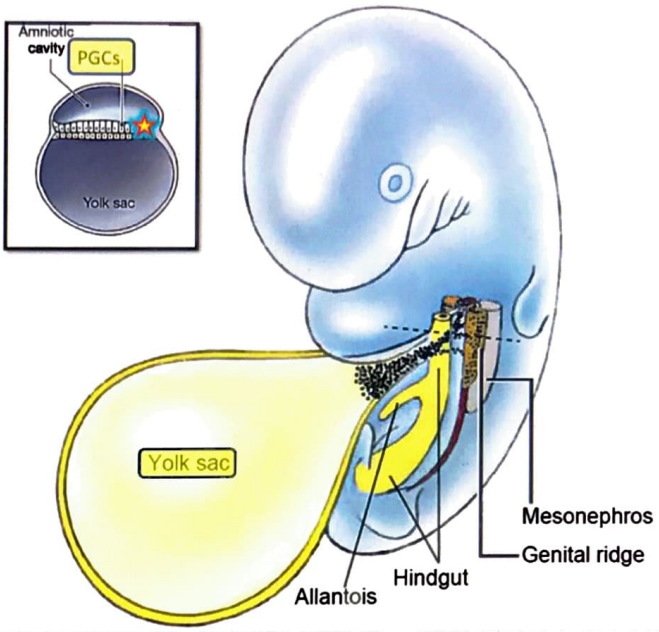


Image 5.1

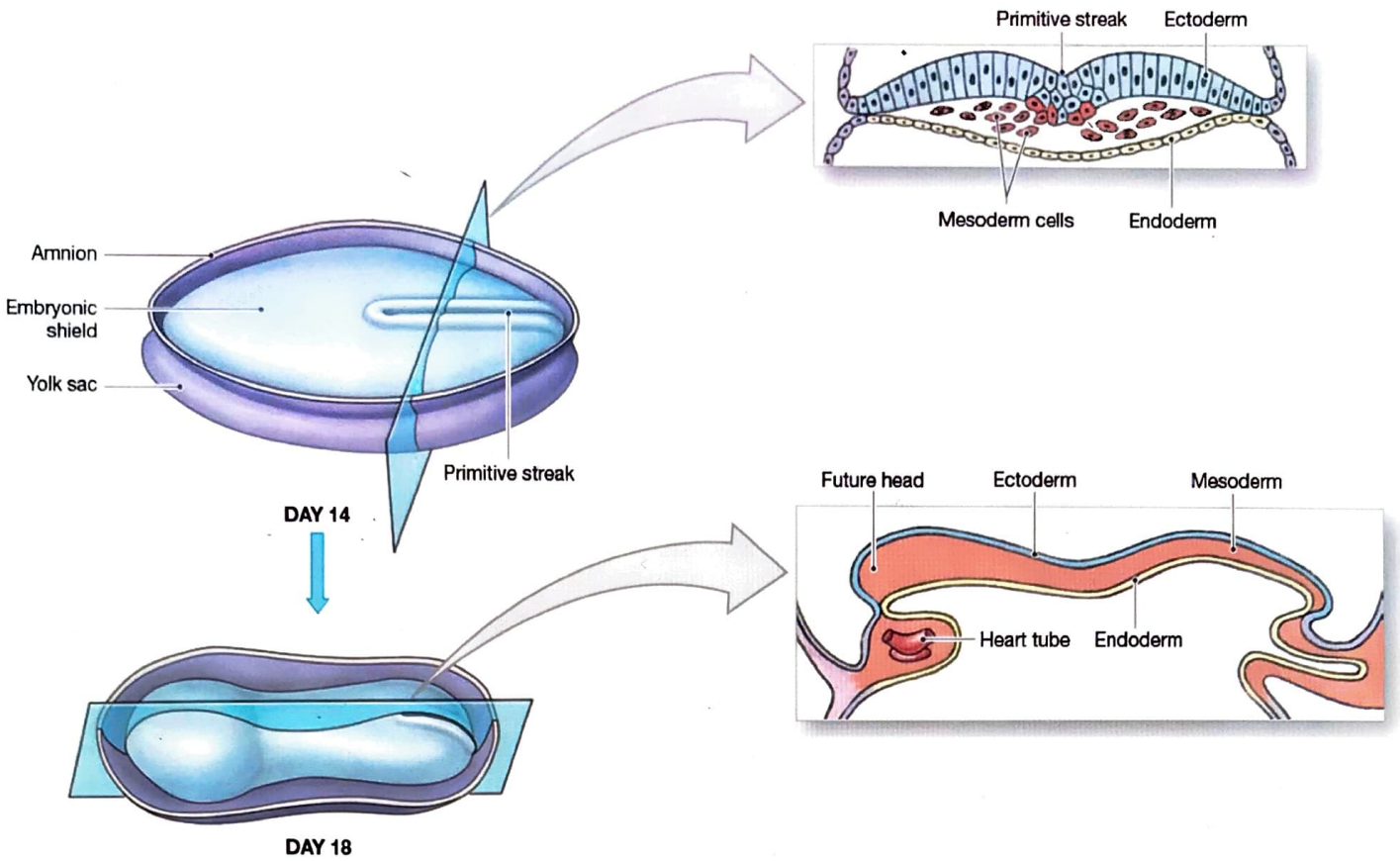
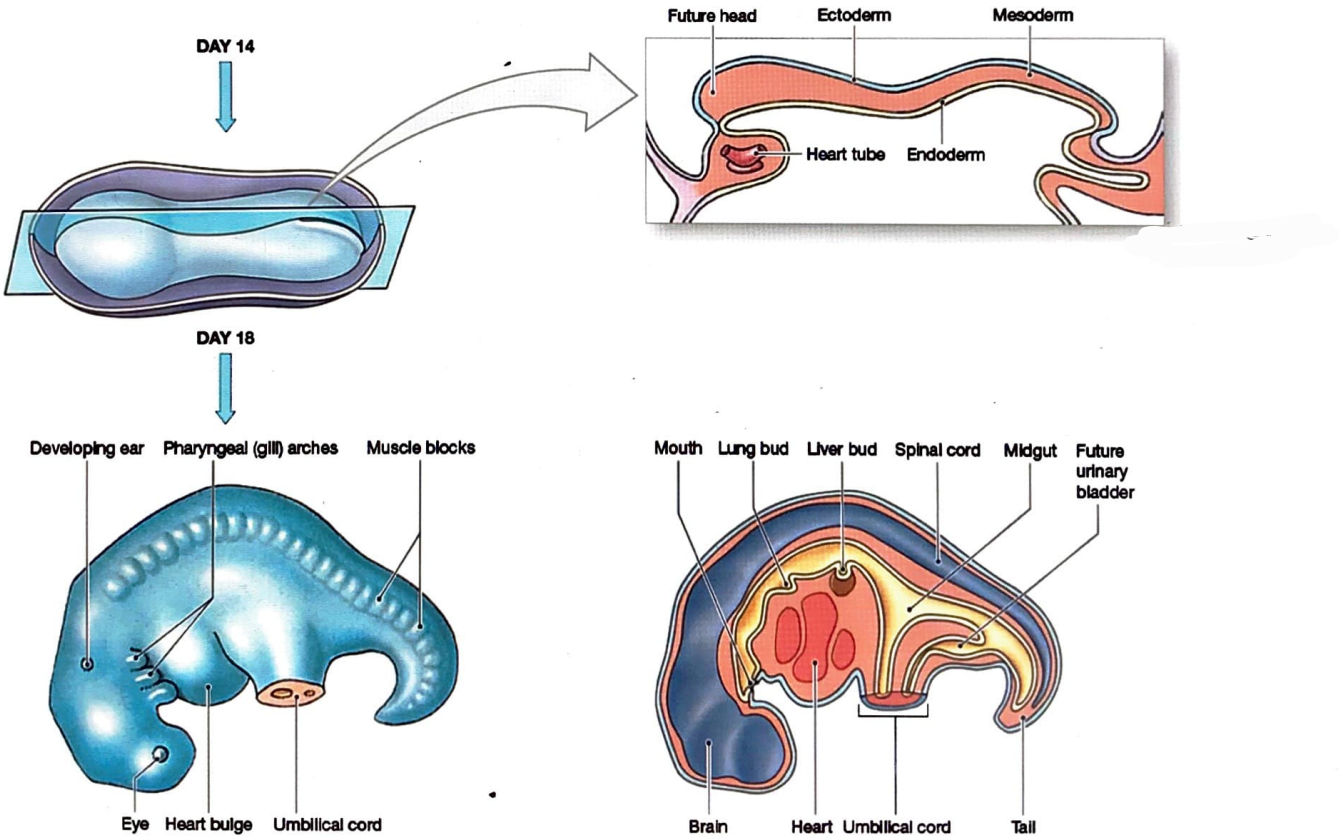


Image 5.2

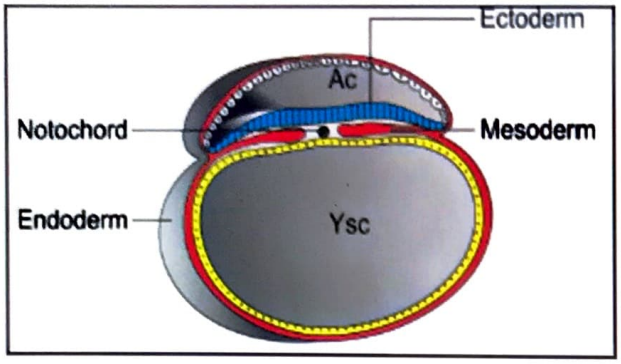


6 GERM LAYER DERIVATIVES

FOLDING OF EMBRYOS

Transverse section of embryo

00:01:50



- LATERAL FOLDING
  - Above amniotic cavity lower is yolk sac
  - (Endoderm)
  - Yolk sac getting incorporated into embryo
  - Forms gut tube
- CAUDOCEPHALIC FOLDING
- Vitelline duct regresses after formation of gut tube by yolk sac
- Surrounding it is coelomic cavity which forms
  - Peritoneal cavity
  - Pleural cavity
  - Peritoneal cavity

Refer Diagram 6.1

Body tubes

00:04:52

Refer Diagram 6.2

- Neural tube – derived from neural plate ectoderm
- Gut tube – derived from endoderm yolk sac
- Cardiovascular tube – derived from mesoderm

Diagram 6.1

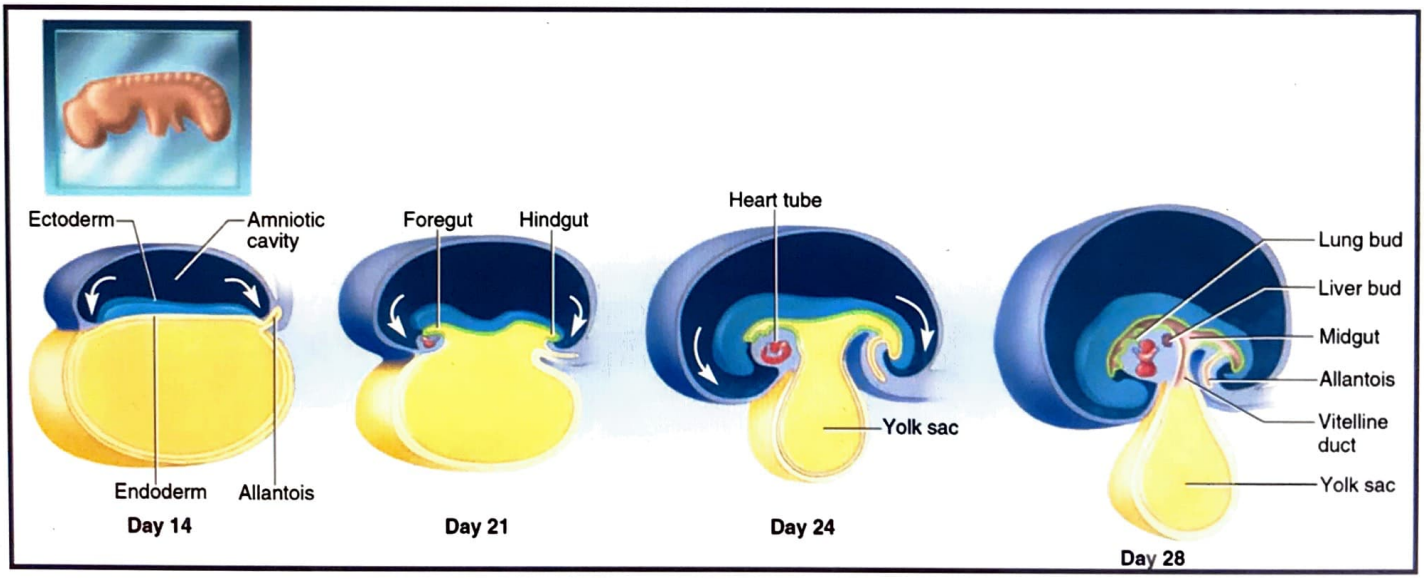
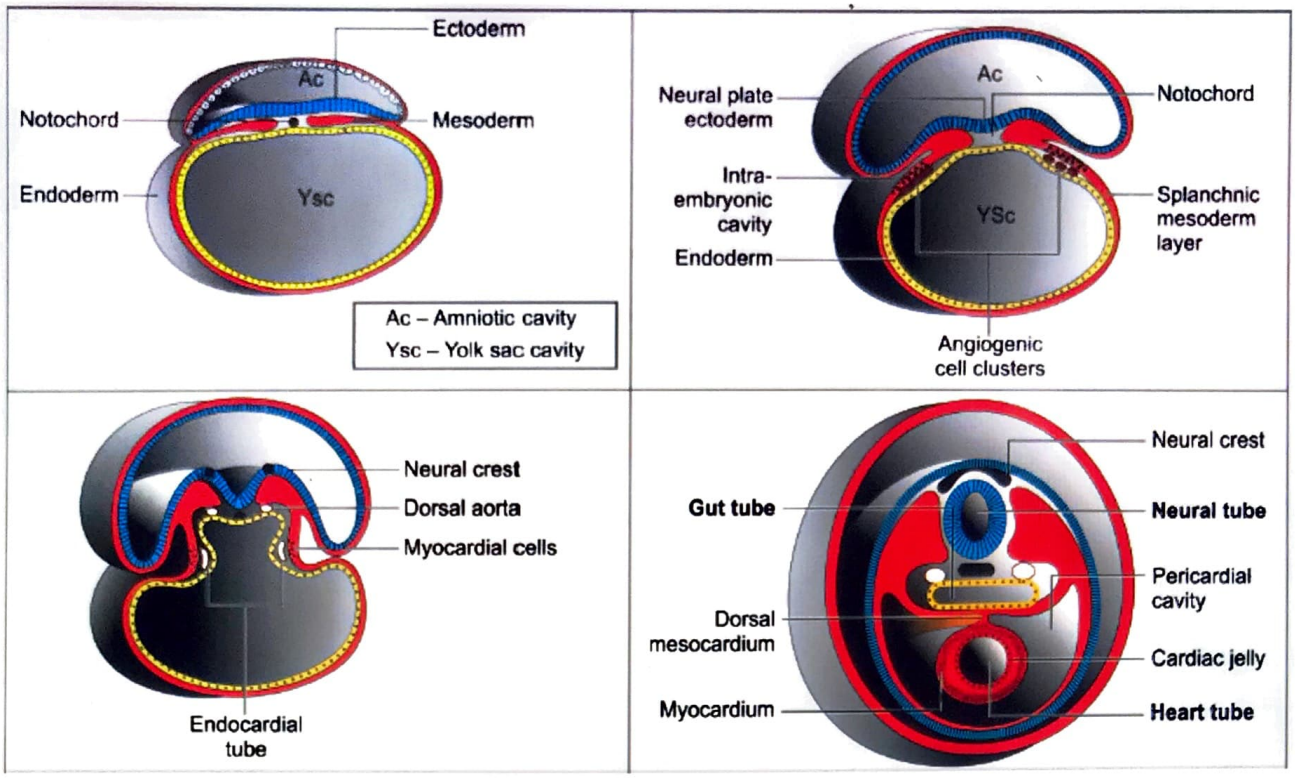
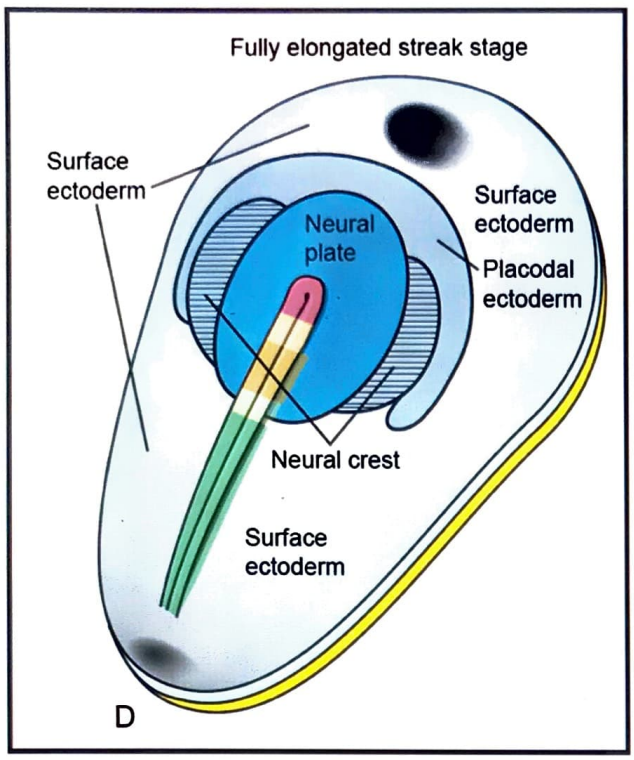


Diagram 6.2


Ectoderm
Ac
Notochord
Mesoderm
Endoderm
Ysc
Ac – Amniotic cavity
Ysc – Yolk sac cavity
Ac
Neural plate ectoderm
Notochord
Intra-embryonic cavity
Splanchnic mesoderm layer
YSc
Endoderm
Angiogenic cell clusters
Neural crest
Dorsal aorta
Myocardial cells
Endocardial tube
Neural crest
Gut tube
Neural tube
Pericardial cavity
Dorsal mesocardium
Cardiac jelly
Myocardium
Heart tube

7 ECTODERM AND NEURAL CREST CELLS DERIVATIVES



Longitudinal section of embryo

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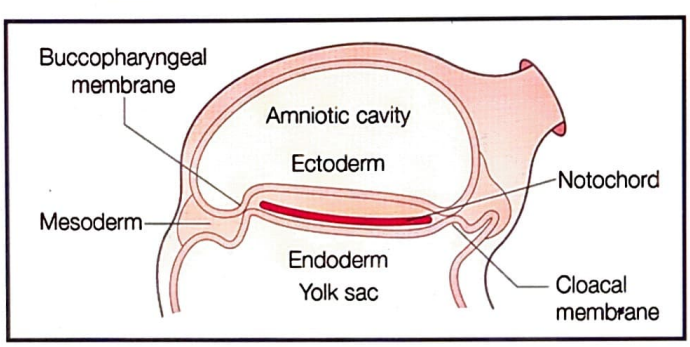
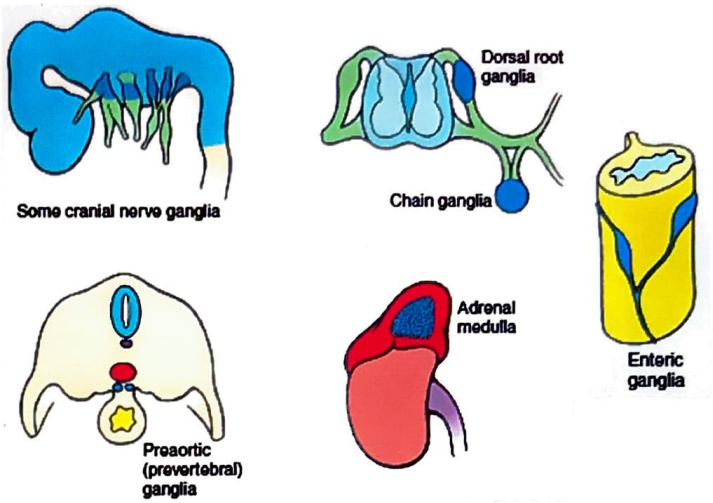


Neural crest cells

00:09:00



- peripheral nervous system [includes ganglia]
- Secondary Mesenchyme/ Mesoderm
  - Most of the skull bones [head & neck ant. & lat. regions] .
  - Most of eye ball mesoderm
  - Pharyngeal arch bones [malleus, incus, stapes, mandible, hyoid bones]
- Aorta pulmonary septum
- Dermis of head & neck
- Odontoblasts

DIGEORGE SYNDROME

00:18:10

- Failure of migration of neural crest cells towards head, neck region
- Presents with
  - Skull defects
  - Eyeball defects
  - Pharyngeal arch Bone defects
  - Aorta pulmonary septum anomaly [MC cause of Death]

SURFACE ECTODERM DERIVATIVES

00:19:13

- **EPITHELIUM & GLANDS**
  - Skin epithelium
  - Sweat glands
  - Sebaceous glands
- **MYOEPITHELIOCYTES [MEC'S] OF SKIN GLANDS**
- **ANY EXTERNAL OPENING**

- Oral opening
- Rathke's pouch [most of pituitary]

NEURAL PLATE ECTODERM DERIVATIVES

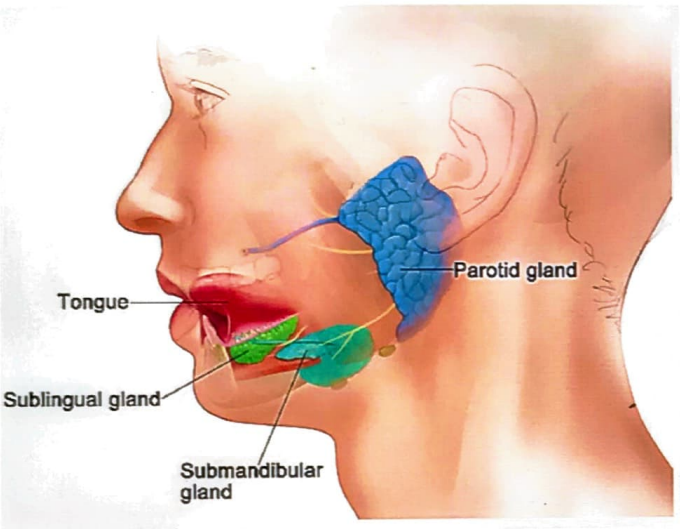
00:21:28

- IRIS MUSCLES
  - Sphincter pupillae
  - Dilator pupillae
- CNS
- NEUROHYPOPHYSIS
  - down word extension of diencephalon

SALIVARY GLANDS

00:24:13

- Parotid glands
- Sub mandibular gland
- Sublingual gland



- Any external opening lined by surface ectoderm
- Stomodeum = Oral opening Proctodeum= Anal opening
- Rathke's pouch derived from roof of stomodeum and forms pituitary glands except neurohypophysis

Previous Year's Questions

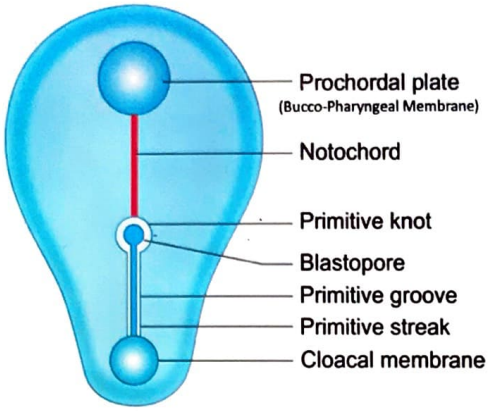
Q. All are derivatives of ectoderm except

Epidermis
parotid gland
Neuro Hypophysis
Arrector pilorum

8 MESODERM DERIVATIVES

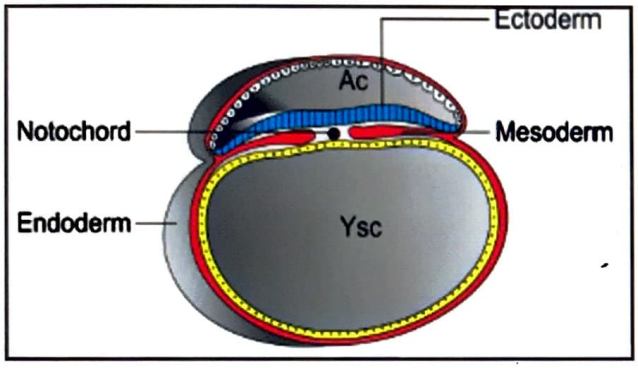
Dorsal view of embryo

00:00:15



Transverse section

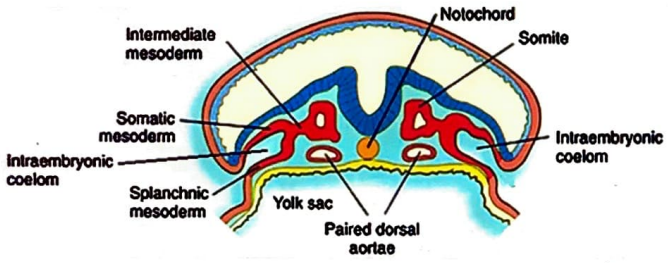
00:02:33



COMPONENTS OF MESODERM

00:00:50

- NOTOCHORD / AXIAL MESODERM
- SOMITE [PARA AXIAL MESODERM derivatives]
- INTERMEDIATE MESODERM → Genito urinary system
- LATERAL PLATE MESODERM→ Pleural urinary system
- INTRA EMBRYONIC COELOM→ Pleural, peritoneal, peri
- cordial cavities



NUCLEUS PULPOSUS

- Vestigial remnant of notochord
- Found in intervertebral DISC

Lateral plate mesoderm

00:05:00

- Somatic Mesoderm [dorsal]
  - Parietal Layers of
    - → Pleura
    - → Peritoneum
    - → Pericardium
- Exceptions are
- MEC [SE]
- Iris muscles [NPE]
- Genitor urinary system
- Detrusor [IMM]
- Ventral Visceral Mesoderm
  - Visceral layers of
    - → Pleura
    - → Peritoneum
    - → Pericardium
- Visceral Muscles
- Cardiac muscles
- CV tube
- Smooth muscles
- Gut tube
- Resp. tube
- Axial mesoderm which is notochord form the nucleus pulposus in the intervertebral disc later.
- Paraxial mesoderm will form the somite
- Intermediate mesoderm will form the kidney, testes and ovary i.e major portion of the genitourinary system.
- The lateral plate mesoderm has two components Dorsal Somatic lateral plate mesoderm and Ventral visceral lateral plate mesoderm.
- Dorsal somatic lateral plate mesoderm will form the parietal layers of peritoneum, pleura, pericardium.Whereas the ventral visceral plate mesoderm/ splanchnic lateral plate mesoderm form visceral layers of peritoneum,pleura and pericardium.

SOMITE DERIVATIVES COMPONENTS

00:10:50

- Dermatome [lateral part] → Skin Dermis
- Myotome [middle part] → Skeletal Muscles
- Sclerotome [medial part] → Bone [vertebra]
  - Sclerotome on each side forms half of vertebrae, which fuse to formfull vertebrae. Myotome forms muscle (skeletal muscle mostly),Dermatome forms dermis (skin).

- Notochord/ Axialmesodermstimulatetheectodermt of ormthener vous system,Neural tube later forms the spinal cord.
- Spinal cord is protected by vertebrae. Vertebrae is formed by the somite which are divided into certain components, one of them is sclerotome .
- Sclerotome Is Of Two Types[Dorsal&VentralSclerotome].
- Dorsal sclerotome fuse to form spinal canal of vertebrae whereas body comes from ventral sclerotome .
- Rachischisis: when the neural tube is open & CSF comes out.
- Whenever the vertebrae is opening spine bifid, that is the problem of the dorsal sclerotome not fusing and forming a spina bifida along with Rachischisis.

SKELETON development

00:17:55

1. AXIAL SKELETON → SKULL & Vertebra
2. APPENDICULAR SKELETON → Upper limb & lower limb

- Most of the skull bone comes from NCC but occipital bone or the vertebrae bone comes from somite [Sclerotome portion] or paraxial mesoderm.
- Upper and lower limb bones come from Dorsal Somaticla teralplatemesoderm.

- Dorsal somatic lateral plate mesoderm form appendicular skeleton like humerus bone & femur bone [Skull bone from NCC mostly & vertebrae from paraxial mesoderm

Previous Year's Questions

Q. All of the following muscles are derivatives of para- axial mesoderm except
Masseter
Diaphragm
Biceps femoris
Detrusor

Previous Year's Questions

Q. Muscles derived from visceral splanchnic lateral plate mesoderm is
Myo Epitheliolytic of skin glands
Iris muscles
Smooth muscles of gut tube
Detrusor

9 ENDODERM DERIVATIVES

Previous Year's Questions

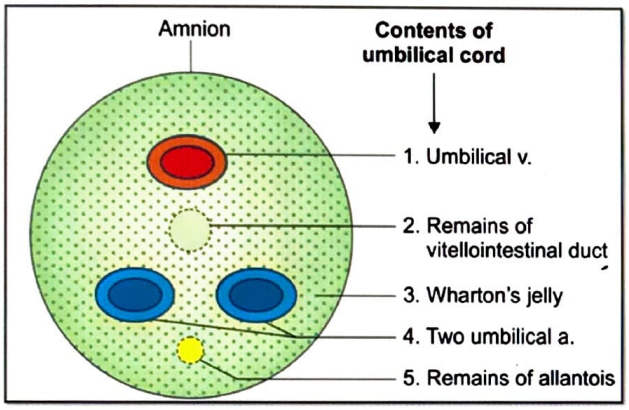
Q. Vaginal epithelium is derived
A. Endoderm of genital ridge
B. Endoderm of urogenital sinus
C. Mesoderm of genital ridge
D. Mesoderm of urogenital sinus

GUT TUBE DERIVATIVES

00:00:50

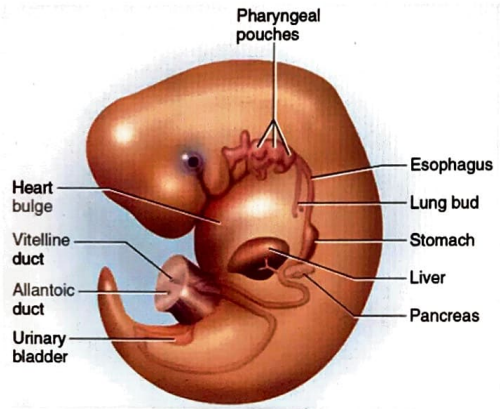
- FOREGUT → Respiratory tube
- MID GUT → Vitelline duct
- HIND GUT →Allantoic duct

Section of umbilical cord



COMPONENTS OF UMBILICAL CORD

- Vitelline Duct
- Allantoic duct
- Hindgut Diverticulum: Allantois Enter the umbilical cord.
  Midgut Diverticulum:Vitellointestinal duct enter the umbilical cord



Lung bud forming lungs

00:06:52

Refer Image 9.1

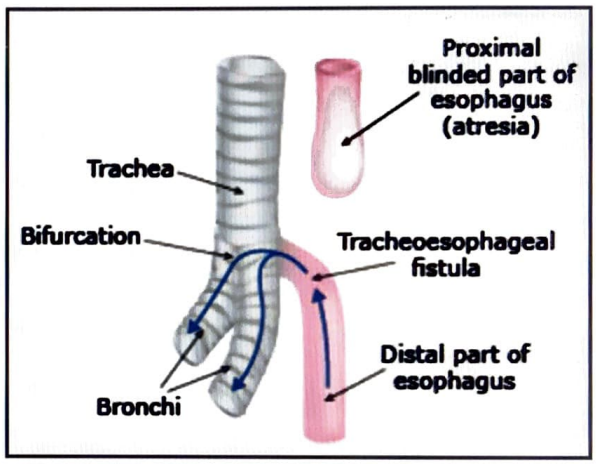
- Trachea
  Bronchus

Lungs

- Epithelium derived from - foregut endoderm
- Smooth muscles derived from - ventral visceral lateral plate mesoderm

TRACHEOESOPHAGEAL FISTULA

- Due to deficiency in tracheoesophageal septum
- Leads to gastric acid aspiration



- Urogenital sinus
  - Endoderm of Urogenital sinus forms epithelium of
  - Urinary bladder
  - Urethra
  - Lower vagina
- Smooth muscles of Genitourinary system derived from Intermediate Mesoderm

Pharyngeal pouches

00:08:35

Developing in lateral wall of pharynx

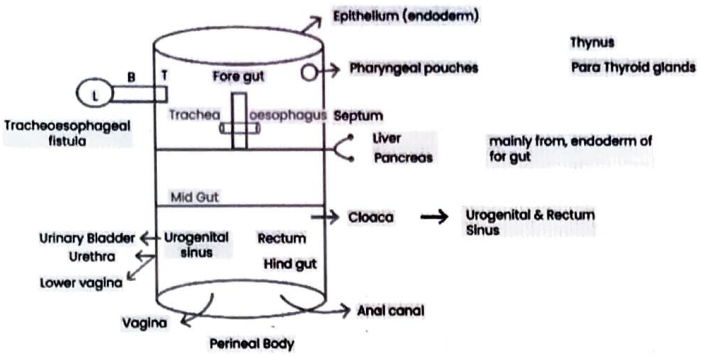
- Forms Parathyroid gland Thymus
- Thymus is derived from→Endoderm of pharyngeal pouches
- Connective tissue of Thymus derived from→Neural crest

cells [sec. mesoderm]

GUT TUBE

00:04:49

- Derived from Endoderm of yolk sac forming epithelium
- Ventral visceral LPM forms muscles



- Liver & pancreas developing at for gut & midgut junction [mainly contributed by endoderm of foregut]
- Perineal Body in Adults separates into
  - Vagina - Anteriorly
  - Anal canal - Posteriorly
- Buccopharyngeal membrane ruptures to form oral opening
- Cloacal membrane: ruptures to form anal opening
- Both membranes do not mesoderm due to fusion of ectoderm & endoderm

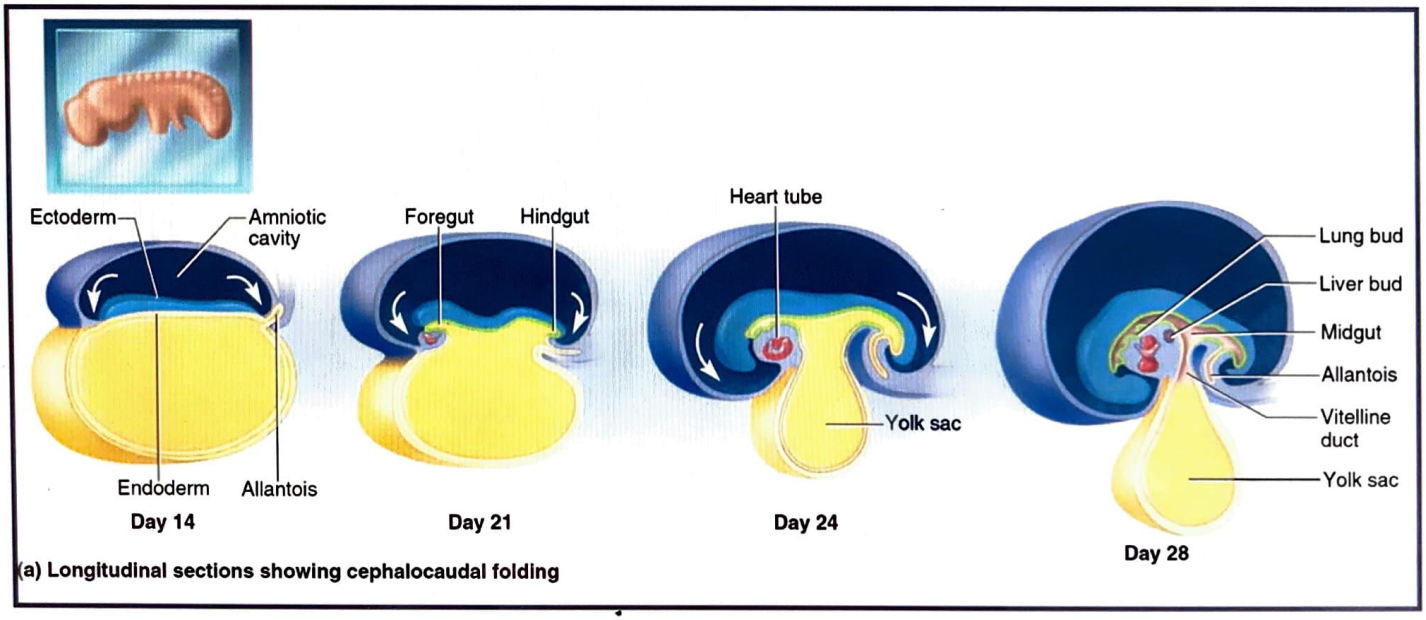
Previous Year's Questions

Q. The wrong statement regarding germ layer derivatives is?
A. Cromaffin cells are derived from neural crest cells
B. Odotoblasts develop from endoderm
C. Pancreas is derived from fore gut
D. Allantoic diverticulum is endodermal

Previous Year's Questions

Q. False statement about development is
Skin has ectoderm mesoderm and NCCs derivatives
A. Ribs develop from lateral plate mesenchyme
B. Positioning of ribs along the craniocaudal axis in the wall is regulated by HOX genes
C. Remnants of notochord is nucleus pulposes

Diagram 9.1



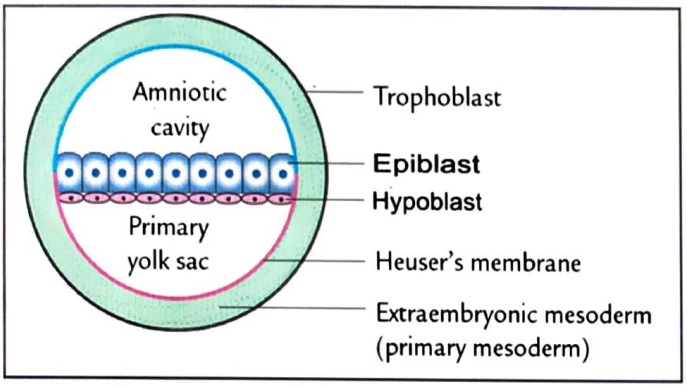
(a) Longitudinal sections showing cephalocaudal folding

10 PLACENTA FORMATION

Previous Year's Questions

Q. FALSE STATEMENT regarding placenta & membranes?

A. Tertiary villi seen on day 10
B. Fetal circulation established at Day 17-21
C. Placenta develops from decidua basalis
D. Placenta develops from chorion frondosum



- EMBRYOBLAST CONSISTS OF
  - HYPOBLAST → dorsal, degenerate & contributes to extra embryonic structures
  - EPIBLAST → ventral columnar cells
  - DORSAL AMNIOTIC CAVITY
  - VENTRAL YOLK SAC CAVITY

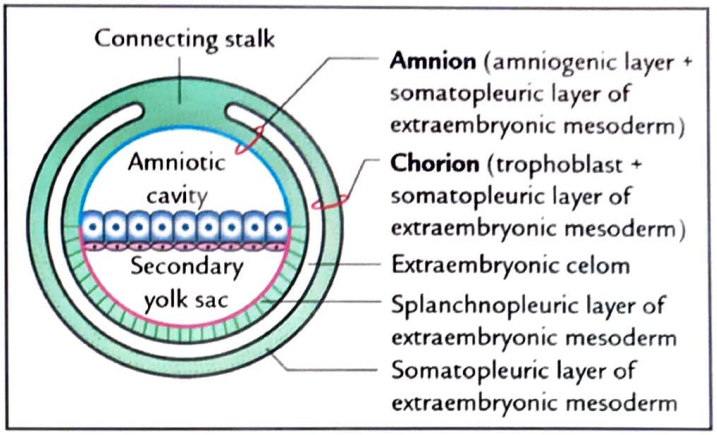
Previous Year's Questions

Q. Origin of extra embryonic mesoderm?

Ans. Cells lining the primary yolk sac> hypoblast / trophoblast /epiblast

EXTRA EMBRYONIC MESODERM 00:01:11

- EXTRA EMBRYONIC MESODERM [EEM] splits to form EXTRA EMBRYONIC coelomic CAVITY which is connected by CONNECTING STALK [connecting stalk forms PRIMARY UMBILICAL CORD]



Amnion
- Covers amniotic cavity
- Contributed by
- Amniogenic cells [from trophoblast]
- Somatopleuric layer of EEM

Chorion
- CONTRIBUTED BY
- Cytotrophoblast
  - Syncytiotrophoblast
  - somatopleuric layer of EEM

- Trophoblast divides to form
  - cytotrophoblast
  - syncytiotrophoblast

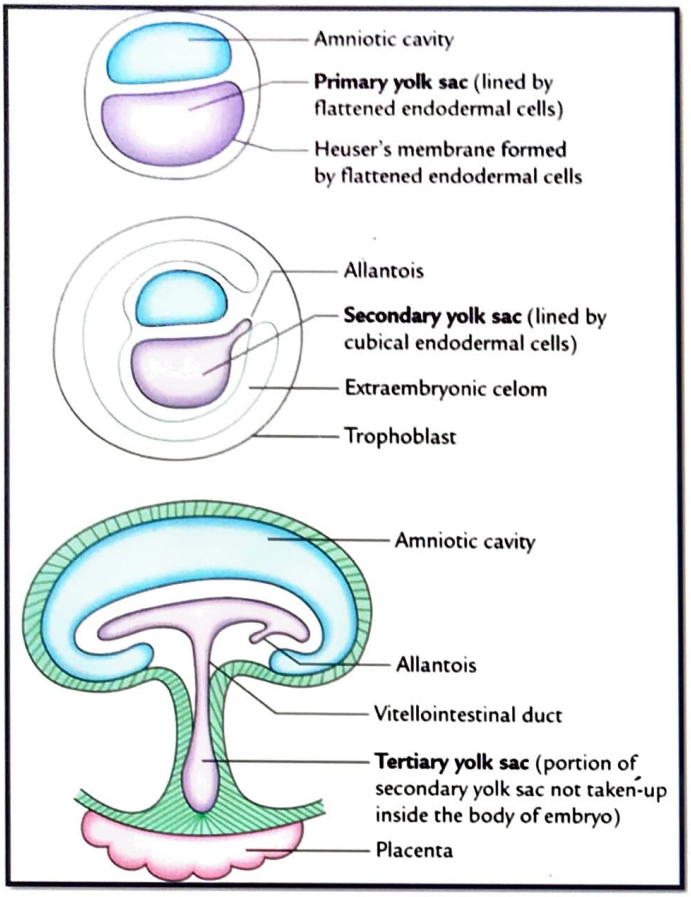
} form placental membrane

Extra Embryonic Coelomic Cavity
- It divides the extra embryonic mesoderm into two parts.
- One towards the yolk sac is called as visceral or splanchnopleuric extra – embryonic mesoderm and beyond that lines the amnioticcavity and outside is called the parietal or somatopleuric extraembryonic mesoderm (towards body wall)
- Between somatopleuric extraembryonic and visceral/ splanchnic mesoderm is the extra embryonic coelomic cavity.

- Chorion formed by trophoblast with somatopleuric layer of extraembryonic mesoderm.
- Amnion formed by amniogenic cells lining amniotic cavity andsomatopleuric layer of extraembryonic mesoderm.
- Connecting stalk later becomes umbilical cord components.

YOLK SAC

00:20:22

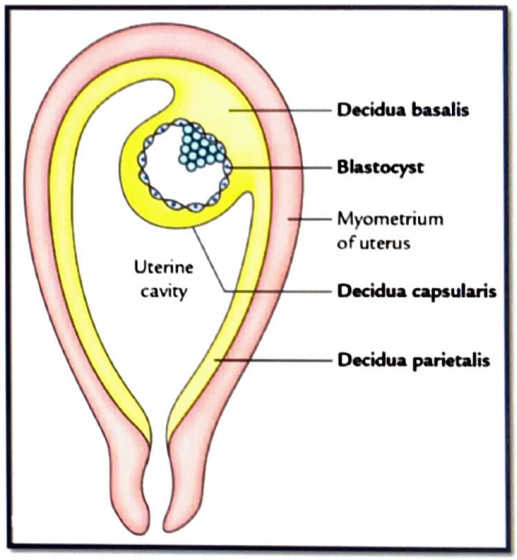


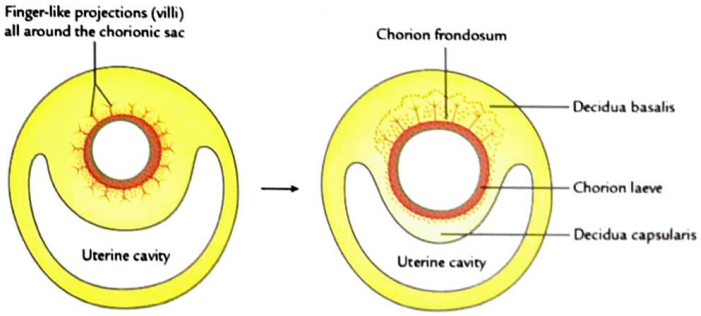
- 1° YOLK SAC → lined by flattened Endodermal cells
- 2° YOLK SAC → lined by cuboidal Endodermal cells
- 3° YOLK SAC → formed during cephalo caudal development of Embryo →forms gut tube → Part of the yolk sac remaining outside the Embryo - 3 YOLK SAC
- In the beginning, we have primary yolk sac. Later it will become secondary yolk sac and then tertiary yolk sac. Tertiary yolk saccommunicates with midgut as vitello – intestinal duct.
- Extra – Embryonic coelomic cavity forming around the baby, there is cephalo- caudal folding of baby. Head comes towards the tail and in this process amniotic cavity surrounds the body of the baby all around.
- Allantois [Hindgut diverticulum] and the Vitello intestinal duct [midgut diverticulum] will enter umbilical cord to become its contents.
- PLACENTAL COMPONENTS
  - Placenta formed by fetal & maternal contributions
    - Placenta formation: Decidua basalis from the maternal side and from the fetal side is chorion frondosum. Chorion layer develops some villi called chorionic villi and they will penetrate into decidua basalis of the maternal side.
    - Maternal placenta is decidua basalis [endometrium of uterus] and chorionic villi from fetal placenta component.

UTERUS

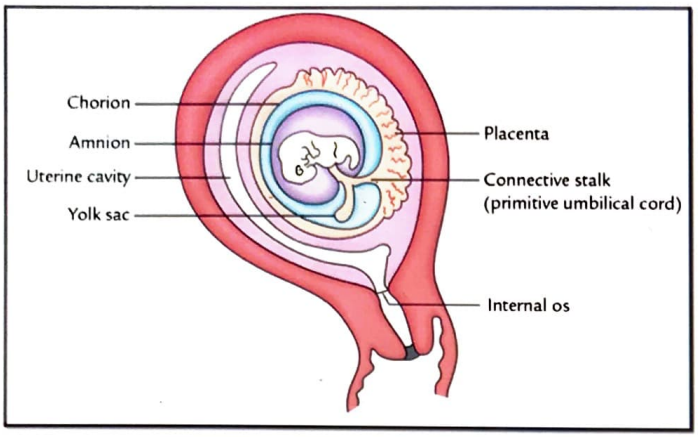
00:26:43

- MATERNAL PLACENTA
- DECIDUA BASALIS [DB] → The endometrium where the embryo implants
  →forms the maternal /uterine placenta
- DECIDUA CAPSULARIS → Surrounds the embryo on luminal side
  DONOT FORM PLACENTA
- DECIDUA PARIETALIS →The rest of the gravid endometrium





- FETAL PLACENTA
  - Derived from chorion
  - CHORION FRONDOSUM - chorion towards DB forms layer like projections into it
  - CHORION LAEVE - chorion on the side of D. capsularis, DO NOT FORM PLACENTA
  - Uterine cavity = Space b/w decidua basalis & Parietalis
- Chorionic cavity = Chorion & Amnion



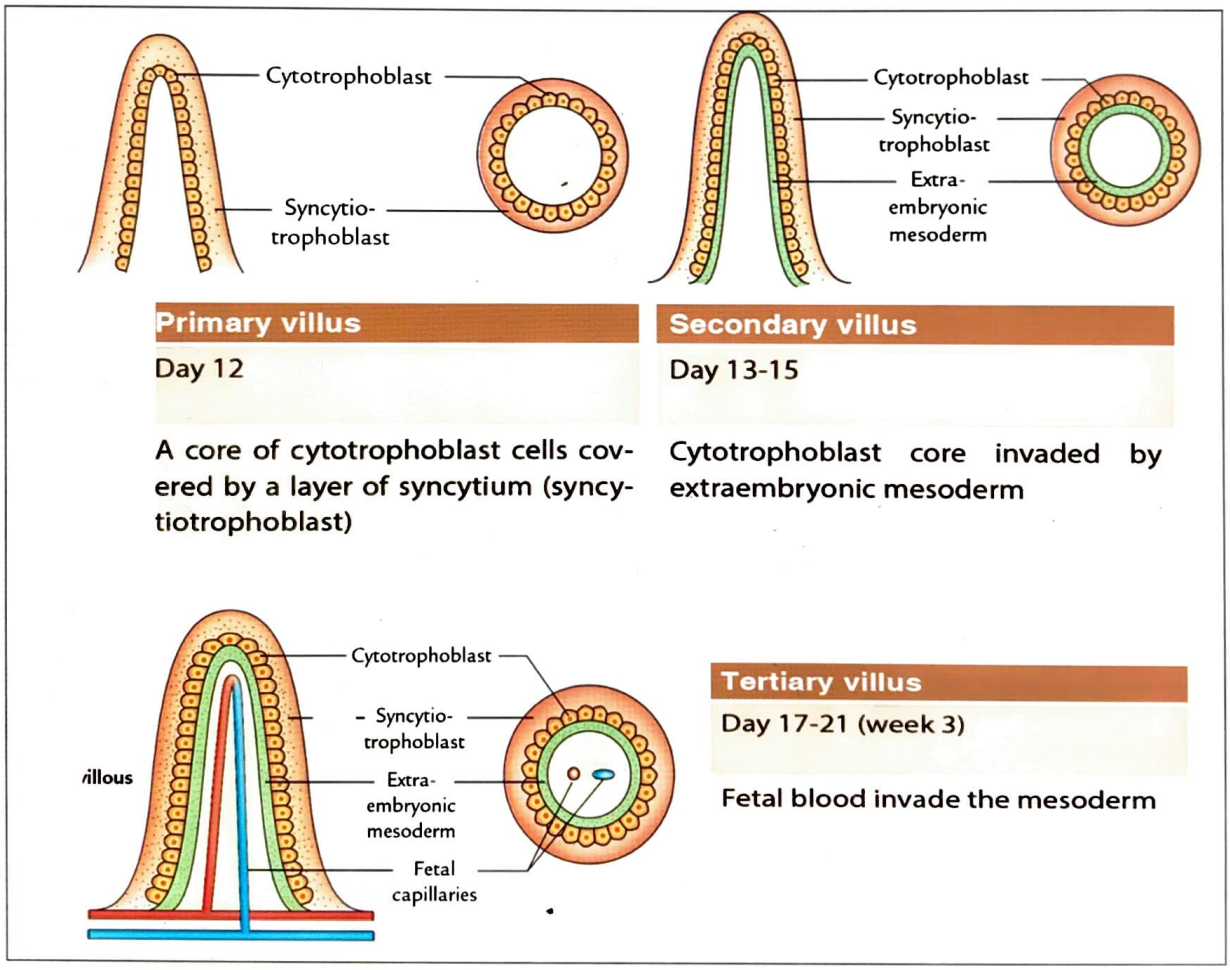
CHORIONIC VILLI

00:30:02

Refer Image 10.1

PRIMARY VILLUS [Day 12]	Core of cytotrophoblast cells, covered by syncytio TB
SECONDARY VILLUS [Day 13-15]	Cytotrophoblast layer invaded by extra Embryonic mesoderm
TERTIARY VILLUS [Day 17-21]	Fetal blood vessels invades the mesoderm

Image 10.1



CLINICAL QUESTIONS

Q. During the anatomy lecture on gametogenesis, your professor mentions that during spermatogenesis, there is a reduction in the chromosomal number to half the original number. In which of the following phases does it occur?

A. During mitosis
B. Meiosis– I
C. Meiosis- II
D. None of above

Answer: B

Solution

- Meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information.
- The **first meiotic division** is known as the **reduction division,**and each primary spermatocyte yields two secondary spermatoctyes.
- Each contains **23 (Haploid)** chromosomes consist of two varieties **22+X** and **22+Y.**
- Here **22 are autosomes** and **X & Y are sex chromosomes.**

Germ Layer derivatives

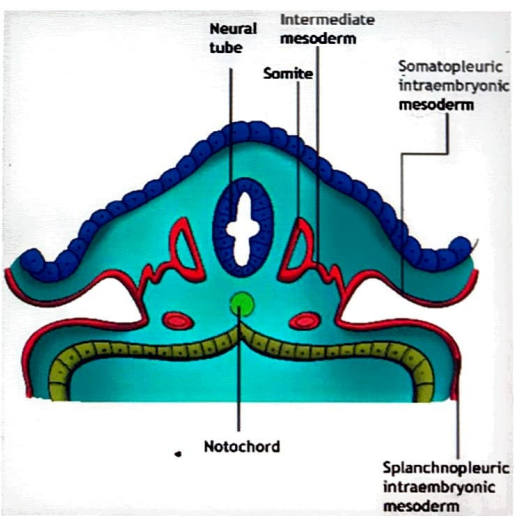
Q. Given that the urogenital sinus is derived from the endoderm, which of the following parts of the urogenital system is derived from the intermediate mesoderm?

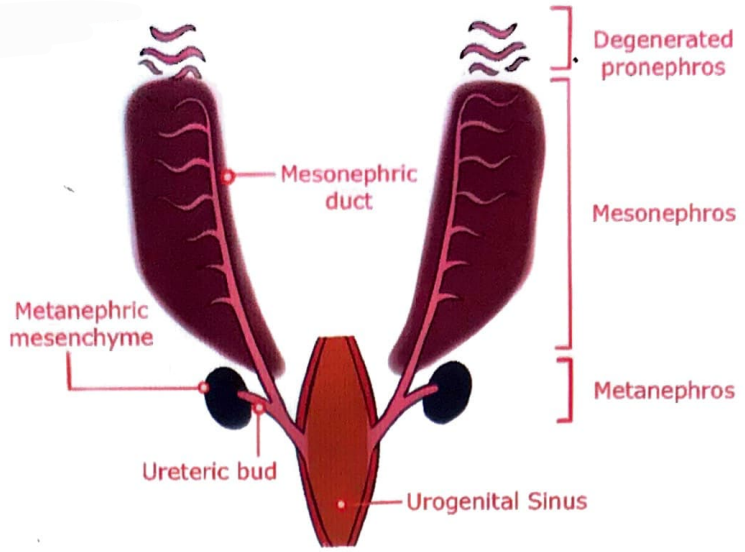
A. Urethra
B. Kidneys
C. Gonads
D. Somites
E. Peritoneal cavity

Answer: B, C

Solution

- **The intermediate mesoderm** is a subdivision of the **intraembryonic mesoderm** that forms a longitudinal dorsal ridge called the **urogenital ridge** from which the kidneys and gonads develop.
- Somites develop from paraxial mesoderm
- Urethra develop from the endoderm of urogenital sinus





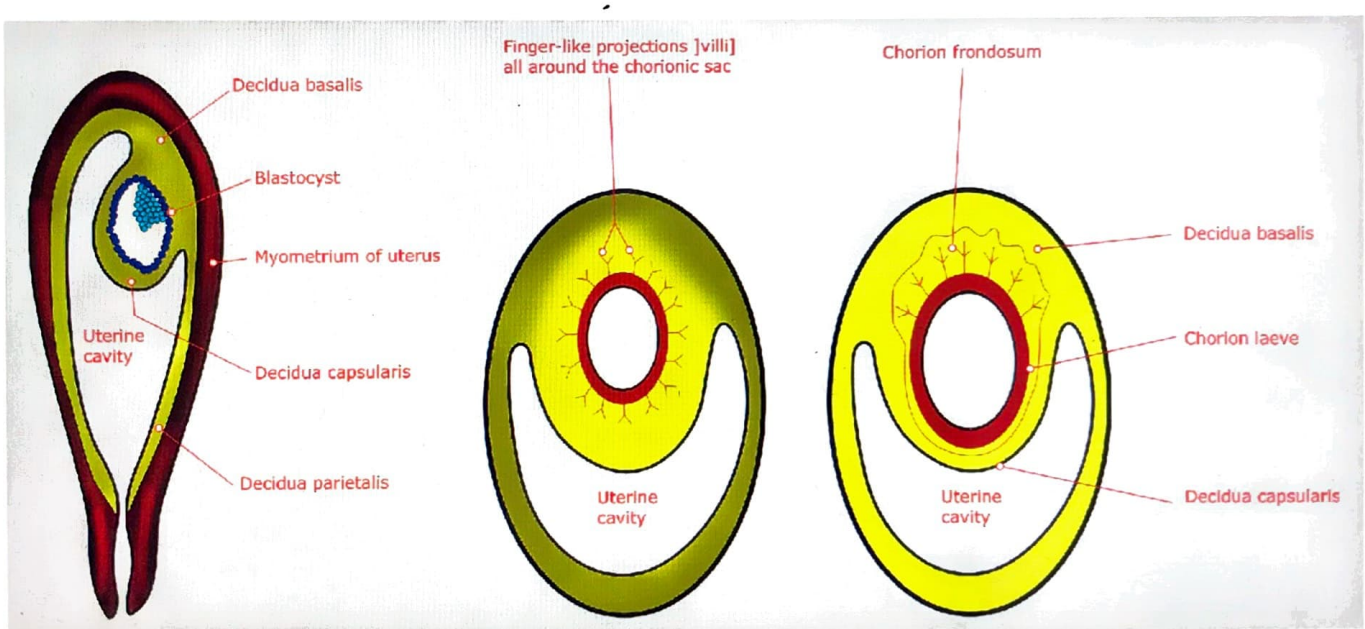
Reference: Langman's Embryology 14th edition

Placental development

Q. Placenta is a temporary organ formed during pregnancy and is essential for the foetus to receive required oxygen and also to remove waste products from foetal circulation. Placenta develops from-

A. Decidua capsularis and Chorion frondosum
B. Decidua capsularis and Decidua basalis
C. Decidua basalis and Chorion frondosum
D. Decidua parietalis and Chorion frondosum

Answer: C
Solution



Development of placenta:

- Placenta has two components : **Maternal** & **Fetal** .
- When the blastocyst attaches to uterus in endometrium, the endometrium is called as **decidua** which is of three types:

- **Decidua basalis , Decidua capsularis & Decidua parietalis.**

- Fetus will also have some **chorionic membrane** developing leading to **villi** formation : **Chorion Frondosum & Chorion laeve.**
- Chorion laeve will **disappear.**
- Chorionic Frondosum persists & contributes to placenta along with Decidua Basalis .

Reference: Gray's page no. 172.

LEARNING OBJECTIVES

UNIT 2 HISTOLOGY

BODY TUBES
- Gut Tube
- Body Tubes-Overview
- Stomach
- Small Intestine
- Respiratory Tube
- Renal Tube
- Skin

EPITHELIAL TISSUES
- Types
- Stratified Epithelium
- Transitional Epithelium (Urothelium)
- Stratified Squamous Epithelium & 7 Openings
- Openings In Perineum
- Squamocolumnar Junctions

GLANDS
- Salivary glands
- Classification of Glands

CONNECTIVE TISSUE
- Types Of Connective Tissues
- Loose areolar connective tissue
- Reticular connective tissue
- Dense regular connective tissue

CARTILAGE TISSUE
- Types Of Cartilage
- Hyaline Cartilage
- Elastic Cartilage
- Fibrocartilage
- Cartilage Features

LYMPHOID TISSUE
- Primary Lymphoid Organs
- Lymph Node
- Thymus
- Spleen
- MALT (Mucosa Associated Lymphocyte Tissue)

INTEGUMENTARY SYSTEM

- Skin Epithelium
- Layers Of Skin
- Receptors
- Merkel's Cell
- Ruffini Receptors

CELL JUNCTIONS

- Gap Junction
- Connexions
- Cell Adhesion Molecules
- Nikolsky Sign

MUSCULAR TISSUES

- Skeletal Muscles
- Cardiac Muscle
- Smooth Muscle
- Intercalated Disc

RESPIRATORY SYSTEM

- Epiglottis
- Larynx
- Trachea
- Bronchioles
- Alveolus

DIGESTIVE SYSTEM

- Oesophagus
- Stomach
- Small Intestine
- Duodenum Glands
- Large Intestine Cells
- Liver Architecture

URINARY SYSTEM

- Male Urethra
- Transitional epithelium

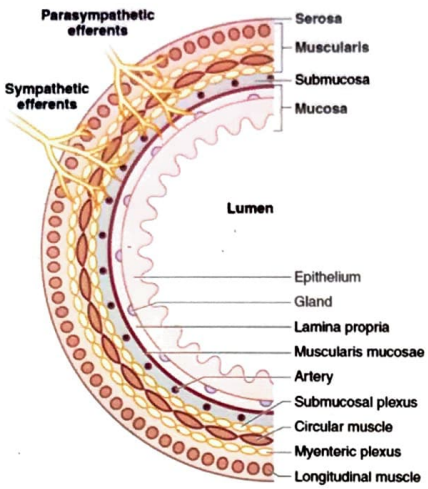
GENITAL SYSTEM

- Testis; Histology
- Blood Testis Barrier
- Sperm – Structure
- Female Reproductive System
- Uterine Cervix
- Vagina

11 BODY TUBES

GUT TUBE

00:00:32



Parasympathetic efferents

- Relax sphincters

MEISSNER'S PLEXUS

- Plexus in submucosa

AUERBACH'S PLEXUS (Myenteric Plexus)

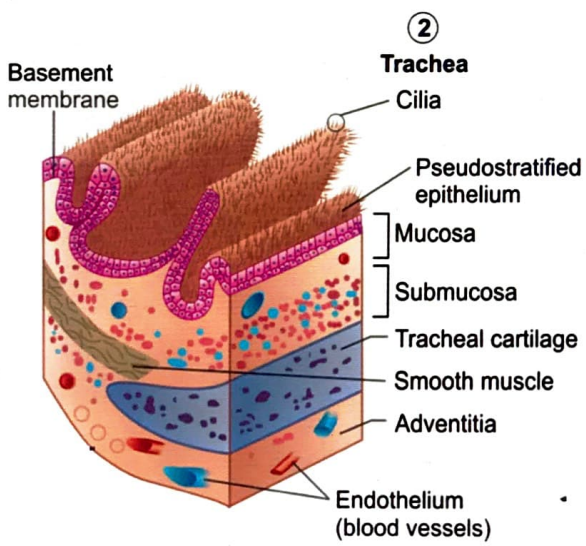
- Plexus in muscle layer
- Present b/w inner circular a outer longitudinal layer

BODY TUBES-OVERVIEW

00:05:08

OESOPHAGUS

- **MUCOSA**
  - Stratified squamous epithelium
  - Lamina propria
  - Muscularis mucosa



- **SUB MUCOSA**
  - Strongest layer
  - Sub mucosal glands present (Exception) Normally glands are present in mucosa

- **MUSCULARIS EXTERNA**
  - Inner circular Muscle layer
  - Myenteric / Auerbach's plexus
  - Outer longitudinal muscle layer

C.T.ADVENTITIA

- No Peritoneum
- Oblique muscle layer (Innermost)

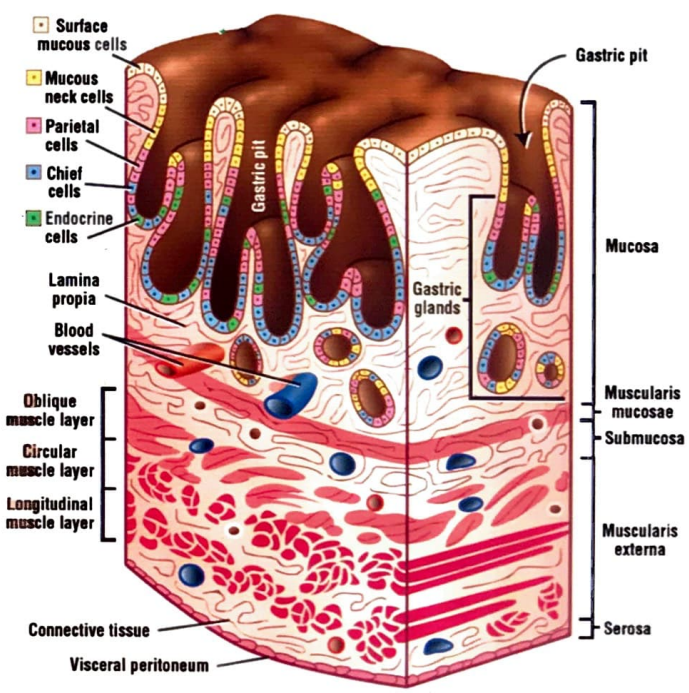
Q.Strongest layer of esophagus small intestine - submucosa

STOMACH

00:06:31

GASTRIC LUMEN

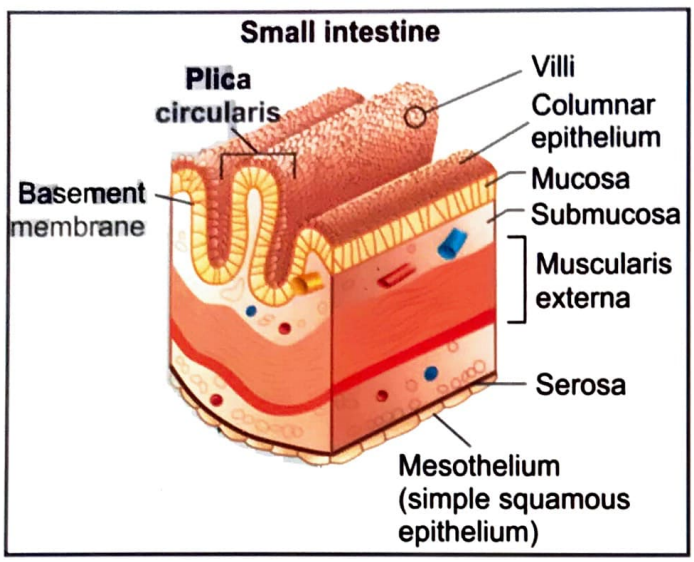
- GASTRIC PIT
  - GASTRIC GLANDS
    - → Surface mucosa cells
    - → Mucous neck cells
    - → Parietal cells from HCL
    - → Chief cells form pepsinogen
    - → Endocrine cells secrete gastrin
    - → Supported by Lamina propria



SMALL INTESTINE

00:07:30

- Columnar epithelium with MICROVILLI (↑Surface area)
- PLICAE CIRCULARES
  - → Max. in Jejunum
  - → Mucosal folds
  - → ↑Surface area for absorption
- SEROSA



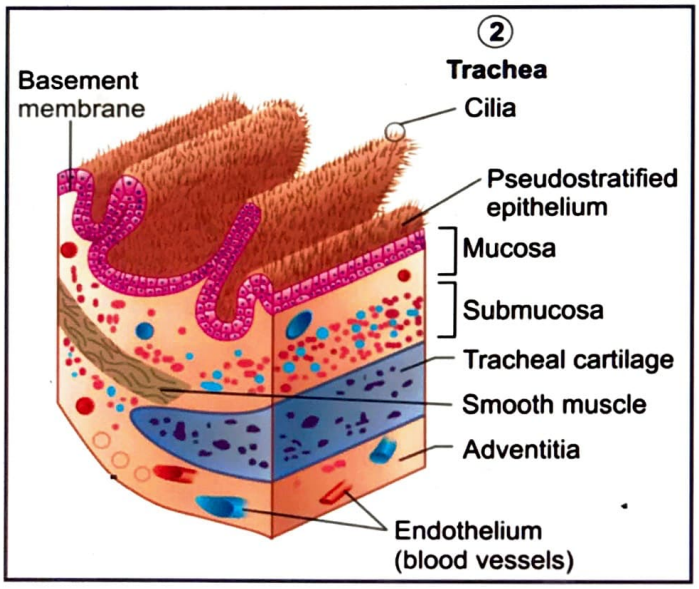
Mesothelium (simple squamous epithelium)

Serosa
Peritoneum
Pleura
Pericardium

RESPIRATORY TUBE

00:09:15

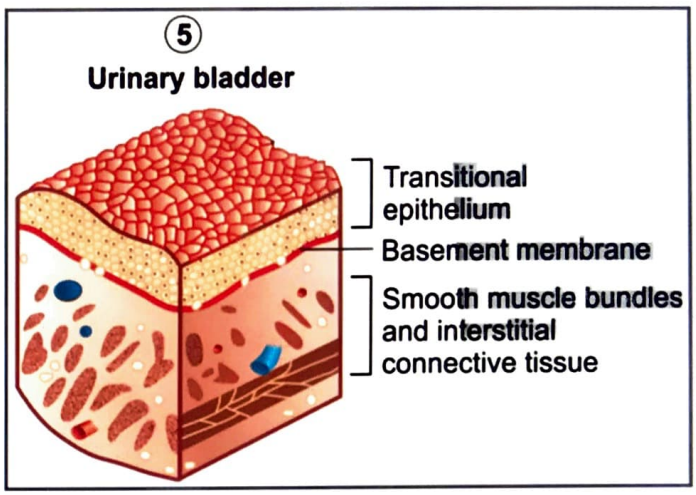
- PSEUDO STRATIFIED CILIATED COLUMNAR EPITHELIUM
- MUCOSA
- SUB MUCOSA
- HYALINE CARTILAGE



- → Rigid and keep the lumen patent
- → Stops at the level of Bronchus
- → Bronchioles do not have hyaline cartilage - more smooth muscles present
- → Cilia + for mucociliary action
- → Patient suffering from immotile cilia syndrome (Kartagener syndrome)
- → No mucociliary clearance
- → Infection in paranasal sinuses (sinusitis)
- → Infection in lung base (bronchiectasis)
- ADVENTITIA

RENAL TUBE

00:11:38

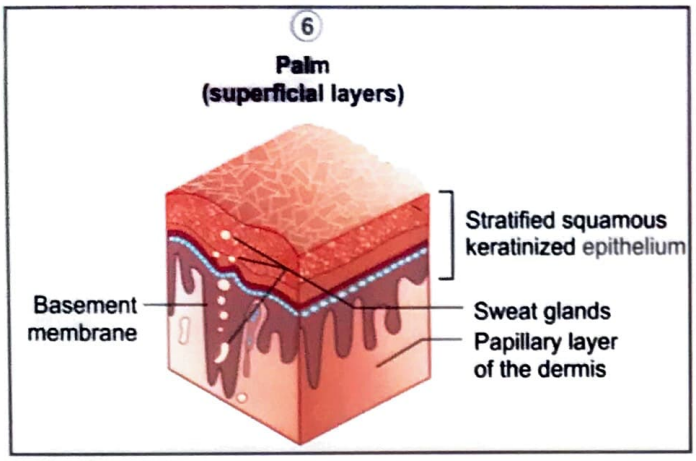


- Transitional Epithelium *or* Smooth muscles
  - Also known as urothelial carcinoma.
  - Most common tumors of the urinary tract system (can occur in renal calyces. renal penis, ureters, and bladder).
  - Can be suggested by painless hematuria (no casts).
  - Associated with problems in your Pee SAC: Phenacetin, smoking, Aniline dyes, and Cyclophosphamide.

SKIN

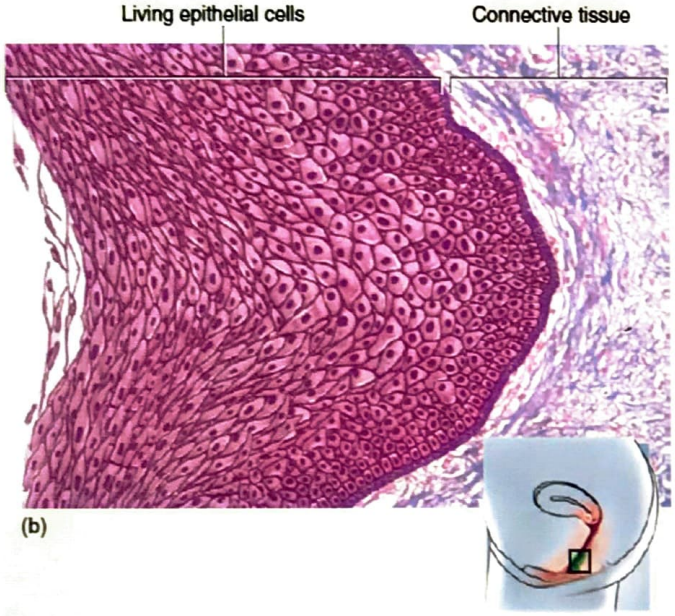
00:12:33

- Stratified squamous keratinized Epithelium (stratified squamous non keratinized Epithelium-Esophagus)
- EPIDERMIS
- DERMIS
  - Papillary layer
    - → Reticular layer
  - SWEAT GLANDS
  - SEBACEOUSGLANDS



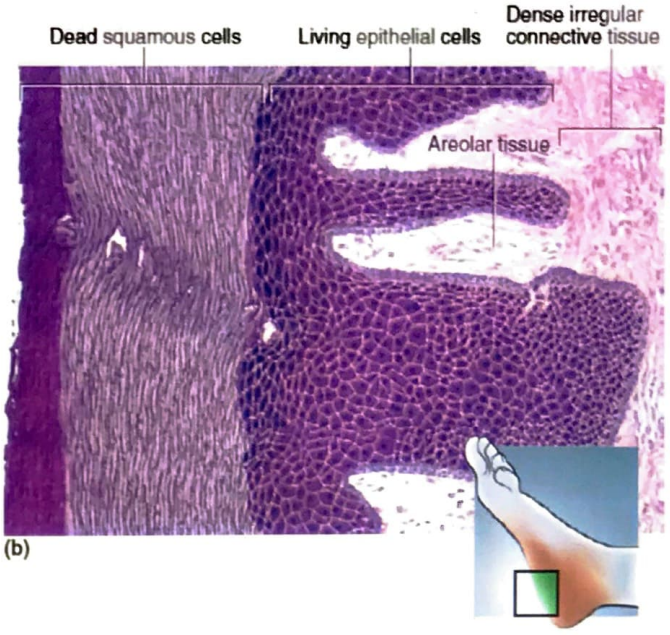
Exception

- Oral cavity
  - Tongue (keratinized anteriorly)
  - Hard palate
  - Ortho + para keratinization
  - Body tubes do not have keratin due to wet mucosa except hard palate (oral cavity)
- Stratified squamous epithelium – Non keratinized



  - Superficial cells have nuclei
  - E.g.
    → VAGINA

- STRATIFIED SQUAMOUS EPITHELIUM – KERATINIZED

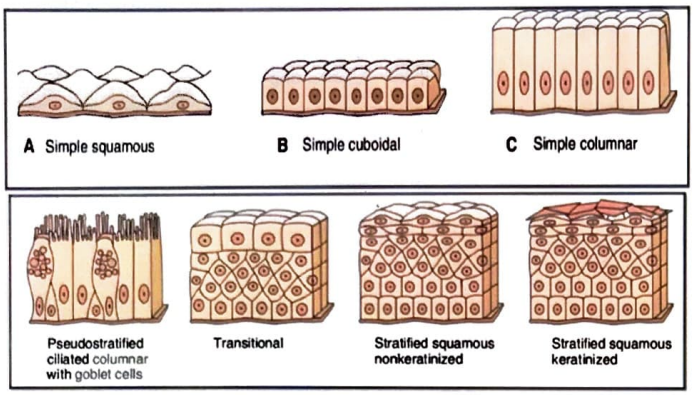


  - Superficial cells do not have nuclei
  - E.g.
    → Skin on sole

12 EPITHELIAL TISSUE

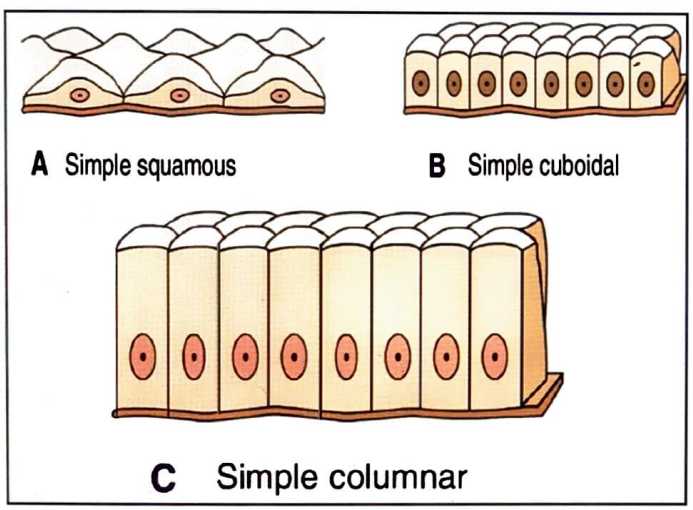
Types

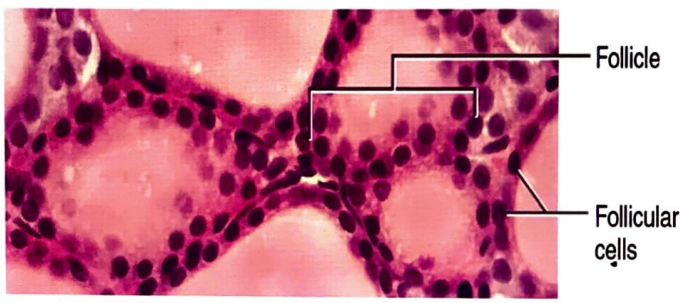
00:00:12



Simple Epithelium

- Simple Squamous: Thin Rim of cytoplasm above flat / Globular nucleus
- Simple Cuboidal: height=Breath; Central Spherical nucleus
- Simple columnar: Height > Breath; Oval Basal nucleus





Previous Year's Questions

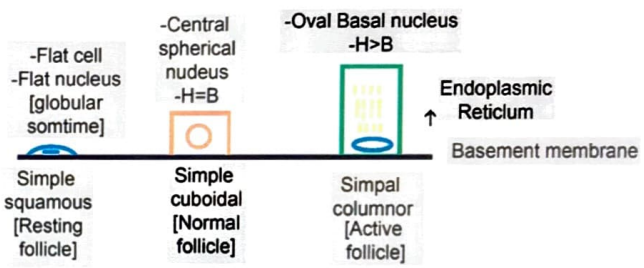
Q. Thyroid follicles are lined by which type of epithelium

a. Simple squamous
b. Simple cuboidal
c. Simple columnar
d. Stratified cuboidal

Important Information

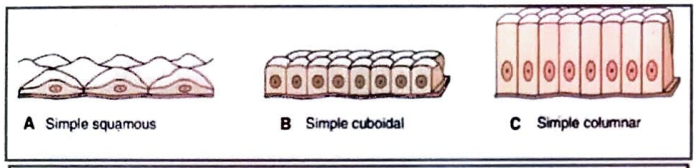
Thyroid follicle lining depends on amount of thyroxine secretion

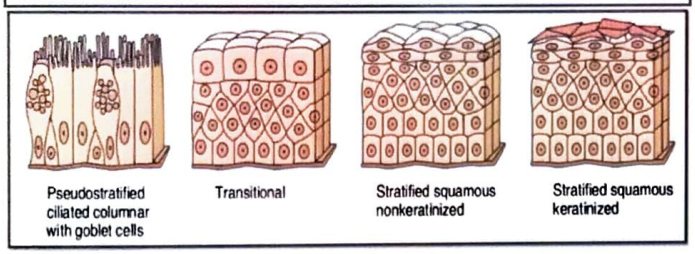
1. Scanty – squamous
2. Medium – cuboidal
3. High - Columnar

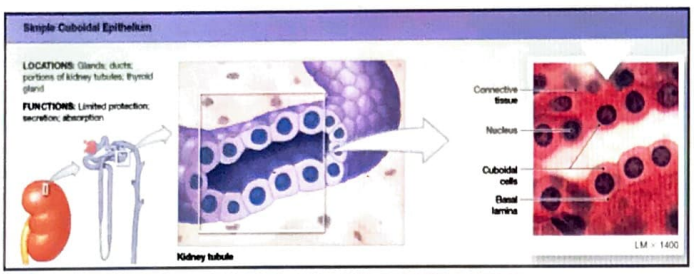


EPITHELIUM-SITES

Simple Squamous Epithelium	Simple Cuboidal Epithelium	Simple Columnar Epithelium
Resting Thyroid Follicle Mesothelium - Peritoneum serosa - Pleura - Pericardium	Thyroid follicle kidney (PCT, DCT)	Active Thyroid Follicle small intestine (Striated border) Stomach





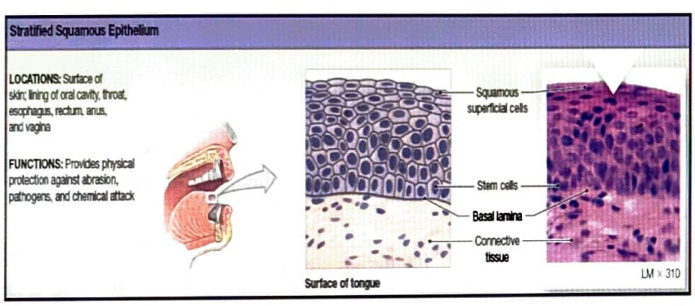


STRATIFIED EPITHELIUM

00:12:45

Stratified Squamous Epithelium

- Present at places where protection needed
- Rule: all the external opening are lined by stratified squamous epithelium



- Superficial layer – squamous (decides the name)
- Middle layer – cuboidal
- Basal cells – Columnar
- Seen in

1. Opening in the body
   - Oral cavity
   - Nasal cavity
   - Eyes, Ears
   - Perineum urethra, vagina, anal canal

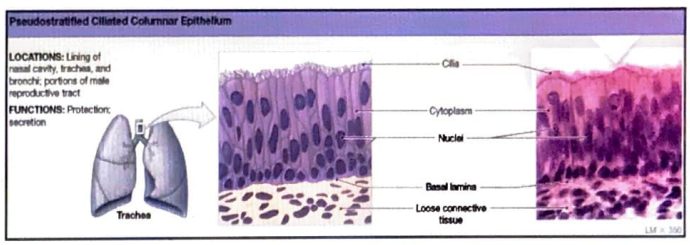
Q. Epithelium lining of Lingual surface Epiglottis is
   a. Simple columnar
   b. Pseudo stratified ciliated columnar
   c. Simple cuboidal

d. Stratified squamous Epithelium

Epiglottis has 2 surfaces

Oral surface lined by-stratified squamous Epithelium laryngeal surface lined by-Pseudostratified ciliated columnar (Respiratory epithelium)

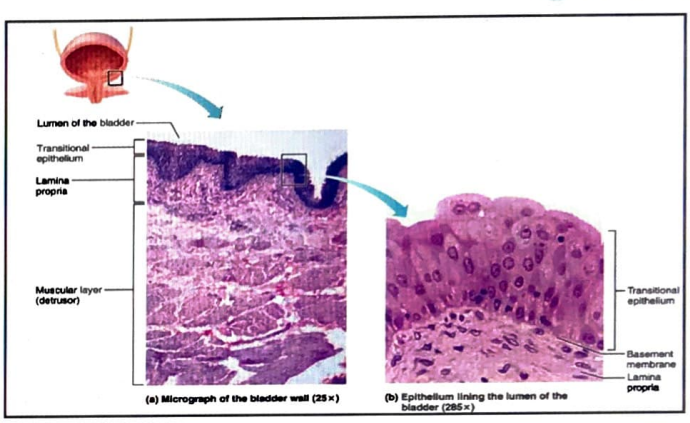
Pseudostratified Ciliated Columnar Epithelium



- Stereocilia – epididymis
- Pseudo stratified-each cell touching the basement membrane
- Seen in respiratory Epithelium

TRANSITIONAL EPITHELIUM (Urothelium)

00:21:45



TRANSITIONAL EPITHELIUM

- Cells towards the lumen are quite larger UMBRELLA CELLS
- Stretchable epithelium
- Each cell attaches to basement membrane

Important Information

TRANSITIONAL EPITHELIUM -Globular towards the surface
STRATIFIED SQUAMOUS EPITHELIUM-Flat Cells towards the surface
PSEUDOSTRATIFIED EPITHELIUM WITH CILIA-Respiratory epithelium

STRATIFIED SQUAMOUS EPITHELIUM RULE

- Any external opening of body is always lined by stratified squamous epithelium

EMBRYOLOGY RULE

- Any external opening of body is always lined by surface ectoderm
- Stratified Squamous Epithelium can also present on mesoderm and endoderm
- Eg. vaginal Epithelium - stratified squamous epithelium
- Upper vagina derived from - mesoderm
- lower vagina derived from - endoderm

Exception:

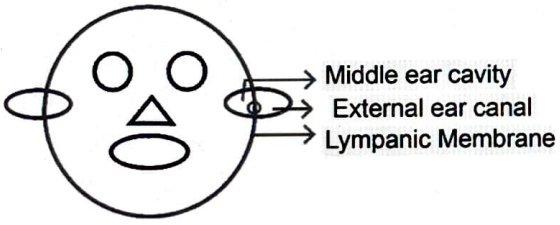
- Stratified Squamous Epithelium can rarely be seen on internal openings Eg. VOCAL CORDS
- Protects from abrasions from cough and sneeze

Larynx lined by pseudostratified columnar/Respiratory Epithelium

STRATIFIED SQUAMOUS EPITHELIUM: 7 openings

00:17:25

1. Eyes Ears
2. Ears
3. Nose
4. Oral rarity
5. Urethra
6. Vagina
7. Anal canal



OPENINGS IN FACE

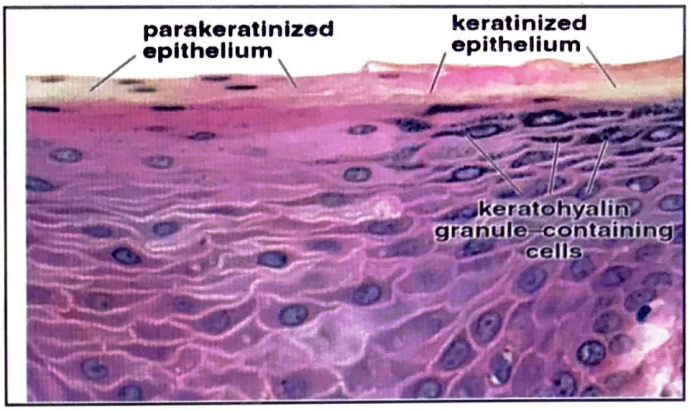
1. EYES-1st layer CORNEA -Stratified squamous
2. EARS-EXTERNAL EAR CANAL outer surface of TYMPANIC MEMBRANE
3. NOSE-VESTIBULE (skin with hair) inner surface of' tympanic membrane- Simple cuboidal epithelium
4. ORAL CAVITY

- TONGUE HARD PALATE (outer) – Ortho and para keratinized st. sq. Epithelium
- TONSIL, EPIGLOTTIS (oral surface) Non keratinized st. sq. Epithelium

KERATINIZATION & PARA KERATINIZATION

00:24:05

- Skin
- Superficial layers have no nuclei



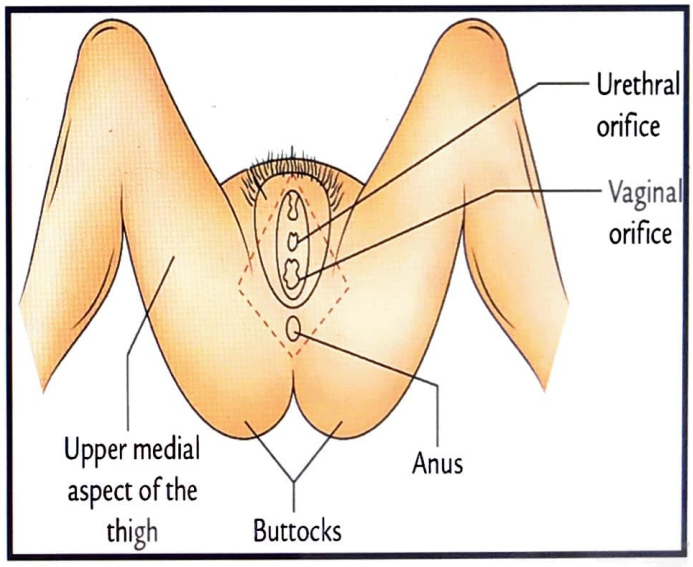
PARA KERATINIZATION

- Seen in tongue and hard palate
- Superficial layers have nuclei

MIDDLE EAR CAVITY + TM [inner surface)- Stratified cuboidal Epithelium

CERUMINOUS GLAND

- Wax gland
- Modified apocrine sweat gland



OPENINGS IN PERINEUM: 00:25:07

5. URETHRA
   FEMALE URETHRA - 4cm
   MALE URETHRA- 20 crn
- Tip lined by st.sq.epithelium
- stratified columnar epithelium

6. VAGINA
7. ANAL CANAL
   Below dentate /(pectinate line) - stsq. epithelium

SQUAMOCOLUMNAR JUNCTIONS 00:27:32

- prone to metaplasia - present at anal canal

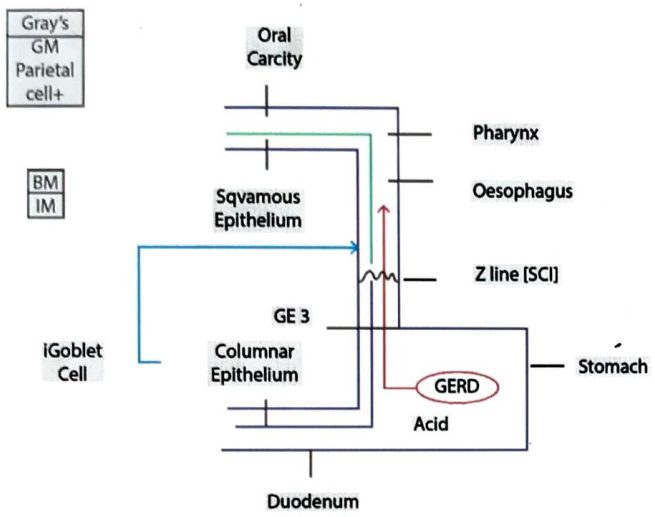
↓ ↓

Dysplasia oesophagus uterine cervix

↓

Cancers

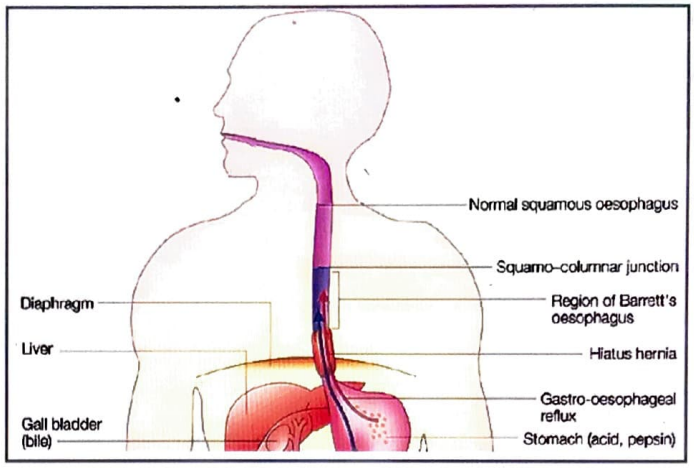
Barrett's Oesophagus



Previous Year's Questions

Q. Barret's oesophagus is diagnosed by
a. columnar metaplasia
b. columnar dysplasia
c. gastric metaplasia
d. intestinal metaplasia (Better answer)

- Normal epithelium - squamous replaced by - columnar with goblet cells (INTESTINAL METAPLASIA)
- ↑Risk of ADENOCARCINOMA



Z-LINE

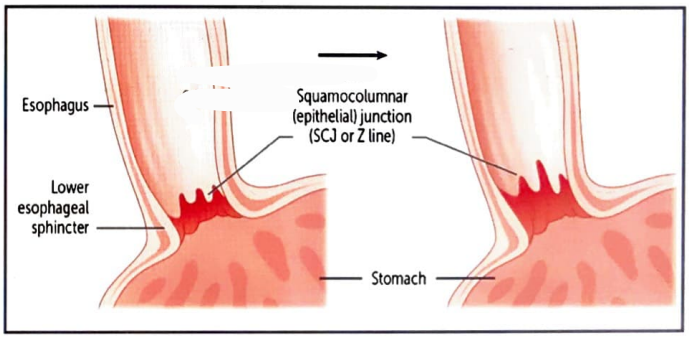
- Zg - zag line
- Squamous columnar.jn. at lower
- levier 2 crn of oesophagus
- lower 2 crn of oesophagus is lined by columnar epithelium
- prone to metaplasia /dysplasia

Z-LINE LOCATED AT

- Normal individuals - 2 cm above GEJ(Gastro esophageal junction)
- Barrett's oesophagus - 5 cm above GEJ
- INTESTINAL METAPLASIA - Misnomer-not used for absorption

Gray's Anatomy Says – GASTRIC METAPLASIA

- Parietal cells found in Bx
- MISNOMER Too
- No goblet cells in stomach



13 GLANDS

Salivary glands 00:02:08

- Merocrine/ Eccrine
  - Seen in parotid gland, salivary glands.
  - No loss of any cell membrane.
- Apocrine
  - Mammary gland [modified sweat gland]
  - There is apical loss of cell membrane (Covering the secretions).
- Holocrine
  - Sebaceous gland in skin
  - Entire cell membrane is lost, cells are broken & organelles becomes contents of secretion like sebum and goes along hair follicle.

Previous Year's Questions

Q. Difference between exocrine pancreas & parotid gland is? (NEET - Jan - 2020)

A. Presence of serous acini with acidophilic tip

B. Absence of striated duct

C. serous Circinus supported by barrel lamina.

D. Apical acinar villi

Refer Diagram 13.1

Q. Which of the following is a holocrine gland

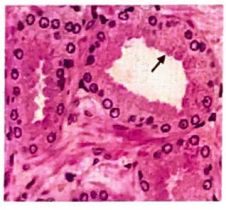
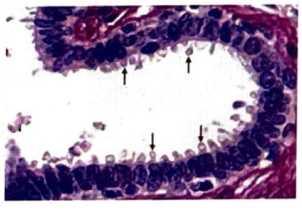
a. sweat gland

b. breast

c. pancreas

d. sebaceous gland

Comparision 00:03:57


- SWEAT GLANDS
  - MEROCRINE - morecannon
  - APOCRINE - less convention seen in Axilla, Perineum
  - Ceruminous gland
  - modified sweat glands IIf mammary glands
  - MEROCRINE (or Eccrine)-PANCREAS (Exocrine component)

Classification of Glands

- Serous glands
  - Parotid Salivary glands
  - Serous glands have dark staining cells.
- Mucinous glands
  - Sublingual gland
  - Has Empty look and light staining cells.
- Seromucinous glands
  - Submandibular gland
  - Mixed salivary glands
  - Serous demilunes: Serous glands are sitting on the mucous gland

Previous Year's Questions

Q. Serous demilunes are present in large numbers in which gland

a. parotid

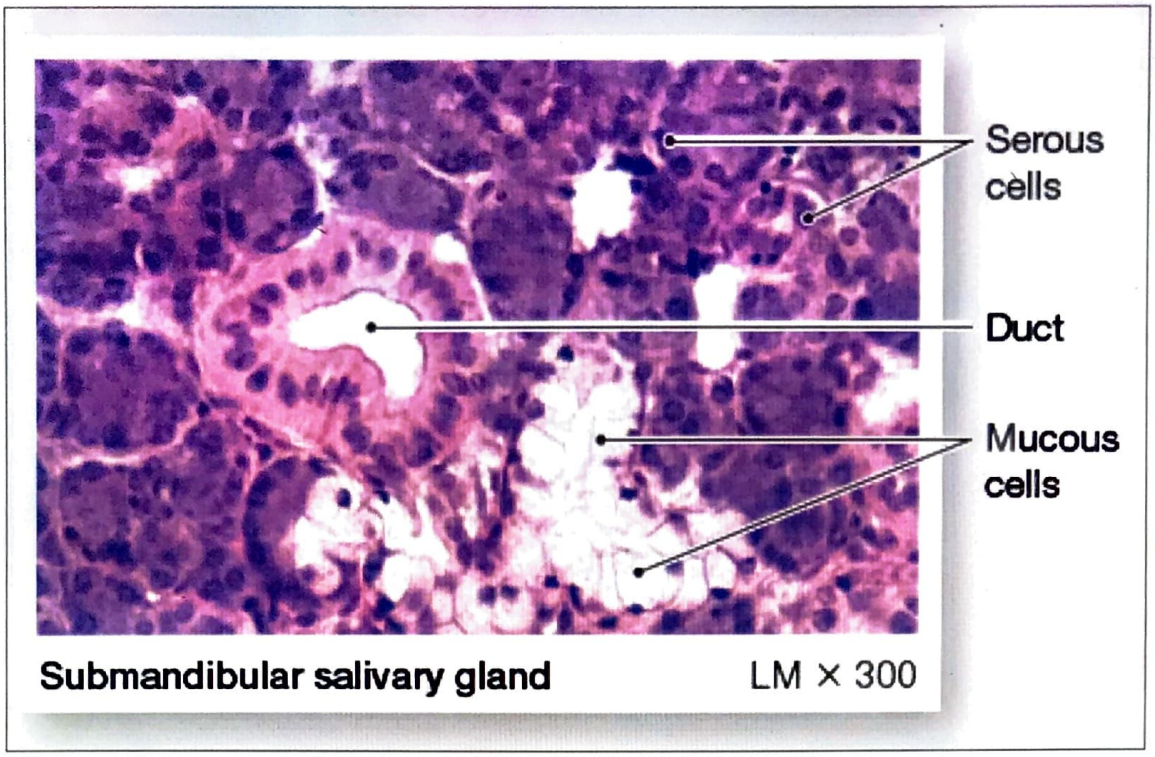
b. Submandibular

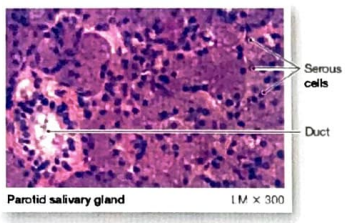
c. sublingual

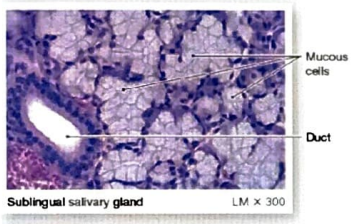
d. pituitary

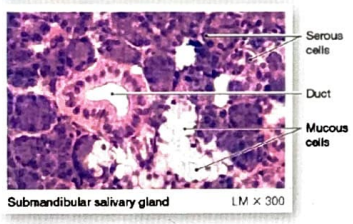
SUBMANDIBULAR SALIVARY GLAND

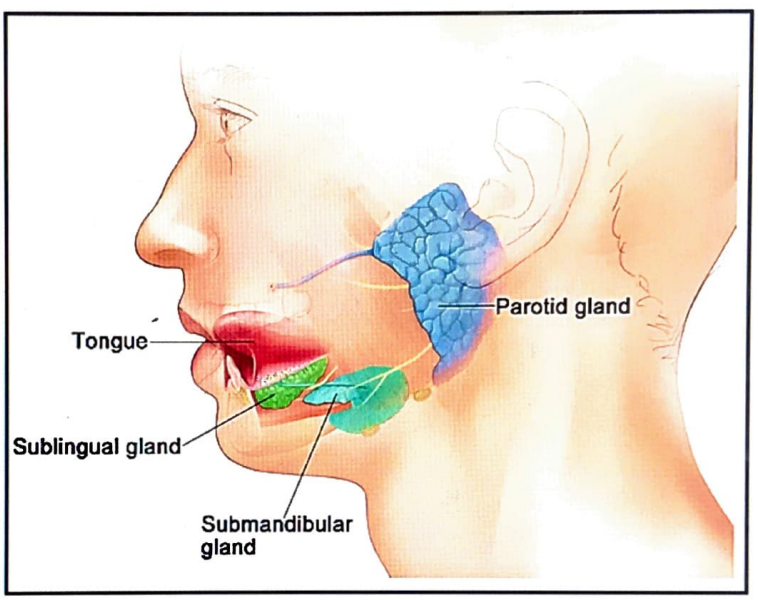
- Sero mucinous gland
- MUCINOUS GLANDS
  - lightly stained, columnar cells
  - foamy appearance
  - cap of serous gland over mucinous gland
  - SEROUS DEMILUNE
  - seen in mixed gland
  - cuboidal cells
  - dark stained eosinophilic cells
- SEROUS CELLS
  - darkly stained

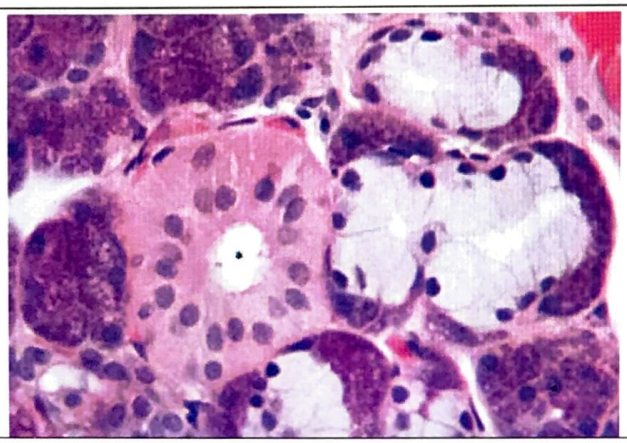

Serous cells
Duct
Mucous cells
Submandibular salivary gland
LM × 300


Serous cells
Duct
Parotid salivary gland
LM × 300


Mucous cells
Duct
Sublingual salivary gland
LM × 300


Serous cells
Duct
Mucous cells
Submandibular salivary gland
LM × 300


Parotid gland
Tongue
Sublingual gland
Submandibular gland



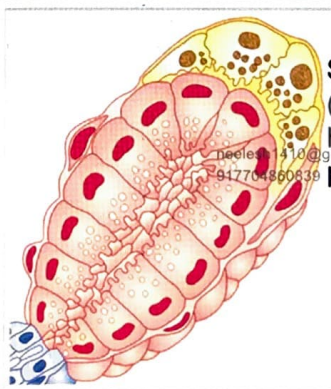
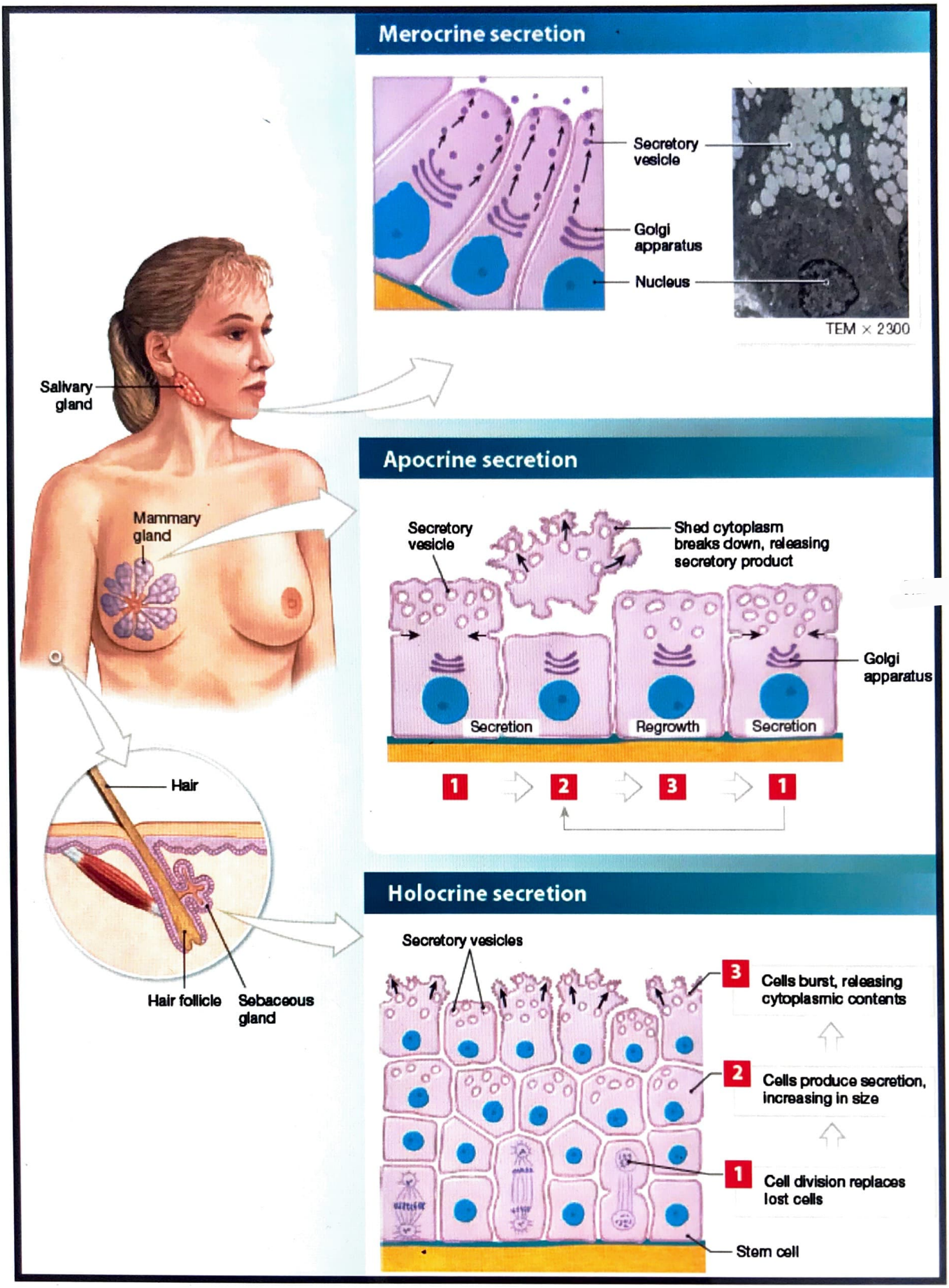

Serous demilune (as seen in routine histological preparations)

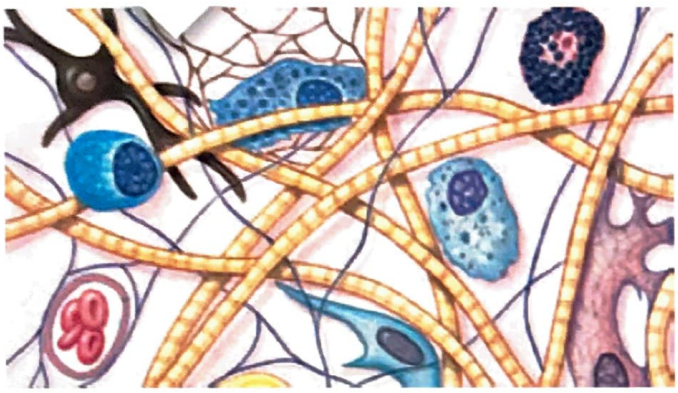
Diagram 13.1


Merocrine secretion
Secretory vesicle
Golgi apparatus
Nucleus
TEM × 2300
Salivary gland
Mammary gland
Apocrine secretion
Secretory vesicle
Shed cytoplasm breaks down, releasing secretory product
Golgi apparatus
Secretion
Regrowth
Secretion
1
2
3
1
Hair
Hair follicle
Sebaceous gland
Holocrine secretion
Secretory vesicles
3
Cells burst, releasing cytoplasmic contents
2
Cells produce secretion, increasing in size
1
Cell division replaces lost cells
Stem cell

14 CONNECTIVE TISSUES

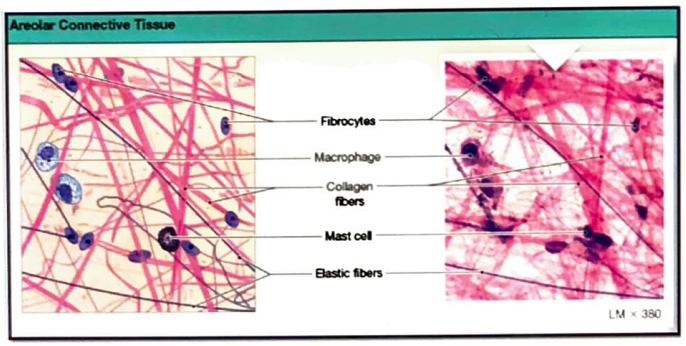
TYPES OF CONNECTIVE TISSUES 00:00:24

Connective Tissue	
Loose	**Dense**
Fibers create loose, open framework • Areolar tissue • Adipose tissue • Reticular tissue	Fibers densely packed • Dense regular • Dense irregular • Elastic



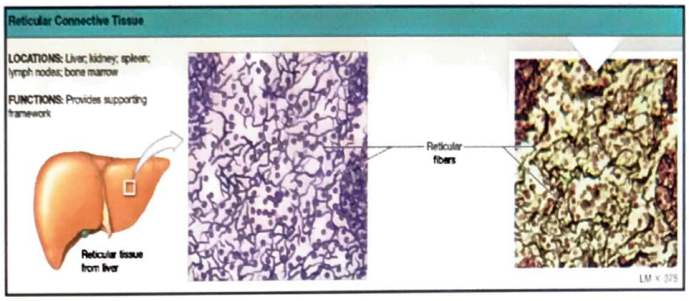
- Loose areolar connective tissue seen in
  - Lamina propria [subepithelial connective tissue]
  - Superficial papillary layer of dermis
- Dense connective tissue
  - Dense regular: seen in tendons or ligaments
  - Dense irregular: seen in deep reticular layers of dermis, periosteum, perichondrium.

Loose areolar connective tissue 00:00:51



- There are less fibers
- 3 types of fibers
  - Collagen fibers; long wavy, running in bundle, appears thick
  - Elastic fiber: single running thin fibers
  - Reticular fibers (rare)

Reticular connective tissue 00:02:13



- Present in liver, spleen, lymph-node organs [thymus].
- Networking type of fibers.
- Thin branching type of fibers.

