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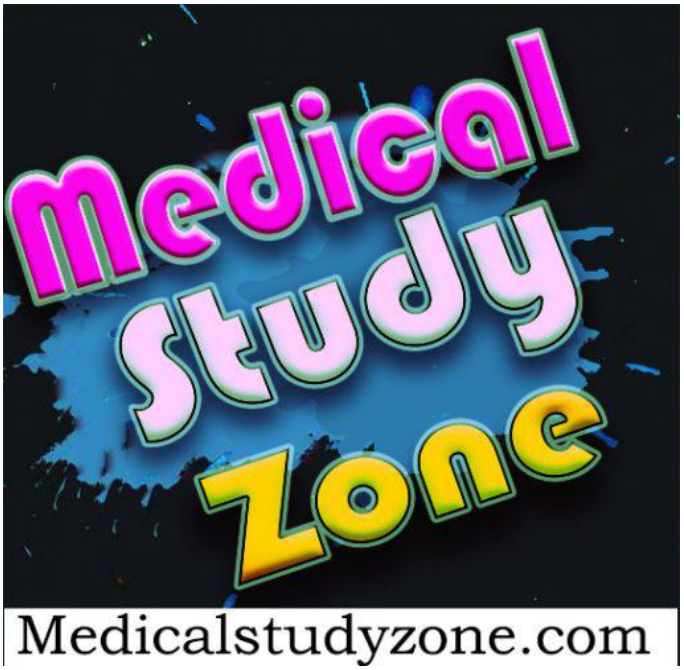

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INTRODUCTION

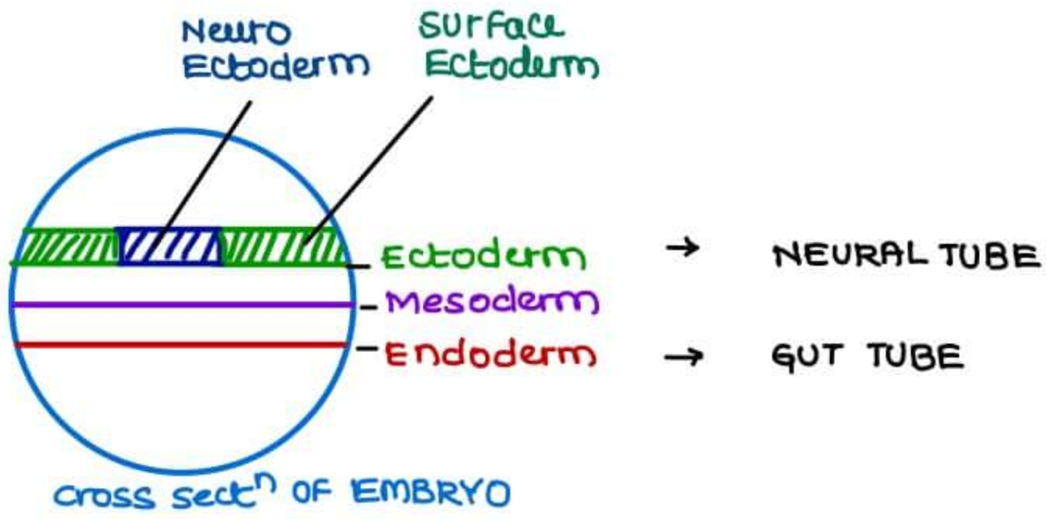
1 Pars intermedia in Pituitary develops from ?

a roof of stomodeum

b neural crest

c Alar plate of diencephalon

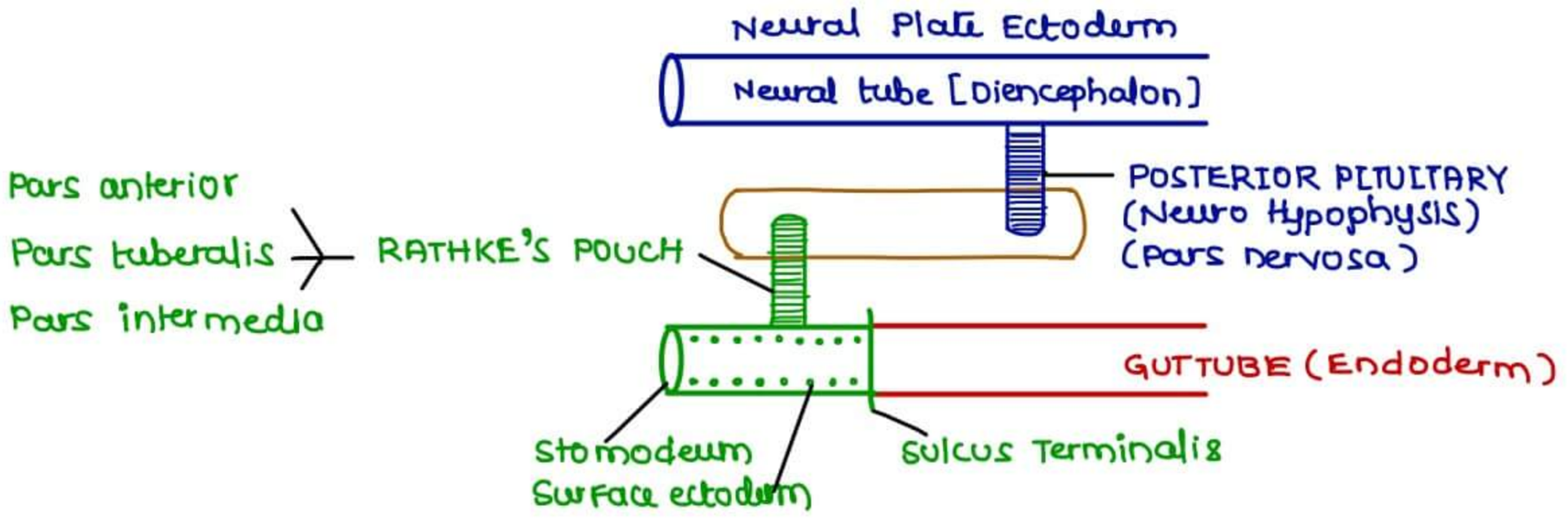
d Endoderm

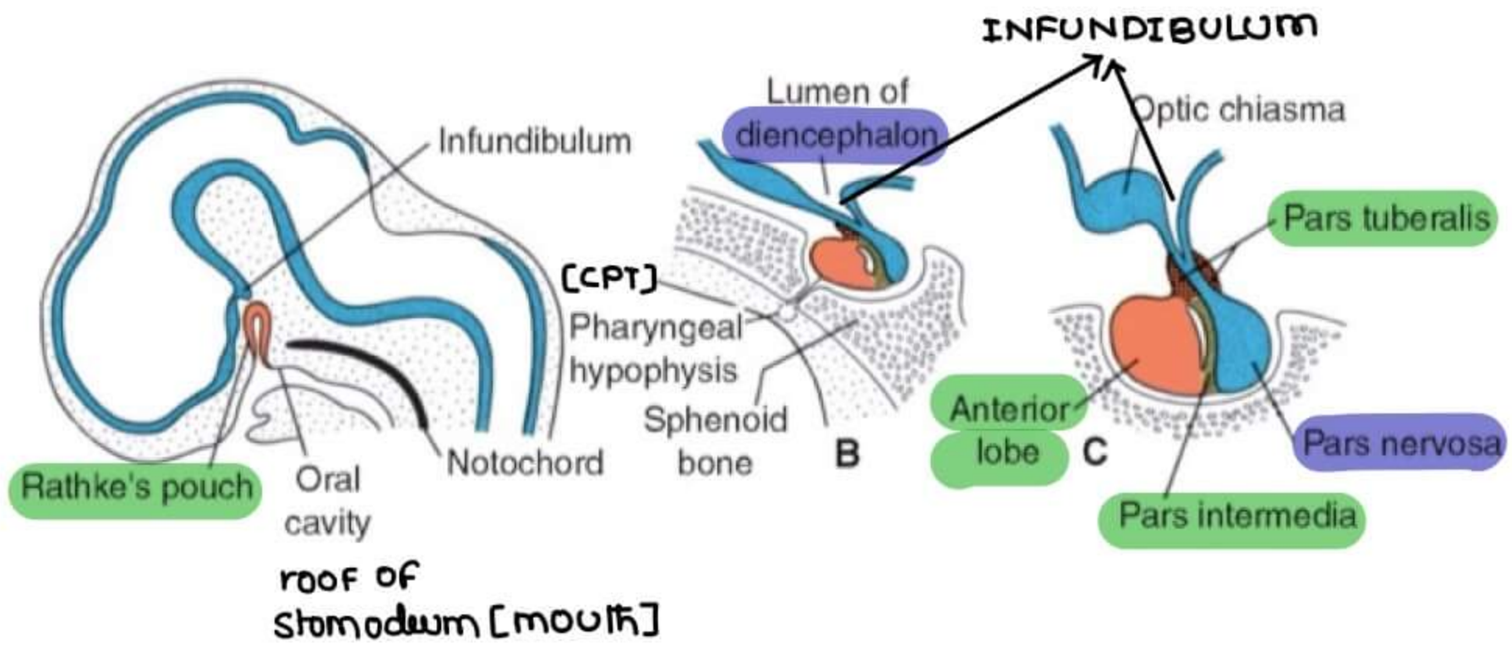


→ Any external opening of the body is lined by surface ectoderm

Eg: Stomodeum [oral opening]

Proctodeum [anal opening]





→ PITUITARY GLAND develops from ECTODERM

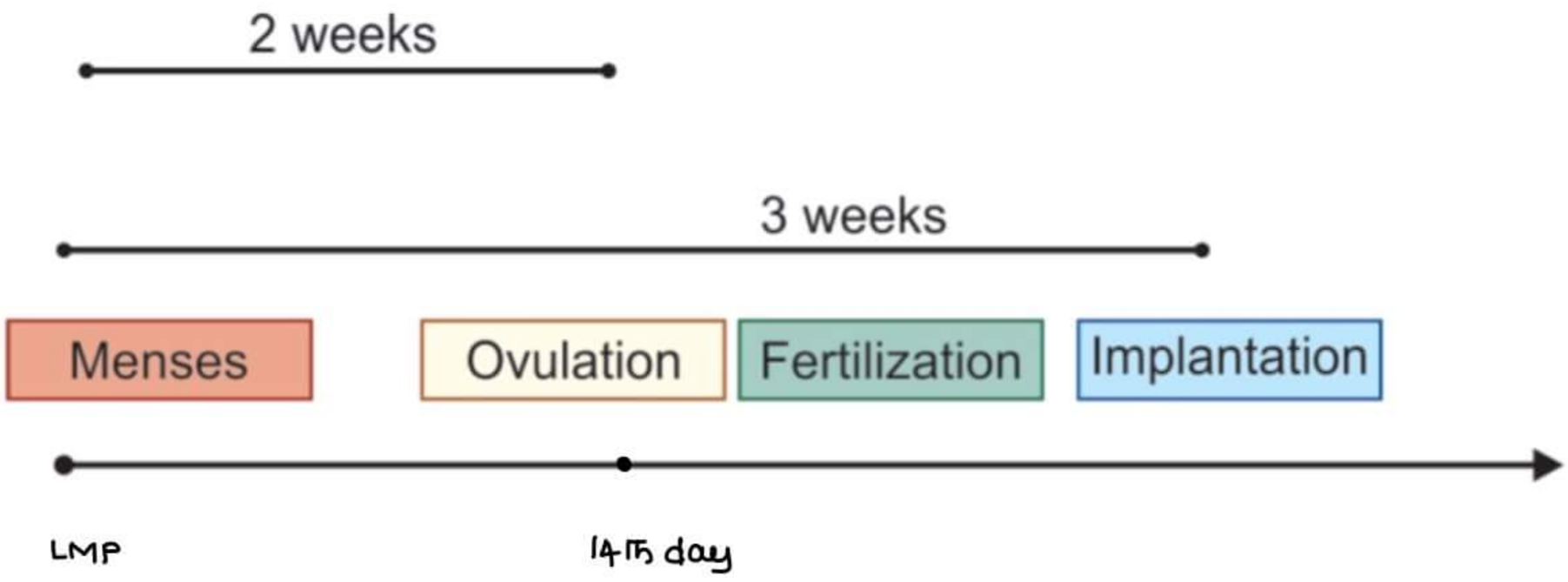
Surface Ectoderm / roof of Stomodeum develops into RATHKE'S POUCH

Rathke's pouch → Pars Anterior
Pars tuberalis
Pars intermedia

Neural Ectoderm develops into Posterior Pituitary / Neurohypophysis / Pars nervosa

GENERAL EMBRYOLOGY

DEVELOPMENTAL TIME LINE



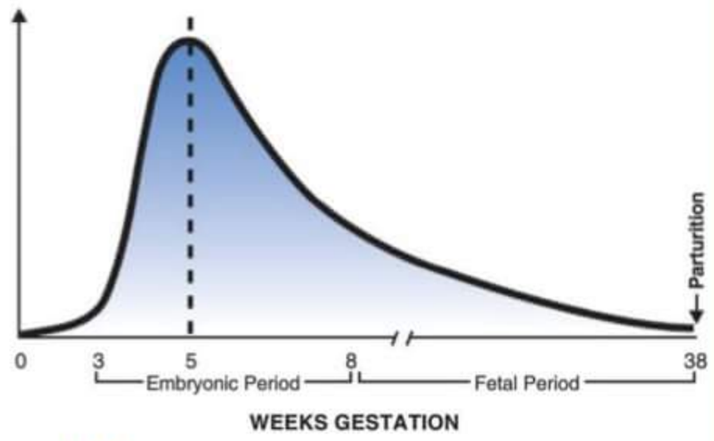
OBSTRESTITIAN FOLLOWS → Gestational Age, Menstrual Age } 40 WKS [280 days]

EMBRYOLOGIST / RADIOLOGIST FOLLOWS → Ovulation Age, Postconceptional Age } 38 WKS

EMBRYONIC PERIOD → 3-8 WKS

PRE EMBRYONIC PERIOD → Before 3 WKS

FETAL PERIOD → > 8WKS - 38 WKS

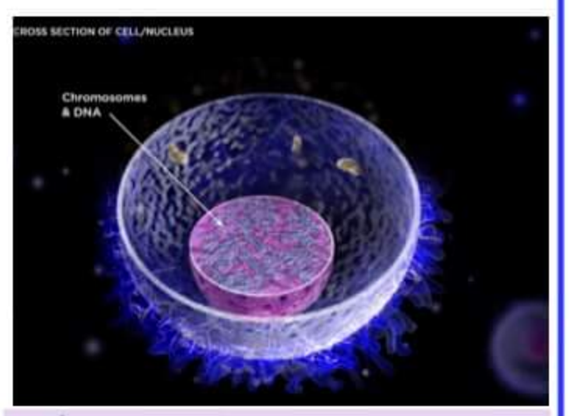


GAMETOGENESIS

CHROMOSOMES

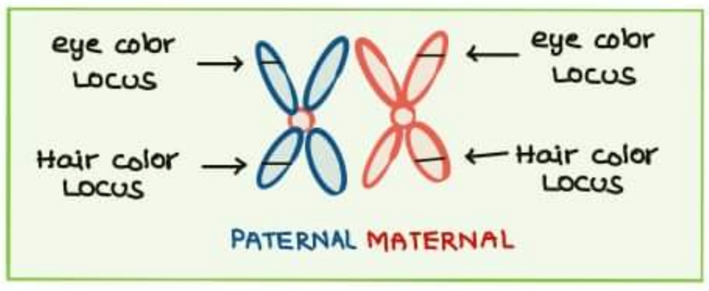
→ Chromosomes are present in the nucleus of a cell

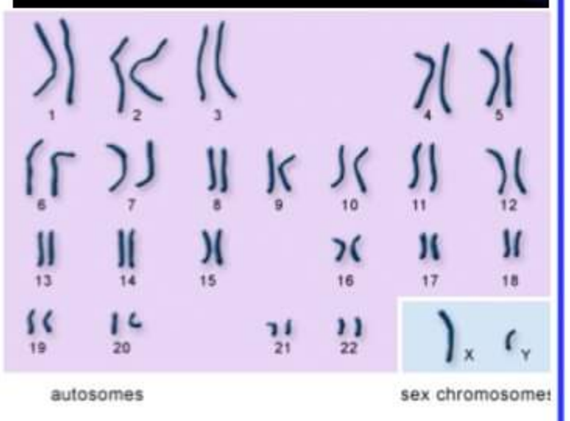
→ 23 pairs → 22 pairs of autosomes
1 pair of Sex chromosome



HOMOLOGOUS CHROMOSOMES

→ 2n 2N

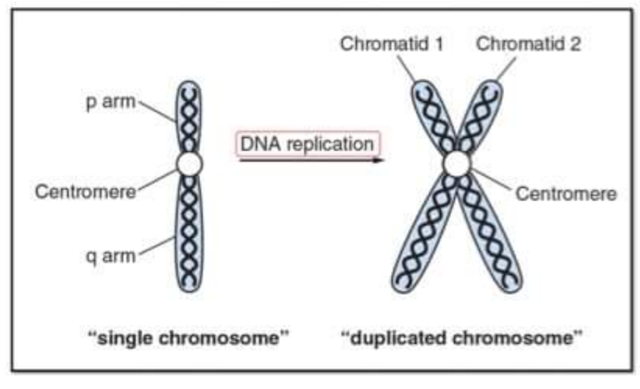




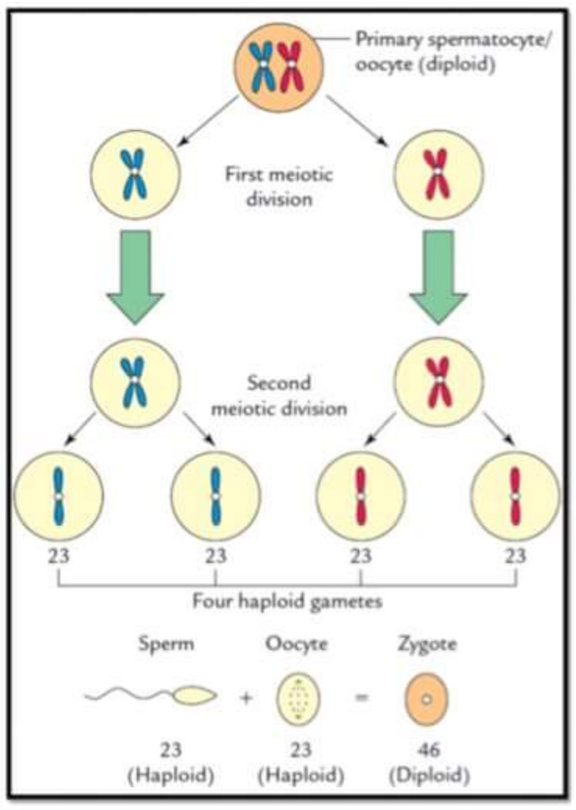
n → no. of chromosomes

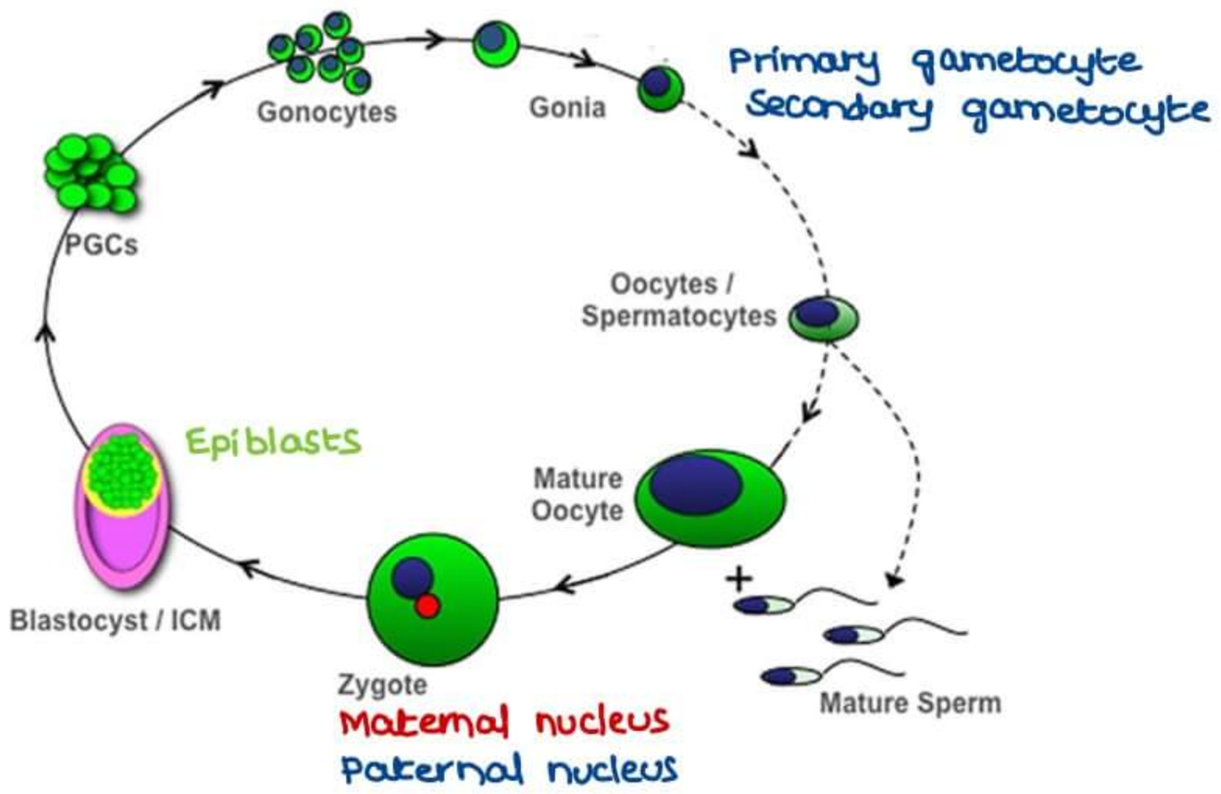
N → amount of DNA

→ DNA Replicat^{n} done in 'S [Synthetic] Phase' of Interphase



GAMETOGENESIS





ICM → Inner cell Mass

PGCs → Primordial Germ cells

PGC → first sex cell of the Body

CELL DIVISIONS

EPIBLASTS ⟶ ○ PGC [2N, 2n]

migration ↓ GAMETOGENESIS [cell divisⁿ occurs]

Genital Ridge ○ GAMETE [n,N (Haploid)]

→ Aberrant migratⁿ of PGC → GERM CELL TUMORS

Teratoma

→ have all 3 Germ Layers [ectoderm, endoderm, mesoderm], as PGC is a pleuripotent cell

→ During Gametogenesis, cell division occurs

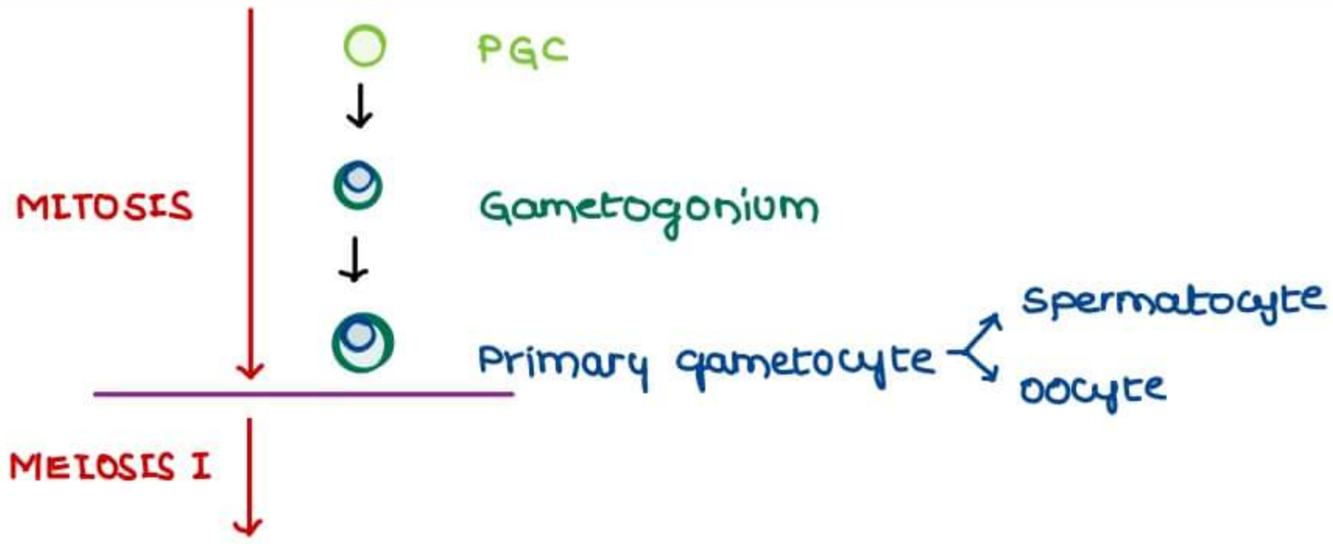
CD → Mitosis [Equational division]

CD → Meiosis → I [Reduction Division]

Meiosis → II

oropharyngeal Teratoma

sacrococcygeal Teratoma



→ Primary oocyte enters meiosis quite early than spermatocyte
  → spermatogenesis occurs after puberty
  → oogenesis begins before birth [in-utero]

CELL DIVISIONS

MITOSIS

MEIOSIS

MITOSIS STAGES

PROPHASE

METAPHASE

ANAPHASE

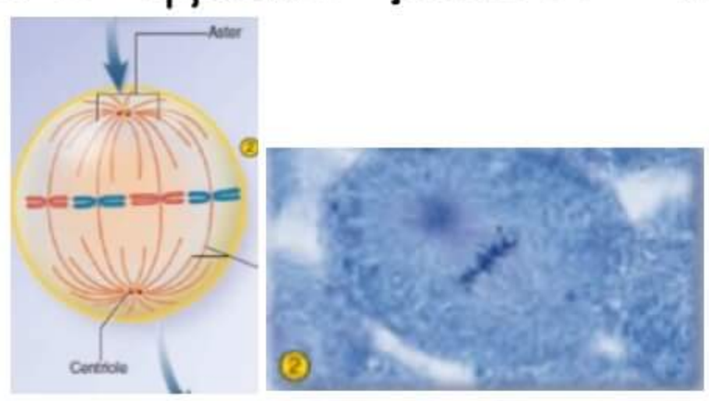
TELOPHASE

PROPHASE

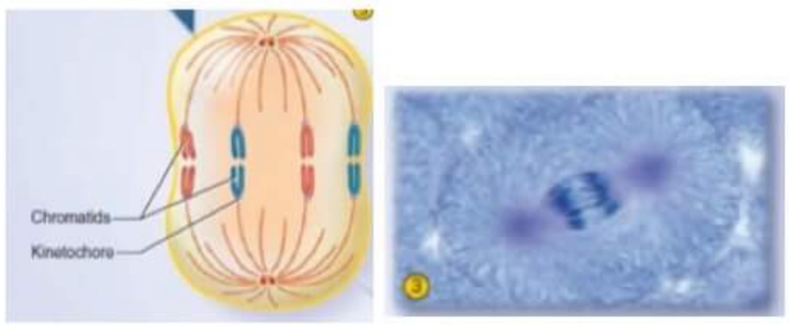
→ condensat^{n} of chromosomes occurs
→ Nuclear envelop breaks down
→ Sister chromatids bound at the centromere
→ Spindle fibres grows from centrioles
→ Centrioles migrate to opposite poles of cells

METAPHASE

→ Chromosome arrange at equator [in midline]
→ Some spindle fibres attach to kinetochores
→ Fibres of aster attach to plasma membrane



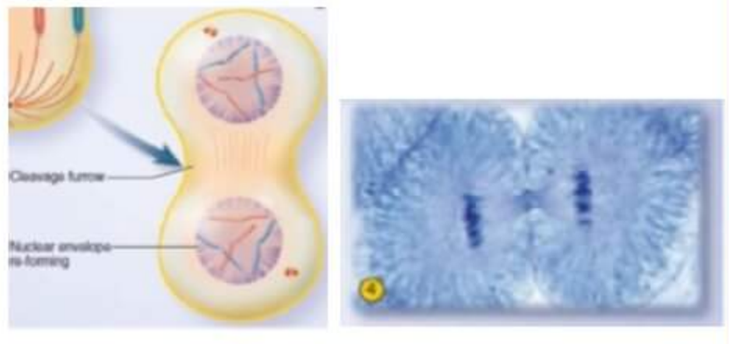
ANAPHASE



→ Centromere Splits
→ Sister chromatids seperate from each other
→ Each pole has an identical set of genes

TELOPHASE

→ 2 daughter cells are formed
→ Chromosomal number are similar to parent cells
→ daughter cells are similar to parent cells

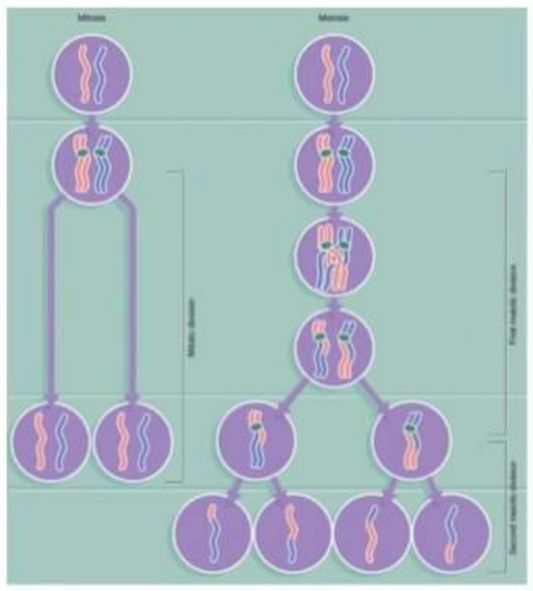


MEIOSIS

Meiosis I → Separat^{n} of Paternal & maternal chromosomes

Meiosis II → Separat^{n} of sister chromatids

MITOSIS	MEIOSIS
Takes place in somatic cells	Takes place in germ cells
Completes in one sequence	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 cell	Daughter cells are not identical to each other & to parent cell
Equational division	Reductional division



MEIOSIS → I, II

MEIOSIS I

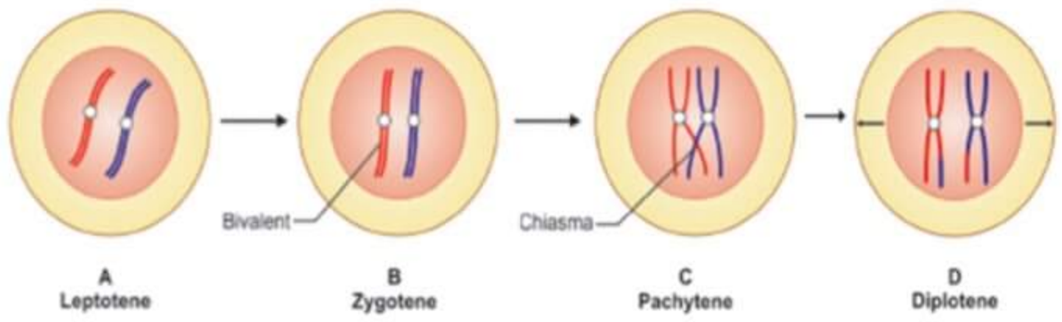
PROPHASE I

Leptotene

Zygotene

Pachytene

Diplotene



LEPTOTENE → chromosome condensat^{n} occurs

ZYGOTENE → Homologous chromosomes appear as BIVALENT

Sister chromatids not evident yet

PACHYTENE → chromosomes appear as TETRAD

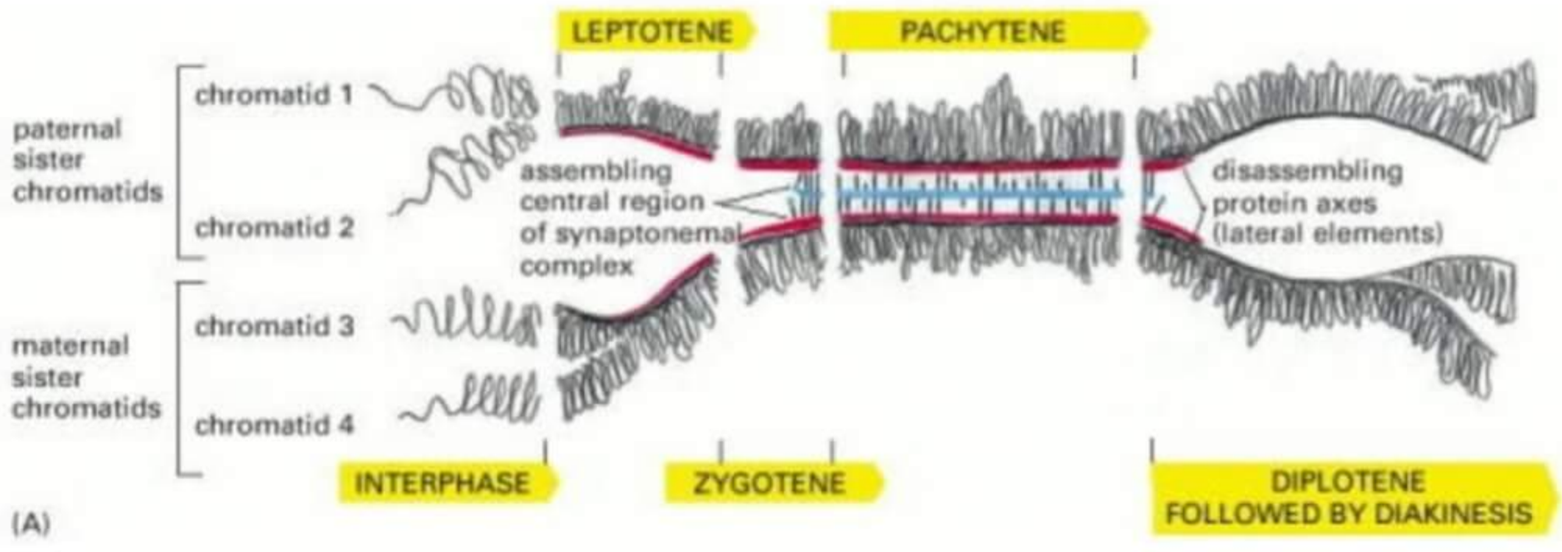
Sister chromatids are evident

P → Pachytene

T → Tetrad

C → Chiasma [cross - over] [exchange of genetic material]

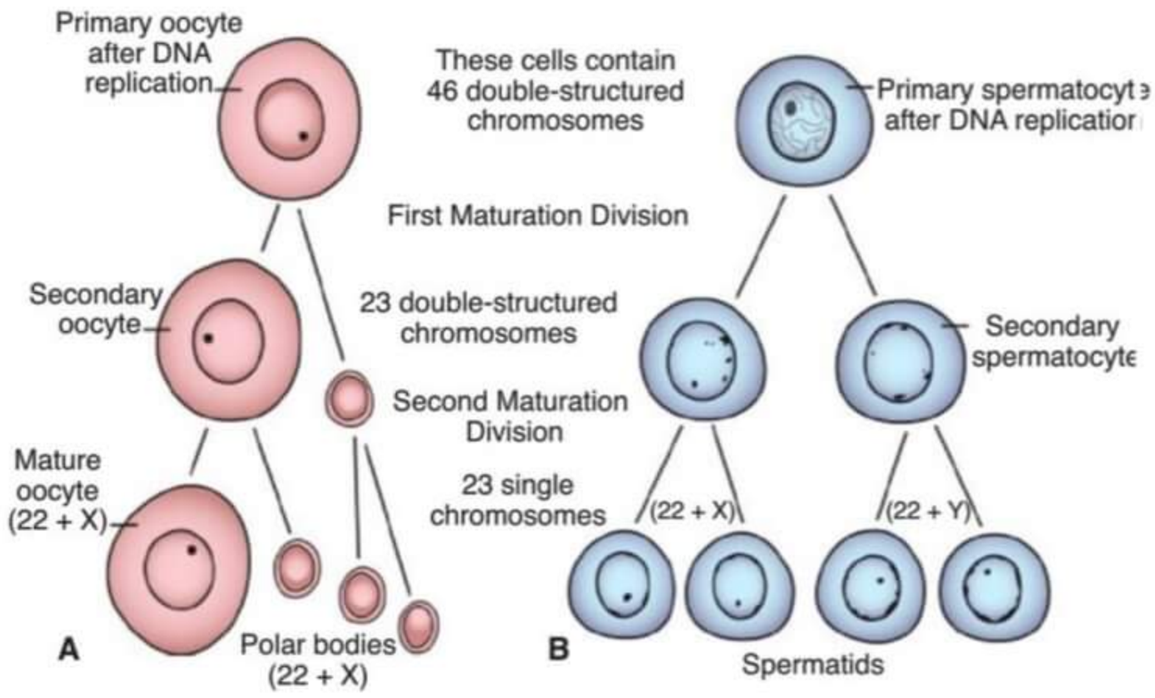
DIPLOTENE → Maternal & paternal chromosomes seperated



INTERPHASE → DNA duplicat^{n} occurs

GAMETOGENESIS

FEMALE & MALE



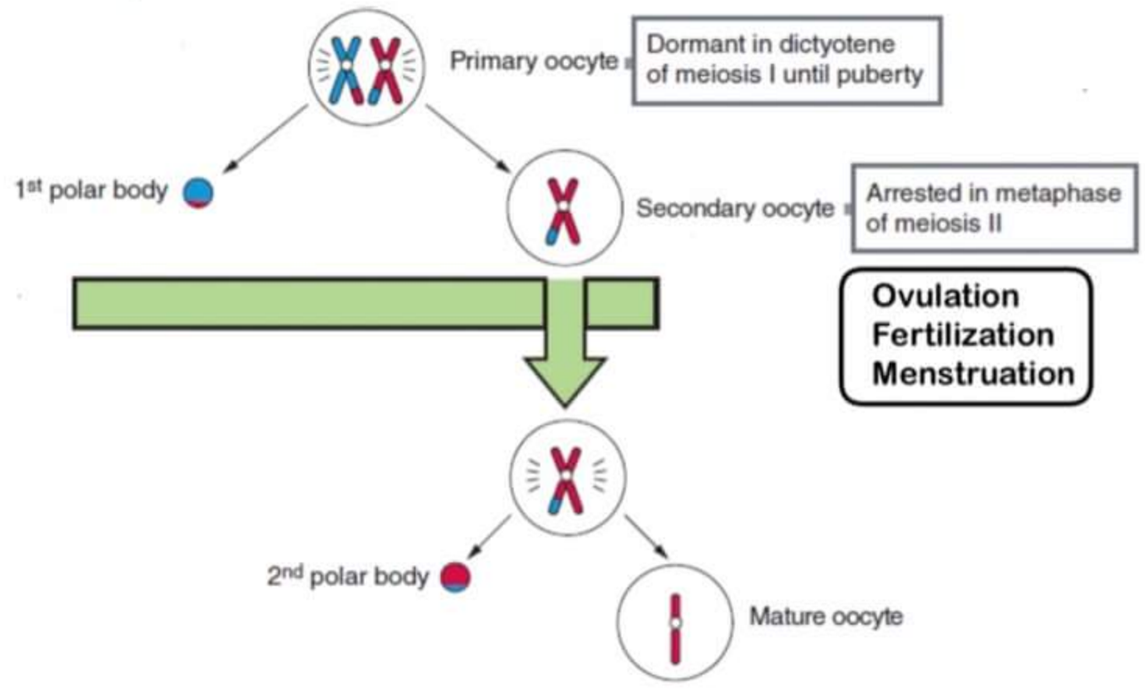
Female Male

→ Female ratio → 1:1 [polar bodies +nt]

Male ratio → 1:4 [No polar bodies]

OOGENESIS

Independent assortment



PRIMARY OOCYTE

→ arrested in diplotene stage OF Meiosis I

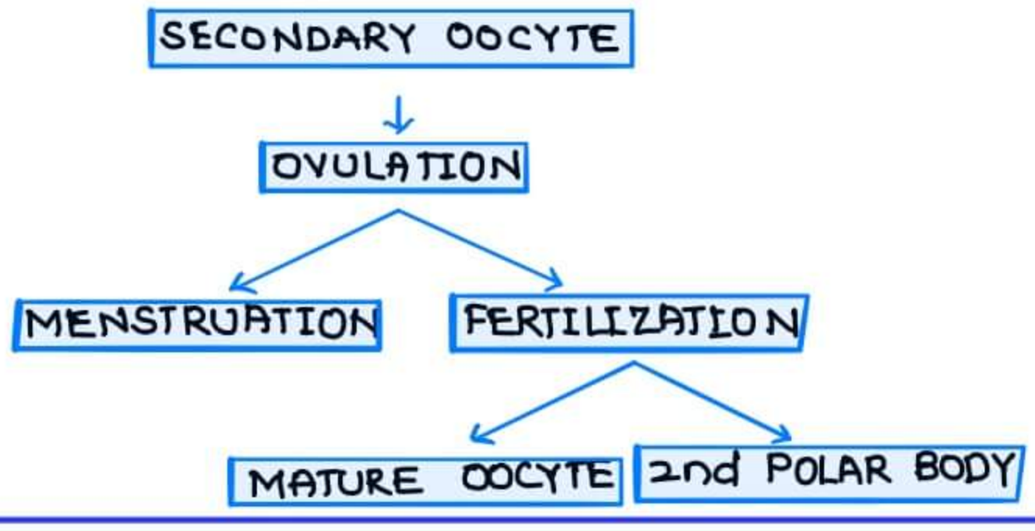
→ after LH Surge, it will form secondary oocyte

→ INDEPENDENT ASSORTMENT

→ separatⁿ of maternal & paternal chromosomes depending on probability factor [50% chances of having either paternal or maternal chromosome in daughter cells]

SECONDARY OOCYTE

→ Secondary oocyte is arrested in metaphase 2 OF meiosis II



Q Which cell undergoing fertilization

a Primary oocyte in prophase arrest

b Primary oocyte in metaphase arrest

c Secondary oocyte in prophase arrest

d Secondary oocyte in metaphase arrest

Q After entering 1st meiotic division, primary oocyte remains arrested in

a Diplotene → dlt oocyte Maturatⁿ Inhibitor

b Pachytene

c Metaphase

d Telophase

OVARY AT BIRTH

Primary oocyte

Ovary (at Birth)

P → Primary oocyte
P → arrested in Prophase I
P → until Puberty achieved

Arrested at **Diplotene** of **Prophase I**

dlt **OMI** (oocyte Maturatⁿ Inhibitor)

→ ↑ cAMP

→ LH surge at puberty reduce cAMP

TESTIS AT BIRTH

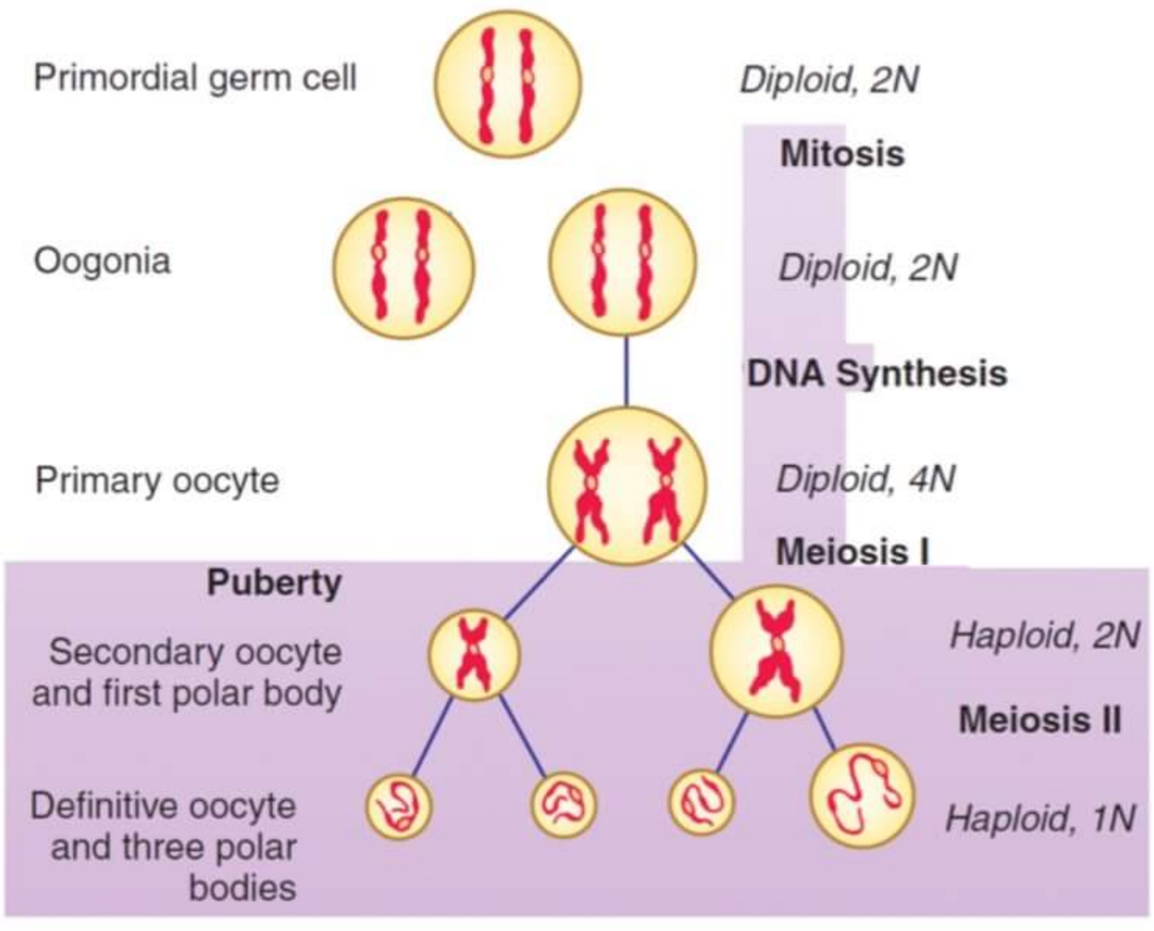
Dormant → Till puberty

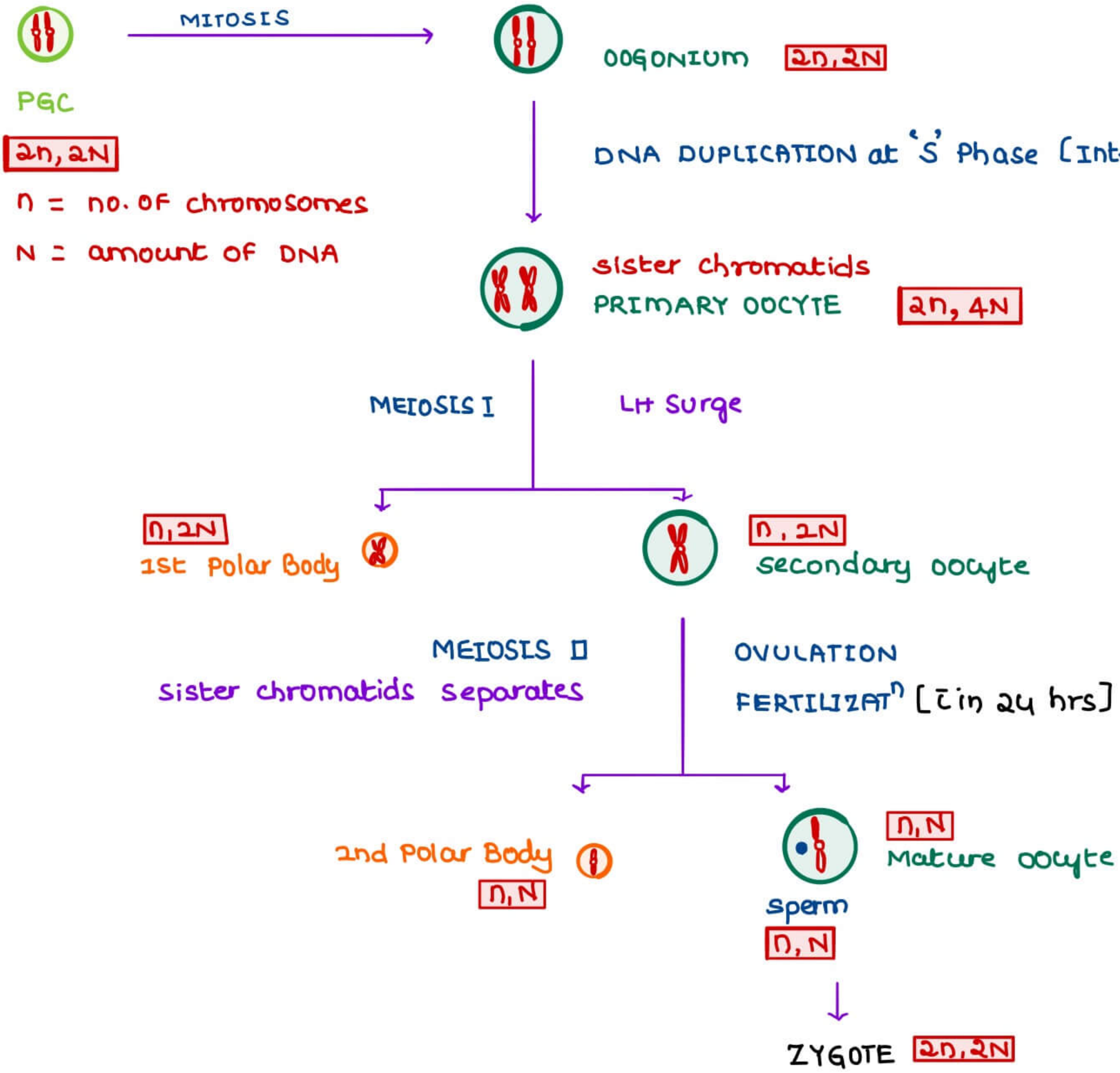
PGC [primordial Germ cell]

Testis (at Birth)

Spermatogenesis takes 74 Days for completion
Oogenesis takes years for completion

OOGENESIS



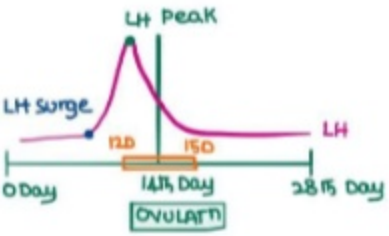


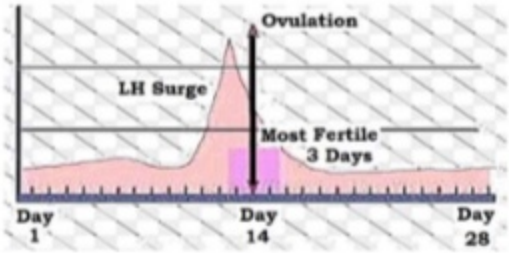
MEIOSIS I

- → Reductional division
- → Maternal & Paternal chromosomes are separated

2nd polar Body released after fertilizatn
1st polar Body released after LH surge [before ovulatn]
LH surge occurs 36 hrs before ovulatn
LH peak occurs 12 hrs before ovulatn [1st Polar Body released]

MENSTRUAL CYCLE [Fertile period]





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

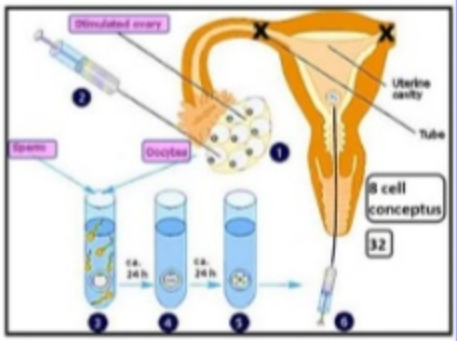
- → WINDOW PERIOD FOR FERTILIZATION
  - → For female → 24 Hrs
  - → For Male → 48 Hrs
    - Sperms are capable of fertilizatn for 48 hrs after ejaculation
    - Sperms survival time in female → 5-10 Days

- → FERTILE PERIOD → 12th to 15th Day [3 Days]

INFERTILITY

IN CASE OF NO ORGANIC CAUSE

LH KIT POSITIVE → indicates Ovulation
→ advise for copulatn
→ have max. chance of fertilizatn



IN CASE OF ORGANIC CAUSE [B/L tubal blockage]

ASSISTED REPRODUCTION TECHNIQUES are indicated

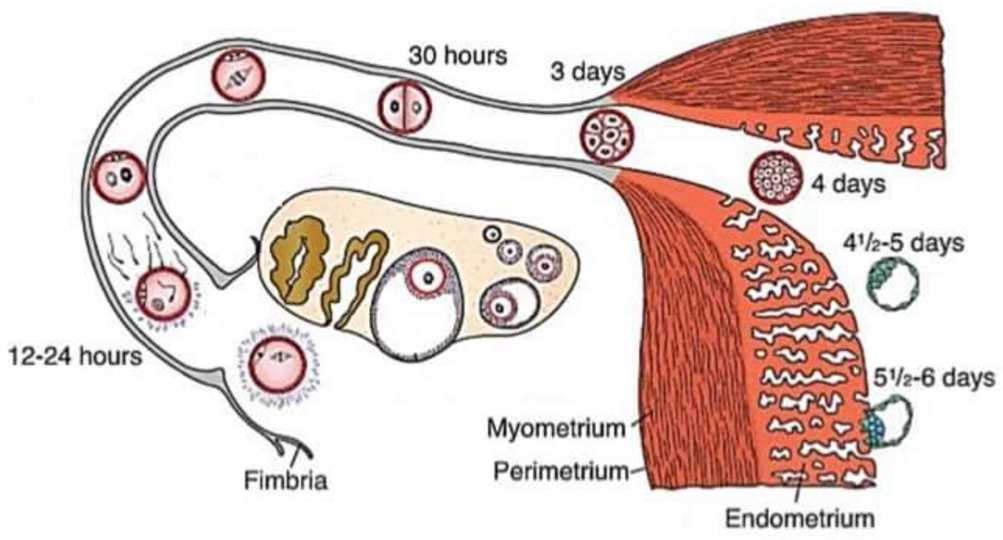
IN VITRO FERTILIZATION

- → ovary is hyperstimulated [clomiphene citrate]
- → aspirate the graffian follicle just before ovulatn → retrieve Secondary oocyte
- → mix Sperm & Secondary oocyte → TEST TUBE BABY
- → Trans vaginal insertn into uterus done at 8 CELL STAGE [Natural Protocol]
  Some experts done it at 32 CELL STAGE

Q conceptus reaches uterine cavity at which stage
a 1 cell
b 2 cell
c 16 cell
d 32 cell

CONCEPTUS ENTERS UTERINE CAVITY ON THE 4th DAY IN 16-64 CELL STAGE

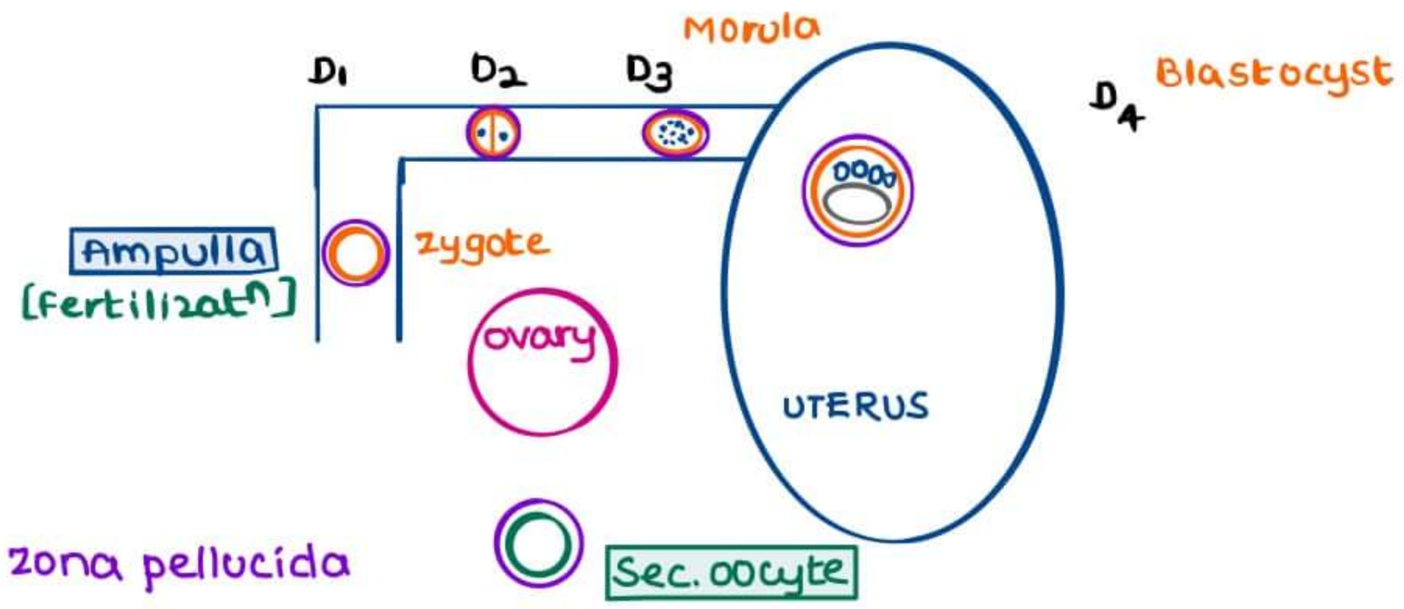
+14386004539



→ Advanced Morula enters uterine cavity on day 4 in 16-64 cell stage

→ Implantation of Blastocyst occurs on day 6

→ Secondary oocyte undergoes ovulat^{n}
→ Fertilizat^{n} occurs in ampulla of fallopian tube



→ glycoprotein
→ attracts sperm
→ also covers zygote & prevents
  1 Polyspermy
  2 Implantat^{n}

POST FERTILIZATION

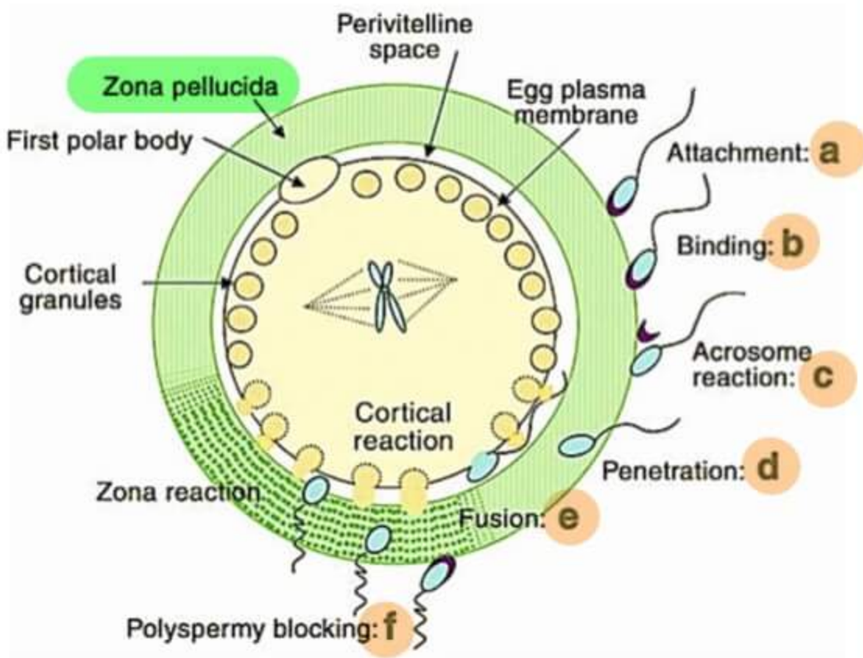
DAY 1	→	Single cell stage
DAY 2	→	2 Cell stage
DAY 3	→	Multicellular stage → MORULA – 12, 16, 32 & > 32 cell stage (MORULA is 16 cell stage) – > 32 cell → Advanced morulla – Advanced morula enters uterine cavity on Day 4
DAY 4	→	BLASTOCYST [by the end of Day 4] – covered by zona pellucida [preventing implantat^{n}]
DAY 5	→	Blastocyst hatches out of zona pellucida [Implantat^{n} begins]
DAY 6	→	Implantation occurs Implantat^{n} → week long process [$D_5 - D_{12}$]
DAY 12	→	UTERINE PLACENTATION Established

Q Choose the correct sequence of embryonic events

a	Cortical Reactⁿ	→	Zona Reaction	→	Acrosome Reaction
b	Zona Reaction	→	Acrosome Reaction	→	Cortical Reactⁿ
c	Acrosome Reaction	→	Cortical Reactⁿ	→	Zona Reaction
d	Acrosome Reaction	→	Zona Reaction	→	Cortical Reactⁿ

SEQUENCE OF EMBRYOGENIC EVENTS

a. Sperm attachment to zona pellucida
b. Binding of Sperm ī ZP
c. **ACROSOME REACTION** → release of enzymes
d Penetratⁿ of sperm
e Fusion → Sperm membrane fuse ī Oocyte membrane & releases Ca^{2+}



CORTICAL REACTION → release of cortical granules
f **ZONA REACTION** → Permeability of ZP changes
Prevents polyspermy

IMPLANTATION

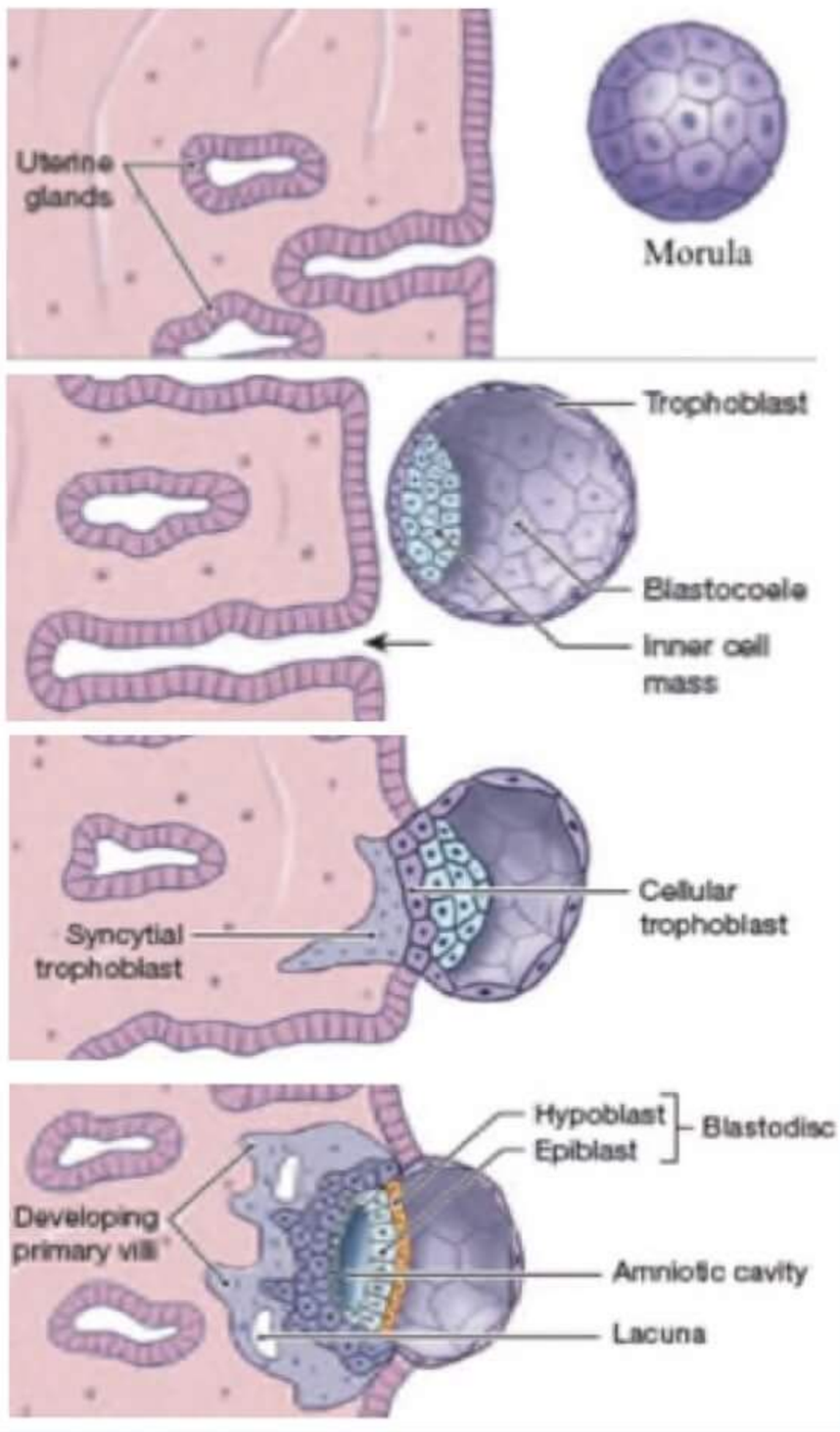
→ Advanced morula entered uterine cavity on Day 4
→ At the end of Day 4, advanced morula changed to

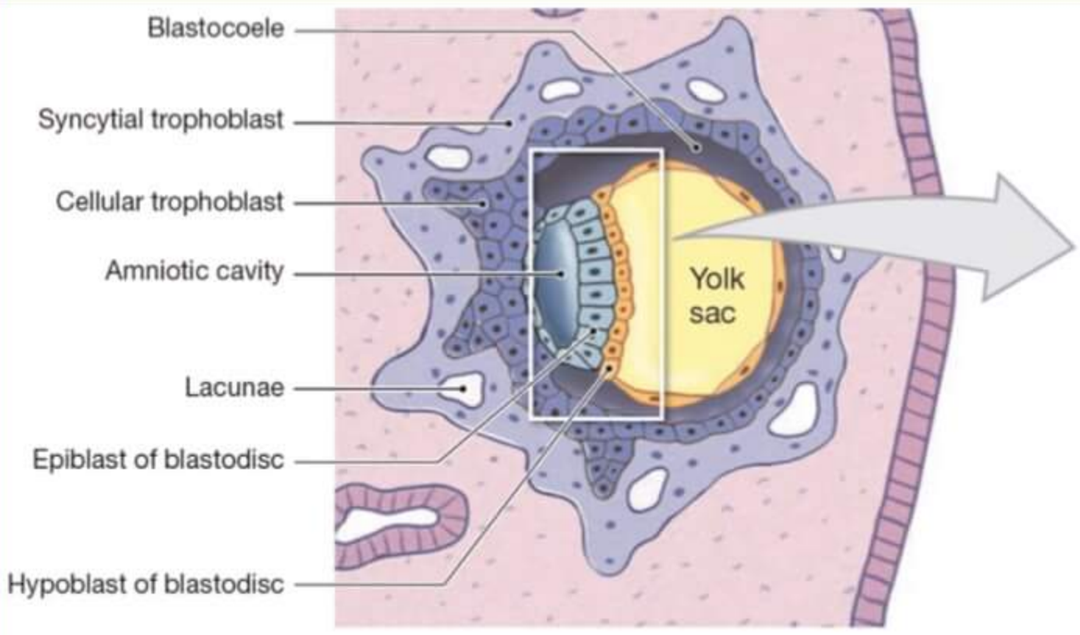
BLASTOCYST

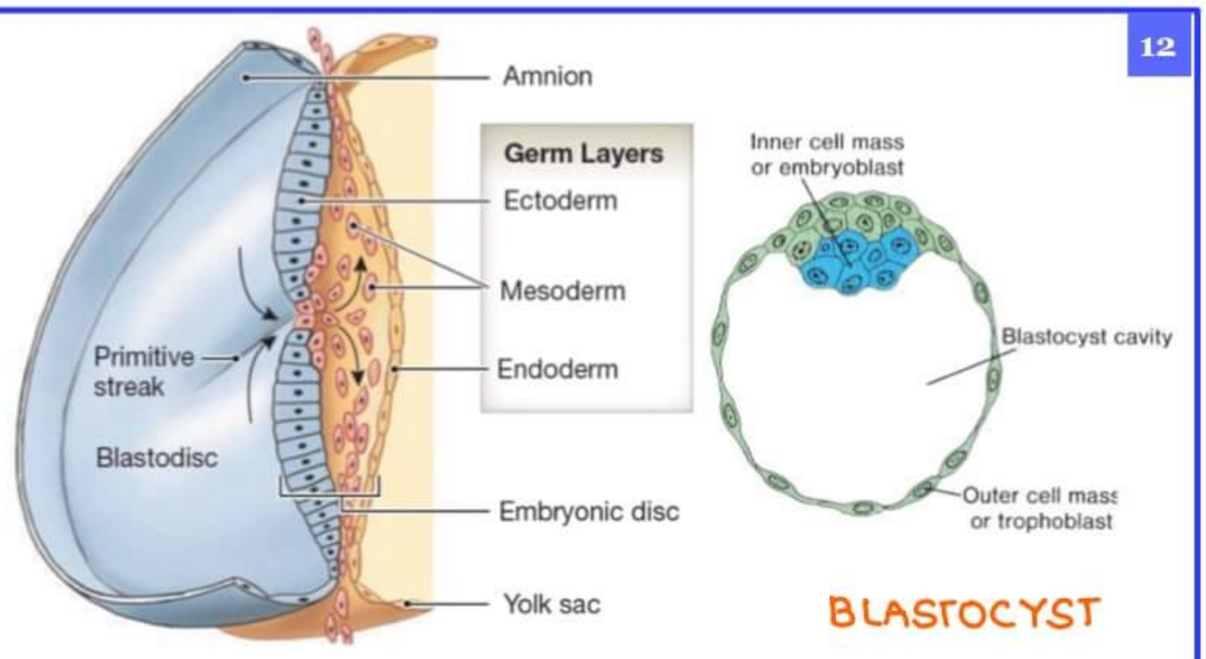
→ contains Blast cells & cyst like cavity
→ containg
Outer cell mass → Trophoblast [helps in placental formation]
Inner cell mass → Embryoblast

→ TROPHOBLAST divides into
cytotrophoblast
Syncytial trophoblast
→ helps in implantatⁿ
→ forms on D_{6-8}

→ EMBRYOBLAST form
Hypoblast [Dorsal]
Epiblast [ventral]
Dorsal amniotic cavity
Ventral yolk sack cavity



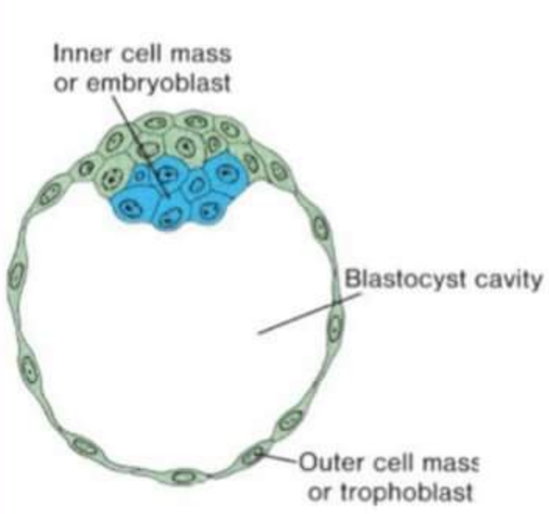


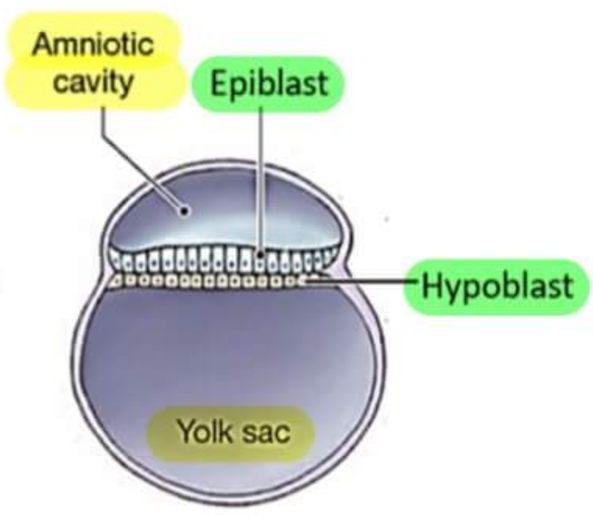


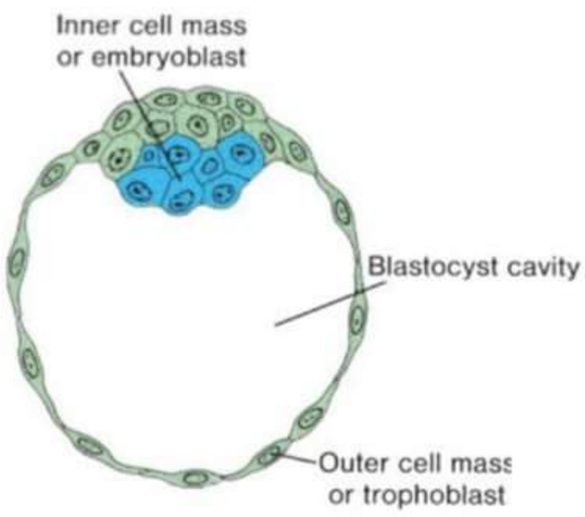
BLASTOCYST

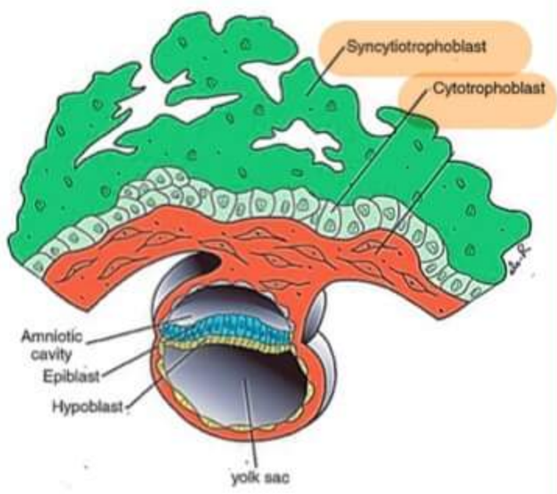
Epiblast forms 3 Germ layers in 3rd week → GASTRULATION

WEEK 2 : WEEK OF 2 (S)





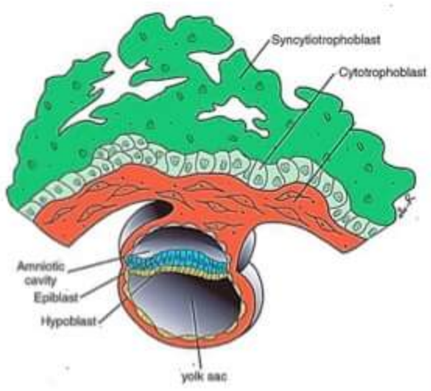




DOUBLE BLEB SIGN ON USG

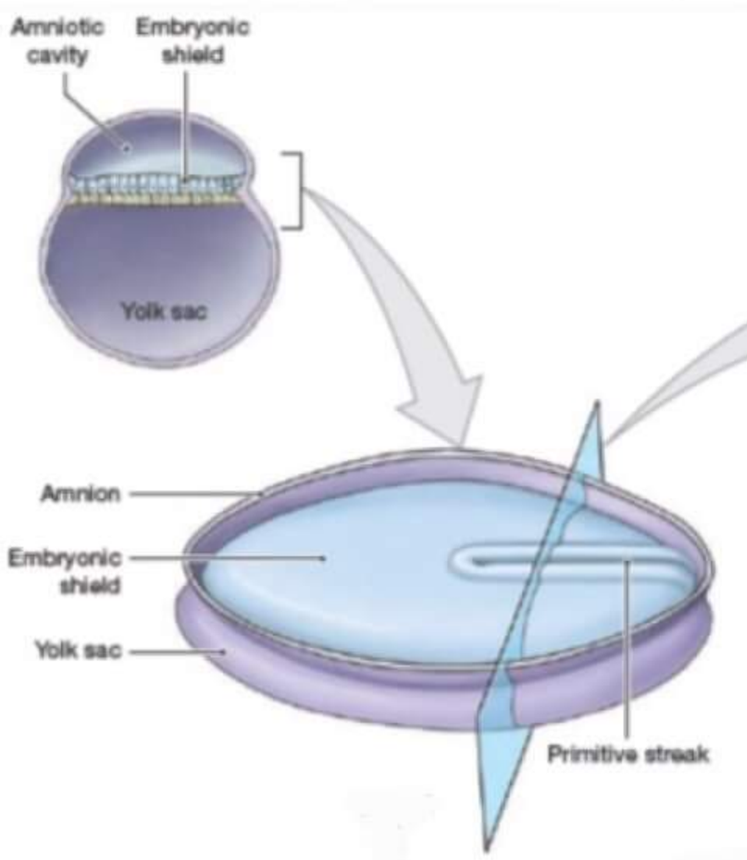
- → dlt amniotic & yolk sac cavities
- → seen in Normal Intra uterine pregnancy in Week 2

DOUBLE BLEB SIGN

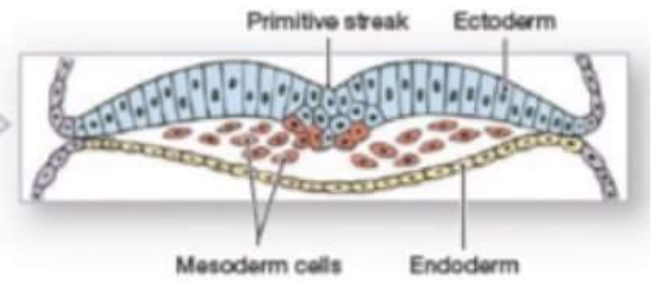


DEVELOPMENTAL PERIOD: WEEK 3 & 4

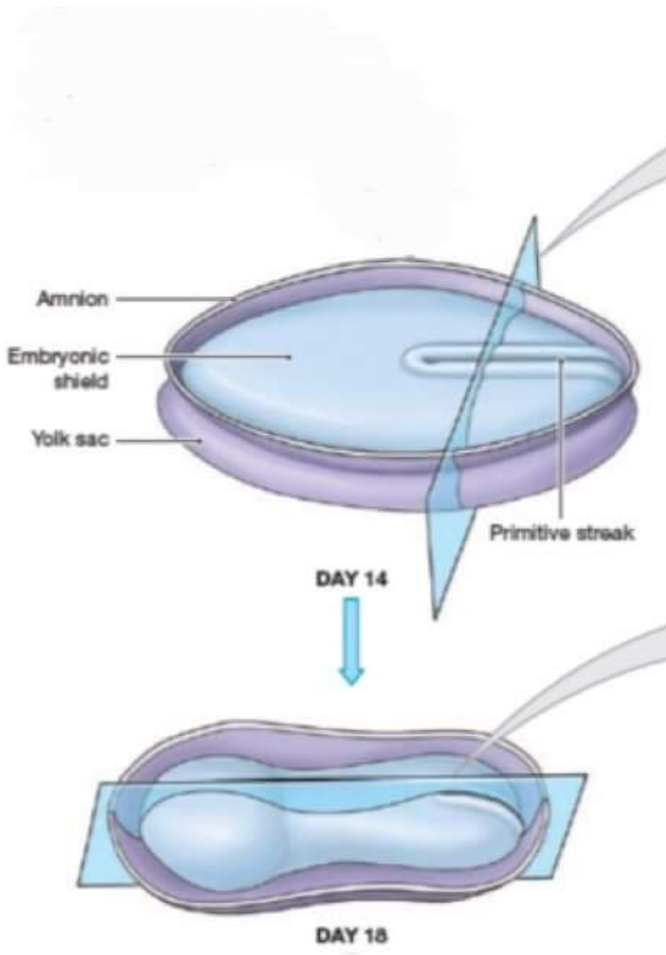
GASTRULATION → 3 germ layers formed in Week 3

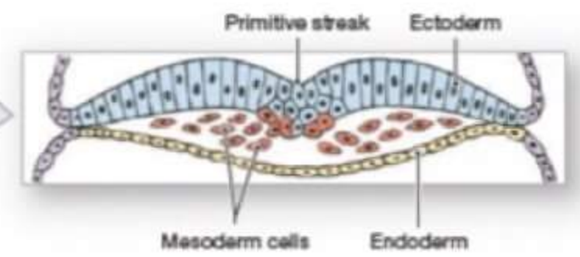


DAY 14

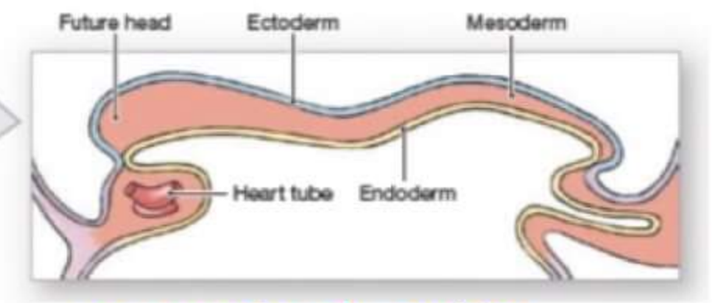


EPIBLAST
↓ proliferatn
PRIMITIVE STREAK
↓
3 GERM LAYERS





Transverse section

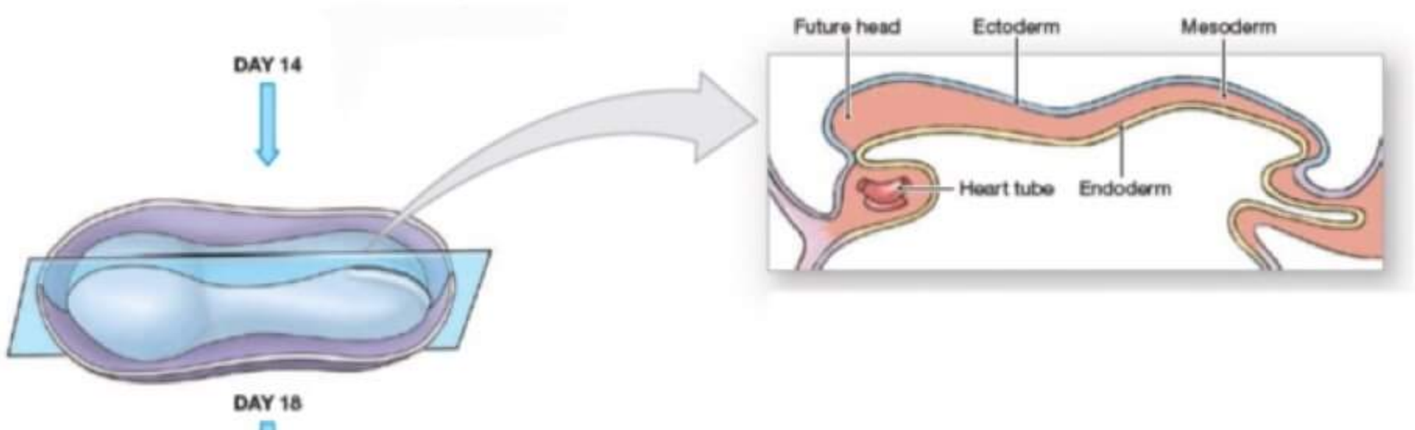


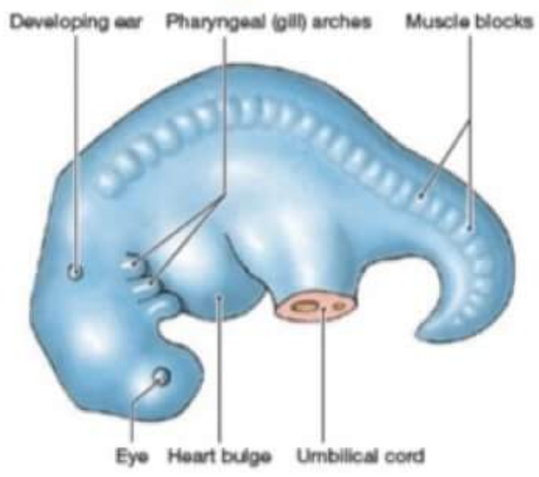
Longitudinal section

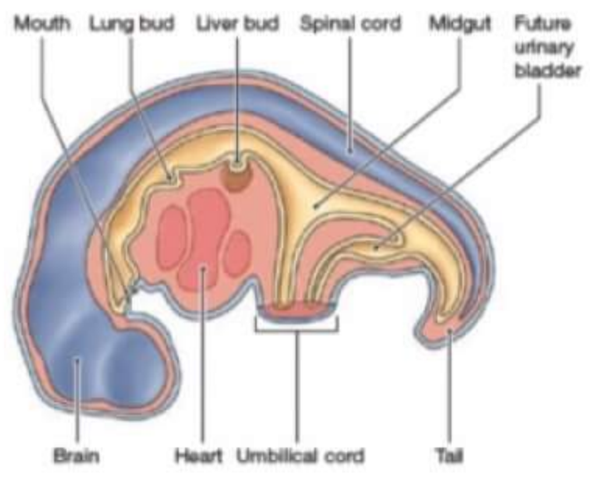
3 GERM LAYERS

Dorsal Ectoderm → forms Neural tube
Middle Mesoderm → forms Cardio vascular tube
ventral Endoderm → Forms Gut tube

WEEK 4





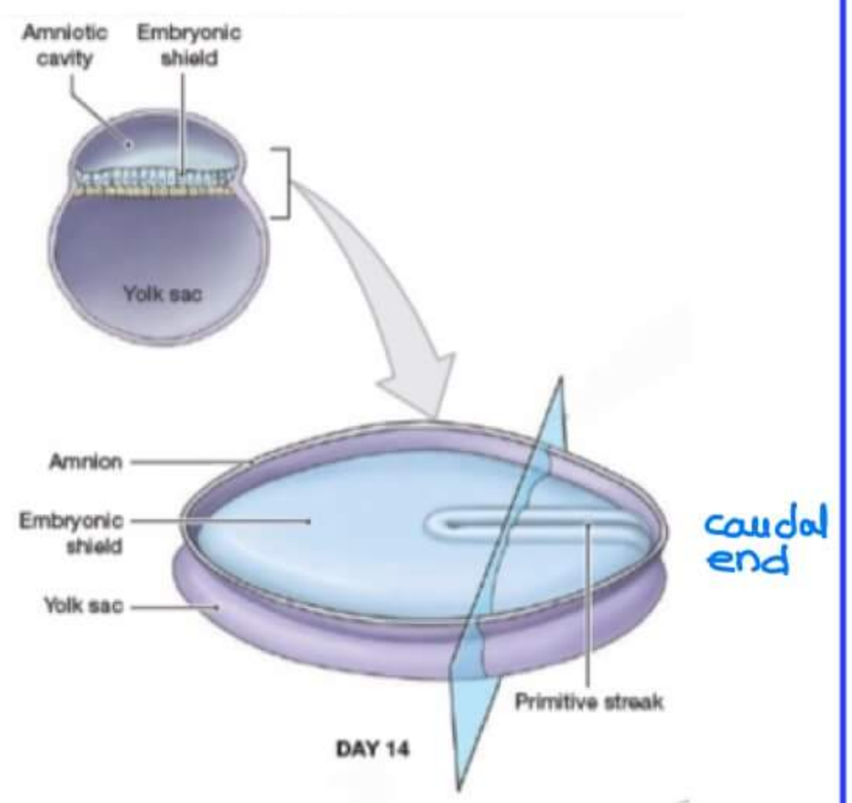


GASTRULATION

PRIMITIVE STREAK

→ Formed from Epiblast proliferat^{n} at end of 2nd week [Day 14]

→ Formed on the floor of amniotic cavity
→ appears at caudal end & migrates to cephalic end

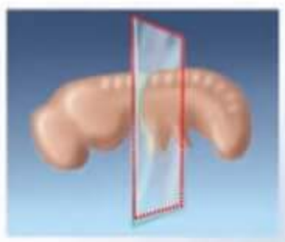


FOLDING OF EMBRYO

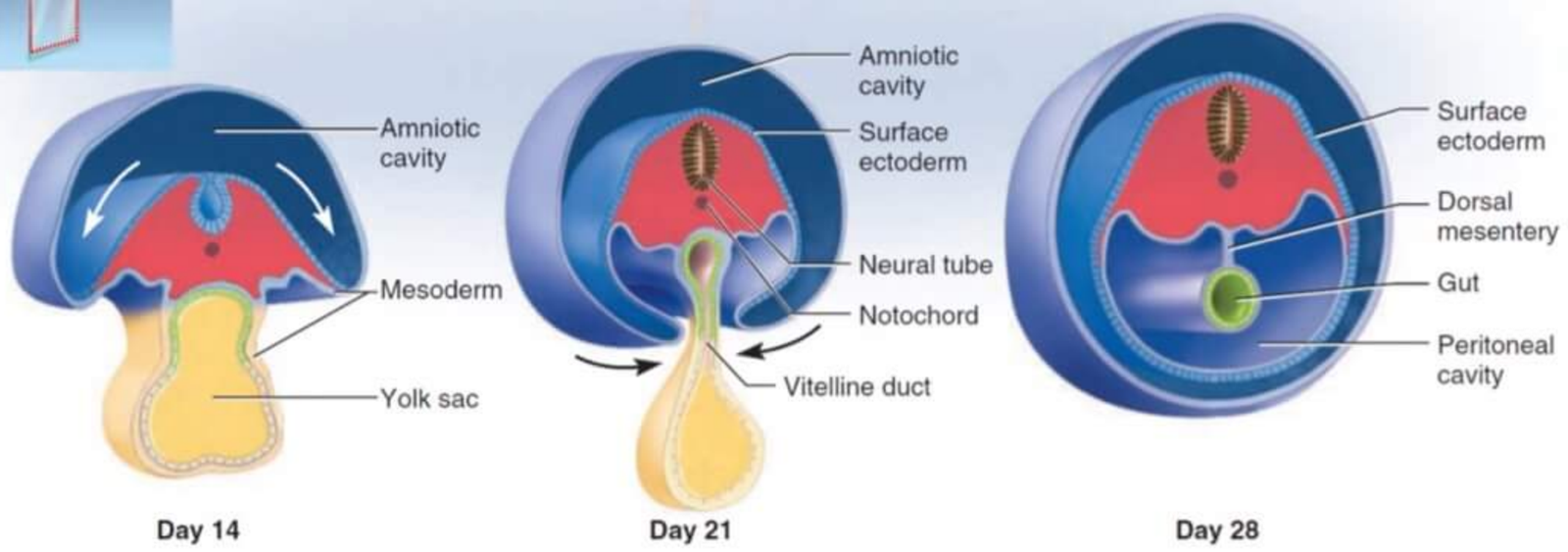
LATERAL FOLDING

CAUDOCEPHALIC FOLDING

LATERAL FOLDING

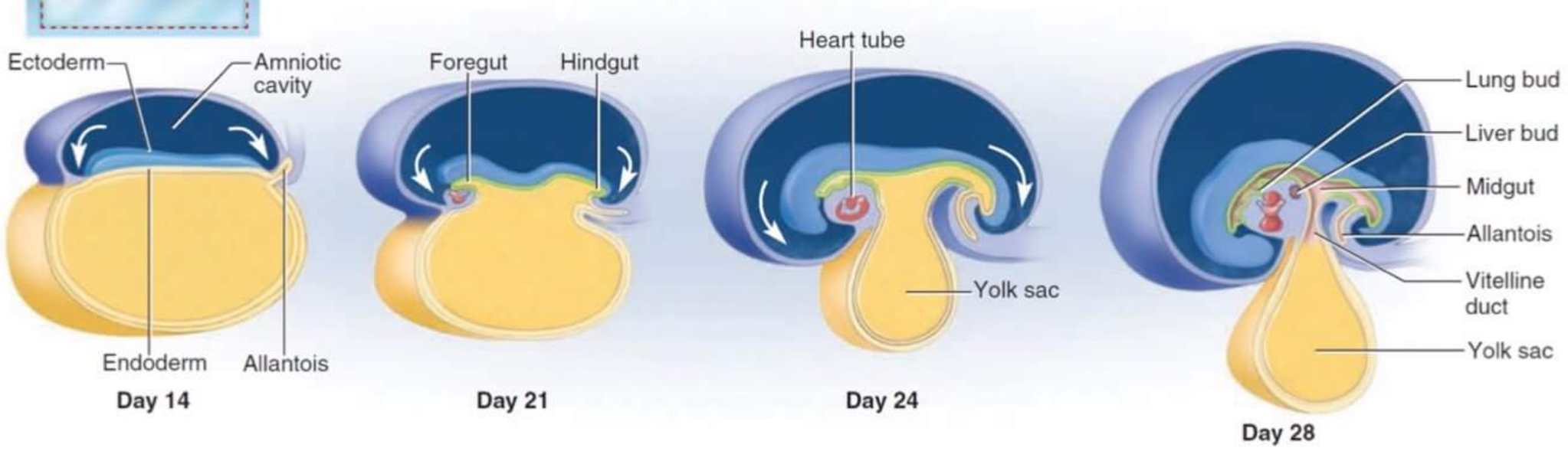


cross sectn



CAUDOCEPHALIC FOLDING

Longitudinal sectn

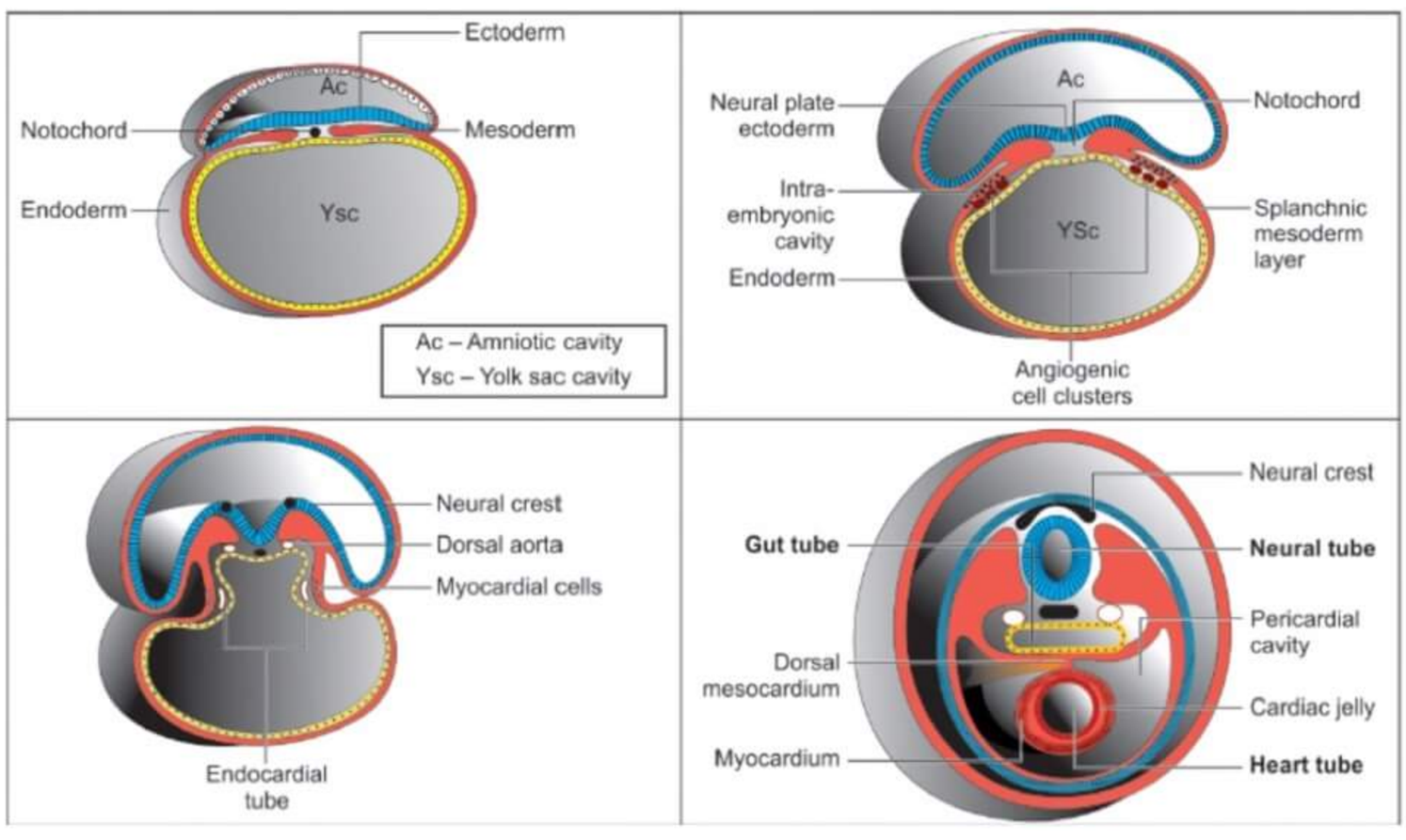


BODY TUBES

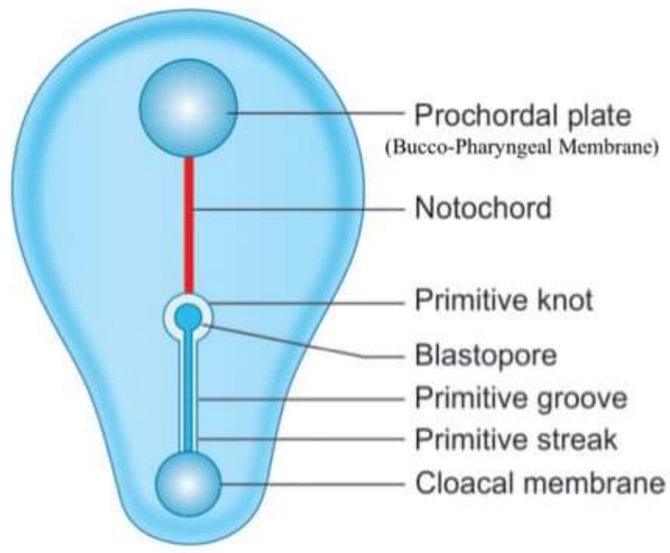
Neural tube → derived from Neural plate ectoderm

Gut tube → derived from endoderm yolk sac

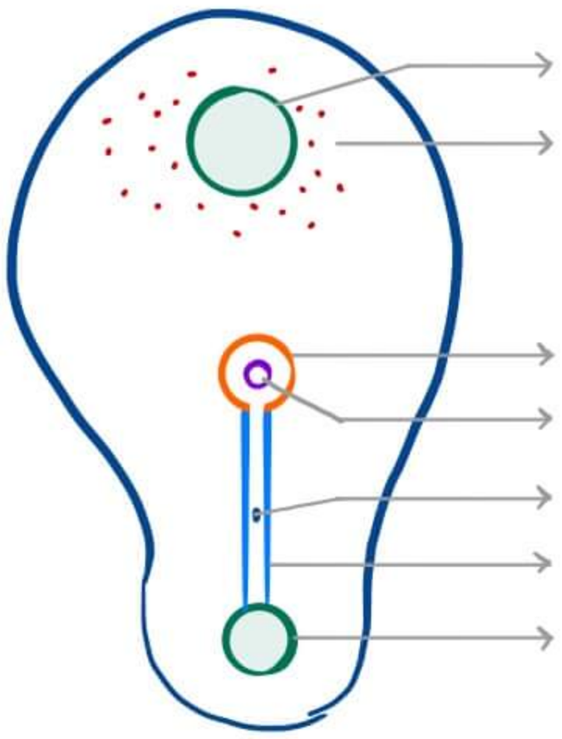
Cardio vascular tube → derived from mesoderm



ECTODERM & NEURAL CREST CELLS DERIVATIVES



CEPHALIC END



BUCCO PHARYNGEAL MEMBRANE

EPIBLASTS [dorsal veiw]

HANSEN'S NODE

PIT

GROOVE

PRIMITIVE STREAK

CLOACAL MEMBRANE

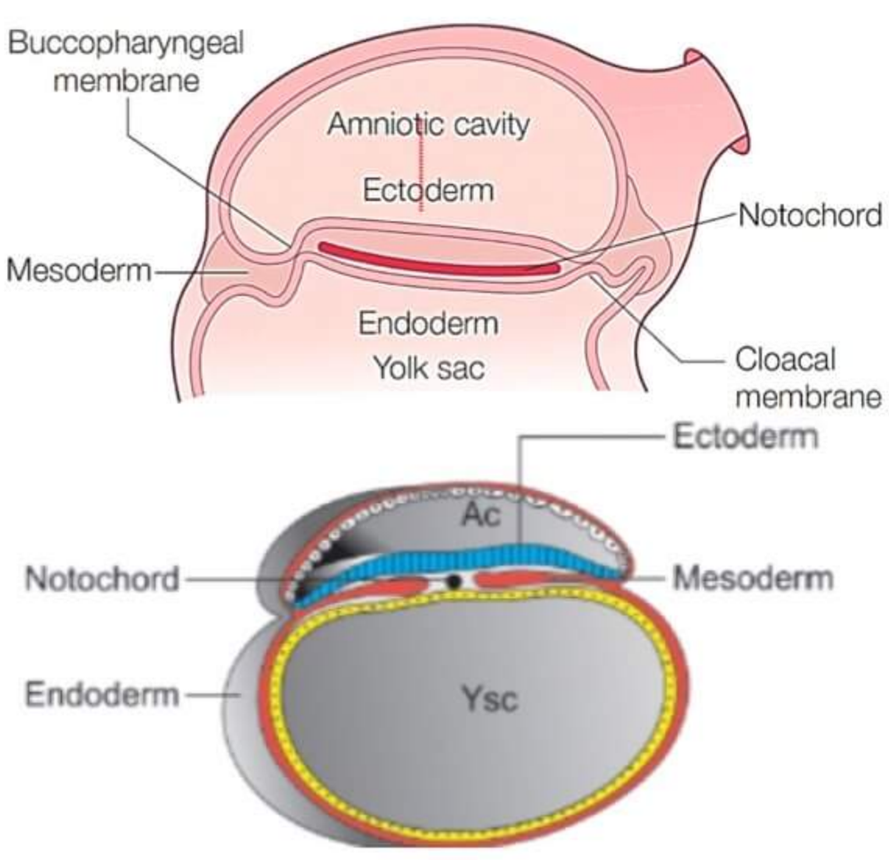
CAUDAL END

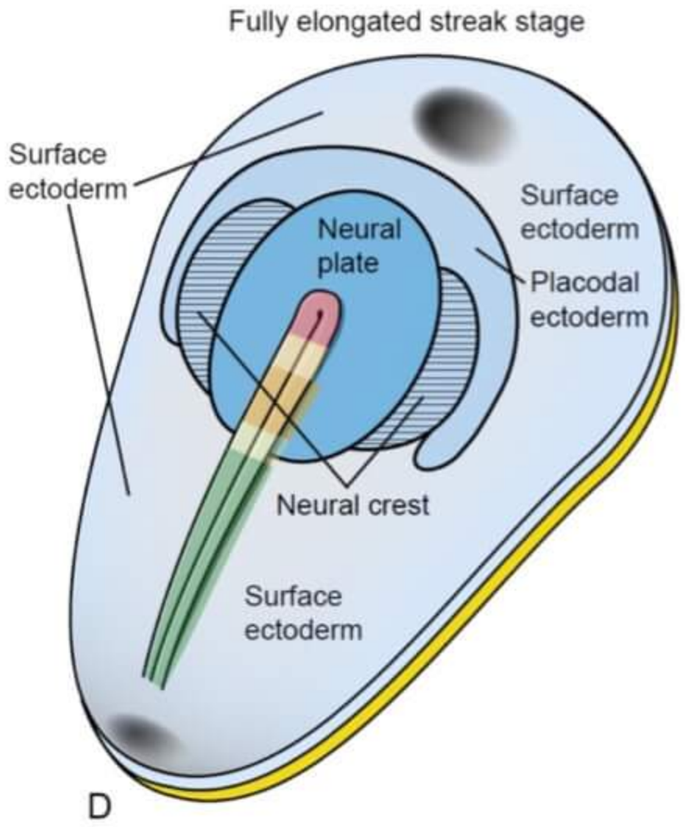
Primitive streak → appear towards caudal end
→ migrating towards cephalic end

Hansen's node → present at the cephalic end of primitive streak

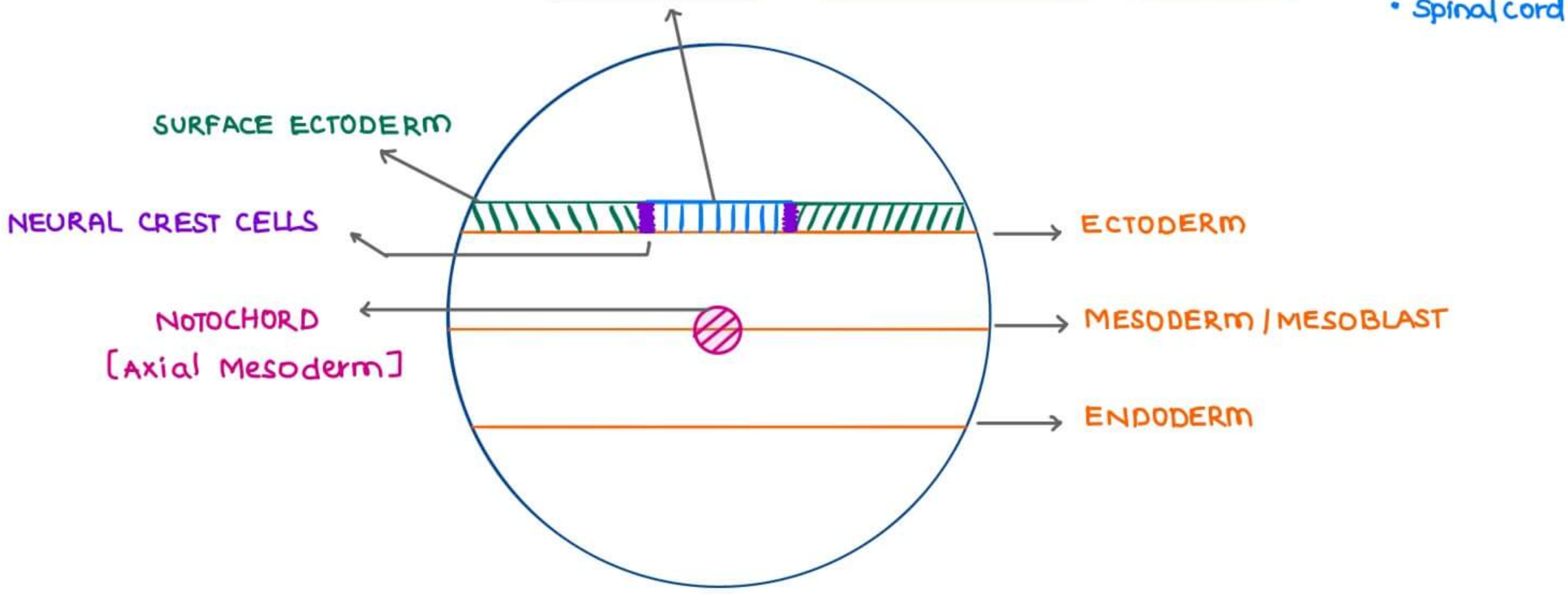
Primitive groove
Primitive Pit
Cloacal membrane
Buccopharyngeal membrane
} have no mesoderm d/t fusion of dorsal ectoderm & ventral endoderm

FORMATION OF ECTODERM





NEURO ECTODERM → NEURAL PLATE ECTODERM → NEURAL TUBE → CNS
- Brain
- Spinal cord

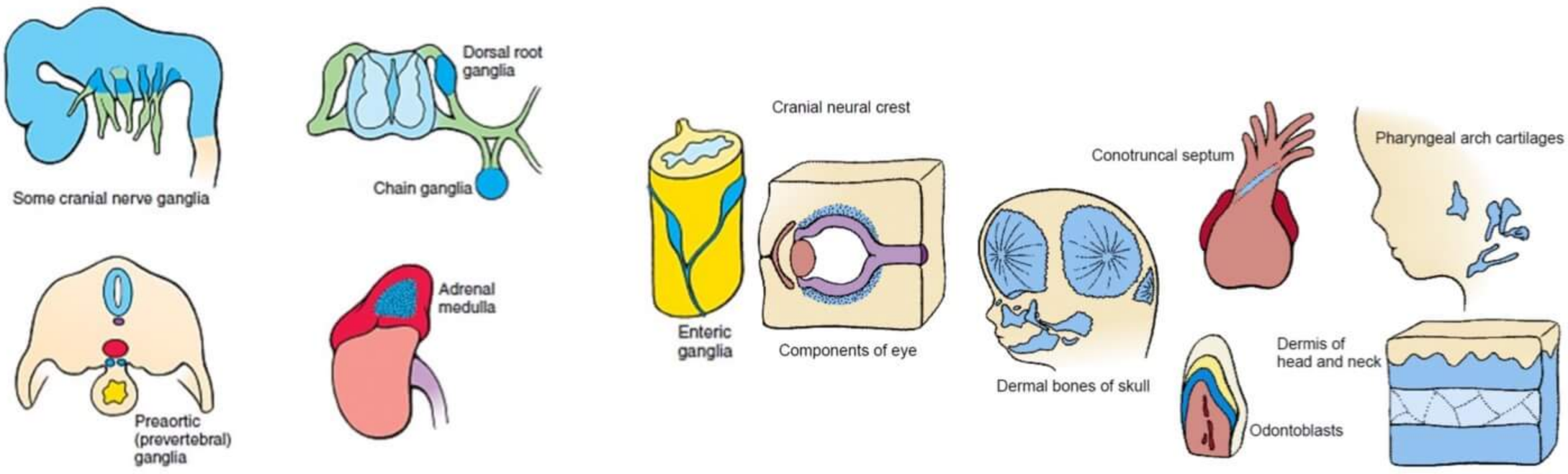


NEURAL CREST CELL DERIVATIVES

1. Peripheral Nervous System [includes ganglia]
2. Secondary Mesenchyme / Mesoderm
   - → most of skull bones [Head & Neck ant. & lat. regions]
   - → most of eye ball mesoderm
   - → Pharyngeal arch bones [malleus, incus, stapes, mandible, hyoid bones]
3. Aorta pulmonary Septum
4. Dermis of head & neck
5. odontoblasts

DI GEORGE SYNDROME

- → Failure of migration of neural crest cells towards head, neck region
- → Presents :
  - Skull defects
  - Eye ball defects
  - Pharyngeal arch bone defects
  - Aorto pulmonary septum anomaly [mc cause of Death]



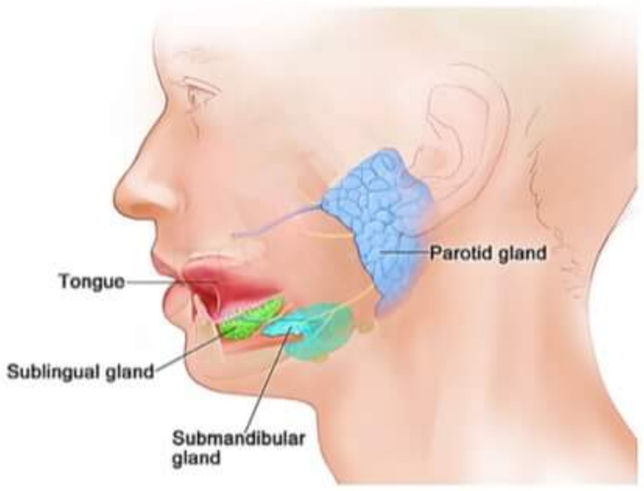
Primary mesenchyme derived from Mesoderm / Mesoblast
- → posterior region of Head & neck (occipital bone)
- → Eye ball [little]
- → Pharyngeal arch muscles

SURFACE ECTODERM DERIVATIVES

1 EPITHELIUM & GLANDS
- → Skin epithelium
- → Sweat glands
  Sebaceous glands

2 MYOEPITHELIOCYTES [MEC'S] OF SKIN GLANDS

3 ANY EXTERNAL OPENING
- → Oral opening
- → Rathke's pouch [most of pituitary]



4 SALIVARY GLANDS
- → Parotid glands
- → Sub mandibular gland
- → Sub lingual gland

NEURAL PLATE ECTODERM DERIVATIVES

1 IRIS MUSCLES
  Sphincter pupillae
  Dilator pupillae

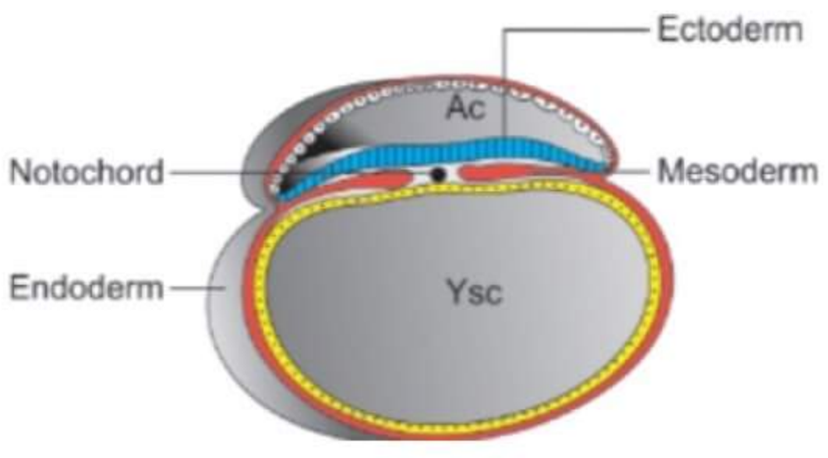
2 CNS

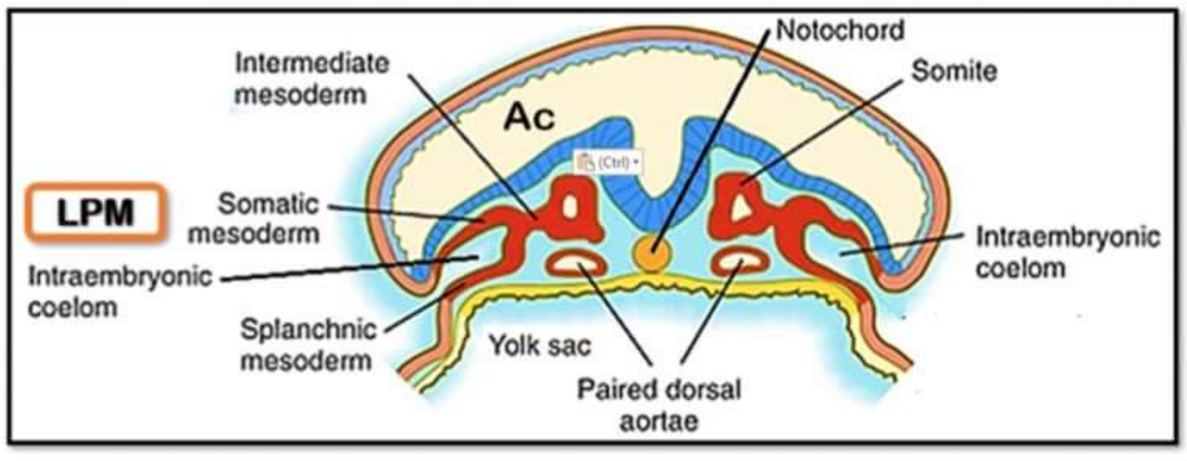
3 NEUROHYPOPHYSIS
- — down ward extensⁿ of diencephalon

@ All are derivatives of Ectoderm except
- a Epidermis
- b Parotid gland
- c Neuro Hypophysis
- d Arrector pilorum

ARRECTOR PILORUM
- → Smooth muscle in Skin
- → derived from Mesenchyme

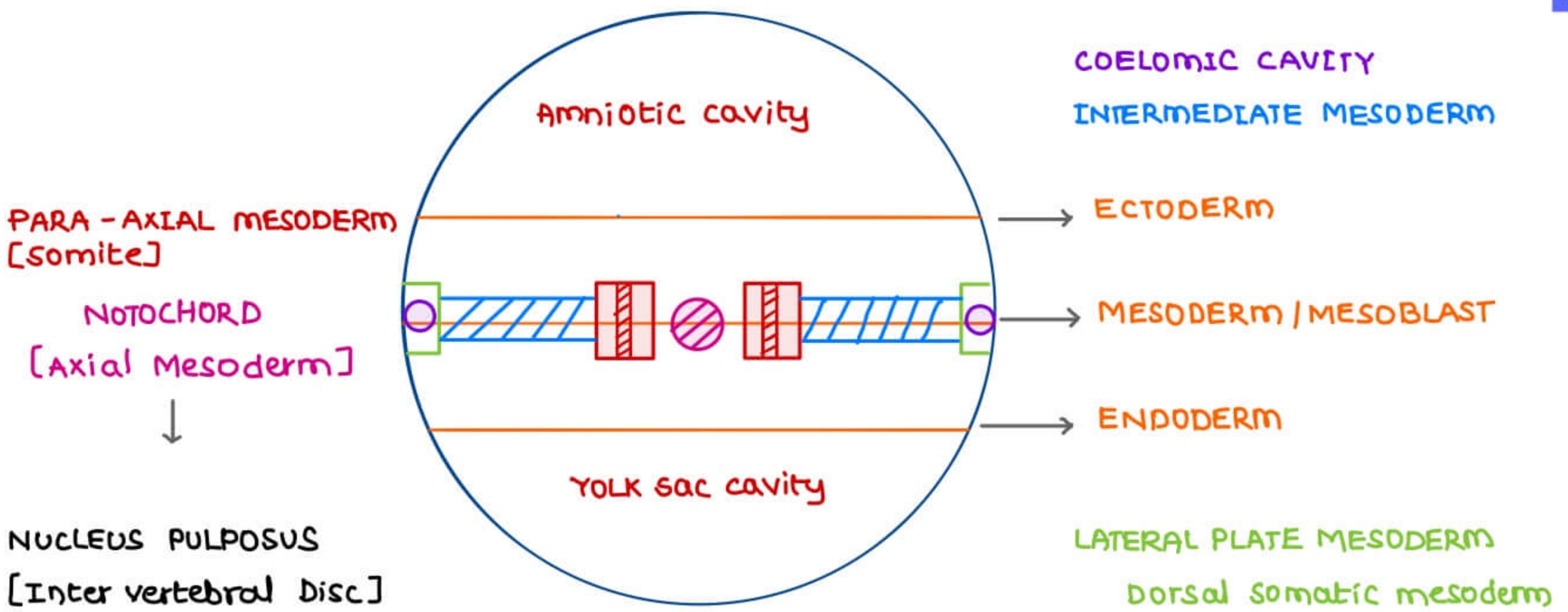
MESODERM DERIVATIVES





COMPONENTS OF MESODERM

1 NOTOCHORD / AXIAL MESODERM
2 SOMITE [PARA AXIAL MESODERM Derivative]
3 INTERMEDIATE MESODERM → Genito urinary system
4 LATERAL PLATE MESODERM → pleura, peritoneum, pericardium
5 INTRA EMBRYONIC COELOM → pleural, peritoneal, peri cardial cavities



NUCLEUS PULPOSUS

→ Vestigial remnant OF notochord

→ Found in Inter Vertebral Disc

LATERAL PLATE MESODERM

SOMATIC MESODERM [Dorsal]

PERITAL LAYERS OF
- pleura
- peritoneum
- pericardium

VENTRAL VISCERAL MESODERM

VISCERAL LAYERS OF
- pleura
- peritoneum
- pericardium

VISCERAL MUSCLES
- cardiac muscles
  - CV Tube
- Smooth muscles
  - Gut tube
  - Resp. tube

EXCEPTIONS
- MEC [SE]
- Iris muscles [NPE]
- Genito Urinary System
  - Detrusor [IMM]

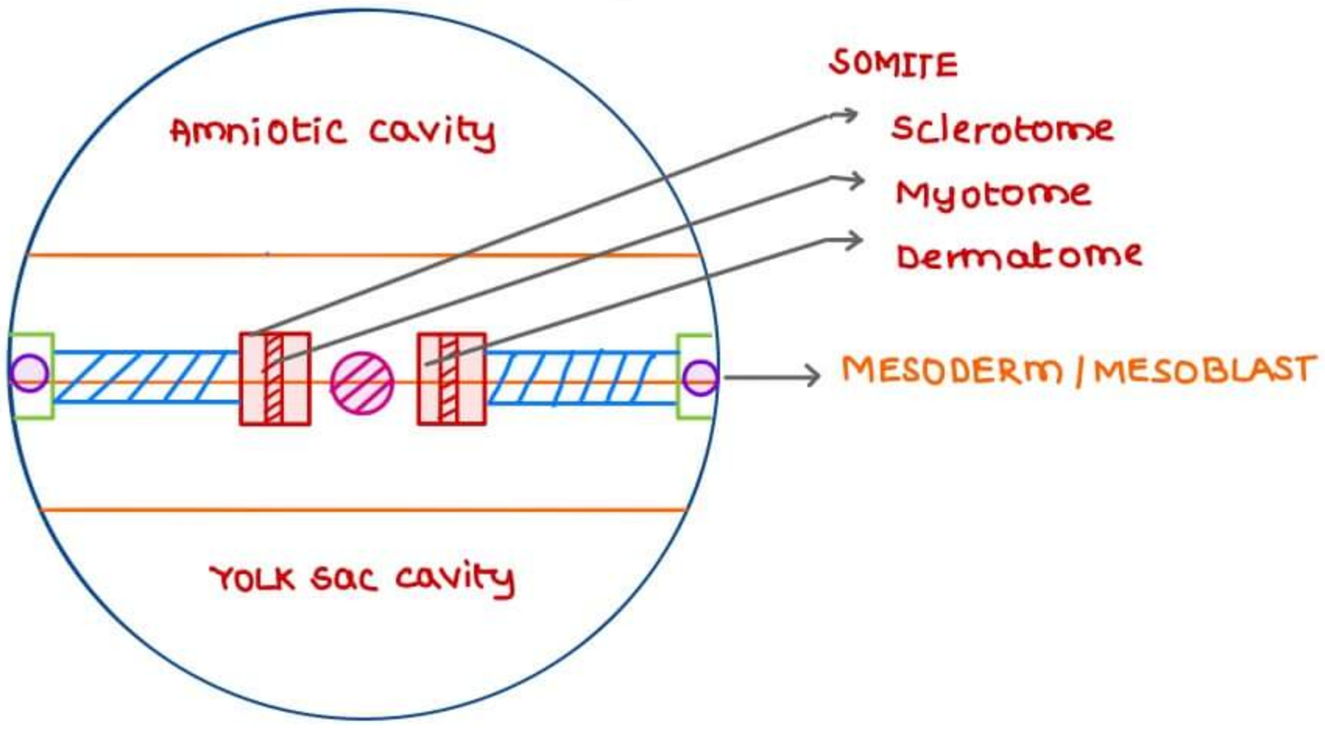
INTERMEDIATE MESODERM DERIVATIVES

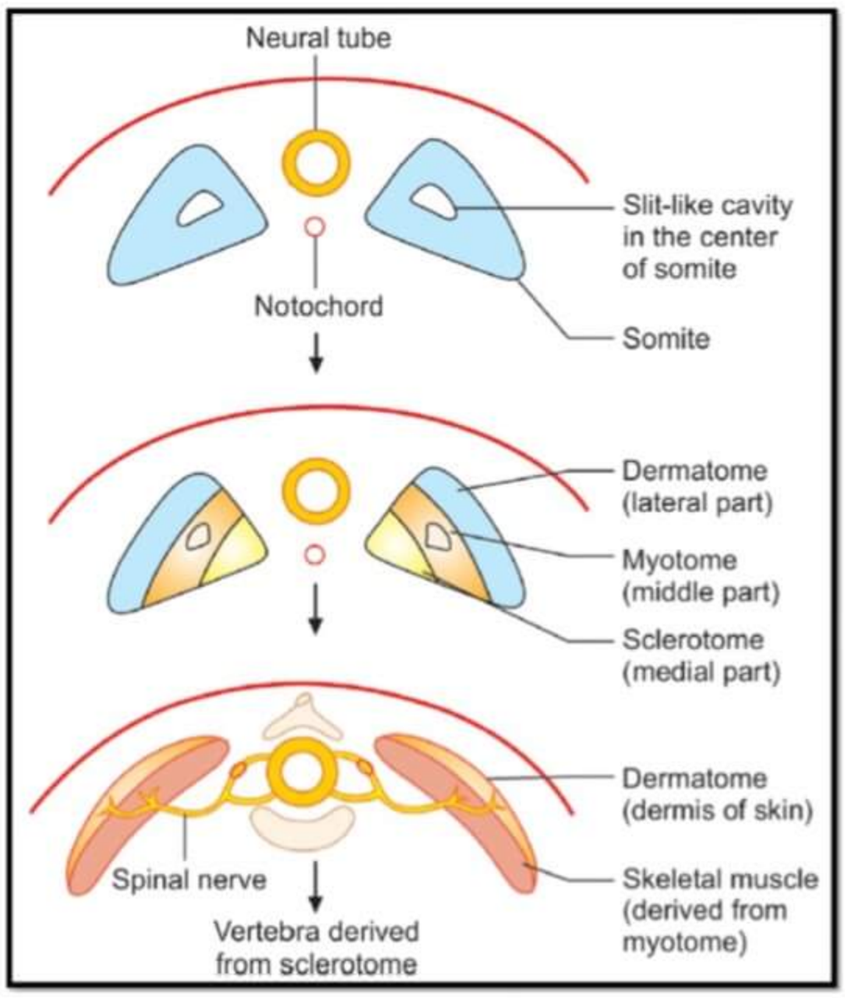
1. GENITO URINARY SYSTEM SMOOTH MUSCLES [Detrusor]
2. EPITHELIAL COMPONENTS OF
   - Kidney
   - Testis
   - Ovary

SOMITE DERIVATIVES

COMPONENTS

1 Dermatome [Lateral part] → Skin Dermis
2 Myotome [middle part] → Skeletal Muscles
3 Sclerotome [medial part] → Bone [vertebra]





SKELETON

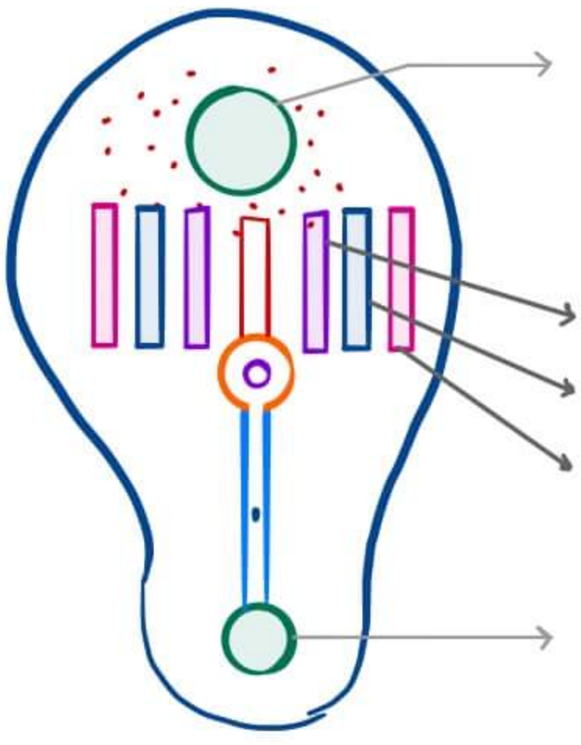
1 AXIAL SKELETON → Skull & vertebra
2 APPENDICULAR SKELETON → Upper limb & lower limb

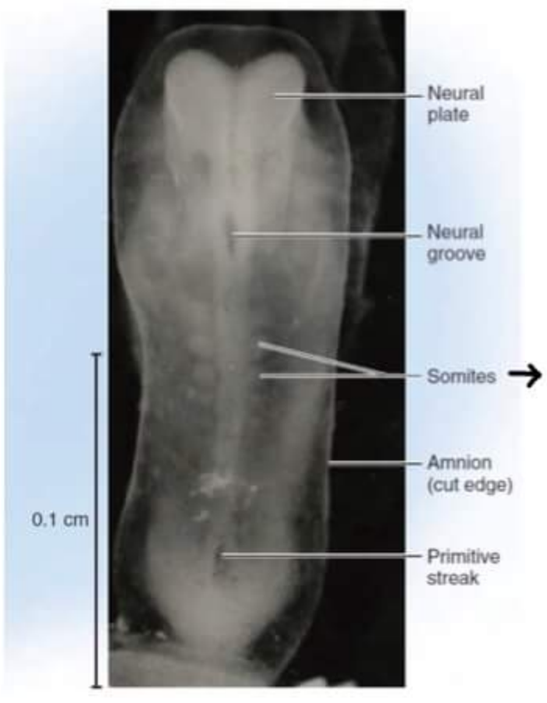
Skull Bones
→ Anterior & Lateral → Neural crest cells
→ posterior (occipital) } somites
Vertebral } [sclerotome]

Upper limb bones [Humerus] } Dorsal somatic
Lower Limb bones [Femur] } Lateral plati mesoderm

DORSAL VIEW OF EMBRYO

CEPHALIC END





→ Somites → vertebra → covers Neural tube ↓ Spinal cord

CAUDAL END

→ 1st pair of somites appear in → cervical occipital region
on → Day 20

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

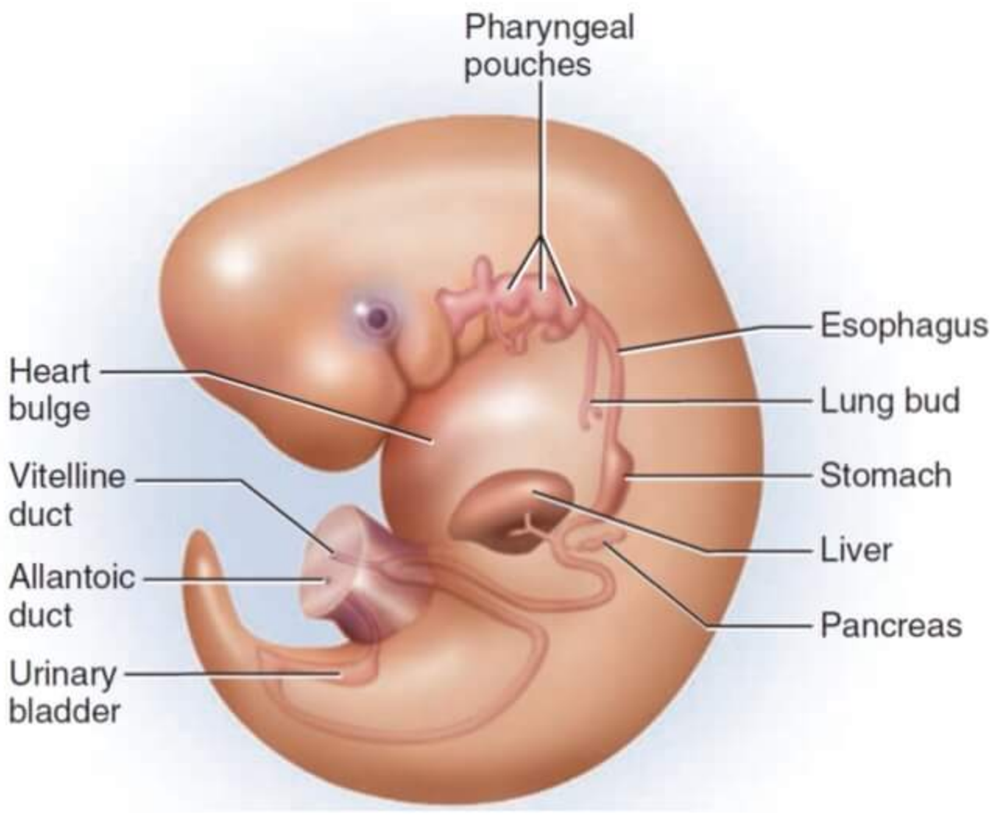
Q. Muscles derived from visceral sphlanchnic lateral plate mesoderm is
- a Myo Epitheliocytes of skin glands
- b Iris Muscles
- c Smooth muscles of gut tube
- d Detrusor

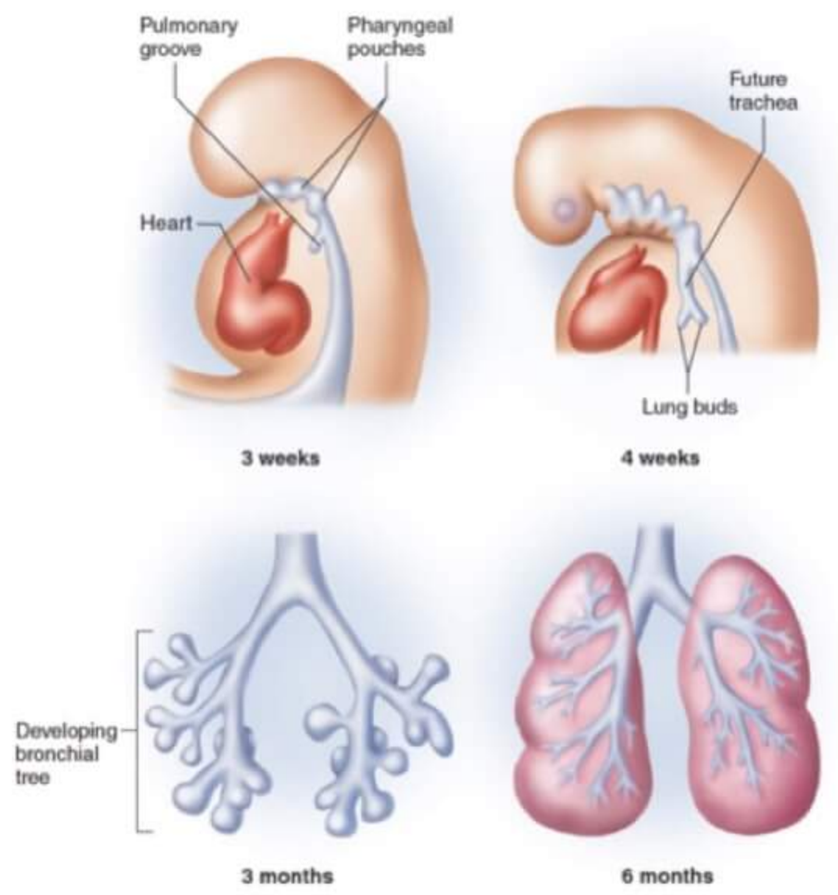
Q. Which of the following develop from para axial Mesoderm
- a Adrenal cortex → derived from Intermediate mesoderm
- b Humerus → derived from Lateral Plate Mesoderm
- c Biceps brachii [Better answer]
- d Masster

Adrenal Medulla derived from Neural crest cell

ENDODERM DERIVATIVES

Q. Vaginal epithelium is derived from
- a Endoderm of genital ridge
- b Endoderm of urogenital sinus
- c Mesoderm of genital ridge
- d mesoderm of urogenital sinus





GUT TUBE DERIVATIVES

FORE GUT → Respiratory tube
MIDGUT → Vitelline duct
HIND GUT → Allantoic duct

COMPONENTS OF UMBILICAL CORD → Vitelline Duct
→ Allantoic Duct

RESPITORY TUBE FORMATION SEQUENCE

→ Trachea
Bronchus
Lungs

→ Epithelium derived from → fore gut endoderm
→ smooth muscles derived from → ventral visceral Lateral plate mesoderm

GUT TUBE

→ derived from Endoderm of yolk sac forming epithelium
→ ventral visceral LPm forms muscles
→ ENDODERM OF HIND GUT
Lower part of Genito urinary system
→ urinary bladder
→ urethra
→ Lower vagina

Major part of Genito urinary system derived from Intermediate mesoderm

→ Pharyngeal pouches are 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]

→ Liver & Pancreas developing at foregut & midgut junction
[mainly contributed by endoderm of foregut]

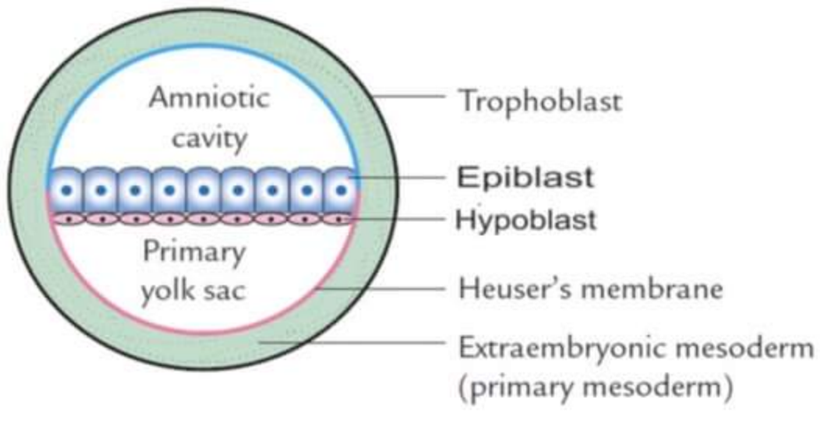
→ Buccopharyngeal membrane rupture to form Oral opening
cloacal membrane rupture to form anal opening

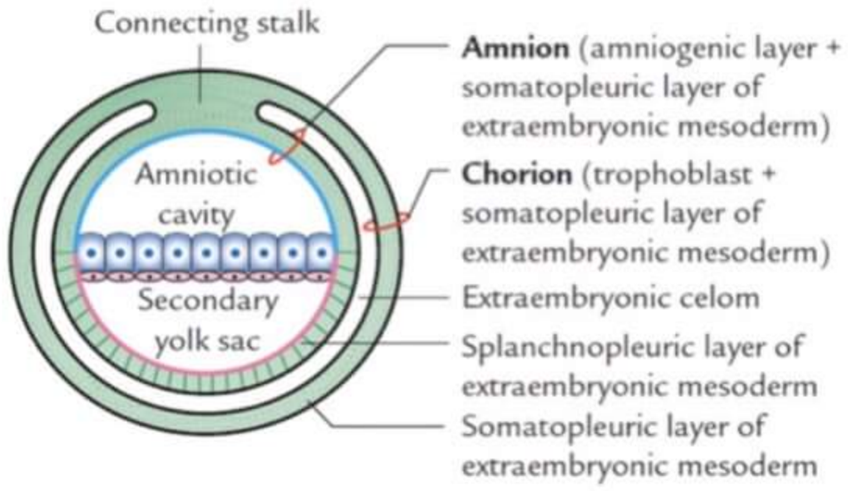
→ Both membranes do not have mesoderm dlt fusion of ectoderm & endoderm

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

Then Mesoderm split into 2 LAYERS seperated by the COELOM

1. SPLANCHNOPLEURIC LAYER → lines the secondary yolk sac
2. SOMATOPLEURIC LAYER → lines the amniotic sac & extends the connective stalk





AMNION

→ covers amniotic cavity

→ contributed by

↳ Amniogenic cells [from trophoblast]

↳ Somatopleuric layer of EEM

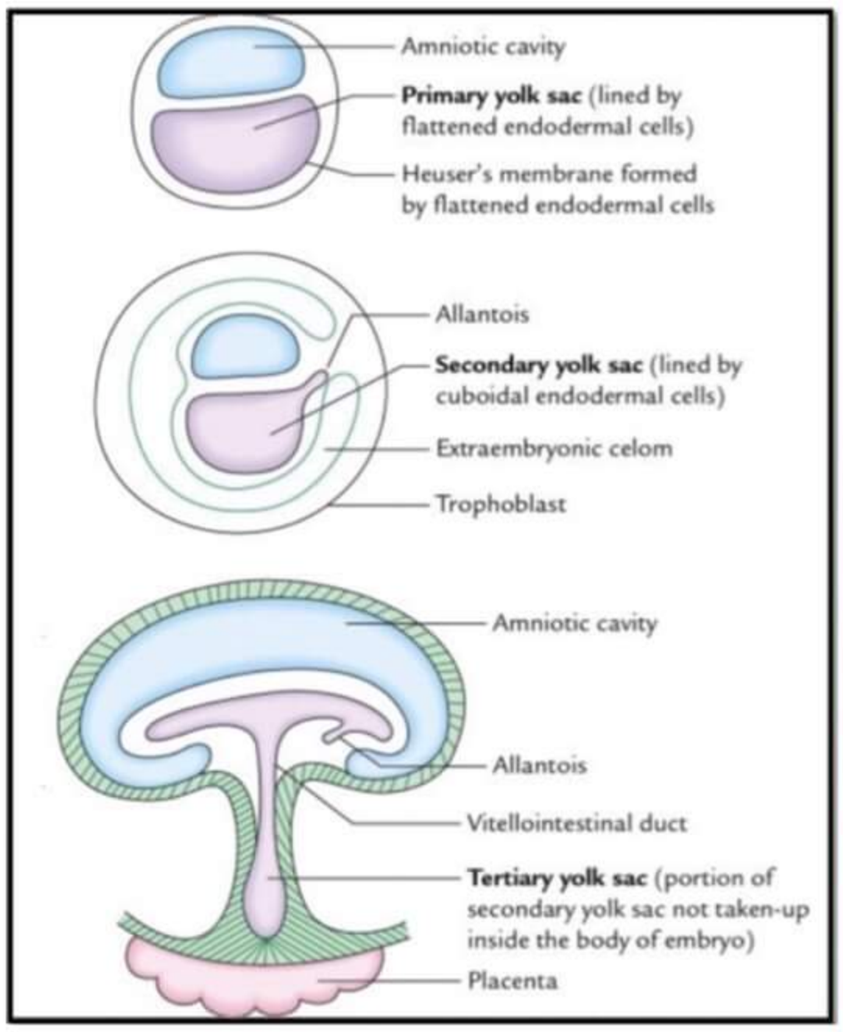
CHORION

→ CONTRIBUTED BY

↳ cytotrophoblast

↳ Syncytiotrophoblast

↳ Somatopleuric Layer of EEM



WEEK 2

Trophoblast divides to form

1. Cytotrophoblast
2. Syncytiotrophoblast

} Form Placental membrane

BY WEEK 3, 3 Layer of cells have formed from Epiblast [Ectoderm, Endoderm, mesoderm]

YOLK SAC

1° YOLK SAC → Lined by Flattened Endodermal cells
2° YOLK SAC → Lined by cuboidal Endodermal cells

} 1° → 2° When embryonic coelom develops

3° YOLK SAC → Formed during cephalocaudal development of Embryo
Forms gut tube
part of the yolk sac remaining out side the Embryo – 3° YOLK SAC

PLACENTAL COMPONENTS

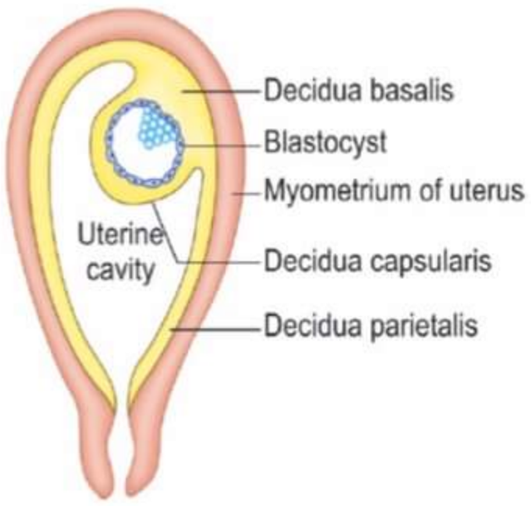
Placenta formed by fetal & maternal contributions

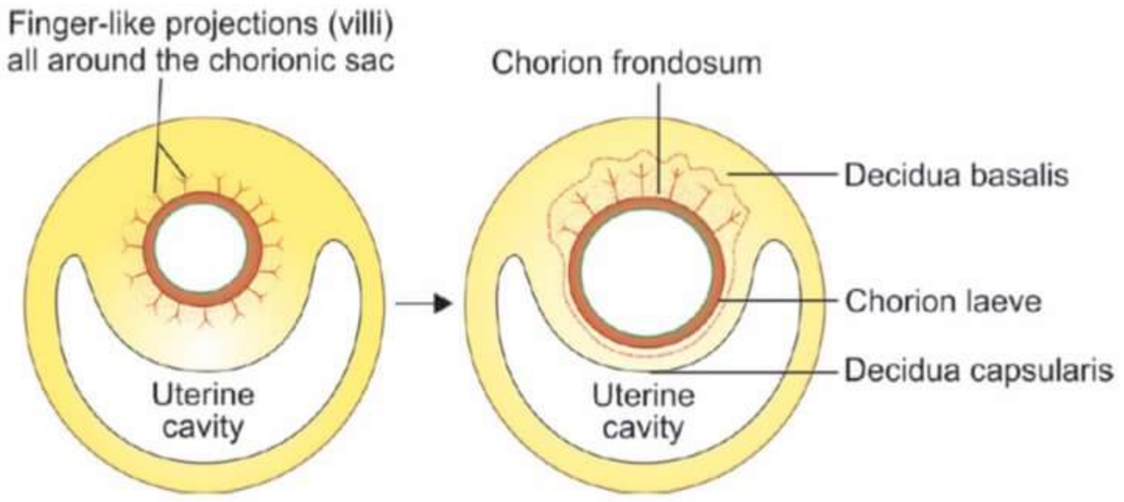
MATERNAL PLACENTA

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





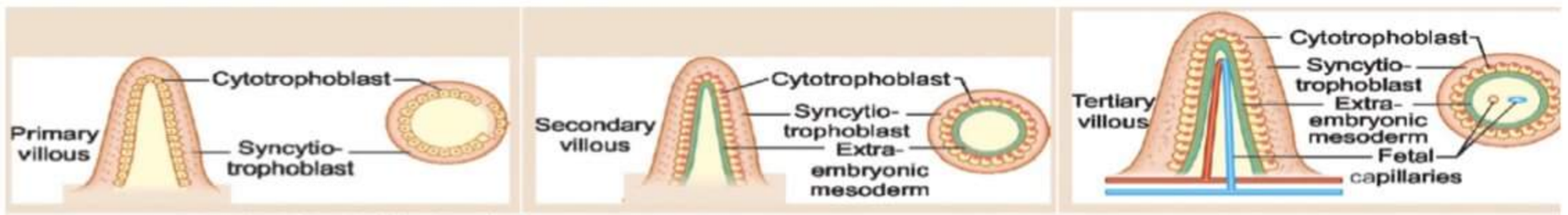
FETAL PLACENTA

→ 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

CHORIONIC VILLI



Villus stage	Primary villus	Secondary villus	Tertiary vill
Time of appearance (post fertilization)	Day 12	Day 13-15	Day 17-21 (w
Structure	A core of cytotrophoblast cells covered by a layer of syncytium (syncytiotrophoblast)	Cytotrophoblast core invaded by extraembryonic mesoderm	Fetal blood ir

PRIMARY VILLUS [Day 12] → core of cytotrophoblast cells, covered by Syncytio TB

SECONDARY VILLUS [Day 13-15] → Cytotrophoblast layer invaded by extra Emb. mesoderm

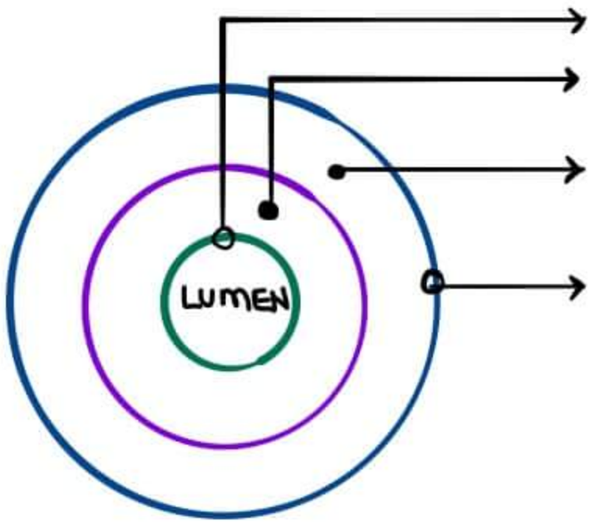
TERTIARY VILLUS [Day 17-21] → Fetal blood vessels invades the mesoderm

UTEROPLACENTAL CIRCULATION → established by Day 12

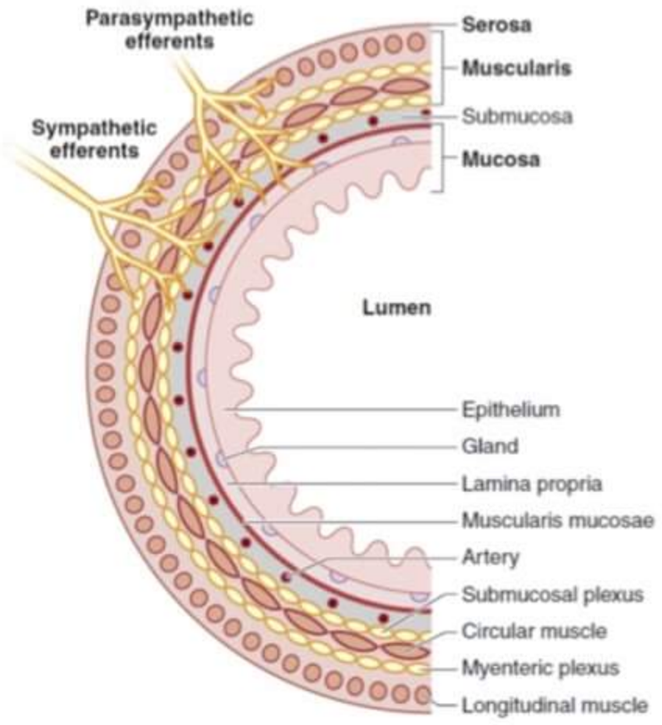
FETOPLACENTAL CIRCULATION → established by DAY 17-21 [misnomer]

BODY TUBES

GUT TUBE



- MUCOSA
  - Epithelium & GLANDS
  - Lamina propria [conn. Tissue]
  - Muscularis mucosa
- SUB MUCOSA
- MUSCULARIS EXTERNA
- SEROSA [Peritoneum]
  - or
- C.T - ADVENTITIA



→ MEISSNER'S PLEXUS → plexus in submucosa
→ AUERBACH'S PLEXUS → plexus in muscle layer
→ present blw inner circular & outer longitudinal layer

BODY TUBES - OVERVIEW

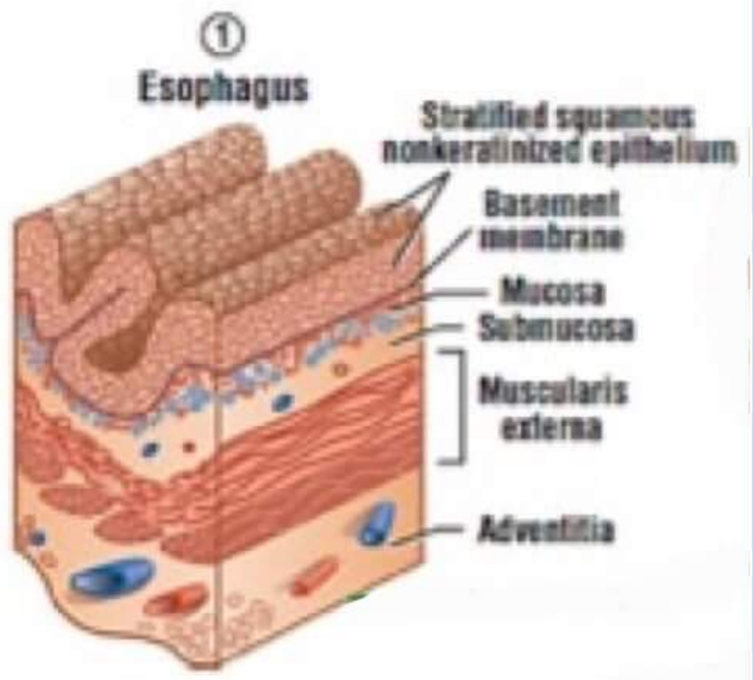
OESOPHAGUS

MUCOSA
- → Stratified squamous epithelium
- → Lamina propria
- → Muscularis Mucosa

SUB MUCOSA
- → Strongest layer
- → Sub mucosal glands present

MUSCULARIS EXTERNA
- → Inner circular Muscle layer
- → Myenteric / Auerbach's plexus
- → Outer Longitudinal layer

ADVENTITIA ⊕



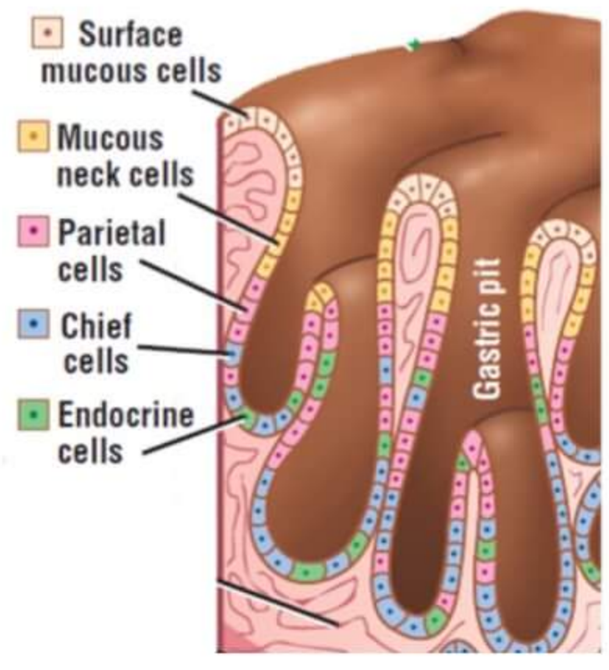
STOMACH

GASTRIC LUMEN

GASTRIC PIT

GASTRIC GLANDS
- → Surface mucous cells
- → mucous neck cells
- → parietal cells → Forms HCl
- → Chief cells → Forms Pepsinogen
- → Endocrine cells → Secretes Gastrin
- → Supported by Lamina propria

SEROSA ⊕



GASTRIC GLANDS

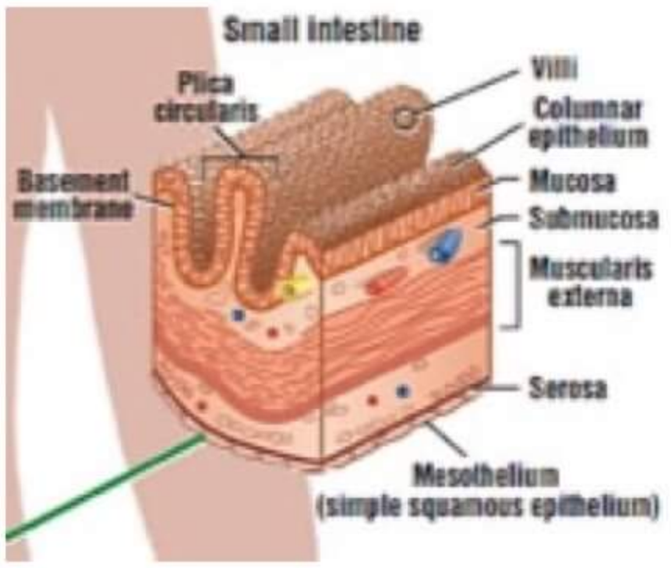
SMALL INTESTINE

→ columnar epithelium ī MICRO VILLI [↑ surface area]

→ PLICA CIRCULARIS
- Mucosal folds
- ↑ surface area for absorptⁿ

→ SEROSA ⊕

MESOTHELIUM [Simple Squamous Epithelium]
Serosa
Peritoneum
Pleura
Pericardium



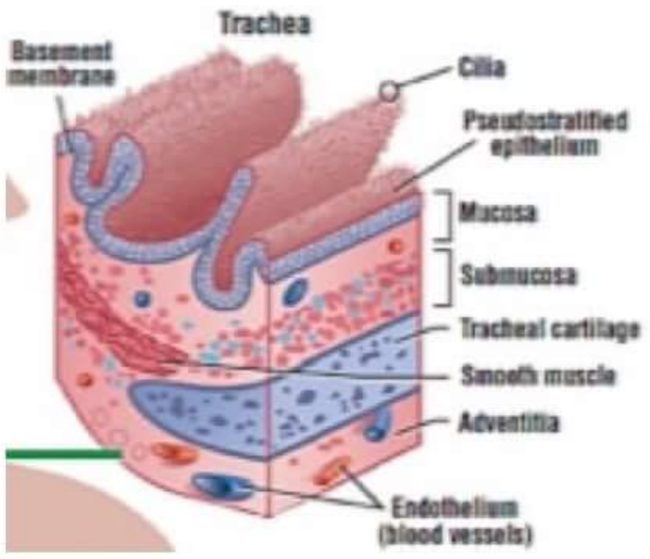
RESPIRATORY TUBE

→ PSEUDO STRATIFIED CILIATED COLUMNAR EPITHELIUM

→ MUCOSA

→ SUB MUCOSA

→ HYALINE CARTILAGE
- → Rigid & Keep the lumen patent
- → Stops at the level of Bronchus
- → Bronchioles do not have hyaline cartilage
  - more smooth muscles + nt

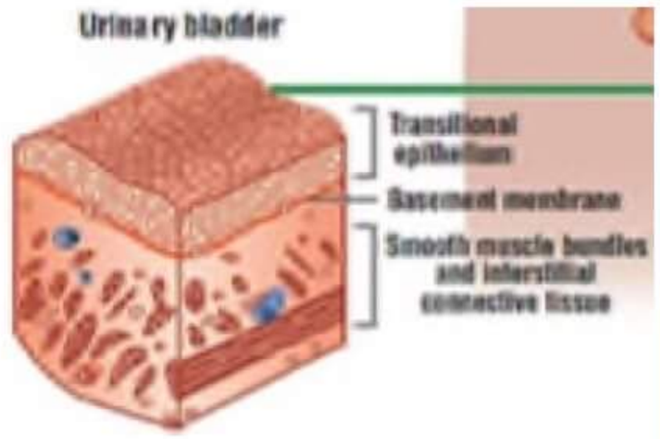


→ ADVENTITIA

RENAL TUBE

→ Transitional Epithelium

→ Smooth muscles



SKIN

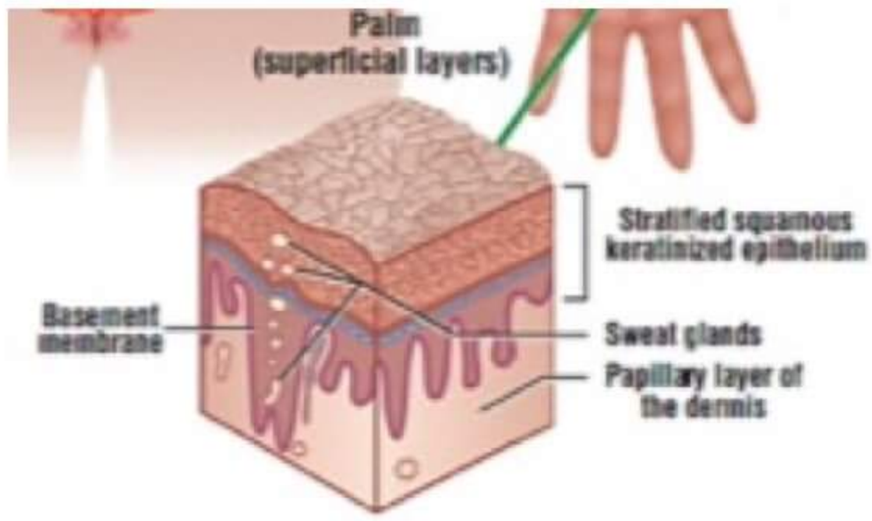
→ Stratified squamous keratinized Epithelium
[Stratified squamous non keratinized Epithelium → Esophagus]

→ EPIDERMIS

→ DERMIS
- Papillary layer
- reticular Layer

→ SWEAT GLANDS

→ SEBACEOUS GLANDS



BODY TUBES do not have keratin d/t wet mucosa except hard palate [oral cavity]

STRATIFIED SQUAMOUS EPITHELIUM – NON KERATINIZED

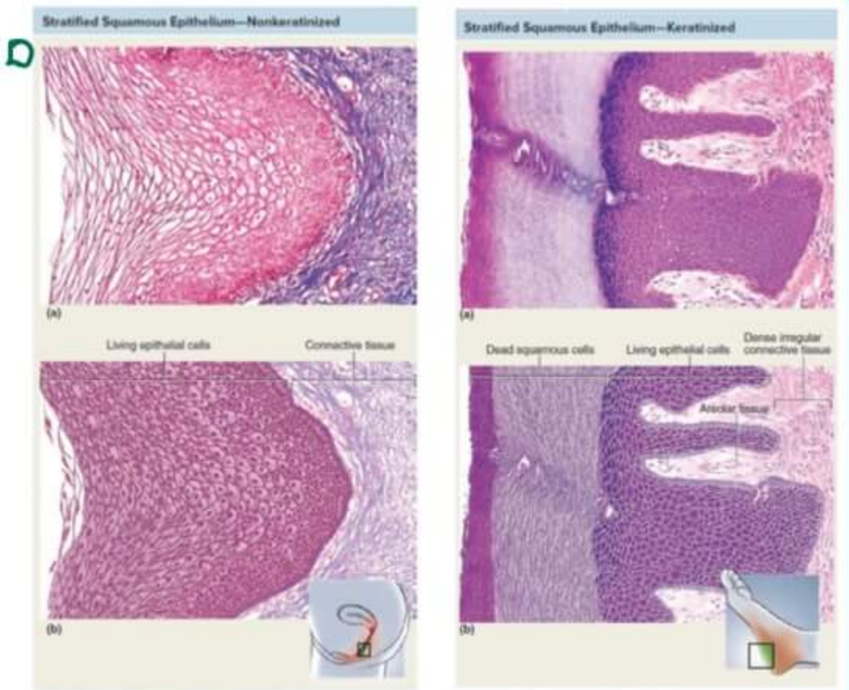
→ Superficial cells have nuclei

→ Eg → VAGINA

STRATIFIED SQUAMOUS EPITHELIUM – KERATINIZED

→ Superficial cells do not have nuclei

→ Eg → Skin on sole



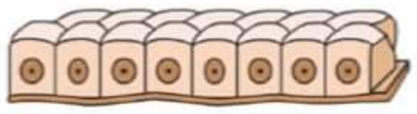
EPITHELIAL TISSUE

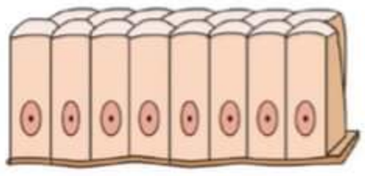
TYPE OF EPITHELIUM

SIMPLE EPITHELIUM → Single layered

STRATIFIED EPITHELIUM → Multiple layered


A Simple squamous


B Simple cuboidal


C Simple columnar

SIMPLE EPITHELIUM

Flat cell ĩ Flat nucleus → Squamous

Height = Breadth ĩ central spherical nucleus → Cuboidal

Height > Breadth ĩ Oval basal nucleus → Columnar

@ Thyroid follicles are lined by which type of Epithelium

a Simple squamous

b Simple cuboidal [BEST ANSWER]

c Simple columnar

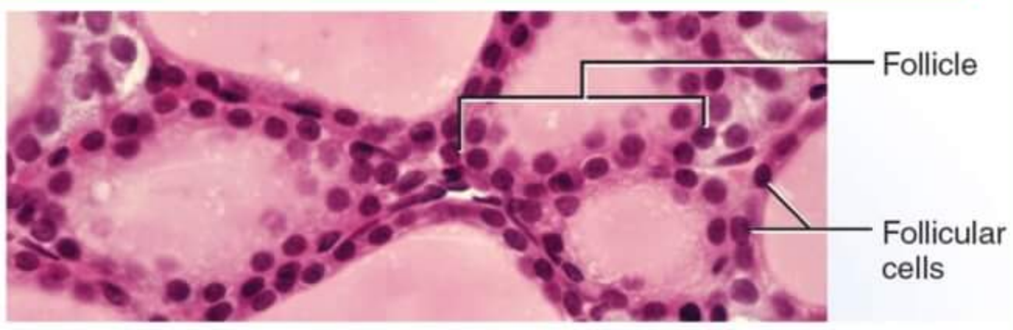
d Stratified cuboidal

→ Thyroid follicle lining depends on amount of Thyroxine secretⁿ

1 Scanty → Squamous

2 Medium → cuboidal

3 High → columnar



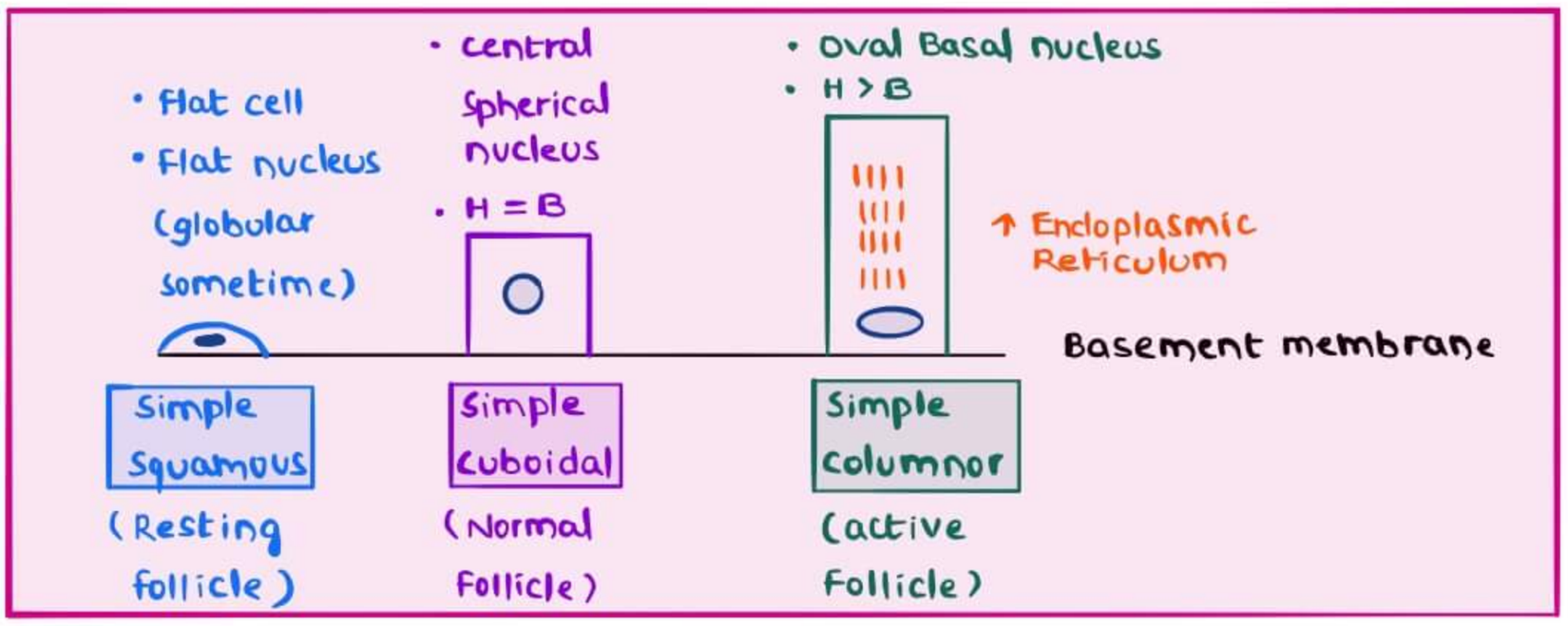
@ Secreting active thyroid follicles are lined by which epithelium

a Simple squamous

b Simple cuboidal

c Simple columnar

d Stratified cuboidal



Q Rt fourth arch artery gives rise to

a Rt subclavian artery

b common carotid artery

c Internal carotid artery

d External carotid artery

Q Double aortic arch 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 aorta

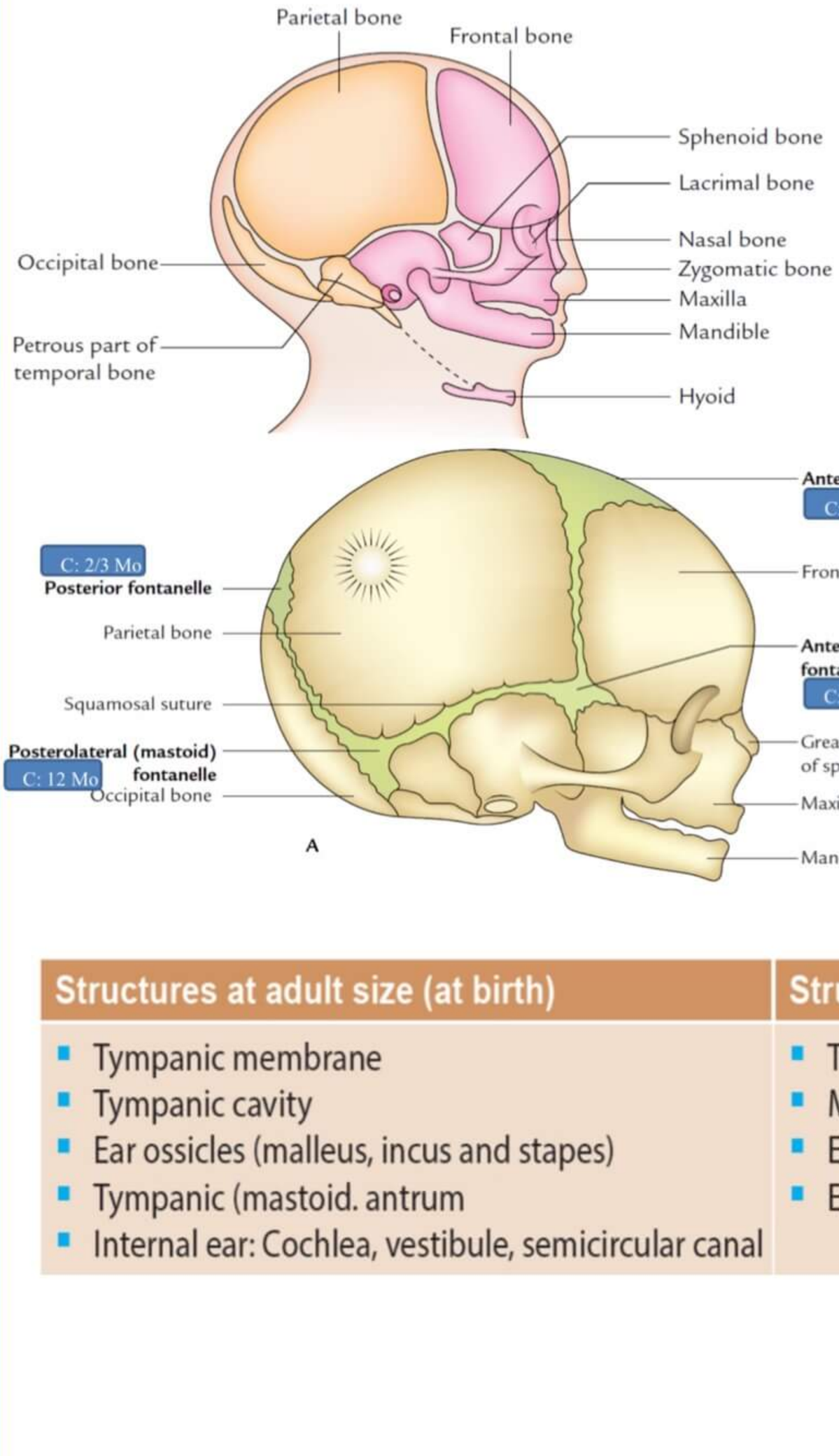
Embryonic	Adult
Aortic arch arteries	
1	Maxillary artery (portion of)
2	Stapedial artery (portion of)
3	Right and left common carotid arteries (portion of) Right and left internal carotid arteries
4	Right subclavian artery (portion of) Arch of the aorta (portion of)
5	Regresses in humans
6	Right and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

DOUBLE AORTIC ARCH

→ Persistent distal portion of rt dorsal aorta

→ Difficulty in breathing & swallowing dlt compression by Rt aortic arch

DEVELOPMENT OF SKULL



FONTANELLE FUSION

1 Posterior → 2/3 m

2 Sphenoidal → 2/3 m

3 mastoid → 12 m

4 Anterior → 18-24 m

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

→ SEEN IN

1 Openings in the body

- Oral cavity
- Nasal cavity
- Eyes, Ears
- Perineum → urethra, vagina, anal canal

Q Epithelial lining of Lingual Surface Epiglottis is

a Simple columnor

b Pseudostratified ciliated columnar

c Simple cuboidal

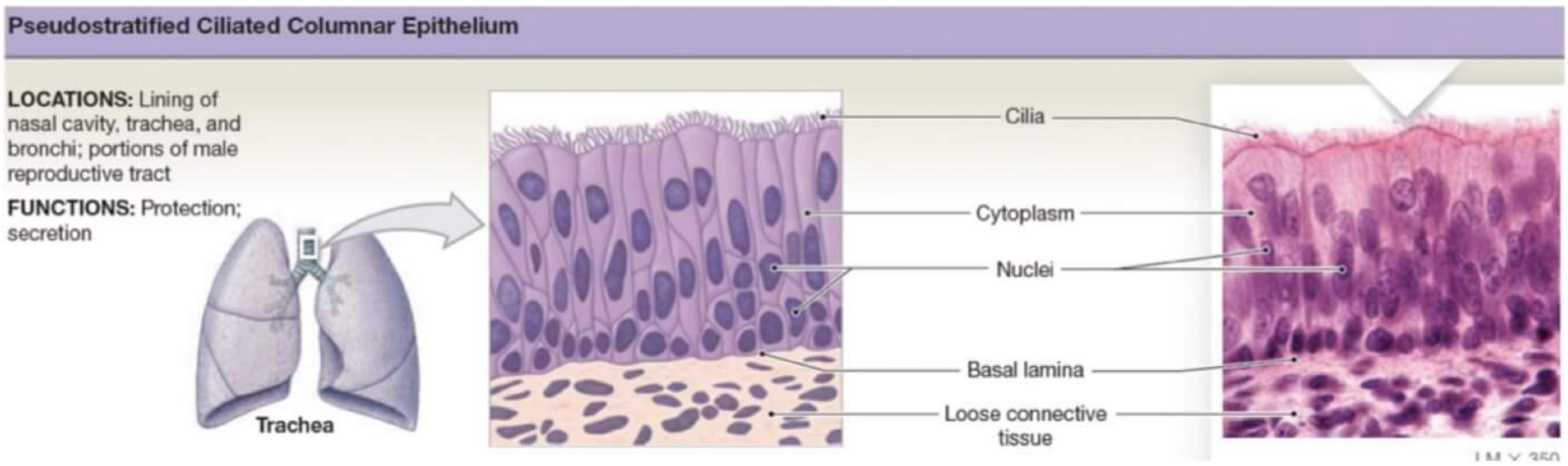
d Stratified squamous Epithelium

Epiglottis has 2 surfaces

oral surface lined by → Stratified Squamous Epithelium

Laryngeal surface lined by → Pseudostratified ciliated columnar

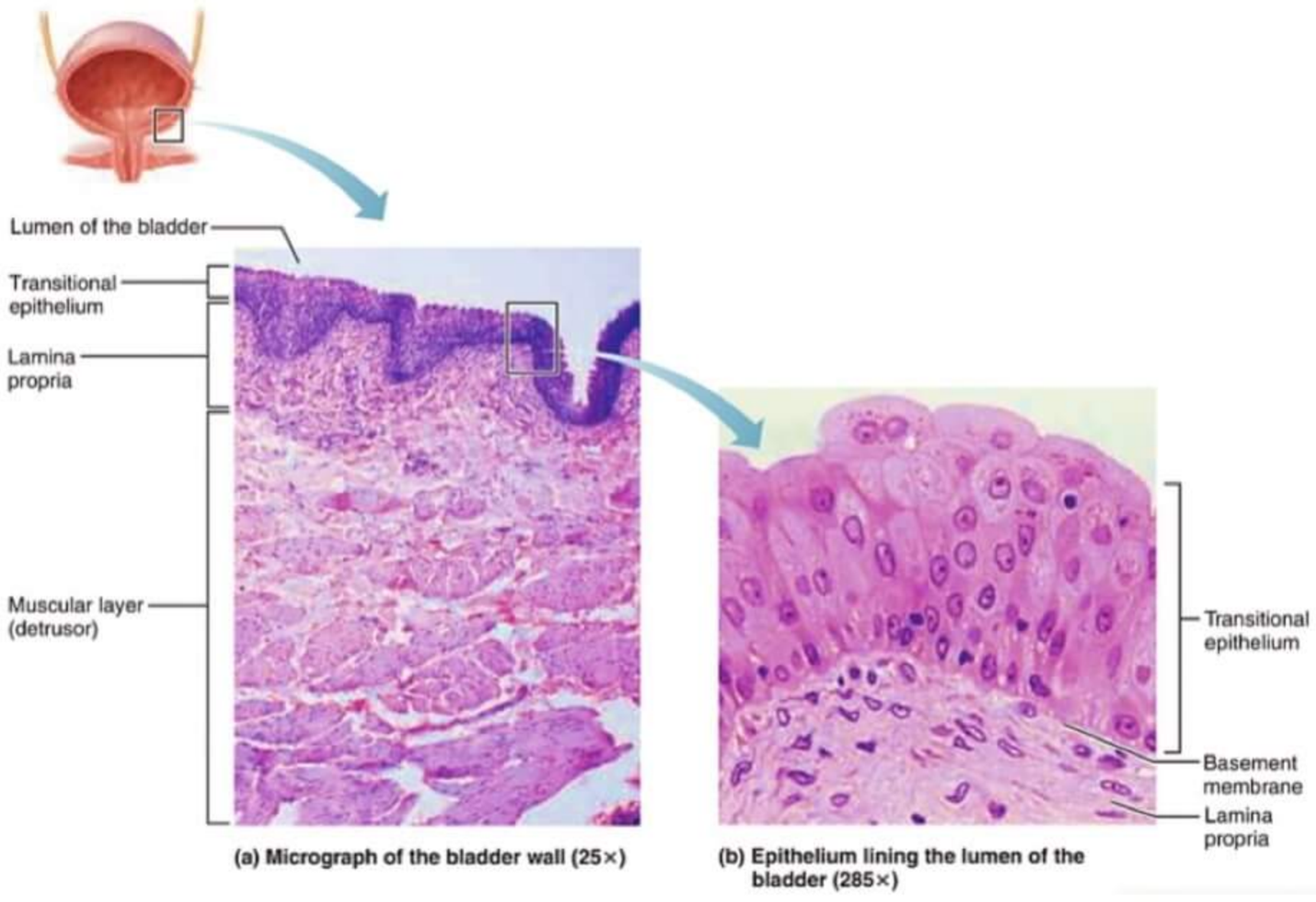
PSEUDO STRATIFIED CILIATED COLUMNAR EPITHELIUM



→ Pseudo Stratified → Each cell touching the Basement membrane

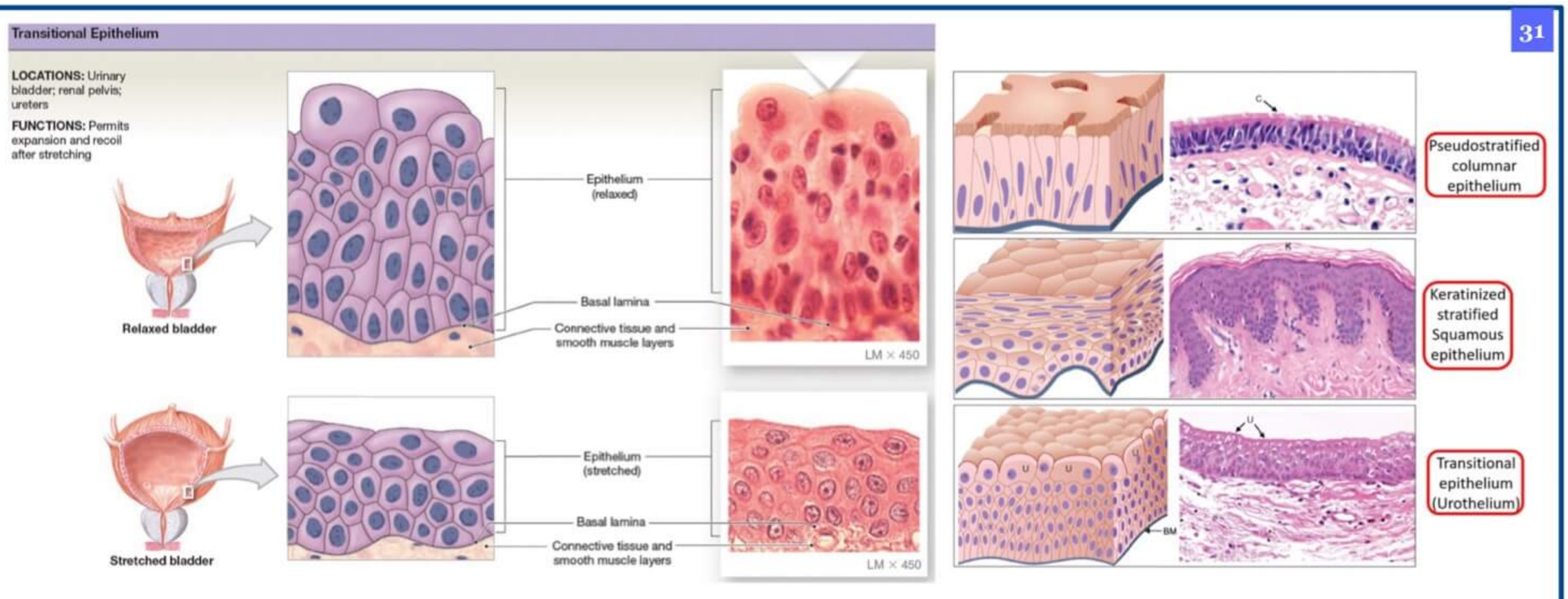
→ Seen in Respiratory Epithelium

TRANSITIONAL EPITHELIUM



(a) Micrograph of the bladder wall (25×)

(b) Epithelium lining the lumen of the bladder (285×)



TRANSITIONAL EPITHELIUM

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

TRANSITIONAL EPITHELIUM [UROTHELIUM]	→	Globular cells towards the surface
STRATIFIED SQUAMOUS EPITHELIUM	→	Flat cells towards the surface
PSEUDO STRATIFIED EPITHELIUM ∩ 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 be present on mesoderm & Endoderm

Eg. Vaginal Epithelium → Stratified squamous Epithelium
Upper vagina derived from → mesoderm
Lower vagina derived from → endoderm

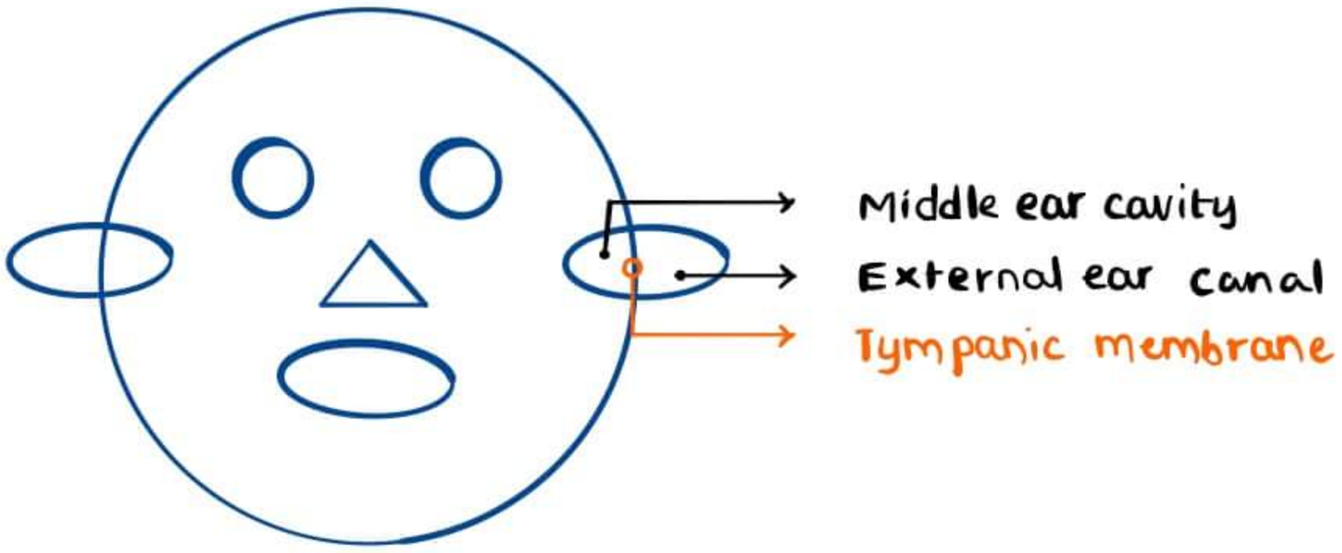
Stratified squamous epithelium can rarely seen on internal opening

Eg. VOCAL CORDS
→ protects from abrasions from cough & sneeze

Larynx lined by Pseudostratified columnar / Respiratory Epithelium

STRATIFIED SQUAMOUS EPITHELIUM : 7 Openings

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



OPENINGS IN FACE

1 EYES → 1st layer of CORNEA

2 EARS → EXTERNAL EAR CANAL + Outer surface of TYMPANIC MEMBRANE

3 NOSE → VESTIBULE (skin & hair)

4 ORAL CAVITY

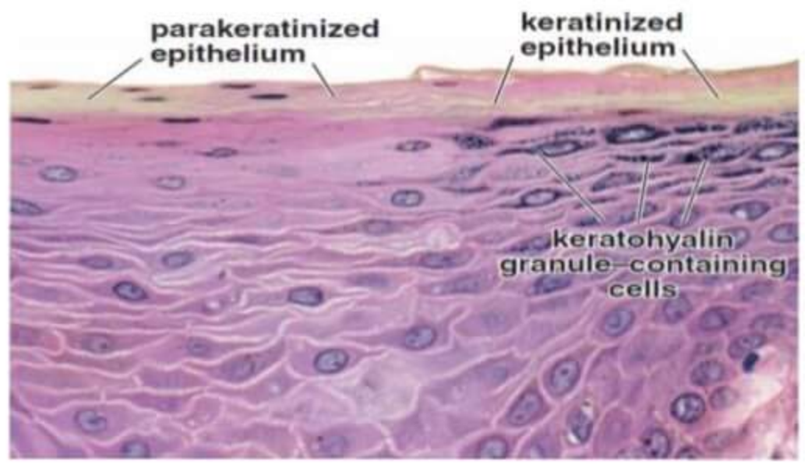
TONGUE, HARD PALATE → ortho & para keratinized St. Sq. Epithelium

TONSIL, EPIGLOTIS [oral surface] → Non keratinized St. Sq. Epithelium

KERATINIZATION

→ Skin

→ superficial layers have no nuclei



PARA KERATINIZATION

→ seen in Tongue & hard palate

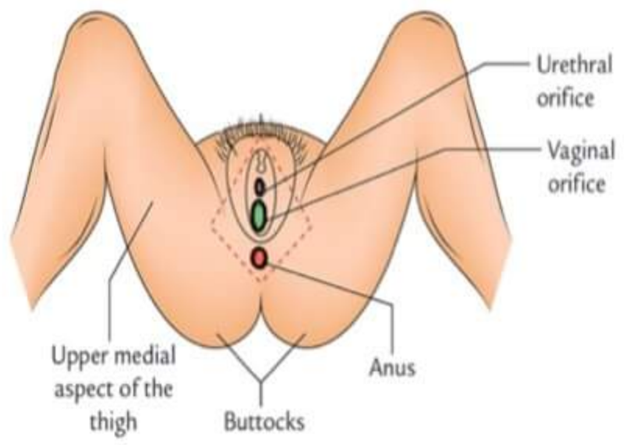
→ superficial layers have nuclei

MIDDLE EAR CAVITY + TM [inner surface] → stratified cuboidal Epithelium

CERUMINOUS GLAND

→ Wax gland

modified apocrine sweat gland



OPENINGS IN PERINEUM

5 URETHRA

FEMALE URETHRA → 4cm.

MALE URETHRA → 20 cm

Tip lined by St. Sq. Epithelium

6 VAGINA

7 ANAL CANAL

Below dentate/ pectinate line → St. Sq. Epithelium

SQUAMD COLUMNAR JUNCTIONS

→ prone to metaplasia

↓

Dysplasia

↓

cancers

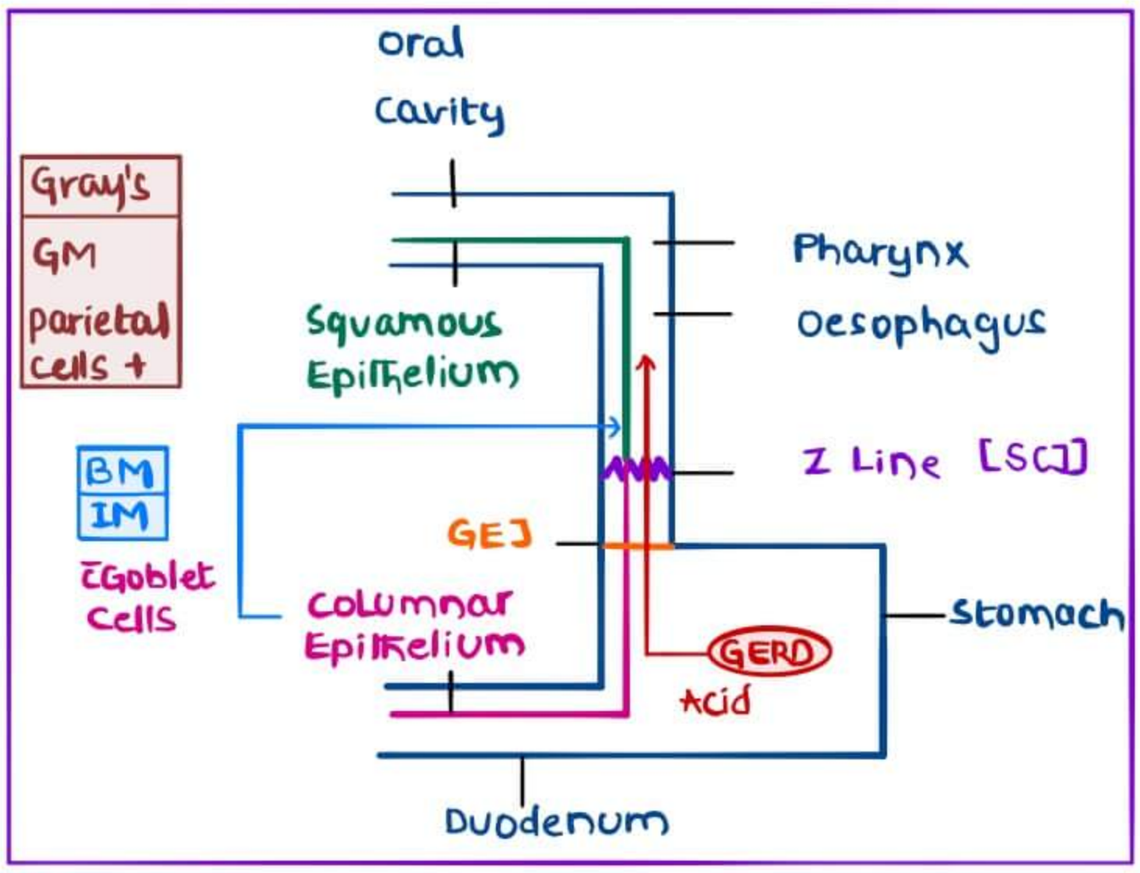
→ Present at

Anal canal

Oesophagus

Uterine cervix

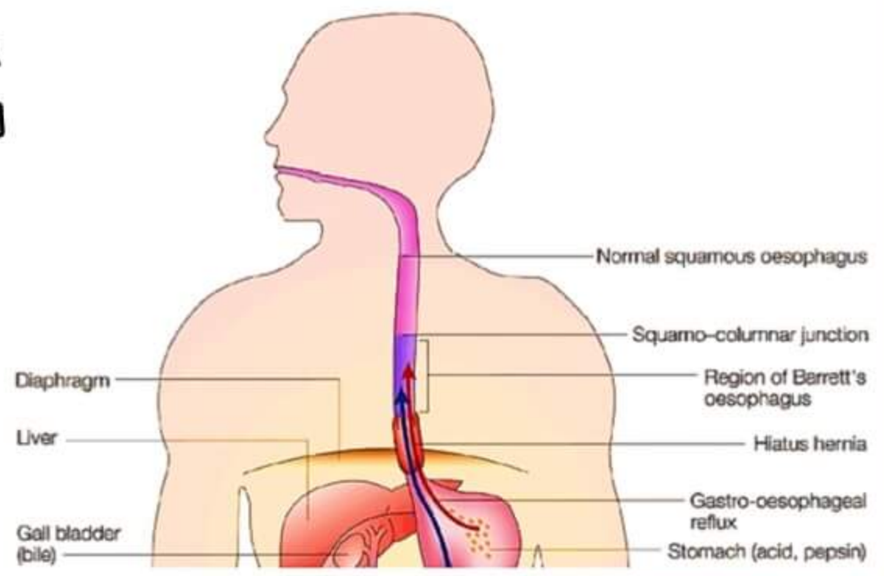
BARRET'S OESOPHAGUS



GEJ → Gastro Esophageal Junction
SCJ → Squamo columnar junction
BM → Barrett's metaplasia
IM → Intestinal metaplasia
GM → Gastric Metaplasia

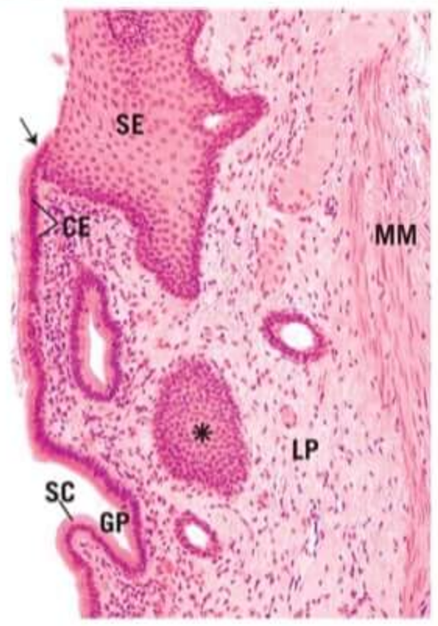
@ Barret's oesophagus Dx by
- a columnar metaplasia
- b columnar dysplasia
- c Gastric metaplasia
- d Intestinal metaplasia [BETTER ANSWER]

→ Normal epithelium → Squamous
Replaced by → columnar ± goblet cells
[INTESTINAL METAPLASIA]



→ ↑ RISK OF ADENOCARCINOMA

→ Z - LINE
- Zig - Zag line
- Squamo columnar jn. at lower oesophagus
- Lower 2 cm of oesophagus is lined by columnar epithelium
- prone to metaplasia | dysplasia

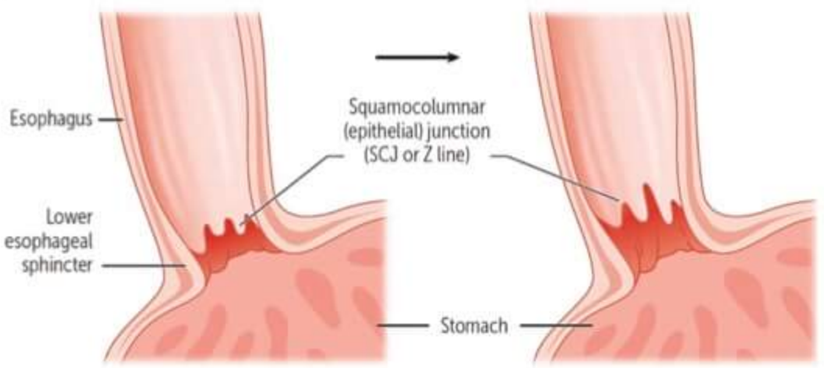


- Z - LINE LOCATED AT
  - Ⓝ individuals → 2 cm above GEJ [Gastro esophageal Junction]

Barrett's oesophagus → 5 cm above GEJ

→ INTESTINAL METAPLASIA → Misnomer
- not used for absorptn

→ GRAY'S ANATOMY says → GASTRIC METAPLASIA
- Parietal cells found in Bx
- MISNOMER too
  - no goblet cells in stomach



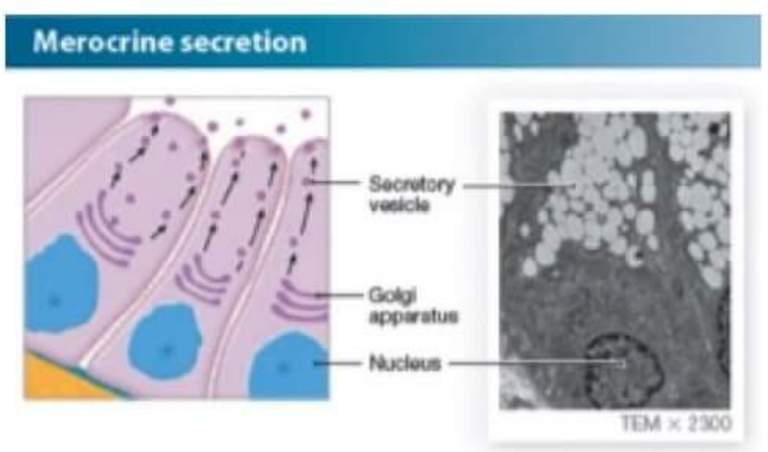
GLANDS

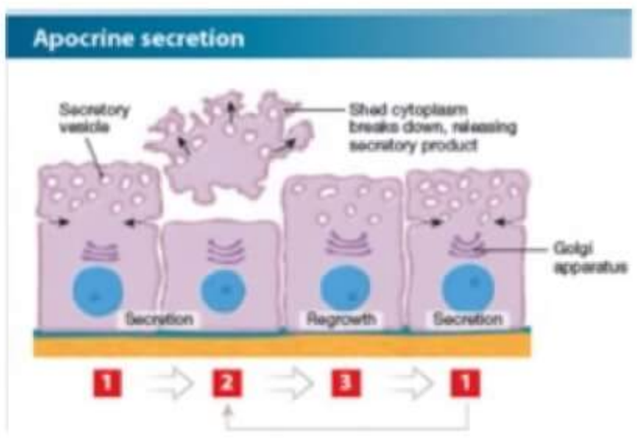
1. MEROCRINE
2. APOCRINE
3. HOLOCRINE

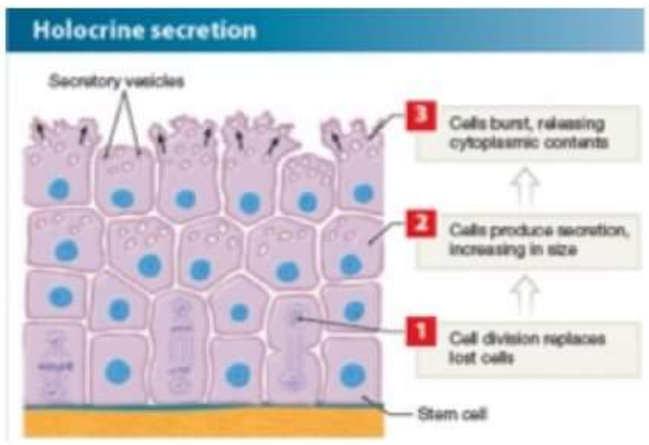
1. MEROCRINE/ ECCRINE → Secretⁿ coming t out loss of cell membrane
   → Eg - Salivary glands

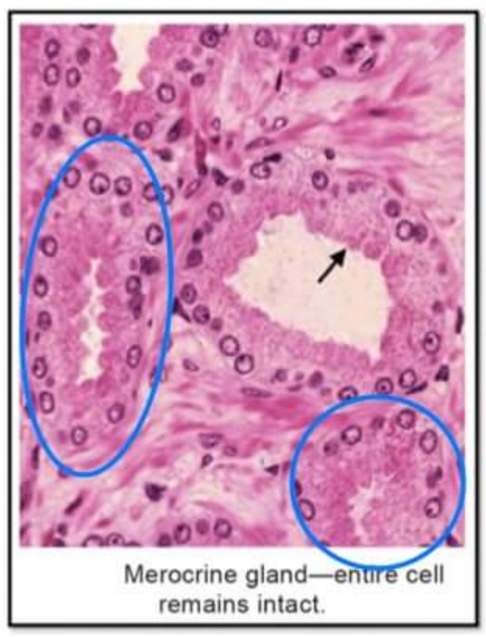
2. APOCRINE → Apical cell membrane is lost & covers the secretions
   Eg - mammary gland [Modified sweat gland]

3. HOLOCRINE Whole cell membrane lost & entire cell will breaks down
   Periphery cells are intact, cells towards ducts breaks down
   Eg - Sebaceous gland

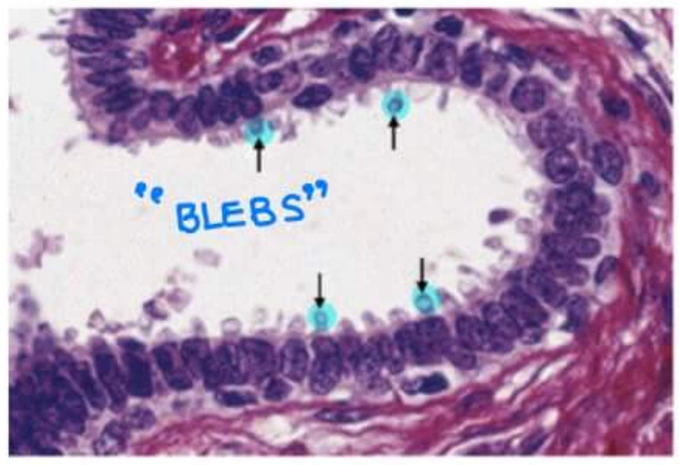




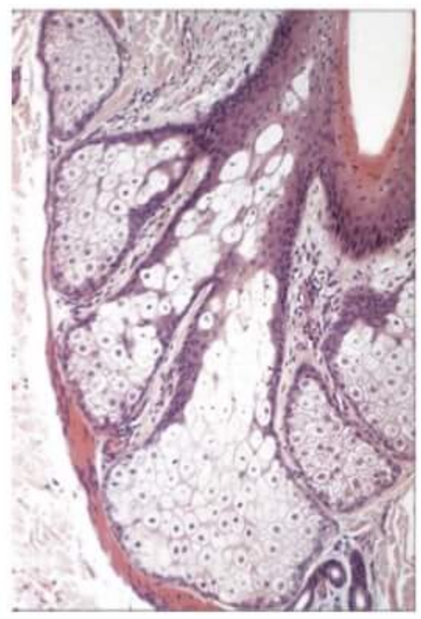


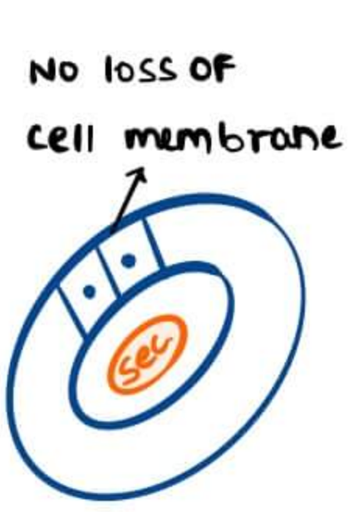


Merocrine gland—entire cell remains intact.



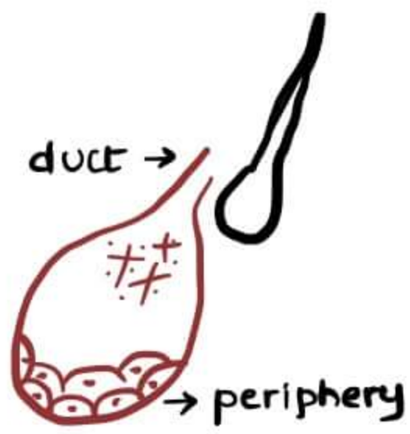
Apocrine gland—cells are intact EXCEPT: the upper portions being detached as secretions (blebs).