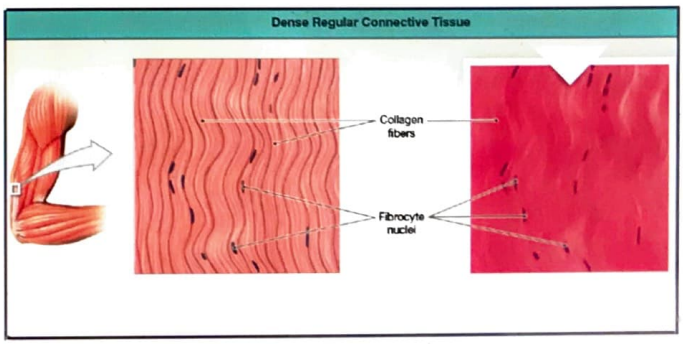
Previous Year's Questions

Q. Reticular Fibers are absent in?

(INICET - NOV - 2020)

A. Bone arrow
B. Spleen
C. Thymus
D. Lymph node

Dense regular connective tissue 00:03:21

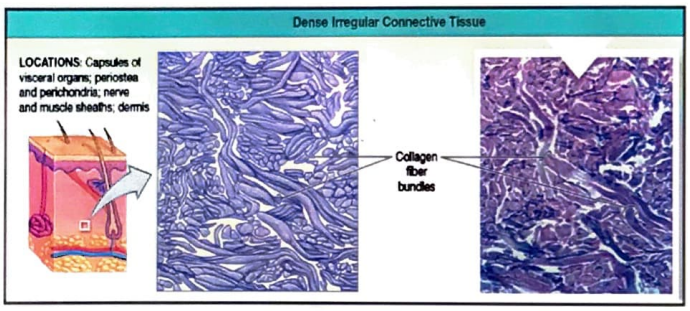


- Thick wavy fibers
- Running parallel to each other's

SEEN IN:

- Tendon
- aponeurosis
- ligaments
- ↑collagen
- Collagen fibres runs parallely in one direction

Dense irregular connective tissue



- Irregularly running collagen fibers

SEEN IN

- Deep reticular layer at DERMIS
- PERIOSTEUM

Q. Dense & regular arrangement of collagen fibres is seen in at except [AIIMS]

a. Tendon
b. Ligaments
c. Aponeurosis
d. Periosteum

Q. Dermis & irregular connective tissue is found in [AIIMS 2017]

a. Dermis-
b. LaminA propria
c. Tendon
d. Ligament

Type Location	Functions
I. Connective tissue of skin, bone, tendon, ligaments, dentin, sclera, fascia, and organ capsules (accounts for 90% of body collagen)	Provides resistance to force, tension, and stretch
II. Cartilage (hyaline and elastic), notochord, and intervertebral disc	Provides resistance to intermittent pressure
III. Prominent in loose connective tissue and organs (uterus, liver, spleen, kidney, lung, etc.), smooth muscle, endoneurium, blood vessels, and fetal skin	Forms reticular fibers, arranged as a loose meshwork of thin fibers, provides a supportive scaffolding for the specialized cells of various organs and blood vessels
IV. Basal laminae of epithelia, kidney glomeruli, and lens capsule	Provides support and filtration barrier

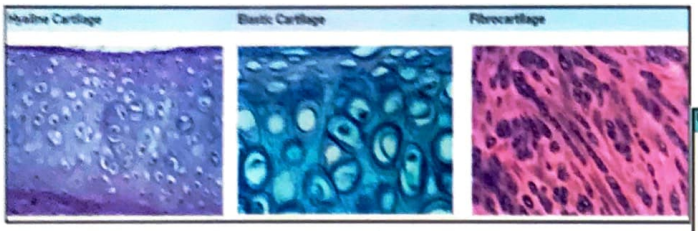
Important Information

- In old scar: type I collagen
- Recently healing tissue: type III collagen
- Type IV collagen gets damaged in Alport syndrome (glomerular nephritis).

15 CARTILAGE TISSUE

TYPES OF CARTILAGE

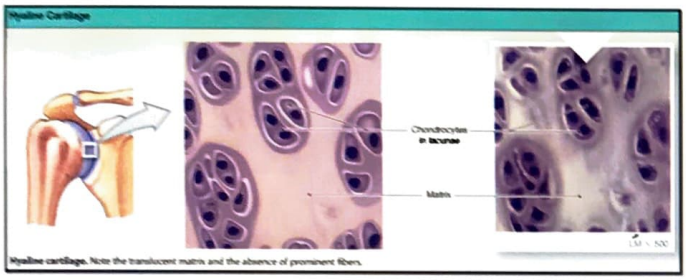
00:00:16



HYALINE CARTILAGE

00:00:38

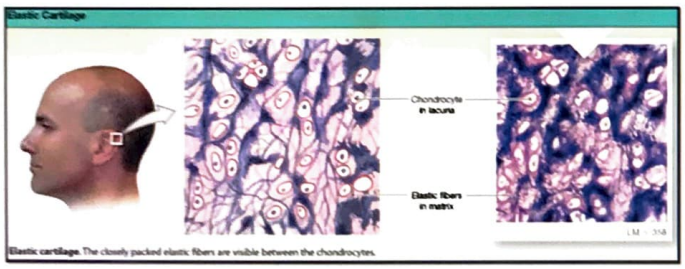
- HYALOS – Glass like
  - Collagen fibres are not evident to eye (optical illusion)
  - Refractive index of Collagen Fibres = RI of matrix
- seen h Articular cartilage
- ISLANDS Of CHONDROCYTES
  - not run in lines



ELASTIC CARTILAGE

00:02:38

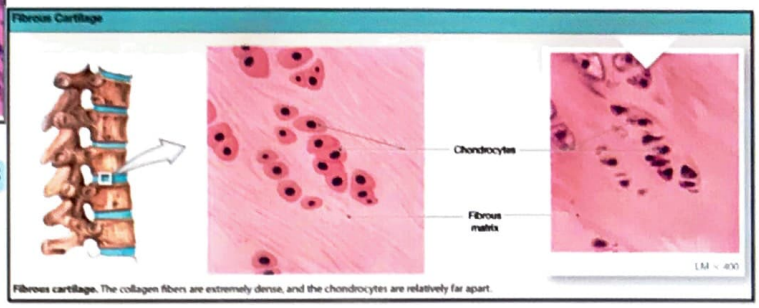
- External ear (pinna)
- Eustachian tube
- Epiglottis
- Consists of ELASTIC DRESS- short, single, branching fibres
- CHONDROCYTES present larger



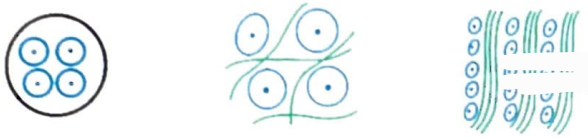
FIBROCARTILAGE

00:03:30

- works as SHOCK ABSORBER
- Seen in Intervertebral discs
- LINES OF CHONDROCYTES [Long Lines] alternating with collagen Fibres
- ↑collagen fibres
- collagen fibres ore evident



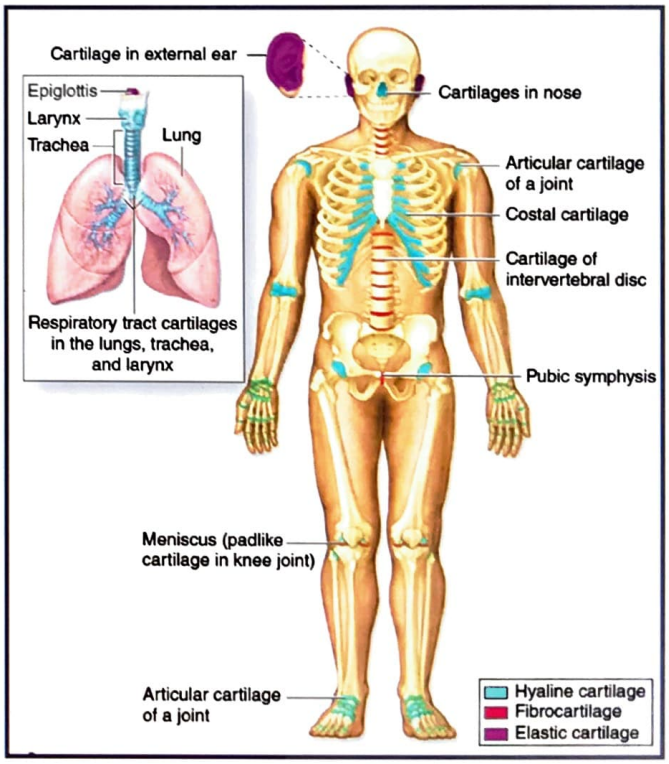
HYALINE CARTILAGE ELASTIC CARTILAGE FIBRO CARTILAGE



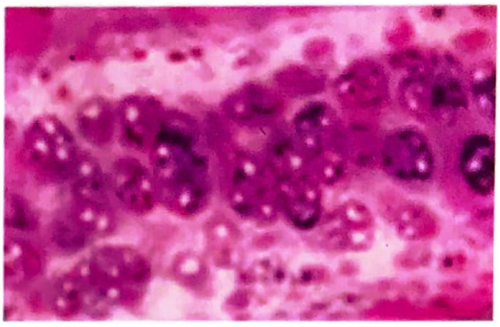
CARTILAGE FEATURES

00:09:22

Refer Table 15.1



Q. Fibro cartilage seen in
a. costal cartilage
b. nasal septum
c. intervertebral disc
d. Auditory tube -

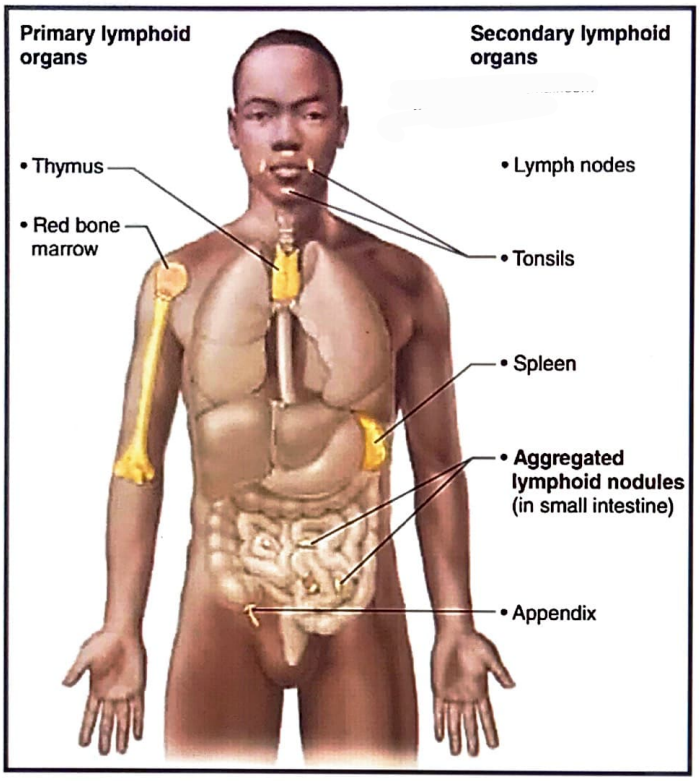


Q. Structure shown is Found in [AIIMS 2016]
a. intervertebral discs -
b. articular discs -
c. epiphyseal plate -
d. pinna -

Table 15.1

Cartilage features			
Types	Hyaline cartilage	Elastic cartilage	Fibrocartilage
Identifying characteristics	Type II collagen	Type II collagen	Type I collagen (predominantly)
Perichondrium	Present (EXCEPT: at articular cartilage)	Present	Absent
location	Most common type • Fetal cartilage • Growth Plate • Articular cartilage • Respiratory tube (with few Exceptions) • Costal cartilage	Rare ($E^3T^3C^2$) • External ear • Eustachian tube • Epiglottis • Tip of nose • Tip of arytenoid • Tritiate cartilage • Corniculate • Cuneiform	Found near the bone/joint • Intervertebral disc • Articular disc (Se, TM) • Knee meniscus • Glenoid/acetabular labrum • Insertion of tendons • SHOCK ABSORBER
CHONDROCYTES	Islands of Chondrocytes Collagen fibers are not Visible	Large chondrocytes short, single and branching elastic fibres	rows of chondrocytes alternating bundles of collagen fibres

16 LYMPHOID TISSUE



PRIMARY LYMPHOID ORGANS

00:01:01

- Have stem cells
- **BONE MARROW**
  - produce B cells
  - ↓
  - plasma cells
  - ↓
  - humoral immunity

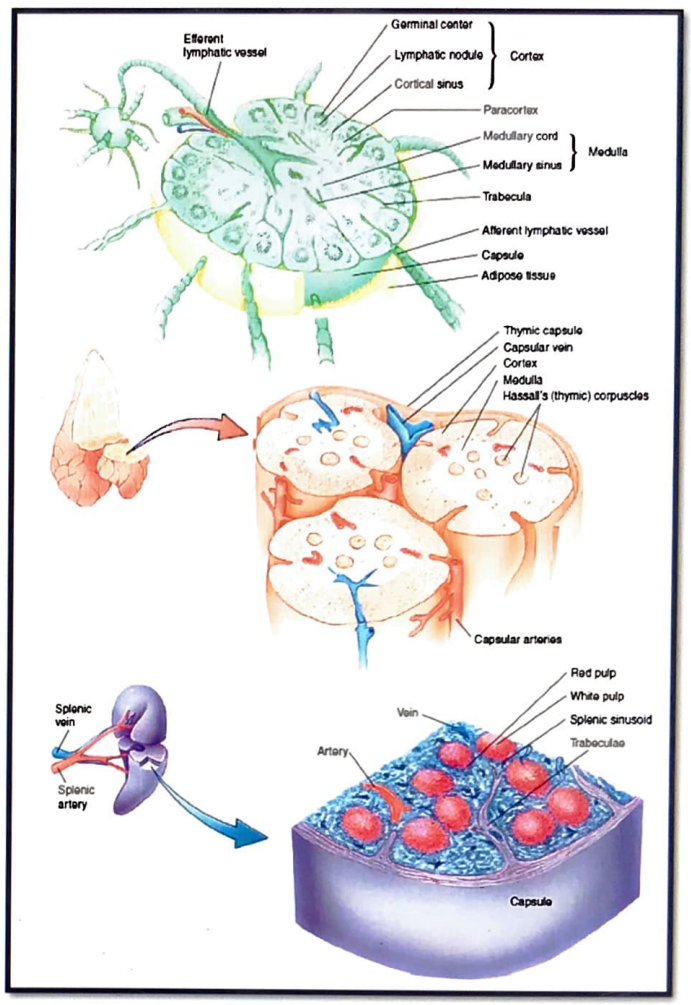
- **THYMUS**
  - Produce T cells
  - responsible for CELL MEDIATED IMMUNITY
  - kills bacteria, protozoa (amoeba)
  - DIGEORGE SYNDROME
  - Thymus absent
    → ↓CMI
    → Severe bacterial infections

SECONDARY LYMPHOID ORGANS

- No stern cells
- NODES
- TONSILS
- SPLEEN
- MALT (peyer's patch)

LYMPH NODE

00:05:31



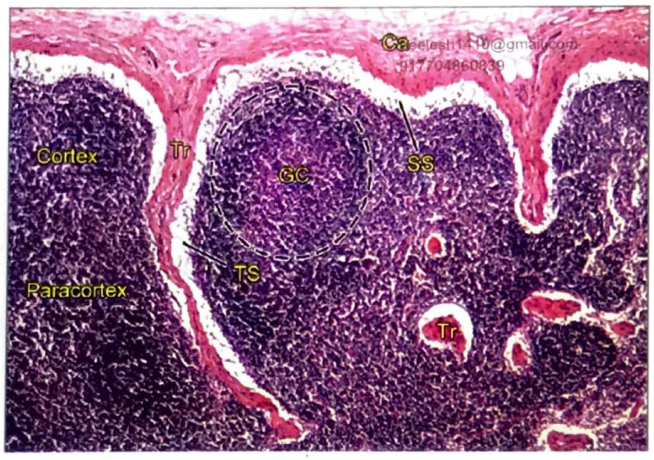
- CORTEX- contains lymphoid Follicles
- PARA CORTX
  - T- lymphocytes - C.M.I
  - No lymphocytic nodules

- MEDULLA
  - Medulla- Plasma cells – Antibodies
- Lymphocytes

- has large nucleus [Basophilic]
- peripheral thin cytoplasm

- Macrophages
- CAPSULES
- LULAROE SUBCAPSULAR

SINUS [filled with lymph]



THYMUS 00:11:00

- MULTIPLE LOBULES
- Multiple cortex
  - at periphery
  - Dark coloured
- Multiple medulla
  - At centre
  - Light coloured \
- HASSAL's CORPUSCLE (THYMIC CORPUSCLE)
  - degenerating cells (epitheliocytes)

SPLEEN 00:13:47

WHITE PULP

- 10-30%
- ↑WBCs C manly lymphocytes / nodules)

1. LYMPHOID FOLLICLES

- with germinal centre (right stained)
- periphery - dark stained
  - → In centre - B lymphocytes
  - → periphery- T lymphocytes

2. PALS

Central arteriole

- Present in lymphoid follicle
- Eccentric (not in centre]
- Surrounded by T lymphocytes

RED PULP

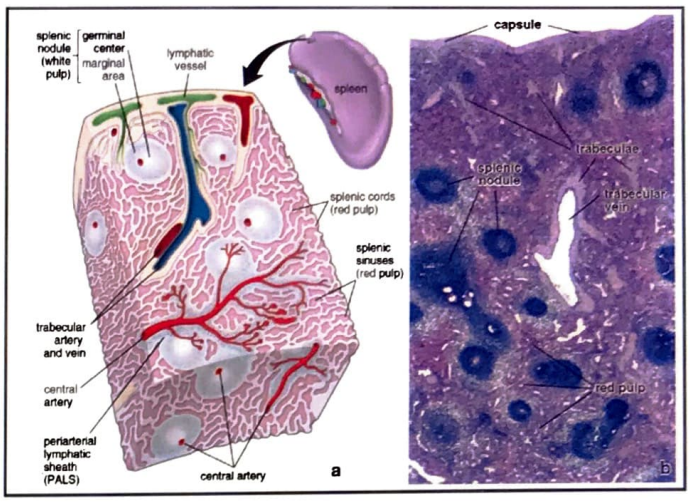
- 70-90%
- ↑RBCs
- Splenic sinusoids filled with blood
- Cords of Billroth
- Reticulocytes

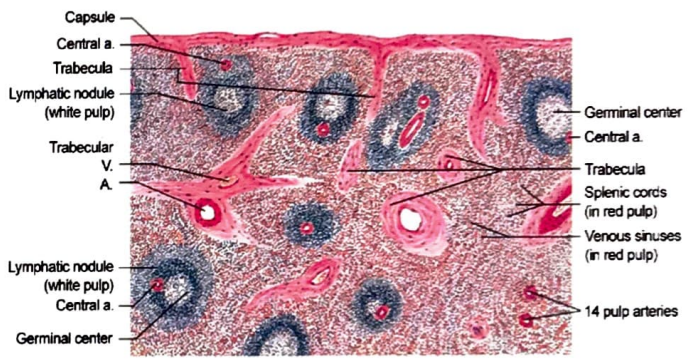
↓

Reticular Fibres

↓

Cords





Q. ALL the following are components white pulp spleen except

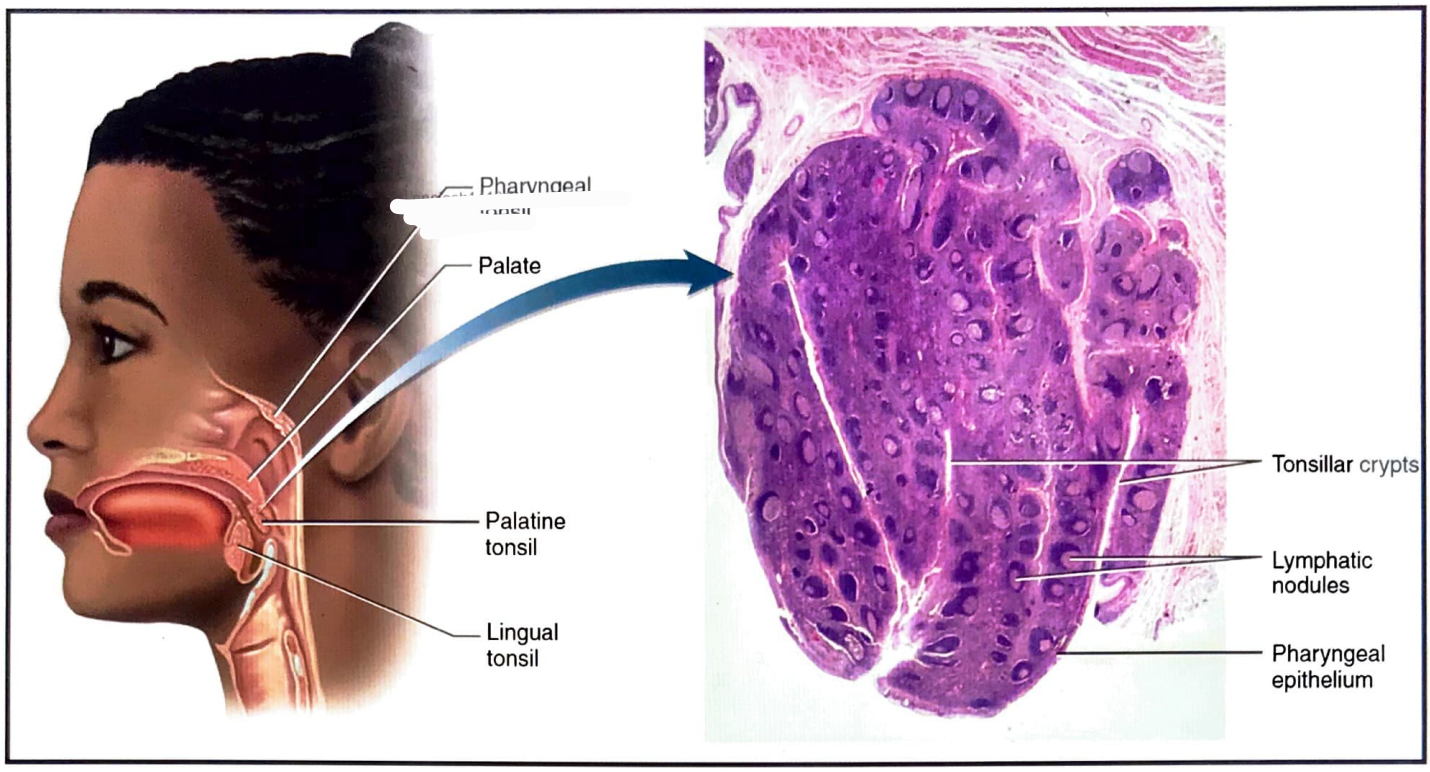
a. peri arteriolar lymphoid sheath
b. B cells
c. Antigen presenting cells
d. Vascular sinus –

TONSIL:

- PALATINE TONSIL
- LINGUAL TONSIL
- PHARYNGEAL TONSIL

PALATINE TONSIL

- Tonsillar crypt ruled by Non keratinized stratified & various epithelium
- LYMPHOID FOLLICLE



MALT (MUCOSA ASSOCIATED LYMPHOCYTE TISSUE)

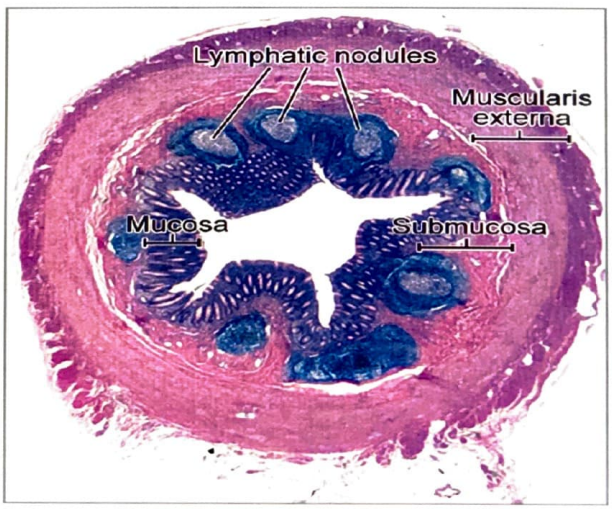
00:24:21

Q. GALT [Gut associated lymphoid tissue] present in

a. sub mucosa
b. lamina propria (BETTER ANSWER)
c. muscularis mucosa
d. adventitia/serosa

VERMIFORM APPENDIX

- MALT present not only in UVANA PROPRIA but also extending SUB MUCOSA (rare)
- Lymphoid nodules present in submucosa

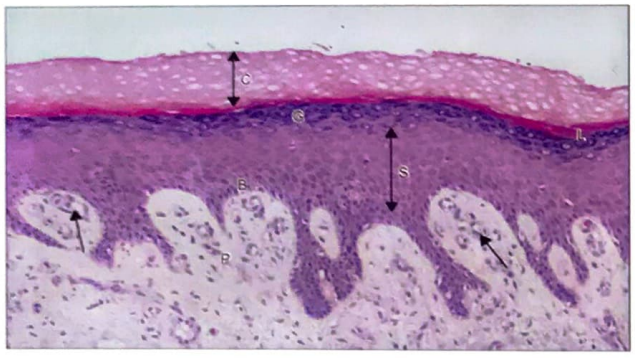


17 INTEGUMENTARY SYSTEM

SKIN EPITHELIUM

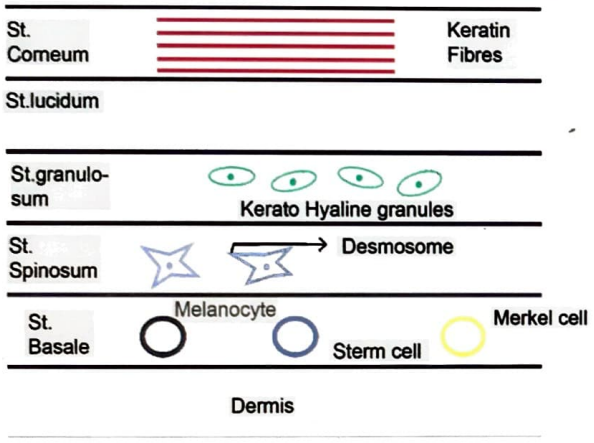
00:00:47

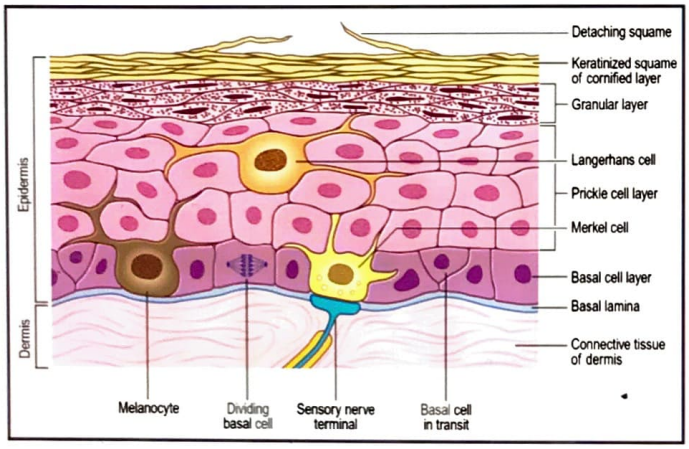
1. STRATUM CORNEUM- contains keratin fibres
2. STRATUM LUCIDUM- in palm and soles
3. STRATUM CRANUWSUM-have kerato hyaline granules
4. STRATUM SP1NOSUM /PRICKLE CELL LAYER
5. STRATUM BASAL/ STRATUM CERMINATIVUM



LAYERS OF SKIN

00:05:29



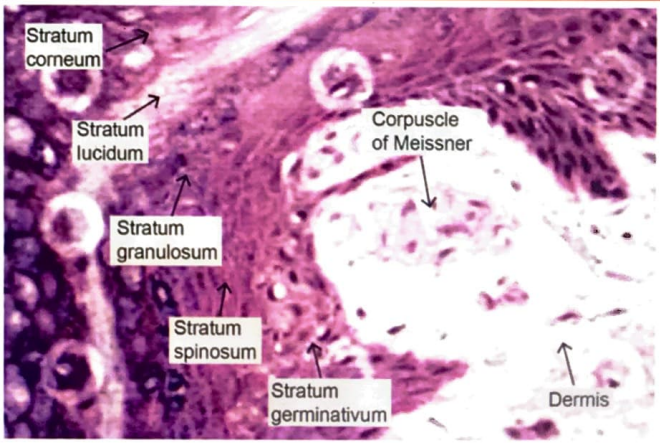


1. Stratum corneum
   - Has lot of keratin fibers coming from 3rd layer
2. Stratum Lucidum
   - Seen in Thick skin of palms, soles only
3. Stratum Granulosum
   - Has keratohyalin granules for the formation of keratin fibers.
4. Stratum Spinosum
   - Also known as prickle cell layer
   - Has desmosomes attached between the cells having spiny appearance
   - In case of pemphigus vulgaris [intraepithelial lesion] desmosomes are broken; may lead to skin blisters.
5. Stratum Basale [Has 3 cells]
   - Melanocytes: From NCC; giving Melanin
   - Merkel Cells: Involved in light touch sensation; reading braille; slow adapting cell.
   - Stem cells: Add more layer of skin as skin disintegrate with time.

- Deep to stratum basalis is dermis
  - Dermis has Meissner's corpuscles which helps in detection of braille
  - Meissner's corpusclesare rapidly adapting receptor which helps to read braille faster

Important Information

- Better one to read braille: Merkel > Meissner's



Important Information

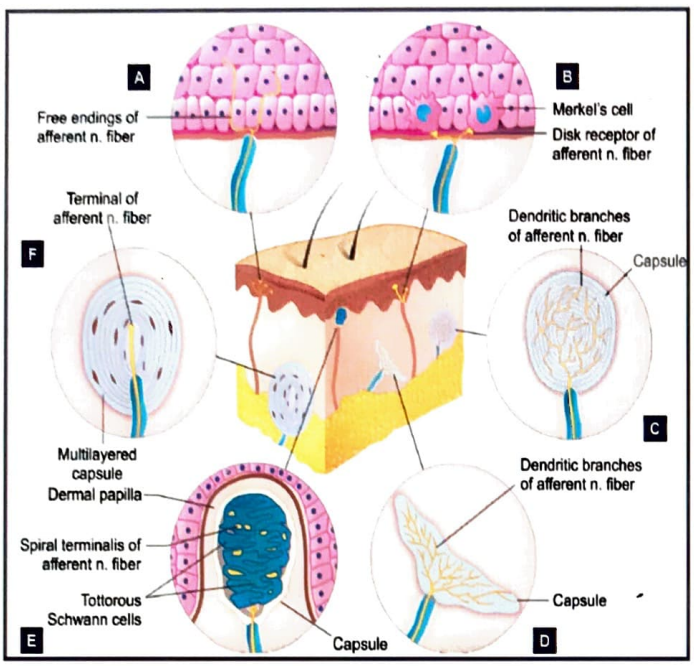
Langerhans cell

- Antigen presenting cell [picks up antigen from skin and carry towards lymph node]
- Not in basal layer

RECEPTORS

00:10:07

- MERKEL's Cell– forlight touch sensation
- MEISSNER's CORPUSCLE - For 2point discrimination\
- PACINIANCORPUSCLE - For pressure a Vibration
- RUFFINI's CORPUSCLE - for demol stretch



MERKEL's Cell

00:10:57

- For light touch sensation
- Helpsreading BRAILLE Q. [MERKEL>MELSSNER]
- Slowly adapting receptor - Precision is mere therefore, involved when starting metes; brae but after 10 yrs ofreadingbraille, Meissner's corpuscle is involved.

MEISSNER's CORNSCLE

- present at dermoepidermal junction–
- rapid adapting receptors
- for 2 point discrimination

Previous Year's Questions

Q. Skin receptor responsible for detecting rapid vibration sense? (FMGE – Aug – 2020)

A. Meissner corpuscle
B. Pacinian corpuscle
C. Merkel cell
D. Ruffini's cell

PACINIAN CORPUSCLE

- Present in deep dermis
- Carriespressure andvibration
- rapidly adapting receptor

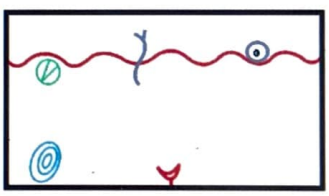
RUFFINI RECEPTORS

00:14:19

- Present in deep receptor
- Slowly adapting receptor
- For dermal stretch
- Thermoreceptor

FREE NERVOUS ENDINGS

- Non myelinated axons
- Slow conducting
- C fibres
- Conduct pain and temperature



FREE NERVE ENDINGS
MERKEL CELLS
MEISSNER'S CORPUSCLE
PACINIAN CORPUSCLE
RUFFINI CORPUSCLE

18 CELL JUNCTION

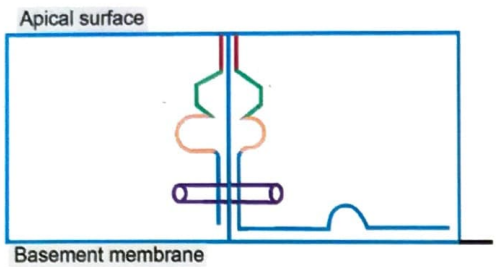
Q. 20mm Intercellular gap is found in

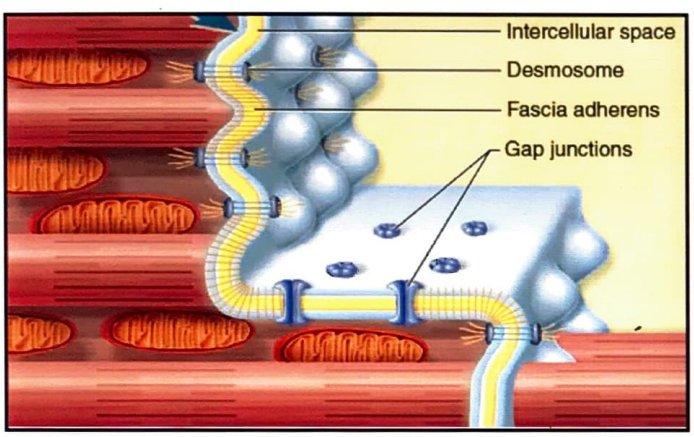
a. Zona occludens

b. zone adherence/

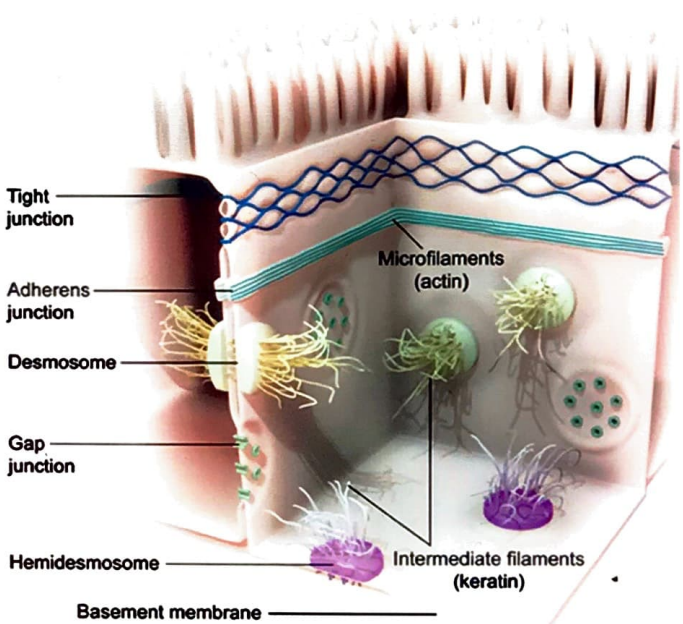
c. macula adherence

d. gap junctions





Cell junctions



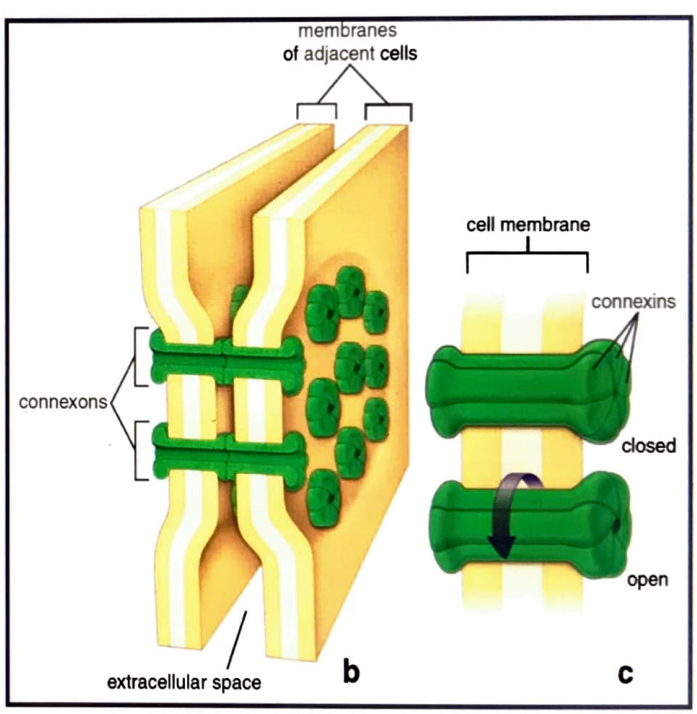
GAP JUNCTION

- Tunnel lke b/w 2cells
- For passage of ions, molecules (glucose, AA] → (functional coupling)
- CONNEXONS → hexagonal structures present
- very narrow IC gap
- ions [Ca^{3+}, Na^{3+}] → for impulse conduction sinter to electricsynapse in
  smooth muscles - causes peristalsis
  cardiac muscles - causes rhythm
- in case of damage
  - disturbed peristalsis
  - cardiac arrhythmias
- Faster conduction than neural conduction

Connexions

00:07:45

- HEXAGONAL
- CONDUCTSIONS [Ca^{3+}, Na^{3+}]



HEMI DESMOSOME - attaches cell to basement membrane
ZONAOCCLUDENCE / TIGHT SUNCTION- very narrow inter cellular gap towardsapical surface

ZONA ADHERENCE / FASCIA ADHERENCE- 20 nm IC gap
DESMOSOMES/ MACULAADHERENCE-25nm IC gap

Important Information

- Desmosomes have cadherins. which are damaged in pemphigus vulgaris [intraepithelial lesion].
- Hemi desmosomes have integrins as cell adhesion molecule: damage in hemi desmosomes occurs in bullous pemphigoid (sub- epithelial)

CELL ADHESION MOLECULES

- INTEGRINGS - hemi desmosomes
- CADHERINS –desmosomes
  - Ca^{2+} modulated adherent molecules

CLINICAL PICTURE

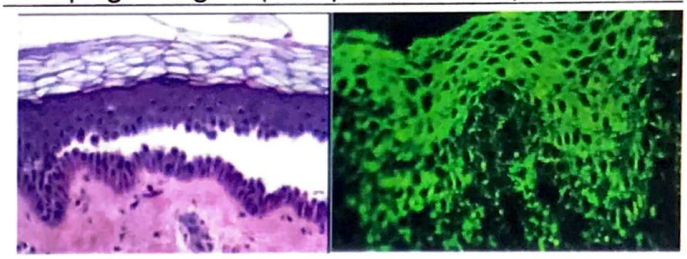
P. VULGARS

- Absto cadherins - Intra epithelial blisters
- NIKOLSKY's SIGN - positive

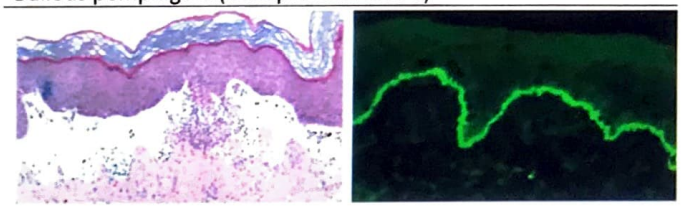
IMMUNO FLOURESCENCE STAINING

- Pemphigus vulgaris-FISHNET APPEARANCE (throughout epithelium)
  - INTRAEPITHELIAL LESION
- Bullous pemphigoid-green flouroscence restricted to basement membrane.
  - SUB EPITHELIAL

Pemphigus vulgaris (intaepithelial lesion)



Bullous pemphigoid (Subepithelial lesion)



NIKOLSKY SIGN

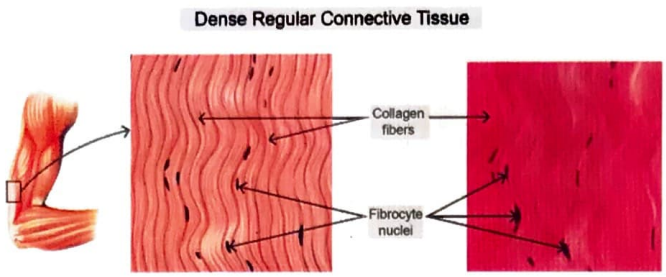
00:11:10

- putting tangential pressure to normal skin
- extension of lesion into normal skin
- die to intercellular separation
- S. spinosum involved

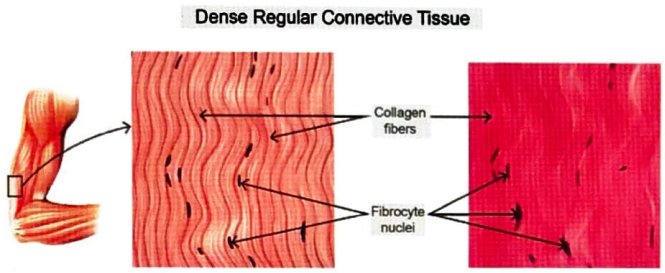
19 MUSCULAR TISSUE

SKELETAL MUSCLES

00:01:20



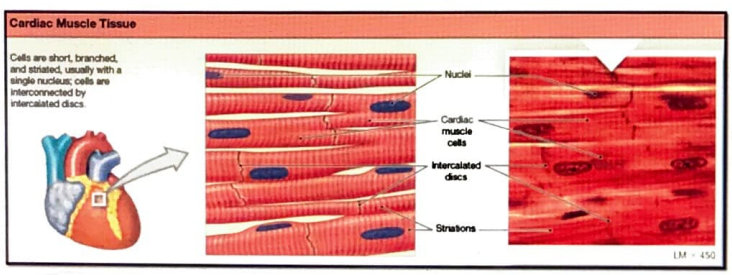
- long cylindrical cells
- SYNCITIUM anatomical)-multi-nucleated due to loss of cell membrane
- Nuclei are at periphery
- STRAITED APPEARANCE
  A Band -Anistropic
  I Band -Isotropic



CARDIAC MUSCLE

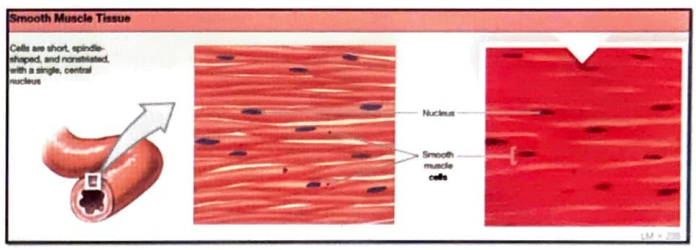
00:02:26

- INTERCALATEDDISCS duetoprominentcellboundaries
- STRIATEDlessstriated
- Gap junctions perinuclear halo present
- Desmosomes
  - Fascia adherens
- Branching seen



SMOOTH MUSCLE

00:03:49



- Spindle shaped cells
- No striation
- Single nucleus
- Gap junction desmosomes

Comparison of skeletal muscle vs cardiac vs smooth muscle

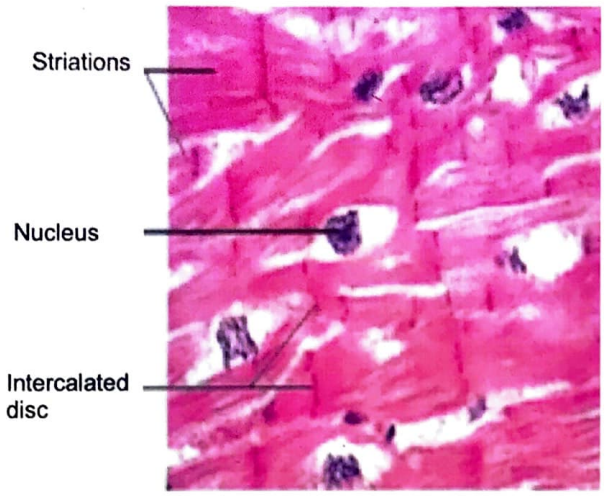
- Skeletal muscle is a syncytium [due to loss of cell member]; has long cells with multinucleate appearance, deeply striated z-band & I-band are present.
- Cardiac muscle: less striated, peri-nuclear halo in intercalated disc; branching cells.
- Smooth muscle: spindle shaped cells, entirely different from cardiac muscle or skeletal muscle.

Q. The marked struc[illegible] all the following cell junction expect [AIIMS 2016]

a. Zona occuldens
b. Zona adherens
c. Macula adherens
d. Gap junction

INTERCALATED DISC

00:07:41



- It has zona adherens, macula adherens, gap junction.
- Gap junction are important at intercalated disc between two cells;
  - It works like an electrical synapse and allow thetransfer of ions [means if one cell is contracting simultaneously another cell should also contract]
  - It there is a problem with gap junction: arrhythmia
- Tight junctions are absent
- Cardiac muscle has nucleus with peri nuclear halo, in intercalated disc.

20 RESPIRATORY SYSTEM

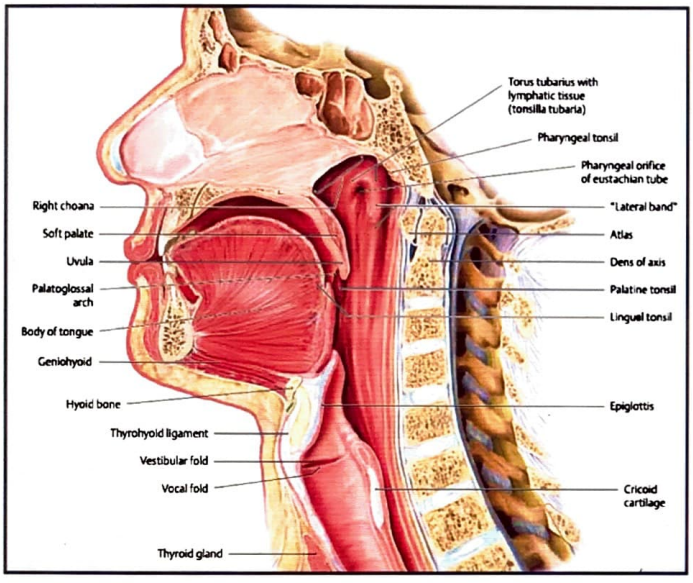
PALATE

- Boundary line b/w respiratory tube and tube
- DOUBLE SURFACES DOUBLE EPITHELIUM
  - hard palate lined by pan keratinized stratified squamous epithelium

EPIGLOTTIS

00:07:21

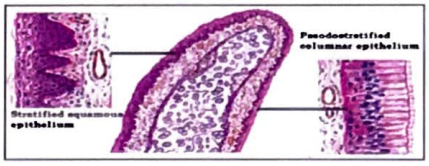
- Oral surface-stratifiedsquamous epithelium
- Laryngeal-surface respiratory epithelium
- NASAL VESTIBULE & VOCAL CORDS are prone to abrasion- st. sq. epithelium
- ADENOIDS & TONSILS - respiratory epithelium

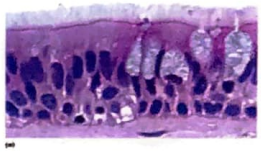


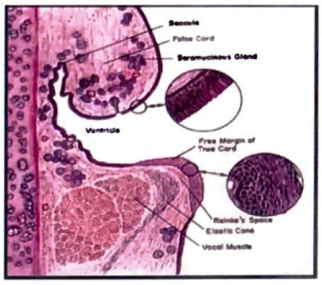
- NEUROEPITHELIUM-present at roof of nasal cavity olfactory epithelium

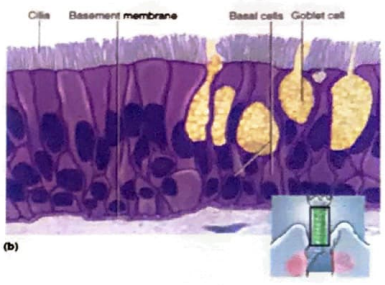
RESPIRATORY EPITHELIUM

- PSEUDO STRATIFIED CILIATED EPITHELIUM WITH GOBLET CELLS
- Ciliated-moves mucus secreted by GOBLET CELL [foaming appearance]
- EPIGLOTTIS – elastic cartilage present









LARYNX

00:10:35

- Lined by respiratory epithelium EXCEPT for VOCAL CORDS
- Hyaena cartilage present
- smaller bronchioles (1 mm Diameter)
  - no hyaline cartilage

Q. Hyaline cartilage of respiratory tube extends till

a. Bronchus smooth muscle
b. Terrain Bronchiole
c. Respiratory Bronchiole
d. Alveolar duct cartilage

- Hyaline cartilage extends upto bronchus, goblet cells extends upto bronchus
  - bronchus
  - Larynx
  - Respiratory Epithelium

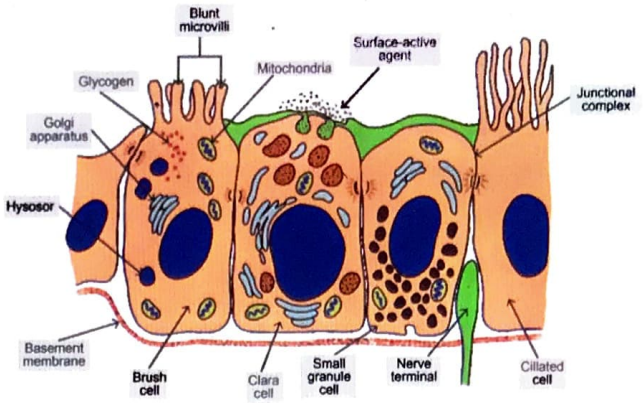
RESPIRATORY PATHWAY

- Alveolar duct
- Alveolar sac
- Alveoli

Refer Image 20.1

CONDUCTING PATHWAY

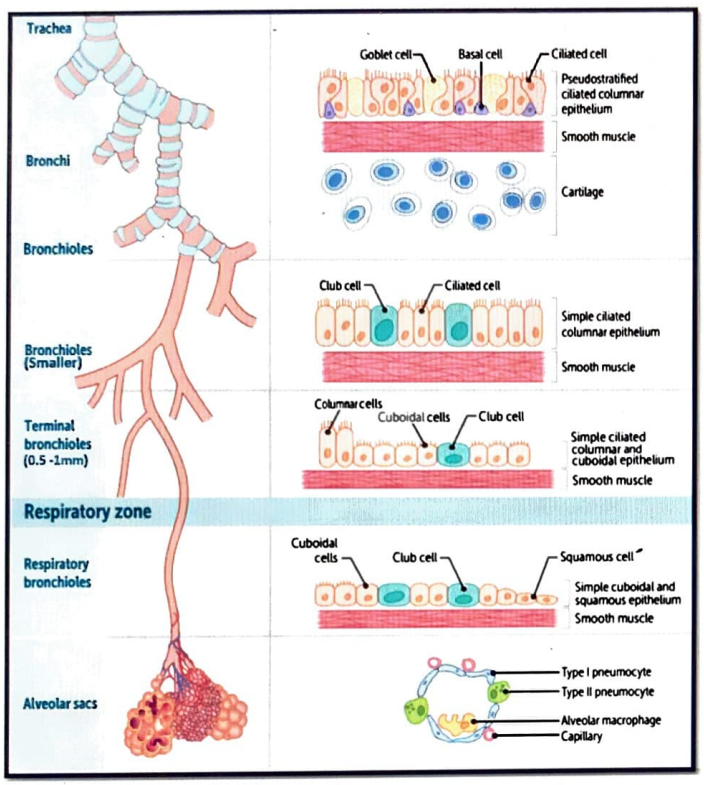
- Trachea
- Bronchus
- Bronchiole
- Terminal bronchiole
- Respiratory bronchiole



Trachea

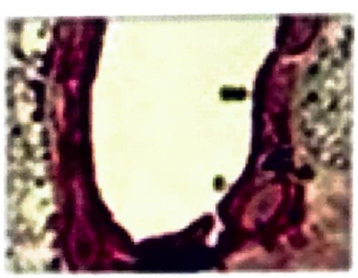
00:17:10

- Respiratory bronchiole cuboidal epithelium
- Alveolar sac simple squamous epithelium for gaseous exchange
- Thin type I pneumocyte



BRONCHUS

- Smooth muscles
- Hyaline cartilage
- Glands (goblet cells)
- Respiratory epithelium
- MALT



Previous Year's Questions

Q. In a Preterm baby with respiratory distress syndrome, which of the following type of cell is deficient? (NEET - Jan - 2020)

A. Alveolar capillary endothelial cell
B. Bronchial Mucosal epithelial cell
C. Type I alveolar cell
D. Type 2 alveolar cell

BRONCHIOLES

00:19:15

- No goblet cells
- No hyaline cartilage
- ↑Smoothmuscles

TERMINAL BRONCHIOLE(lumen diameter .0.5-1mm)

- CLARA CELLS
- Ciliated cells +
- Club cells
- Squamous cells

Q. All of the following cells are found in lung except

a. Kulchitsky cells- Neuro endocrine cell secretesSerotinine
b. Clara cells
c. Brush cells
d. Langerhans cells - APC- skin & lymph nodes

CLARA CELLS	BRUSH CELL
• Secretes surfactant • Detoxify air • Acts as stem cell	Function exactly not known (receptor)

Previous Year's Questions

Q. In a preterm baby with respiratory distress syndrome, which of the following lipid would be deficient? (NEET - Jan - 2020)

A. Sphingomyelin
B. Cardiolipin
C. Dipalmitoyl Phosphatidyl choline
D. None of the above

ALVEOLUS

00:24:14

- Type 1 pneumocytes (mostly) – gaseous exchange
- Type 2 pneumocytes – secretes surfactant
  - Alveolar marchophage – engulf dust particle
  - Capillaries – ↑CO_2 & less O_2
  - Alveolar pores of KOHN – helps in communication
    - → With other alveoli
    - → Can move fluids, bacteria, malignant cells also.

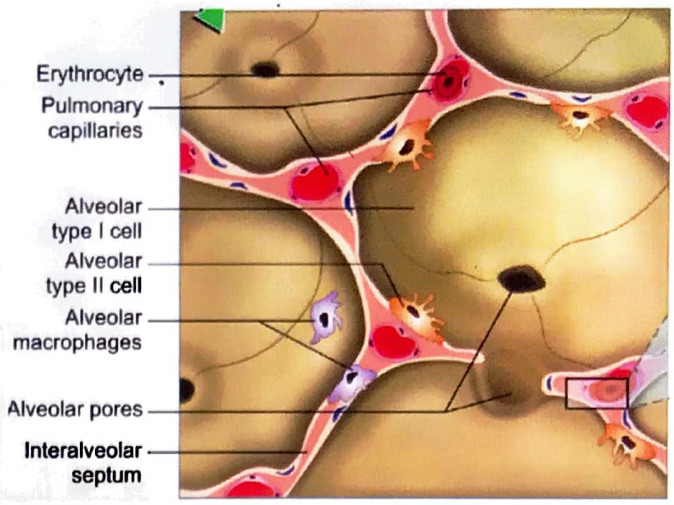
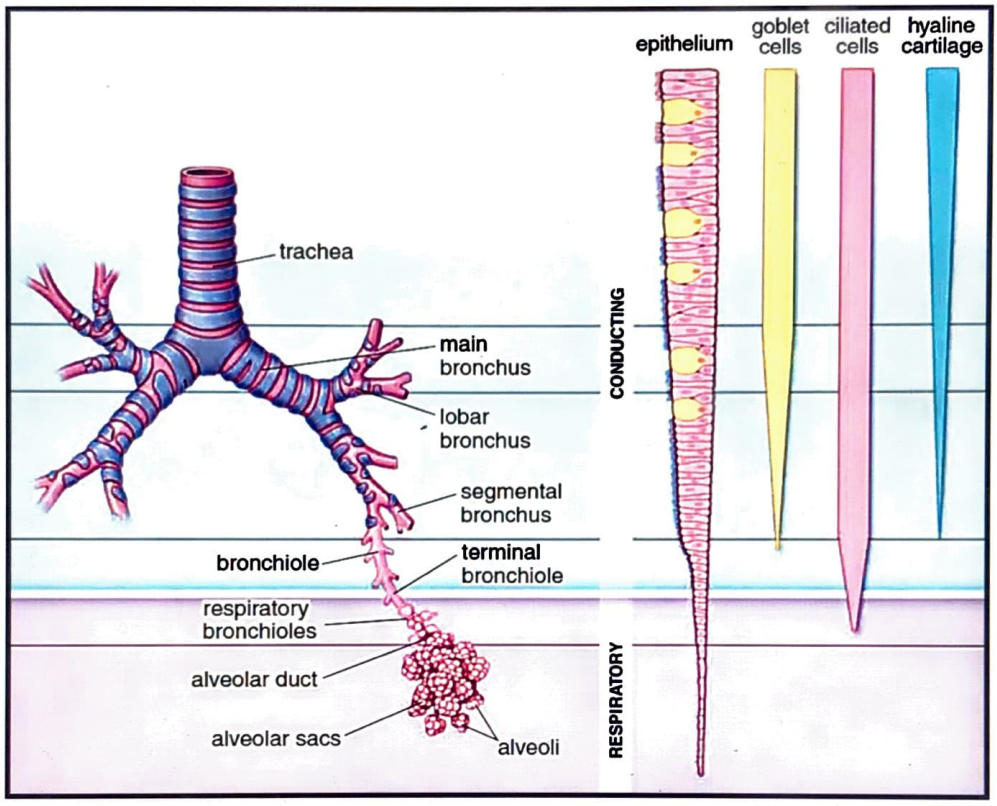


Image 20.1

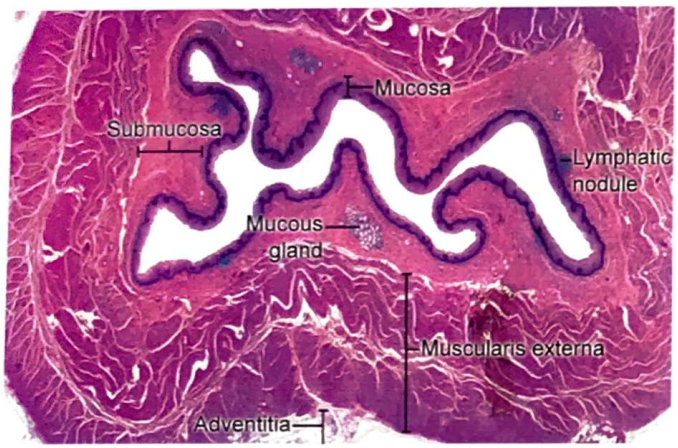


21 DIGESTIVE SYSTEM

OESOPHAGUS

00:00:48

- Upper 1/3rd – skeletal muscles
- Middle 1/3rd – skeletal muscles
- Lower 1/3rd - smooth muscle
  - Prone to adeno Ca.

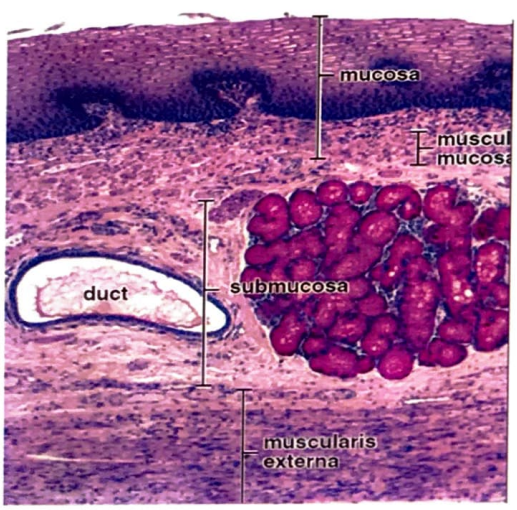


MUCOSA

- Sub mucosa
- Muscularis exrerna
- Adventitia (mostly) & Serosa **MUCOSA**
- Stratified squ amosithelium
- Lamina propria
- Muscularis mucosa

Sub mucosa

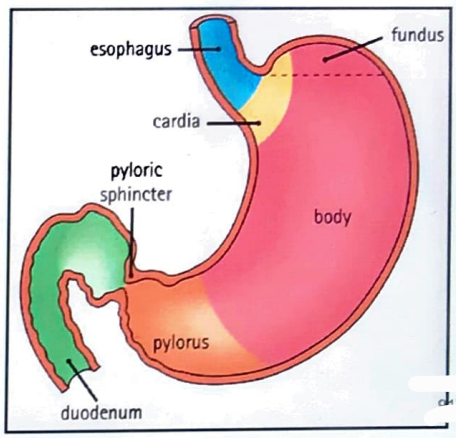
- Strongestlayer of oesophagus
  - Should include in sutures
- Sub mucosal glands present



Stomach

00:04:04

1. Cardia fundus
2. Fundic body
3. Pylorus



- Cardia pylorus have more mucous glands-neutralizes acid
  - Parietal cells secretes HCL (fluids)
  - Parietal cells are rare in cardia and pylorus

Previous Year's Questions

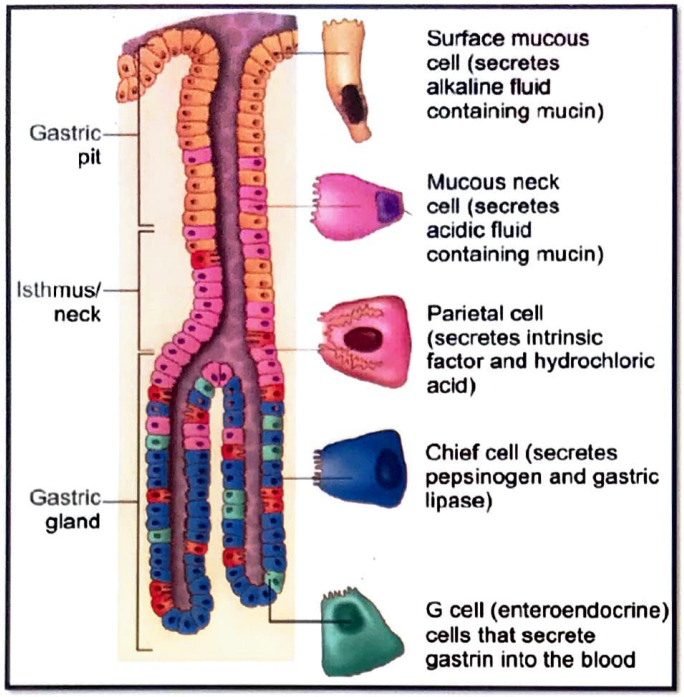
Q. All are correct about stomach except
A. Pylorus has more acid secreting cells
B. Lots of mucosa secreting cells in pylorus
C. Chief cells secrets pepsinogen – more in fundus
D. Parietal cells secrete intrinsic factor

GASTRIC GLANDS

CELLS

1. SURFACE MUCOUS CELL : secretes alkaline fluid with mucin
2. MUCOUS NECK CELL : secretes acidic fluid with mucin
3. PARIETAL CELL : secretes HCL & intrinsic factor
4. CHIEF CELL : secretes pepsinogen & gastric lipase
5. G CELL (ENTERO ENDOCRINE CELL): secretes gastrin

- No goblet cellS



Previous Year's Questions

Q. Predominant cells present at isthmus of gastric Pit? (NEET – Jan - 2020)

A. Chief cells

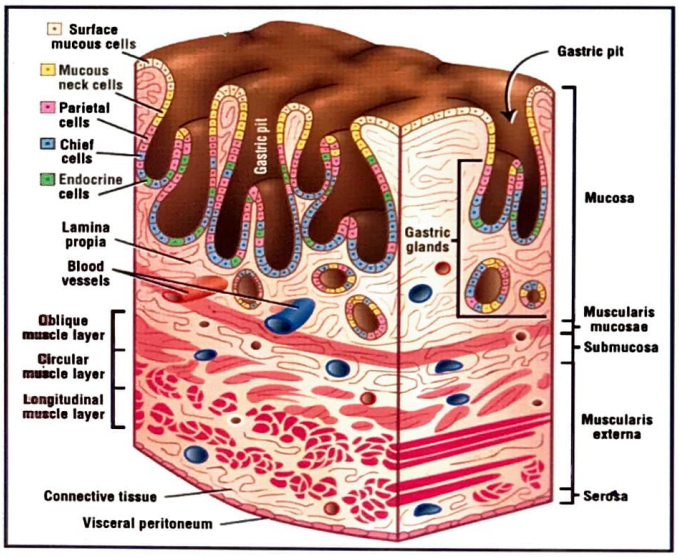
B. Parietal cells

C. Mucous cells

D. Stem cells

- UPPER ½ consists

1. MUCOUS NECK CELL
2. PARIETAL CELL – Pink (eosinophiloic)
   - Lower ½ consists
   1. CHIEF CELL – BLUE (Haematoxylin)
   2. G CELL



Previous Year's Questions

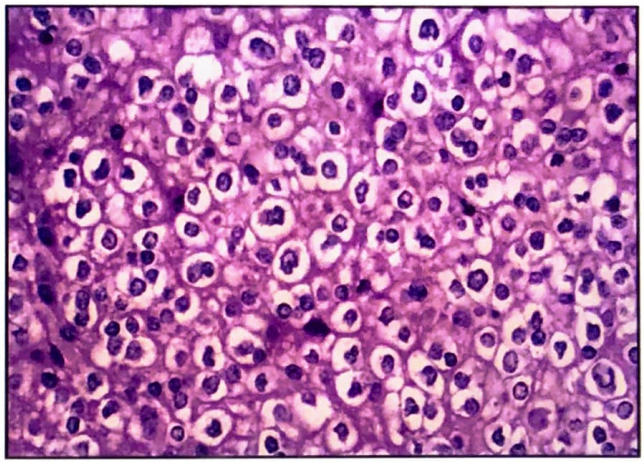
Q. Which of the following marked cells secretes HCL

A. Surface neck cell

B. Mucous neck cell

C. Parietal cell

D. Chief cell



Central spherical nucleus

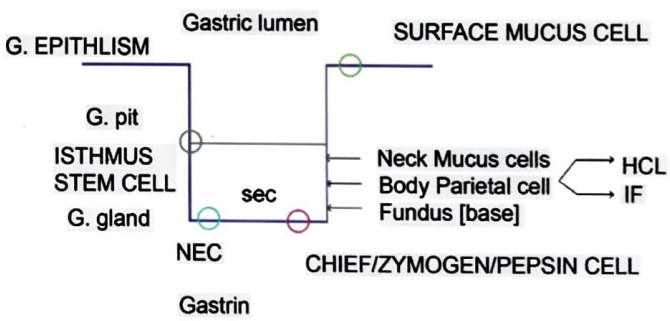
FRIED EGG APPEARANCE

Parietal Cell

- Present in upper half
- Pink colored
- Cuboidal cell with fried egg appearance

Chief Cells

- Basophilic, blue in color, takes haematoxylin (base)
- Present in lower half columnar cell



- ISTHMUS : junction b/w gastric & gastric gland
- CELL LOCATIONS shown in the diagram and predominant locations, they can be present anywhere in the gland
- STEM CELLS : helps in repair (post gastric etc)

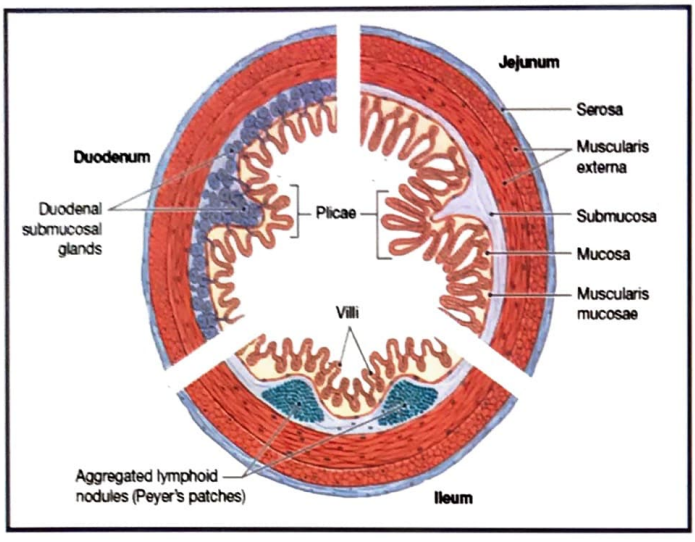
SMALL INTESTINE

00:19:49

- DUODENUM: acidic chyme, H.P. duct opens in 2nd part
- JEJUNUM : has finger like villi & microvilli (which give striated border)
- ILEUM (has peyer's patch)-has leaf like villiABSORPTION by (more in jejunum, towards ileum)

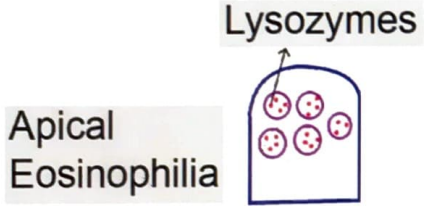
1. PLICAE CIRCULARES
- Mucosal folds increase SA

2. VILLI & MICROVILLI
- Absent in stomach + L.I



Common Features
- MUCOSA
- SUB MUCOSA
- MUSCULARIS EXTERNA
- SEROSA

Intestine glands (crypts of Lieber Kuhn)



Cells

> **Important Information**
> - Duodenum: Brunner's gland (in submucosa)
> - Ileum: Peyer's patches (In lamina propria)
> - Jejunum: Neither Brunner's nor Peyer's

1. ENTEROCYTE
- Columnar cell
- Helps in absorption

2. GOBLET CELL
- Secretes mucus

3. PANETH CELL
- Provides immunity (kills amoeba & bacteria)
- Secretes sytokines
- Maintains intestinal flora
- APICAL EOSINOPHILLIA (dark pink apex)
- Due to lysozymes (cytokines are present inside them TNF-a)

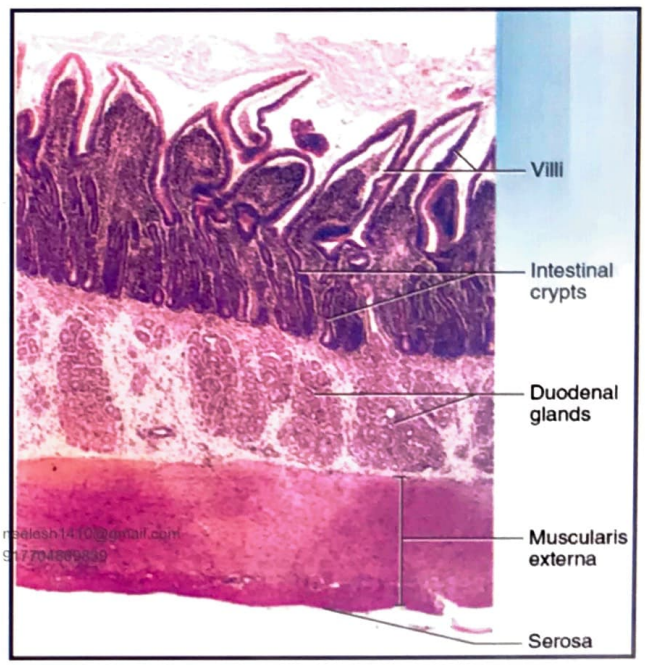
4. M. CELL
- MICROFOLD CELL
- APC

5. NEC
- Secretes hormones, CCK

6. STEM CELL
- Pleuriopotent- helps in repairing the epithelium

> **Previous Year's Questions**
>
> Q. All found in small intestine except
> A. Stem cell – towards the base
> B. Goblet cell
> C. Neck cell – stomach
> D. Paneth cell

DUODENUM
- VILLI : ↑SA
- MICROVILLI : Straited border
- INTESTINAL CRYPTS : Forms glands



Duodenum Glands

00:25:45

- BRUNNER's GLANDS
- Present in sub mucosa of proximal duodenum
- Secretes URO-GASTRONE / HEGF
  - ↓Parietal activity duodenal ulcer
  - ↑Mitotic activity heals duodenal ulcer

Important Information

- Submucosal glands are also seen in esophagus [which usually are not present in GIT].

Previous Year's Questions

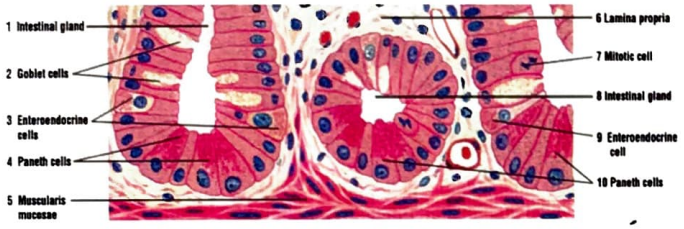
Q. All are true about BRUNNER'S GLAND EXCEPT

A. Sub mucosal glands

B. Secretes urogastrone, which inhibit gastric HCL production

C. Secretes human epidermal growth factor (HEGF)

D. Present in lower duodenum



Q. PANETH CELL : present towards Base (fundus) of the gland

- Dark pink apex
- Release TNF- Destroy excess pathogens
- Maintain intestine flora

LARGE INTESTINE CELLS

00:32:40

COLONOCYTES

- Columnar
- Absorbs water, electrolytes & vitamins

Goblet Cells

- No. of goblet cell keep increasing
- More distal, more no.
- Lubricates fecal matter with mucin

On gross anatomy

- L.I is identified by haustrations, Taenia coli (3)

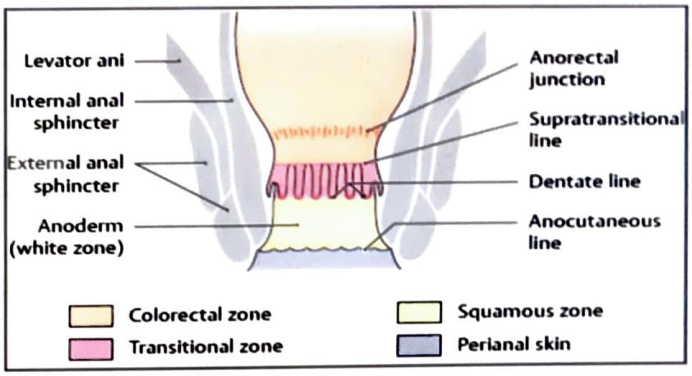
Anal Canal

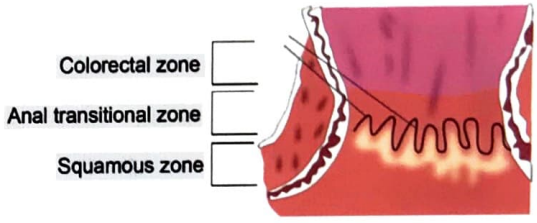
Dentate Line

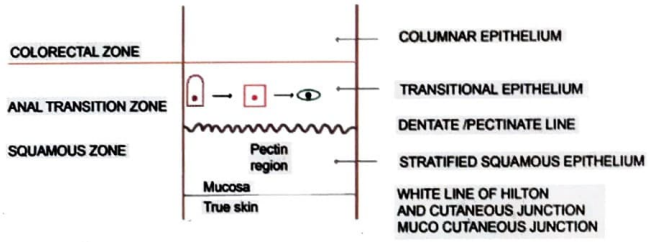
- Squamo columnar junction
- Below to it : squamous zone
- Above to it : transitional zone colorectal / columnar zone

Anal Transitional Zone

- Columnar →Cuboidal →Squamous







WHITE LINE OF HILTON / AND CUTANEOUS / MUCO CUTANEOUS JUNCTION

Pecten Region

- Present above the white line
- Lined by stratified squamous non – keratinized (wet) epithelium

Below white line

- Lined by stratified squamous keratinized epithelium (dry)
- Sweat & sebaceous glands present

Previous Year's Questions

Q. Lining epithelium of anal canal below pectinate line is
A. Columnar epithelium
B. Transitional epithelium
C. Non-keratinized stratified squamous epithelium
D. Keratinized stratified squamous epithelium

LIVER ARCHITECTURE

00:41:45

Dual Blood Supply

- HEPATIC ARTERY : Carries O_2
- PORTAL VEIN : Carries nutrients

Portal Triad

- HEPATIC ARTERY
- PORTAL VEIN
- BILE DUCT

Important Information

DAV structures
- Duct: Bile Duct
- Artery: Hepatic artery
- Vein: portal vein

CENTRAL VEIN : Receives nutrients from portal vein

CIRCULATION OF NUTRIENTS

INTESTINE→PORTAL VEIN→HEPATOCYTES →CENTRAL VEIN

↓

(IVC) SYSTEMIC CIRCULATION←HEPATIC VEIN

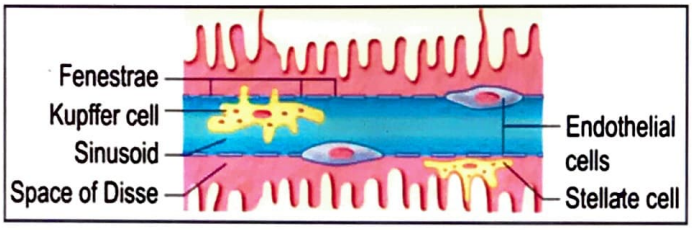
Hepatocytes form bile

Hepatic Sinusoids

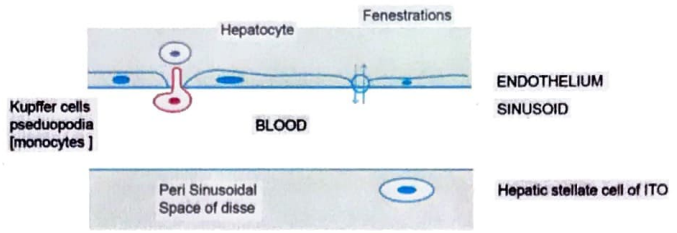
- Fenestrated →non continuous endothelium
- Helps in transfer of contents into PERI SINUSOIDAL SPACE OF DISSE

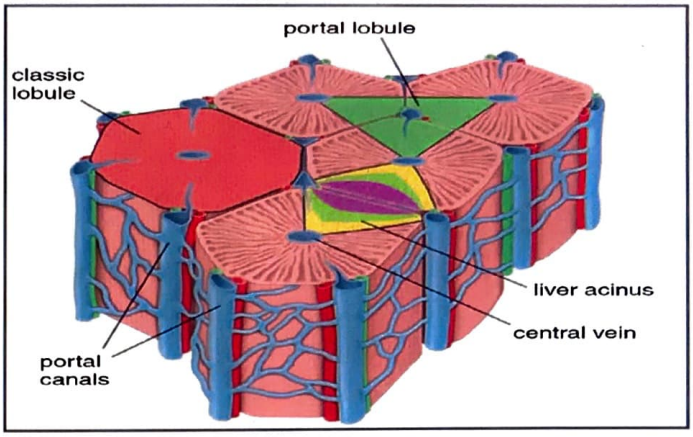
  STELLATE CELL OF ITO- helps in absorption of Vit, A,D

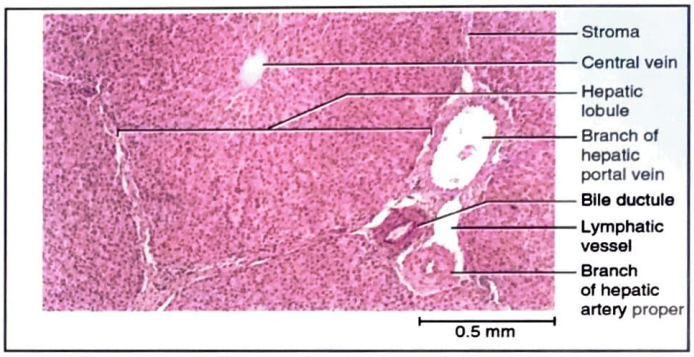
KUPFFER CELLS



- Present with in sinusoids
- Monocyte
- Phagocytic
- Pseudopodia aids in capture of antigens

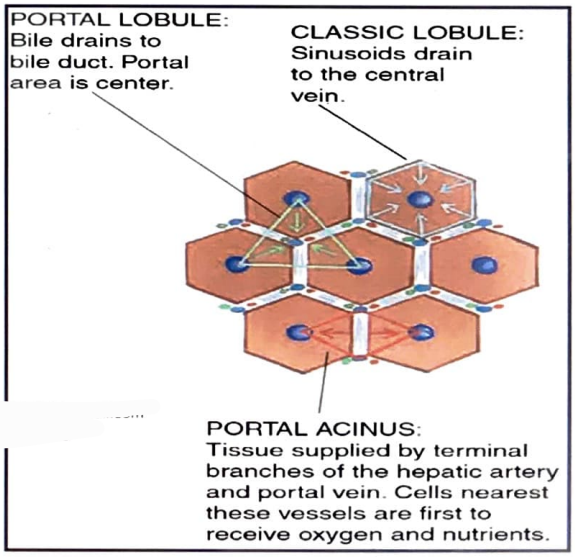






LIVER HISTOLOGY

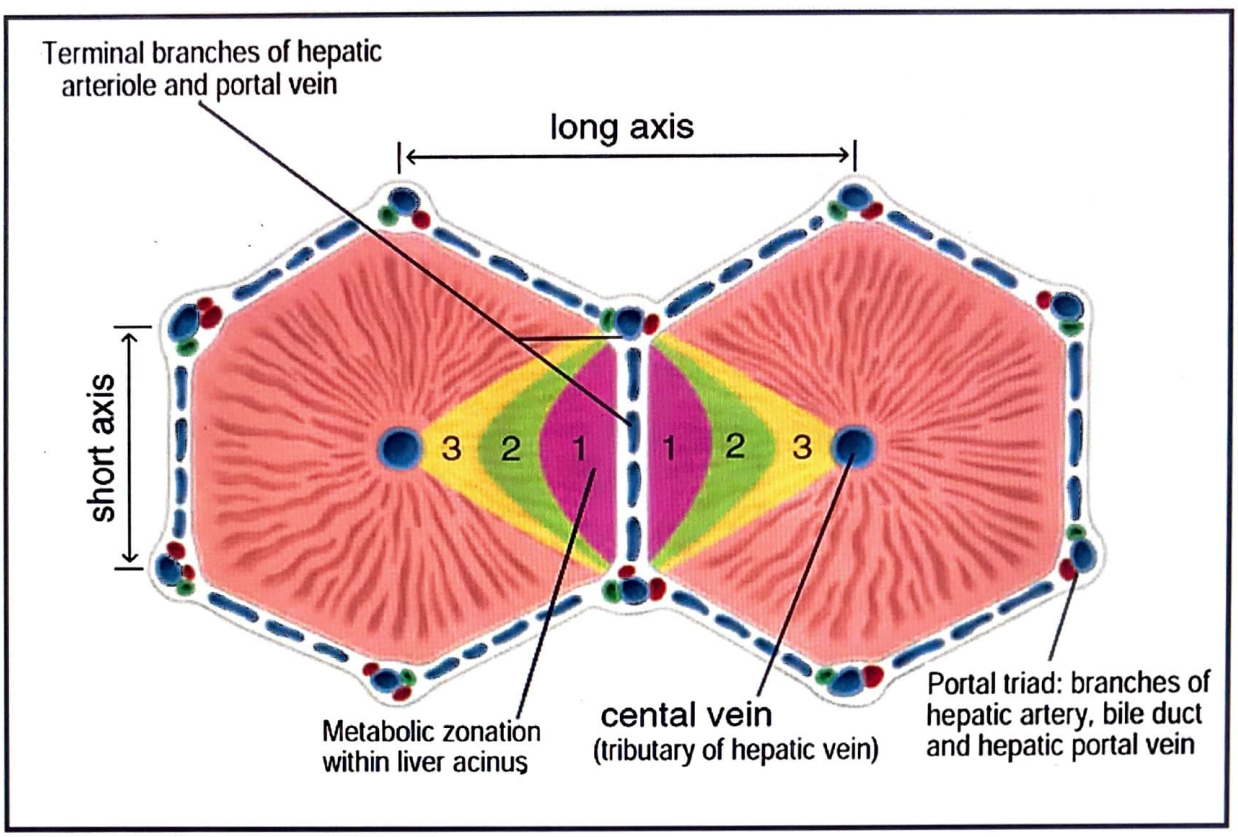
- Hepatic veins (metabolites)



LOUBLE / ACINI

CLASSIC LOBULE

- Hexagonal
- Central vein is present at centre
- Triads are at periphery
- Triangular
- Centered on portal triads
- At sides, 3 central veins



Portal Acinus

Widely accepted concept

- Depends upon blood carried by branches of hepatic artery & portal vein
- At sides, central vein on one side and portal triad on other side diagonally
- Tell us about zones of ischemia or toxic injury

Area 1- high oxygenated, more affected by toxins

Area 2- less oxygenated, less affected by toxins

Area 3- least oxygenated, least affected by toxins

22 URINARY SYSTEM

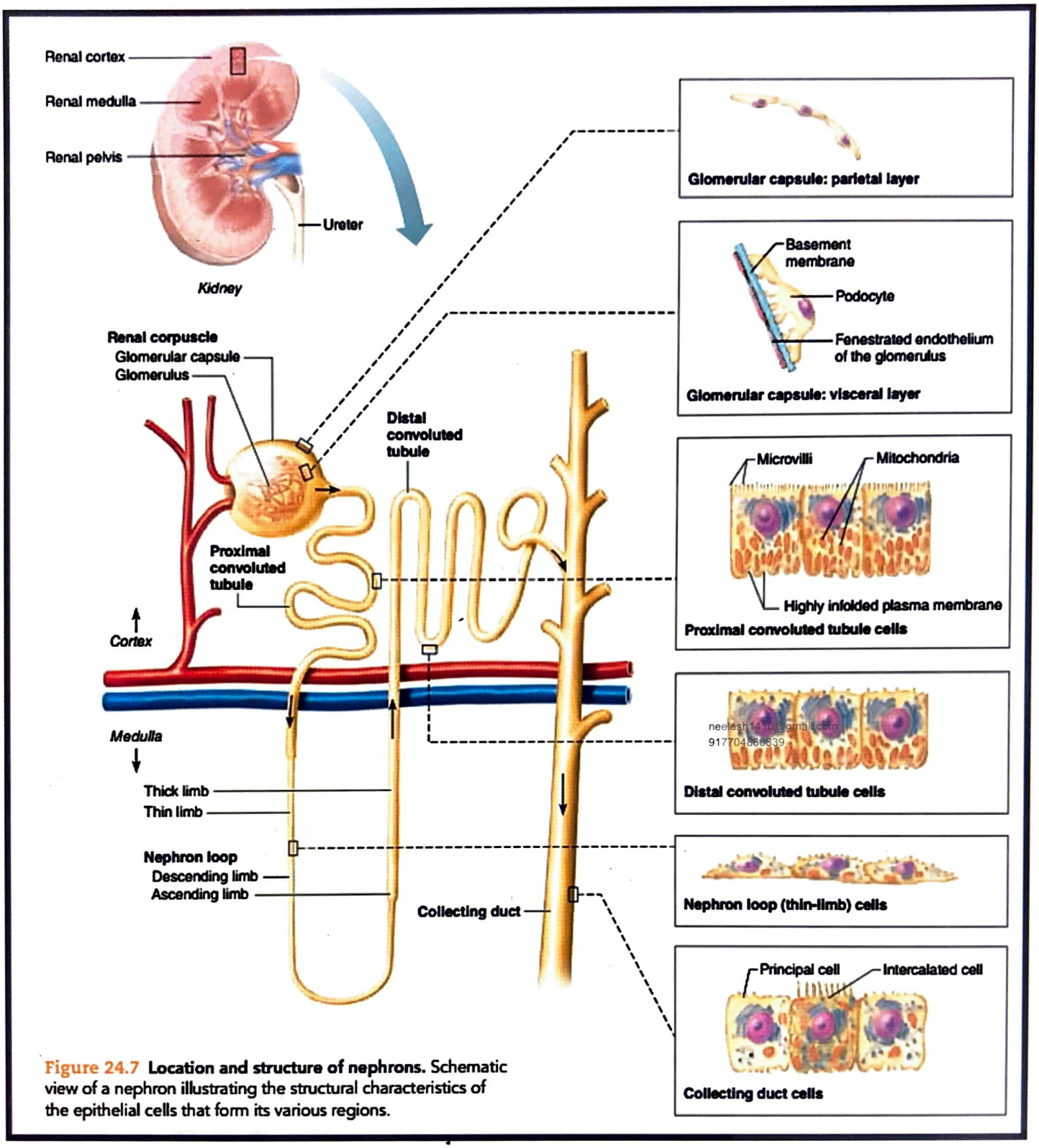
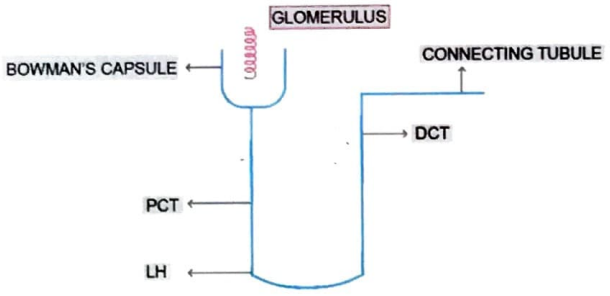


Figure 24.7 Location and structure of nephrons. Schematic view of a nephron illustrating the structural characteristics of the epithelial cells that form its various regions.

- Two portions
  - Excretory [nephron based → forming urine]
  - Collecting portion
- Endothelium of glomerulus or bowman capsule, loop of Henle : simple squamous
- PCT, DCT: Cuboidal epithelium
  - PCT: has more microvilli so it becomes striated
  - DCT: has less microvilli so not striated
- Collecting duct: Columnar epithelium.



URINE

- Ultra filtration of blood by GLOMERULUS [capillary plexus]
- Collected by Bowman's Capsule

LOOP OF HENLE

- At least level of descending & ascending limb low cuboidal epithelium

PCT

- Irregularly arranged brush border microvilli present [for absorption]
  (solid bullet) DCT - less/no microvilli - No brush border

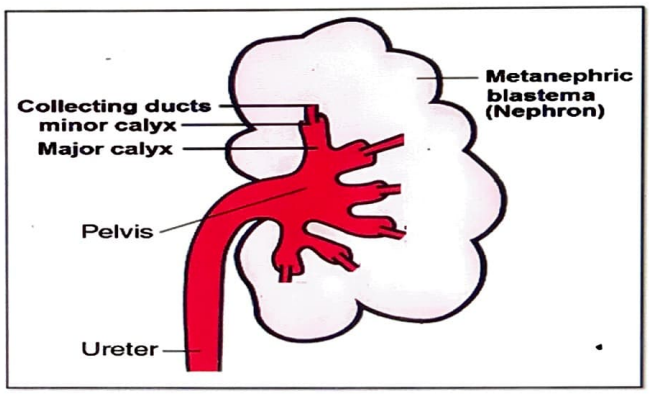
Transitional epithelium

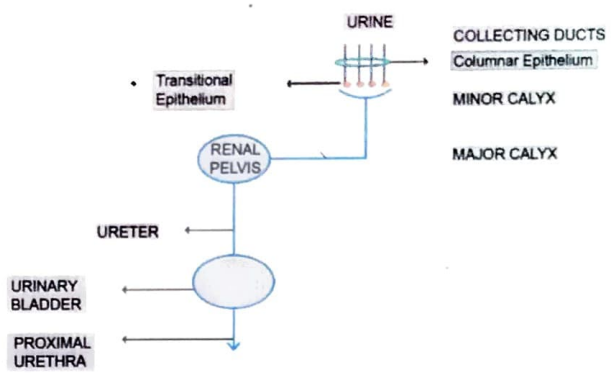
00:05:59

- Begins at tip of CD
- Terminates at proximal urethra

In Female:

Proximal urethra → Transitional epithelium
Distal urethra →Stratified squamous epithelium





MALE URETHRA

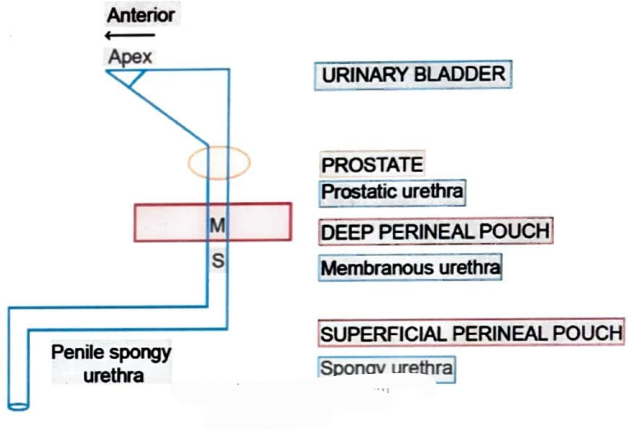
00:09:30

- **20 cm long**

Previous Year's Questions

Q. Transitional epithelium lines all except?
(NEET - Jan - 2020)

A. Minor calyx
B. Renal Pelvis
C. Ureter
D. Membranous Urethra



- Bulbar spongy (small)
- Penile spongy (non- keratinized)

  - Tip of male urethra-Stratified squamous epithelium
  - Transitional epithelium-line urinary bladder & till proximal half of prostatic urethra

Major part of male urethra line by-stratified columnar epithelium > pseudostratified columnar

Q. Urothelium lines all except
a. Urethra
b. Calyces
c. Urinary bladder
d. Membranous urethra stratified/ pseudo stratified columnar epithelium

23 GENITAL SYSTEM

Male reproductive system

TESTIS

00:00:14

SEMINIFEROUS TUBULES – spermatogenesis occurs

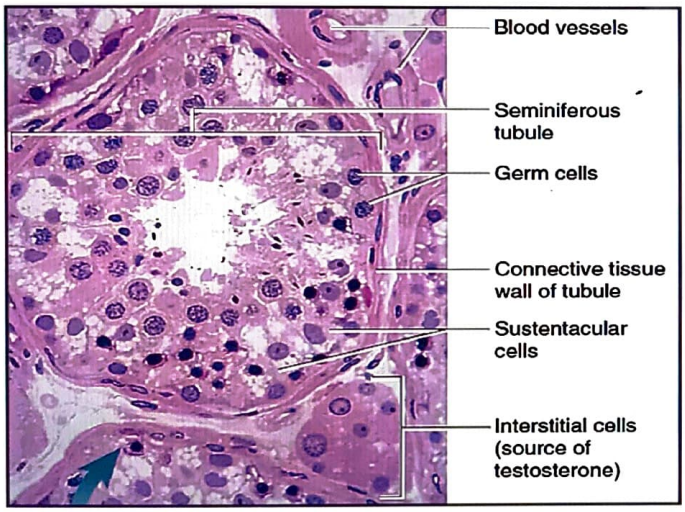
Cells:

1. SERTOLI CELL
   - Nurse cell [supports gametocytes]
   - Secreted INHIBIN/MIS[Mullerianinh. Substances]
2. LEYDIG CELL
   - Secretes TESTOSTERONE

HISTOLOGY

00:01:51

- Sperms are found in Lumen
- Peripherally:
  PGC most peripheral
- Gametogonium
- Gametocytes



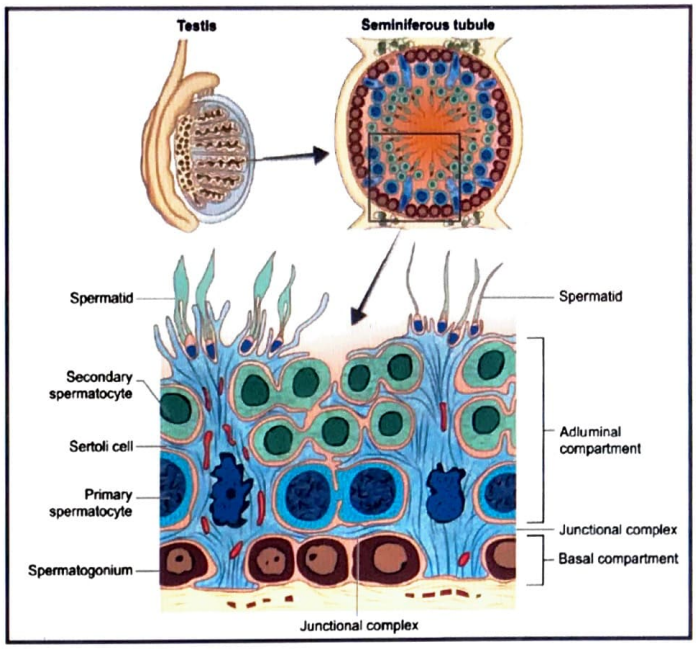
SUSTENTACULAR / SERTOLI CELLS

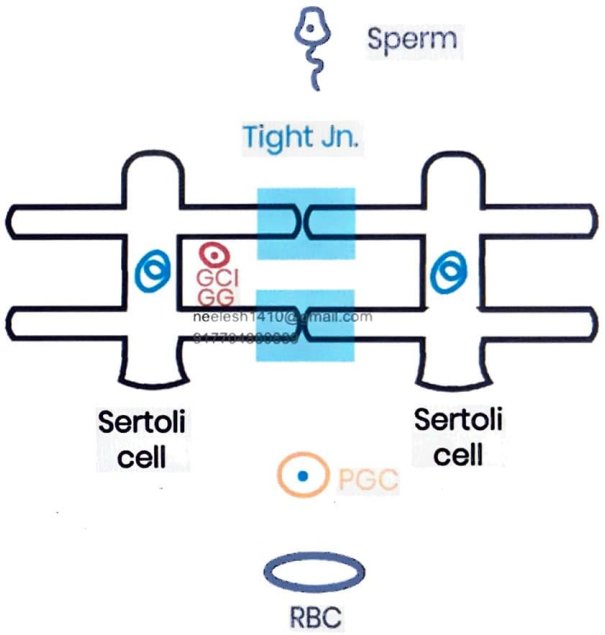
- Around the semiferous tubule,
  INTERSTITIAL/ LEYDIG CELL present

BLOOD TESTIS BARRIER

00:04:26

- Separates sperms from blood
- Strengthened by sertoli cells by forming strong intercellular junctions
- Permeable to PGC, GG/GC SEMI PERMEABLE



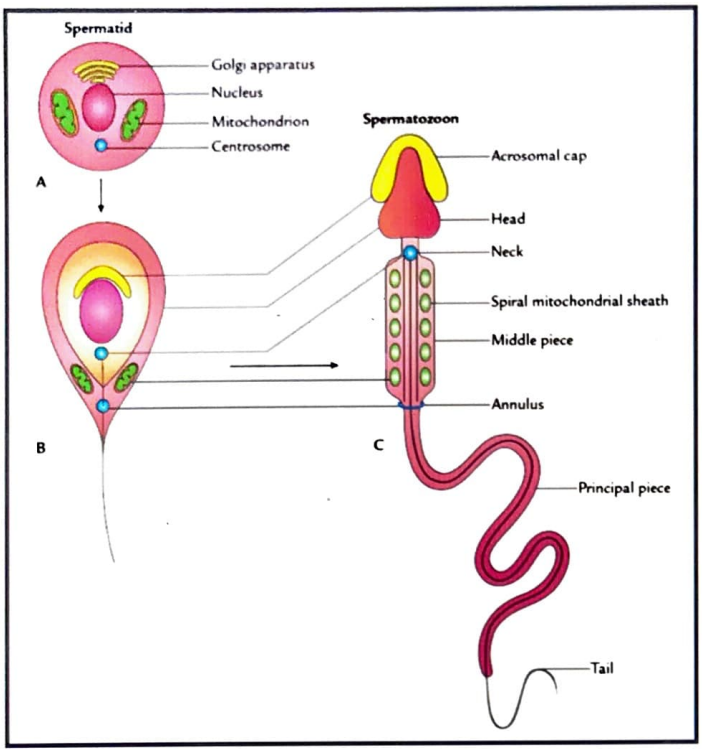


SPERM – STRUCTURE

00:08:27

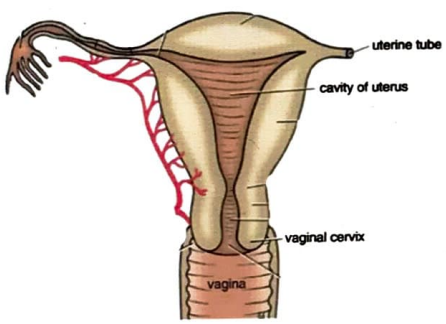
- Golgi apparatus forms ACROSOME
- Acrosome has lytic enzymes – helps in penetration of (ACROSIN) ZonaPellucida
- NUCLEUS present in head of sperm
  - Carries chromosome into oocyte

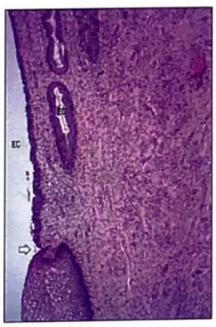
- CENTRIOLES [microtubules]
  - Helps in formation of long cilia [Tail of sperms] / flagella [misomer]
- Mitochondria
  - Present in middle piece
  - Power house of the cell



FEMALE REPRODUCTIVE SYSTEM 00:11:08

- MAMMARY GLAND Modified apocrine sweat gland
- Ovary lined by cuboidal epithelium
- Uterus lined by columnar epithelium
- Vagina lined by squamous epithelium





UTERINE CERVIX 00:12:06

Squamo–columnar junction

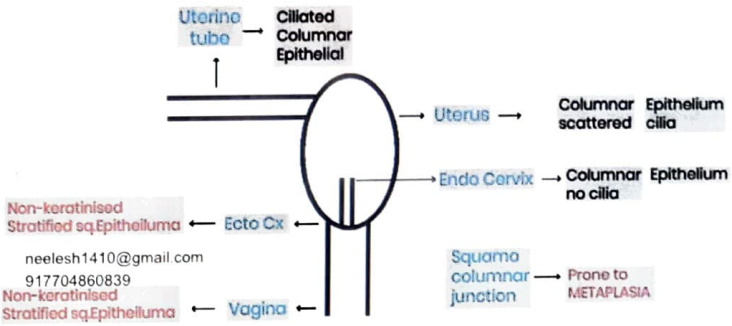
- Prone to cancer
- On Bx, columnar epithelium with stratified Squamous epithelium – METAPLASIA

ENDO CERVIX lined by columnar epithelium

ECTO CERVIX lined by stratified squamous epithelium

→ Ratio of connective tissue: smooth muscle = 8:2

Ratio of connective tissue: smooth muscle



KARTAGENER SYNDROME [immotile cilia syndrome]

- Cilia are absent
- Leads to infertility in female
- Also leads to ectopic pregnancy

VAGINA

- Has no glands, no muscularis mucosa.
- Wet due to trasudation [highly vascular]
- Cx gland secretion

Q. lining epithelium of vagina is

a. Pseudo stratified columnar epithelium

b. keratinized stratified squamous epithelium

c. non-keratinized stratified squamous epithelium

d. ciliated columnar epithelium – uterine tube

CLINICAL QUESTIONS

Connective Tissue

Q. During the histology practical examination, a slide of a cartilage is placed. The question reads as follows- "The type of cartilage shown in the image does not have perichondrium and collagen is more visible than chondrocytes. Identify and mention a location where it is present."
You identify it is fibrocartilage. Which of the following locations do you think fibrocartilage is present in?

A. Costal cartilage
B. Nasal septum
C. Intervertebral disc
D. Auditory tube
E. Pinna

Answer: C
Solution

- **Fibrocartilage** is shock absorber which provides strength to cartilage and is found in Intervertebral disc.
- **Costal cartilage** and **nasal septum** are made up of **Hyaline Cartilage**.
- **Auditory tube** has **elastic cartilage.**

Reference: Textbook of human histology by Inderbir Singh 9th Ed pg no. 96

Digestive system

Q. A 28 year old G2P1 mother gave birth to a male healthy infant without any complications during delivery. However, there was no passage of meconium for the next the 36 hours, feed attempts resulted in bilious vomiting. The abdomen is distended with hypoactive bowel sounds and reducible umbilical hernia with a patent anal canal. You have a diagnosis at this point of the stage, in the suspected disorder, which among the following ganglia is absent ?

A. Auerbach's plexus
B. Meissner's plexus
C. Lumbar plexus
D. Sacral plexus
E. Brachial plexus

Answer: A
Solution

HIRSCHPRUNG DISEASE

- No migration of neural crest cells into distal intestine
- No ganglia
- Fecal retention causing megacolon
- Also known as congenital agangliamegacolon
- Ganglia missing Auerbach's >> Meissner's plexus

Reference: Langman's Medical Embryology, Twelfth Edition, page 230

LEARNING OBJECTIVES

UNIT 3 OSTEOLOGY AND ARTHROLOGY

OSTEOLOGY

- Long Bone Parts
- Bone Ossification
- Bone Structure - Histology
- Bone And Cartilage Difference

ARTHROLOGY

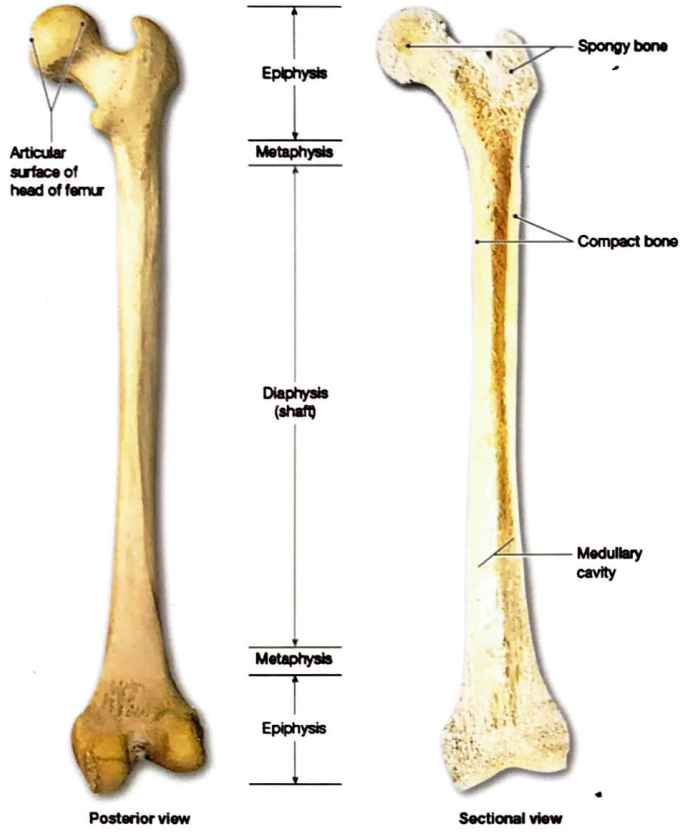
- Schindylesis
- Classification
- Joint Classification: Freedom Of Mobility

24 OSTEOLOGY

LONG BONE PARTS

00:00:18

- **DIAPHYSIS [shaft]**→ 1 in number derived from
  - PRIMARY OSSIFICATION CENTRE
  - Present from 6-8 weeks of IUL
- **EPIPHYSIS [ENDS]**→> 1 in number derived from
  - SECONDARY OSSIFICATION CENTRE
  - appear at growth birth
- **METAPHYSIS**
  - Epiphyseal end of DIAPHYSIS
  - Appears at growth plate
- **CANCELLOUS BONE/ SPONGY BONE**
  - Present at ends & near Bone marrow
- **COMPACT BONE/CORTICAL BONE**
  - Present at shaft



BONE OSSIFICATION

00:02:40

ENDOCHONDRAL

- Most bones → Hyaline cartilage model, skull base

MEMBRANOUS

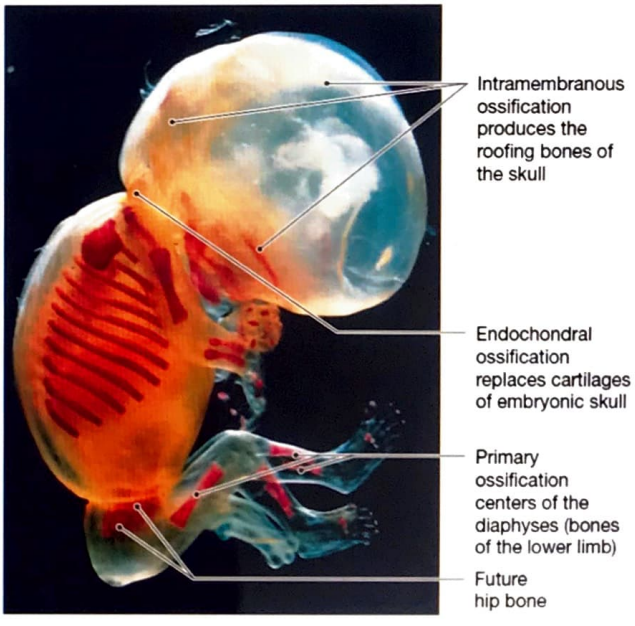
- Few skull bones [cap]
- Clavicle Bone [partly]

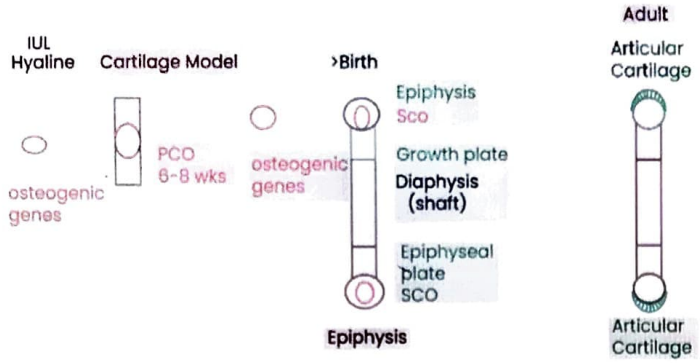
ENDOCHONDRAL OSSIFICATION

- Most of bones start with HYALINE CARTILAGE MODEL
- Develops PCO in 6-8 wks of IUL→develops into diaphysis
- Sec. centre ossification appears after birth & forms ends & multiple in number
- Some hyaline cartilage persists→growth plate/ epiphyseal plate

This also replaced by newly formed METAPHYSIS

- Some hyaline cartilage persists as ARTICULAR CARTILAGE at ends articular cartilage never ossifres
  - Makes ends of the Bone smooth facilitates smooth movements at synovial joints
  - During aging, undergo osteo arthritis
  - Do not have perichondrium





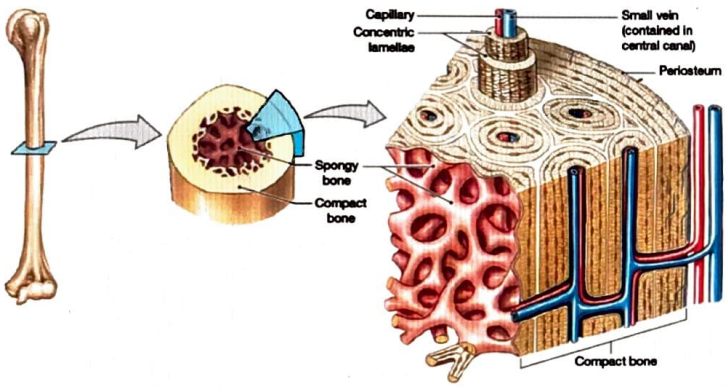
BONE STRUCTURE - HISTOLOGY

00:11:57

- ENDOSTEUM → inside, lining the Bone marrow
  → cells present towards it
- PERIOSTEUM → on ext. surface
  → perichondrium present towards it
- NEUROVASCULAR BUNDLE is passing in HAVERSIAN CANAL
- Haversian canals connect with each other with VOLKMAN'S CANAL
- Compact Bone have CONCENTRIC LAMELLAE

CONCENTRIC LAMELLAE

- Haversian canal is present in its centre
- Osteocytes are present in lacunae
- CANALICULI processes of osteocytes
  CENTRAL CANAL consists of blood vessels



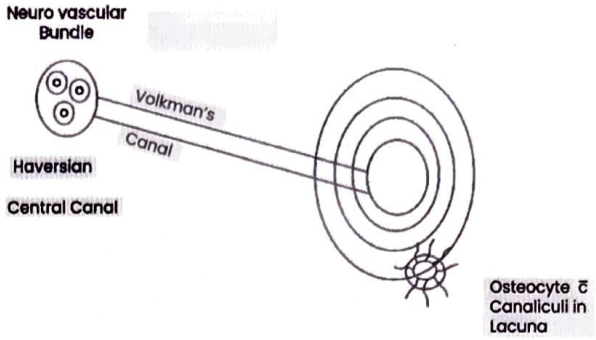
CELLS

OSTEOPROGENITOR CELLS

- Bone cell
- Stem cells
- gives OSTEOBLAST
  - Involved in bone formation (Osteoid) (Osteogenesis)
  - OSTEOCYTE
    - Older version of osteoblast
    - Do not form
    - Assist in maintenance of bone

OSTEOBLAST

- Blood cell
- Several monocytes multinucleated cell [osteoclast]
- Responsible for Bone resorption
  Canaliculi help in diffusion of metabolites [gases, nutrients]



Bone and cartilage difference

00:18:56

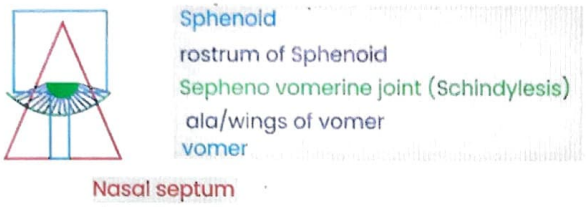
Characteristic	Cartilage	Bone
Celle	Chondrocytes in lacunae	Osteocytes in lacunae
Matrix	Chondroitin sulfates with proteins, forming hydrated proteoglycans	Insoluble crystals of calcium phosphate and calcium carbonate
fibers	Collagen, elastic, reticular fibers (proportions vary)	Collagen fibers predominate
Vascularity	None & non neural	Extensive
Covering	Perichondrium, two layers	Periosteum, two layers
Repair capabilities	Limited ability	Extensive ability

- Cartilage
  - Type 2 collagen Bone & fibroCartilage
  - Type 1 collagen Fibrocartilage has NV

25 ARTHOLOGY

- TIBULO - FIBULAR JOINT
  - Slightly mobile joint
  - Fibrous joint
  - Desmos fibre

- **SCHINDYLESIS** 00:01:28
  - Spheno vomerine joint at root of nasal cavity



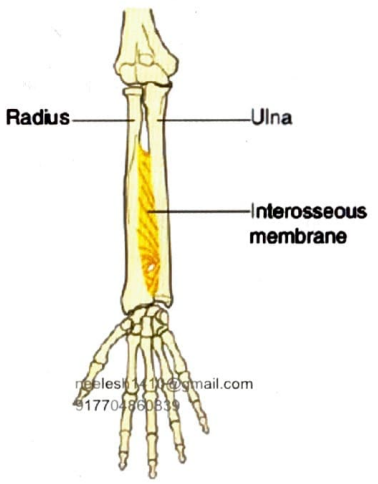
Previous Year's Questions

Q. Inferior tibio fibular joint is
synchondrosis syndesmosis → 1° cartilage joint
symphysis schindylesis → 2° cartilage joint

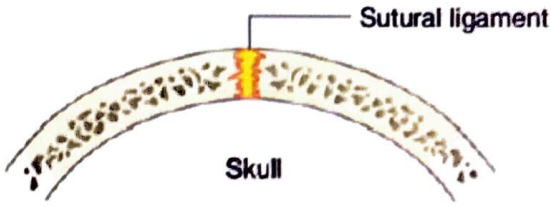
CLASSIFICATION 00:03:11

- FIBROUS JOINTS
  - SUTURES → seen in skull Bone Immobile
  - GOMPHOSIS → seen in skull Bone
  - SYNDESMOSIS → middle radio ulnar joint → slightly mobile

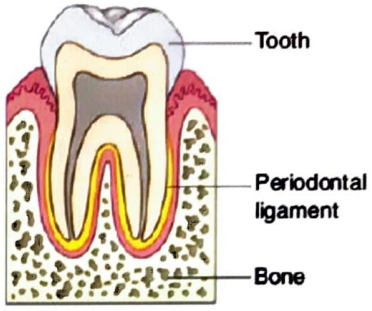
Syndesmosis



Sutures

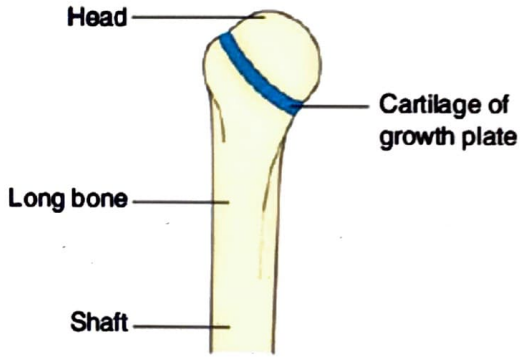


Gomphosis



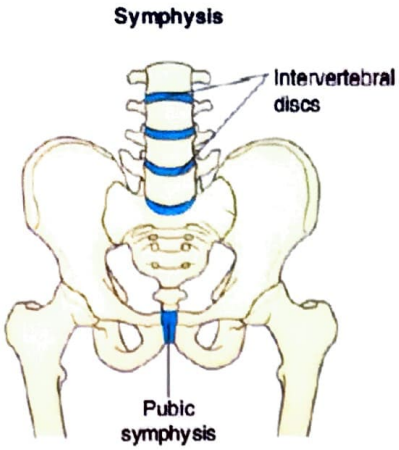
- CARTILAGENOUS JOINT
  - SYNCHODROSIS / 1 CARTILAGENOUS JOINT

Synchondrosis



→ epiphysio diaphyseal joint
→ immobile
→ in adults, they fuse to become
SYNOSTOSIS [no catilage]

  - SYMPHYSIS / 2 CARTILAGENOUS JOINT
    → HYALINE CARTILAGE AND
    → FIBROID CARTILAGE



→ Midline intervertebral disc

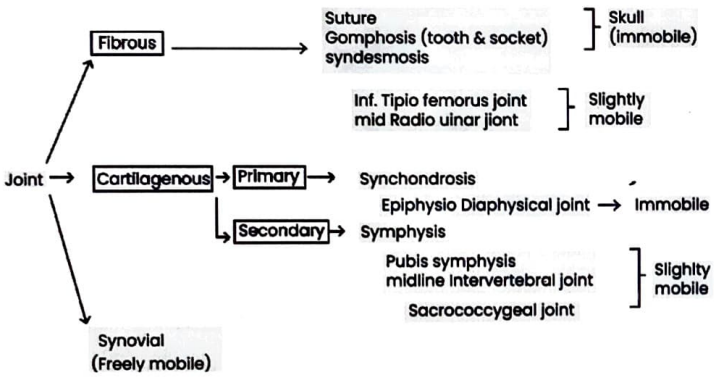
- sacrococcygeal joint
- slightly mobile
- more mobile during term pregnancy

→ PUBIC SYMPHYSIS

- Usually slightly immobile
- Mobility during delivery

JOINT CLASSIFICATION: FREEDOM OF MOBILITY

00:09:28



SYNOVIAL JOINTS

00:13:00

- SADDLE SYNOVIAL JOINTS
  - Malleus & Incus (Middle ear cavity)
  - Sterno clavicular joint (upper limb)
  - 1st capro Meta carpal joints [upper limb]
  - lateral longitudinal arch/ calcaneo cuboid joint [lower limb]
- ELLIPSOID SYNOVIAL JOINT
  - Wrist/ radio carpal jointarticular surface is eplliptical
  - Metacarpophalangeal joints/ knucle joint
  - Atianto occipital joint

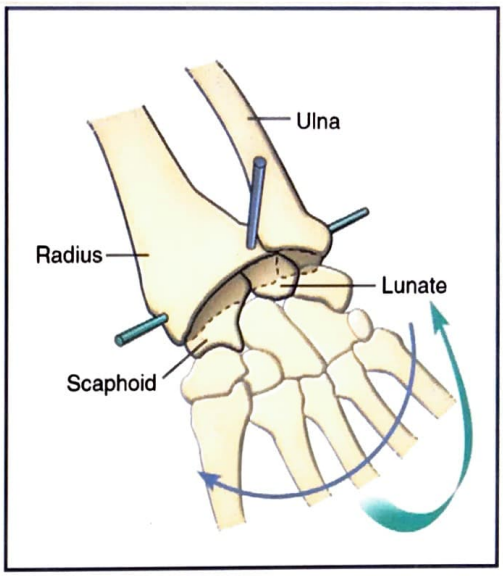
→ joint between skull & 1st vertebra

→ helps in head nod

Previous Year's Questions

Q Which of the following is the type of joints between malleus & Incus?