MEROCRINE GLAND

APOCRINE GLAND



HOLOCRINE GLAND

Q Which of the following is a holocrine gland
a Sweat gland
b Breast
c Pancreas
d Sebaceous gland

SWEAT GLANDS

- MEROCRINE → more common
- APOCRINE → less common
  - → seen in
    - Axilla, perineum
    - ceruminous gland } modified sweat glands
    - mammary gland

- MEROCRINE → PANCREAS

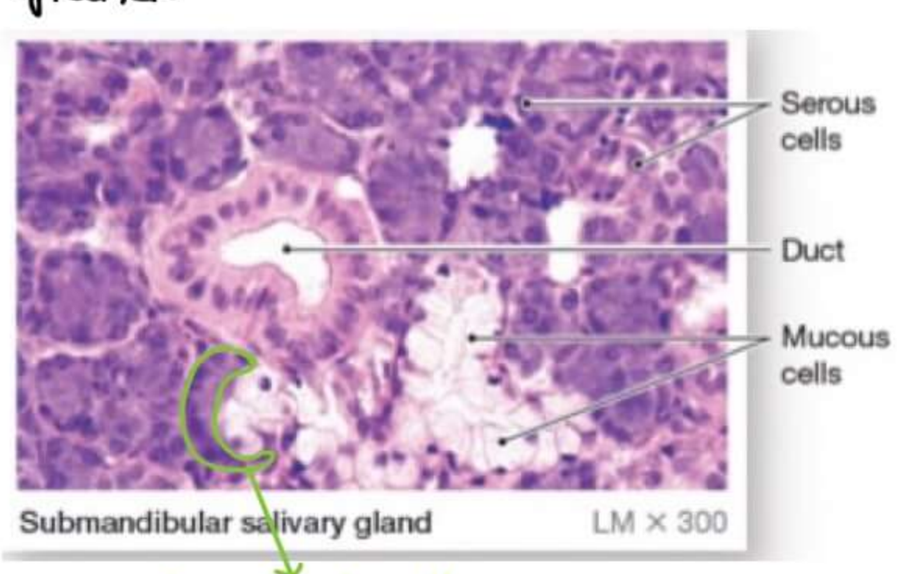
GLANDS

SEROUS	→	Thin watery	→	parotid salivary gland
MUCINOUS	→	Thick viscous secretion	→	Sub lingual salivary gland [major]
MIXED	→	Both	→	Sub mandibular salivary gland Sub lingual salivary gland

Q Serous demilunes are present in Large number in Which gland

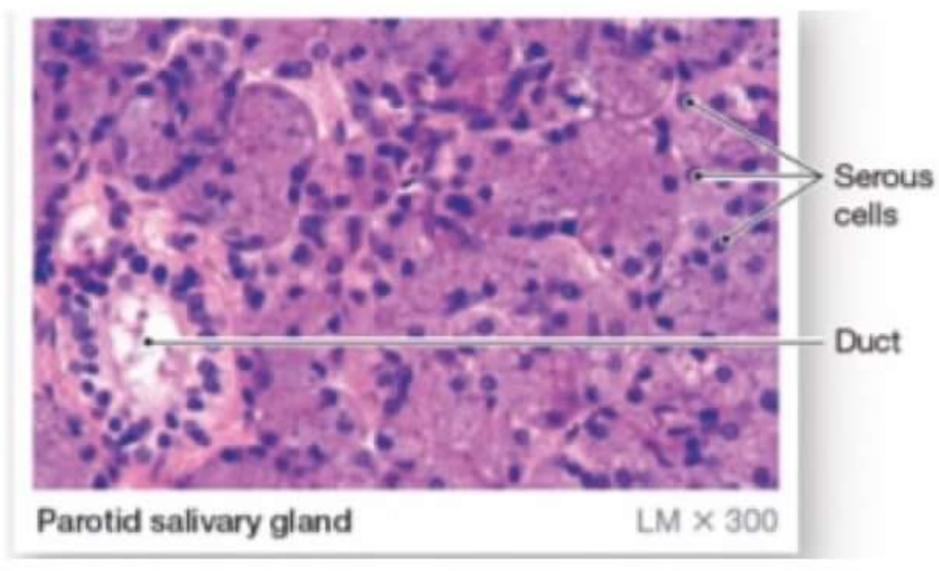
a Parotid
b Submandibular
c Sub lingual
d Pituitary

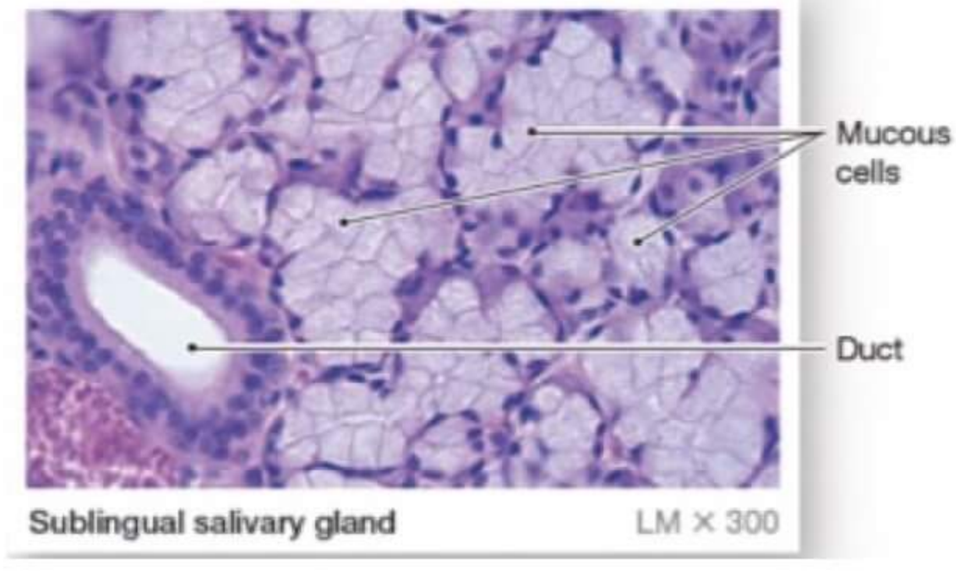
SEROUS DEMILUNES → Feature of sero mucous glands



SUB MANDIBULAR 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





CONNECTIVE TISSUE

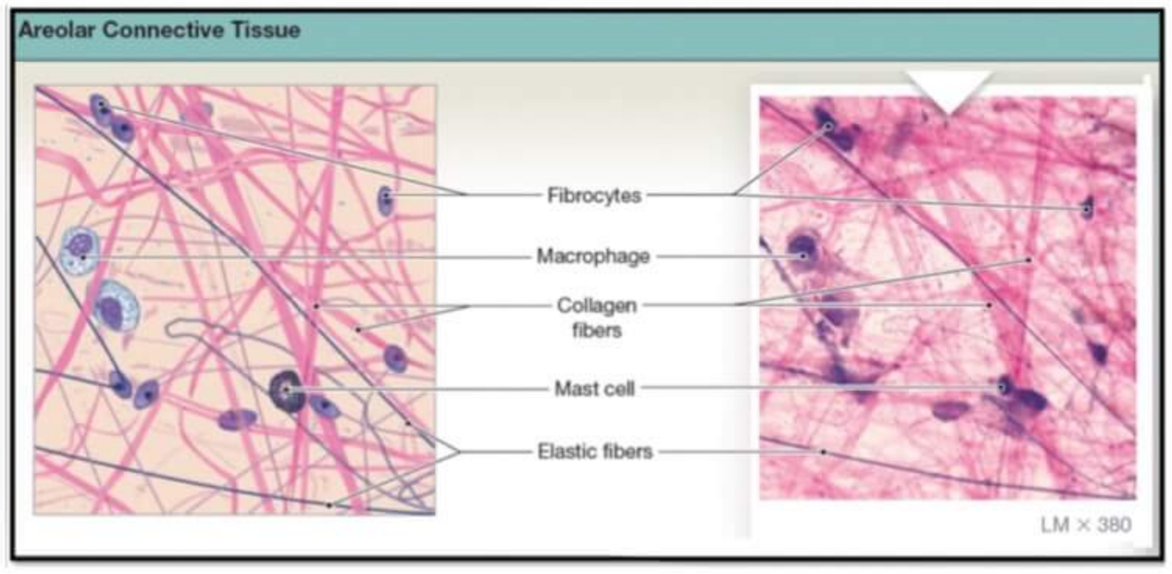
CONNECTIVE TISSUE PROPER

1 LOOSE
- a areolar Tissue
- b adipose Tissue
- c reticular Tissue

2 DENSE
- a Dense regular Tissue
- b Dense Irregular Tissue
- c Elastic Tissue

LOOSE AREOLAR CONNECTIVE TISSUE

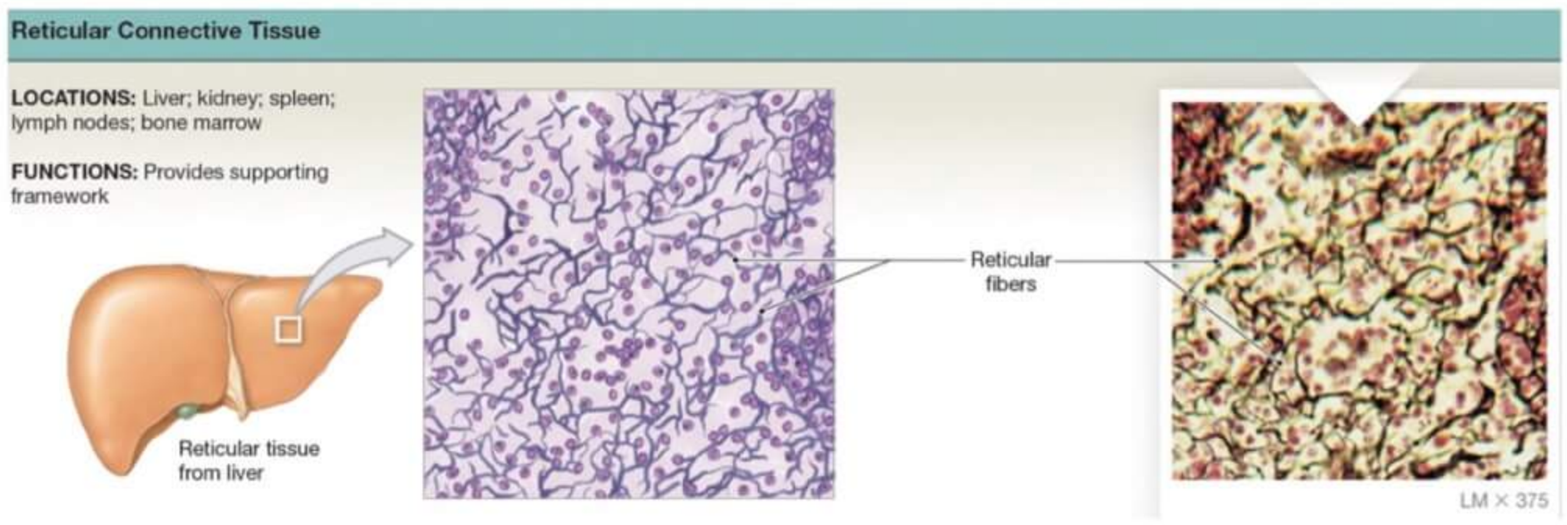
→ ↓ collagen [FIBRES]



COLLAGEN FIBRES
→ group of long length fibres

ELASTIC FIBRES
→ Short, thin & branching fibres

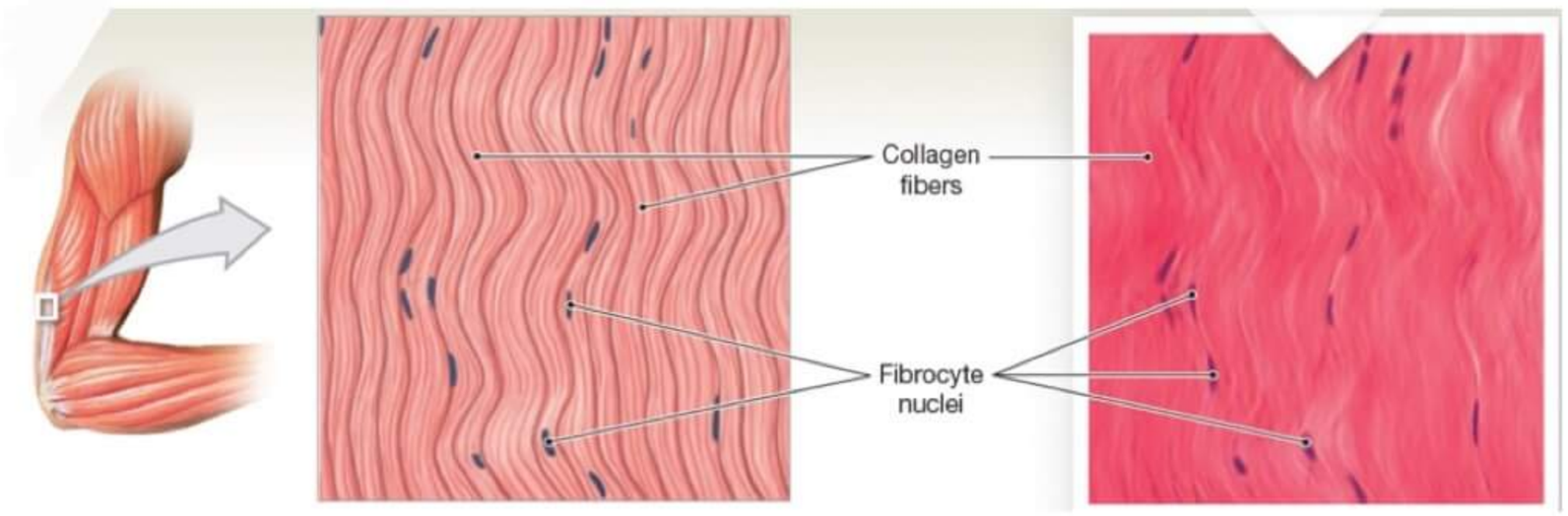
RETICULAR CT → short, thin branching fibres



Seen in
- LYMPHOID ORGANS
- Liver
- Spleen
- LN
- Bone Marrow

EXCEPT^{n} → THYMUS

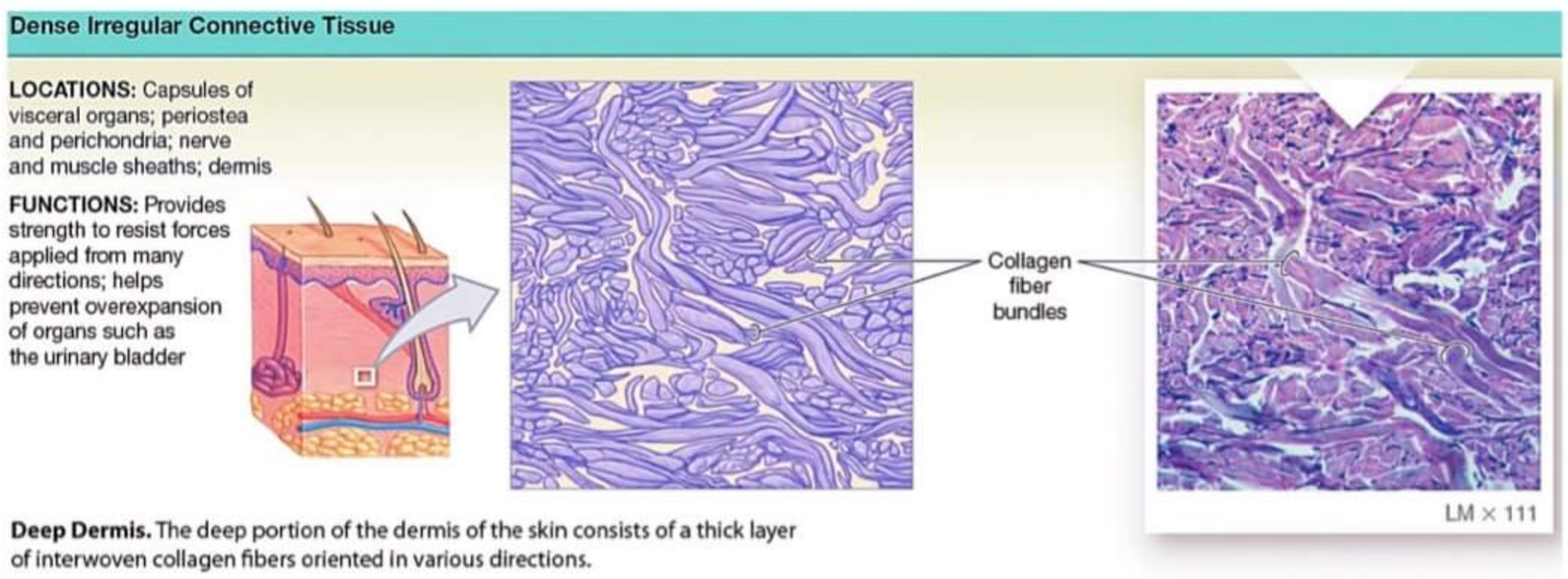
DENSE REGULAR CT



SEEN IN
- Tendon
- Aponeurosis
- Ligaments

→ ↑ collagen
→ collagen fibres runs parallelly in one direction

DENSE IRREGULAR CT → Fibres run haphazardly



SEEN IN
- Deep reticular layer OF DERMIS

CONNECTIVE TISSUE CLASSIFICATION

- CT
  - LOOSE AREOLAR → LAMINA PROPRIA
    - Sub Epithelial CT
  - DENSE
    - DENSE REGULAR → TENDON, APONEUROSIS, LIGAMENTS
    - DENSE IRREGULAR → DERMIS [deep reticular layer], PERIOSTEUM

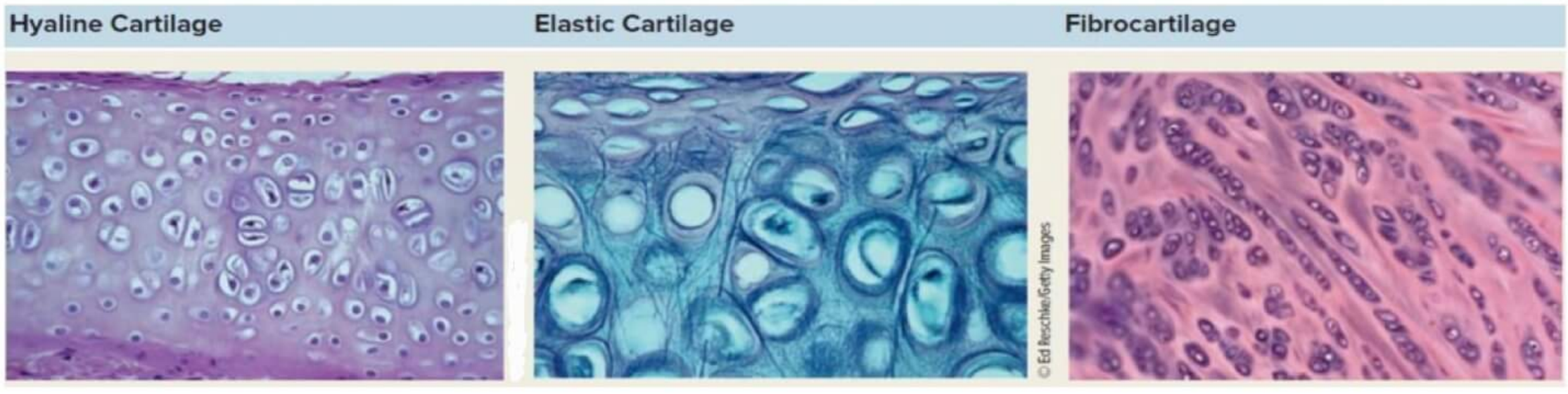
Q Dense & regular arrangement of collagen fibres is seen in all EXCEPT
a Tendon
b Ligament
c Aponeurosis
d Periosteum

Q Dense & irregular connective tissue is found in
a Dermis → deep reticular layer
b Lamina propria
c Tendon
d Ligament

TYPES OF COLLAGEN FIBRES

TYPE I [mc]	TYPE II	TYPE III	TYPE IV
① BONES ② FIBROCARTILAGE [Atypical cartilage] ③ DERMIS [SKIN] ④ OLD SCAR	① CARTILAGE Hyaline Elastic	① LYMPHOID ORGANS Spleen Liver LN ② HEALING / GRANULATⁿ TISSUE	① BASAL LAMINA / MEMBRANE ② ALPORT SYNDROME [problem in Type IV]

CARTILAGE TISSUE



HYALANE CARTILAGE

→ HYALOS → Glass like

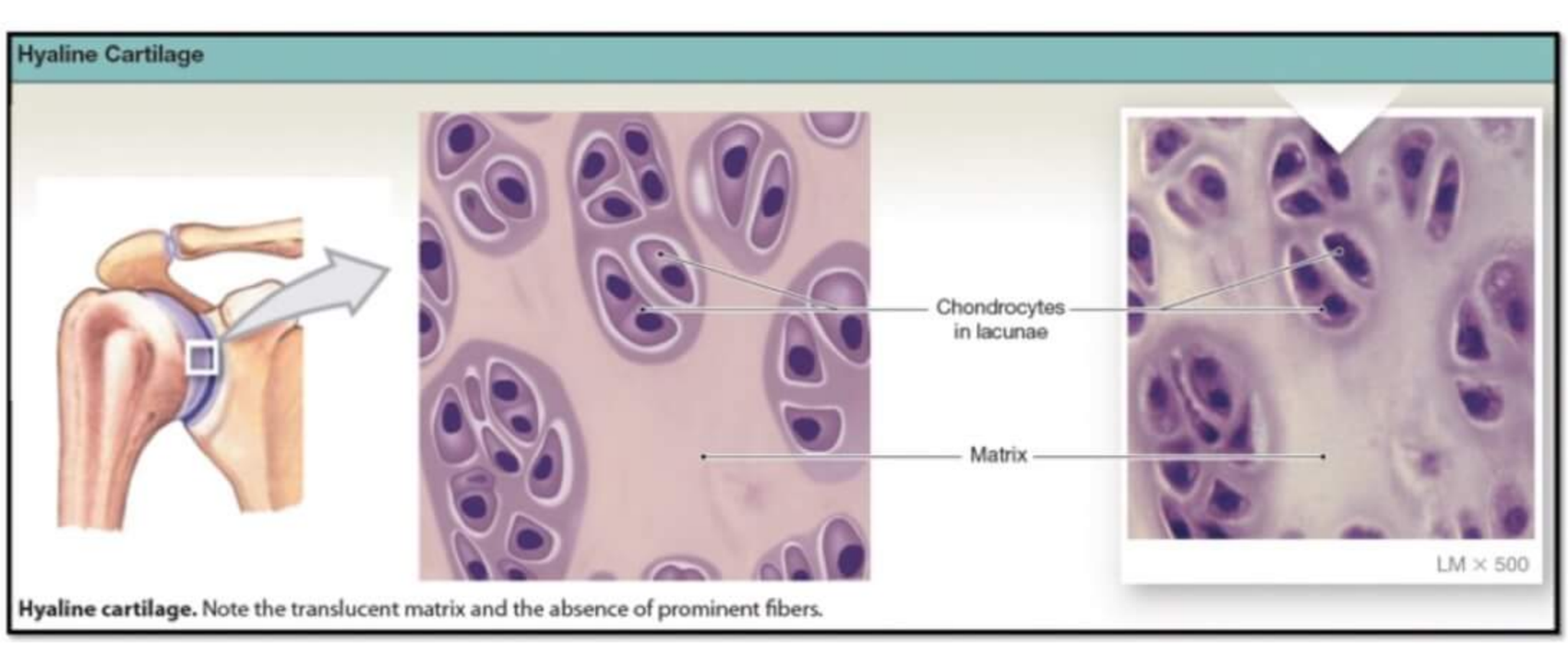
collagen fibres are not evident to eye [optical illusion]

Refractive index of collagen fibres = RI of matrix

→ seen in Articular cartilage

→ ISLANDS OF CHONDROCYTES

- not run in lines



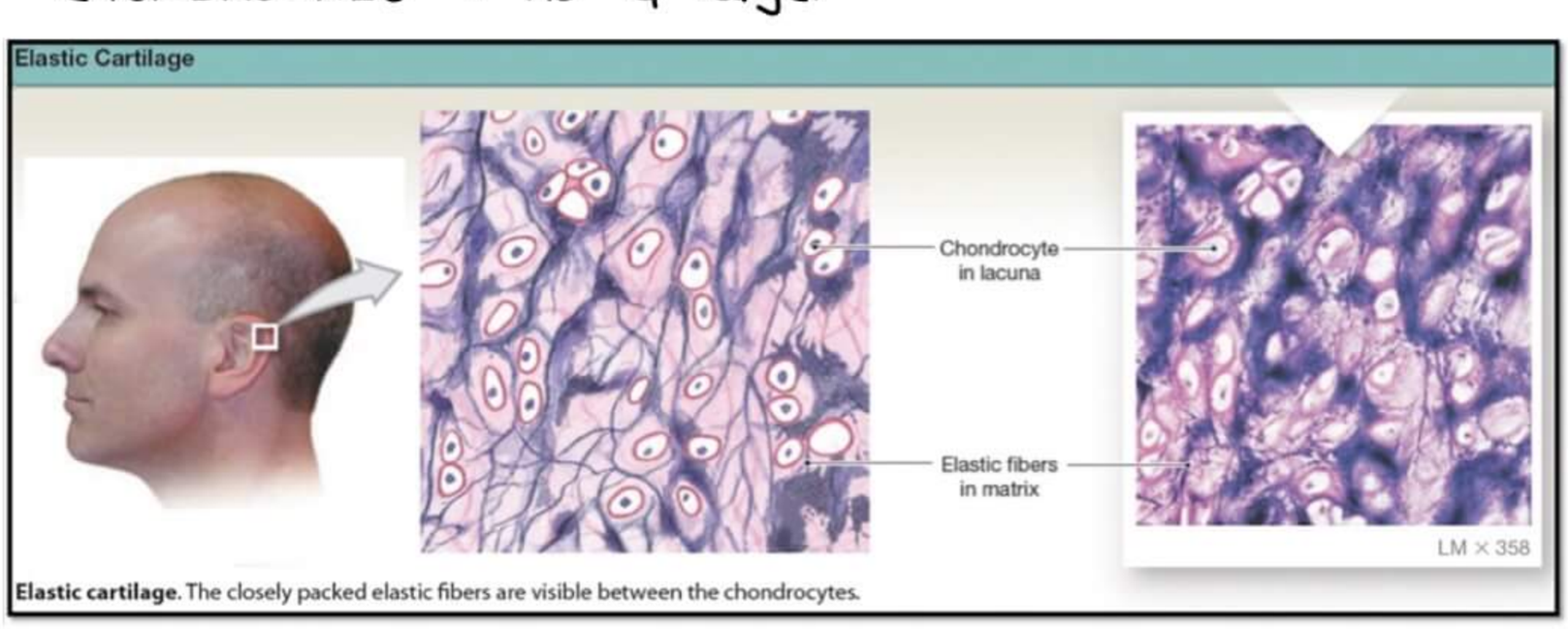
Hyaline cartilage. Note the translucent matrix and the absence of prominent fibers.

ELASTIC CARTILAGE

→ seen in pinna

→ consists of ELASTIC FIBRES → short, single, branching fibres

→ CHONDROCYTES + nt & larger



Elastic cartilage. The closely packed elastic fibers are visible between the chondrocytes.

FIBRO CARTILAGE

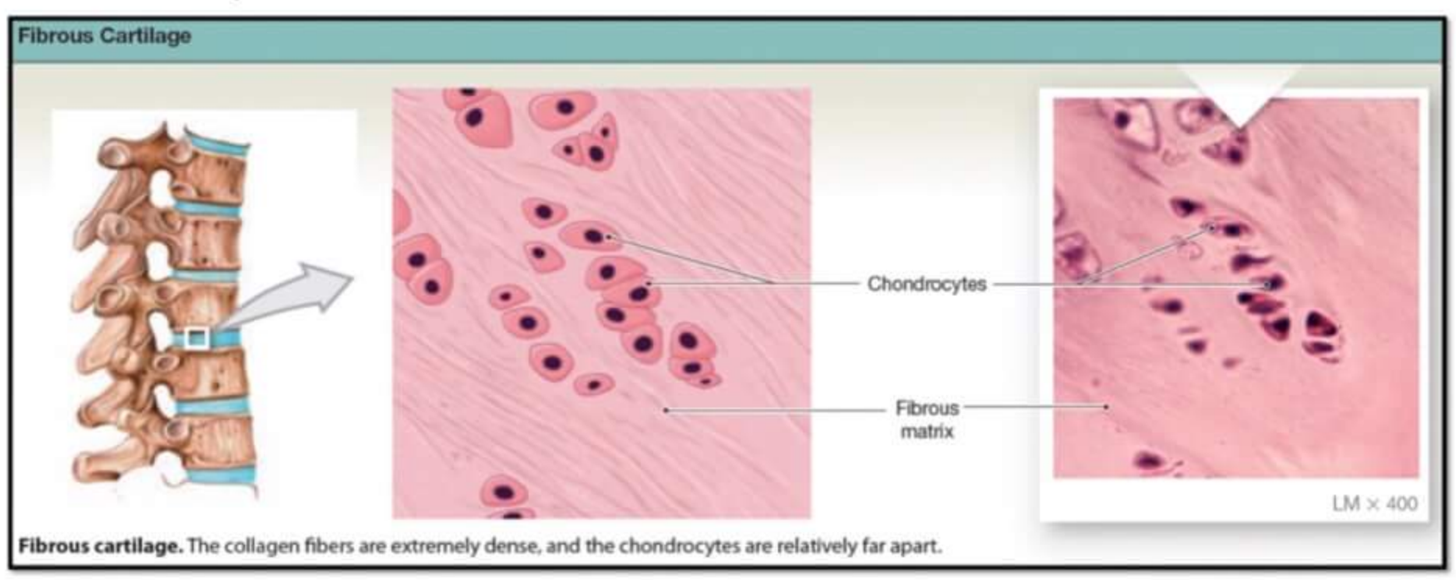
→ works as SHOCK ABSORBER

→ seen in Intervertebral discs

→ LINES OF CHONDROCYTES [Long lines] alternating ε collagen fibres

→ ↑ collagen fibres

→ collagen fibres are evident



Fibrous cartilage. The collagen fibers are extremely dense, and the chondrocytes are relatively far apart.

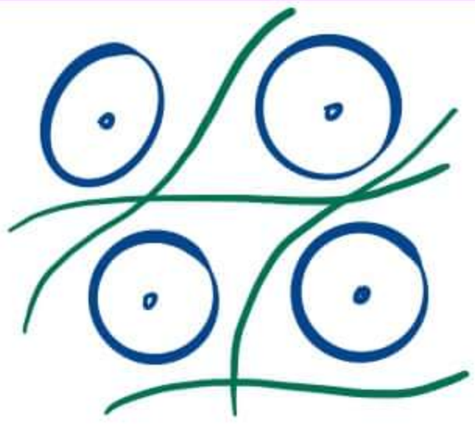
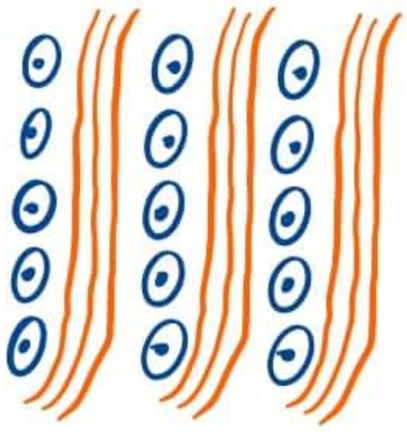
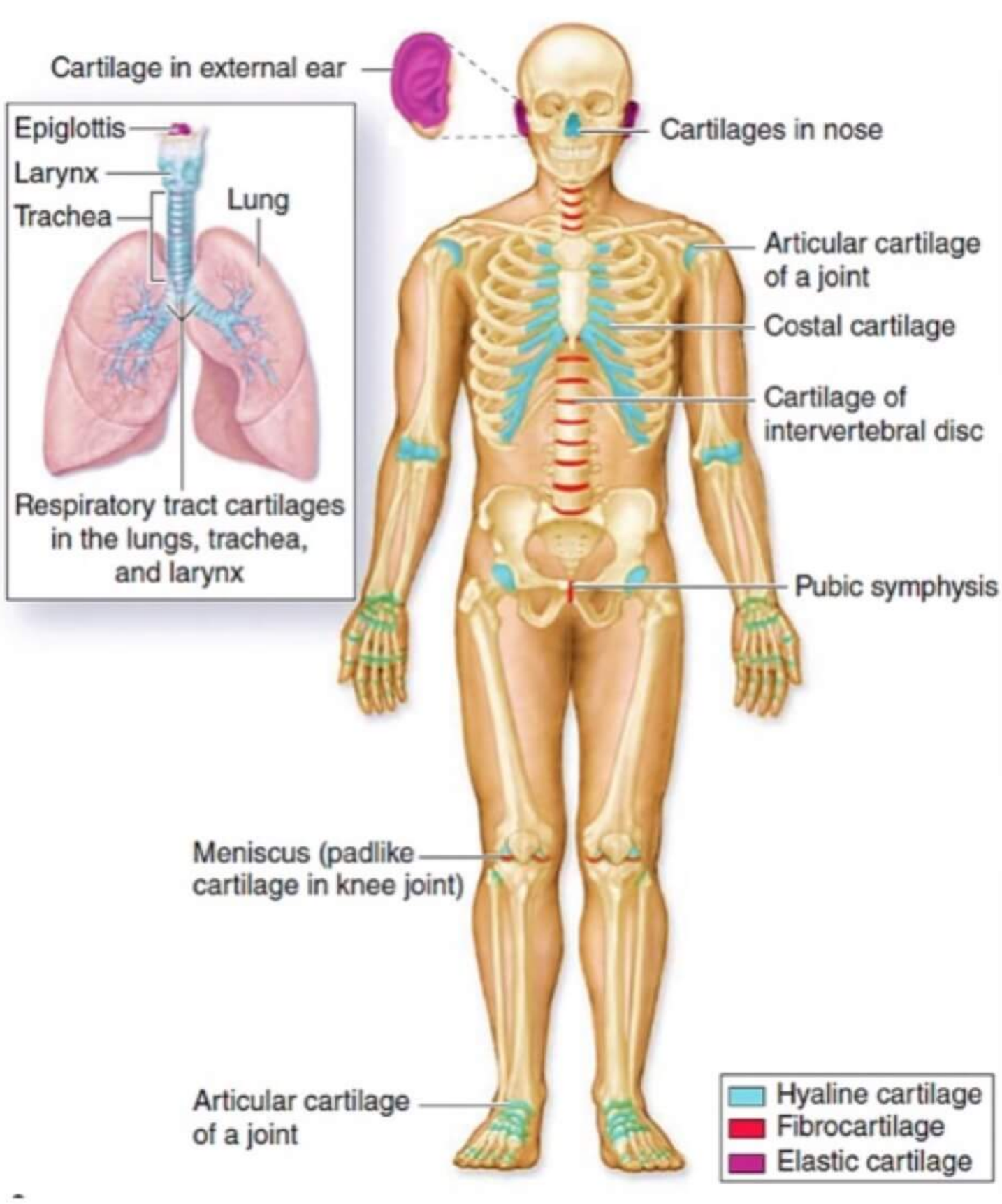
HYALINE CARTILAGE	ELASTIC CARTILAGE	FIBRO CARTILAGE
		
ISLANDS OF CHONDROCYTES collagen Fibres are not visible	LARGE CHONDROCYTES short, single & branching ELASTIC FIBRES	Rows of chondrocytes alternating Bundles of collagen fibres

Table 7: Cartilage features

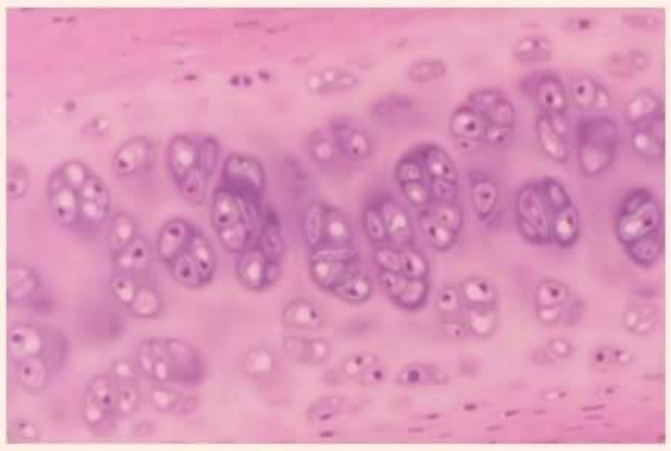
Types	Hyaline cartilage	Elastic cartilage	Fibrocartilage
Identifying characteristics	Type II collagen	Type II collagen	Type I collagen (predominantly)
Perichondrium	Present (EXCEPT: at articular cartilage)	Present	Absent
Location	Most common type ▪ Fetal cartilage ▪ Growth plate ▪ Articular cartilage ▪ Respiratory tube (with few EXCEPT:ions) ▪ Costal cartilage	Rare (E^3 T^3 C^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 (SC, TM) ▪ Knee meniscus ▪ Glenoid/acetabular labrum ▪ Insertion of tendons SHOCK ABSORBER



Q Fibro cartilage seen in

a costal cartilage } Hyaline cartilage
b Nasal Septum }
c Intervertebral Disc
d Auditory Tube → Elastic cartilage

Q Structure shown is found in



a Intervertebral discs
b Articular discs
c Epiphyseal plate
d Pinna

LYMPHOID TISSUE

TYPES

PRIMARY LYMPHOID ORGANS

→ have stem cells

1 BONE MARROW

→ Produce B cells

↓

Plasma cells

↓

Humoral Immunity

2 THYMUS

→ produce T cells

→ responsible for CELL MEDIATED IMMUNITY

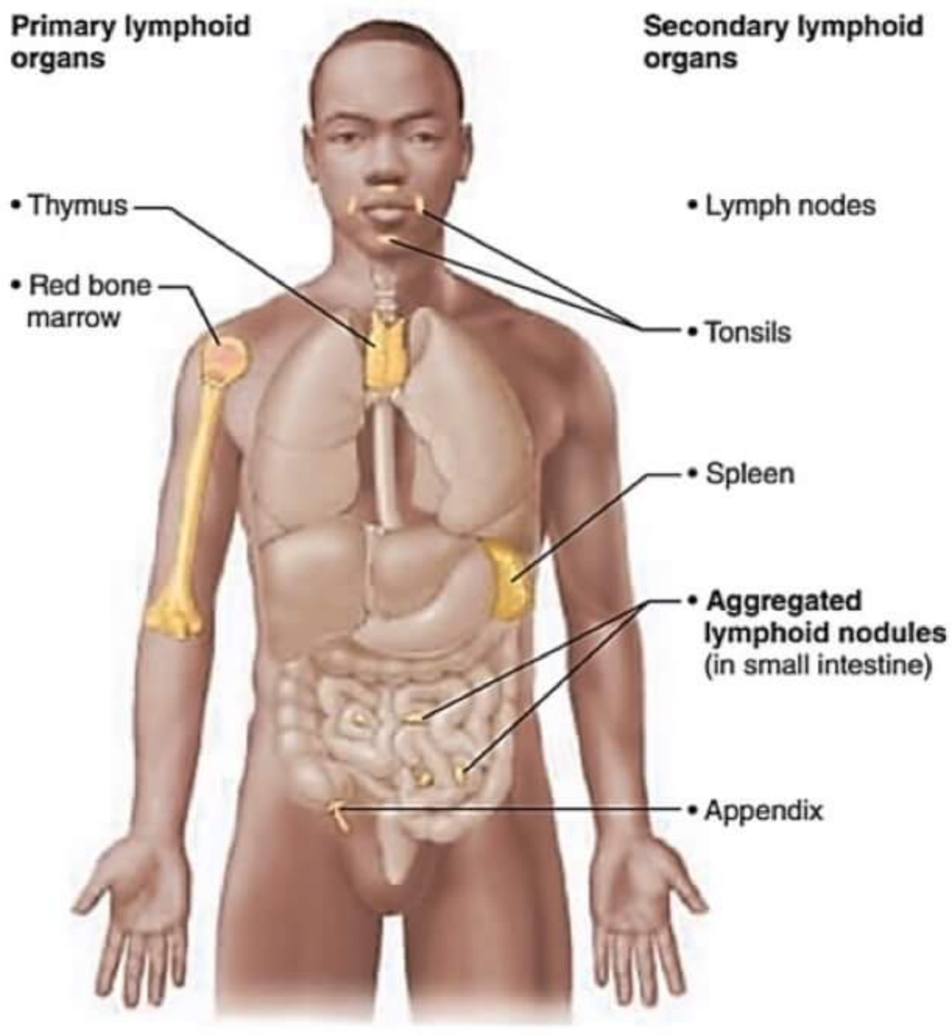
– Kills bacteria
Protozoa (amoeba)

→ DI GEORGE SYNDROME

→ Thymus absent

→ ↓ CMI

→ Severe bacterial Infections



SECONDARY LYMPHOID ORGANS

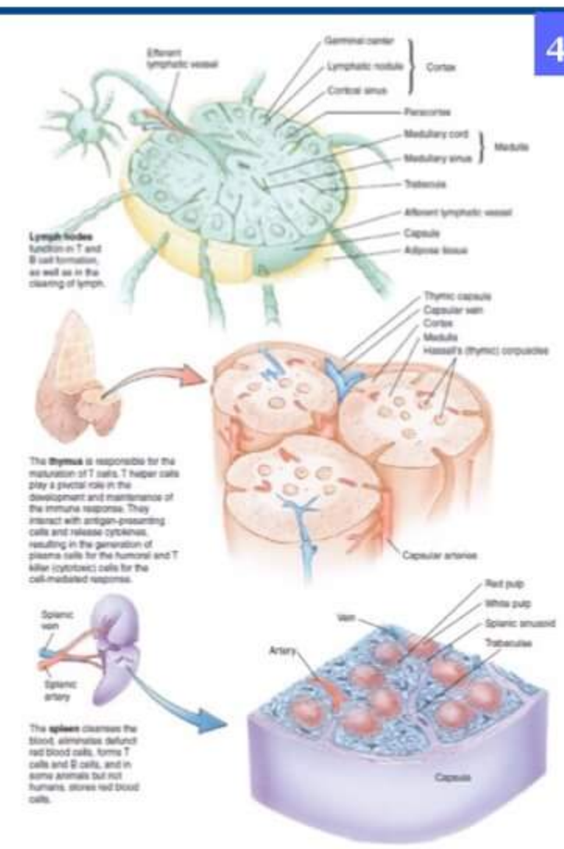
→ no stem cells

→ L. NODES
TONSILS
SPLEEN
MALT (Payer's Patches)

LYMPH NODE

COMPONENTS

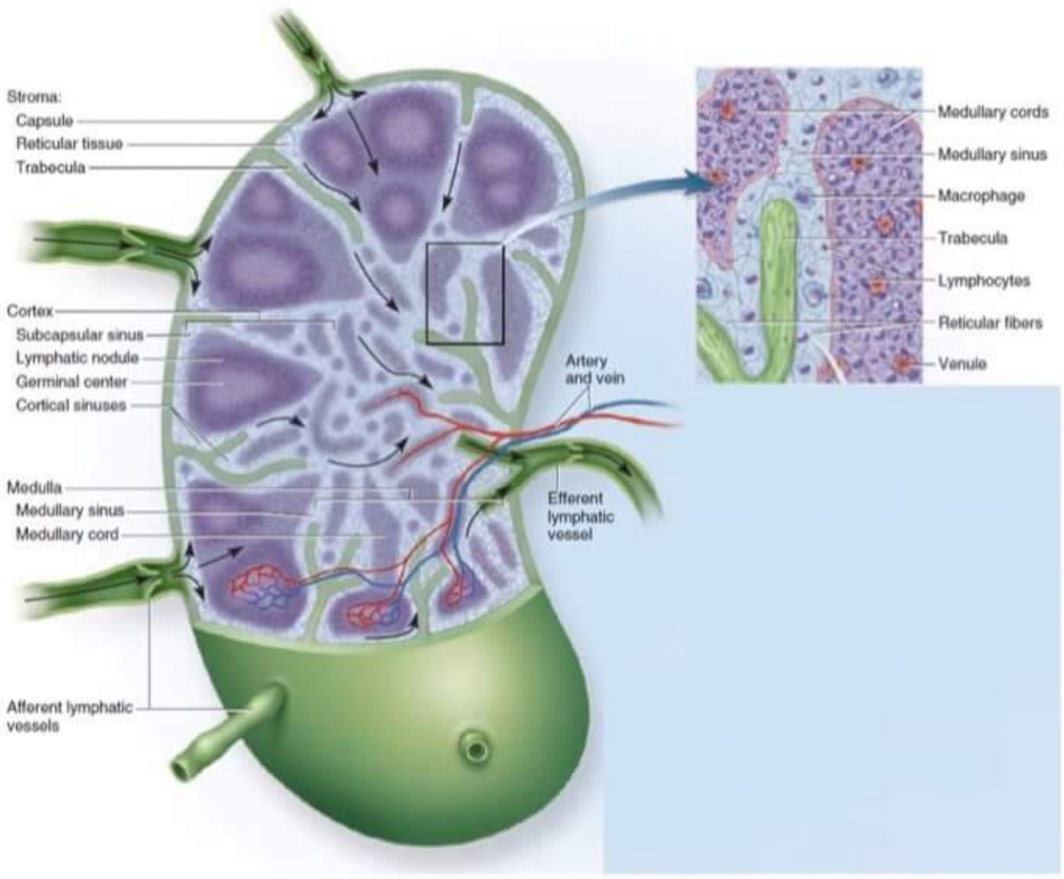
1. CORTEX
2. PARA CORTEX
3. MEDULLA
4. CAPSULE
5. LARGE SUB CAPSULAR SINUS [Filled ĩ lymph]

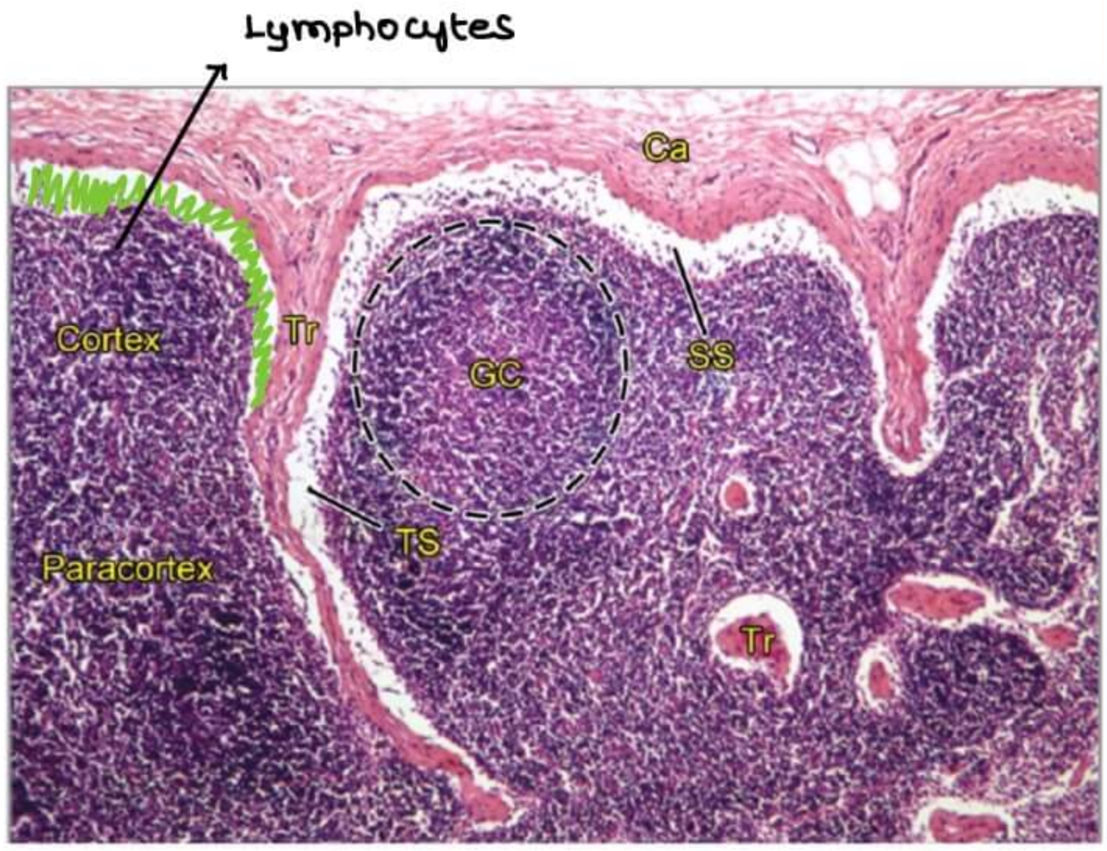


CORTEX → contains Lymphoid follicles

LYMPHOCYTES

→ has large nucleus [Basophilic]
peripheral thin cytoplasm



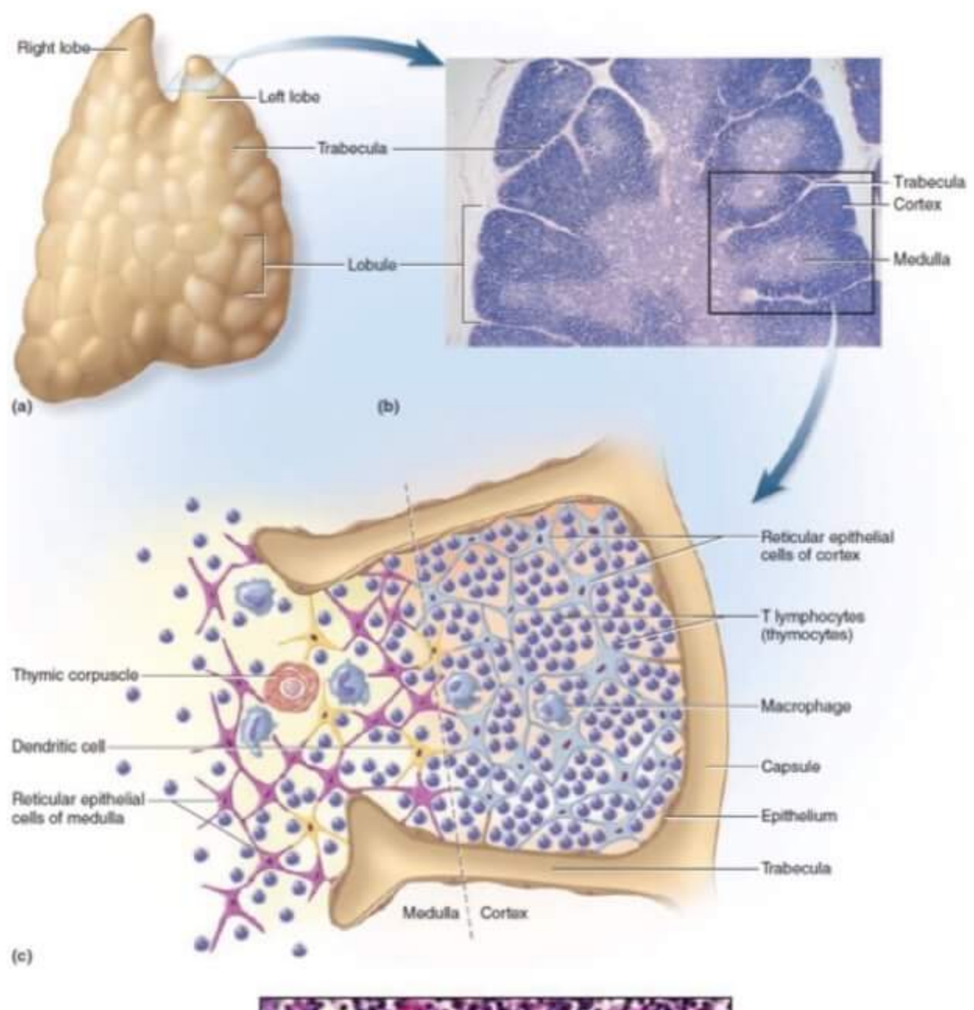


THYMUS

→ MULTIPLE LOBULES
→ multiple cortex
→ at periphery
→ dark coloured

→ multiple medulla
→ at centre
→ light coloured

→ HASSAL'S CORPUSCLE [THYMIC CORPUSCLE]
→ degenerating cells
(epithelicytes)

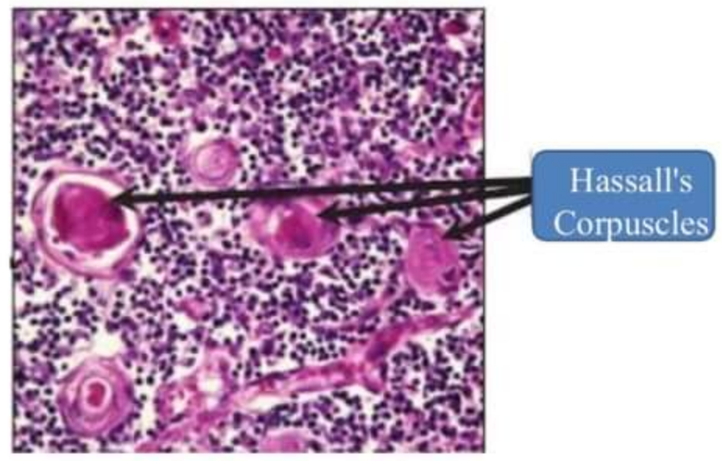


SPLEEN

WHITE PULP

→ 10 - 30%
→ ↑ WBCs
→ LYMPHOID FOLLICLES
- ĩ Germinal centre [Light stained]
- Periphery → Dark Stained

→ on centre → B Lymphocytes
Periphery → T Lymphocytes

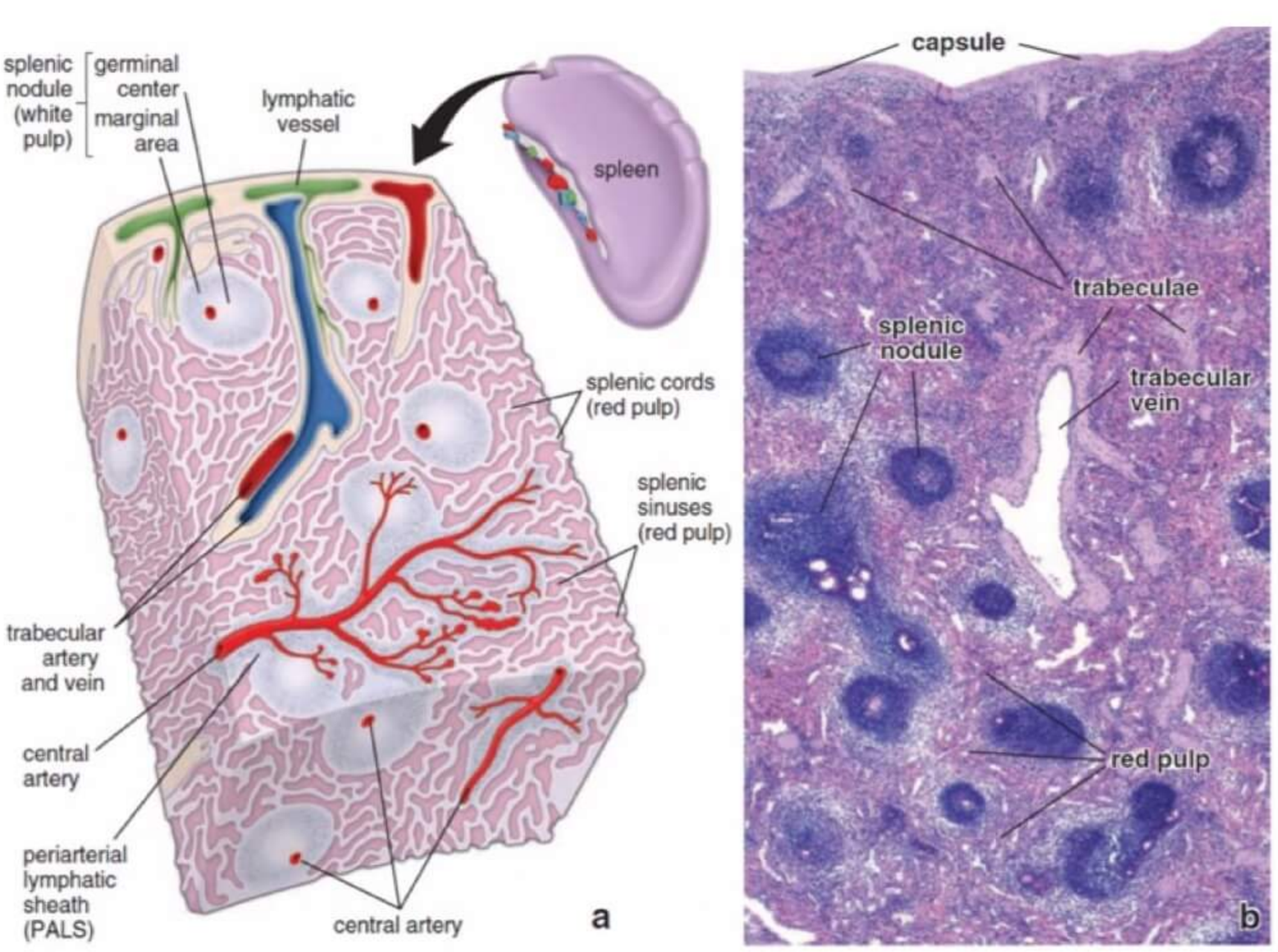


Germinal centre

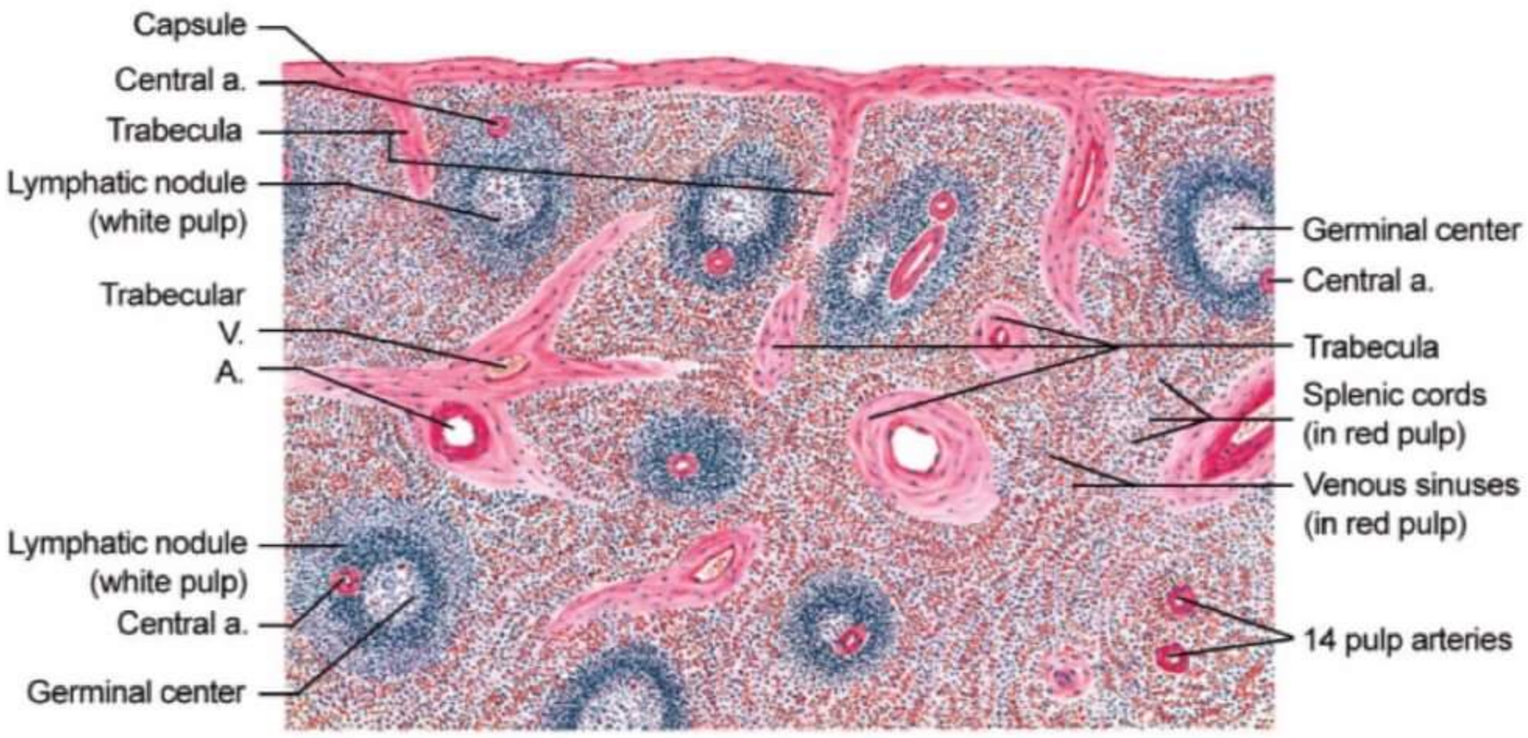
RED PULP

- → 70 - 90%
- → ↑ RBCs
- → SPLEENIC SINUSOIDS filled ī blood
- → CORDS OF BILLROTH
  - → Reticulocytes
    ↓
    Reticular fibres
    ↓
    cords

- → Central Arteriole
  - → Present in Lymphoid follicle
  - → Eccentric [not in centre]
  - → surrounded by T lymphocytes



CAPSULATED
Thymus
Lymph Node
Spleen



@ All of the following are Components of White pulp of Spleen Except
- a Peri arteriolar lymph sheath
- b B cells
- c Antigen Presenting cells
- d vascular sinus

PERI ARTERIOLAR LYMPH SHEATH → contains T lymphocytes

TONSIL

PALATINE TONSIL

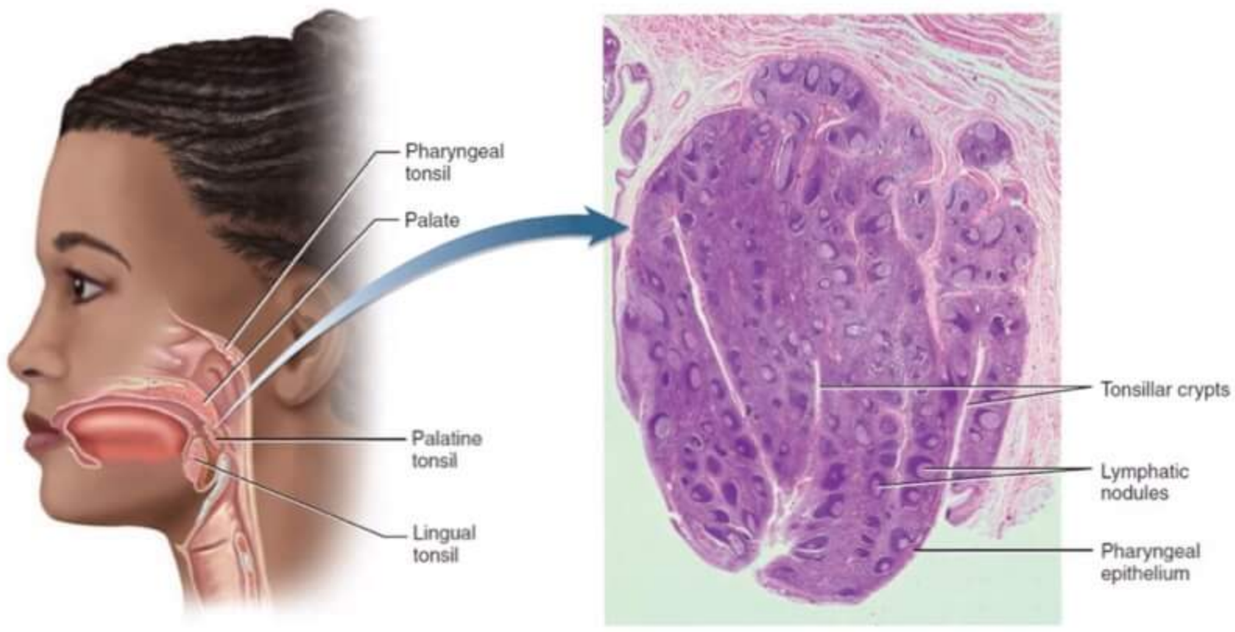
LINGUAL TONSIL

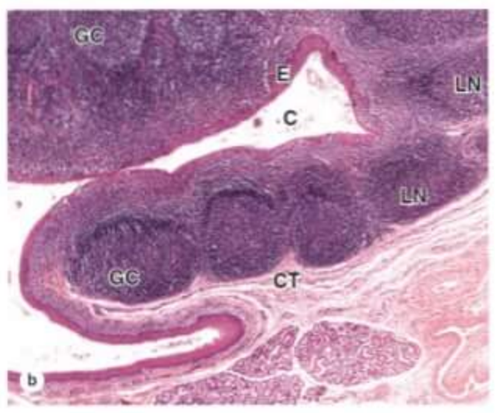
PHARYNGEAL TONSIL

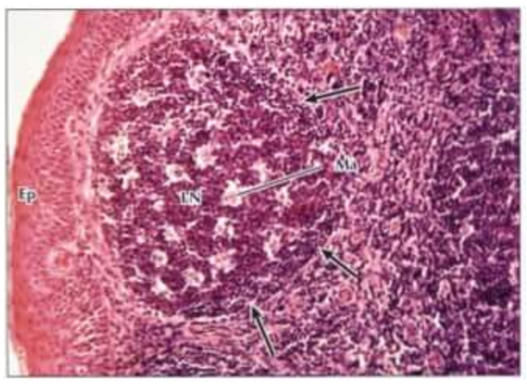
PALATINE TONSIL

→ Tonsilar crypt lined by Non Keratinized Stratified Squamous Epithelium

→ LYMPHOID FOLLICLE







MALT (MUCOSA ASSOCIATED LYMPHOCYTE TISSUE)

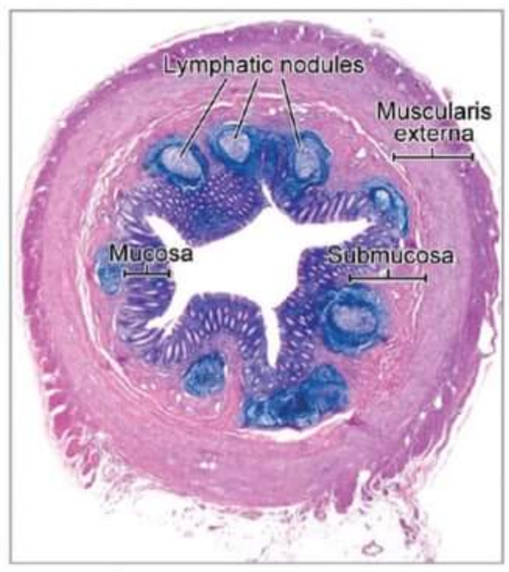
Q GALT [Gut Associated Lymphoid Tissue] present in

a Sub Mucosa

b Lamina propria [BETTER ANSWER]

c Muscularis Mucosa

d Adventitia / serosa



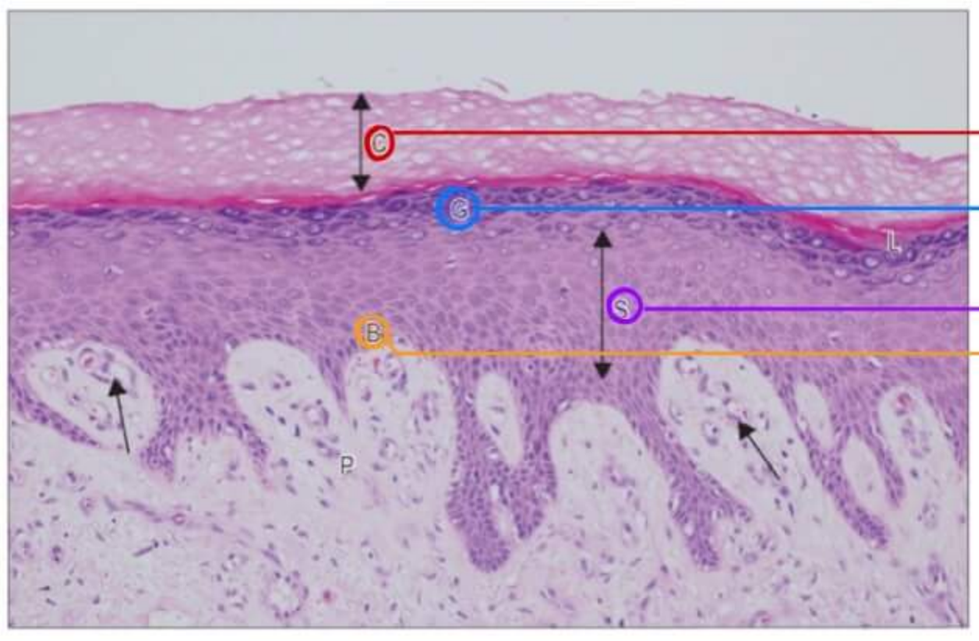
VERMIFORM APPENDIX

→ MALT present not only in LAMINA PROPRIYA but also extending into SUB MUCOSA [Rare]

INTEGUMENTARY SYSTEM

SKIN EPITHELIUM

1. STRATUM CORNEUM → contains Keratin fibres
2. STRATUM LUCIDUM → on palm & Soles
3. STRATUM GRANULOSUM → have Kerato Hyaline Granules
4. STRATUM SPINOSUM / PRICKLE CELL LAYER
5. STRATUM BASALE / STRATUM GERMINATIVUM



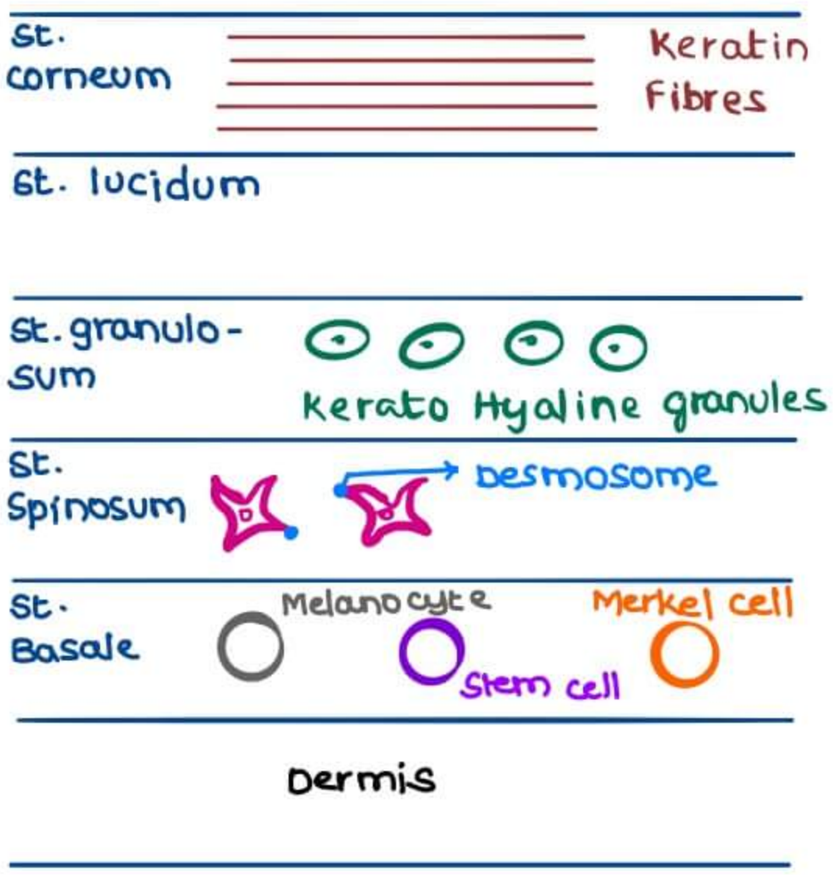
PRICKLE CELL LAYER } STRATUM MALPHIGII
BASAL CELL LAYER }

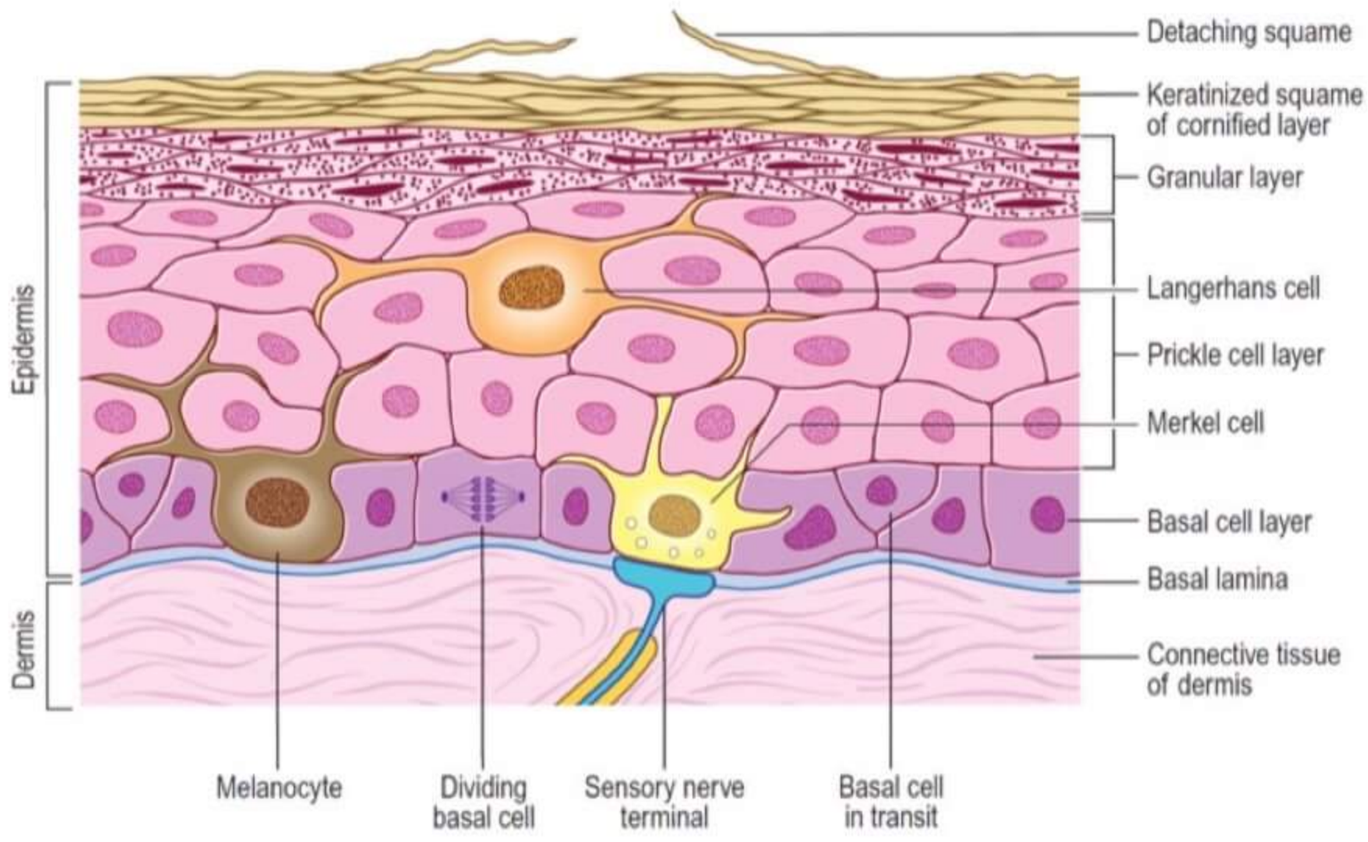
BASAL CELL LAYER - CELLS

MERKEL CELL → Receptor for light touch sensation

STEM CELL → adds more layers
MELANOCYTE → Produce melanine

LANGERHAN CELLS
→ present in upper layer
→ APC
→ monocyte derived Phagocytic type of cell
→ presents bacteria to lymphocyte





Spine appearance is dlt Desmosomes

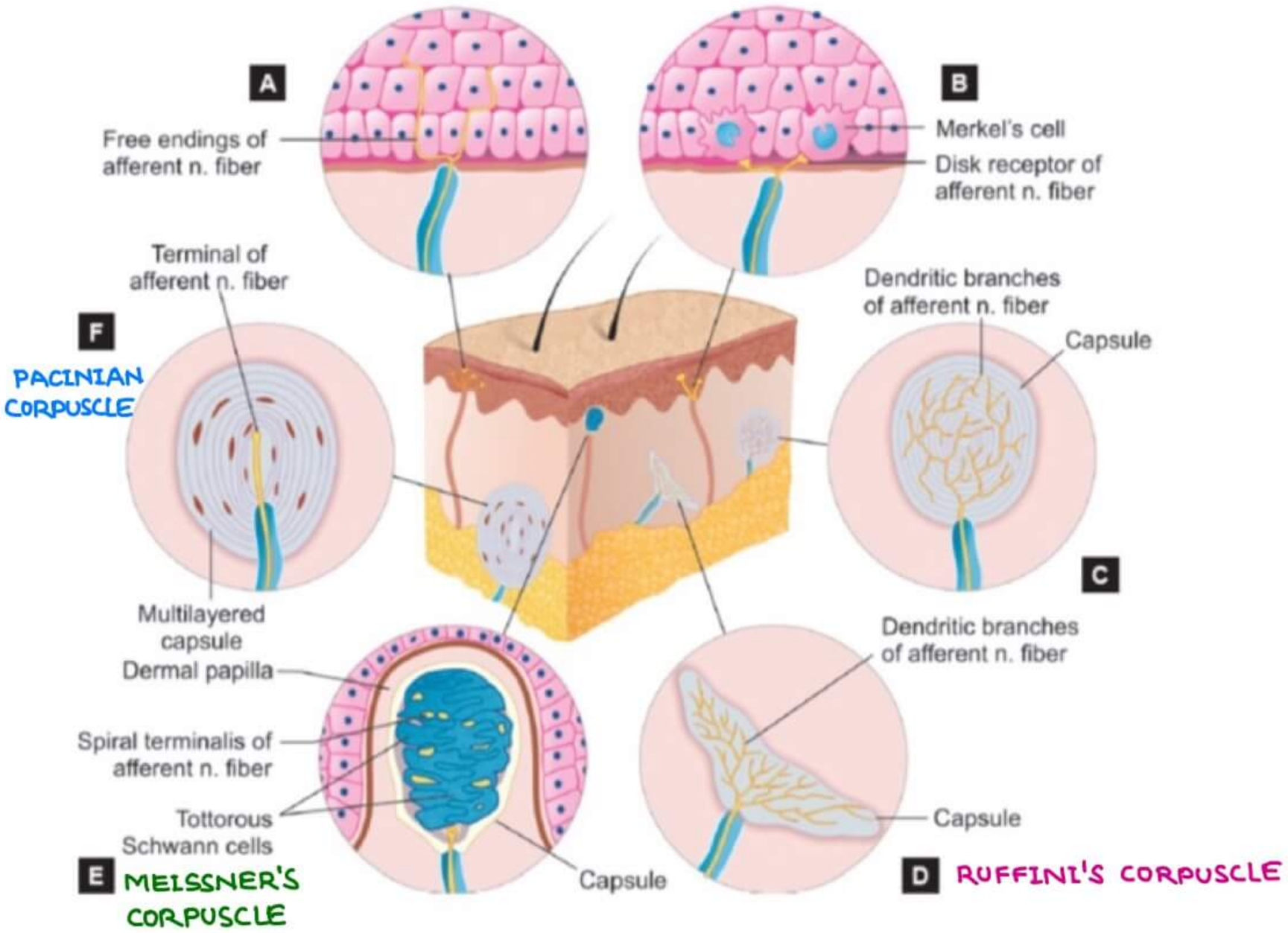
Pemphigus vulgaris
→ auto antibodies destroys Desmosomes
→ Blisters
→ involvement of S. Spinosum
→ Intercellular separation tnt

MELANOCYTES
→ produce melanin
→ derived from Neural crest cells

Merkel cell derived from Surface Ectoderm
Skin Epithelium derived from Surface ectoderm

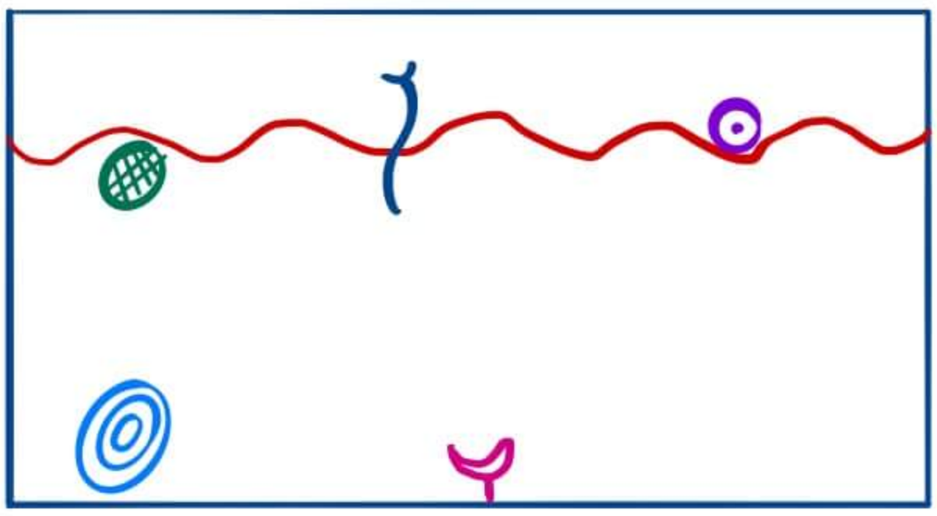
RECEPTORS

- MERKEL'S CELL → For light touch sensation
- MEISSNER'S CORPUSCLE → for 2 point discrimination
- PACINIAN CORPUSCLE → for pressure & vibratn
- RUFFINI'S CORPUSCLE → For Dermal stretch



MERKEL'S CELL

- → For light touch sensatn
- → helps reading BRAILLE [MERKEL > MEISSNER]
- → Slowly adopting Receptor



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

MEISSNER'S CORPUSCLE

- → present at dermo epidermal junction
- → rapidly adopting receptor
- → for 2 point discriminatn

PACINIAN CORPUSCLE

- → present in deep dermis
- → carries pressure & vibration
- → rapidly adopting receptor

RUFFINI RECEPTOR

→ present in deep receptor
→ Slowly adopting receptor
→ for dermal stretch
Thermoreceptor

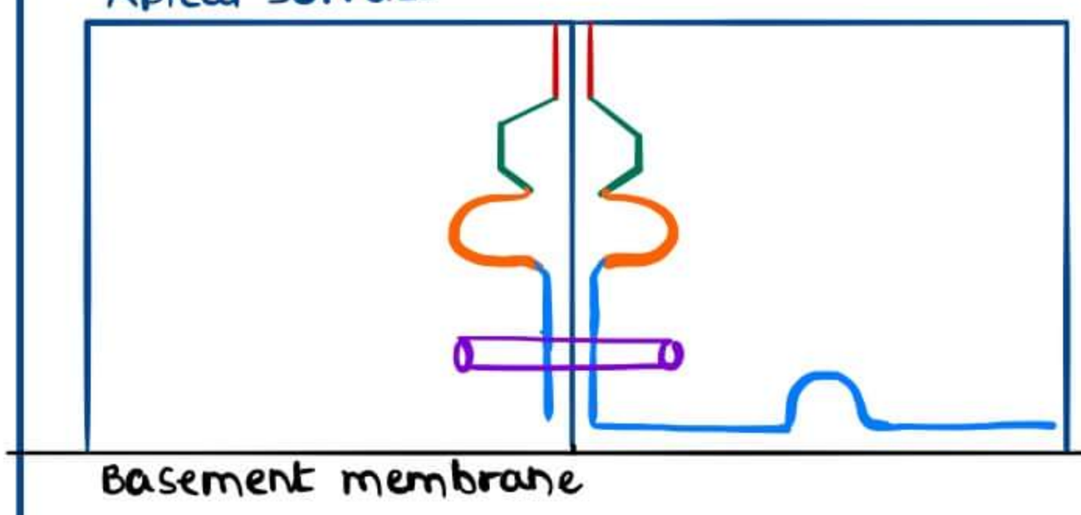
FREE NERVE ENDINGS

→ non myelinated axons
→ Slow conducting
→ C fibres
→ conducts Pain & Temperature

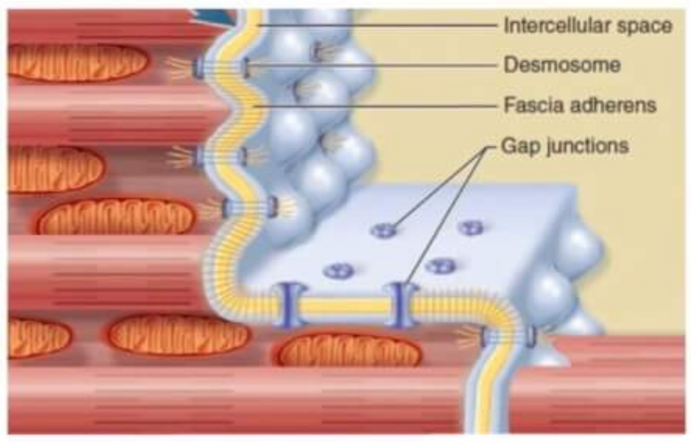
CELL JUNCTIONS

20 nm Intercellular gap is found in

a zona occludens → very narrow Intercellular gap
b zona adherens / FASCIA ADHERENS
c Macula adherens / Desmosomes → 25 nm [max]
d Gap junctions → very narrow Intercellular gap



Zona occludens / Tight junction
Zona Adherence / Fascia Adherence
Desmosomes / macula adherence
Gap junction
Hemi Desmosomes



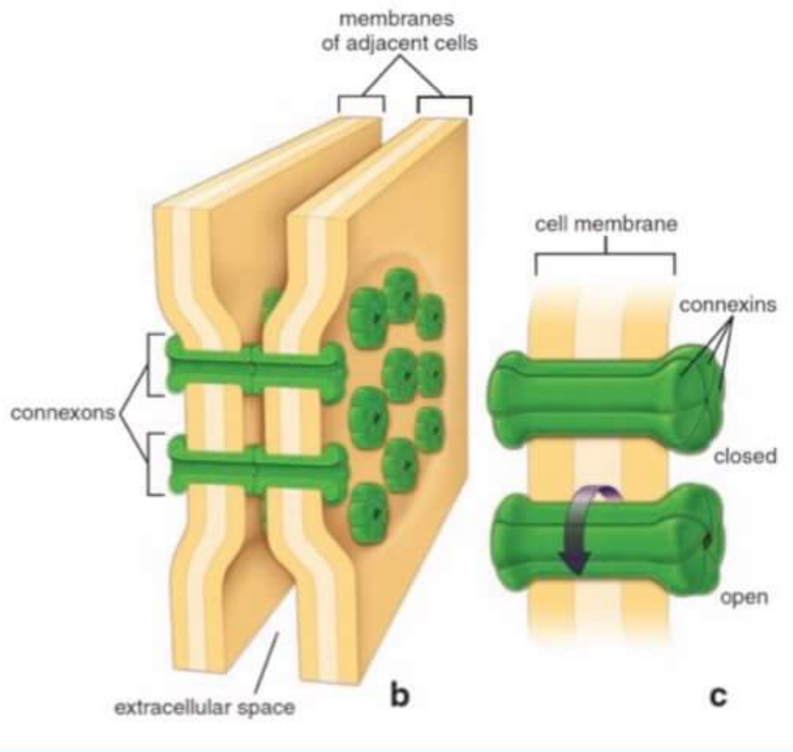
GAP JUNCTION

→ Tunnel like b/w 2 cells
→ for passage of ions, molecules [Glucose, AA]
→ CONNEXONS → hexagonal structures + nt
→ very narrow IC Gap
→ ions [ca^{2+}, Na^{2+}] → for impulse conduction
similar to ELectric synapse in
Smooth muscles → causes Peristalsis
cardiac muscles → causes Rhythm

→ in case of damage
- Disturbed peristalsis
- cardiac arrythmias

→ Faster conducting than neural conduction

→ contain CONNEXONS
→ hexagonal
→ conducts ions [ca^{2+}, Na^{+}]



HEMI DESMOSOME → attaches cell to basement membrane

ZONA OCCLUDENCE / TIGHT JUNCTION → very narrow inter cellular gap towards apical surface

ZONA ADHERENCE / FASIA ADHERENCE → 20 nm IC gap

DESMOSOMES / MACULA ADHERENCE → 25 nm IC gap

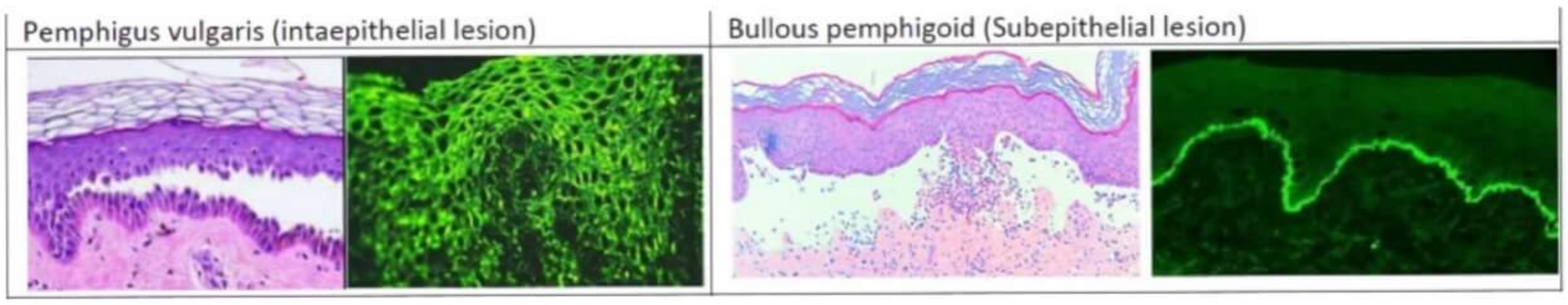
CELL ADHESION MOLECULES

INTEGRINS → Hemi Desmosomes

CADHERINS → Desmosomes
Ca^{2+} modulated adherent molecules

In P. VULGARIS → Abs to Cadherins → Intra epithelial Blisters
NIKOLSKY'S SIGN → Positive

Bullous pemphigoid → auto Abs against hemidesmosomes
→ separates epithelium from BM
– subepithelial lesion



IMMUNO FLOURESCENCE STAINING

Pemphigus vulgaris → FISHNET APPEARANCE [Through out epithelium]
Bullous pemphigoid → Green flouroscence restricted to basement mem.

NIKOLSKY SIGN

→ putting tangential pressure to normal skin } positive
Extension of lesion into normal skin }

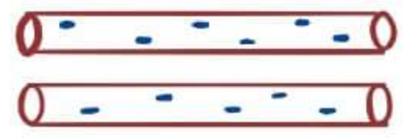
→ d/t intercellular separation
→ S. spinosum involved

MUSCULAR TISSUE

SKELETAL MUSCLES } striated [alternate bands]
CARDIAC MUSCLES }
SMOOTH → non striated

SKELETAL MUSCLES

→ Long cylindrical cells
→ SYNCITIUM → multinucleated d/t loss of cell membrane
→ nuclei are at periphery



→ STRIATED APPEARANCE
A Band → Anisotropic
I Band → Isotropic

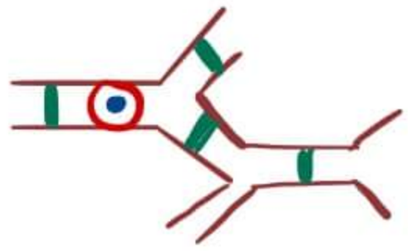
CARDIAC MUSCLE

- → INTERCALATED DISCS
- → STRIATED
- → BRANCHING SEEN

- → dlt prominent cell boundaries
- → less striated
- → perinuclear halo present

SMOOTH MUSCLE

- → Spindle shaped cells
- → no striations



@ The marked structure has all the following cell junctions EXCEPT

a zona occuldens
b zona adherens
c Macula adherens
d Gap junction

RESPIRATORY SYSTEM

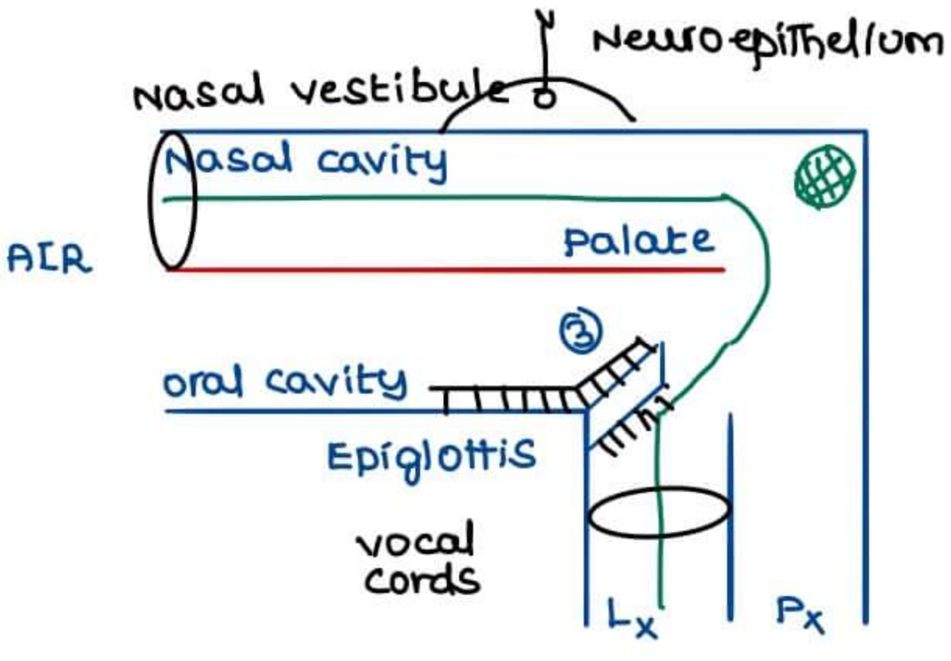
PALATE

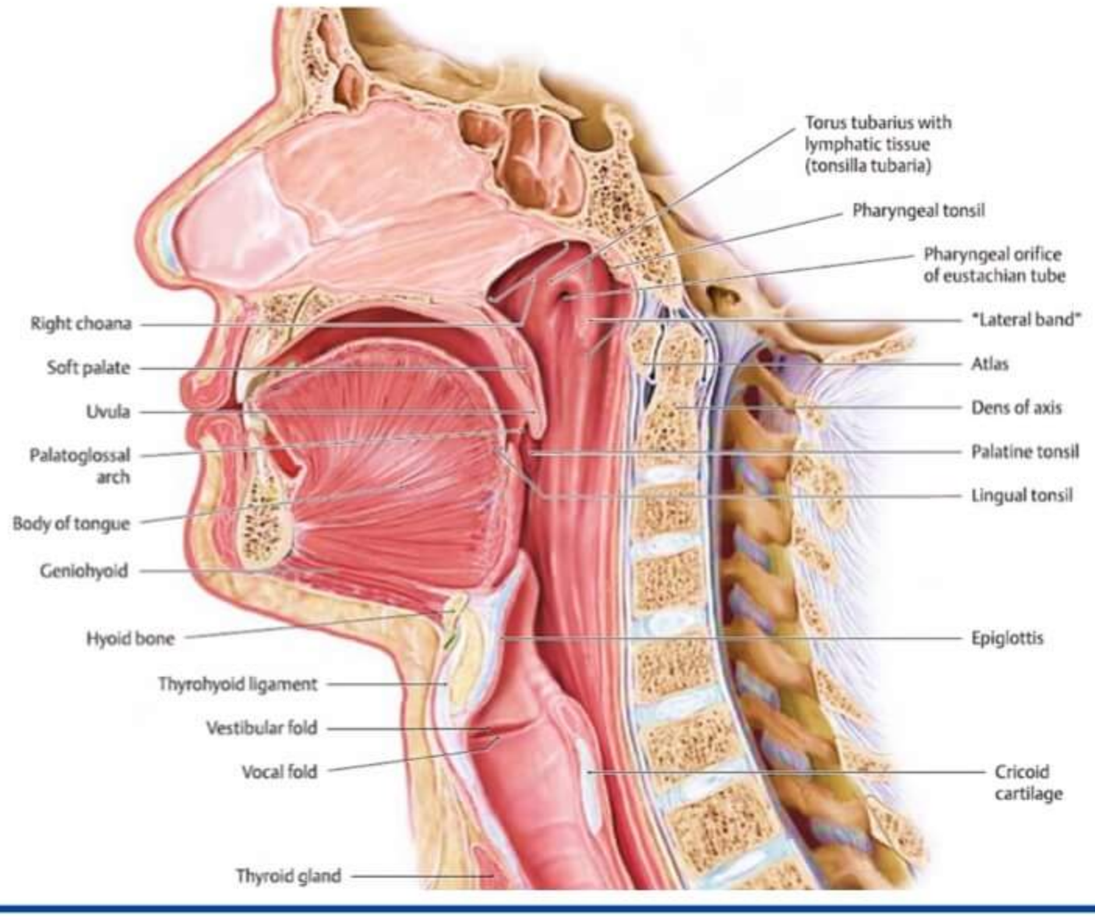
- → boundary line blw respiratory tube & gut tube
- → DOUBLE SURFACE & DOUBLE EPITHELIUM
  - → Hard palate lined by Para Keratinized Stratified Squamous epithelium on Oral surface
  - → Upper surface of palate lined by respiratory epithelium

EPIGLOTTIS

- → Oral surface → Stratified squamous epithelium
- → Laryngeal surface → Respiratory epithelium

NASAL VESTIBULE & VOCAL CORDS are prone to abrasion → St. Sq. Epithelium
ADENOIDS & TONSILS → Respiratory epithelium





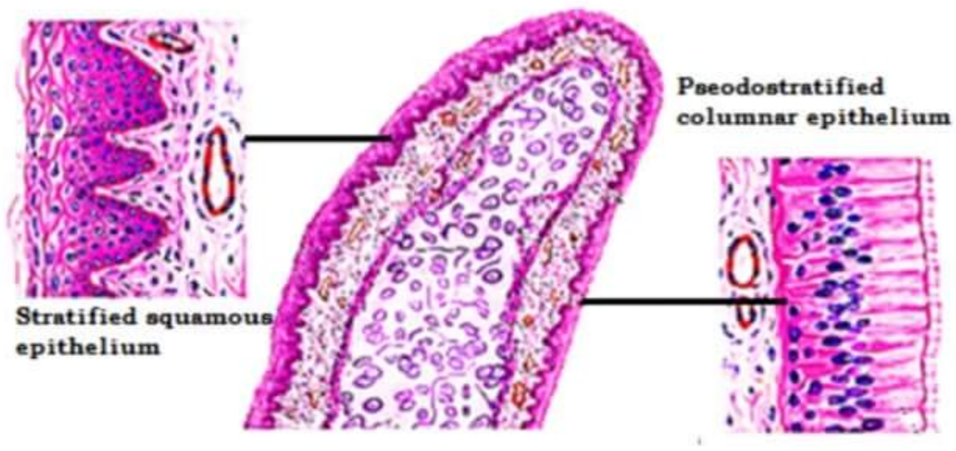
NEURO EPITHELIUM → present at roof of nasal cavity → olfactory epithelium

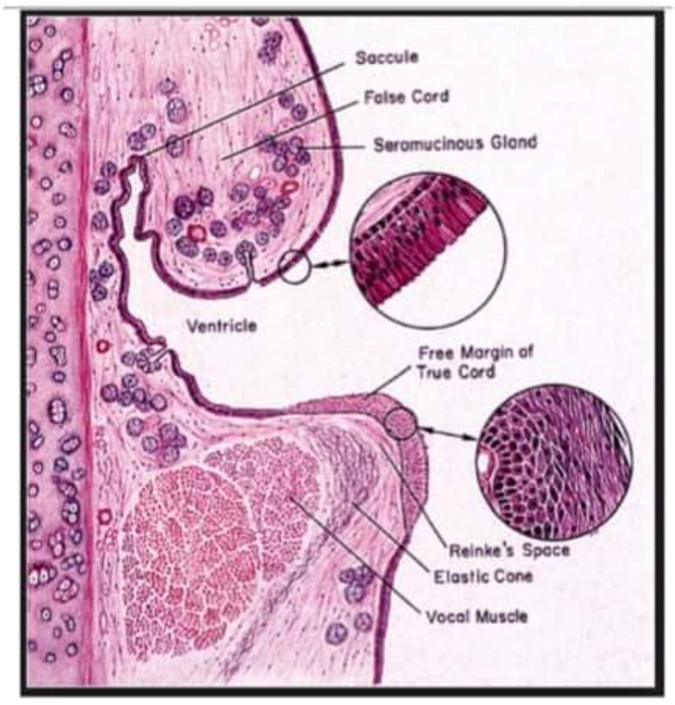
RESPIRATORY EPITHELIUM

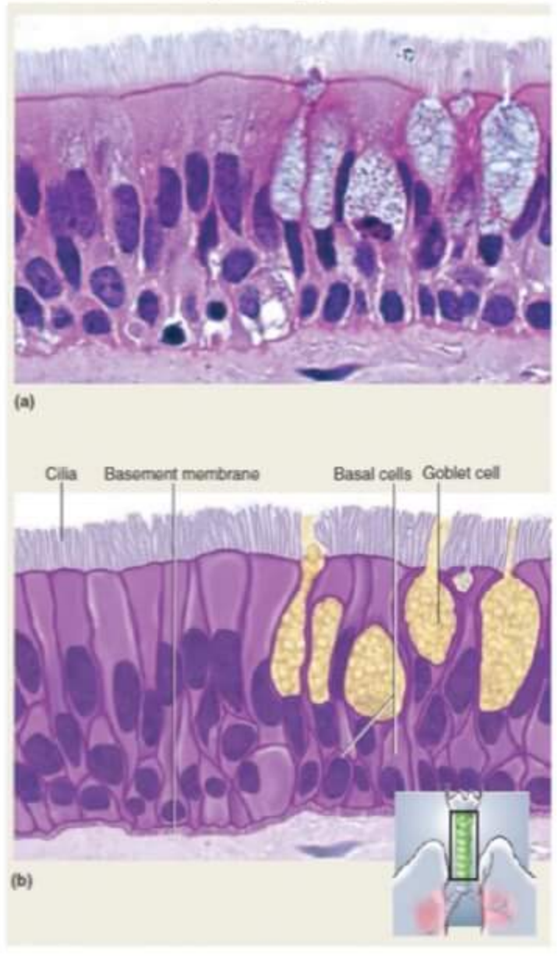
→ PSEUDO STRATIFIED CILIATED COLUMNAR EPITHELIUM ⊤ GOBLET CELLS

→ ciliated → moves mucus secreted by GOBLET CELLS [foamy appearance d/t mucus]

EPIGLOTTIS → Elastic cartilage +nt







LARYNX

→ lined by Respiratory epithelium EXCEPT for VOCAL CORDS

→ Hyaline cartilage +nt

@ Hyaline cartilage of respiratory tube extends till

a Bronchus

b Terminal Bronchiole } ↑ smooth muscle

c Respiratory Bronchiole

d Alveolar duct

RESPIRATORY PATHWAY

→ Alveolar duct

→ Alveolar Sac

→ Alveoli

CONDUCTING PATHWAY

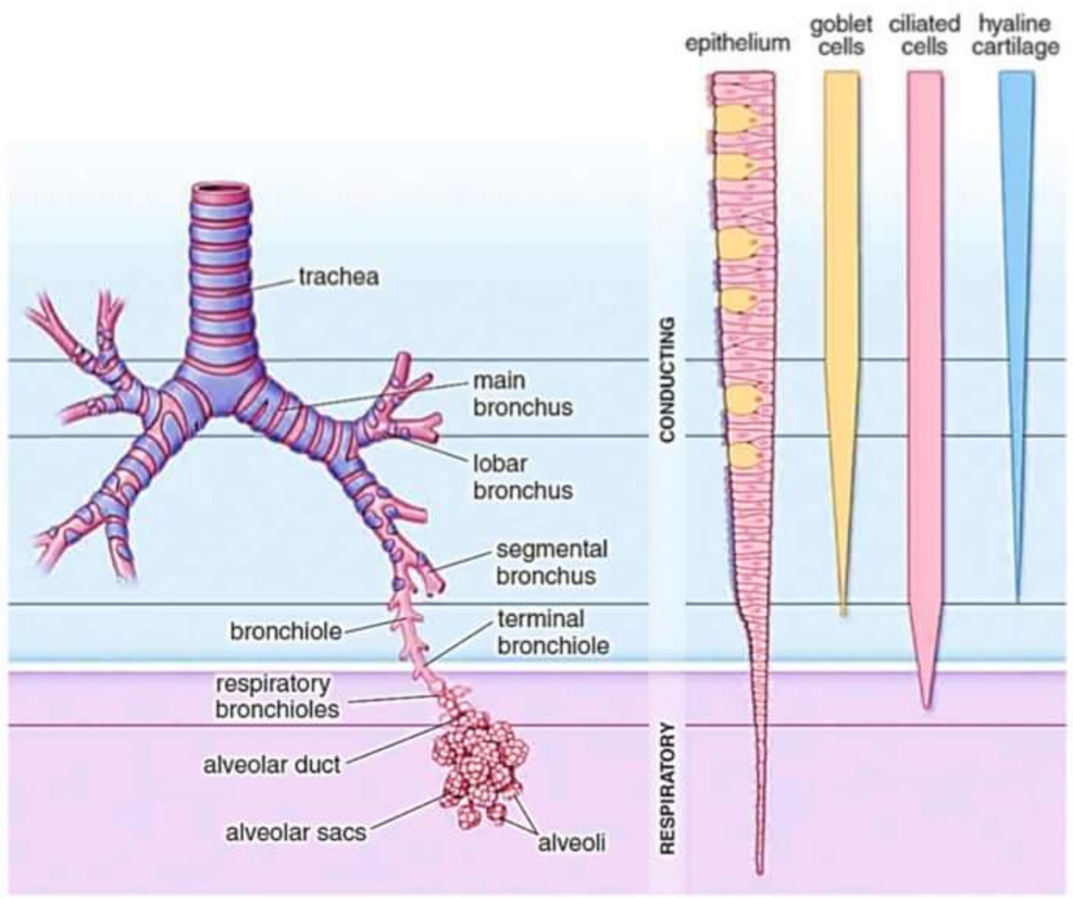
→ Trachea

Bronchus

Bronchiole

Terminal bronchiole

Respiratory bronchiole



Hyaline cartilage extends upto bronchus

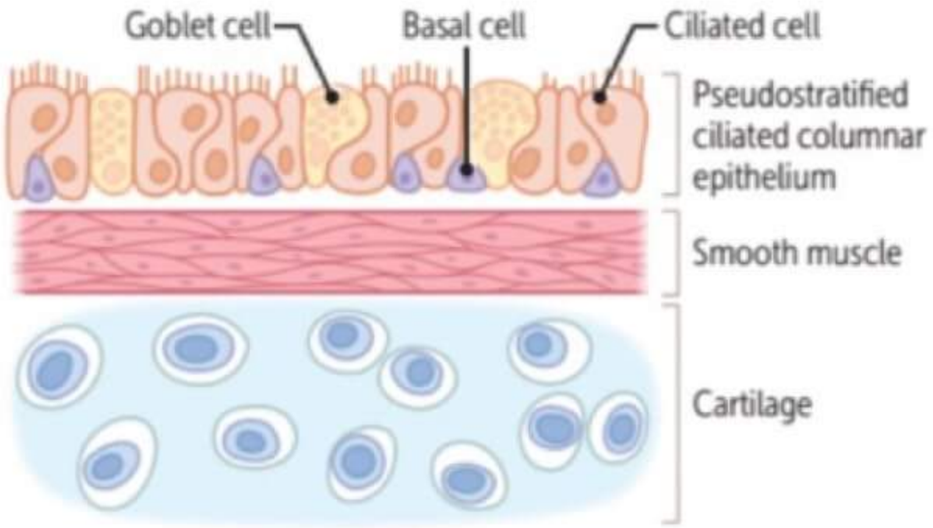
Goblet cells extends upto bronchus

Larynx, Trachea } Respiratory Epithelium

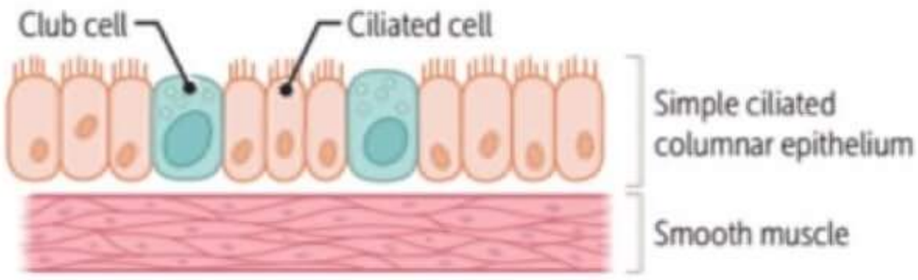
Respiratory bronchiole → cuboidal epithelium

Alveolar Sac → simple squamous epithelium for gaseous exchange

Thin type 1 pneumocyte



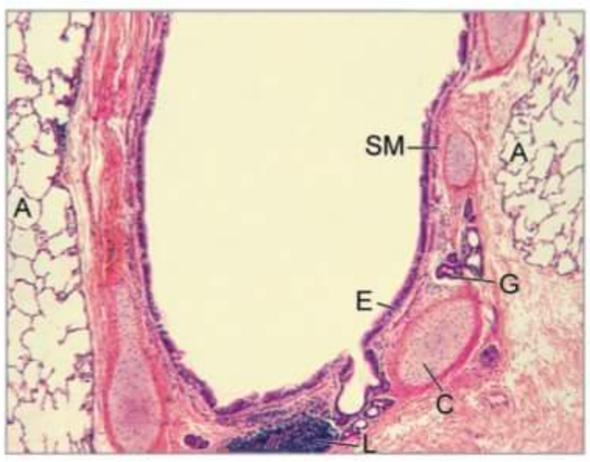
BRONCHUS

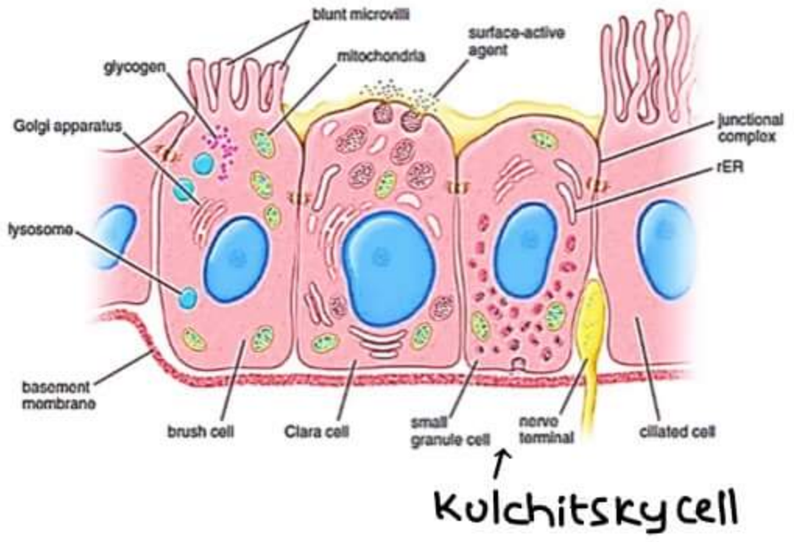


BRONCHIOLES

BRONCHUS

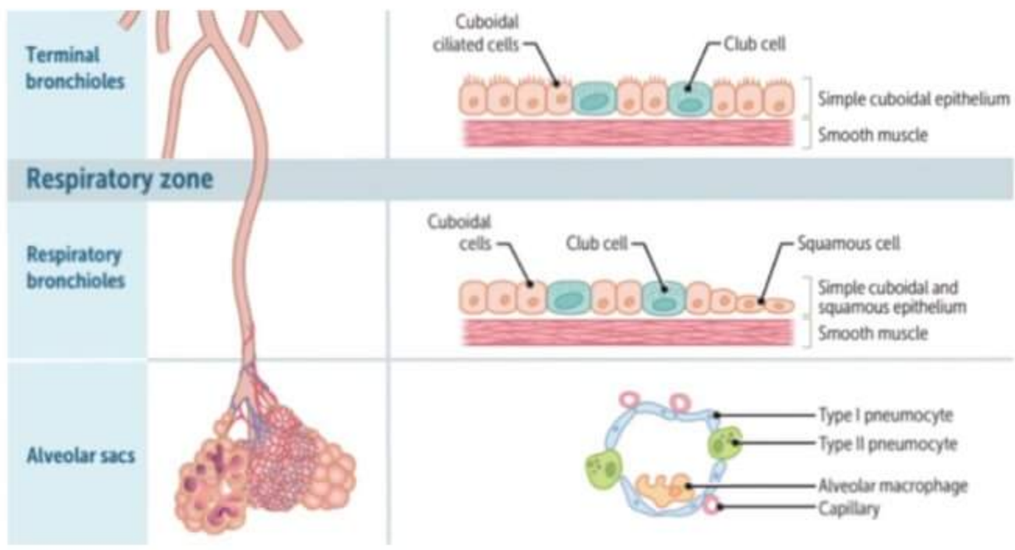
- → smooth muscles
- → Hyaline cartilage
- → Glands [Goblet cells]
- → Respiratory Epithelium
- → MALT





BRONCHIOLES

No Goblet cells
No Hyaline cartilage
↑ smooth muscles



TERMINAL BRONCHIOLE

Clara cells
Ciliated cells +
Club cells
Squamous cells

Q All of the following cells are found in Lung Except

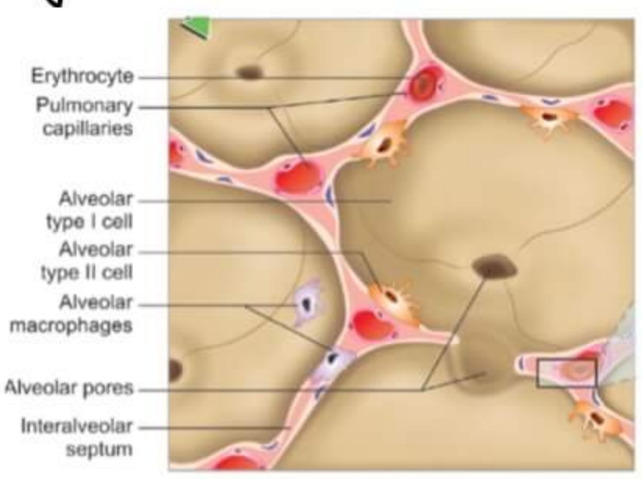
a Kulchitsky cells → Neuro endocrine cell → Secretes Serotinine
b Clara cells
c Brush cells
d Langerhans cells → APC → Skin & Lymph Nodes

CLARA CELL
→ Secretes surfactant
→ Detoxify air
→ acts as Stem Cell

BRUSH CELL
Function exactly not known

ALVEOLUS

- → Type 1 pneumocytes [mostly] → gaseous exchange
- → Type 2 pneumocytes → Secretes surfactant
- → Alveolar macrophage → engulf dust particles
- → Capillaries → ↑↑ CO_2 & Less O_2
- → Alveolar pores of KOHN → helps in communicatn ī other alveoli



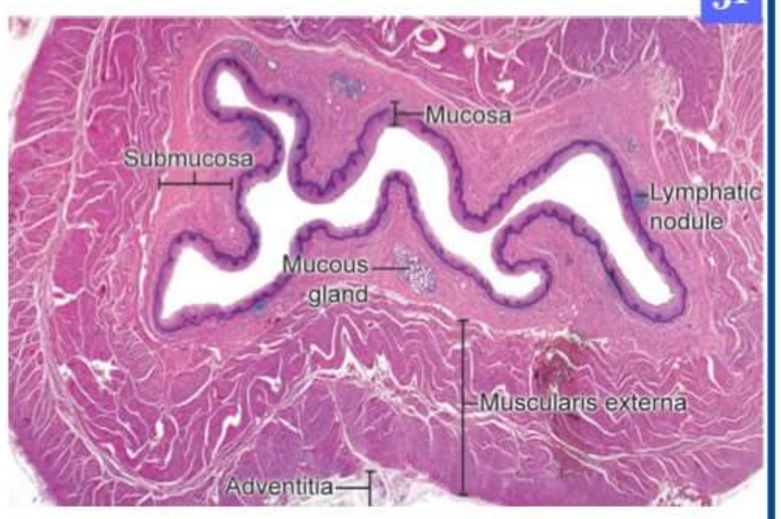
OESOPHAGUS

MUCOSA

SUB MUCOSA

MUSCULARIS EXTERNA

ADVENTITIA [mostly] & SEROSA

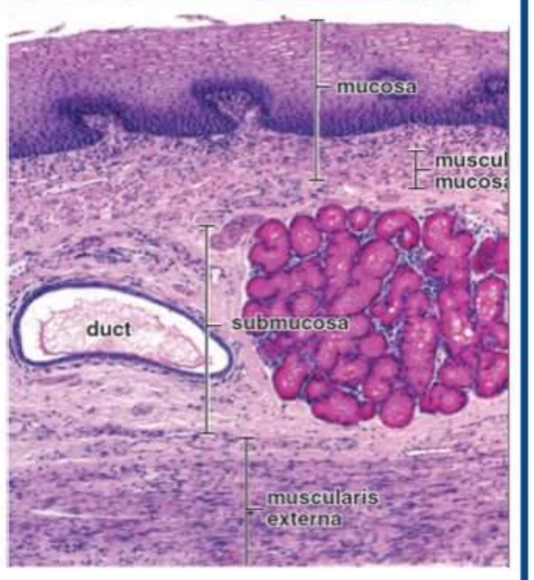


MUCOSA

→ Stratified Squamous Epithelium

→ Lamina propria

→ Muscularis mucosa



SUB MUCOSA

→ Strongest layer of Oesophagus
- should include in sutures

→ sub mucosal glands + nt

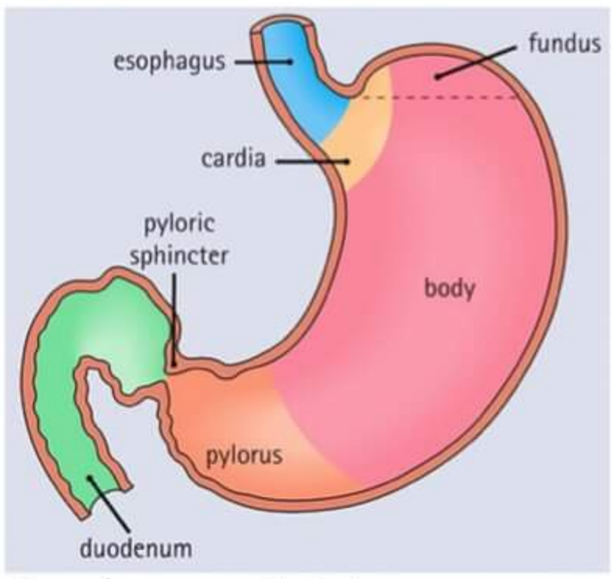
STOMACH

CARDIA

FUNDUS

BODY

PYLORUS



→ cardia & Pylorus have more mucous glands → neutralizes Acid

→ Parietal cells secretes Hcl

→ parietal cells are rare in cardia & pylorus

Q All are correct about stomach except

a Pylorus has more acid secreting cells

b Lots of mucous secreting cells in pylorus

c chief cells secrete pepsinogen → more in FUNDUS

d Parietal cells secrete intrinsic factor

GASTRIC GLANDS

CELLS

1 SURFACE MUCOUS CELL → Secretes alkaline fluid & mucin

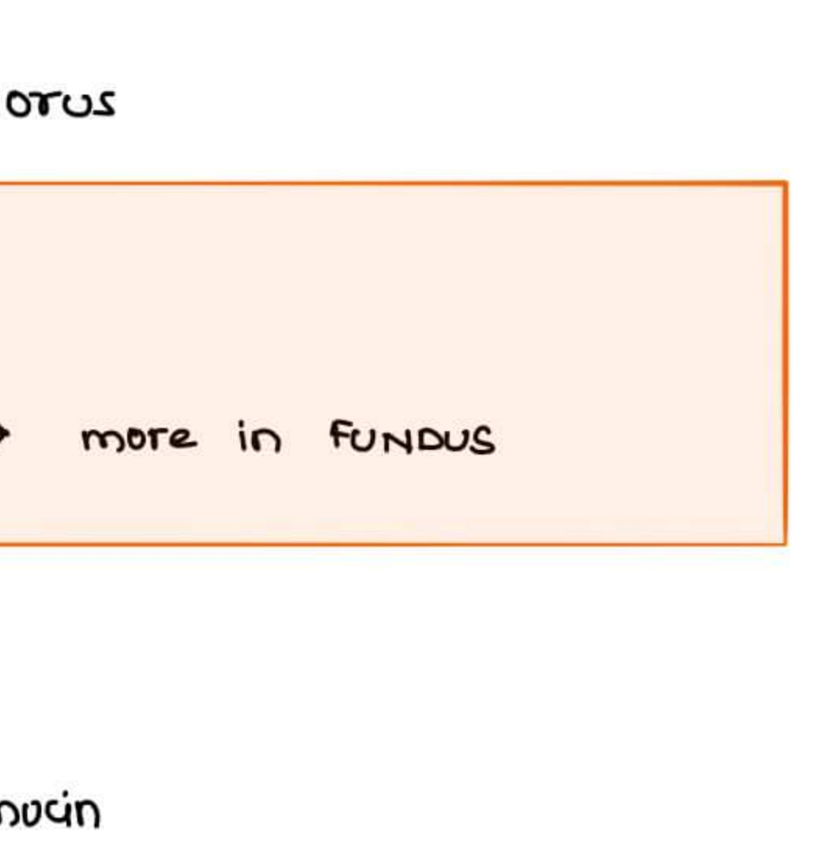
2 MUCOUS NECK CELL → secretes acidic fluid & mucin

3 PARIETAL CELL → Secretes Hcl & Intrinsic factor

4 CHIEF CELL → Secretes Pepsinogen & gastric lipase

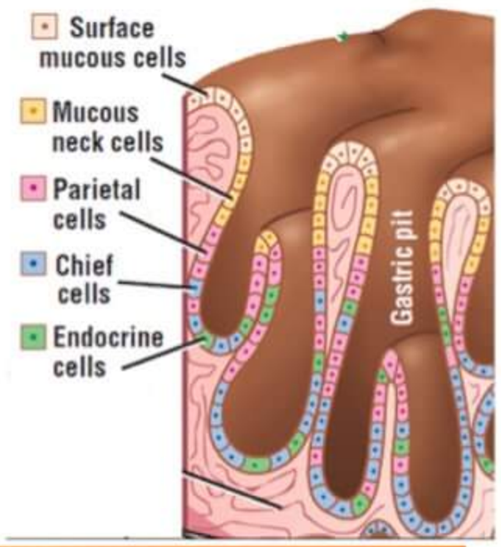
5 G CELL [ENTERO ENDOCRINE CELL] → secretes gastrin

NO Goblet cells



→ Upper 1/2 consists
1. MUCOUS NECK CELL
2. PARIETAL CELL → Pink [Eosinophilic]

→ Lower 1/2 consists
1. CHIEF CELL → Blue [Haematoxylin]
2. G CELL



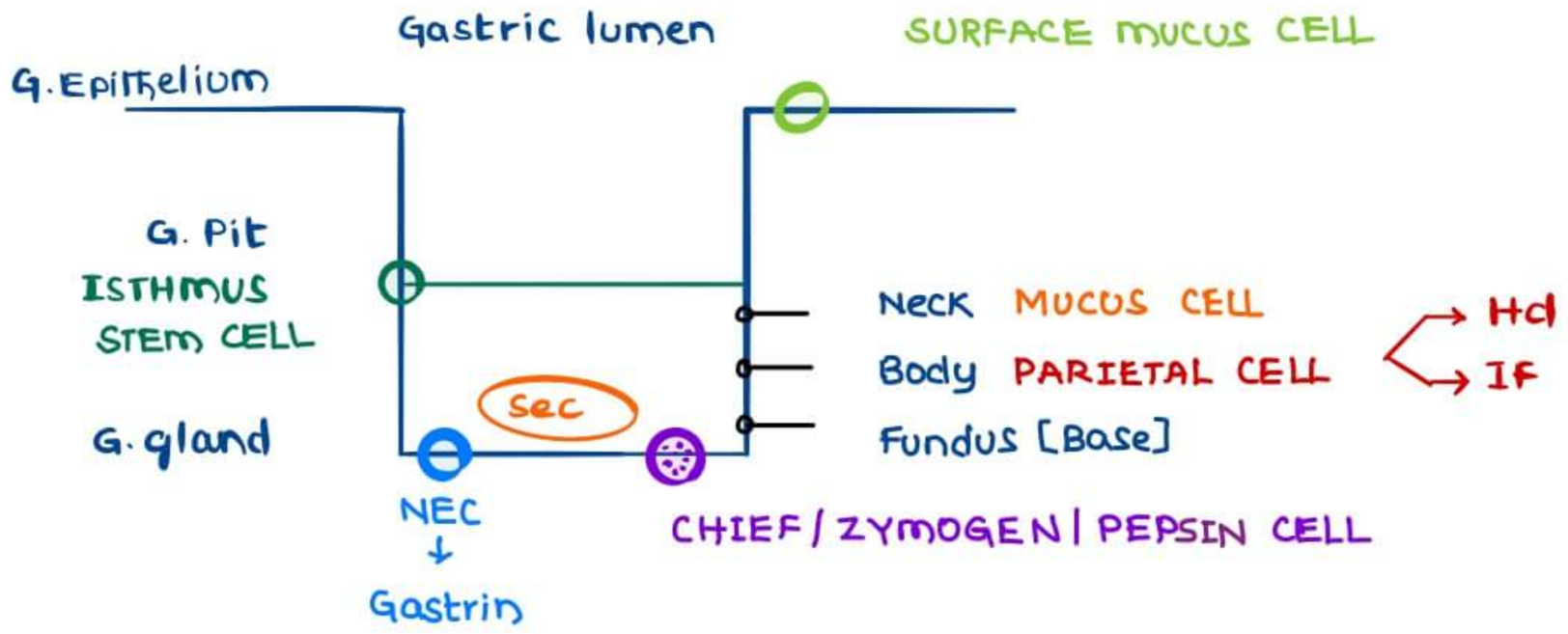
Q Which of the Following marked cells Secrete HCl

a	A	→ Surface neck cell
b	B	→ mucous neck cell
c	C	→ Parietal cell
d	D	→ Chief cell

PARIETAL CELLS
→ present in upper 1/2
→ pink colored
→ cuboidal cells ∴ FRIED EGG APPEARANCE

Central Spherical Nucleus
FRIED EGG APPEARANCE

CHIEF CELLS
→ Basophilic, blue in color, takes Haematoxylin
→ present in Lower half



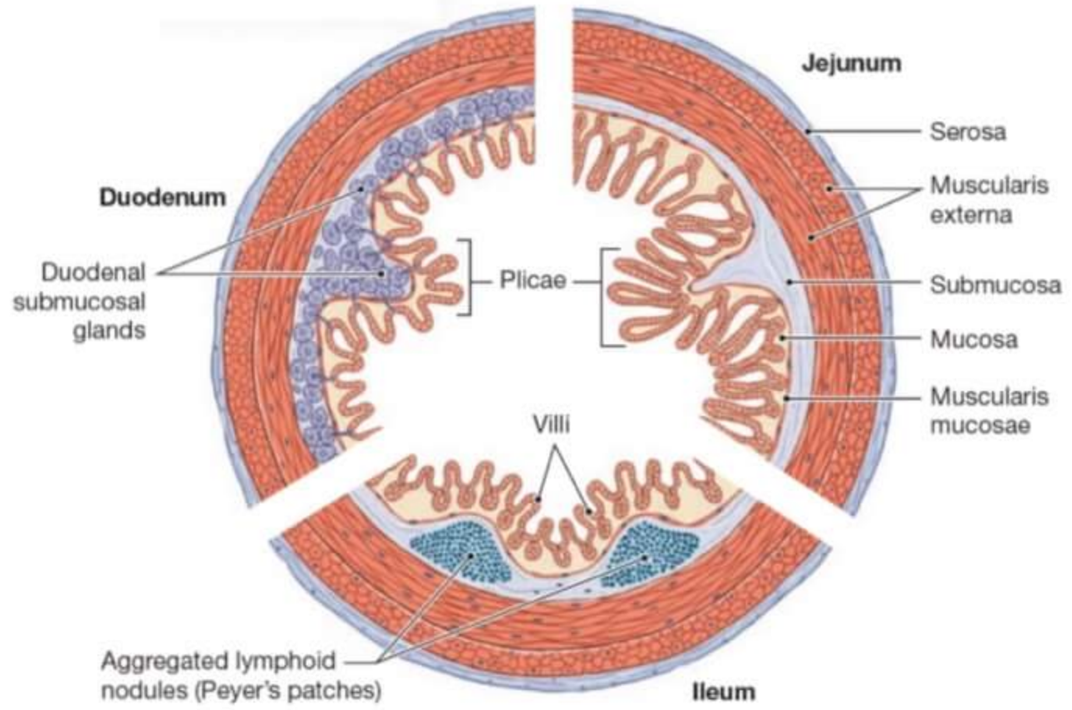
ISTHMUS → Junction blw gastric pit & gastric gland
CELL LOCATIONS shown in the diagram are Predominant locations, they can be present anywhere in the gland

STEM CELLS → helps in repair [post gastritis etc]

SMALL INTESTINE
DUODENUM
JEJUNUM
ILEUM (has peyer's patch)

↑ ABSORPTION by [more in jejenum, ↓ towards Ileum)

1. PLICARE CIRCULARES
   → mucosal folds, ↑ SA
2. VILLI & MICROVILLI



COMMON FEATURES

MUCOSA
SUB MUCOSA
MUSCULARIS EXTERNA
SEROSA

CELLS

1 ENTEROCYTE → columnar cell
→ helps in absorption

2 GOBLET CELL → Secretes mucus
3 PANETH CELL → Provides Immunity [Kills amoeba & Bacteria]
→ Secretes cytokines
→ maintains intestinal flora
→ APICAL EOSINOPHILIA [dark pink apex]
- dlt Lysozymes [cytokines are + nt inside them]
TNF-α

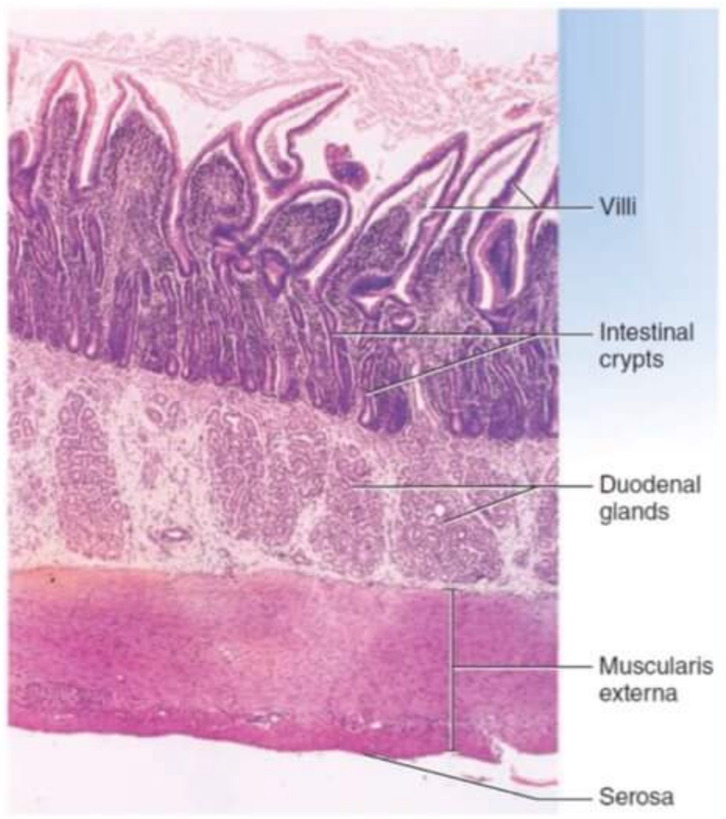
4 'M' CELL → MICROFOLD CELL
→ APC

5 NEC → secretes Hormones
6 STEM CELL → Pleuripotent → helps in repair

Q All found in small Intestine EXCEPT
a Stem cells
b Goblet cells
c Neck cells
d Paneth cells

DUODENUM

→ VILLI → ↑ SA
→ MICROVILLI → Striated border
→ INTESTINAL CRYPTS → forms glands
→ DUODENAL GLANDS
→ BRUNNER's GLANDS
→ present in Submucosa of proximal duodenum
→ secretes URO-GASTRONE / HEGF
→ ↓ Parietal activity → ↓ duodenal ulcer
→ ↑ mitotic activity → heals duodenal ulcer



DUODENUM

Q All are true about BRUNNER'S GLAND EXCEPT

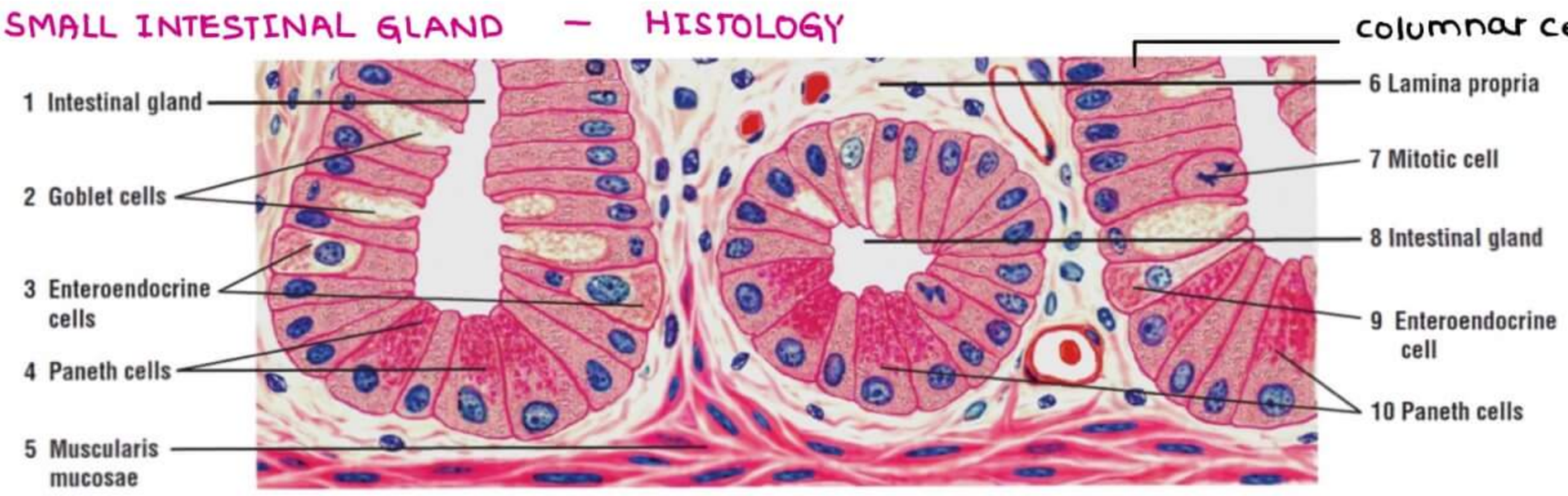
a sub mucosal glands

b Secretes urogastrone, which inhibit gastric Hcl production

C Secretes Human Epidermal Growth factor [HEGF]

d present in Lower duodenum

SMALL INTESTINAL GLAND – HISTOLOGY



PANETH CELL → Present towards Base [fundus] OF the gland

→ Dark pink apex

LARGE INTESTINE

CELLS

COLONOCYTES

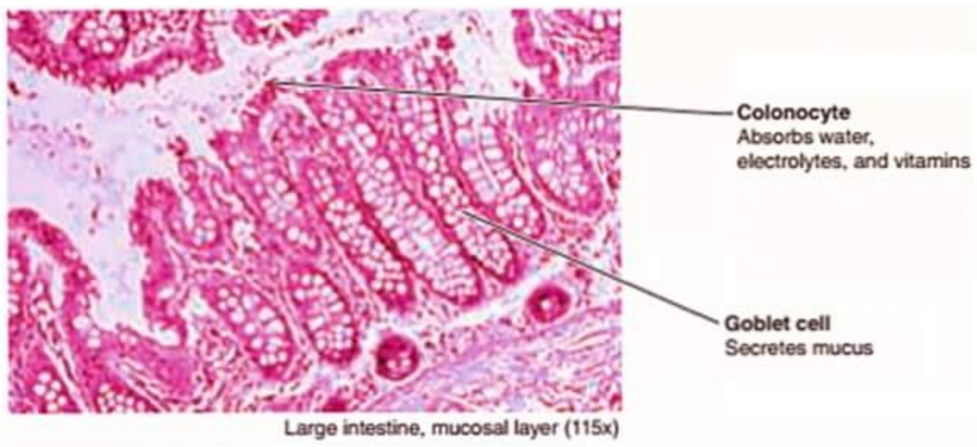
→ columnar

→ absorbs water, electrocytes & vitamins

GOBLET CELLS

→ no. of goblet cell keep increasing more distal, more no.

→ Lubricates fecal matter i mucin



Large intestine, mucosal layer (115x)

ANAL CANAL

DENTATE LINE

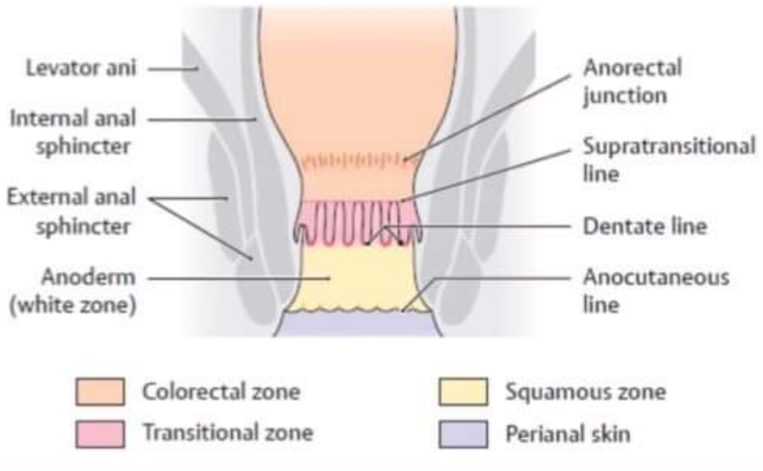
→ Squamo columnar junction

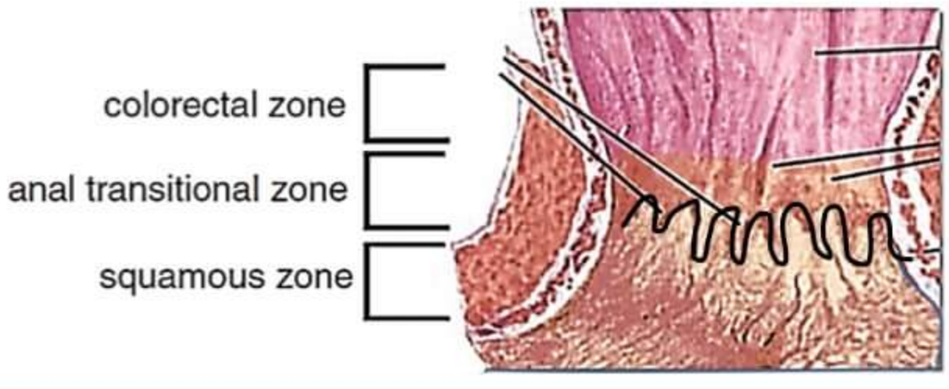
→ below to it → Squamous zone

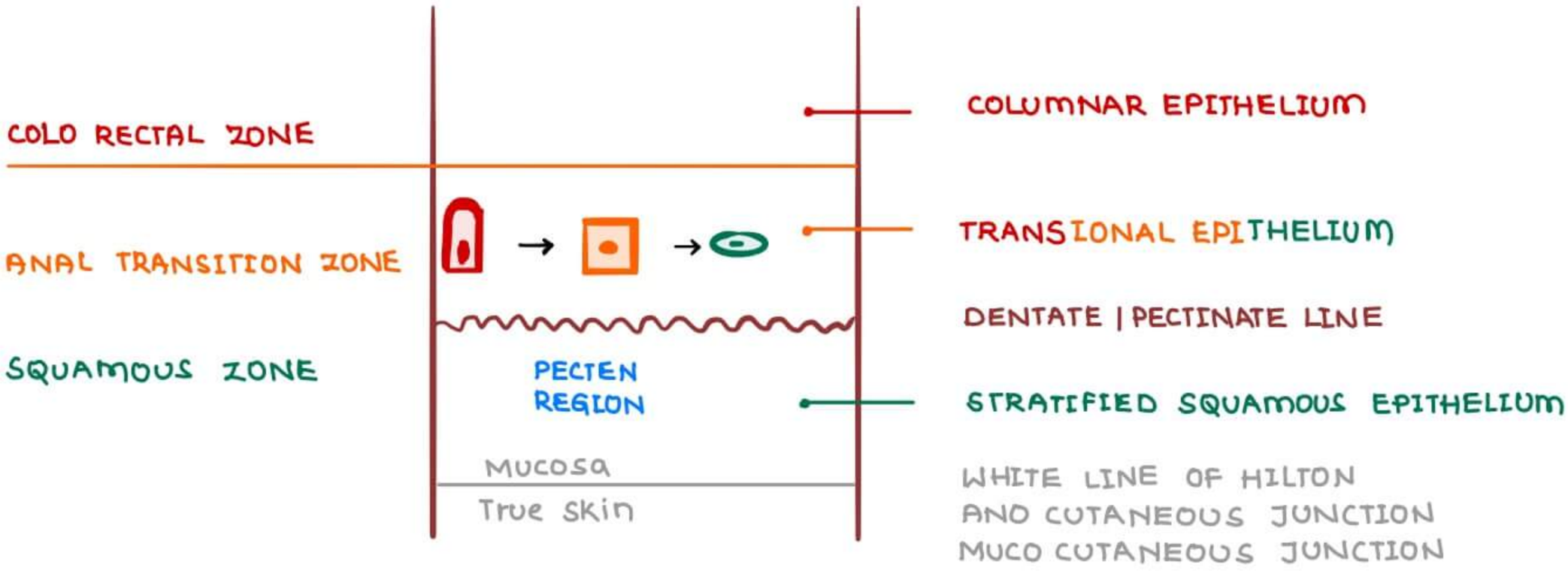
→ above to it → transitional zone colorectal | columnar zone

ANAL TRANSITION 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 the White line
  → lined by Stratified squamous Keratinized epithelium [Dry]
  → Sweat & Sebaceous glands + nt

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

DUAL BLOOD SUPPLY

HEPATIC ARTERY → carries O_2
PORTAL VEIN → carries nutrients

PORTAL TRIAD

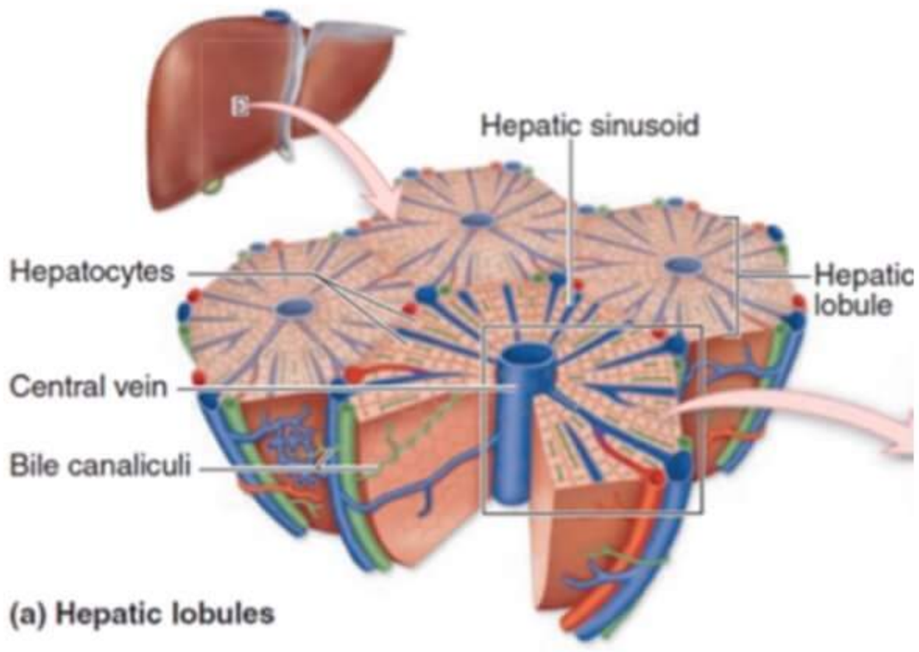
HEPATIC ARTERY
PORTAL VEIN
BILE DUCT

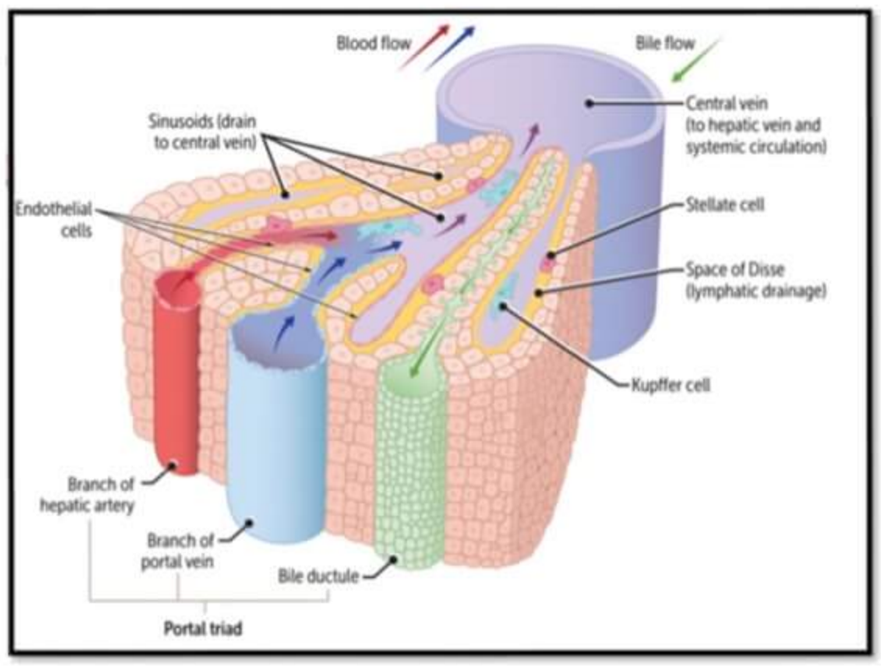
CENTRAL VEIN → Recieves nutrients from portal vein

CIRCULATION OF NUTRIENTS

INTESTINE → PORTAL VEIN → HEPATOCYTES → CENTRAL VEIN → HEPATIC VEIN → SYSTEMIC CIRCULATION [IVC]

Hepatocytes forms Bile

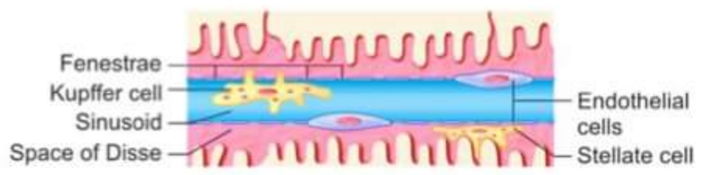




HEPATIC SINUSOIDS

→ fenestrated → non continuous endothelium

→ helps in transfer of contents into PERISINUSOIDAL SPACE OF DISSE



STELLATE CELL OF ITO → helps in absorpt^{n} of vit A, D

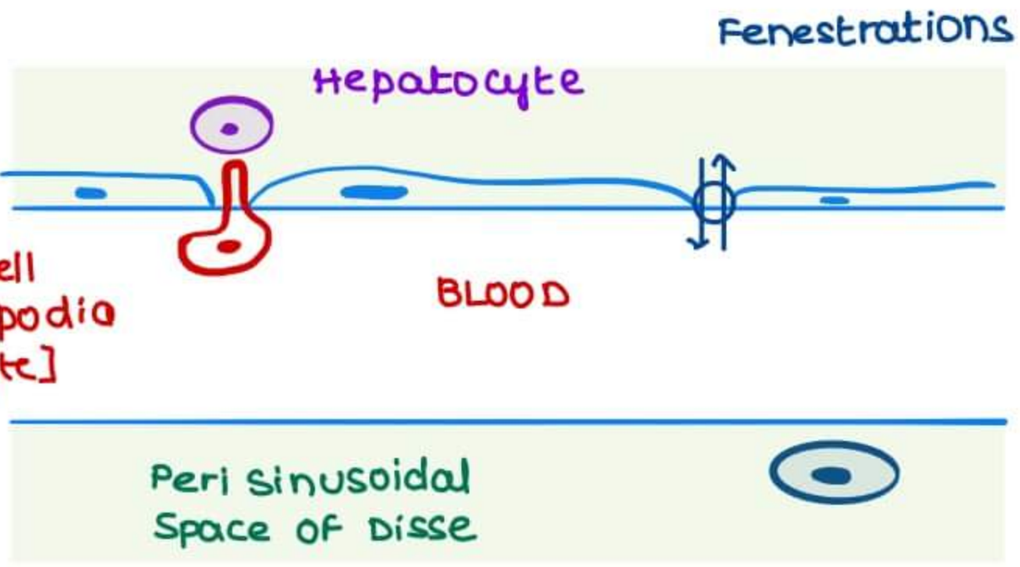
KUPFFER CELLS

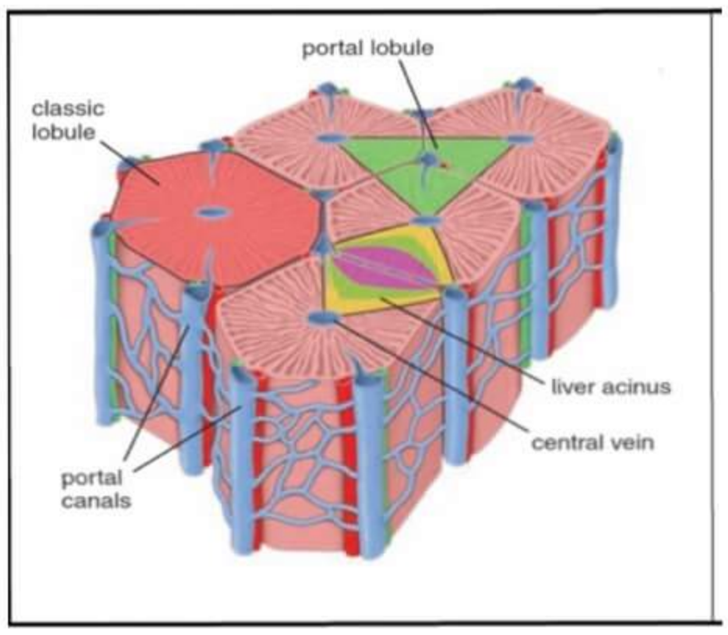
→ present in sinusoids

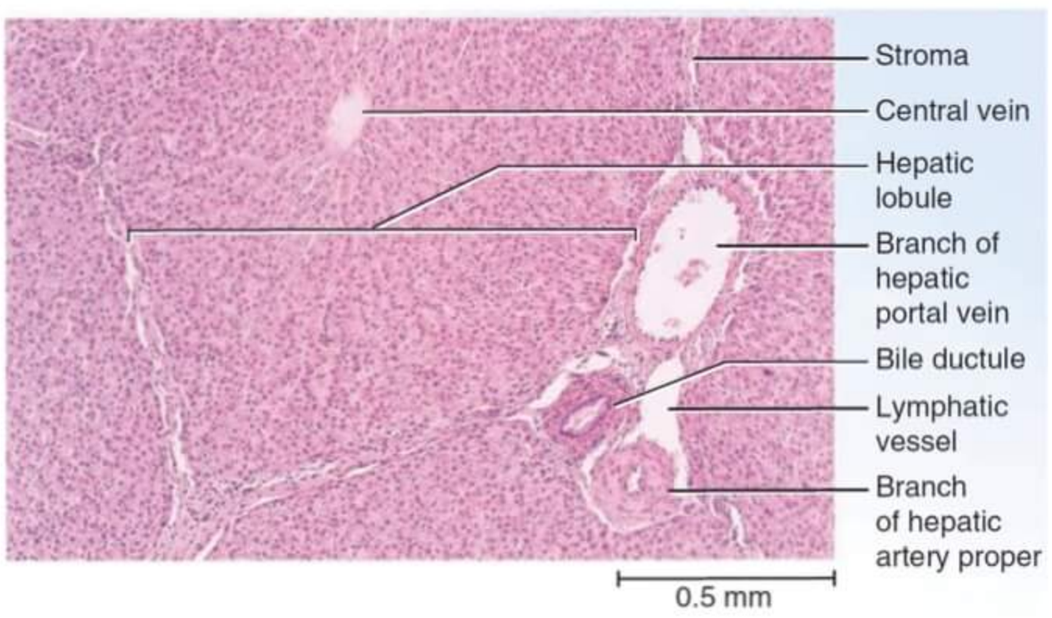
→ monocyte

→ phagocytic

→ pseudopodia aids in capture antigens







LIVER HISTOLOGY

Hepatic veins [metabolites]

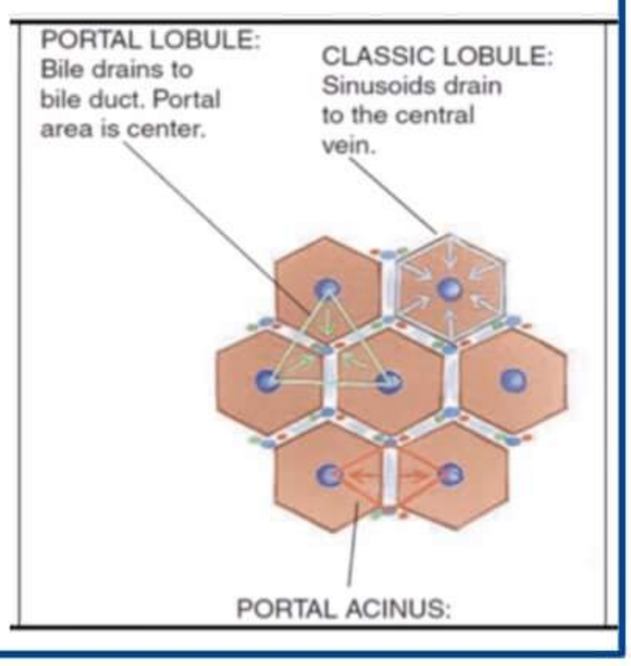
LOBULE / ACINI

CLASSIC LOBULE

→ Hexagonal

→ central vein is present at centre

→ Triads are at periphery

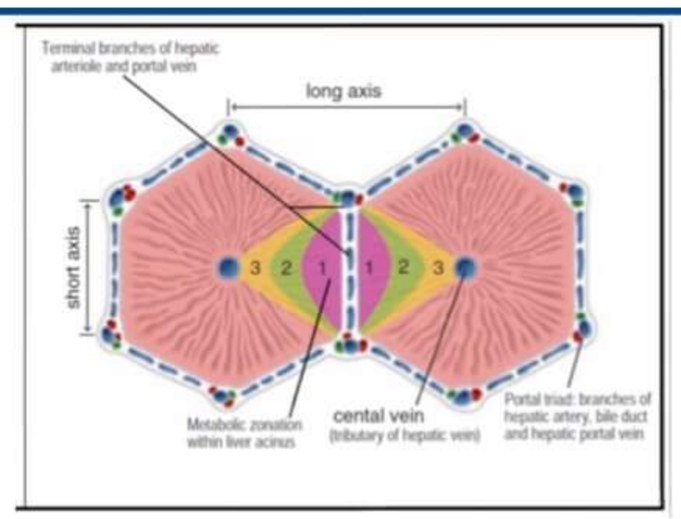


PORTAL LOBULE → based on bile drainage

→ Triangular

→ centred on portal triad

→ at sides, 3 central veins



PORTAL ACINUS

→ widely accepted concept

→ depends upon blood carried by branches of Hepatic artery & Portal Veins

→ at sides, central vein on one side
Portal triad on other side diagonally

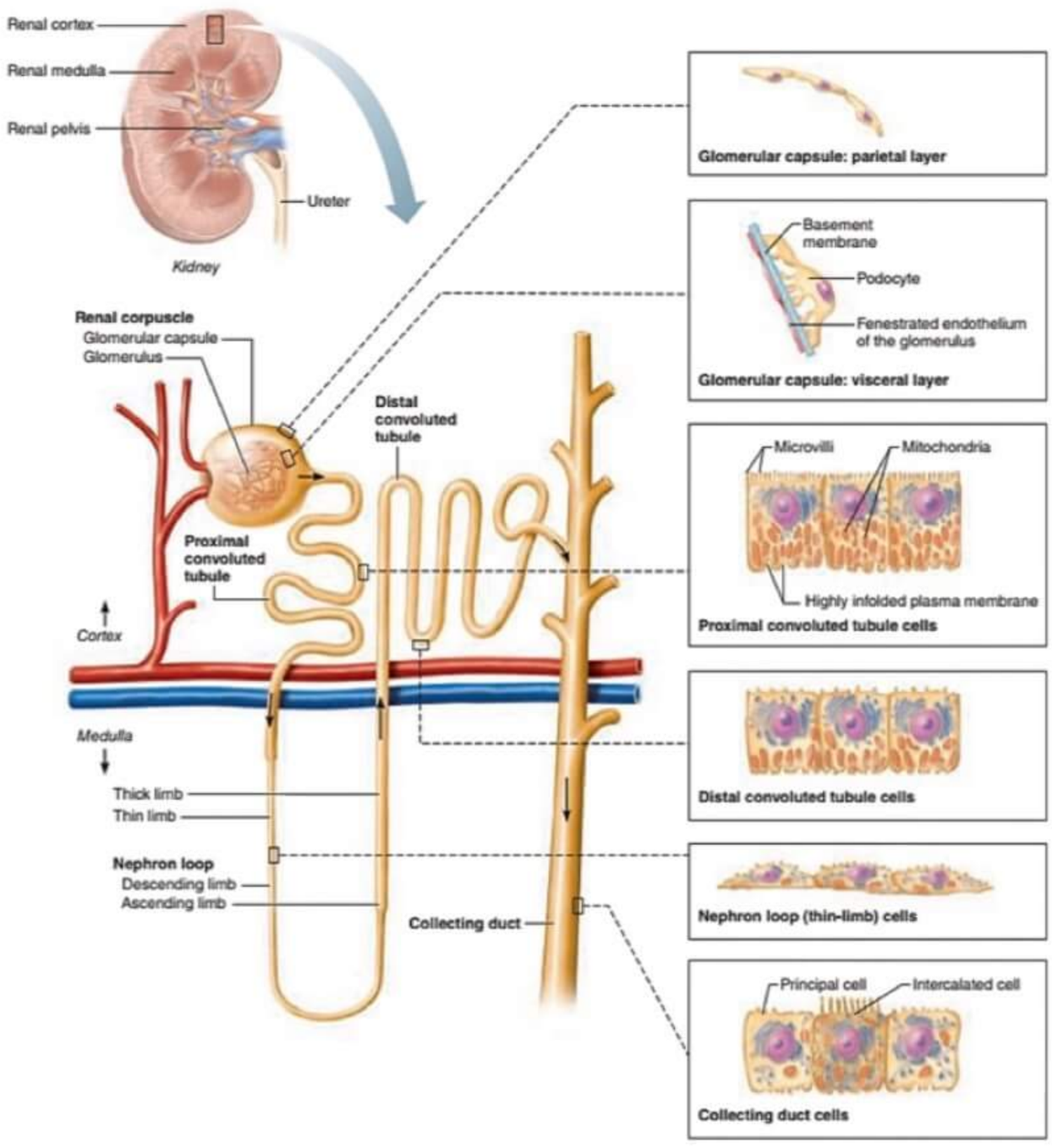
→ Tells us about zones of ischemia or toxic injury

Area 1 → highly oxygenated, more affected by toxins

Area 2 → less oxygenated, less affected by toxins

Area 3 → least oxygenated, least affected by toxins

URINARY SYSTEM



NEPHRON

COMPONENTS

GLOMERULUS

BOWMAN'S CAPSULE

PCT (Proximal convoluted tubule)

LH (Loop of Henle)

DCT (Distal Convuted tubule)

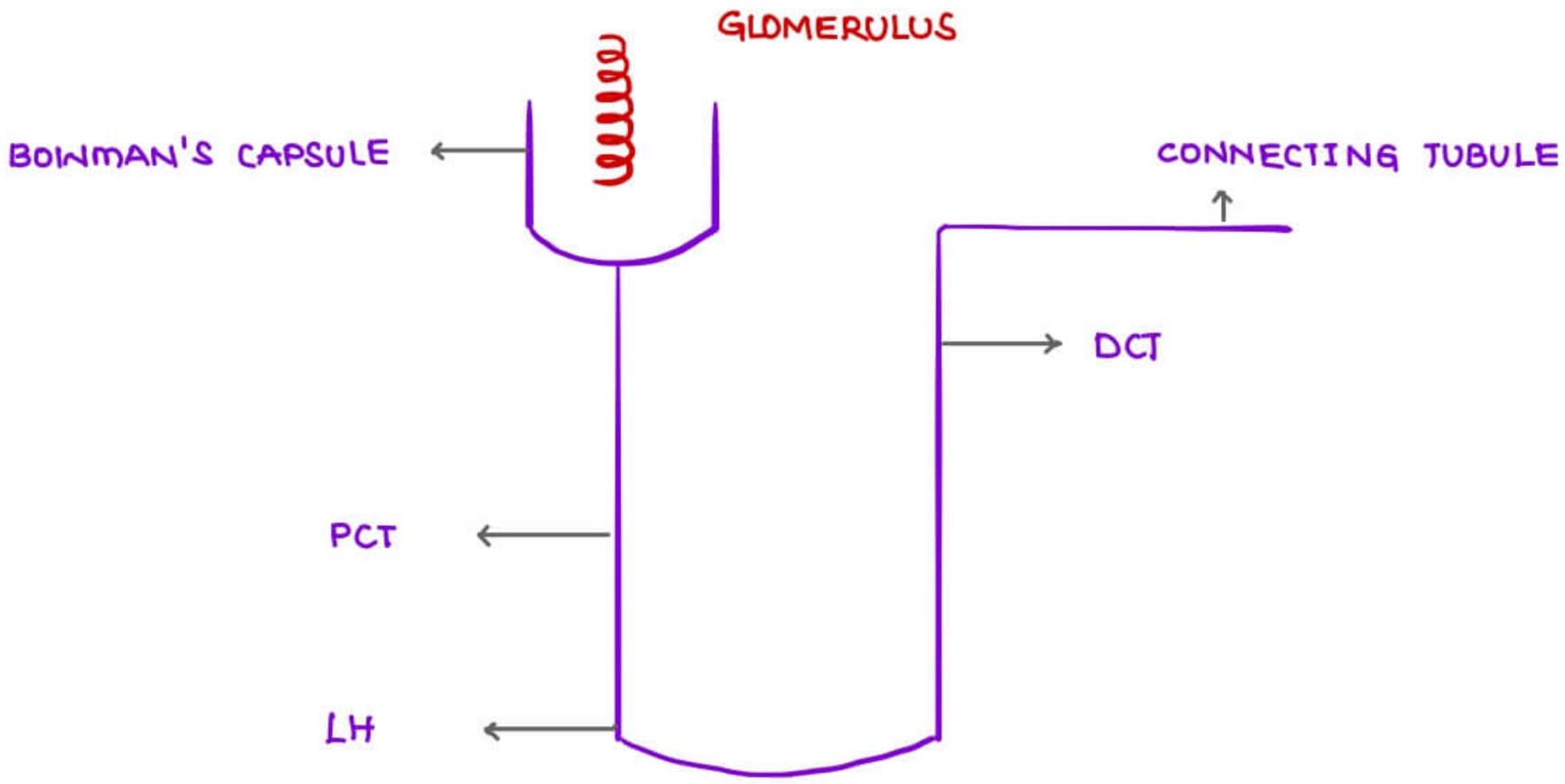
CD (Collecting duct)

BOWMAN'S CAPSULE → Simple squamous epithelium

PCT, DCT } Cuboidal epithelium

CD → Columnar epithelium

LH → Simple squamous epithelium



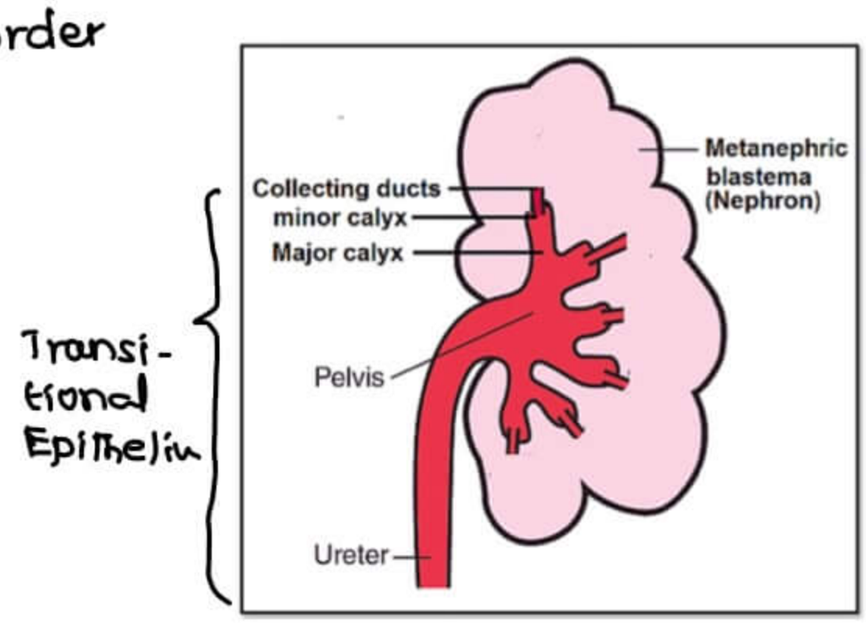
URINE → ultra filtrat^{n} of blood by GLOMERULUS [capillary plexus]
→ collected by BOWMAN'S CAPSULE

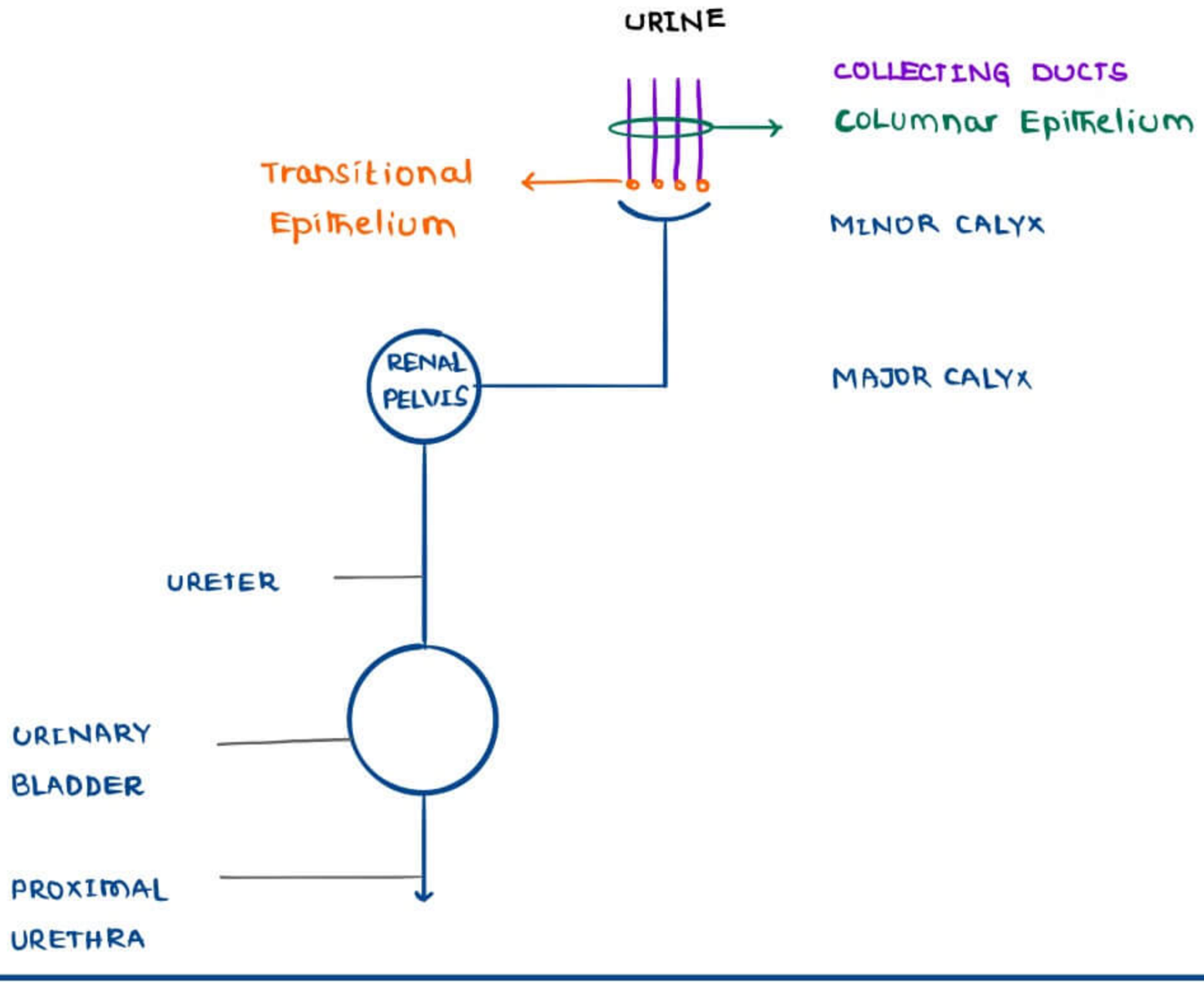
LOOP OF HENLE
→ at the level of descending & Ascending limb → Low cuboidal epithelium

PCT
→ Irregularly arranged micro villi +nt → Brush border [↑ SA for absorpt^{n}]

DCT → less / no microvilli → no Brush Border

COLLECTING SYSTEM → Transitional Epithelium
→ Begins at Tip of CD
→ Terminates at Proximal Urethra





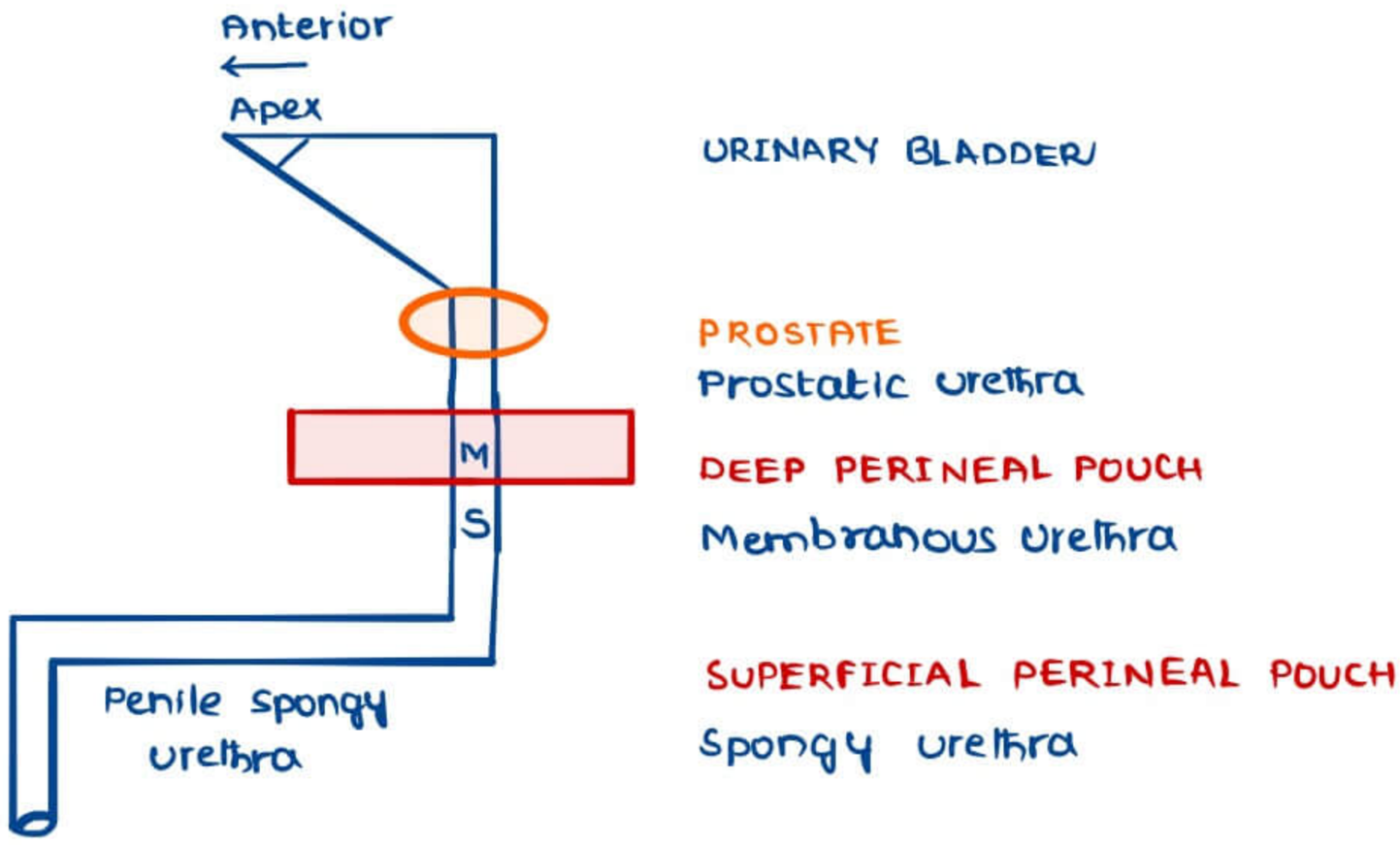
IN FEMALE

Proximal urethra → Transitional Epithelium

Distal urethra → Stratified Squamous Epithelium

IN MALE,

MALE URETHRA → 20cm long



Tip of Male urethra → Stratified squamous epithelium

Transitional Epithelium → Lines urinary bladder & till proximal half of Prostatic urethra

Major part of male urethra lined by → Startified columnar Epithelium > Pseudo Stratified columnar

Q Urothelium lines all EXCEPT

a Ureters

b Calyces

c Urinary Bladder

d Membranous urethra

GENITAL SYSTEM

MALE REPRODUCTIVE SYSTEM

TESTIS

SEMINIFEROUS TUBULES → Spermatogenesis occurs

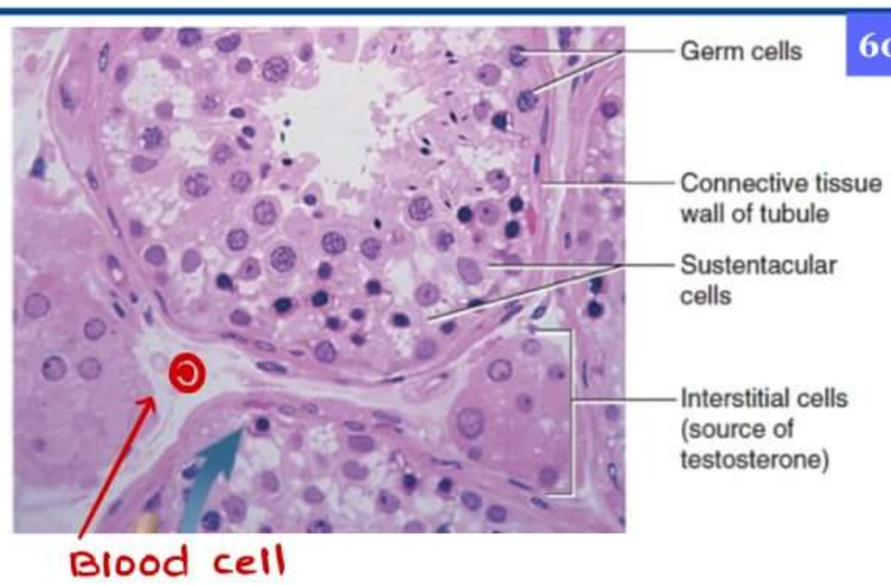
CELLS

1 SERTOLI CELL → Nurse cell [Supports gametocytes]

→ Secretes INHIBIN | MIS [Mullerian Inh. substance]

2 LEYDIG CELL → Secretes TESTOSTERONE

HISTOLOGY



→ Sperms are found in Lumen

→ Peripherally

PGC → most peripheral

Gametogonium

Gametocytes

SUSTENTACULAR / SERTOLI CELLS

→ Around the seminiferous tubule,

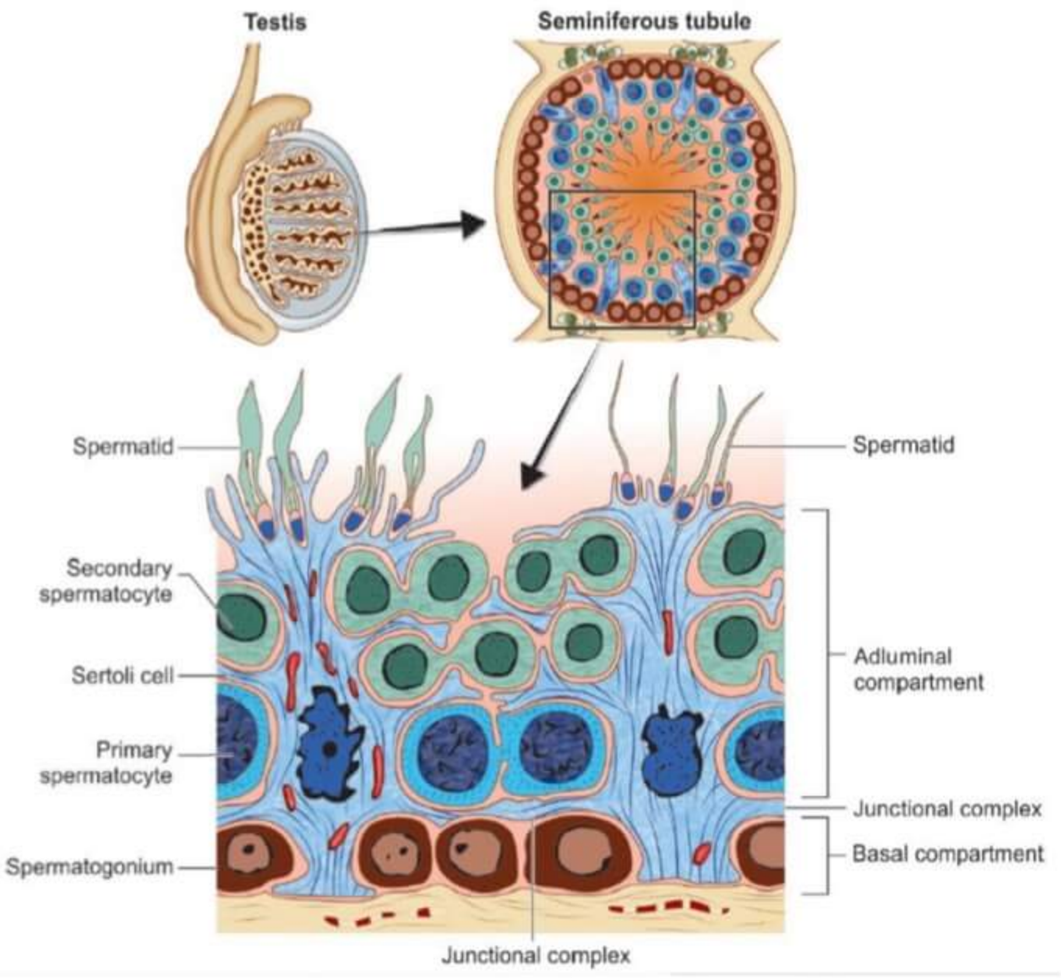
INTERSTITIAL / LEYDIG CELLS +nt

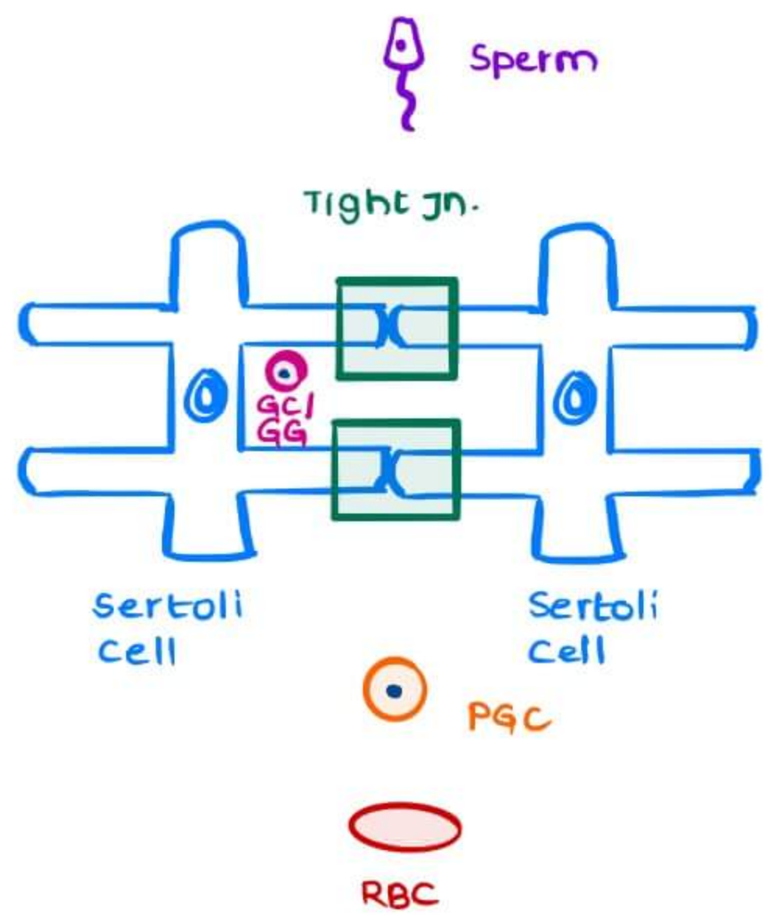
→ BLOOD TESTIS BARRIER

→ Separates Sperms from blood

→ Strengthned by Sertoli cells by forming strong intercellular junctions

→ permeable to PGC, GG|GC → SEMI PERMEABLE





SPERM - STRUCTURE

→ Golgi Apparatus forms ACROSOME

→ Acrosome has lytic enzymes (ACROSIN) → helps in penetrat^{n} of Zona pellucida

→ NUCLEUS present in Head of Sperm

→ carries chromosome into oocyte

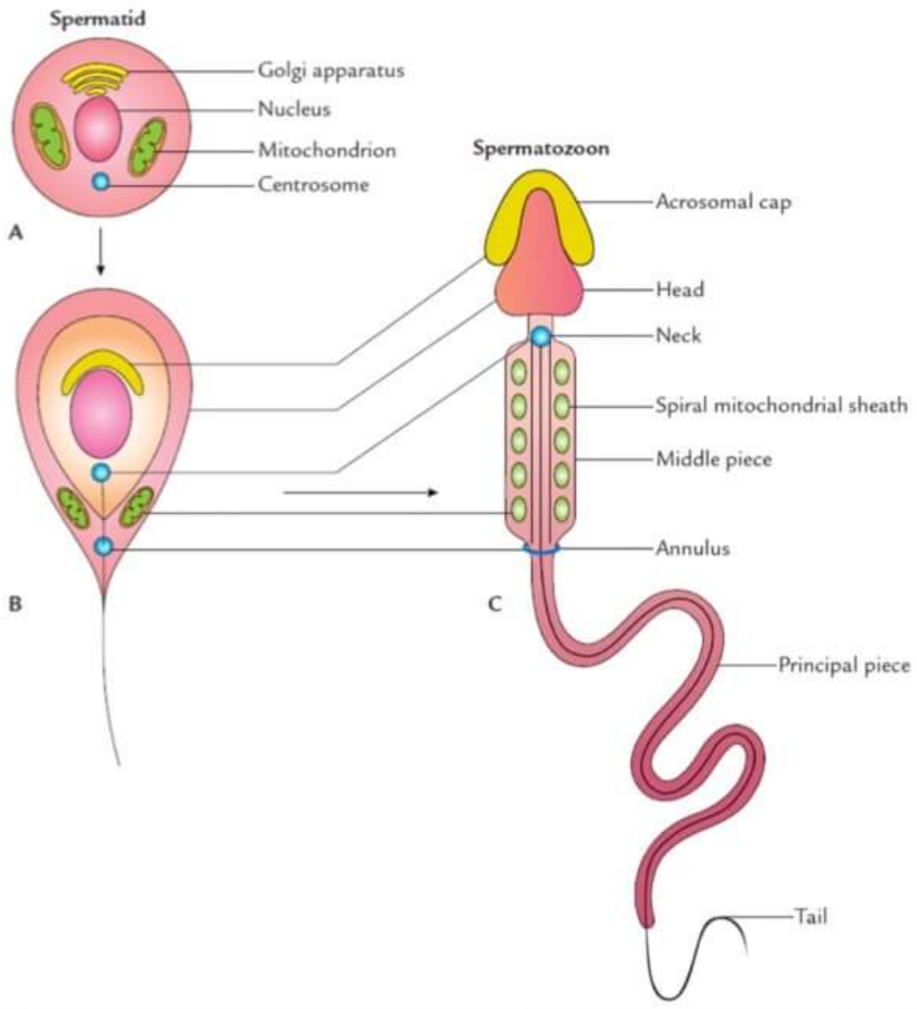
→ CENTRIOLES (microtubules)

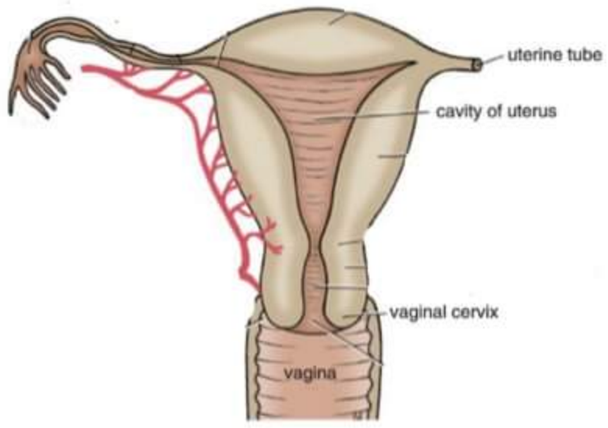
→ helps in formation of Long cilia [Tail of Sperms] / Flagella (misnomer)

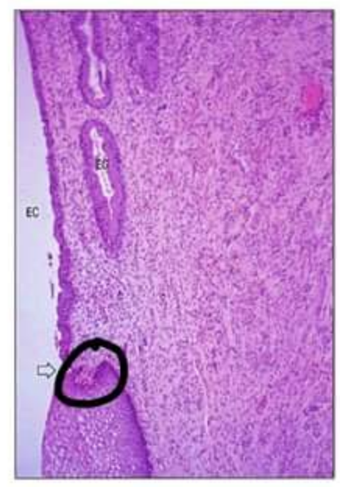
→ Mitochondria

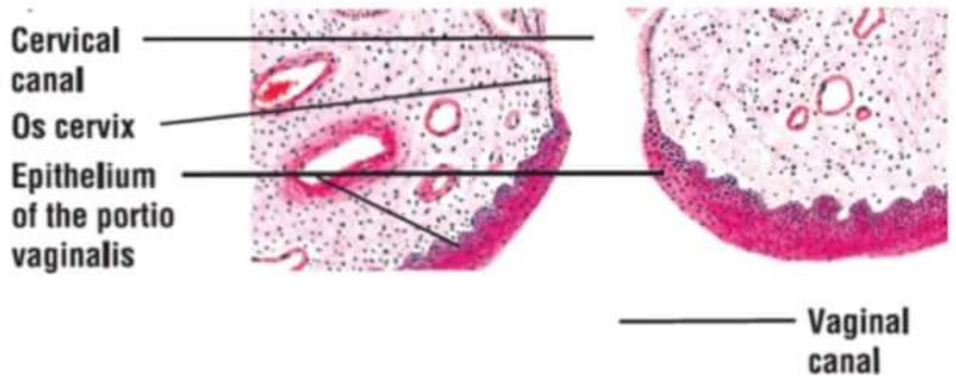
→ present in middle piece

→ Power house of the cell









FEMALE REPRODUCTIVE SYSTEM

MAMMARY GLAND → modified apocrine sweat gland

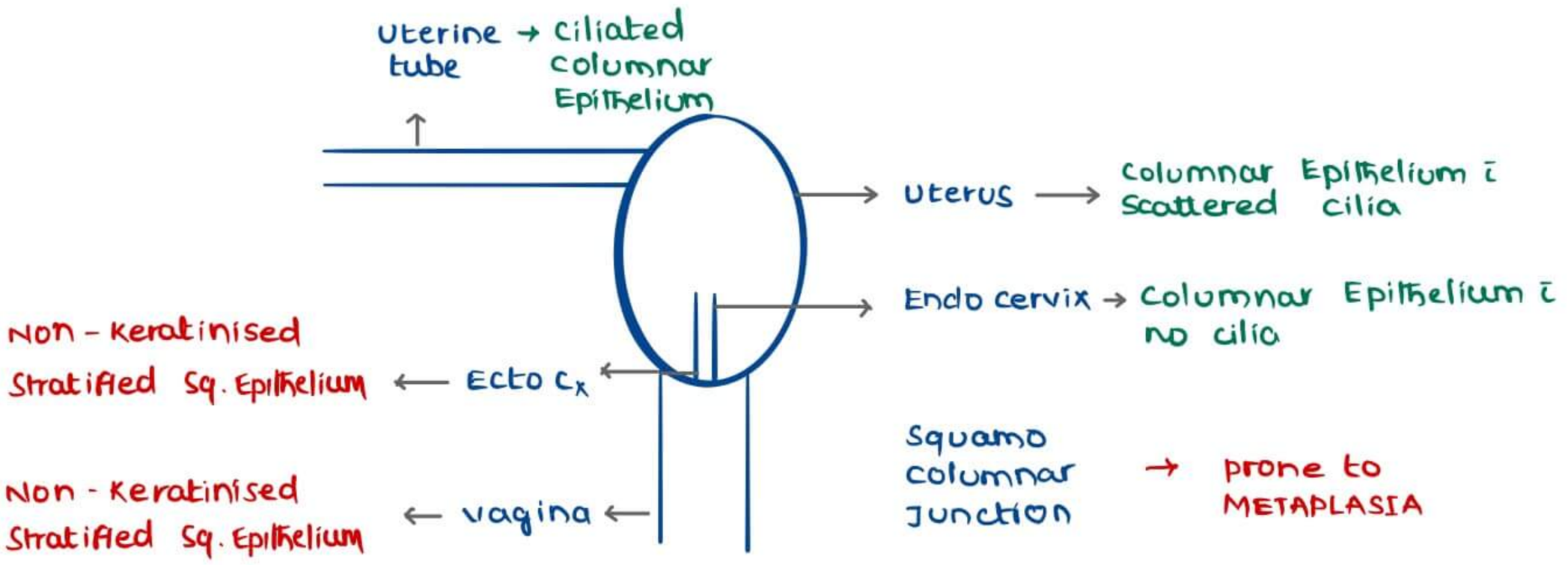
ovary lined by cuboidal epithelium
uterus lined by columnar epithelium
vagina lined by squamous epithelium

UTERINE CERVIX

Squamo - columnar junction
→ prone to cancer
→ on Bx, Columnar epithelium ± Stratified Squamous epithelium → METAPLASIA

ENDOCERVIX Lined by Columnar Epithelium
ECTOCERVIX Lined by Stratified squamous Epithelium

Ratio of connective tissue : smooth muscle → 8 : 2



KARTAGENER SYNDROME [Immotile cilia syndrome]
→ cilia are absent
→ leads to infertility in female
→ also leads to ectopic pregnancy

VAGINA

→ has no glands

→ wet dit transudation [highly vascular]

C_x gland secretion

Q Lining Epithelium of vagina is

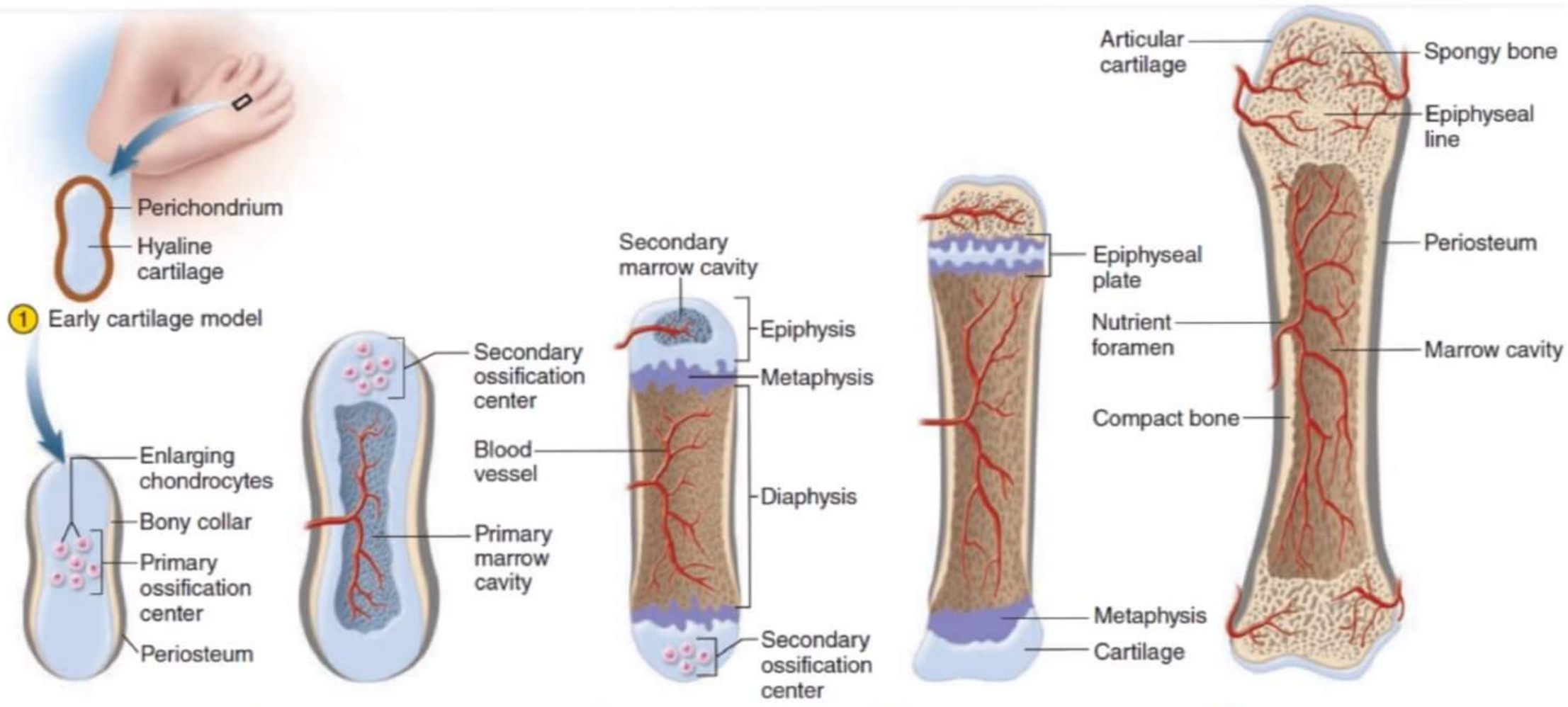
a Pseudo stratified columnar Epithelium

b Keratinized stratified squamous Epithelium

c Non - Keratinized stratified squamous Epithelium

d ciliated columnar Epithelium → Uterine Tube

OSTEOLOGY



2 Formation of primary ossification center, bony collar, and periosteum

3 Vascular invasion, formation of primary marrow cavity, and appearance of secondary ossification center

4 Bone at birth, with enlarged primary marrow cavity and appearance of secondary marrow cavity in one epiphysis

5 Bone of child, with epiphyseal plate at distal end

6 Adult bone with a single marrow cavity and closed epiphyseal plate

LONG BONE

PARTS

DIAPHYSIS [Shaft] → 1 in number

EPIPHYSIS [Ends] → > 1 in number

Diaphysis derived from

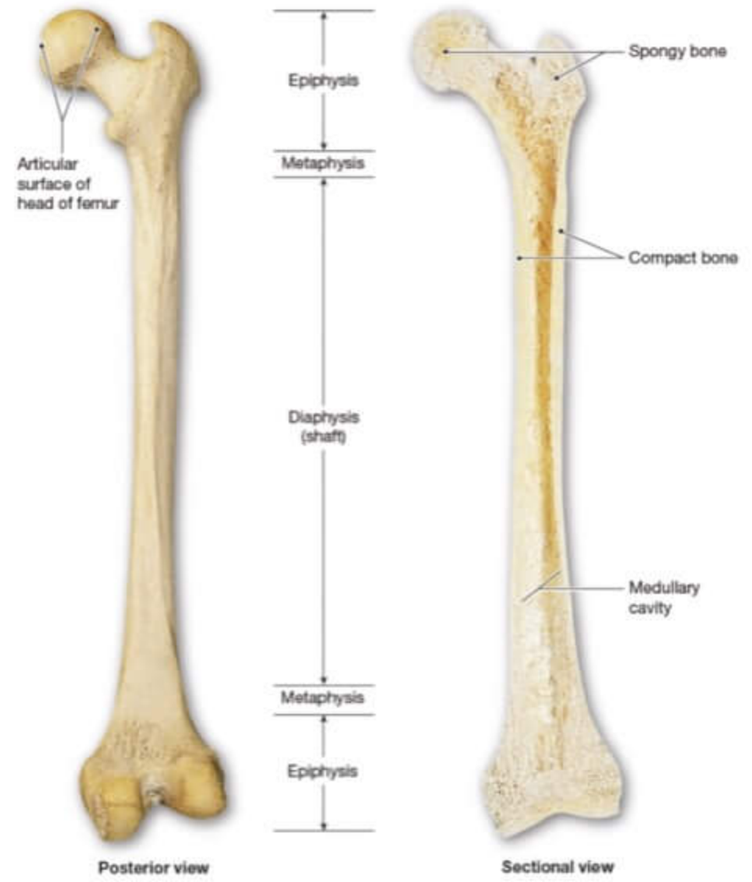
→ PRIMARY OSSIFICATⁿ CENTRE

→ present from 6-8 Weeks OF IUL

Epiphysis derived from

→ SECONDARY OSSIFICATⁿ CENTRE

→ appear after 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

ENDOCHONDRAL → most bones → Hyaline cartilage model, Skull base

MEMBRANOUS → few skull bones [cap]
clavicle bone [partly]

ENDOCHONDRAL OSSIFICATION

→ Most of Bones start ℓ HYALINE CARTILAGE MODEL

→ develops PCO in 6-8 WKS OF IUL →
develops into diaphysis

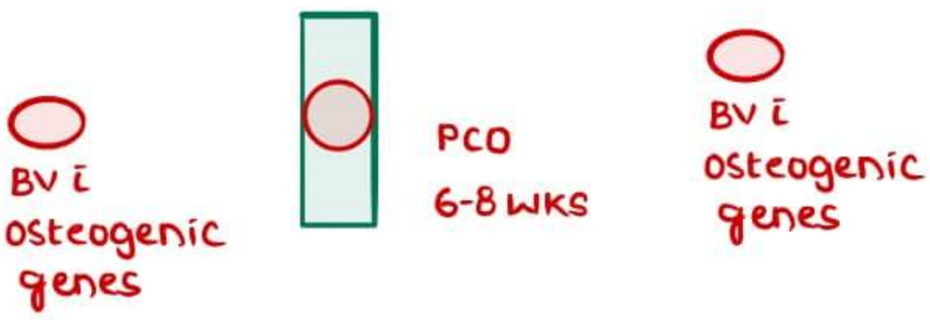
→ Sec. centre ossificatⁿ appears after birth & forms
ends & multiple in number

→ Some hyaline cartilage persists → Growth plate/
Epiphyseal plate
This also replaced by newly formed METAPHYSIS

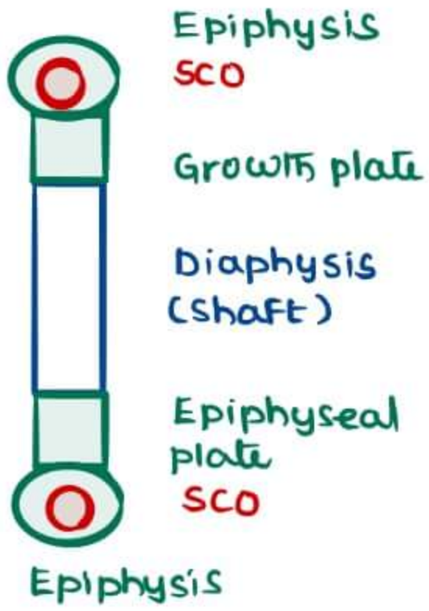
→ Some hyaline cartilage persists as ARTICULAR CARTILAGE at ends
Articular cartilage never OSSifies
→ makes ends of bone smooth → facilitates smooth movements at synovial joints
→ during aging, undergo osteo arthritis
→ do not have perichondrium

IUL

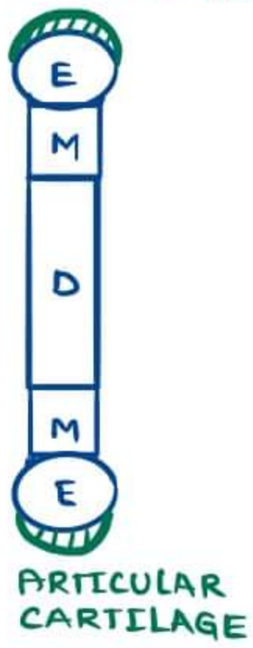
HYALINE CARTILAGE MODEL



> BIRTH



ADULT



BONE STRUCTURE – HISTOLOGY

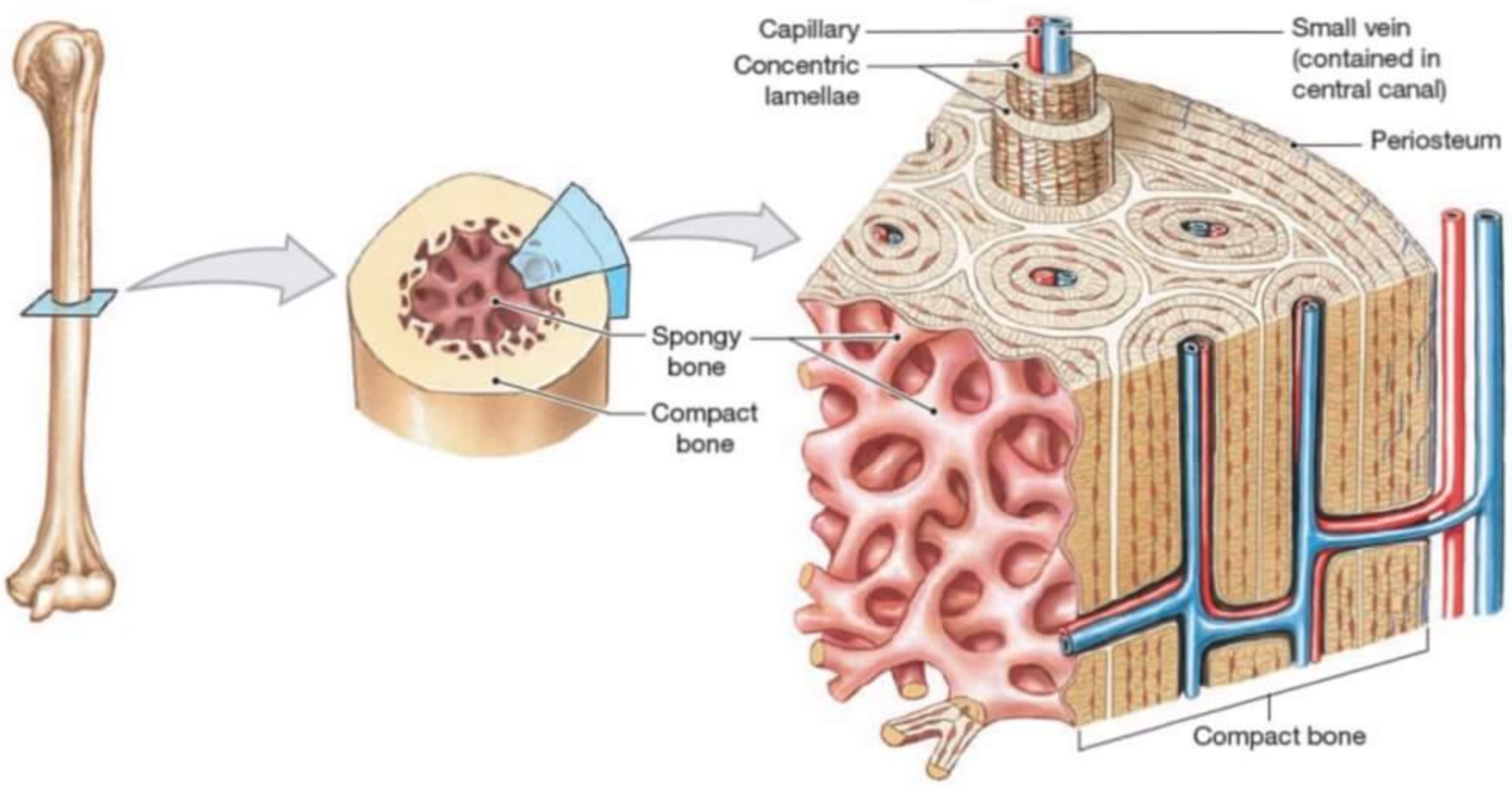
→ ENDOSTEUM → inside, lining the bone marrow
→ cells present towards it

PERIOSTEUM → on ext. surface
→ perichondrium present towards it

→ NEURO VASCULAR BUNDLE is passing in HAVERSIAN CANAL
→ Haversian canals connect with each other ī VOLKMAN'S CANAL
→ compact bone have CONCENTRIC LAMELLAE

CONCENTRIC LAMELLAE

→ Haversian canal is present in its centre
→ Osteocytes are present in lacunae
→ CANALICULI → processess of osteocytes
→ CENTRAL CANAL → Consists of Blood vessels



CELLS

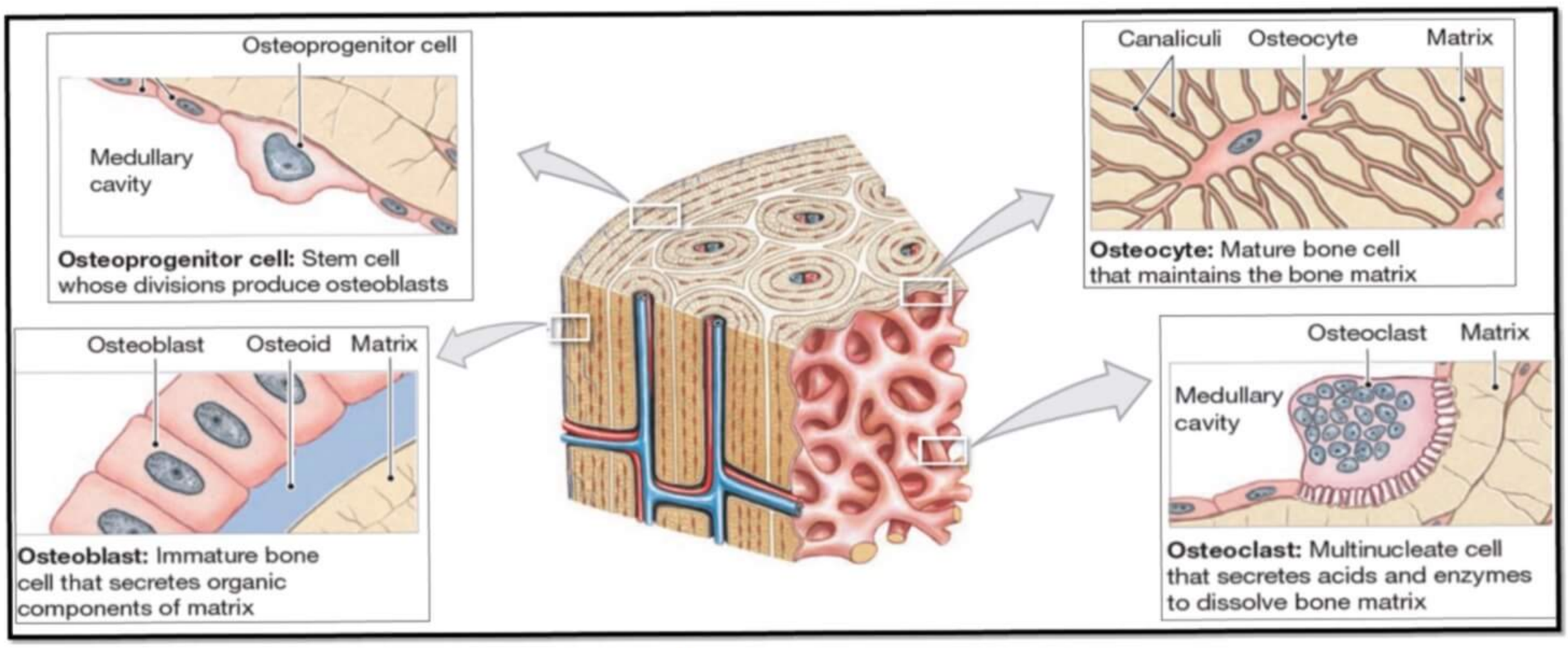
OSTEO PROGENITOR CELLS

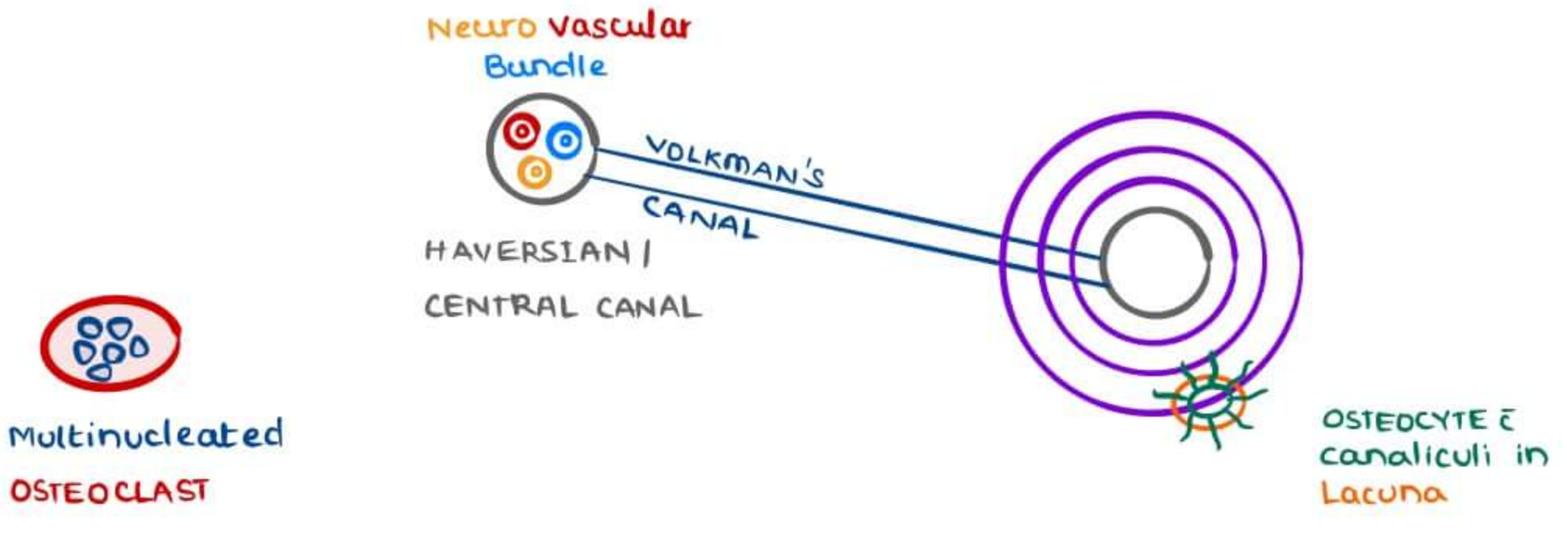
→ Bone cell
→ Stem cells
→ gives OSTEOBLAST
  → involved in bone formatn [osteoid] [OSTEOGENESIS]
  → OSTEOCYTE
    - older version of osteoblast
    - do not form
    - assist in maintainance of bone

OSTEOCLAST

→ Blood cell
→ several monocytes → multinucleated cell [osteoclast]
→ responsible for bone resorption

canaliculi helps in diffusion of metabolites [gases, nutrients]





Characteristic	Cartilage	Bone
Cells	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 & fibro cx
→ Type 1 collagen

Fibro cx has NVB

JOINTS

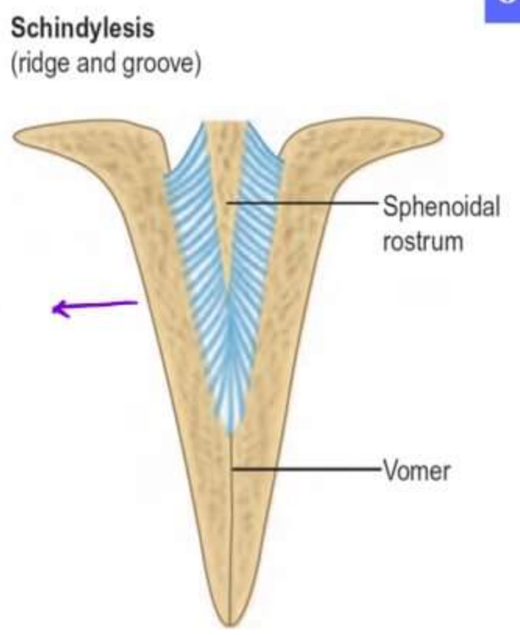
Q Inferior tibio fibular joint is

a Synchondrosis → 1° cartilage joint

b syndesmosis

c Symphysis → 2° cartilage joint

d Schindylesis



ala/ wings of vomer ←

TIBUO – FIBULAR JOINT

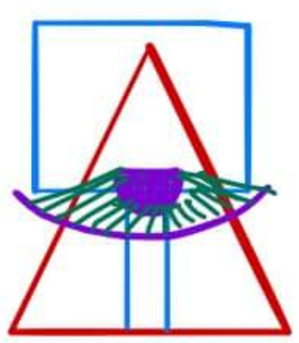
→ Slightly mobile joint

→ Fibrous joint

→ Desmos → fibre

SCHINDYLESIS

→ Spheno vomerine joint at root of nasal cavity



Sphenoid

rostrum of Sphenoid

Spheno vomerine joint [SCHINDYLESIS]

ala/wings of vomer

Vomer

Nasal Septum

CLASSIFICATION

1. FIBROUS
2. CARTILAGENOUS

1 FIBROUS JOINTS

a SUTURES → seen in skull bone } Immobile

b GOMPHOSIS → seen in skull bone }

c SYNDESMOSIS → Middle Radio ulnar joint → Slightly mobile

2 CARTILAGENOUS JOINT

a SYNCHONDROSIS / 1° CARTILAGENOUS JOINT

→ epiphysio diaphyseal joint

→ Immobile

→ In adults, they fuse to become SYNOSTOSIS [NO cartilage]

Growth plate/
Hyaline cartilage

b SYMPHYSIS / 2° CARTILAGENOUS JOINT

→ Midline Intervertebral disc

→ Sacro coccygeal joint

→ Slightly mobile.