Primary cartilaginous
Secondary cartilaginous
Saddle synovial
Ball & Socket synovial



- CONDYLAR JOINTS GOOD EXAMPLES
  - Temporo mandibular joint
  - Knee joint
  - Wrist/ Radio carpal joint
- CONDYLAR JOINTS BAD EXAMPLES
  - Metacarpo phalangeal/ knuckle joint poor examples
  - Atlanto occipital joint

Important Information

All above are
funtionally 'ELLIPSOID JOINTS'
All above are structurally 'CONDYLAR JOINTS'
ELLIPSOID JOINT > CONDYLAR JOINTS

Previous Year's Questions

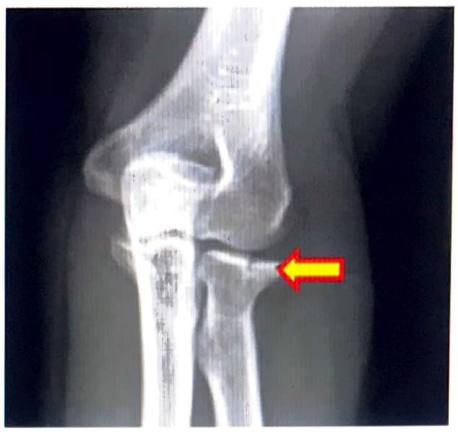
Q. Type of joint present at middle radio-ulnar joint?
(INICET – Nov – 2020)

A. Fibrous
B. primary cartilaginous
C. Secondary cartilaginous
D. Plain synovial

CLINICAL QUESTIONS

Chapter: Osteology

Q. A 33 year old male patient, came in after suffering a fall from the bike. He was riding on the pillion and fell to his left and his elbow had an impact on the ground. He complains of tolerable pain with no associated swelling or reduction of ROM. You order an X-ray to rule out any chance of fracture. The X-Ray turned out to be a normal study (as seen below). You ask the intern what the pointed structure is and her, being a studious person, answers:-



A. Capitulum
B. Olecranon
C. Trochlea
D. Radial head
E. Ulnar

Answer: D

Solution

- The X-ray shows an elbow joint in which the head of the radius is marked seen laterally which articulates with capitulum present on lateral epicondyle on the lower end of the humerus.

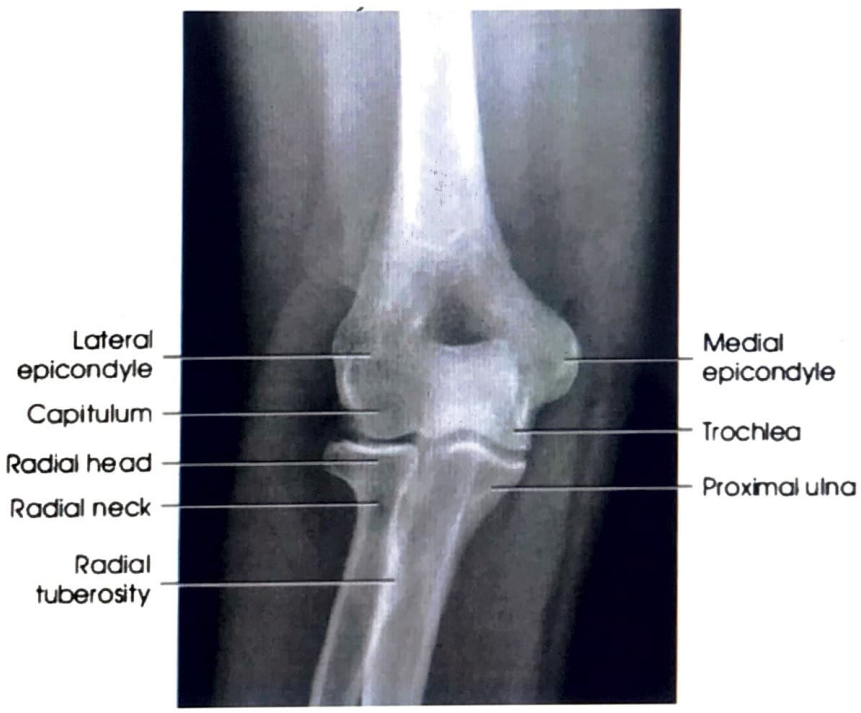


fig:-labeled x-ray of elbow joint

Reference: Grays 41st Edition, *Page nos 870 and 875*

Arthrology

Q. During anatomy viva, the external examiner places a skull bone on the table and asks each student a different kind of question. Your friend was asked which blood vessel passes behind Pterion, while your crush was asked which bones are broken in LeFort II fracture. You frantically go through all topics awaiting your turn. The consultant asks you this question:- "Which type of suture is found between the two parietal bones?"
What would you answer?

A. Serrate
B. Denticulate
C. Squamous
D. Plane
E. Schindylesis

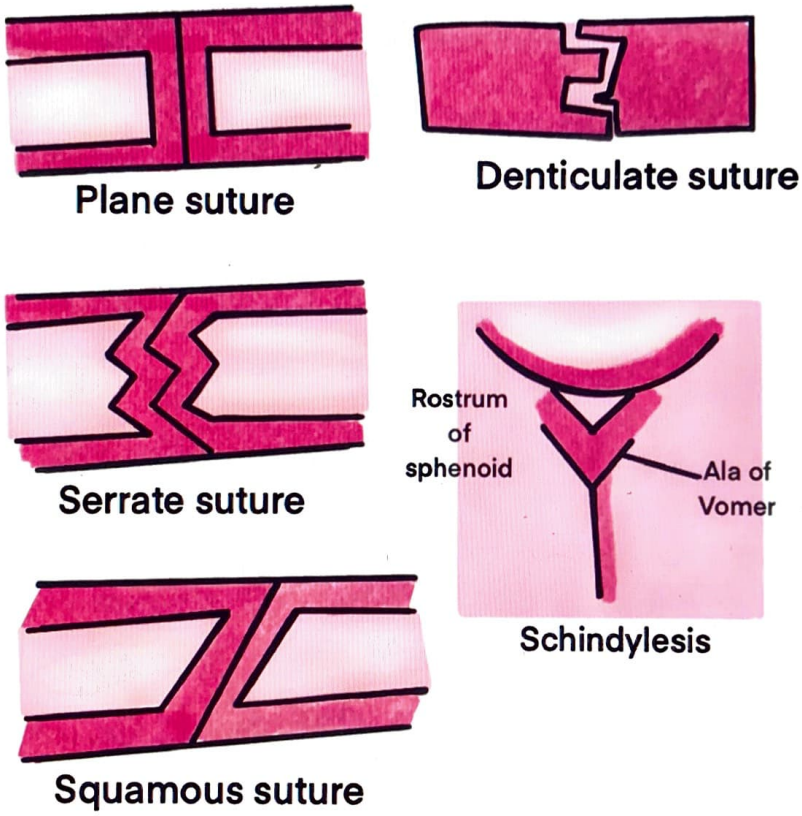
Answer: A

Solution

Types of sutures are as follows:-

1. **Serrate Suture**:- The edges of bones present saw toothed appearance e.g. sagittal suture between two parietal bones.
2. **Denticulate suture**:-The margins present teeth with tips being broader than the roots e.g. lambdoid suture.
3. **Squamous suture**:- Here the edges of bones are united by overlapping e.g. suture between the parietal bone and squamous part of temporal bone.
4. **Plane suture**:- The borders are plane and joined by sutural ligaments e.g. suture between palatine bones of two maxilla.

Note: Schindylesis:-Ridged bone fits into the groove present on a neighboring bone e.g. Vomerosphenoid suture



Reference: Grays 41st Edition pg no.96

LEARNING OBJECTIVES

UNIT 4 NEURO ANATOMY

ORGANIZATION OF NERVOUS SYSTEM
- Grey & White Matter
- Optic Nerve

DEVELOPMENT OF NERVOUS SYSTEM
- Dorsum
- Ectodermal Placodes
- Anencephaly
- Cranio - Rachis - Chisis
- Parts Of Brain
- Development Of Brain : Sagittal View
- Papez Circuit
- Cerebrum & Ventricles
- Brain- Coronal Section

THIRD VENTRICLE
- Sagittal Section
- Structures In Lateral Wall Of 3rd Ventricle

FOURTH VENTRICLE
- Structures and relations in 4th Ventricle Ventricle
- Medial Medullary Syndrome

WHITE MATTER
- Types Of Fibres
- Corpus Callosum

NEURAL COLUMNS
- Motor Components
- Sensory Components
- Alar & Basal Plates
- Polio Virus Lesions
- Seven Neural Columns

CEREBRUM
- Sulci & Lobes
- Cerebrum Homunculus; Medical View
- Brodmann Number
- Language Areas

- **BASAL GANGLIA**
  - Nuclei
  - Superior View Of The Brain
  - Internal Capsule
  - Extra Pyramidal Symptoms

- **INTERNAL CAPSULE**
  - Artery Supply
  - Internal Capsule

- **THALAMUS AND HYPOTHALAMUS**
  - Thalamus
  - Hypothalamus
  - Mammillary Body
  - Paraventricular & Supraoptic Nuclei

- **BRAIN STEM AND CRANIAL NERVE NUCLEI**
  - Cranial Nerves
  - Brain Stem
  - Brain Stem & CN Nuclei
  - Wallenberg Syndrome
  - CN V [Trigeminal Nerve] Nuclei

- **NEURAL COLUMNS AND BRAINSTEM NUCLEI**
  - Motor and sensory components
  - Arches and nerves

- **CEREBELLUM**
  - Cerebellar Ataxia
  - Cerebellum
  - Cerebellar Pathway
  - Deep Cerebellar Nuclei [DEFG]
  - Cells In Cerebellar Cortex
  - Cerebellar Afferent Pathways

- **SPINAL CORD**
  - BROWN SEQUARD SYNDROME
  - Spinal Cord Transverse section
  - Spino-thalamic tract - Spinal Lemniscal system
  - Pyramidal tract

- **AUTONOMIC NERVOUS SYSTEM**
  - Sympathetic And Parasympathetic Nervous System
  - Comparison Between Parasympathetic &
  - Sympathetic Nervous System
  - Horner Syndrome

- **US SYSTEM**

- **ARTERIAL SUPPLY OF BRAIN**
  - Circle Of Willis

- Basilar Artery
- Cortical Blindness
- Wallenberg Syndrome
- Medulla Oblongata Branches
- INTERNAL CAPSULE ARTERIAL SUPPLY

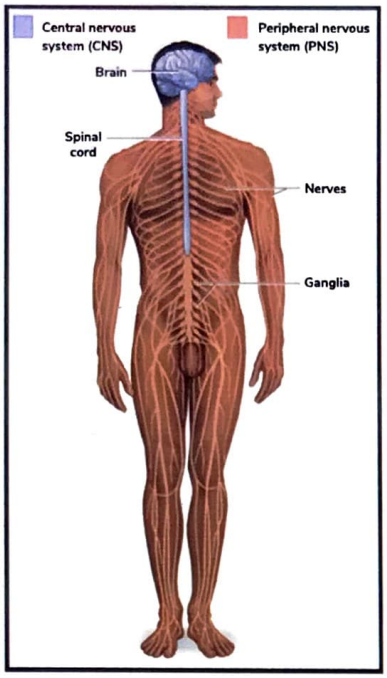
BRAIN STEM LESIONS

- Pons - Transverse Section
- Medulla Oblongata Transverse Section
- Lateral Brain Stem Lesions;Wallenberg Syndrome
- Medial Medullary Syndrome

VENOUS DRAINAGE OF CRANIAL CAVITY

- Dural Venous Sinuses
- Falx Cerebri
- Dural Venous Folds & Sinuses
- Dangerous Area Of Face

26 ORGANIZATION OF NERVOUS SYSTEM

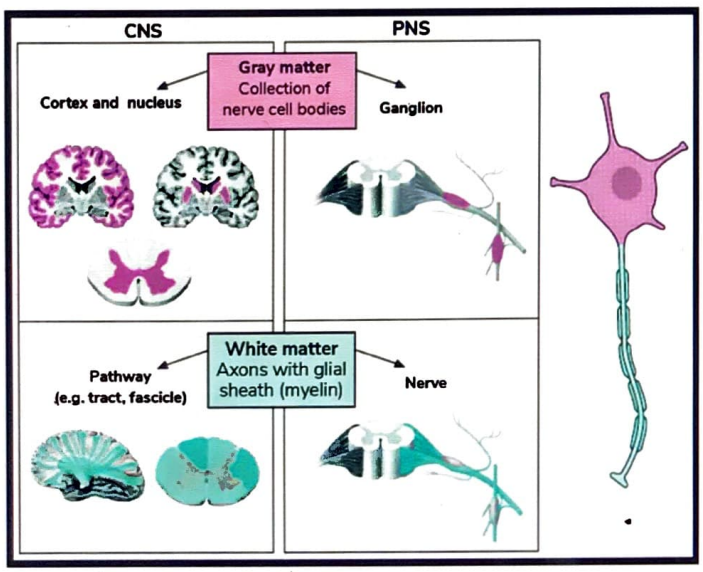


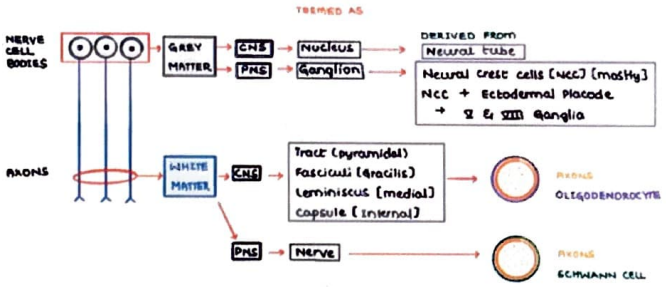
- PNS → contributed by NCC [Neural crest cell]
- CNS → contributed by neural tube

GREY & WHITE MATTER

00:00:56

- GREY MATTER → Collection of neuron bodies from CNS & PNS
- WHITE MATTER → Collection of Axons from CNS & PNS



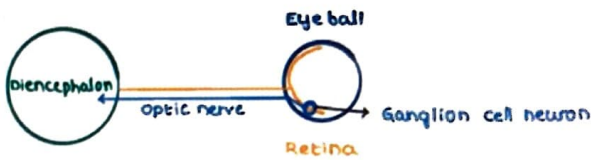


- MISNOMER
- Basal nucleus [present in CNS]

OPTIC NERVE

00:09:40

Misnomer



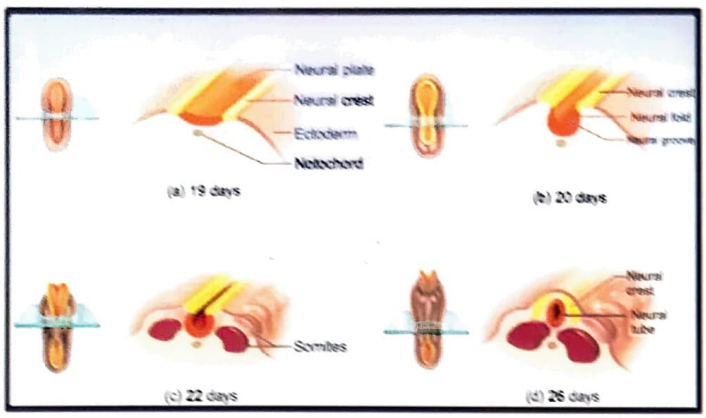
- Retina is the extension of diencephalon [CNS]
- Ganglion cell neuron in retina collecting visual information towards CNS by optical nerve [CNS tract]
- Optical nerve myelinated by oligodendrocytes
- If injured, NERVE REGENERATE [No schwann cell]

MULTIPLE SCLEROSIS
CNS MYELINATION → spare peripheral NEURON. SCHWANN CELL

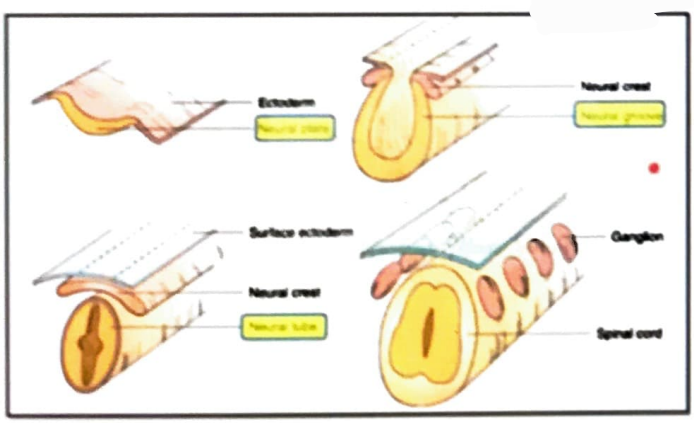
27 DEVELOPMENT OF NERVOUS SYSTEM

DORSUM

00:00:23



- At the dorsum of baby, a plate develops called Neural plate
- Neural plate develops to form neural groove and later neural tube
- Two neural pores are formed: Cranial and caudal neuropore
- Cranial Neuropore closure -At day 25 (Leading to formation of brain)
- Caudal Neuropore closure - At day 28 (Leading to formation of spinal cord)



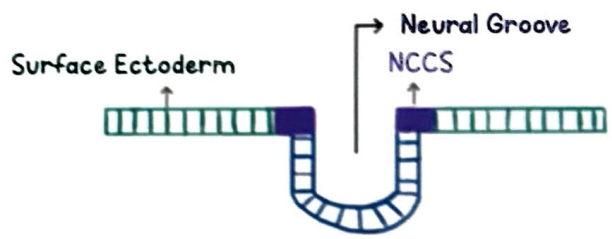
- Dorsum of baby & T. Section seen Dorsum of baby
- NOTOCHORD stimulated overlying ectoderm → Neural plate ectoderm → CNS
- SURFACE ECTODERM → skin epidermis
- NCC → peripheral nervous system

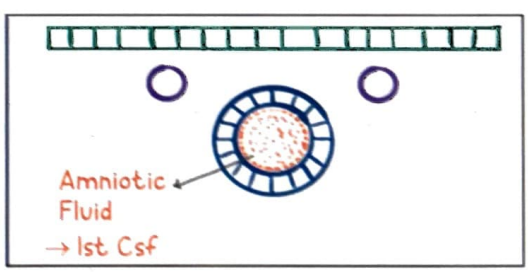
Cut section of developing brain

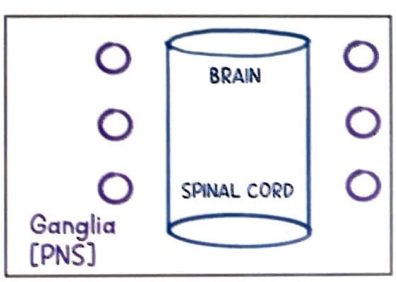
- Notochord stimulates overlying ectoderm-it forms neural plate ectoderm- neural groove and neural tube.
- Neural groove detaches themselves to form Neural tube
- Neural tube in cranial part forms the brain and caudal part will form the Spinal cord
- Peripheral nervous system:Neural crest cells detach themselves from the dorsal side (periphery) and lie on the dorso lateral to neural tube forming dorsal root ganglia,sympathetic and parasympathetic ganglia, Preaortic and paraaortic ganglia come from neural Crest cell.
- Sometimes Cranial and caudal neuropores do not close leading to open Neural tube defects
- If Anterior Neuropore do not close: Anencephaly
- If Posterior Neuropore do not close: Rachischisis

CSF

- 1st CSF formed by amniotic fluid
- once ventricles are formed, CSF formed by choroid plexus







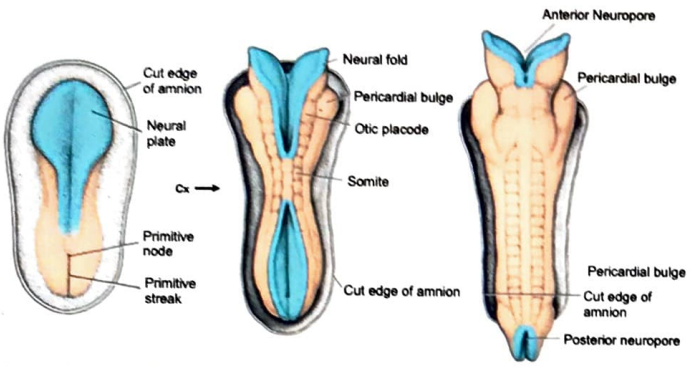
Ectodermal Placodes

00:07:41

- Develop from junction of surface ectoderm & neural plate ectoderm & distribution in surface ectoderm
- Contributes to trigeminal (V) & vestibulo cochlear (VIII) ganglia along with NCCs
- Neural Plate → Neural Groove → Neural Tube

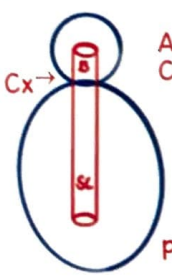
Neural Tube Formation

- On day 20, fusion at cervical occipital region occurs forming first pair of somites [Neural tube formation begins]
- Continues upwards & down wards → forms neural tube
- Anterior neuropore closes by [illegible]
- Posterior neuropore closes by Day 28



Neural Tube Defects

- Mother have ↑αFP
  - ↑Acetylcholinesterase
- ANENCEPHALY → non fusion of ant. pore
- RACHISCHISIS → non fusion of posts. pore



Ant. neuropore/ [closes by DAY 25]
Cranial neuropore

post./caudal neuropore [closes by DAY 28]

ANENCEPHALY

00:14:15

- Brain is small / degenerated/ exposed
- Skull cap is missing [defect]
- Swallow reflex lost leading to polyhydramnios

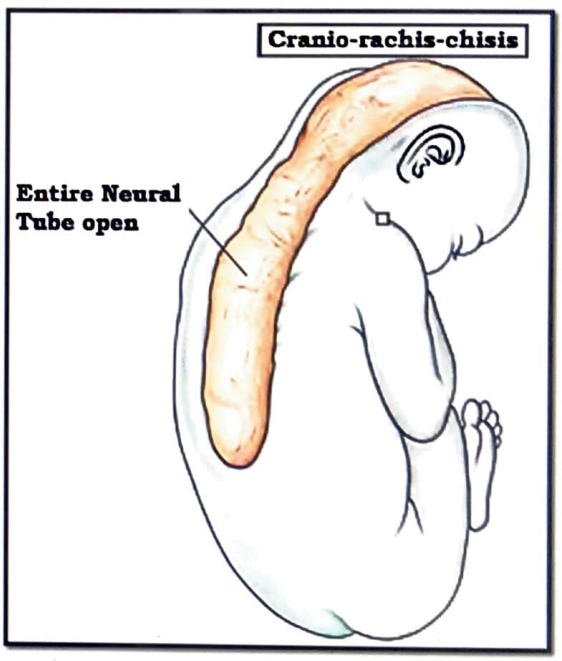
RachisChisis

- CSF leaking outside
- Open spinal cord [exposed]
- Open vertebra [spina bifida]
- Open skin
- Neural tube defects prevented by
  - 400 mg/day folic acid perinatally

CRANIO - RACHIS - CHISIS

00:20:03

- Anencephaly + Rachischisis



Previous Year's Questions

Q. Failure of closure of rostral neuropore at 25th day lead to? (FMGE - Jun - 2019)

A. Hydranencephaly
B. Pachychilids
C. Anencephaly
D. Spina bifida

Previous Year's Questions

Q. Identify the congenital anomaly (AIIMS 2015)

Spina bifida occulta
Meningocele
Myelomeningocele
Craniorachischisis

An Infant with Spina Bifida Cystica. The sac in the lumbar region is called a myelomeningocele.

Spina Bifida Occulta

- Mc
- Tuft of hair on lumbosacral region +nt
- Incidental finding

Spinal Bifida Cystica with Meningocele

- Meninges moved into cyst in lumbosacral region
- Clear cyst

Spina Bifida Cystica with Meningomyelocele

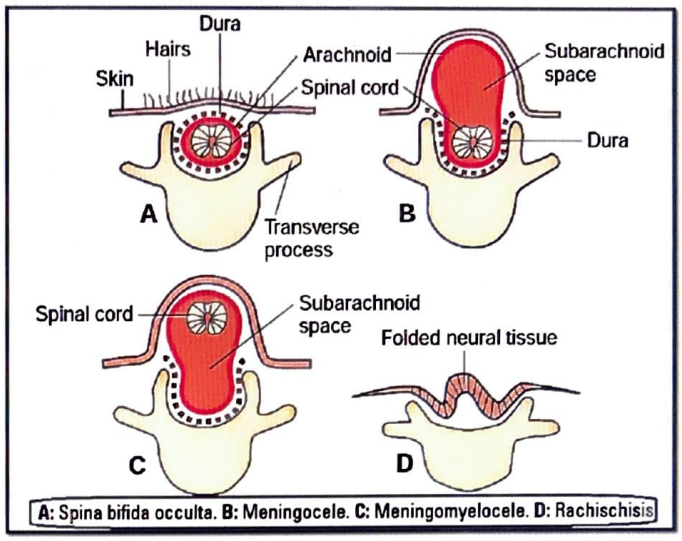
- Component of spinal cord & some neural tissue also moved out
- Cyst is not clear [dark lines d/t neural tissue +nt]

Rachischisis

- Least common
- More dangerous
- Open vertebra
- Open skin
- Spinal cord open
- CSF leaking out

Important Information

If clear cyst: Meningocele
If non clear cyst: Neural tissue positive.



A: Spina bifida occulta. B: Meningocele. C: Meningomyelocele. D: Rachischisis

Previous Year's Questions

(NBEP 2014)

Q. Spinal cord develops from
Neural tube
Mesencephalon → Mid brain
Rhombencephalon → Hind brain
Prosencephalon → Fore brain

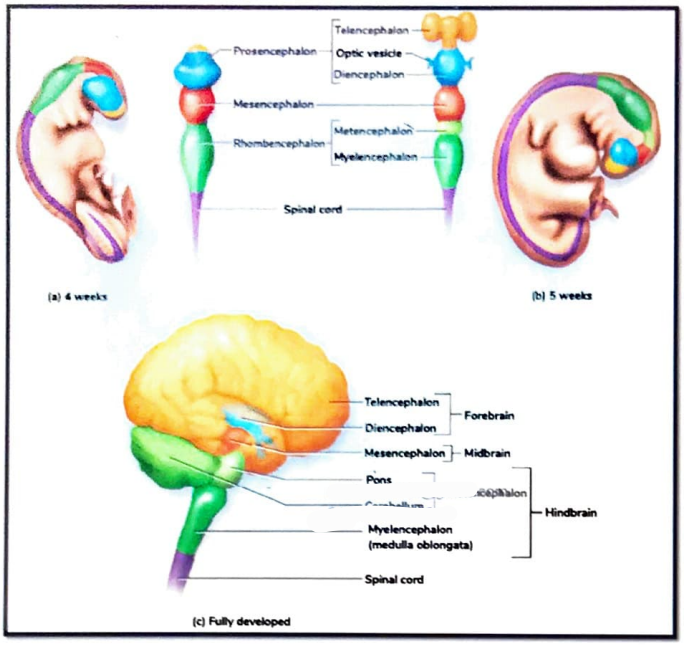
Previous Year's Questions

(Nbep 2013)

Q. 3rd ventricle belongs to
Telencephalon
Diencephalon
Metencephalon
Myelencephalon

PARTS OF BRAIN

00:33:48



Fore Brain [Prosencephalon]

- TELENCEPHALON
  - Consists LATERAL VENTRICLES moves laterally to right & left Present
  - DIENCEPHALON
    - → Thalamic region
    - → Third ventricle → midline ventricle

MidBrain [Mesencephalon]

- Cerebral aqueduct→ midline ventricle

HindBrain [Rhombencephalon]

- Fourth ventricle
- PONS CEREBELLUM : METENCEPHALON
- MEDULLA OBLONGATA → MYELENCEPHALON
  - Diamond shaped / Rhomboid shaped
  - Continues as central canal inside spinal cord
  - **CHOROID PLEXUS**

→ Project into lateral ventricle [mostly], 3rd ventricle, 4th ventricle

→ Produce CSF

- **OLFACTORY NERVE**

→ Nerve of telencephalon part of forebrain Diencephalon grows into eye ball to become retina & becomes optic nerve

Brain Stem

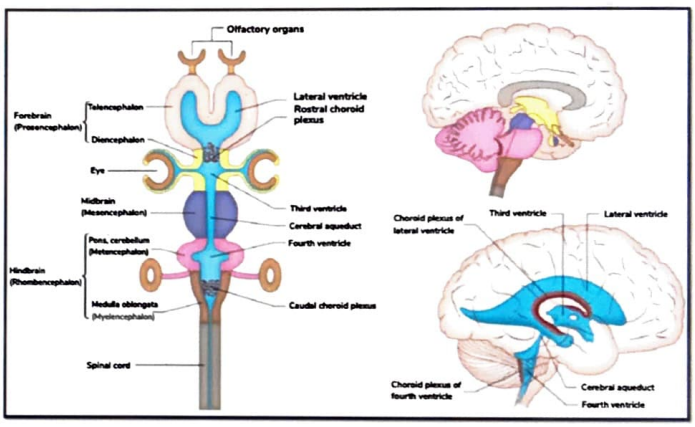
- MIDBRAIN
- PONS
- MEDULLA OBLONGATA
  - Cranial nerves from 3 to 12 comes from brain stem
  - CN VIII [VESTIBULOCOCHLEAR NERVE]
    - → Develops from Ponto medullary junction

Optic nerve, Vestibulo-cochlear nerve, olfactory nerve are the pure sensory nerve

→ Brain becomes 'c' shaped from straight tube due to cephalo caudal folding

TELENCEPHALON	forms CEREBRUM
DIENCEPHALON	forms THALAMUS
MESENCEPHALON	MIDBRAIN
METENCEPHALON	PONS, CEREBELLUM
MYELENCEPHALON	MEDULLA OBLONGATA

→ lateral ventricles also become c- shaped



Primary Vesicles	Secondary Vesicles	Adult Derivatives
Prosencephalon	Telencephalon	Cerebral hemispheres, caudate, putamen, amygdaloid claustrum, lamina terminalis, olfactory bulbs, hippocampus

	Diencephalon	Epithalamus, subthalamus, thalamus, hypothalamus, mammillary bodies, neurohypophysis, pineal gland, retina, iris ciliary body, optic nerve (CN II), optic chiasm, optic tract
Mesencephalon	Mesencephalon	Midbrain
Rhombencephalon	Metencephalon	Pons, cerebellum
	Myelencephalon	Medulla

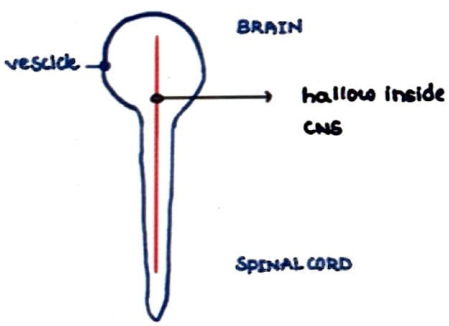
Refer Image 27.1

Basal Ganglia

- Caudate nucleus
- Putamen nucleus
- Amygdaloid Nucleus

Hippocampus

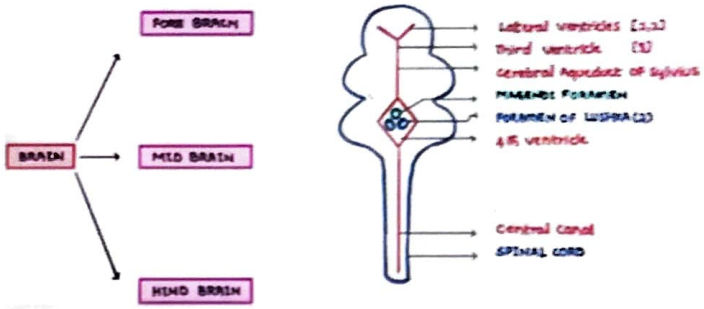
- Involves in recent memory
- Also part of LIMBIC SYSTEM [Papez circuit]
  - Involves in Emotion/ memory



CSF

- 1st CSF formed by → Amniotic fluid
- Once ventricles are formed, CSF formed by → Choroid plexus

- CSF is ultrafiltrate of blood

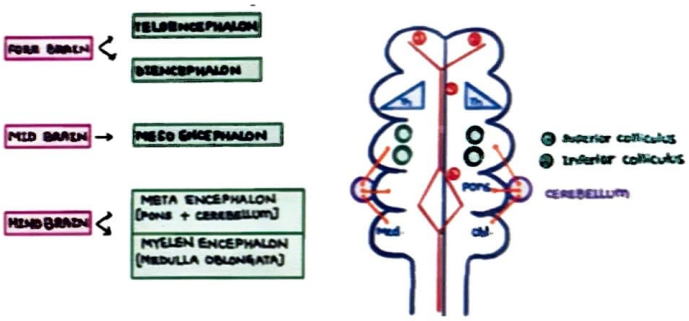


- CSF ESCAPES ventricular system into sub arachnoid space by
  - Midline MAGENDIE FORAMEN
    → Present on roof of 4th ventricle
  - Lateral FORAMEN OF LUSCHKA [2]

CSF at 4th ventricle
↓
Subarachnoid space
↓Arachnoid granulations
Dural venous sinuses

Aqueductal Stenosis

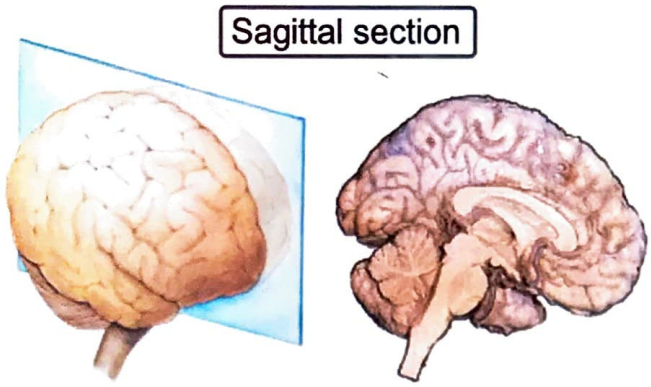
- Leads to internal hydrocephalus
- Lateral & third ventricle dilates
- Fore brain will die due to flattening effect



- 2 superior colliculus CORPORA QUADRIGEMINA
- 2 Inferior colliculus Present on tectum dorsum of midbrain
- Pons develops before the cerebellum
- Cerebellum attaches to brain stem by 3 peduncles
  - Superior cerebellar peduncle →to midbrain
  - Middle cerebellar peduncle →to pons
  - Inferior cerebellar peduncle →to medulla oblongata
- 4th ventricle
  - Sandwiched between cerebellum posteriorly [roof] & brainstem anteriorly [floor]
  - Comes till upper half of M. oblongata
- Central canal →begins at lower half of medulla oblongata & continues in spinal cord

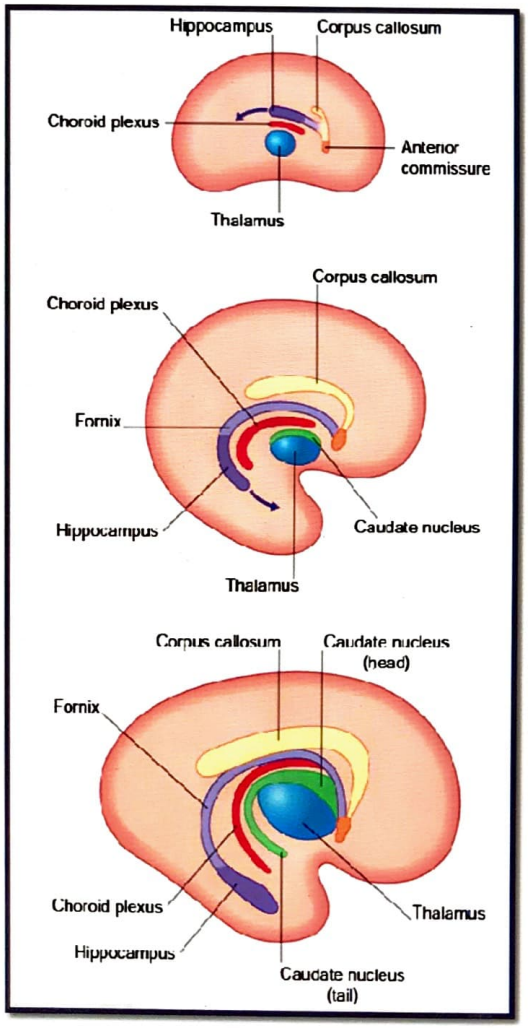
DEVELOPMENT OF BRAIN : SAGITTAL VIEW

00:52:36



- Brain becomes 'c' shape on thalamus axis
- 1st commissure to develop anterior commissure
  - **COMMISSURE FIBERS** → Axons that connect right brain & left brain

- 2nd commissure to develop → Fornix
- 3rd commissure to develop → Corpus callosum



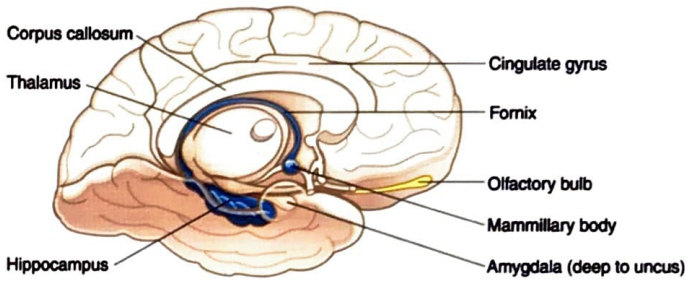
- CORPUS CALLOSUM becomes
- FORNIX c-shaped
- FORNIX : Collection of axons
  - Major efferent tract of Hippocampus
    → Hippocampus in adult brain present in temporal/ inferior lobe
  - Helps in consolidation of memory
    → Lesion leads to AMNESIA SYNDROME

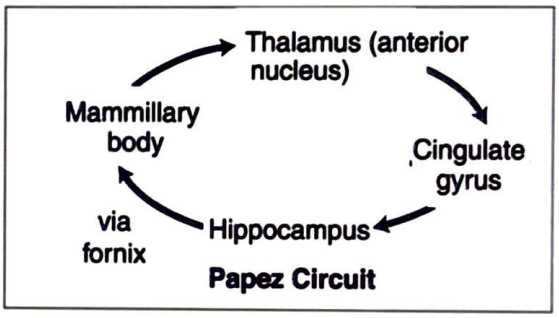
Caudate Nucleus

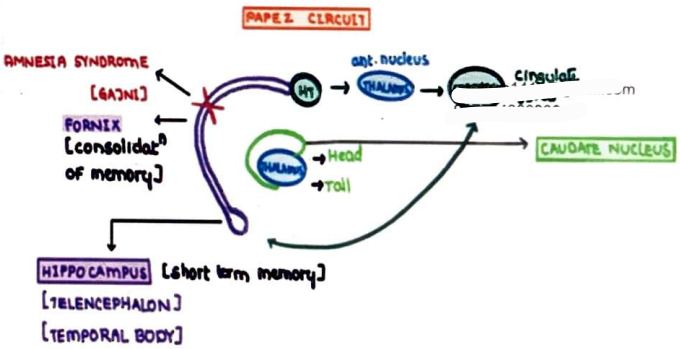
- Comma/c shaped
- Have anteriorly present head & tail CEREBRUM → also become 'c' shape
  - Cerebrum → also become 'C' shape

PAPEZ CIRCUIT

01:00:52







- Part of limbic system
- Concerned with memory & emotions

Previous Year's Questions

Q. Fornix fibers contain?

(NEET – Jan - 2020)

A. Association fiber
B. Projection & commissural fiber
C. Association & projection fiber
D. Commissural & association fiber

CEREBRUM & VENTRICLES

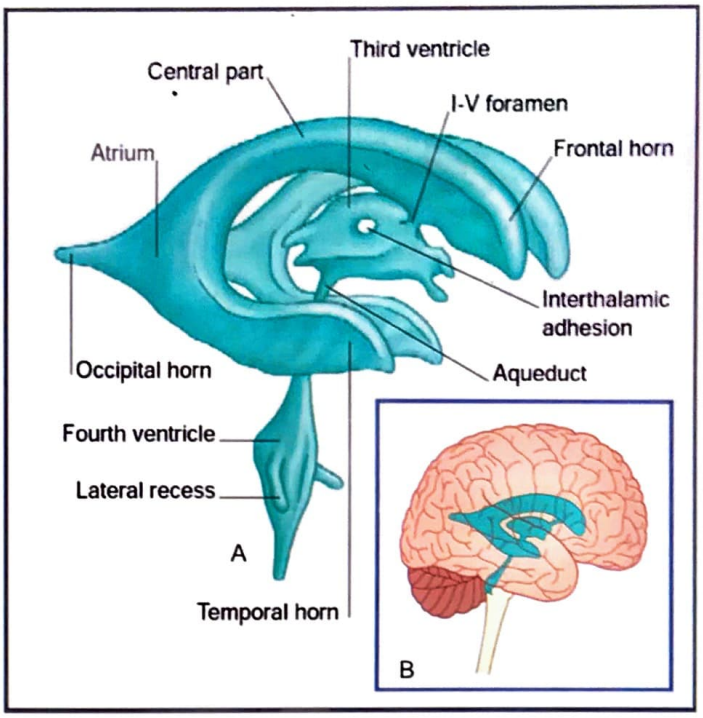
01:03:50

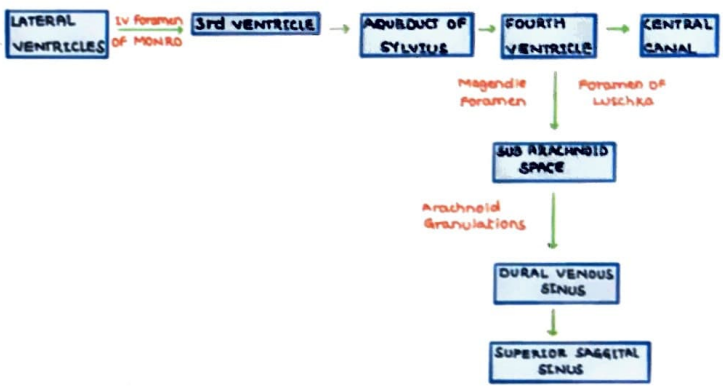
Lobes Of Cerebrum

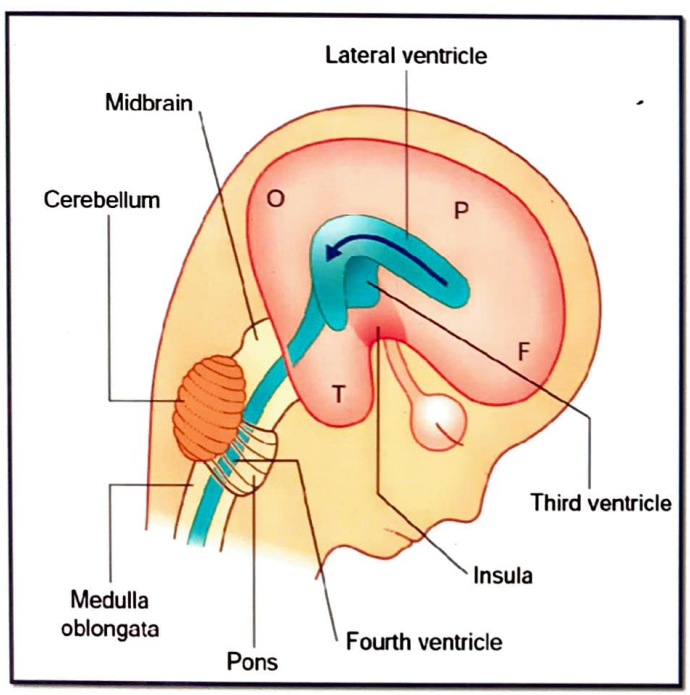
- Anterior → FRONTAL
- Posterior → OCCIPITAL
- Inferior → TEMPORAL
- Superior → PARIETAL

lateral ventricle

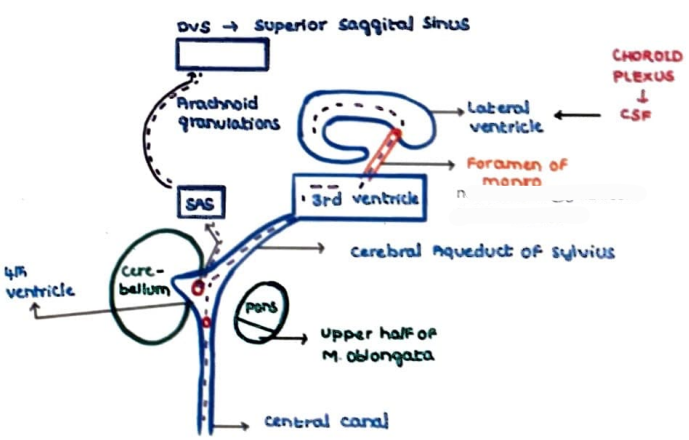
- Acquires 'c' shape has
  - Frontal pole/ horn
  - Occipital pole/ horn
  - Temporal pole/ horn
- Major amount of CSF formed here by choroid plexus





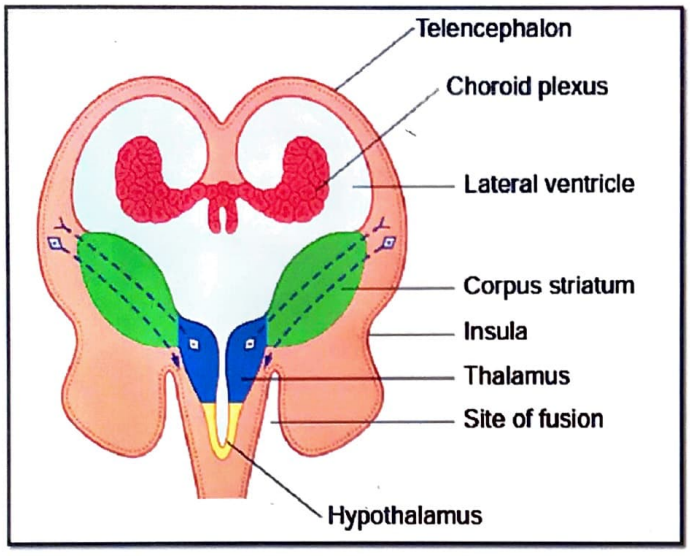


Refer Image 27.2

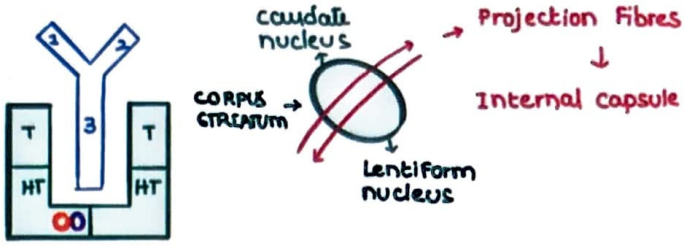


BRAIN - CORONAL SECTION

01:11:14



- Projection fibers form internal capsule
- **INTERNAL CAPSULE**
  - → Bisects corpus striatum into 2 parts
    - LENTIFORM NUCLEUS [lateral]
    - CAUDATE NUCLEUS [medial]



1 Tuber cinerium
2 Mammillary body

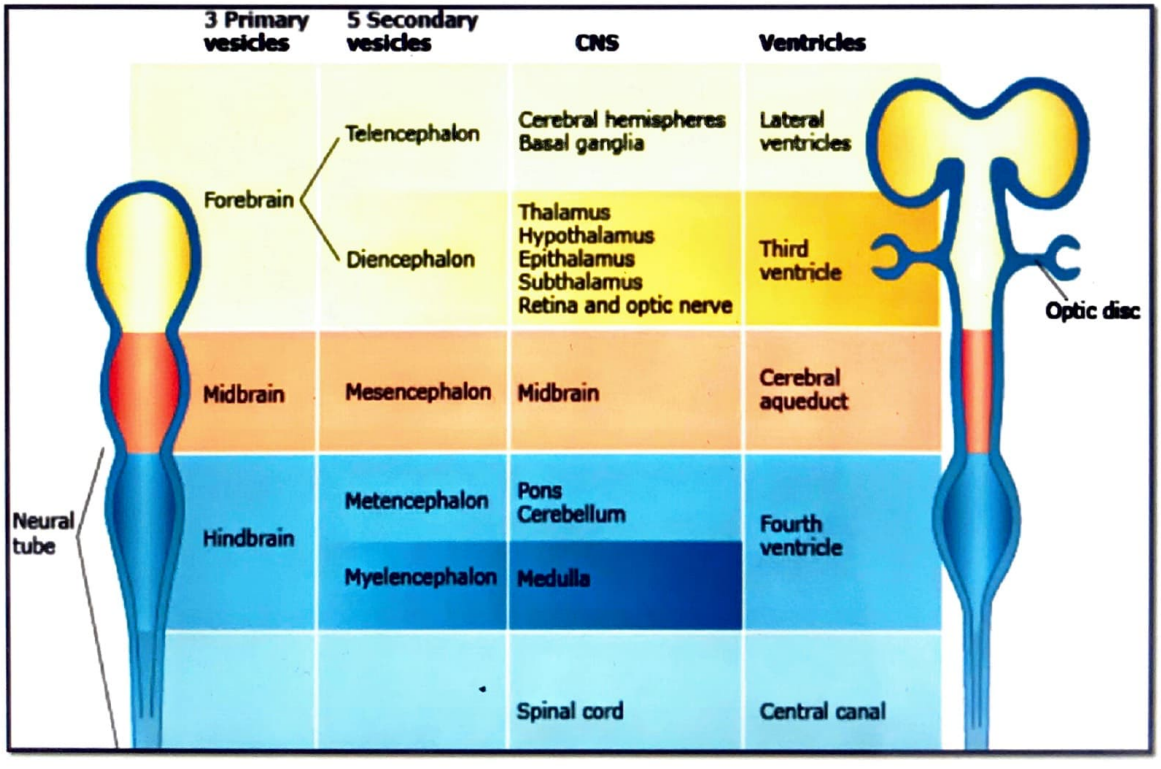
3rd VENTRICLE

- Sandwiched between thalamus & hypothalamus
- Thalamus forms lateral wall
- Hypothalamus forms floor & also contributes to lateral wall

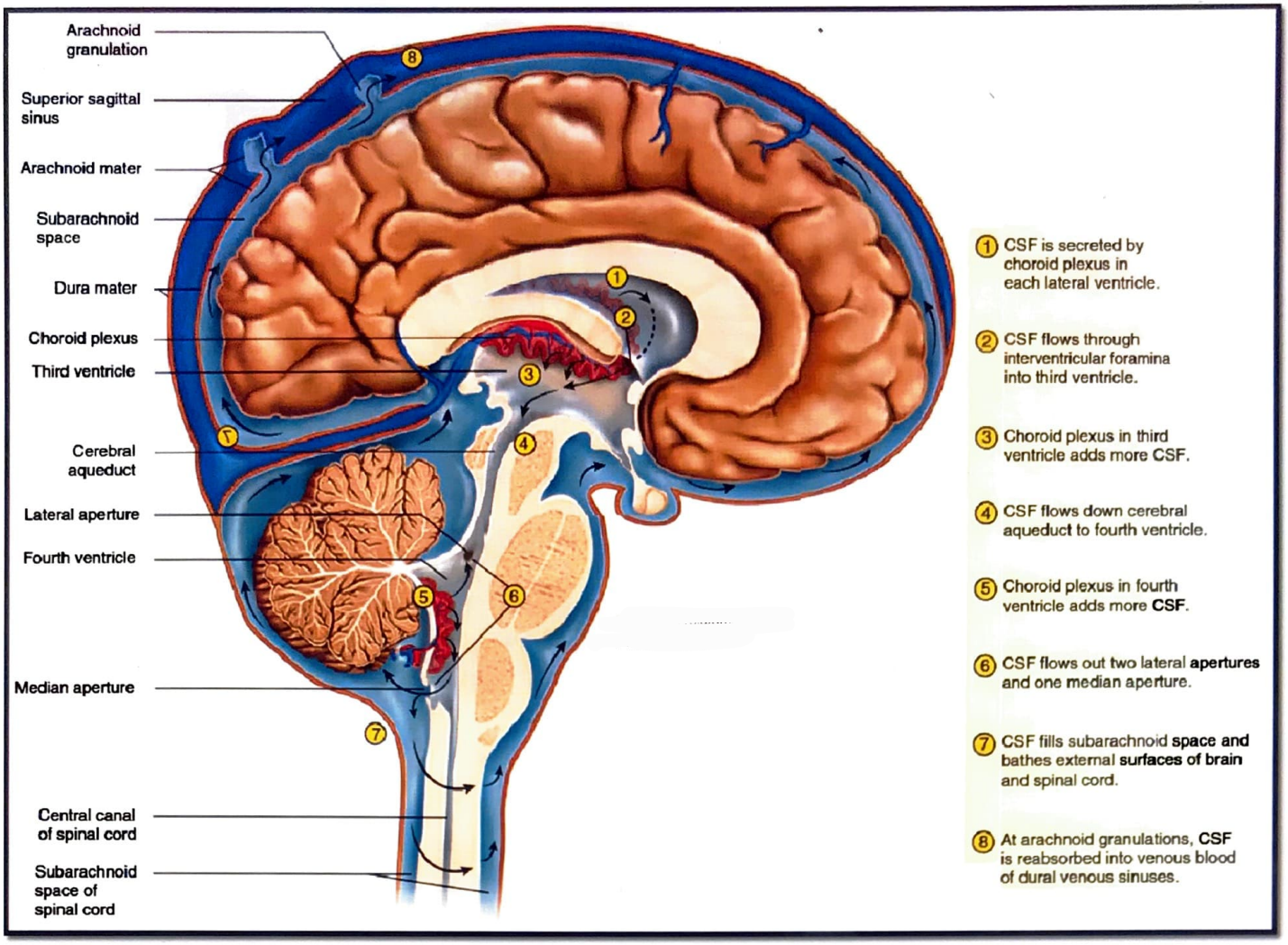
Corpus Striatum

- Parts of basal ganglia
- Has projection fibers [connect upper brain center to lower & vice versa]

Refer Image 27.1



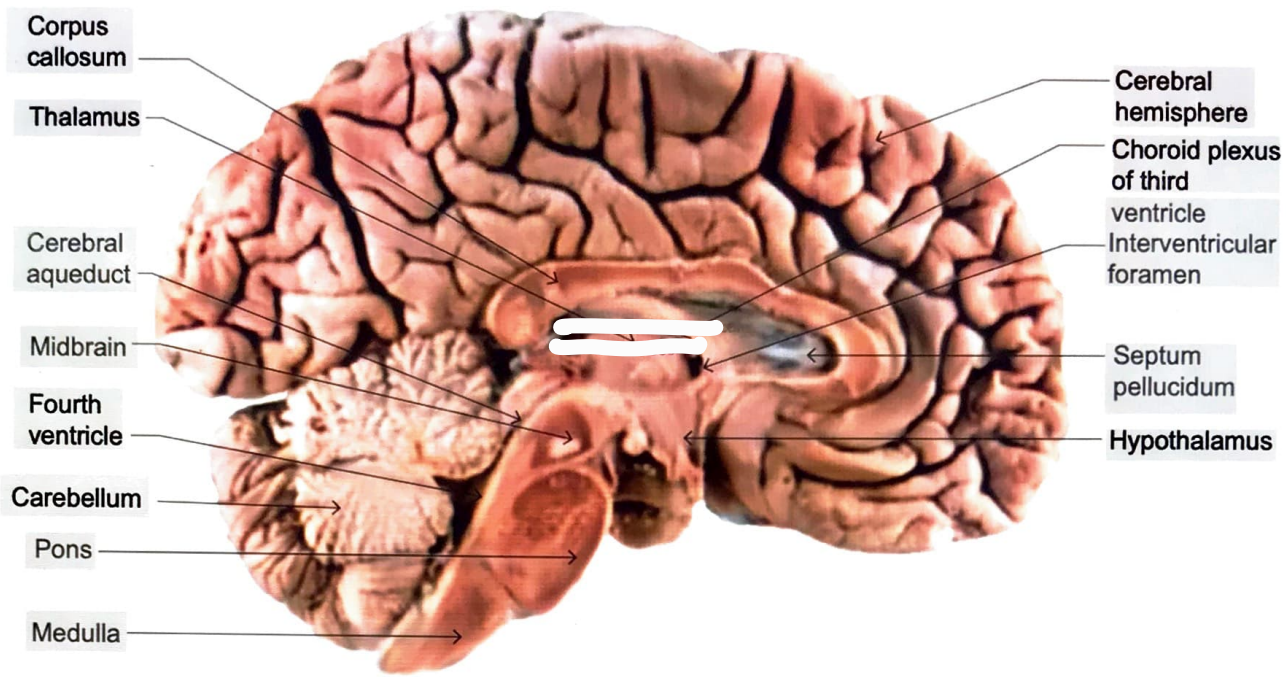
Refer Image 27.2



28 THIRD VENTRICLE

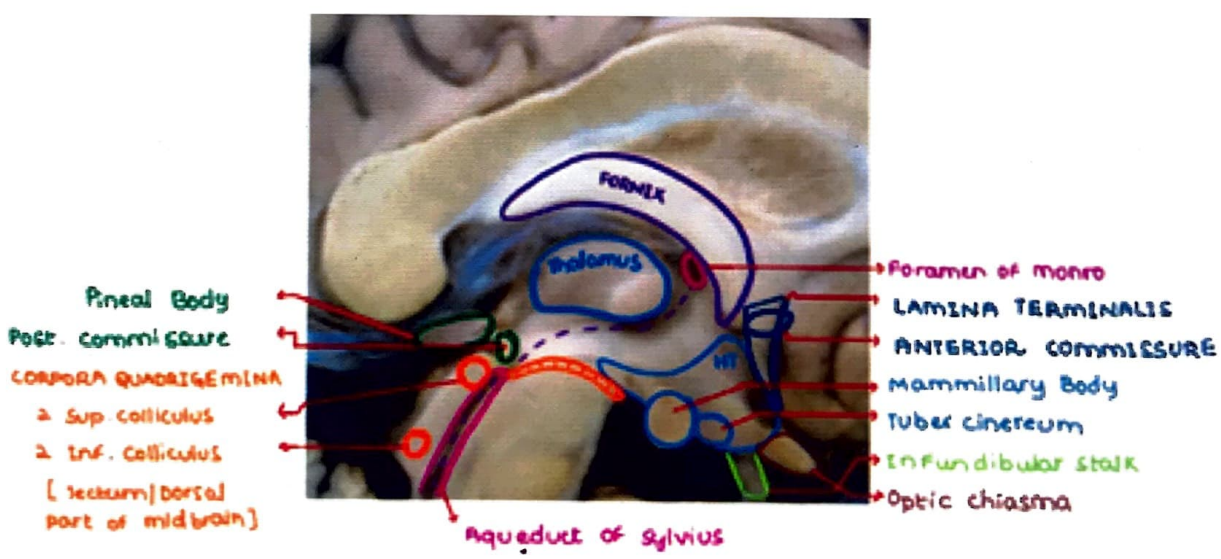
SAGITTAL SECTION

00:00:22

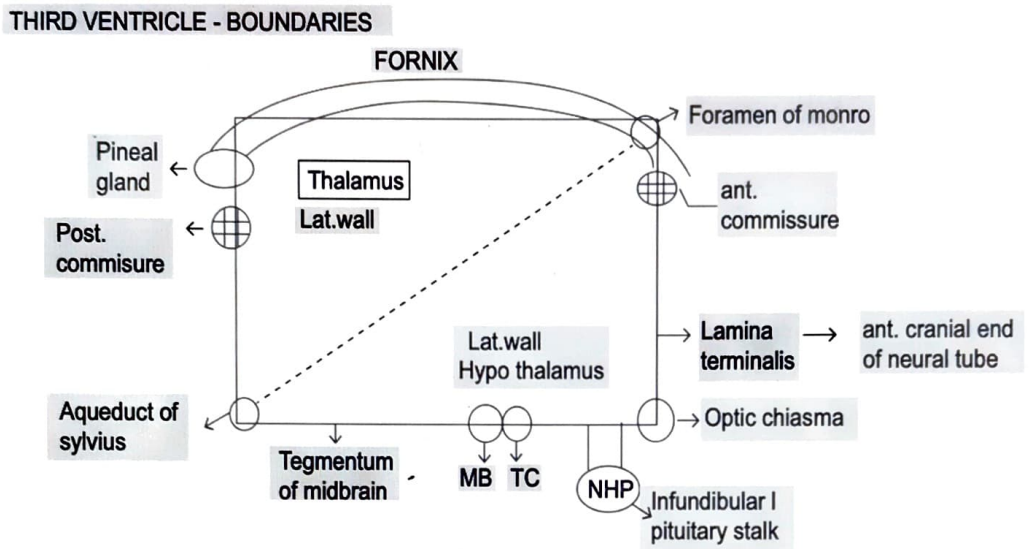


STRUCTURES IN LATERAL WALL OF 3RD VENTRICLE

00:01:11



- EXTENT
  - Starts from FORAMEN of MONRO to beginning of CEREBRAL AQUEDUCT OF SYLVIUS
- LATERAL WALL
  - Thalamus
  - Hypothalamus
- FLOOR
  - Mammillary body of HYPOTHALAMUS
  - Tegmentum part of MIDBRAIN
  - TUBER CINEREUM of HYPOTHALAMUS
- INFUNDIBULAR STALK
  - Downward extension of diencephalon
  - Connects neurohypophysis / posterior pituitary
  - OPTIC CHIASMA
    → Most anterior structure
- ROOF
  - FORNIX [C shaped structure]
  - Choroid plexus
- ANTERIOR
  - FORNIX [some part]
  - LAMINA TERMINALIS
  - ANTERIOR COMMISSURE
- POSTERIOR
  - PINEAL BODY
  - POSTERIOR COMMISSURE

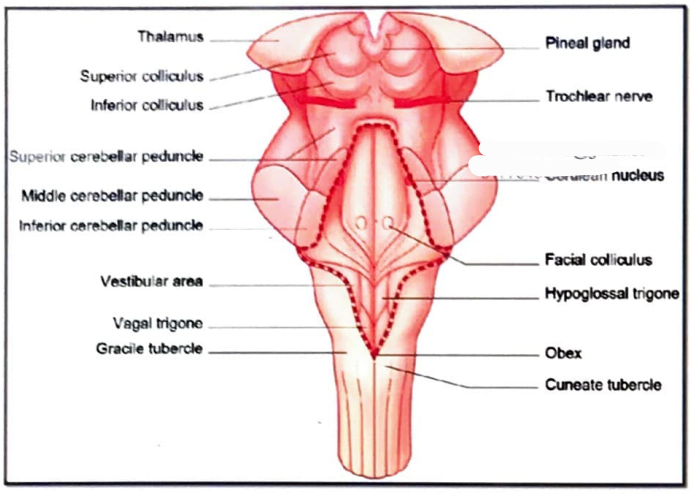


Previous Year's Questions

Q All is seen in the floor of 3rd ventricle EXCEPT
Mammillary body
Occulomotor nerve
Optic chiasma
Tuber cinereum

29 FOURTH VENTRICLE

- FLOOR → Pons & upper half of M. oblongata
- Extent from aqueduct of Sylvius to upper medulla



Structures and relations in 4th Ventricle Ventricle

00:00:25

- FACIAL COLLICULUS
  - Rounded elevations by axons of facial nerve [deep to this abducens nucleus[present, but abducens nucleus do not produce elevation]
  - present in the dorsum of lower pons.

Q Injury to facial colliculus, which muscle is compromised?

a. Risorius → Supplied by facial nerve [better answer]

b. lateral Rectus → Supplied by abducens nerve

- STRIA MEDULLARIS→Striations moving towards medulla
- HYPOGLOSSAL TRIGONE
  - Most medial nucleus → Hypoglossal nucleus
  - Elevation of hypoglossal nucleus (XII)→Hypoglossal trigone

- VAGAL TRIGONE
  - Lateral to hypoglossal trigone
  - Due to elevation of vagal nerve nucleus (X)
  - Vestibular area
    - → Most lateral
    - → On medial medullary syndrome
      - Hypoglossal nucleus is involved
      - Tongue muscle palsy
    - → In lateral medullary Syndrome
      - Vestibular nucleus is involved

Wallenberg syndrome with vertigo

MEDIAL MEDULLARY SYNDROME

00:09:38

- In medial medullary syndrome → Hypoglossal nucleus is involved
  - Tongue muscle palsy
  - In lateral medullary syndrome
    - → Vestibular nucleus is involved
    - → Wallenberg syndrome with vertigo
- LOCUS CERULEUS
  - Dark colored d/t melanin deposition
  - Seen in dorsum of upper pons
- CORPORA QUADRIGEMINA
  - 2 Superior colliculi
  - 2 Inferior colliculi

Refer Diagram 29.1

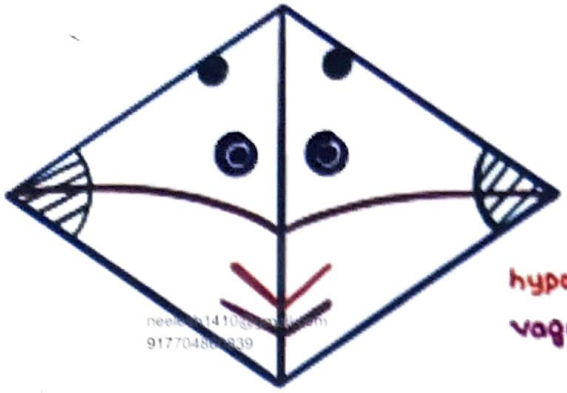
Previous Year's Questions

Q All is seen in the floor of the fourth ventricle EXCEPT
Vagal triangle
Hypoglossal triangle
Vestibular area
Stria terminalis

Trochlear Nerve

- Only cranial nerve with dorsal exit in brain
- Comes from midbrain
- Present at level of inferior colliculus

Diagram 29.1



vestibulo cochlear Nuclear area

Stria medullaris

vestibular area ↓ Vertigo

Locus ceruleus (melanin) (upper pons)

Abducent nucleus

Facial colliculus (lower pons)

Pons

M. oblongata upper half

hypoglossal trigone (XII) → Medial Medullary Syndrome

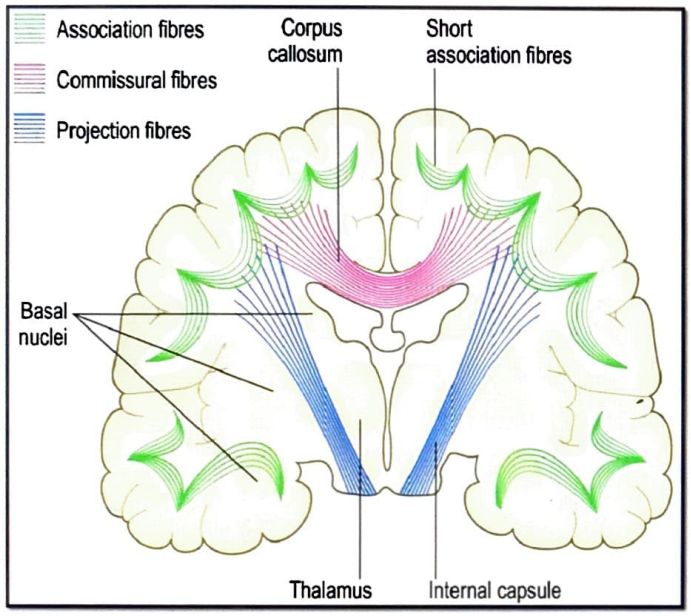
vagal trigone (X)

30 WHITE MATTER

TYPES OF FIBRES

00:00:20

- COMMISSURAL FIBRES
  - Connects right side of brain to left side of brain
  - Crosses midline
- PROJECTION FIBRES
  - Connects higher brain centre with lower brain centre
- ASSOCIATION FIBRES
  - Connects cerebrum on same side
  - Do not cross midline



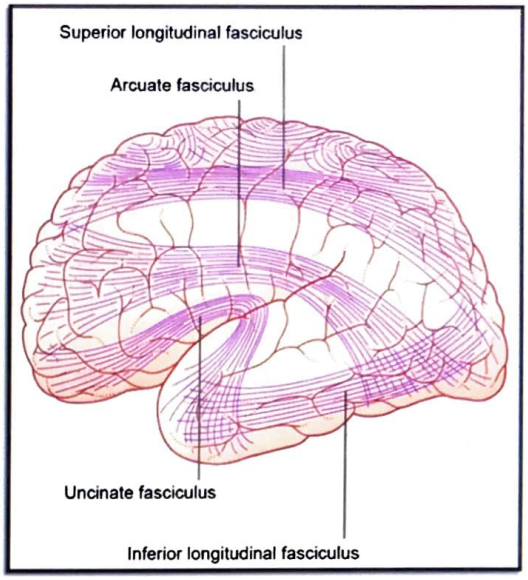
Previous Year's Questions

Q Association fibres are all except

uncinate
cingulum
longitudinal fasciculus
forceps major of corpus callosum → commissural fibres

Association Fibres

- ARCUATE FASCICULUS
  - Seen on left side of cerebrum

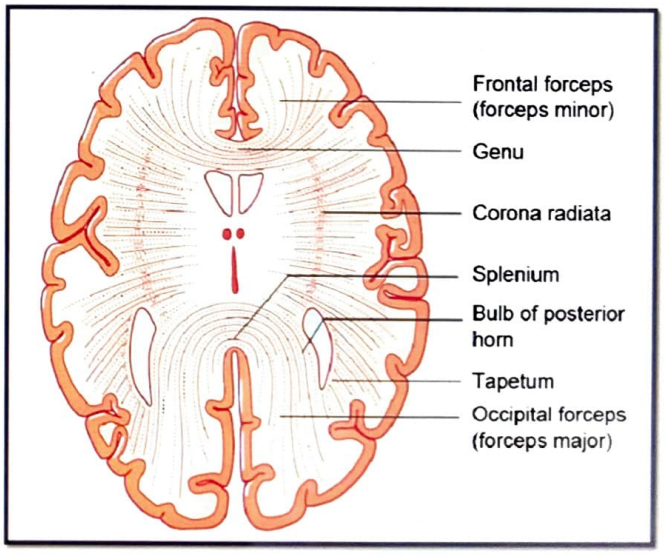


  - Connecting language areas (Wernicke's speech area with Broca's motor)

CORPUS CALLOSUM

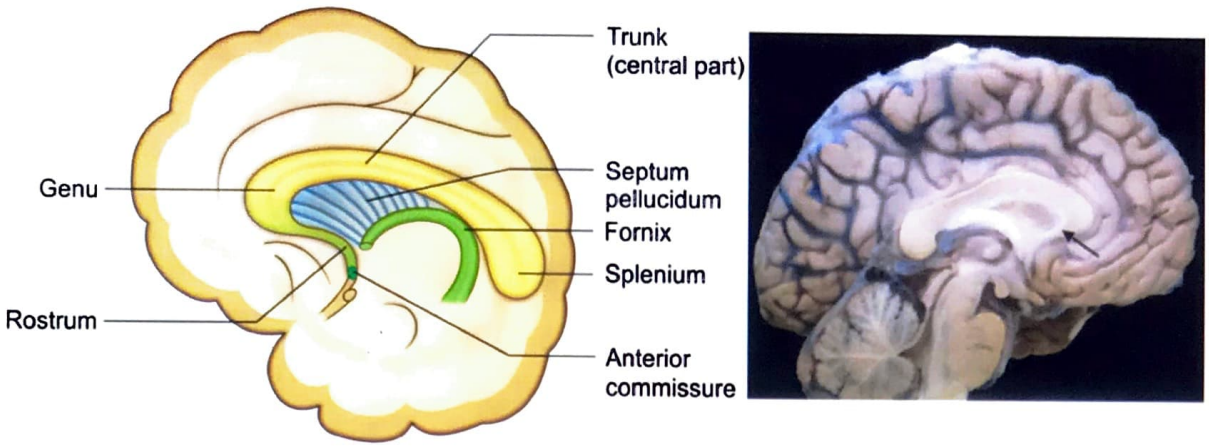
00:03:14

- FORCEPS MAJOR
  - Connects occipital visual cortex from one side to other
  - Fibres passes in splenium part of corpus callus
- FORCEPS MINOR
  - Connects frontal lobe from right to left side
  - Fibres passes in Genu part of corpus callosum
- TAPETUM → connects temporal lobe



Corpus callosum consists

- Rostrum [anterior]
- Genu
- Body trunk
- Splenium [posterior]



- [TTT]
  - Tapetum fibers connecting one temporal lobe to other

31 NEURAL COLUMNS

MOTOR COMPONENTS

00:00:30

- EFFERENT ≅ MUSCLE
  - Skeletal/somatic muscle
    → Controlled by somatic nervous system
  - Visceral:smooth and cardiac
    → Controlled by ANS

G → General
S → Skeletal
E → Efferent ≅ Muscles

G → General
V → Visceral
E → Efferent ≅ Muscle

SENSORY COMPONENTS

00:05:00

- SOMATIC PARIETAL SENSATIONS
  - Outside the body wall
    → Touch, Pain, Pressure Vibrations, Temperature, Proprioception

- VISCERAL SENSATIONS
  - Inside the body wall
    → Angina, Colicky pain, Blood pressure, stretch

How to remember

G → General
S → Somatic
A → Afferent sensation

G → General
V → Visceral
A → Afferent sensation

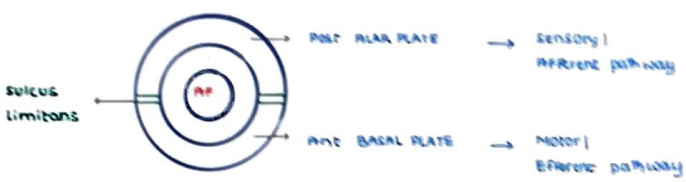
- SKELETAL MUSCLE SPASM : GSE → GSA
- SMOOTH MUSCLE SPASM : GVE → G V A
  [colicky pain]

Motor Components	
Somatic Motor (SM)	**Visceral Motor (VM; Autonomic)**
Motor innervation to skeletal muscles 	Motor innervation to smooth muscle, cardiac muscle, and glands 

Sensory Components	
Somatic Sensory (SS)	**Visceral Sensory (VS)**
GENERAL: Touch, pain, pressure, vibration, temperature, and proprioception from the skin, body wall, and limbs 	**GENERAL:** Stretch, pain, temperature, chemical changes, and irritation in viscera; nausea and hunger 

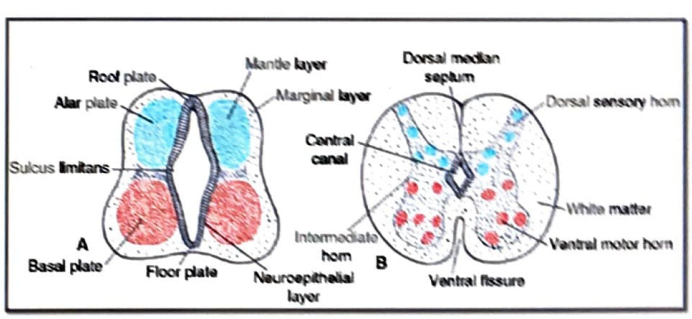
ALAR & BASAL PLATES

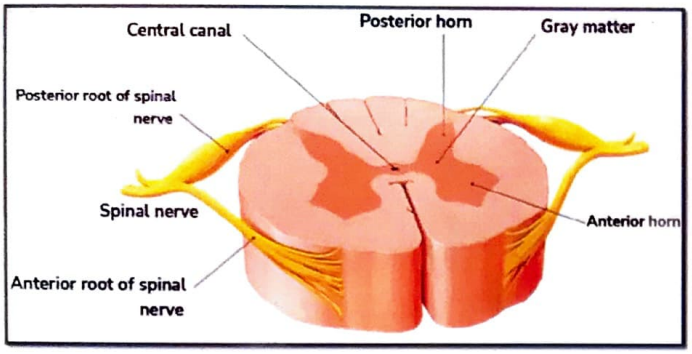
00:07:39

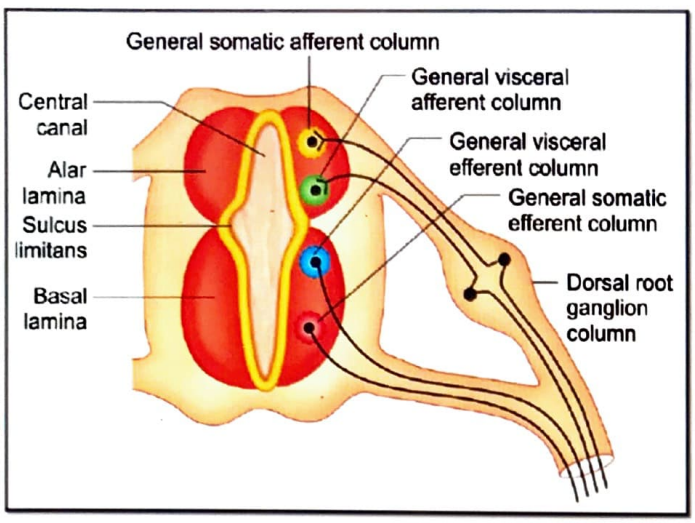


Previous Year's Questions

Q. Visceral efferent column from which plate of neural tube ?
Alar → Afferent [sensory]
Basal
Roof
Floor





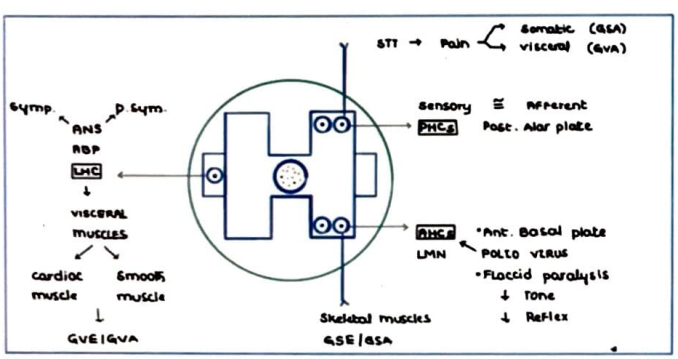


- Ant. Basal Plate
  - Gives ant. horn cells → controls skeletal muscles
  - Gives lat. horn cells → controls cardiac & smooth muscles
- Post. Alar Plate → gives post. horn cells → spinothalamic tract [pain & temp]

POLIO VIRUS LESIONS

00:15:06

- Flaccid paralysis
- Muscle atrophy
- Fasciculations
- Areflexia
- Common at lumbar levels

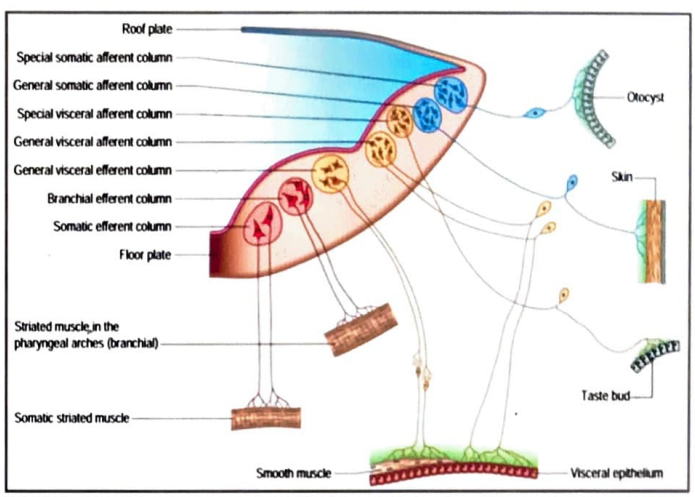


SEVEN NEURAL COLUMNS

00:25:13

- 3 MOTOR
  - GSE most of skeletal muscles except pharyngeal arch Muscles
  - GVE visceral muscles
  - SVE special visceral efferent
    - → S → Special
    - → V → Visceral [Pharyngeal arch muscles]
    - → E → Efferent

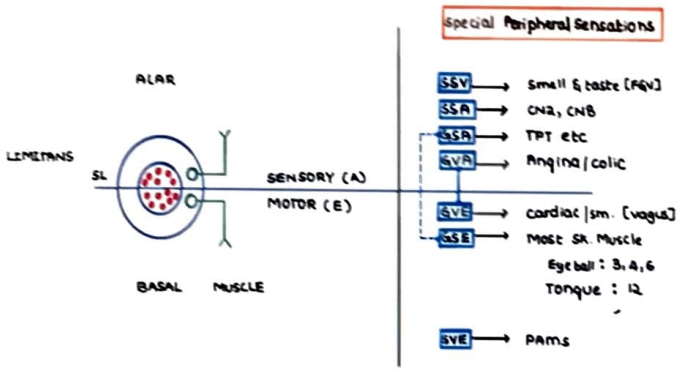
- 4 SENSORY
  - GSA
  - GVA
  - SSA → Special somatic afferent
  - SVA → Special visceral afferent



Sensory Components	
Somatic Sensory (SS)	**Visceral Sensory (VS)**
GENERAL: Touch, pain, pressure, vibration, temperature, and proprioception from the skin, body wall, and limbs	**GENERAL:** Stretch, pain, temperature, chemical changes, and irritation in viscera; nausea and hunger
	
SPECIAL: Hearing, equilibrium, and vision	**SPECIAL:** Taste and smell
	

PHARYNGEAL ARCH MUSCLES Misnomer

- Skeletal muscles
- 1st pharyngeal arch gives → muscles of mastication
- 2nd pharyngeal arch gives → muscles of facial expression
- 3, 4, 5 pharyngeal arch gives → muscles of palate, pharynx & larynx [speech & swallowing]
- Develops around gut & respiratory tube
- SPECIAL SOMATIC SENSATIONS [somatic ≅ periphery]
- Vision [CN IIpure sensory Nerves
- Hearing & balance [CN VIII]
- SPECIAL VISCERAL SENSATIONS
  - TASTE
  - SMELL
    - → Misnomer
    - → Develops around gut tube & respiratory tube
  - Taste received by
    - → F: Facial nerve
    - → G: Glossopharyngeal nerve
    - → V: Vagus nerve



- GVE: General category for visceral muscles
- GSE: General category for peripheral muscles
- GVA: General category for visceral sensations
- GSA: General category for sensations

Eyeball & tongue muscles do not develop in the pharyngeal arches

Skeletal Muscles	
GSE	SVE
Most of Skeletal muscles Eyeball : 3, 4, 6 Tongue : 12	PAM's 1st arch→ 5_3 muscles of mastication 2nd arch → 7 muscles of facial expression 3,4,6 arch →Muscles of 1. Palate, 2. pharynx, 3. larynx [speech & swallowing]

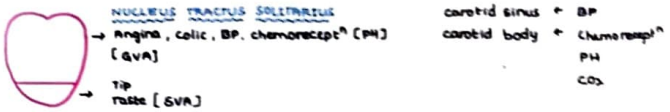
- Every efferent column has a corresponding afferent column
- GSE → GSA
- GSA carries
- Skeletal muscle spasm
- Touch, pain, temp, proprioception
- SVE → SVA
- SSA → 2 & 8
- SSV → smell & taste [FGV]
  - There is no counterpart for SSA in the body
  - SSA is not paired

Previous Year's Questions

Q. Taste pathway comes under the neural column

SSA
GSA
SVA
GVA

- SVA - Taste [Nucleus Tractus solitarius]



Previous Year's Questions

Q. All of the following cranial nerves contains somatic efferent EXCEPT

VII nerve
III nerve
IV nerve
VI nerve

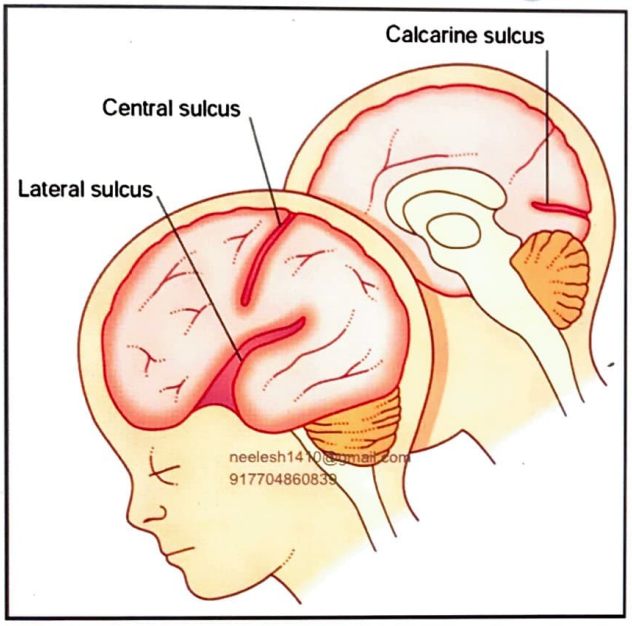
32 CEREBRUM

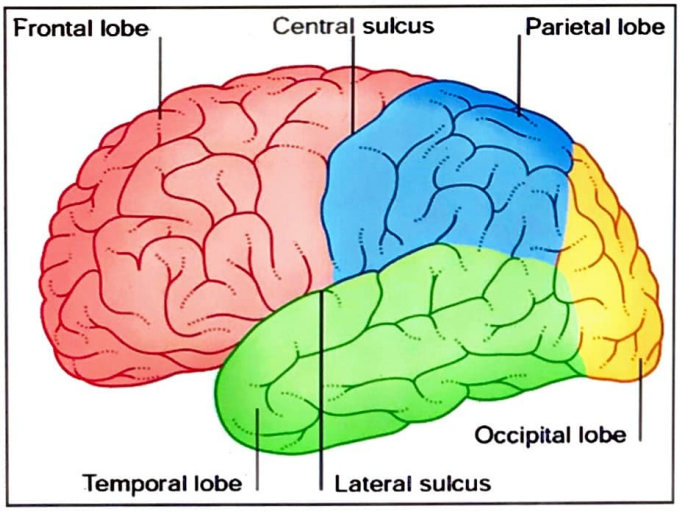
Previous Year's Questions

Q While doing surgery for meningioma on cerebral hemisphere, there occurred injury to the paracentral lobule, it will lead to paresis of
- Left face
- Right neck & scapular region
- Right leg & perineum
- Right shoulder & trunk

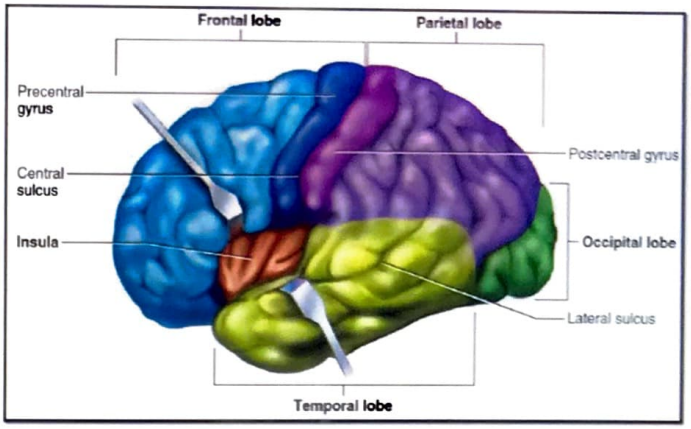
SULCI & LOBES

00:01:31





CEREBRUM - LATERAL VIEW



Central Sulcus
- Runs anterior inferiorly
- Separates frontal lobe in front, parietal lobe posteriorly

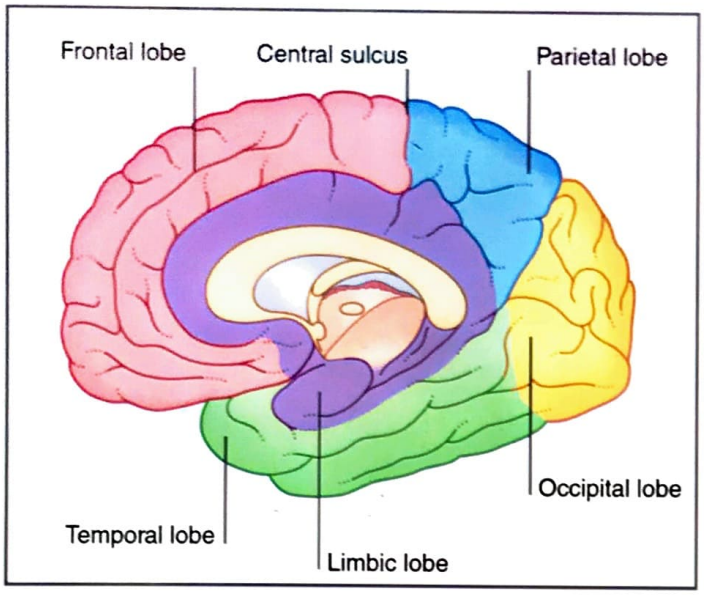
Lateral Sulcus
- Separates temporal lobe inferiorly from frontal & parietal lobes

Imaginary Line
- Separating occipital lobe posteriorly
- Started at parieto occipital sulcus

Precentral Gyrus
- Frontal motor cortex → controls
- Skeletal muscles of body
- Present in front of central sulcus

PostCentral Gyrus
- Presents behind the central sulcus
- PARIETAL SENSORY CORTEX
- Receives general sensations
  - Touch, pain, temperature, proprioception
- **INSULA** : seen on opening of lateral sulcus at the floor of lateral sulcus

CEREBRUM - MEDIAL VIEW



Central Sulcus

- Encroaches onto medial surface separating anterior frontal motor cortex [pre central gyrus] & posterior parietal sensory cortex

Para Central Lobule

- Sensory motor homunculus that controls
  - C/L lower limb, pelvis & perineum

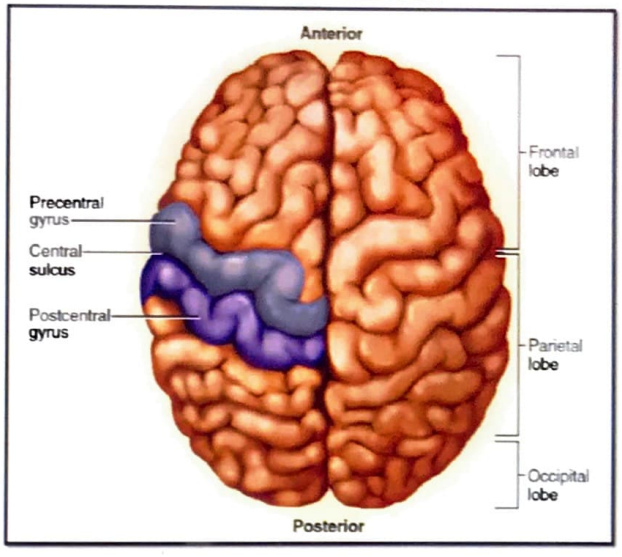
Calcarine Sulcus

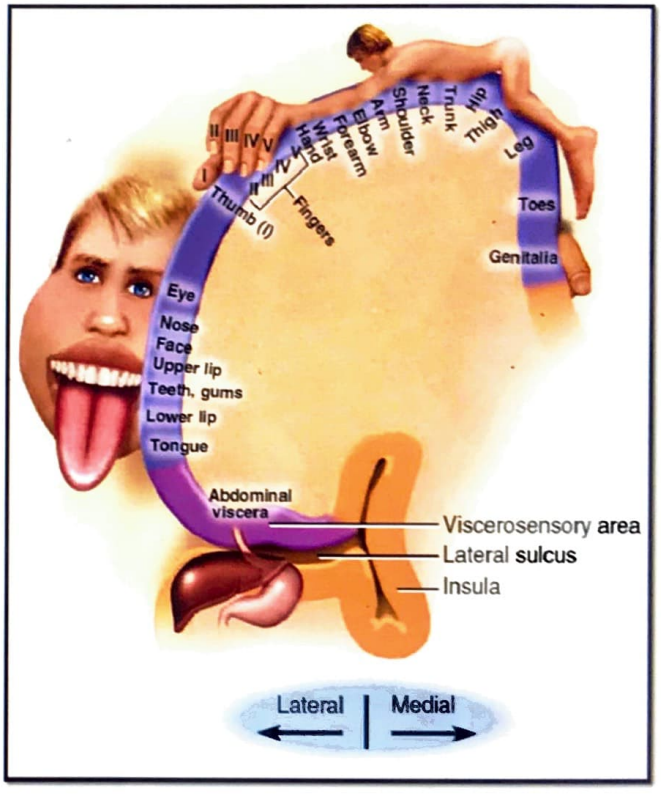
- Occipital visual cortex present in the vicinity
- **Limbic Lobe**→ Responsible for emotions & memory

CEREBRUM HOMUNCULUS

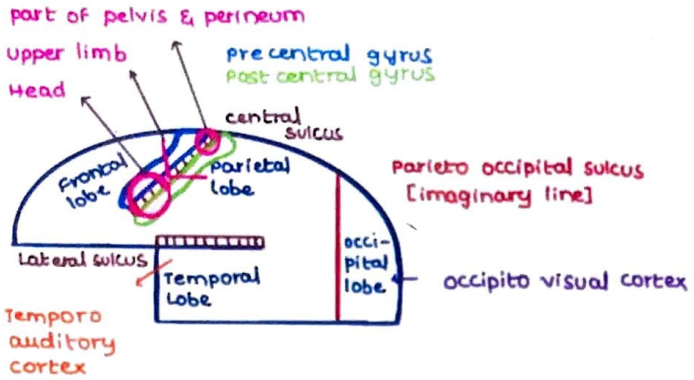
00:08:27

- Cerebral Homunculus
  - Sensory Motor Homunculus: Representation of body on cerebrum
  - Upside down
  - In a oblique fashion [along the central sulcus]
  - Both motor & sensory
  - Hand & Face has more representation
- Lower & lateral: face area
- Higher: upper limb area
- Still higher: pelvis perineum area
- On medial surface:Lower limb area, part of pelvis & perineum

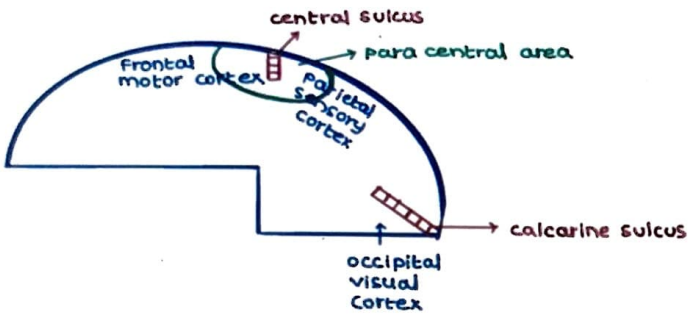




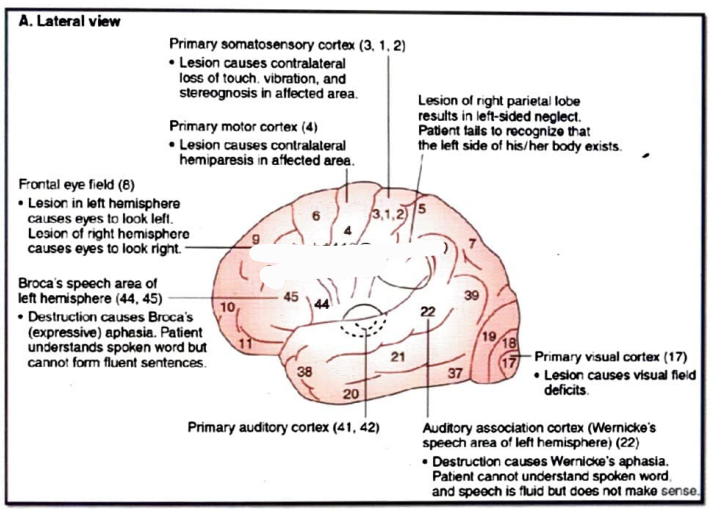
(lateral view): HOMUNCULUS



(MEDICAL VIEW): HOMUNCULUS 00:17:20



BRODMANN NUMBER 00:19:57



- Area 4: precentral gyrus- control skeletal muscle of body
- Area 3,1,2: post precentral gyrus- control general sensation
- Area 17: occipital visual cortex
- Area 41,42: temporal auditory cortex
- Area22:Wernicke's sensory area; superior temporal gyrus
- Area 44,45: Broca's motor speech area; inferior frontal gyrus
- Area 8: frontal eye field; middle frontal gyrus

Previous Year's Questions

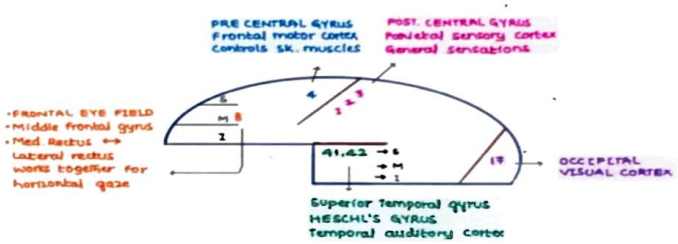
Q. A boy met with a motor bike accident. CT brain shows Injury to Posterior end of Superior temporal gyrus. He is likely to Suffer from? (NEET - Jan - 2020)

A. Fluent aphasia
B. Non fluent aphasia
C. Conduction aphasia
D. Global aphasia

Previous Year's Questions

Q. A 65-year-old lady presents with a cerebrovascular accident involving inferior frontal gyrus. which functional area would mostly be affected? (NEET – Jan – 2020)

A. Visual
B. Auditory
C. Sensory Speech
D. Motor speech



Frontal Eye Field [B]

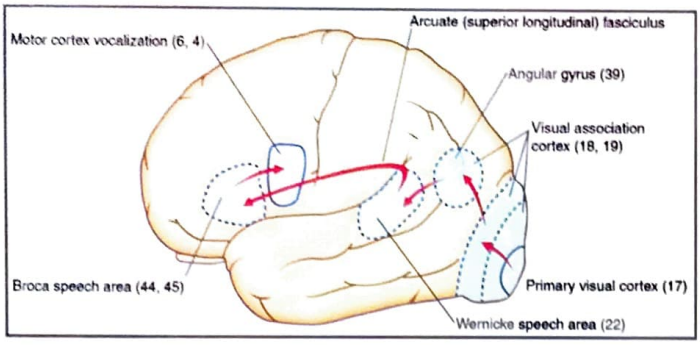
- Controls c/l horizontal gaze
- Lesion results in inability of voluntary horizontal movement on C/L side
- Causes diplopia nystagmus

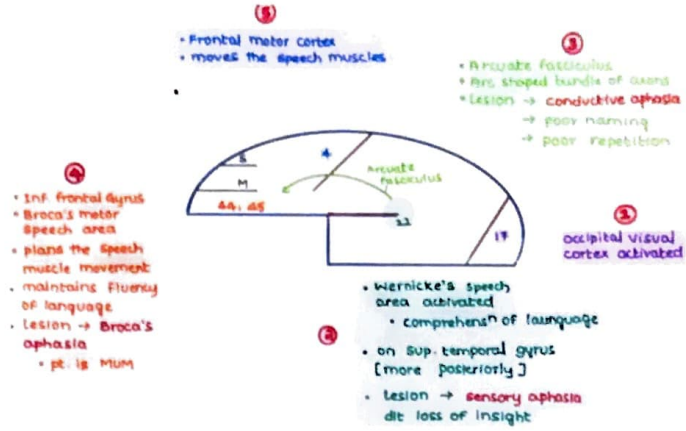
LANGUAGE AREAS 00:26:57

TASK → Read the word 'ANATOMY' Aloud

- PRIMARY VISUAL CORTEX [17] activated to look at the end
- WERNICKE'S SPEECH AREA [22] is activated to understand the word
- BROCA'S SPEECH AREA [44] is activated to plan the speech muscles

- MOTOR CORTEX VOCALIZATION [4] is activated to move the muscles





Type	Specific fluency	Comprehension	Comments
Repetition impaired			
Broca (expressive)	Nonfluent	Intact	Broca = Broken Boca (boca = mouth in Spanish). Broca area in inferior frontal gyrus of frontal lobe. Patient appears frustrated, insight intact.
Wernicke (receptive)	Fluent	Impaired	Wernicke is Wordy but makes no sense. Patients do not have insight. Wernicke area in superior temporal gyrus of temporal lobe.
Conduction	Fluent	Intact	Can be caused by damage to arcuate fasciculus.
Global	Nonfluent	Impaired	Arcuate fascicle; Broca and Wernicke area affected (all areas).