→ more mobile during term pregnancy

Inter vertebral disc ← [Fibro cartilage] [Shock Absorber]

SYMPHYSIS

→ pubic symphysis

→ usually slightly immobile

→ mobility ↑ during delivery

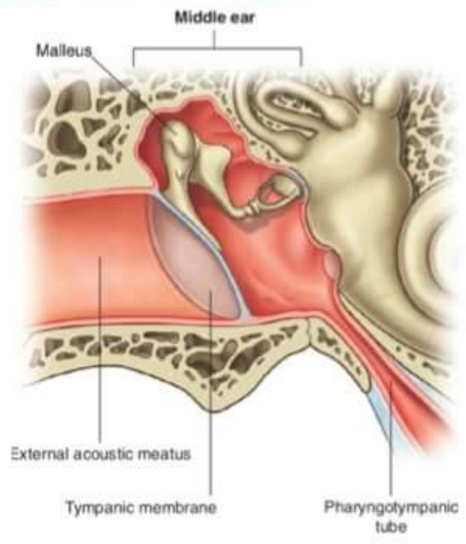
JOINT

- FIBROUS →
  - Suture
  - Gomphosis [Tooth & socket] } SKULL [immobile]
  - Syndesmosis
    - Inf. Tibio femorus joint } slightly mobile
    - mid. Radio ulnar joint
- CARTILAGENOUS → Primary →
  - Synchondrosis
    - Epiphysio Diaphysial jt → immobile
- CARTILAGENOUS → Secondary →
  - Symphysis
    - Pubis symphysis
    - midline Intervertebral joint } slightly mobile
    - Sacrococcygeal joint
- SYNOVIAL [Freely mobile]

3 SYNOVIAL JOINTS

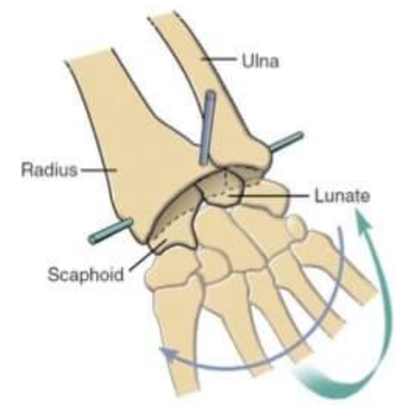
Q Which of the following is the type of joints between malleus & Incus

a Primary cartilagenous
b Secondary cartilagenous
c Saddle synovial
d Ball & socket synovial



SADDLE SYNOVIAL JOINTS

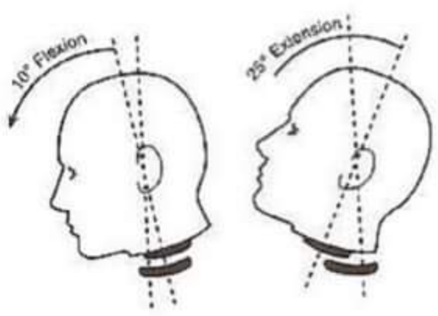
1 Malleus & Incus [Middle ear cavity]
2 Sterno clavicular joint [upper Limb]
3 1st Carpo Meta carpal Joints [upper Limb]
4 Lateral Longitudinal arch | calcaneo cuboid Joint [Lower Limb]



ELLIPSOID SYNOVIAL JOINT

1 Wrist | Radio carpal joint → articular surface is elliptical
2 Metacarpophalangeal Joints | Knucle joint
3 Atlanto occipital joint
   → Joint between Skull & 1st vertebra
   → helps in Head nod

HEAD NOD



→ All above are Functionally 'ELLIPSOID JOINTS'
→ All above are structurally 'CONDYLAR JOINTS'

ELLIPSOID JOINTS > CONDYLAR JOINTS

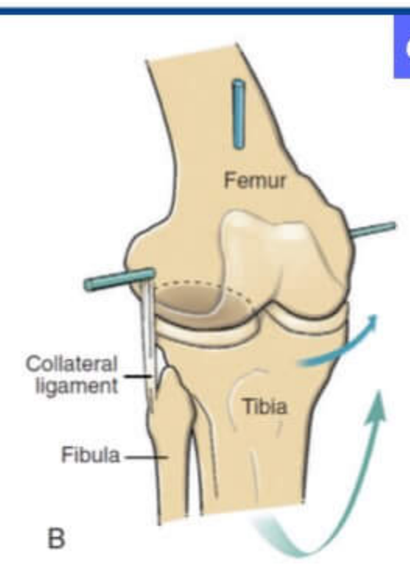
CONDYLAR JOINTS

1 TemporoMandibular Joint } Good examples
2 Knee joint
3 Wrist | Radio carpal joint } poor examples
4 Meta carpo phalangeal | Knuckle joint
5 Atlanto occipital joint

TemporoMandibular Joint
Knee joint
} CONDYLAR > MODIFIED HINGE JOINTS

KNEE JOINT

→ Double condylar joint



Q Atlanto - occipital is of Synovial variety

a Trochoid

b Ellipsoid [BETTER ANSWER]

c condylar

d Saddle

ORGANIZATION OF NERVOUS SYSTEM

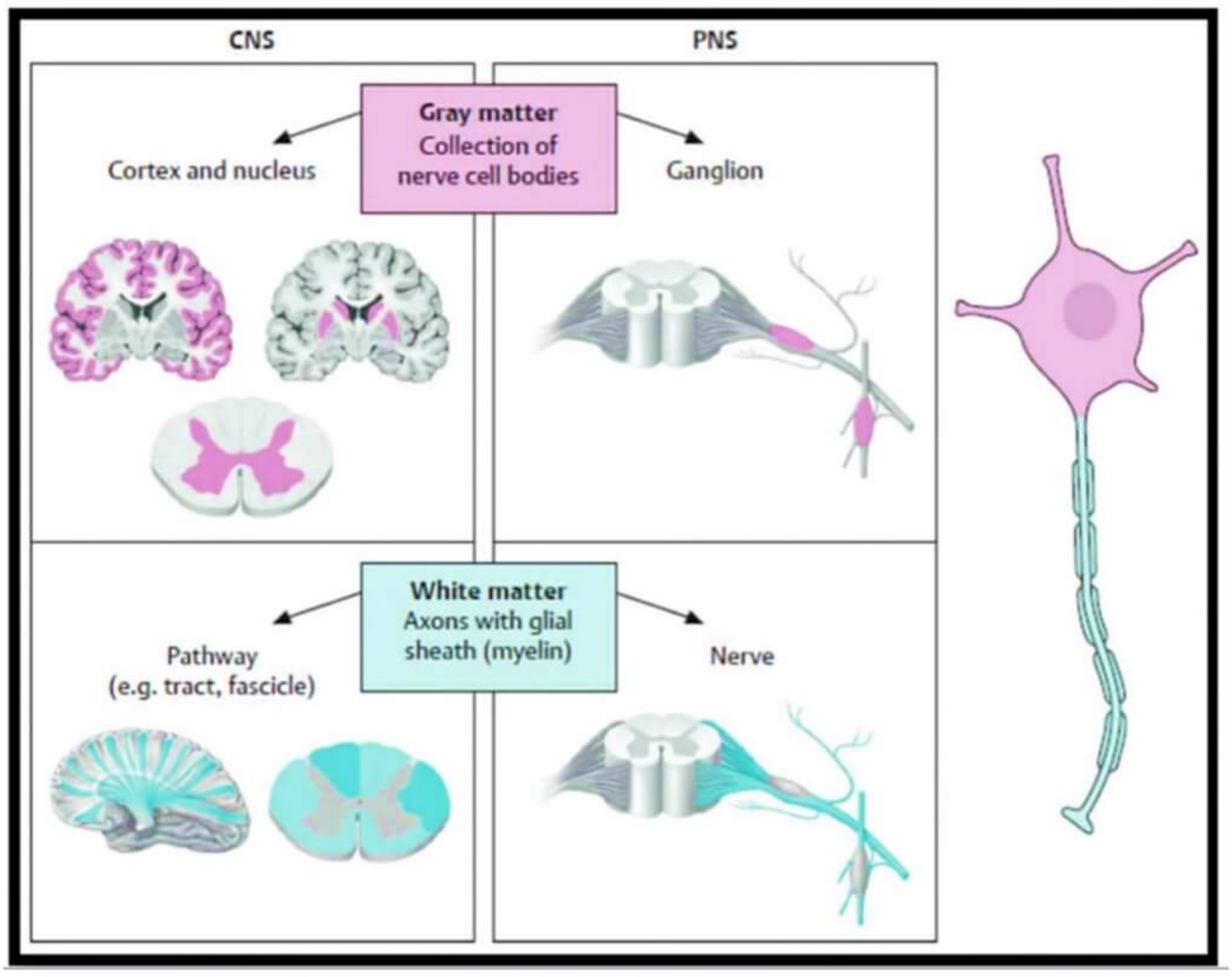
PNS → contributed by NCC (Neural crest cell)s.

CNS → contributed by Neural tube

GREY & WHITE MATTER

→ GREY MATTER → collection of Neuron bodies from CNS & PNS

WHITE MATTER collection of Axons from CNS & PNS



TERMED AS

NERVE CELL BODIES → GREY MATTER → CNS → Nucleus → DERIVED FROM → Neural tube

GREY MATTER → PNS → Ganglion → DERIVED FROM → Neural crest cells [NCC] [mosHy]
NCC + Ectodermal Placode
→ V & VIII Ganglia

AXONS → WHITE MATTER → CNS → Tract (pyramidal)
Fasciculi [Gracilis]
Leminiscus [medial]
Capsule [Internal]
→ AXONS
OLIGODENDROCYTE

WHITE MATTER → PNS → Nerve → AXONS
SCHWANN CELL

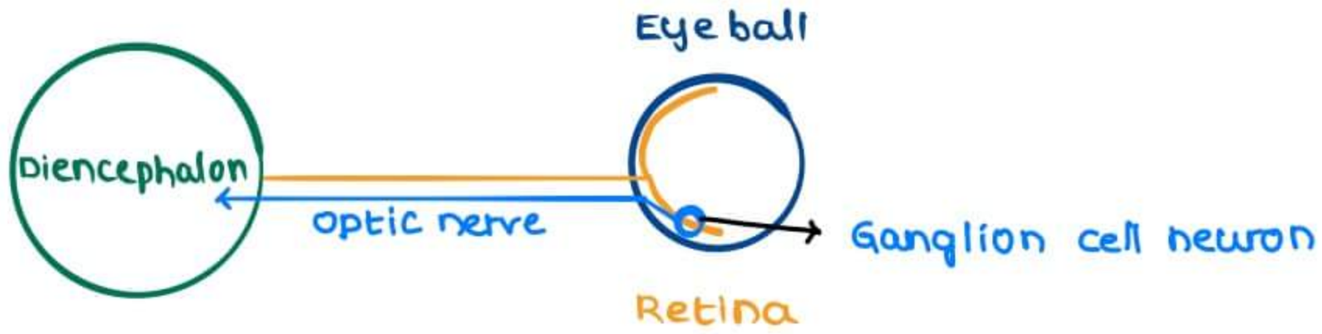
BASAL GANGLIA

→ MISNOMER

→ Basal Nucleus [present in CNS]

OPTIC NERVE

→ Misnomer



→ Retina is the extension of Diencephalon [CNS]

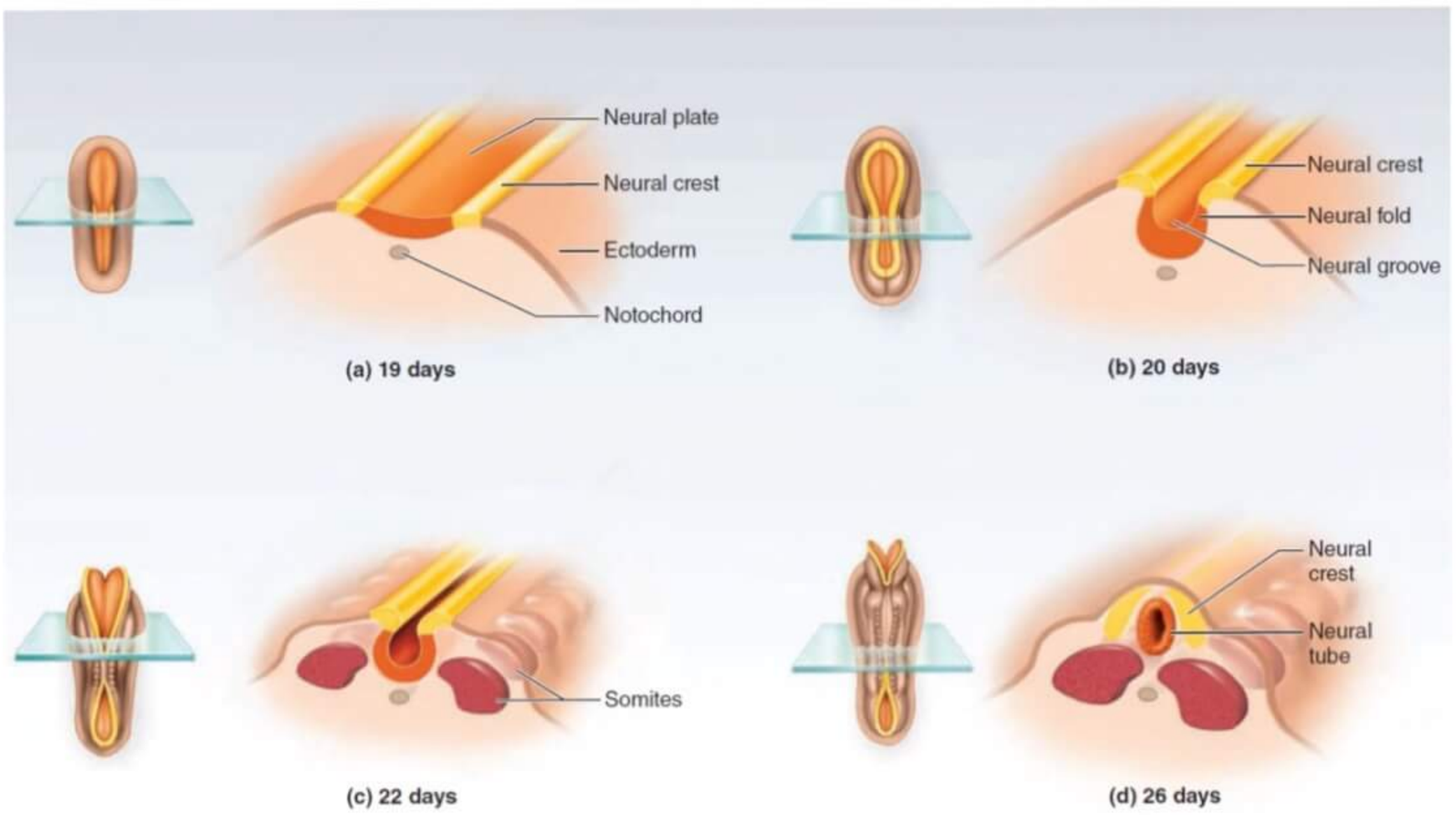
→ Ganglion cell neuron in retina collecting visual informat^{n} towards CNS by Optic nerve [CNS Tract]

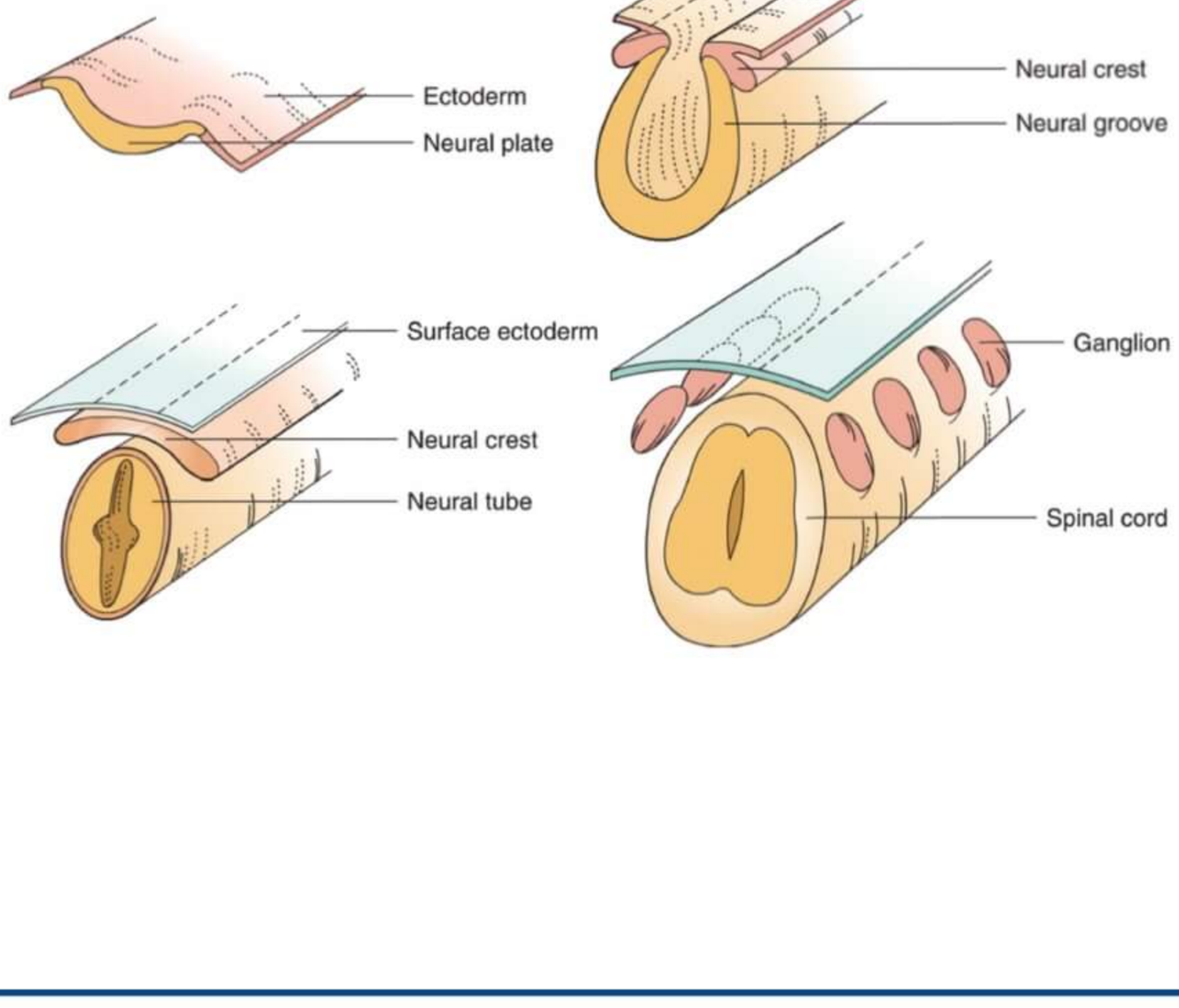
→ Optic Nerve myelinated by Oligodendrocytes

→ IF Injured, NEVER REGENERATE [No Schwann cell]

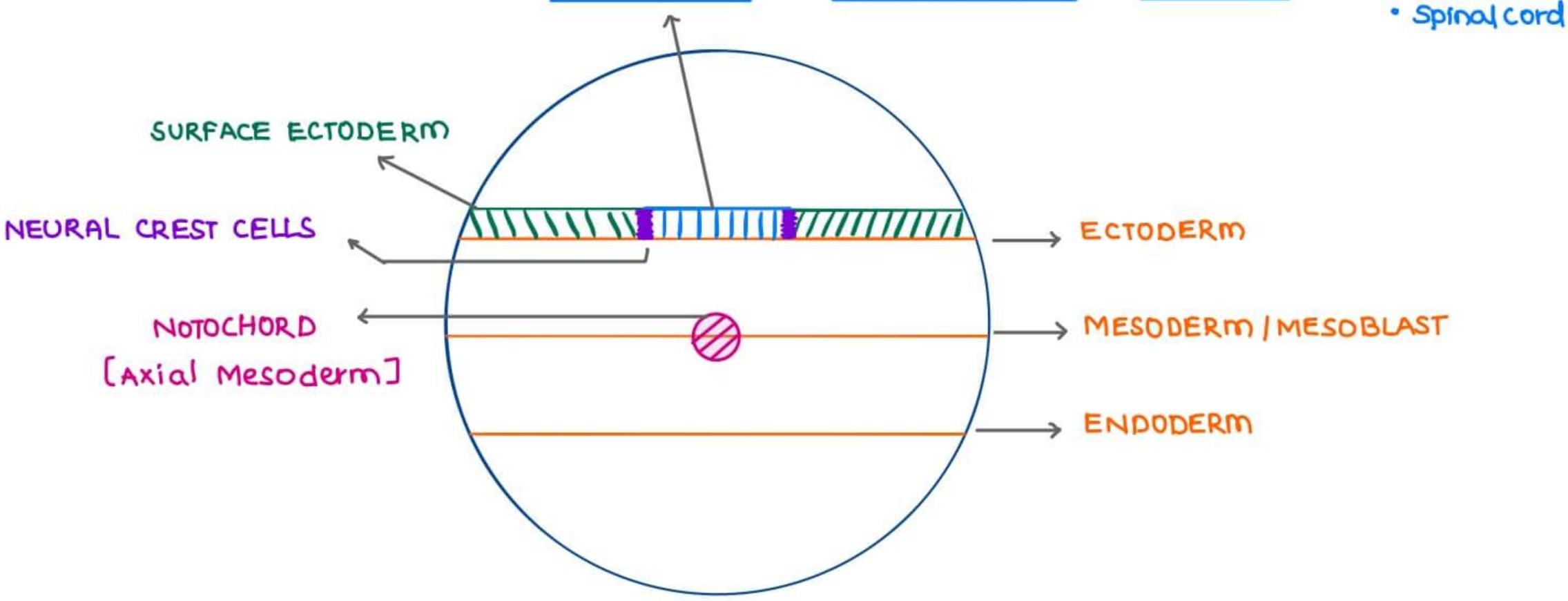
MULTIPLE SCLEROSIS → CNS MYELINAT^{n} involved → Spare Peripheral nerves, Optic nerve is Involved

DEVELOPMENT OF NERVOUS SYSTEM

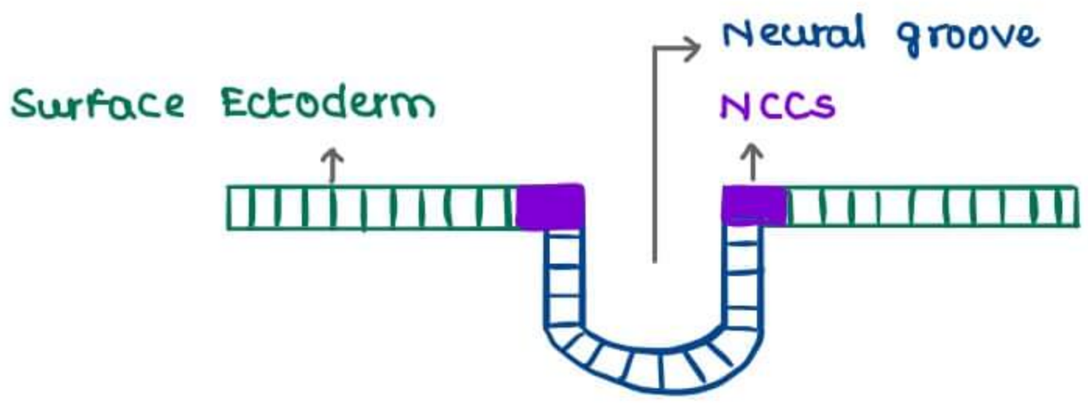


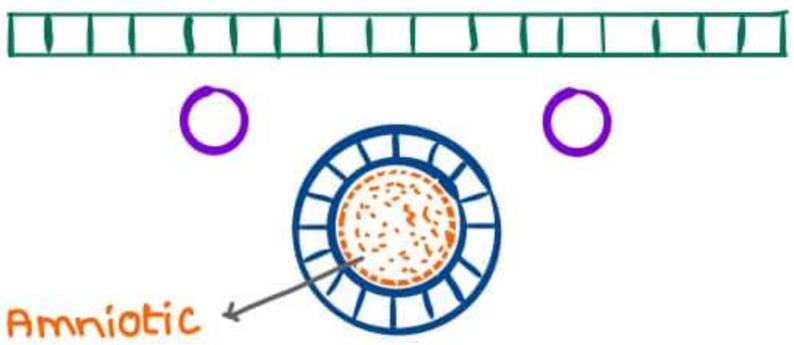


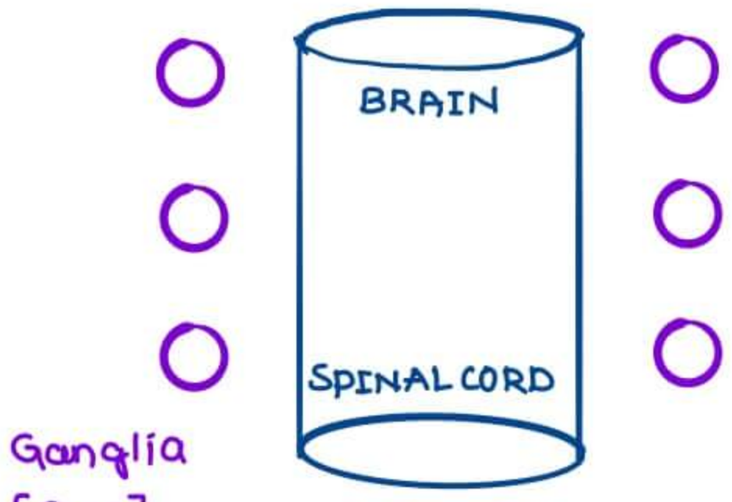
NEURO ECTODERM → NEURAL PLATE ECTODERM → NEURAL TUBE → CNS
- Brain
- Spinal cord



NOTOCHORD Stimulates Overlying Ectoderm → Neural plate Ectoderm → CNS
SURFACE ECTODERM → Skin epidermis
NCC → Peripheral Nervous System







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

ECTODERMAL PLACODES
→ develop from junction of surface ectoderm & Neural plate ectoderm & distributed in surface ectoderm

→ contributes to Trigeminal (V) & vestibulo cochlear (VIII) ganglia along with NCCs

NEURAL PLATE → NEURAL GROOVE → NEURAL TUBE

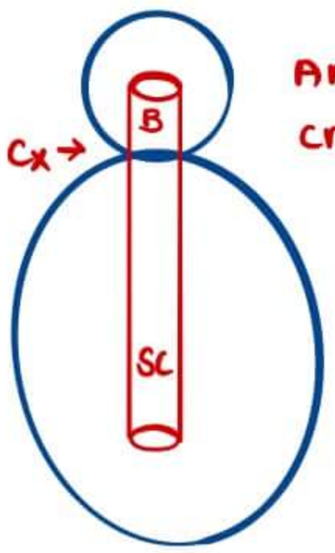
NEURAL TUBE FORMATION

→ on DAY 20, Fusion at cervical Occipital region occurs forming 1st pair of somites [Neural Tube formation begins]

→ continues upwards & down wards → forms neural tube

→ Anterior neuropore closes by DAY 25
→ Posterior neuropore closes by DAY 28

NEURAL TUBE DEFECTS



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

post./caudal neuropore [closes by DAY 28]

Mother have ↑ α FP
↑ Acetyl Cholinesterase

1 AN-ENCEPHALY → Non fusion of Ant. pore
2 RACHIS CHISIS Non fusion of post. pore

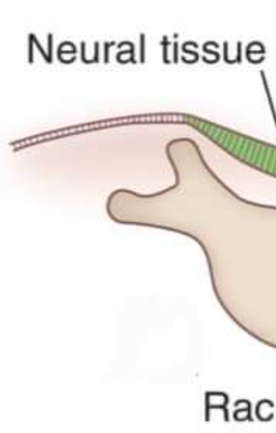
ANENCEPHALY

→ Brain is small/degenerated/exposed
→ Skull cap is missing [Defect]
→ Swallow reflex lost → Polyhydromnias


Anencephaly

RACHIS CHISIS

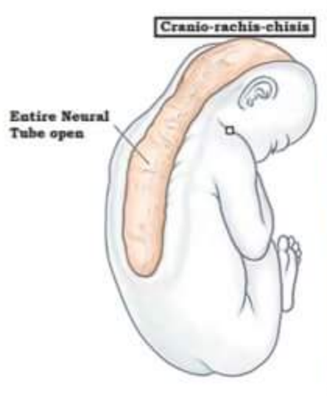
→ CSF leaking out side
→ open spinal cord [exposed]
→ Open vertebra [spina bifida]
→ Open skin
→ Neural Tube Defects prevented by
- 400 Mg/day Folic Acid Perinatally



Rachischisis

CRANIO - RACHIS - CHISIS

Anencephaly + Rachis chisis



Q Identify the congenital anomaly

a Spina bifida occluta → hidden
b Meningocele → clear cyst should be present
c Myelomeningocele → cyst is not clear [SB Cystica]
d Craniorachischisis → skin should be open

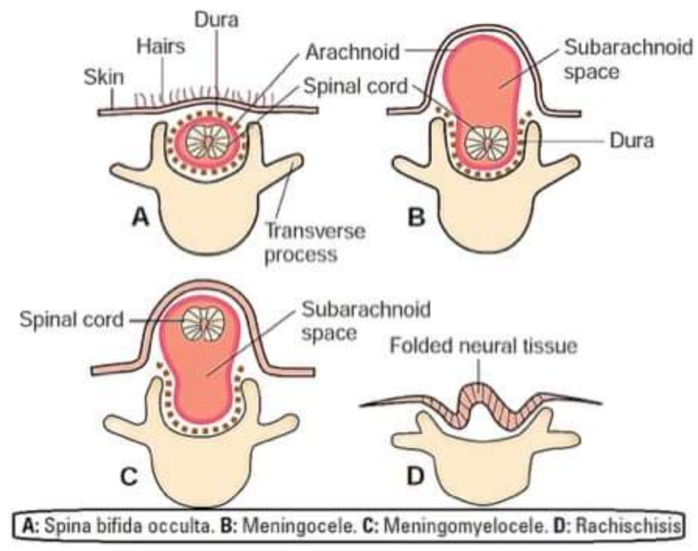
SPINA BIFIDA

1 Spina Bifida occulta
- → mc
- → tuft of hair on lumbosacral region + nt
- → incidental finding

2 SPINA BIFIDA CYSTICA I MENINGIOCELE
- → meninges moved into cyst in lumbosacral region
- → clear cyst

3 SPINA BIFIDA CYSTICA I Meningomyelocele
- → component of spinal cord & some neural tissue also moved out
- → cyst is not clear [dark lines dlt neural tissue +nt]

4 Rachischisis
- → least common
- → more dangerous
- → Open vertebra
- → Open skin
- → Spinal cord open
- → CSF leaking out



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

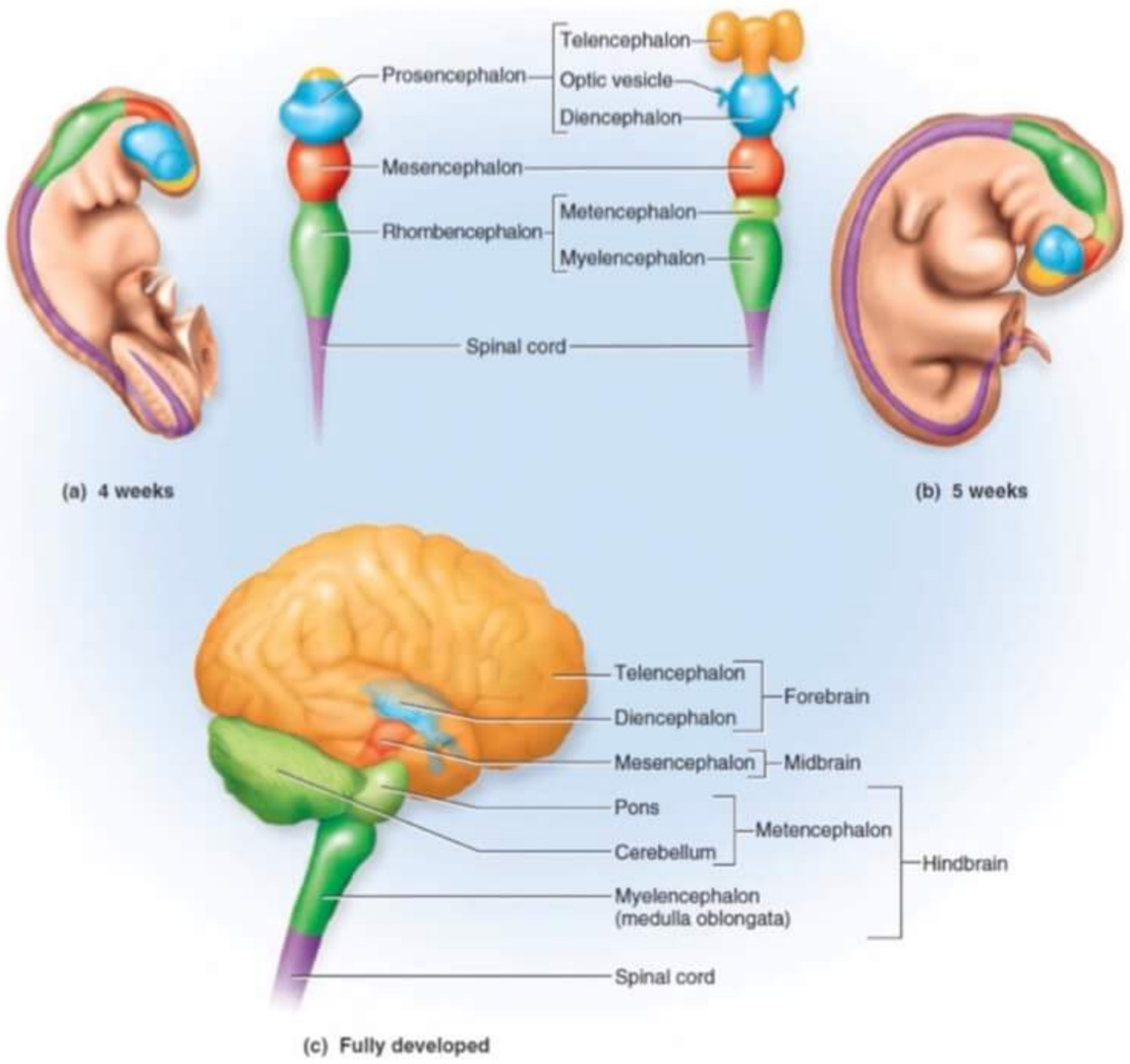
DEVELOPMENT OF BRAIN PARTS & CORRESPONDING VENTRICLES

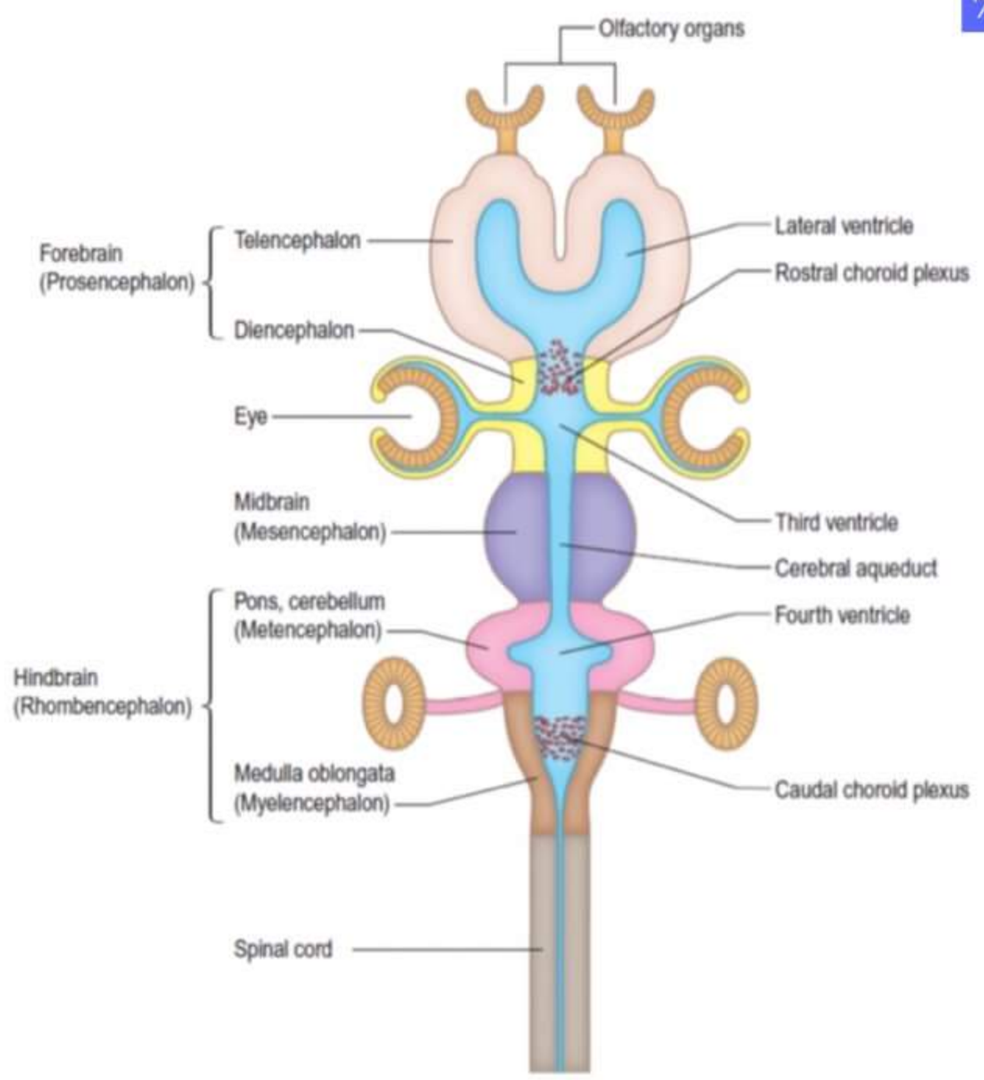
Q Spinal cord develops from

a Neural tube
b Mesencephalon → Mid brain
c Rhombencephalon → Hind brain
d Prosencephalon → Fore brain

Q 3rd ventricle belongs to

a Telencephalon → lateral ventricle
b Diencephalon
c Metencephalon } Hind brain → 4th ventricle
d Myelencephalon }





1 FORE BRAIN [PROSENCEPHALON]
- a TELENCEPHALON
- b DIENCEPHALON

2 MID BRAIN [MESENCEPHALON]

3 HIND BRAIN [RHOMBENCEPHALON]
- a PONS } METENCEPHALON
- b CEREBELLUM }
- c MEDULLA OBLONGATA → MYELENCEPHALON

TELENCEPHALON
→ consists LATERAL VENTRICLES → moves Laterally to right & left
→ present in cerebrum region

DIENCEPHALON → Thalamic region
→ Third ventricle → midline ventricle

MID BRAIN → Cerebral aqueduct → midline ventricle
HIND BRAIN → Fourth ventricle
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 fore brain
Diencephalon grows into eye ball to become retina & becomes Optic nerve

BRAIN STEM

1. MID BRAIN
2. PONS
3. MEDULLA OBLONGATA

→ Cranial Nerves from 3 to 12 comes from Brain stem

→ CN VIII [VESTIBULO COCHLEAR NERVE] → develops from Ponto Medullary Junct^n
→ For hearing & balance

CN I
CN II
CN VIII
} Pure sensory Nerves

CEPHALO CAUDAL FOLDING

→ Brain becomes 'C' shaped from straight tube dlt cephalo caudal folding

→ TELENCEPHALON → forms CEREBRUM
DIENCEPHALON → forms THALAMUS

MESENCEPHALON → MID BRAIN

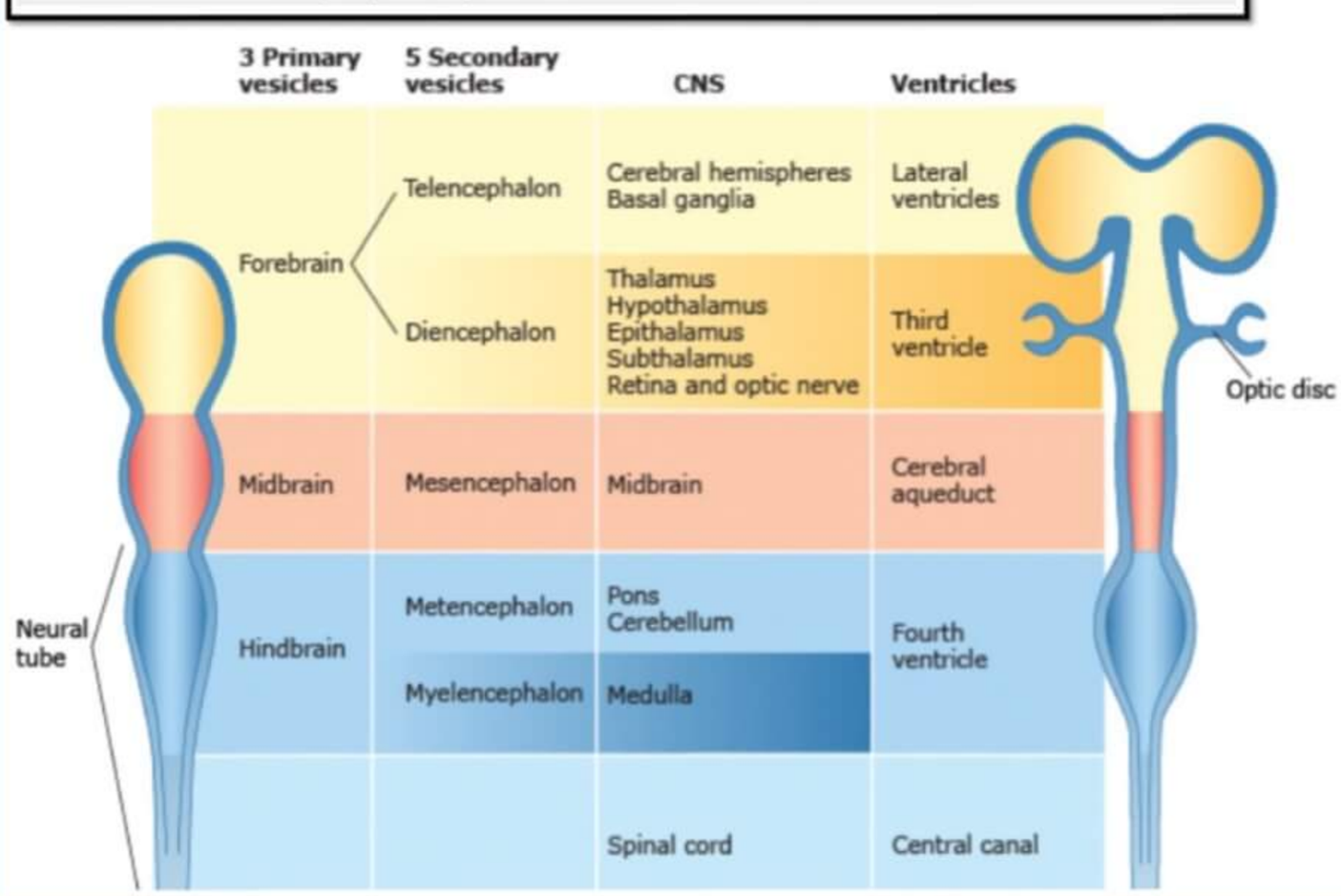
METENCEPHALON → PONS , CEREBELUM
MYELENCEPHALON → MEDULLA OBLONGATA

→ Lateral ventricles also become C - shaped

→ CSF Flows from Lateral ventricle to 3rd ventricle → 4th ventricle → central canal

PARTS OF BRAIN

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



BASAL GANGLIA

caudate Nucleus

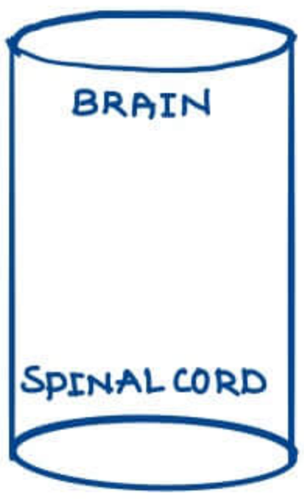
putamen Nucleus

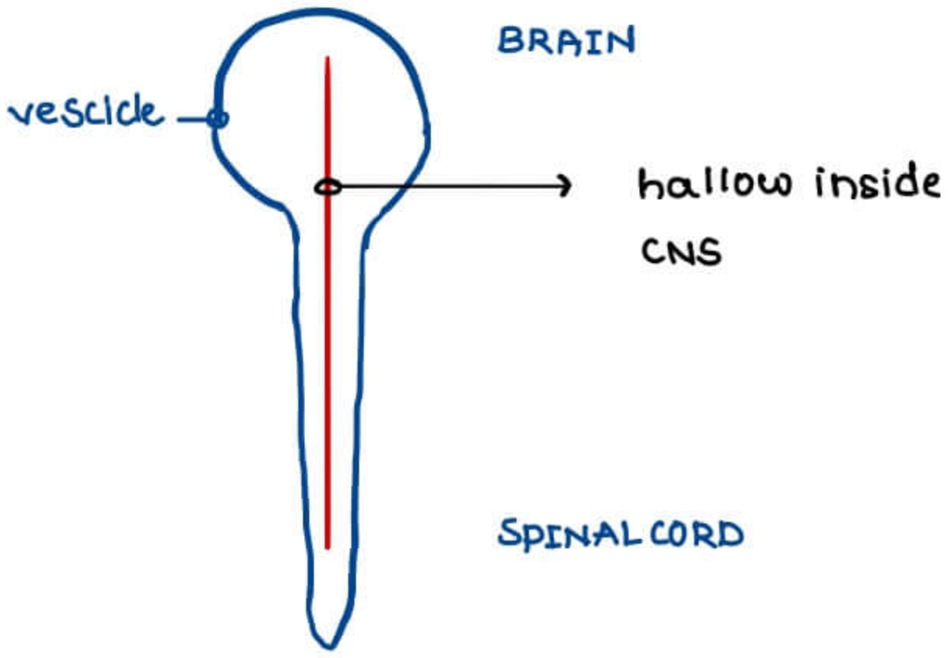
Amygloid Nucleus

Hippocampus → involves in recent memory

→ also part OF LIMBIC SYSTEM [Papez circuit]

– involves in Emotion / memory



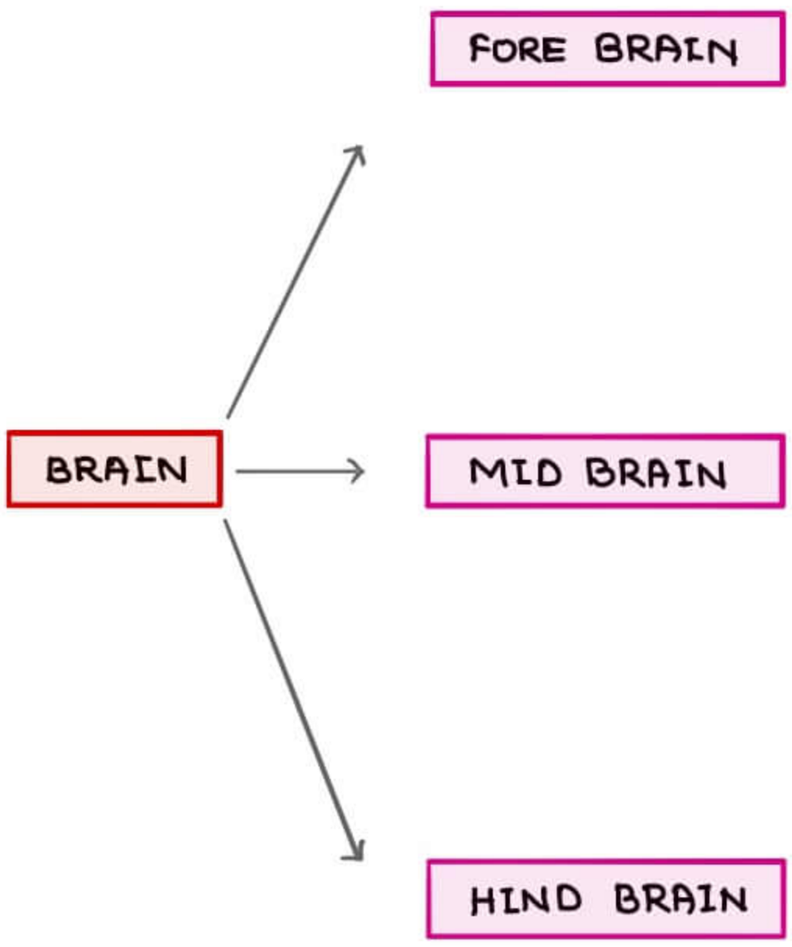


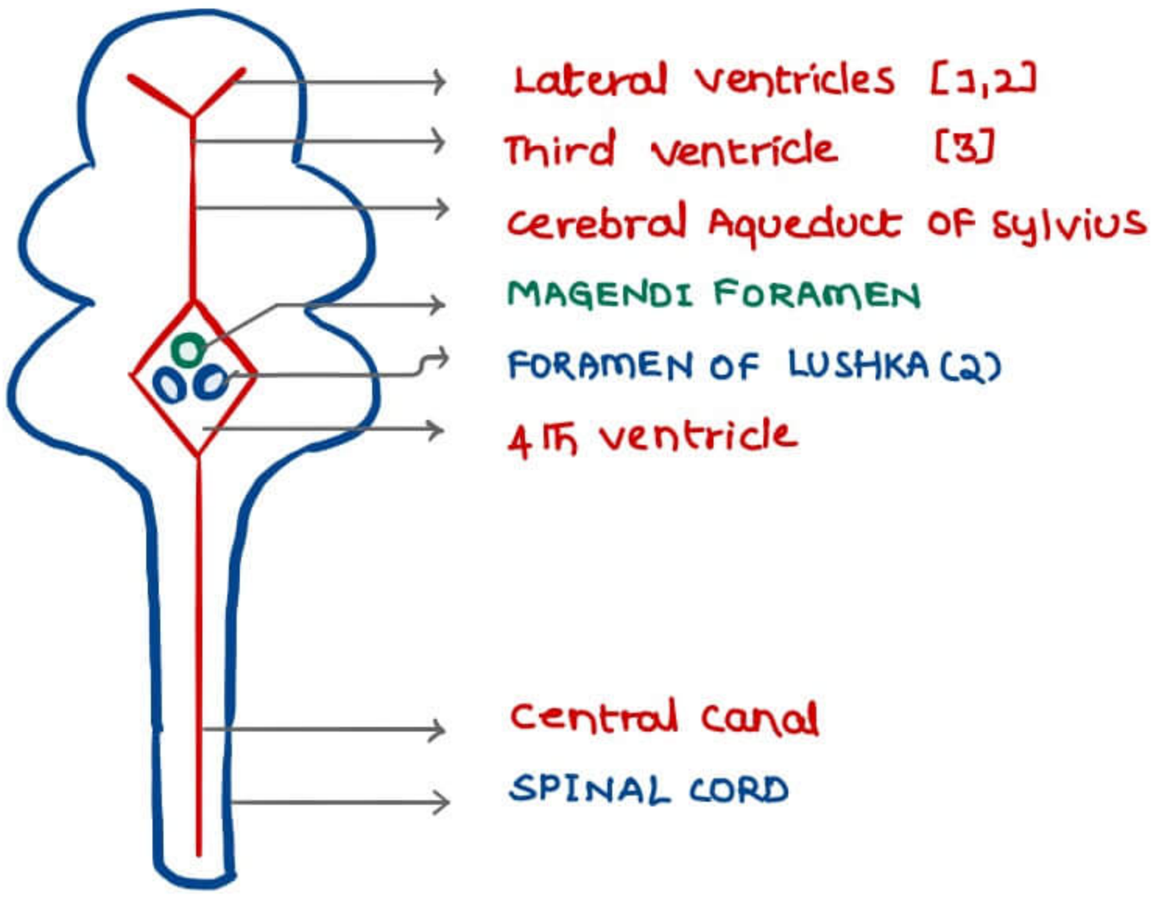
CSF

→ 1st CSF formed by → Amniotic fluid

→ once ventricles are formed, CSF formed by → choroid plexus

→ CSF is ultra filtrate of blood





CSF ESCAPES Ventricular system into Sub Arachnoid space by

1 Midline MAGENDIE FORAMEN
2 Lateral FORAMEN OF LUSHKA [2]

} Present on roof of 4th ventricle

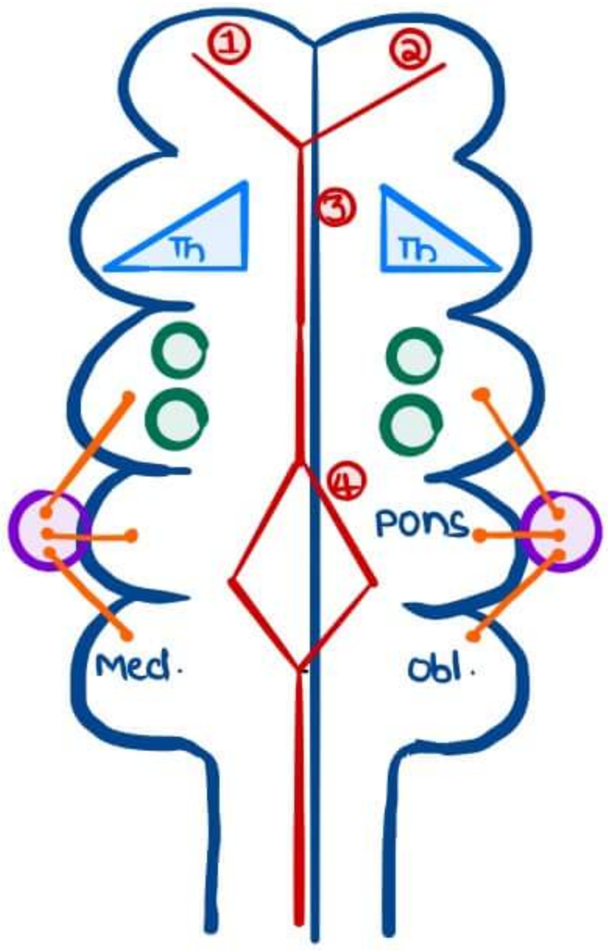
CSF at 4th ventricle → Sub Arachnoid Space —Arachnoid granulations→ Dural venous Sinuses

→ AQUEDUCTAL STENOSIS
- → leads to Internal Hydrocephalus
- → Lateral & Third ventricles dilates
- → Fore brain will die dlt flattening EFFECT

FORE BRAIN → TELOENCEPHALON
FORE BRAIN → DIENCEPHALON

MID BRAIN → MESO ENCEPHALON

HIND BRAIN → META ENCEPHALON [PONS + CEREBELLUM]
HIND BRAIN → MYELEN ENCEPHALON [MEDULLA OBLONGATA]



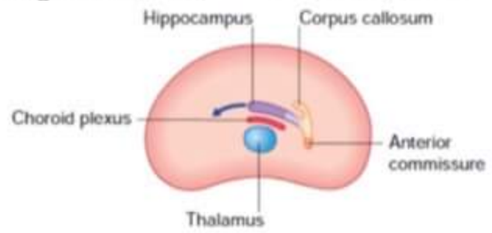
② superior colliculus
② Inferior colliculus
CEREBELLUM

→ 2 superior colliculus } CORPORA QUADRIGEMINA
2 Inferior colliculus } present on tectum | dorsum of midbrain

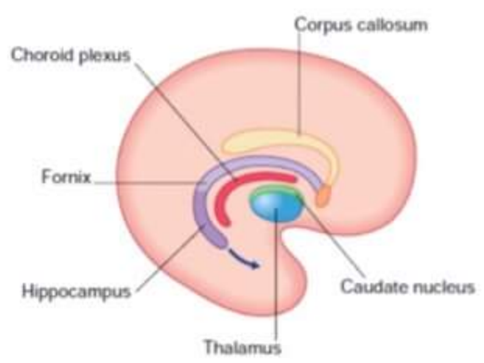
→ Pons develops before the cerebellum
→ Cerebellum attaches to brain stem by 3 peduncles
1 Superior cerebellar peduncle → to mid brain
2 Middle cerebellar peduncle → to pons
3 Inferiorcerebellar peduncle → to medulla oblongata

→ 4th ventricle → sandwiched b/w 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

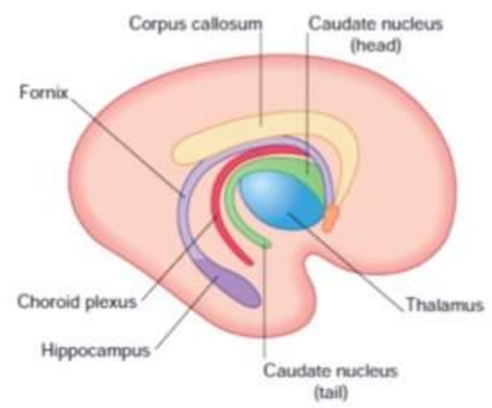


DEVELOPMENT OF BRAIN : SAGITTAL VIEW
→ Brain becomes 'c' shape on Thalamus axis
→ 1st commissure to develop → Ant. commissure

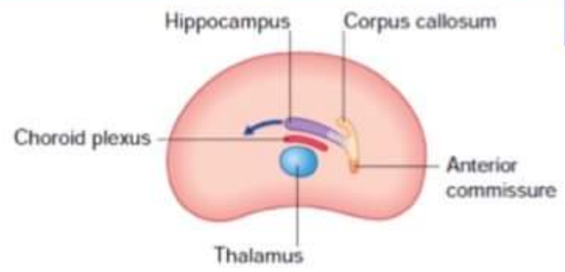


COMMISSURE FIBRES → axons that connect right brain & left brain

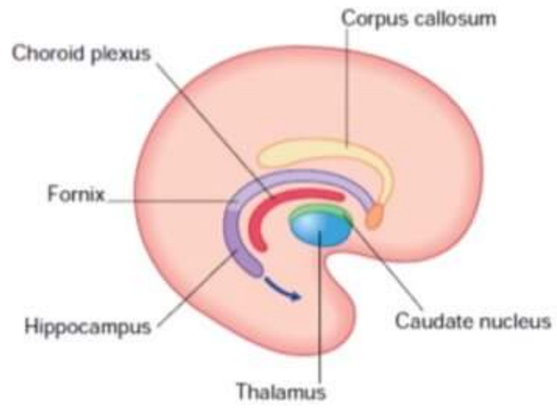
→ 2nd commissure to develop → corpus callosum



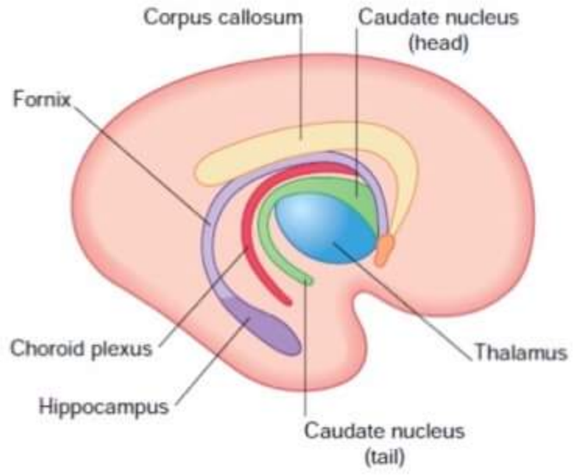
CORPUS CALLOSUM } becomes
FORNIX } C - Shape



FORNIX → collectⁿ 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

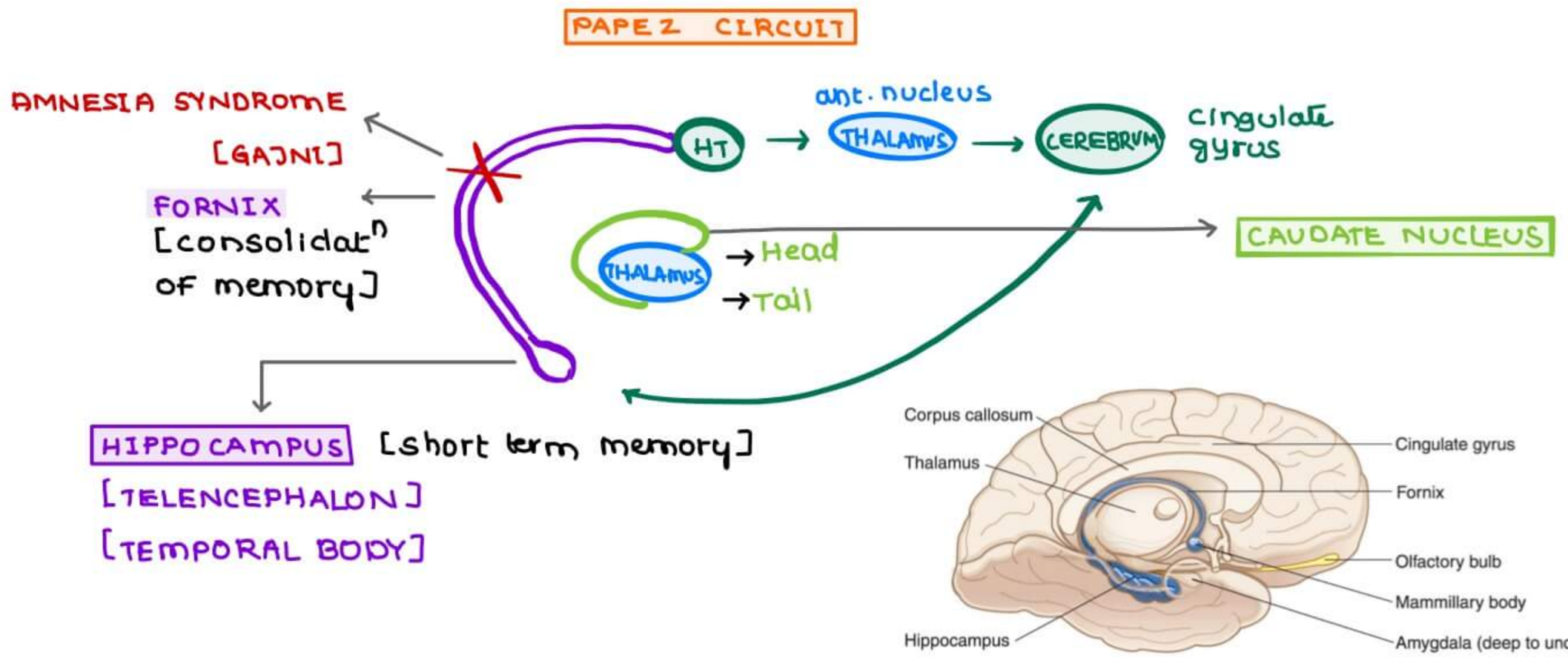


CAUDATE NUCLEUS
→ comma / C Shaped
→ have anteriorly present head & tail

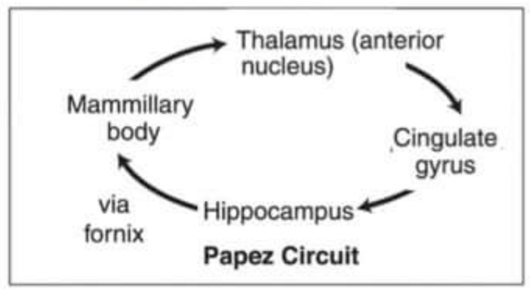


CEREBRUM → also become 'C' shape

PAPEZ CIRCUIT



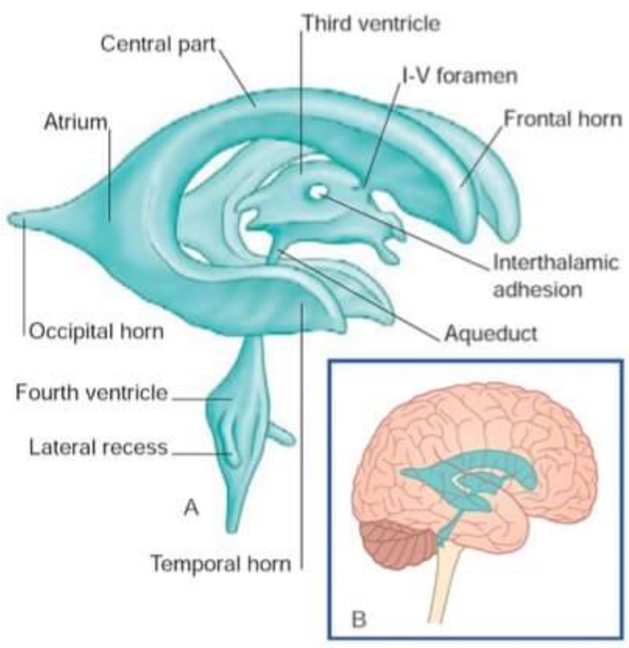
→ part of Limbic system
→ concerned ⊼ memory & Emotions

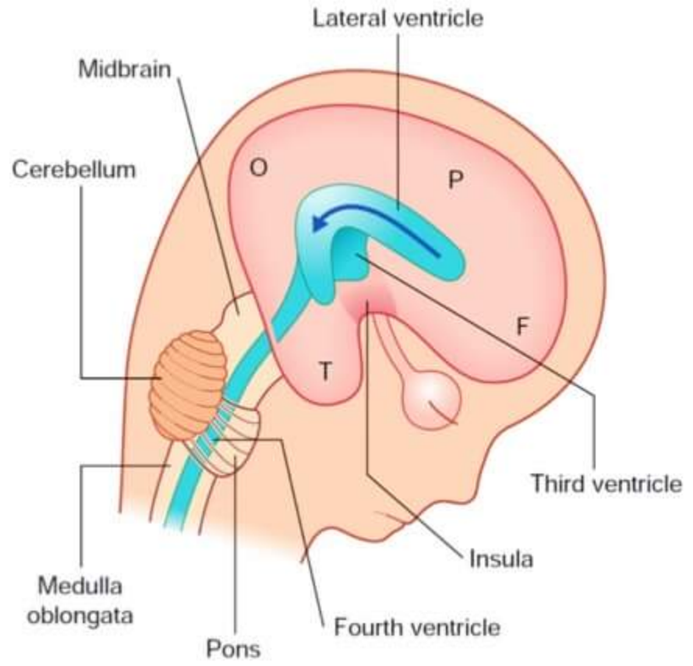


CEREBRUM & VENTRICLES

LOBES OF CEREBRUM

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





LATERAL VENTRICLE
→ aquires 'C' Shape
→ has
1 frontal pole /horn
2 occipital pole /horn
3 Temporal pole /horn

→ major amount OF CSF formed here by choroid plexus

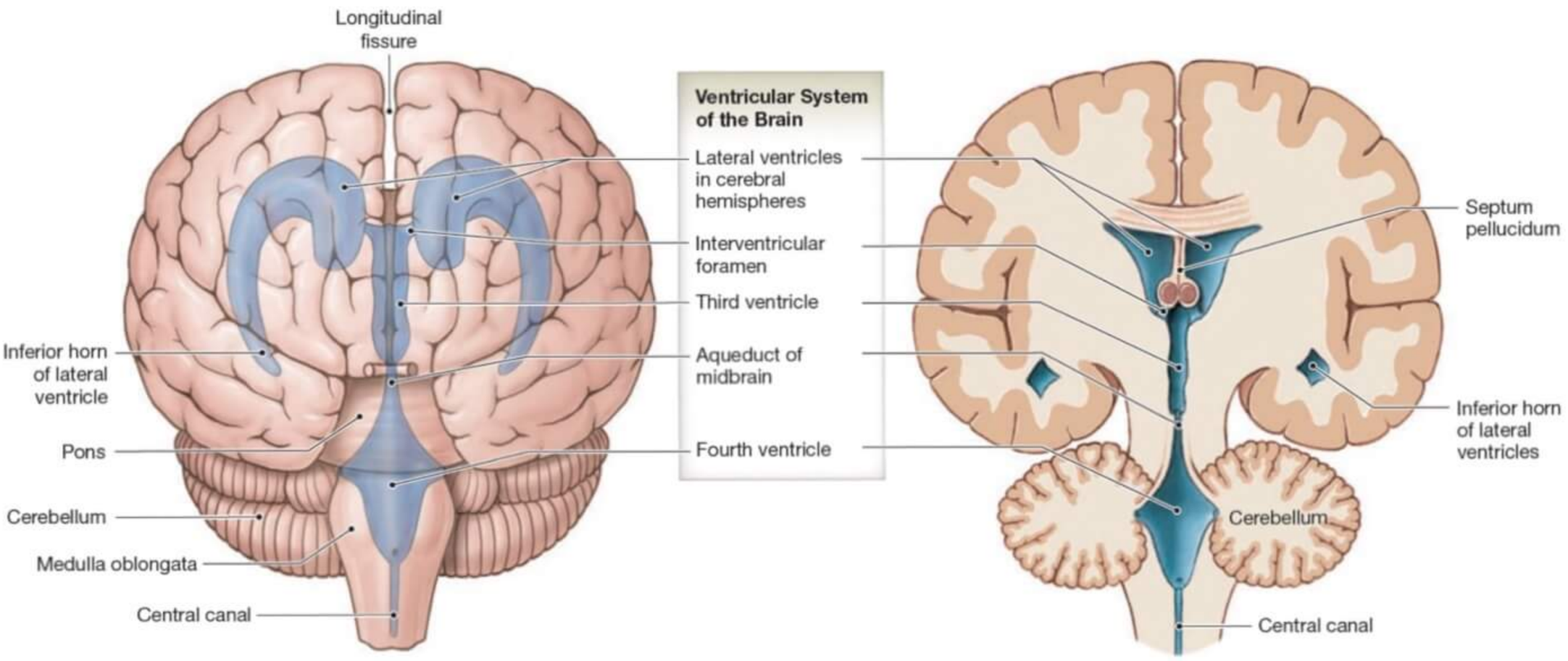
CSF - FLOW SEQUENCE

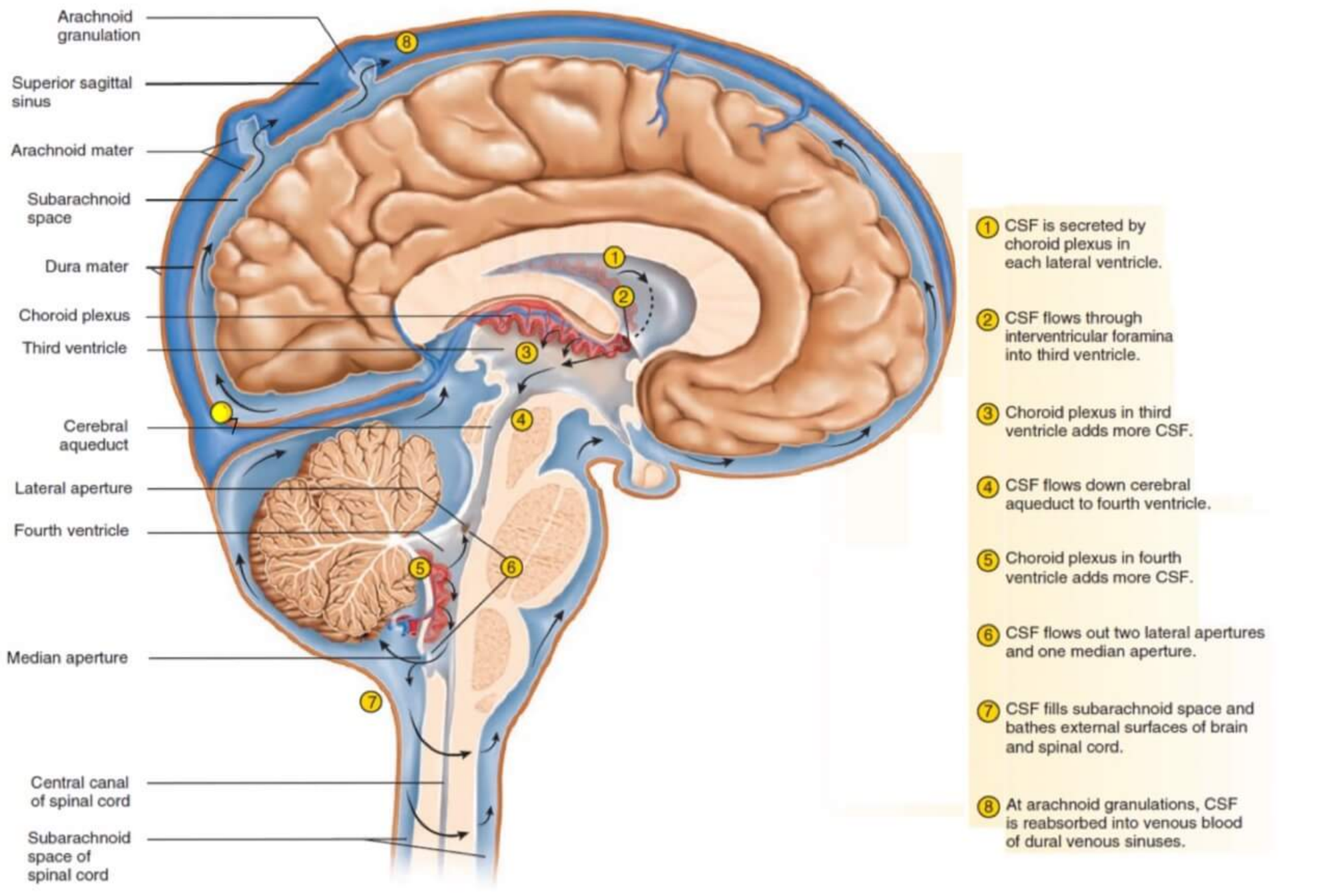
LATERAL VENTRICLES → (IV foramen of MONRO) → 3rd VENTRICLE → AQUEDUCT OF SYLVIUS → FOURTH VENTRICLE → CENTRAL CANAL

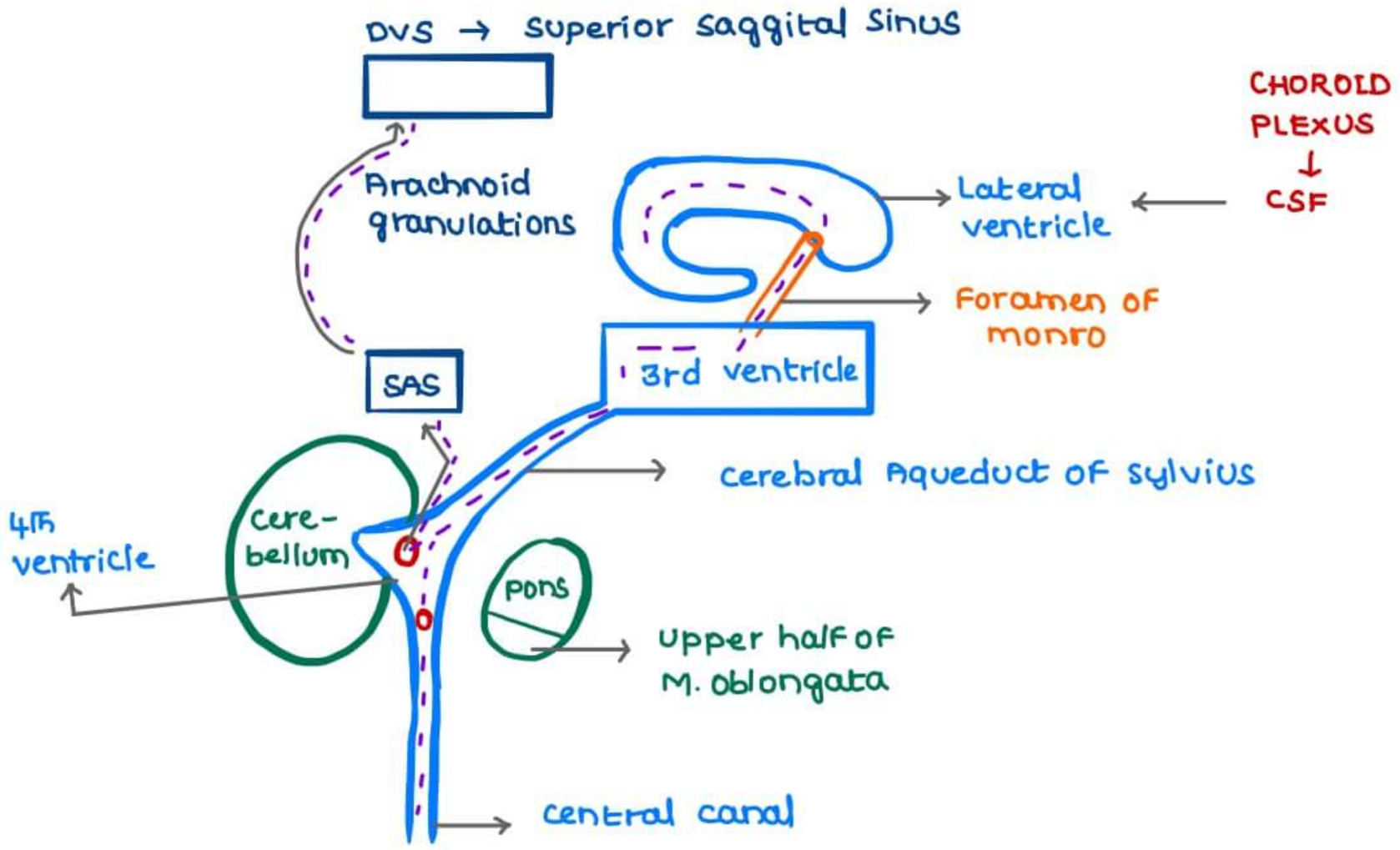
FOURTH VENTRICLE → (Magendie Foramen / Foramen of Luschka) → SUB ARACHNOID SPACE

SUB ARACHNOID SPACE → (Arachnoid Granulations) → DURAL VENOUS SINUS

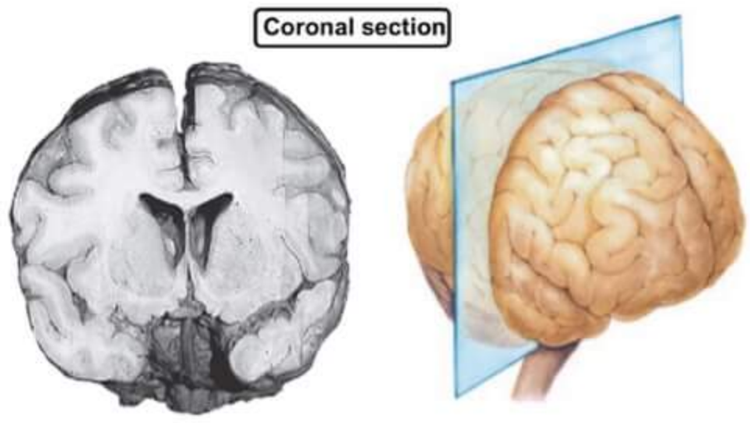
DURAL VENOUS SINUS → SUPERIOR SAGGITAL SINUS





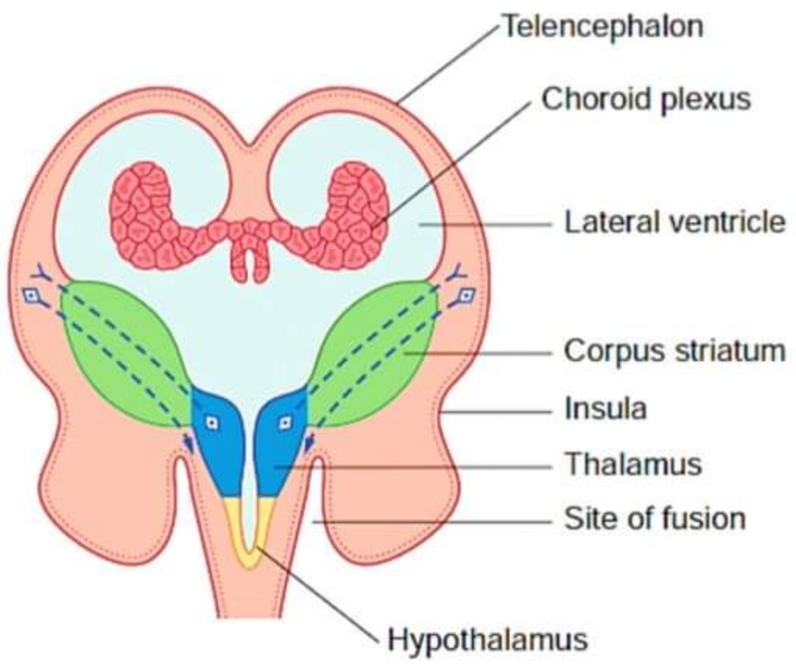


BRAIN – CORONAL SECTION



3rd VENTRICLE

→ Sandwiched b/w Thalamus & Hypothalamus
→ Thalamus forms lateral wall
→ Hypothalamus forms floor & also contribute to lateral wall

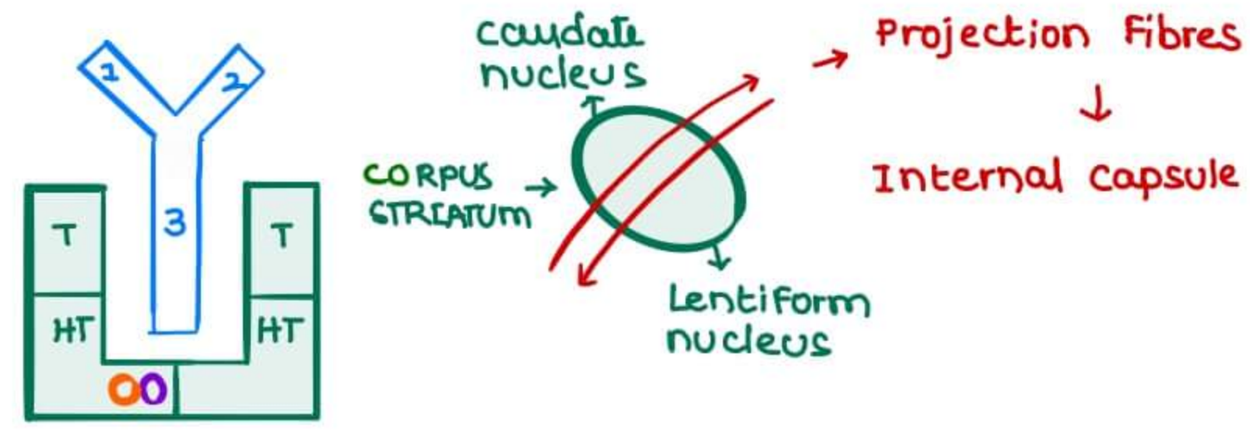


CORPUS STRIATUM

→ part of basal ganglia
→ has projection fibres [connect upper brain centre to lower & vice verca]
→ Projection fibres form Internal capsule

INTERNAL CAPSULE

→ bisects corpus striatum into 2 parts
1 LENTIFORM NUCLEUS [lateral]
2 CAUDATE NUCLEUS [medial]



1 Tuber cinerium
2 Mammillary body

THIRD VENTRICLE

BOUNDARIES

EXTENT → starts from FORAMEN OF MONRO to begining of AQUEDUCT OF SYLVIUS

LATERAL WALL

→ Thalamus
Hypothalamus

FLOOR

→ mammillary Body of HYPOTHALAMUS
→ Tegmentum part of MIDBRAIN
→ TUBER CINEREUM of HYPOTHALAMUS

→ **INFUNDICULAR STALK**
- Downward extension of Diencephalon
- connects neurohypophysis | posterior pituitary

→ **OPTIC CHIASMA**
- most anterior structure

ROOF

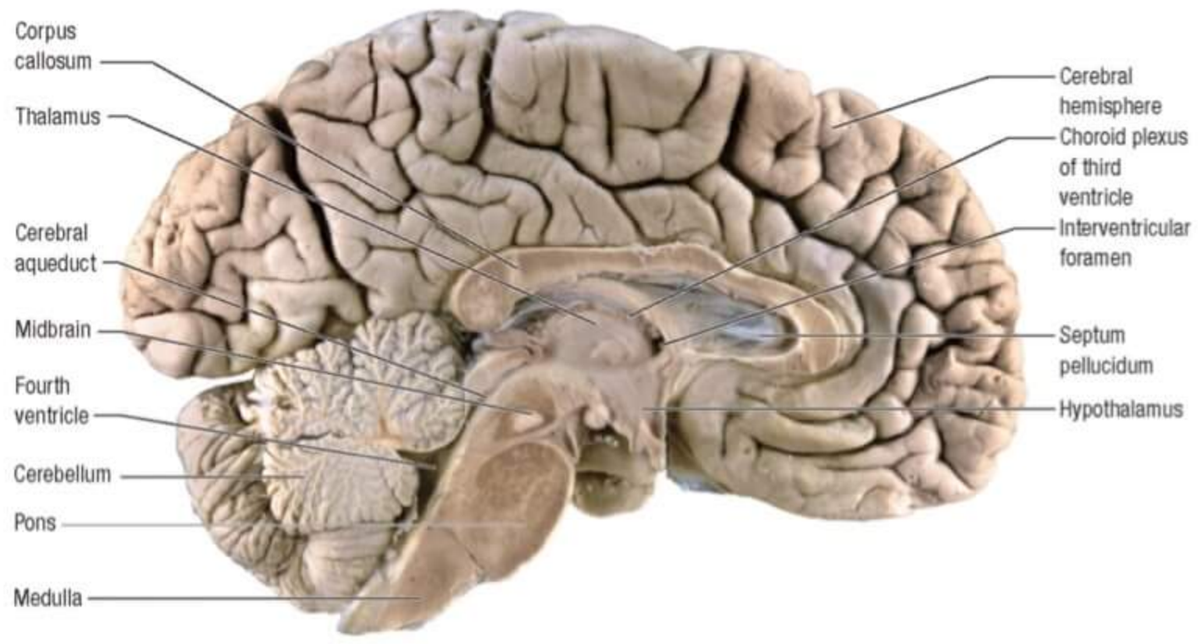
→ FORNIX

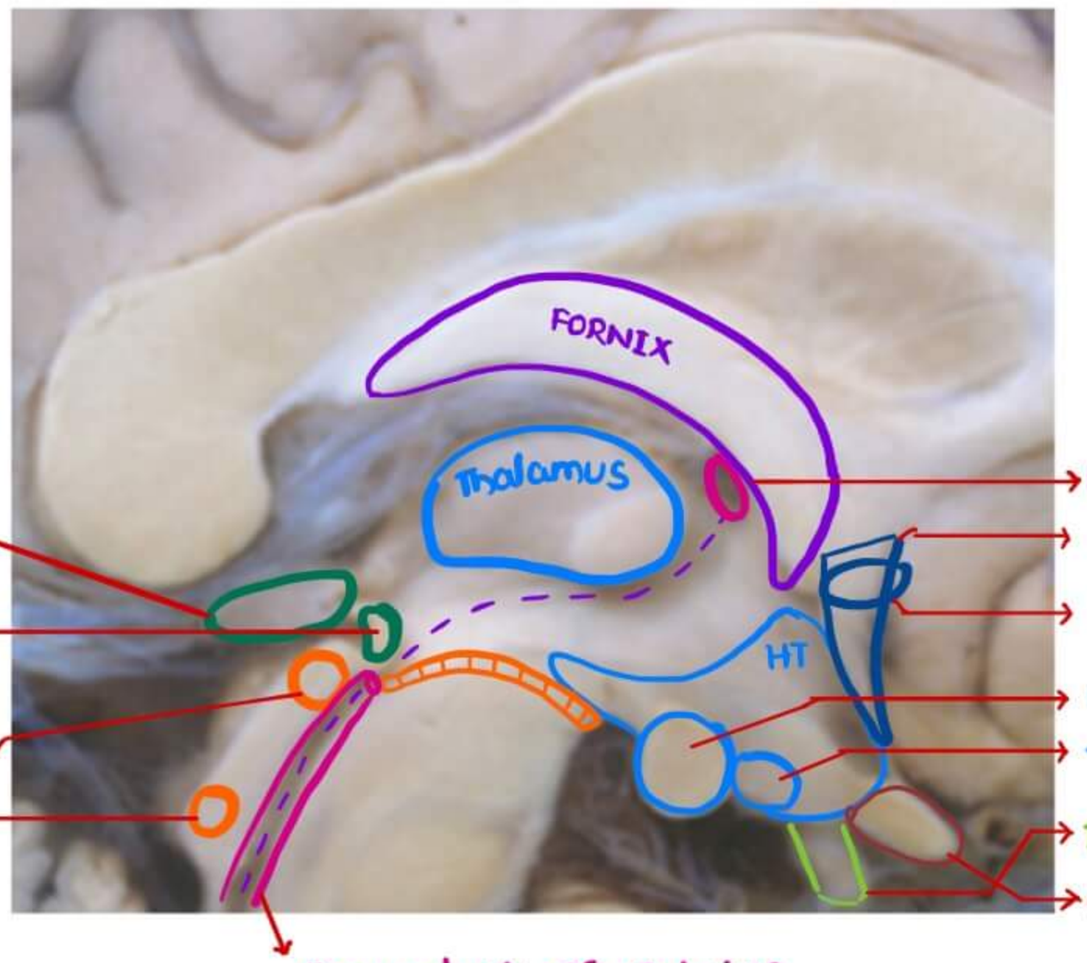
ANTERIOR

→ FORNIX [some part]
LAMINA TERMINALIS
ANTERIOR COMMISSURE

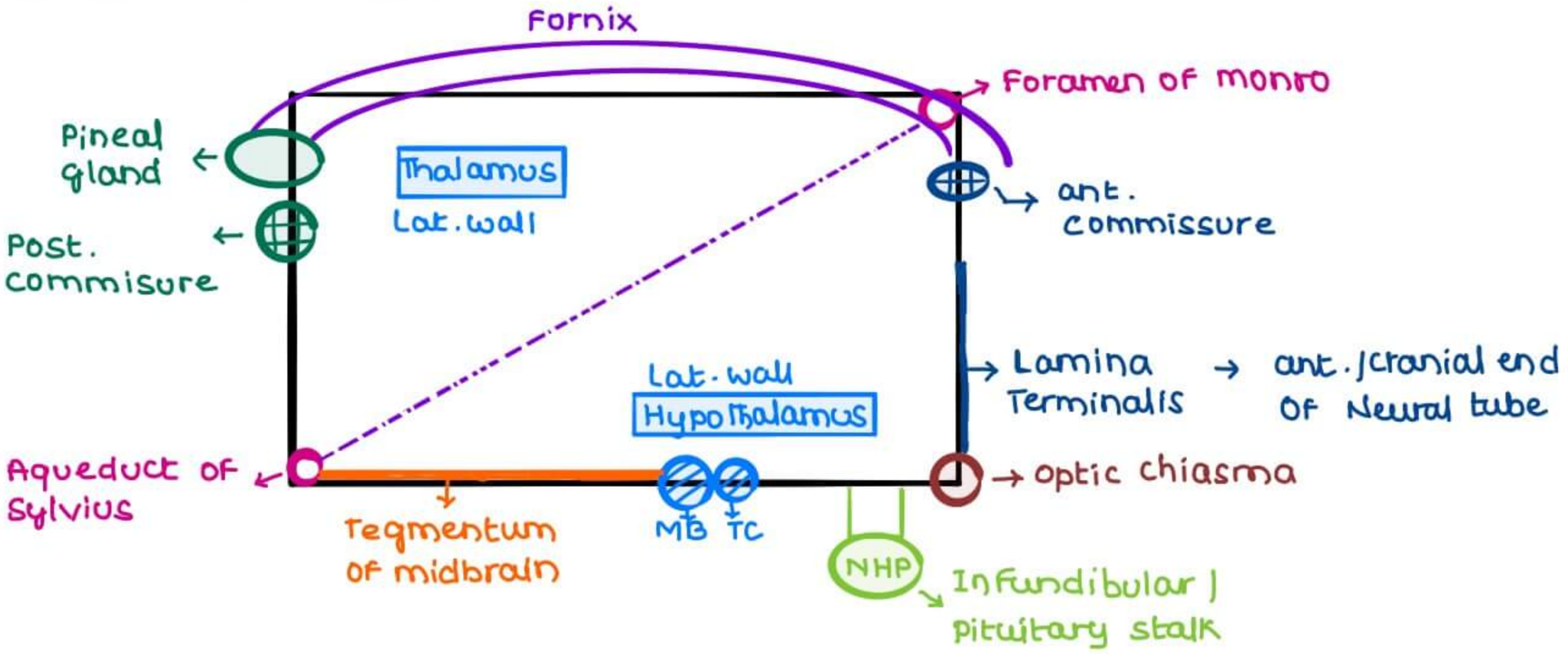
POSTERIOR

PINEAL BODY
POSTERIOR COMMISSURE





THIRD VENTRICLE - BOUNDARIES

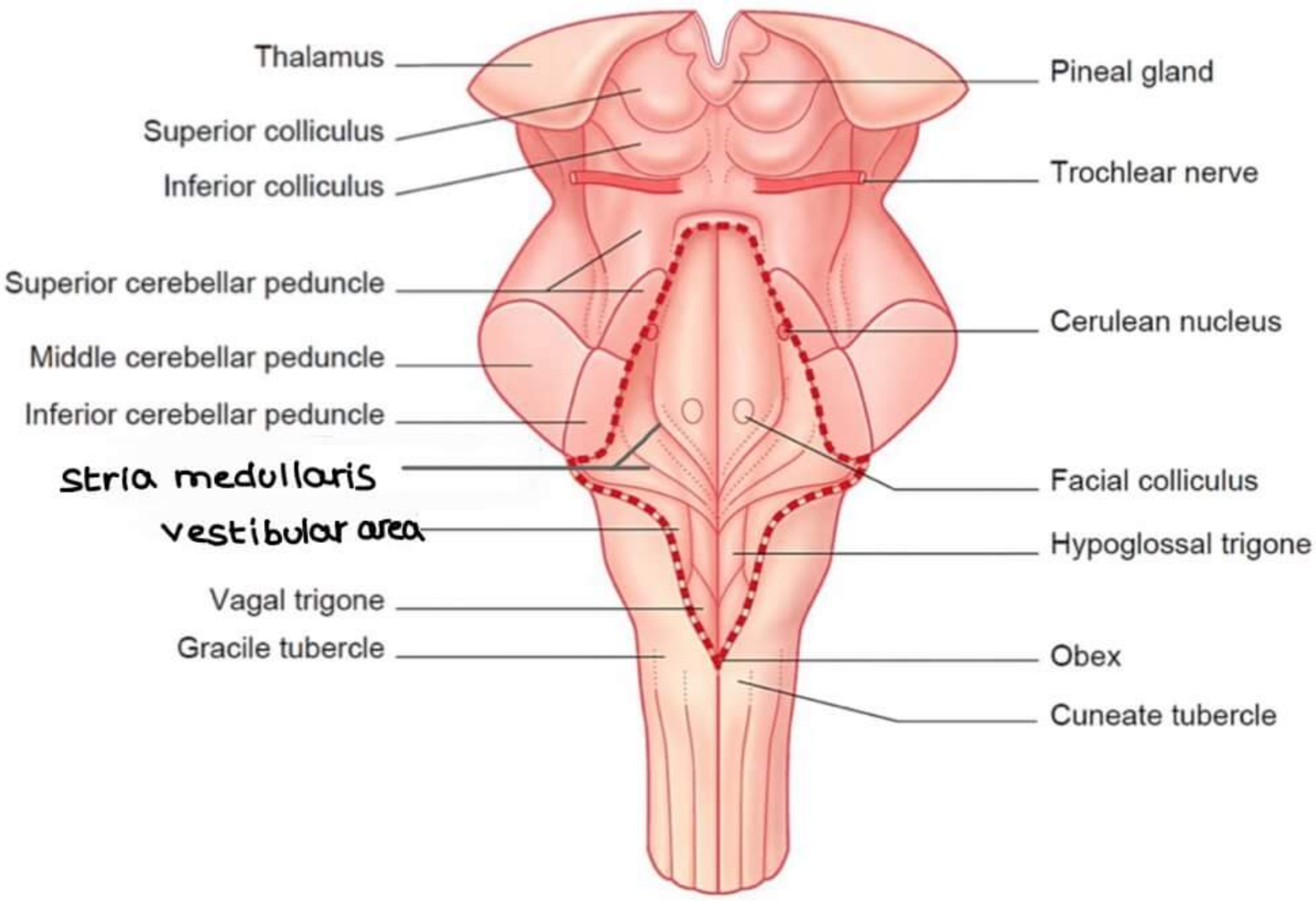


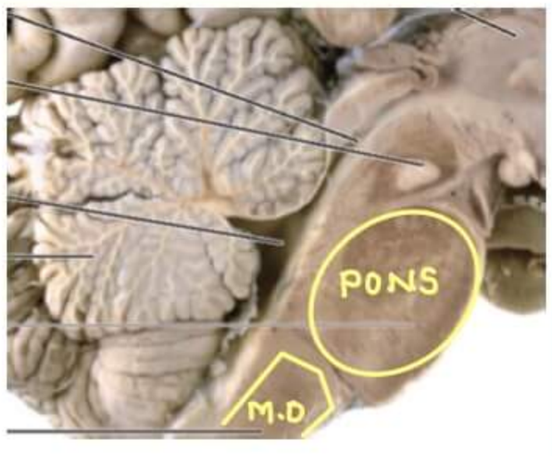
Q All is seen in the floor of 3rd ventricle EXCEPT

a Mammillary Body
b Occulomotor Nerve
c Optic chiasma
d Tubercinereum

FOURTH VENTRICLE

FLOOR → Pons & upper half of M. oblongata





CONTENTS OF 4th VENTRICLE

1. FACIAL COLLICULUS → rounded elevations by axons of facial nerve
   [Deep to this, Abducens nucleus +nt, but abducence nucleus do not produce elevation]

   → present in dorsum of Lower pons

Q Injury to facial colliculus, which muscle compromised ?

a Risorius → supplied by facial nerve [BETTER ANSWER]
b Lateral rectus → supplied by Abducens nerve

2. STRIA MEDULARIS → striations moving towards medulla

3 HYPOGLOSSAL TRIGONE

→ most medial nucleus → Hypoglossal nucleus
→ Elevation of hypoglossal nucleus (XII) → Hypoglossal TRIGONE

4 VAGAL TRIGONE

→ lateral to hypoglossal trigone
→ due to elevation of Vagal Nerve nucleus (X)

5 VESTIBULAR AREA

→ most lateral
→ VIII Nerve presents here

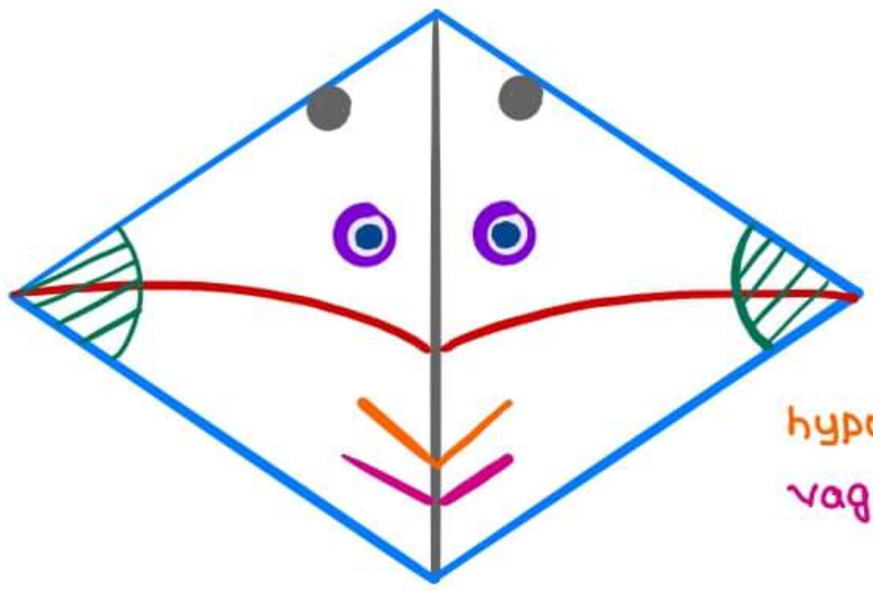
→ Hypoglossal Trigone
vagal trigone
Vestibular area
} Present in upper half of M. oblongata

→ on Medial Medullary Syndrome → hypoglossal nucleus is involved
→ Tongue muscle palsy

→ on Lateral Medullary Syndrome → vestubular nucleus is involved
→ Wallenberg Syndrome ∴ vertigo

6 NUCLEUS CERULEUS

→ dark colored dlt melanin deposition
→ seen in dorsum of upper pons



Q All is seen in the floor of the Fourth ventricle EXCEPT
a vagal triangle
b Hypoglossal triangle
c vestibular area
d Stria terminalis

TROCHLEAR NERVE → only cranial nerve ∴ dorsal exit in brain
→ comes from mid brain
→ present at level of inferior colliculus

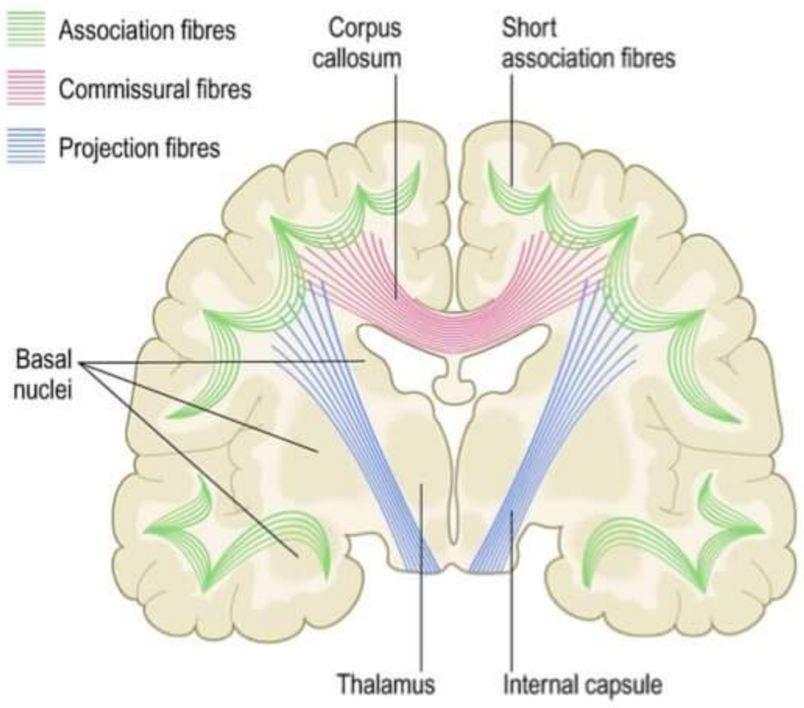
CORPORA QUADRIGEMINA
2 Superior colliculi
2 Inferior colliculi

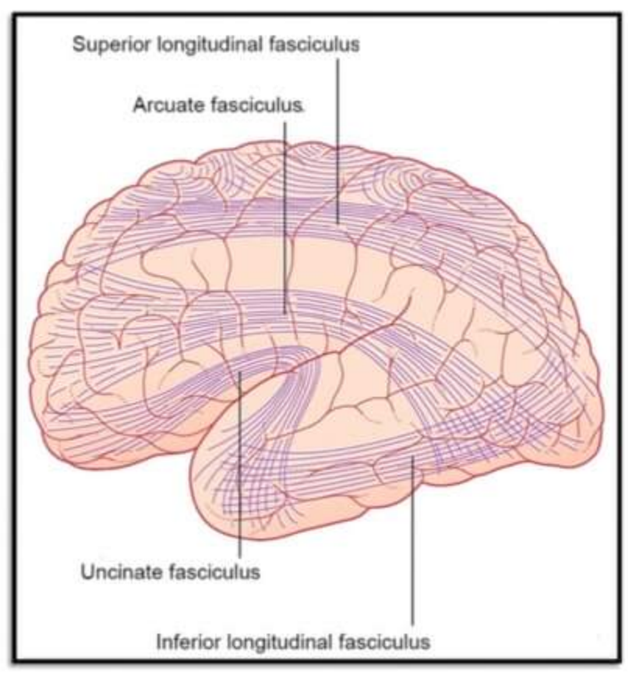
TYPES OF FIBRES

1 COMMISSURAL FIBRES → connects rt side of brain to lt. side of Brain
2 PROJECTION FIBRES → connects higher brain centre ī lower brain centre
3 ASSOCIATION FIBRES → connects cerebrum on same side
→ do not cross midline

Q Association fibres are all except
a uncinate
b cingulum
c Longitudinal fasciculus
d forceps major of corpus callosum → commissural fibres

COMMISSURAL FIBRES → crosses midline





ASSOCIATION FIBRES

ARCUATE FASCICULUS

→ Seen on left side of cerebrum
→ connecting language areas [Wernicke's speech area ī Broca's motor speech area)

COMMISSURAL FIBRES

CORPUS CALLOSUM

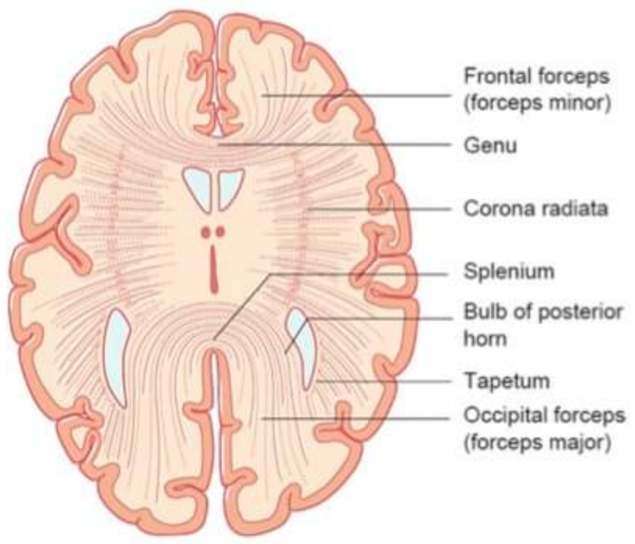
FORCEPS MAJOR

→ 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
[TTT] → passes in trunk of corpus callosum



CORPUS CALLOSUM

1 Rostrum [anterior]
2 Genu
3 Body / trunk
4 Splenium [posterior]

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

MOTOR COMPONENTS

EFFERENT ≅ Muscle

Skeletal / somatic muscle → controlled by somatic Nervous Sy.