33 BASAL GANGLIA

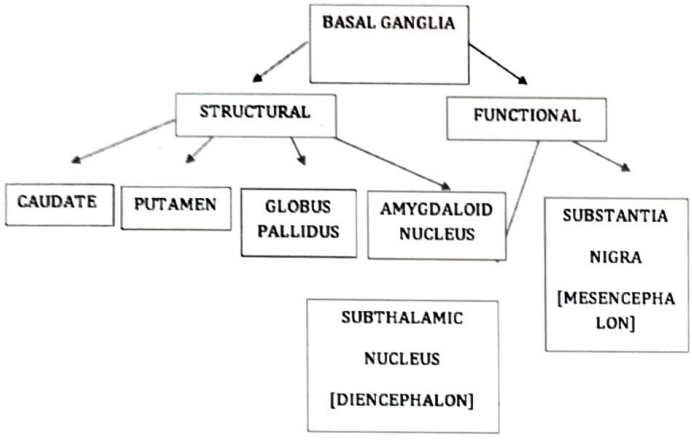
Introduction

- Misnomer
- Part of telencephalon

NUCLEI

00:01:06

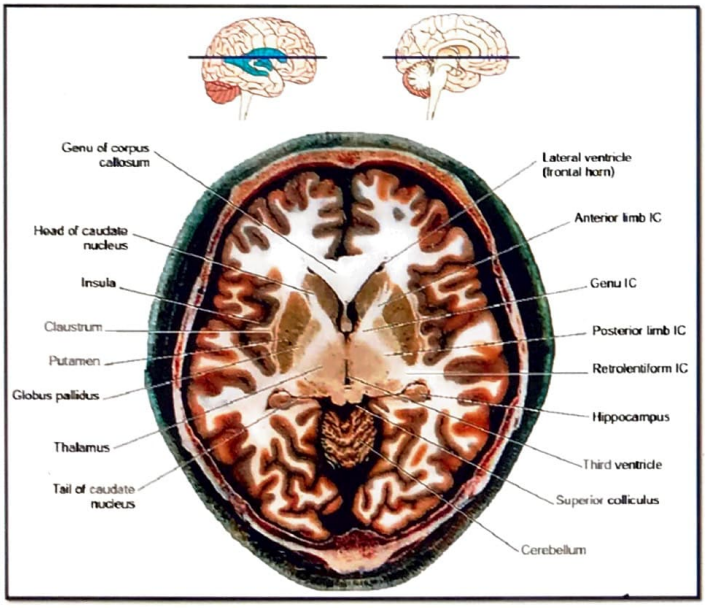
- STRUCTURE NUCLEI → Nuclei present in Telencephalon
- FUNCTIONAL NUCLEI
  - Nuclei present in Diencephalon, Mesencephalon &



Transverse section

- Superior view of the brain

00:04:54

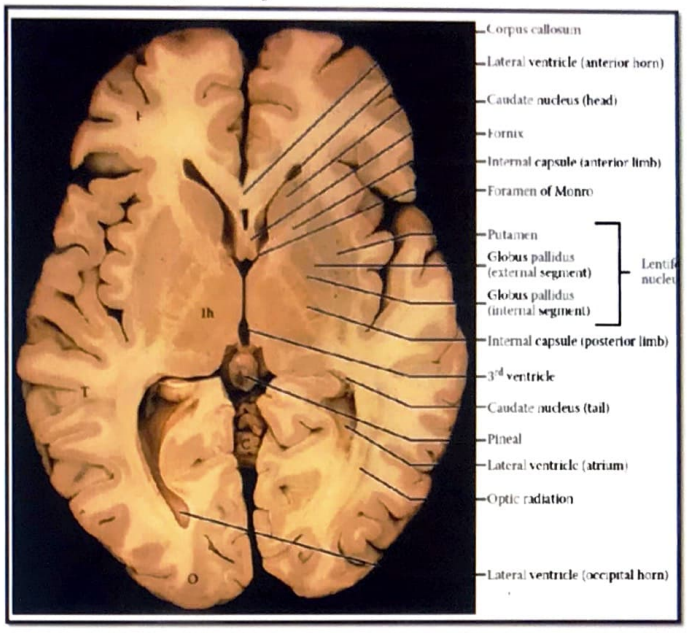


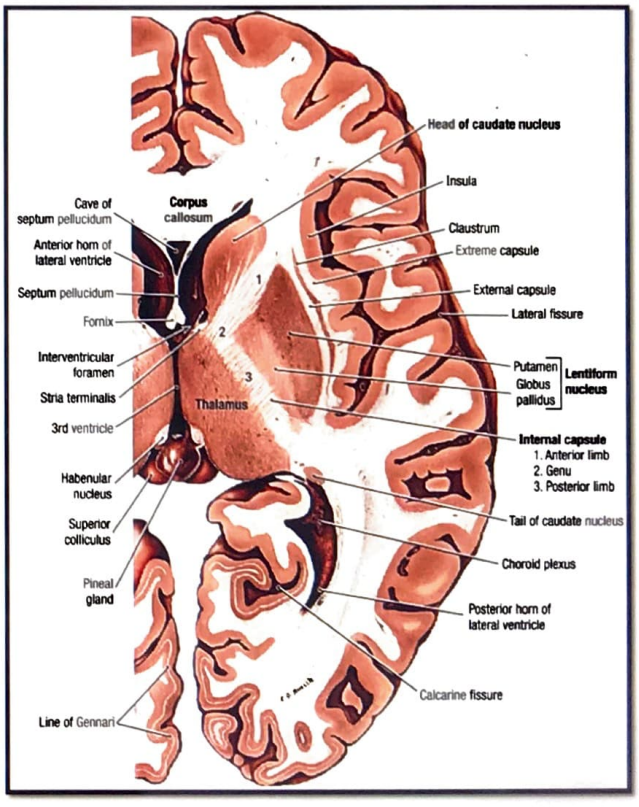
Lentiform nucleus Putamen + Globus Pallidus

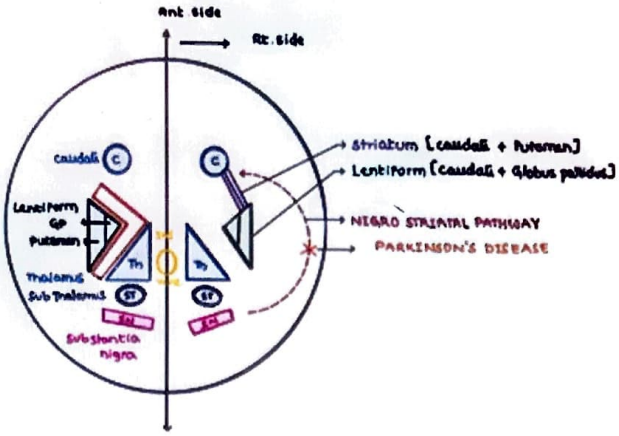
Internal capsule

00:07:20

- Anterior limb sandwiched between → Lentiform [lateral] & caudate[medial]
- Posterior limb sandwiched between → Lentiform [lateral & thalamus[medial]







SUBSTANTIA NIGRA

- Dark colored d/t melanin
- Produce Dopamine [Neurotransmitter] for NIGROSTRIATAL PATHWAY
- PARKINSON'S DISEASE
  - ↓ Dopamine
  - Nigrostriatal pathway compromised
  - Relative ↑ Ach
  - C/f
    - → Pill rolling tremor
    - → Cog – wheel or lead pipe rigidity
    - → Hypokinesia
  - R/x
    - → L Dopa
    - → TRIHEXYPHENIDYL [anticholinergic]

BASAL GANGLIA – FUNCTIONS

- Planning & programming of voluntary motor activity [ExtraPyramidal System]
  - [Voluntary motor activity done by Pyramidal system]

EXTRA PYRAMIDAL SYMPTOMS

00:24:46

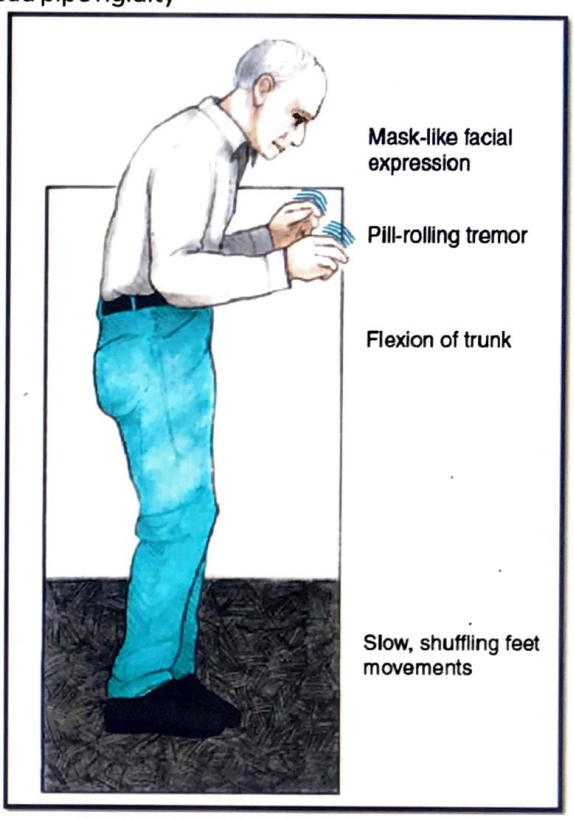
- Tremor [Purposeless involuntary movement]
- Chorea
- Athetosis
- Ballismus

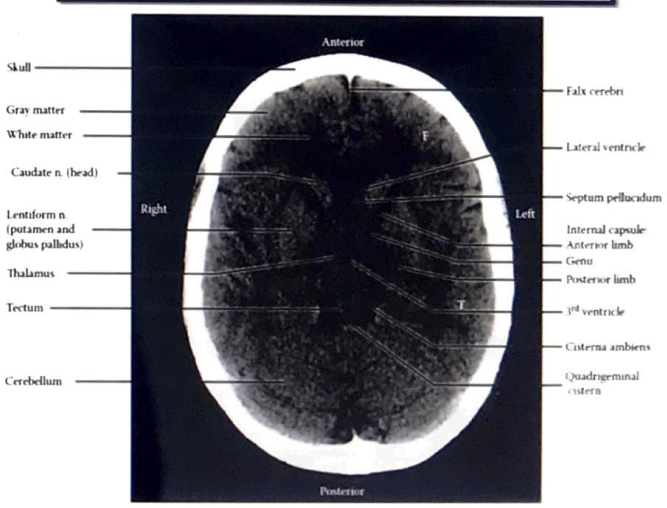
- **HemiBallismus**
  - Seen in lesion of subthalamic nucleus
  - Purposeless involuntary movements
- **In Wilson's Disease**
  - Lesion of Lentiform nucleus,
  - Purposeless involuntary movements +nt

PYRAMIDAL SYSTEM → controls fine & skilled voluntary motor activity

Parkinson's Disease Features

- Mask like facial expression
- Slow & shuffling gait →difficulty in starting &
- Pill rolling tremor stopping movements
- Cogwheel rigidity
- Lead pipe rigidity





34 INTERNAL CAPSULE

Previous Year's Questions

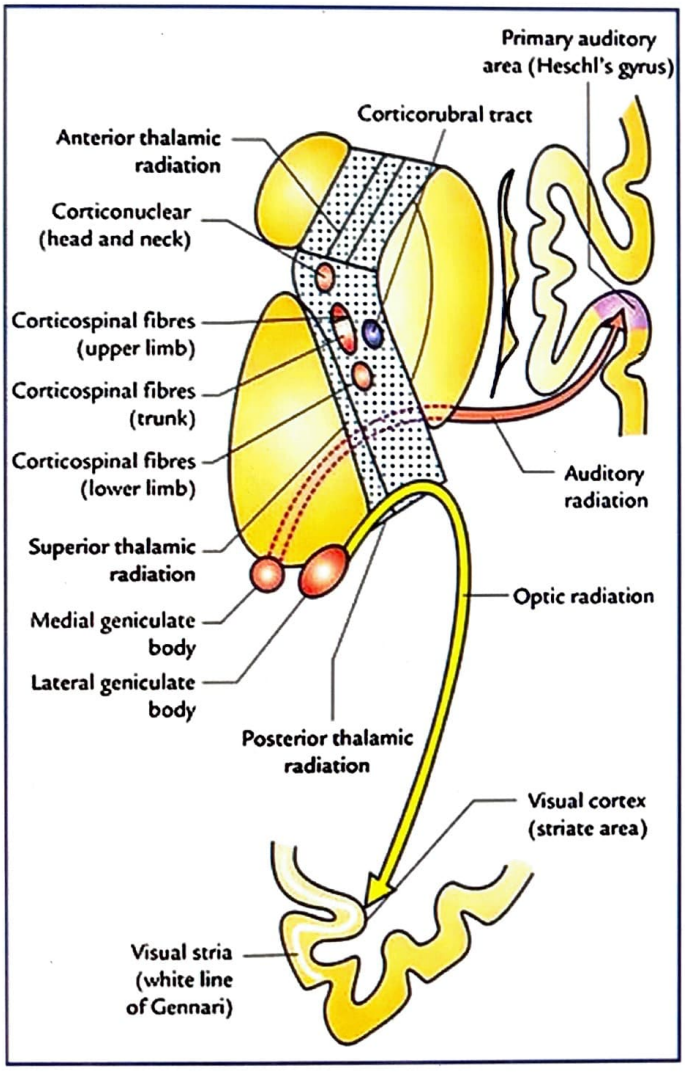
Q Relations of internal capsule are

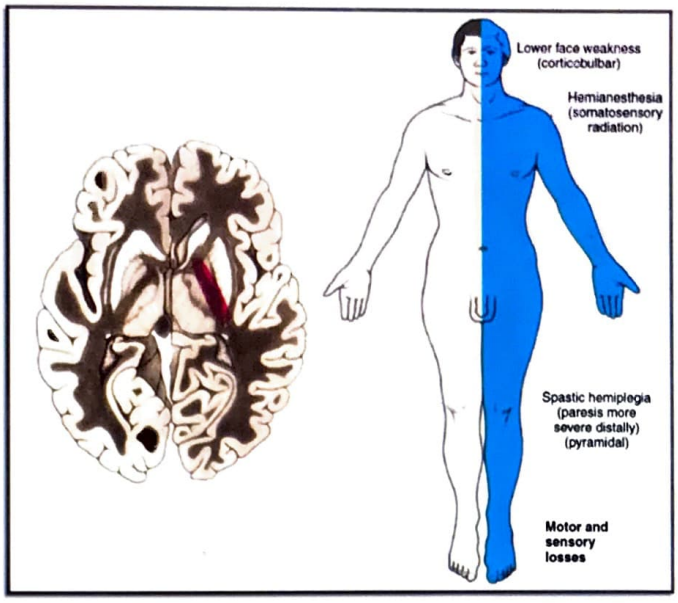
Thalamus medially, caudate & lentiform nuclei laterally

Thalamus laterally, caudate & lentiform nuclei medially

Thalamus & caudate nuclei medially & lentiform nucleus laterally

Thalamus & caudate nucleus laterally & lentiform nucleus medially





- Corticonuclear tract
  - Passing through Genu of IC
  - Controls head(eye) & neck fibres
- Corticospinal tract
  - Passing through posterior limb of IC
  - Controls upper limb, trunk & lower limb fibres

Lesions of internal capsule of one side involves c/l side of the body

- Only posterior limb involved → UL, trunk & LL of C/L side involved
  - Face area spared
- Only Genu involved
  - Body spared

METATHALAMUS

- MEDIAL GENICULATE BODY
  - Concerns with auditory pathway [MUSIC]
- LATERAL GENICULATE BODY
  - Concerns with visual pathway [LIGHT]

Medial Geniculate / Auditory Pathway

- Fibres pass through IC & reach HESCHL'S GYRUS [sup. gyrus 41, 42]
- Sublentiform fibres of IC are involved
- In posterior part of IC

Lateral Geniculate / Visual Pathway

- Fibres pass through IC & reach occipital visual / striate cortex [17]
- STRIATE CORTEX - Striations of Gennari's present
- aka GENICULOCALCARINE TRACT [starts from LGB & reaches calcarine sulcus]
- Retro lentiform fibres are involved
- In posterior part of IC

ARTERY SUPPLY

00:07:55

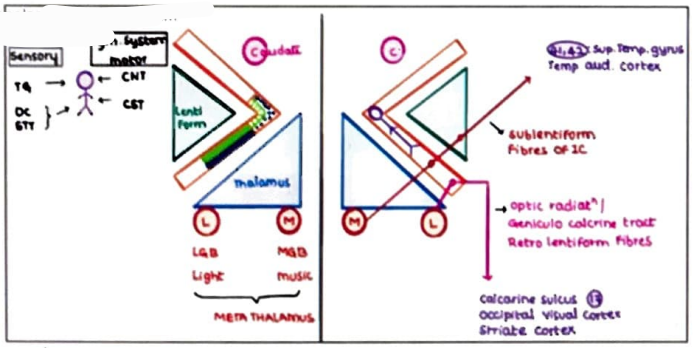
- Branch of internal carotid artery
- Supplies posterior limb of IC
- Blocks leads to ANTERIOR CHOROIDAL ARTERY SYNDROME
- Homonymous hemianopia
- Sensory motor loss on UL, truck & LL
  - [face spared on Genu supplied by direct branch of Interior carotid artery]
    → Auditory problems present

Previous Year's Questions

Q. Regarding Anterior choroidal Artery syndrome, all are true except

Hemiparesis
Hemi sensory loss
Predominant involvement of anterior limb of internal capsule
Homonymous hemianopia

Anterior limb of IC supplied by → Recurrent branch of HEUBNER Br. of Anterior cerebral Artery



INTERNAL CAPSULE

00:11:35

- Anterior limb sandwiched between → Lentiform [lateral] & caudate [medial]
- Posterior limb sandwiched between → Lentiform [lateral] & Thalamus [media]

Pyramidal System

- MOTOR SYSTEM
  - CORTICONUCLEAR TRACT
    → Present in lateral part of genu
    → Controls face fibres

  - CORTICOSPINAL TRACT
  - Present in the lateral part of the post.
  - Limb
  - Control UL, Trunk & LL fibres

- SENSORY SYSTEM
  - Trigeminal Nucleus
    → Presents in medial part of genu
    → Controls Face fibres

- Dorsal cortical tract
  - Present in medial part of posterior limb
- Spino thalamic tract
  - Control UL, Trunk & LL fibres

Previous Year's Questions

Q. Which of the following fibres DON'T pass through the posterior limb of IC

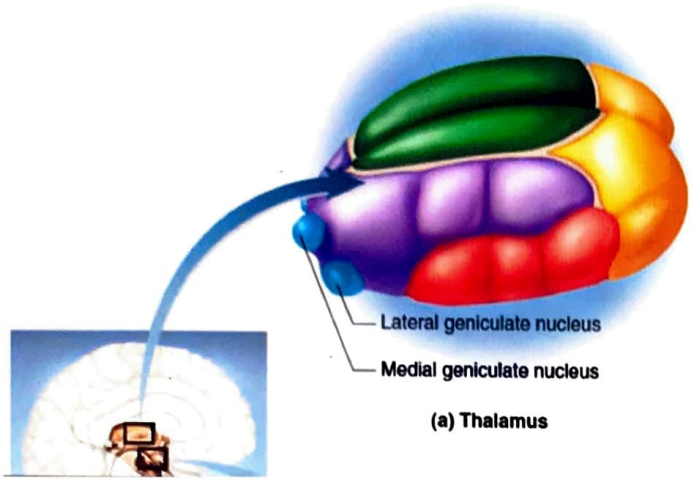
Sublentiform
Retrolentiform
Corticonuclear
Dorsal column

35 THALAMUS & HYPOTHALAMUS

- Both belongs to Diencephalon

THALAMUS

00:00:53



(a) Thalamus

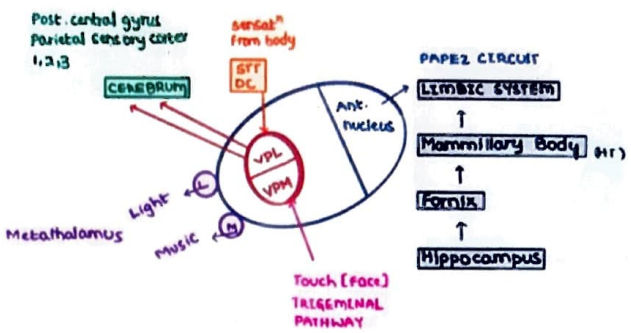
Thalamic nuclei	
Anterior group	Part of limbic system; memory and emotion
Medial group	Emotional output to prefrontal cortex; awareness of emotions
Ventral group	Somatosensory output to postcentral gyrus; signals from cerebellum and basal nuclei to motor areas of cortex
Lateral group	Somatosensory output to association areas of cortex; contributes to emotional function of limbic system
Posterior group	Relay of visual signals to occipital lobe (via lateral geniculate nucleus) and auditory signals to temporal lobe (via medial geniculate nucleus)

Relay Centre → Integration of sensory motor information

Ventral Group

- VENTRO POSTERO LATERAL [VPL] NUCLEUS → For body region
- VENTRO POSTERO MEDIAL [VPM] → For head region

- VPM NUCLEUS
  - Receives spino thalamic & dorsal column [brings touch sensation from upper limb and lower limb] & projects to post central gyrus



HYPOTHALAMUS

00:09:16

Maintains homeostasis [Internal Environment]

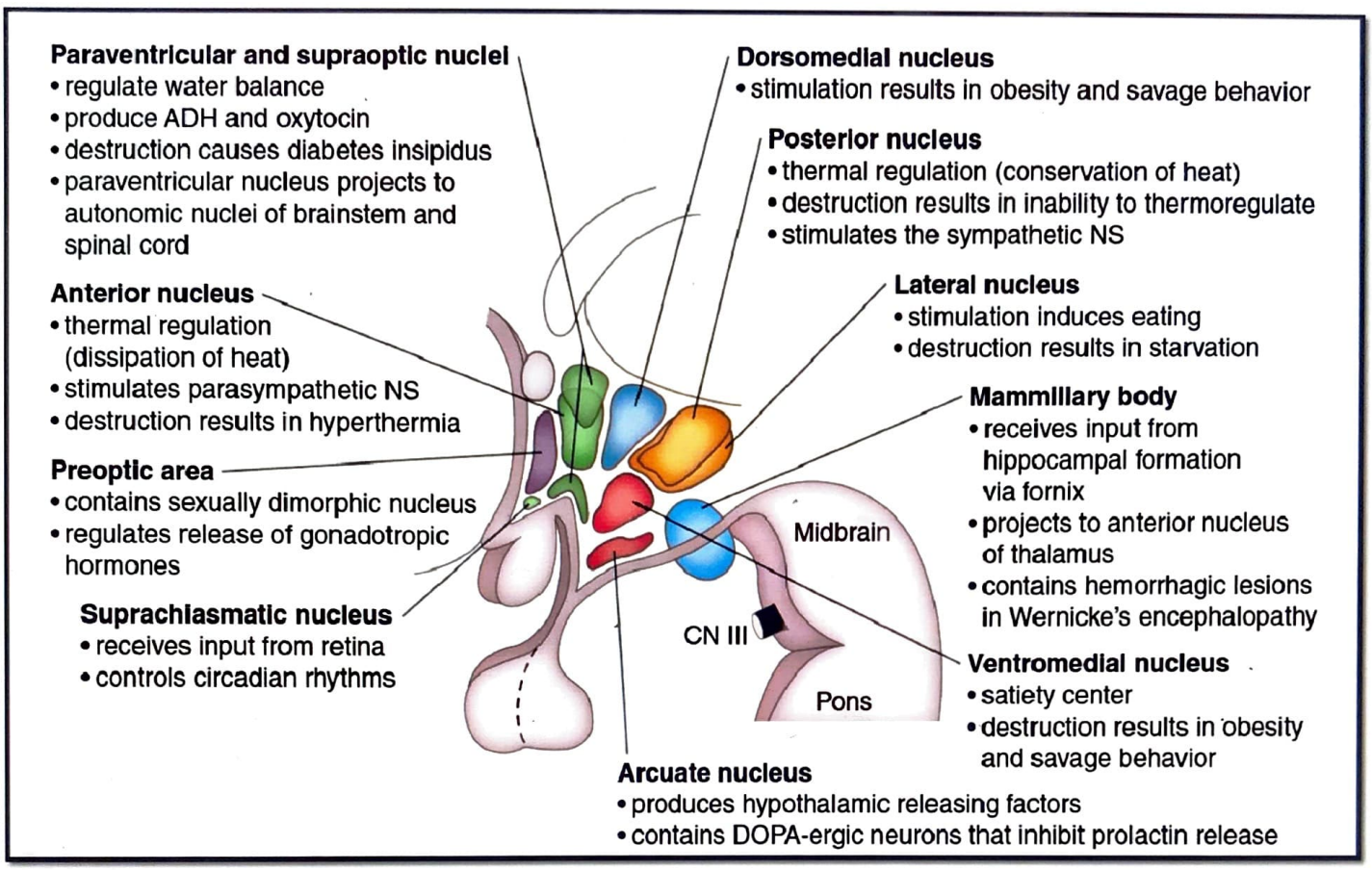
- Anterior Nucleus
  - Thermal regulation [Dissipation of Heat]
  - Stimulation of parasympathetic system
    → Vasodilation in peripheral
- Posterior Nucleus
  - Thermal regulation [conservation of heat]
  - Stimulation of sympathetic Nervous system
    → Vasoconstriction in periphery

- VMS [ventro medial satiety] centre
  - Satiety centre
  - Destruction → Obesity

- Lateral Nucleus
  - Hunger centre
  - Destruction → Starvation

- Mammillary Body
  - Present in floor of 3rd ventricles
  - Part of PAPEZ CIRCUIT
  - Receives input from hippocampus via fornix
  - Projects to ant. Nucleus of thalamus
  - Contains & haemorrhagic lesions in WERNICKE\S ENCEPHALOPATHY

- Paraventricular & Supraoptic Nuclei
  - Regulates water balance
  - Produce ADH & oxytocin

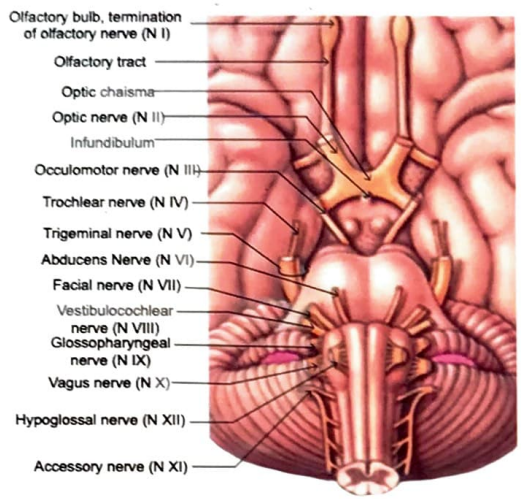


36 BRAINSTEM & CRANIAL NERVE NUCLEI

CRANIAL NERVES

00:00:12

- 12 pairs
  - 1, 2 : Come from forebrain
  - 3-12 : Come from Brain stem
    - → MidBrain
    - → Pons
    - → Medulla



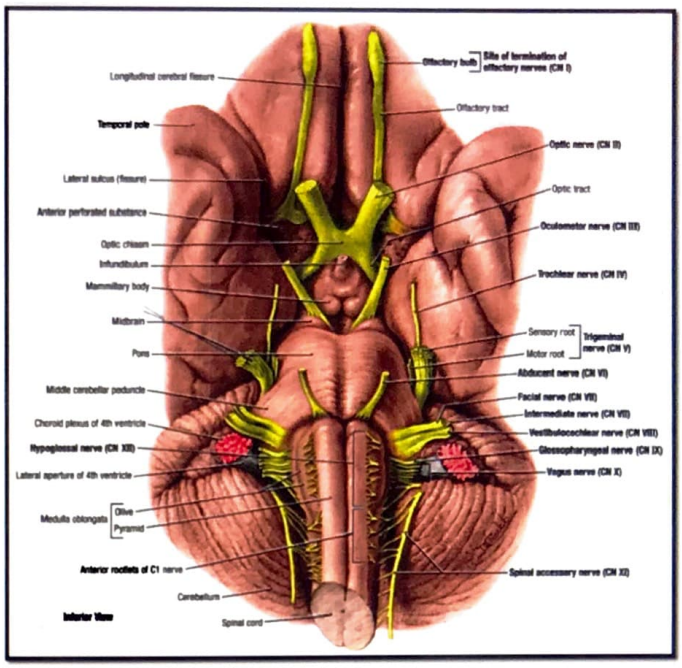
THICKEST → TRIGEMINAL NERVE (V)
THINNEST → TROCHLEAR NERVE

- CN I, II → Comes from foreBrain
- CN III, IV → Comes from MidBrain
- CN V → Comes from Pons
- CN VI
- CN VII Comes from Ponto medullary junction
- CN VIII
- CN IX
- IX Comes from Medulla oblongata behind Olive
- CN IX
- CN XII → Comes from Medulla oblongata in front of olive

BRAIN STEM

00:04:48

- MIDBRAIN [crus cerebri]
- PONS
- MEDULLA OBLONGATA
  Pyramid [anterior]
  Olive [slightly posterior]

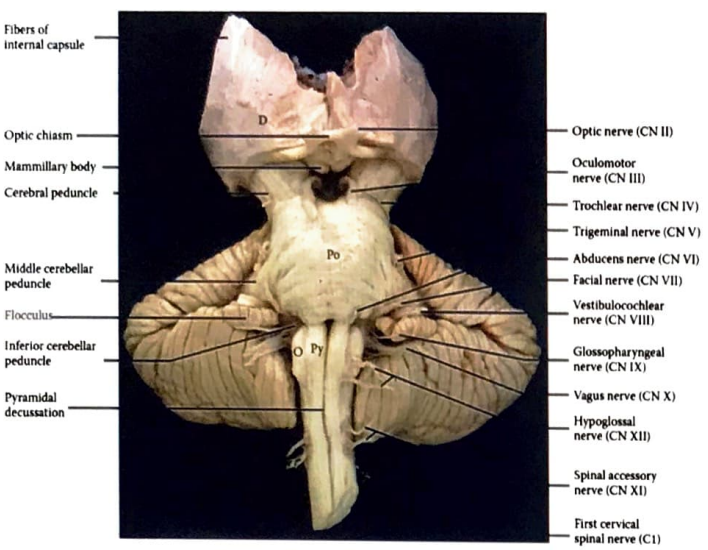


CRANIAL NERVES	LOCATIONS
OCULOMOTOR NERVE [III]	MIDBRAIN
TROCHLEAR NERVE [IV]	
TRIGEMINAL NERVE [V]	PONS
ABDUCENS NERVE [VI] (Near midline)	PONTOMEDULLARY JUNCTION
FACIAL NERVE [VII] (Lateral to CN VI)	
VESTIBULOCOCHLEAR NERVE [VIII] [Lat. To CN VII] ○ Has 2 components	
GLOSSOPHARYNGEAL NERVE [IX] VAGAL NERVE [X] CRANIAL ACCESSORY NERVE [XI] **All Present behind Olive**	MEDULLA OBLONGATA NUCLEUS AMBIGUUS
HYPOGLOSSAL NERVE [XII] → Present b/w pyramid & Oliver	MEDULLA OBLONGATA

SEQUENCE OF STRUCTURES IN MEDULLA OBLONGATA- from anterior to posterior

- Pyramid → most anterior

- CN XII
- olive
- CN IX, X, XI
  - **CN IX** : comes from NUCLEUS AMBIGUUS [M. oblongata]
  - **CN X** : controls muscles of
  - **Cranial accessory**: Palate muscles of Pharynx speech & swallowing Larynx
  - **Spinal accessory nerve [XI]** → comes from C1 - C5 of spinal cord
    → moves upwards via foramen & joints with cranial nerve IX.



BRAIN STEM & CN NUCLEI

00:16:04

- CN 3-12 nuclei are found in brain stem
- CN 3 & 4 NUCLEI Present in MIDBRAIN
  - OCULOMOTOR NUCLEUS (3)→at the level of superior colliculus
  - TROCHLEAR NUCLEUS (4) → at the level of inferior colliculus

- CN 5, 6, 7, 8 NUCLEI MAINLY PRESENT IN PONS BUT [illegible]RICTED
- CN 9, 10, 11, 12 NUCLEI PRESENT IN M. OBLONGATA

Previous Year's Questions

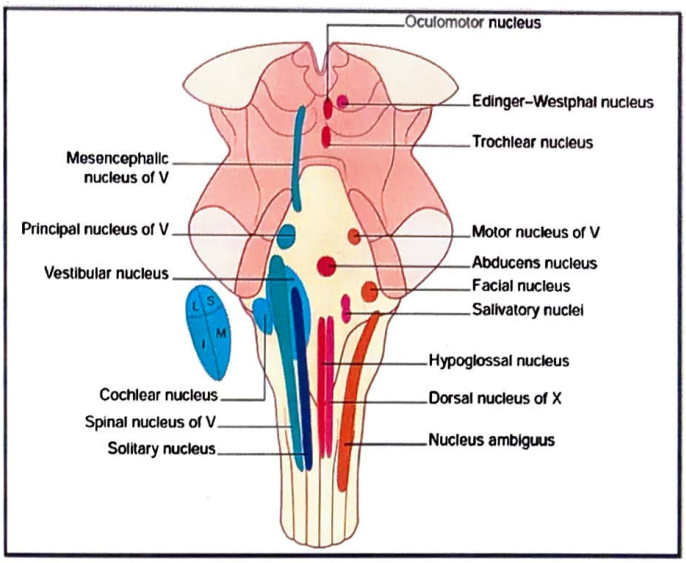
Q. Nucleus tractus solitarius receives fibres from all of following CN EXCEPT
Facial
Glossopharyngeal
Vagus
Accessory→Pure motor nerve

Nucleus Ambiguus

- Includes CN 9,10,11 nuclei
- Present in M. Oblongata

Trigeminal Nuclei

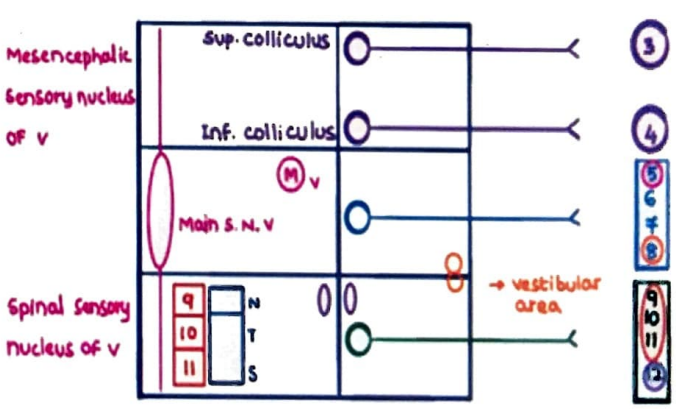
- Principal sensory nuclei is in PONS
- Mesencephalic sensory nucleus goes to midbrain
- Spinal sensory nucleus goes to spinal cord



Nuclei present in lateral medulla

1. Nucleus ambiguus
2. Spinal sensory nucleus of V
3. Solitary nucleus [nucleus tractus solitarius]

- In Wallenberg [lateral medullary] syndrome, above nuclei are affected
- Hypoglossal nucleus [XII] not involved
  - Present near midline→ Involved in medial medullary syndrome
  - Tongue muscle palsy

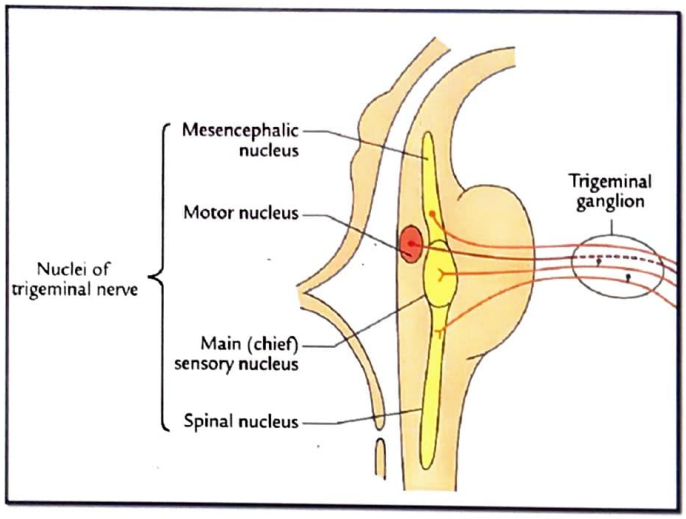


CN VIII can extend into medullary area

WALLENBERG SYNDROME 00:20:15

Clinical features

- Vertigo [injury of vestibular nucleus]
- I/L loss of pain & temperature on face [injury of spinal sensory nucleus of V]
- I/L loss of taste [injury to nucleus tractus solitarius]
- Difficulty of speech & swallowing [injury of N. ambiguus]



CN V [TRIGEMINAL NERVE] NUCLEI 00:33:42

- 1 Motor nucleus
  - 3 Sensory nuclei
- Motor nucleus present in pons
  - Controls muscles of 1st pharyngeal arch [muscles of mastication]

3 sensory nuclei

- Main sensory nucleus [pons]
  - → Receives touch & vibrations sensations
- Mesencephalic sensory nucleus [midbrain]
  - → Receives proprioception [position sense] of eyeball, mandible, tongue
- Spinal sensory nucleus [spinal cord]
  - → Receives pain & temperature of same side of face

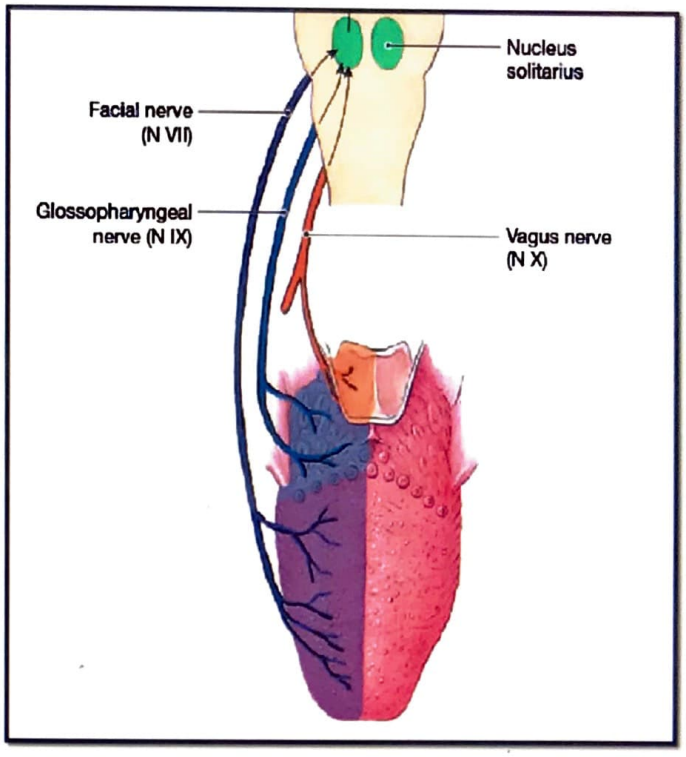
Nucleus Ambiguus

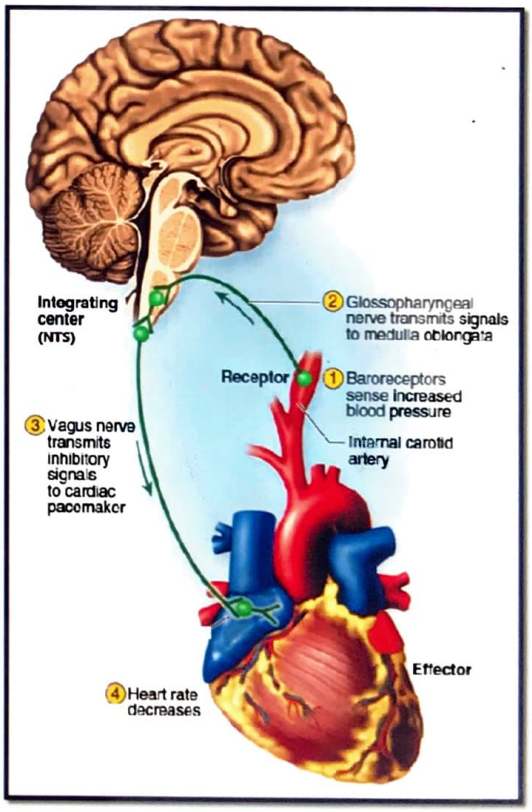
- Present in lateral medulla
- Includes CN 9, 10, 11 (cranial part) nuclei
- Control 3, 4, 5, 6 pharyngeal arch muscles
  - Muscles of Palate
  - Larynx

} Pharynx muscles of speech & swallowing

Nucleus Tractus solitaries

- Has two parts tip (for taste) and bottom (visceral sensation)
- Tip will receive taste sensation (SVA) by
- FGV
  - F:Facial nerve: anterior 2/3 of tongue
  - G:Glossopharyngeal nerve (from posterior 1/3rd)
  - V:Vagus nerve (posterior Most of tongue and epiglottis)
- Bottom receive sensation from Chemoreceptor and baroreceptor carried by
- Glossopharyngeal nerve(blood PH, blood co2 or BP) integrated in the bottom of NTS Activates vagus nerve (cardioinhibitory) and it control the activity of atria



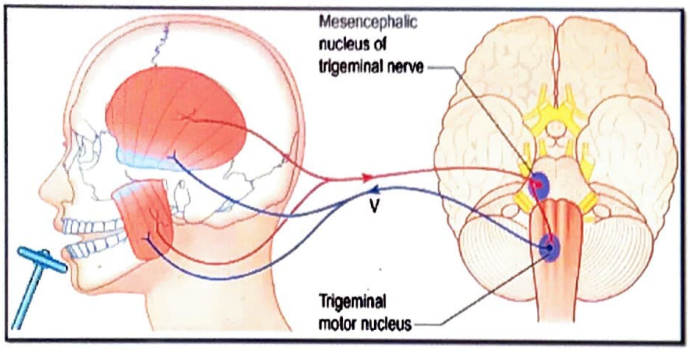


Hypoglossal Nucleus [Xii]

- Present near the midline
- Affected in middle medullary syndrome

Masseter Reflex (jaw reflex)

- Mandibular branch of trigeminal nerve
- Procedure



Hit the mentum of mandible down and move the mandible down

↓

Changes position of mandible

↓

Proprioception carried by mandibular Branch of trigeminal nerve (sensory fibers)

↓

Mesencephalic sensory nucleus of T & N, Receives proprioception

↓

Motor nucleus of trigeminal in pons is activates

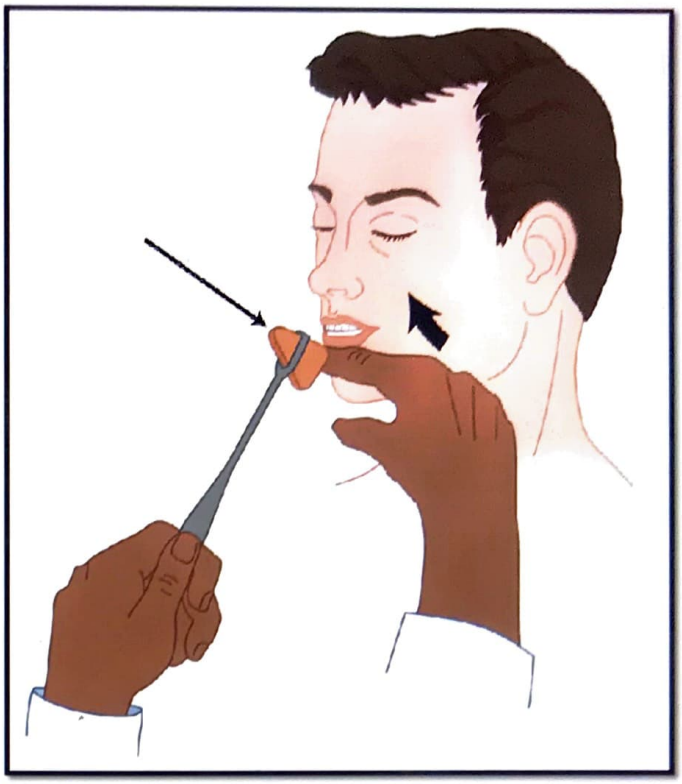
↓

Activates mandibular branch of Trigeminal nerve (motor fibers) →

Masseter activated (elevates mandible)

↓

Elevates mandible (Mouth closes suddenly)

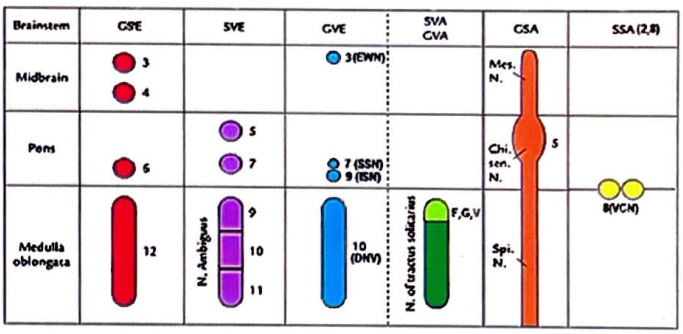


37 NEURAL COLUMNS & BRAINSTEMNUCLEI

motor and sensory components

00:00:30

Classification of Neural Columns	
Motor (Efferent)	**Sensory (Afferent)**
GSE (General Somatic Efferent) • All skeletal muscles except pharyngeal arch muscle • Includes EyeBall (CN: 3, 4, 6) and Tongue muscle (CN:12)	GSA (General Somatic Afferent) • Carry general sensations such as touch, pain temperature, proprioception etc. SK muscle spasm • Includes three sensory nuclei of CN 5
SVE (Special Visceral Efferent) • Pharyngeal arch muscles • Includes CN: 5, 7, 9, 10, 11	SVA (Special Visceral Afferent) • Transmit information regarding smell and Taste • Includes CN: 1 and 7, 9, 10
GVE (General Visceral Efferent) • Visceral (Cardiac & Smooth) muscles and glands • Includes parasympathetic CN: 3, 7, 9, 10	GVA (General Visceral Afferent) • General Visceral sensations like angina, colicky pain • Information from viscera such as carotid body & sinus
	SSA (Special Somatic Afferent) • Special Somatic sensation like Vision (eye) and Hearing & Balance (ear) • Includes CN : 2 and 8



arches and nerves

00:05:38

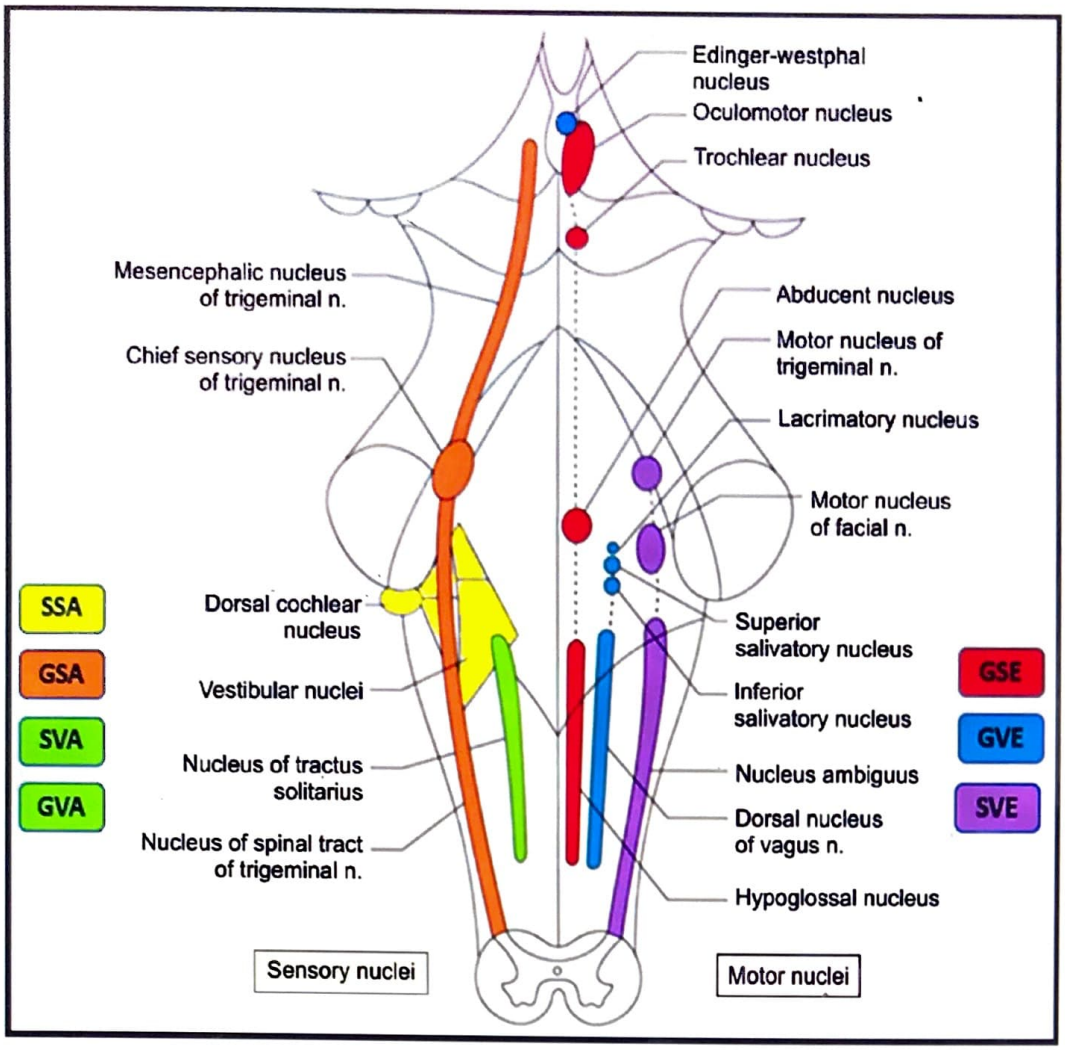
SVE [Special Visceral Efferent]

- PHARYNGEAL ARCH MUSCLES

Pharyngeal arch	Cranial Nerve	Supply
1st	V_3	Muscles of Mastication
2nd	VII	Muscles of Facial Expression
3rd , 4th , 6th	IX, X, XI	Muscle of Pharynx palate and larynx

GVE [General Visceral Efferent]

- Controlled by para sympathetic component of ANS PARASYMPATHETIC V=NERVES & NUCLEI
  - 3 → EWN → Eye ball
  - 7 Superior salivatory nucleus& Salivary glands
  - 9 Inferior salivatory nucleus & Salivary glands
  - 10 Dorsal nucleus of vagus → Cardiac, smoothmuscles &glands



Previous Year's Questions

Q. All of the following pairs regarding neural columns & associated nuclei are correct except

hypoglossal nucleus
Nucleus ambigus
Dorsal nucleus of vagus →GVA
NTS

38 CEREBELLUM

Previous Year's Questions

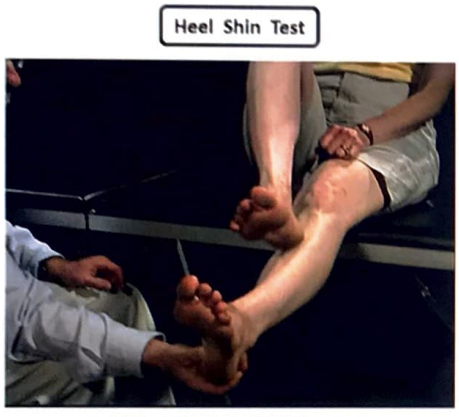
Q. Function of spinocerebellar tract [AIIMS 2009]
a Equilibrium
b Coordinates movements [BETTER ANSWER]
c Learning induced by change in vestibular reflexes
d. Planning & Programming → Function of Basal ganglia

- Spino cerebellar tract carry unconscious proprioception of lower limb to cerebellum

CEREBELLAR ATAXIA

00:03:40

- Due to injury to spinocerebellar tract [anterior lobe]
- Uncoordinated clumsy movements
  - Can't able to walk in straight line [loss of coordination]
  - Keep falling towards side of lesion




CEREBELLAR ATAXIA

Previous Year's Questions

Q. In cerebellar lesion not seen is [AIIMS 2016]
a Ataxia
d Nystagmus
c Resting tremors
D. Past pointing

- HEEL SHIN TEST positive
  - PROCEDURE→ Ask the patient move his heel on his Shin
  - Unable to do so → POSITIVE
- Intentional tremor present

CEREBELLUM

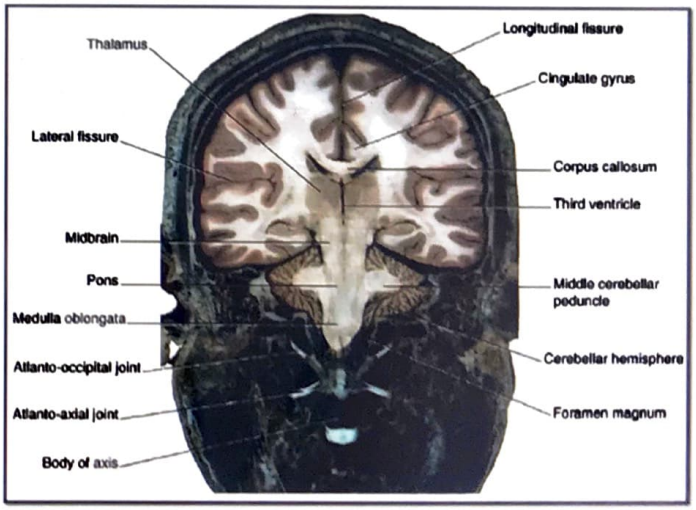
00:06:08

- Cerebellum present in posterior cranial fossa
- Leaf like [foliated] ARBOR VITAE
- Present at roof of 4th ventricle
- Attaches to brain stem with peduncles

Superior peduncle → with midbrain
Middle peduncle → with pons
Inferior peduncle → with M. Oblongata

Comprises
Vermis → midline and axial balance
Hemisphere → [UL and LL coordination]

→LOBES
1. ANTERIOR LOBE → Paleocerebellum
2. POSTERIOR LOBE → latest → NEO CEREBELLUM
3. FLOCCULONODULAR LOBE→oldest→ ARCHICEREBELLUM

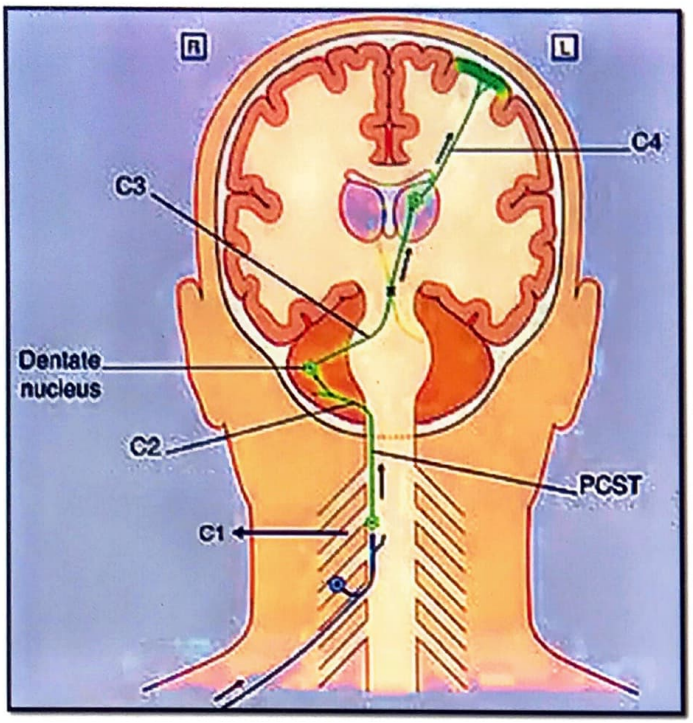


Coronal Section - front view

Middle cerebellar peduncle carries→ Ponto cerebellar tract

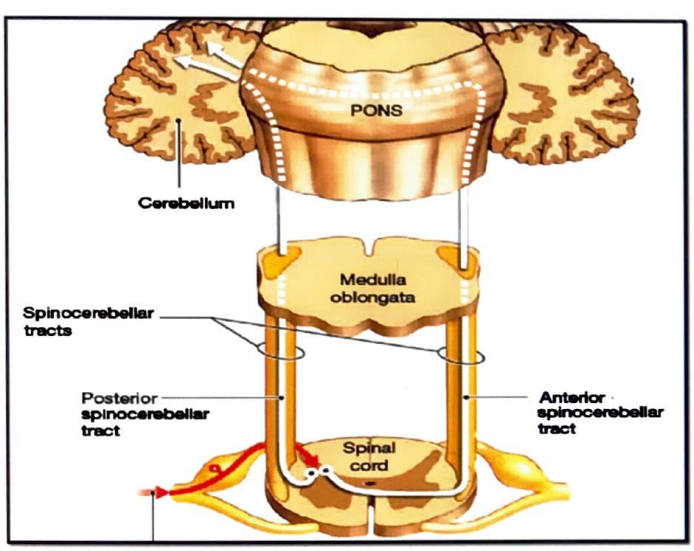
Superior cerebellar peduncle carries→ Dentato thalamic tract

Inferior cerebellar peduncle carries → Spino cerebellar tract



CEREBELLAR PATHWAY

00:14:24



→ Rt. LL moving

↓

Rt. dorsal spinocerebellar tract activated

↓

positional sense carried towards rt. cerebellum

↓

cerebellum communication with C/L thalamus via dentato thalamic tract

↓

Thalamus communicates with left cerebellum

↓

Rt. LL moved by Lt. cerebellum via cortico spinal tract [crossing occurs in lower medulla]

MOSSY FIBRES

fibres reaching cerebellum

- most of mossy fibres runs as dorsal / ventral spinocerebellar tract & reaches ipsilateral cerebellum
- Very few crosses midline in spinal cord & runs as ventral / anterior spino cerebellar tract & recrossing occurs within cerebellum and reaches ipsilateral cerebellum
- dorsal spinocerebellar tract uses inferior peduncle & reaches I/L cerebellum
- ventral spinocerebellar tract uses superior peduncle & reaches C/L cerebellum but recrossing occurs & reaches I/L cerebellum again

Cerebellum Lesions Causes Ipsilateral Manifestations

Previous Year's Questions

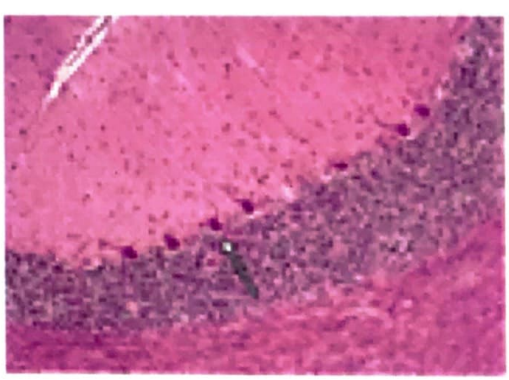
Q. The marked cell inhibits which of the following Structure :

A Golgi cell

B Basket cell

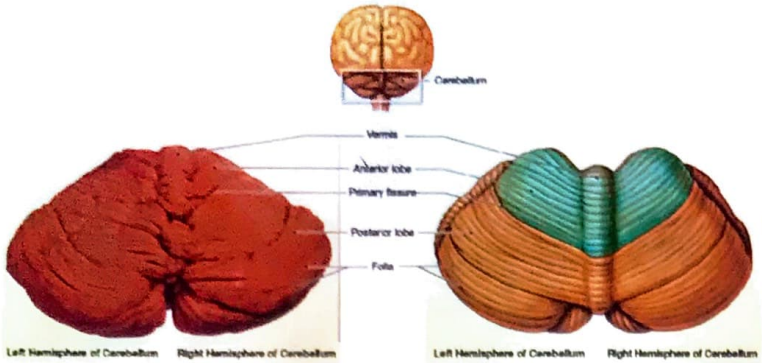
c Vestibular nuclei

D Deep cerebellar nuclei



CEREBELLAR CORTEX – LAYERS

1. Molecular layer [outer]
2. Purkinje layer
3. Granular layer [Inner]



→ Emboliform nucleus
Globose nucleus
→ De ntate Nucleus
→ Fastigial Nucleus

INTERPOSED NUCLEI,
→ most lateral, latest
→ most medial, oldest

Revision

Refer Table 38.1

Lesions

Important Information

Purkinje cells: only efferent fibers from cerebellum. It uses GABA(going to inhibit the dentate nucleus)

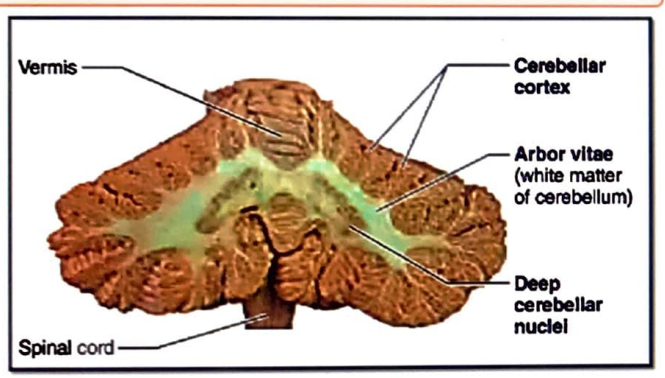
Vermis → Present in midline, most medial,oldest
Primary fissure → Separate anterior & posterior lobes
ARBOR VITAE → White matter of cerebellum

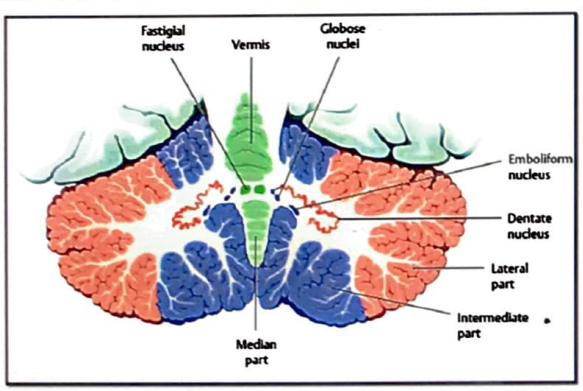
DEEP CEREBELLAR NUCLEI [DEFG] 00:21:06

D → Dentate Nucleus
E → Emboliform Nucleus
F → Fastigial Nucleus
G → Globose Nucleus

Important Information

Fastigial nucleus is important for saccadic eye movement





Flocculo-Nodular Lobe lesions

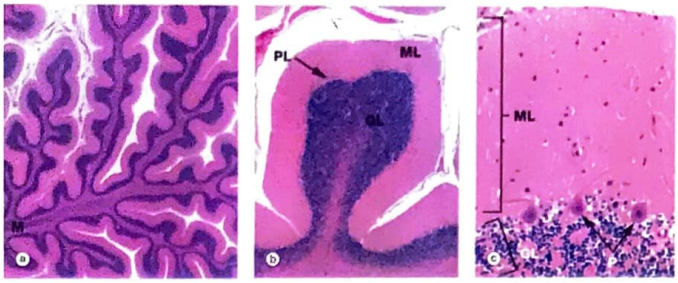
Truncal Ataxia

Intention tremors

CELLS IN CEREBELLAR CORTEX

00:31:37

3 Layer and 5 cells in cerebellar cortex



- Outer molecular layer: Contains stellate & basket cells
- Middle Purkinje layer: Contains purkinje's cells(processes goes to outer molecular layers)
- Inner granular layer:Contains granule & Golgi cells

CLIMBING FIBRES → Comes from inferior olivary nucleus of medulla oblongata

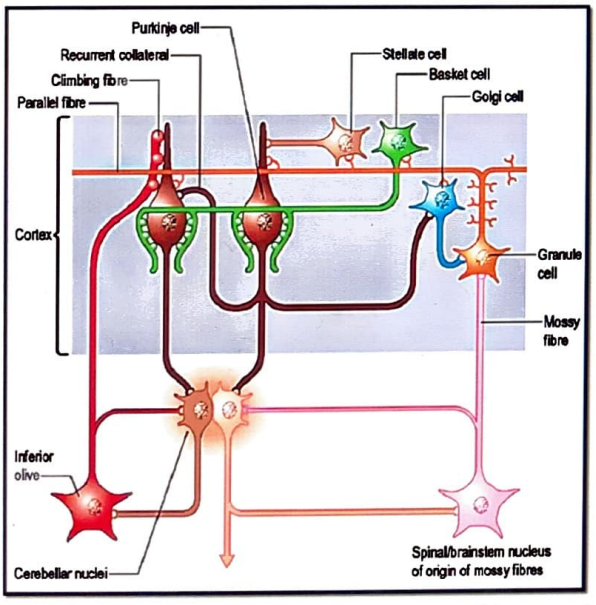
MOSSY FIBRES → Most predominant

PURKINJE CELLS → Only efferent cells of cerebellar cortex

→ Flask shaped cells with multiple projections into outer molecular layer

CEREBELLAR AFFERENT PATHWAYS

00:34:00



- Fibers reaching cerebellum Synapses with granule cell which communicate with remaining cells fibers
- Granule cells uses parallel fibers to communicate with other cells
- Purkinje cells can only reach DEFG nucleus
- Most of mossy fibers runs as dorsal/ ventral spinocerebellar tract & reaches ipsilateral cerebellum
- Very few crosses midline in spinal cord & runs as ventral/ anterior spinocerebellar tract & recrossing occurs within cerebellum and reaches ipsilateral cerebellum
- Dorsal spinocerebellar tract uses inferior peduncle & reaches I/L cerebellum
- Ventral spinocerebellar tract uses superior peduncle & reaches C/L cerebellum but recrossing occurs & reaches I/L cerebellum again
- Climbing fibers: Comes from inferior olivary nucleus of medulla oblongata and goes to purkinje cell in cerebellar cortex

Previous Year's Questions

Q. Efferent from cerebellum arises from
Purkinje cells
Stellate neurons
Deep nuclei
Grade III fibres

CEREBELLAR PATHWAYS

00:50:00

- CEREBRO PONTO CEREBELLAR TRACT
  - → via middle cerebellar peduncle, useful in FEEDBACK/ LOOP MECHANISM

INCOMING FIBRES & CEREBRAL PEDUNCLES

- Inferior cerebellar peduncle
  - Olivo cerebellar tract
  - Dorsal spinocerebellar tract
- Middle cerebellar peduncle
  - Cortico ponto cerebellar tract
- Superior cerebellar peduncle
  - Ventral spinocerebellar tract

OUTGOING FIBRES & CEREBELLAR PEDUNCLES

- Superior cerebellar peduncle
  - → Dentato rubro thalamic tract

Previous Year's Questions

Q Tract not present in inferior cerebellar peduncle is
Dentato rubro thalamic
Posterior spino cerebellar
Olivo cerebellar
Cuneo cerebellar

Previous Year's Questions

Q. Structure not passing through inferior cerebellar peduncle [PGIC 07.08.09]
Pontocerebellar
Cuneocerebellar
Anterior Spinocerebellar
Vestibulocerebellar

Table 38.1

Subdivisions	Components	Nucleus	Chief Connections	Functions
Archicerebellum (oldest part)	Flocculonodular lobe+lingual	Nucleus fastigii (Fish)	Vestibulocerebellar	Maintenance of equilibrium (responsible for maintaining the position of body in space)
Paleocerebellum (in between, i.e. neither oldest nor newest)	Whole of anterior lobe except lingual pyramid Uvula	Nucleus interpositus consisting of nucleus globosus and nucleus emboliformis	Spinocerebellar	Controls clued movements of the limbs
Neocerebellum (most recent part)	Whole of posterior lobe except pyramid and uvula	Nucleus dentatus	Corticoponto cerebellar	Smooth performance of highly skilled voluntary movements of precision

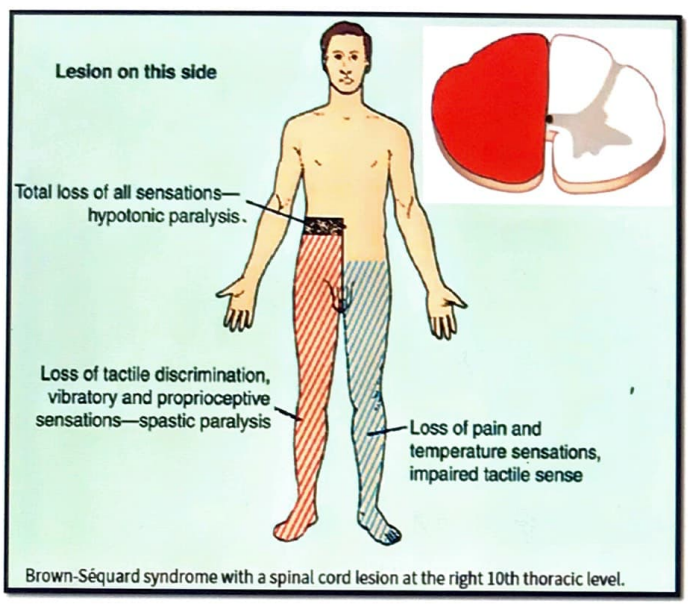
39 SPINAL CORD

Previous Year's Questions

Q. All are true about Sequard syndrome except
Hemisection of spinal cord
Ipsilateral loss of vibration sensations
Ipsilateral loss of crude touch sensations → carried by ant. spinothalamic tract
Ipsilateral paralysis below the level of lesion

BROWN SEQUARD SYNDROME

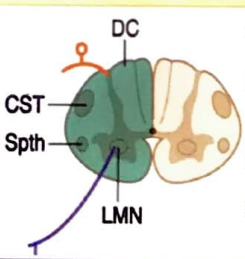
00:00:20



Brown-Séquard syndrome with a spinal cord lesion at the right 10th thoracic level.

- Manifestations occurs 1 & 2 segments below the lesion
- Flaccid paralysis due to injury to LMN
- Spastic paralysis below the level of lesion
- due to injury UMN [pyramidal tract]

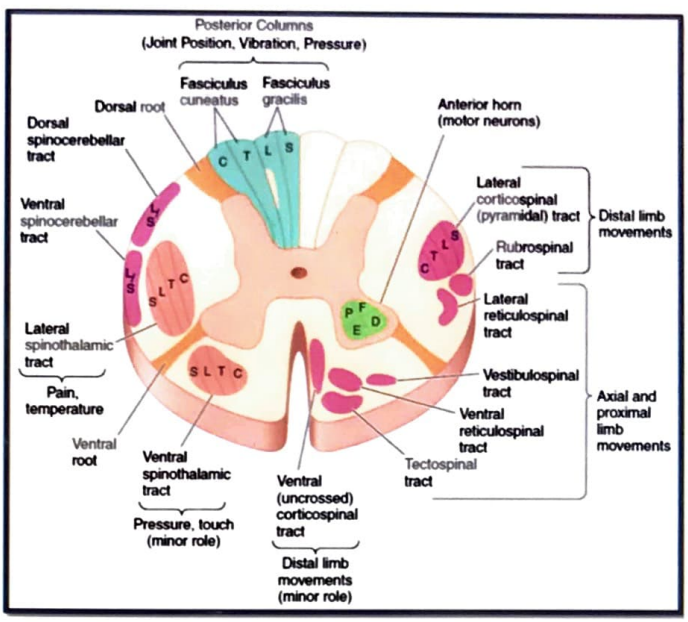
Hemisection: Brown-Séquard Syndrome



a. DC: Ipsilateral loss of position and vibratory senses at and below level of the lesion
b. Spinothalamic tract: Contralateral loss of pain and temp 1–2 segments below lesion and ipsilateral loss at the level of the lesion
c. CST: Ipsilateral paresis below the level of the lesion
d. LMN: Flaccid paralysis at the level of the lesion

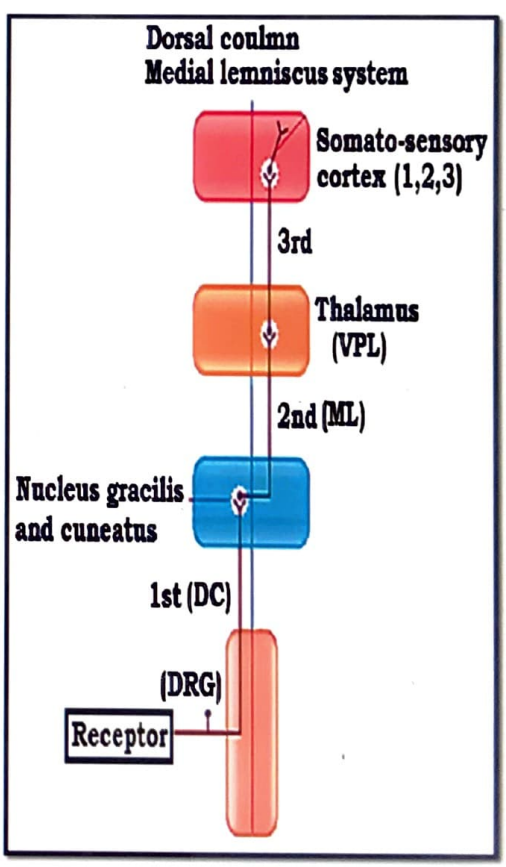
Spinal Cord Transverse section

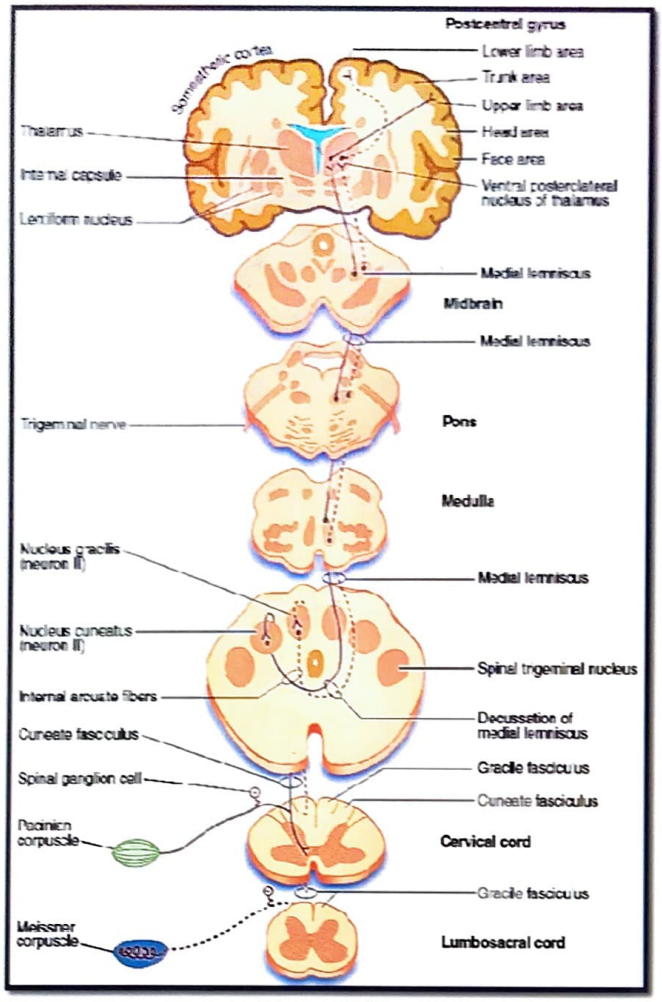
00:04:45



Dorsal column - Medial Lemniscus system

00:06:05





Receptor

↓

Dorsal Root Ganglion [1° neuron]; runs ipsilaterally

↓

Synapsing in Nucleus Gracilis Nucleus Cuneatus in medulla

↓

Medial Lemniscus [2° neuron] begins runs contra laterally to reach 3° neuron in Thalamus

↓

Then passes through Internal capsule to reach parietal sensory cortex [1, 2, 3]

- Receptors
  - Meissner corpuscle: for tactile discrimination
  - Pacinian corpuscle: for pressure & vibration
- Fasciculus cuneatus } Dorsal column
- Fasciculus Gracilis }
- Fasciculus gracilis carries lower body (below diaphragm) sensations
- Fasciculus cuneatus carries upper body (above diaphragm) sensations
- Synapse in medial medulla
- Dorsal column (MLS) not affected in Wallenberg syndrome (as runs in midline)
- Lemniscus →Bundle of axons
- 3-degree pass through the posterior Limb of internal capsule
- left side ischemia of post limb of IC →right side loss of pressure, vibration, tactile discrimination of body
- Left side medial lemniscal injury in brain stem → rt side loss of pressure, vibration, tactile discrimination of body
- Fasciculus cuneatus and Fasciculusgracilis→ I/L loss of pressure, vibration, tactile discrimination of body
- In brown Sequard syndrome→Ipsilateral loss of sensation.

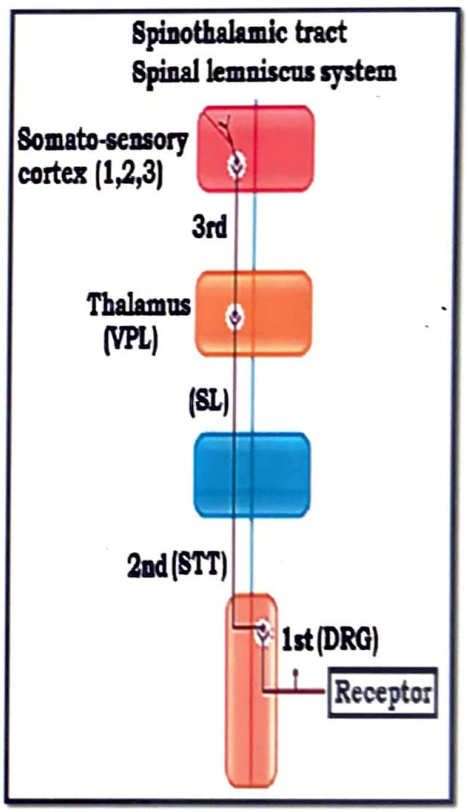
Previous Year's Questions

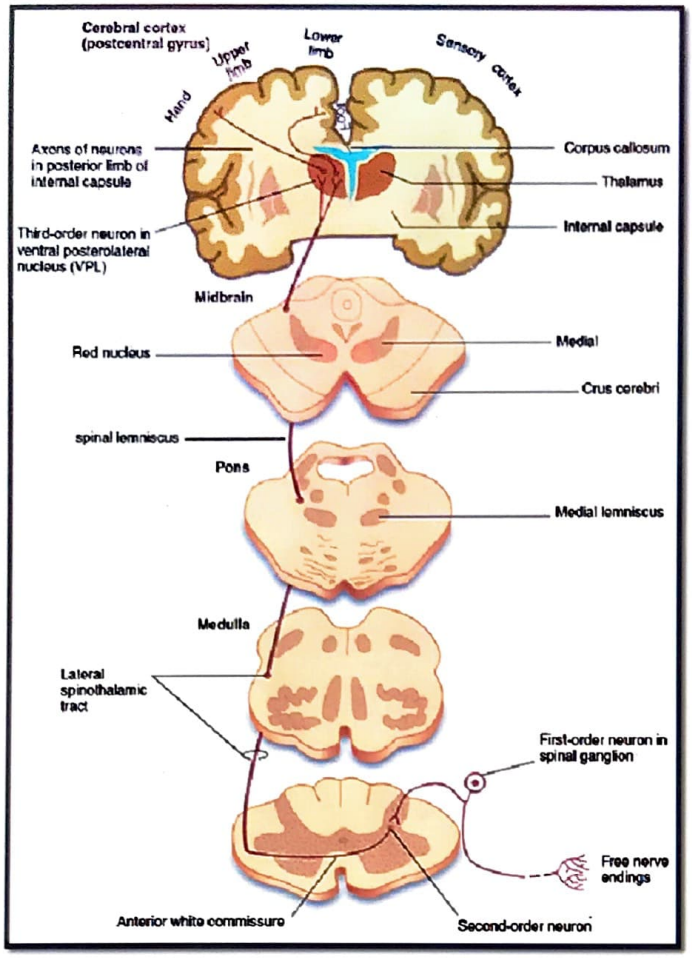
Q. Medial lemniscus is continuation of?

(AIIMS - Jun - 2020)

A. Spinothalamic tract
B. Fasciculus gracilis
C. Spinocerebellar tract
D. Spinotectal tract

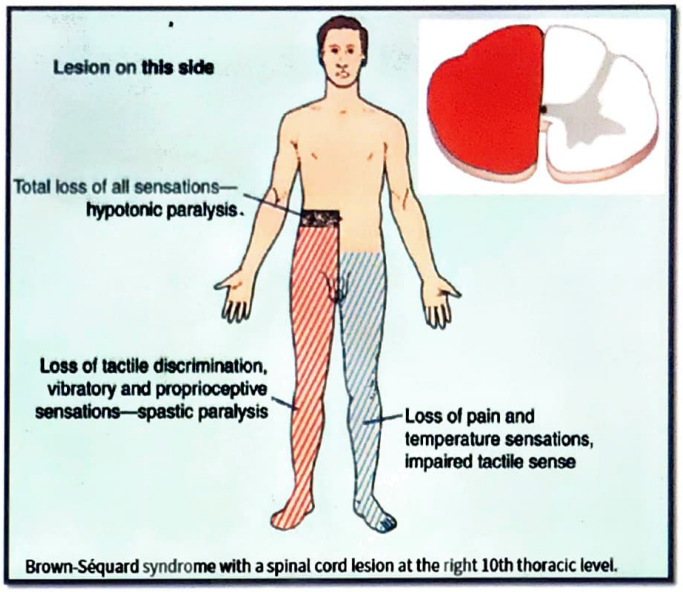
SPINO-thalamic tract - Spinal Lemniscal system 00:16:15

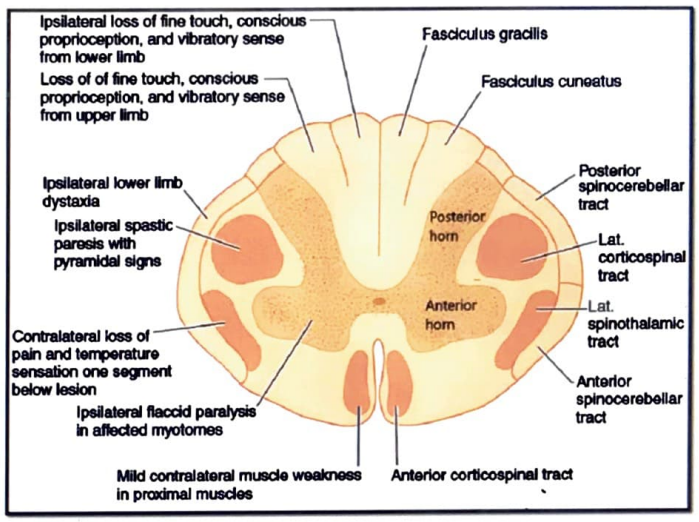




- Receptors for pain & Temperature → free nerve endings
- Dorsal root ganglion
  - 1st degree neuron
  - Immediately synapse on post horn cell on same side
- Post horn Cells
  - 2nd degree neuron
  - Fibers from posterior horn cells cross midline & runs as spinothalamic tract (2nd degree neuron)
  - crossing occurs in anterior Commissure
  - Spinal lemniscus
  - Lateral spinothalamic tract in brainstem as spinal lemniscus
  - Synapses in VPL nucleus of thalamus →3 degree neuron then passes through posterior limb or IC and relies on parietal sensory cortex (1,2,3)→If compromised in brown squared syndrome:C/L pain, temperature sensation lost

Injury

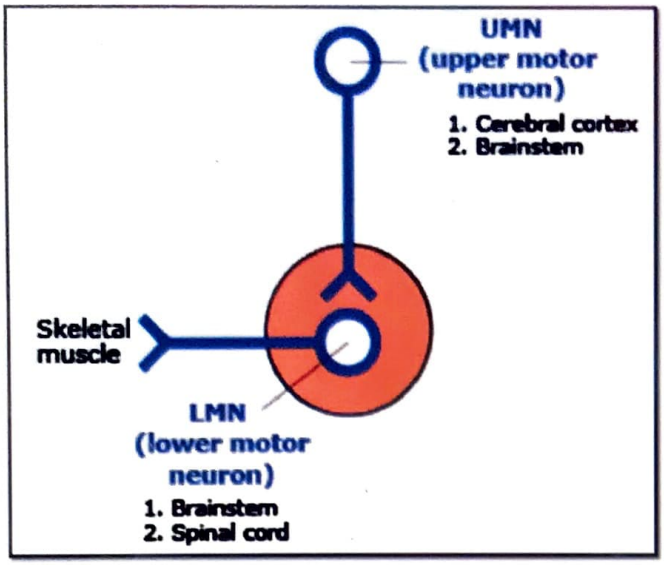




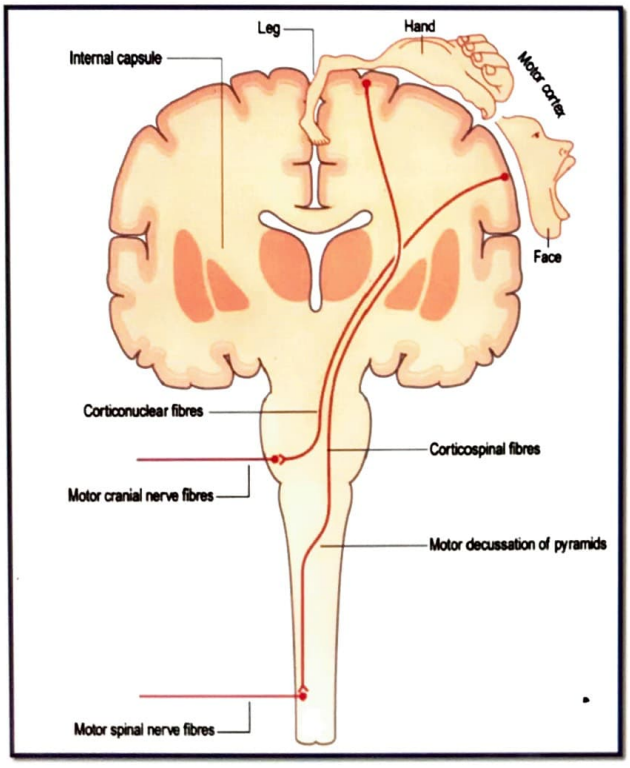
- To lateral spinothalamic tract: loss of pain,temp sensation C/L
- To dorsal column: I/L loss of tactile discrimination, pressure, vibration, stereognosis,proprioception
- To pyramidal tract: I/L spastic paresis below the level of lesion
- To LMN: Flaccid paralysis at the level of lesion
- To spinocerebellar tract: I/L cerebellar ataxia

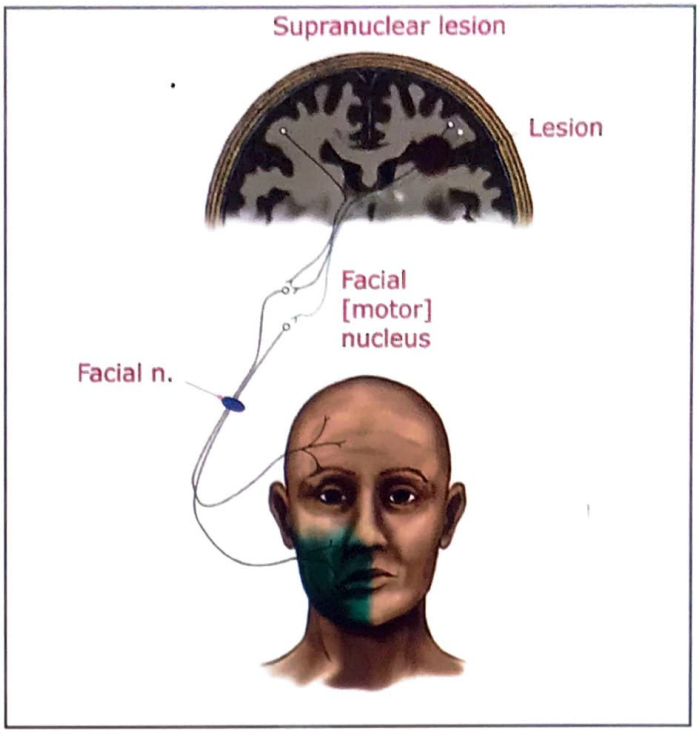
Pyramidal tract

00:26:15



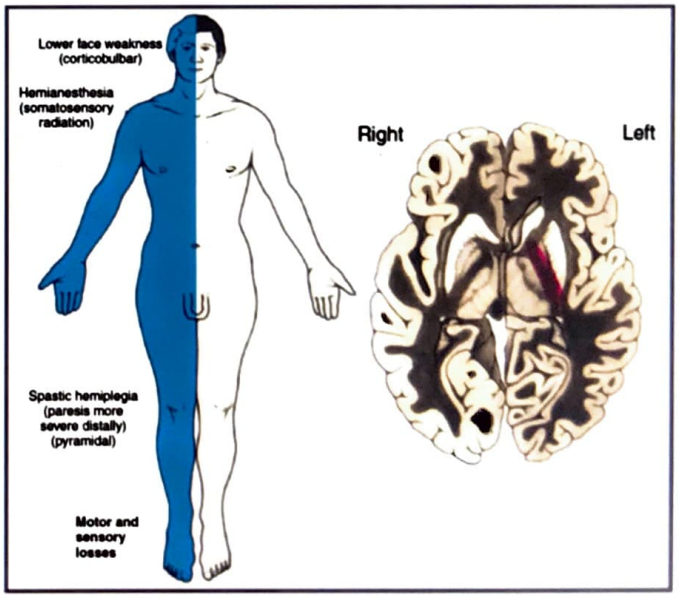
- UMN are Modulatory to LMN
  - Preferably inhibiting but also excitatory
  - UMN palsy leads LMN to fire frequently spastic para[illegible]
  - On LMN injury (polio virus) flaccid paralysis
- Pyramidal system consists
  - Corticospinal tract controls finger movements →crosses at lower medulla and synapsids with spinal cord
  - Corticonuclear/ Corticobulbar tract controls eye movement→ crosses the genu of IC and Crosses at the level of motor nuclei→ LMN fibers CN 3,4,6

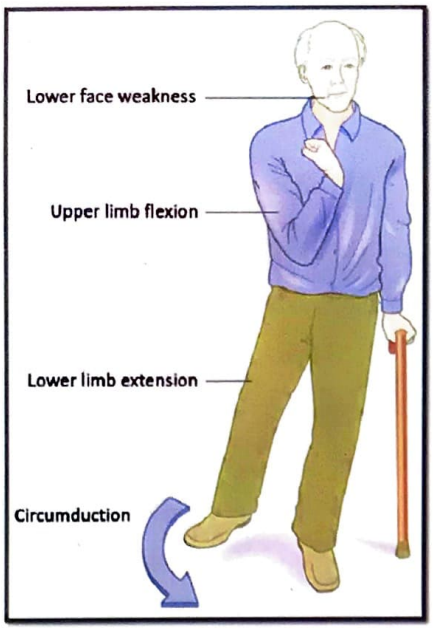




UMN Palsy

- Lesion of genu (UMN injury) C/L paralysis of lower face
  - Lower face muscle like Orbicularis Oris involved dribbling of saliva (only has C/L cerebral innervation)
  - Upper face muscle like Orbicularis oculi is spared because it has B/L innervation (no need of padding) (has dual innervation)
- Intranuclear palsy like In Bell's palsy → Both upper & lower face involved(same side)
- Injury of Genu of internal capsule

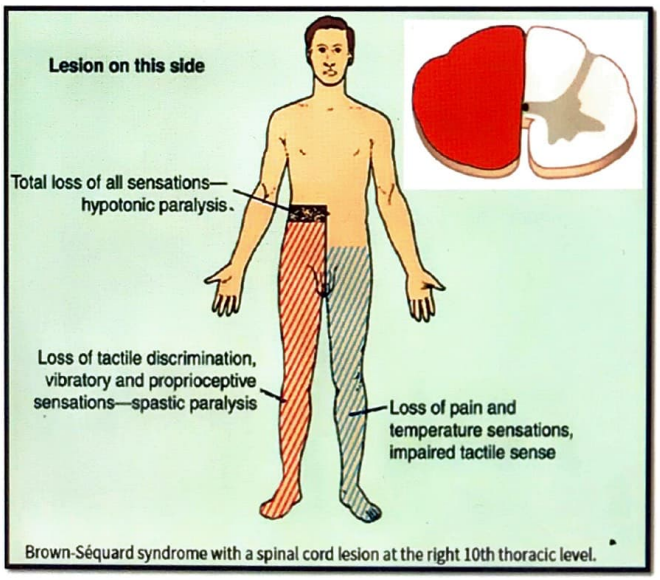




- C/L Lower face muscle weakness
- C/L hemiparesis, spastic hemiplegia
- C/L Upper limb flexion
- C/L [illegible] tension
- C/L Circumduction gait
- C/L loss of touch, pain, temperature, pressure

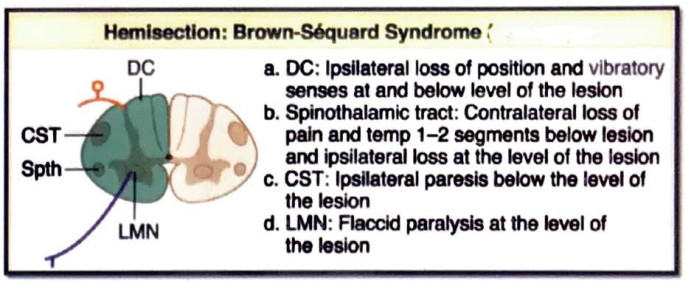
LMN injury (polio virus)

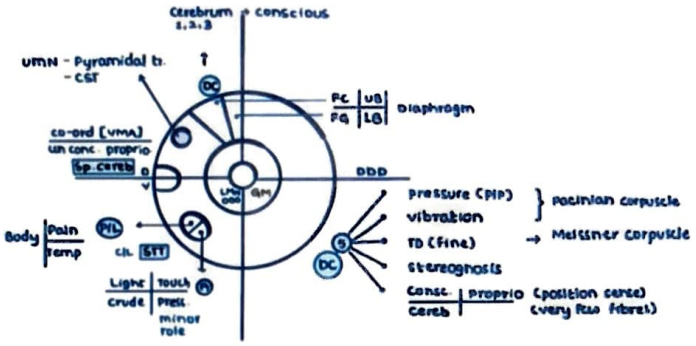
- Injury after synapse
- Flaccid paralysis
  BROWN SEQUARD SYNDROME at T10 segment on Rt. side
- UMN & LMN injury
  - (only very few) LMN involved [injury to T_{10}] flaccid T_{10} muscles
- At the level of lesion (T_{10}) → Flaccid paralysis



Brown-Séquard syndrome with a spinal cord lesion at the right 10th thoracic level.

- Manifestations occurs 1 & 2 segments below the lesion
- Flaccid paralysis due to injury to LMN
- Spastic paralysis below the level of lesion
  due to injury UMN [pyramidal tract]





- DC→ Dorsal column
- FC → Fasciculus cuneatus
- FG → Fasciculus gracilis → carries urinary bladder pressure sensation
- TD → Tactile discrimination / 2 point discrimination / fine touch
- P/L →Posterior/Lateral GM → Grey Matter
- Pacinian & Meissner are rapidly adapting receptor
- Stereognosis → ability to identify the object by closing the eye with touch

40 AUTONOMOUS NERVOUS SYSTEM

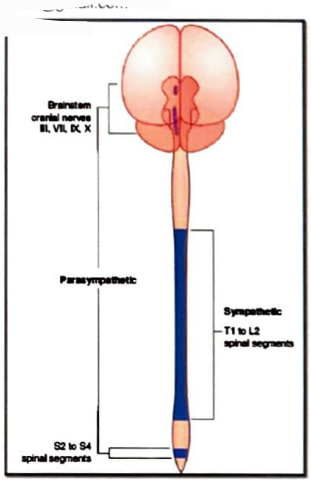
- Under the control of Hypothalamus with sympathetic & parasympathetic components

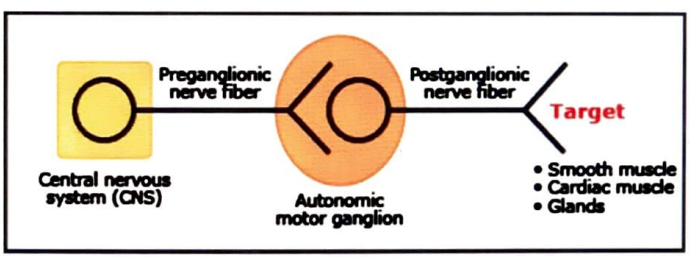
Previous Year's Questions

Q. Sweating is mediated by
Adrenal hormones
Sympathetic adrenergic system
Sympathetic cholinergic system [better answer]
Parasympathetic cholinergic system

Sympathetic and parasympathetic nervous system

00:02:00





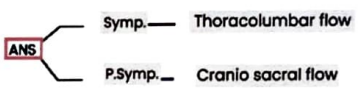
- Sympathetic system
  - Thoracolumbar flow (T1-L2)
- Parasympathetic system
  - Cranial: CN 3,7,9,10
  - Sacral: S2 - S4 Flow

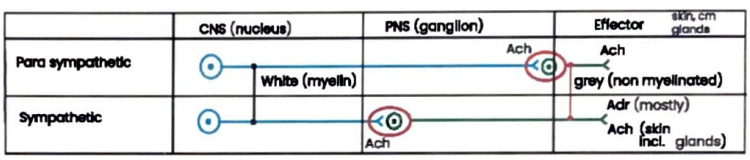
ANS - ORGANISATION

GANGLIONATED

1. CND neuron nucleus
2. PNS neuron ganglia
3. Effectors → Smooth muscle
   Cardiac muscle
   Glands [secreto motor fibres]

- Parasympathetic ganglia are close to the target organ
  - Post ganglionic fibers are shorter
- Sympathetic ganglia are close to CNS
  - Pre ganglionic fibers are shorter
- Pre ganglionic fibers are myelinated (white)
- Post ganglionic fibers are unmyelinated (gray matter)
- Sympathetic & parasympathetic system used neurotransmitter : Ach at the level of ganglia
- Ach: parasympathetic post ganglionic (effector) neurotransmitter
- Adrenaline: sympathetic post ganglionic (effector) neurotransmitter; exception skin: ach





Previous Year's Questions

Q. In multiple Sclerosis, Slow conduction of motor and sensory pathway is due to? (NEET - Jan - 2020)
A. Defect in node of Ranvier
B. Loss of myelin sheath
C. Leaking sodium channels
D. Loss of oligodendrocytes

Previous Year's Questions

Q. All are true about nerve except
Supplies heart & lung→causes Brady cardia & bronchoconstriction
post ganglionic para sympathetic fibres
Innervates right 2/3rd of transverse colon
Stimulates peristalsis & relaxes sphincters

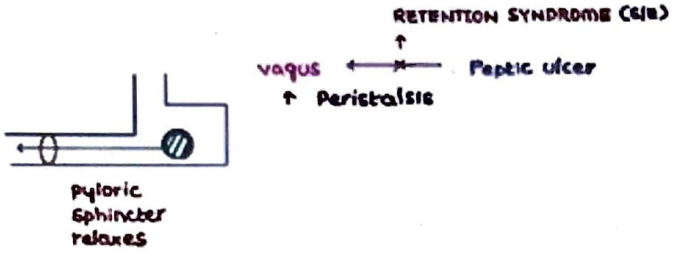
VAGUS NERVE

→ Parasympathetic nerve

→ White → carries pre ganglionic fibres

→ Comes from CNS

→ Cause bladder & bowel evacuation



S_2-S_4 → NERVI ERIGENTES / PELVIC SPLANCHNIC NERVES

→ Causes defection & urination

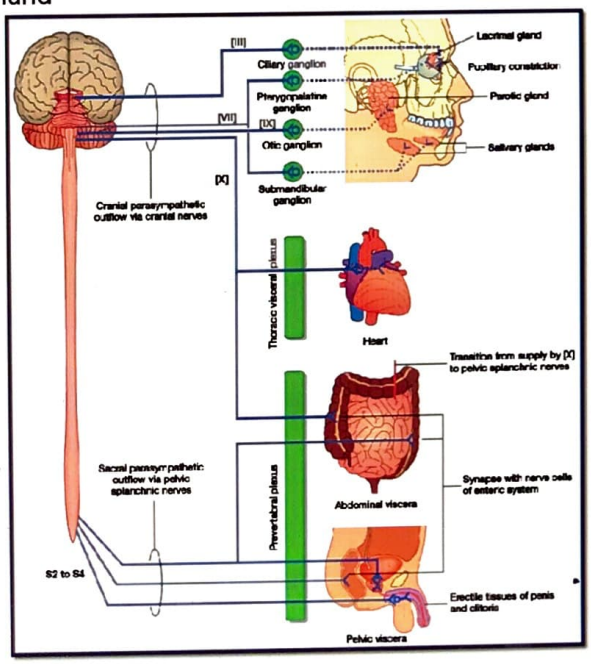
→ Causes Erection

Cranial NerveIII

- Oculomotor nerve
- Has Ed... ...l nucleus in midbrain
- Contains ciliary ganglion & controls eye ball smooth muscles (sphincter pupillae: light reflex and ciliary muscle: accommodation reflex)

Cranial NerveVII

- Facial nerve
- Has superior salivatory nucleus in lower pons
- Contains pterygopalatine ganglion- lacrimal, nasal, palatine gland
- Submandibular ganglion- sublingual, submandibular gland



Refer image 40.1

Cranial Nerve IX

- Glossopharyngeal nerve
- Has inferior salivatory nucleus in lower pons
- Contains optic ganglion & controls parotid salivary glands

CN X

- Vagus nerve
- Longest cranial nerve & widest distribution in body
- Supplies
  - Head neck: secretomotor
  - Thorax: bradycardia, bronchoconstriction
  - Abdomen: bladder & bowel evacuation.
- Supplies till 2/3 of transverse colon incl. vermiform appendix

S2-S4 Nervi erigentes / pelvic splanchnic nerves

- Supplies hind but including splenic flexure & rectum
- Supplies pelvic viscera (pelvic splanchnic nerves)
- Causes defecation & urination

Post ganglionic fibers

- No names
- In head & neck region, they are carried by branches of trigeminal nerve topographic nerve/ location wise/anatomical nerve
- Topographical/ anatomical nerves: Trigeminal nerve
- Functional nerves: CN 3, 7, 9, 10, Nervi Erigentes

TOPOGRAPHICAL ANATOMICAL NERVES

→ Trigeminal nerve

FUNCTIONAL NERVES

→ CN 3,7,9,10 NERVI ERIGENTES

Refer Image 40.2

Refer image 40.3

A → Auerbach ganglion

M → Meissner ganglion

Q. General visceral fibres do not supply

a. Smooth muscles
b. Skeletal muscles
c. Cardiac muscles
d. Glands

Q. All of the following nuclei belong to GVE EXCEPT

a. Edinger westphal nucleus
b. Lacrimatory nucleus
c. Dorsal nucleus of vagus
d. Abducent→ LR6 → GSE

COMPARISON BETWEEN PARASYMPATHETIC & SYMPATHETIC NERVOUS SYSTEM

00:47:00

	Sympathetic	Parasympathetic
Heart rate	Increased	Decreased
Blood pressure	Increased	Mildly decreased
Bladder	Increased sphincter tone	Voiding (decreased tone)
Bowel motility	Decreased motility	Increased
Lung	Bronchodilation	Bronchoconstriction
Sweat glands	Sweating → Ach	-
Pupils	Dilation [Mydriasis]	constriction [Miosis]
Adrenal glands	Catecholamine release	-
Sexual function	Ejaculation, orgasm	Erection
Lacrimal glands	-	Tearing
Parotid glands	-	Salivation

DILATORY PUPILLAE

- Adrenergic muscle
- Causes mydriasis

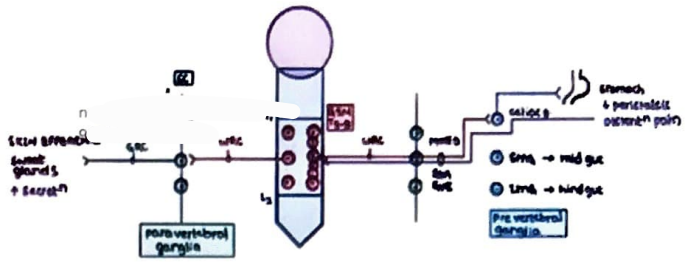
SPHINCTER PUPILLAE

- Cholinergic muscle
- Causes miosis

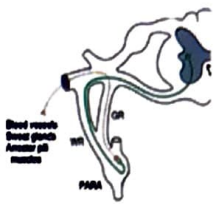
Sympathetic nervous system

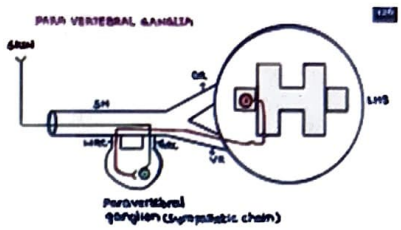
00:55:40

- Thoracolumbar flow
- 12 thoracic and 2 lumbar on each side
- So, 14 preganglionic fibers from each side; total 28
- Hypothalamus has 1st order neuron→spinal cord→ will send 2nd order neuron (will synapse either in paravertebral ganglion or prevertebral ganglion)
- Para vertebral ganglia
  - Controls skin effectors (sweat glands)

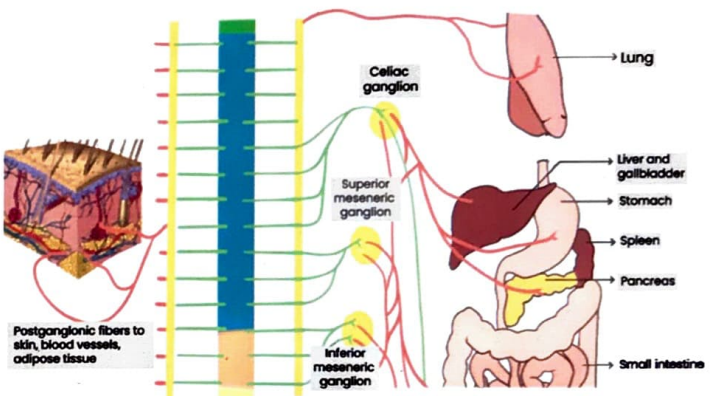


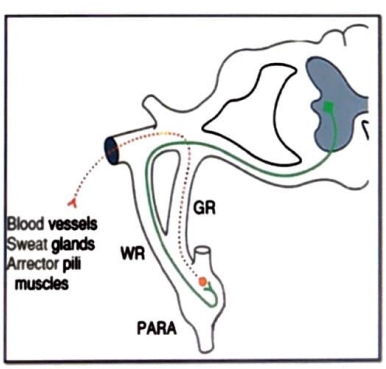
- Pre vertebral /pre aortic ganglia
  - In midline & controls viscera
- White ramus communicans
  - Comes from CNS
  - Myelinated fibers: White



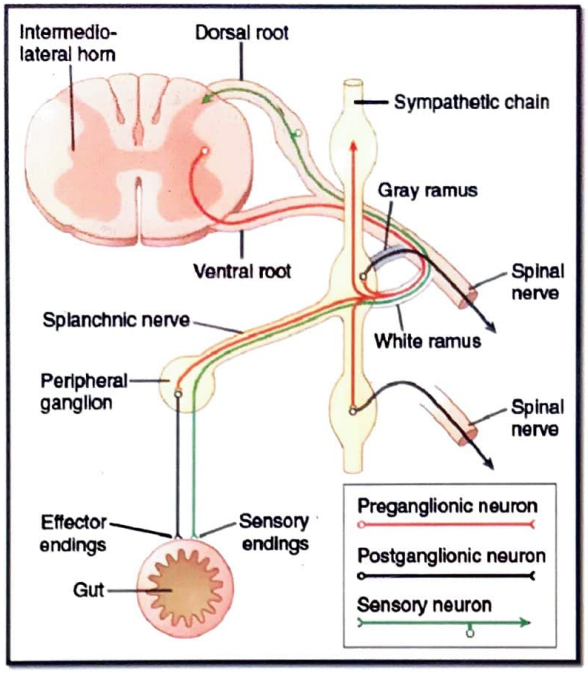


- Gray ramus communicates
  - Comes from sympathetic chain
  - Non - myelinated fibers: grey
- Prevertebral ganglia/ preaortic ganglia
  - E.g., celiac ganglion: supply foregut
  - Superior mesenteric ganglion: supply midgut
  - Inferior mesenteric ganglion: supply hindgut





Greater Splanchnic nerve



- Comes from CNS white (myelinated) uses WRC
- Root value: T5-T9
- Leaves sympathetic chain and synapse with celiac ganglia
- Post ganglionic fibers go to foregut derivatives Causes sympathetic storage (by reducing peristalsis; so distension: causes pain)

Refer Image 40.4

- Pain of stomach is carried back by same GSN
- GSN is both sensory (GVA) & motor (GVE)
- Lateral horn in spinal cord→Pre ganglionic neuron (pass through ventral root of spinal cord)→enters spinal nerve →leaves spinal nerve through WRC→synapse with paravertebral ganglia→from there comes post ganglionic fibers(GRC)→re-enters spinal nerve and control skin effectors.
- LHN→preganglionic fiber by ventral root of spinal cord→ enters spinal nerve→ leaves spinal nerve by distal white ramus(bypass paravertebral ganglion)→GSN→ synapse with prevertebral ganglia (like celiac ganglion)→post ganglionic fibers to stomach→decrease peristalsis and increase distension
- Increase distension→pain→ carried by GNS→ distal WRC→spinal nerve→ dorsal root of spinal cord→ posterior horn of spinal cord.