Smooth, Cardiac } visceral → controlled by ANS

G → General
S → Skeletal
E → Efferent ≅ Muscles

G → General
V → Visceral
E → Efferent ≅ Muscle

SENSORY COMPONENTS

SOMATIC / PARIETAL SENSATIONS → Outside the body wall

VISCERAL SENSATIONS → inside the body wall

G → General
S → Somatic
A → Afferent ≅ sensation

- Touch
- pain
- pressure
- vibrations
- temperature
- proprioception

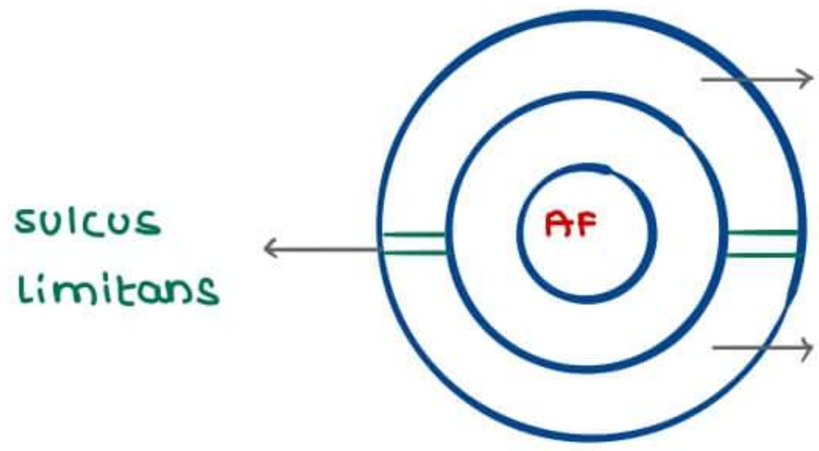
G → General
V → Visceral
A → Afferent ≅ sensation

- Angina
- Colicky pain
- Blood pressure
- Stretch

SKELETAL MUSCLE SPASM : GSE → GSA

SMOOTH MUSCLE SPASM : GVE → GVA [colicky pain]

ALAR & BASAL PLATES



Post. ALAR PLATE → Sensory / Afferent pathway

Ant. BASAL PLATE → Motor / Efferent pathway

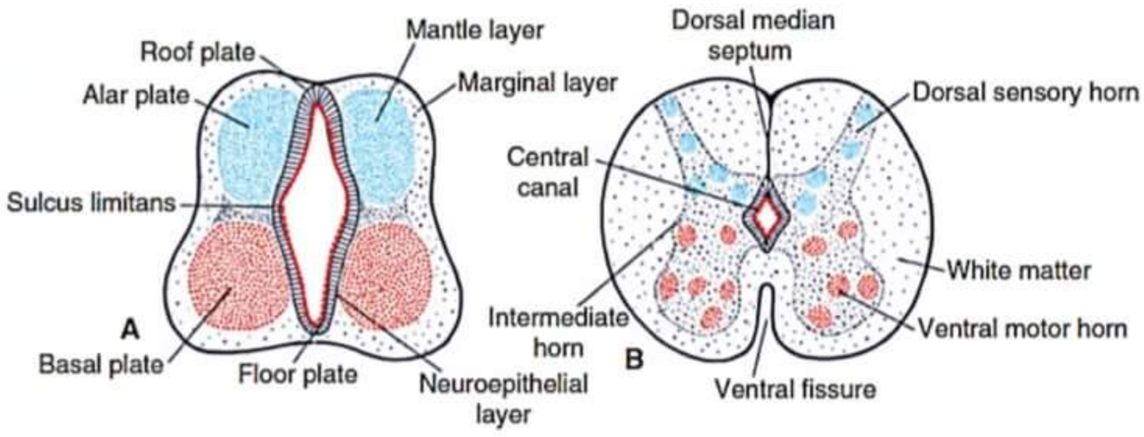
Q visceral efferent column arises from which plate of neural tube

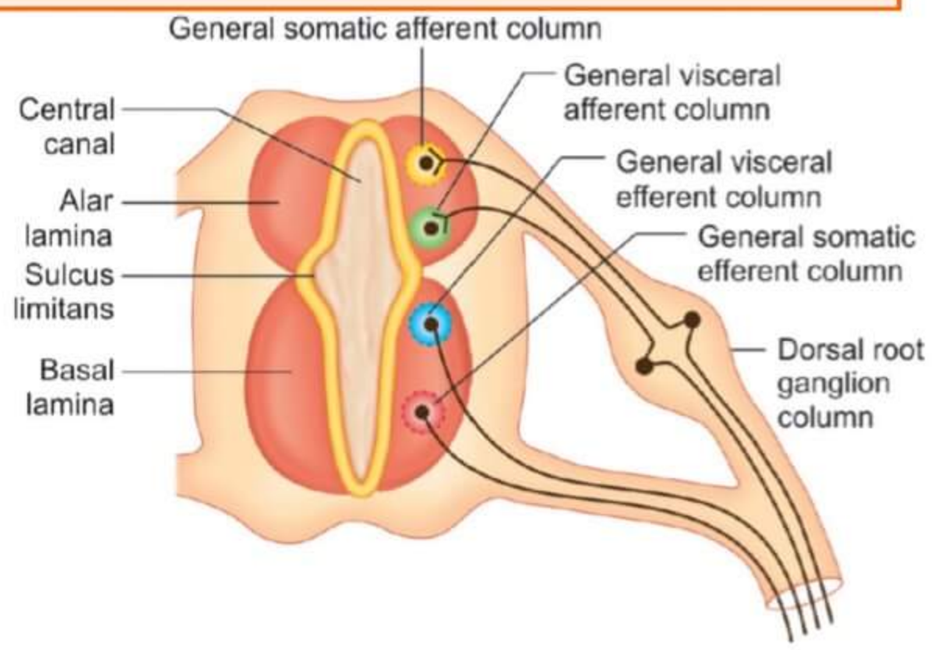
a Alar → Afferent [sensory]

b Basal

c Roof

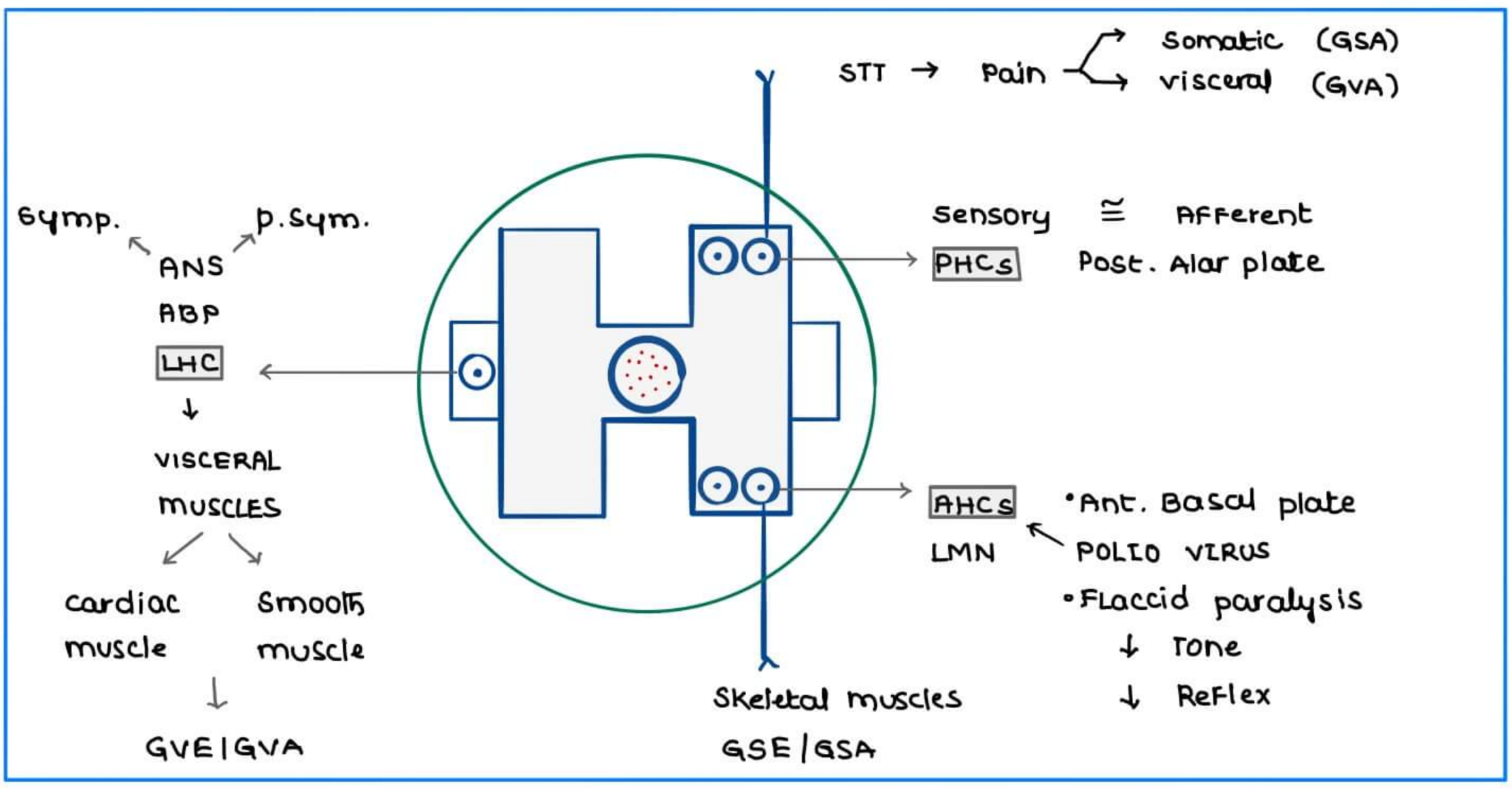
d Floor



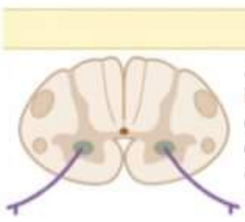


Ant. Basal Plate → gives ant. horn cells → controls skeletal muscles
gives Lat. horn cells → controls cardiac & smooth muscles

Post. Alar plate → gives post. horn cells → Spino Thalamic Tract [pain & temp]



Flaccidity
↓ Tone
↓ Reflex



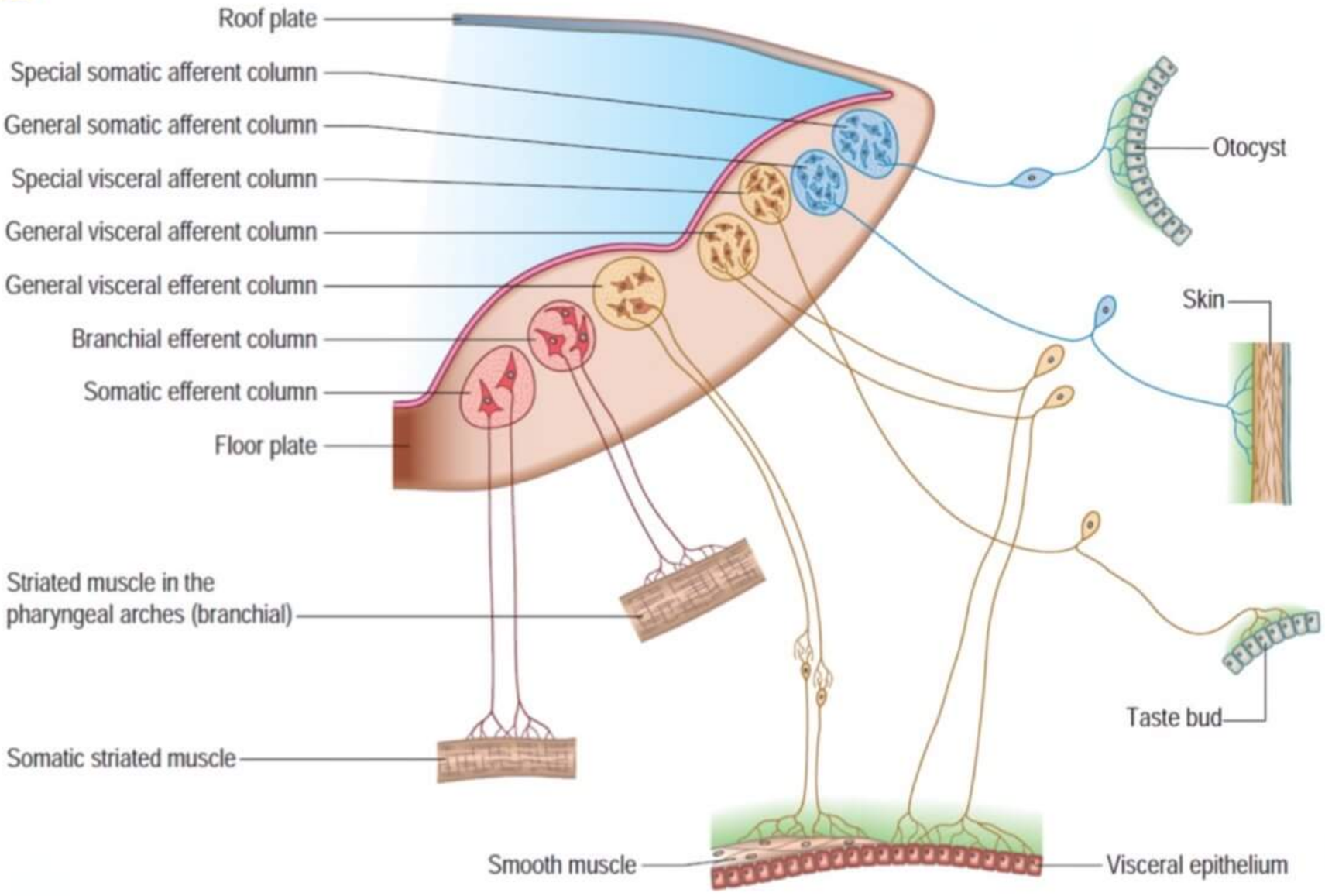
Polio

a. Flaccid paralysis
b. Muscle atrophy
c. Fasciculations
d. Areflexia
e. Common at lumbar levels

SEVEN NEURAL COLUMNS

③ MOTOR

④ SENSORY



3 MOTOR COLUMNS

1. GSE → most of skeletal muscles Except Pharyngeal arch Muscles
2. GVE → visceral muscles
3. SVE → Special visceral Efferent
   - S → Special
   - V → Visceral [Pharyngeal arch muscles]
   - E → Efferent

PHARYNGEAL ARCH MUSCLES → Misnomer

→ skeletal muscles

→ 1st pharyngeal arch gives → muscles of mastication
and pharyngeal arch gives → muscles of facial expression
3, 4, 6 pharyngeal arch gives → muscles of palate, pharynx & larynx [speech & swallowing]

→ develops around gut & respiratory tube

SENSORY COLUMNS

1. GSA
2. GVA
3. SSA → Special somatic Afferent
4. SVA → Special visceral Afferent

SPECIAL SOMATIC SENSATIONS [somatic ≅ Periphery]

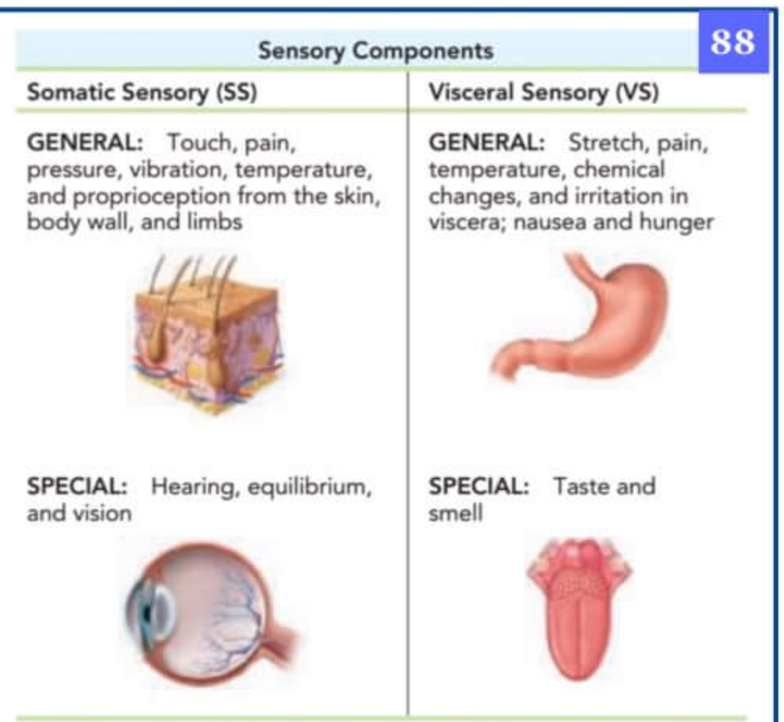
1. Vision [CN II] } Pure Sensory Nerves
2. Hearing & balance [CN VIII] }

SPECIAL VISCERAL SENSATIONS

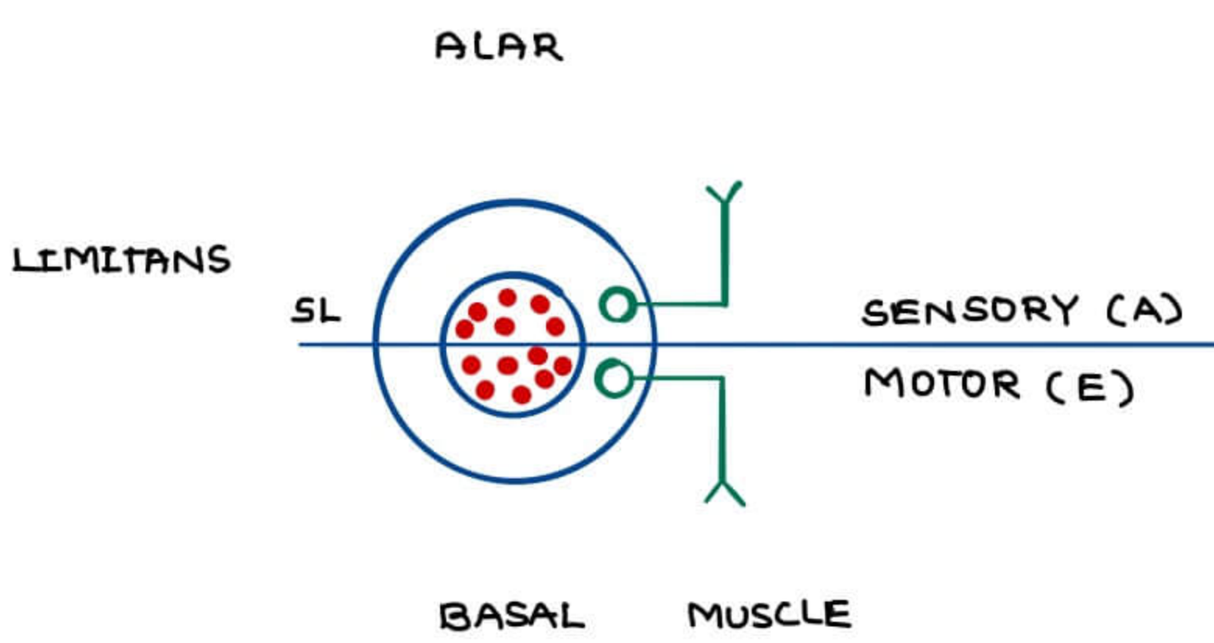
1 TASE
2 SMELL

→ misnomer
→ develops around gut tube & respiratory tube

→ Taste recieved by
- F → Facial Nerve
- G → Glossopharyngeal Nerve
- V → Vagus nerve



GSA : General category for peripheral sensations
GVA : General category for visceral sensations



GVE : General category for visceral muscles
GSE : General category for Peripheral muscles

Special Peripheral Sensations

- SSV → Smell & taste [FGV]
- SSA → CN2, CN8
- GSA → TPT etc
- GVA → Angina / colic
- GVE → cardiac / sm. [vagus]
- GSE → Most SK. Muscle
  - Eye ball : 3, 4, 6
  - Tongue : 12
- SVE → PAMs

Eye Ball & Tongue muscles do not develop in the pharyngeal arches

SKELETAL MUSCLES

GSE → most of Skeletal muscles
- Eyeball : 3, 4, 6
- Tongue : 12

SVE → PAMs
- Ist Arch → 5_3 → muscles of masticatⁿ
- IInd arch → 7 → muscles of facial expression
- 3,4,6 → 9 / 10 / 11 → muscles of palate, Pharynx, larynx [speech & Swallowing]

NA

5_3 → mandibular branch of Trigeminal nerve
NA → Nucleus ambiguis

→ Every Efferent column has a corresponding Afferent column
→ GSE → GSA
→ GSA carries
- → Skeletal Muscle spasm
- → Touch, Pain, Temp., proprioception

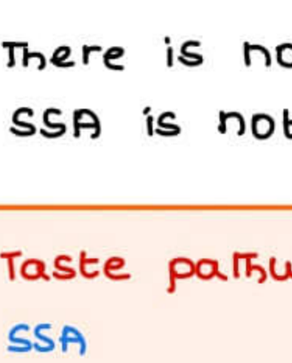
→ SVE → SVA

→ SSA → 2 & 8
SSV → Smell & Taste [FGV]

There is no counterpart for SSA in the body
SSA is not paired

Q Taste pathway comes under the neural column
a SSA
b GSA
c SVA
d GVA

SVA - T [NTS]
SVA - Taste [Nucleus Tractus Solitarius]



NUCLEUS TRACTUS SOLITARIUS
→ Angina, colic, BP, chemoreceptⁿ [PH] [GVA]
→ Tip Taste [SVA]

carotid sinus ← BP
carotid body ← Chemoreceptⁿ
PH
CO_2

Q All of the following cranial nerves contains somatic efferents EXCEPT

a VII Nerve
b III Nerve
c IV Nerve
d VI Nerve

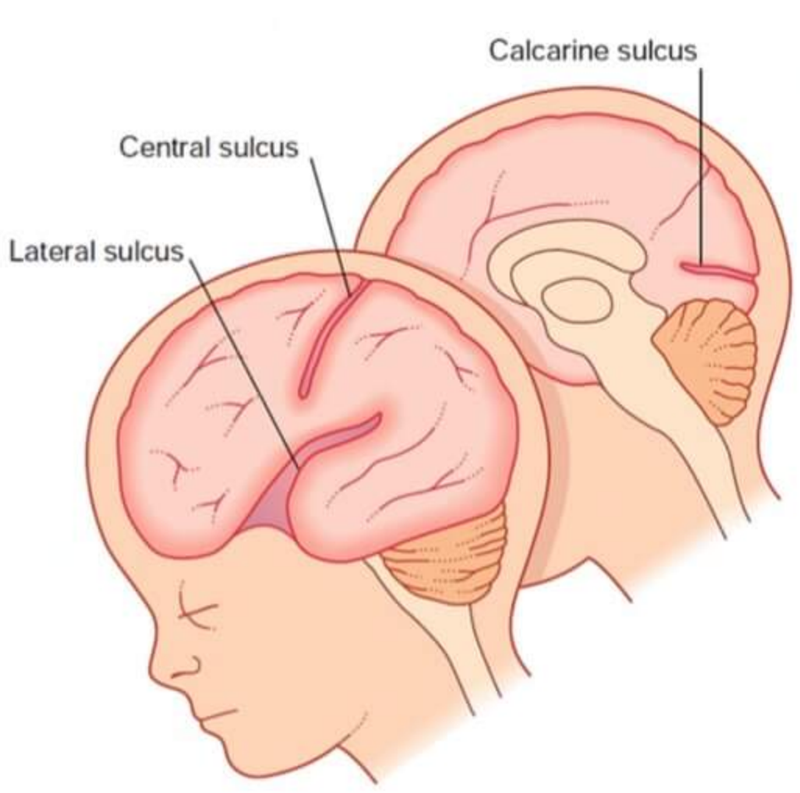
CEREBRUM

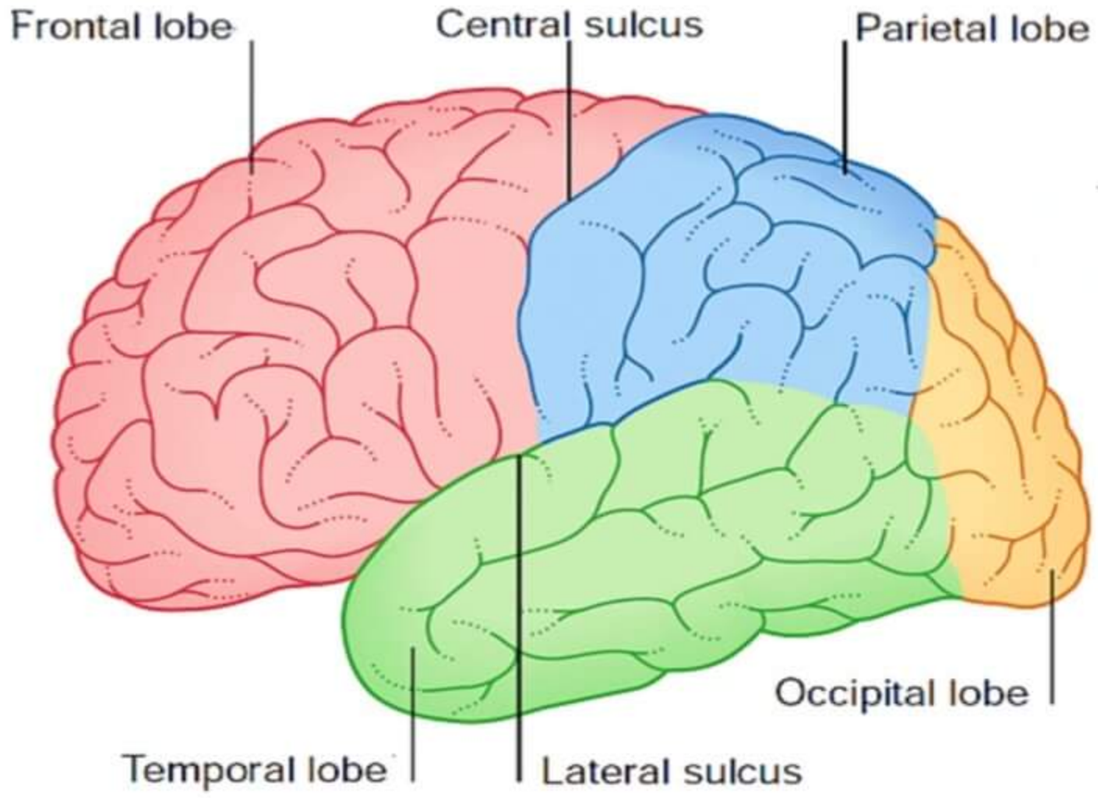
Q While doing surgery for meningioma on cerebral hemisphere, there occurred injury to left paracentral lobule, it will lead to paresis of

a Left face
b Right neck & scapular region
c Right leg & perineum
d Right shoulder & trunk

Para central Lobule → controls Lower Limb on C/L side & part of pelvis & perineum

SULCI & LOBES





LATERAL VIEW

LOBES OF CEREBRUM

Frontal lobe
Temporal lobe
parietal lobe
Occipital lobe

SULCI OF CEREBRUM

→ Sulci increases the surface area of cerebrum
→ Lateral sulcus, central sulcus } on lateral surface

→ Calcarine sulcus → on medial surface
→ occipital visual cortex present here

CEREBRUM - LATERAL VIEW

CENTRAL SULCUS

→ runs antero inferiorly

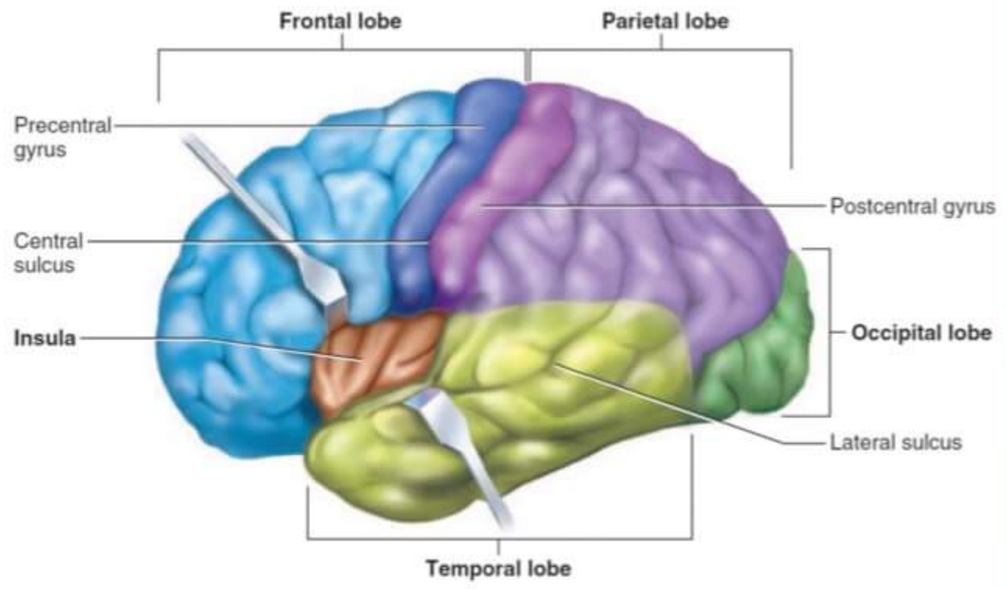
→ Separates frontal lobe in front, parietal lobe posteriorly

LATERAL SULCUS

→ Separates temporal lobe inferiorly from frontal & parietal lobes

IMAGINARY LINE → Separating occipital lobe posteriorly

started at parieto occipital sulcus



PRE CENTRAL GYRUS

→ frontal motor cortex → controls skeletal muscles of body

→ present infront of central sulcus

POST CENTRAL GYRUS

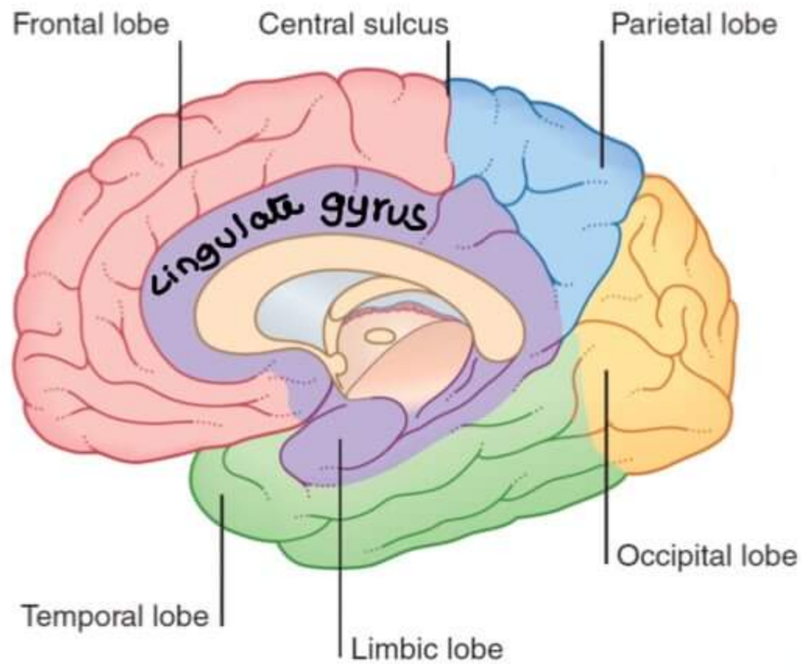
→ present behind the central sulcus

→ PARIETAL SENSORY CORTEX

→ recieves General Sensations

- touch, pain, temperature, proprioceptⁿ

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

HOMUNCULUS

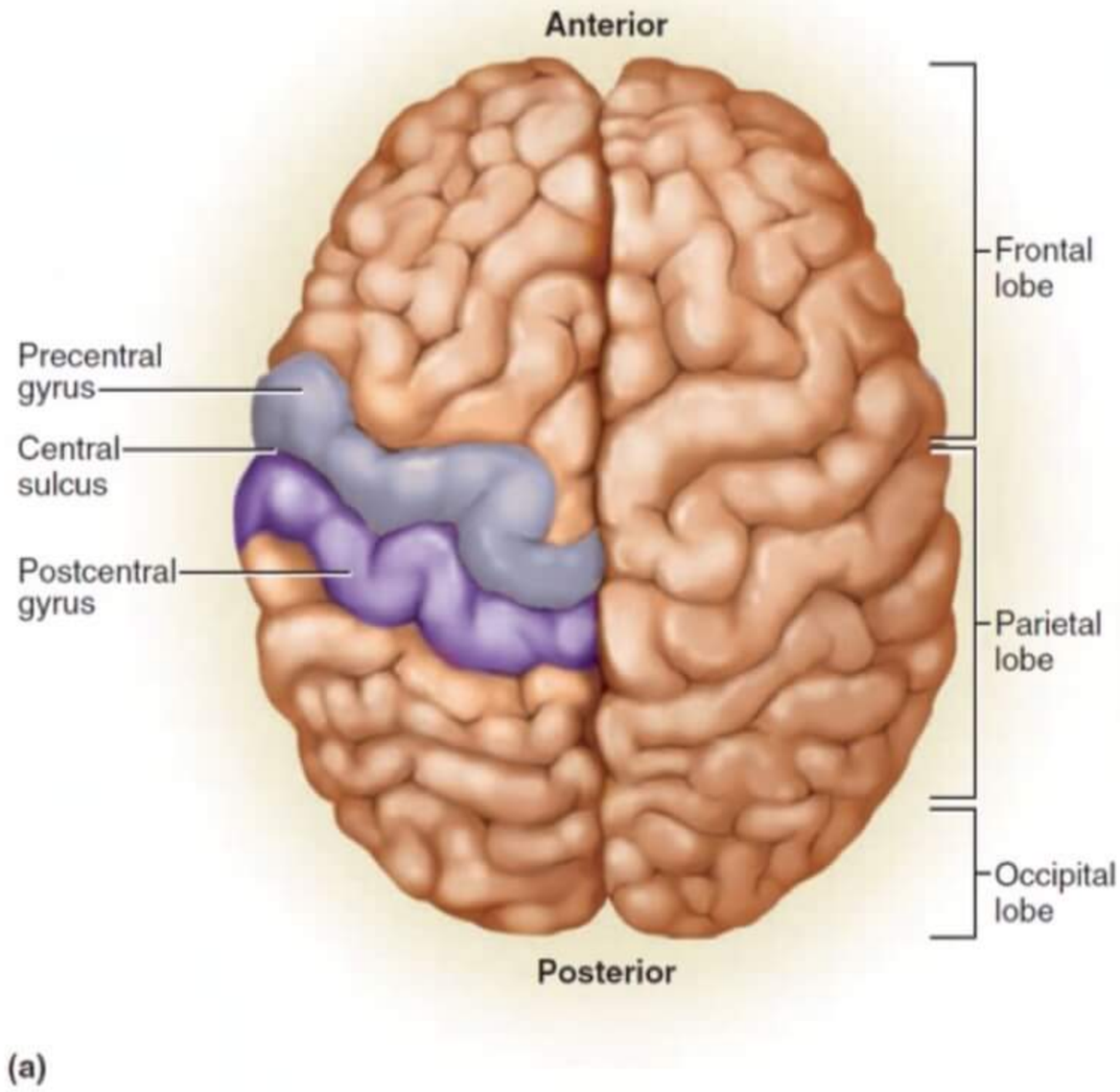
→ Representatⁿ of body on cerebrum

→ upside down

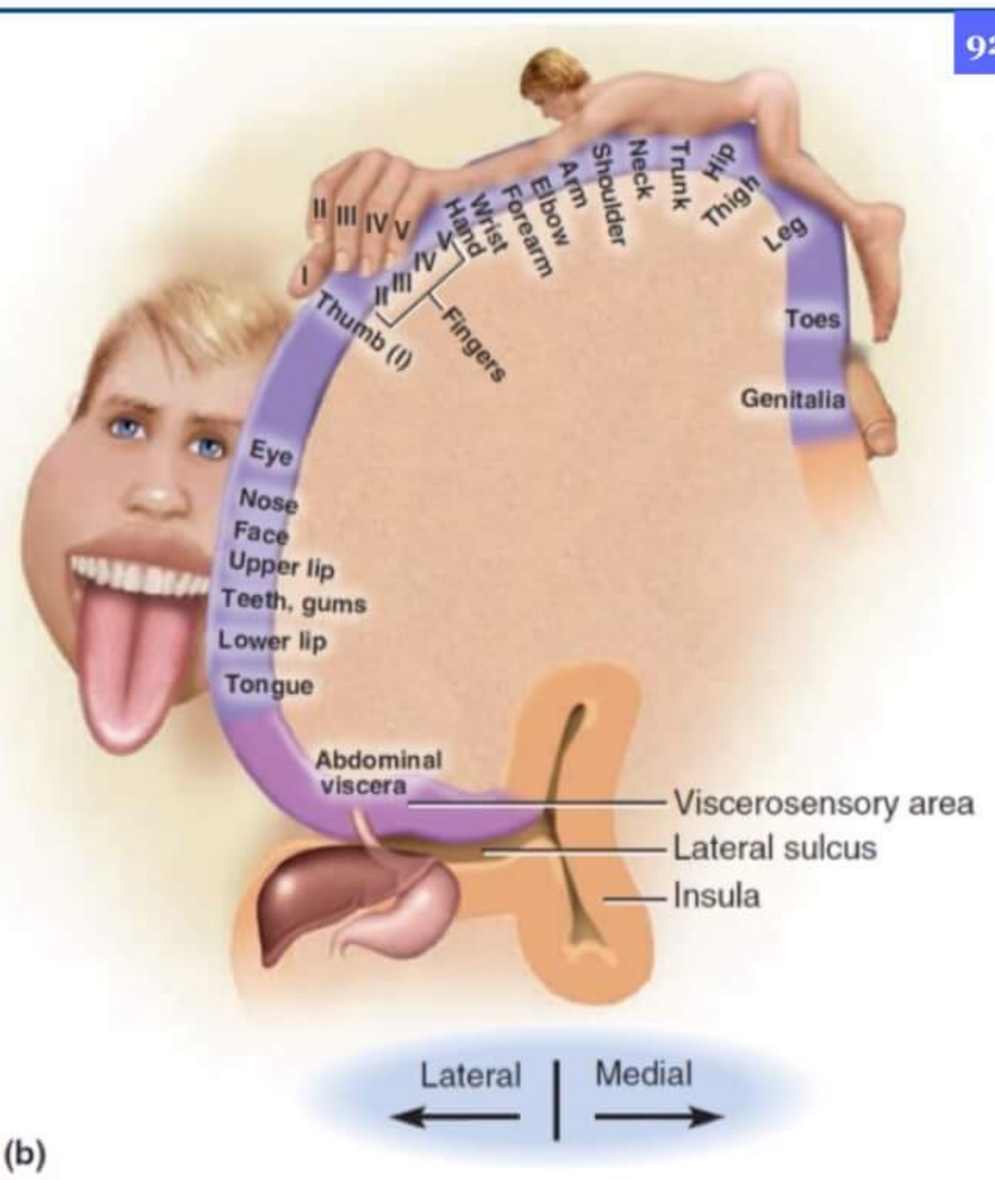
→ in a oblique fashion [along the central sulcus]

→ both motor & sensory

→ Hand & face has more representation



(a)



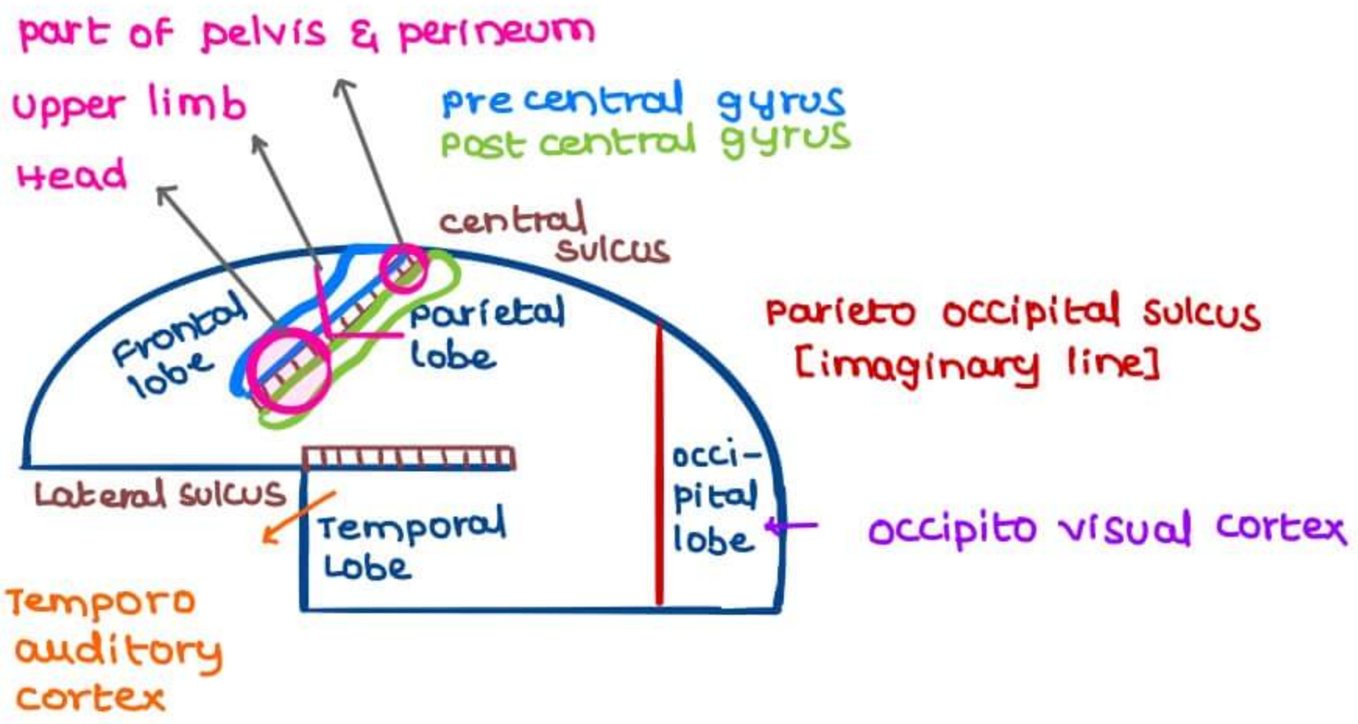
(b)

SUPERIOR VIEW

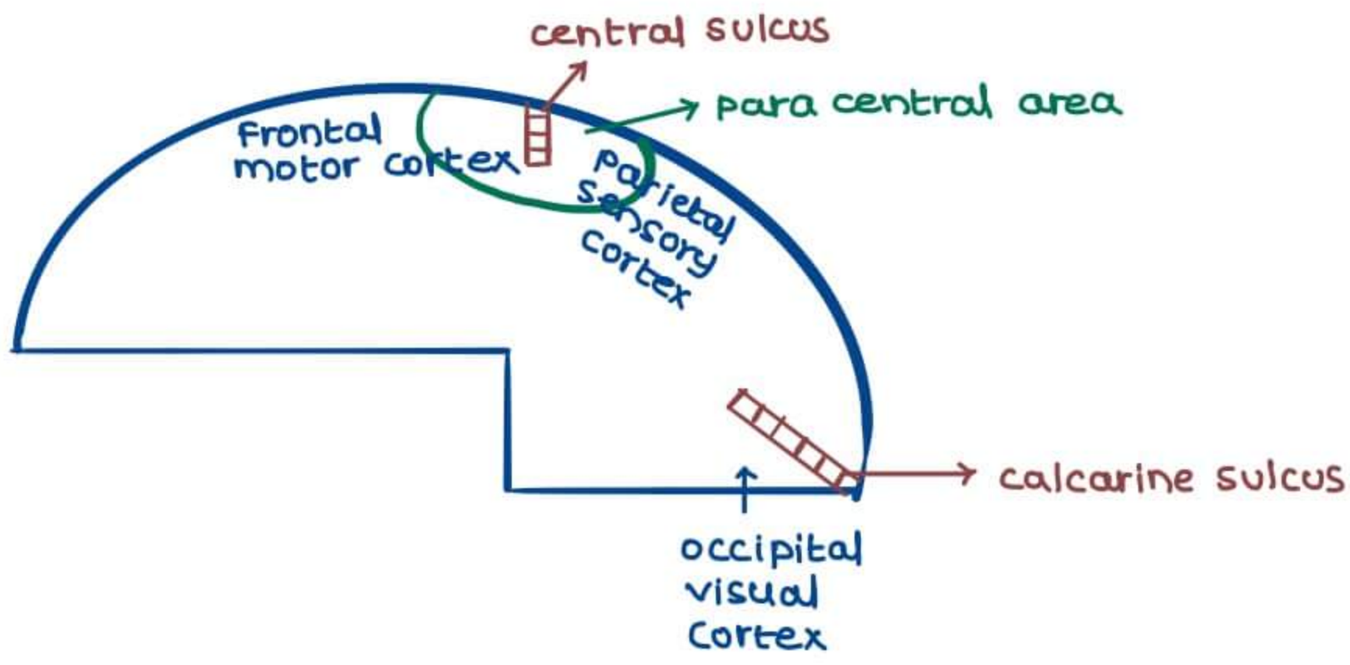
CORONAL SECTION

Lower & Lateral → Face area
Higher → upper limb area
still higher → Pelvis perineum area
on medial surface → Lower limb area, part of pelvis & perineum

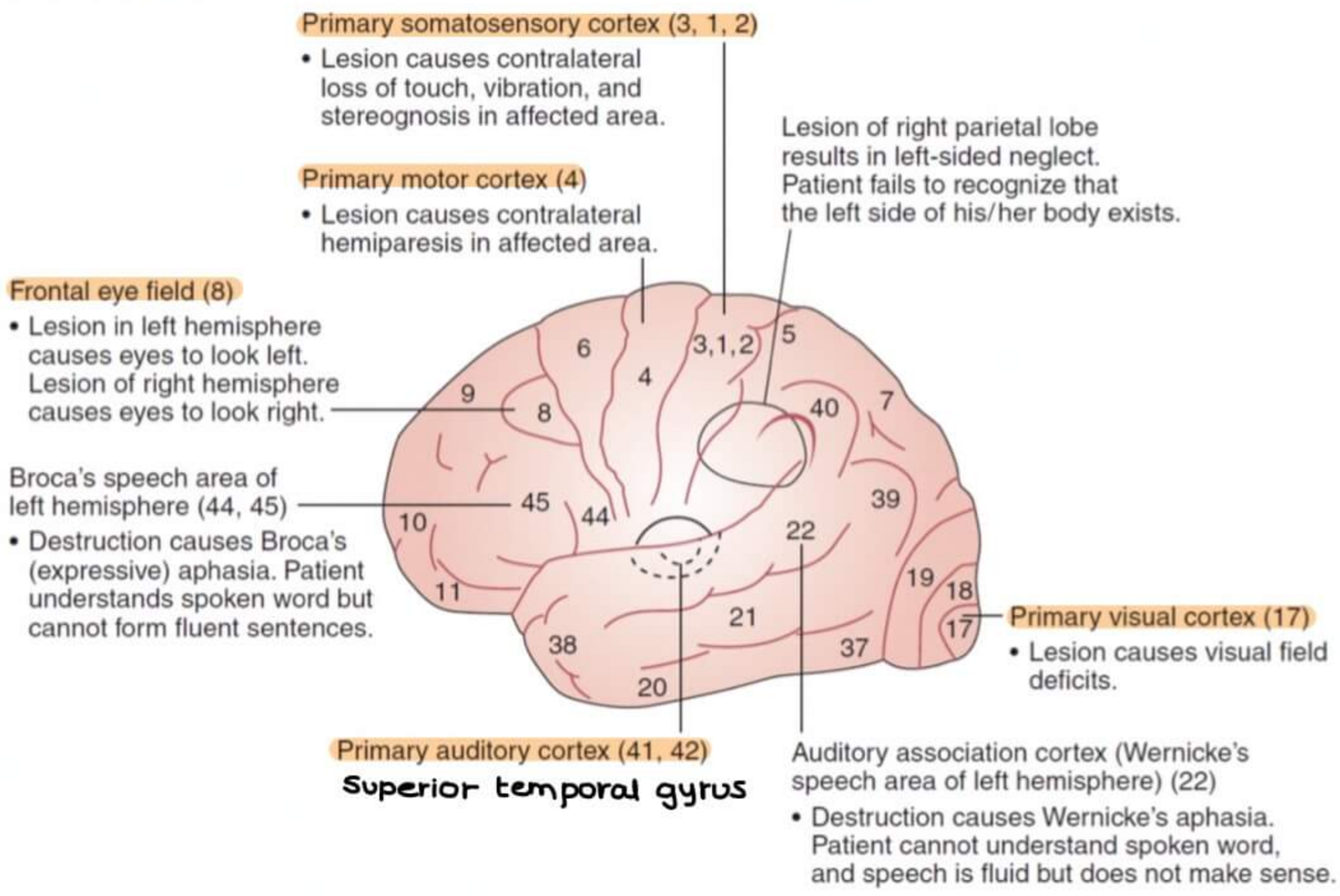
CEREBRUM (Lateral view) : HOMUNCULUS



CEREBRUM (MEDIAL VIEW) : HOMUNCULUS

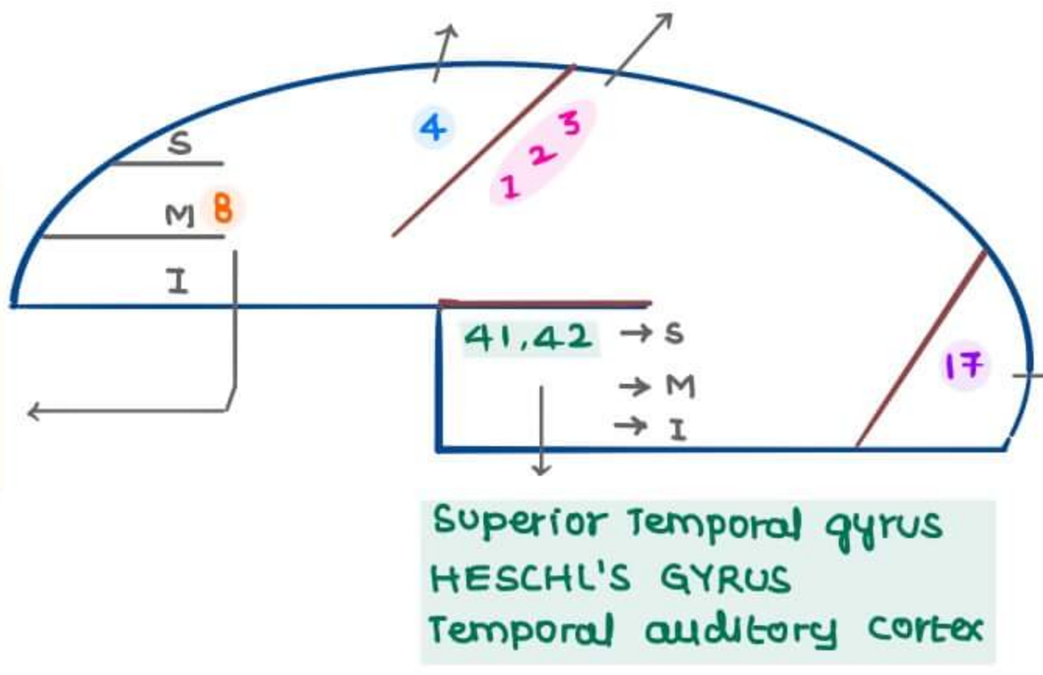


CEREBRUM : BRODMANN NUMBERS



PRE CENTRAL GYRUS
Frontal motor cortex
Controls Sk. muscles

POST. CENTRAL GYRUS
Parietal sensory cortex
General sensations



- FRONTAL EYE FIELD
- Middle frontal gyrus
- Med. Rectus ↔ Lateral rectus works together for horizontal gaze

Superior Temporal gyrus
HESCHL'S GYRUS
Temporal auditory cortex

FRONTAL EYE FIELD [8]

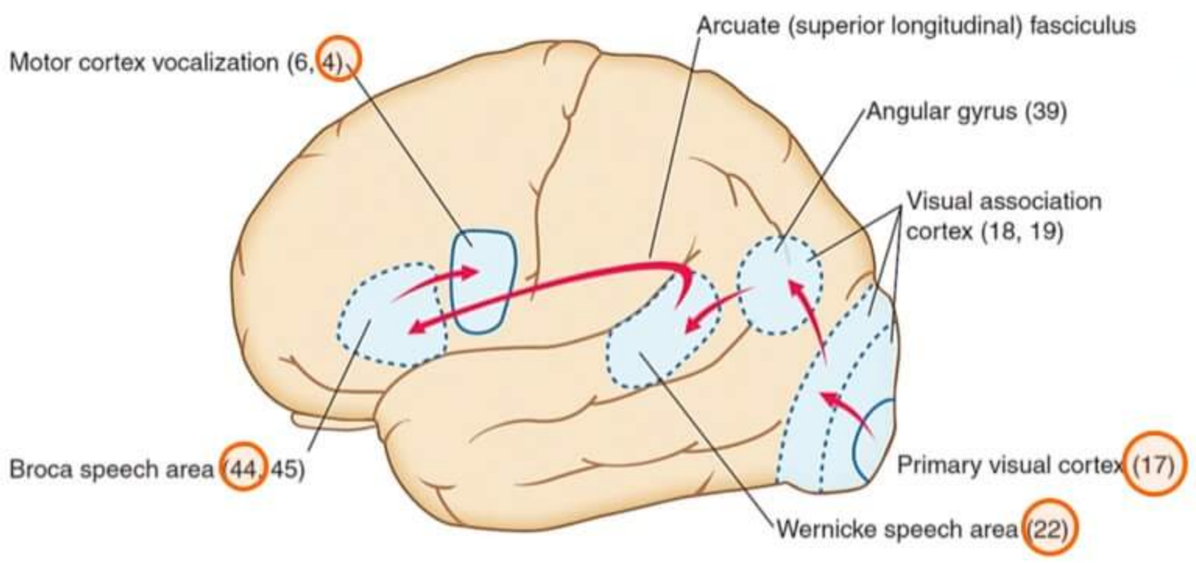
→ controls C/L horizontal gaze

→ lesion results in inability of voluntary horizontal movement on C/L side

→ causes diplopia & nystagmus

CEREBRUM : LANGUAGE AREAS

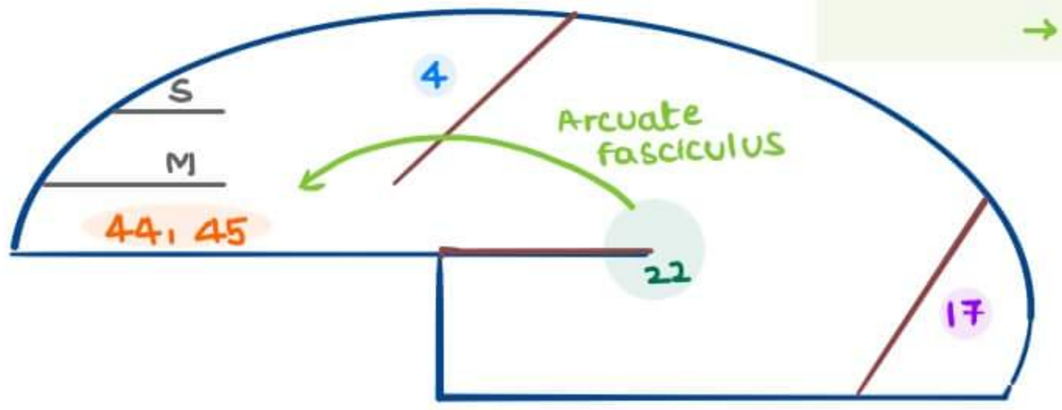
TASK → Read the word 'ANATOMY' aloud



1. PRIMARY VISUAL CORTEX [17] activated to look at the word
2. WERNICKE SPEECH AREA [22] is activated to understand the word
3. BROCA'S SPEECH AREA [44] is activated to plan the speech muscles
4. MOTOR CORTEX VOCALIZAT^{n} [4] is activated to move the muscles

⑤
- Frontal motor cortex
- moves the speech muscles

③
- Arcuate fasciculus
- Arc shaped bundle of axons
- Lesion → conductive aphasia
  → poor naming
  → poor repetition



④
- Inf. frontal Gyrus
- Broca's motor speech area
- plans the speech muscle movement
- maintains fluency of language
- lesion → Broca's aphasia
  - pt. is MUM

①
occipital visual cortex activated

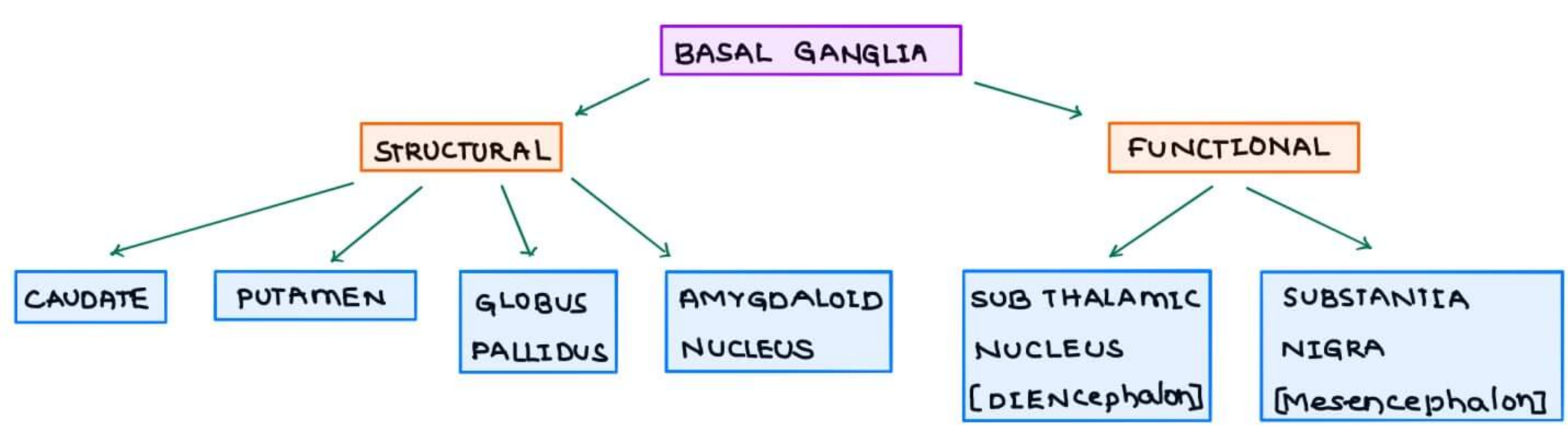
②
- Wernicke's speech area activated
  - comprehensn of lawnguage
- on sup. temporal gyrus [more posteriorly]
- lesion → sensory aphasia
  dlt loss of insight

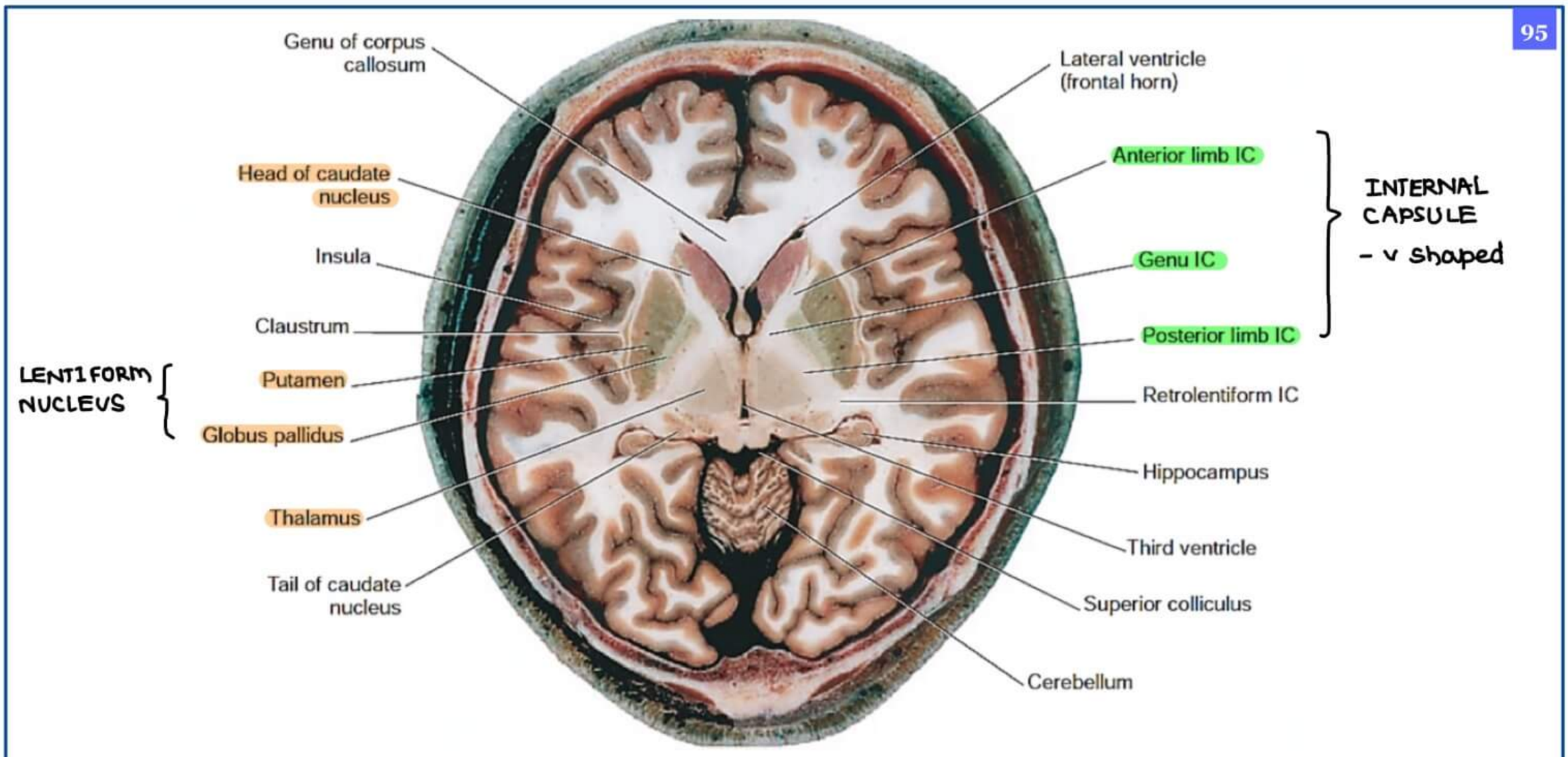
TYPE	SPEECH FLUENCY	COMPREHENSION	COMMENTS
Repetition impaired			
Broca (expressive)	Nonfluent	Intact	Broca = Broken Boca (*boca* = mouth in Spanish). Broca area in inferior frontal gyrus of frontal lobe. Patient appears frustrated, insight intact.
Wernicke (receptive)	Fluent	Impaired	Wernicke is Wordy 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 fasciculus; Broca and Wernicke areas affected (all areas).

BASAL GANGLIA

→ Misnomer
→ Part of Teloencephalon
→ NUCLEI

STRUCTURAL NUCLEI → Nuclei present in Telencephalon
FUNCTIONAL NUCLEI → Nuclei present in Diencephalon, Mesencephalon & have functional relation



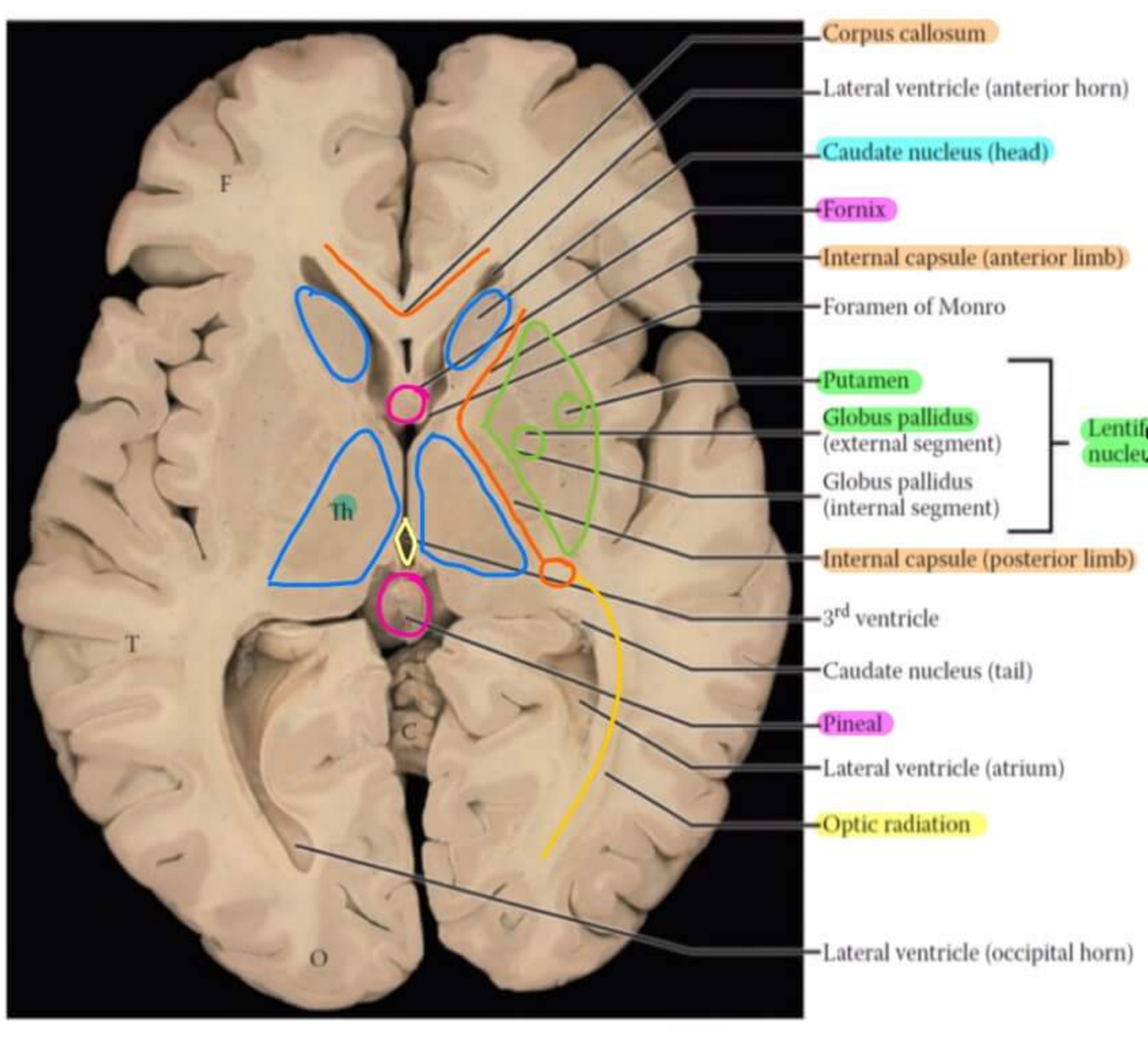


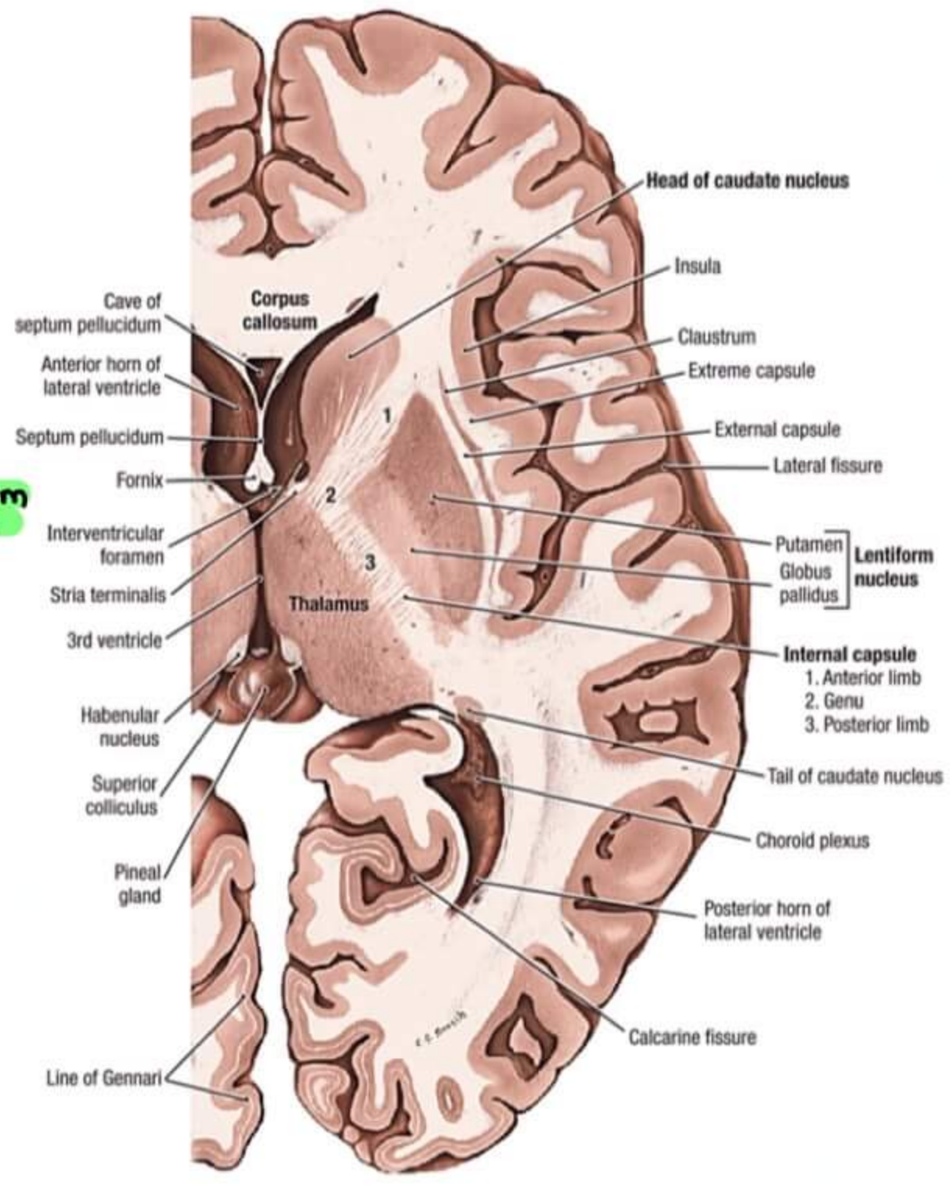
TRANSVERSE SECTION - SUPERIOR VIEW

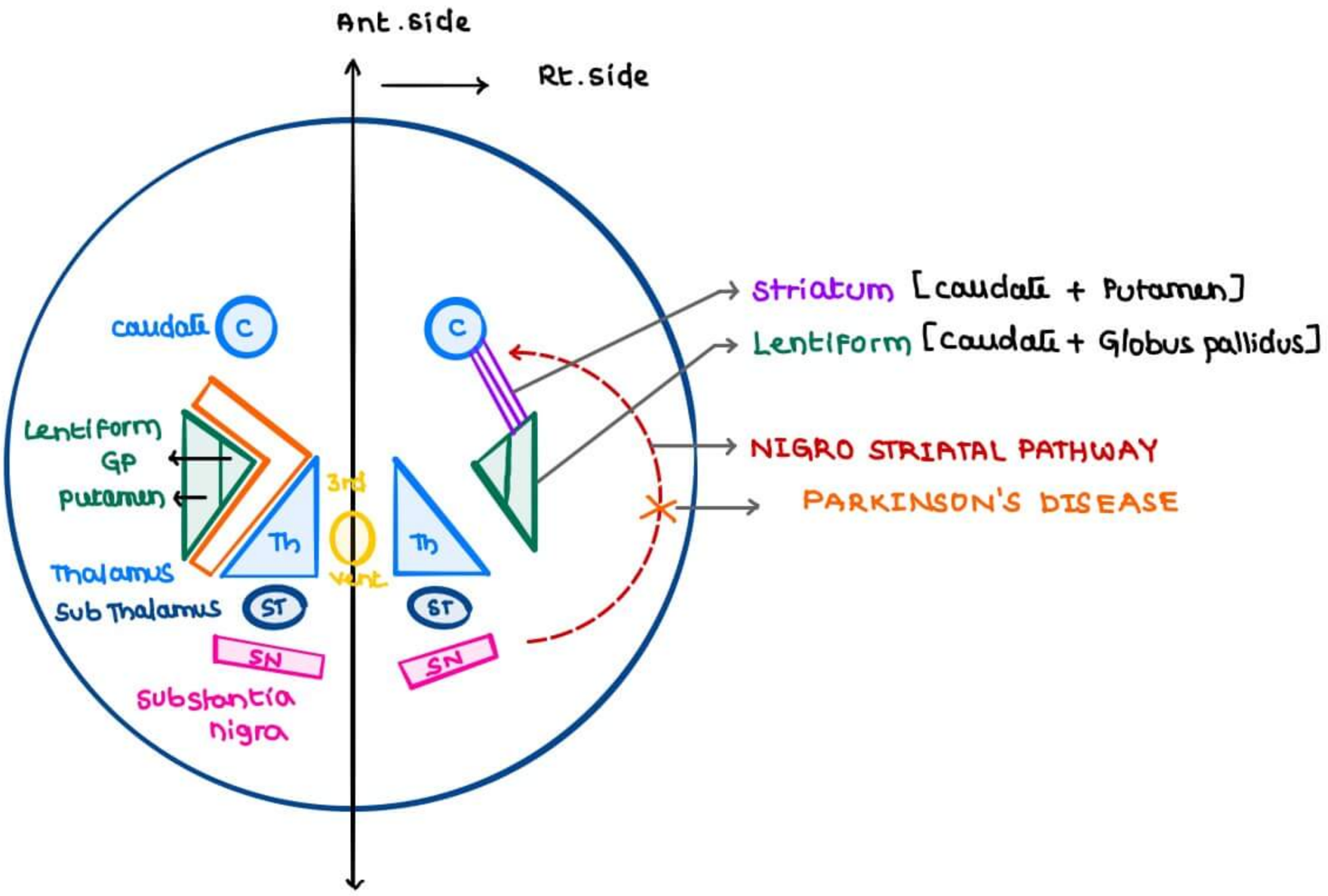
Internal capsule

→ Anterior Limb sandwiched b/w → Lentiform [Lateral] & Caudate [medial]

→ Posterior Limb sandwiched b/w → Lentiform [Lateral] & Thalamus [medial]







SUBSTANTIA NIGRA

→ dark colored dlt melanin

→ produce Dopamine [Neuro transmitter] for NIGRO STRIATAL PATHWAY

→ PARKINSON'S DISEASE

→ ↓ Dopamine

→ Nigro striatal pathway compromised

→ relative ↑ Ach

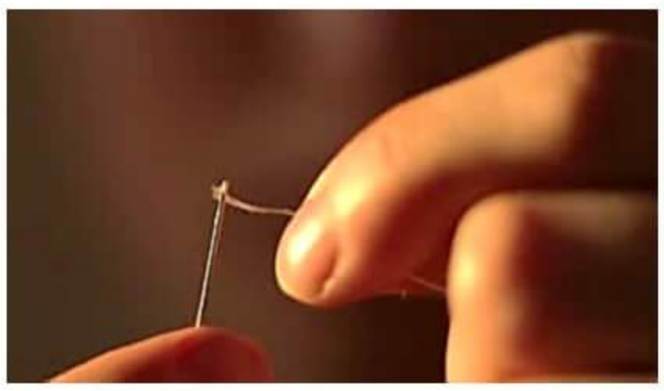
→ C/F

→ Pill rolling Tremor
Cog-wheel or lead pipe rigidity
hypokinesia

→ Rx

1 L DOPA

2 TRIHEXYPHENIDYL [anti cholinergic]



BASAL GANGLIA — FUNCTIONS

1 Planning & Programming of voluntary motor activity [Extra Pyramidal system]

→ [voluntary motor activity done by Pyramidal system]

→ EXTRA PYRAMIDAL SYMPTOMS

→ Tremors (purposeless involuntary movements)

→ Chorea

→ Athetosis

→ Ballismus

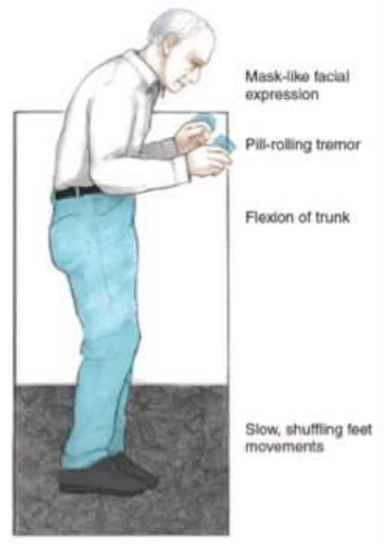
→ Hemi Ballismus — seen in lesion of Subthalamic nucleus
— purposeless involuntary movements

→ ∋n WILSON'S DISEASE — lesion of Lentiform nucleus
— purposeless involuntary movements +nt

PYRAMIDAL SYSTEM → controls fine & skilled voluntary motor activity

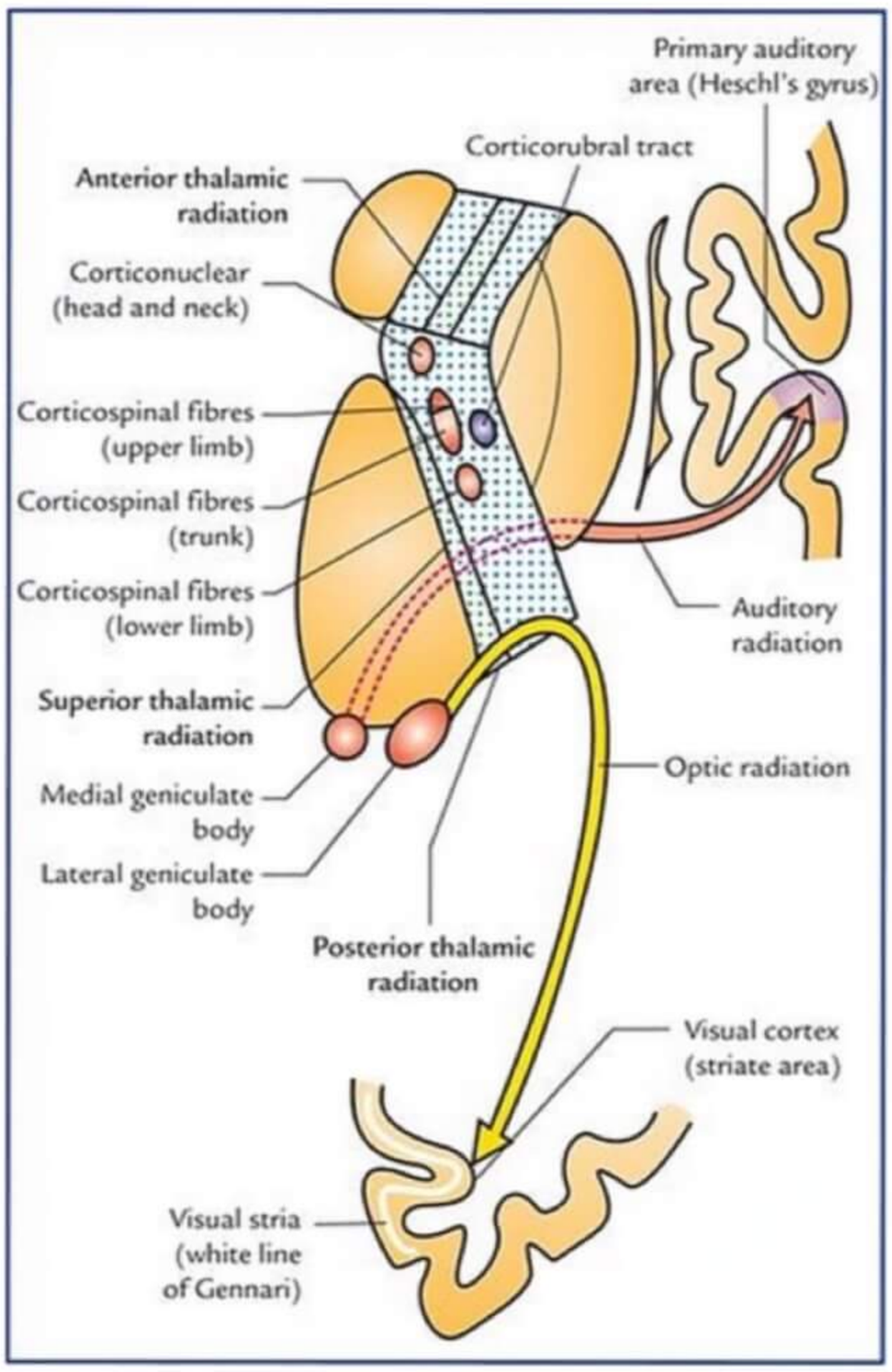
PARKISON'S DISEASE FEATURES

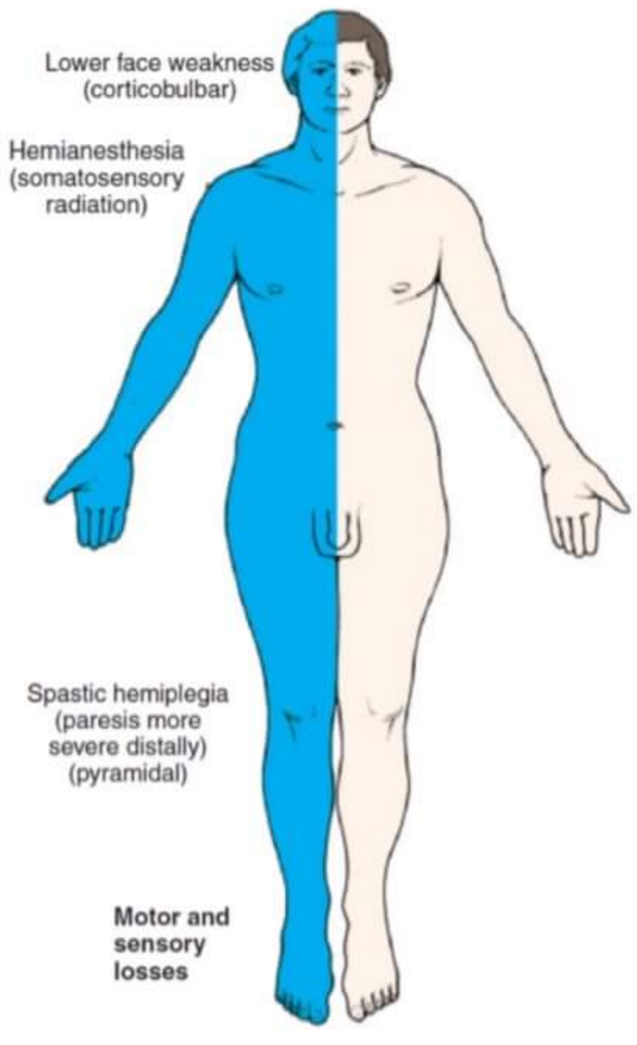
1 Mask like facial expression
2 Slow & Shuffling gait → difficulty in starting & stopping movements
3 Pill rolling tremor
4 Cog Wheel rigidity
5 Lead pipe rigidity

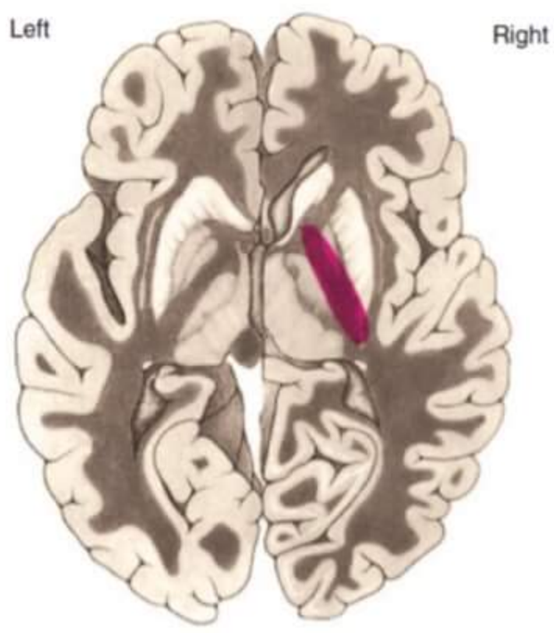


INTERNAL CAPSULE

Q Relations of Internal capsule are
a Thalamus medially, caudate & lentiform nuclei laterally
b Thalamus laterally, caudate & lentiform nuclei medially
c Thalamus & caudate nucleus medially & lentiform nucleus laterally
d Thalamus & caudate nucleus laterally & lentiform nucleus medially







corticonuclear tract → passing through Genu of IC
→ controls head & neck fibres

corticospinal tract → passing through posterior limb of IC
→ controls Upper limb, trunk & Lower Limb fibres

LESIONS of Internal capsule on one side involves C/L side of the body
Only post. limb involved → UL, Trunk & LL of C/L side involved
face area spared

only Genu involved → Body spared

META THALAMUS

MEDIAL GENICULATE BODY → concerns ī auditory pathway [MUSIC]
LATERAL GENICULATE BODY → concerns ī visual pathway [LIGHT]

MEDIAL GENICULATE / AUDITORY PATHWAY

→ Fibres pass through IC & reach HESCHL'S GYRUS [Sup. Temp. 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 / Striata cortex [17]
  - STRIATE CORTEX - striations of Gennari + nt.