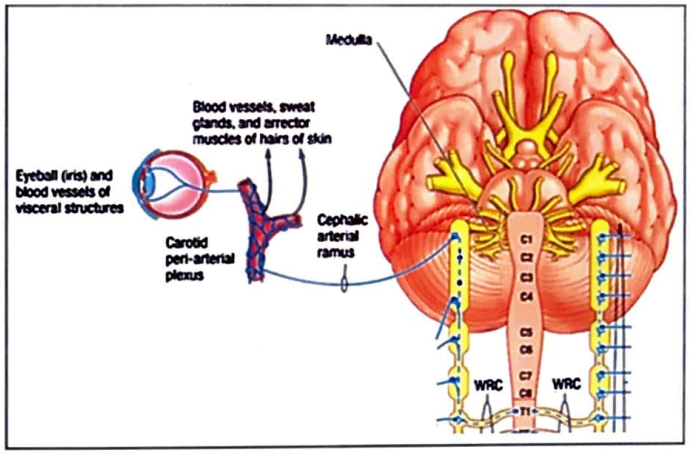
Refer Image 40.5

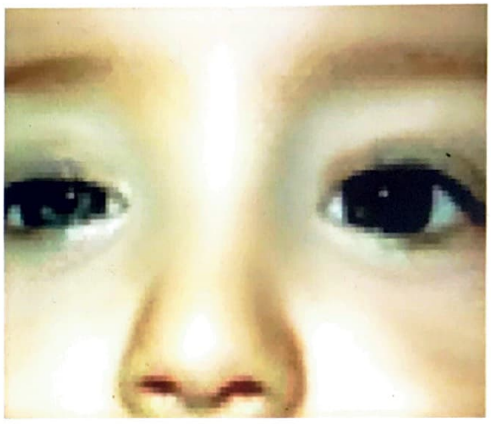
HORNER SYNDROME

01:25:45

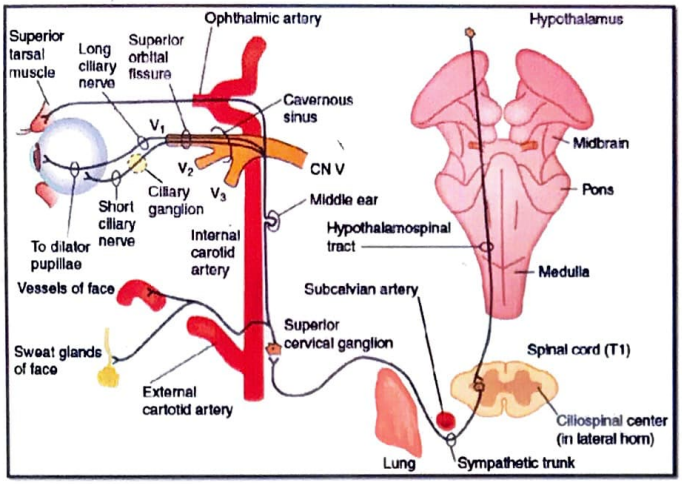
Previous Year's Questions

Q. All are seen in Horner's Syndrome due to cavernous Sinus pathology EXCEPT
Enophthalmos
Ptosis
Miosis
Anhydrosis





- Hypothalamus sends 1st order neuron→synapse with T1 sympathetic neurons →2nd order neuron→ sympathetic chain→synapses sup. Cervical ganglion→3rd order neuron→sympathetic plexus around internal carotid artery→ dilator pupillae and superior tarsal muscle



- Etiology
  - Hypothalamus spinal pathway compromised - Lateral medullary syndrome: I/L Horner syndrome
  - Pancoast tumor: 2nd Order neuron compromised leading to I/L Horner syndrome
  - Cavernous sinus pathology: 3rd order neuron injury: Horner Syndrome but in this no problem of sweating or vasoconstriction
- Clinical features
  - Ptosis
    - → Superior Tarsal muscle OR muller muscle paralysis partial ptosis
    - → [illegible] 1- Sympathetic fibers compromisation
  - Miosis
    - → Sphincter pupillae become more powerful
    - → Dilator pupillae paralyzed (supplied by T1symp. Fibers)
  - Enophthalmos (Sunken eyeball)
    - → Paralysis of orbitalis (supplied by T1symp. fibers)
    - → Orbitalis normally pushes the eyeball out of socket

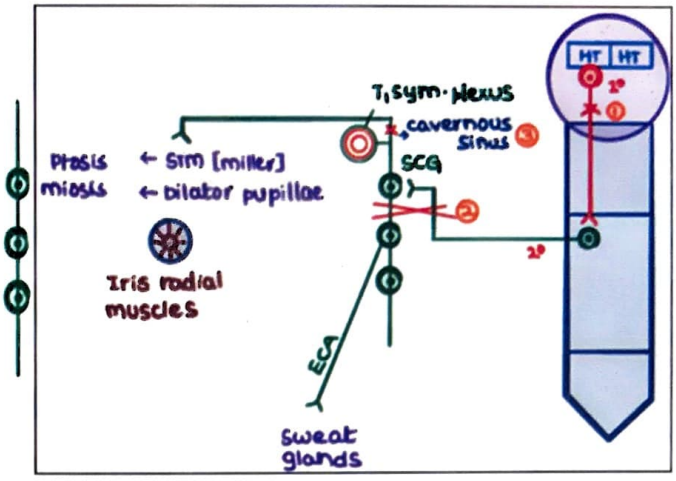


Image 40.1

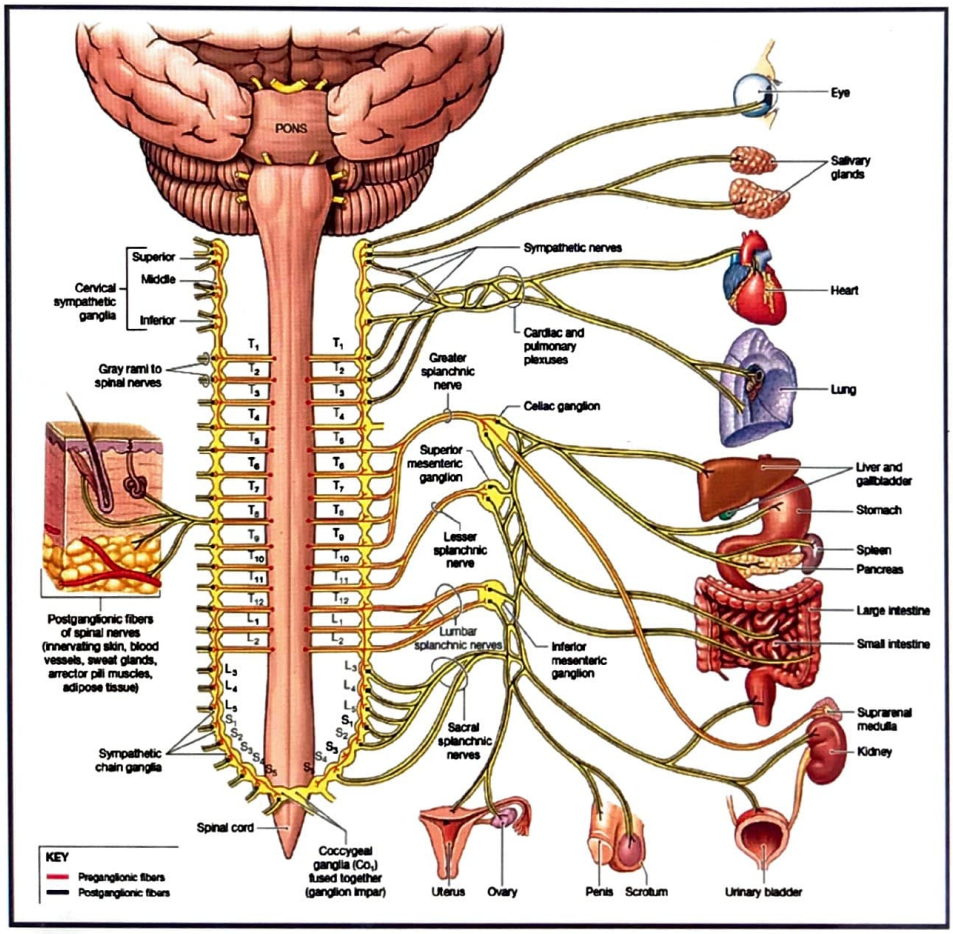


Image 40.2

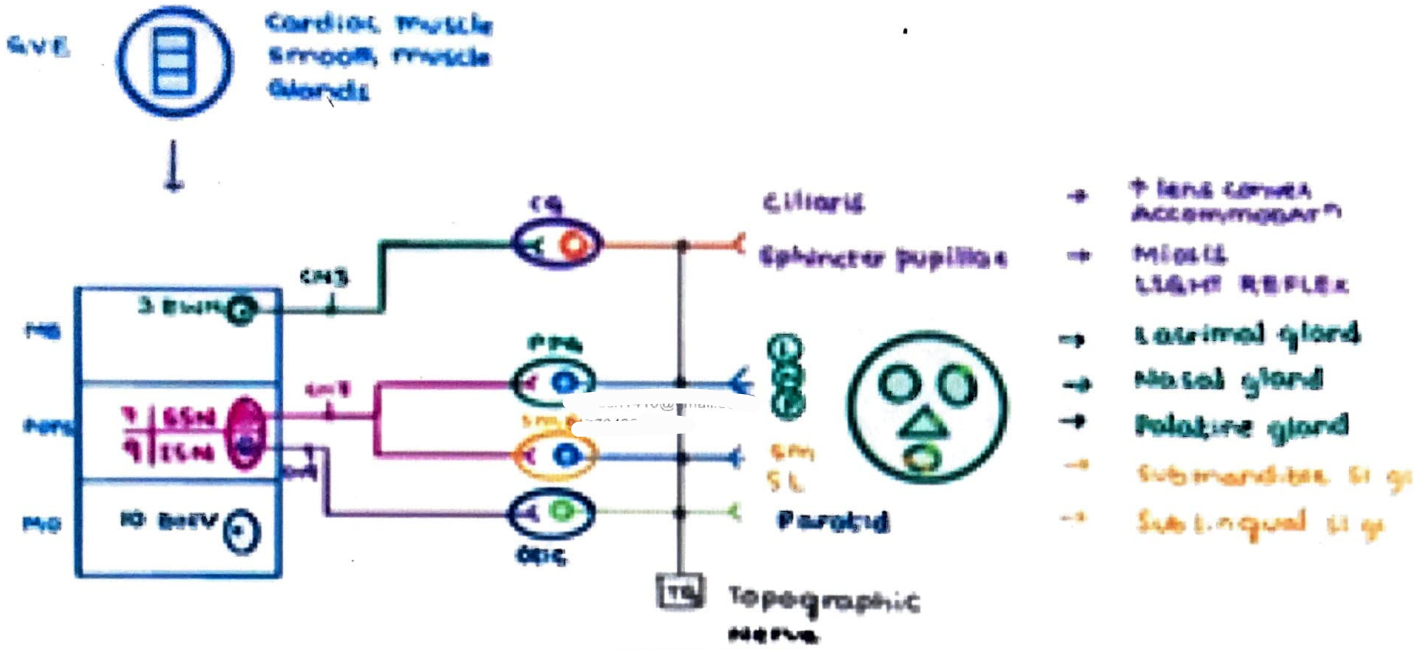


Diagram 40.3

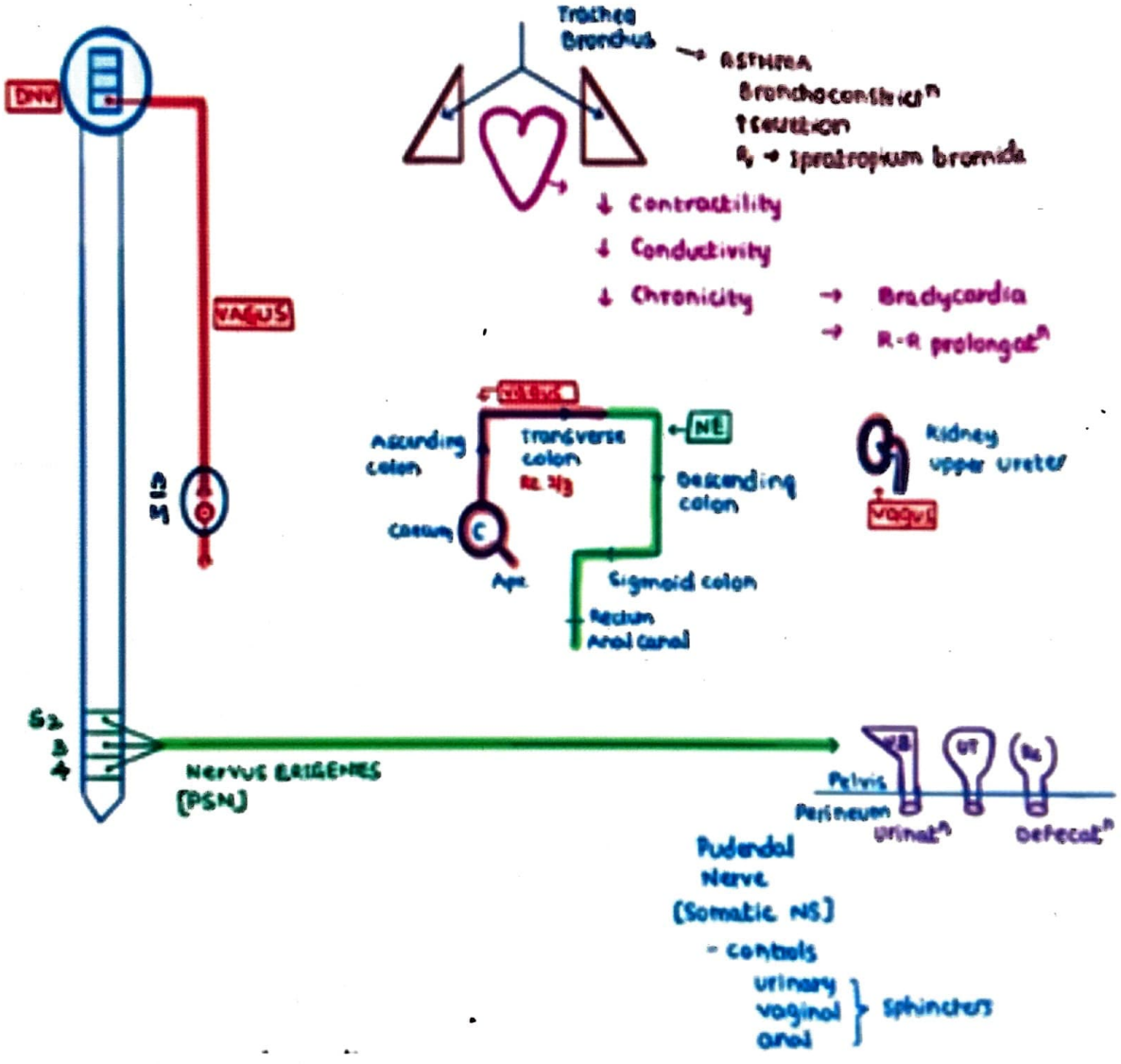
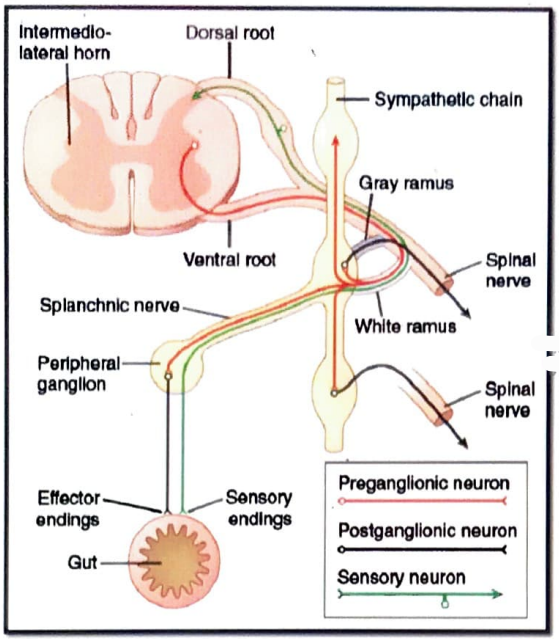


Image 40.4



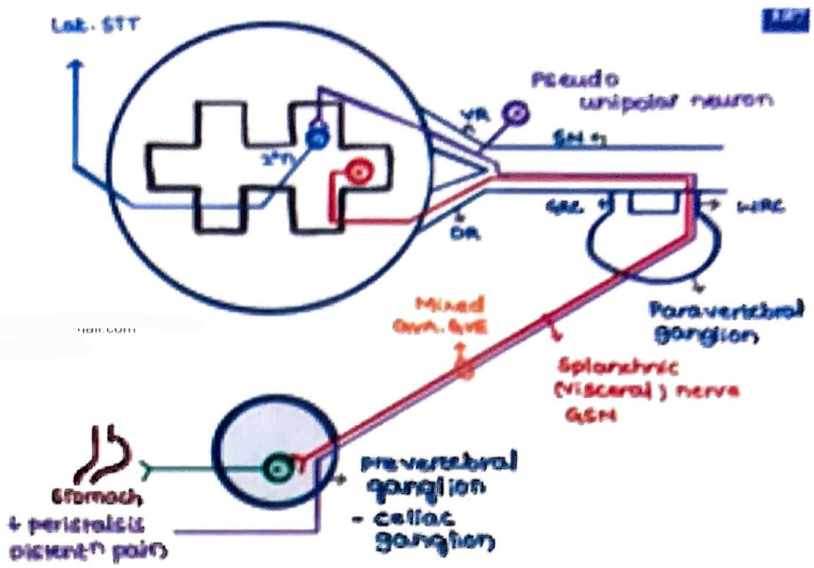
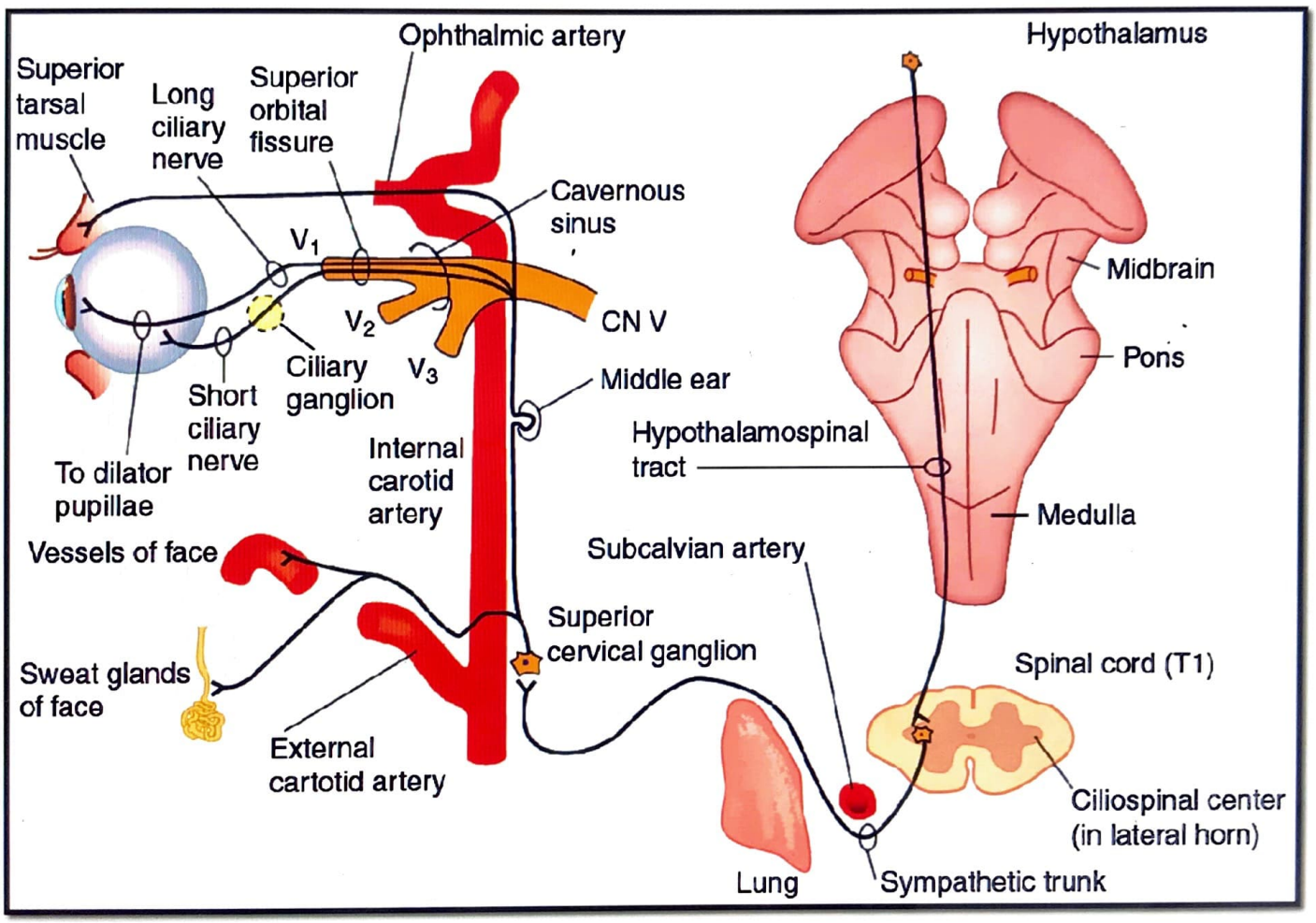


Image 40.5



41 ARTERY SUPPLY BRAIN

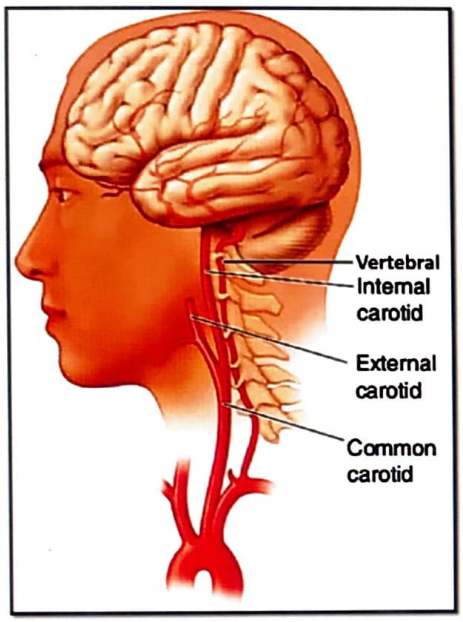
Previous Year's Questions

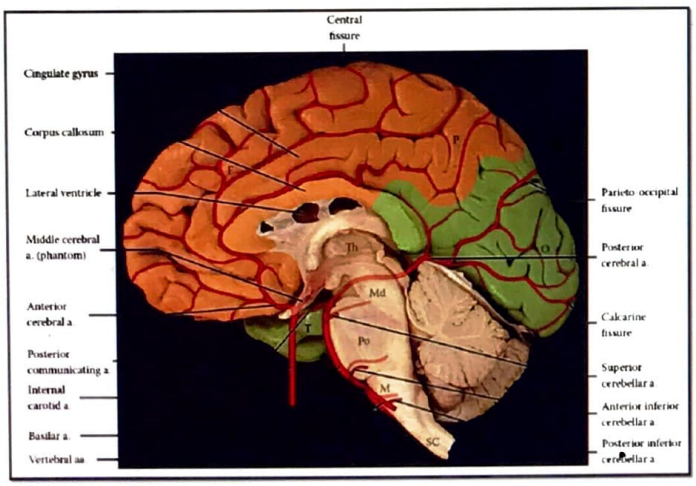
Q. Labyrinthine artery is a branch of
Superior cerebellar artery
Basilar artery
Anterior inferior cerebellar artery [Better answer]
Posterior inferior cerebellar artery

CIRCLE OF WILLIS

00:02:12

- At Base of brain in interpeduncular (cerebral) area at subarachnoid space





- Circle of Willis contributed by 2 arteries
  - Anteriorly by: ICA
  - Posteriorly by: Vertebral artery forming basilar artery

VERTEBRAL ARTERIES

- Enter the cranial cavity by passing foramen magnum
- 2 vertebral arteries joins to form → Basilar artery at base of pons
- BRANCHES
  1. 2 Posterior inferior cerebellar artery [PICA] one on each side
  2. 2 Anterior spinal arteries Later → 1 anterior spinal artery in midline Supplies ant. 2/3rd of spinal cord
  3. 2 posterior spinal arteries→ supplies post 1/3rd of spinal cord
- Internal carotid artery gives middle cerebral artery
  - Middle cerebral artery supply: Broca's motor speech area,Wernicke's area,macular area
  - It also supplies Homunculus representing face and upper limb area (not pelvis, perineum as that is by ACA)
  - So macular area is spared if their is lesion in PCA
- 2 vertebral arteries join to form basilar artery at base
  - As it reaches midbrain, divide into 2 posterior cerebral arteries (supplying posterior cerebrum especially occipital visual cortex, iflesion in PCA C/L homonymous hemianopia sparing macular region as it has additional supply from middle cerebral artery)
- Vertebral artery gives PICA- supplies lateral medulla and cerebellum

Previous Year's Questions

Q. A patient presented with clinical features of ataxia and incoordination. It is most likely due to involvement of which artery among the following?
(NEET - Jan - 2020)

A. Anterior cerebral
B. Middle cerebral
C. Posterior cerebral
D. Superior cerebella

BASILAR ARTERY

00:05:19

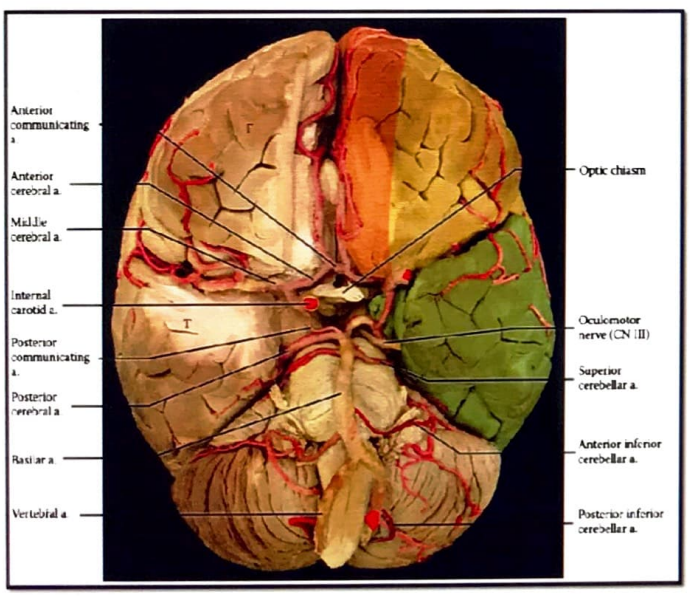
- Supplies the pons, upper medulla, midbrain
  → BRANCHES
  1. Anterior inferior cerebellar artery [AICA]
     → Gives labyrinthine artery [in 80%]
  2. labyrinthine artery [in 20%]
  3. superior cerebellar artery to cerebellum
  4. Posterior cerebral artery → supplies posterior cerebrum & communicates with posterior communicating br. of ICA & forms CIRCLE OF WILLIS
- In berry aneurysm on posterior communicating artery, the most commonly damaged nerve is oculomotor NERVE
- Basilar artery
  - AICA (supply cerebellum)
  - Superior cerebellar artery (supply cerebellum)

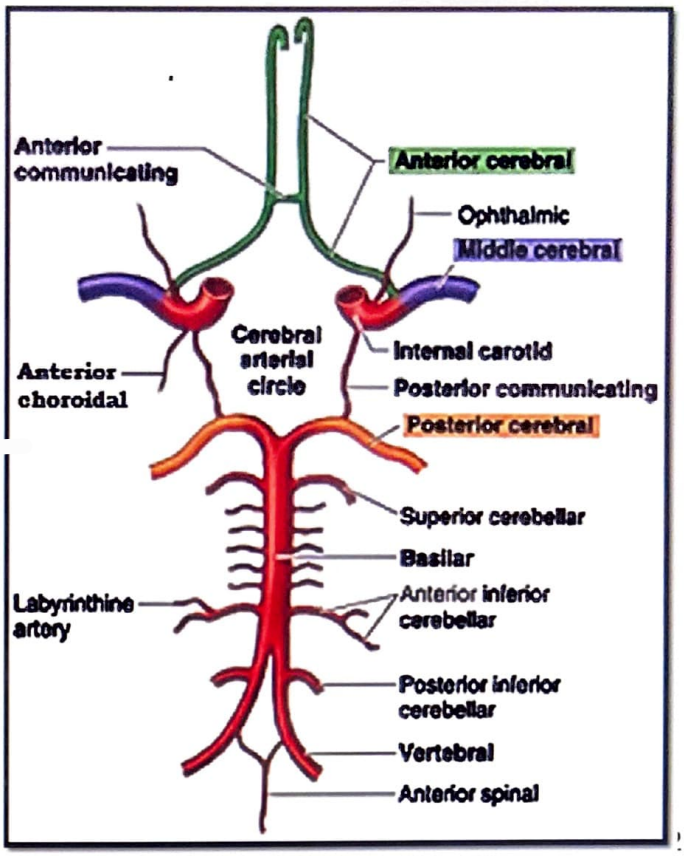
Previous Year's Questions

Q. A patient present with sudden onset of dysarthria, sensory loss of right side if face, right upper limb ataxia, tendency to fall on the right side. There is sensory loss on left side of body (with no motor symptoms). Which artery is involved?

(AIIMS - Jun - 2020)

A. Basilar
B. Superior cerebellar
C. Posterior inferior
D. Anterior inferior cerebellar



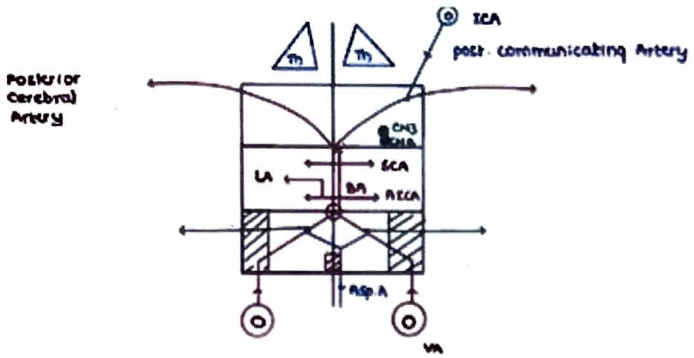


posterior cerebral artery (one on each side)

- posterior communicating artery(branch of ICA)→ anastomosis with posterior cerebral artery
- ICA also gives MCA, ACA
- 2 ACA has anterior communicating artery to complete circle of Willis

BERRY ANEURYSM

- Present in subarachnoid space
- Leads to subarachnoid hemorrhage
- CSF mixes with blood
- ICA gives branches
  - Anterior cerebral artery (major artery on medial cerebrum especially supplying paracentral lobule); controlling lower limb and part of pelvis and Perineum; block causes urinary incontinence and lower limb paralysis and sensory problem.
  - Middle cerebral artery (supplying lateral cerebrum)
  - Posterior communicating artery (contributing circle of Willis)
  1. Ophthalmic artery → supplies eyeball
  2. Anterior choroidal artery→supplies post. limb of internal capsule genu IC supplied by direct br. of ICA ant. Limb of IC supplied by



1. BASILAR ARTERY	PONS Upper medulla Midbrain
2. PICA	Posterior cerebellum Lateral medulla
3. posterior cerebral artery	posterior cerebrum Occipital visual cortex/striate cortex Calcarine sulcus Midbrain Thalamus
4. Posterior communicating artery	Thalamus
5. Anterior Cerebral Artery	Ant. cerebral Medial cerebrum [major contribution] Paracentral lobule Lateral cerebral (pelvis, perineum)
6. Middle Cerebral Artery	Lateral cerebrum [major contribution] Wernike's, Broca's areas macular area

PICA occlusion leads to lateral medullary / wallenberg syndrome

WALLENBERG SYNDROME 00:15:28

resulted from Vertebral artery occlusion [more often] > PICA occlusion

Medial medullary syndrome is due to occlusion of anterior. spinal artery

MEDULLA OBLONGATA BRANCHES 00:17:14

Supplied by by artery ; SUPERIOR CEREBELLAR ARTERY DO NOT SUPPLY

- Basilar artery → upper medulla
- 2 AICA
- 2 PICA
- 2 Vertebral arteries
- 2 anterior spinal arteries
- 2 posterior spinal arteries

In berry aneurysm on posterior communicating artery, the most commonly damaged nerve is OCULOMOTOR NERVE

OCULOMOTOR NERVE & TROCHLEAR NERVE

- Comes from midbrain
- Sandwiched b/w posterior cerebral artery & superior cerebellar artery
- Mid brain has dual blood supply

CORTICAL BLINDNESS 00:26:44

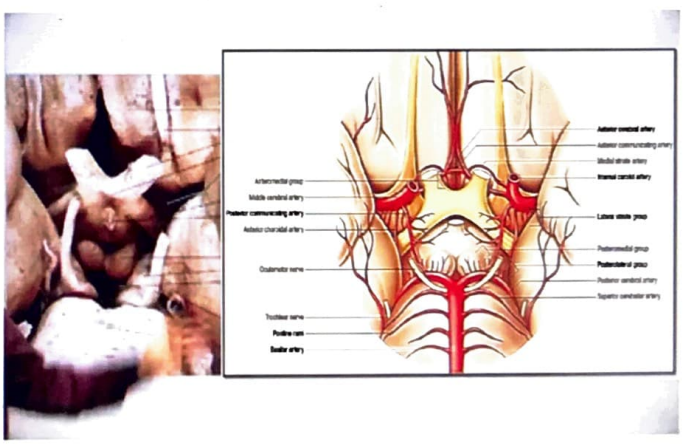
- Due to a block in the rt. sided
- Posterior cerebral artery
- C/L Homonymous hemianopia
- Left temporal & rt. nasal vision lost
- Left visual field lost
- Macular area spared

NORMALLY

Lt temporal Vision	Rt. temporal Vision
↓	↓
Nasal retina	Temporal retina
↓	
Cross midline in Optic chiasma	
↓	
Opposite side Brain	Same side Brain

a. right optic nerve injury → Rt. eye is blind
b. pituitary midline tumor → Bitemporal hemianopia tunnel vision
c. optic tract injury → C/L Homonymous hemianopia

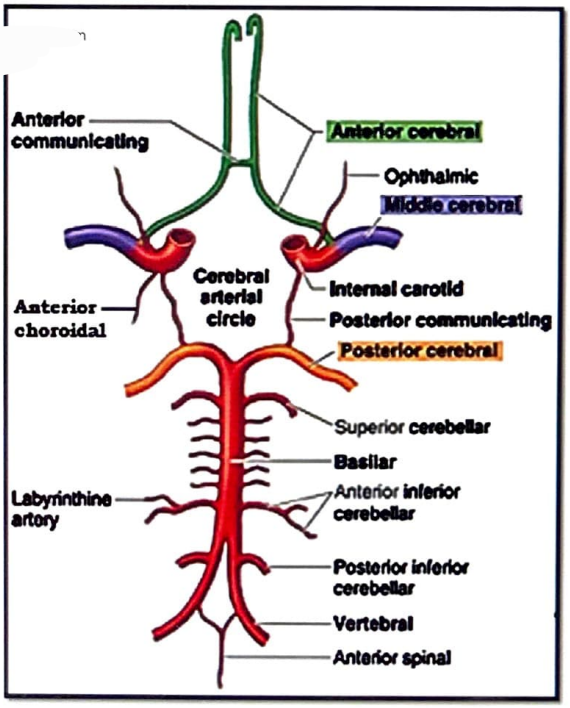
Inferior view of circle of Willis



- Circle of Willis is present in interpeduncular fossa in sub arachnoid space
- Interpeduncular fossa boundaries
  - 2 cerebral peduncles in midbrain
  - Posteriorly: pons
  - Anteriorly: optic chiasma
  - Antero-lateral: Optic tract
- Contents of Interpeduncular fossa
  - Pituitary stalk
  - Tuber cinereum
  - Mammillary bodies
  - Posterior perforated substances
  - Oculomotor nerve
- Arteries making circle of Willis
  - 2 PCA
  - 2 Posterior communicating artery (20% incidence of Berry's aneurysm)
  - 2 Internal carotid arteries
  - 2 ACA
  - 1 Anterior communicating artery (40% incidence of Berry's aneurysm)

Important Information

Oculomotor nerve can be compressed by 3 artery aneurysms
- PCA aneurysm
- SCA aneurysm
- Posterior communicating



Important Information

Berry aneurysm rupture: subarachnoid hemorrhagic
Trochlear nerve is outside the Interpeduncular fossa
Trochlear nerve can be compressed by PCA aneurysm and SCA aneurysm

INTERNAL CAPSULE ARTERIAL SUPPLY

00:43:31

Posterior limb → Anterior choroidal artery of middle cerebral artery

Anterior limb → Anterior cerebral artery by recurrent br. Of heubner

Genu → Direct branch of ICA

Major supply by → Middle cerebral artery

UPPER DORSAL PART → Middle cerebral artery by lenticulo striatal branches

BASAL GANGLIA
UPPER DORSALIC } Supplied by Lenticulo striate branches

LOWER VENTRAL PART OF IC supplied by

Anterior Limb → Recurrent branch of heubner [Ant. cerebral artery branch]

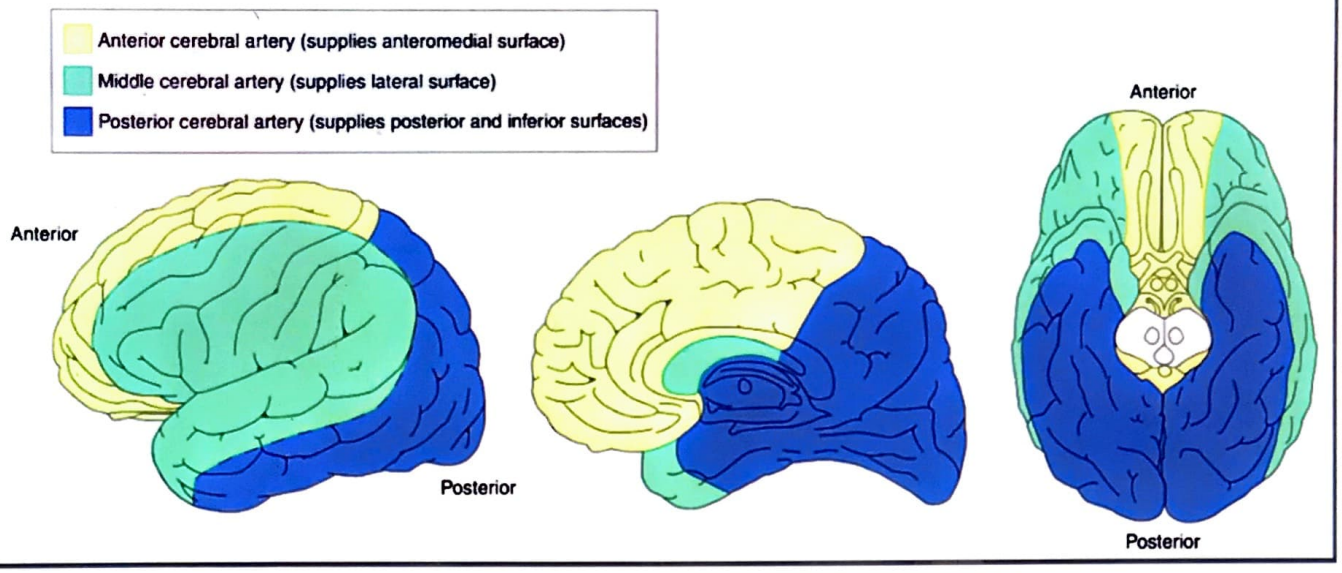
Genu → Direct branch from ICA

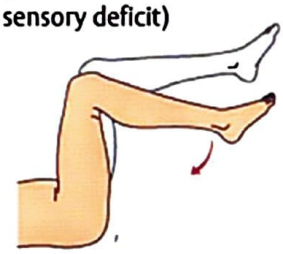
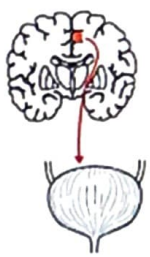
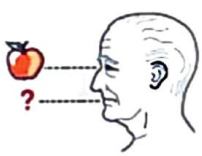
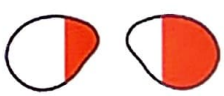
Posterior → Limb ant. choroidal artery [ICA branch]
- also supplies retro lentiform fibres

Q. All of the following pairs are correct for the artery supply to the lower parts of internal capsule EXCEPT
a. Anterior Limb Recurrent branch of anterior cerebral artery
b. Genu Internal carotid artery
c. Posterior Limb Anterior choroidal artery
d. Sub lentiform part Heubner's artery

Q. Primary motor area [Area no. 4] of brain supplied by
a. Anterior cerebral artery
b. Middle cerebral artery
c. Anterior & middle cerebral artery
d. Anterior & posterior cerebral artery

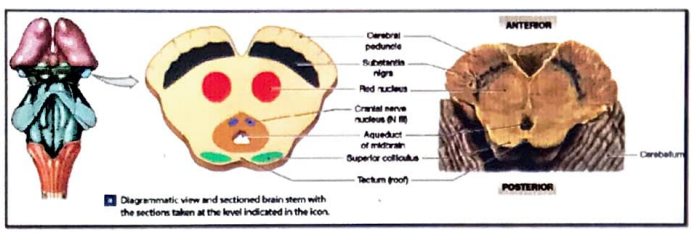
Cerebral arteries—cortical distribution



Vascular territory	Neurological symptoms	
Anterior cerebral artery	Paralysis of lower limb (with or without hemi-sensory deficit) 	Bladder dysfunction 
Middle cerebral artery	Hemiparesis (with or without hemi-sensory deficit) mainly affecting the arm and face (Wernicke-Mann type) 	Aphasia 
Posterior cerebral artery	Hemisensory losses 	Hemianopia 

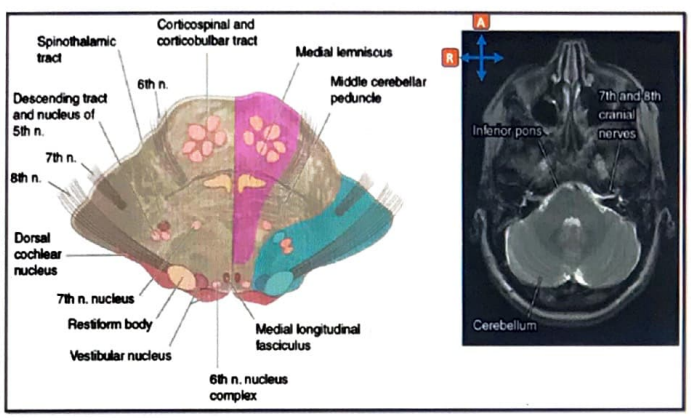
42 BRAINSTEM LESIONS

Midbrain transverse section



PONS - TRANSVERSE SECTION

00:02:54



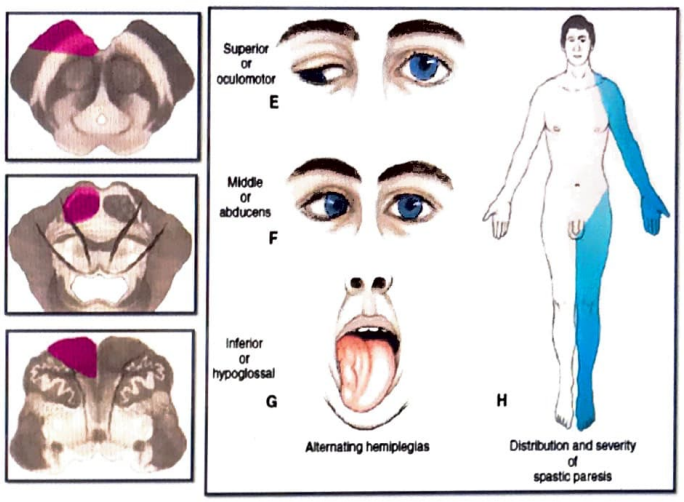
- , 7th, 8th nerves exit at
  - ponto medullary junctions
  - most medial: 6th nerve
  - most lateral: 8th nerve
- 7th nerve nucleus sends axons,
  - making a winding around abducens
  - nucleus 6th produces rounded elevation [facial colliculus] posteriorly at the floor of 4th ventricle at lower pons & exits at pontomedullary junction

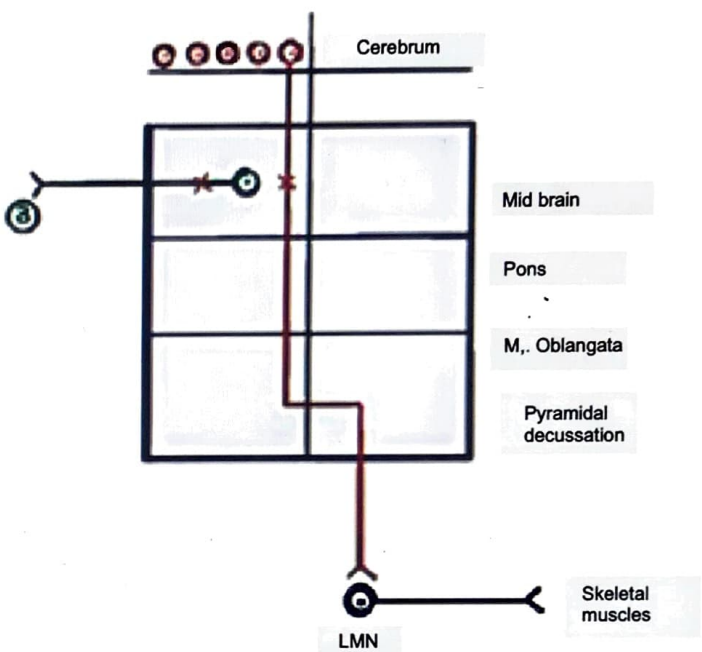
MEDULLA OBLONGATA TRANSVERSE SECTION

00:08:57

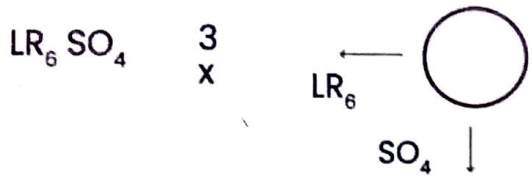
Refer Image 42.1

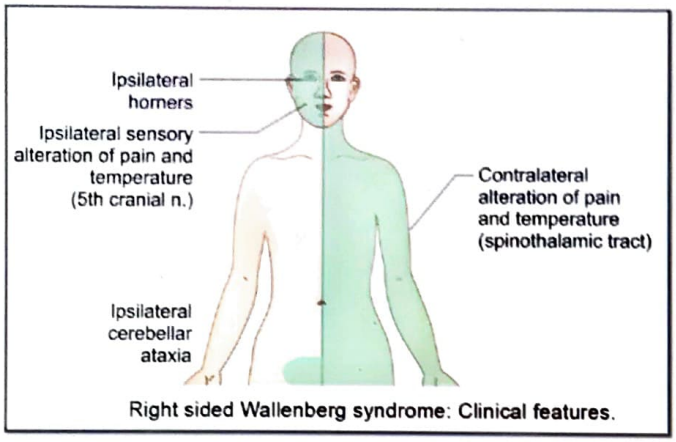
Medial Brainstem Lesions (Alternating Hemiplegia)



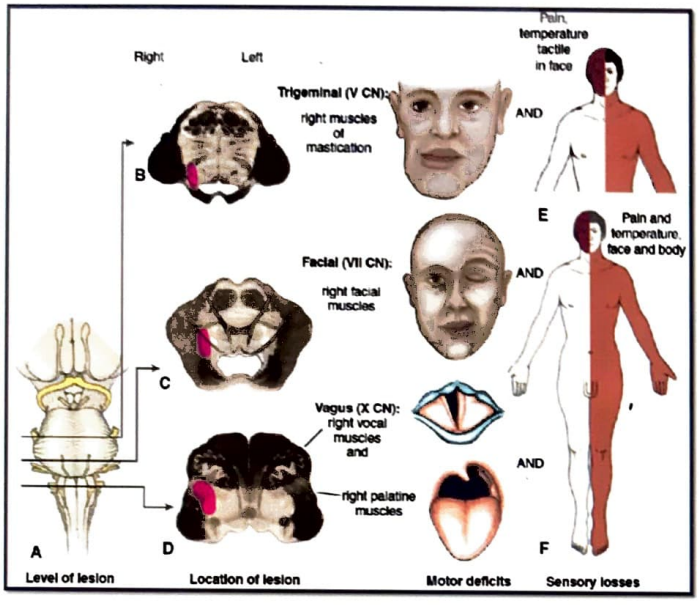


- Pons Lesion: 6th nerve involved lateral rectus compromised SQUINT
- Medullaryllary lesion [Medial Medullary syndrome]
  - 12th nerve involved Tongue palsy
- Weber syndrome [Rt. sided]
  - Down & out eye [Action of superior oblique Down, Out,Intorsion]





Right sided Wallenberg syndrome: Clinical features.



- Fixed Dilated pupil
  - Fixed: sphincter pupillae not working
  - Dilated: Dilator pupillae more powerful
- Rt. oculomotor nerve injured → rt. sided down & out eye partial ptosis
  - Pyramidal tract injured C/L spastic paralysis
  - C/L facial & hypoglossal paralysis

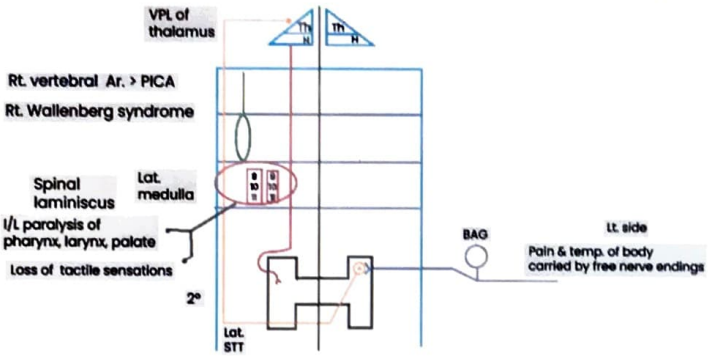
Injury of Midbrain

- Branches of Basilar artery and posterior
- Cerebral arteries are injured
- Anterior midbrain syndrome
- Medial midbrain syndrome
- CN 3 injured on same side
- CST + CNT tract injured
  - CL paralysis
  - CN 5,7,12 injured C/L
  - Body C/L involved
- Substantia nigra involved C\L parkinsonism

LAT. BRAIN STEM LESIONS WALLENBERG SYNDROME

00:24:43

- Hypo thalamo spinal pathway compromised in lateral medulla
- Ipsilateral sensory loss of pain & temp. [Spinal sensory nucleus of CN V] → C/L loss of pain & temp. [spinothalamic tract injury]
- I/L cerebellar ataxia [dorsal spino cerebellar tract injury]



  - Rt. sided Horner syndrome→Descending sympathetic tract injury
  - Difficulty in speech & swallowing → NA injury
  - I/L loss of taste → NTS injury
  - Vertigo → Vestibular nucleus injury

MEDIAL MEDULLARY SYNDROME

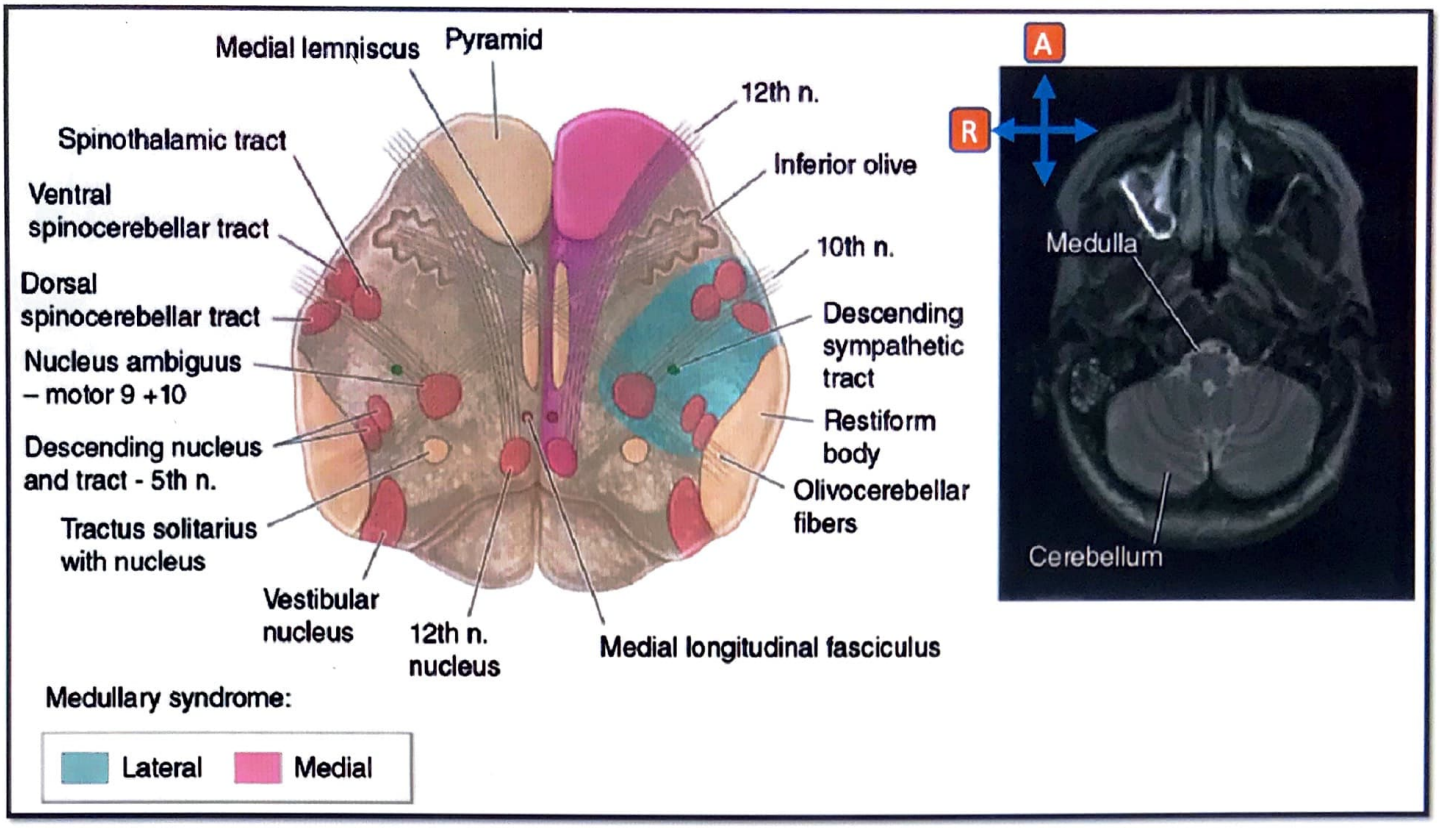
00:40:18

- Tongue muscle palsy 12th nerve involved
- Dorsal column medial Lemniscal system involved
- Pressure, vibrations, Tactile Discrimination, Stereognasis, concious proprioception
- C/L spastic paralysis pyramidal tract involved
- Pyramid
- 12th nerve
- Olive Inferior nucleus
- Nucleus Ambiguus 9,10,11
  - Posteromedial to olive

Previous Year's Questions

Q. Position of nucleus ambiguus is
A. Anteromedial to olive
B. Anterolateral to olive
C. Posteromedial to olive
D. posterolateral to olive

Image 42.1


Medial lemniscus
Pyramid
12th n.
Spinothalamic tract
Inferior olive
Ventral spinocerebellar tract
10th n.
Dorsal spinocerebellar tract
Descending sympathetic tract
Nucleus ambiguus – motor 9 +10
Restiform body
Descending nucleus and tract - 5th n.
Olivocerebellar fibers
Tractus solitarius with nucleus
Vestibular nucleus
12th n. nucleus
Medial longitudinal fasciculus
Medullary syndrome:
Lateral
Medial
A
R
Medulla
Cerebellum

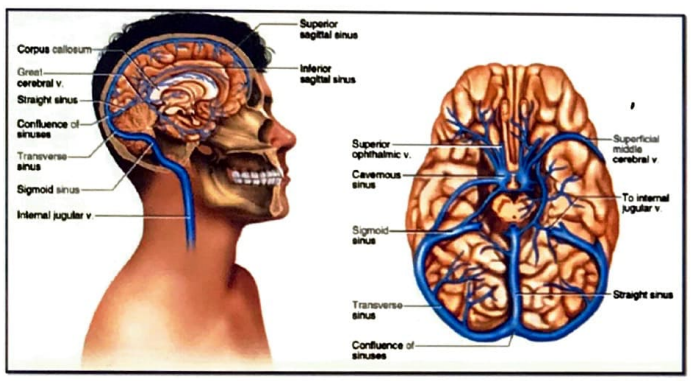
43 VENOUS DRAINAGE OF CRANIAL CAVITY

DURAL VENOUS SINUSES

00:00:24

- Intra dural B/w → double fold of dura mater
- Duramater has
  - Meningeal layer
  - Endosteal layer
- Venous blood is present

  - Superior sagittal sinus
  - Inferior sagittal sinus
  - Straight sinus
  - Confluence of sinus
  - Transverse sinus
  - Sigmoid sinus
  - Internal jugular vein



- Superficial middle cerebral vein drains into cavernous sinus
  - cavernous sinus drains into personal sinus
  - Superior petrosal sinus drains into transverse sinus
  - Inferior petrosal sinus drains into Int. jugular vein
- Straight sinus is deep circulation
  - Straight sinus drains into confluence of sinus
  - Confluence of sinuses drains into transverse sinus
  - Transverse sinus drain into sigmoid sinus
  - Sigmoid sinus drains into Internal jugular vein

Previous Year's Questions

Q. Internal cerebral veins join to form
A. Interior cerebral vein
B. Middle cerebral vein
C. Great cerebral vein
D. Anterior cerebral vein

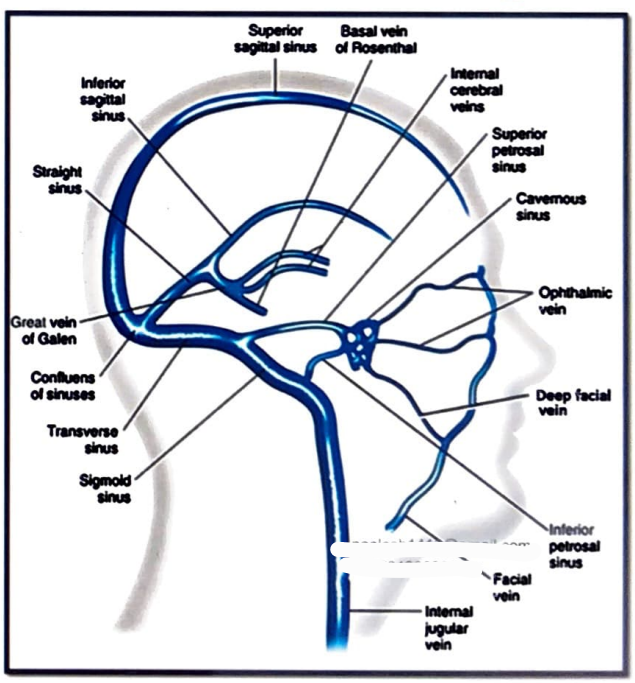
- Internal cerebral veins are around the brain stem & run behind to join to great cerebral vein of Galen
- SOS TRIBUTARIES [CONFLUENCE OF SINUS]
  - **S** - Straight sinus
  - **O** - Occipital sinus
  - **S** - Superior Sagittal Sinus

Previous Year's Questions

Q. Falx cerebri contains [NBEP 2014]
A. Straight sinus
B. Occipital sinus
C. Transverse sinus
D. Sigmoid sinus

FALX CEREBRI

00:09:36

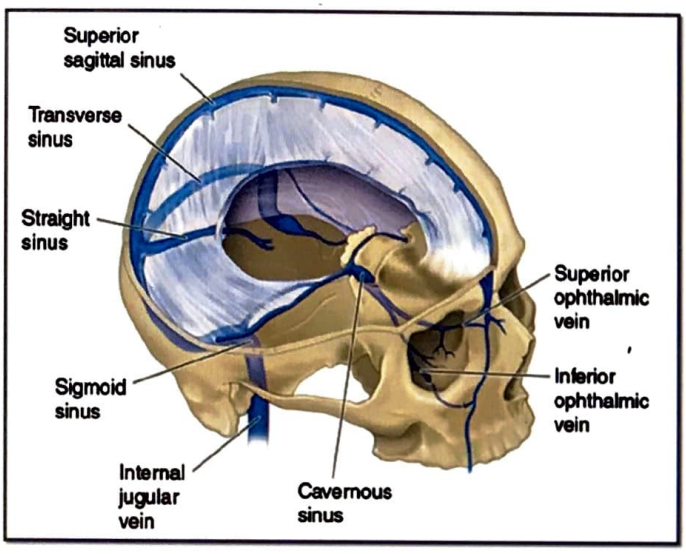


- Double layer of dura
- Separates right and left cerebrum
- Contain 3 sinuses
  - Superior sagittal sinus
  - Inferior sagittal sinus
  - Straight sinus
  - * Right and left internal cerebral vein (joins behind brain stem)→great vein of Galen(also receives basal vein of Rosenthal which receives internal cerebral vein; also receives inferior sagittal sinus)→ straight sinus(base of falx cerebri) → confluence of sinus

Draining channel from cavernous sinus

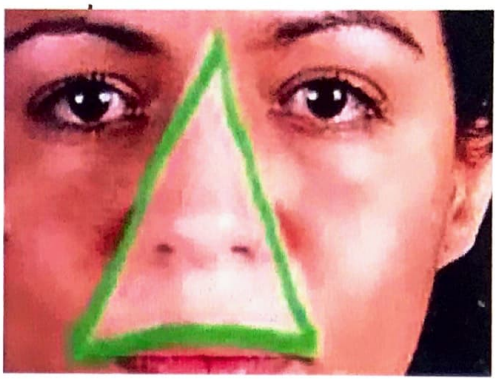
- Superior petrosal sinus
- Inferior petrosal sinus
- Deep facial vein

DURAL VENOUS FOLDS & SINUSES 00:10:37



- SUPERIOR OPHTHALMIC VEIN Tributaries
- INFERIOR OPHTHALMIC VEIN

DANGEROUS AREA OF FACE 00:17:51



- It includes upper lip, nose and medial canthus of eye
- Infections [staph. aureus] can access cavernous sinus without proper by

NOSE [Nasal pustule]
↓
FACIAL VEIN [mostly] DEEP FACIAL VEIN
↓
ANGULAR VEIN PTERYGOID PLEXUS
↓
SUPERIOR OPHTHALMIC VEIN [Mostly]
CAVERNOUS SINUS
INFERIOR OPHTHALMIC VEIN
↓
CAVERNOUS SINUS

Previous Year's Questions

Q. Septic emboli in the facial vein can cause cavernous sinus thrombosis because the facial vein makes clinically important connections with the cavernous sinus. The most commonly involved communicating vein is

A. Superior ophthalmic
B. Deep facial
C. Inferior ophthalmic
D. Pterygoid plexus of veins

CLINICAL QUESTIONS

Cerebrum

Q. During anatomy viva, the external examiner places a skull bone on the table and asks each student a different kind of question. Your friend was asked which blood vessel passes behind Pterion, while your crush was asked which bones are broken in LeFort II fracture. You frantically go through all topics awaiting your turn. The consultant asks you this question:- "Which type of suture is found between the two parietal bones?"

What would you answer?

A. Serrate
B. Denticulate
C. Squamous
D. Plane
E. Schindylesis

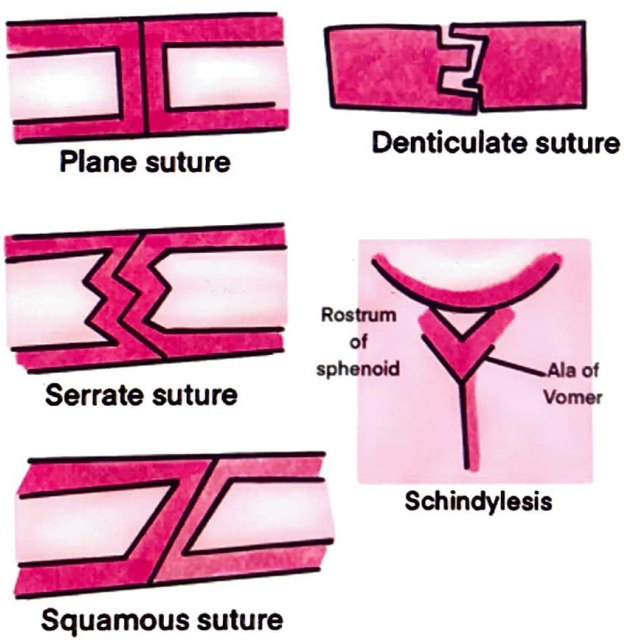
Answer: A

Solution

Types of sutures are as follows:-

1. **Serrate Suture**:- The edges of bones present saw toothed appearance e.g. sagittal suture between two parietal bones.
2. **Denticulate suture**:-The margins present teeth with tips being broader than the roots e.g. lambdoid suture.
3. **Squamous suture**:- Here the edges of bones are united by overlapping e.g. suture between the parietal bone and squamous part of temporal bone.
4. **Plane suture**:- The borders are plane and joined by sutural ligaments e.g. suture between palatine bones of two maxilla.

Note: Schindylesis:-Ridged bone fits into the groove present on a neighboring bone e.g. Vomerosphenoid suture



Reference: Grays 41st Edition pg no.96

Development of nervous system

Q. Neural tube defects are birth defects due to an opening that remains on from the early developmental period. It can be prevented by daily supplementation of folic acid for pregnant women early in their pregnancy.
Given that the above-mentioned statements are both true, when do the anterior and posterior neuropores close during embryonic development?

A. Week 2
B. Week 3
C. Week 4
D. Week 5
E. Week 7

Answer: C

Solution

- Anterior & posterior neuropores **close during week 4** of development—the **anterior neuropore by day 25**, the **posterior neuropore by day 28**.
- **Failure** of the Fusion of **anterior neuropore** results in **Anencephaly.**
- **Failure** of the fusion of **posterior neuropore** results in **Rachischisis**.
- Failure of fusion of both anterior and posterior neuropore results in Craniorachischisis

Reference: Gray's Anatomy 41st ed. pg. 238

Autonomous nervous system

Q. A 3-month-old baby was brought to the Paediatric OPD with complaints of bruising underneath the left eye and a palpable, non-tender, fixed mass on the left pre-auricular region. On examination, you notice the baby could potentially have Horner's syndrome and suspect primary tumor-like neuroblastoma. You inform the parents about it, order tests. Which of the following findings would not be found in this case of Horner's syndrome?

A. Heterochromia iridis

B. Ptosis

C. Miosis

D. Apparent exophthalmos

Answer: D

Solution

- **Horner syndrome** presents with **enophthalmos** (and **not exophthalmos**).
- This is due to paralysis of **orbitalis** muscle which anatomically protrudes the eyeball out of the socket.
- Its paralysis leads to the eyeball staying back in the orbit, giving the appearance of a **sunken eyeball** (enophthalmos).
- **Heterochromia iridis** may be present if the lesion occurred in a child younger than 2 years (congenital Horner syndrome).
- **C/F of HS**
  - Ptosis +
  - Miosis +
  - Anhidrosis +/-
  - Apparent enophthalmos
  - Nasal congestion
  - Conjuctival congestion

- Skin becomes red
- Ciliospinal reflex

The image below shows Horner's syndrome (not associated with any tumor):

Horner syndrome

LEARNING OBJECTIVES

UNIT 5 HEAD AND NECK

PHARYNGEAL ARCHES
- Pharyngeal Arches
- Skeletal Elements
- Pharyngeal Arch Nerves

PHARYNGEAL POUCHES AND CLEFTS
- Lateral Wall
- Thyroid Development
- Branchial Arch Anomalies

TONGUE DEVELOPMENT
- Floor Of Pharynx
- Circum Vallate Papillae
- Tongue Epithelium
- Motor Nerves & Sensory Nerves

PHARYNGEAL ARCH ARTERIES
- Blood Circulation
- Remnants

DEVELOPMENT OF SKULL

INTRODUCTION TO CRANIAL CAVITY
- Introduction
- Floor Of Anterior Cranial Fossa
- Greater Wing Of Sphenoid
- Floor Of Posterior Cranial Fossa
- Cranial Nerves & Related Skull Foramina

CRANIAL CAVITY PART 2
- Dangerous Area of Face
- External Ophthalmoplegia

TRIGEMINAL NERVE
- Ophthalmic Branch (V1)
- Maxillary Nerve
- Mandibular Nerve
- Muscles Of Mastication
- Lateral Pterygoid Actions

CRANIAL CAVITY PART 3

- **CAVERNOUS SINUS**
  - Contents
- **CRANIAL CAVITY PART 4**
- **FACIAL NERVE**
  - Crocodile Tear Syndrome
  - Bell's Palsy
  - Facial Nerve Branches
  - Middle Ear Cavity
  - Lower Pons
- **GLOSSOPHARYNGEAL NERVE**
- **VAGUS NERVE**
  - Supplies
  - Right Sided Lesion
  - Vagus Accessory Complex
- **HYPOGLOSSAL NERVE**
  - Hypoglossal Nerve [CN 12]
  - Rt. Sided Hypoglossal Nerve Injury
  - Genioglossal Muscle
  - Ansa Cervicalis
- **CERVICAL PLEXUS**
  - Cervical Plexus Branches
  - All Branches Coming From Anterior Primary Ramus
- **RELATIONS OF SCALENUS ANTERIOR MUSCLE**
  - Relations In Neck Region
  - Inter Scaleni Triangle
- **HEAD AND NECK: ARTERIAL SUPPLY**
  - Subclavian Artery - Branches
  - External Carotid Artery Branches
  - Tonsil Arterial Supply
  - Subclavian Steal Syndrome
- **HEAD AND NECK:VENOUS DRAINAGE**
  - Azygous Venous System
  - Block In Inferior Vena Cava
- **HEAD AND NECK:LYMPHATIC DRAINAGE**
  - Introduction
  - Thoracic Duct Course
- **SCALP**
  - Pneumonics
  - Deep Structure To Scalp

NECK TRIANGLE

- Sternocleidomastoid
- Posterior Triangles
- Anterior Triangle
- Digastric Triangle
- Carotid Triangle
- Stellate Ganglion Block
- Posterior (Occipital) Triangle

NECK FASCIA AND SPACES

- Cervical Fascia
- Pre Vertebral Fascia
- Retro Pharyngeal Space

NECK FASCIA AND SPACES:REVISION

PAROTID GLAND

- Relations
- Structures Passing Through Parotid Gland

PHARYNX

OESOPHAGUS

- Barium Radiography
- Sphincter

LARYNX

- Sensory nerves
- Larynx Muscles
- External Laryngeal Nerve Injury
- Vagus Nerve

VERTEBRAL LANDMARKS

- Trachea
- In Tracheostomy

EAR

- Nerve Supply
- Middle Ear Cavity
- Inner Ear
- Membranous Labyrinth
- Inner Ear- Sound Conduction
- Organ Of Corti
- Auditory Pathway

NOSE

- Bones
- Nasal Septum
- Lateral Wall
- Direction Of Nasolacrimal Duct

EYE BALL

- Development
- Optic Nerve
- Orbit
- Blunt Trauma To Orbit (Blowout Fracture Of Orbit)
- In-torsion: Inwards Rotation
- Eye Ball Muscles

CRANIAL NERVE :3,4,6

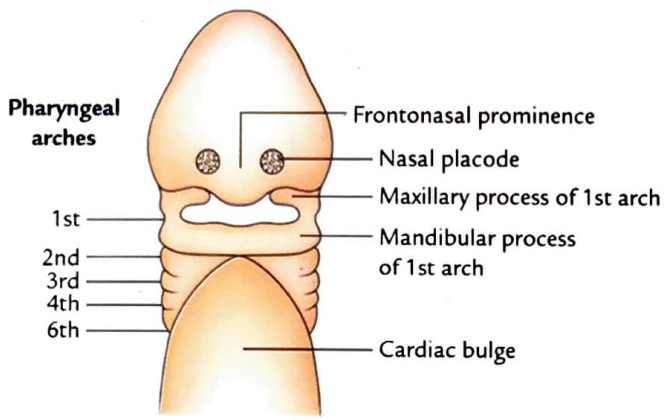
- Occulomotor Nerve (CN 3)
- Edinger Westphal Nucleus

44 HEAD & NECK

FMGE Aug 2020

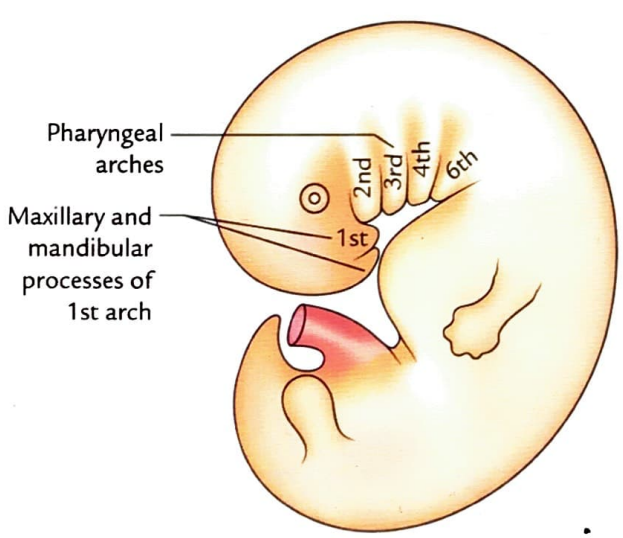
Q. Epiglottis develops from which branchial arch?

a. Third
b. fourth
c. Fifth
d. Sixth

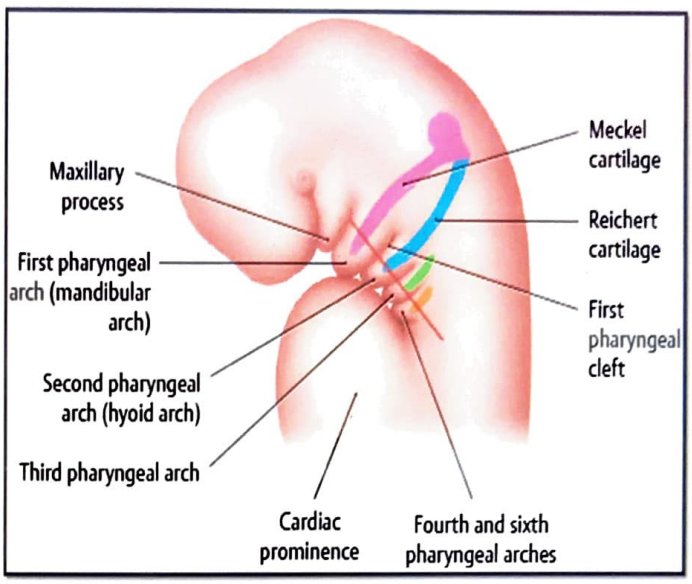


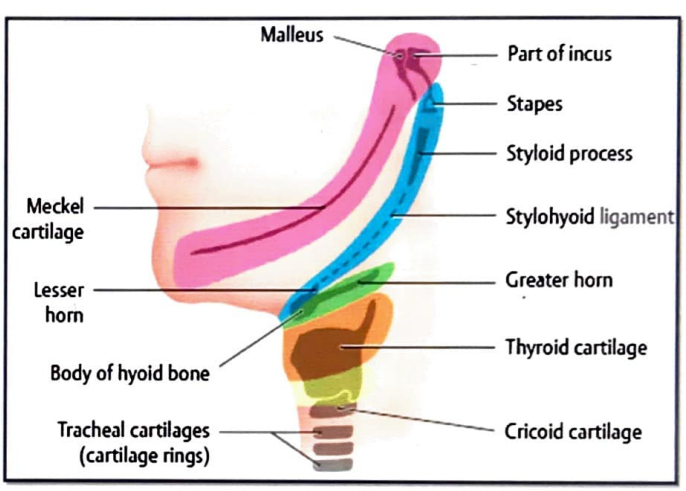
PHARYNGEAL ARCHES

- 6 u shaped arches
- around pharynx
- develops from neural crest cells
- 5th arch become rudimentary in humans
- 1 arch has
  - Upper maxillary process
  - Lower mandibular process



Refer Table 44.1



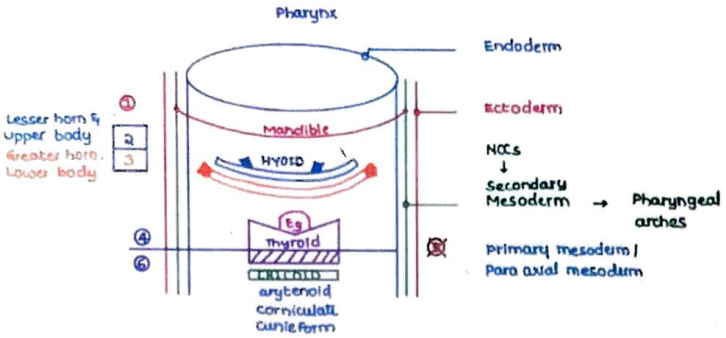


SKELETAL ELEMENTS

- 1st ARCH — Meckel's cartilage — [illegible] Bone
- 2nd ARCH — Reichert's — upper hyoid Bone
- 3rd ARCH — lower hyoid Bone
- 4th ARCH
- 6th ARCH

} Laryngeal Cartilages

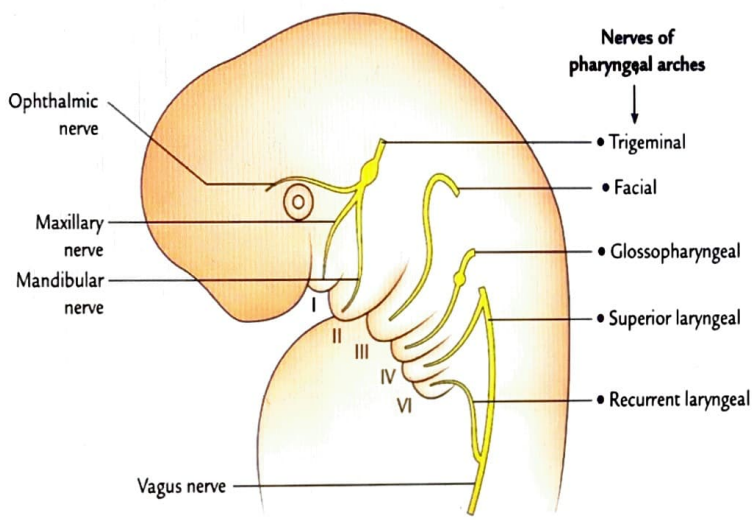
Refer Image 44.1

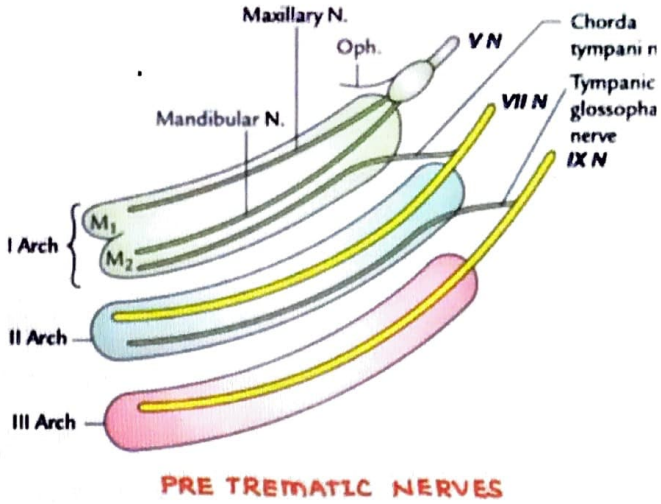


- NCCs → Mandible, Hyoid
- Para axial mesoderm → PAM's (Pharyngeal arch muscles) E.g. muscles of mastication 4th Arch
  → Thyroid cartilage
  Epiglottis cartilage
- 6th ARCH → Cricoid
  Arytenoid
  Corniculate
  Cuneiform

PHARYNGEAL ARCH NERVES

- 1st ARCH → Mandibular division of Trigeminal nerve
- 2nd ARCH → Facial nerve
- 3rd ARCH } NUCLEUS AMBIGUUS
- 4th ARCH } CN 9
- 6th ARCH } CN 10
  CN 11 (cranial part)





PRE TREMATIC NERVES

- 1st ARCH → V_3
  → Chorda tympani nerve of facial nerve (1st Pre-trematic N.)
- 2nd ARCH → Tympanic branch of glossopharyngeal nerve

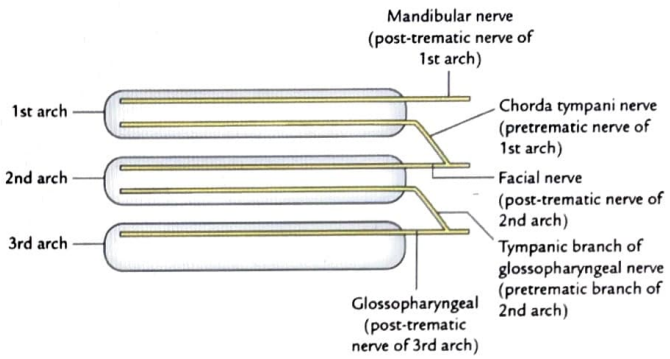
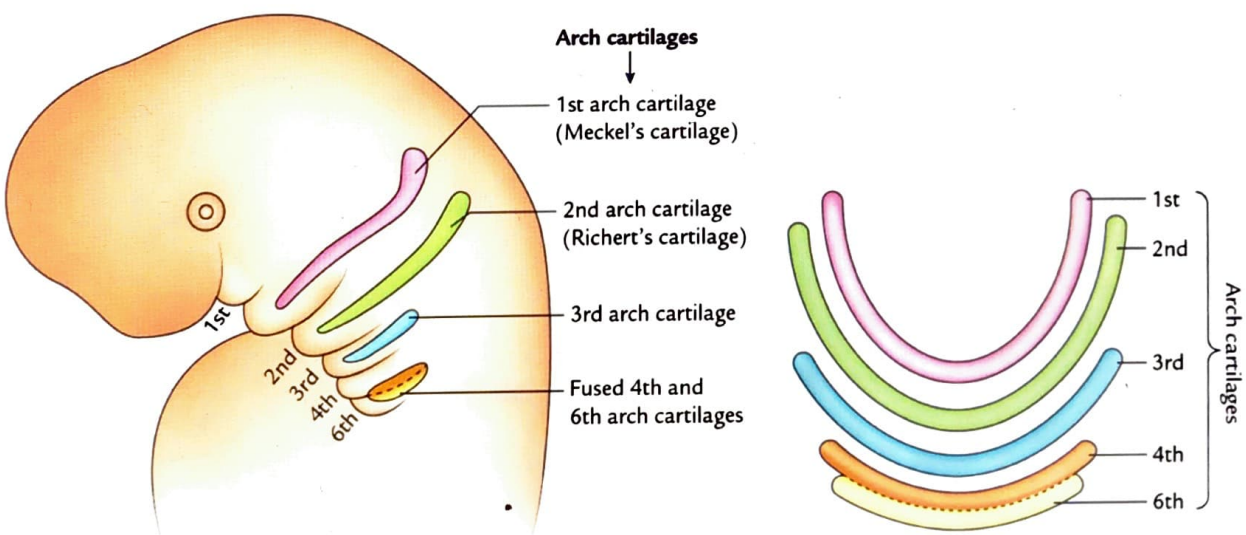


Table 44.1

Derivatives of the Pharyngeal arches

Arch No.	Nerve	Embryonic Cartilage	NCCs/Mesoderm	Mesoderm (Muscles)	Misc.	Artery
1.	CN V_3	Quadrate / Meckel's	Maxilla Mandible (GT) Incus Malleus Anterior ligament of malleus Sphenomandibular ligament	Tensor tympani Tensor veli palatini Muscles of mastication Mylohyoid Anterior belly digastric	Anterior 2/3 of tongue	Maxillary (transitory)
2.	CN VII	Reichert's	Stapes Styloid process Stylohyoid ligament Lesser horn and upper part of body of hyoid bone	Stapedius Stylohyoid Facial muscles (incl. Buccinator/ Platysma, Auricular, occipitofrontalis) Posterior belly digastric		Stapedial/ Hyoid artery (transitory)
3.	**CN IX**		**Greater horn and lower part of , body of hyoid**	**Stylopharyngeus**	**Posterior 1/3 of tongue**	**Common carotid artery internal carotid artery (first part)**

Image 44.1



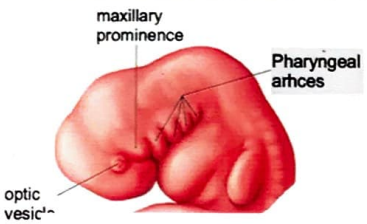
45 PHARYNGEAL POUCHES & CLEFTS

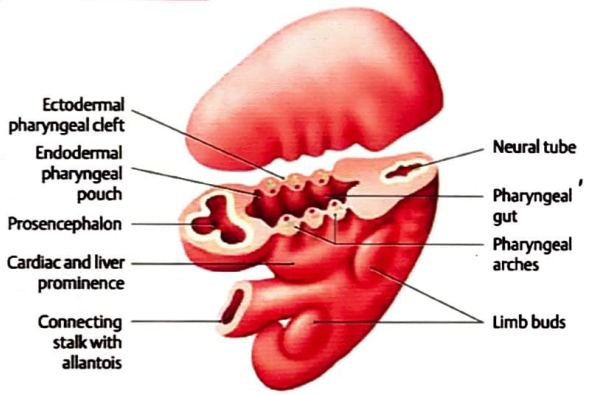
- Pouches → in the lateral wall of pharynx inside →lined by ectoderm
- Clefts→ in the lateral wall of pharynx outside →lined by endoderm

Previous Year's Questions

Q. Parafollicular C cells are derived from

a. Ultimo-branchial body
b. Pharyngeal Pouch 4
c. Pharyngeal Pouch 5 d>a>b>c
d. neural crest cells

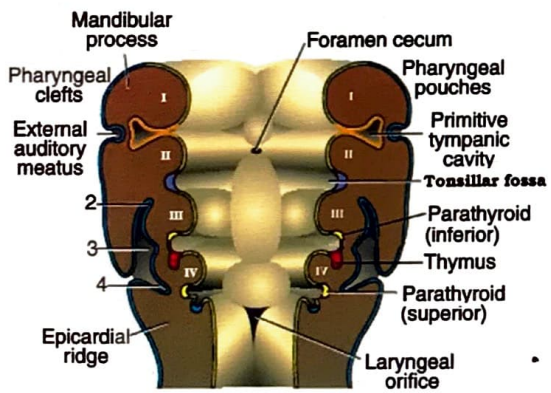


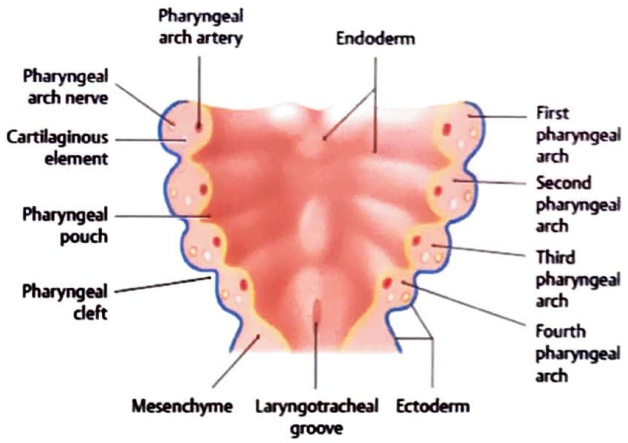


LATERAL WALL

00:03:43

- Pouches inside lined by endoderm.
- Clefts outside lined by ectoderm.





POUCH 2→ Forms endo dermal epithelium for tonsil Lines and tonsillar crypt
TONSIL IS DERIVED from MESODERM [Sec.] from NCCs,

POUCH 3 → Ventral → thymus
Dorsal → Inferior para thyroid

DIGEORGE SYNDROME

→ Pouch 3 & 4 compromised
→No thymus→↓Cell mediated immunity→Severe bacterial infection
Hypocalcemia (Tetany) → Causes cardiac anomalies
IPT defect ↓PTH ↓Ca^{2+} → MC cause of death → AP septum anomalies

POUCH 4 → Superior parathyroid

POUCH 5→Ultimobranchial body body [vestigial remnant]
→ Fuse with 4th pouch
→ Receives NCCs & changes to parafollicular 'C' cells.

Tympanic membrane has all 3 germ layers

Inner Epithelium →Endoderm of pouch 1
Outer Epithelium → Ectoderm of cleft 1
Connective Tissues →Pharyngeal pouches

Previous Year's Questions

Q. Which of these is correct about the development of tonsil? NEET PG 2020

a. Is a derivative of Ist pharyngeal arch
b. Develops from 2nd pharyngeal pouch
c. Develops from 3rd pharyngeal pouch
d. Is a derivative of neural crest cells [Better Answer]

Previous Year's Questions

Q. Thymus develops form fmge 2019 dec

a. 2nd PP (Ventral portion)
b. 3rd PP (Ventral portion)
c. 3rd PP (Dorsal portion)
d. 4th PP (Ventral portion)

THYROID DEVELOPMENT

00:17:42

→ Endodermal

→ At floor of pharynx Tongue development

↓

Foramen caecum

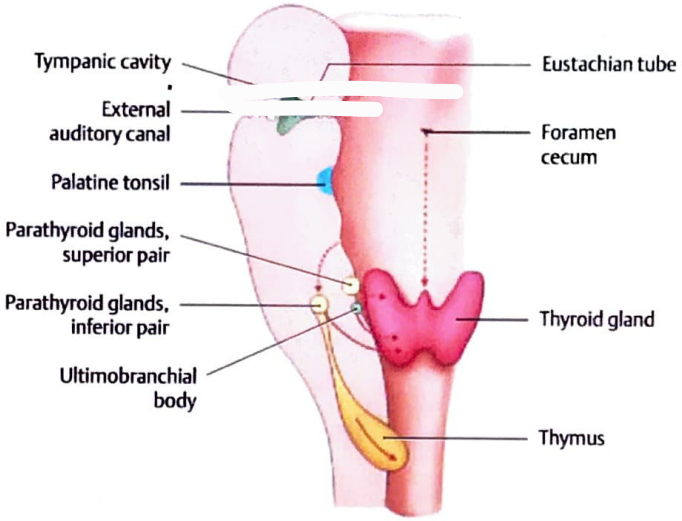
↓

Thyroglossal duct

↓

Thyroid

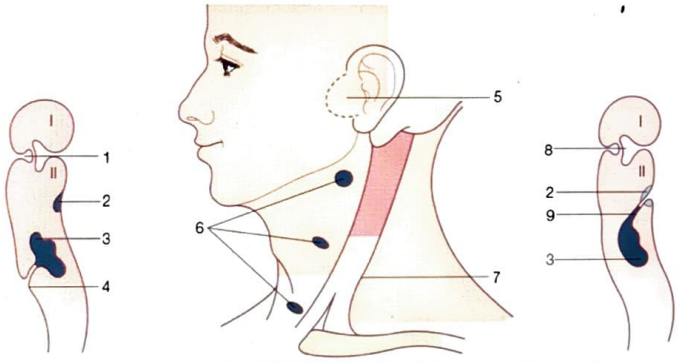
UBB → NCCs comes here → Parafollicular 'C' cells



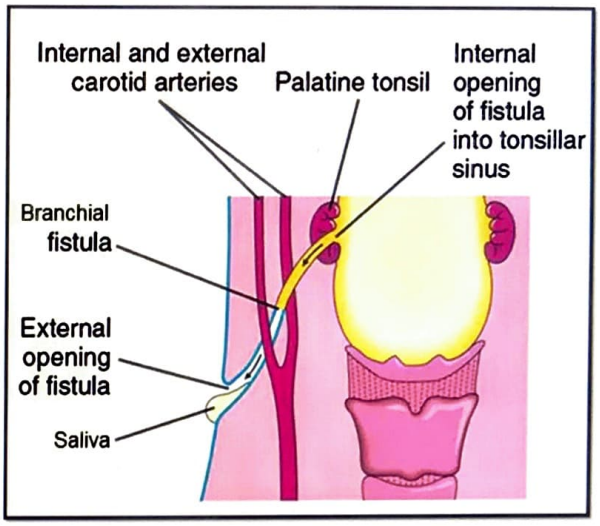
BRANCHIAL ARCH ANOMALIES

00:20:40

- 95% are from 2nd Arch
- 2nd Arch fistula and sinuses are commonest of the branchial anomalies



1, external auditory meatus; 2, palatine tonsil; 3, lateral cervical (branchial) cyst; 4, external branchial sinus; 5, region of preauricular fistulae; 6, region of lateral cervical cysts and fistulae; 7, sternocleidomastoid muscle; 8, tubotympanic recess; 9, internal branchial sinus.



BRANCHIAL CYST

- Vestigial remnant of cleft 2, 3, 4 mainly from cleft 2
- Cyst near angle of mandible
- If cyst opens outside on skin → Branchial sinus/ fistula
- Branchial cyst is in → upper neck region
- Branchial sinus/ fistula is in → lower neck region
- All are at anterior border of sternocleidomastoid → ant. triangle of neck

46 TONGUE DEVELOPMENT

Previous Year's Questions

Q. Tongue develops from all except neet pg 2018
a. Tuberculum impar
b. Hypobranchial eminence
c. Second arch → Minimal contribution
d. Lingual swelling

FLOOR OF PHARYNX

00:01:44

2 LINGUAL SWELLING 1. Pharyngeal arch→Anterior 2/3rd of Tongue

TUBERCULUM IMPAR 2. Pharyngeal arch → Disappear at foramen caecum minimal Contribution

3. Pharyngeal arch → Post. 1/3rd of tongue
4. Pharyngeal arch → Epiglottis Posterior most tongue

CIRCUM VALLATE PAPILLAE

→ Embryologically develops from posterior 1/3rd of tongue Later migrate anterior to sulcus terminals

→ Supplied by CN 9 (Glossopharyngeal nerve)

TONGUE EPITHELIUM

At beginning → Endodermal [whole tongue]
Any external opening lined by SURFACE ECTODERM → Ant. 2/3rd of tongue
At sulcus terminals→ Ectoderm & Endodermal junction
Post 1/3rd → Endodermal

TONGUE DERIVED FROM 3 GERM LAYERS

TONGUE→ Connective tissue & muscles → mesodermal origin
Tongue muscles come from occipital somites [post occipital myotomes] [eye ball muscles come from pre ottic myotomes]
Connective tissue derived from pharyngeal arches (1, 3, 4)
Some epithelium is endodermal & remaining is ectodermal
- Supplies palate, pharyngeal larynx

MOTOR NERVES

00:07:29

All muscles of tongue derived from Hypoglossal nerve (12) Except Palatoglossal
- Supplied by superior laryngeal nerve
- VAGUS ACCESSORY COMPLEX

Sensory nerves

General sensations of ant. 2/3rd of tongue→Lingual nerve [53]
branch of mandibular nerve
branch of trigeminal nerve
Posterior 1/3rd & circumvallate papillae→ Glossopharyngeal nerve
Posterior most tongue & epiglottis→ Internal laryngeal nerve
branch of superior laryngeal nerve
branch of vagus nerve

Q. Taste pathway from circumvallate papillae of tongue goes through? Neet pg 2021
a. Chorda tympani br. of facial nerve → from anterior 2/3rd of tongue
b. Greater petrosal br. of facial nerve→carry taste from palate
c. Superior laryngeal br. of vagus nerve→carry taste epiglottis & post. most
d. Lingual branch of Glossopharyngeal nerve

47 PHARYNGEAL ARCH ARTERIES

b. 7 weeks
a. 3 – 4 weeks

BLOOD CIRCULATION

00:01:26

HEART
↓
AORTIC SAC
↓
PHARYNGEAL ARTERIES 1-6
↓
DORSAL AORTA [Rt & Lt]
↓
DORSAL AORTA FUSED INFERIORLY

ARCHES 1,2,5 disappear
ARCHES 3,4,6 persists

REMNANTS

00:03:07

1ST ARCH-MAXILLARY ARTERY
2ND ARCH-STAPEDIAL ARTERY 5 TH ARCH- NO REMNANTS

ARCH 3	Rt. & Lt. COMMON CAROTID ARTERIES	[portion of]
	Rt. & Lt. INTERNALCAROTID ARTERIES	[portion of]
ARCH 4 Rt. side Lt. side	Rt. SUBCLAVIAN ARTERY [portion of] ARCH OF AORTA [part b/w left subclavian & left common carotid Artery	
ARCH 6	Pulmonary Artery Ductus arteriosus	[Rt. & Lt.] [Left is left, Rt. disappears]

EXTERNAL CAROTID ARTERY → DE NOVO BRANCH

Rt. SUBCLAVIAN ARTERY → Rt. 4th Arch
CONTRIBUTED BY

Lt SUBCLAVIAN ARTERY → Rt. dorsal aorta part of
contributed by → Inter segmental artery no. 7

DOUBLE AORTIC ARCH

→ Persistent distal portion of Rt dorsal aorta
→ Difficulty in breathing & swallowing due to compression by Rt aortic arch

Refer Image 47.1

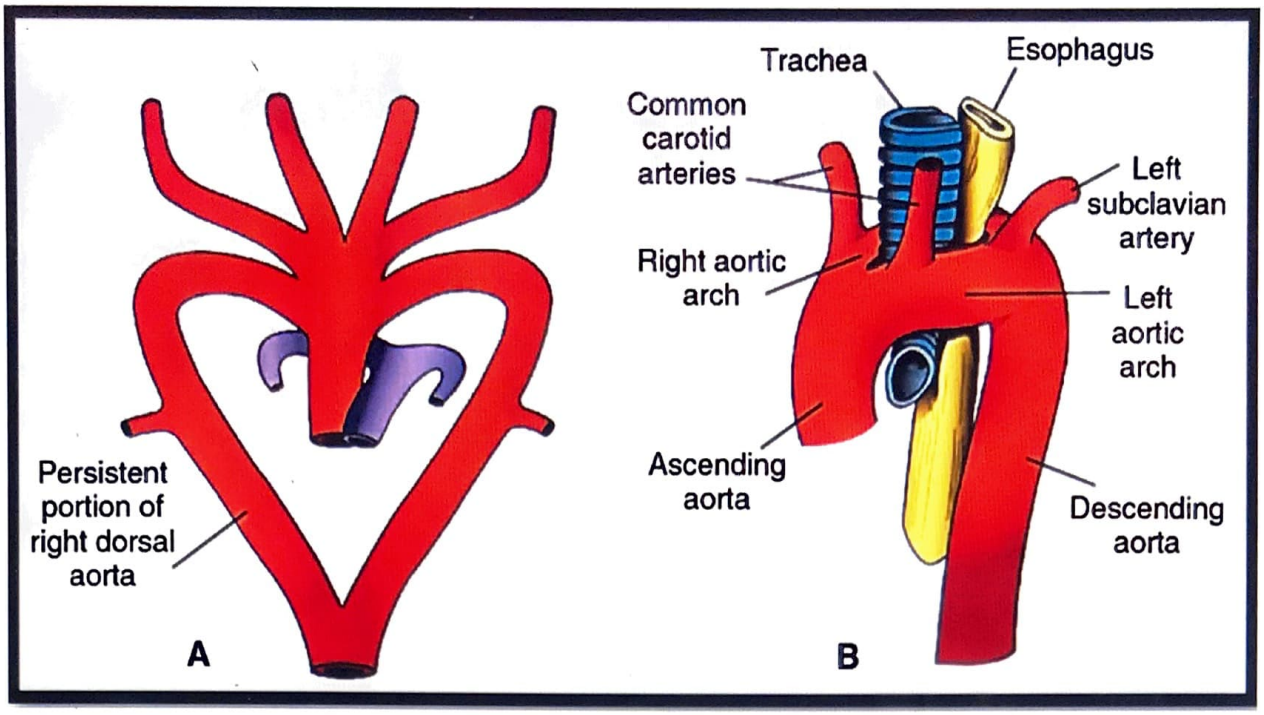
Embryonic	Adult
Aortic arch arteries	
1.	Maxillary artery (protion of)
2.	Stapedial artery (Protion of)
3.	Right and left common carotid arteries (Portion of Right and left internal carotid arteries
4.	Right subclavian artery (portion of) Arch of the aorta (portion of)
5.	Regresses in humans
6.	Right and left pulmonary arteries (portion of) Ductus arteriosus

Previous Year's Questions

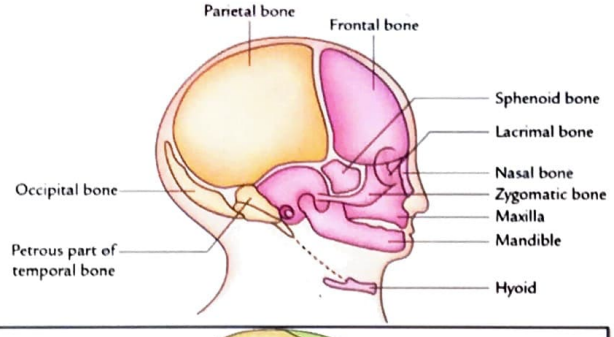
Neet pg 2017, 2019

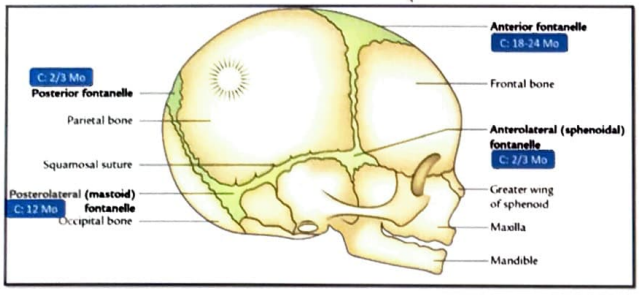
Q. Double aortic arc occurs due to
a. Non development of right 4th aortic arch
b. Non development of left 4th aortic arch
c. Non division of truncus arteriosus
d. Persistent distal portion of right dorsal ao

Image 47.1


Persistent portion of right dorsal aorta
A
Trachea
Esophagus
Common carotid arteries
Left subclavian artery
Right aortic arch
Left aortic arch
Ascending aorta
Descending aorta
B

48 DEVELOPMENT OF SKULL





FONTANELLE FUSION

00:01:43

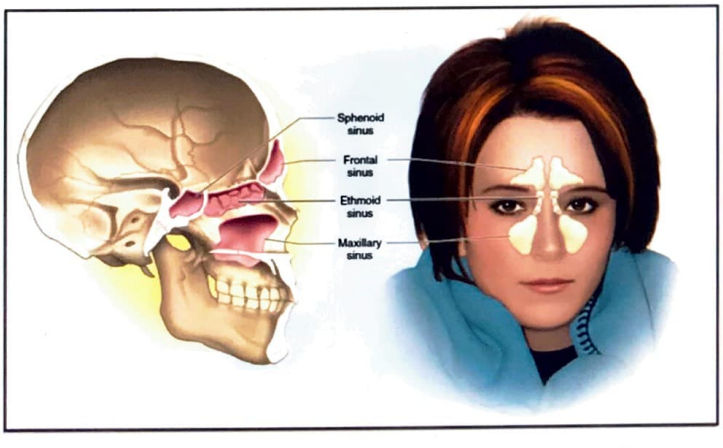
1. Posterior → 2/3 m
2. Spherical → 2/3 m
3. Mastoid → 12 m
4. Anterior → 18-24m

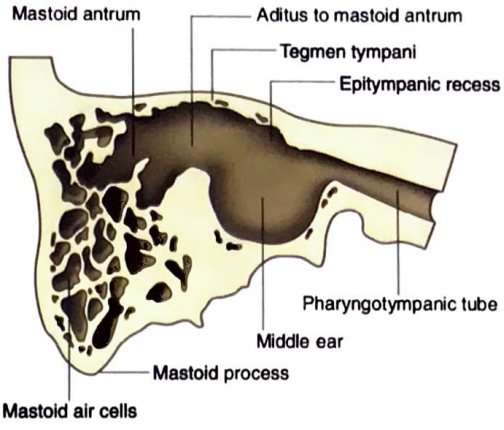
Refer Table 48.1

- AT birth, orbital cavity is 75% of adult size and continues to grow passively in response to globe growth before reaching adult size by age 7 yrs.

PNEUMATIC BONES

00:07:40





- FRONTAL SINUS : In frontal Bone
- ETHMOID SINUS : In ethmoid Bone [nose]
- SPHENOID SINUS
  - In sphenoid Bone
  - Pituitary glands is present
- MAXILLARY SINUS: Largest sinus
- MASTOID AIR CELLS
  - In temporal Bone
  - MASTOID PROCESS
    - → Comes around 2 yrs of age
    - → Traction epiphysis

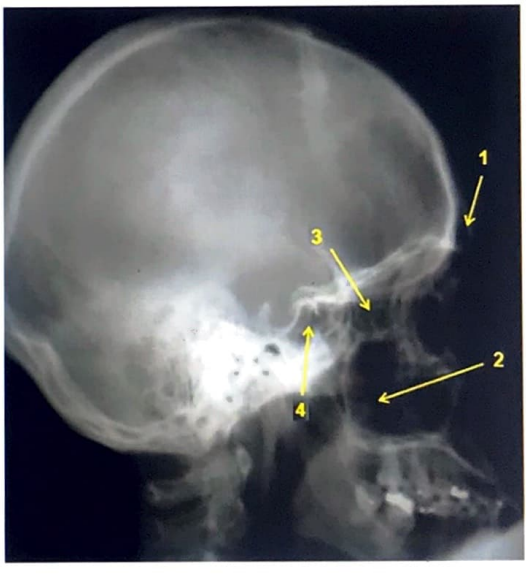


Table 48.1

Structures at adult size (at birth)	Structures not at adult size (at birth)
• Tympanic membrane	• Tegmen tympani
• Tympanic cavity	• Mastoid process
• Ear ossicle (malleus, incus and stapes)	• External ear and external auditory canal
• Tympanic (Mastoid, Antrum)	• Eustachian tube
• Internal ear: Cochlea, vestibule, semicircular canal	

49 CRANIAL CAVITY

INTRODUCTION

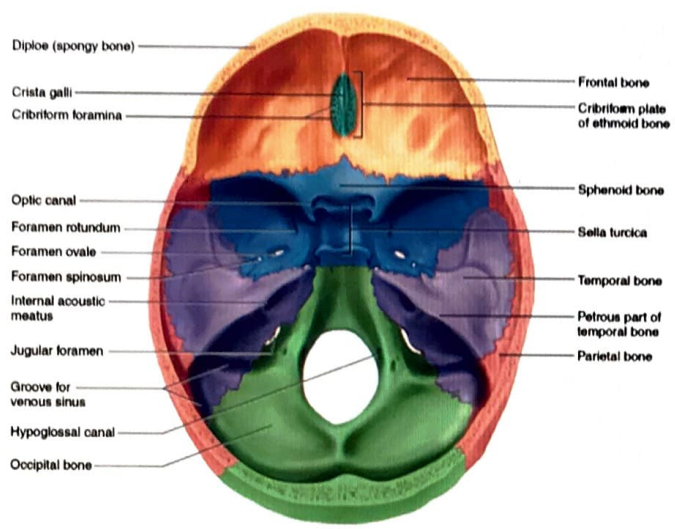
00:00:15

- Posterior cranial fossa contains brain stem.
- Brain stem has 3-12 CN
- ACF contains Frontal lobe
- MCF contains Temporal lobe
- PCF contains Brain stem &cerebellum

Previous Year's Questions

Q. Which of the following nerves are present in posterior cranial fossa? Neet 2018, 2020

A. 3rd to 12th
B. 4th to 12th
C. 5th to 12th
D. 6th to 12th

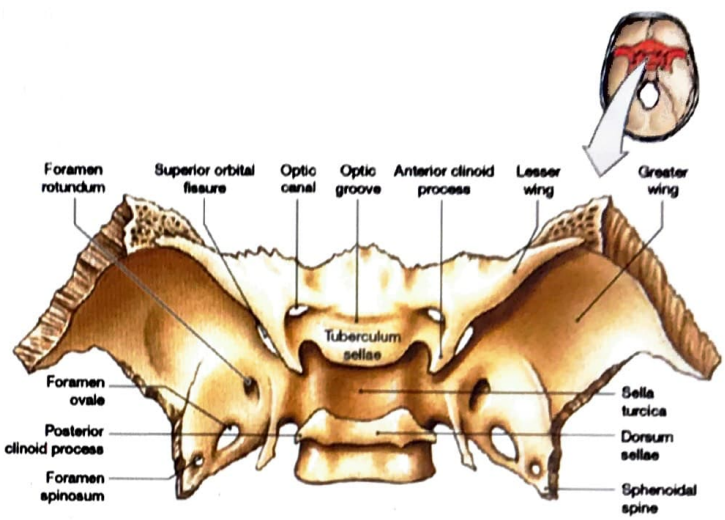


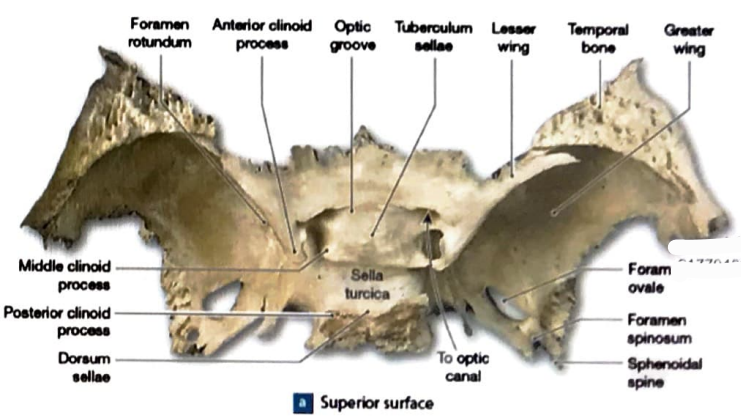
FLOOR OF ANTERIOR CRANIAL FOSSA

00:03:09

1. CRIBRIFORM PLATE OF ETHMOID BONE
   - Roof of nasal cavity
   - Contains multiple openings for olfactory nerve axons nasal cavity to olfactory bulb in brain
2. FRONTAL BONE
3. LESSER WING OF SPHENOID
   - SPHENOID BONE → Butterfly shaped Bone
   - LESSER WING → Present at floor of anterior cranial fossa
   - GREATER WING → Present at floor of middle cranial fossa
   - SUPERIOR ORBITAL FISSURE → Present b/w lesser wing & greater wing
   - Contains optic canal for passage of optic nerve coming from eyeball

Refer Image 49.1





1. GREATER WING OF SPHENOID

00:04:48

- OPENINGS
  1. Foramen rotundum
  2. Foramen ovale
  3. Foramen spinosum

2. SUPERIOR ORBITAL FISSURE

- Gap b/w lesser wing & greater wing

3. BODY OF SPHENOID

- Present in
  - Anterior cranial fossa
  - Middle cranial fossa
  - Posterior cranial fossa
- SELLA TERCICA → Body of sphenoid in floor of MCF to keep pituitary gland

SPHENOID BONE

Boundaries Of Orbit

- Roof → Lesser wing of sphenoid
- Lateral wall → Greater wing of sphenoid
- Medial wall→ Body of sphenoid

Pterygoid Plate gives origin

- On medial surface → Medial pterygoid
- On lateral surface → Lateral pterygoid

Foramen Lacerum

- Has lacerated margins
- Medial to fossa ovalis

Cavernous Sinus

- Lateral to sella turcica (pituitary gland)
- Internal carotid artery passing at floor of foramen lacerum before entering into cavernous sinus

Refer Image 49.2

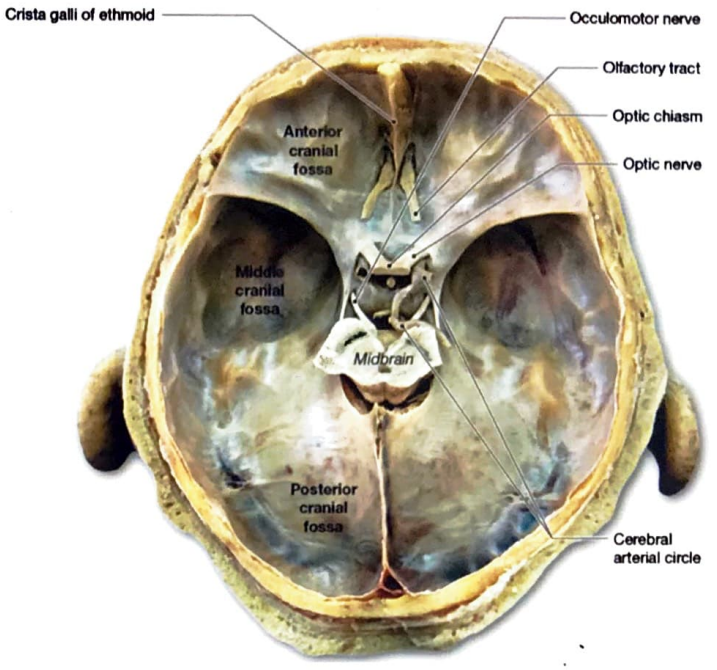
FLOOR OF POSTERIOR CRANIAL FOSSA

00:12:05

1. INTERNAL AUDITORY MEATUS
   - In petrous temporal Bone
   - Facial nerve enter through it
2. JUGULAR FORAMEN → Present below IAM
3. HYPOGLOSSAL CANAL → For CN XII
4. FORAMEN MAGNUM → Present in occipital Bone

CRANIAL NERVES & RELATED SKULL FORAMINA

00:14:03



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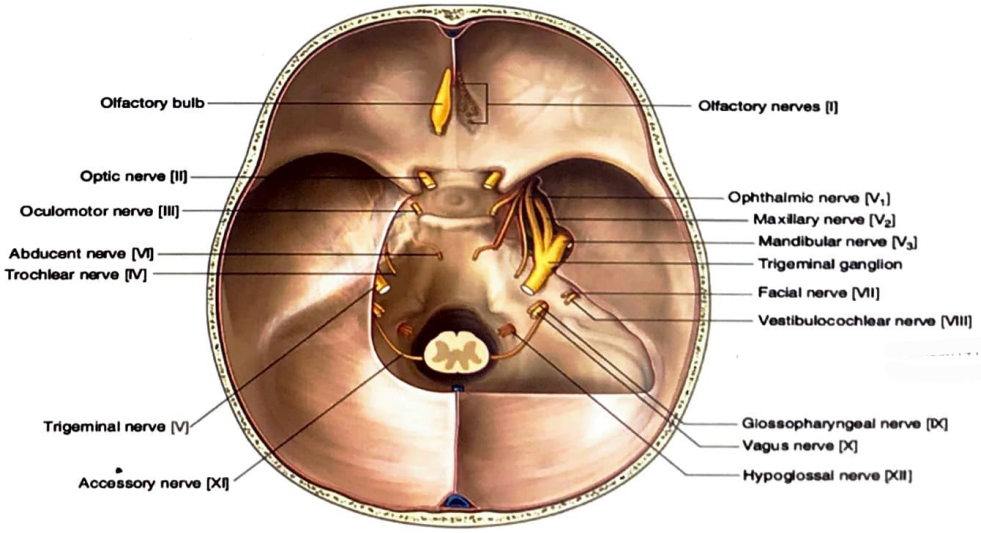


ANTERIOR CRANIAL FOSSA

Foramina Skull

1. OLFACTORY NERVE →Cribriform plate of Ethmoid
2. OPTIC NERVE →Optic canal
3. IN MIDLINE TUMOR OF PITUITARY GLAND→ Optic chiasma affected
   - Bitemporal Hemianopia
     - Peripheral vision is lost
     - Tunnel vision present

MIDDLE CRANIAL FOSSA

Cavernous Sinus Contents

1. INTERNAL CAROTID ARTERY
2. OCCULOMOTOR NERVE (III) →most medial
3. ABDUCENT NERVE (IV) → puncture dura matter at floor of post. cranial fossa & becomes Intradural [has longest intra dural course] & enter cavernous sinus
4. TROCHLEAR NERVE (VI) →most lateral
   - Thinnest cranial nerve
5. OPHTHALMIC DIVISION OF TRIGEMINAL NERVE (V_1)→ Gives 3 sensory branches & pass through superior orbital fissure
6. MAXILLARY DIVISION OF TRIGEMINAL NERVE (V_2)→ Pass through foramen rotundum & supply maxilla CN 3,4,6 passes through superior orbital fissure & supply eye ball

Trigeminal Nerve

- Forming ganglia at middle cranial fossa floor
- Largest cranial nerve
  - V1 → Ophthalmic nerve
  - V2 → Maxillary nerve
  - V3 → Mandibular nerve (passes foramen ovale & supply mandible)

POSTERIOR CRANIAL FOSSA	FORAMEN OF SKULL
1. CN 7 CN 8	Internal auditory meatus
2. CN 9 CN 10 CN 11 (spinal part)	jugular foramen

Spinal Accessory Nerve

- Enter the cranial cavity through foramen magnum
- Exit the cranial cavity through jugular foramen
- Have short intra cranial course

3. CN 12 →Hypoglossal canal

Substantia Nigra

- Present in mid brain in posterior cranial fossa
- Oculomotor nerve comes anterior to it at the level of superior colliculus
- **Foramen Magnum** → contains lower part of M. Oblongata
- **Spinal Cord** → present below foramen magnum

Image 49.1

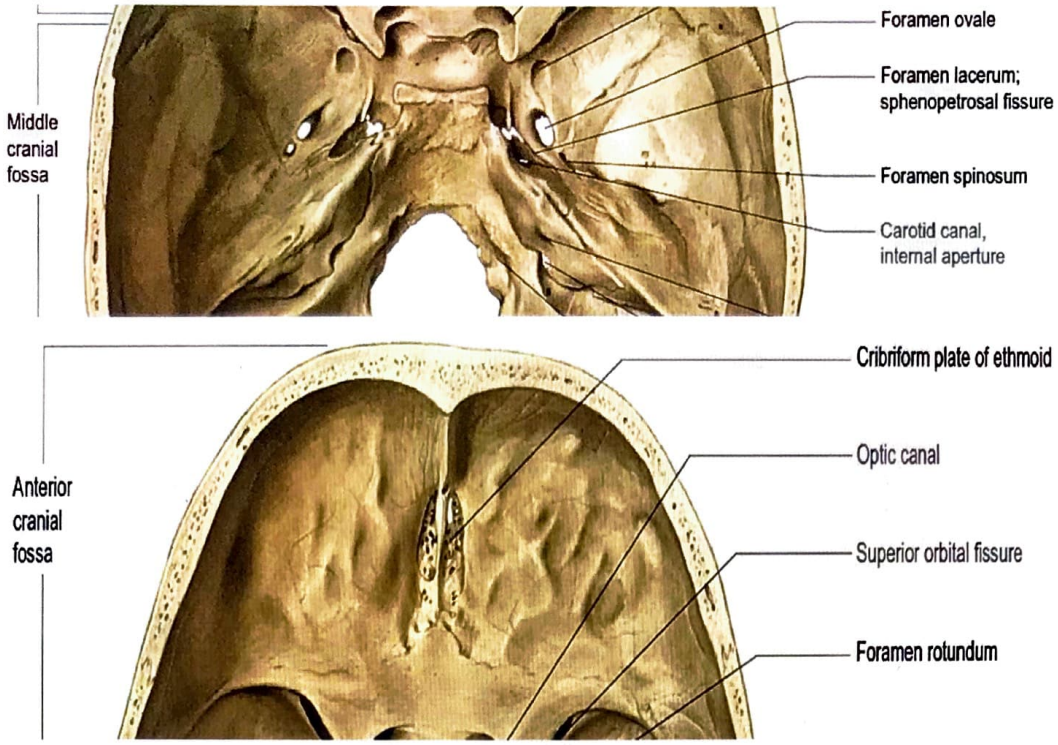


Image 49.2

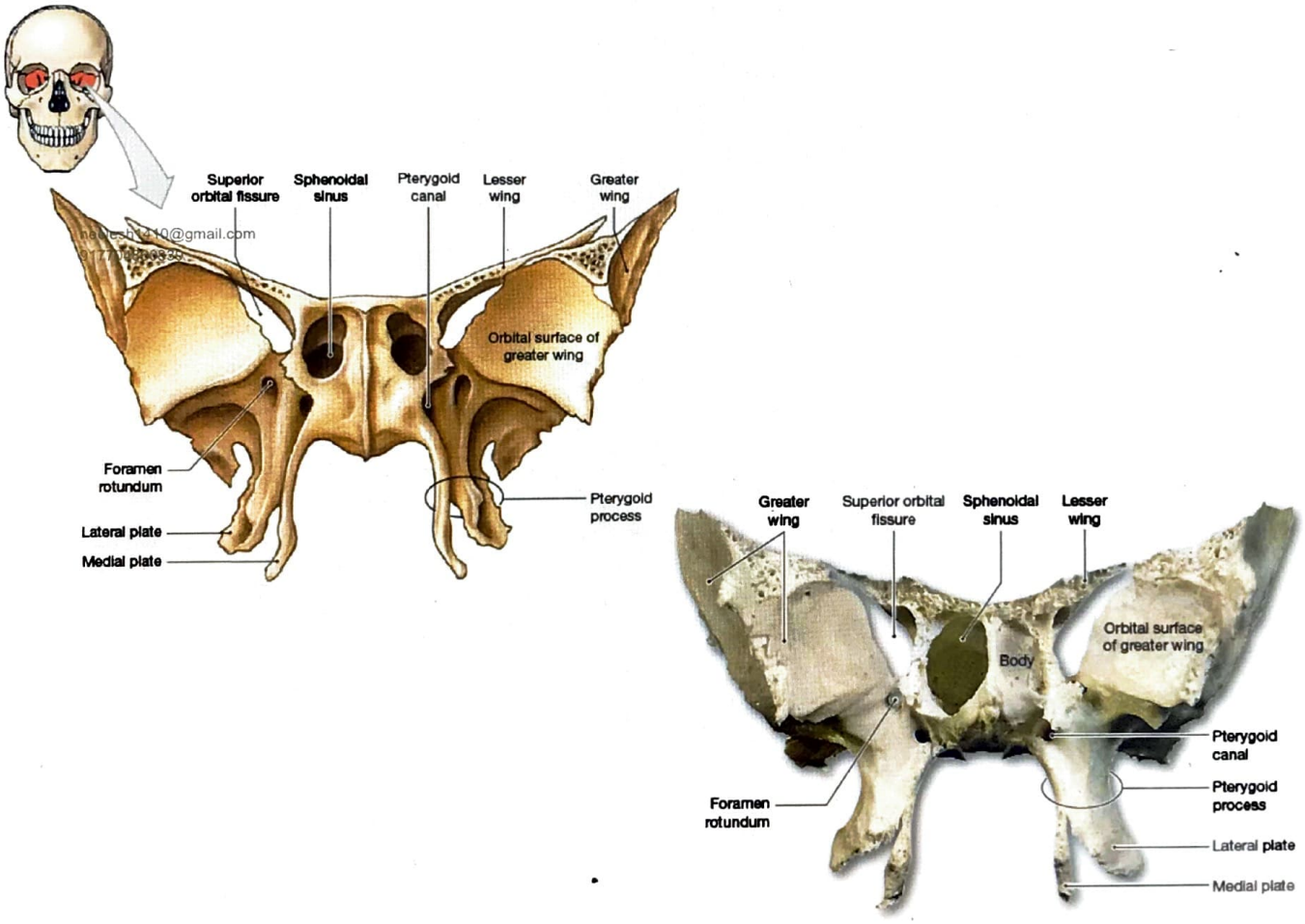
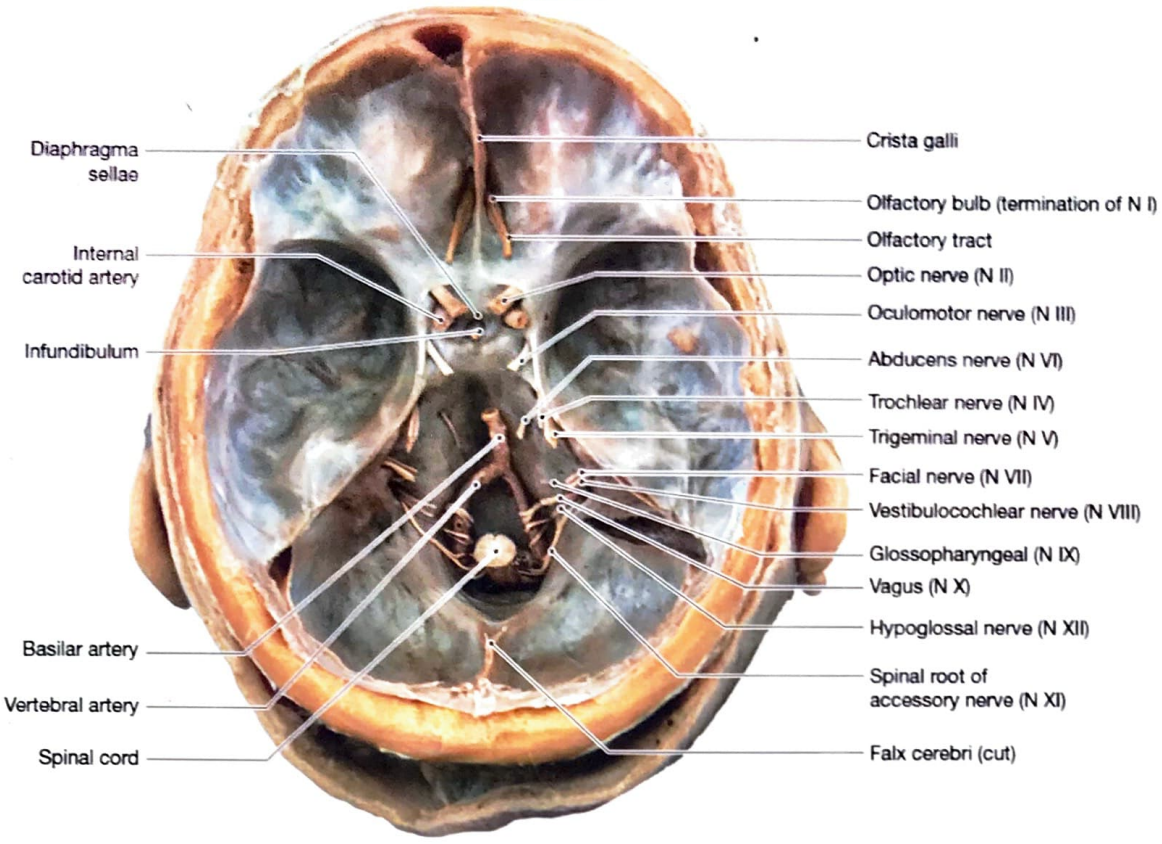


Image 49.3

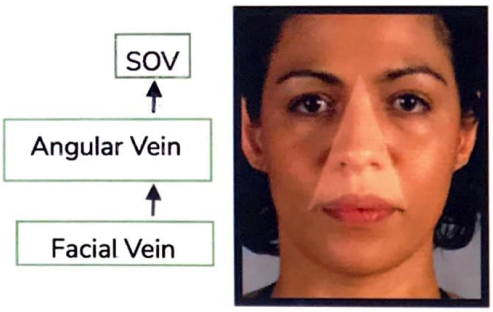

Diaphragma sellae
Internal carotid artery
Infundibulum
Basilar artery
Vertebral artery
Spinal cord
Crista galli
Olfactory bulb (termination of N I)
Olfactory tract
Optic nerve (N II)
Oculomotor nerve (N III)
Abducens nerve (N VI)
Trochlear nerve (N IV)
Trigeminal nerve (N V)
Facial nerve (N VII)
Vestibulocochlear nerve (N VIII)
Glossopharyngeal (N IX)
Vagus (N X)
Hypoglossal nerve (N XII)
Spinal root of accessory nerve (N XI)
Falx cerebri (cut)

50 CRANIAL CAVITY II CRANIAL FOSSAE & RELATED FORAMINA

Thinnest sclera → Just behind the insertion of recti muscles

Dangerous Area of Face

- Upper lip Nose
- Medial canthus of eye [angular vein + nt here]



↑ICT

- Medial squint (early sign)
- MR more powerful
- LR affected
- Earliest nerve involved → Cn6

External ophthalmoplegia

- Later onset
- Eye [illegible] still.
- All nerves are affected
- Ethmoid air sinus

At floor of ACF (roof of nasal cavity) CSF Rhinorrhea
Sphenoid air sinus

Medial Wall of Orbit

- Body of SPHENOID [more posterior]
- Ethmoid Bone
- Lacrimal Bone
- ZMaxilla Bone [more anterior]

Lateral Wall of Orbit

- Greater wing of SPHENOID
- ZYGOMATIC BONE

Ophthalmic Division of CNV

Gives 3 sensory branches & passes SOF

1. Nasociliary nerve [most med] → passes through CTR of Zinn → supplies cornea (corneal reflex)
2. Frontal nerve [middle]
3. Lacrimal nerve (most lat.) → passes outside Zinn

Anterior Ethmoidal Nerve Supplies

1. Nose (inside & outside)
2. Dura matter at the floor of ACF

- Br. of nasociliary nerve
- COURSES
  - Given in orbit by nasociliary nerve
  - Exits orbits by passing through ethmoidal foramen
  - Comes to floor of ACF
  - Supplies
    - → Dura matter at floor of ACF
    - → Nose (inside & outside), ethmoid Bone & sinus air ethmoid [carries pain]

Pain of Ethmoid Sinusitis

Pain → Ant. Ethmoidal Nerve → Naso Ciliary nerve → Ophthalmic division of TG nerve

Previous Year's Questions

Q. Anterior ethmoidal nerve branch of nasociliary nerve supplies all except?
a. Dura matter in anterior cranial fossa
b. Ethmoidal cells
c. Internal nasal cavity
d. Maxillary sinus lining → carries by branches of maxillary nerve

Nerves left outside the ring of ZINN

- L : Lacrimal nerve
- F : Frontal nerve
- T : Trochlear nerve

Veins left outside the ring of ZINN

- Superior ophthalmic vein
- Inferior ophthalmic vein

Nerves passing inside the ring of ZINN

- CN 3 [superior division (supplies sup. rectus) & inferior division (supplies inf. rectus)]
- CN 6

- Nasociliary nerve

Previous Year's Questions

Q. Structures passing through the tendinous ring of ZINN

a. Superior ophthalmic vein
b. Trochlear nerve
c. Naso ciliary nerve
d. Lacrimal nerve

51 TRIGEMINAL NERVE

OPHTHALMIC BRANCH (V1)

00:00:15

- Supplies skin fore head & tip of nose
- In herpes zoster (vesicles at tip of nose)
- Ophthalmic branch is involved

MAXILLARY BRANCH [V2]

- Supplies skin lower eye lid, upper lip & maxilla Bone

MANDIBULAR BRANCH [V3]

- supplies skin of mandible except angle of mandible

OPHTHALMIC BRANCH

3 SENSORY BRANCHES passes SOF & enters orbit

1. Lacrimal nerve → Most lateral
2. Frontal nerve → Middle
3. Nasociliary nerve → Most medial

CILIARY GANGLION

1. EDW nucleus sends pre ganglionic fibre carried by occulomotor Nerve (3) [functional nerve] & synapse in CILIARY GANGLION

2. post ganglionic fibres carried by Trigeminal nerve [NCN] [Topographic n.] & supplies

- CILIARIS → ↑ Lens convexity (Accomodation reflex
- SPHINCTER PUPILLAE → Miosis (light reflex)

MAXILLARY NERVE

00:07:40

- Passes foramen rotundum
- PTERYGOPALATINE GANGLION in pterygopalatine fossa
- Supplies
  L → Lacrimal gland
  N → Nasal gland
  P → Palatine gland
- Functional nerve → facial nerve
- Topographic nerve → maxillary branch of CN V
- Passes inferior orbital fissure & become inferior orbital Nerve & run at floor of orbit
- It carries → pain of upper teeth [pain of lower teeth of mandibular nerve] → pain of maxillary sinusitis

MANDIBULAR NERVE (53)

- Supplies mandible Bone, mandibular teeth (carries lower teeth pain)
- Passes through foramen ovale & related topographically with OTIC ganglion

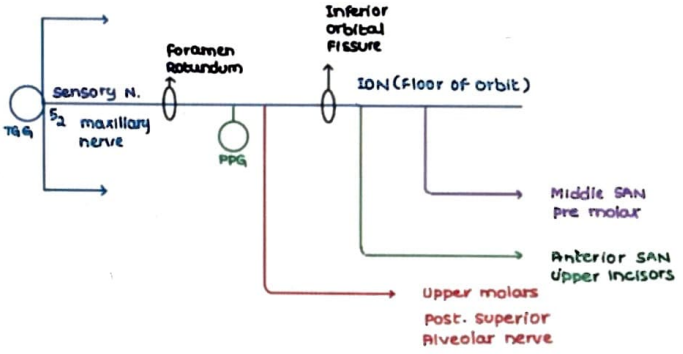
OTIC GANGLION

- Functional nerve → Glossopharyngeal nerve
- Topographic nerve → Mandibular nerve CNV
- Supplies → Parotid salivary gland
- Otic ganglion is more medial & deeper to mandibular nerve

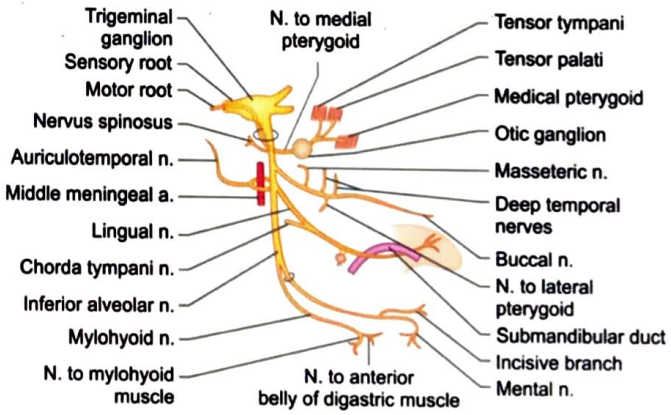
SUB MANDIBULAR GANGLION

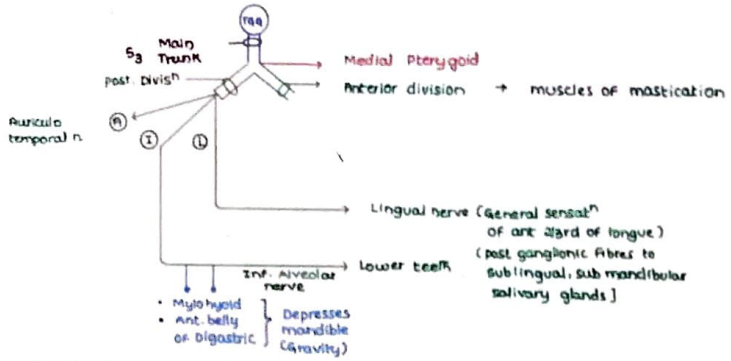
- Functional nerve → Facial nerve
- Topographical nerve → Lingual branch of mandibular branch of CN V
- Supplies → Sub mandibular salivary gland
  Sublingual salivary gland

MAXILLARY NERVE



MANDIBULAR NERVE [MIXED NERVE]





- Auriculotemporal nerve supplies → skin of tragus
  → Temporal skin

MUSCLES OF MASTICATION

00:14:56

- Develops from 1st pharyngeal arch
- Supplied by mandibular nerve of V
- 8 MUSCLES

3 ELEVATORS

- M → Masseter [by Anterior division]
- T → Temporalis [by Anterior division]
- Me → Medial pterygoid [by main trunk]

3 DEPRESSOR

- Mylohyoid [by inferior alveolar nerve]
- Anterior belly of digastric [by inferior alveolar nerve]
- Lateral pterygoid [chief depressor] [by mandibular nerve]

} gravity

2 TENSORS

- Tensor tympani → ↓ intensity of sound
- Tensor palati → tense the palates open the eustachian tube

- ELEVATORS & DEPRESSORS
  - INSERTION → Mandible

LATERAL PTERYGOID MUSCLE

- inserted on Pterygoid fossa
- Helps in protrusion (chief action) depression
- Masseter inserted on ramus & angle of mandible on lateral side Medial pterygoid inserted on ramus & angle of mandible on medial side

Temporalis inserted into coronoid process

- Helps in retraction, elevation
- Origin of temporalis → Temporal Bone

DIGASTRIC MUSCLE (HYBRID MUSCLE, dual motor nerve supply)

ANTERIOR BELLY

- Attaches to mandible Bone & hyoid Bone
- Develops from 1st pharyngeal arch
- Depressor of mandible
- Both mylohyoid & anterior belly supplied by mandibular N (V_3)

POSTERIOR BELLY

- Attaches to hyoid Bone & mastoid Bone
- develops from 2nd pharyngeal arch
- supplied by facial nerve

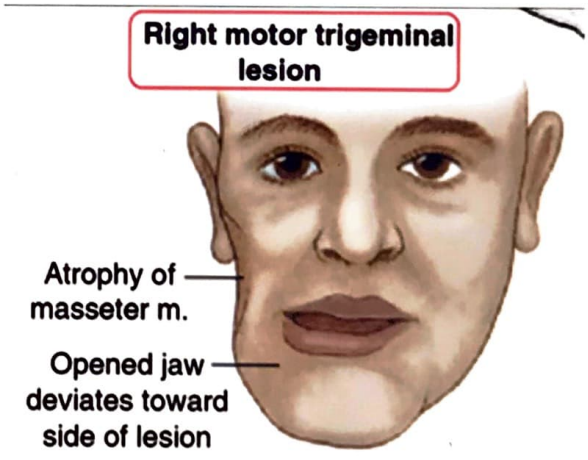
00:25:05

Movements of Mandible	Muscle (S)
Elevation (Close mouth)	Temporalis, masseter, and medial pterygoid
Depression (open mouth)	Lateral pterygoid, suprahyoid and infrahyoid muscles
Protrusion (protrude chin)	Lateral pterygoid, masseter and medial pterygoid
Retrusion (retrude chin)	Temporalis and masseter
Lateral movement (grinding and chewing)	Pterygoids of opposite side

LATERAL PTERYGOID ACTIONS

00:28:15

A → Anterior
I → Inferior
M → Medial



52 CRANIAL CAVITY III MIDDLE CRANIAL FOSSA

Previous Year's Questions

Q. All structures pass through foramen ovale EXCEPT
A. Accessary meningeal artery
B. Middle meningeal artery
C. Lesser petrosal nerve
D. Emissary vein

STRUCTURES PASSING THROUGH

1. Foramen Ovale 00:00:15

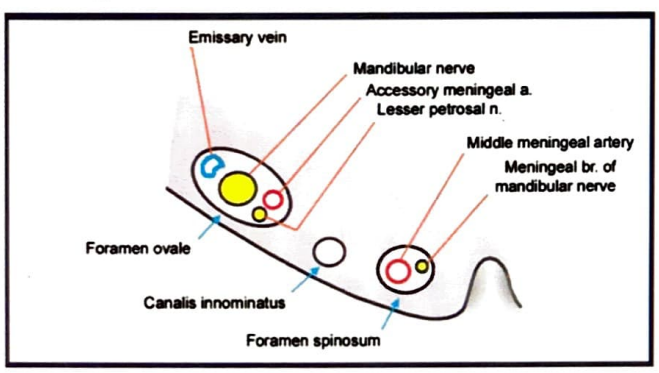
- M - Mandibular nerve
- A - Accessory meningeal artery
- L - Lesser petrosal nerve
- E - Emissary vein

How to remember

- MALE

2. Foramen Spinosum 00:04:52

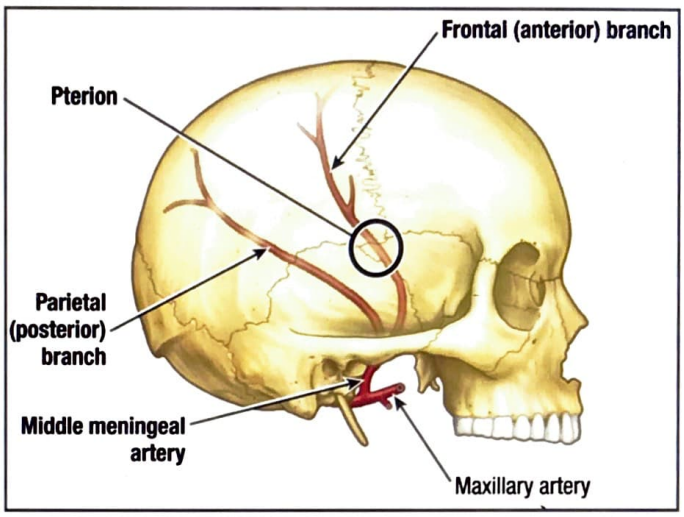
- Middle meningeal artery
- Nervous spinosus (br. of mandibular nerve) supplies meninges on floor of MCF



MIDDLE MENINGEAL ARTERY

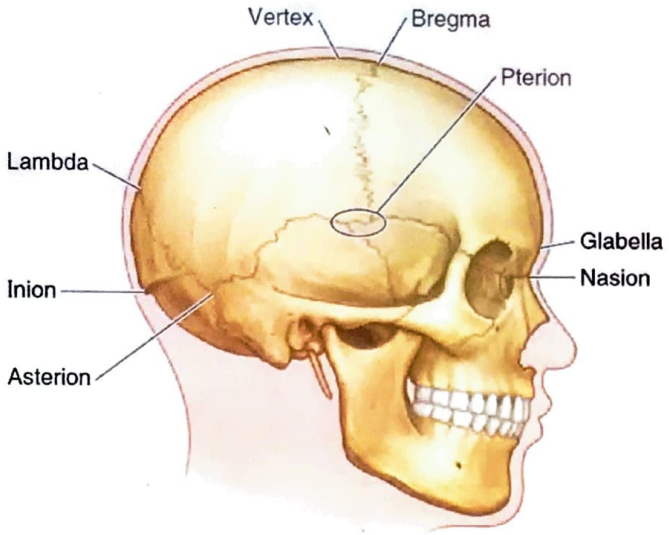
- Bleeds deep to pterion during injury
- Causes Epidural/ extra dural haemorrhage Emergency

- **Lucid Interval**
  - Short period of consciousness b/w 2 periods of unconsciousness
  - Patient appears normal
  - Come from 1st part of maxillary artery Pass through spinosum



PTERION

- H shaped suture
- Contributing bones
  - Frontal Bone (front)
  - Parietal Bone (posterior)
  - Temporal Bone (inferior)
  - Greater wing of sphenoid
- Sphenoidal / antero lateral fontanelle is present earlier
  - Mastoid fontanella: Present at ASTERION earlier
  - Posterior fontanella: Present at lambda earlier
  - Anterior fontanella: Present at bregma earlier
- Deep to pterion, anterior branch of middle meningeal artery present injury causes bleeding
- Lateral sulcus / sylvian sulcus of cerebrum begins at pterion

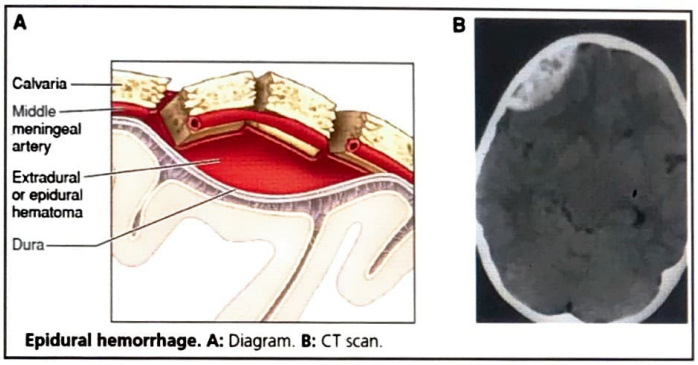


Lateral view

EXTRA DURAL/EPIDURAL HEMORRHAGE

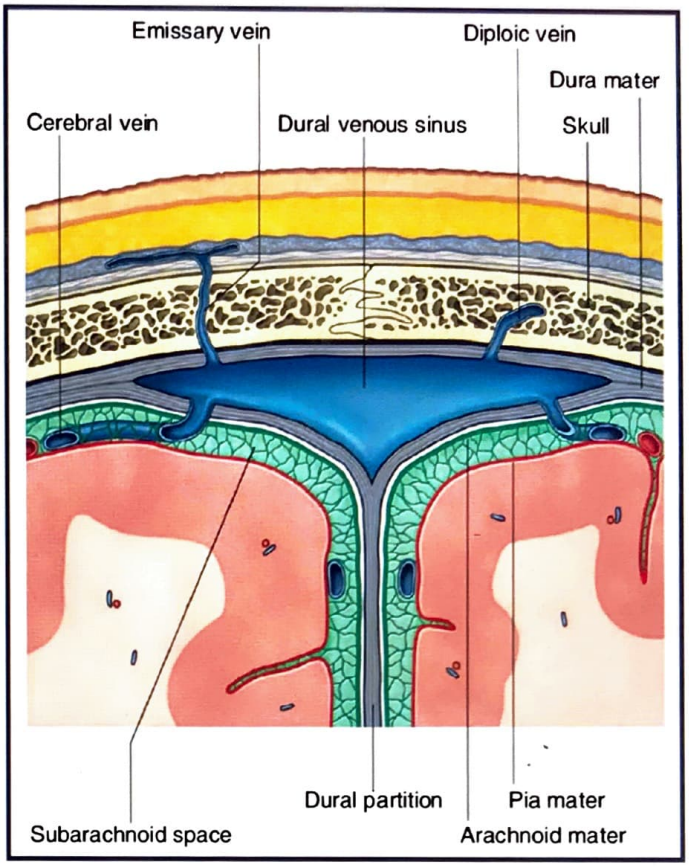
00:07:18

- Due to bleeding of middle meningeal arteries
- CT scan shows Biconvex Shadow
- Lucid interval is present



Epidural hemorrhage. A: Diagram. **B:** CT scan.

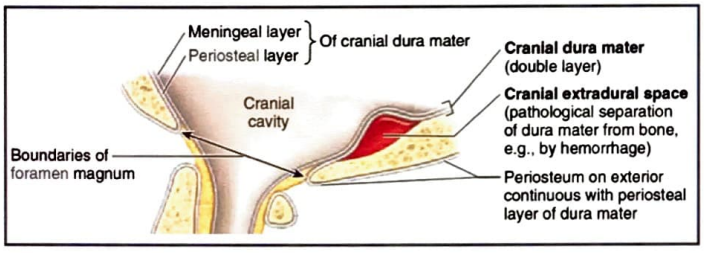
Haemorrhage	Location
Extra Dural Hemorrhage	Outside dura matter
Extra Dural Hemorrhage	Under dura matter due to rupture of bridging veins
Sub Arachnoid Hemorrhage	Under arachnoid due to berry aneurysm Blood stained with CSF

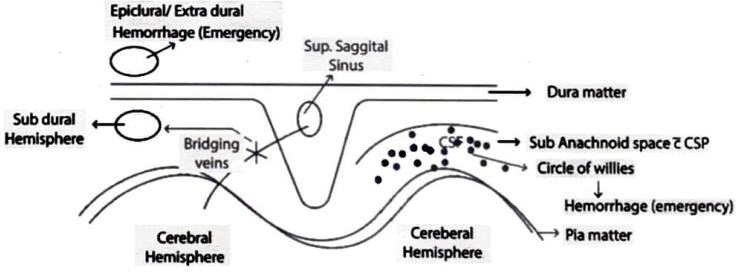


Duramater

Double layered split to enclose dural venous Sinuses

- Meningeal layer
- Endosteal layer





CAVERNOUS SINUS THROMBOSIS

00:18:45

Previous Year's Questions

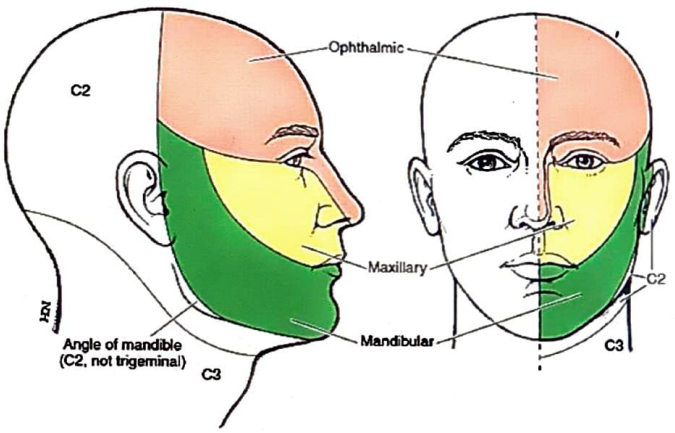
Q. All are features of cavernous sinus thrombosis EXCEPT
A. Papilloedema
B. Proptosis
C. Sensory deficits on face due to involvement of 3 branches of trigeminal nerve
D. External ophthalmoplegia d/t compression of 3 motor nerve to eye ball muscles

Previous Year's Questions

Q. Dermatone at angle of jaw is
A. V3
B. C-1,2
C. C-2,3 → Greater Auricle Nerve
D. C-3,4

Clinical features

- Pain on fore head & tip of nose → ophthalmic branch of CN 5 involved
- Pain on skin of cheek → maxillary branch of CN 5 involved
- No pain on skin of cheek in some → maxillary branch is outside CS in some
- Mandibular Branch of CN V not a content of cavernous sinus Jaw jerk → Masseter reflex is intact
- Greater Auricular Nerve
  - Supplies greater part of auricle laterally & medially (incl. lobule)
- Lesser Auricular Nerve
  - Medial surface of upper auricle



- Skin of Angle Of Mandible supplied by greater auricular nerve
- Dermatome of angle of mandible + C2
- No C_1 dermatone in body → C_1 spinal cord do not supply skin

53 CAVERNOUS SINUS

Previous Year's Questions

Which of the following is a direct content of cavernous sinus?

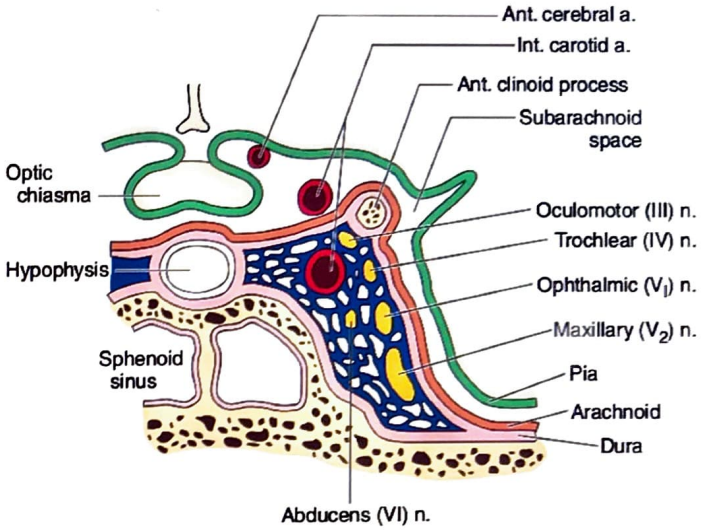
A. Occulomotor nerve
B. Trochlear branch of Trigeminal
C. Maxillary branch of Trigeminal
D. Abducent nerve.

CONTENTS

00:00:15

→ Intra dural sinus [b/w endosteal & meningeal layer of dura mater

→ Abducens nerve has longest intradural course & inferio lateral to ICA



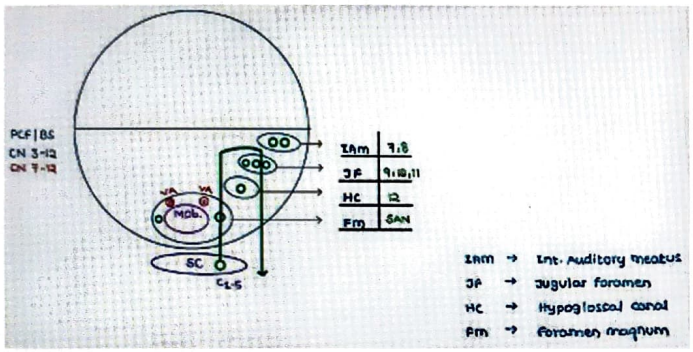
54 CRANIAL CAVITY IV POSTERIOR CRANIAL FOSSA

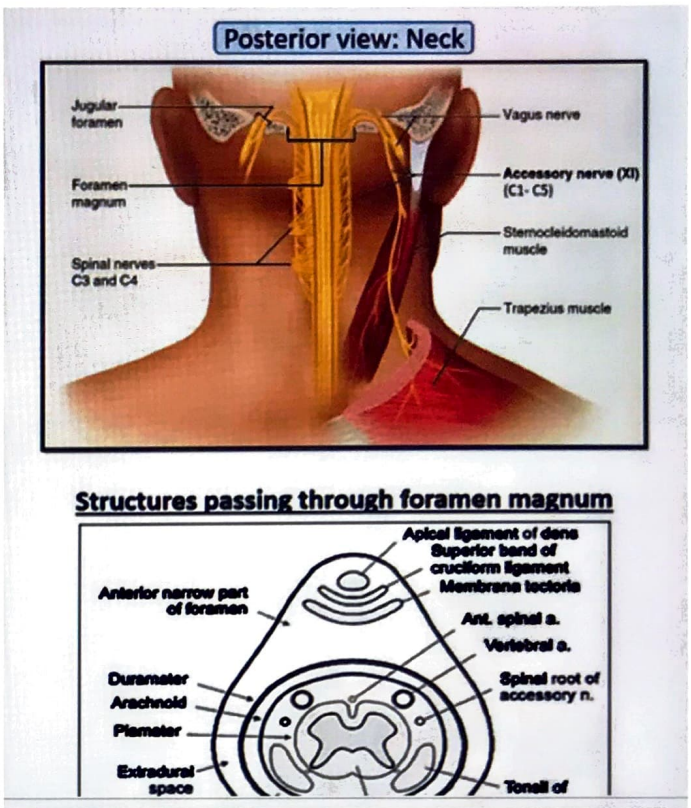
Previous Year's Questions

Q. Mass in Jugular foramen may result in all except

00:00:39

A. Difficulty in swallowing
B. Hoarseness
C. Difficulty in turning the neck to opposite side
D. Tongue deviates to same side: CN 12 not present in jugular foramen





SPINAL ACCESSORY NERVE

00:08:58

- Comes from C1-5 of spinal cord
- Entry point into cranial cavity: Foramen magnum
- Exit point out of cranial cavity: Jugular foramen
- Supplies sternocleidomastoid and trapezius

IN JUGULAR FORAMEN MASS/ TUMOR

00:09:41

1. Spinal Accessory Nerve Compromised
2. Nucleus Ambiguus Compromised
- Cn9, CN 10, CN 11 (cranial part) compromised
- Difficult in speech swallowing

FORAMEN MAGNUM CONTENTS

00:09:56

1. Medulla oblongata } present under Arachnoid
2. SAN on each side } meatussurrounded by CSF
3. Vertebral arteries on each side
4. Tectorial membrane: Upward continuation of posterior longitudinal ligament enters foramen magnum attaches to occipital Bone
5. Superior band of cruciform ligament
6. Apical ligament of Dens (Cranial vertebrae 2)

55 FACIAL NERVE

Previous Year's Questions

Q. A patient with crocodile tear syndrome has spontaneous lacrimation during eating due to misdirection of regenerating autonomic nerve fibres. Which of the following nerves has been injured? Aug 2020 fmge

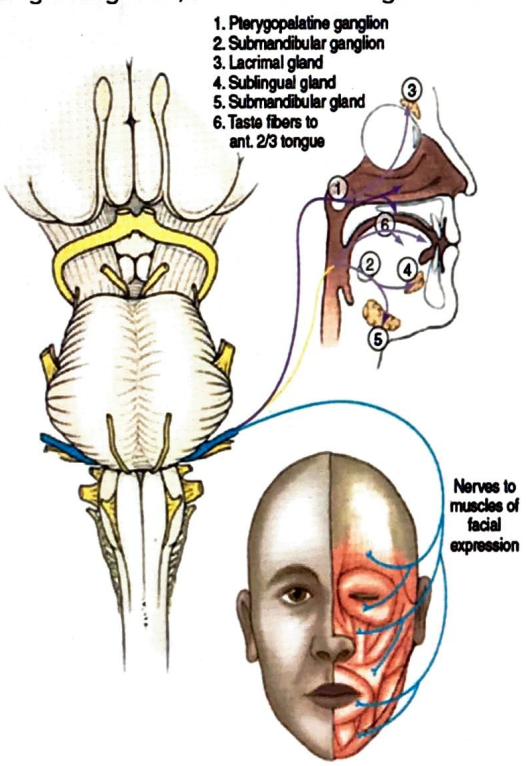
A. Facial nerve proximal to geniculate ganglion
B. Chorda tympani in the infratemporal fossa
C. Facial nerve at the stylomastoid foramen
D. Lacrimal nerve

CROCODILE TEAR SYNDROME

00:00:22

- Vital exposure / Bell's palsy
- Lacrimatory nucleus (part of superior salivatory nucleus) control lacrimal gland
- Facial nerve (salivary) fibres regenerating
  - Only 8 reaches salivary gland
  - Other 2 misdirected lacrimal gland
- Injury occurs proximal to geniculate ganglion

During taking food, tears comes along with saliva

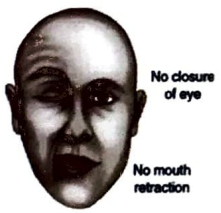


Facial nerve comes from Ponto medullary junction
Nuclei present in the pons

BELL'S PALSY

00:05:20

- Failure to close lt. eye
- Can't smile, collection of food
- Dribbling of saliva



FN supplies

1. Sub mandibular Ganglion
2. Pterygopalatine Ganglion
3. Lacrimal Gland
4. Sub lingual gland
5. Sub mandibular gland
6. Carry taste from anterior 2/3rd of tongue
7. Supply muscles of Facial expression

00:07:55

- Orbicularis oculi
- Orbicularis ori
- Zygomaticus major (smile muscle)
- Buccinator (Whistle muscle)

Facial Nerve Branches

Anterior. 2/3rd of tongue carried by chorda tympani nerve towards facial nerve towards tip of nucleus tractus solitarius

Geniculate ganglion

- Present in middle ear cavity
- Have taste sensory neurons
- Present in taste pathway

Superior salivatory nucleus controls

- Lacrimal gland
- Nasal gland } controlled by pterygopalatine ganglion
- Palatine gland
- Sublingual gland
- Sub mandibular gland

Sub mandibular ganglion

Greater petrosal nerve controls pterygopalatine ganglion
Chorda tympani nerve control sublingual & sub mandibular glands

Functional nerves → greater petrosal nerve chorda tympani nerve
Topographical nerves → Trigeminal nerve

Lingual nerve of mandibular nerve joins with chorda tympani nerve in infra temporal fossa

- Deep petrosal nerve of T_1 sympathetic plexus joins with greater petrosal nerve (para sympathetic nerve) & forms VIDIAN NERVE OF PTERYGOID CANAL to Pterygopalatine ganglion
- Vasomotor rhinitis with intractable rhinorrhea Rx by VIDIANECTOMY
- Facial nerve exits cranial cavity passing stylomastoid foramen & passes through parotid gland (do not supply) & supplies muscles of facial expression

MIDDLE EAR CAVITY

00:08:51

GENU OF FACIAL NERVE

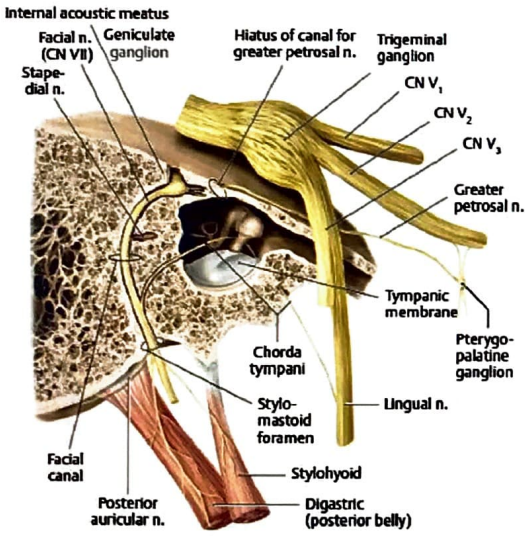
- Contains geniculate ganglion
- Gives greater petrosal nerve which is topographically related with maxillary nerve

FACIAL NERVE CANAL

- Present in posterior wall
- Contains facial nerve

Gives 3 branches

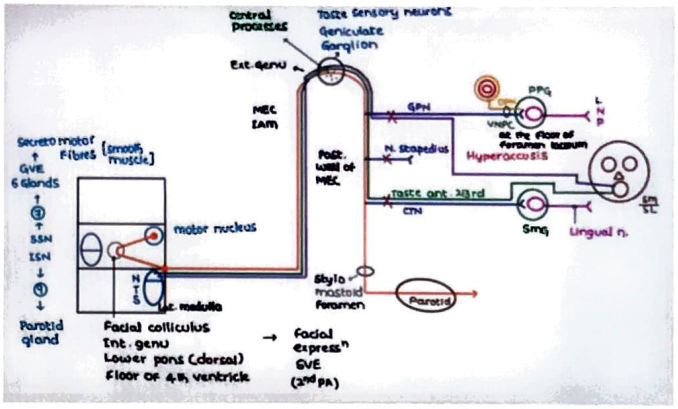
1. Greater petrosal nerve
2. Nerve to stapedius
3. Chorda tympani nerve (present on TM & related to malleus Bone) joins with lingual nerve in infra temporal fossa



Facial nerve exits cranial cavity by passing through stylomastoid foramen

MIDDLE EAR CAVITY (Boundaries)

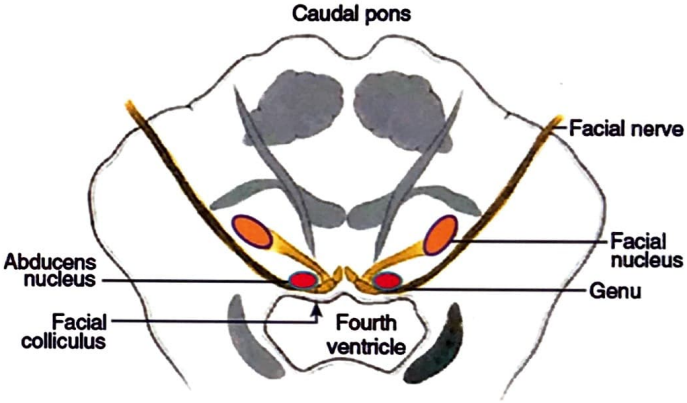
ROOF	→	Tegmen tympani
Posterior wall	→	Facial N
Lateral wall	→	Tympani membrane with chorda tympani
Anterior wall	→	Eustachian tube (body part)



LOWER PONS

00:22:43

- FACIAL COLLICULUS
- Rounded elevation due to internal genu of facial nerve (axons) from facial nucleus at the floor of IV ventricle
- Abducens nucleus present deep to facial colliculus
- If facial colliculus damaged, muscles paralyzed are
- Risoreus > Lateral rectus



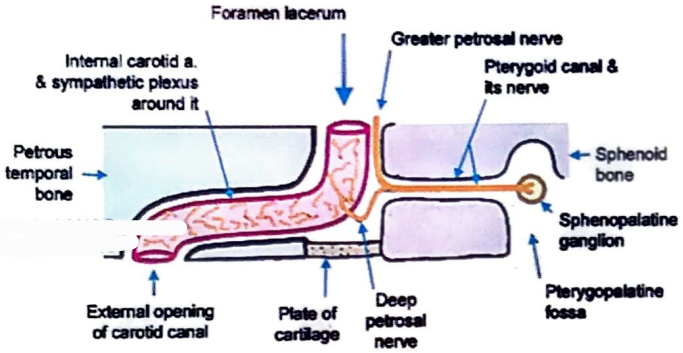
Previous Year's Questions

Q. All is true about facial colliculus except?
A. Raised by axons of facial nerve internal genu
B. Abducent nucleus lies deep to it
C. Located at the floor of fourth ventricle
D. Present on the dorsal aspect of Lower pons

FORAMEN LACERUM

- Closed by plate of fibro cartilage
- ICA enter at carotid canal at the base of the skull & passing at floor of foramen lacerum
- Vidian nerve of pterygoid canal formed at floor of FL &

goes towards sphenopalatine ganglion



5 STRUCTURES AT THE FLOOR OF FORAMEN LACERUM

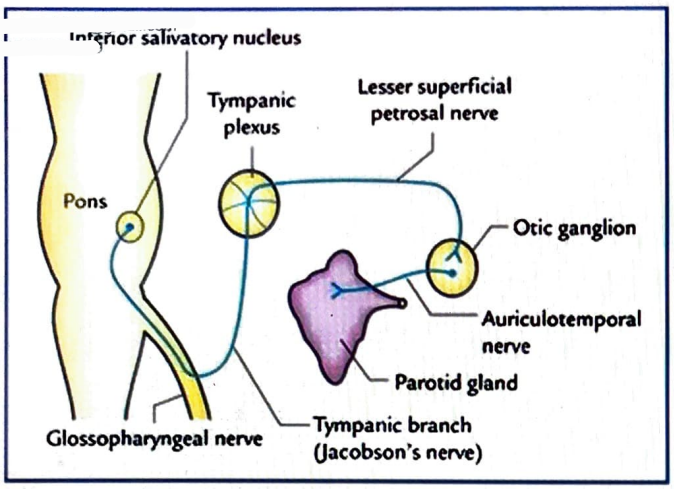
1. Vidian nerve
2. ICA
3. T1 sympathetic plexus
4. Deep petrosal nerve
5. Greater petrosal nerve

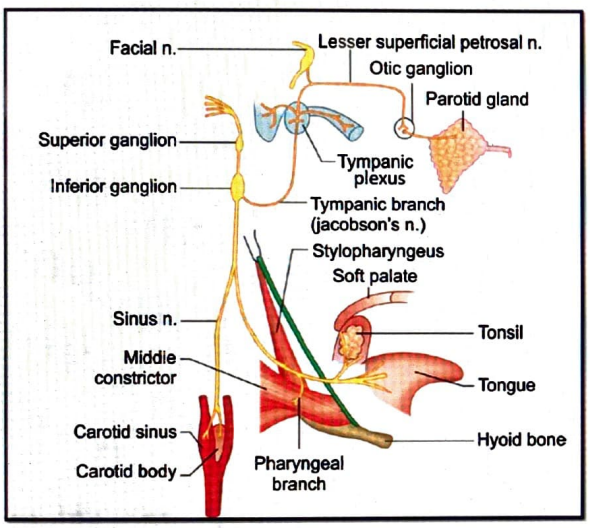
Previous Year's Questions

Q. Facial nerve has all the following neural columns except?

A. GVE
B. SVE
C. SVA
D. SSA

56 GLOSSOPHARYNGEAL NERVE





- CN 9 comes from medulla oblongata behind the olive

00:01:14

Supplies

1. Carotid body & sinus
2. Posterior 1/3rd of tongue
3. Tonsil
4. Stylopharyngeus

} REFERRED OTALGIA occurs in these pathology

00:03:42

Parotid Pathway

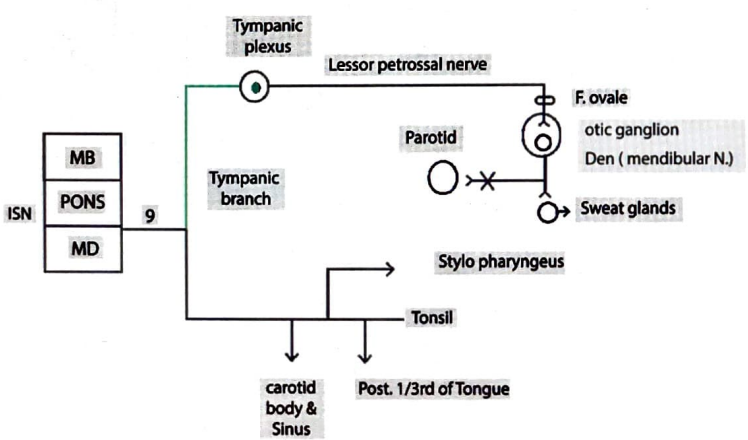
Cn9 → Tympanic branch → Tympanic plexus → Lesser petrosal nerve —*vis Foramen ovale*→ OTIC GANGLIA → Auriculotemporal n. (53) → Parotid gland

Frey's Syndrome/ Auriculo Temporal Nerve Syndrome

- Due to injury to Auriculo temporal nerve during parotidectomy
- Gustatory sweating occurs while taking food

NEURAL PATHWAY

00:00:18



57 VAGUS NERVE

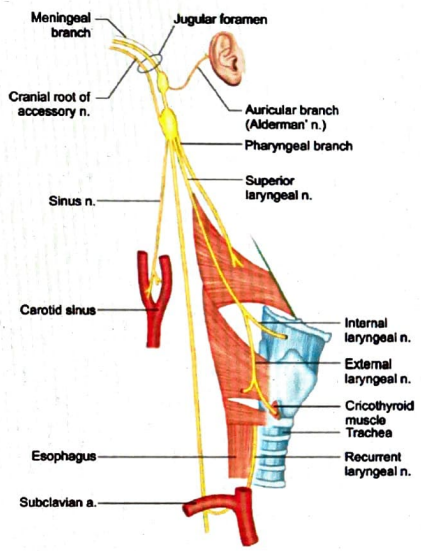
- Longest
- Widest distribution in the body

00:00:16

SUPPLIES

00:00:55

1. Head & Neck region
2. Thorax
3. Larynx (sensory & motor supply)
4. VAC (VAGUS ACCESSORY COMPLEX)
   - Vagus nerve + cranial accessory nerve
     - Controls muscles of
       Palate
       Pharynx
       Larynx
5. Abdomen till midgut
6. Pelvis till upper ureter



VAGUS NERVE

↓

Meningeal branch

→ Supplies dura mater in PCF

↓

Jugular foramen

Followed by cranial accessory nerve

VAGUS ACCESSORY COMPLEX

↓

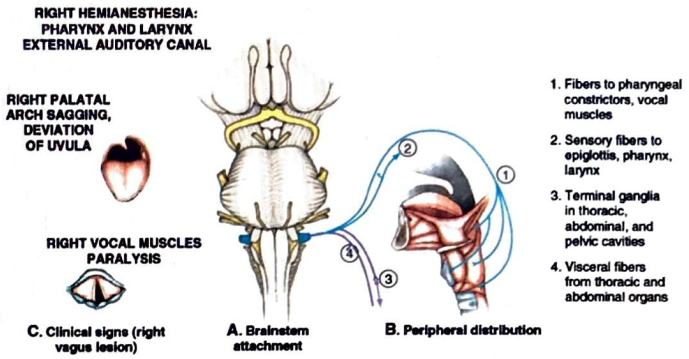
Auricular branch [ALDERMAN'S NERVE] →

Supplies Ext. ear near Ext. auditory meatus

↓

Pharyngeal branch

- Supplies muscles of palate, pharynx, larynx (SLN, RLN)
- Supplies carotid sinus
- Supplies superior, middle, inferior constrictors of oesophagus (helps in deglutition)



Vagus & glossopharyngeal nerves from M. Oblongata [posterior lateral to olive]

- Supplies constrictors, laryngeal muscles
- Sensory to Tongue, epiglottis, larynx, pharynx
  Thorax → bradycardia, bronchoconstriction
  Abdomen → till midgut, till upper ureter
  Pelvic → Gonads

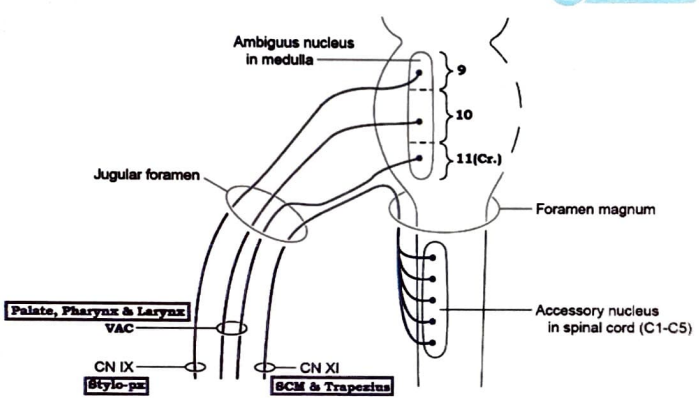
RIGHT SIDED LESION

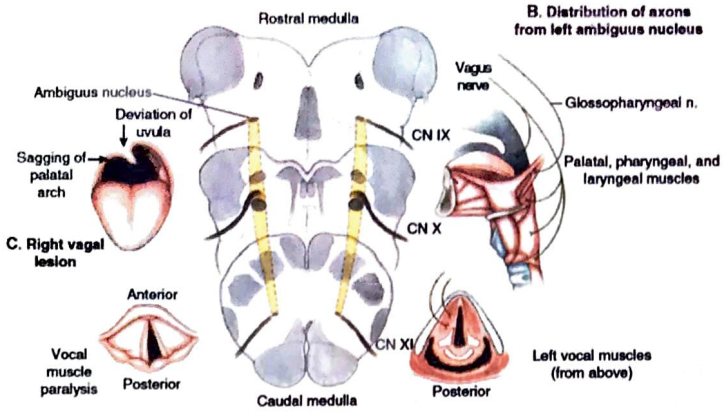
00:04:38

- Right hemianesthesia (pharynx, larynx, tongue, external auditory canal)
- Right palatal arch sagging
- C/L deviation of uvula
- Right vocal muscle paralysis
  - Abduction possible on normal side
  - Abduction not possible on affected side

VAGUS ACCESSORY COMPLEX

00:06:59





- Vagus nerve carries (vehicle) axons of cranial accessory nerve but do not supply muscles of palate, pharynx, larynx
- Cranial accessory nerve supplies muscles of palate, pharynx, larynx EXCEPT
  1. Stylopharyngeus supplied by CN IX
  2. Tensor palati supplied by CN V_3

All the muscles of tongue are supplied by hypoglossal nerve (12) EXCEPT palatoglossus (supplied by cranial accessory nerve)

Rt. NUCLEUS AMBIGUUS LESION/ WALLENBERG SYNDROME

- CN 9,10,11 compromised
- Difficulty in speech & swallowing
- C/L deviation of uvula
- Right vocal muscle paralysis
  - Abduction possible on normal side
  - Abduction not possible on affected side (cadaver position in midline)

Refer Table 1

00:17:10

NUCLEUS AMBIGUUS

9, 10, 11 (cranial part) } Controls muscle of speech & swallowing

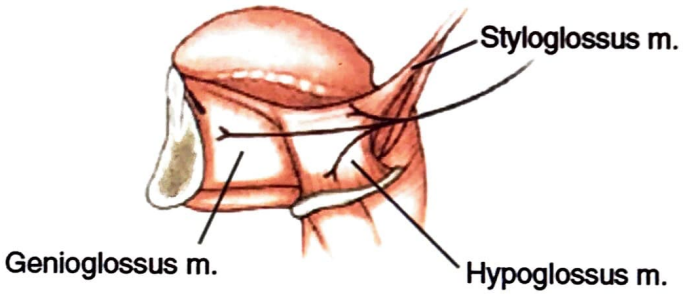
Table 57.1

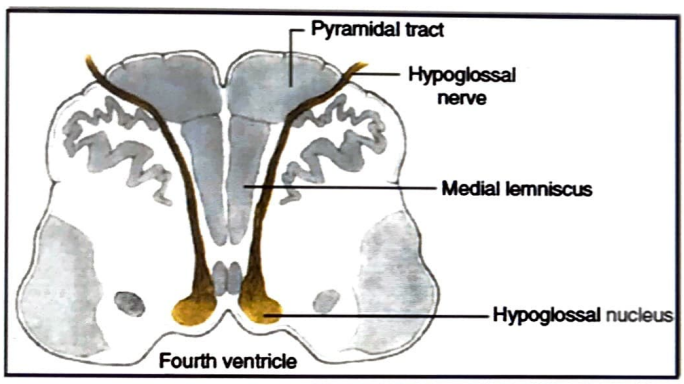
ARCH	NERVES	CONTROLS
III	CN 9	Stylopharyngeus
IV	Superior laryngeal nerve	• Muscle of palate except tensor palati • Muscle of pharynx except stylopharyngeus • CriMuscles ocothyroid (muscle of larynx, Tensor of vocal cord)
VI	Recurrent laryngeal nerve	f larynx except cricothyroid

58 HYPOGLOSSAL NERVE

Q Not seen in hypoglossal injury

a. Atrophy of same side
b. Ipsilateral deviation of tongue
c. Loss of tactile sensation of anterior part of tongue
d. Larynx deviation towards the opposite side during swallowing





HYPOGLOSSAL NERVE [CN 12]

00:00:15

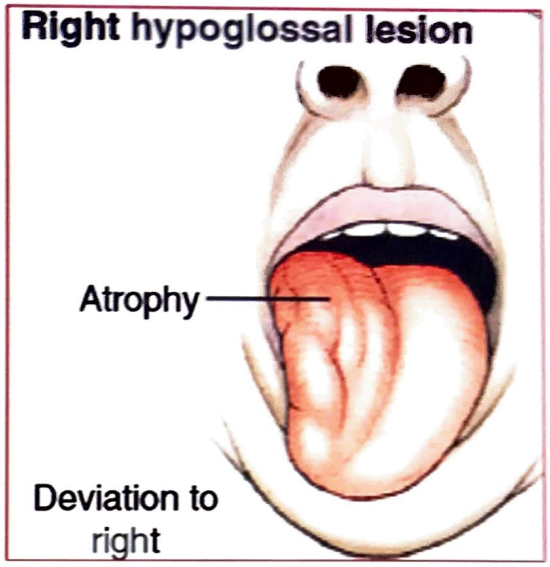
- Pure motor nerve
- CN 12 nucleus present at the floor of 4th ventricle in upper medulla near the midline
- Gives CN 12 → exits b/w
  pyramid (anteriorly),
  olive (posteriorly)

supplies tongue muscles except palatoglossus (supplied by VAC)

Rt. SIDED HYPOGLOSSAL NERVE INJURY

00:00:40

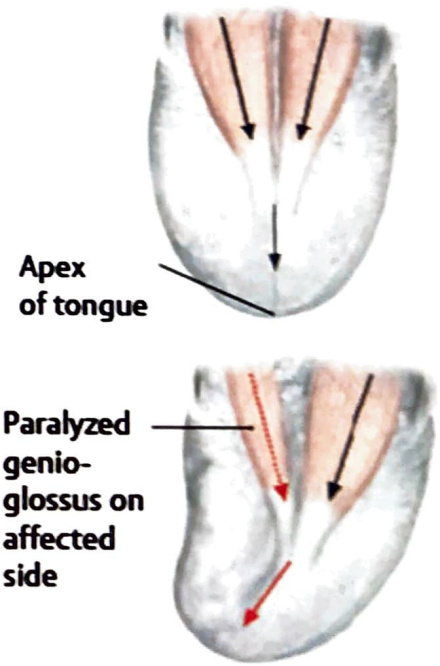
- Tongue deviates to Rt. side (I/L side)
- Pharynx deviates to Lt. side (C/L side)



GENIOGLOSSAL MUSCLE

00:04:11

- Genioglossal muscle 'AIM' the tongue
  A → Anterior Protrusion of tongue
  I → Inferior Depression of tongue
  M → Medial



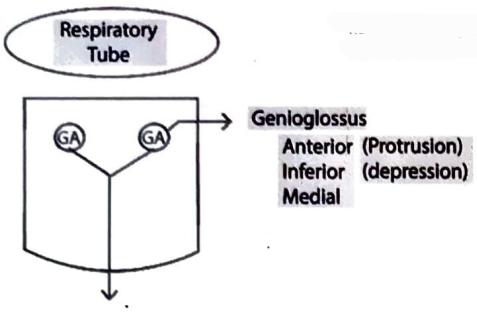
In Rt. sided lesion

- Balance lost, Lt. genioglossus is more powerful
- Tongue deviates to rt. side (same side of lesion)

Skeletal muscle

SAFETY MUSCLE OF TONGUE

- Prevents back falling of tongue into the resp. tube



IN POST EPILEPSY UNCONSCIOUSNESS

1. Turn the patient to one side
2. Pull the tongue outside

- Because drive to genioglossal muscle is lost (Deep unconsciousness)
- During sleep drive is maintained (no deep unconsciousness)

IN SLEEP APNEA SYNDROME

Culprit muscle → genioglossus

Drives reduced → Tongue fall backwards → wakes up

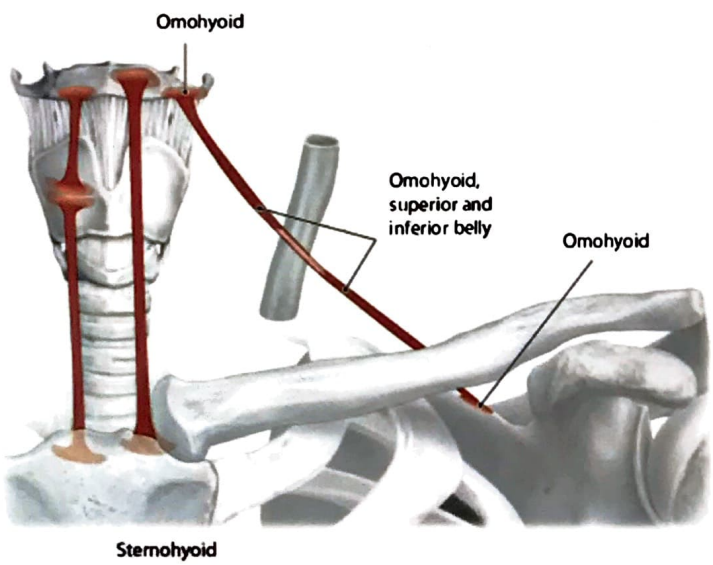
Rx → prosthetic Sx to be done to enlarge respiratory tube

→pacemaker for genioglossal muscle [future option]

ANSA CERVICALIS

00:13:15

- Nerve loop in ant. neck supplies ant. neck muscles



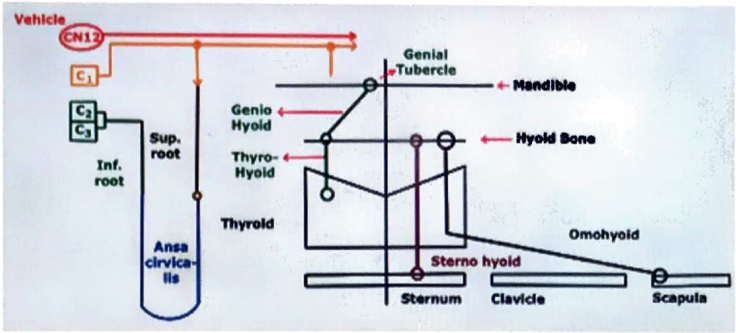
ANTERIOR NECK MUSCLES

Supplied by ANSA CERVICALIS

1. Inferior & superior belly of OMOHYOID
2. STERNOHYOID

Supplied by CN 12 carrying C1 fibres

3. THYROHYOID
4. GENIOHYOID



- Superior root of AC contributed by C1
- Inferior root of AC contributed by C2 & C3
- CN 12 acts as vehicle to carry C1 fibres
- C1 fibres supplies geniohyoid & thyroid & contributes to superior root of an cervicalis
- Ant. neck muscles stabilize larynx by attaching to larynx cartilages

In 12th nerve right side injury (C1 fibres)

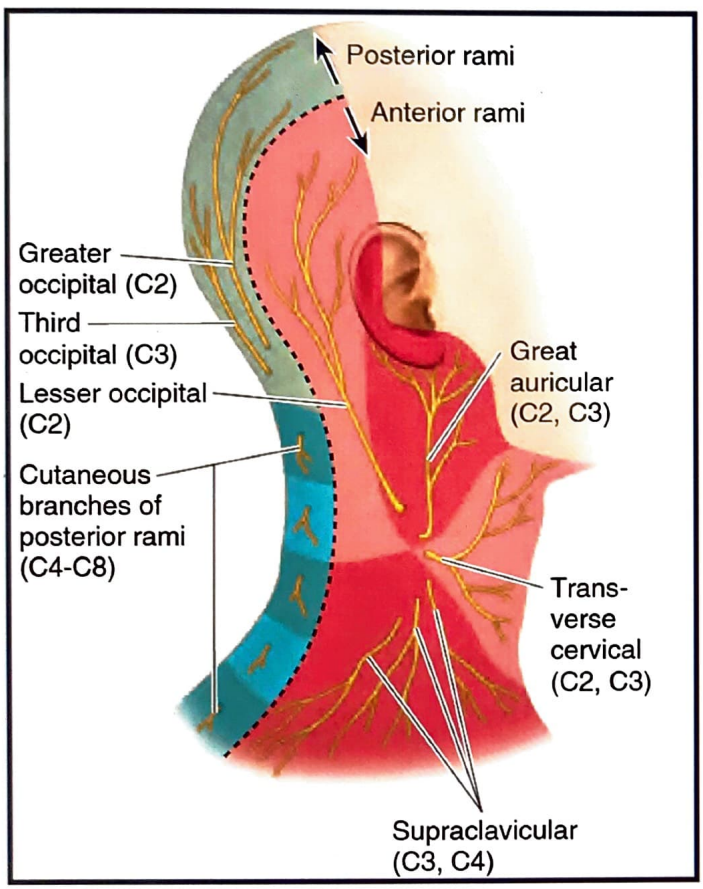
- Tongue muscles are deviated to same side
- Larynx destabilized → larynx deviated to Lt. side while swallowing due to ant. neck muscles of same side are paralysed

59 CERVICAL PLEXUS

CERVICAL PLEXUS BRANCHES

00:00:18

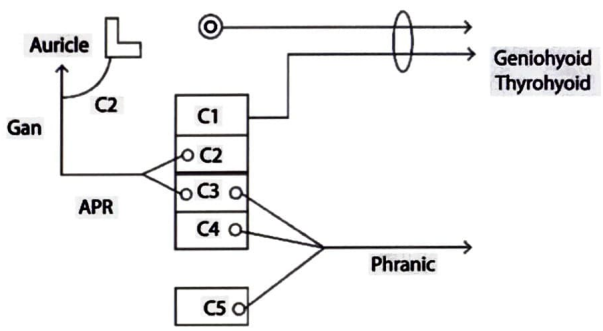
- At posterior border of sternocleidomastoid midpoint cervical plexus gives branches
  1. GREATER AURICULAR NERVE
     → Supplies greater part of auricle
     → Skin on the angle of mandible
  2. LESSER AURICULAR NERVE
     → Behind the auricle
  3. TRANSVERSE CERVICAL NERVE
     → Supplies neck region transversely
  4. SUPRA CLAVICULAR NERVE
     → Goes to supra clavicular region

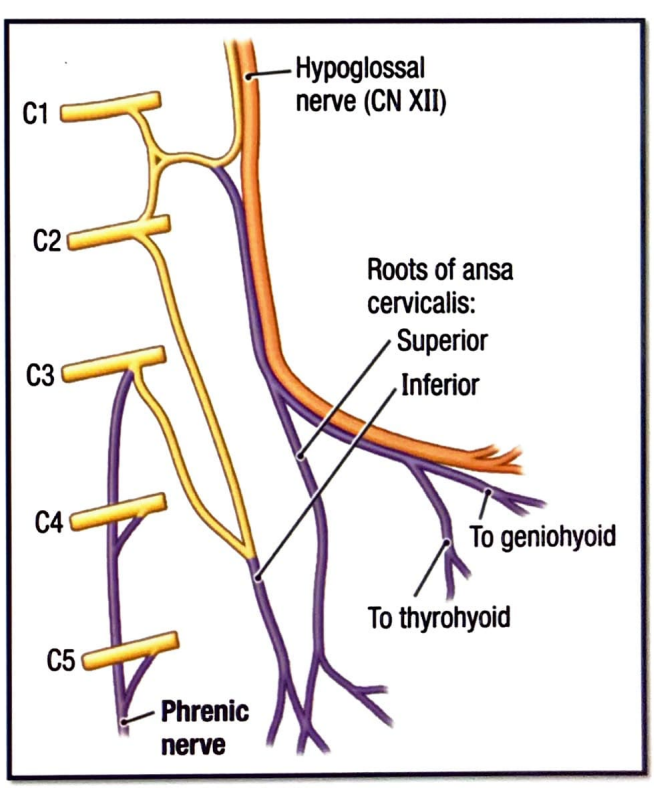


ALL BRANCHES COMING FROM ANTERIOR PRIMARY RAMUS

00:02:57

- C1 FIBRES → Carried by CN 12 & supplies thyrohyoid & geniohyoid
  → Contributes to superior root of ansa cervicalis
- C2, C3 FIBRES → Contributes to inferior root of ansa cervicalis
  Supplies omohyoid, sternohyoid & stabilizes larynx





PHRENIC NERVE

- Comes from cervical plexus (C3,C4) & C5
- Major root value C4
- Sensory motor nerve
  - Motor to → diaphragm
  - Sensory to → central partition of diaphragm

Carry sensations from pleura, pericardium, peritoneum near midline Responsible for referred pain on shoulder (C4 dermatome)

60 SCALENUS ANTERIOR MUSCLE

RELATIONS IN NECK REGION

00:00:30

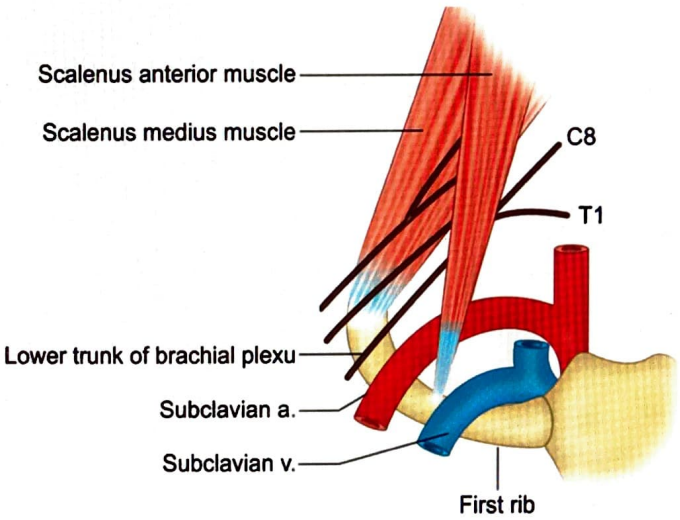
Origin → from cervical vertebra
INSERTION → on the inner border of 1st rib
(Scalenus medius attaches on the superior of 1st rib)

INTER SCALENI TRIANGLE

- Present b/w scalenus anterior & scalenus medius
- Branchial plexus block given here for multiple pain
- Block given lateral to S. anterior muscle

Vessel	Crosses (In Axilla)	To become
SUBCLAVIAN ARTERY	Outer border of 1st rib	AXILLARY ARTERY
AXILLARY VEIN	Outer border of 1st rib	SUBCLAVIAN VEIN

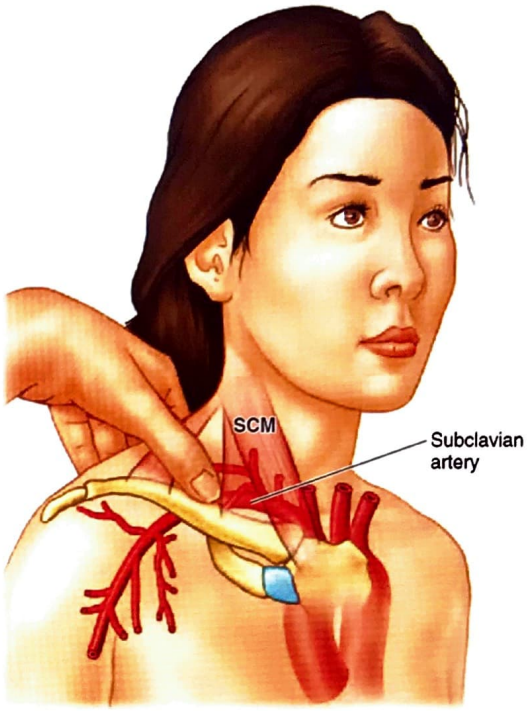
- S. anterior is b/w 2 vessels (vein anterior & artery posterior)
- Subclavian artery & vein running on superior surface of 1st rib in a groove



- Scalenus anterior divides SUBCLAVIAN ARTERY into

1st part → Proximal to muscle
2nd part → Deep to muscle
3rd part → Distal to muscle

3rd part of subclavian artery block can be given by compressing 1st rib



61 HEAD & NECK: ARTERIAL SUPPLY

SUBCLAVIAN ARTERY - BRANCHES

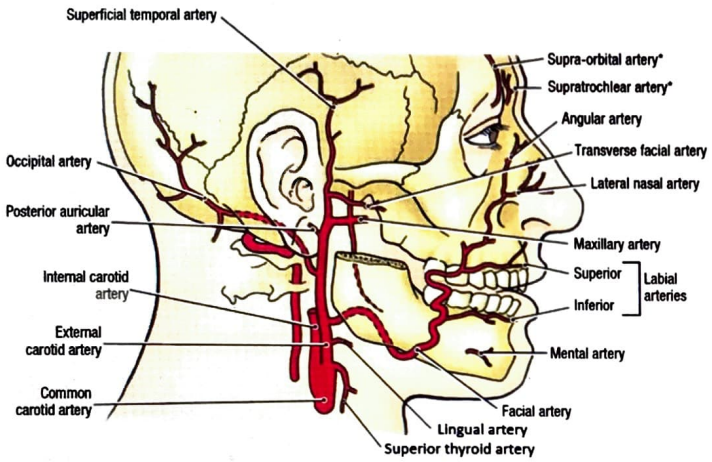
00:00:57

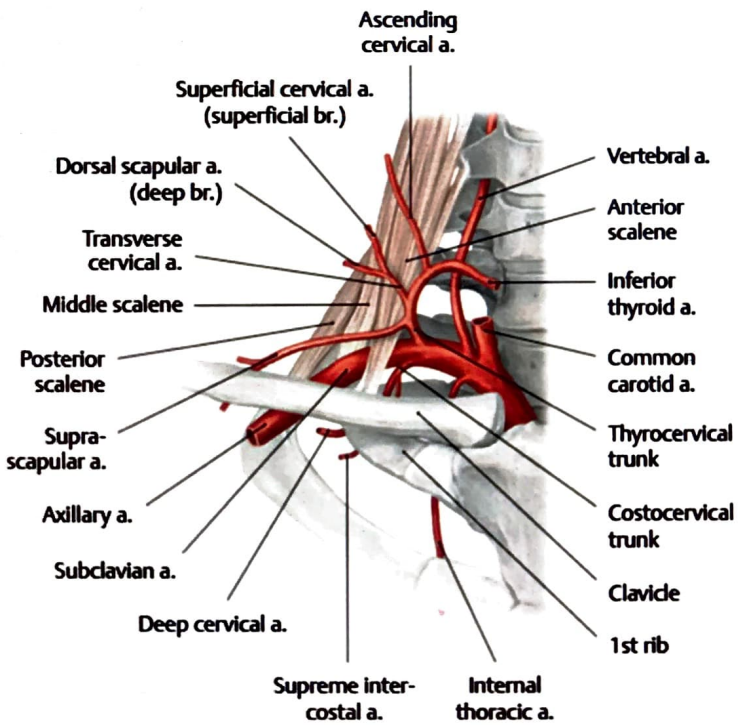
1st PART BRANCHES

V → VERTEBRAL supply circle of Willis

I → INTERNAL THORACIC A supply thorax

T → THYROCERVICAL TRUNK supply thyroid

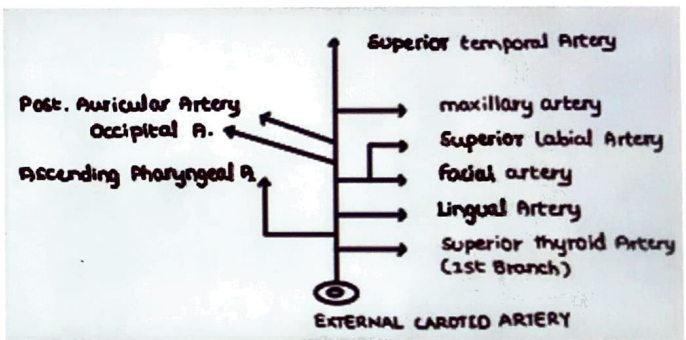




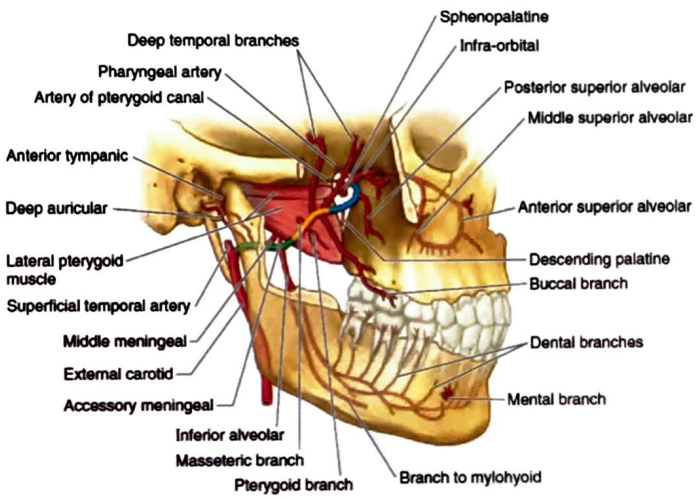
EXTERNAL CAROTID ARTERY BRANCHES

00:03:49

- 8 Branches → 3 anterior, 2 posterior, 2 terminal, 1 medial
  1. Superior thyroid → Supplies thyroid
  2. Lingual artery → Supplies tongue
  3. Facial artery → Supplies face
  4. Post auricular → Supplies auricle
  5. Occipital artery → Supplies occipital
  6. Maxillary artery → Supplies maxilla
  7. Sup. temporal a. → Supplies temporal Bone
  8. ASC. pharyngeal a → Supplies pharynx, ET tonsils
- Superior labial artery → Supplies Kiesselbach area of little's (Br. of facial artery) plexus



MAXILLARY ARTERY (3 parts)

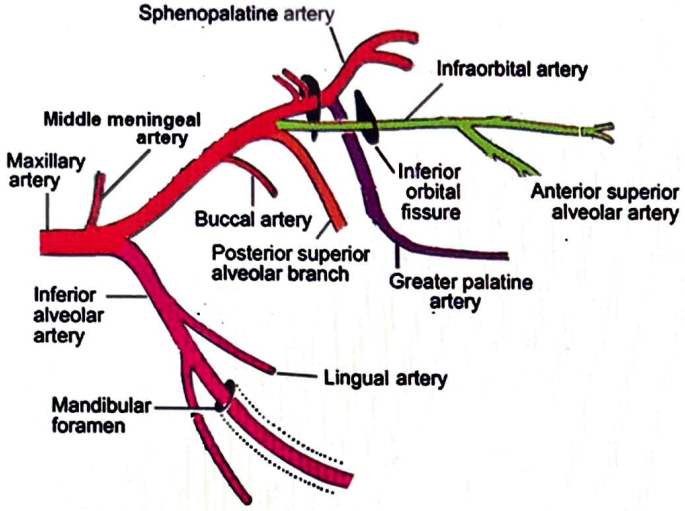


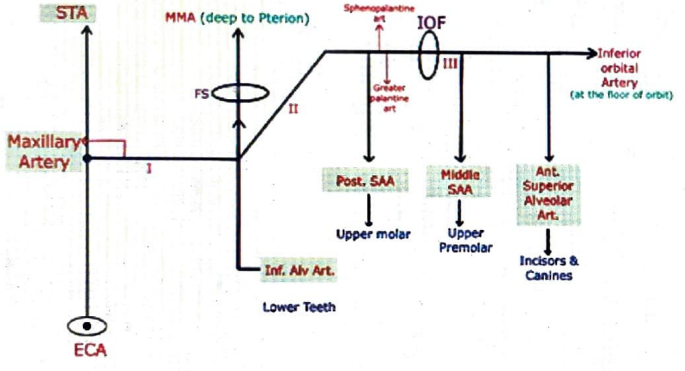
1st PART

1. Inferior alveolar artery → Supplies lower teeth
2. Middle meningeal artery

3rd PART

1. Superior alveolar artery → Supplies upper teeth
2. Spheno palatine artery
3. Descending palatine artery } Supplies little's area
   - Greater palatine artery

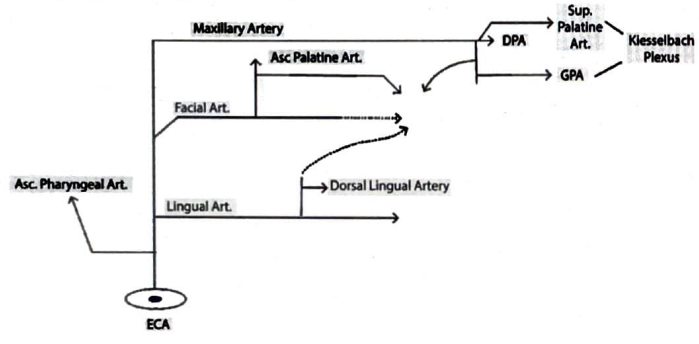


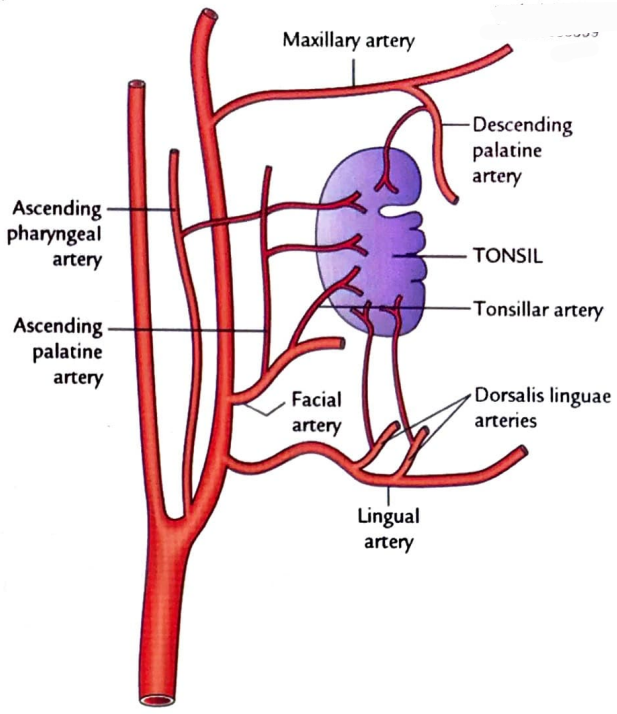


TONSIL ARTERIAL SUPPLY

00:14:10

1. FACIAL ARTERY → Asc. palatine artery also
2. MAXILLARY → Des. palatine artery
3. LINGUAL → Dorsal lingual artery
4. ASC pharyngeal artery





NOSE: KIESSELBACH'S PLEXUS / LITTLE'S AREA OF EPISTAXIS

- Present at antero inferior aspect of nasal septum
- Provided by Br. of ECA & ICA

Previous Year's Questions

Q. Which of the following are not a branch of external carotid artery in Kiesselbach's plexus
a. Sphenopalatine artery
b. Anterior ethmoidal artery → br. Of ophthalmic artery → ICA
c. Greater palatine artery
d. Septal branch of superior labial artery

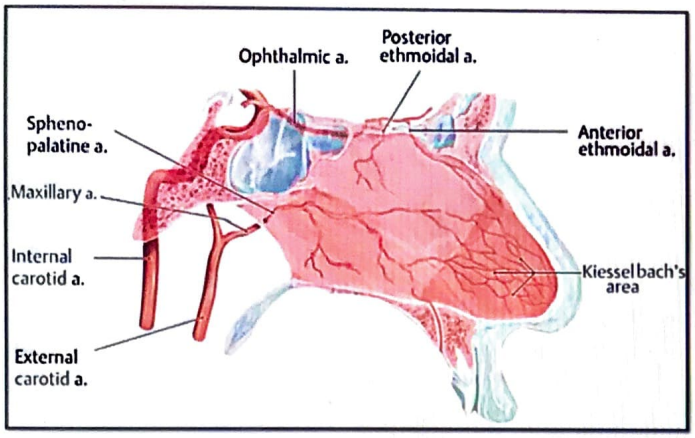
Supply

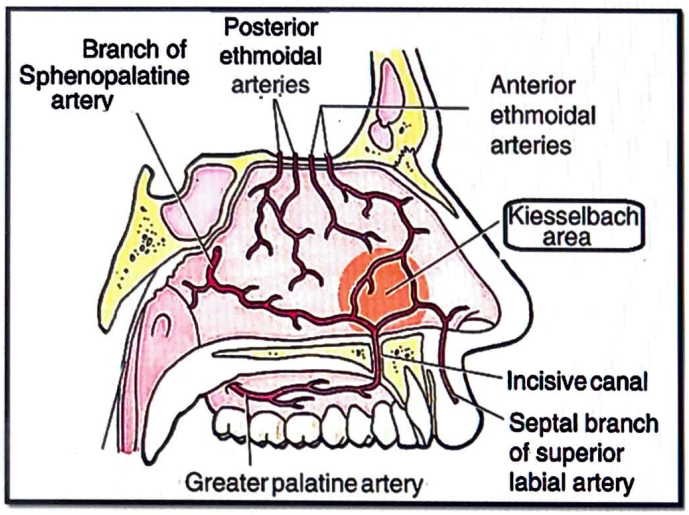
Sphenopalatine artery	→ br. of 3rd part of maxillary artery of ECA
Greater palatine artery	→ br. of Des. Palatine artery of 3rd part of maxillary artery
Superior labial artery	→ br. of facial artery of ECA
Ant. Ethmoidal artery	→ br. of ophthalmic artery of ICA
Post. Ethmoidal artery	→ br. of ophthalmic artery of ICA

Major contribution from ICA is by anterior ethmoidal artery

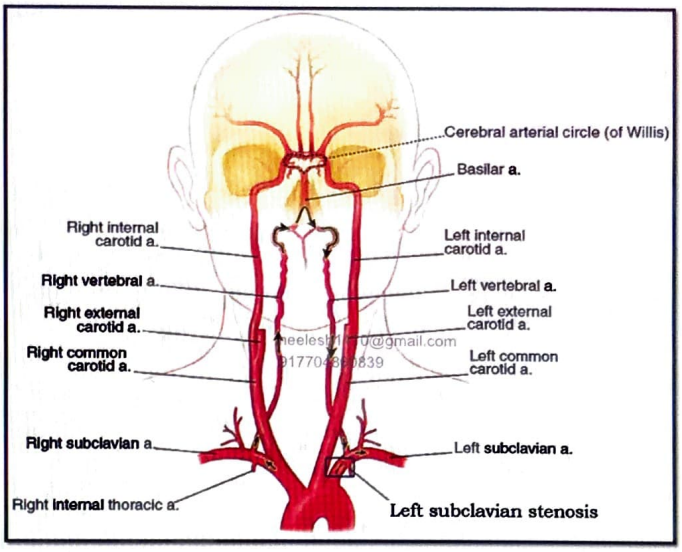
Sphenopalatine artery is mostly resp. for severe epistaxis

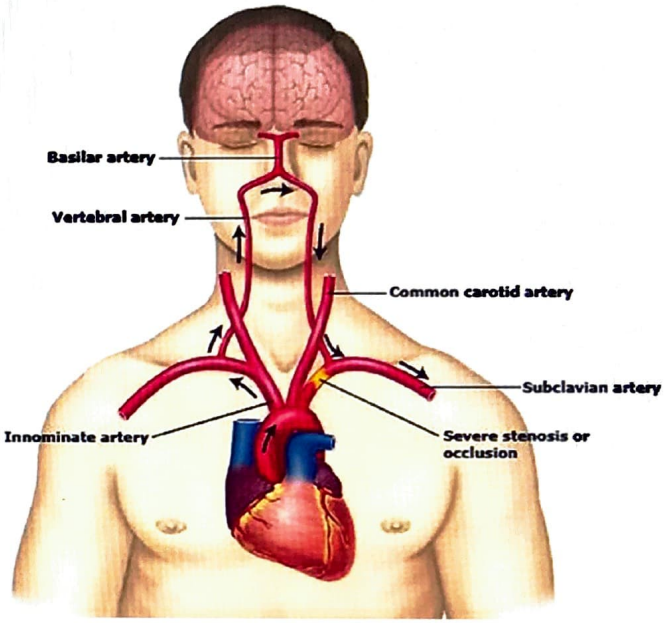
- for embolism, ECA branches to be approached, not ICA branches





- Advised not to do heavy work on affected





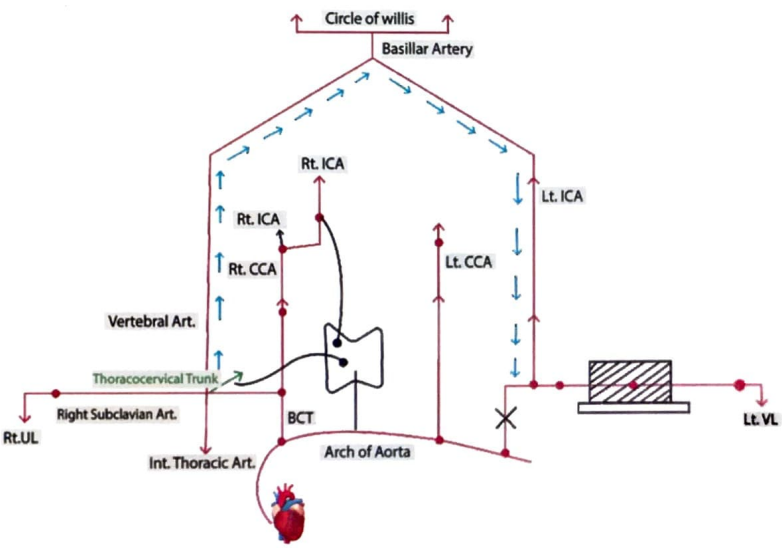
SUBCLAVIAN STEAL SYNDROME

00:24:36

- Subclavian artery steals blood from circle of willis to supply upper limb

LEFT SUBCLAVIAN STENOSIS

- Can lead to left upper limb ischemia
- Prevented by Rt subclavian steal syndrome
- Ipsilateral vertebral artery has reversal blood flow
- Subclavian artery steals blood from circle of willis
- Circle of willis supplied by ICA



Previous Year's Questions

Q. In subclavian steal syndrome there is reversal of blood flow in

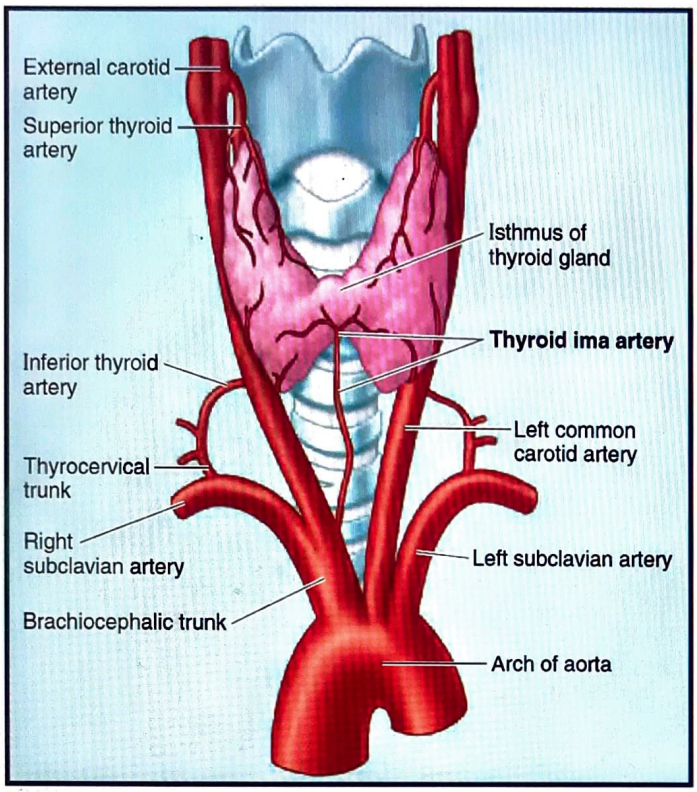
a. Ipsilateral vertebral artery
b. Contralateral vertebral artery
c. I/L subclavian artery
d. C\L subclavian artery

10% have THYROID IMA ARTERY

- Br. of variable origin

1. Arch of aorta
2. Brachiocephalic trunk
3. ECA

- Midline artery
- Prone to injury during isthmectomy



Previous Year's Questions

Q. In emergency tracheostomy the following structures are damaged EXCEPT

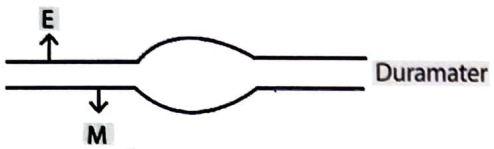
a. Isthmus of thyroid
b. Inferior thyroid artery
c. Thyroid IMA artery
d. Inferior thyroid vein

62 VENOUS DRAINAGE OF CRANIAL CAVITY

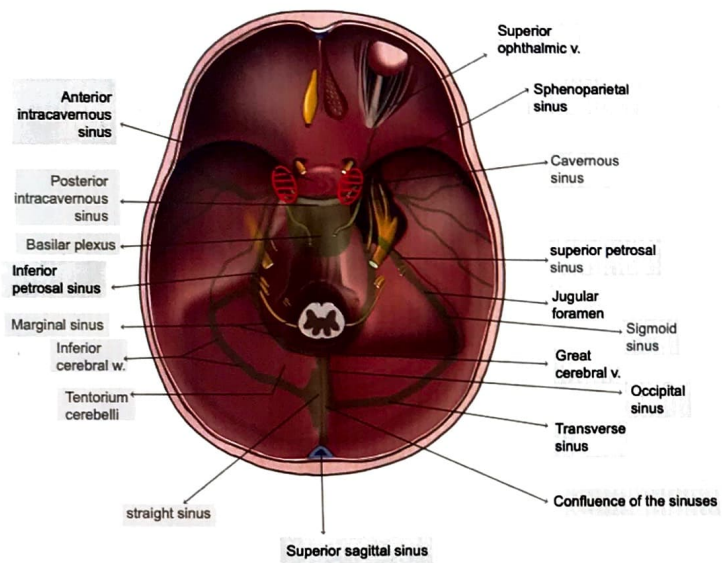
DURAL VENOUS SINUSES

00:00:24

- Intra dural B/w → double fold of dura mater
- Duramater has
  - Meningeal layer
  - Endosteal layer
- Venous blood is present



  - Superior sagittal sinus
  - Inferior sagittal sinus
  - Straight sinus
  - Confluence of sinus
  - Transverse sinus
  - Sigmoid sinus
  - Internal jugular vein



- Superficial middle cerebral vein drains into cavernous sinus
  - cavernous sinus drains into personal sinus
  - Superior petrosal sinus drains into transverse sinus
  - Inferior petrosal sinus drains into Int. jugular vein
- Straight sinus is deep circulation
  - Straight sinus drains into confluence of sinus
  - Confluence of sinuses drains into transverse sinus
  - Transverse sinus drain into sigmoid sinus
  - Sigmoid sinus drains into Internal jugular vein

Previous Year's Questions

Q. Internal cerebral vein [illegible] form
A. Interior cerebral vein
B. Middle cerebral vein
C. Great cerebral vein
D. Anterior cerebral vein

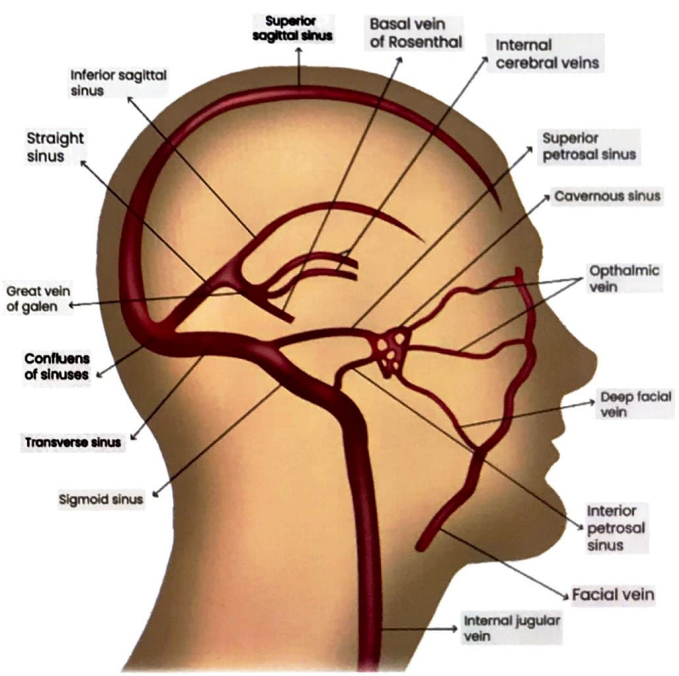
- Internal cerebral veins are around the brain stem & run behind to join to great cerebral vein of Galen
- SOS TRIBUTARIES [CONFLUENCE OF SINUS]
  - **S** - Straight sinus
  - **O** - Occipital sinus
  - **S** - Superior Sagittal Sinus

Previous Year's Questions

Q. Falx cerebri contains [NBEP 2014]
A. Straight sinus
B. Occipital sinus
C. Transverse sinus
D. Sigmoid sinus

FALX CEREBRI

00:09:36

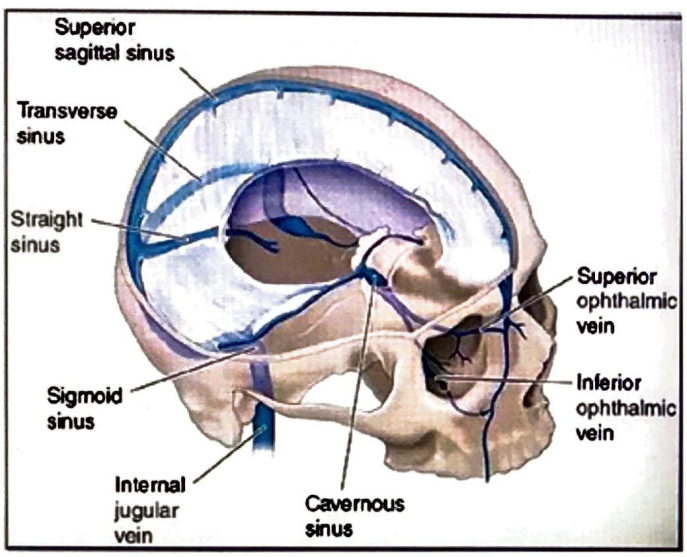


- Double layer of dura
- Separates right and left cerebrum
- Contain 3 sinuses
  - Superior sagittal sinus
  - Inferior sagittal sinus
  - Straight sinus
  - * Right and left internal cerebral vein (joins behind brain stem)→great vein of Galen(also receives basal vein of Rosenthal which receives internal cerebral vein; also receives inferior sagittal sinus)→ straight sinus(base of falx cerebri) → confluence of sinus

Draining channel from cavernous sinus

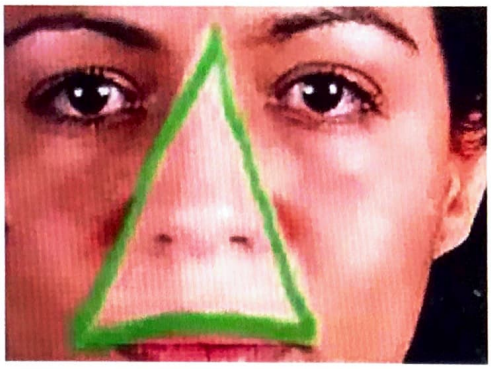
- Superior petrosal sinus
- Inferior petrosal sinus
- Deep facial vein

DURAL VENOUS FOLDS & SINUSES 00:10:37



- SUPERIOR OPHTHALMIC VEIN Tributaries
- INFERIOR OPHTHALMIC VEIN

DANGEROUS AREA OF FACE 00:17:51



- It includes upper lip, nose and medial canthus of eye
- Infections [staph. aureus] can access cavernous sinus without proper by

NOSE [Nasal pustule]
↓
FACIAL VEIN [mostly] DEEP FACIAL VEIN
↓
ANGULAR VEIN PTERYGOID PLEXUS
↓
SUPERIOR OPHTHALMIC VEIN [Mostly]
CAVERNOUS SINUS
INFERIOR OPHTHALMIC VEIN
↓
CAVERNOUS SINUS

Previous Year's Questions

Q. Septic emboli in the facial vein can cause cavernous sinus thrombosis because the facial vein makes clinically important connections with the cavernous sinus. The most commonly involved communicating vein is

A. Superior ophthalmic
B. Deep facial
C. Inferior ophthalmic
D. Pterygoid plexus of veins

63 HEAD & NECK – LYMPHATIC DRAINAGE

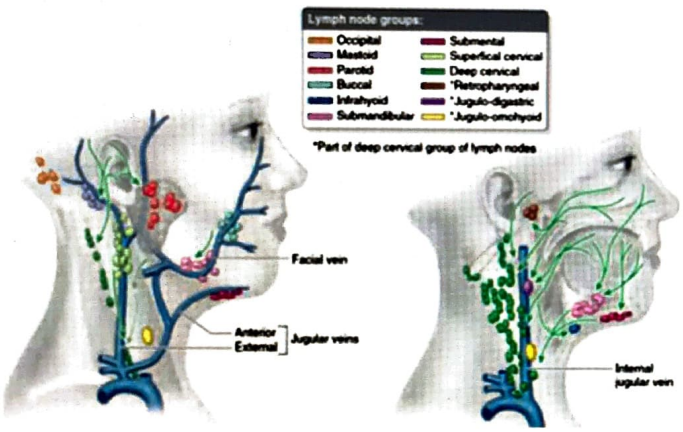
CIRCLE

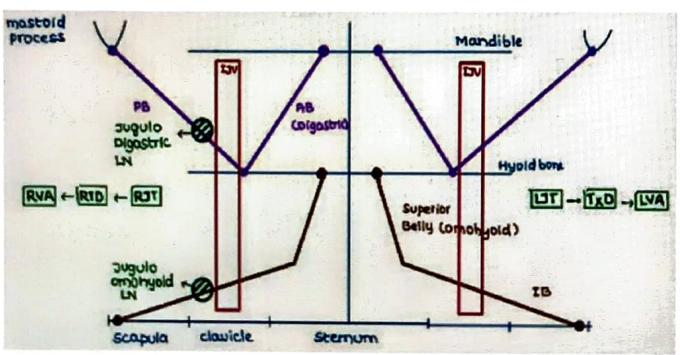
00:00:15

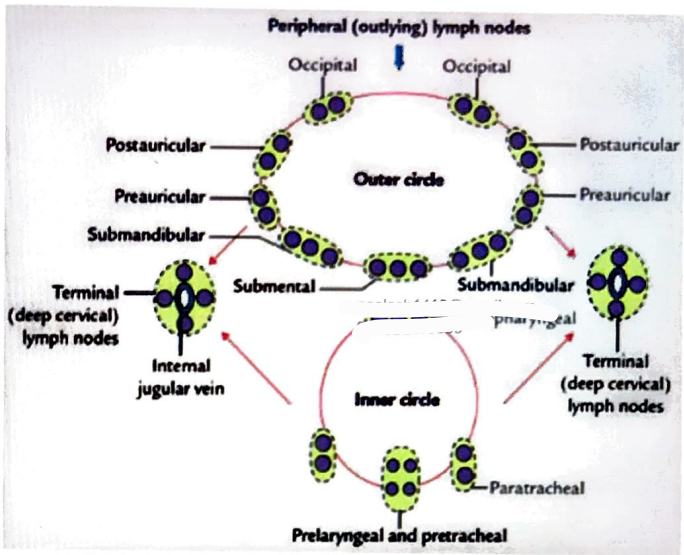
Inner Most Circle [MALT]	Inner Circle
Present at entry point tube	Para tracheal
Respiratory tube	Pre tracheal
Gut tube	Para pharyngeal

Outer Circle

- Sub mental lymph node
- Sub mandibular LN
- Pre auricular LN
- Post auricular LN
- Occipital LN







CERVICAL LYMPH NODES

00:03:07

Superficial	Deep
• Submental • Sub mandibular • Preotic/ Pre auricular • Parotid • Postotic • Occipital	• Retropharyngeal • Jugulo digastric • Jugulo - omophoid

Deep Lymphatic

- Upper Deep Cervical → jugulo digastric LN → drains Tonsils
- Lower Deep Cervical → jugulo omohyoid LN drains tongue
- Deep cervical LN are related to internal jugular vein

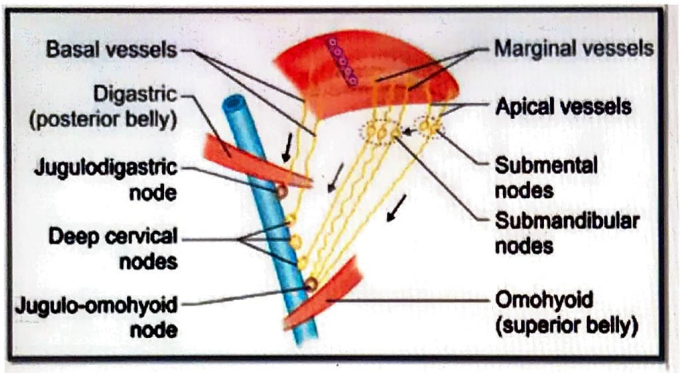
TONGUE LYMPHATIC DRAINAGE

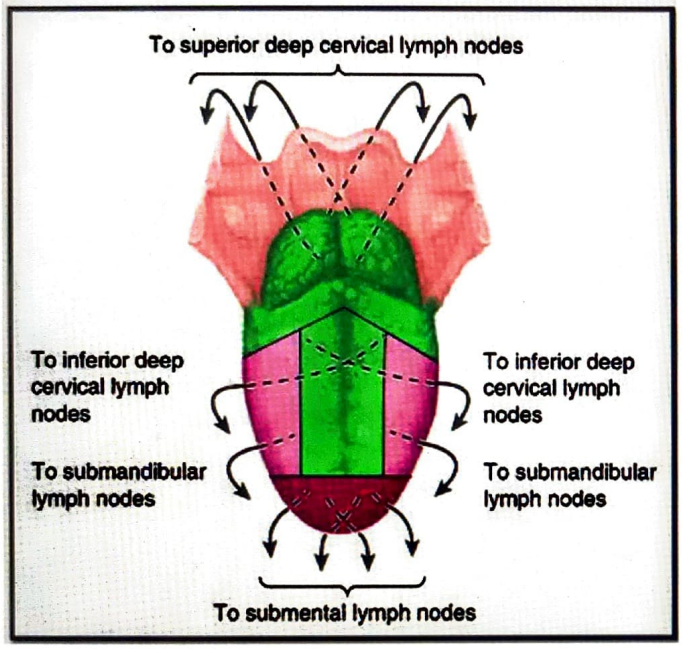
00:09:16

Part	Superficial LN	Deep LN
TIP	Sub mental LN	Lower deep Cx LN ↓ Jugulo omohyoid LN
Middle Portion	Sub mandibular LN	
Root	Upper deep	Jugulo digastic

Midline of Tongue

- Has bilateral drainage (Crossing of lymphatics)
  - Lateral Tongue → Drained by I/L LN
  - Root of Tongue → Drained has B/L drainage
  - Tumor on lateral side → I/L LN enlarged
  - Tumor on midline/ root → B/L LN enlarge