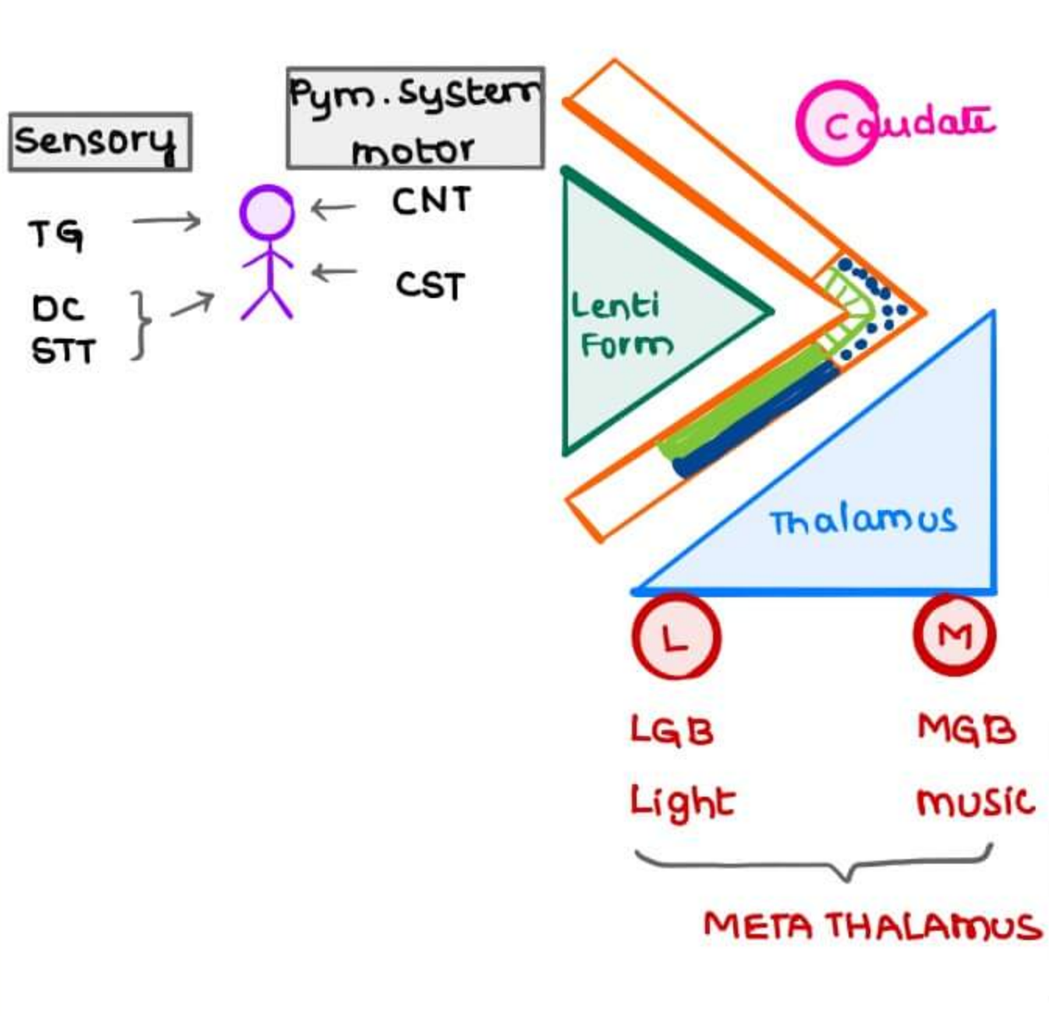
→ aka GENICULO CALCARINE TRACT [starts from LGB & reaches calcarine sulcus]
→ Retro lentiform fibres are involved
→ in post. part of IC

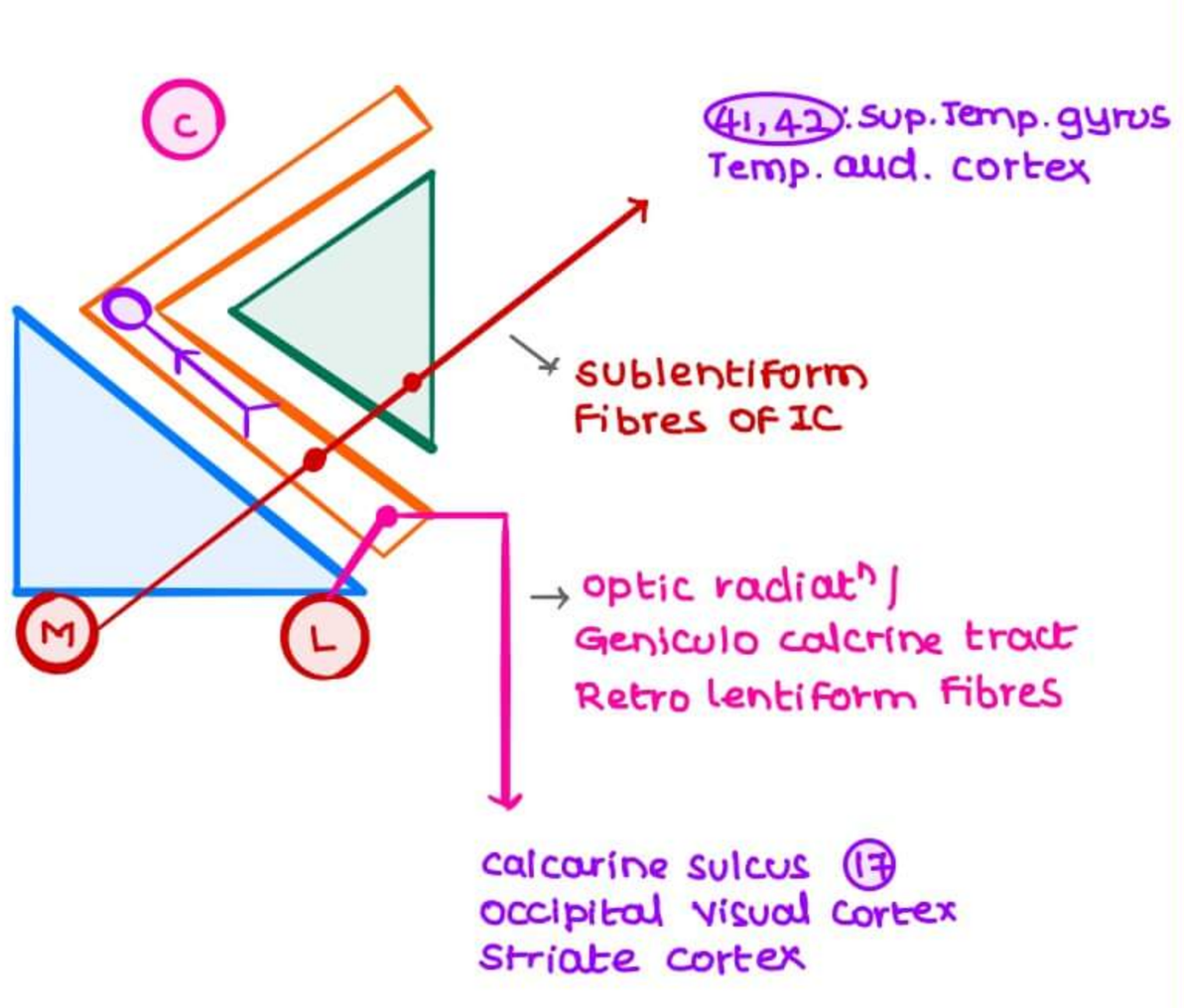
ANTERIOR CHOROIDAL ARTERY

→ Branch of Internal carotid artery
→ supplies posterior limb of IC
→ Block leads to ANTEROIDAL ARTERY SYNDROME
  → Homonimous hemianopia
  → Sensory motor loss on UL, trunk, & LL
    [face spared as Genu supplied by Direct branch of Int. carotid Artery]
  → Auditory problems + nt

Q Regarding Anterior choroidal Artery syndrome, all are true EXCEPT
a Hemiparesis
b Hemi sensory loss
c predominant involvement of ant. limb of internal capsule
d Homonymous hemianopia

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





Internal capsule

→ Anterior Limb sandwiched b/w → Lentiform [Lateral] & caudate [medial]
→ Posterior Limb sandwiched b/w → Lentiform [Lateral] & Thalamus [medial]

PYRAMIDAL SYSTEM [MOTOR]

CORTICO NUCLEAR TRACT → present in lateral part of genu
→ controls face fibres

CORTICO SPINAL TRACT → present in lateral part of post. limb
control UL, Trunk & LL fibres

SENSORY SYSTEM

TRIGEMINAL NUCLEUS → present in medial part of genu
control face fibres

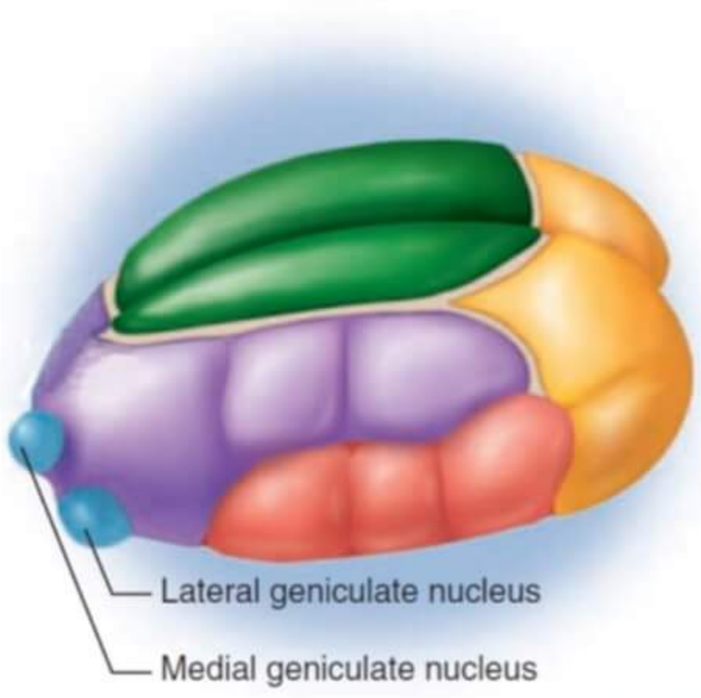
Dorsal Cortical Tract } present in medial part of posterior limb
Spino thalamic Tract } control UL, Trunk & LL fibres

Q Which of the following fibres DON'T pass through the posterior limb of IC
a Sublentiform
b Retrolentiform
c Corticonuclear
d dorsal column

THALAMUS & HYPOTHALAMUS

Both belongs to Diencephalon

THALAMUS → RELAY CENTRE



(a) Thalamus

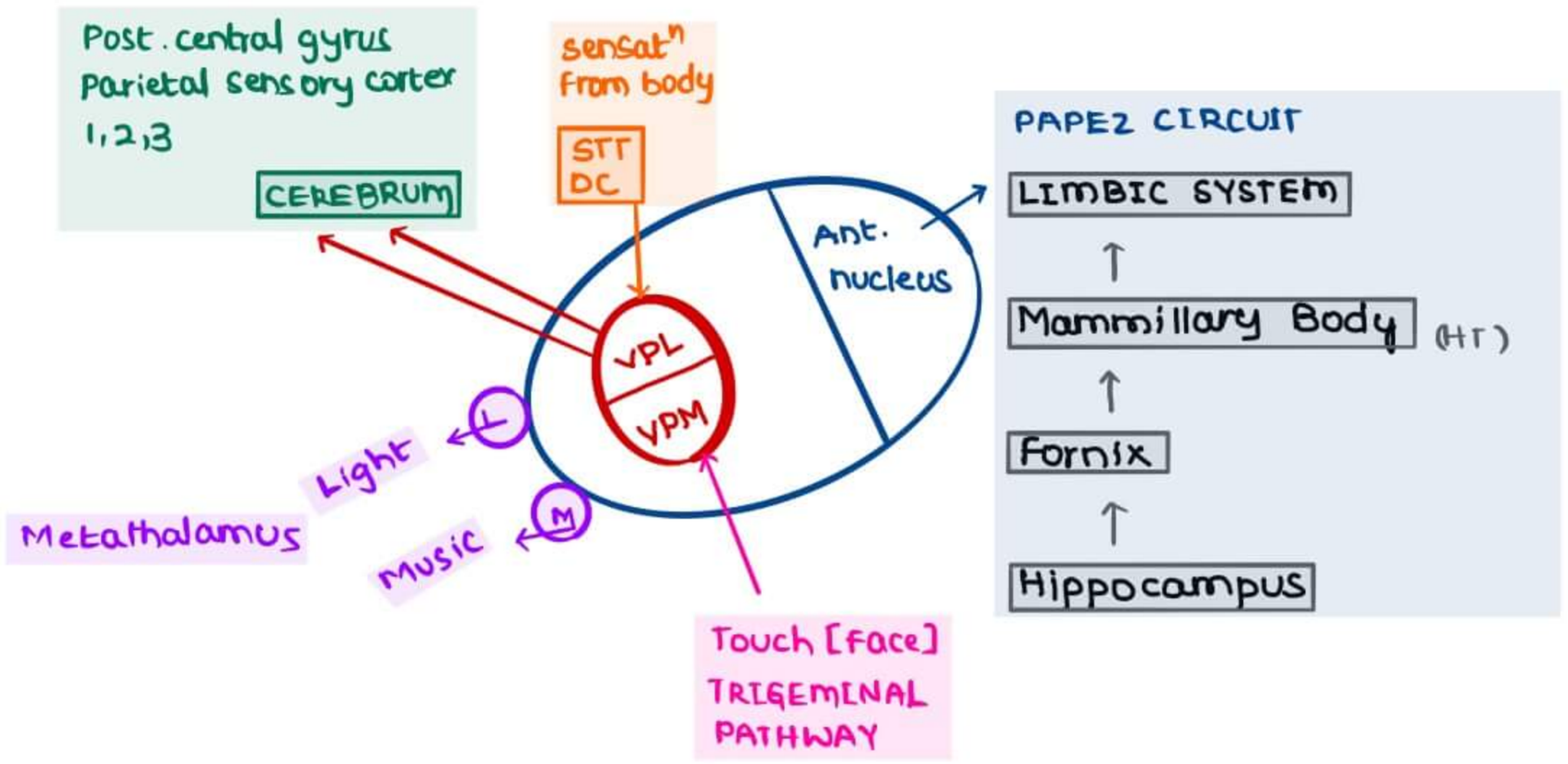
Thalamic nuclei	
Anterior group	Part of limbic system; memory and emotion
Medial group	Emotional output to prefrontal cortex; awareness of emotions
Ventral group	Somatosensory output to postcentral gyrus; signals from cerebellum and basal nuclei to motor areas of cortex
Lateral group	Somatosensory output 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)

VENTRAL GROUP

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

VPM NUCLEUS

→ Recieves Spino thalamic tract & Dorsal column [brings touch sensation from upper limb and Lower Limb] & projects to post central gyrus



HYPOTHALAMUS

VMS [Ventro Medial SATIETY] CENTRE

- → Satiety centre
- → destructn → Obesity

LATERAL NUCLEUS

- → Hunger centre
- → Destructn → starvatn

ANTERIOR NUCLEUS

- → Thermal regulatn [Dissipatn of Heat]
- → Stimulatn of Parasympathetic system
  - → vasodilatn in periphery

POSTERIOR NUCLEUS

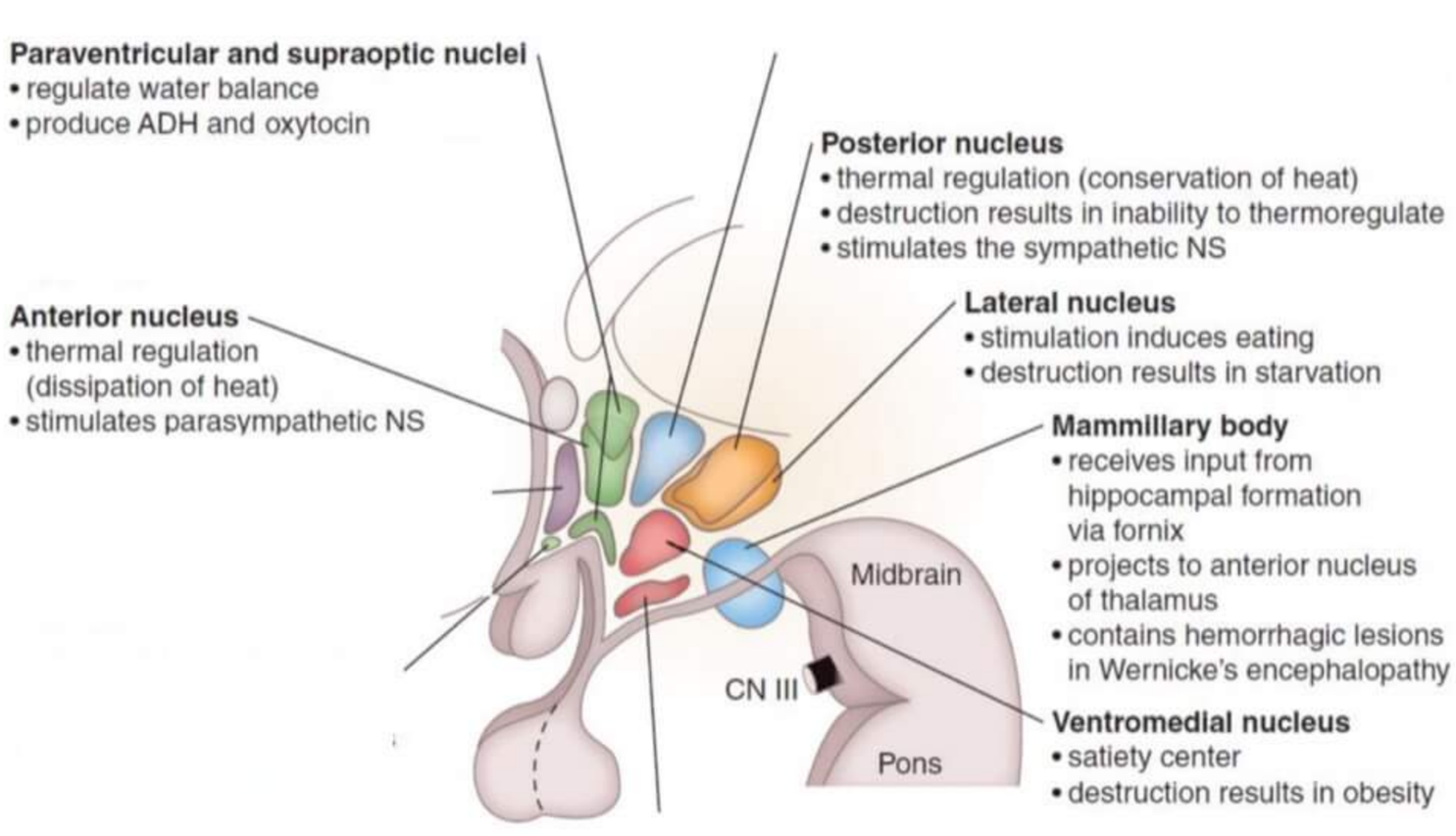
- → Thermal regulatn [conservatn of heat]
- → Stimuatn of Sympathetic Nervous system
  - → vasoconstrictn in periphery

PARAVENTRICULAR & SUPRAOPTIC NUCLEI

- → Regulates water balance
- → produce ADH & Oxytocin

MAMMILLARY BODY

- → present in floor of 3rd ventricles
- → part of PAPEZ CIRCUIT
- → recieves input from hippocampus via fornix
- → projects to ant. nucleus of thalamus
- → contains haemorrhagic lesions in WERNICKE'S ENCEPHALOPATHY

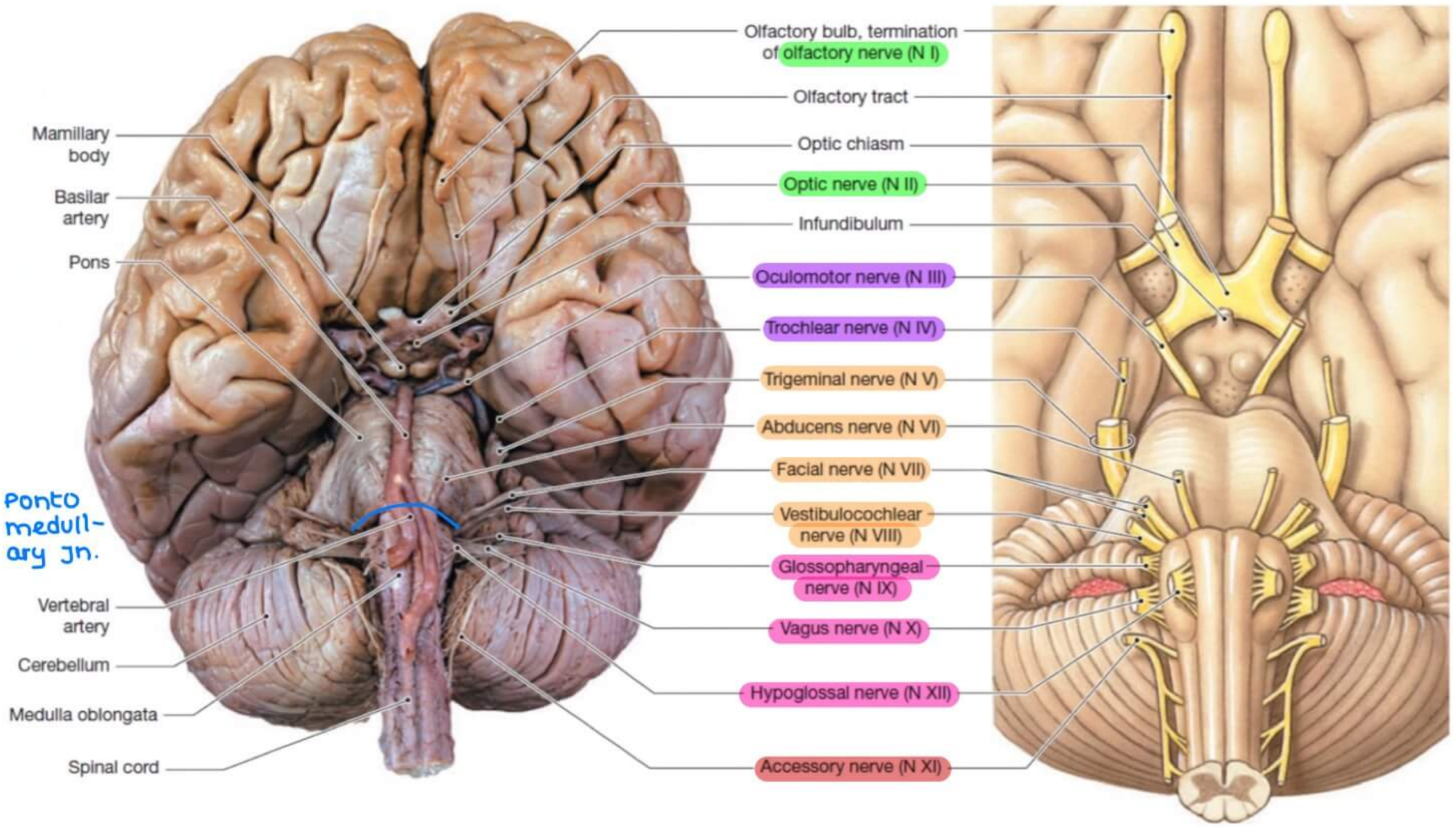


CRANIAL NERVES

→ 12 pairs

→ 1, 2 → come from fore brain

3-12 → come from Brain Stem → Mid Brain, Pons, Medulla



INFERIOR VIEW [BASE]

Thickest → TRIGEMINAL NERVE (V)

CN I, II → comes from Fore Brain

CN III, IV → comes from Mid Brain

CN V → comes from Pons

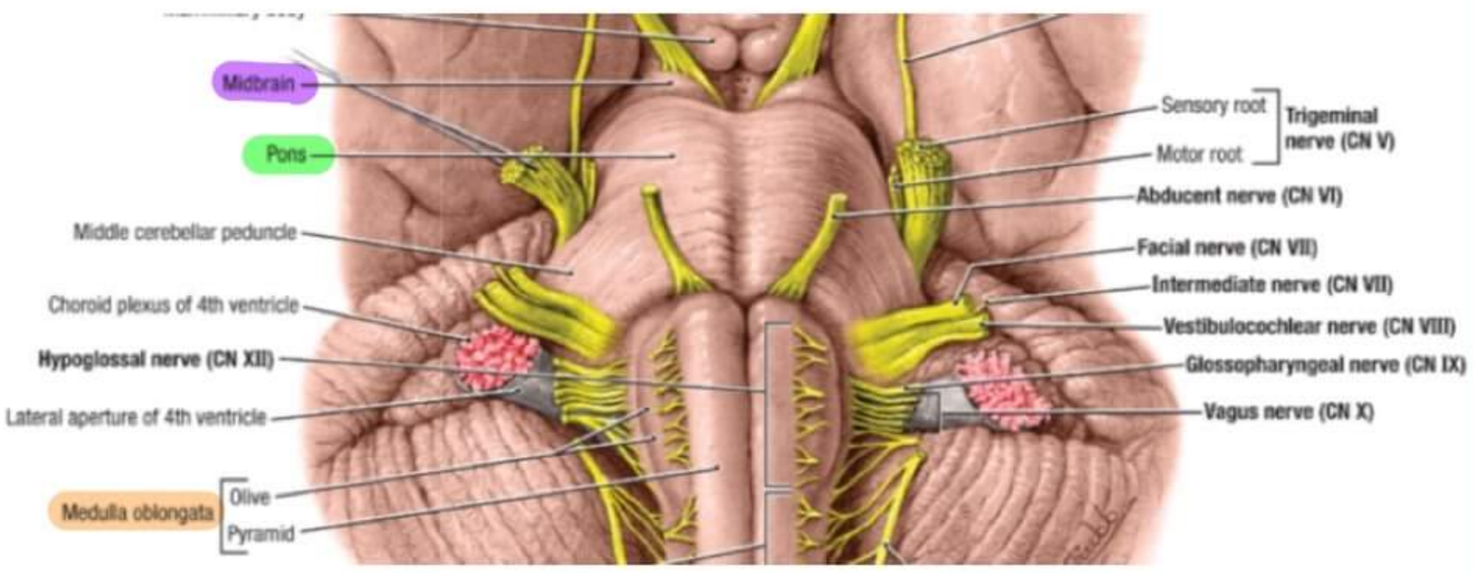
CN VI, CN VII, CN VIII → comes from Ponto medullary junction

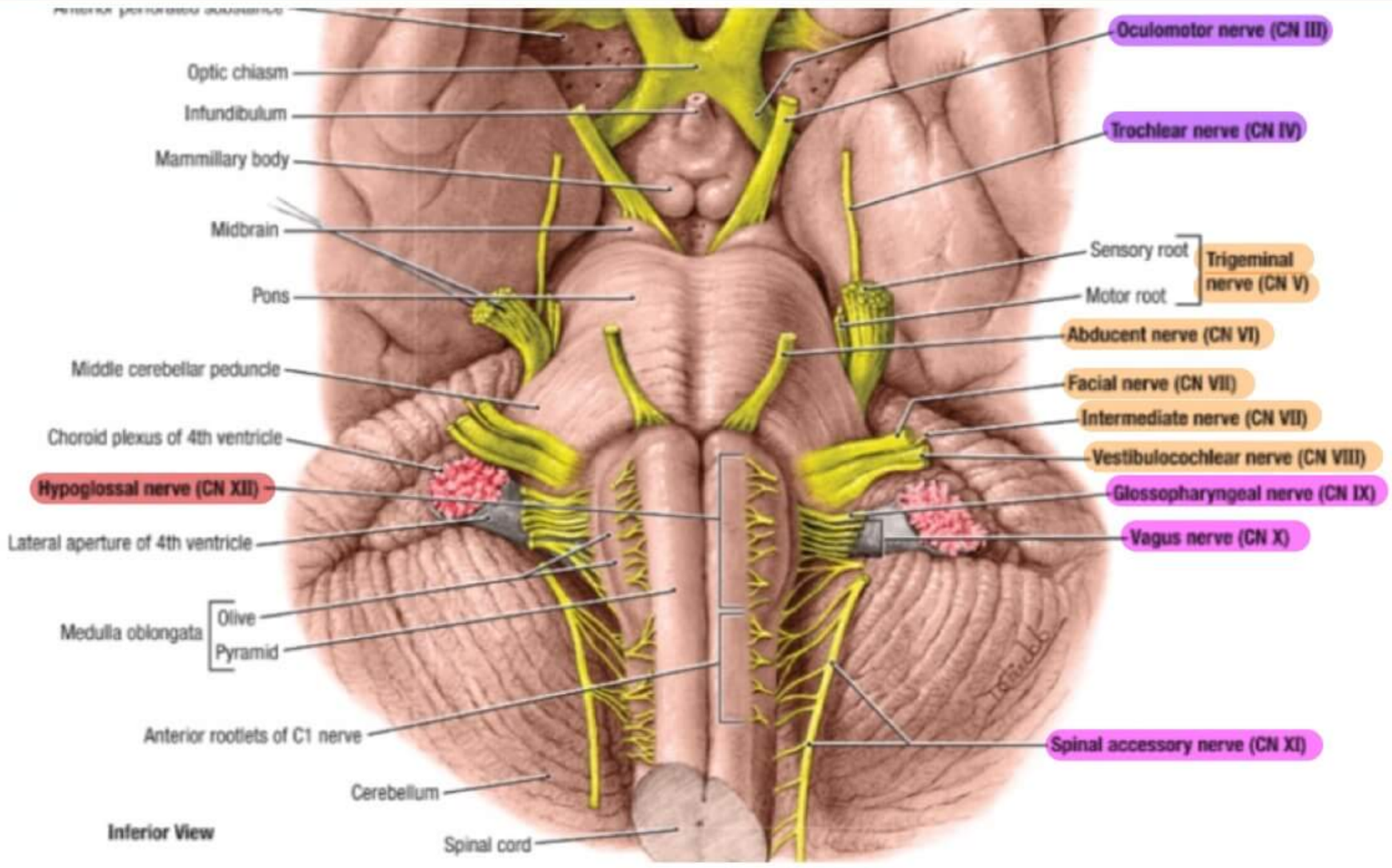
CN IX, CN X, CN XI → Comes from Medulla Oblongata behind olive

CN XII → Comes from Medulla Oblongata infront of olive

BRAIN STEM

1. MID BRAIN [crus cerebri]
1. PONS
3. MEDULLA OBLONGATA
   - Pyramid [anterior]
   - Olive [slightly posterior]





CRANIAL NERVES		LOCATION
OCCULOMOTOR NERVE [III]		MID BRAIN
TROCHLEAR NERVE [IV]		MID BRAIN
TRIGEMINAL NERVE [V]		PONS
ABDUCENT NERVE [VI] (near midline)		PONTO MEDULLARY JUNCTION
FACIAL NERVE [VII] [Lateral to CN VI)		PONTO MEDULLARY JUNCTION
VESTIBULO COCHLEAR NERVE [VIII] [lat. to CN VII] – has 2 components		PONTO MEDULLARY JUNCTION
GLASSOPHARYNGEAL NERVE [IX] VAGAL NERVE [X] CRANIAL ACCESSORY NERVE [XI]	present behind Olive	MEDULLA OBLONGATA NUCLEUS AMBIGUS
HYPOGLOSSAL NERVE [XII]	→ present blw pyramid & olive	MEDULLA OBLONGATA

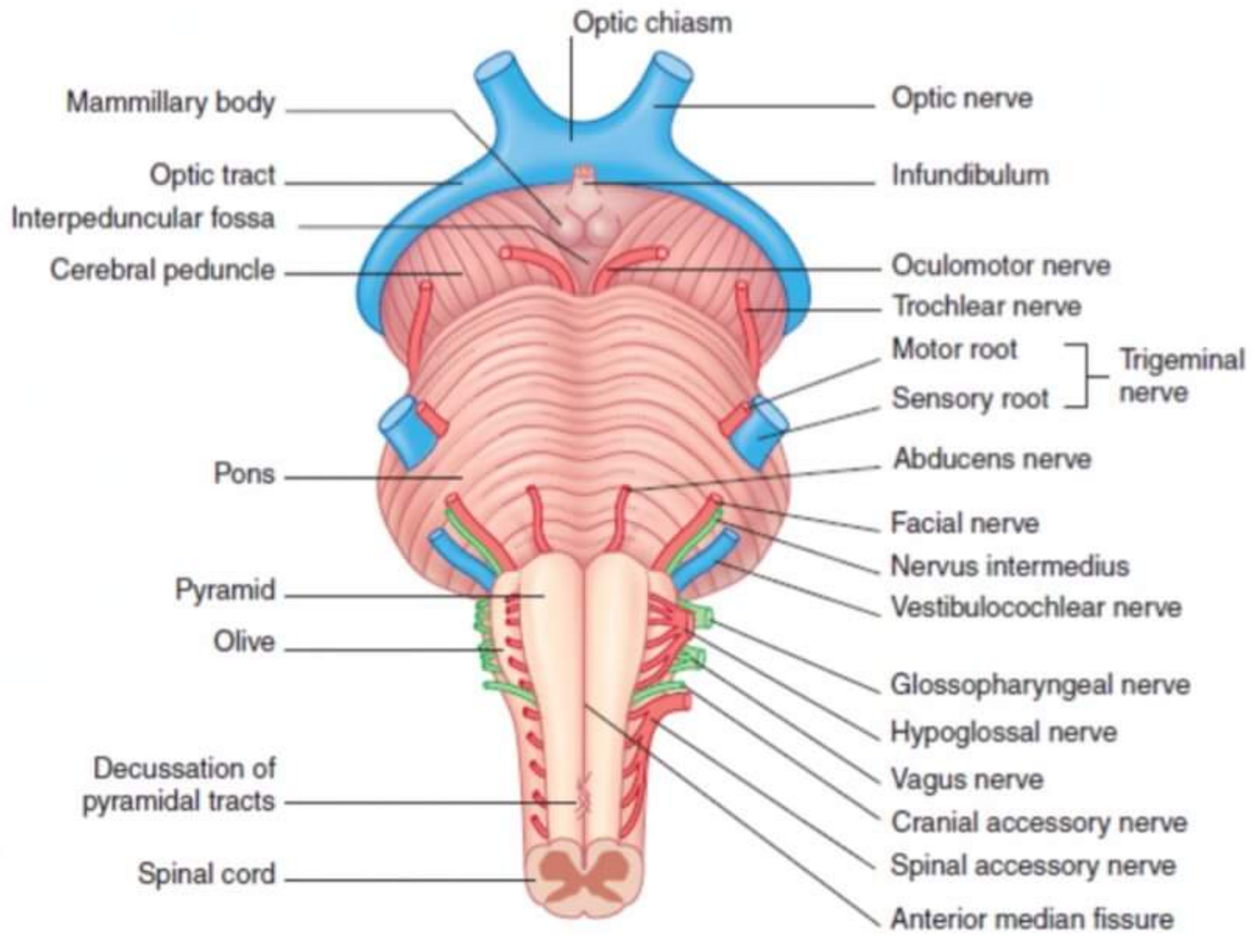
SEQUENCE OF STRUCTURES IN MEDULLA OBLONGATA – from anterior to posterior

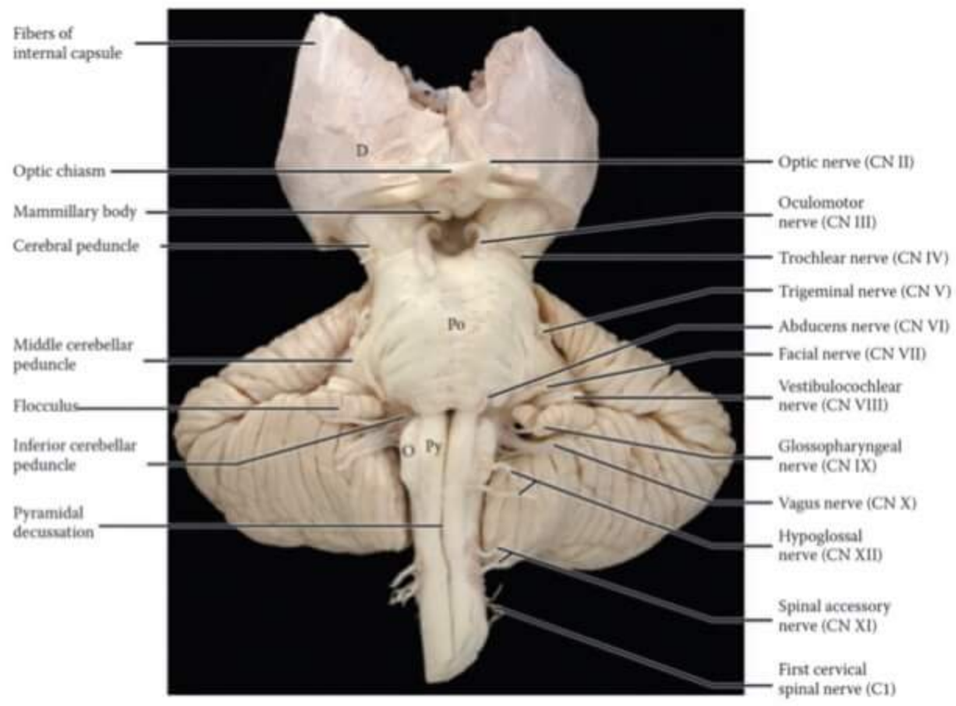
1 Pyramid → most anterior
2 CN XII
3 Olive
4 CN IX, X, XI

CN IX
CN X
Cranial accessory N[XI]
} comes from NUCLEUS AMBIGUS [M. oblongata]
– controls muscles of
Palate
Pharynx
Larynx
} muscles of Speech & swallowing

Spinal Accessory Nerve [XI] → comes from $C_1 - C_5$ of Spinal cord
→ moves upwards via foramen & joins CN IX

BRAIN STEM





Q Nucleus tractus solitarius recieves fibres from all of following CN EXCEPT

a Facial

b Glossopharyngeal

c Vagus

d Accessory → Pure motor nerve

BRAIN STEM & CN NUCLEI

CN 3-12 nuclei are Found in Brain Stem.

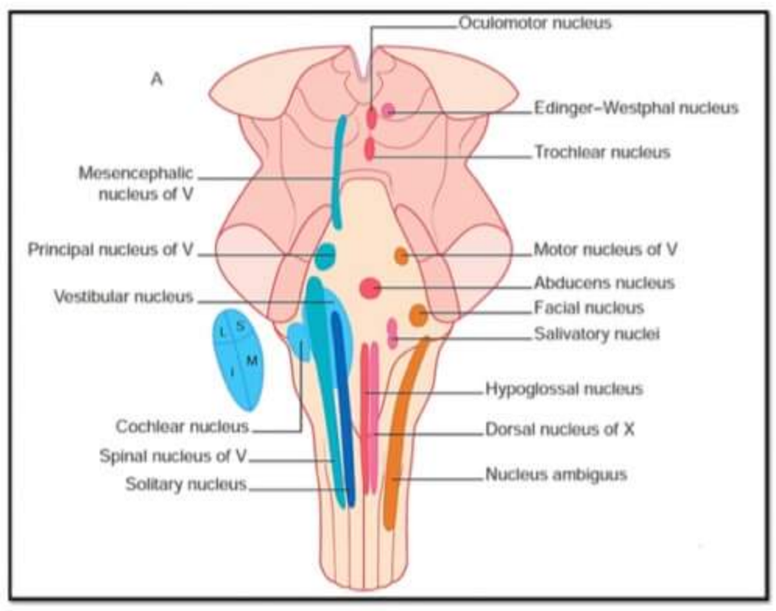
CN 3 & 4 NUCLEI present in MID BRAIN

OCCULOMOTOR 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 NOT RESTRICTED

CN 9,10,11,12 NUCLEI PRESENT IN M. OBLONGATA



NUCLEUS AMBIGUS

→ includes CN 9,10,11 Nuclei

→ present in M. oblongata

TRIGEMINAL NUCLEI

→ Principal sensory nuclei is in PONS

→ Mesencephalic sensory nucleus goes to mid Brain

→ Spinal sensory nucleus goes to Spinal cord

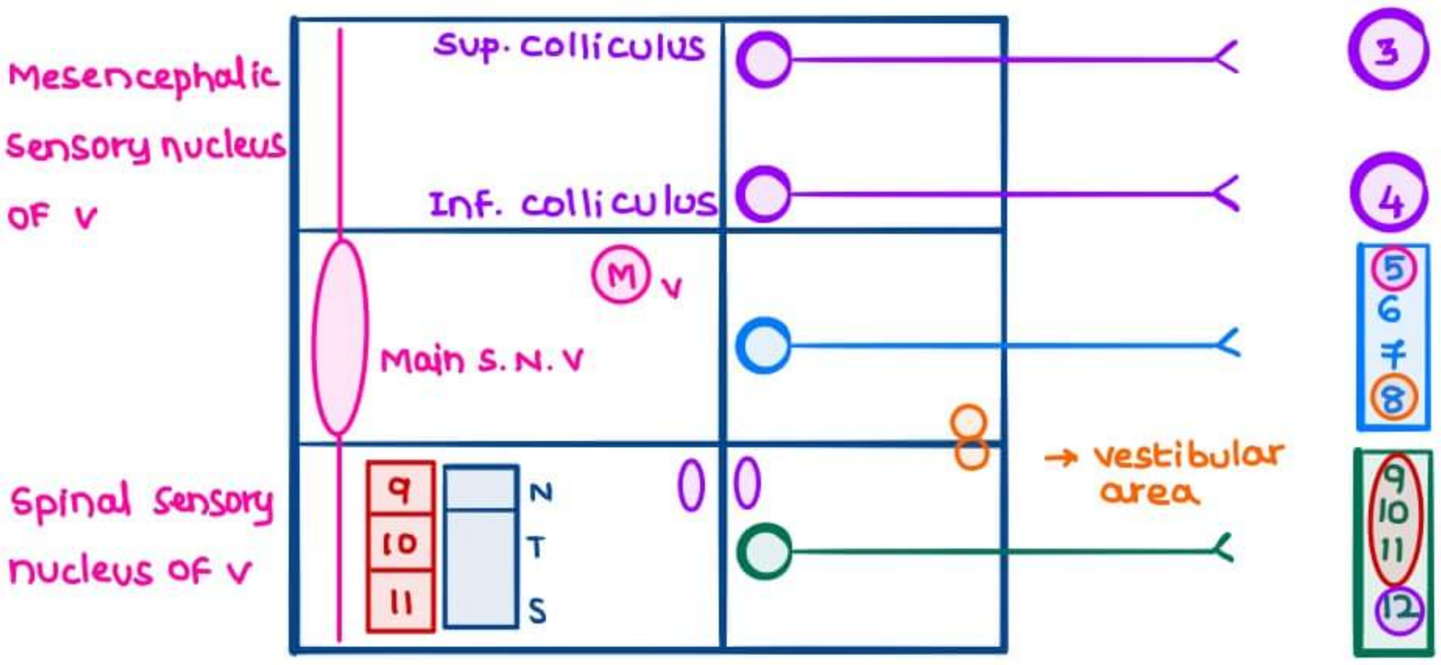
NUCLEI PRESENT IN LATERAL MEDULLA

1. Nucleus ambiguus
2. Spinal sensory nucleus of V
3. Solitary nucleus [Nucleus Tractus solitareus]

→ In Wallenberg [Lateral medullary] syndrome, above nuclei are affected

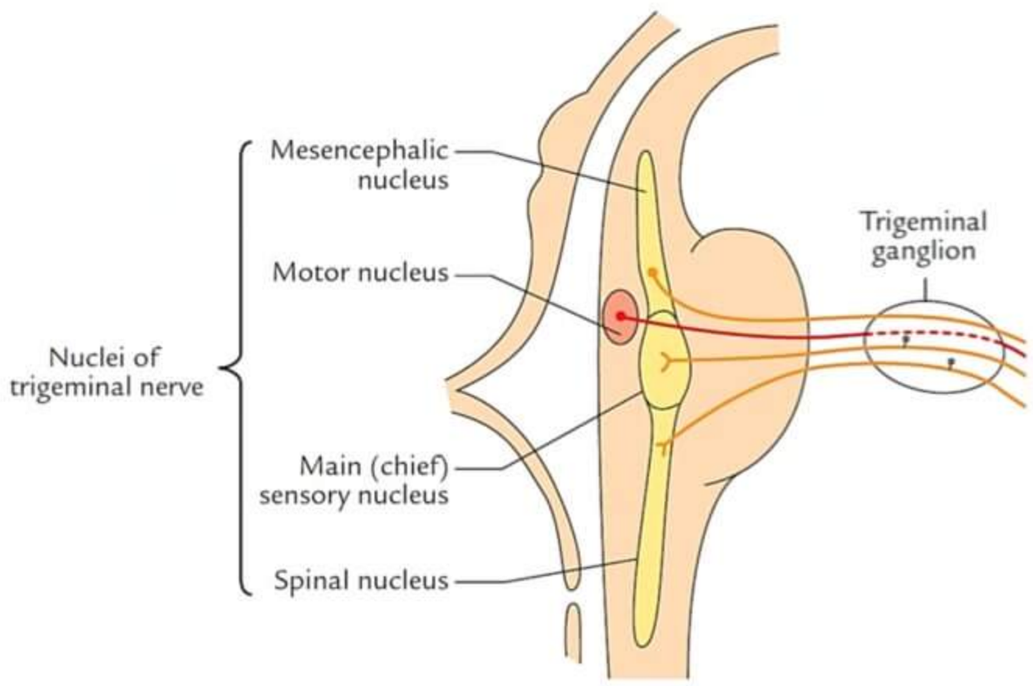
→ Hypoglossal Nucleus [XII] not involved

- present near mid line → Involved in Medial Medullary syndrome
  → Tongue muscle palsy



CN VIII can extend into medullary area

WALLENBERG SYNDROME
Lateral Medullary Ischemia
↓
vestibular area Injury
↓
vertigo



CN V [TRIGEMINAL NERVE] NUCLEI

→ 1 motor Nucleus
3 Sensory Nuclei

→ Motor Nucleus present in Pons
controls muscles of 1st pharyngeal arch [muscles of masticatⁿ]

→ 3 sensory nuclei
1. Main sensory nucleus [pons]
→ receives touch & vibratⁿ sensations

2. Mesencephalic sensory nucleus [MidBrain]
→ receives propriocepth [positⁿ sense] of Eye ball, mandible, tongue

3. 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, pharynx, larynx } muscles of speech & swalloing

NUCLEUS TRACTUS SOLITARIUS

→ present in Lateral medulla

→ Tip will receive taste sensation (sVA) by

F → Facial Nerve [choda tympani br. from ant. 2/3rd]

G → Glossopharyngeal Nerve [from post. 1/3rd]

V → Vagus Nerve [post. most & epiglottis]

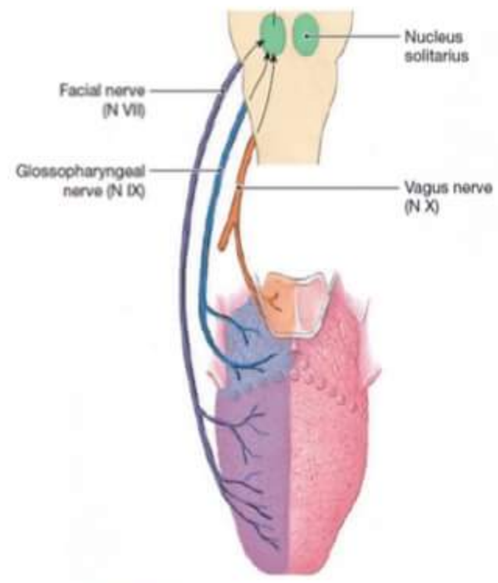
→ Bottom receive GVA of

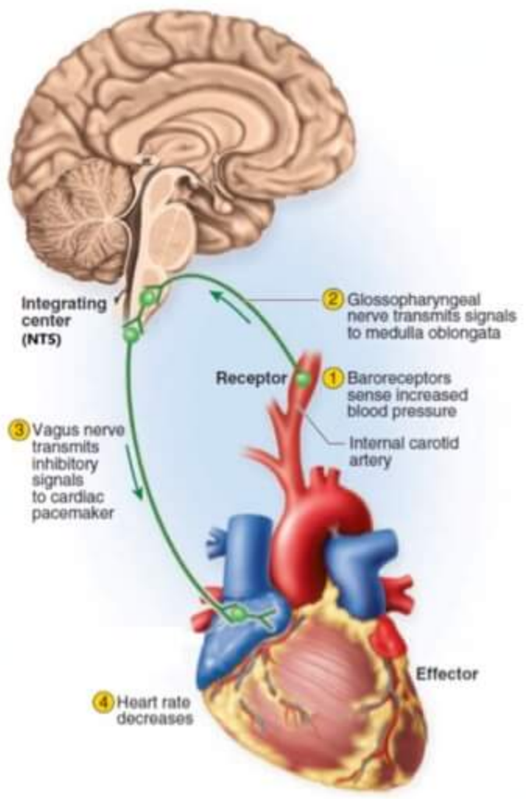
chemoreception &

vassopression carried by Glossopharyngeal nerve

integrated in the bottom of NTS

activates vagus nerve & causes bradycardia





HYPOGLOSSAL NUCLEUS [XII]

→ present near the midline

→ Affected in Middle Medullary Syndrome

WALLENBERG SYNDROME – C/F

1. vertigo [injury of vestibular nucleus]
2. I/L loss of pain & temperature on face [Injury of Spinary sensory nucleus ofV]
3. I/L loss of taste [Injury to Nucleus tractus solitarius]
4. Difficulty of speech & swallowing [injury of N. ambiguus]

MASSETER REFLEX [JAW REFLEX]

PROCEDURE

→ Hit ℄ Knee hammer on examiner finger placed on mentum of patient to open mouth suddenly → Sudden closure of mouth occurs

→

Sudden opening of mouth

↓

changes posit^{n} of mandible

↓

PROPRIOCEPTION carried by mandibular branch of Trigeminal Nerve (Sensory fibres)

↓

Mesencephalic sensory nucleus of TG N. receives proprioceptn

↓

Motor nucleus of TG N. activates

↓

Activates mandibular branch of Trigeminal Nerve [motor fibres]

↓

Masseter activated [elevator mandible]

↓

Mouth closes suddenly

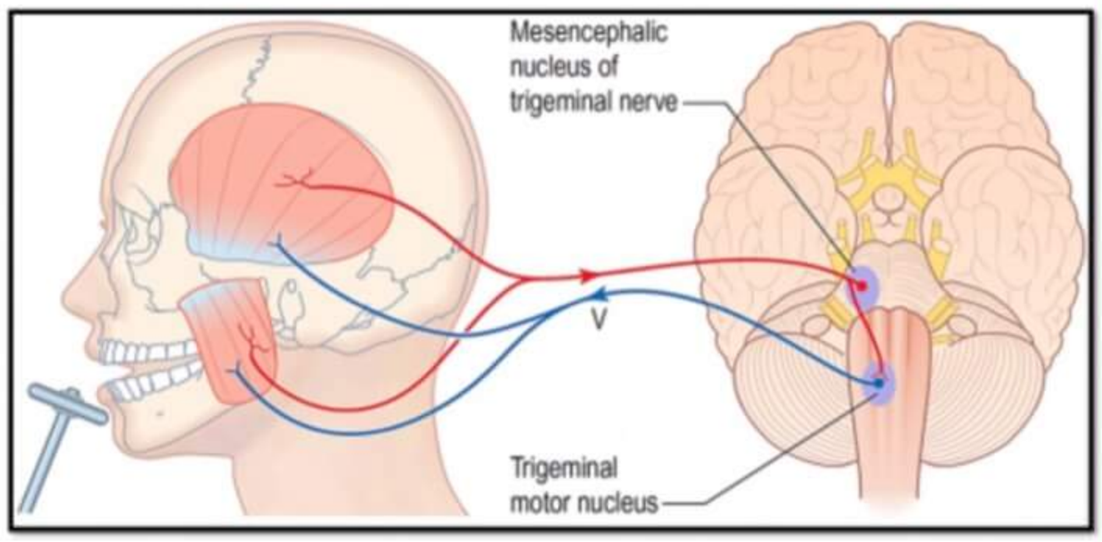
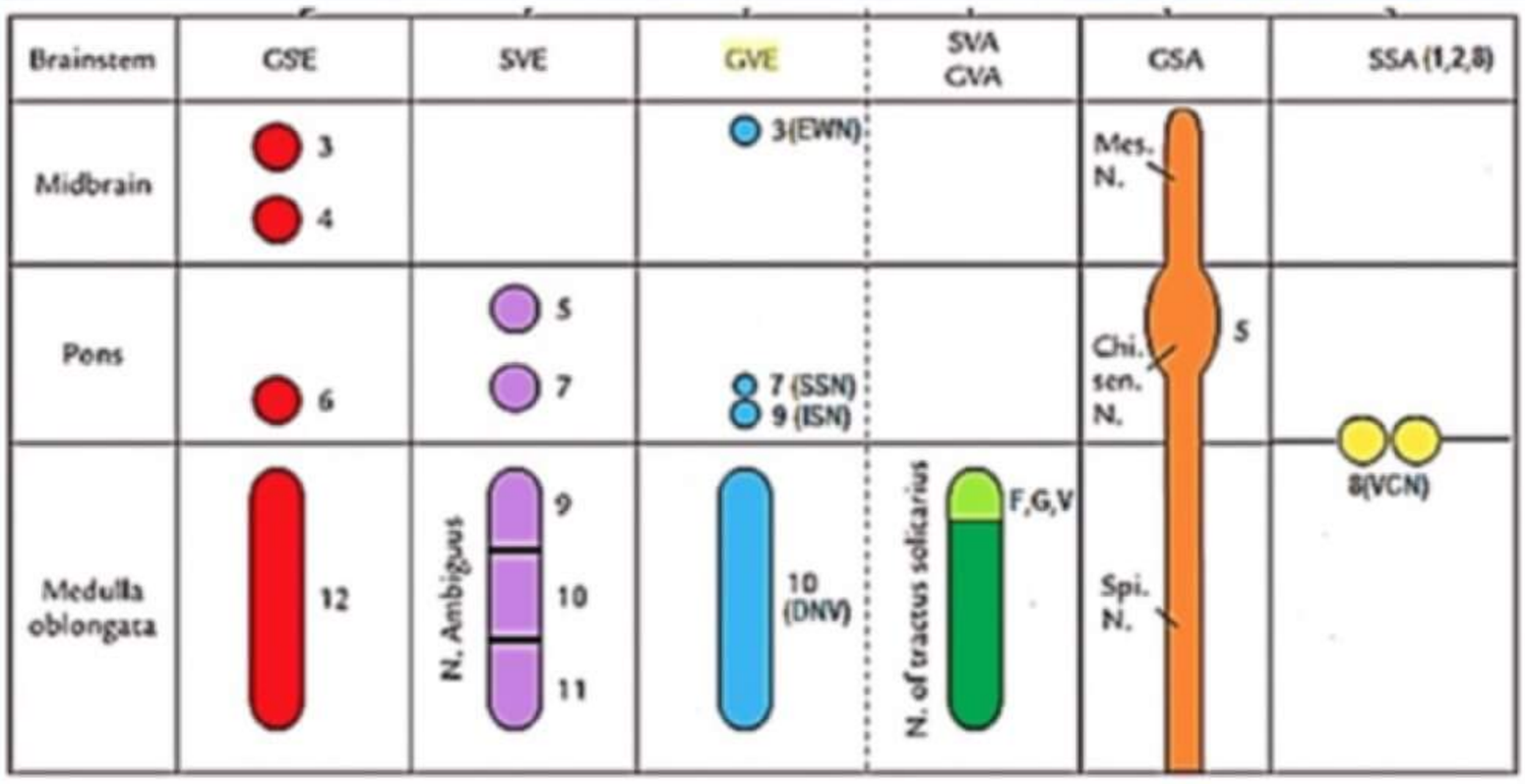


TABLE: Classification of Neural Columns	
Motor (Efferent)	**Sensory (Afferent)**
GSE (General Somatic Efferent) • All skeletal muscles except pharyngeal arch muscles • Includes EyeBall (CN: 3,4,6) and Tongue muscle (CN: 12)	GSA (General Somatic Afferent) • Carry general sensations such as touch, pain 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 sensations like Vision (eye) and Hearing & Balance (ear) • Includes CN: 2 and 8



VCN - vestibulo cochlear junctn

SVE [SPECIAL VISCERAL EFFERENT]

PHARYNGEAL ARCH MUSCLES

1st Pharyngeal Arch → 5_3 → muscles of mastication

2nd Pharyngeal Arch → 7 → muscles of facial Expression

3, 4, 6 Pharyngeal Arches → 9, 10, 11 → muscles of (Palate, Pharynx, Larynx) } Speech & Swallowing

GVE [GENERAL VISCERAL EFFERENT]

→ controlled by Para sympathetic component of ANS

PARASYMPATHETIC NERVES & NUCLEI

3	→	EWN	→	Eye ball
7, 9	}	Superior salivatory nucleus, Inferior salivatory nucleus	}	Salivary Glands
10	→	Dorsal Nucleus of vagus	→	cardiac, smooth muscles & glands

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

a	Hypoglossal nucleus	→	GSE
b	Nucleus ambigus	→	SVE
c	Dorsal nucleus of vagus	→	GVA
d	NTS	→	SVA

Q Function of spinocerebellar tract
a Equilibrium
b coordinates movement [BETTER ANSWER]
c Learning induced by changes in vestibular reflexes
d Planning & programming → function of Basal ganglia

spino cerebellar tract carry unconscious proprioception of lowerlimb to cerebllum

CEREBELLAR ATAXIA

→ dlt injury to spinocerebellar tract [anterior lobe
→ uncoordinated clumpsy movements
  → can't able to walk in straight line [loss of coordinat°]
  → Keep falling towards side of lesion

→ HEEL SHIN TEST Positive
  → PROCEDURE → Ask the patient move his heel on his shin
  → Unable to do so → POSITIVE

HEEL SHIN TEST

Q In cerebellar lesion not seen is
a Ataxia
b Nystagmus
c Resting tremors → Seen in Parkinson's Disease
d past pointing

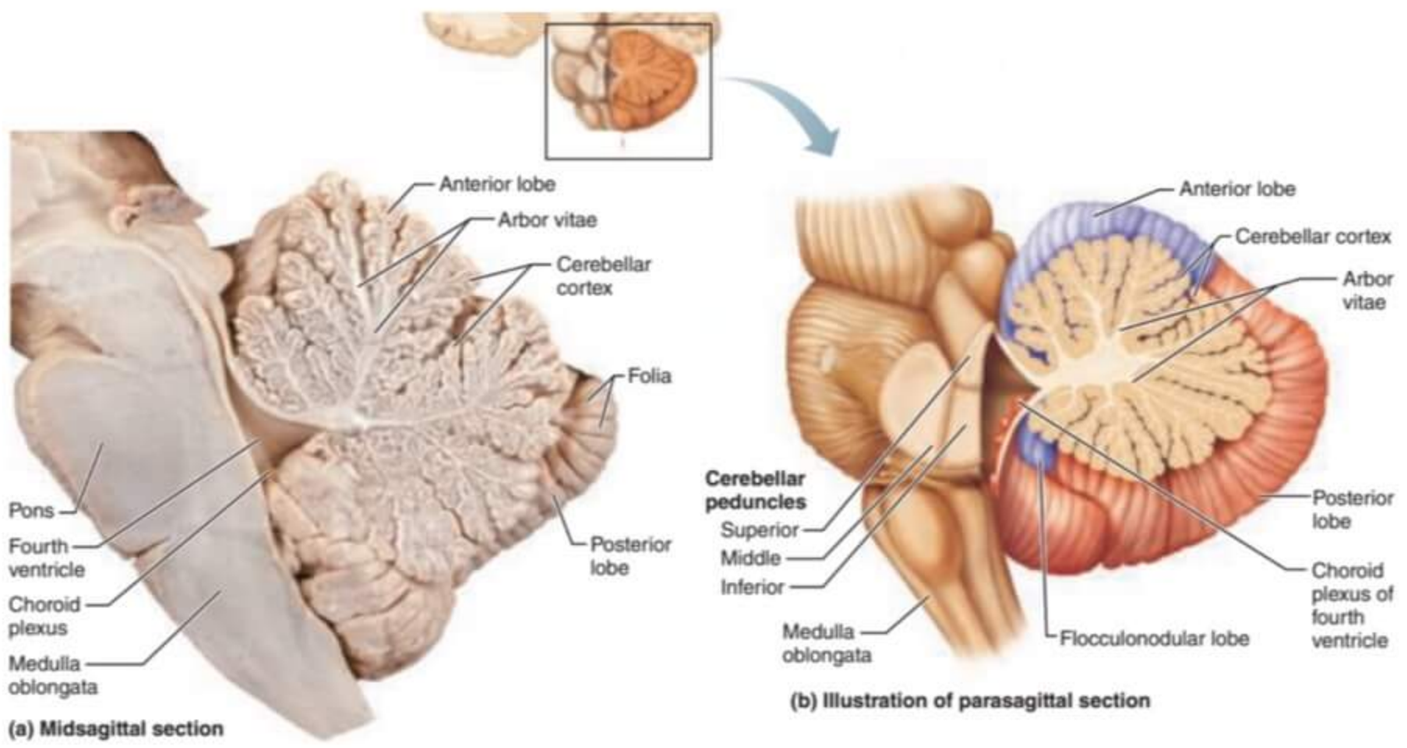
Past pointing test

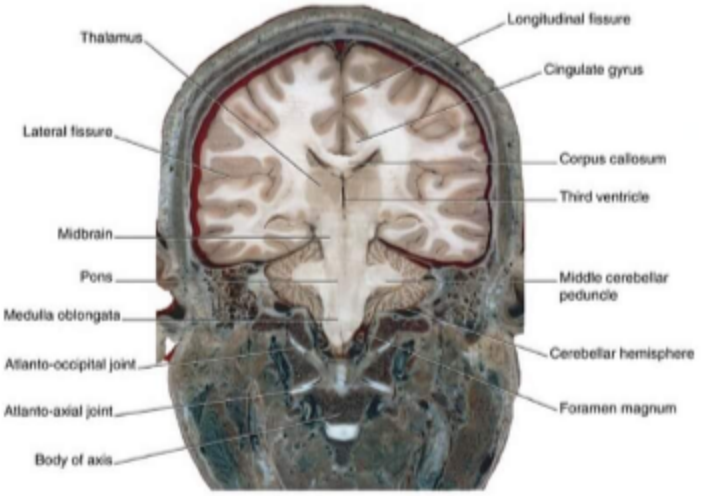
→ Intentional tremor + nt

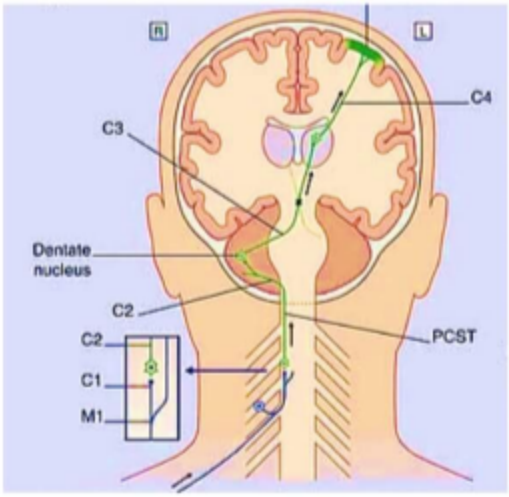
CEREBELLUM

→ cerebellum present in posterior cranial fossa
→ Leaf like [foliated] → ARBOR VITAE
→ present at roof of 4th ventricle
→ attaches to Brain stem ĩ peduncles
  Superior peduncle → ĩ mid brain
  middle peduncle → ĩ pons
  Inferior peduncle → ĩ M. oblongata

→ LOBES
  1. ANTERIOR LOBE
  2. POSTERIOR LOBE → Latest → NEO CEREBELLUM
  3. FLOCCULO NODULAR LOBE → oldest → ARCHI CEREBELLUM



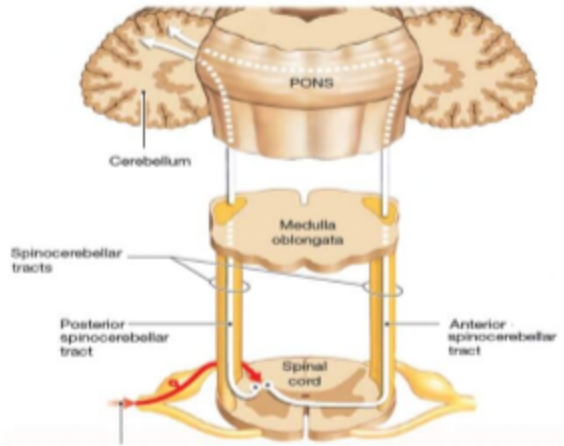




coronal section - front view

Middle cerebellar peduncle carries → Ponto cerebellar tract
Superior cerebellar peduncle carries → Dentato Thalamic tract
Inferior cerebellar peduncle carries → Spino cerebellar tract

CEREBELLAR PATHWAYS



→ Rt. LL moving
↓
Rt. dorsal Spinocerebellar tract activated
↓
Position sense carried towards Rt. cerebellum
↓
Cerebellum communicates ī C/L Thalamus via Dentato Thalamic tract
↓
Thalamus communicates ī left cerebrum
↓
Rt. LL moved by Lt. cerebrum via cortico Spinal tract [crossing occurs in Lower medulla]

MOSSY FIBRES → Fibres reaching cerebellum

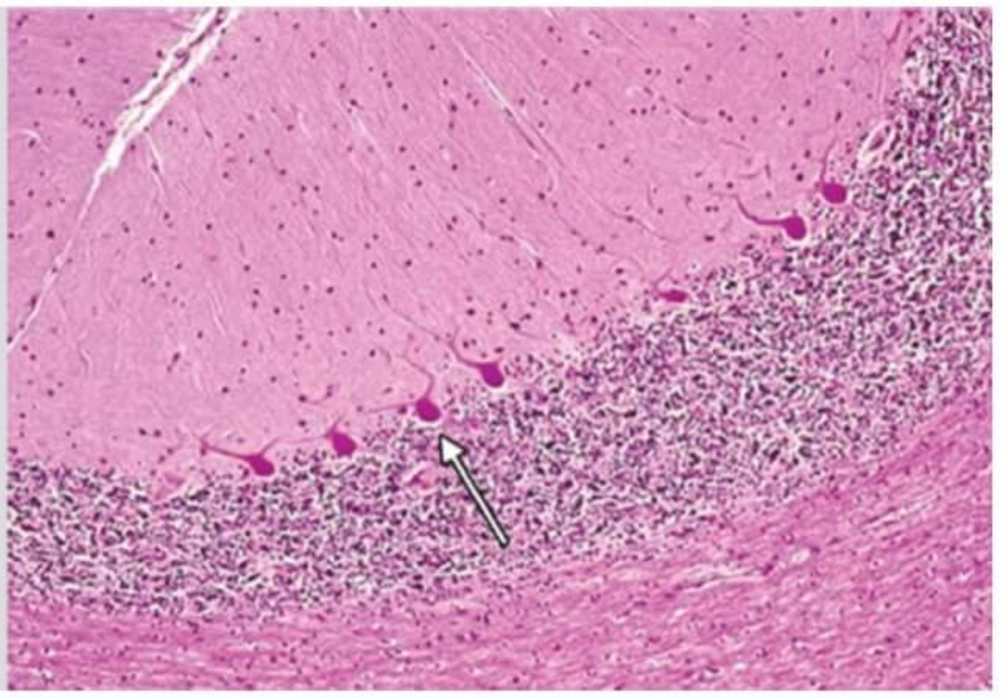
→ most of mossy fibres runs as Dorsal | ventral spinocerebellar tract & reaches ipsilateral cerebellum
→ very few crosses midline in spinal cord & runs as ventral | anterior spino - cerebellar tract & Recrossing occurs ī in cerebellum and reaches ipsilateral cerebellum

→ 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

CEREBELLAR LESIONS CAUSES IPSILATERAL MANIFESTATIONS

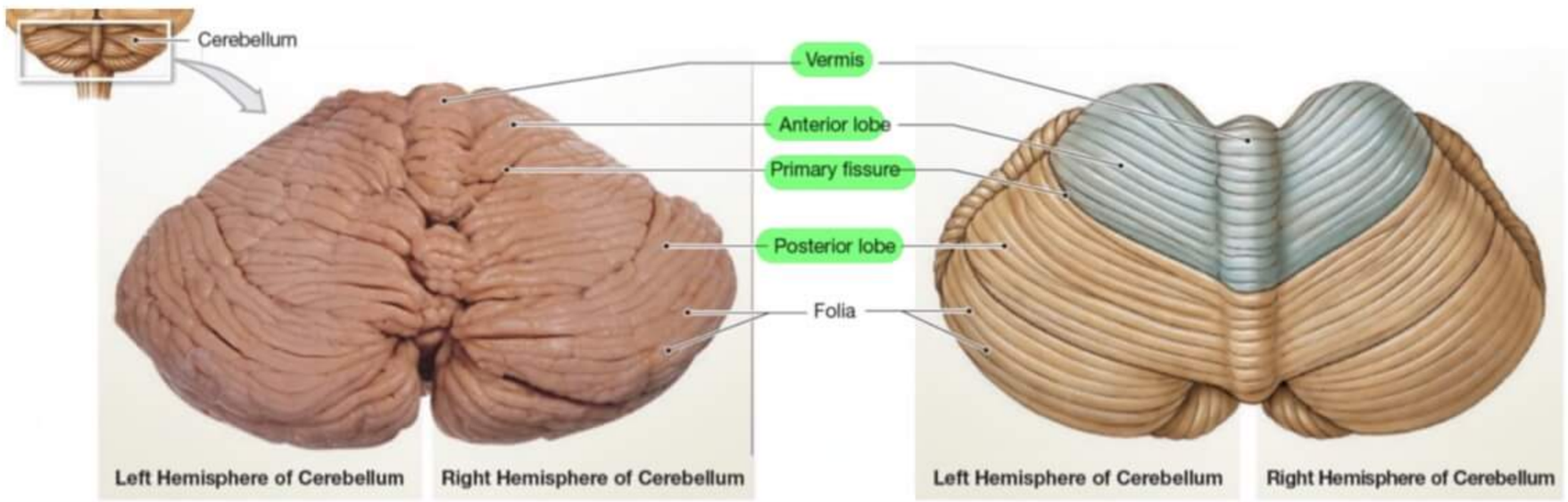
The marked cell inhibits which of the following structure:
(AIIMS 2017)

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]



POSTERIOR VIEW

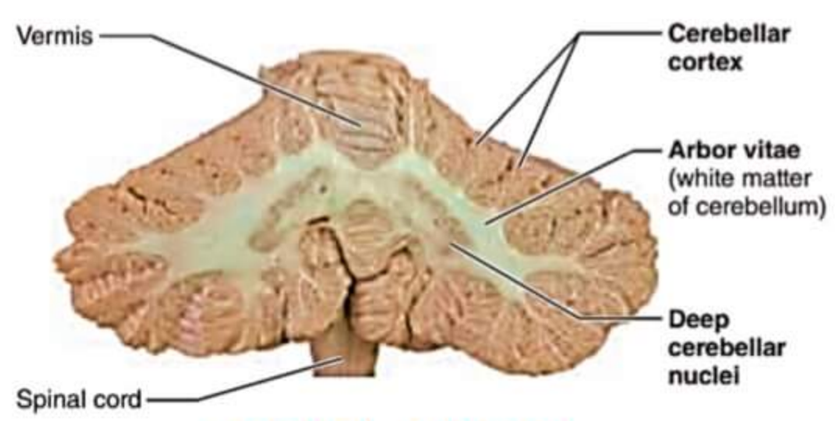
vermis → present in midline, most medial, oldest
Primary fissure → separates anterior & posterior lobes
ARBOR VITAE → White matter of cerebellum

DEEP CEREBELLAR NUCLEI [DEFG]

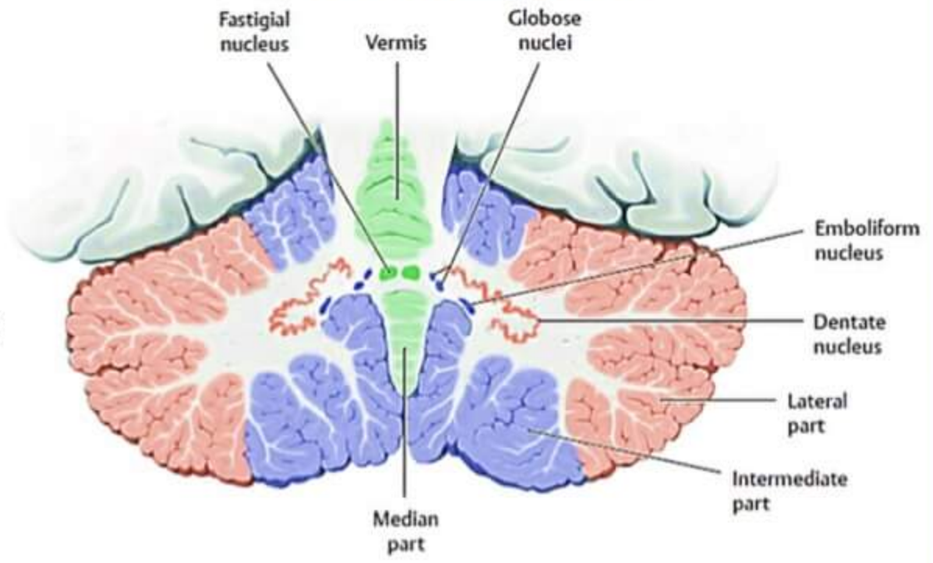
D → Dentate Nucleus
E → Emboliform Nucleus
F → Fastigial Nucleus
G → Globose Nucleus

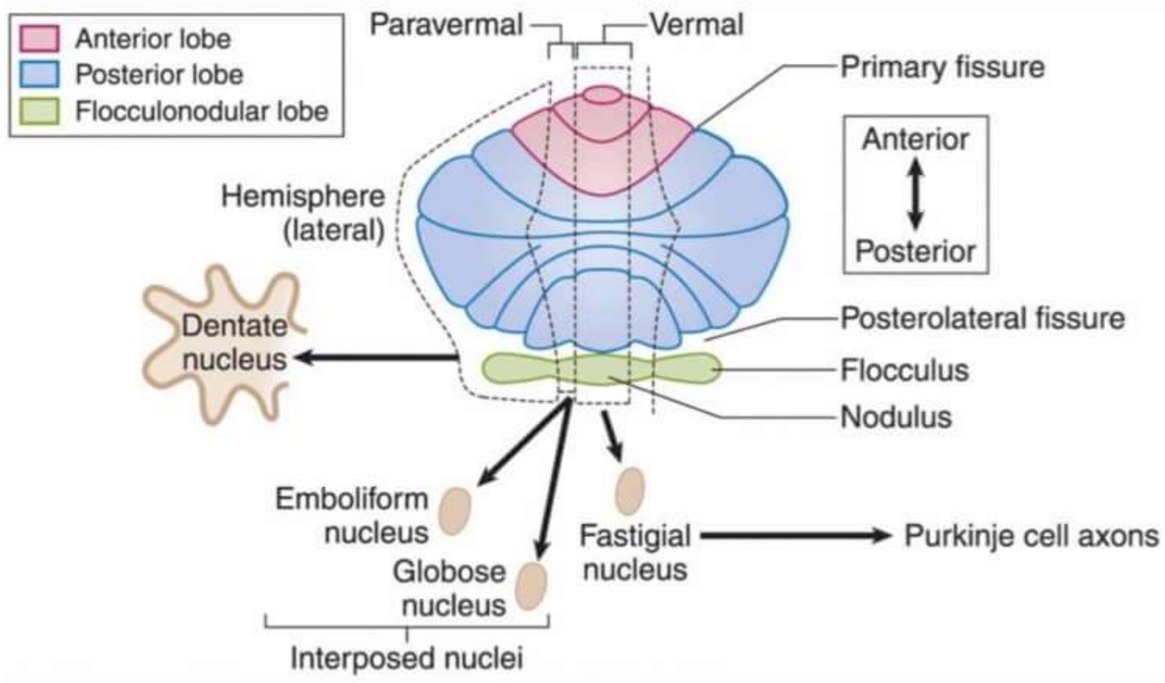
→ Emboliform nucleus } INTERPOSED NUCLEUI
Globose Nucleus }

→ Dentate Nucleus → most lateral, latest
→ Fastigial Nucleus → most medial, oldest



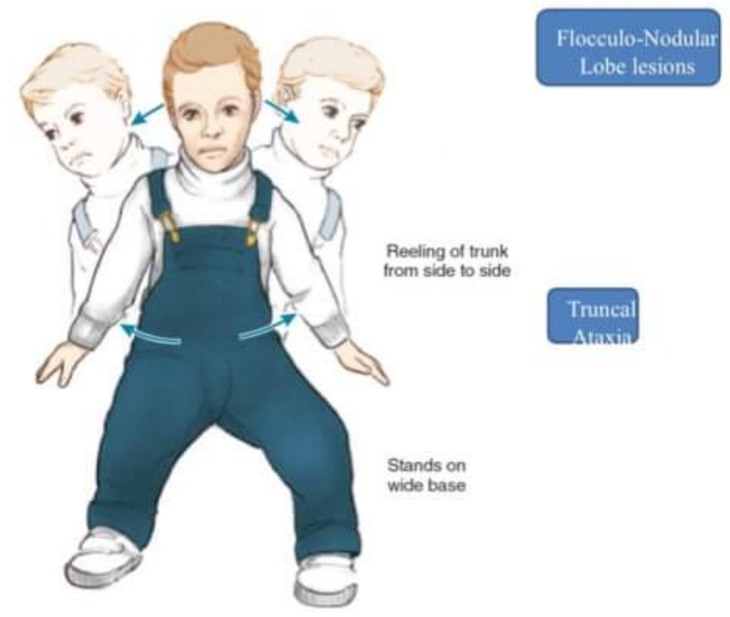
CORONAL SECTION

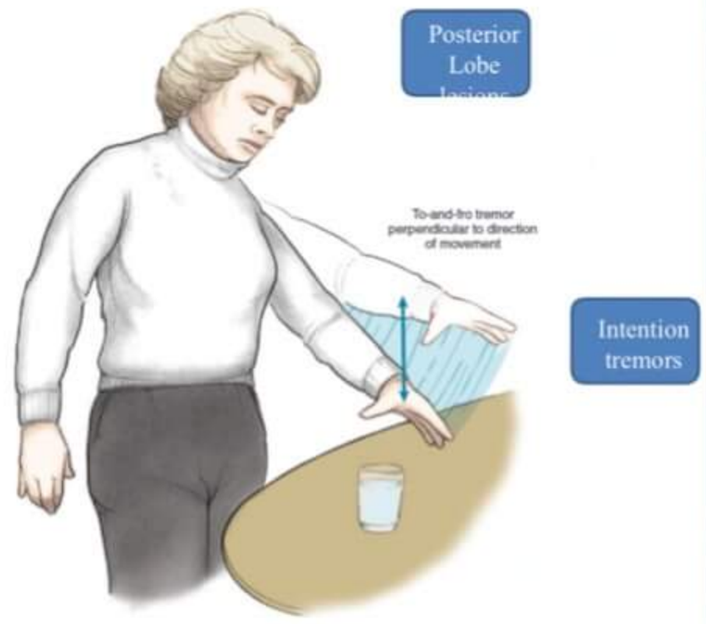




Subdivisions	Components	Nucleus	Chief connections	Functions
Archicerebellum (oldest part)	Flocculonodular lobe + lingula	Nucleus fastigii [Fish]	Vestibulocerebellar	Maintenance of equilibrium (responsible for maintaining the position of body in space)
Paleocerebellum (in between, i.e. neither oldest nor newest)	Whole of anterior lobe except lingula Pyramid Uvula	Nucleus interpositus consisting of nucleus globosus and nucleus emboliformis	Spinocerebellar	Controls crude 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

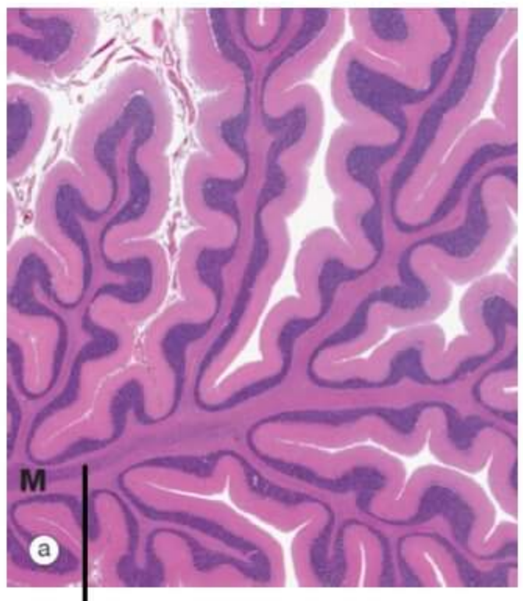
LESIONS





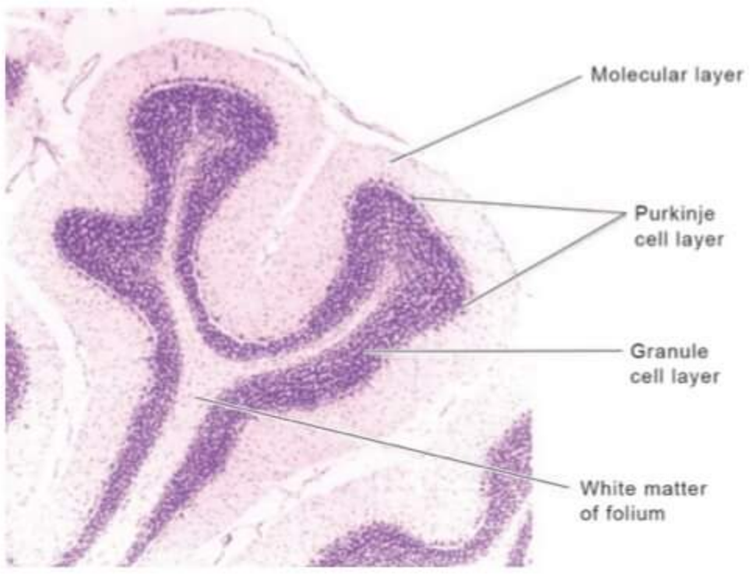
CELLS IN CEREBELLAR CORTEX

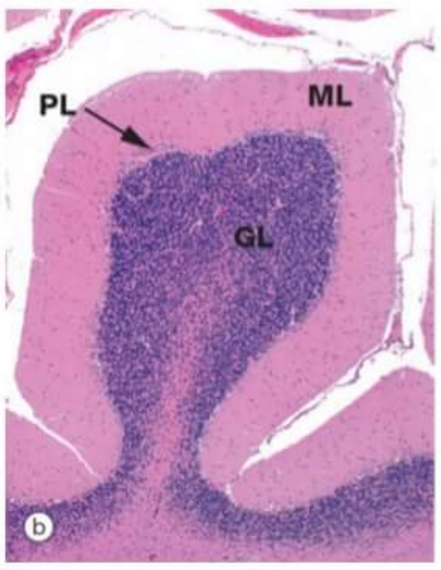
1. OUTER MOLECULAR LAYER → contains stellate & Basket cells
2. MIDDLE PURKINJE LAYER → contains Purkinje cells
3. INNER GRANULAR LAYER → contains Granule & Golgi cells

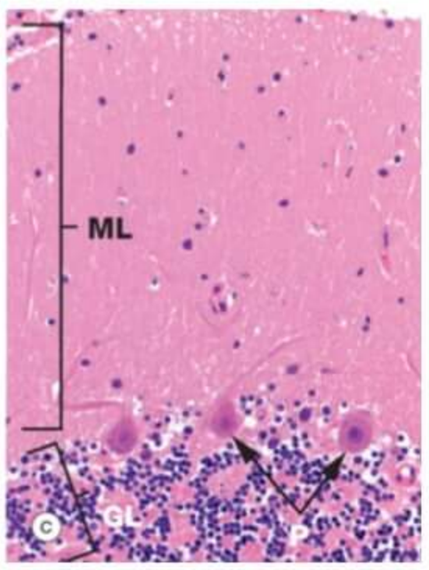


CEREBELLAR FOLIA

ARBOR VITAE

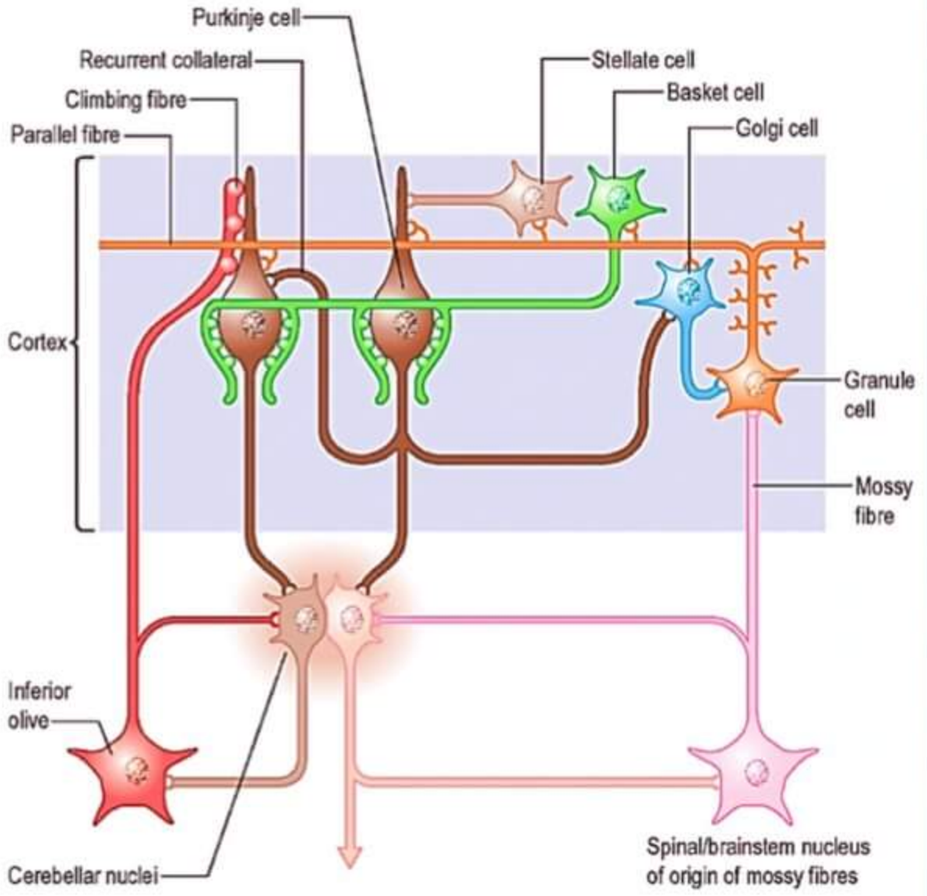






CEREBELLUM - AFFERENT FIBRES

Name	Tract	Enter Cerebellum Via	Target and Function
Climbing fibers	Olivocerebellar	Inferior cerebellar peduncle (decussate)	Excitatory terminals on Purkinje cells (glutamate)
Mossy fibers	Vestibulocerebellar	Inferior cerebellar peduncle	Excitatory terminals on granule cells (glutamate) which are excitatory to Purkinje cells
	Spinocerebellar	Inferior cerebellar peduncle and superior cerebellar penduncle	
	(Cortico) pontocerebellar	Middle cerebellar peduncle (decussate)	



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 i multiple projections into outer molecular layer

CEREBELLAR PATHWAY

Rt. LL moving
↓
Rt. dorsal Spinocerebellar tract activated [MOSSY FIBRES]
↓
Excitatⁿ of GRANULE CELLS
↓ via parallel fibres
Excites
STELLATE CELLS
BASKET CELLS
PURKINJE CELLS
GOLGI CELLS
↓
Information processed in 5 cells

Purkinje cells sents information to DEEP CEREBELLAR NUCLEI [uses GABA (inhibitory)]
↓
Deep cerebellar nuclei sends DENTATO THALAMIC TRACT to Thalamus

Q EFFerent in Superior cerebellar peduncle arise mostly from
a Purkinje cells
b Stellate neurons
c Deep nuclei
d Grade III fibres

Q EFFerent from Cerebellum arises from
a Purkinje cells → efferent from CEREBELLAR CORTEX
b Stellate neurons
c Deep nuclei
d Grade III fibres

CEREBELLAR PATHWAYS

CEREBRO PONTO CEREBELLAR TRACT → via middle cerebellar peduncle, useful in FEED BACK / LOOP MECHANISM

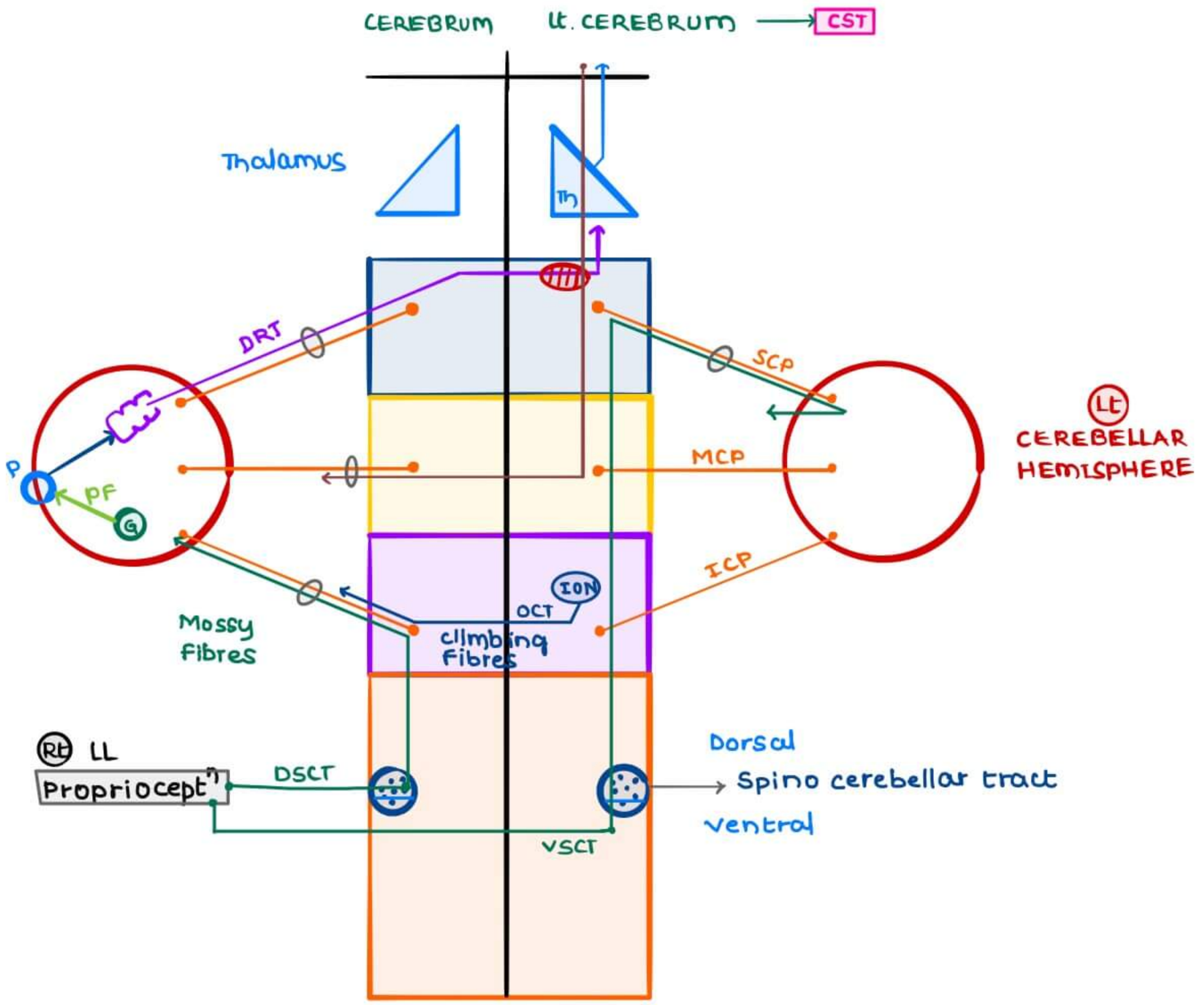
INCOMING FIBRES & CEREBRAL PEDUNCLES

Inferior cerebellar peduncle → Olivo cerebellar tract
Dorsal Spinal cerebellar tract

Middle cerebellar peduncle → cortico ponto cerebellar tract
Superior cerebellar peduncle → Ventral Spinal cerebellar tract

OUTGOING FIBRES & CEREBELLAR PEDUNCLES

Superior Cerebellar peduncle → Dentato Rubro Thalamic tract



DSCT → Dorsal Spinocerebellar tract
VSCT → ventral Spinocerebellar tract
G → Granule cell
PF → Parallel fibres
P → Purkinje cell
DRT → Dentato Rubro Thalamic Tract

SCP → Superior cerebellar peduncle
MCP → Middle cerebellar peduncle
ICP → Inferior cerebellar peduncle
CST → Cortico spinal tract

Q Tract not present in inferior cerebellar peduncle is
a Dentato Rubro thalamic
b Posterior Spino Cerebellar
c Olivo cerebellar
d cuneo cerebellar

CUNEOCEREBELLAR TRACT
→ For upper Limb proprioception
→ run via cuneate fasciculus, to the accessory cuneate nucleus

Q Structures not passing through inferior cerebellar pedunclc [PGI]
a Pontocerebellar
b cuneocerebellar
c Anterior spinocerebellar
d posterior Spinocerebellar
e Vestibulocerebellar

Q All are true about Brown Sequard syndrome EXCEPT

a Hemisection of spinal cord

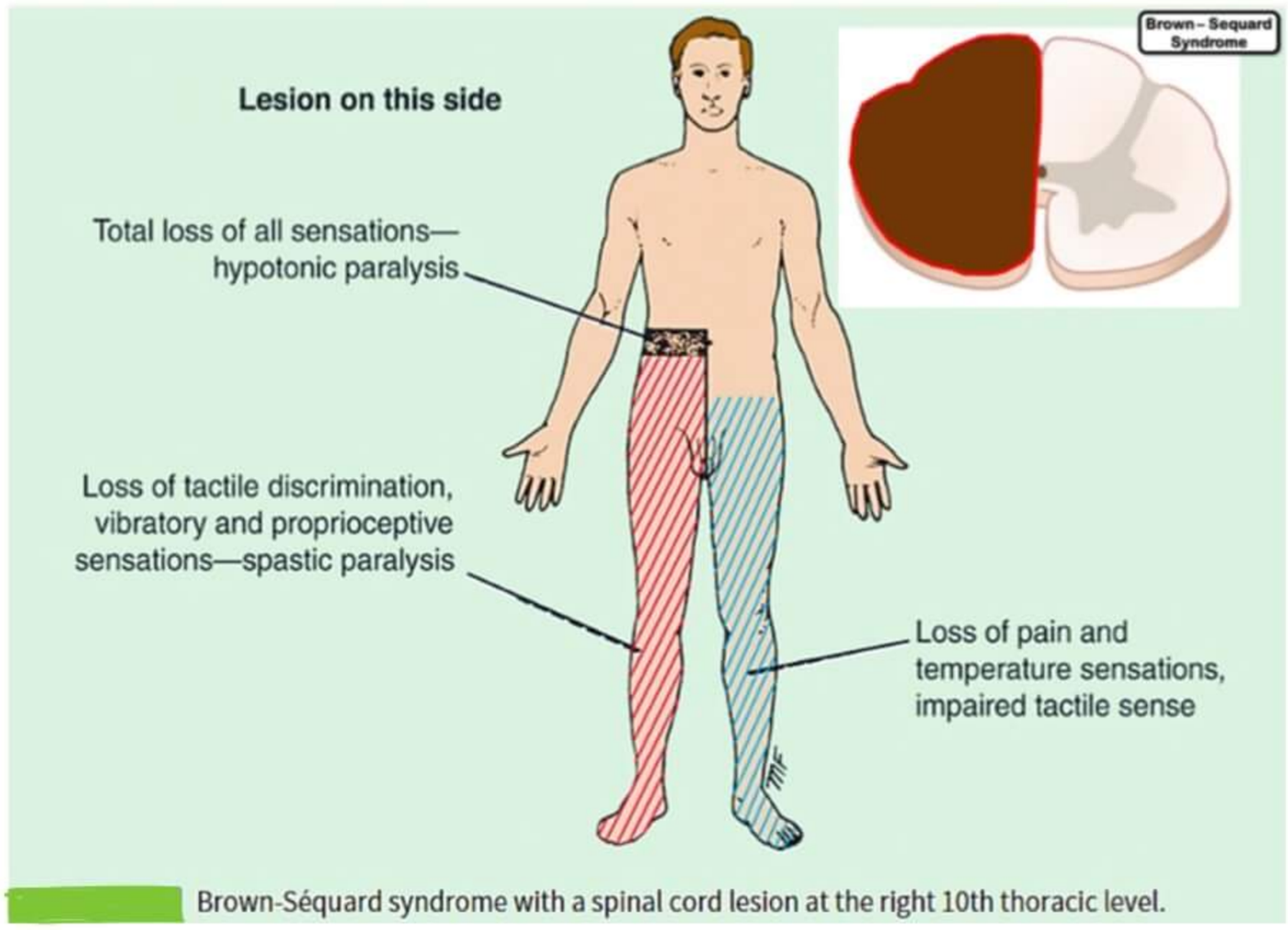
b Ipsilateral loss of vibration sensations

c Ipsilateral loss of crude touch sensations → carried by ant. Spinothalamic tract

d Ipsilateral paralysis below the level of lesion

Ant. Spinothalamic tract is a crossed tract

BROWN SEQUARD SYNDROME



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

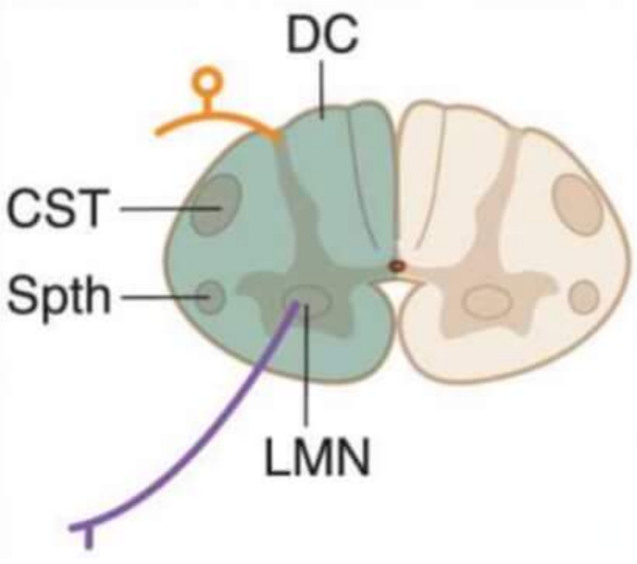
→ manifestations occurs 1 or 2 segments below the lesion

→ Flaccid paralysis → dlt injury to LMN

→ Spastic paralysis below the level of lesion

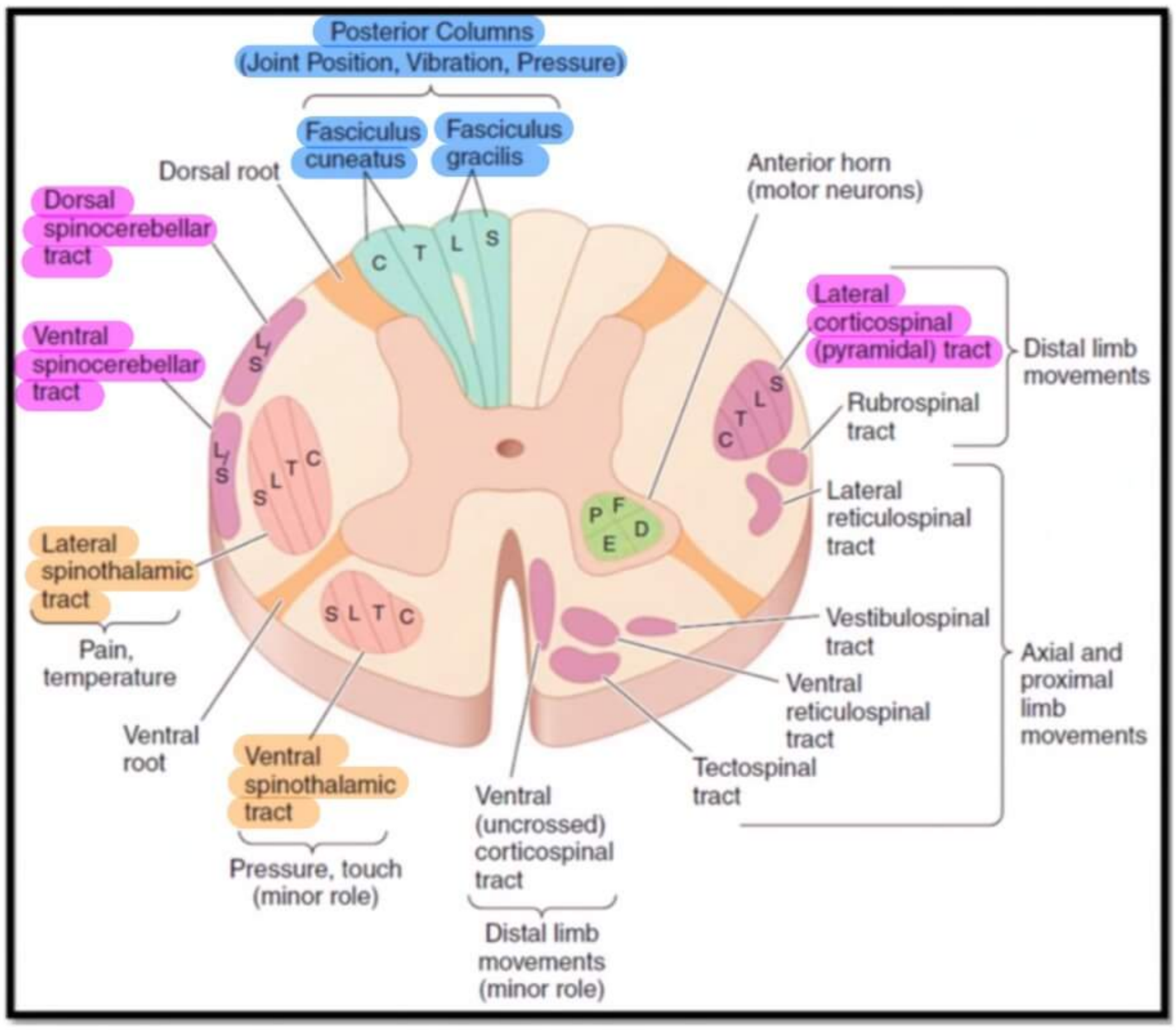
→ dlt injury to UMN [pyramidal tract]

Hemisection: Brown-Séquard Syndrome

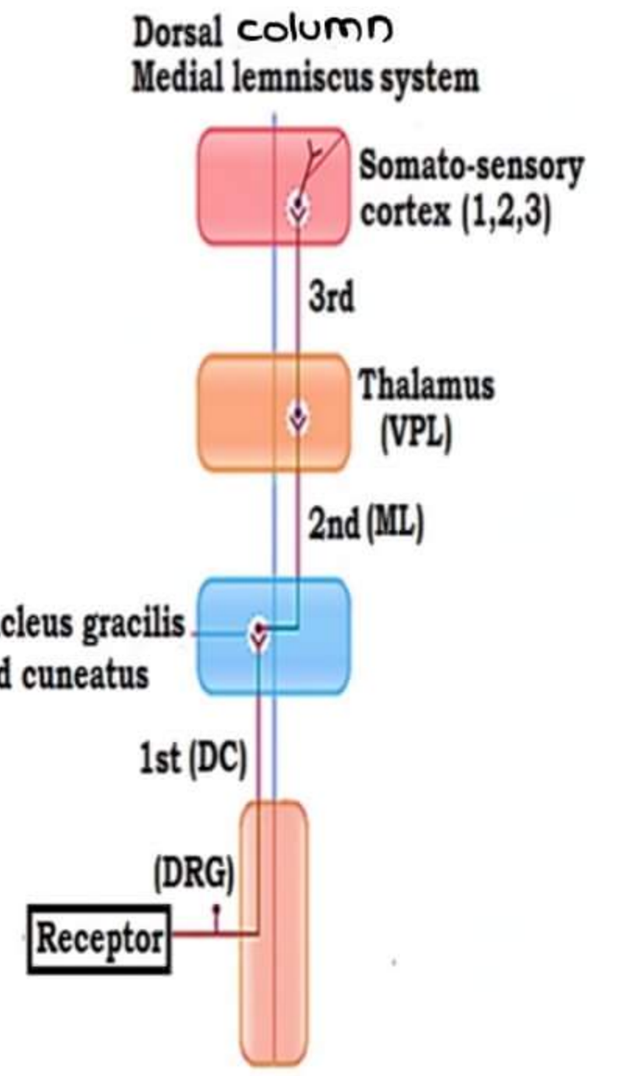


a. DC: Ipsilateral loss of position and vibratory senses at and below level of the lesion
b. Spinothalamic tract: Contralateral loss of pain and temp 1–2 segments below lesion and ipsilateral loss at the level of the lesion
c. CST: Ipsilateral paresis below the level of the lesion
d. LMN: Flaccid paralysis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