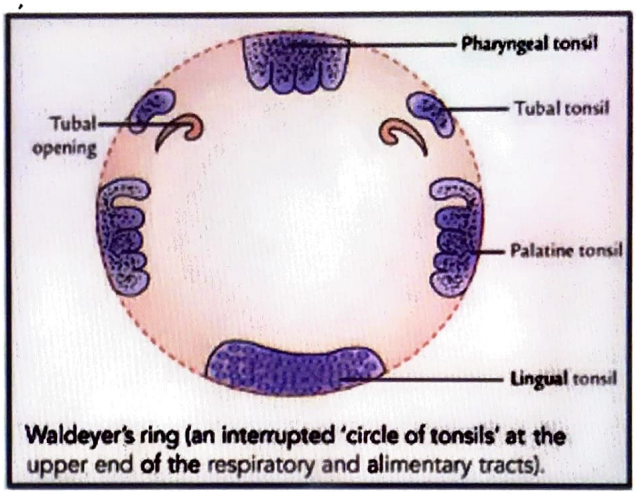


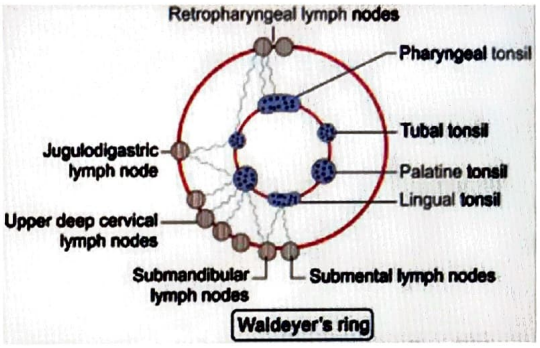
LYMPHATIC DRAINAGE AROUND PHARYNX

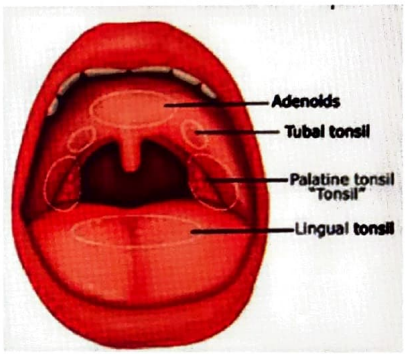
- MALT → WALDEYER'S → inner ring and outer ring
- Inner waldeyer's ring/ Waldeyer's ring

Tonsils

- Lingual tonsil
- Palatine tonsil (tonsil)
- Pharyngeal tonsil/ adenoid
- Tubal tonsil







Inner Waldeyers Ring	Outer waldeyers Ring
Pharyngeal tonsils	Retro pharyngeal LN
Palatine tonsil	Jugular digastric LN
Tubal tonsil	
Palatine tonsil	Outer upper deep cervical LN
Lingual tonsil	Submental and submandibular LN

64 SCALP

PNEUMONICS

00:00:05

- **S** - Skin
- **C** - Connective Tissue (dense)
- **A** - Aponeurosis (occipital frontalis)

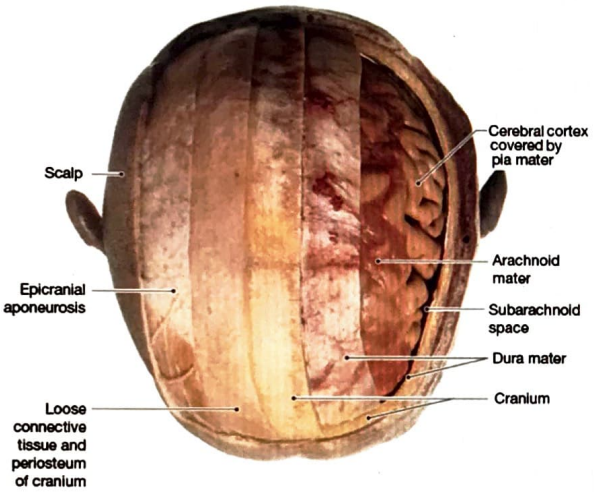
} True Scalp

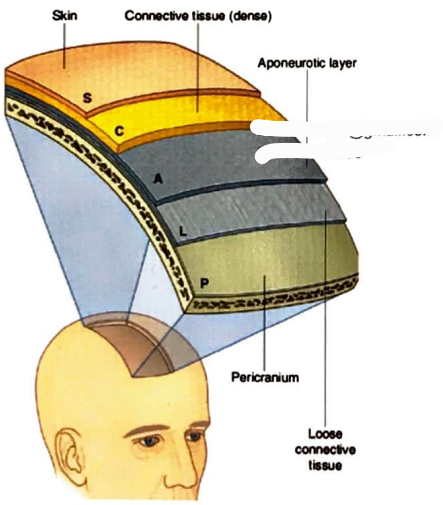
- **L** - Loose Connective Tissue = Sx Plane/ Danger Area
- **P** - Peri Cranium / Periosteum

Surgical Plane (Loose Connective Tissue)

- Pressure below true scalp
- Tissue expanders can be inserted here for surgical grafting
- Danger Area & Scalp
  - Blood & pus accumulate here
  - Can spread infections into
    Dural Venous sinuses → Meninges → Thrombosis

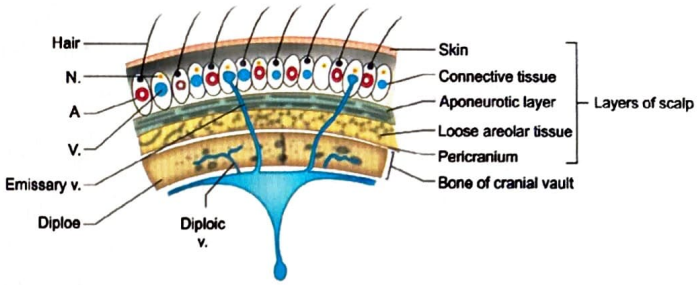
Aponeurosis: Flat tendon of occipito frontalis



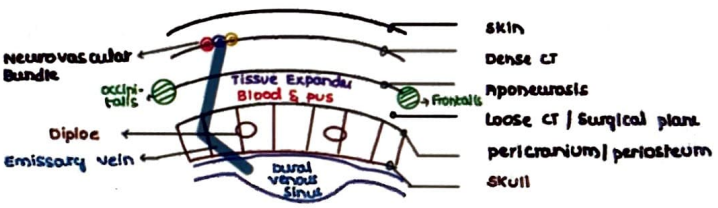


DEEP STRUCTURE TO SCALP

1. Skull bone
2. Dura mater (opaque)
3. Arachnoid mater (transparent)
4. Sub arachnoid space
5. Pia mater covering brain



- **Emissary Veins**: Intra cranial & extra cranial connections



- **Scalp bleeding is profuse:** Vessels are adherent to dense fibres
  DIPOLE → Skull (flat bone) with bone marrow

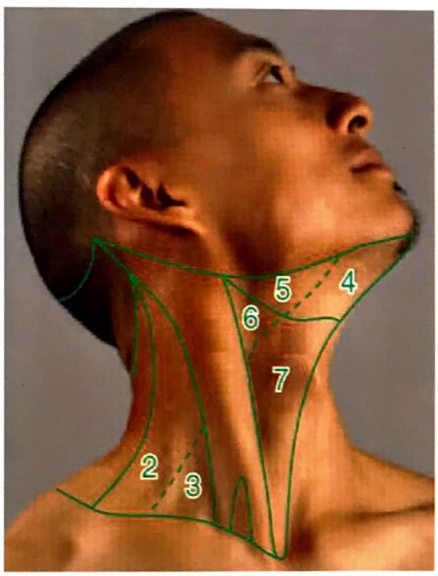
65 NECK TRIANGLES

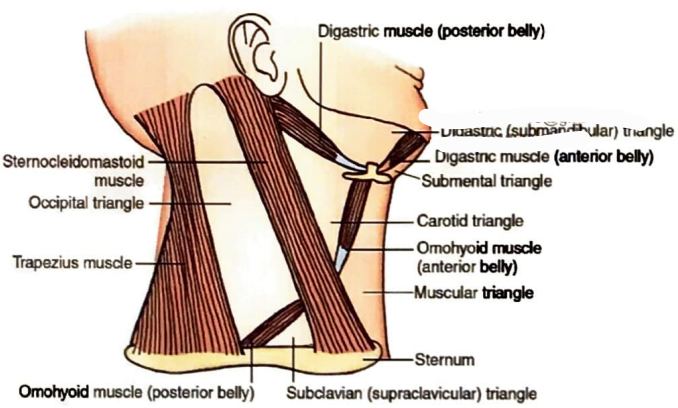
Sternocleidomastoid 00:00:10

- Boundary line b/w ant & posterior triangles
- Origin: sternum, clavicle
- Insertion: mastoid

Previous Year's Questions

Q. All of the following are in the anterior triangle of neck except
A. Digastric
B. Subclavian
C. Muscular
D. Submental





POSTERIOR TRIANGLES 00:01:41

- Pre vertebral fascia covers the floor of posterior triangle covers muscles Extends as axillary sheath into axilla
- Boundaries
  - Anteriorly - SCM
  - Posteriorly - Trapezius
  - Base - Middle 1/3rd of clavicle

Inferior belly of OMOHYOID divides posterior triangle into 2 parts

1. occipital triangle [larger]
2. subclavian triangle [smaller]

- Branchial plexus block given in subclavian triangle for multiple fracture pain - 3rd part of subclavian artery blocked here

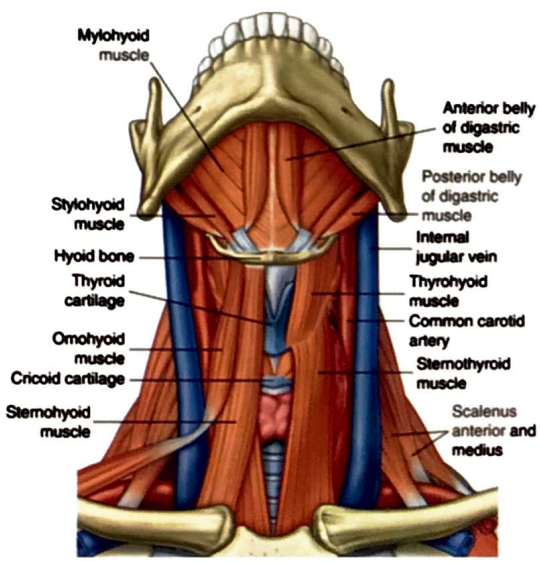
ANTERIOR TRIANGLE 00:24:58

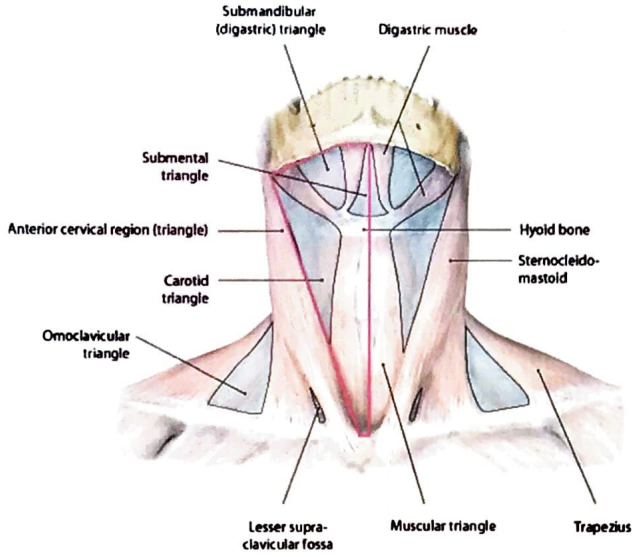
1. **Carotid Triangle** (bounded by sup. belly of OH) common carotid artery bifurcation occurs here
2. **Digastric Triangle** Bounded by digastric
   - Base: Mandible
3. **Muscular Triangle**
   - Strap muscles (anterior neck muscles) → sternohyoid
   - Thyroid gland covered by strap muscles

4 **Sub Mental Triangle**

- Middle triangle under mentum of mandible
- Only unilateral Neck Triangle
- Boundaries

1. anteriorly belly of digastric on both sides
2. Base: Hyoid Bone





- Tip of tongue drains into sub mental LN → drains directly to lower deep Cx or submandibular LN

Mylohyoid Muscle

- coming from mandible to hyoid bone
- present at the floor of mouth (floor of DG triangle)
- Depressor of mandible along with AB of digastric (act as a diaphragm when thumb is used to push the oral cavity down)

Thyroid Gland

- Covered by STRAP MUSCLE (Sternohyoid)
- Present in anterior muscular triangle

Subclavian Triangle

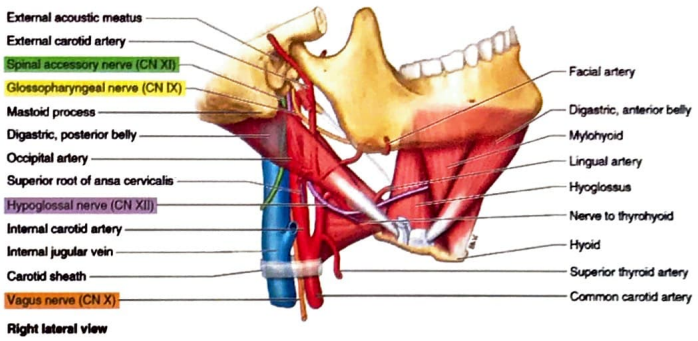
- 3rd part of subclavian artery can be blocked here lateral to scalenus anterior

Previous Year's Questions

Q All is true about digastric triangle EXCEPT
A. On either side is anterior belly of digastric muscle
B. Floor is formed by mylohyoid muscle
C. Contains mylohyoid nerve & vessels
D. Contains mylohyoid nerve & vessels

DIGASTRIC TRIANGLE

- DIGASTRIC MUSCLE
- Anterior belly
  - Depressor of mandible
  - Origin: mandible
  - insertion: Hyoid
- Posterior belly
  - attaches to hyoid & mastoid
- △ Bounded by → AB & PB of digastric
  - Base: Mandible
  - Floor: Mylohyoid
  - Hyoglossus (depressor of tongue)
    → supplied by CN XII



CN XII: came out of hypoglossal canal enter carotid triangle & goes to digastric triangle & supplies Hyoglossus

Digastric muscle is Hybrid muscle

- Anterior belly develops from 1st Pharyngeal arch supplied by V_3
- Posterior belly develops from 2nd Pharyngeal arch supplied by VII

CAROTID TRIANGLE

- Common carotid artery bifurcates into 2 branches
- CCA followed by int. jugular vein outside
- Carotid sheath covers interior jugular vein laterally, CCA & ICA medially & Vagus nerve between & behind the vessels Ansa cervicalis embedded anteriorly

Bounded by

1. Superior belly of omohyoid
2. Posterior belly of digastric
3. Sternomastoid

CAROTID SHEATH

- Cover int. jugular vein laterally, CCA & ICA medially & vague nerve between & behind the vessels External carotid artery present outside the sheath
- Ansa cervicalis embedded in anterior wall
- Sympathetic chain present behind carotid sheath
- Stellate ganglion block can be given here for Raynaud's phenomenon

STELLATE GANGLION BLOCK

00:35:20

Indications

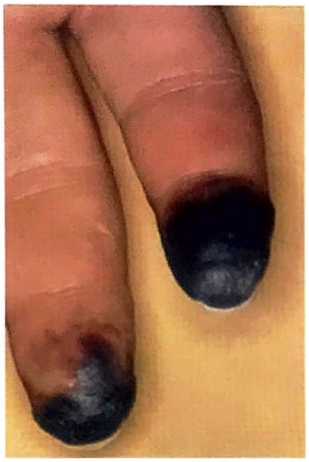
- SYMPATHETIC OVER ACTIVITY

1. RAYNAUD'S PHENOMENON (Impending gangrene)

2. HYPERHIDROSIS

Procedure

- Stellate ganglion is identified by us probe behind carotid sheath & inject agent



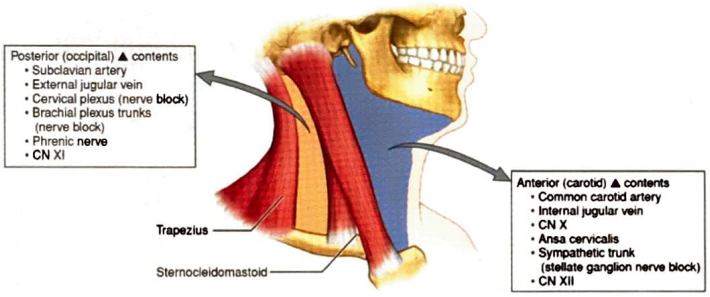
Raynauds phenomenon

Stellate ganglion block

POSTERIOR (OCCIPITAL) TRIANGLE

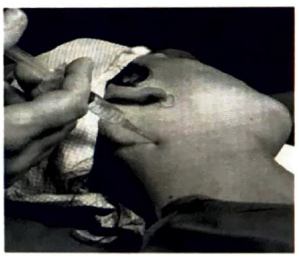
- Branchial plexus trunks
- Subclavian artery

Branchial plexus block & subclavian artery 3rd part given in subclavian triangle



Cervical plexus (nerve block) (at mid-point of SCM)

1. Greater auricular nerve
2. Lesser occipital nerve
3. Transverse nerve
4. supra clavicular nerve

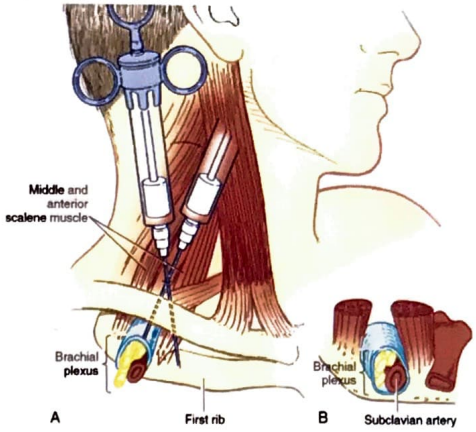


Cervical plexus nerve block

Spinal accessory nerve (CN XI)

- Supplies SCM & trapezius

- In' iatrogenic injury, Trapezius is paralysed (difficult in shrugging of shoulder) (in nerve injury, distal area is involved)

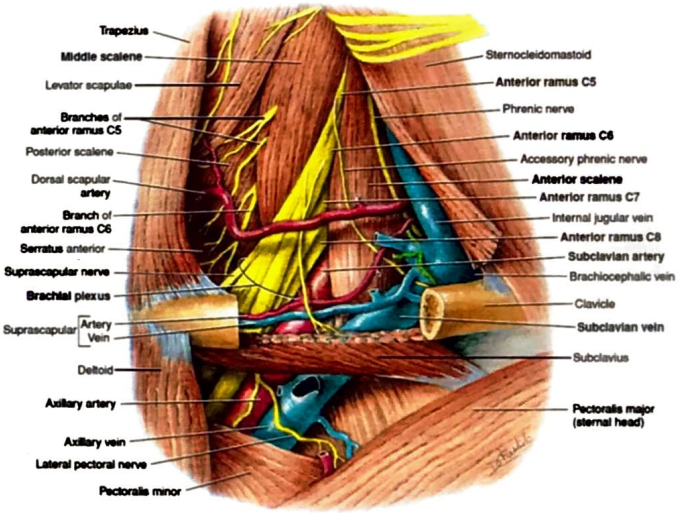


External jugular vein
Phrenic nerve

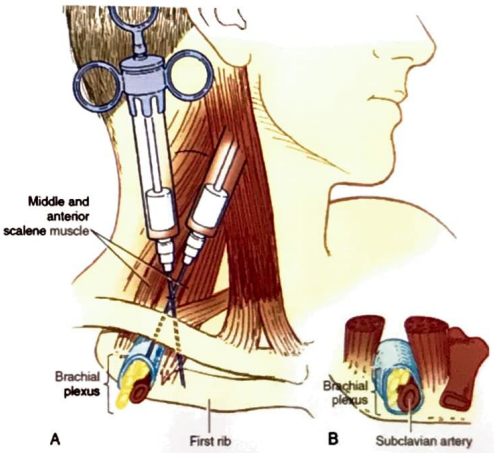
- Don't block (risk of diaphragmatic paralysis)

Subclavian Artery (3rd part) BLOCK

- Runs on superior surface of 1st rib
- Lateral to scalenus anterior & SCM pressure given by thumb



Supra Clavicular Block



Axillary Sheath

- Continuation of prevertebral fascia into axilla
- Contents
  - Branchial plexus
  - Axillary artery
  - Axillary vein is outside the axillary sheath

Phrénic Nerve

- Br. of cervical plexus
- Coming from posterior border of sternomastoid to anterior border of sternomastoid
- Runs on anterior surface of scalenus anterior
- Supplies diaphragm
- Carries sensations from
  1. central portion diaphragm
  2. Central pleura
  3. Central pericardium
  4. Central peritoneum

  } mediastinal portion

Previous Year's Questions

Q. If there is a superficial cut in the region of the middle part of posterior triangle of neck, patient will experience problem in

A. Abduction arm

B. Protraction of scapula

C. Shrugging of shoulder (Better Answer)

D. Overhead abduction of arm (along with serratus anterior)

66 NECK & FASCIA SPACES

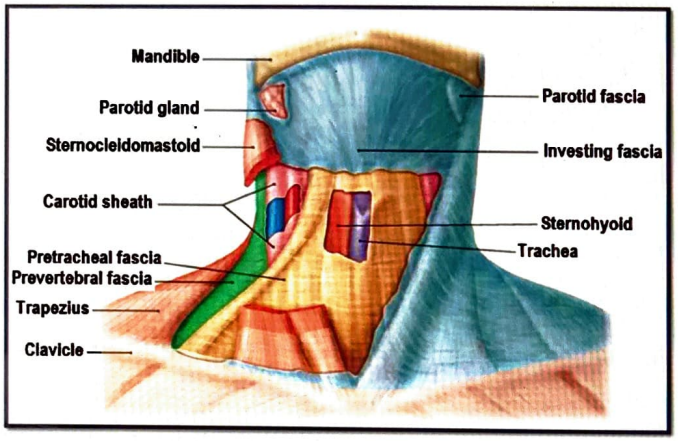
CERVICAL FASCIA

00:00:01

Deep Cervical Fascia

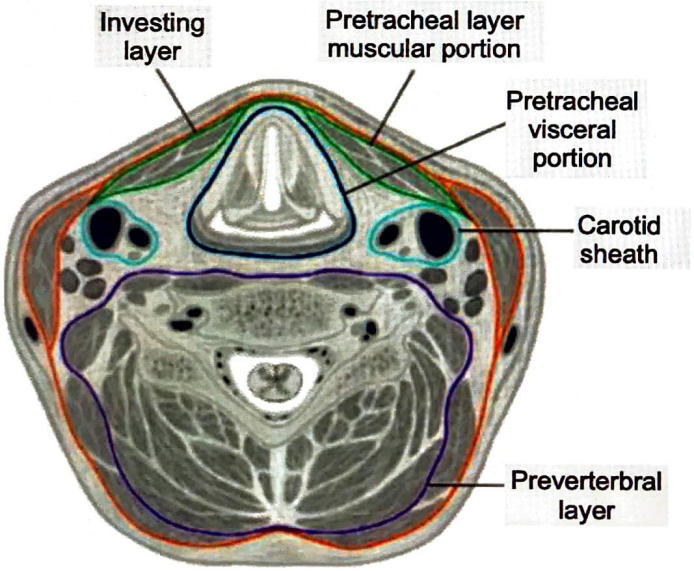
1. Investing Fascia (most superficial)
2. Pre-Tracheal Fascia
3. Pre-Vertebral Fascia [at floor of triangle]

All 3 fascia contributes to Carotid Sheath



INVESTING FASCIA

- Forms roof of post. triangle
- Bounded by
  - SCM (anterior)
  - Trapezium (posterior)
- Spilt & enclose SCM & goes all around the neck circumferentially



PRE VERTEBRAL FASCIA

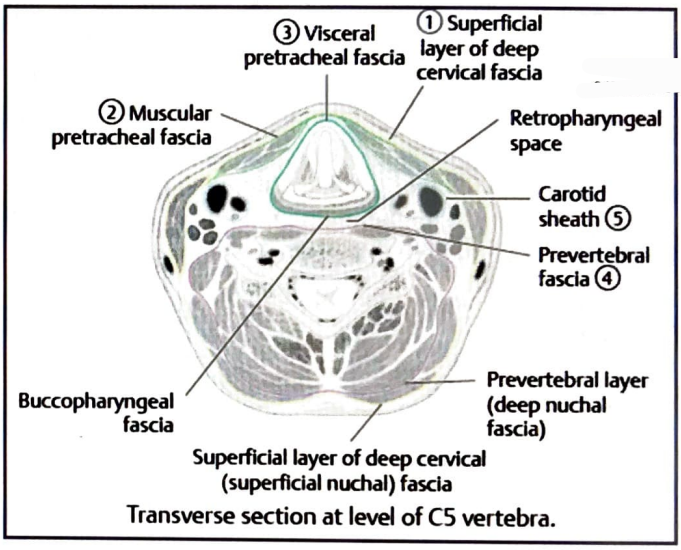
00:07:20

- Forms floor of post triangle & covers scalenus medius

PRE TRACHEAL FASCIA

- Goes behind pharynx & oesophagus → Circumferential → Buccopharyngeal Fascia
- Has multiple layers
- Encloses

1. Trachea & oesophagus
2. Ant. neck muscles
3. Thyroid gland



Transverse section at level of C5 vertebra.

- Carotid sheath contributed by
  - Pre vertebral (posterior)
  - Pre tracheal (anterior)
  - Investing fascia (lateral)

PREVERTEBRAL FASCIA

- Encloses para vertebral muscles

PRE-TRACHEAL FASCIA

- Goes antero lateral to trachea
- Continues posteriorly around pharynx & oesophagus as Buccopharyngeal Fascia

1. Visceral: Encloses thyroid, trachea, oesophagus
2. Buccopharyngeal

- Continuation of pretracheal fascia

- Retro Pharyngeal Space present behind pharynx & buccopharyngeal fascia

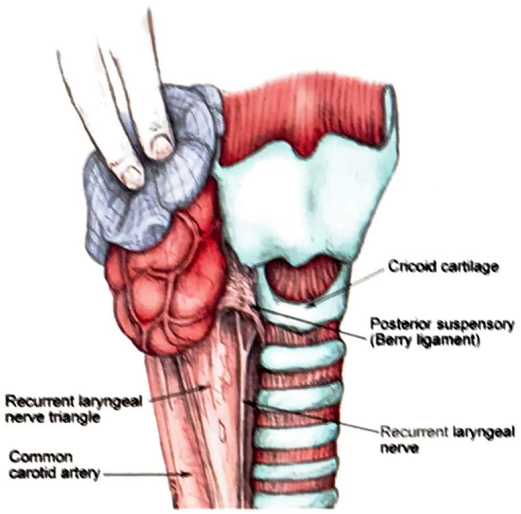
00:12:13

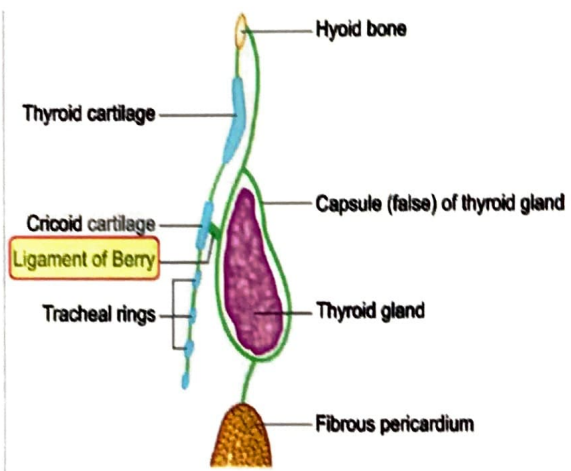
Previous Year's Questions

Q. All are true about cervical fascia (FMGE Aug 2020)
A. Ligament of berry fixes thyroid gland to cricoid cartilage
B. Prevertebral fascia forms the roof of posterior triangle
C. Ansa cervicalis is embedded in the anterior wall of carotid sheath
D. Carotid sheath is formed by pre tracheal & prevertebral fascia

Ligament of Berry / Posterior Suspensory Ligament

- Modification of deep cervical fascia
- Fixes thyroid gland to Cricoid cartilage of larynx anteriorly
- Due to thyroid gland moves up & down during deglutition



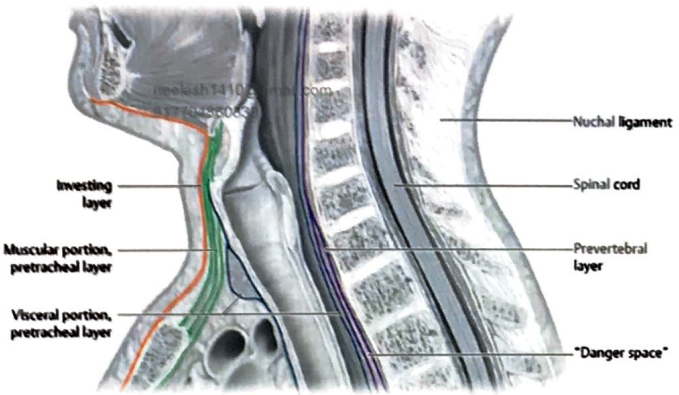


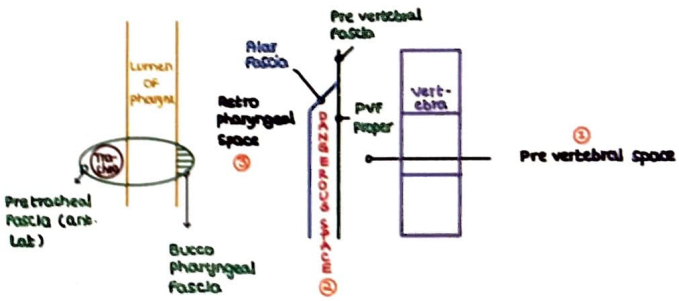
NECK FASCIA & SPACES

1. Investing Fascia
2. Pre-Tracheal Fascia (anterior): Buccopharyngeal Fascia (posterior)
3. Retropharyngeal Space
4. Pre-Vertebral Space
5. Pre-Vertebral Fascia: splits into 2 layers
   a. Anteriorly: Alar fascia
   b. Posteriorly: prevertebral fascia proper

DANGEROUS SPACE present b/w these 2 layers

- Potential space
- Spreads infections into mediastinum





Previous Year's Questions

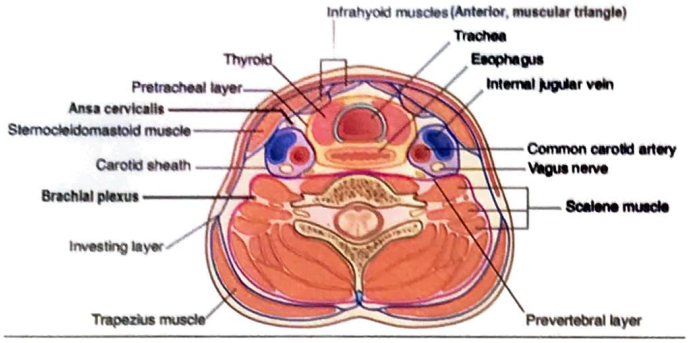
Q. Dangerous space situated b/w
A. Pre vertebral & Bucco pharyngeal fascia
B. Pre vertebral & pharyno basilar fascia
C. Pre vertebral & alar fascia
D. Bucco pharyngeal & pharyngo basilar fascia

Refer Image 66.1

BRACHIAL PLEXUS

- Present at floor of post triangle
- Present in interscalene triangle (b/w sc. anterior & sc medius)
- Pulls the pre vertebral fascia into axilla Axillary Sheath

- Present behind & lateral to scalenus anterior (most posterior)

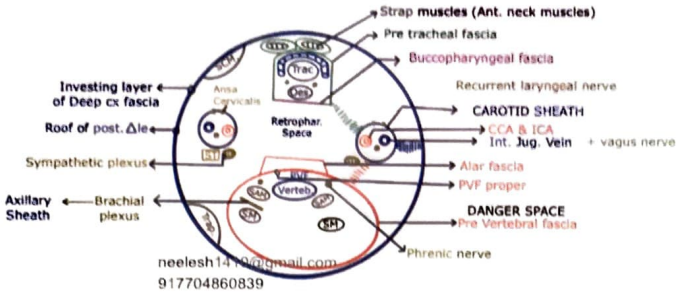


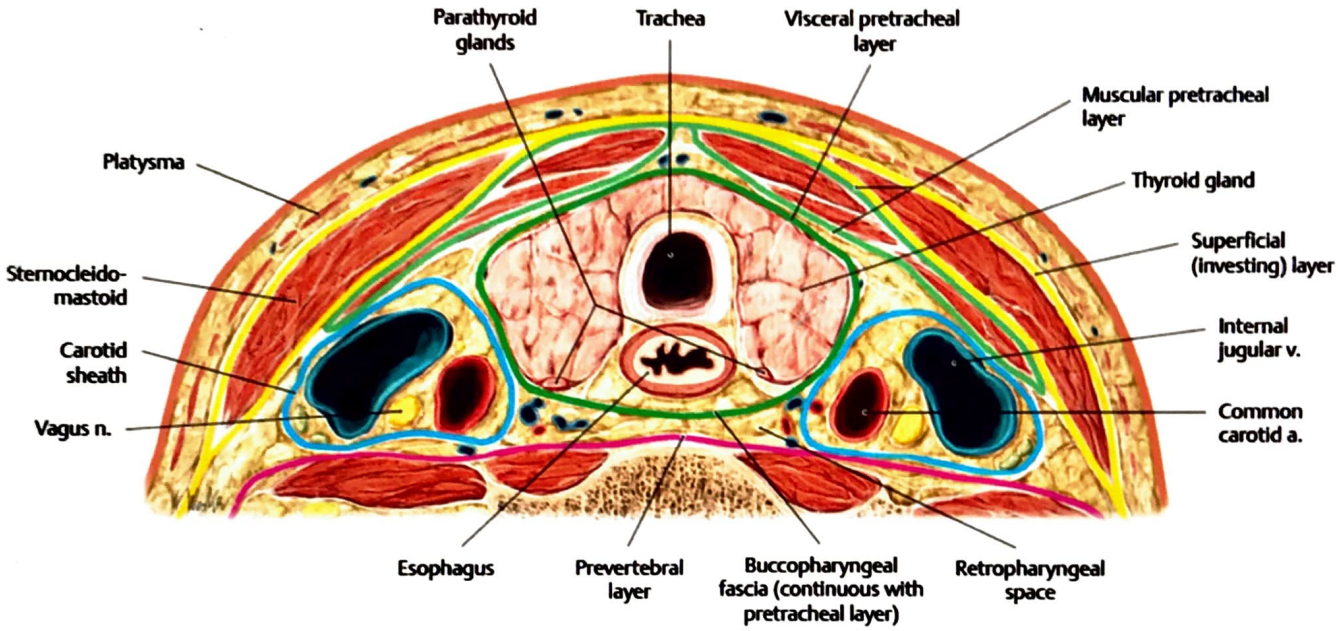
PHRENIC NERVE

- Anterior to scalenus anterior
- Sclanenus anterior covered by prevertebral fascia

SYMPATHETIC CHAIN

- Present behind carotid sheath





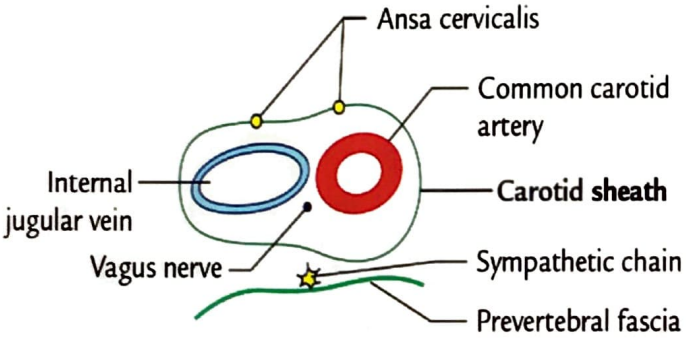
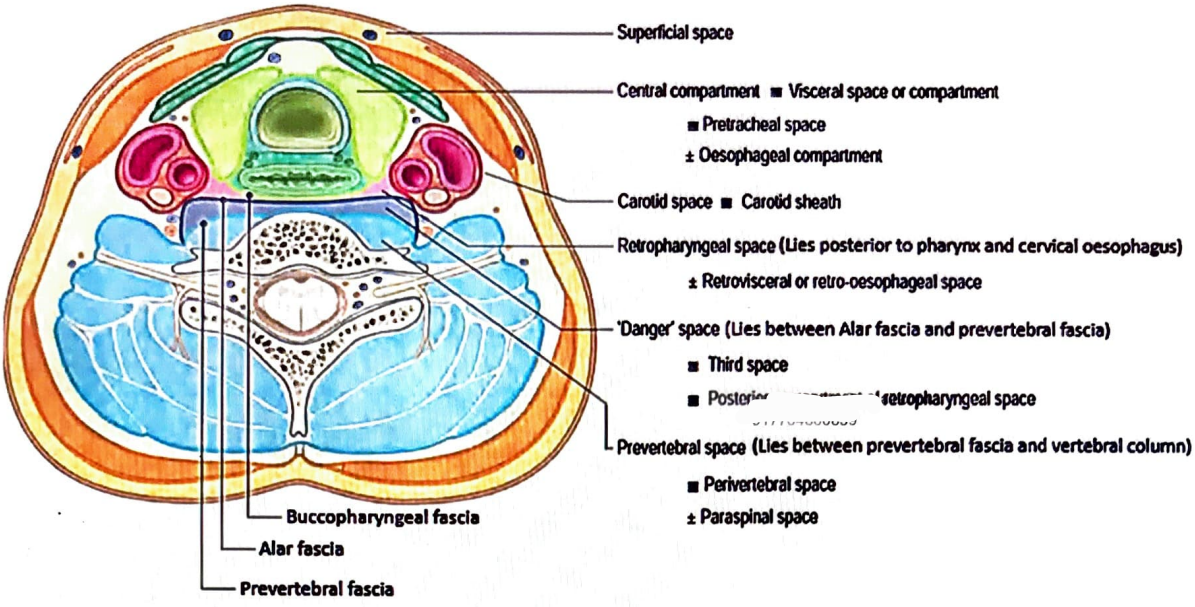
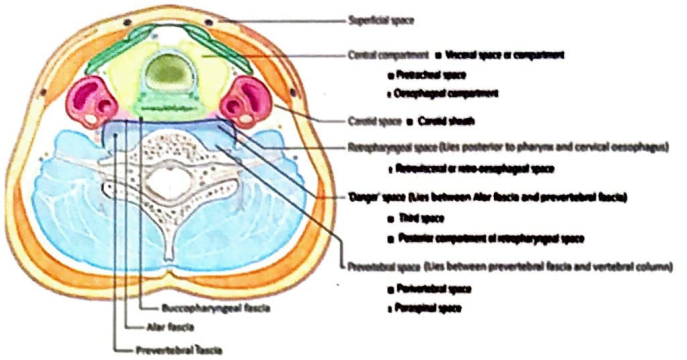


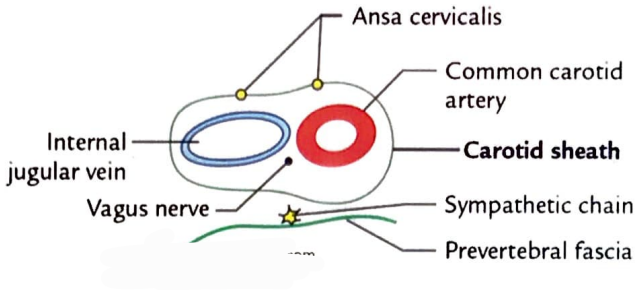
Image 66.1


Superficial space
Central compartment ■ Visceral space or compartment
■ Pretracheal space
± Oesophageal compartment
Carotid space ■ Carotid sheath
Retropharyngeal space (Lies posterior to pharynx and cervical oesophagus)
± Retrovisceral or retro-oesophageal space
'Danger' space (Lies between Alar fascia and prevertebral fascia)
■ Third space
■ Posterior [illegible] retropharyngeal space
Prevertebral space (Lies between prevertebral fascia and vertebral column)
■ Perivertebral space
± Paraspinal space
Buccopharyngeal fascia
Alar fascia
Prevertebral fascia

67 NECK FASCIA AND SPACES: REVISION

00:00:01





BRACHIAL PLEXUS

- Present at Cloor post triangle
- Present in interscalene triangle (b/w sc. Anterior & sc medius)
- Pulls the pre vertebral Cascia into axilla Axillary Sheath
- Present behind lateral to scalenus anterior (most posterior)

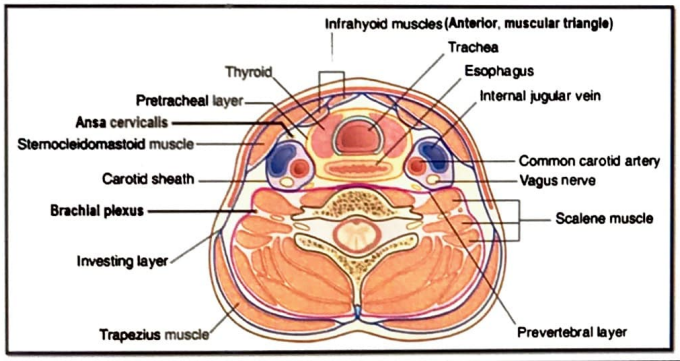
Phrenic Nerve

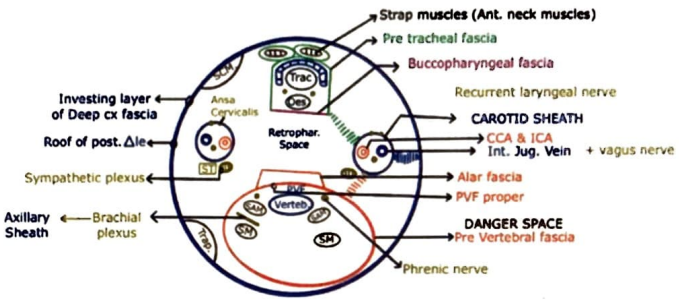
- Anterior to scalenus anterior
- Sclanenus anterior covered by prevertebral fascia

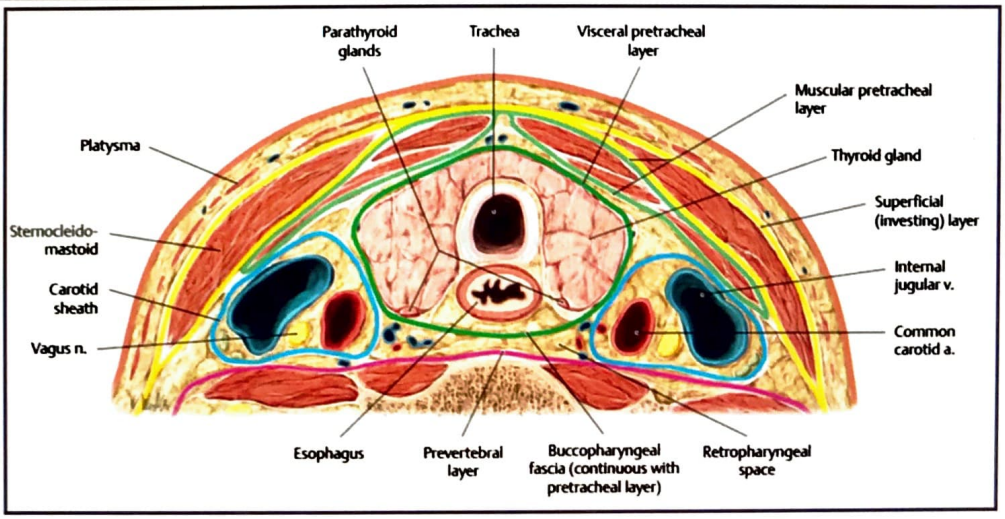
Sympathetic Chain

- Present behind carotid sheath

00:06:04

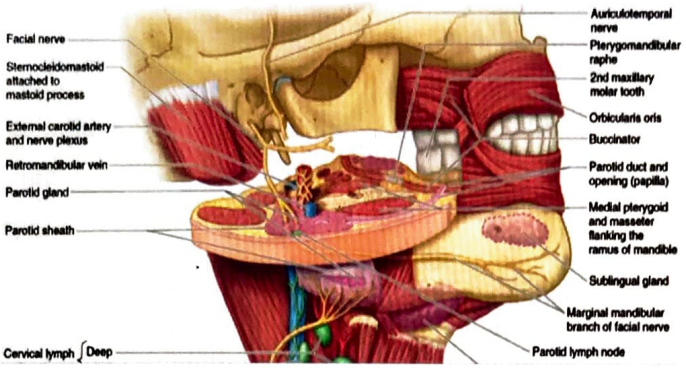






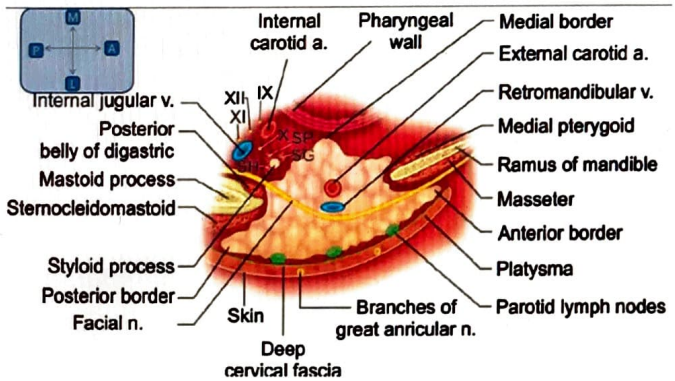
68 PAROTID GLAND

- Largest salivary gland 00:00:01
- Stenson's duct of parotid gland opens opposite to the upper 2nd molar in vestibule

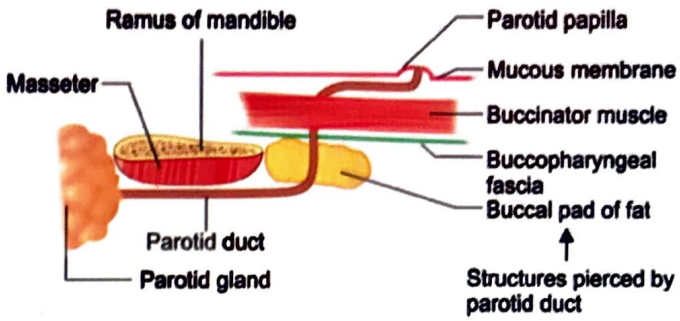


RELATIONS 00:00:50

- Anterior
  - ramus of Mandible
  - Masseter inserted on lateral surface
  - Medial pterygoid inserted on medial surface
- Posterior
  - Mastoid Bone
  - SCM inserted on lateral side
  - Posterior belly of digastric inserted on medial surface
- Deeper: Pharynx
- Behind: Mastoid
- Medial: Pharynx

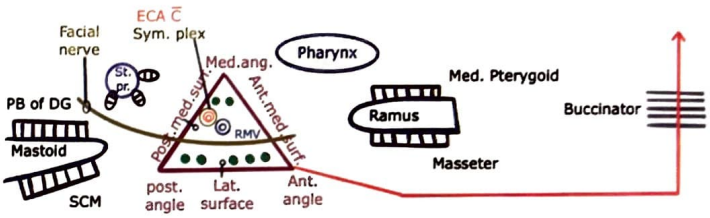


- Styloid process related to parotid gland
- Stenson's duct of parotid passes lateral to masseter & pierces buccinator to open opposite to the upper 2nd molar.



STRUCTURES PASSING THROUGH PAROTID GLAND 00:03:21

1. Retromandibular Vein → Passes through parotid gland
2. External Carotid Artery
3. Sympathetic Plexus (a/w ECA)
4. Facial Nerve
   - Passes in the middle of gland
   - Do not supply parotid gland
   - Creates a surgical plane
     - Deep: LN are less
     - Superficial: LN are more



69 PHARYNX

PHARYNX

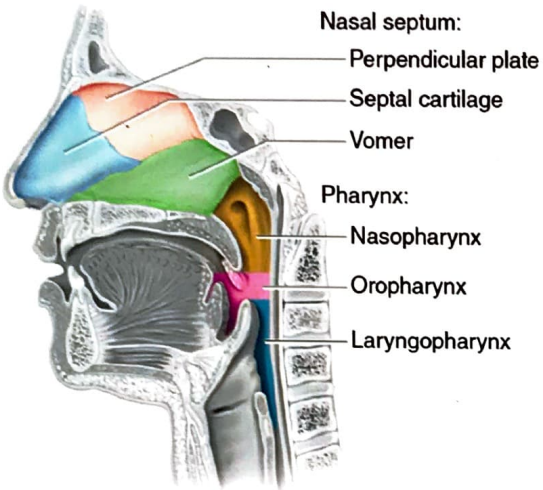
00:00:01

It is a fibro muscular tube of 12cm

00:06:03

Has 3 parts

1. Naso pharynx
2. Oropharynx
3. Laryngopharynx



- Anterior wall deficient
- It extends from base of skull to the lower border of C_6 vertebrae (Cricoid Cartilage also at same level)

MUSCLES

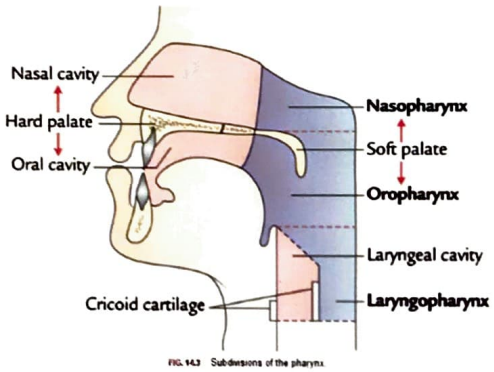
00:18:25

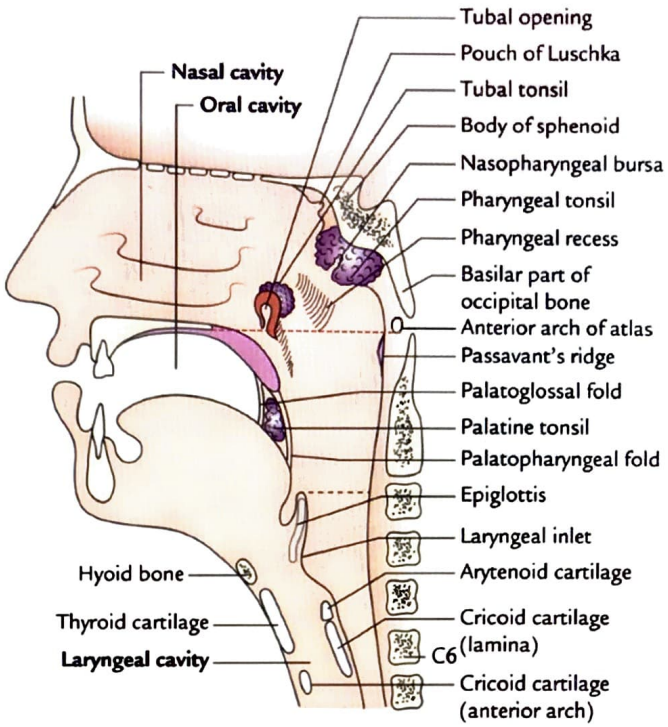
Pharyngeal constrictors

1. Superior pharyngeal constrictor
2. Middle pharyngeal constrictor
3. Inferior pharyngeal constrictor

Pharyngeal Elevator

1. Stylopharyngeus
2. Salpingopharyngeus
3. Palatopharyngeus



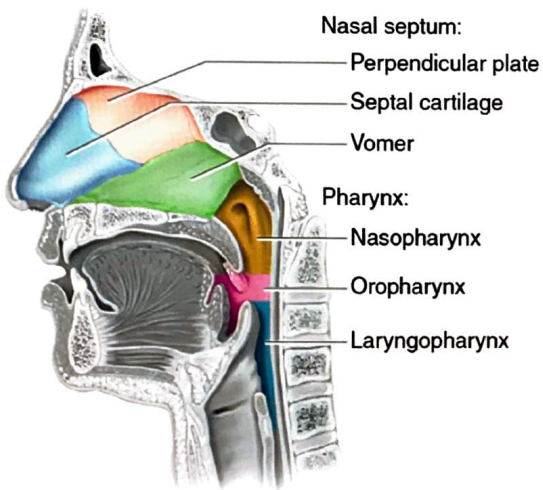


NERVE SUPPLY

- All pharyngeal muscles supplied by pharyngeal plexus
  It comprises of

1. Vagal accessory nerve (chief supply)
2. Glossopharyngeal nerve
3. Symphathetic

- Cranial accessory nerve is the main nerve supplying pharyngeal muscles
- Nerve fibres originate from nucleus ambiguous and are carried by vagus nerve.



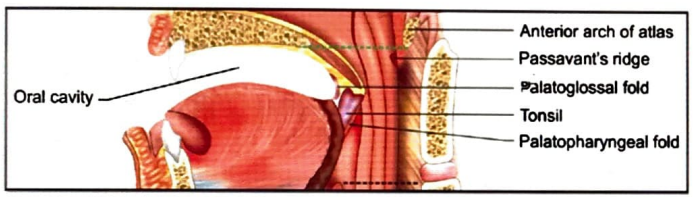
NASOPHARYNX CONTENTS

- Opening of ET
  - Present 1.25 cm behind the inferior turbinate in lateral wall of nose
- Tors Tubarius Elevation
- Fossa of Rosenmuller
  - Behind opening o? ET
- Adenoids (Tubal and Pharyngeal Tonsil)

OROPHARYNX CONTENTS

1. PALATINE TONSIL
2. Lingual Tonsil
3. Vallecula
4. Passavants Ridge

- Closing mechanism of oropharynx from nasopharynx
- Formed from superior pharyngeal constrictor palatopharyngeus muscle
- Avoids Good entering into nasopharynx
- Present at the Junction of Nasopharynx and Oropharynx
- It formed by
  - Superior pharyngeal constrictor
  - Palato pharynx



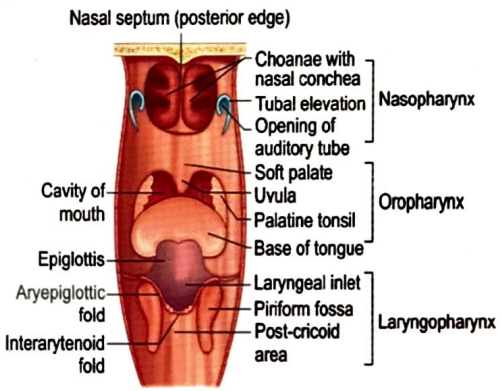
LARYNGO PHARYNX CONTENTS

Pyriform Fossa

- Present lateral aryepiglottic Cold
- Filled with saliva in painful situations (Tonsillitis)
- Lateral to midline
- Entry point OQ larynx

Levator Veli Palatini

- Elevates palate
- Opens Eustachian tube
- Comes along with in sinus of Morgagni



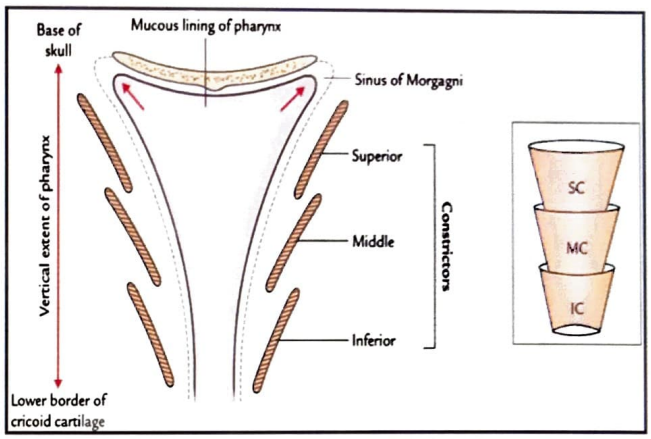
SINUS OF MORGAGNI

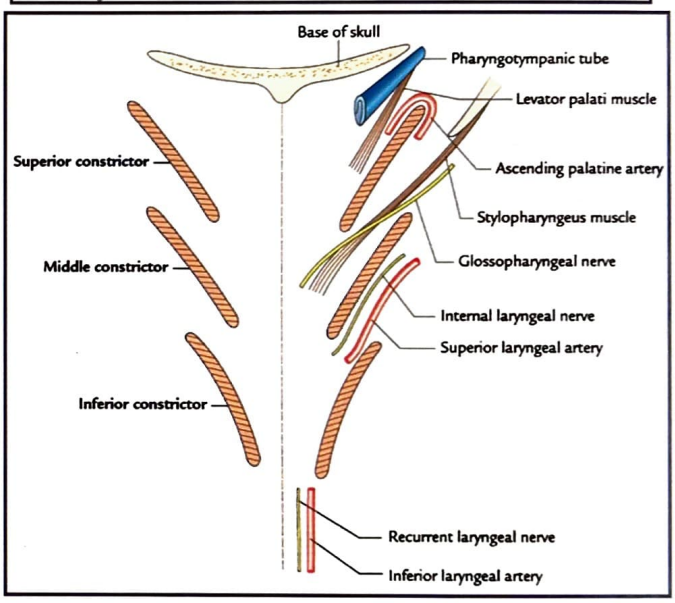
00:34:16

- Space b/w base of skull & superior Pharyngeal constrictor

Structures passing through som

1. Eustachian tube
2. Tensor veli palati
3. Ascending pharyngeal artery (medial be. Of ECA)
   - Supplies ET and pharnynx and tonsil
4. Ascending palatine artery (br. Of facial artery)





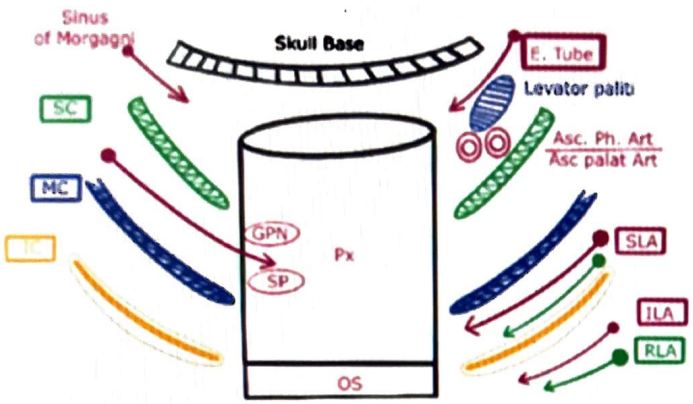
Pharyngeal constrictor	Origin	Insertion
Superior	• Pterygoid plate of sphenoid • Mandible	
Middle	• Hyoid Bone	Posterior Medial Raphae
Inferior	• Thyropharyngeus • Cricopoharyngeas	

Stylopharngeal muscles

- Elevator of pharynx
- Supplied by Glossopharyngeal nerve → Only muscle developed from 3rd arch

Contents

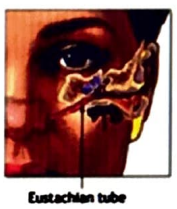
- Between superior and middle constrictor
  - Stylopharyngeus muscle
  - Glossopharyngeus nerve
- b/w middle inferior constrictor
  - Intralaryngeal nerve
  - Superior Laryngeal artery
- B/w Esophagus larynx
  - Recurrent laryngeal nerve in tracheo esophageal groove
  - Inferior laryngeal artery

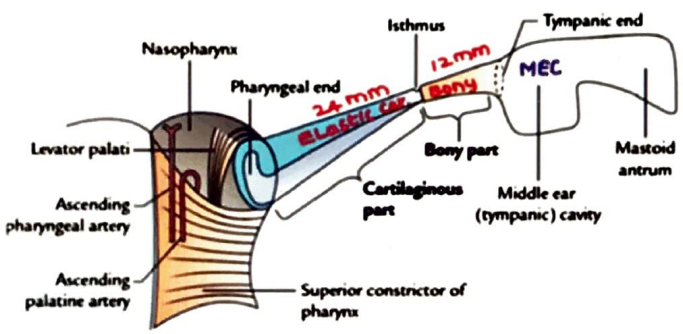


EUSTACHIAN TUBE

00:42:48

- Start from tympanic cavity and opens in nasopharynx
- Anterior 1/3rd bony posterior 2/3rd cartilaginous
  - Total length 36 mm
  - Bony part = 12 mm
  - Cartilaginous part = 24 mm
- Junction has narrowest lumen known as isthmus

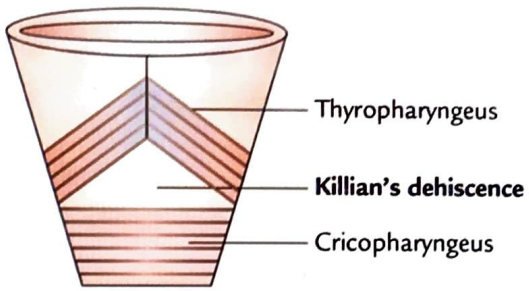


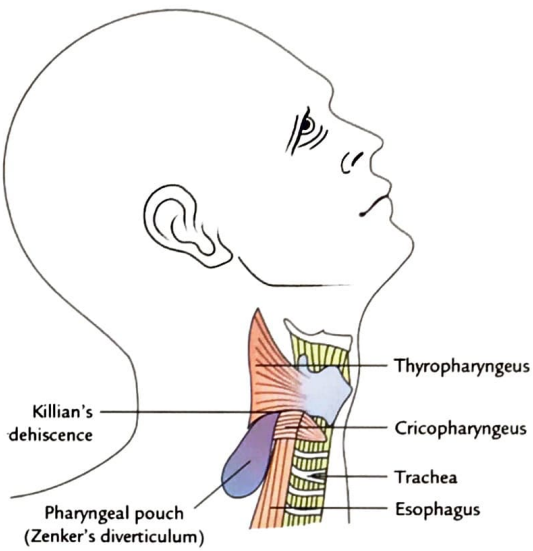


ZENKER'S DIVERTICULUM

00:47:57

- Pharyngeal pouch coming into Killian dehiscence
- Inferior Pharyngeal Constrictor
- Thyropharngeus muscle (Oblique fibres)
- Cricopharyngeus muscle (Horizontal fibres → supplied by recurrent laryngeal nerve)
- Killian Dehiscence
- Post deficiency present b/w above 2 muscles



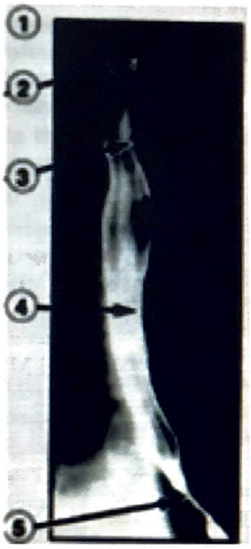


70 OESOPHAGUS

00:01:16

Previous Year's Questions

Q. Marker 4 in the Wowing diagram shows oesophageal narrowing produced by
A. Cricopharyngeal sphincter
B. Arch of aorta
C. Left principal Bronchus
D. Left atrium



BARIUM RADIOGRAPHY

Narrowing's

- Marker 1: At beginning of oesophagus due to cricopharyngeus Sphincter
  - Narrowest lumen of oesophagus
- Marker 2: Due to arch of aorta passing in front of oesophagus
- Marker 3: due to principal bronchus in front of oesophagus
- Marker 4: Due to Bronchoaortic constriction & Left atrium
  - Seen due to Lt atrial hypertrophy
- Marker 5: While oesophagus is passing through diaphragm
- TRANSOESOPHAGEAL: It atrium seen first
- ECHOCARDIOGRAPHY: MC evaluated structure is LA

Levels from Upper Incisor

- 15 cm (C6): due to cricopharyngeal sphincter
- 23 cm: Due to aortic arch
- 28 cm: It main bronchus
- 25 cm: BRONCHO AORTIC CONSTRICTION (b/ w T1&T4) Lt. Atrium
- 40 cm (T10): While passing through diaphragm
- 50 cm (T11): Continues as stomach

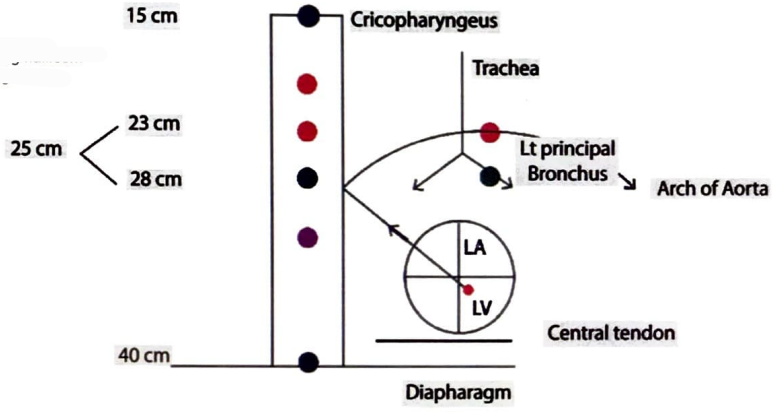
Divided into

1. Cervical part
2. Thoracic part
3. Abdominal part

Refer Image 70.1

Sphincter 00:04:20

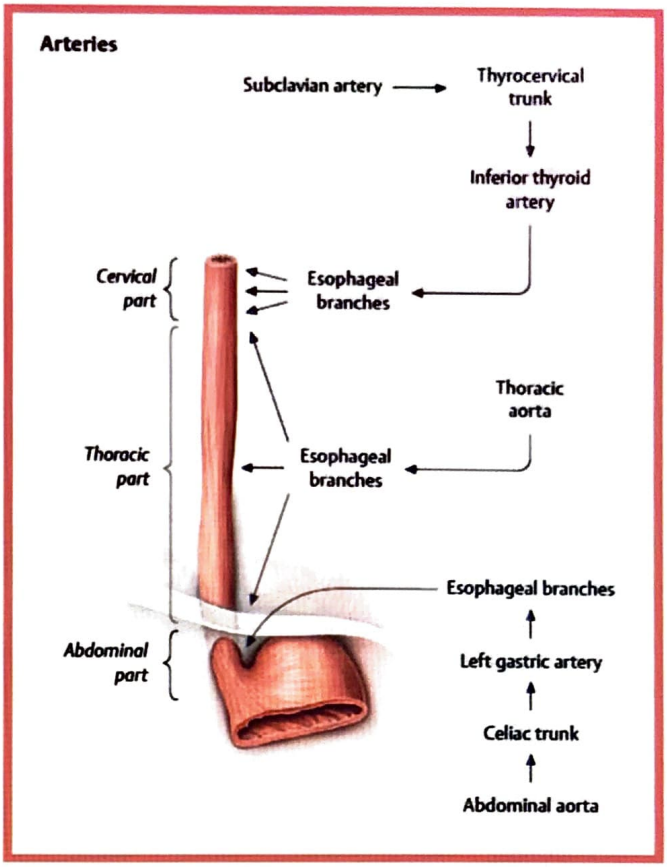
- Upper Oesophageal sphincter (3-5cm)
- Lower Oesophageal Sphincter Involved in disease
  - Upper 1/3rd: Striated muscle
  - Middle 1/3rd: Smooth and striated muscle
  - Lower 1/3rd: Smooth muscles
- Achalasia Cardia: Congenital absence of Auerbach's plexus leading to no relaxation of the lower esophageal sphincter leading to spasm.



OESOPHAGUS VENOUS DRAINAGE 00:25:53

Previous Year's Questions

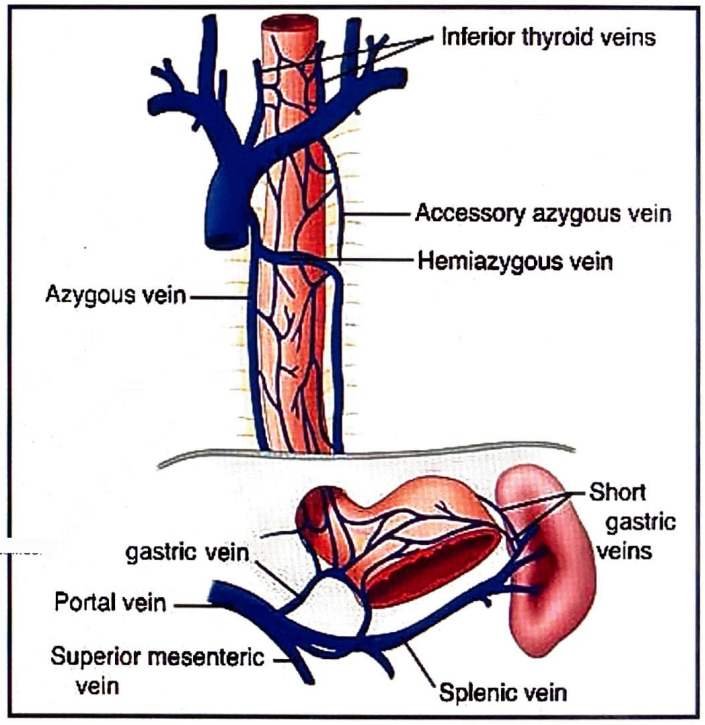
Q. Venous drainage of oesophagus
A. Azygous vein, inferior thyroid, right gastric vein
B. Azygous vein, Inferior thyroid left gastric vein
C. Azygous vein, right gastric vein, left gastric vein
D. Superior thyroid vein, inferior thyroid vein, azygous vein, hemizygous vein

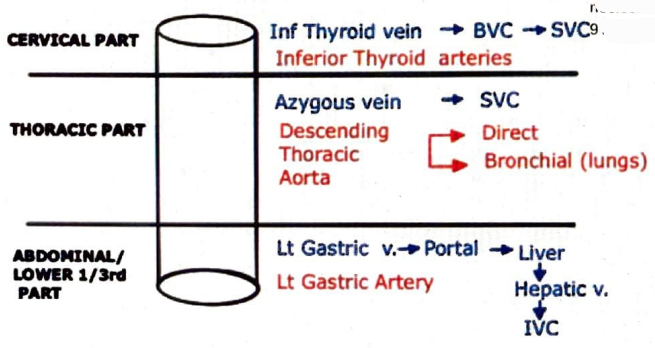


Thoracic Part
- Rt side → Azygous v → SVC
- Lt Side → Hemiazygous v / Accessory azygous v → Azygous Vein → SVC

Cervical Part → Inf. Thyroid vein → Brachiocephalic vein → Sup. venous cava

Abnominal/ower 1/3 rd Part → Lt Gastric Vein → Portal Vein → Liver → Hepatic vein → IVC



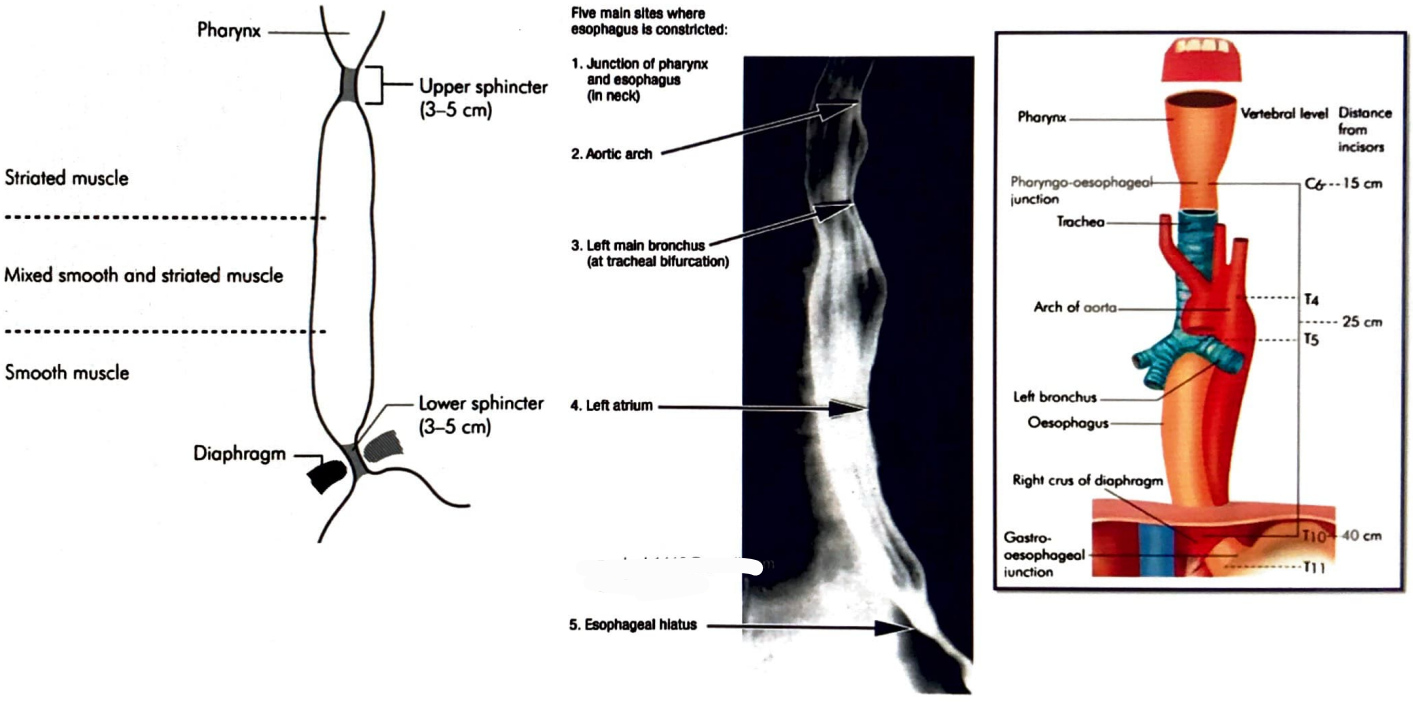


Site of Constriction	Vertebral Level	Distance from Upper incisor
Beginning (Pharyngo oesophaeal junction)	C6	15 cm
Aortic arch	T4	23 cm
Left principal bronchus	T6	28 cm
Esophageal hiatus in diaphragm	T10	40 cm

Previous Year's Questions

Q. What is the blood supply thoracic oesophagus
A. Inferior thyroid artery
B. Inferior phrenic artery
C. Bronchial artery
D. Left gastric artery

Image 70.1



71 LARYNX

Previous Year's Questions

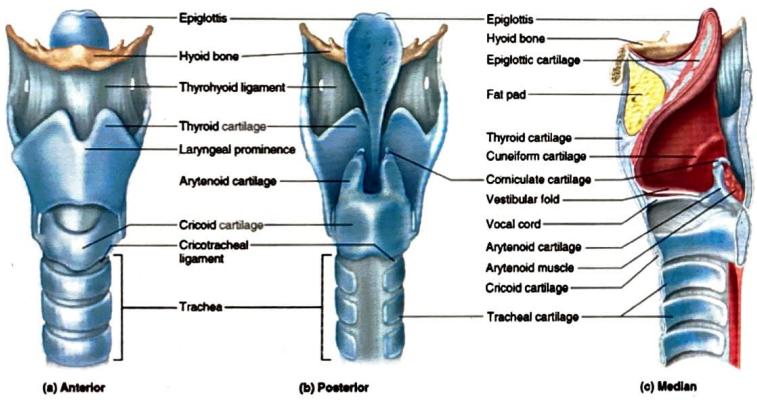
Q. False about larynx 00:00:28
A. 9 cartilages: 3 paired & 3 unpaired cartilages
B. Extends from C3 to C6 vertebrae
C. External laryngeal nerve supply all larynx muscles cricothyroid
D. Cricothyroid is a tensor oevocal cord

- All larynx muscles supplied by recurrent laryngeal nerve except cricothyroid

LARYNGEAL CARTILAGES 00:02:11

3 Unpaired Midline Cartilages

1. Epiglottis
2. Thyroid (largest)
3. Cricoid (ring shaped)



3 Paired Cartilages

1. Arytenoid
2. Corniculate
3. Cuneiform

Cartilages seen Posteriorly

1. Cricoid
2. Arytenoid
3. Corniculate
4. CuneiQorm

Elastic Cartilages

1. Epiglottis
2. Tip of arytenoid
3. Cuneiforms
4. Corniculate

Hyaline Cartilages

1. Thyroid cartilage
2. Cricoid cartilage
3. Most of arytenoid

LARYNX MUSCLES

Cricothyroid

- Tensor of Vocal cord
- ↑ Pitch of voice

Posterior Cricoarytenoid

- Most posterior muscle of larynx

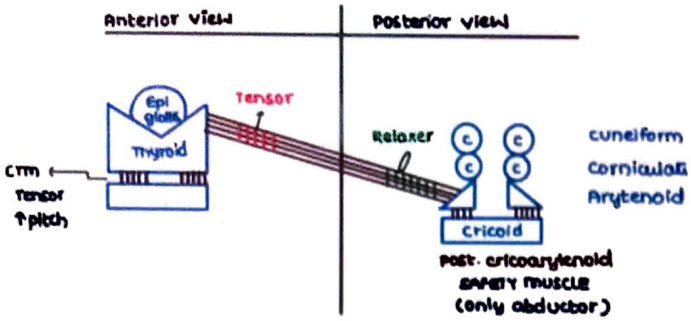
Refer Image 71.1

- Safety Muscle: Only abductor cord
- Lateral Cricoarytenoid: Adductor VC
- Thyroarytenoid
  - Comes from thyroid cartilage anterior to arytenoid posterior
  - Vocalis: Inner part of thyroarytenoid
  - Tensor of VC: Anteriorly
  - Relaxer of VC: Posteriorly

- Anterior most cartilage: Thyroid
- Ring shaped cartilage: Cricoid
- Adductor of VC: Arytenoid

B/L paralysis posterior cricoarytenoid

- VC in cadaveric position
- Difficulty in breathing
- May require tracheostomy
- During general anesthesia, endotracheal intubation should be done



Previous Year's Questions

Q. Relaxer of vocal cord is muscle 00:26:07

A. Thro arytenoid (posterior)

B. Cricothyroid

C. posterior crico arytenoid

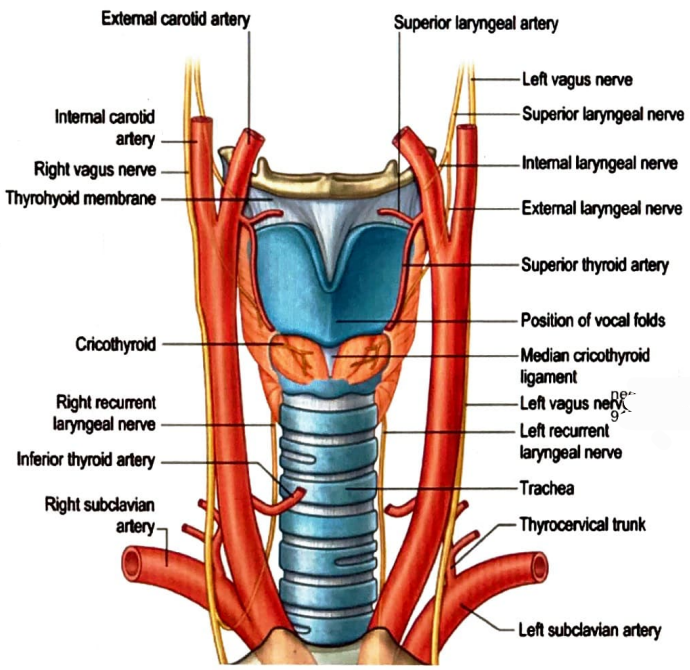
D. Lateral crico arytenoid

Refer Image 71.2

EXTERNAL LARYNGEAL NERVE INJURY

00:28:00

- Supply cricothyroid (tensor of VC)
- Produce weak voice
- Br. of Sup. Laryngeal nerve (Br. of vagus nerve)
- Follows superior thyroid artery



- To prevent injury, sup. thyroid artery should be ligated dose to thyroid gland

Inferior Thyroid Artery

(Br. of thyrocervical trunk) accompanied by RLN

- Supplies thyroid gland, RLN parathyroid glands (rnajor supply)
- Ligate the artery as close as possible to thyroid gland

VAGUS NERVE

00:28:55

Branches

1. Superior laryngeal nerve (on both sides)
2. Recurrent laryngeal nerve (on both sides)

- Left branch is longer
- Hooks under ligamentum arteriosum arch of aorta goes back into tracheo oesophageal groove
- Supplies larynx muscles laryngeal mucosa below VC
- Right branch is stays in neck

Previous Year's Questions

Q. Damage to external laryngeal nerve during thyroid Sx could result in the inability to

00:26:51

A. Relax the VC

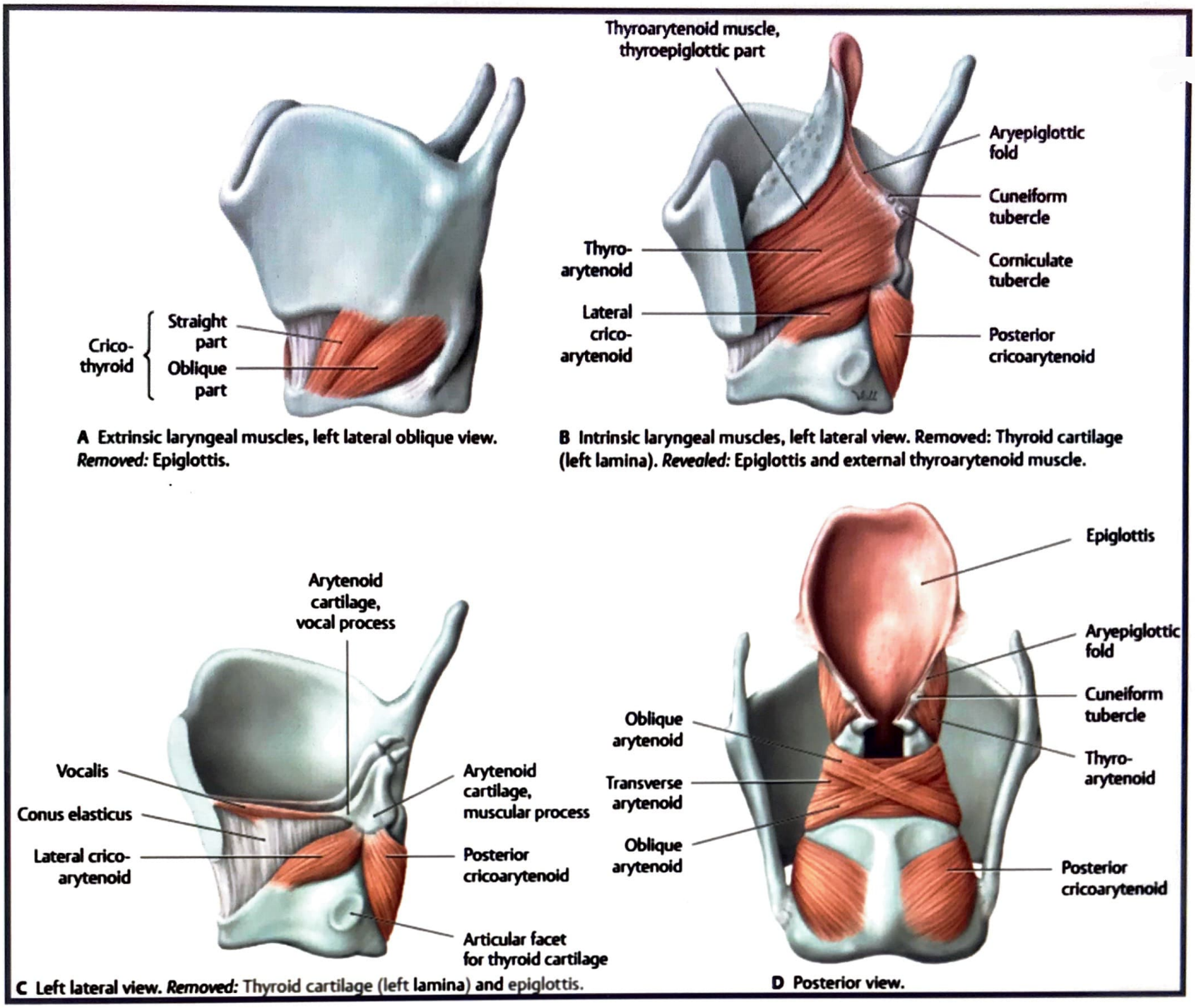
B. Tense the VC

C. Widen the rima glottidis

D. Abduct the VC

.Laryngeal Mucosa Supply

- Till the vocal cord/ upper surface of VC: Internal LN.
- Below vocal cord/form lower surface of VC: Recurrent LN
- Laryngeal Mucosa on Vocal Cord Supplied by: Internal LN.
- In Thoracic inlet syndrome: Lt recurrent laryngeal nerve is Involved



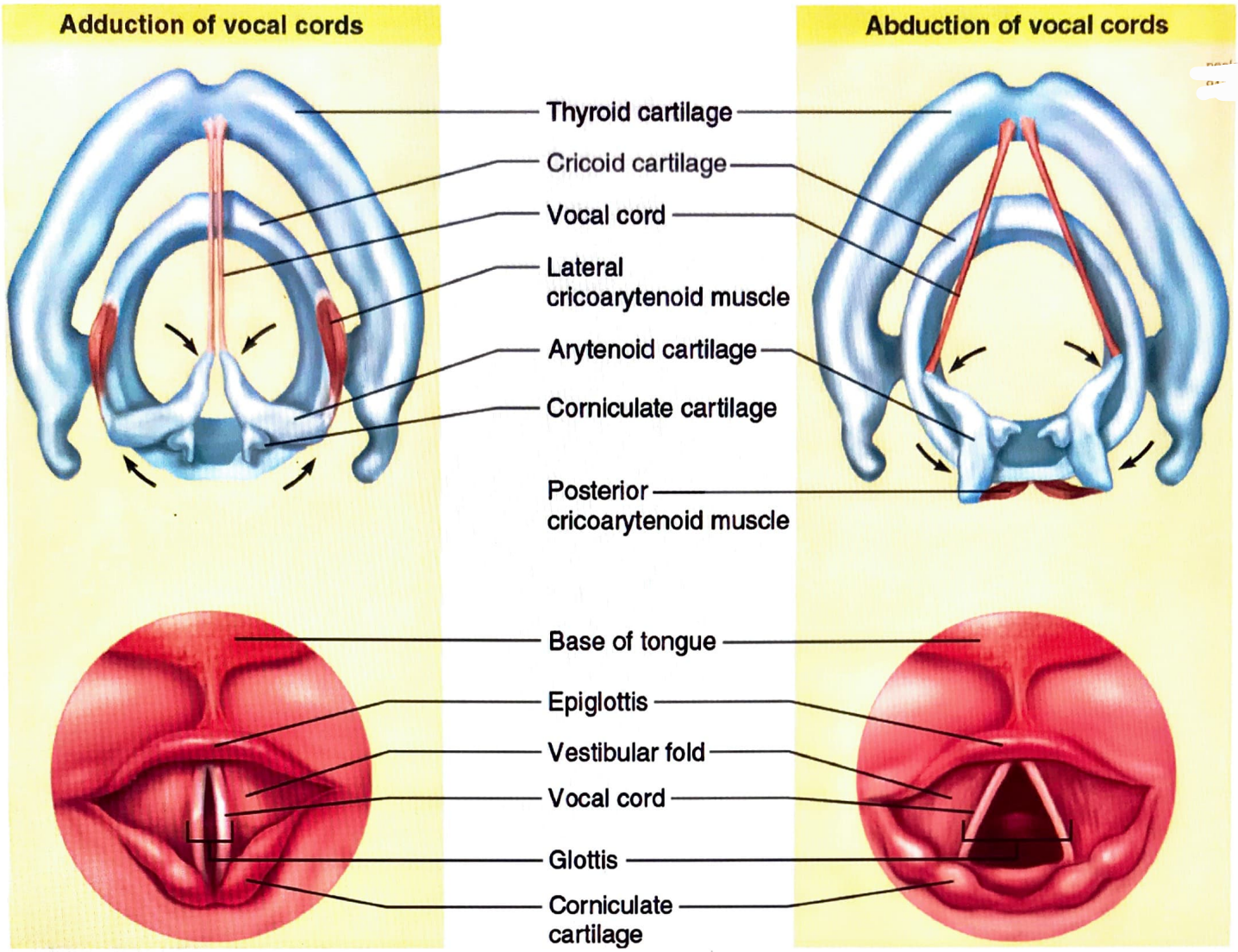
A Extrinsic laryngeal muscles, left lateral oblique view. *Removed:* Epiglottis.

B Intrinsic laryngeal muscles, left lateral view. Removed: Thyroid cartilage (left lamina). *Revealed:* Epiglottis and external thyroarytenoid muscle.

C Left lateral view. *Removed:* Thyroid cartilage (left lamina) and epiglottis.

D Posterior view.

Image 71.2


Adduction of vocal cords
Abduction of vocal cords
Thyroid cartilage
Cricoid cartilage
Vocal cord
Lateral cricoarytenoid muscle
Arytenoid cartilage
Corniculate cartilage
Posterior cricoarytenoid muscle
Base of tongue
Epiglottis
Vestibular fold
Vocal cord
Glottis
Corniculate cartilage

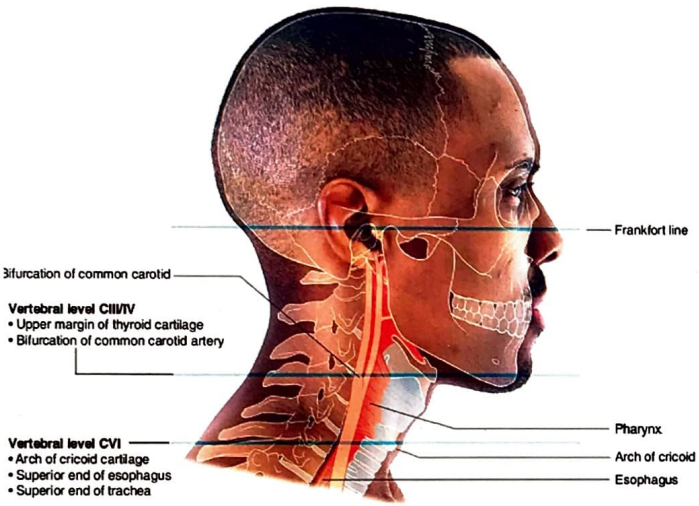
72 VERTEBRAL LANDMARKS

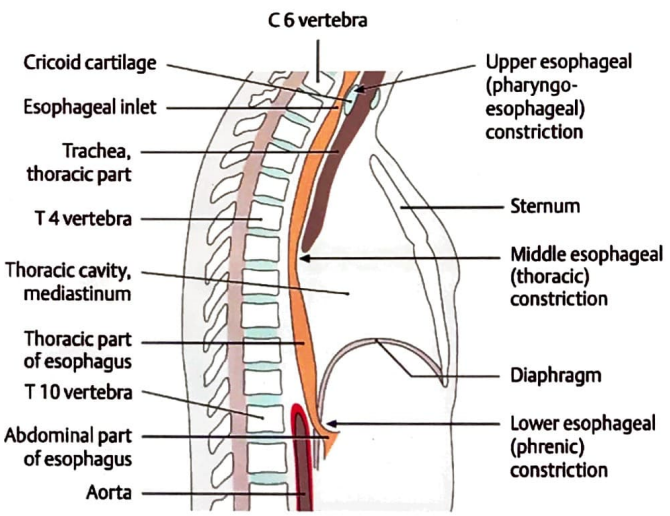
00:00:05

- **Common Carotid Artery:** bifurcates at sup. border of the lamina of the Thyroid cartilage of larynx
- CCA bifurcation: C_3
- Carotid body 8 carotid sinus: C_3
  - Carotid body tumor present here
  - CB massage done here

C6 LOWER BORDER

1. Cricoid cartilage
2. Cricopharyngeal sphincter
3. Ending larynx, pharynx
4. Beginning





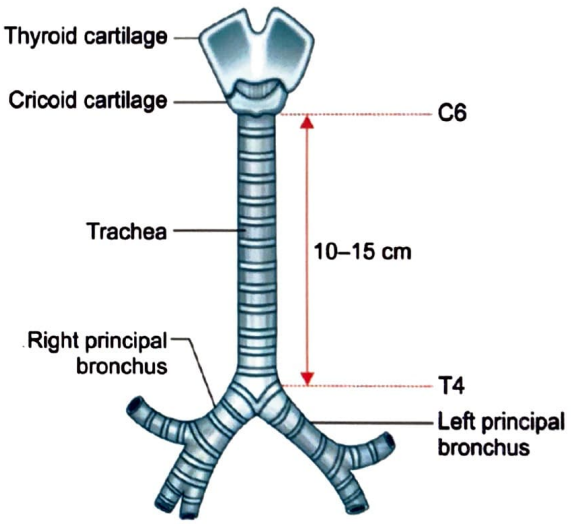
Larynx Extent

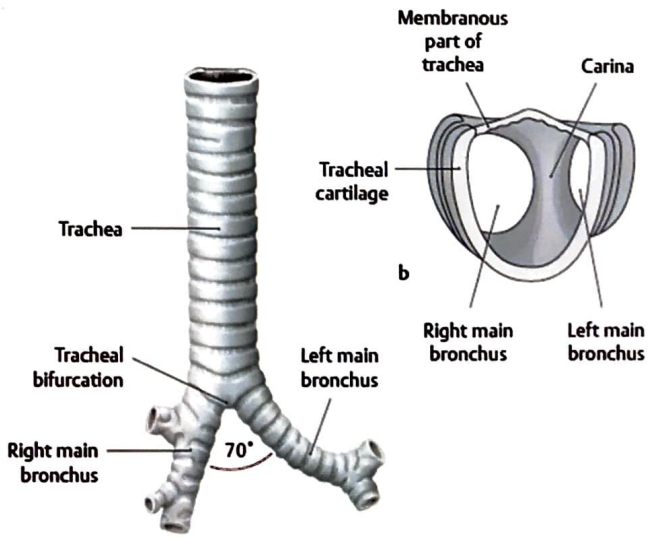
- Adult male: C3-C6
- Adult female: Still higher
- Infant while swallowing: reaches upto atlas vertebra

TRACHEA

00:05:20

- Length: Approx. 11 cm
- Bifurcatio
  - Disc b/w T4, T5 vertebra >
  - Upper border of T5 >
  - Upper border of T6 (deep anspiration)
  - Lower border of T4 (cadaver)
- 16-20 C: Shaped tracheal rings present in trachea



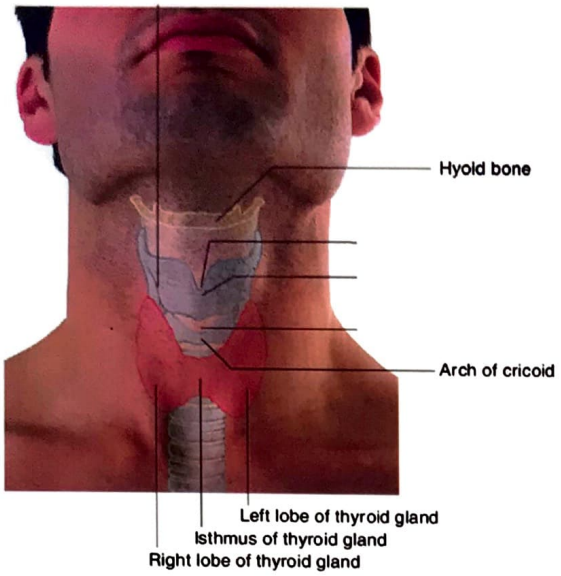


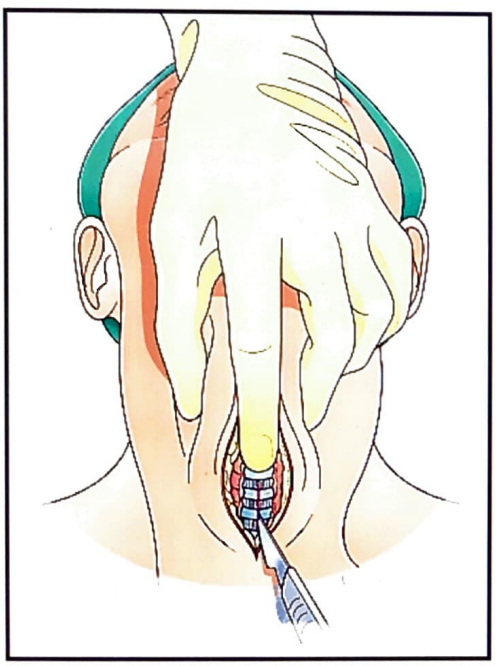
Carina

- Present at bifurcation (T4-T5 Vertebrae)
- Angle b/w right and left principal bronchus = 70

In Tracheostomy 00:18:05

- Isthmus thyroid gland to be cut in front of 2, 3, 4 > 2, 3 > 3 trachea rings
- C' 2&3 rings out

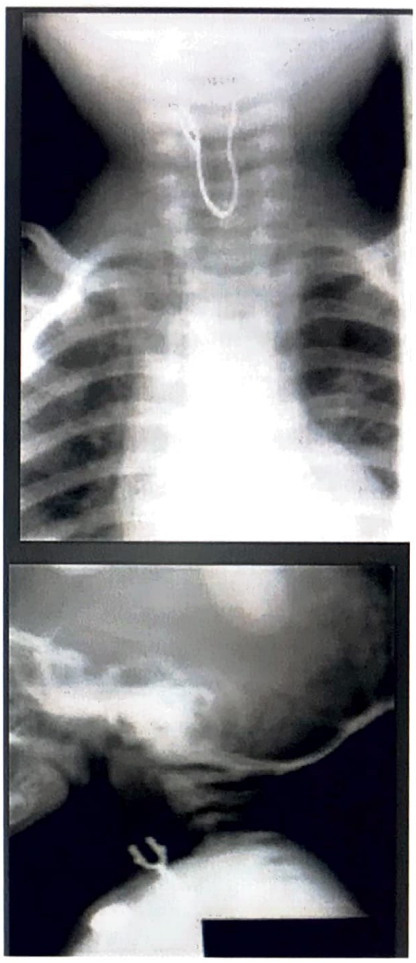




Previous Year's Questions

Q. Isthmus of thyroid gland overlies the
A. Ist tracheal ring
B. Ist & 2nd tracheal ring
C. 2nd, 3rd & 4th tracheal ring
D. 3rd & 4th tracheal cartilage

- Most of foreign bodies found at cricopharyngeal sphincter level
  - Common in children psychiatric patients
  - Length of oesophagoscope required is 15 cm

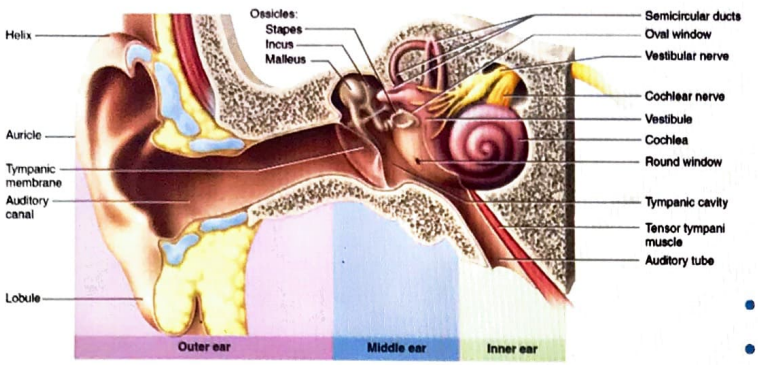


OESOPHAGUS

- Length: 25 cm
- Beginning: C6 lower vertebra
- Passing Diaphragm: T10

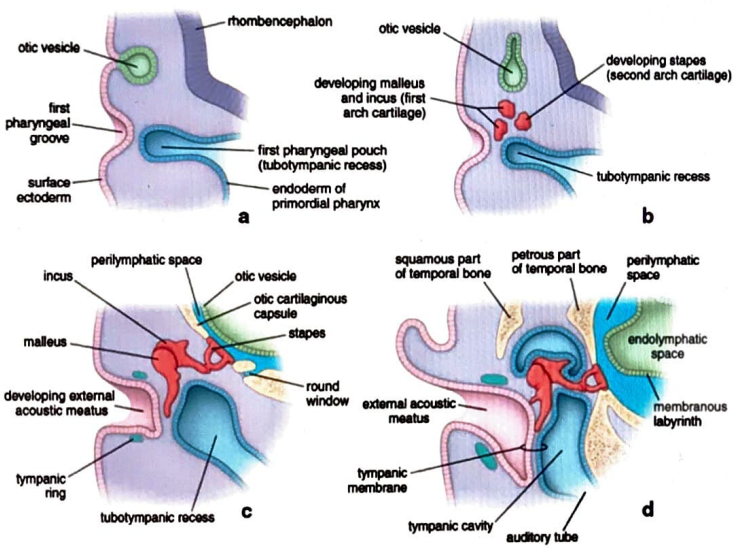
73 EAR

00:03:06



00:03:06

- Middle ear cavity formed by endoderm of pouch 1 (mainly) & 2 (partly) → Form middle ear cavity with epithelium
- Pharyngeal cleft 1 lined by surface ectoderm → Forms external auditory meatus



Embryology

- Neural plate ectoderm - CNS
- NCCs - PNS

Ectodermal placodes

- Distributed among surface ectoderm cell
- Forms some ganglia

- Forms OTICPLACODE on Day 20

OTIC PLACODE
↓
OTIC PIT
↓
OTIC VESICLES
↓
INNER EAR

- Inner Ear
- Formed in territory of hind brain (rhombencephalon)

a. Vestibule
   - Utricle } Comes from 1st arch (Meckel cartilage)
   - Saccule } (Secondary mesenchyme)

b. 3 Semi Circular Canals

c. Cochlea

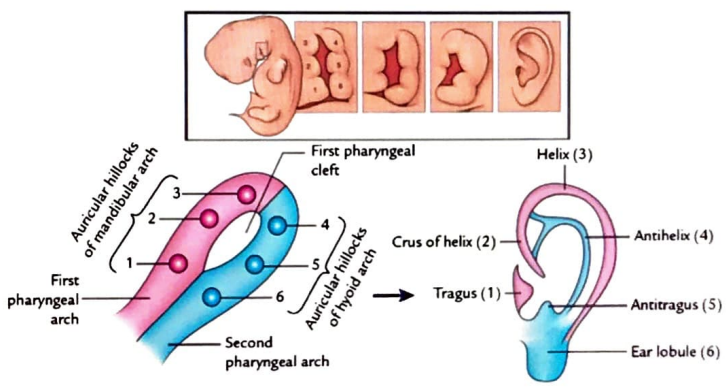
- Malleus
  Incus
- Stapes: Comes from 2nd arch (Reichert's cartilage) (sec.mesenchyme)
- Outer margin formed by otic cup/ vesicle
- Foot plate formed by NCCs sec, mesenchyme Reichert's Cartilage

Tympanic Membrane

- Outer epithelium: Ectodermal
- Inner epithelium: Endodermal
- Connective tissues: Mesodermal

Auricle Development

00:12:05



6 Auricular Hillocks

- Arch 1: gives 1st 3 auricular hillocks
- Arch 2: 4 gives next 3 auricular hillocks
- 1st Hillocks: Anterior part of auricle including tragus
- Next 3 Hillocks
  - Major portion of auricle
  - Outer part/ peripheral part
  - Ear lobule

NERVE SUPPLY

00:14:28

External Ear

1. Greater Auricular Nerve
- Greater part of auricle laterally and medially (lobule)

2. Lesser Occipital Nerve
- Supplies medial part of upper auricle

3. Auricle Temporal Nerve: Supplies tragus

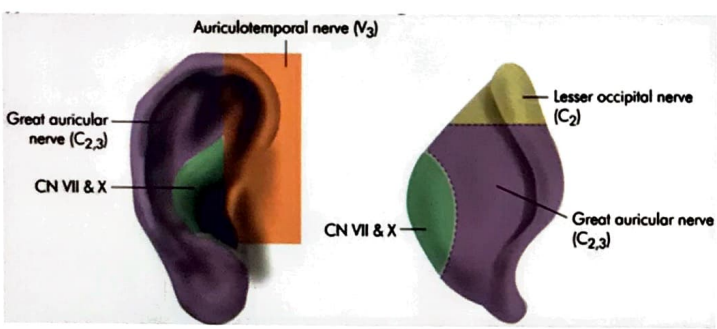
4. Ext. Auditory Meatus:
- Auricular br. of vagus
- Facial nerve carries it
  - Facial nerve injury carries loss of sensation here

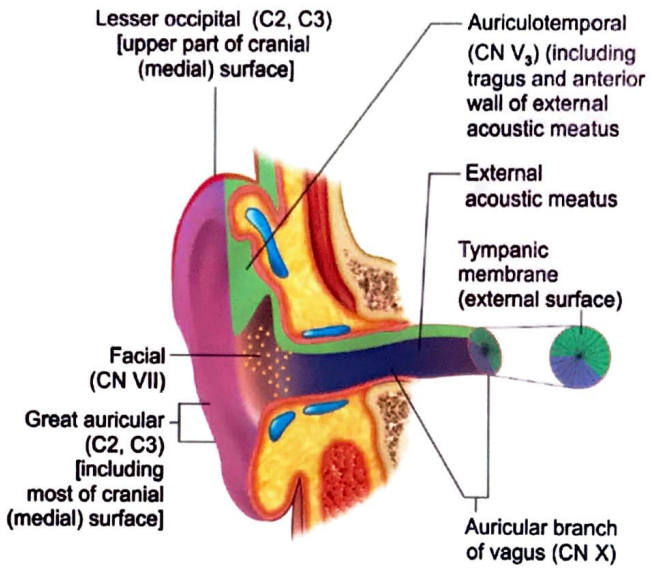
Auriculotemporal Nerve (V3) supplies

1. Tragus
2. Ant. Part of auricle
3. Temporal area

Greater Auricular Nerve (V3) Supplies

- Greater part of auricle
  - Laterally
  - Medially (lobule) (medial upper part by lesser auricular nerve)
  - Vagus supplies root





External Auditory Meatus

- Posterior wall & floor: Auricular br. of vagus
- Anterior wall and roof: Auricular temporal nerve

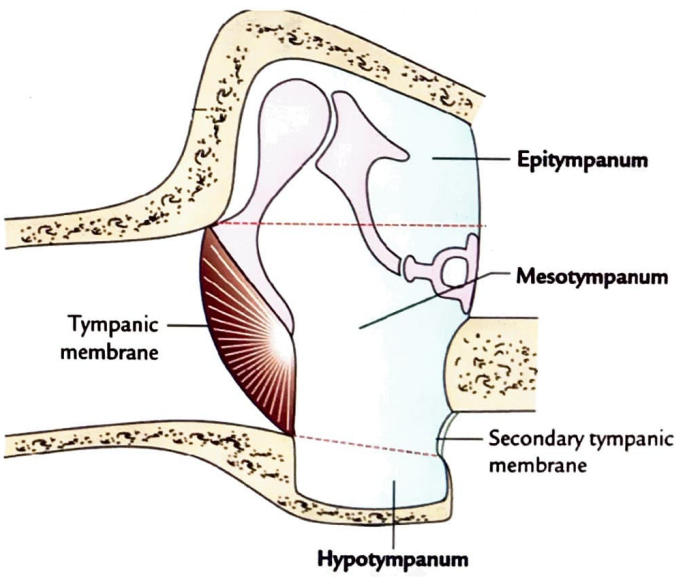
Tympanic Membrane

- Posterior wall & floor: Auricular br. of vagus
- Ant. Wall & roof: Auricular temporal nerve

MIDDLE EAR CAVITY

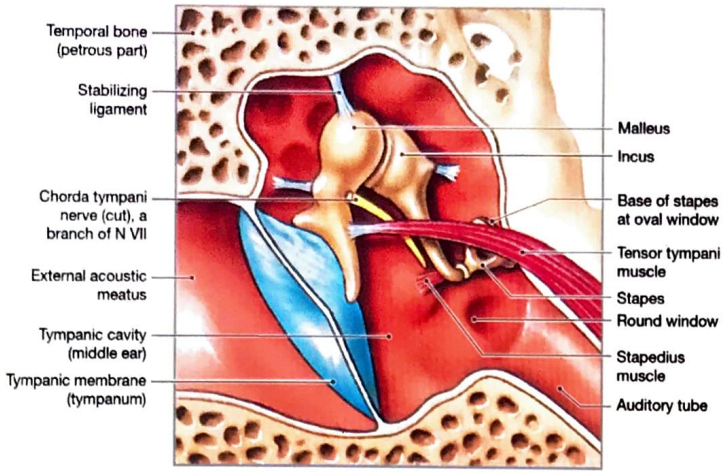
00:21:17

- Contains ossicles
- Divided into
  - Epitympanum (superior)
  - Mesotympanum (middle)
  - Hypotympanum (Inferior)



Epitympanum

- Largest part (6 mm)
- Contains most of malleus & incus
- Contains ossicles (most part) and tympanic membrane



Mesotympanum

- Narrowest part (2 mm)
- Contains stapes, pars tensa of TM

Hypotympanum (4 mm)

- Tensor tympani: dampens sound
- Stapedius
  - Dampens sound (pulls stapes back)
  - Injury to above muscle cause Hypercusis

Boundaries

- Roof: Tegmen tympani
- Posterior: Mastoid antrum
- Anterior: Et (nasopharynx)
- Medial: Cochlea (inner ear)

Facial Nerve Course

- Accompanied by vestibulo cochlear nerve
- Both enter internal auditory meatus
- Facial nerve takes a bend (EXTERNAL GENU) in the petrous part of temporal bone have geniculate ganglion
- Then gives 3 branches runs on medial wall Cora brief distance & then runs on posterior wall of MEC exits cranial cavity at stylomastoid foramen
- In MEC, it gives
  1. Greater petrosal nerve
     - Runs at floor of cranial cavity towards foramen lacerum and Joint with deep petrosal nerve (br. of T1 sympathetic plexus) & forms vidian nerve of pterygoid canal
  2. Nerve to stapedius
  3. Chorda tympani

Refer Diagram 73.1

Lesser petrosal nerve

- Accompanies greater petrosal nerve
- Carries preganglionic fibres towards parotid gland coming from tympanic plexus

Tympanic Plexus present on medial wall of MEC (Basal turn of cochlea producing elevation → Promontory)

- Supplies MEC, ET, mastoid antrum air cells, TM (inner surface)
- Contributed by
  - Tympanic Br. of Glosso pharyngeal nerve (main)
  - T1 sympathetic plexus around ICA
  - Branch from Geniculate ganglion

Roof

- By tegmen tympani
- Separates MEC from cerebrum [temporal lobe]
- Anterior/superior semi circular canal eminence
  - Arcuate Eminence at floor of cranial cavity
- Lateral SCC produces impression over medial wall of MEC, just above the course of facial nerve

Anterior wall structure

- ICA
- ET
- Tensor tympani

Medial Wall Structures

- Promontory
- Oval window (postero superior)
- Round window (postero inferior)

Foot plate of stapes fixed to oval window

↓

Vibrations of footplate of stapes

↓

Perilymph vibrations in scala vestibuli

↓

Continues as scala tympani

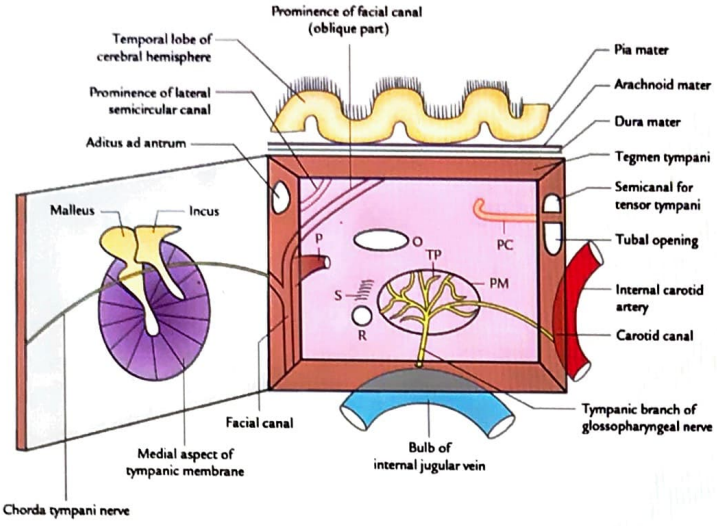
↓

Continues with round window (covered by 2 tympanic membrane)

- Slight course of facial nerve
- Raised elevation by lateral SCC

Posterior Wall Structures

- Mastoid antrum/aditus
- Facial nerve course
- Pyramid
- Tendon of stapedius muscle attaches here, Stapedius pulls stapes posteriorly (stapedial reflex) (prevent damage)

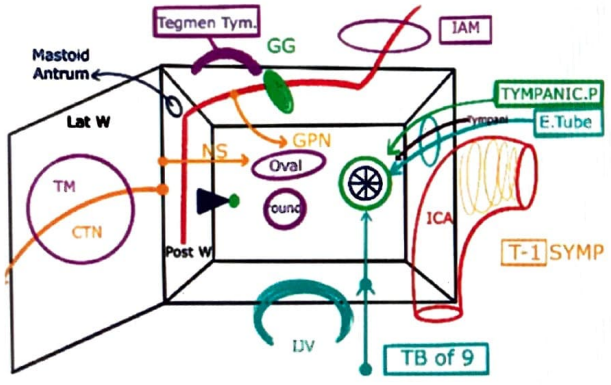


Lateral Wall Structure

- Tympanic membrane

Floor Structures

- Br. of CNIX
- Internal Jugular vein (continuation of sigmoid sinus (ghosted))

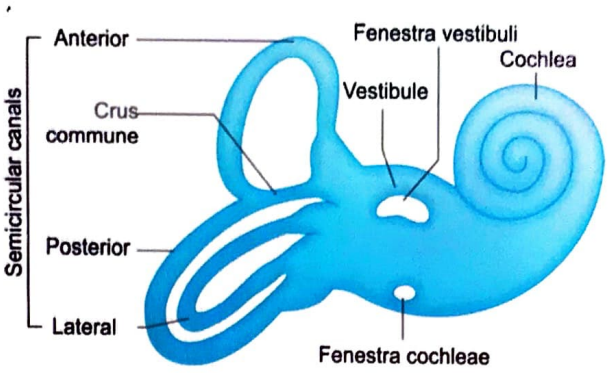


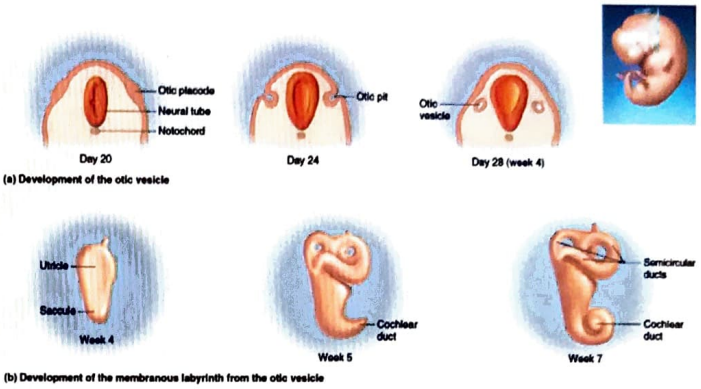
INNER EAR

00;45:48

Labyrinth

1. Outer Bony Labyrinth
2. Inner Membranous Labyrinth





BONY LABYRINTH

00;52:51

- Includes cochlea (anteriorly) vestibule (middle) SCC (posterior)

Cochlea

- Has 2.75 turns
  - Basal turn: Receive high frequency sound
  - Apical turn: Receive low frequency sound
- Spiral ganglion: Cochlear ganglion

Vestibule

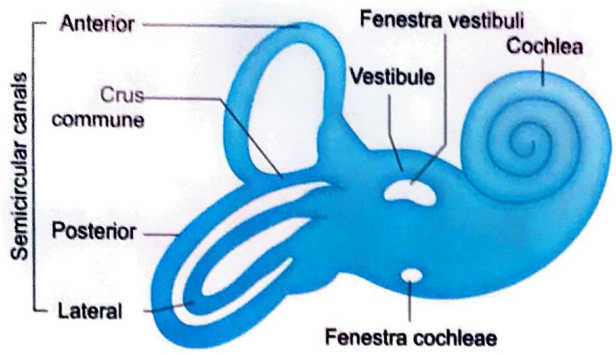
- Membranous labyrinth: Utricle & saccule
- Saccule connecting with cochlear duct
- Utricle connecting with SCC

Bony Labyrinth	Membranous Labyrinth
Cochlea	Cochlear duct
Vestibule	Utricle and Saccule
Semicircular canals	Semi-circular ducts

Membranous Labyrinth

00:59:00

- Cochlear duct
- Utricle
- Saccule



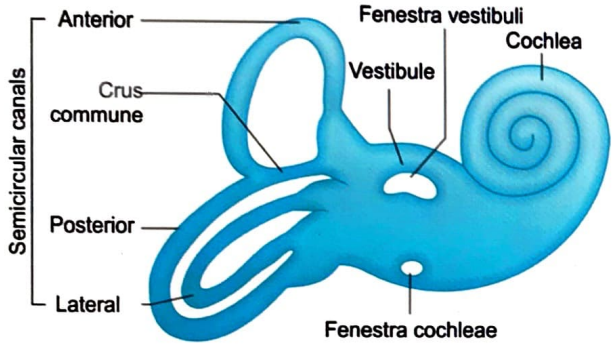
Endolymph and Perilymph

- Ultra-filtrate of blood
- Formed by capillary plexus
- Drains into extra dural venous plexus

Refer Diagram 73.2

Semi Circular Canal

- **L** - Lateral
- **A** - Anterior
- **P** - Posterior



- Communicate with utricle with 5 openings (ampulla)
- Ampulla have crista angularis (receptor Cor angular rotation)
- Macula receptor present in utricle saccule for linear/ static balance

Function

1. Equilibrium
   - vestibule → linear acceleration
   - SCC → Angular acceleration
2. Hearing: By cochlear nerve

Ductus Reunion

- Cochlear duct communication with saccule

Ductus Endolymphaticus

- Utricle communication with saccule

Saccus endolymphatus

- Sub dural > intra dural > Extra dural

Refer Diagram 73.3

INNER EAR- SOUND CONDUCTION 01:06:38

Foot plate of stapes fixed to oval window

↓

Vibrations of footplate of stapes

↓

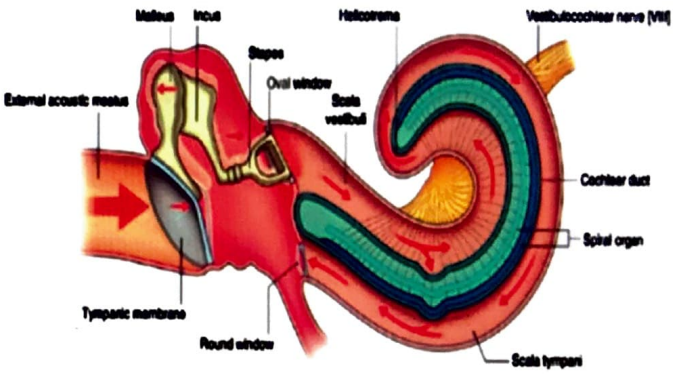
Perilymph vibrations in scala vestibuli

↓

Continues as scala tympani

↓

Continues with round window (covered by tympani membrane)



Scala Media

- Filled with endolymph
- Hair cells present here detects vibrations & passes information to cochlear nerve

ORGAN OF CORTI 01:14:55

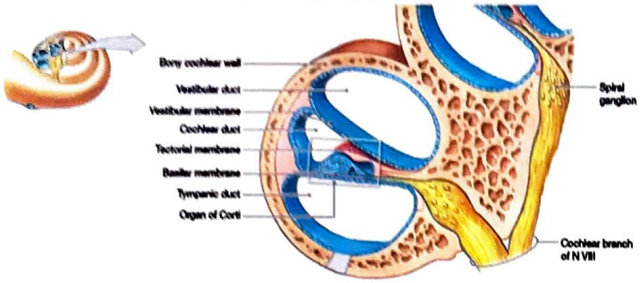
- Located at cochlear duct area
- Transducer
  - Changes mechanical energy —Electrical energy
- Contain Hair cells
- Contains Stereo Celia
  - Acts as transducers
  - Converts mechanical energy into electrical energy
- Types
  - Inner cells for sound production
  - Outer cells modulates the activity of inner cells

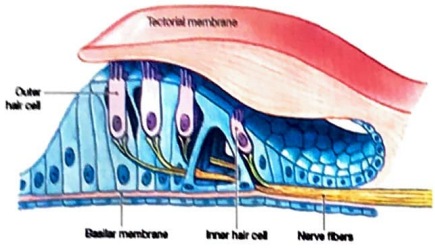
Cochlear Nerve

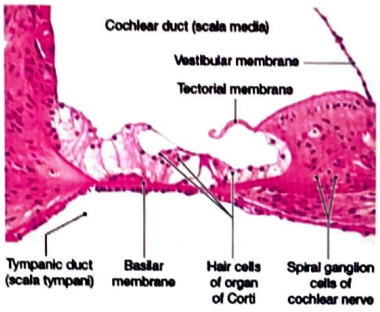
- Carry 95% of contribution from inner cells
- Carry 5-10% of contribution from outer cells

Stria Vascularis

- Secretes endolymph
- Endolymph receives vibration and moves tectorial membrane which stimulates hair cells







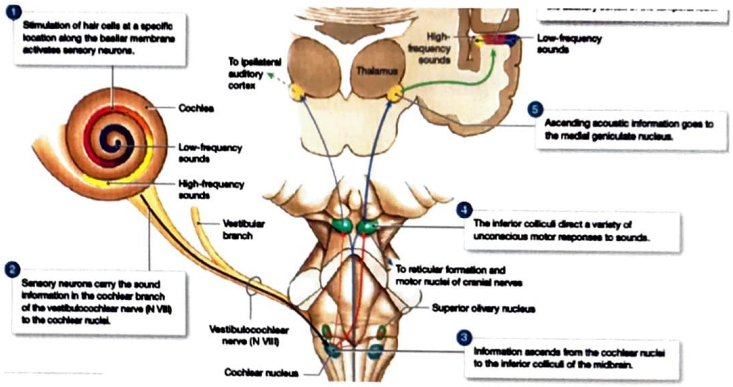
1. **Vestibular/Reisner Membranes:** separates scala vestibuli & scala media
2. **Basilar Membranes:** Separates scala media and scala tympani
3. **Tectorial Membranes**

Endolymph vibration
↓
Vibrates tectorial membranes
↓
Stereocilia Deviated
↓
Sound production

AUDITORY PATHWAY

01:27:40

Cochlea
↓
Spiral Ganglion
↓
Cochlear Nerve
↓
Superior Olivary N.
↓
Lateral of Lemniscus
↓
Inferior Colliculus
↓
Medial Geniculate Body
↓
Sub lentiform fibres of IC
↓
HESCHL/ superior Temporal Gyrus (41, 42)



- Stapedial reflex is controlled by superior olivary nucleus

Diagram 73.1

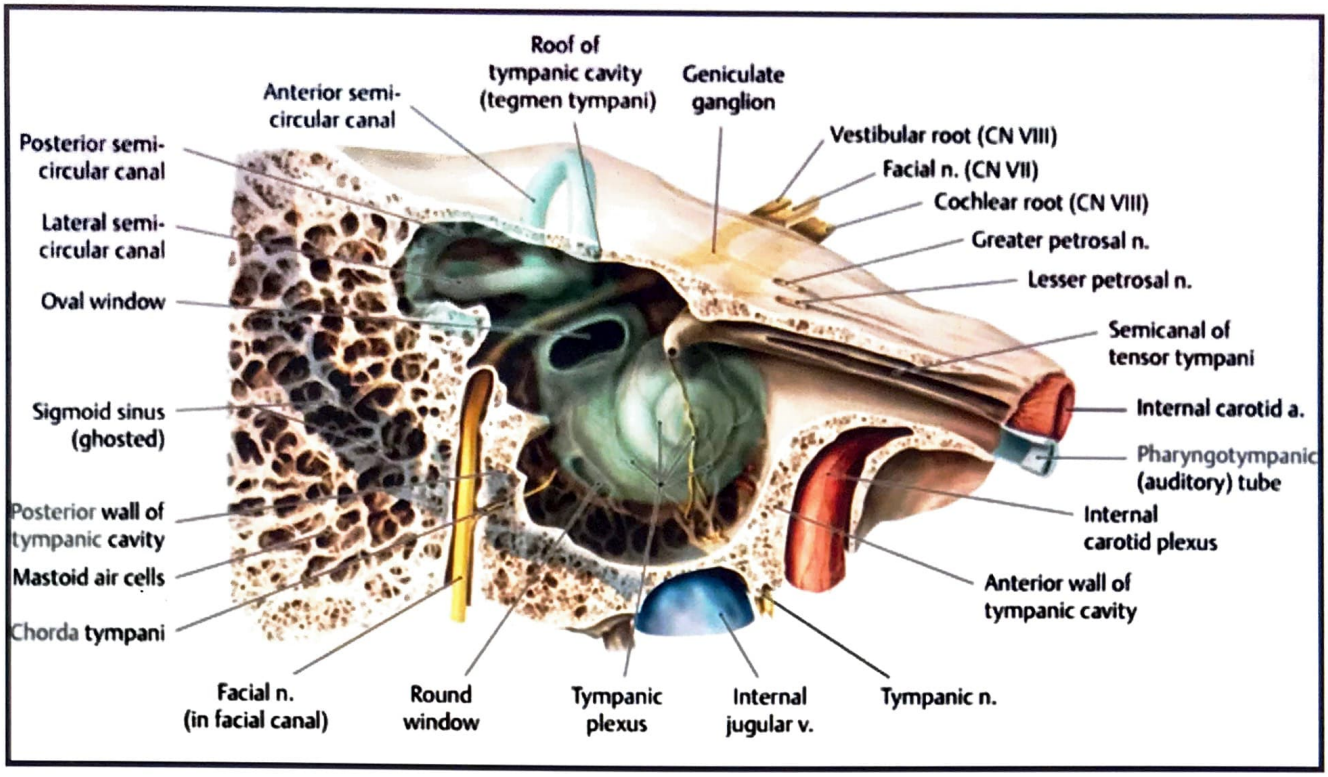
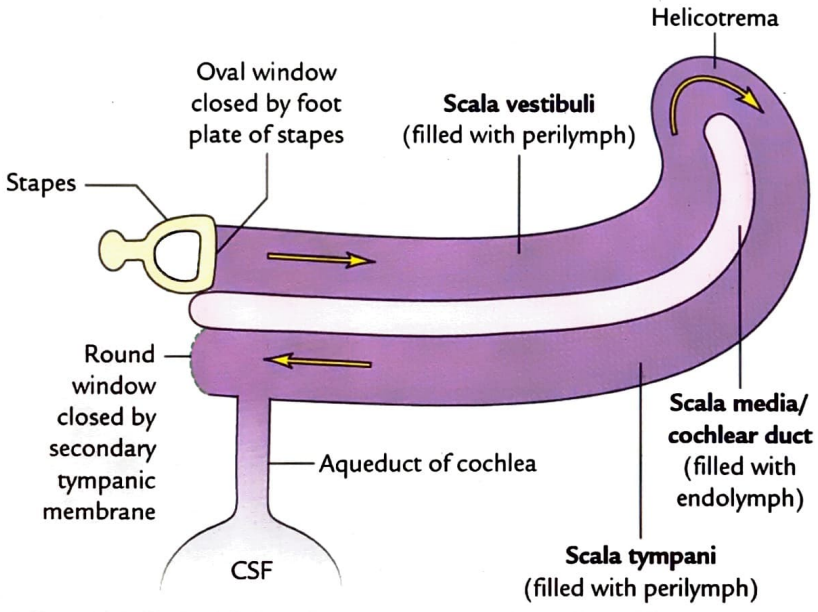


Diagram 73.2



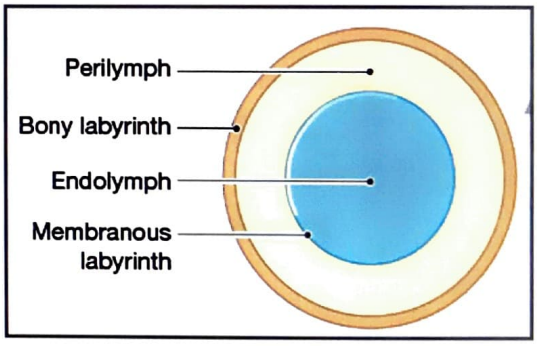
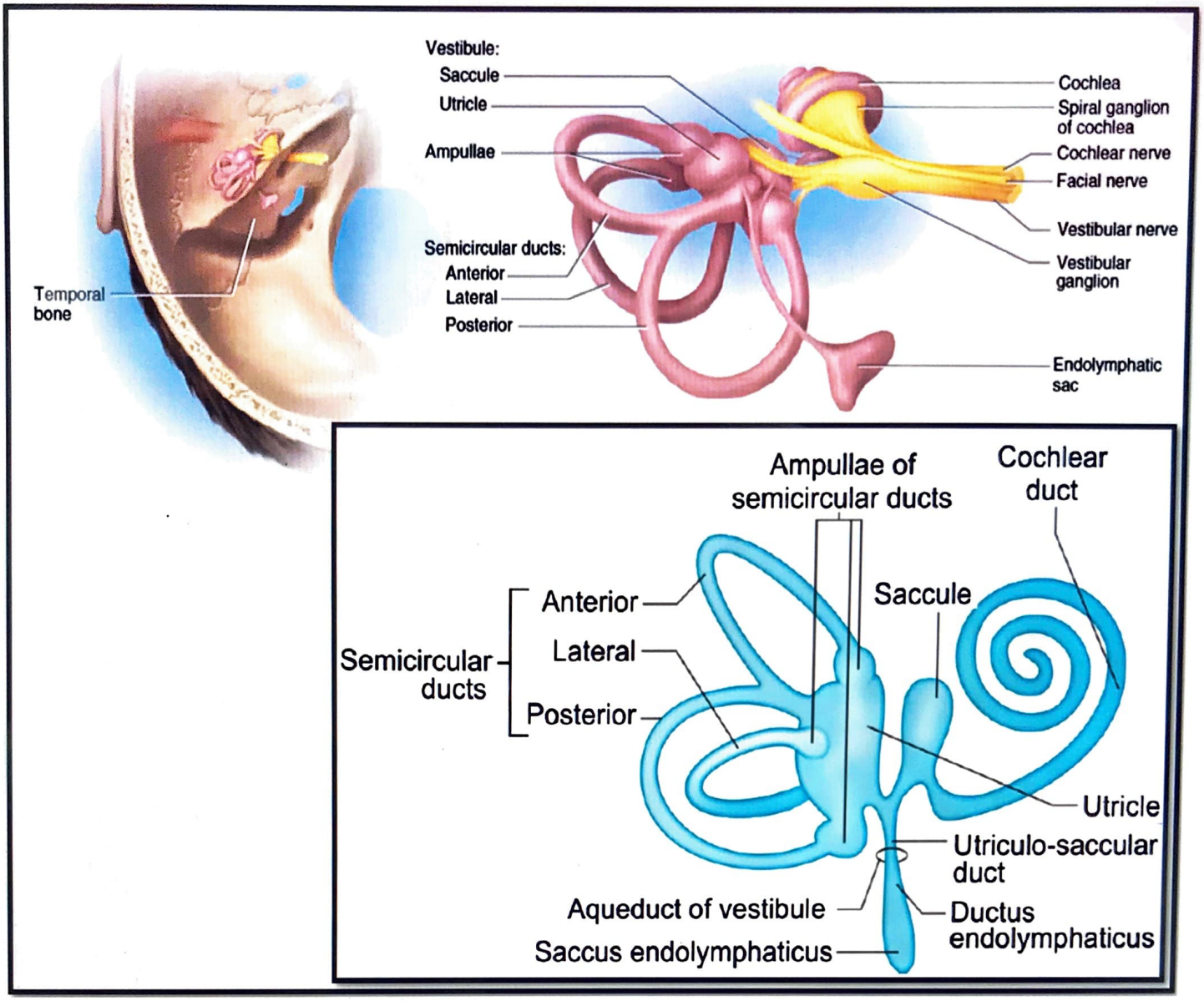


Diagram 73.3


Temporal bone
Vestibule:
Saccule
Utricle
Ampullae
Semicircular ducts:
Anterior
Lateral
Posterior
Cochlea
Spiral ganglion of cochlea
Cochlear nerve
Facial nerve
Vestibular nerve
Vestibular ganglion
Endolymphatic sac
Ampullae of semicircular ducts
Cochlear duct
Semicircular ducts
Anterior
Lateral
Posterior
Saccule
Utricle
Utriculo-saccular duct
Aqueduct of vestibule
Saccus endolymphaticus
Ductus endolymphaticus

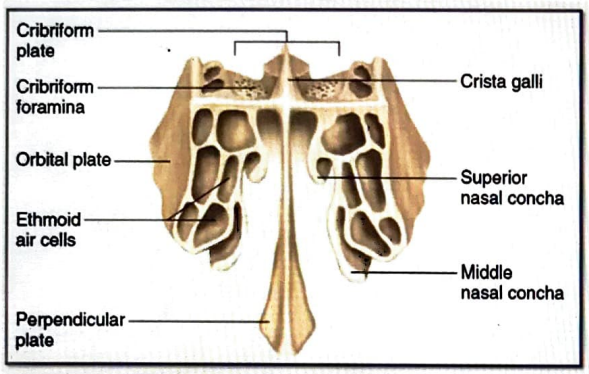
74 NOSE

BONES

00:00:57

1. Ethmoid Bone

- Hallow from inside
- Ethmoid air sinus present
- Forms medial wall of orbit (papery min)
- Orbit
  - Roof formed by frontal bone
  - Lateral wall by zygomatic bone
  - Floor by maxilla bone



2. Nasal Concha/ Turbinate

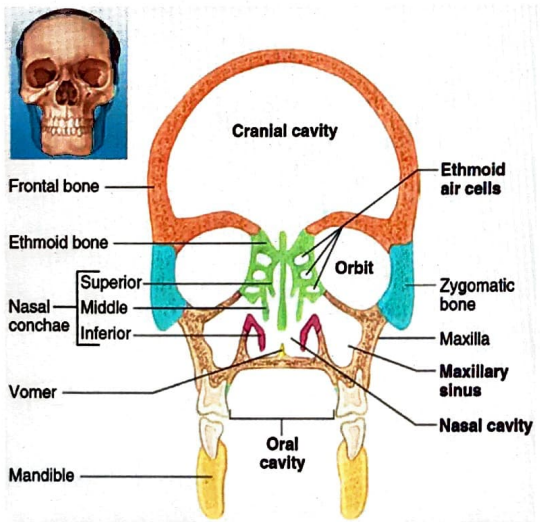
- Superior & middle turbinate
- Present in lateral wall of nose

3. cribriform of plate of ethmoid

- # at floor of ACF → CSF Rhinorrhea
- Passage of axons of olfactory nerve at the floor of ACF
- Forms roof of nose

4. Crista Galli

- Midline projection at the floor of ACF



5. Inferior Choncha

- Separate bone
- Articulate with maxilla bone
  - Forms floor & medial wall of orbit
  - Forms roof of oral cavity
- palate is formed by palatine & maxilla bone
  - Forms floor of nasal cavity

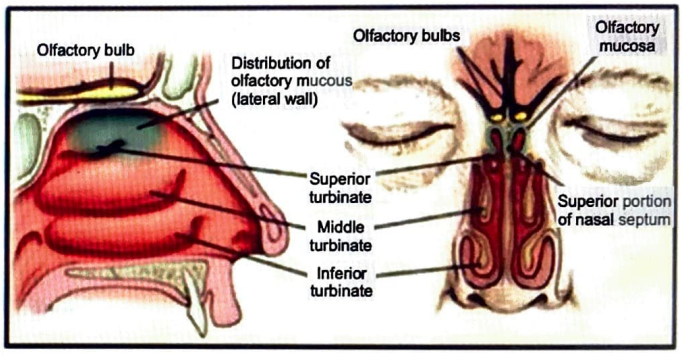
6. Perpendicular Plate of Ethmoid

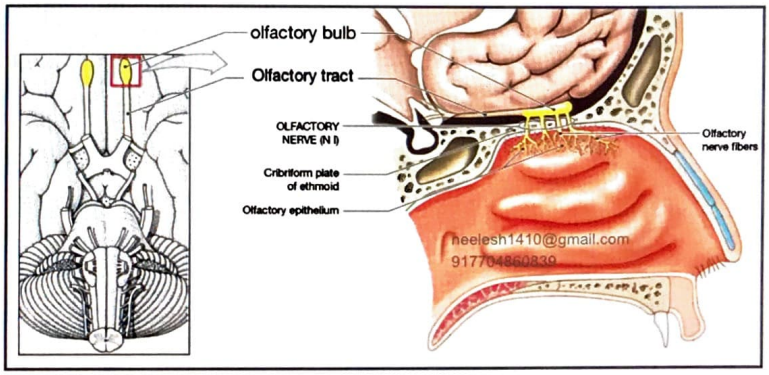
- forms nasal septum from above (vomer forms nasal septum from below)

7. Ethmoid Air Sinuses (Phenumatic bone)

OLFACTORY MUCOSA

- Nasal mucosa above the superior turbinate
- Olfactory neuron bodies present here





- Shortest cranial nerve: Olfactory N.
- Longest cranial nerve: Vagus N.

NASAL SEPTUM

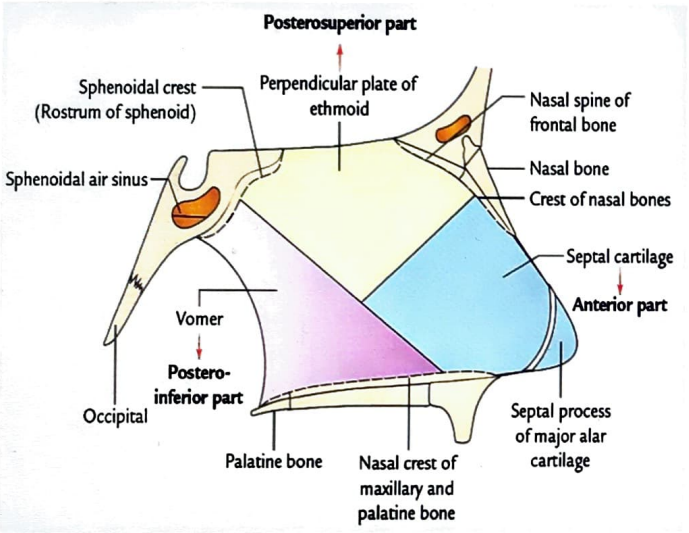
00:13:35

Previous Year's Questions

Q. Bony nasal septum if formed by all except
A. Vomer
B. Sphenoid
C. Ethmoid
D. Nasal spine of nasal nerve

Formed By

1. Perpendicular plate of ethmoid from above
2. Vomer from below
3. Nasal spine of frontal bone
4. Crest of nasal bone
5. Crest/ rostrum of sphenoid at the roof of nasal cavity
6. Nasal crest of maxillary & palatine bone



Schindylesis

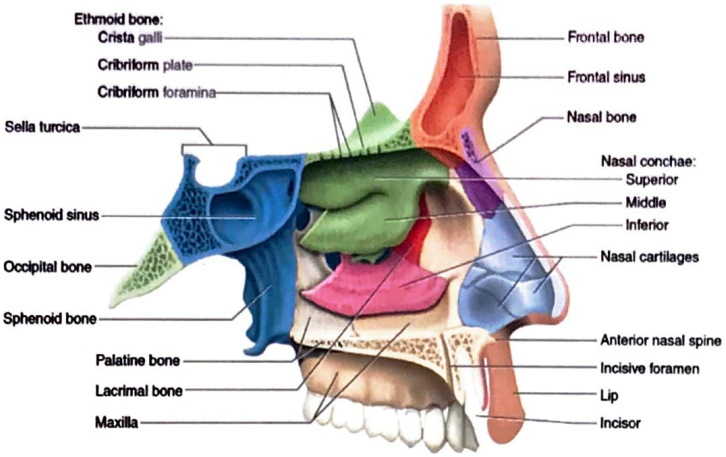
- Suture at the roof of nasal cavity
- Spheno vomeric joint
- Rostrum of sphenoid with Ala of vomer

LATERAL WALL

00:20:02

Bones

1. Middle Turbine comes from
2. Superior Turbine ethmoid bone
3. Inferior Turbine
   - Separate bone
   - Articulate with maxilla & lacrimal bone
4. Lacrimal Bone
5. Ethmoid Bone (labyrinth)
6. Maxilla Bone
7. Palatine Bone
8. Sphenoid Bone (medial pterygoid plate)
9. Nasal Bone
10. Uncinate process of ethmoid



- Largest turbinate: Inferior turbinate
- Largest meatus: Inferior meatus

Opening

1. At anterior end of inferior meatus → Nasolacrimal duct
2. Behind the nasal cavity & inferior turbinate & in nasopharynx → ET Opens
3. Hiatus semilunaris →situated in middle meatus
   - Openings of frontal sinus, maxillary sinus, Ethmoidal sinus
4. Sphenoid air sinus → Sphenoethmoid recess
5. Posterior ethmoidal sinus → Superior meatus
6. Anterior and middle ethmoidal sinus → Ethmoidalis bulla

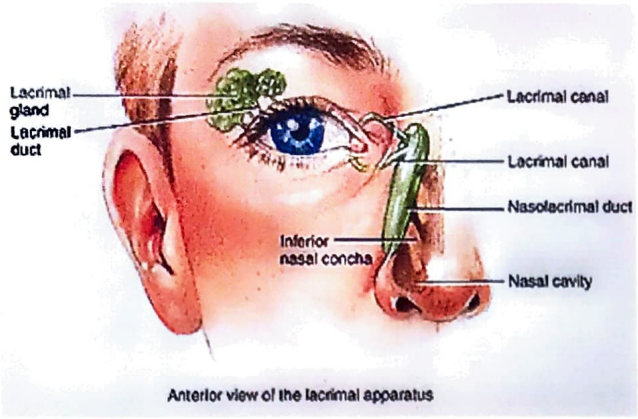
Previous Year's Questions

Q. All are true about the opening in the lateral wall of nasal cavity & nasopharynx except a. Nasolacrimal duct opens in the inferior meatus
A. Nasolacrimal duct opens in the inferior meatus
B. Posterior ethmoidal sinus open in the superior meatus
C. Inferior turbinate is a part of ethmoid bone
D. Eustachian tube open in nasopharynx behind the inferior turbinate

Direction of Nasolacrimal Duct

00:31:05

- Down ward
- Backward
- Lateral



Anterior view of the lacrimal apparatus

75 EYEBALL

Previous Year's Questions

Q. Ciliaris muscle if derived from 00:00:36
A. Neural crest cells (Better answer)
B. Neural plate ectoderm
C. Surface ectoderm
D. Mesoderm

DEVELOPMENT

00:06:25

Epiblast

1. 3 Germ Layers
- Endoderm
- Mesoderm (Primary)
- Ectoderm

2. NCCs (4th Germ layers)
- Sec. Mesoderm of Eye ball (most of eye ball)

Neural Plate Ectoderm

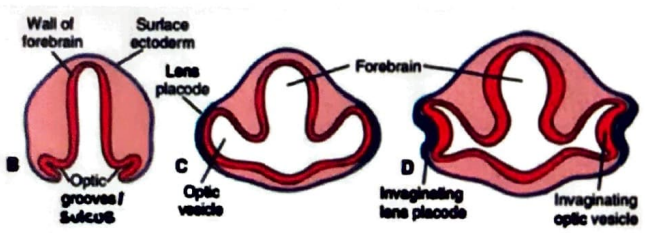
- CNS → Diencephalon
  - Retina
  - Optic Nerve

Epithelium of diencephalon

- Epithelium of ciliary body
- Epithelium of IRIS
- Muscles
  - Sphincter pupillae
  - Dilator pupillae

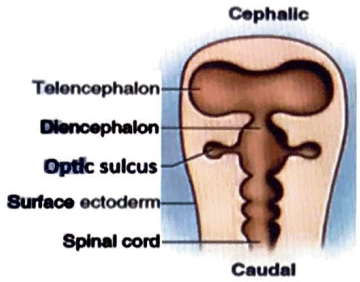
Surface Ectoderm

1. Cornea (1st layer)
2. Eye lens

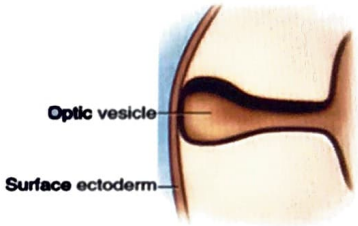


Diencephalon

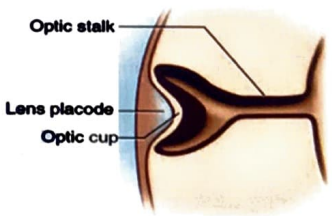
- optic groove/ sulcus → Optic vesicle → Optic cup
  - Retina
  - Optic nerve
- Surface Ectoderm: Cornea (I) & eye lens



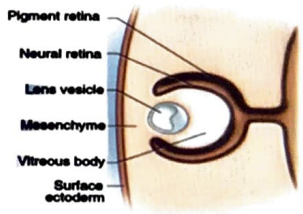
(a) Day 24



(b) Day 28



(c) Day 32



(d) Day 33

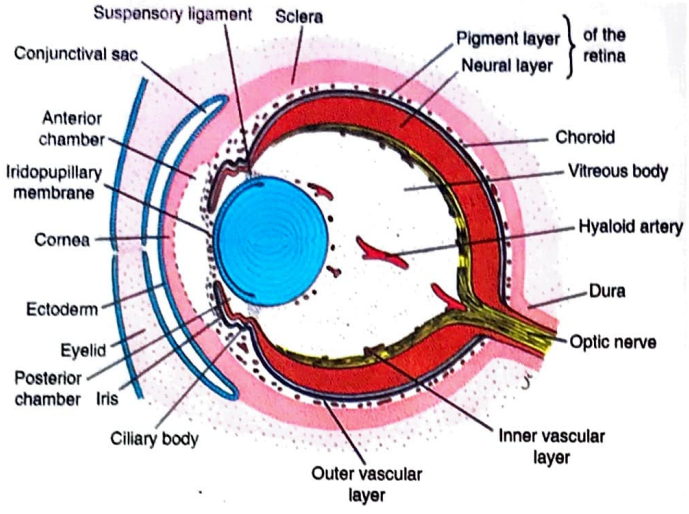
- Ora Serrata → Here neural layer becomes non neural
- Iris & Ciliary Body covered by non-neural epithelium & pigment epithelium
  - Sphincter pupillae & dilator pupillae derived from above epithelium

NCC (SECONDARY MESODERM) DERIVATIVES

Most of eye ball

- Connective Tissue

- All layers of cornea except 1st layer
- Vitreous
- Sclera, choroid
- Dura mate



Previous Year's Questions

Q. Corneal Endothelium develops from a. Neural crest cells

A. Neural Crest cells

B. Neural Plate ectoderm

C. Surface ectoderm

D. Mesoderm

OPTIC NERVE

00:23:32

- Not a true nerve, It is a TRACT
- Multiple Sclerosis
- Defects in oligodendrocytes (myelination affected)
- Optic nerve affected
- Peripheral nerves spaced (myelination by schwann cells)
- 3° Neuron
  - Rods & cones: 1 neurons
  - Bipolar cells; 2 neurons
  - Ganglion cells: 3 neurons
  - Optic nerve: 3 neurons

Refer Image 75.1

ORBIT

00:33:07

Bony Boundaries

- Roof
  - Frontal bone
  - Lesser wing of sphenoid with optic canal
- Lateral Wall
  - Zygomatic bone
  - Greater wing of sphenoid
- Floor
  - Maxilla (major contribution)
  - Zygomatic bone
  - Palatine bone (small piece)
- Medial Wall
  - Maxilla (most anterior)
  - Lacrimal bone
  - Ethmoid bone
  - Body of sphenoid

Refer Diagram 75.2

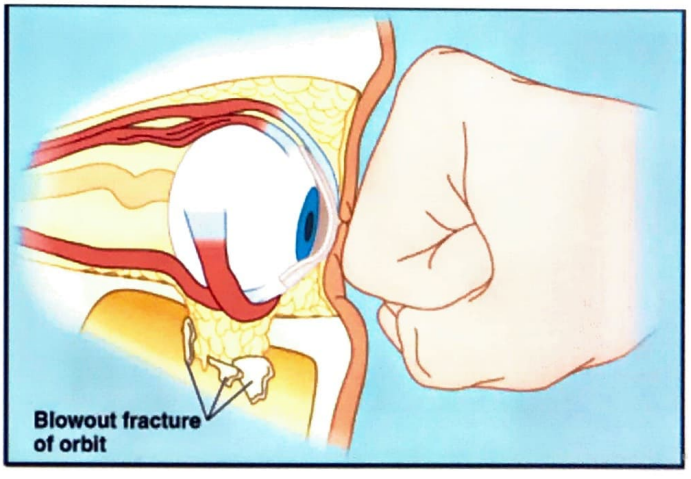
Structure	Location
• Inferior Orbital Fissure	• junction of lateral wall & floor
• Superior Orbital Fissure	• gap b/w lesser wing, greater wing of sphenoid
• Optic Canal	• present b/w less wing & body of sphenoid

Refer Diagram 75.3

BLUNT TRAUMA TO ORBIT (BLOWOUT FRACTURE OF ORBIT)

00:52:34

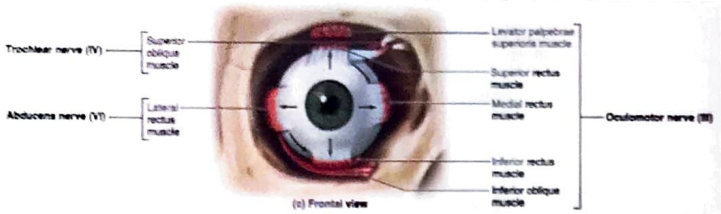
- Floor damaged
- Maxilla broken
- Protrustion of contents in maxillary sinus occurs
- Medial wall damaged
- Ethmoid bone also damaged



EYE BALL MUSCLES

00:53:22

- Skeletal muscles controlled by somatic nervous system
- All muscles are inserted on sclera



- Superior oblique muscle
- Inferior oblique muscle
  - Origin: Floor of orbit
  - Insertion: sclera
  - Passing under inferior rectus & inserts on sclera

Recti Muscles

- Medial rectus - Adduction
- Lateral rectus - Abduction
- Superior rectus - Elevation
- Inferior rectus - Depression

SIN

- Only superior muscles can do intorsion
- Superior muscles

1. Superior obligue
2. Superior rectus

- Intorsion: Inwards rotation

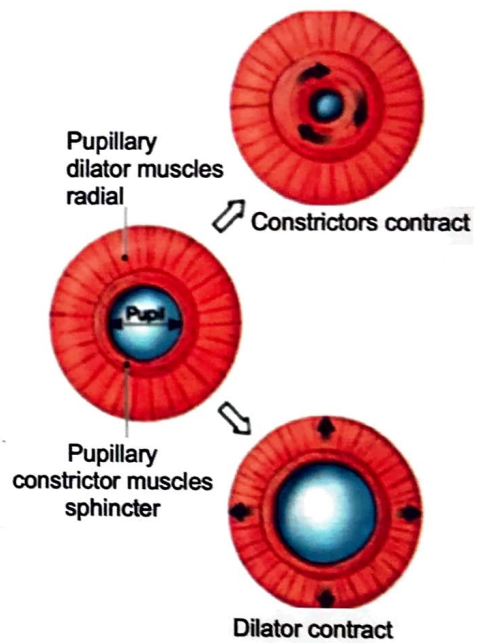
00:58:05

Muscles	Action	Movement
Superior Rectus	Elevation, abduction, intorsion	Up, Inside and intorsion
Superior oblique	Depression, abduction, intorsion	Down, out and intorsion

- Superior rectus & superior oblique are antagonistic except for intorsion
- Superior oblique muscle synergistic with
  - Superior rectus in intorsion
  - Lateral rectus in abduction
- Superior rectus muscle synergistic with medial rectus in abduction
- Superior rectus & superior oblique antagonistics except for intorsion
- Superior oblique & inferior oblique are antagonistics except for abduction
- superior rectus & inferior rectus are antagonistics except for abduction
- Both obliques are abductors
- All recti are adductors except lateral rectus (abductors)

Iris muscles

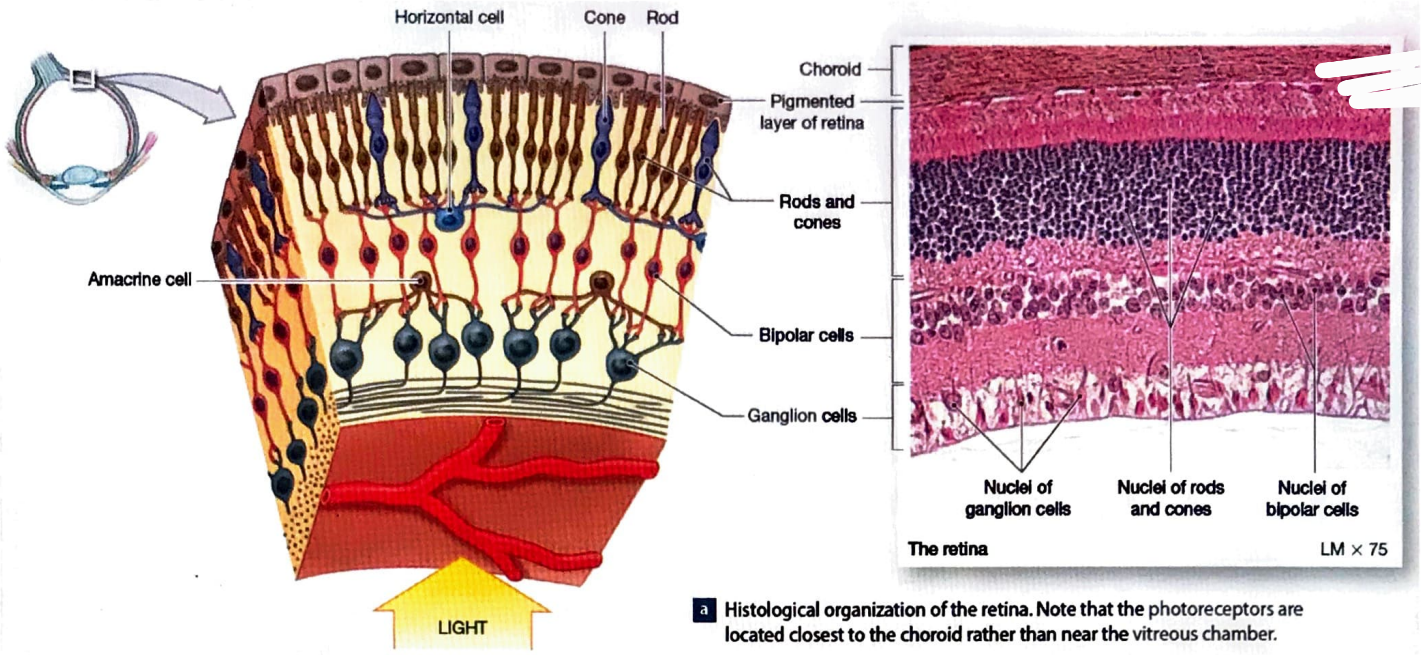
- Smooth muscles controlled by ANS
- Dilator Pupillae
  - Fibres are arranged radially
  - Controlled by T1 sympathetic fibres
  - Adrenergic muscle causes mydriasis
- Sphincter Pupillae
  - Concentric fibres controlled by parasympathetic system cholinergic muscles causes miosis



Levator Palpebrae superiors

- Skeletal part
  - Supplied by CN3
  - Injury leads to complete ptosis
- Muller muscle (Superior Tarsal Muscle)
  - Smooth muscle
  - Elevated the eye lid
  - Supplied by T1 sympathetic fibres
  - Compromised in Horner syndrome (partial ptosis)

Diagram 75.1



a Histological organization of the retina. Note that the photoreceptors are located closest to the choroid rather than near the vitreous chamber.

Diagram 75.2

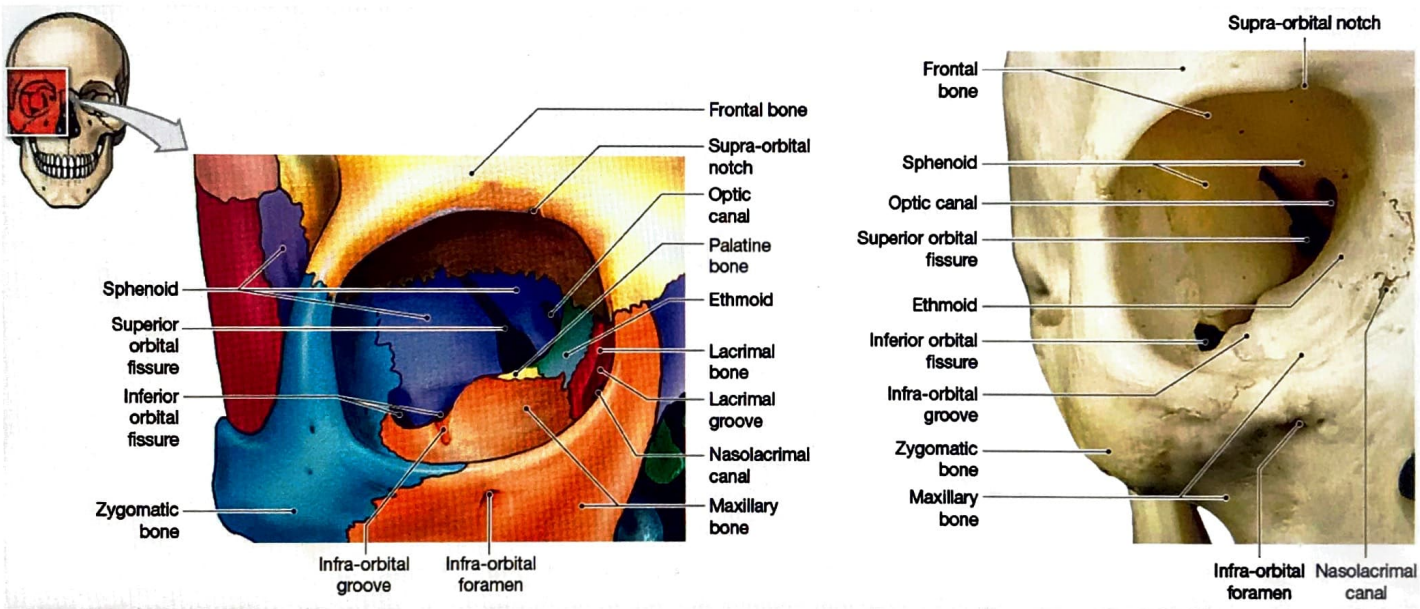
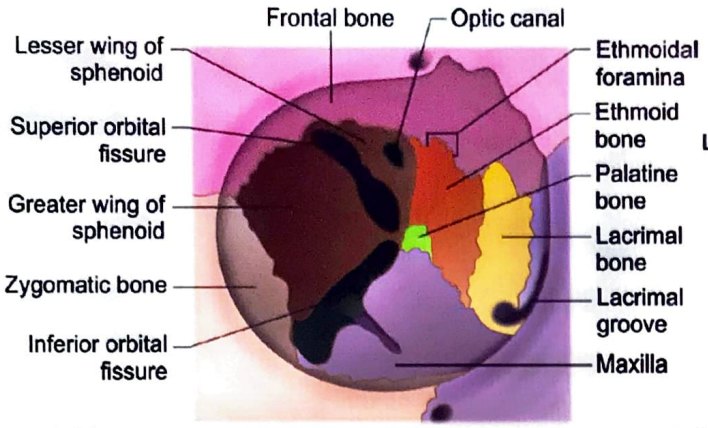
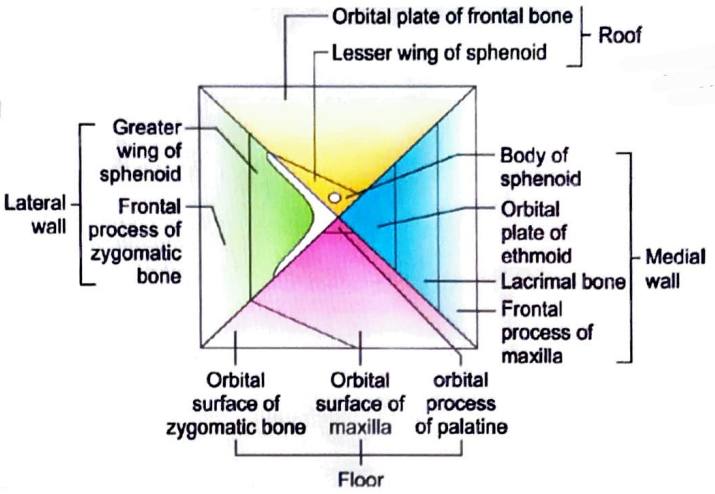


Diagram 75.3

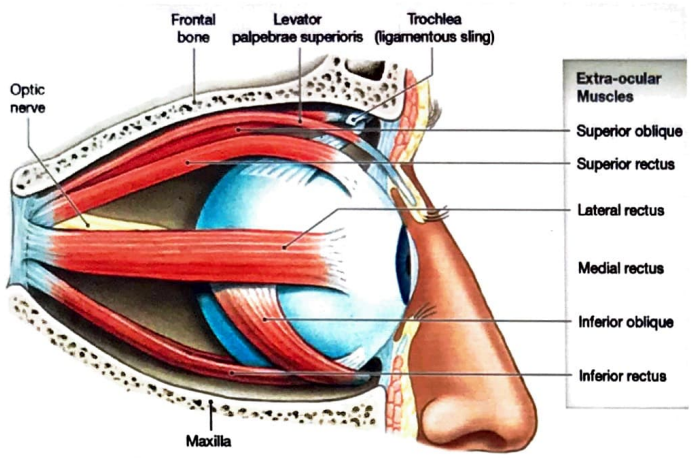

Frontal bone
Optic canal
Lesser wing of sphenoid
Superior orbital fissure
Greater wing of sphenoid
Zygomatic bone
Inferior orbital fissure
Ethmoidal foramina
Ethmoid bone
Palatine bone
Lacrimal bone
Lacrimal groove
Maxilla


Orbital plate of frontal bone
Lesser wing of sphenoid
Roof
Greater wing of sphenoid
Frontal process of zygomatic bone
Lateral wall
Body of sphenoid
Orbital plate of ethmoid
Lacrimal bone
Frontal process of maxilla
Medial wall
Orbital surface of zygomatic bone
Orbital surface of maxilla
orbital process of palatine
Floor

76 CRANIAL NERVES: 3,4,6

00:00:01

- Common tendinous ring of zinn common origin of all 4 recti
- Inferior oblique muscle passes under Inf. rectus & deep to lateral rectus & inserts on sclera



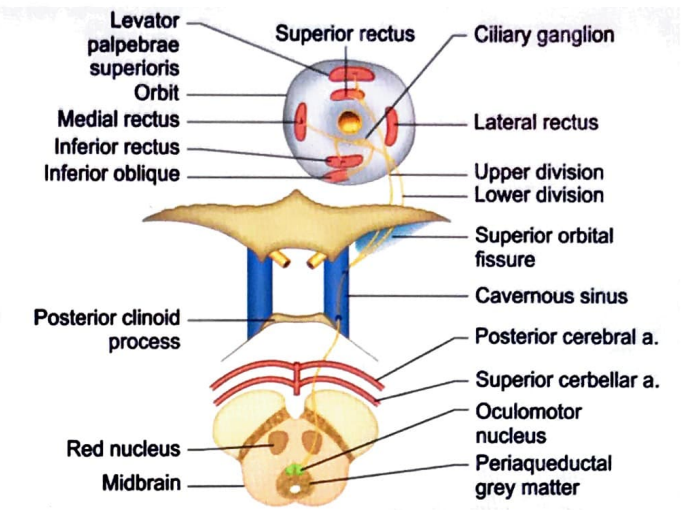
- CN 3,4: comes from midbrain
- CN 6: Comes from ponto medullary junction near the midline
  - Trochlear Nerve: Supply superior oblique muscle
  - Abducent Nerve; supply lateral rectus
  - Occulomotor Nerve
- Superior division: supply superior rectus
- Inferior division: supply inferior rectus
  - Trochlear nerve passes outside the ring of zinn
  - CN3, 6 passes inside the ring of zinn

OCCULOMOTOR NERVE (CN 3)

00:13:14

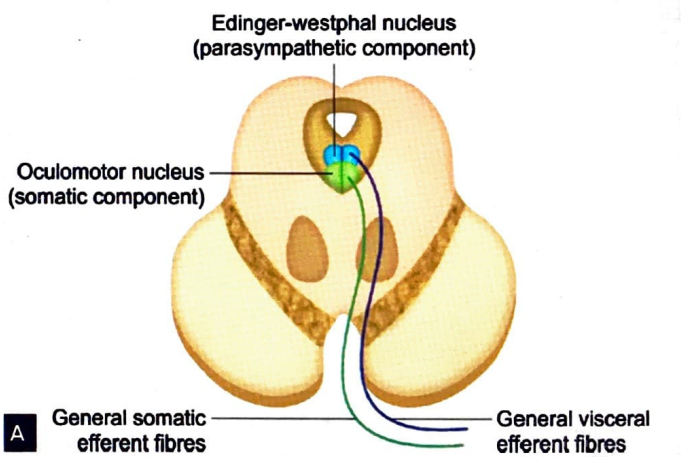
Course

- Comes from midbrain at the level of superior colliculus (periaqueductal grey)
- Passes b/w superior cerebellar post. cerebral arteries
- Becomes content o? cavernous sinus (lateral wall)
- Exits through superior orbital Qissure (2 division)
- Reaches orbit supply eyeball muscles (except superior oblique & lateral rectus)

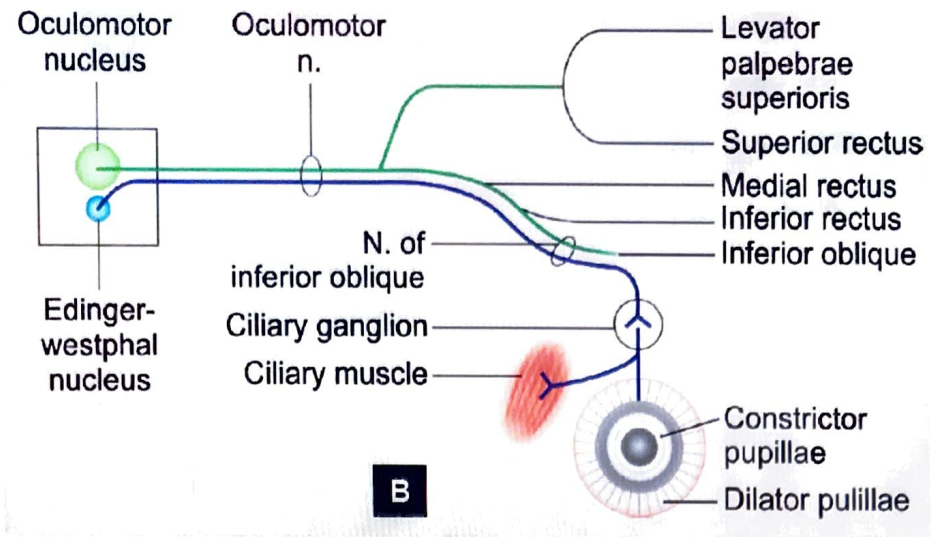


Edinger Westphal Nucleus

- Para sympathetic component
- Controls
  i. sphincter pupillae (light reflex)
  ii, ciliaris (accommodation reflex)



- GVE
- Sends pre ganglionic fibres to ciliary ganglion post ganglionic fibres carried by br. Of trigeminal nerve supply sphincter papilla and ciliaris


Oculomotor nucleus
Oculomotor n.
Levator palpebrae superioris
Superior rectus
Medial rectus
Inferior rectus
Inferior oblique
N. of inferior oblique
Ciliary ganglion
Ciliary muscle
Edinger-westphal nucleus
Constrictor pupillae
Dilator pulillae
B

CLINICAL QUESTIONS

Triangles of Neck

Q. The triangles of the neck are topographic areas of the neck bounded by the neck muscles. The carotid triangle is an important division of the anterior set of triangles, with multiple important structures passing through it. It is bounded posteriorly, by:-

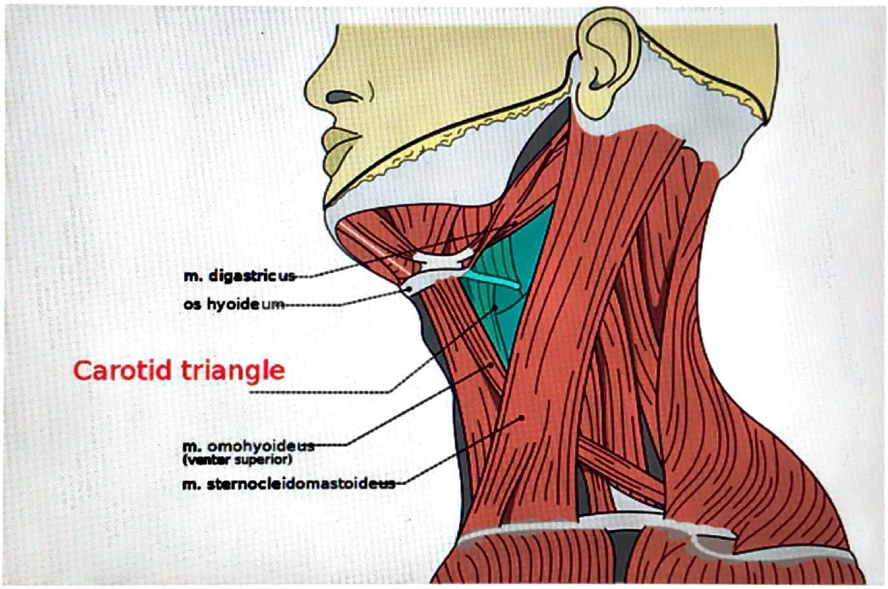
A. Superior belly of omohyoid
B. Posterior belly of digastric
C. Sterno hyoid
D. Sternocleido mastoid

Answer: D

Solution

Boundaries of the carotid triangle

- IN FRONT & ABOVE- Posterior Belly of Digastric and Stylohyoid Muscle.
- IN FRONT & BELOW- Superior Belly of Omohyoid.
- BEHIND- Anterior Border of Sternocleidomastoid.



Reference: Gray's Anatomy 41st edition / page. 444

LEARNING OBJECTIVES

UNIT 6 BACK REGION

- **SPINAL CORD TERMINATION**
  - Stages Of Spinal Cord Termination

- **SPINAL CORD ENLARGEMENTS AND SPACES**
  - Enlargements
  - Lumbosacral enlargement
  - Filum terminale

- **VERTEBRAE**
  - Body
  - Vertebral Canal
  - Transverse Process
  - Superior Articular Facet Direction
  - Foramen Transversarium

- **LUMBAR PUNCTURE**
  - Ligaments That Are Associated With Vertebra
  - Ligaments That Are Punctured
  - Procedure

- **VERTEBRAL CURVATURE AND SLIP DISC**
  - Curvatures
  - Slip Disc Between L4 & L5

- **CRANIO VARTEBRAL JOINTS**
  - Atlas (C - 1) Vertebra
  - Axis (C - 2) Vertebra
  - Atlanto Axial Joint

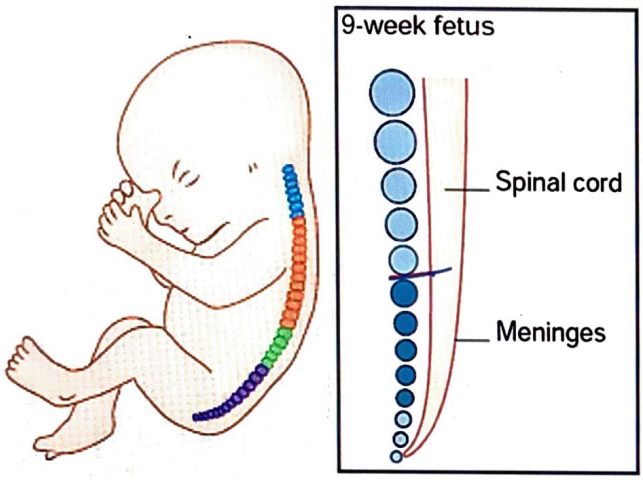
- **VERTEBRAL LANDMARKS AND TRIANGLES**
  - Scapula
  - Triangles
  - Lower Lumbar / Petit's Triangle

77 SPINAL CORD TERMINATION

Previous Year's Questions

Q. In a neonate spinal cord ends at?
(FMGE june 2017, dec 2018)

A. Lower border of T_{12}
B. Lower border of L_1
C. Lower border of L_3
D. Upper border of L_3

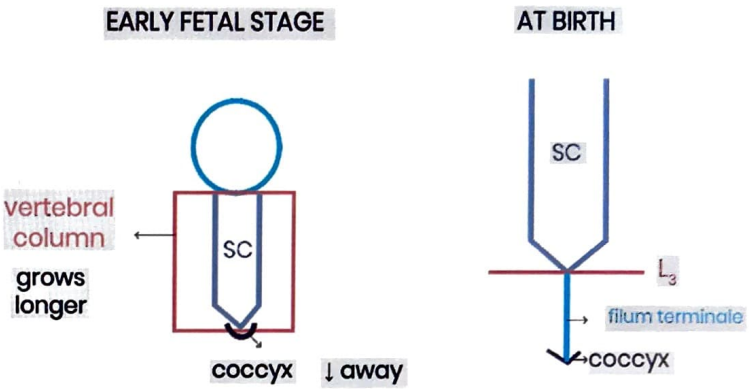


At Birth

- Spinal cord level is at → Upper border of L_3 vertebra
- Coccyx bone attaches spinal cord with filum terminale (collagen fibres)

Adult Level

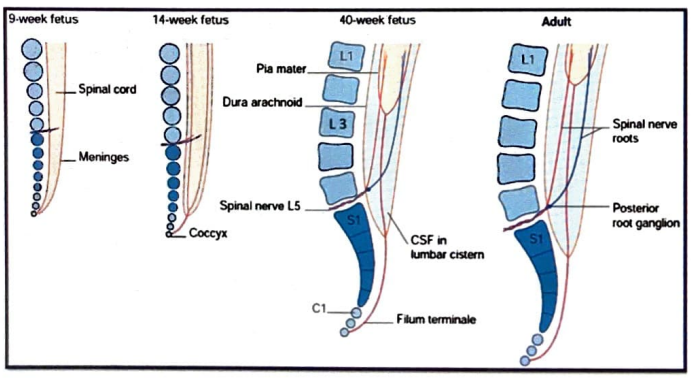
- Trans pyloric plane → Lower border of L_1
- < 2 yrs after birth, it reaches adult level



STAGES OF SPINAL CORD TERMINATION

Early Fetal Stage

- Length of spinal cord = length of vertebral column
- Spinal cord fuse with coccyx bone
- Relative faster growth of vertebral column
  - Vertebral column attains - 60 cm
  - Spinal cord attains - 45 cm



78 ENLARGEMENT & SPACES

ENLARGEMENTS

00:00:22

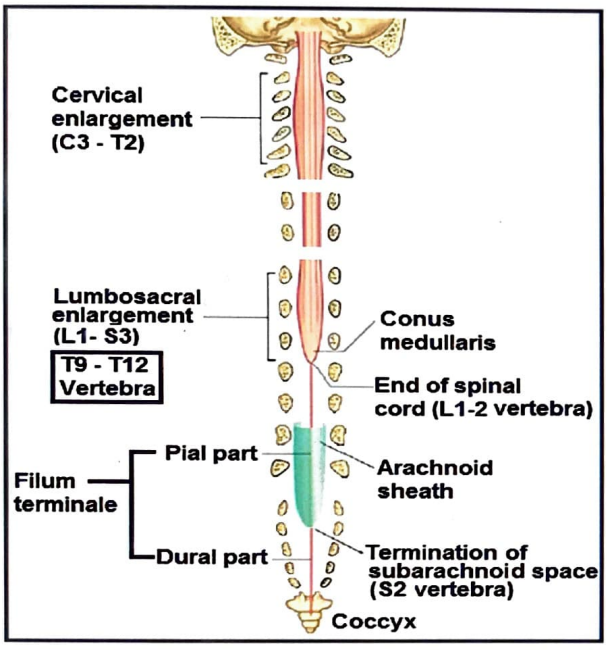
Cervical Enlargement

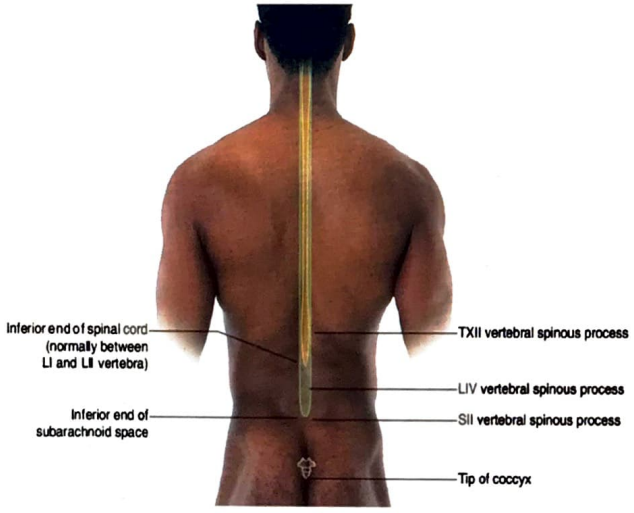
- Collection of neural bodies that [illegible] plexus
- Root value:
  - Brachial plexus: C_5 - T_1
  - Cervical enlargement: C_3 - T_2

Lumbosacral Enlargement

00: 01: 28

- Root value
  - Lumbosacral enlargement: L_1-S_3
  - Sciatic nerve: L_4-S_3
- Vertebrae surroundings LSE: T_9-T_{12}

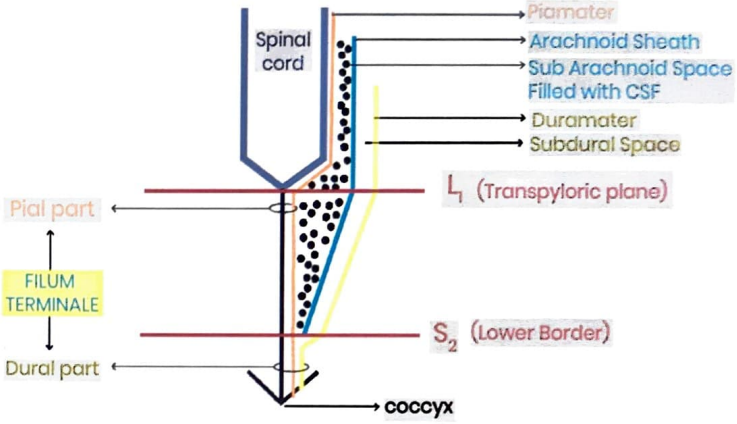




FILUM TERMINALE

00:10:36

- Collagen fibres connecting tip of spinal cord with coccyx
- Pial Part: Present above S_2, longer, covered by pia mater
- Dural Part: Present below S_2, shorter, covered by both pia & dura mater
- Termination of sub arachnoid space is at → Lower border of S_2 vertebra
- Lumbar puncture for CSF aspiration is done at L_4 vertebral vicinity
  - L_3 - L_4 or
  - L_4 - L_5 (Better option)



Previous Year's Questions

Following are the various structures related to spinal cord & their respective terminal extent: Choose the WRONG PAIR (NEET PG Sep 2021)

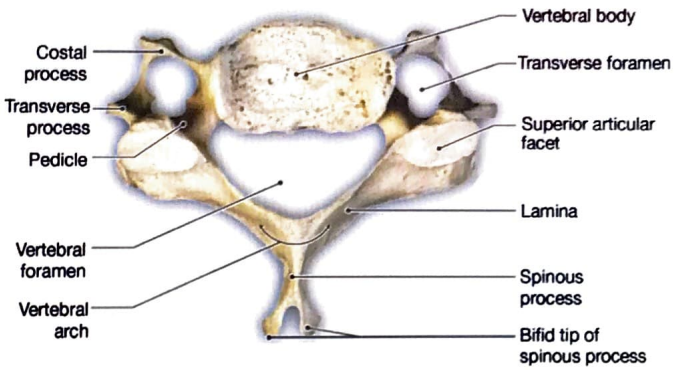
A. Adult spinal cord : Transpyloric plane
B. Pia mater : coccyx
C. Dura mater : S_2 vertebra
D. Arachnoid: S_2 vertebra

79 VERTEBRAE

BODY

00:00:14

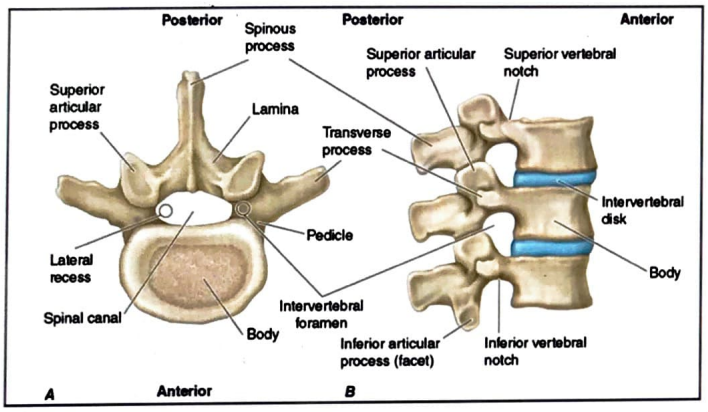
- Large & oval: Lumbar vertebra
- Small & oval: Cervical vertebra
- Thoracic vertebra
  - Heart shaped
  - Triangular

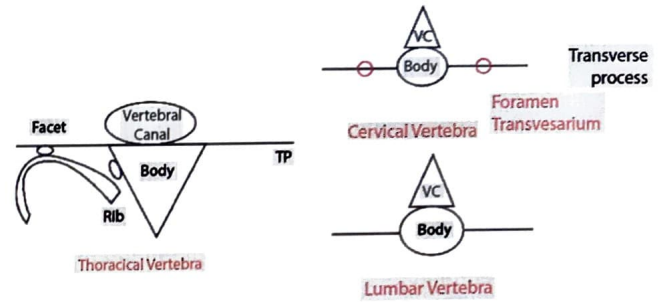


VERTEBRAL CANAL

00:06:00

- Oval - Thoracic vertebra
- Triangular - Lumbar & cervical

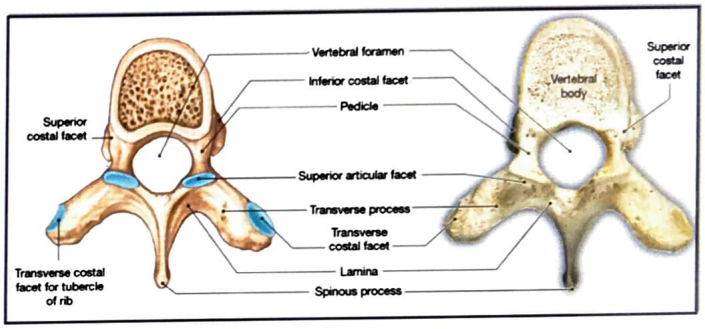




TRANSVERSE PROCESS

00:08:12

- Foramen transversarium: Present in cervical vertebra
  - For the passage of vertebral artery
- Costal/ Rib facet: Present in thoracic vertebra



Inter Vertebral Disc

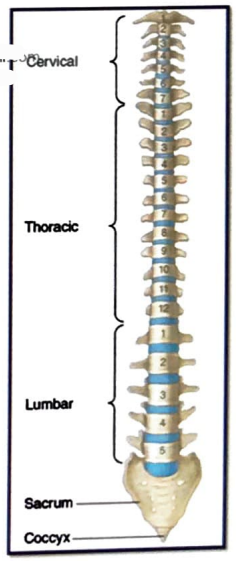
- Spine: Fibro cartilage, acts as SHOCK ABSORBER
- Blunt: Directed posteriorly
  - Lumbar

Inter Vertebral Foramen: For the passage of spinal nerves from spinal cord

00:12:18

SUPERIOR ARTICULAR FACET DIRECTION

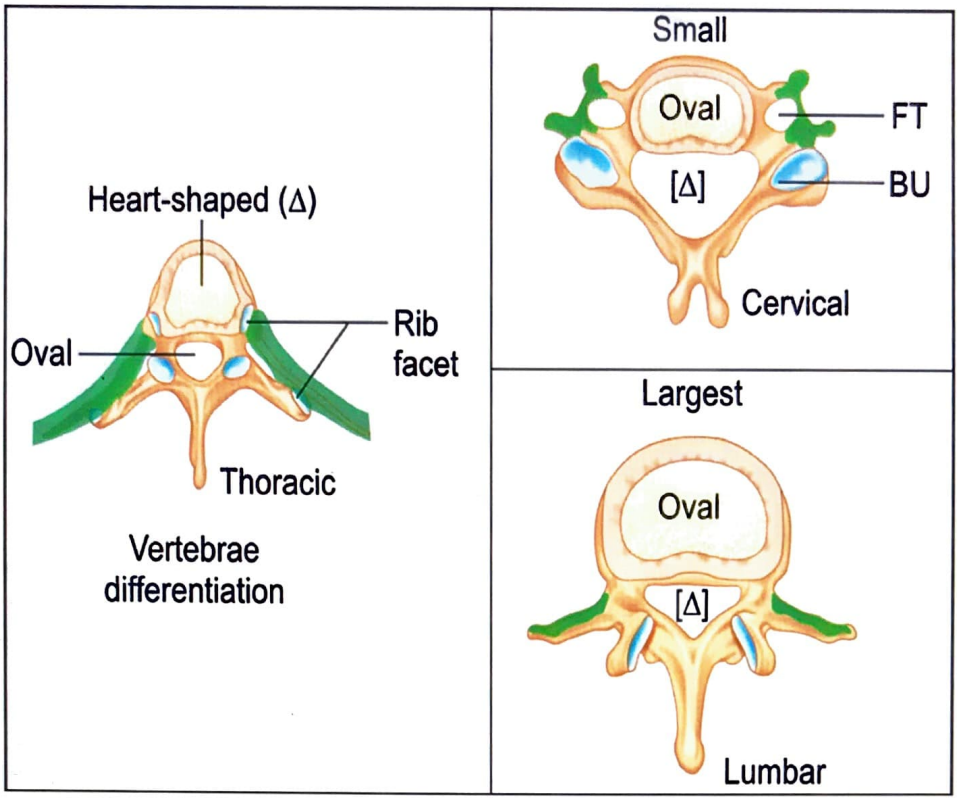
- Cervical vertebra - Backward, upward
- Thoracic vertebra - Backward, upward, lateral (T-BUL)
- Lumbar vertebra - Medial



FORAMEN TRANSVERSARIUM

00:13:20

- Present in transverse process of CERVICAL VERTEBRA
- Vertebral artery pass though it
- C_1 - C_6 vertebra carries vertebral artery, but not C_7



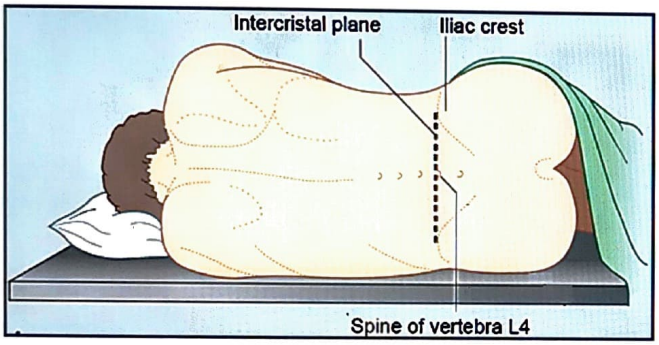
80 LUMBAR PUNCTURE

Previous Year's Questions

Q. During a procedure to remove cerebrospinal fluid from the subarachnoid space below the end of the spinal cord, the needle was advanced too far and penetrated the ligament forming the anterior border of the vertebral canal. Which of the following ligaments, not normally pierced during this procedure, was accidentally penetrated

A. Anterior longitudinal
B. Ligamentum flava
C. Posterior longitudinal
D. Supraspinous

- Put the patient in flexion posture
- Mark the highest point of iliac crest ($L\text{-}_4$)
- Needle to be inserted here ($L\text{-}_4$, $L\text{-}_5$ space)



LIGAMENTS THAT ARE ASSOCIATED WITH VERTEBRA

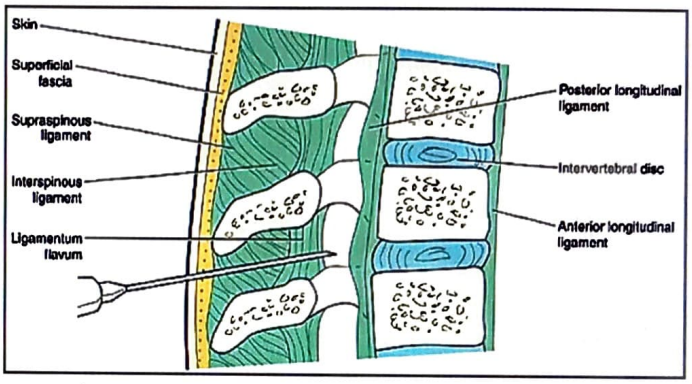
- Anterior longitudinal ligament
- Posterior longitudinal
- Ligament flavum
  - Present more posteriorly
  - B/w the lamina of vertebra
  - Lamina present behind the body
- Supra spinous ligament
- Inter spinous ligament

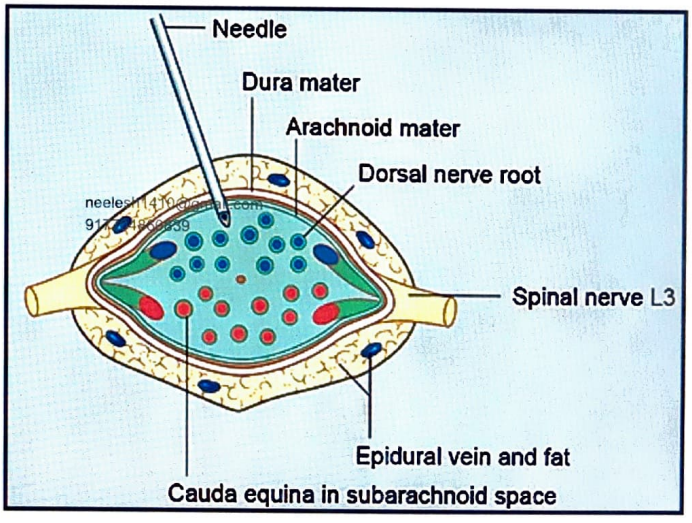
LIGAMENTS THAT ARE PUNCTURED

- Ligamentum flavus
- Supra spinous ligament
- Inter spinous ligament
- Resistance will be present while puncturing the ligaments
- Feel of sudden loss of resistance after puncturing the ligaments (ligamentum flavum)
  - 1st Popping Sensation

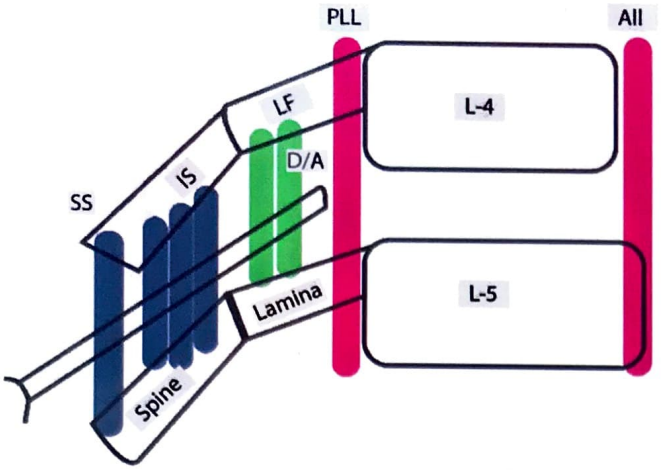
PROCEDURE

- Needle is inserted b/w L4 & L5
- Structures that are Punctured
- Ligaments
  - Ligamentum flavus
  - Supra spinous ligament
  - Inter spinous ligament





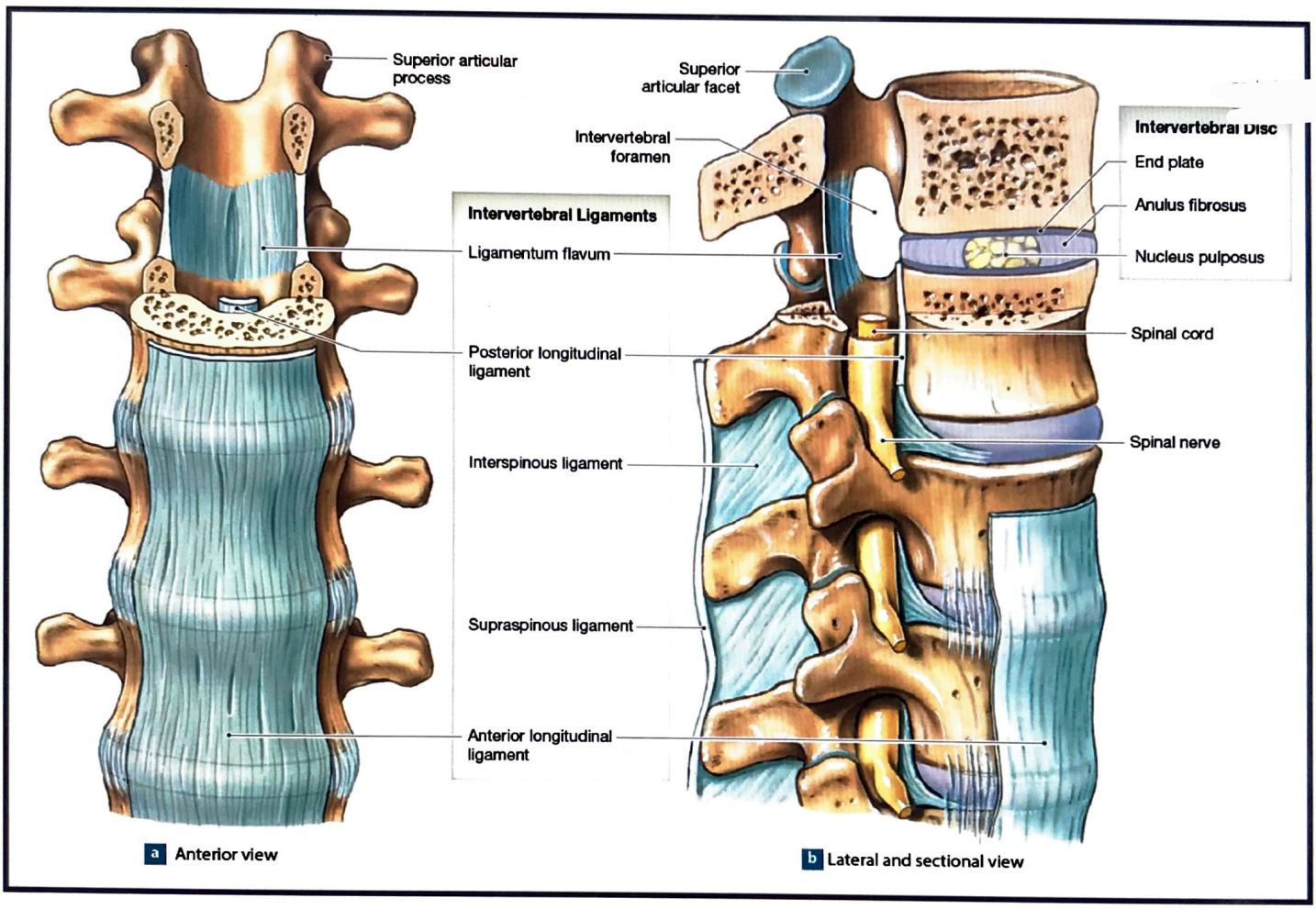
- Meninges
  - Dura mater (2nd popping sensation occur after its puncture)
  - Arachnoid matter



Previous Year's Questions

Q. Popping sensation felt on doing lumbar puncture is while piercing (Better Answer)

A. Ligamentum flavum
B. Supra spinous ligament
C. Inter spinous ligament
D. Dura mater



81 VERTEBRAL CURVATURES & SLIP DISC

00:50:22

Vertebrae		Spinal nerves	
1. Cervical	7	1. Cervical	8 pairs
2. Thoracic	12	2. Thoracic	12 pairs
3. Lumbar	5	3. Lumbar	5 pairs
4. Sacral	5	4. Sacral	5 pairs
5. Coccygeal	4	5. Coccygeal	1 pair
	33		**31 pairs**

CURVATURES

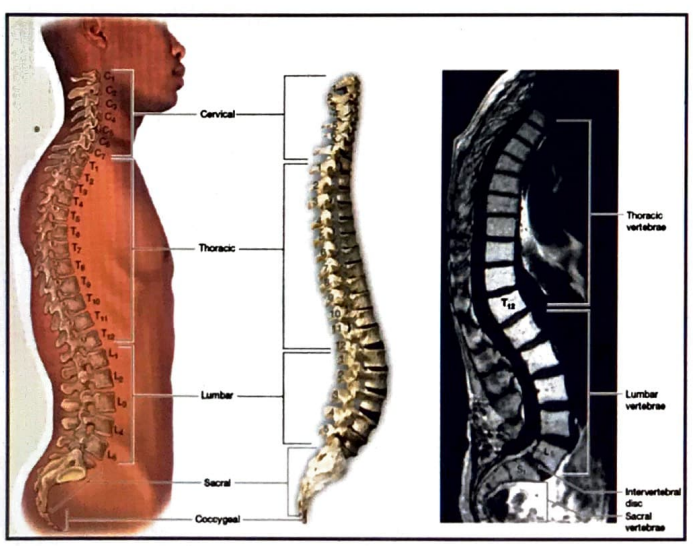
00:02:10

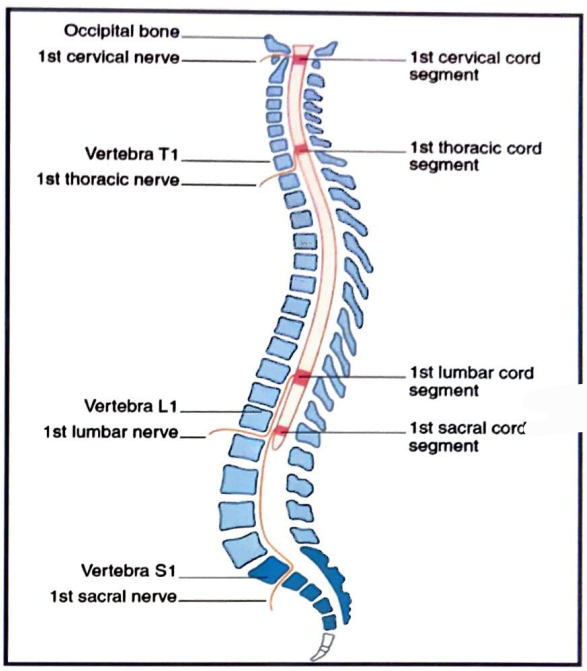
Primary / Fetal Curvature

- Universal attitude of flexion
- Primary
  - Thoracic
  - Sacral
- Concave anteriorly
- Convex posteriorly (KYPHOSIS)

Secondary Curvatures

- At 2 months (holding of neck) - cervical LORDOSIS present
- At 1 yr, lumbar lordosis present (lordosis - ant. convexity)
- Cervical lordosis is due to - neck holding
- Lumbar lordosis is due to - sitting, standing, walking
- During pregnancy - Exaggerated lumbar lordosis

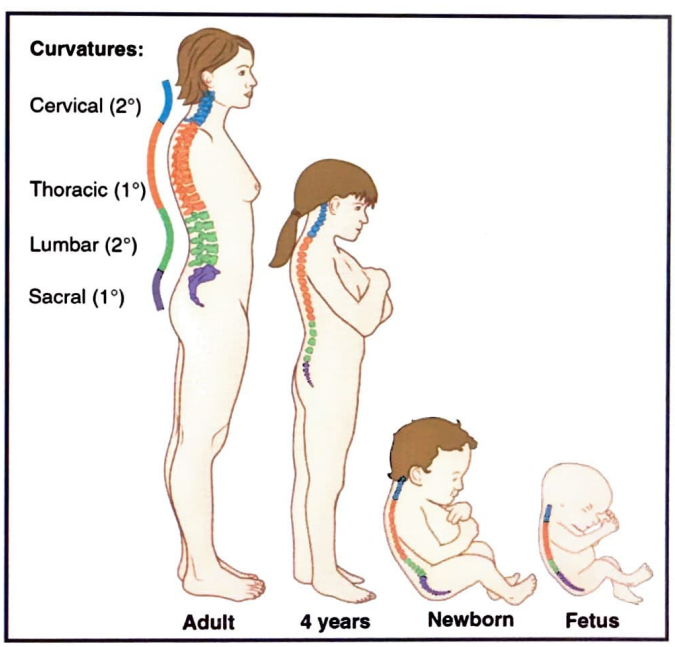




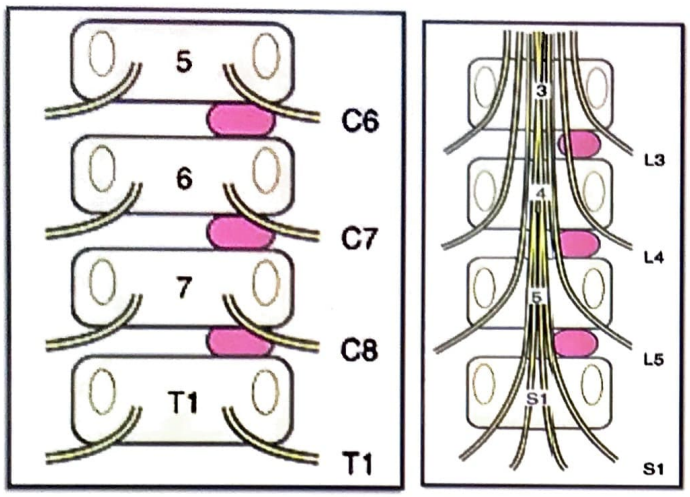
Previous Year's Questions

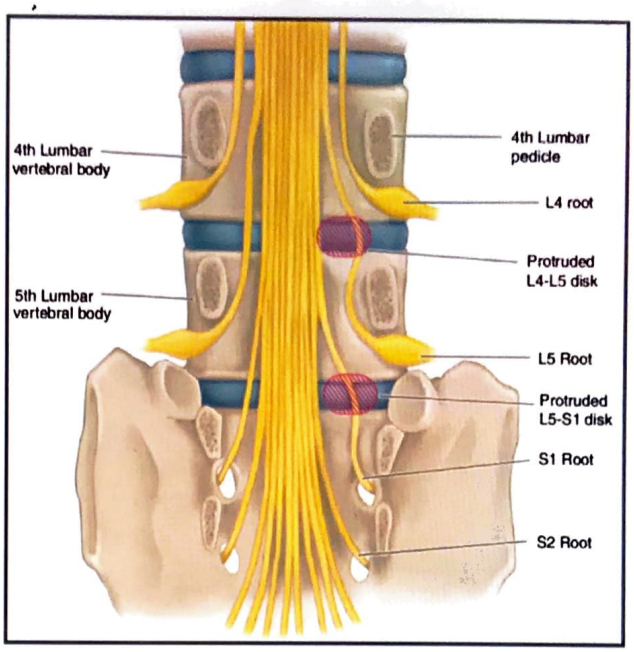
Q. Disc herniation between L_4 & L_5 involves nerve root

A. L_2
B. L_3
C. L_4
D. L_5

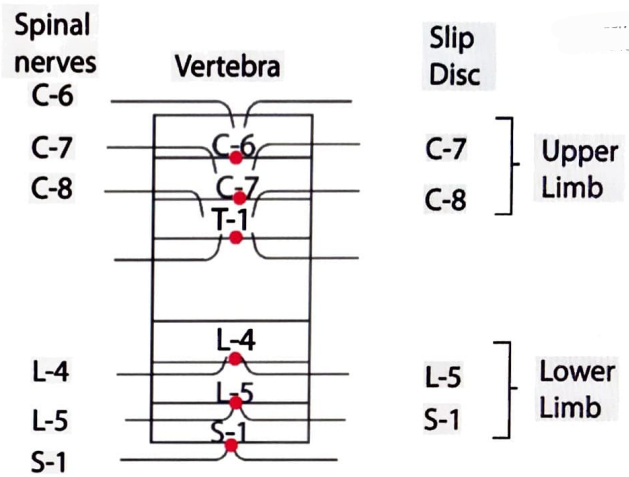


- TRICK: Go to upper vertebra & add 1 (next nerve)
- SLIP DISC, usually Cervical (10%), lumbo sacral (90%)





- In cervical region, Each spinal nerve reach superior to corresponding vertebra
- In cervico thoracic region, each spinal nerve passes below corresponding vertebra
- In thoracic & lumbar region, each spinal nerve passes below corresponding vertebra
- Nerves are short & straight in cervical region
- Nerves are long & oblique in thoraco lumbar region
- In slip disc in cervical region, corresponding nerve is involved
- In slip disc in thoraco lumbar region, next nerve below is involved



Slip Disc Between L_4 & L_5 00:08:32

- L_4 root not involved (posterior lateral herniation)
- L_5 nerve involved

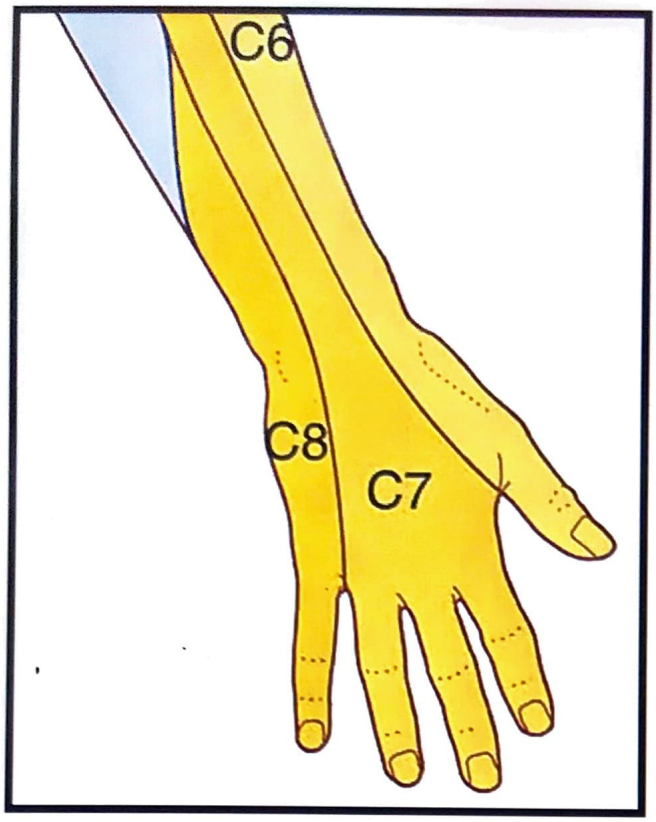
slip Disc Between L_5 & S_1

- L_5 nerve not involved
- S_1 nerve involved

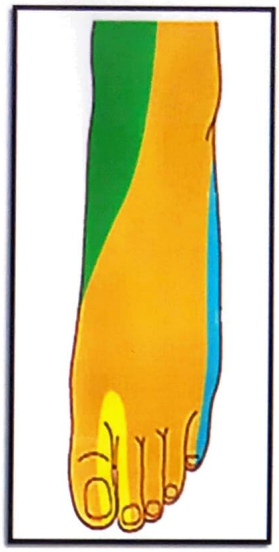
Herniated Disc between	Compressed Nerve Root
C_4 and C_5	C_5
C_5 and C_6	C_6
C_6 and C_7	C_7
L_3 and L_4	L_4
L_4 and L_5	L_5
L_5 and S_1	S_1

Case 1 00:16:57

- Burning sensation in middle finger (C_7 dermatome)
- Triceps reflex is weak (C_7 myotome)
- SLIP DISC?
- Slip disc = $C-_6$ & $C-_7$



Refer Table 81.1



Case 2

- Burning sensation in little toe (S_1 dermatome)
- Ankle reflex is weak (S_1 myotome)
- slip disc?
- Slip disc = L-5 & S-1

Herniated Disc Between	Compressed Nerve Root	Dermatome Affected	Muscle Affected	Movement Weakness	Nerve and Reflex Involved
• L_5 and S_1	• S_1	• S_1 • Heel, Little toe	• Gastrocnemius, • Soleus, Plantaris	• Plantar flexion of ankle (patient cannot stand on toes), Flexion of toes	• Tibial nerve • ↓ ankle jerk

Table 81.1

Herniated Disc Between	Compressed Nerve Root	Dermatome Affected	Muscle Affected	Movement Weakness	Nerve and Reflex Involved
• C_6 and C_7	• C_7	• C_7 • Middle finger	• Triceps • Wrist extensors	• Extension of arm • Extension of wrist	• Radial nerve • ↓ triceps jerk

82 CRANIO - VERTEBRAL JOINTS

ATLAS (C - $_1$) VERTEBRA

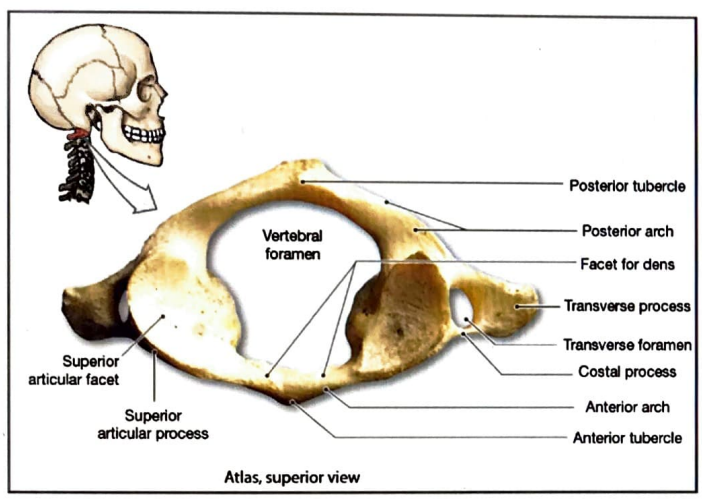
00:00:13

- Atlas vertebra don't have body
- Atlanto - occipital joint
  - For head nodding
  - Ellipsoid synovial / condylar joint
- Vertebral artery comes from foramen transversarium & arches over superior surface of atlas vertebra (POSTERIOR ARCH) & enters cranial cavity by passing through foramen magnum upwards

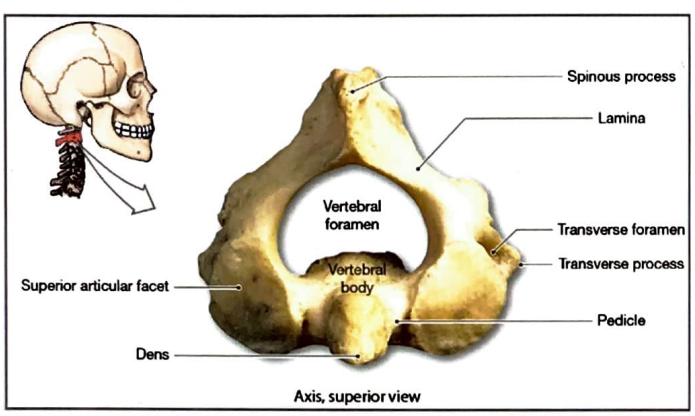
AXIS (C - $_2$) VERTEBRA

00:03:27

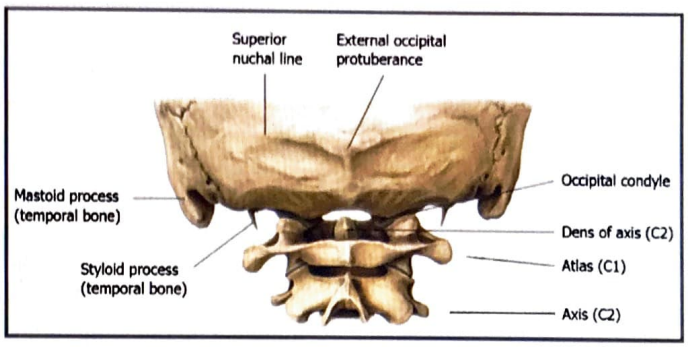
- ODONTOID PROCESS/ DENS OF AXIS
- Body of C_1 vertebra fusing with body C - $_2$
- Goes to ant. arch of atlas & held by transverse ligament of C - $_1$

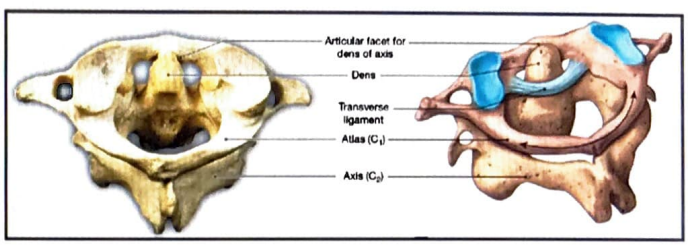


Atlas, superior view



Axis, superior view





ATLANTO AXIAL JOINT

00:07:04

- Rotatory joint
- Trochoid / pivot joint
- Skull & atlas became 1 unit and rotates on axis joint

83 VERTEBRAL LANDMARKS TRIANGLES

SCAPULA

00:00:32

- Superior angle - $T-_2$
- Spine - $T-_3$
- Inferior angle - $T-_7$

ILIAC BONE

- Highest point of iliac crest: $L-_4$ spine

TRIANGLES

Triangle of Auscultation

00:01:58

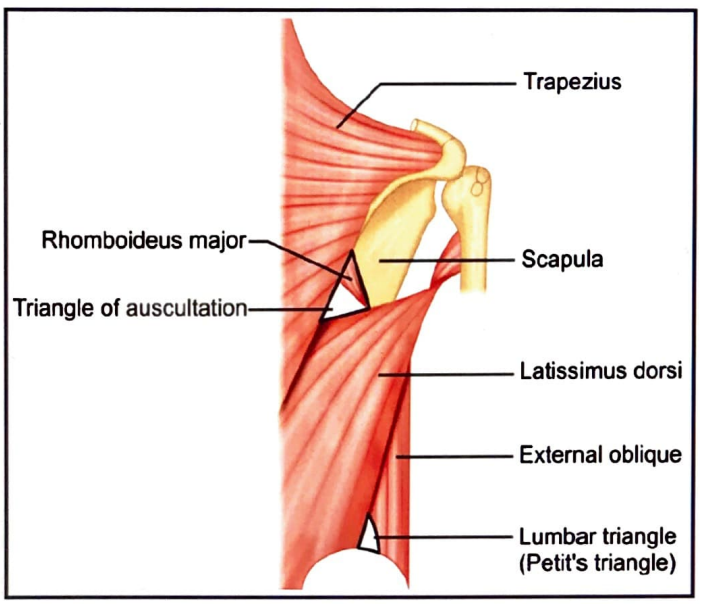
- Boundaries
  - Medial border of scapula - Lateral
  - Trapezius (triangular muscle) - Supero medial
  - Latissimus dorsi - Inferior
  - Rhomboid major - floor
- Sounds of peristalsis of stomach
- Sounds of lower lobes of lungs

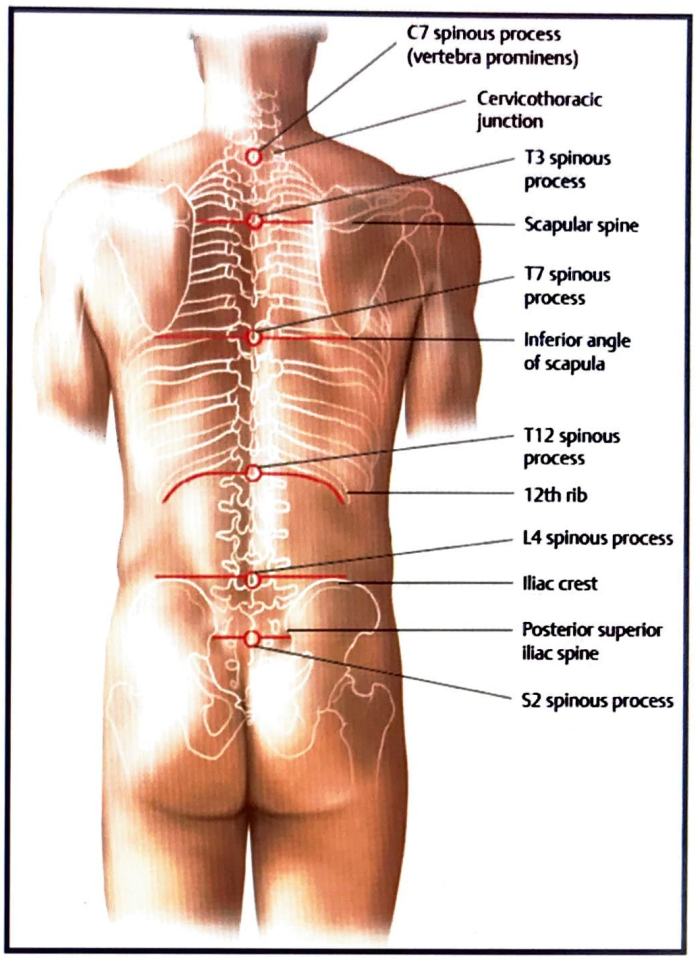
Lower Lumbar / Petit's Triangle

00:05:16

- Boundaries
  - Latissimus dorsi - Posterior
  - Iliac crest of hip bone - Base
  - External oblique muscle - Anterior

Deficiency of thick muscular coat here, Prone to hernias





CLINICAL QUESTIONS

Vertebral curvature and slip disk

Q. A 27-year-old mountain climber falls from a steep rock wall and is brought to the emergency department. His physical examination and computed tomography (CT) scan reveal dislocated fracture of the upper thoracic vertebrae. The fractured body of the T7 vertebra articulates with which of the following parts of the ribs?

A. Head of the sixth rib

B. Head of the eighth rib

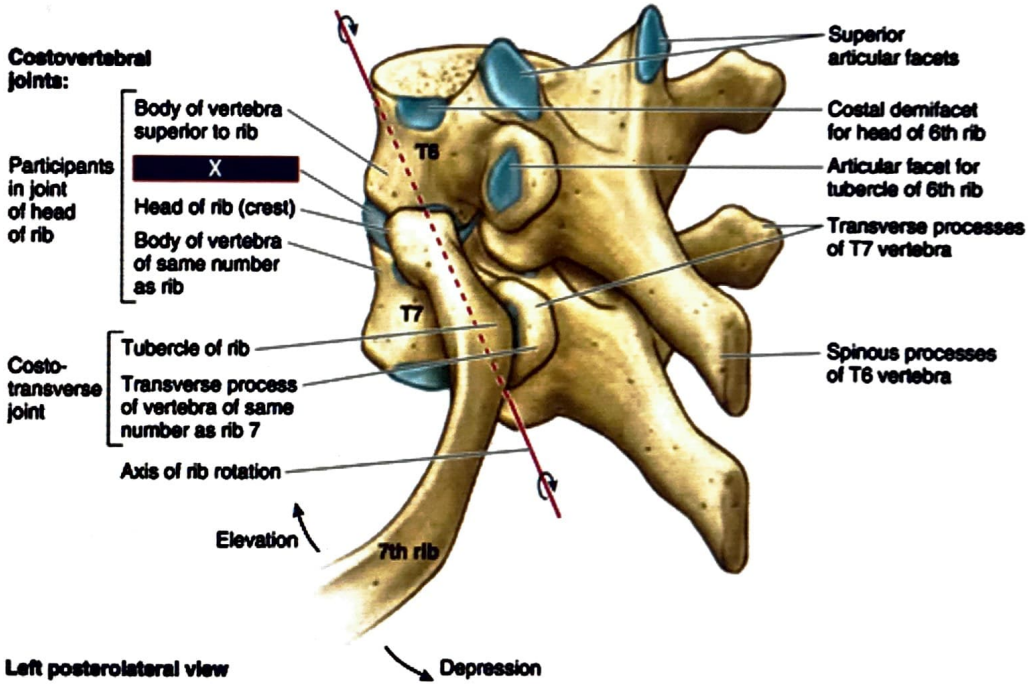
C. Neck of the eighth rib

D. Tubercle of the seventh rib

Answer: B

Solution

- The body of vertebra T7 articulates with the heads of the seventh and eighth ribs.
- The body of the T6 vertebra articulates with the head of the sixth and seventh ribs
- The neck of a rib does not articulate with any part of vertebra.
- The transverse process of vertebra articulates with the tubercle of the corresponding rib.
- Therefore, the transverse process of vertebra T7 articulates with the tubercle of the seventh rib.



Reference: Grays 41st edition pg no.-719

Lumbar Puncture

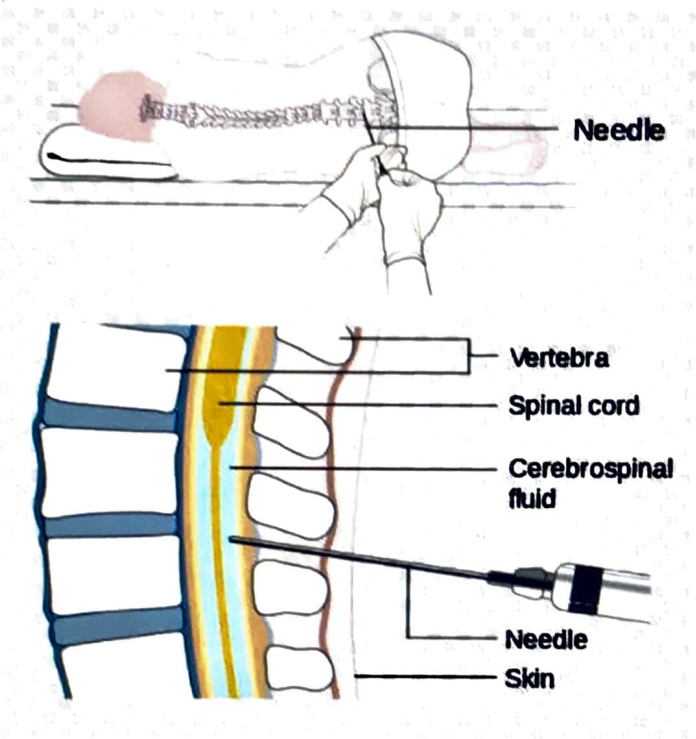
Q. Arrange the following structures in the order they are pierced during lumbar puncture. (SEQUENTIAL ARRANGEMENT)

a. Epidural space
b. Interspinous ligament
c. Supraspinous ligament
d. Ligamentum flavum
e. Subarachnoid space

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

Answer: D

Solution



Lumbar puncture in adult:

- **Patient lying on side with maximally flexed spine**
- A line took between the **highest points of ASIS at the L4 level**
- Skin cleaned & anesthetised
- Spinal needle inserted between **L4 – L5 vertebrae**
- Structures pierced: **skin, fat, supraspinous & interspinous ligaments, ligamentum flavum, epidural space, dura, arachnoid, subarachnoid space.**

Reference: B. D Chourasia, edition 6 volume 3 page 185

PREP NUGGETS

Prep Nuggets

Subdivision tube	Fate
Truncus arteriosus	_____
Conus	_____
Right common cardinal vein	_____
Umbilical vein	_____
Right vitelline vein	_____
Left horn of sinus venosus	Forms part of the coronary sinus

Prep Nuggets

Deltoid muscle fibres	Movements
Middle (lateral) fibres	_____
Anterior fibres	_____
Posterior fibres	_____

Prep Nuggets

Muscle	Movement
Supraspinatus	_____
Coracobrachialis	_____
Triceps	_____
Pectoralis Minor	_____

Prep Nuggets

NERVE	ROOT VALUE
Femoral nerve	_____
Sciatic nerve	_____
Superior gluteal nerve	_____
Inferior gluteal nerve	_____

Prep Nuggets

Embryological structure	Genital derivatives
Labio scrotal swelling	_____
Genital ridge	_____
Urogenital folds	_____
Urogenital sinus	_____
	Urethra