SPINAL CORD – TRANSVERSE SECTION



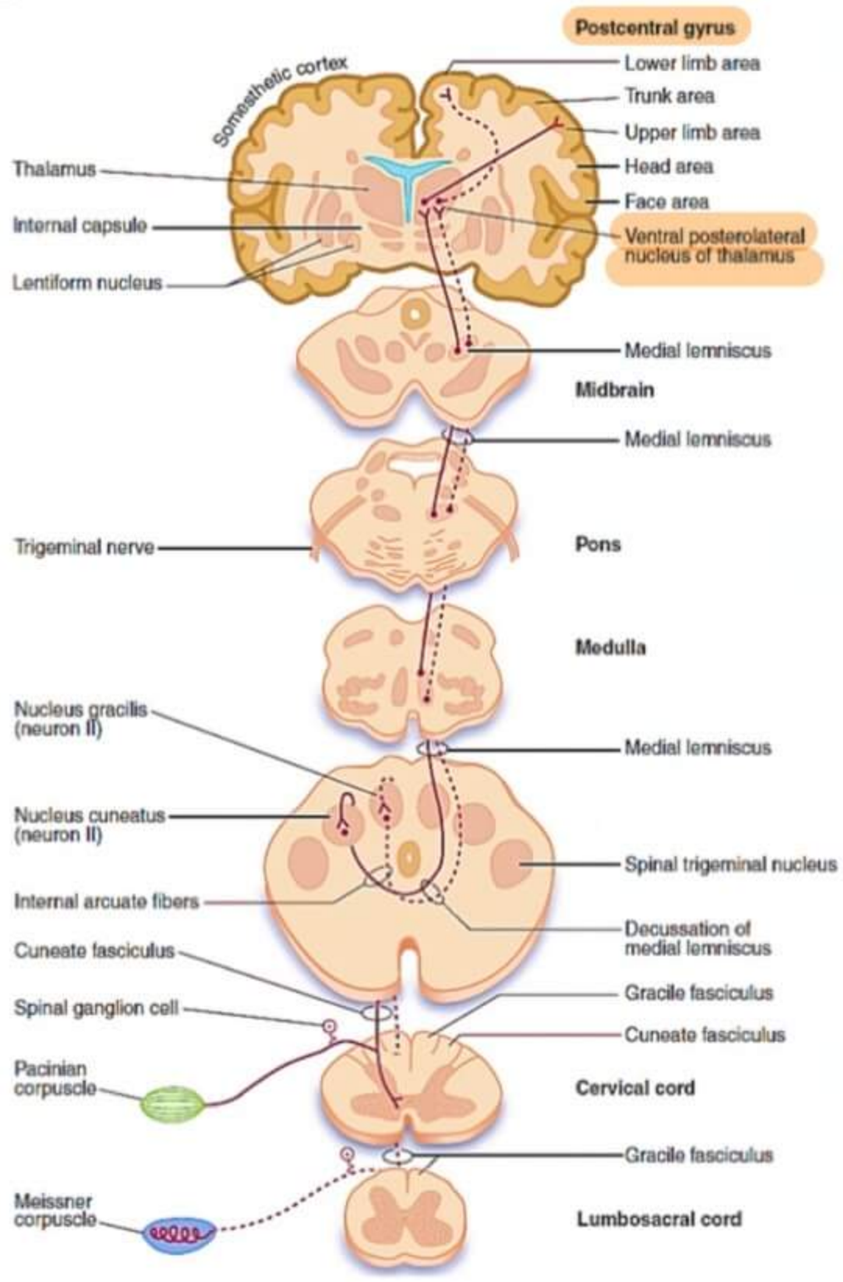
Dorsal / posterior column carries
Touch & pressure



DORSAL COLUMN – MEDIAL LEMINISCUS SYSTEM

→ Dorsal column → 1° neuron
Medial Lemniscus → 2° neuron

→
Receptor
↓
Dorsal Root Ganglion [1° neuron]
runs ipsilaterally
↓
Synapsing in NUCLEUS GRACILIS & NUCLEUS CUNEATUS in medulla
↓
MEDIAL LEMNISCUS [2° neuron] begins
runs contralaterally to reach
3° neuron in Thalamus
↓
Then passes through Internal capsule
to reach PARIETAL SENSORY CORTEX [1,2,3]



→ RECEPTORS → MEISSNER CORPUSCLE → for 2 point discriminat^{n}
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
Medial Lemniscus → 2° neuron

→ VPL (ventral postero lateral) Nucleus of Thalamus → 3° neuron
Pass through the POSTERIOR LIMB OF INTERNAL CAPSULE

→ Dorsal column carries pressure, vibration & tactile discrimination

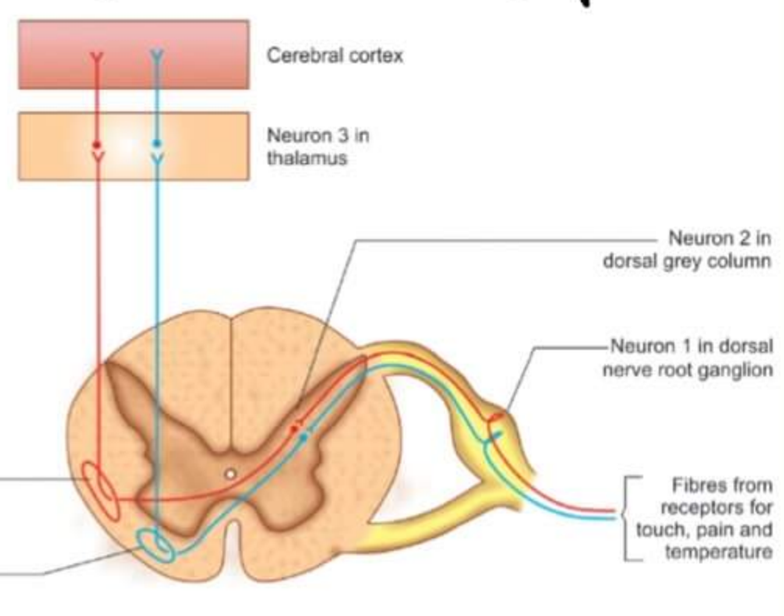
In Left side ischemia of post. limb of IC → Rt side loss of pressure, vibrat^{n}, tactile discrimination of body

In Medial Lemniscal injury in Brain stem → Rt side loss of pressure, vibrat^{n}, tactile discrimination of body

In Brown Sequard Syndrome | hemisection on Right side → Ipsilateral loss of sensations

DORSAL SPINO CEREBELLAR TRACT

→ carries more axons [more important than ventral spinocerebellar tract]
→ carries unconscious proprioceptn from LL for co-ordinatn of voluntary motor activity
→ Lesion → CEREBELLAR ATAXIA

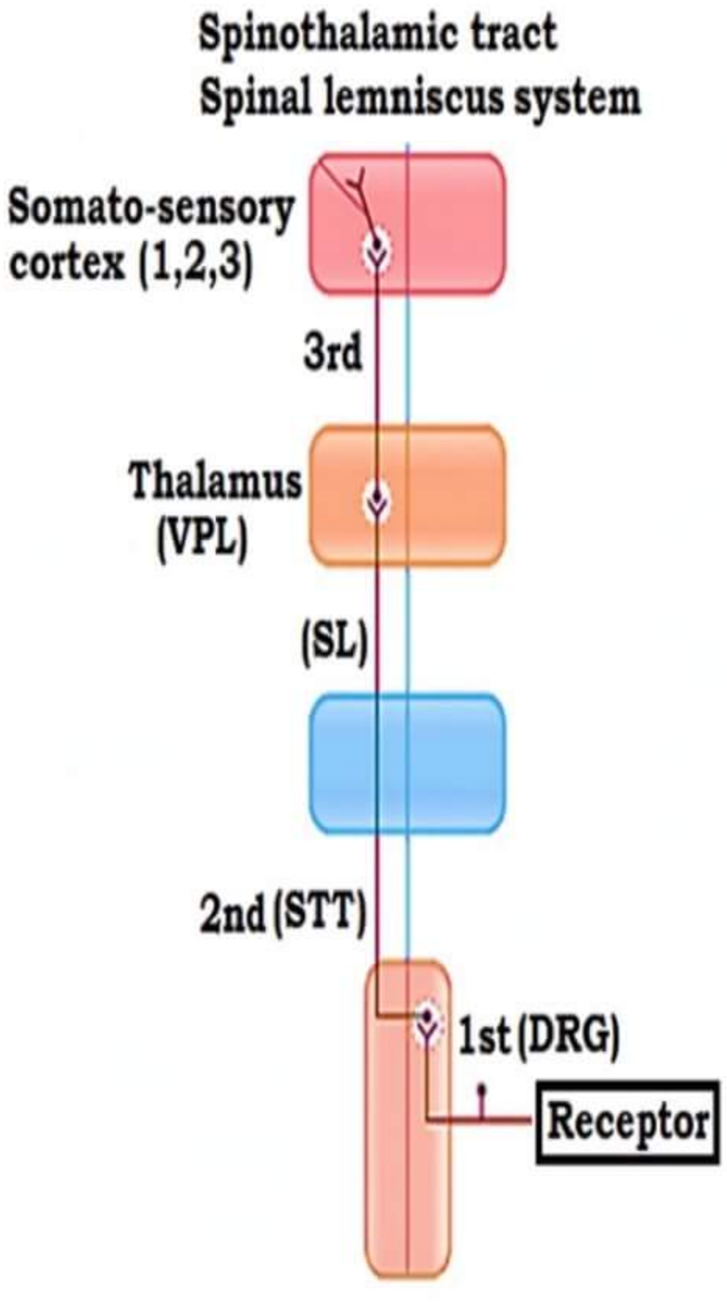


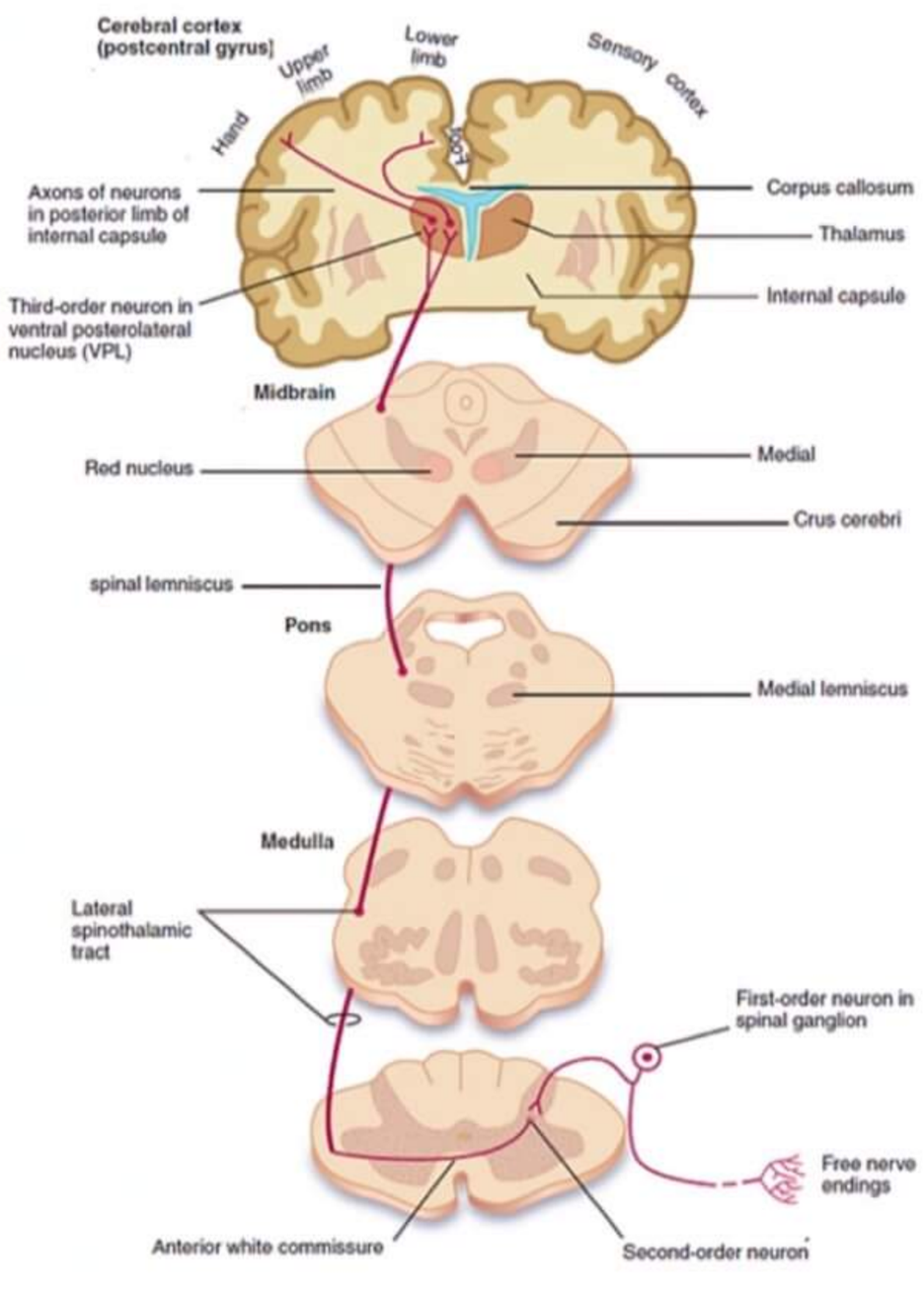
ANTERO LATERAL SPINO THALAMIC TRACT

→ Runs contralaterally
Injury leads to c/L manifestations

→ Lateral spinothalamic tract carries pain & temperature

SPINO THALAMIC TRACT - SPINAL LEMNISCAL SYSTEM





RECEPTOR FOR PAIN & TEMPERATURE → free nerve endings

Dorsal Root Ganglion

→ 1° neuron

→ Immediately synapse on post. horn cell on same side

Post. horn cells

→ 2° neuron

→ Fibres from post. horn cells cross midline & runs as SPINOTHALAMIC TRACT [2° neuron]

→ crossing occurs in ant. commissure

Spinal Lemniscus

→ Lateral spinothalamic Tract in Brain stem → Spinal Lemniscus

→ Synapses in VPL nucleus of Thalamus → 3° neuron

→ Then passes through posterior limb of IC and relies on parietal sensory cortex [1,2,3]

INJURY

1 to Post. limb OF Internal capsule → C|L loss of pain & temperature

2 Wallenberg Syndrome → C|L loss of pain & temperature

3 Brown Sequard Syndrome → C|L loss of pain & temperature

→ FIBRES FROM BODY ASCEND 1 or 2 SEGMENTS BEFORE THEY SYNAPSE & CROSSING MIDLINE

→ In Rt side T_{10} injury → Loss of sensations at T_{12} on left side

ANTERIOR SPINO THALAMIC TRACT

→ runs contra laterally

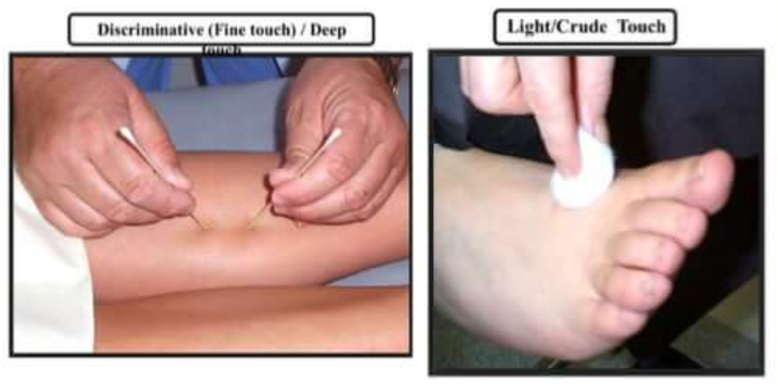
→ carries crude sensations [Touch & pressure] → minor role

DORSAL COLUMN carries Deep touch & Discriminative touch [Fine touch]

D → Dorsal column

D → Deep touch

D → Discriminative touch



Fine touch → touching 1 point

crude touch → touching wide area

PYRAMIDAL TRACT

UMN [Upper motor Neurons]

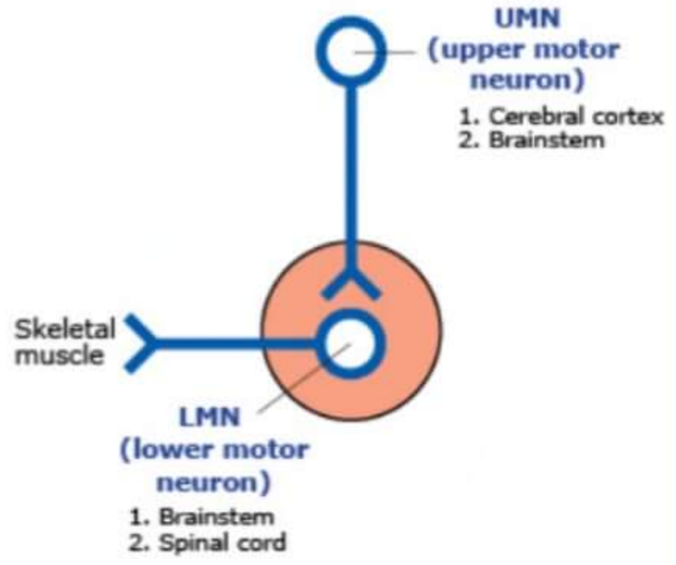
→ present in → Cerebral cortex [mostly]

Brain stem

LMN [Lower Motor Neuron]

→ present in → Brain stem

Spinal cord



Brain stem → Cranial nerves → control skeletal muscles

Spinal Stem → Spinal nerves → control skeletal muscles

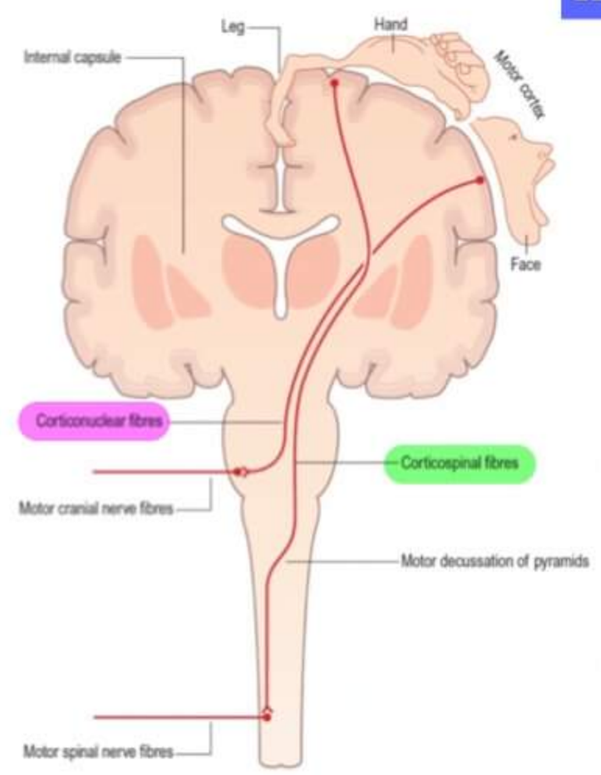
→ IF LMN free to fire frequently → Spastic paralysis

UMN are MODULATORY to LMN

→ preferably Inhibitory but also excitatory

→ UMN Palsy Leads to Spastic paralysis

→ In LMN Injury [Polio virus] → flaccid paralysis



→ Pyramidal system consists

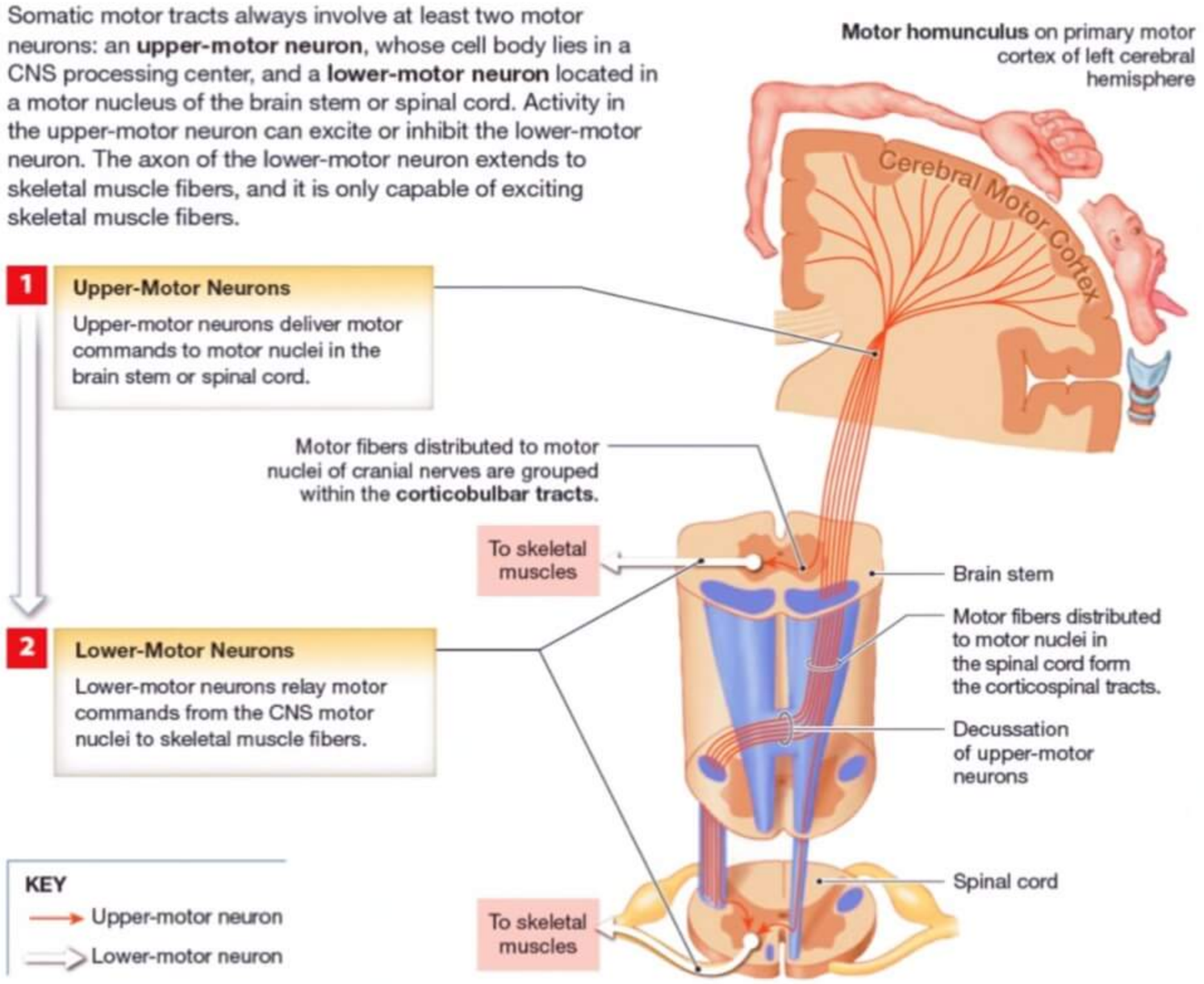
CORTICOSPINAL TRACT → controls finger movements

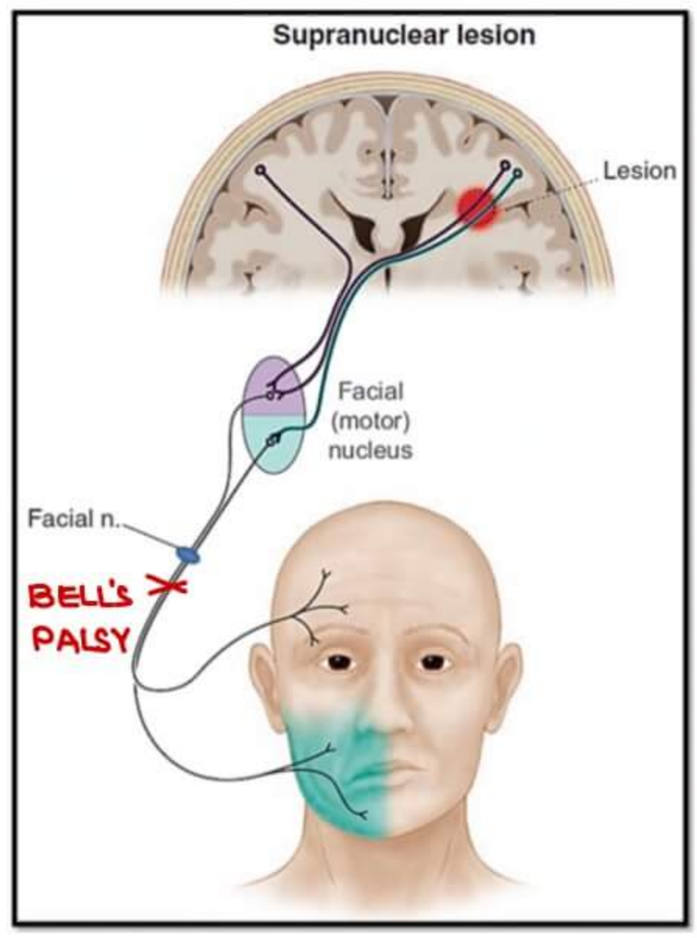
→ crosses at Lower medulla

CORTICO NUCLEAR TRACT → controls Eye movement

CORTICO BULBAR TRACT → crosses at the level of synapse ∵ LMN

Somatic motor tracts always involve at least two motor neurons: an **upper-motor neuron**, whose cell body lies in a CNS processing center, and a **lower-motor neuron** located in a motor nucleus of the brain stem or spinal cord. Activity in the upper-motor neuron can excite or inhibit the lower-motor neuron. The axon of the lower-motor neuron extends to skeletal muscle fibers, and it is only capable of exciting skeletal muscle fibers.





CNT passes through genu of Internal capsule

→ Injury of Genu → C/L Paralysis of body &
[UMN INJURY] Lower face is involved

- Orbicularis oris involved → Dribbling of Saliva
[only has C/L innervation]

→ Orbicularis occuli is spared [no need of Padding]
[has dual innervation]

In BELL'S PALSY → Both upper & Lower face involved
[LMN INJURY] → I/L facial palsy

CST passes through posterior Limb of Internal capsule

→ Injury to post. limb → C/L Spastic paralysis

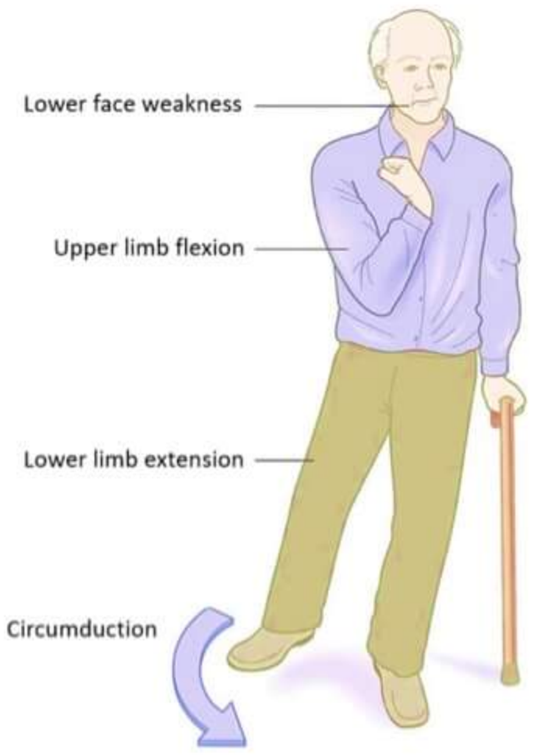
Pyramidal decussation occurs in Lower medulla [80-90%] in CST

Injury in spinal cord [after decussatn] → I/L Spastic paralysis

BOUNDARY LINE b/w UMN & LMN → Till the synapse

INJURY OF GENU OF INTERNAL CAPSULE

→ Lower face weakness
→ Upper limb flexion
→ Lower limb Extension
→ Circumduction Gait



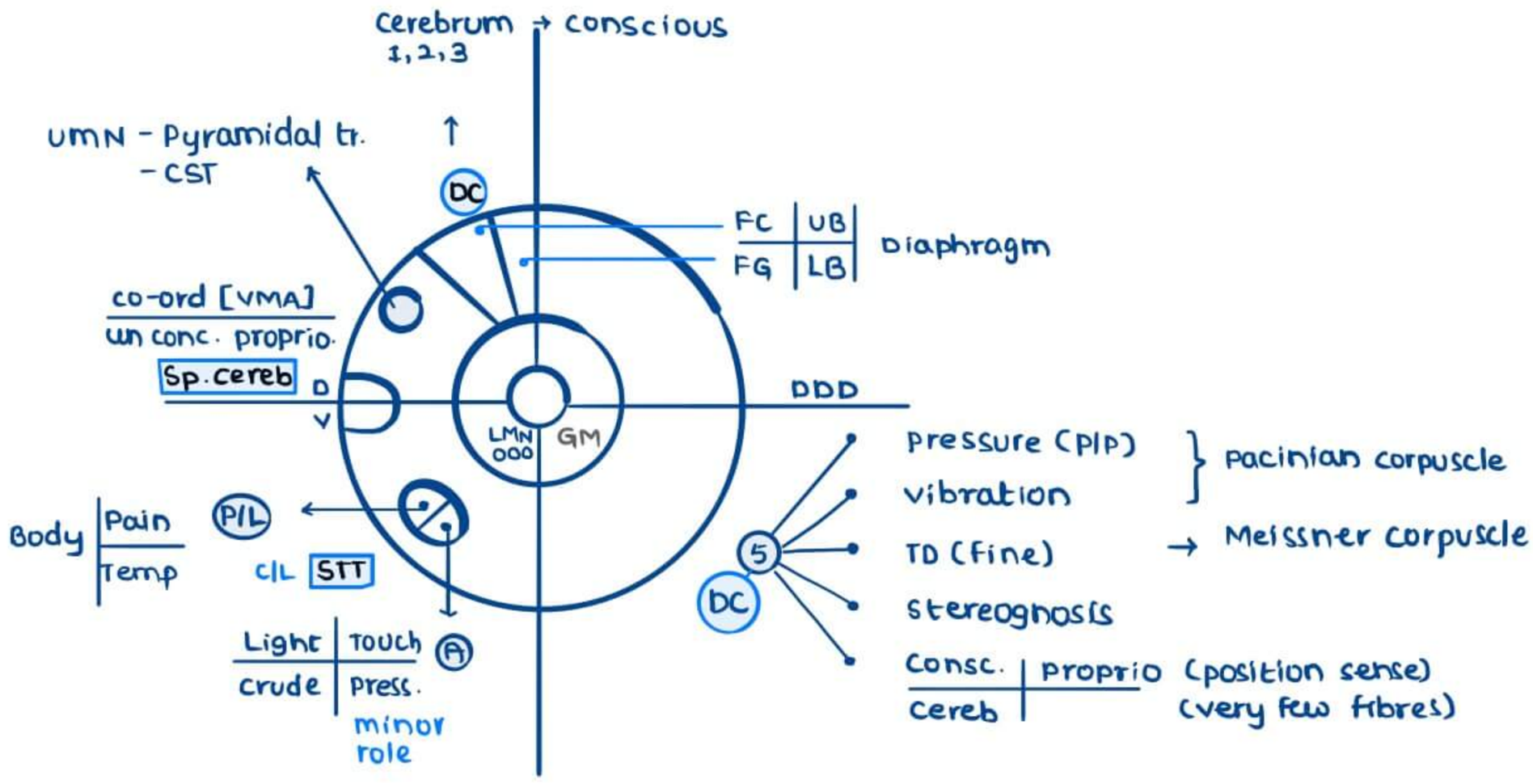
LMN INJURY [Polio virus]

→ Injury after Synapse
→ FLACCID PARALYSIS

BROWN SEQUARD SYNDROME at T_{10} Segment on Rt side

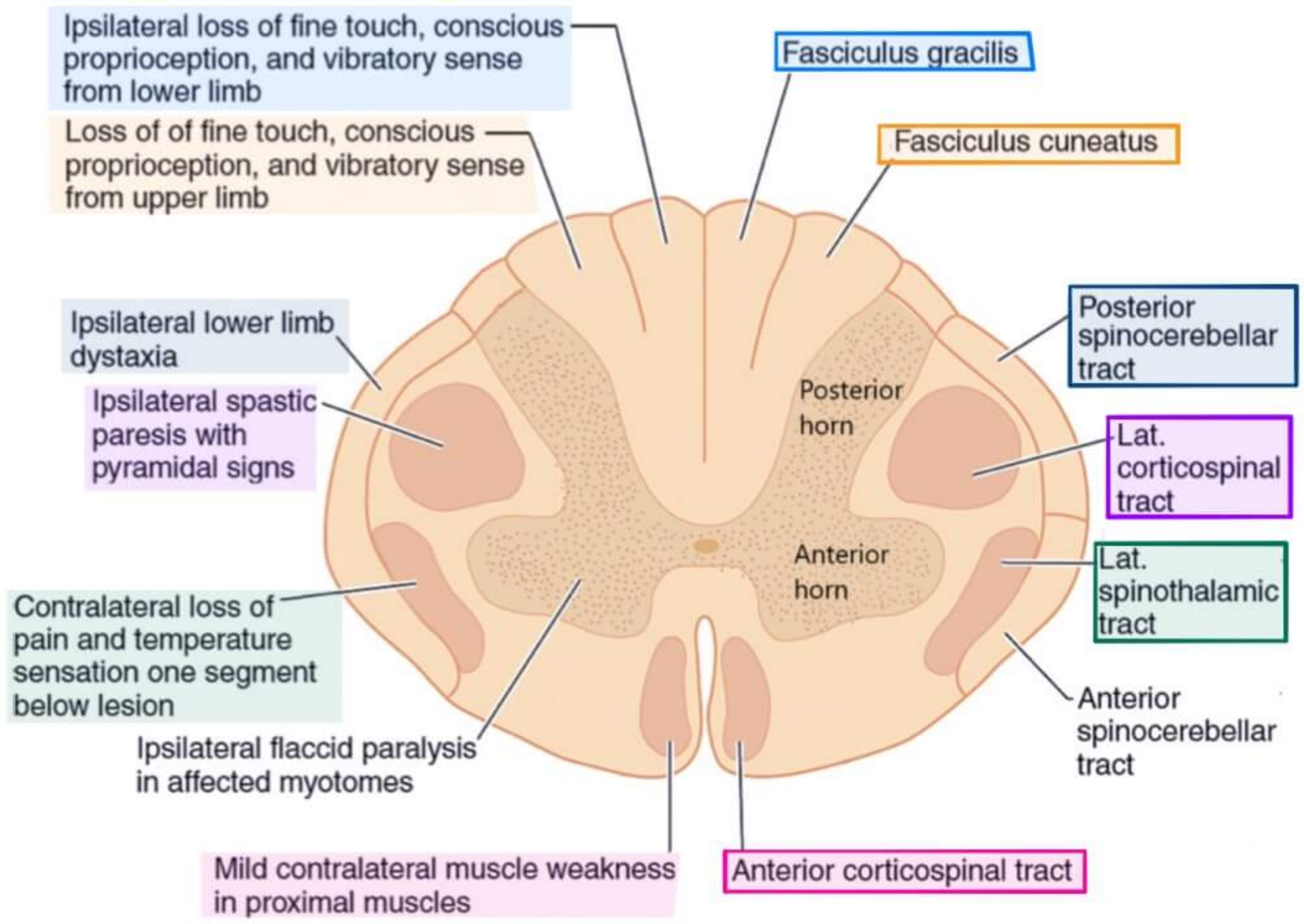
→ UMN & LMN Injury
(Only very few) LMN involved [Injury at T_{10}] → Flaccid T_{10} muscles

→ at the level of lesion (T_{10}) → Flaccid paralysis
→ Below the level of lesion → Spastic paralysis
dlt UMN injury → LMN free to fire



DC → Dorsal column
FC → Fasciculus cuneatus
FG → fasciculus gracilis → carries urinary bladder pressure sensation
TD → Tactile discriminat^{n} / 2 point discriminat^{n} / fine touch
P/L → post. / Lateral
A → Anterior
GM → Grey matter

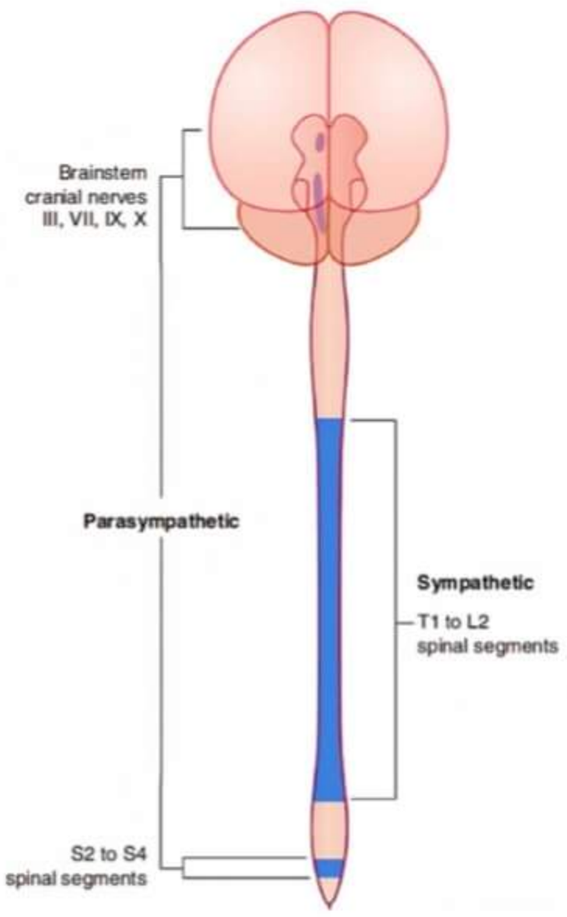
Pacinian & Meissner corpuscles are rapidly adopting receptor
Stereognosis → ability to identify the object by closing the eye & touch



AUTONOMOUS NERVOUS SYSTEM

→ under the control of Hypothalamus ī Sympathetic & parasympathetic components

Q Sweating is mediated by
a Adrenal hormones
b Sympathetic adrenergic system
c Sympathetic cholinergic System [Better Answer]
d Parasympathetic cholinergic system



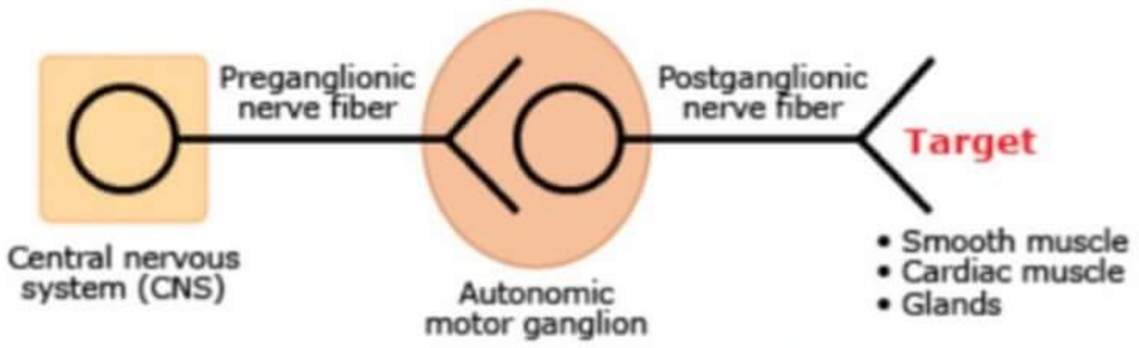
SYMPATHETIC SYSTEM → Thoracolumbar flow

PARASYMPATHETIC SYSTEM → CRANIO – CN 3,7,9,10
SACRAL – S_2 - S_4
FLOW

ANS - ORGANISATION

GANGLIONATED

1. CNS Neuron → Nucleus
2. PNS Neuron → Ganglia
3. Effectors → Smooth muscle
   cardiac muscle
   Glands [secreto motor fibres]

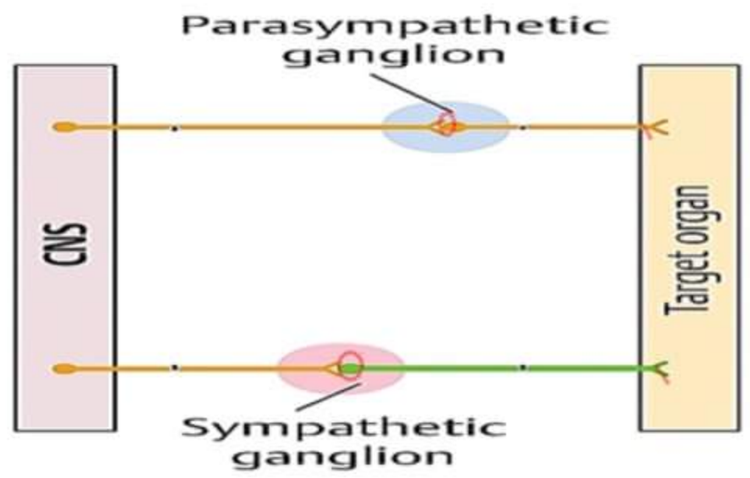


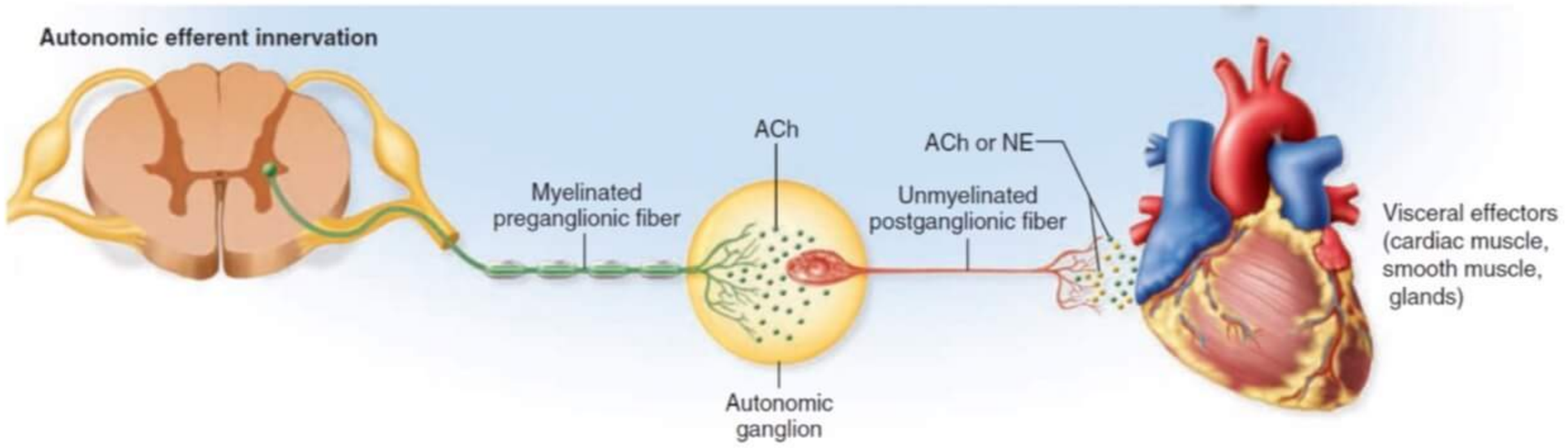
Pre ganglionic fibres & Post ganglionic fibres

→ Parasympathetic ganglia are close to the target organ
→ Post ganglionic fibres are shorter

→ Sympathetic ganglia are close to CNS
→ pre ganglionic fibres are shorter

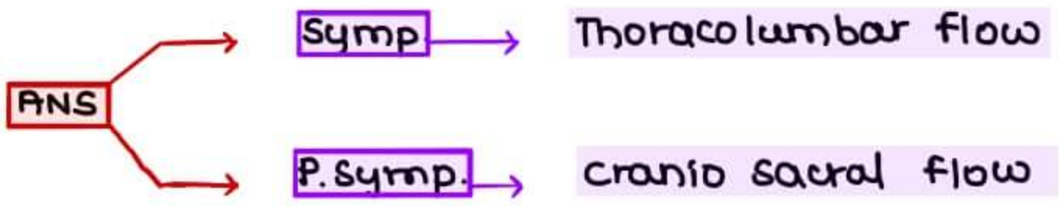
→ pre ganglionic fibres are myelinated [White]
post ganglionic fibres are non myelinated
[grey matter]





→ Sympathetic & para sympathetic neurons present in Lateral Horn cells of Spinal cord

→ Ach → preganglionic neurotransmitter
Ach → para sympathetic post ganglionic [Effector] neurotransmitter
Adr → Sympathetic post ganglionic [Effector] neurotransmitter



	CNS (Nucleus)	PNS (Ganglion)	Effector ↷ sm, cm ↳ glands
Para sympathetic	White (myelin)	Ach	Ach grey (non myelinated)
Sympathetic		Ach	Adr [mostly] Ach [skin - sweat glands]

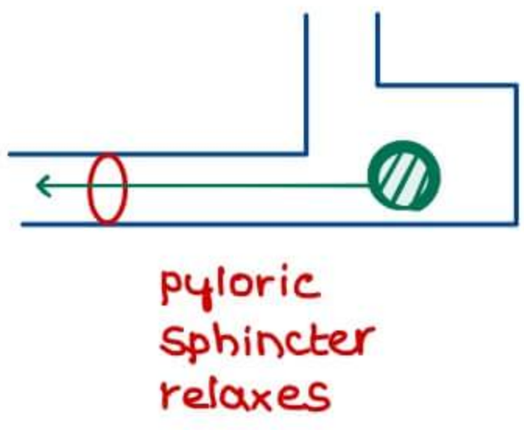
PARA SYMPATHETIC SYSTEM

Q All are true about vagus nerve except
a Supplies heart & lung → causes bradycardia & bronchoconstriction
b Carries post ganglionic para sympathetic fibres
c Innervates right 2/3rd of transverse colon
d Stimulates peristalsis & relaxes sphincters

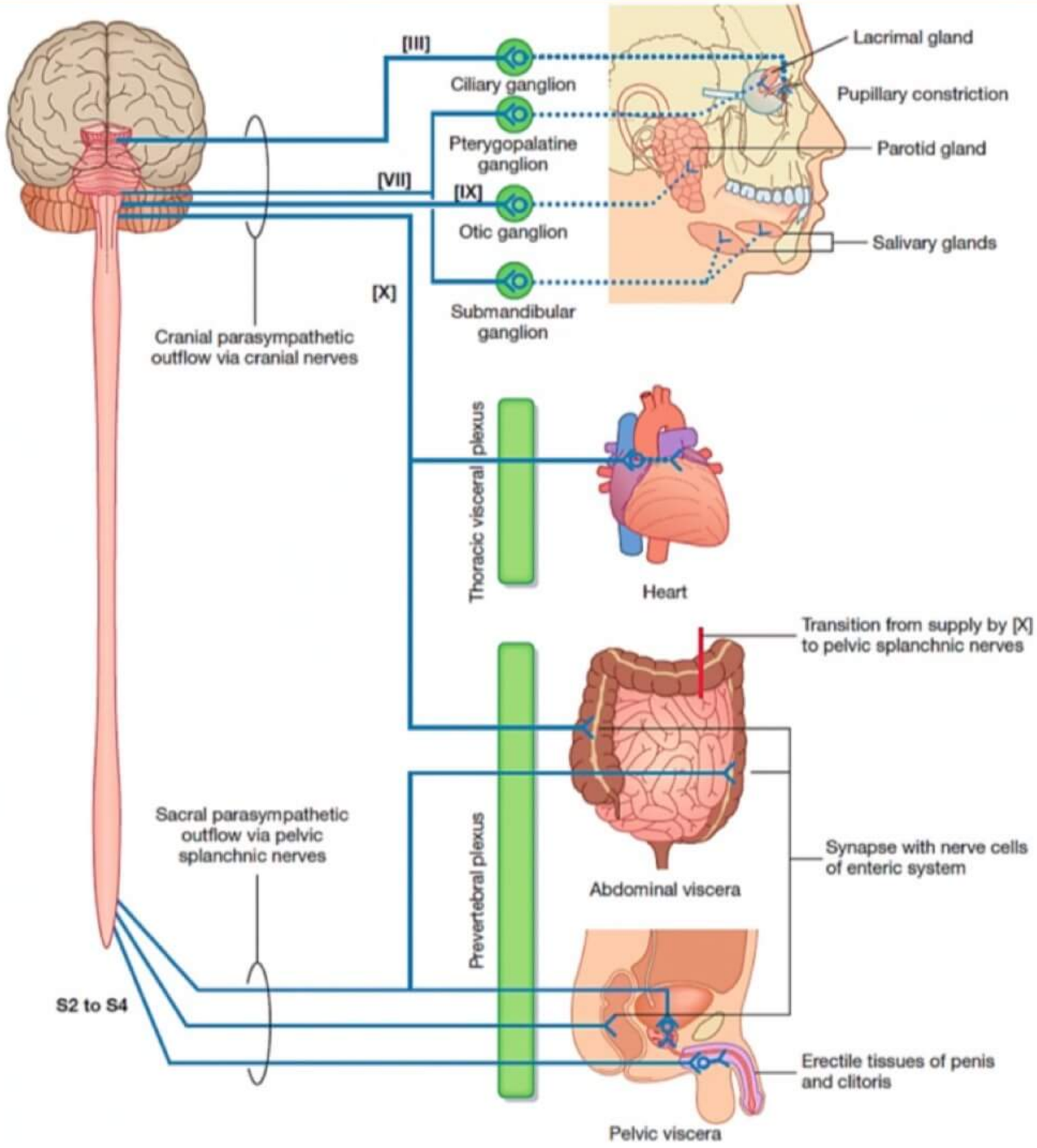
CN 3, 7, 9, 10, & Nervi Erigentes → Para Sympathetic nerves & White

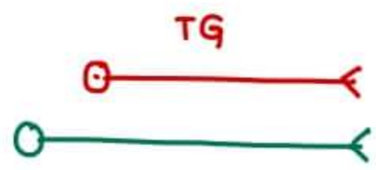
VAGUS NERVE

→ Para sympathetic nerve
→ White → carries pre ganglionic Fibres
→ comes from CNS
→ cause Bladder & Bowel evacuation



RETENTION SYNDROME (S/E)
↑
vagus ← × — Peptic ulcer
↑ Peristalsis





Topographic Relath

- Locomotⁿ
- Anatomical

Functional Nerves

CN 3,7,9,10

$S_2 - S_4$ → NERVI ERIGENTES | PELVIC SPLANCHNIC NERVES

→ causes defecation & urinatⁿ

causes erectⁿ

CN 3 → OCCULO MOTOR NERVE

contains ciliary glanglion & controls eye ball smoth muscles

CN 7 → FACIAL NERVE

comes from Brain stem

contains Pterygopalatine ganglion } controls 5 glands on face
Submandibular ganglion }

CN 9 → GLASSOPHARYNGEAL NERVE

comes from brain stem

contains otic ganglion & controls parotid salivary glands

CN X → VAGUS NERVE

Longest cranial nerve & widest distributⁿ in body

- supplies head neck → secreto motor
  thorax → brady cardia, Brochoconstrictⁿ
  abdomen → Bladder & bowel evacuatⁿ

- supplies till 2/3rd of transverse colon incl. vermiform appendix

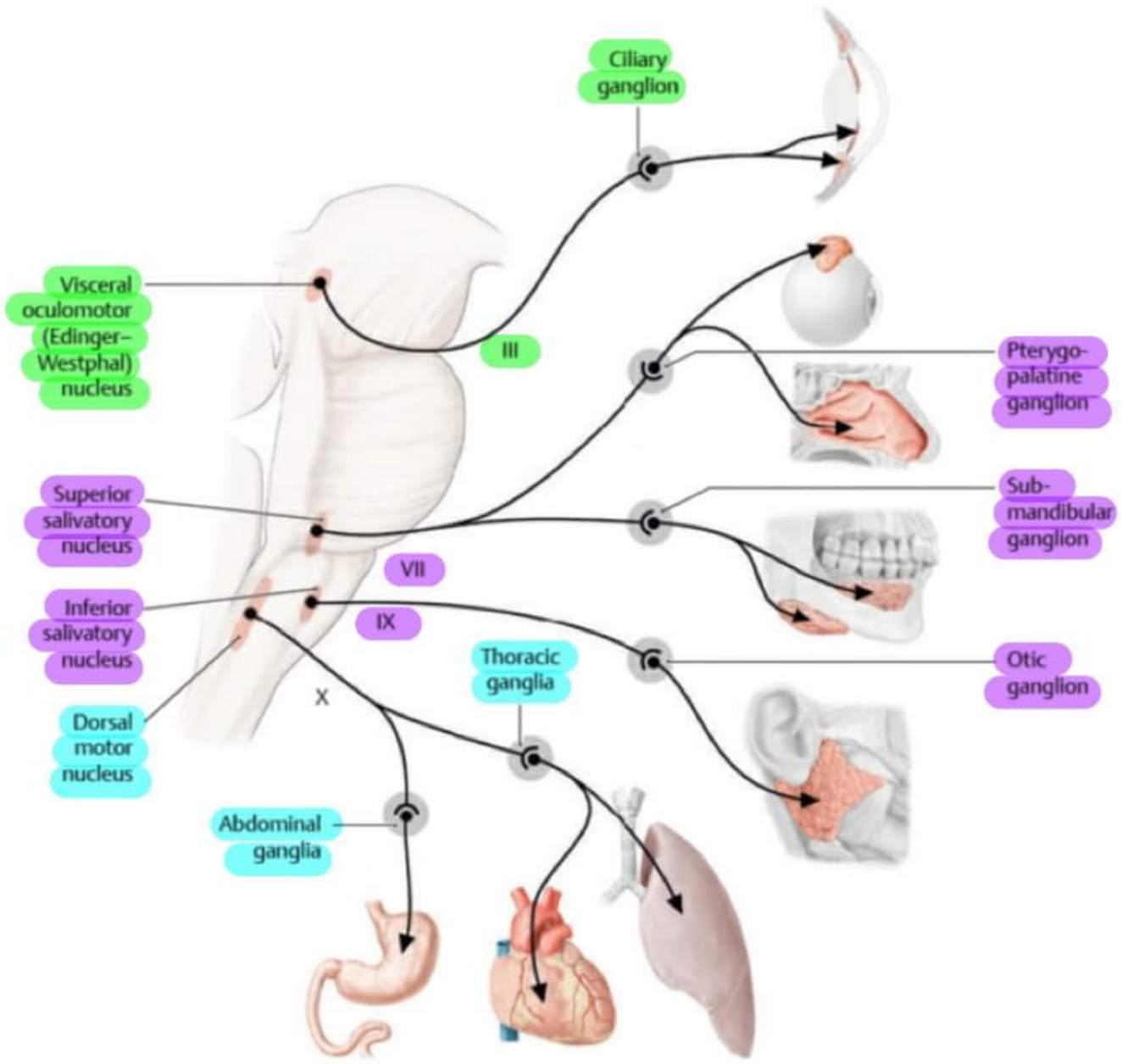
NERVI ERIGENTES

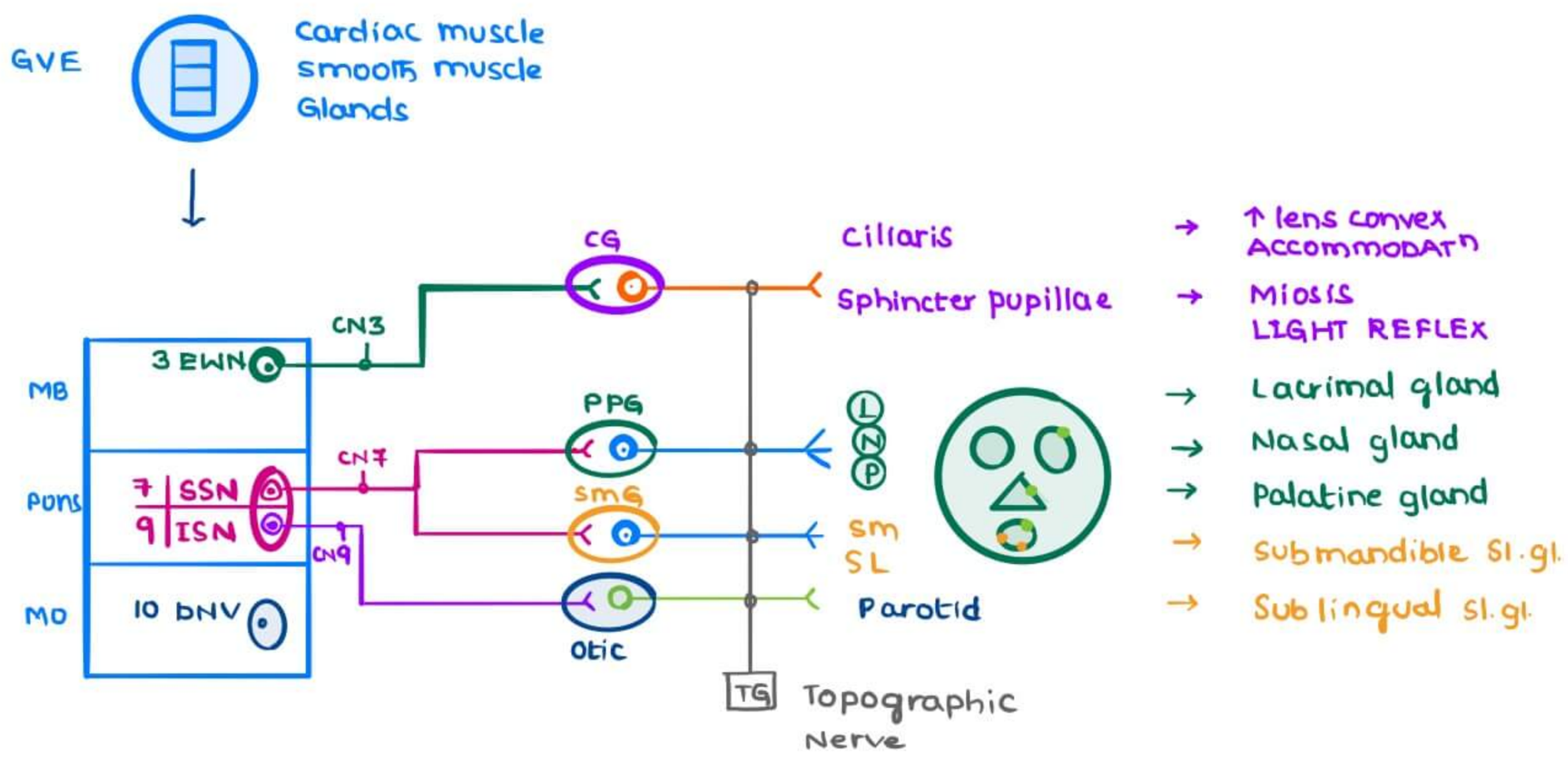
→ Supplies hind gut including splenic flexure & rectum
→ Supplies pelvic viscera [PELVIC SPLANCHNIC NERVES]

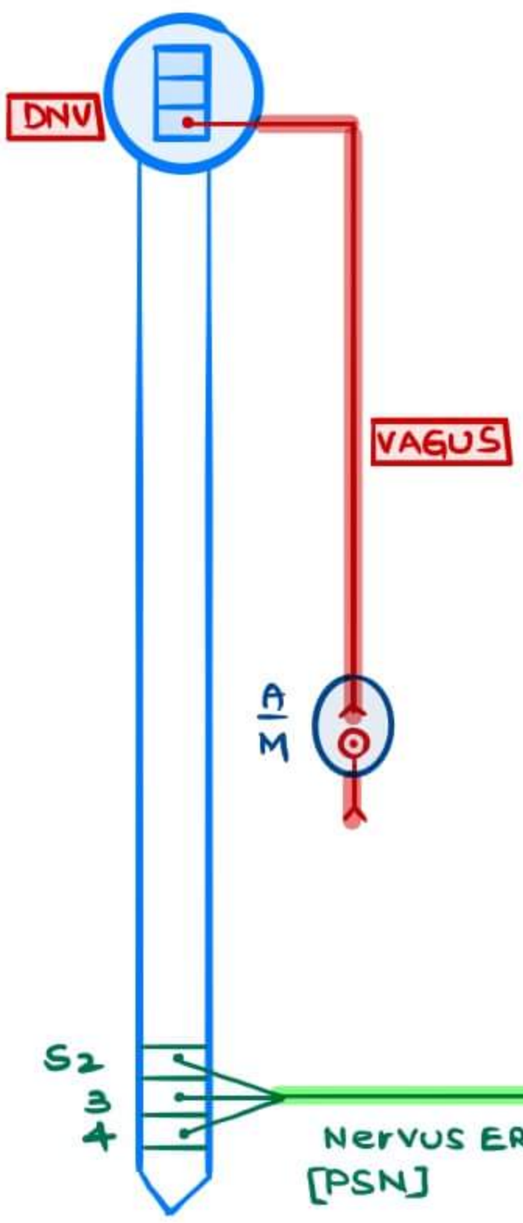
POST GANGLIONIC FIBRES

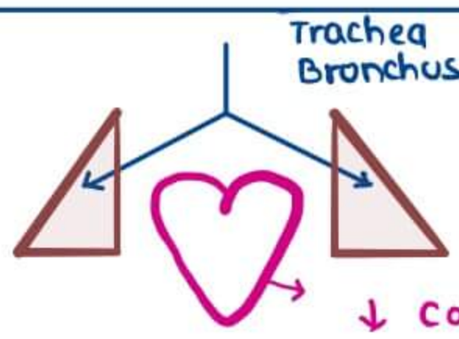
→ NO NAMES
→ In head & neck region, they are carried by branches of TRIGEMINAL NERVE
TROPOGRAPHIC NERVE/ Location wise | Anatomical nerve

TROPOGRAPHICAL / ANATOMICAL NERVES	→	Trigeminal Nerve
FUNCTIONAL NERVES	→	CN 3, 7, 9, 10, NERVI ERIGENTES



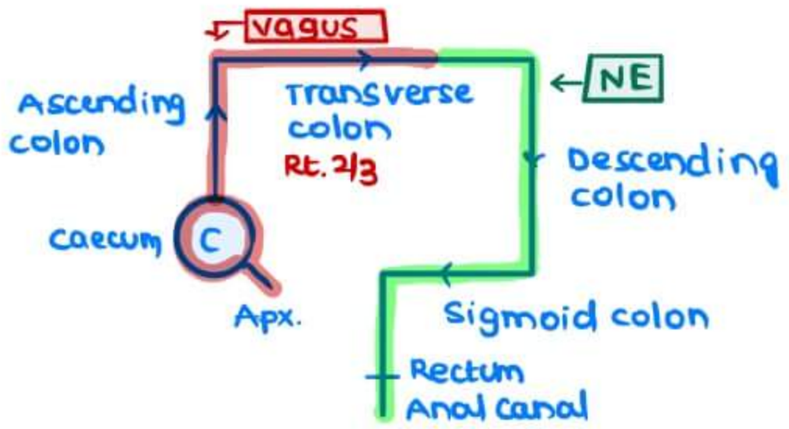






→ ASTHMA
Bronchoconstrictⁿ
↑secretion
Rx → Ipratropium bromide

↓ Contractility
↓ Conductivity
↓ Chronicity → Bradycardia
→ R-R prolongatⁿ



Pudendal Nerve
[Somatic NS]
- controls
urinary
vaginal
anal
} Sphincters

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 → LR_6 → GSE

COMPARISION BETWEEN PARASYMPATHETIC & SYMPATHETIC NERVOUS SYSTEM

Resting
Digesting
} Parasympathetic system → Anabolic

Fight
Flight
Fright
} Sympathetic System → catabolic
Short burst

→ Eyes → dilated
→ Skin → cold in periphery

	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

DILATOR PUPILLAE

→ Adrenergic muscle

→ causes mydriasis

SPHINCTER PUPILLAE

→ Cholinergic muscle

→ causes miosis

SYMPATHETIC NERVOUS SYSTEM

→ Thoraco Lumbar flow

→ Present in LHC [Lateral Horn cells] of Spinal cords

→ Starting at T_1 spinal segment
ending at L_2 Spinal segment
} 12 + 2 spinal segments (CNS)

→ GANGLIA (PNS)

PARA VERTEBRAL GANGLIA

→ controls skin Effectors [sweat glands]

→ forms sympathetic chain

PRE VERTEBRAL / PRE AORTIC GANGLIA

→ in midline & controls viscera

→ Named according to branches of aorta

→ WHITE RAMUS COMMUNICANTES

→ pre vertebral fibres

→ myelinated fibres → White

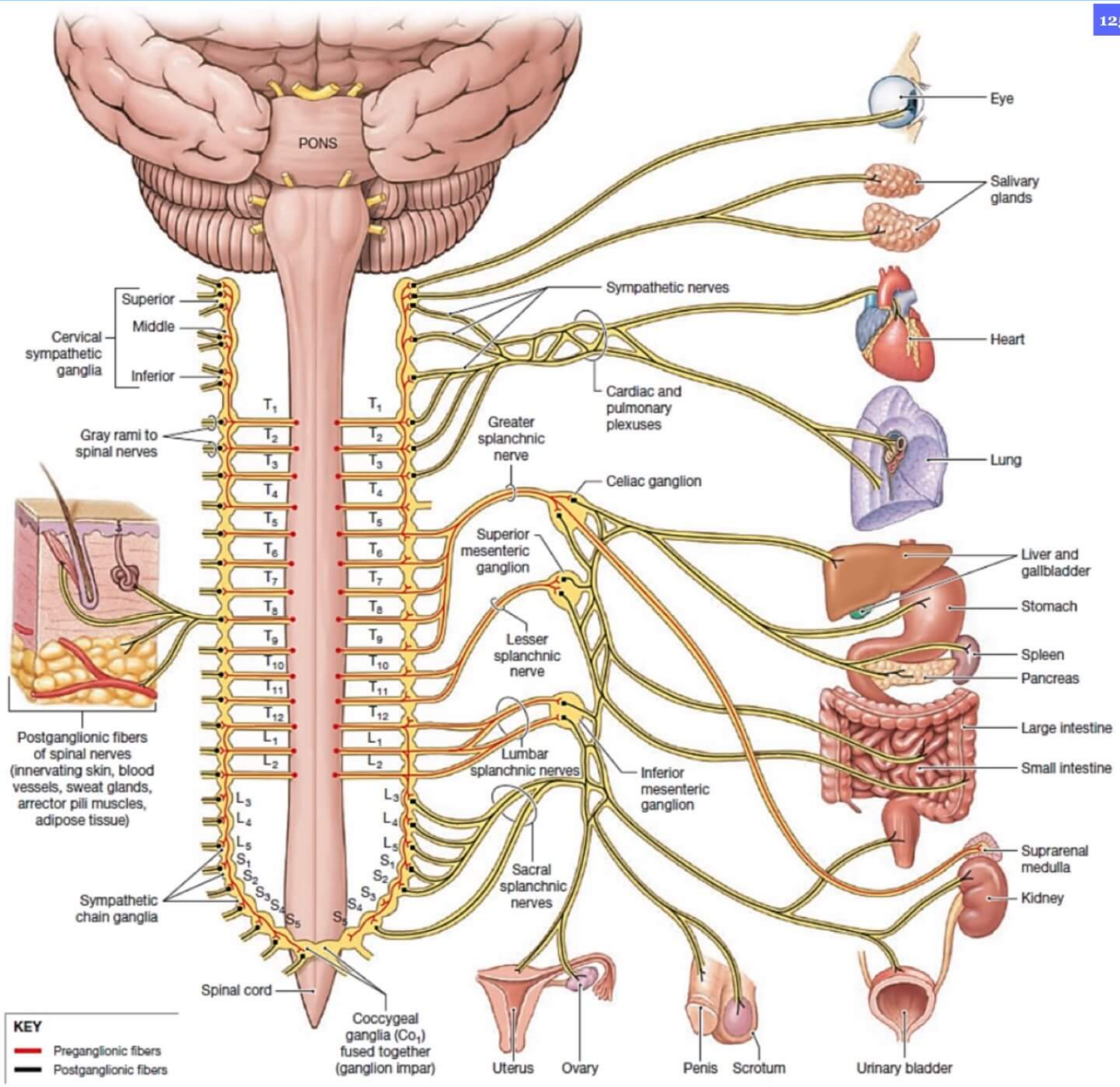
→ GRAY RAMUS COMMUNICANTES

→ post vertebral fibres

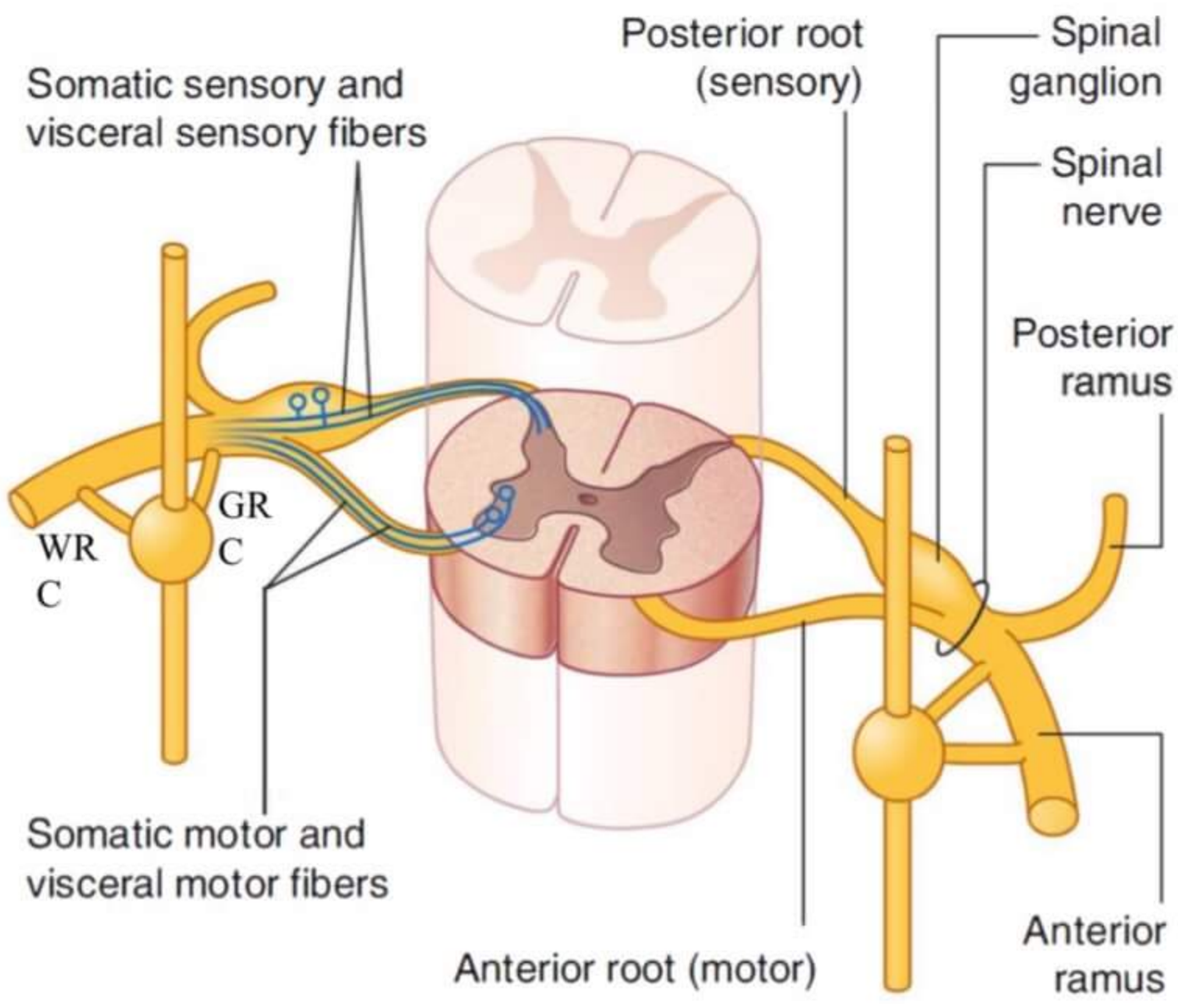
→ non - myelinated fibres → grey

→ some fibres bypassing para vertebral ganglia to synapse in prevertebral ganglia

→ Greater splanchnic nerve [GSN] Least splanchnic nerve
Lesser Splanchnic nerve [LSN] Lumbar splanchnic nerve



RAMUS COMMUNICANTES

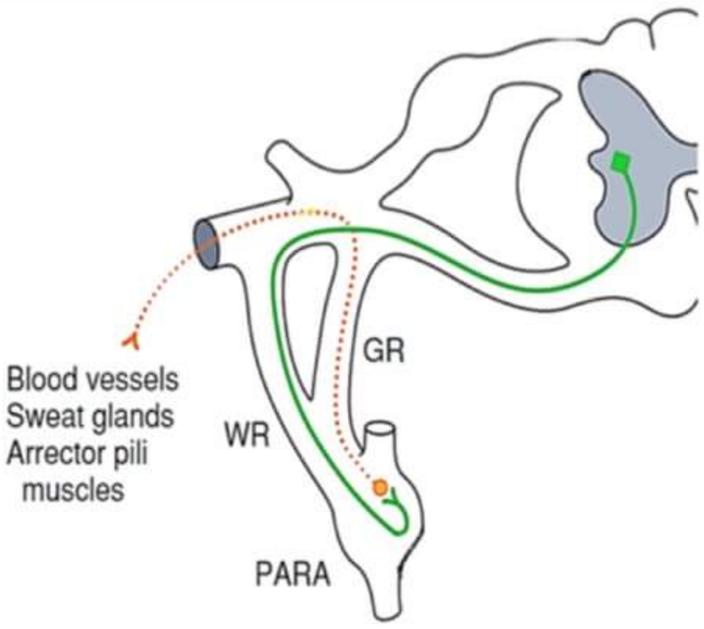


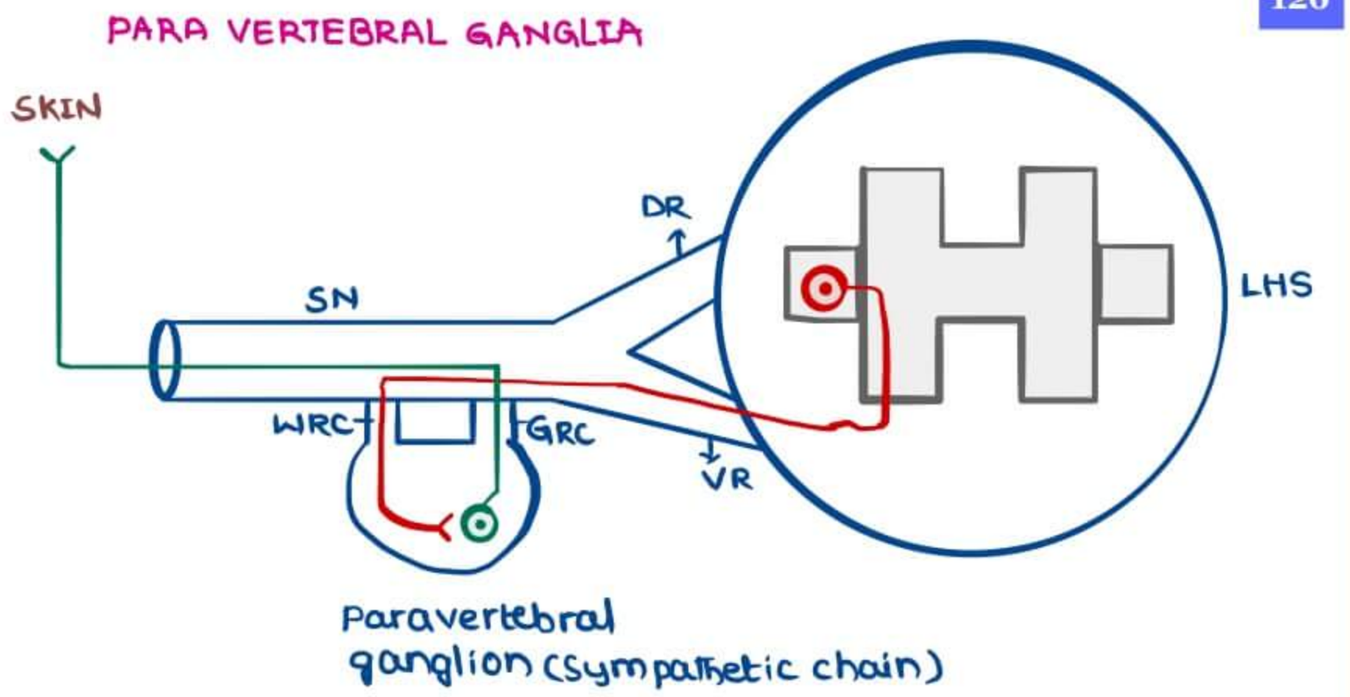
→ ventral root + doral root

↓

Spinal nerve

→ Spinal nerve connected to sympathetic ganglia by → Distal White Ramus communi - cantes & proximal Grey Ramus communicantes





PRE VERTEBRAL GANGLIA → Supplies viscera

GREATER SPLANCHNIC NERVE

→ comes from CNS → White [myelinated] → uses WRC

→ comes from $T_5 - T_9$ Spinal cord

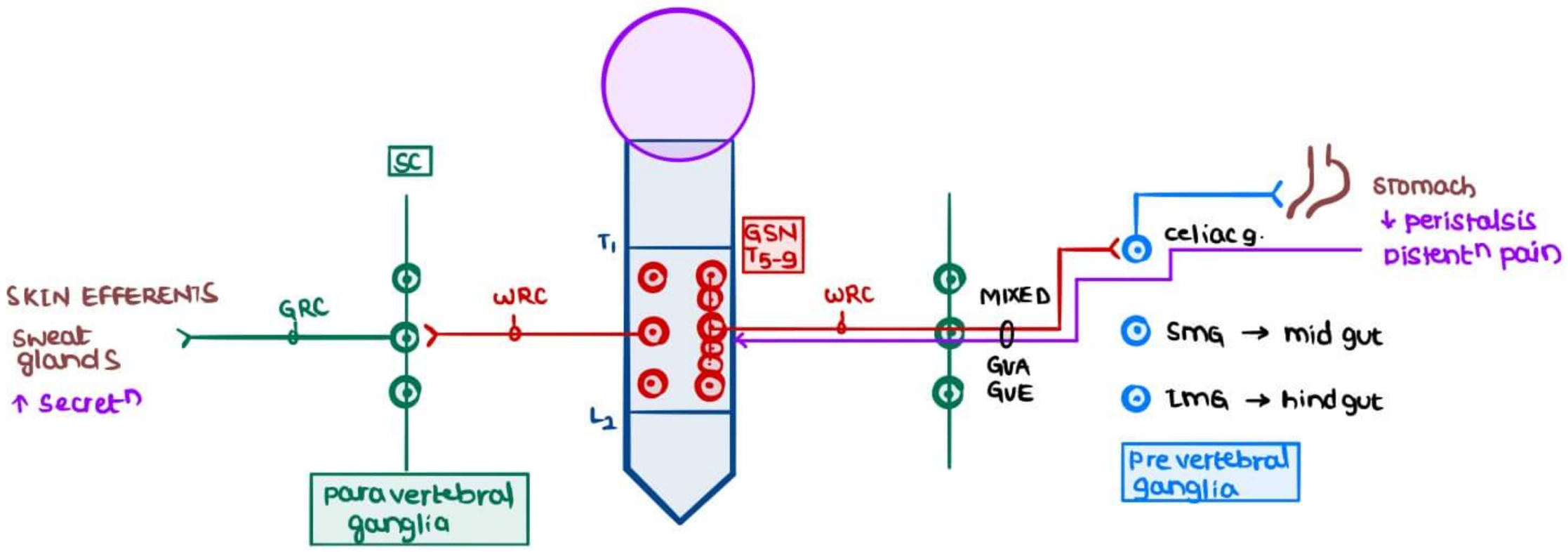
→ Pre vertebral fibres bypassing sympathetic chain to synapse in pre vertebral ganglia [celiac ganglia]

→ Celiac ganglia controls fore gut derivatives [stomach]

→ ↓ Peristalsis → distentⁿ pain [carried by GSN]

→ GSN is both sensory [GVA] & motor [GVE]

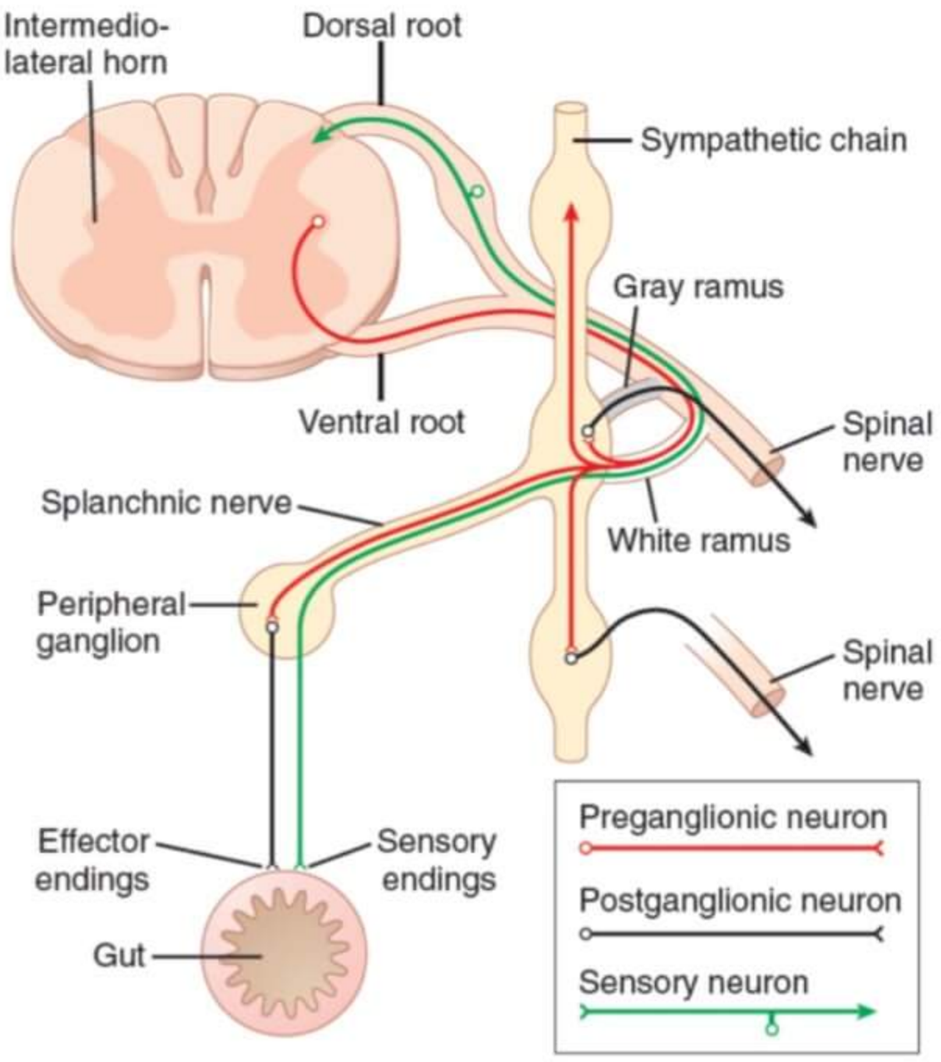
→ Pre ganglionic fibres of sympathetic system → shorter

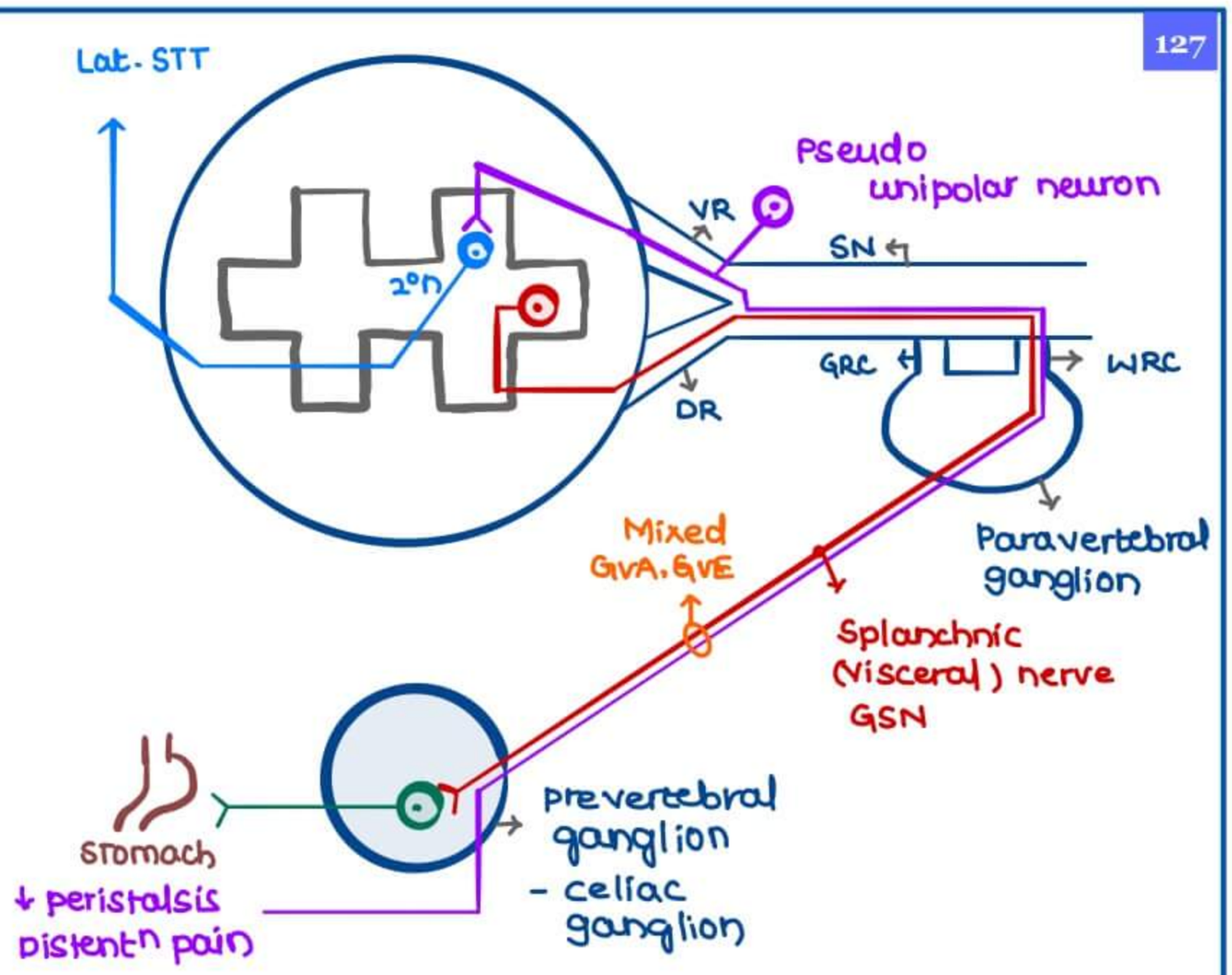


SMG → Superior mesenteric ganglia

IMG → Inferior mesenteric ganglia

Post ganglionic fibres are carried by branches of celiac artery





NO. OF Pre ganglionic sympathetic fibres [WRC] → 14 + 14 → 28

NO. OF post ganglionic fibres → 1 : 30 → 30 times of pre ganglionic fibres

HORNER SYNDROME

Q All are seen in Horner's syndrome due to cavernous sinus pathology EXCEPT

a Enophthalmos

b Ptosis

c Miosis

d Anhydrosis

T_1 Symp. plexus compromised

3°n injury

cavernous sinus pathology → Internal carotid artery dissection

HORNER SYNDROME

CIF

1 Ptosis +

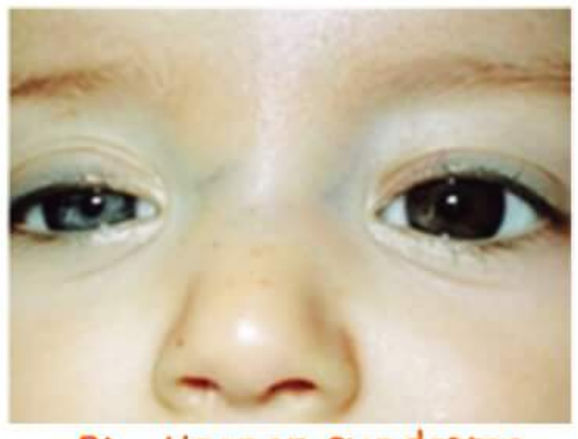
2 miosis +

3 Anhidrosis +|-

4 Nasal congestn

5 conjunctival congestn

6 Skin becomes red



Rt Horner syndrome

PTOSIS

→ Superior Tarsal muscle of miller muscle paralysis → Partial Ptosis

→ dlt T_1 sympathetic fibre compromisatn

MIOSIS

→ Sphincter pupillae become more powerful

Dilator pupillae paralysed [supplied by T_1 symp. fibres]

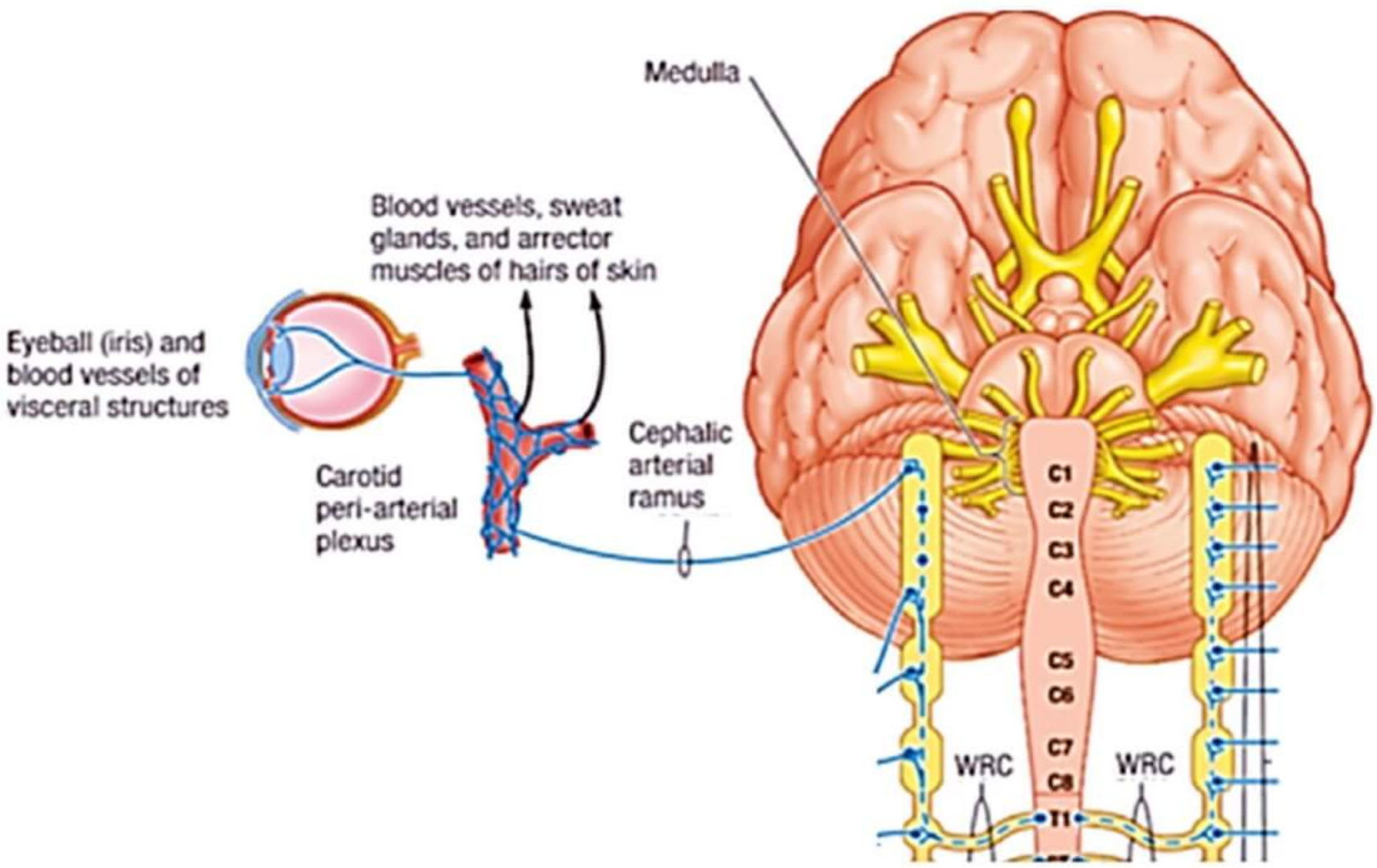
ENOPHTHALMOS [sunken Eye ball]

→ paralysis of Orbitalis [supplied by T_1 Symp. fibres]

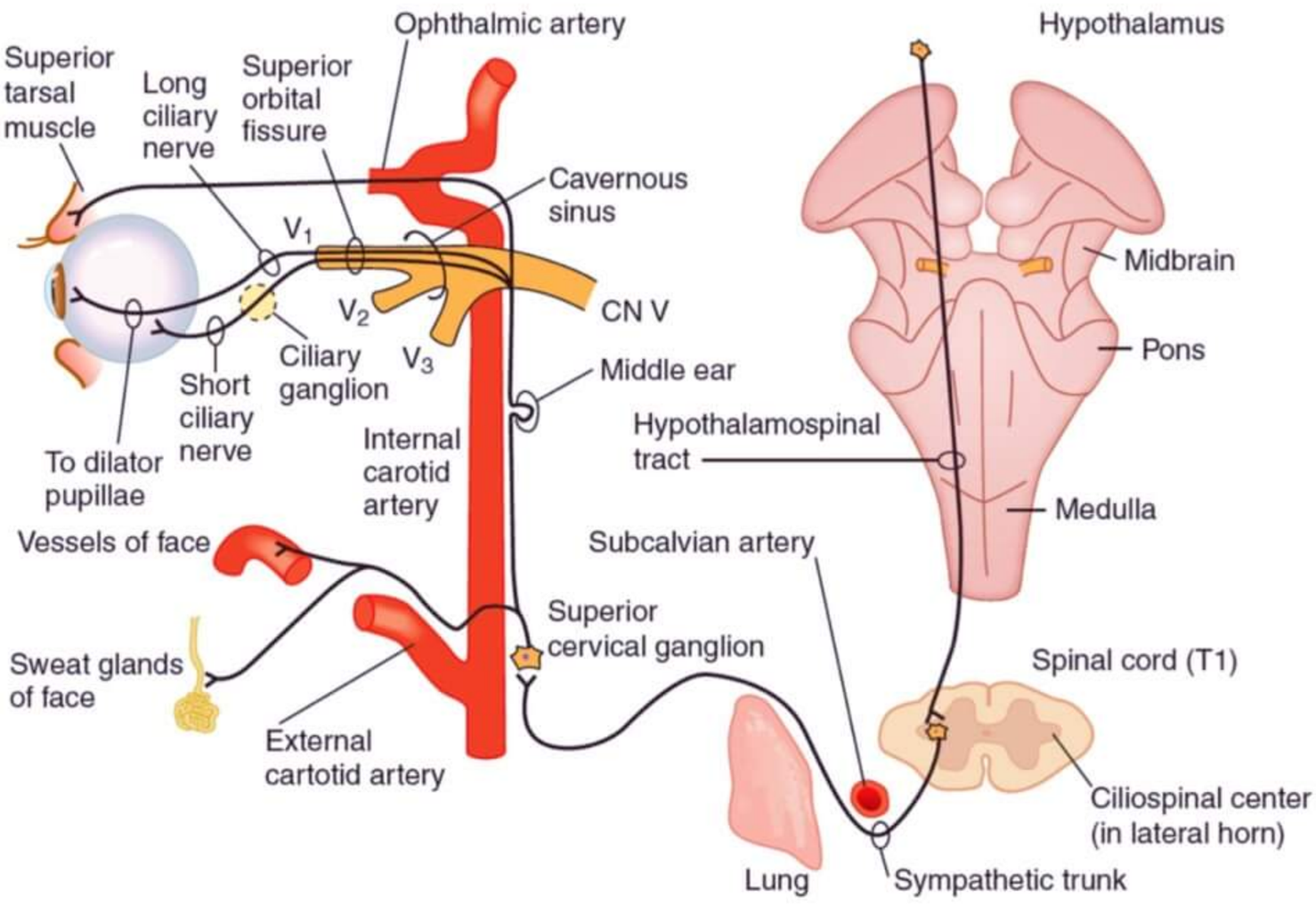
→ Orbitalis normally pushes the eye ball out of socket

NASAL CONGESTION
CONJUNCTIVAL CONGESTION
SKIN becomes red

} dlt vasodilation [Hyperemia] as T_1 sympathetic vasoconstriction is gone



HYPOTHALAMO SPINAL PATHWAY & HORNER SYNDROME



IN CASE OF NERVE INJURY, ONLY DISTAL AREA AFFECTED

→ Hypothalamo Spinal tract passes in lateral medulla

→ 1° neuron → Hypothalamus
2° neuron → Spinal cord
3° neuron → Superior cervical ganglion (sympathetic chain)
Fibres climbs up the sympathetic chain

→ CONTROLS

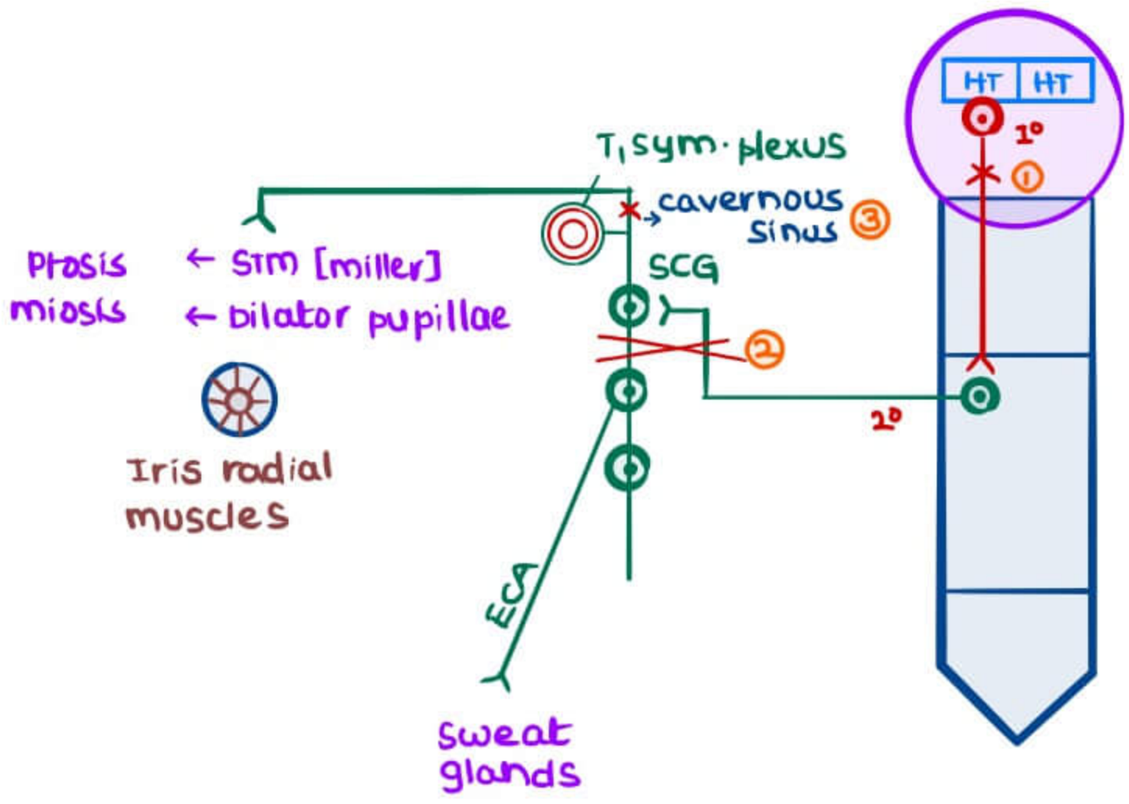
1 Superior Tarsal muscle of MILLER MUSCLE
2 Dilator papillae

→ INJURIES

1. WALLENBERG SYNDROME / LATERAL MEDULLARY SYNDROME | I/L HORNER SYNDROME
   → 1° neuron injury
   → loss of sweating on same side of face

2. APICAL LUNG CANCER / PAN COAST TUMOR
   → causes I/L Horner syndrome
   → 2° neuron injury [pre ganglionic fibre injury]
   → pre ganglionic fibres involved
   → Loss of sweating on same side of face

3. INTERNAL CAROTID ARTERY DISSECTION
   → T_1 Symp. fibres compromised
   → No problem in sweating



1 Lateral medullary / Wallenberg syndrome
2 Apical Lung cancer / pancoast tumor
3 cavernous sinus pathology

Q Labyrinthine artery is a branch of

a Superior cerebellar artery

b Basilar artery

c Anterior inferior cerebellar artery [Better answer]

d Posterior inferior cerebellar artery

Labyrinthine artery

→ Supplies ear

→ In 80%, it is branch of Ant. inf. cerebellar artery of Basilar artery

→ In 20%, it is direct branch of Basilar artery

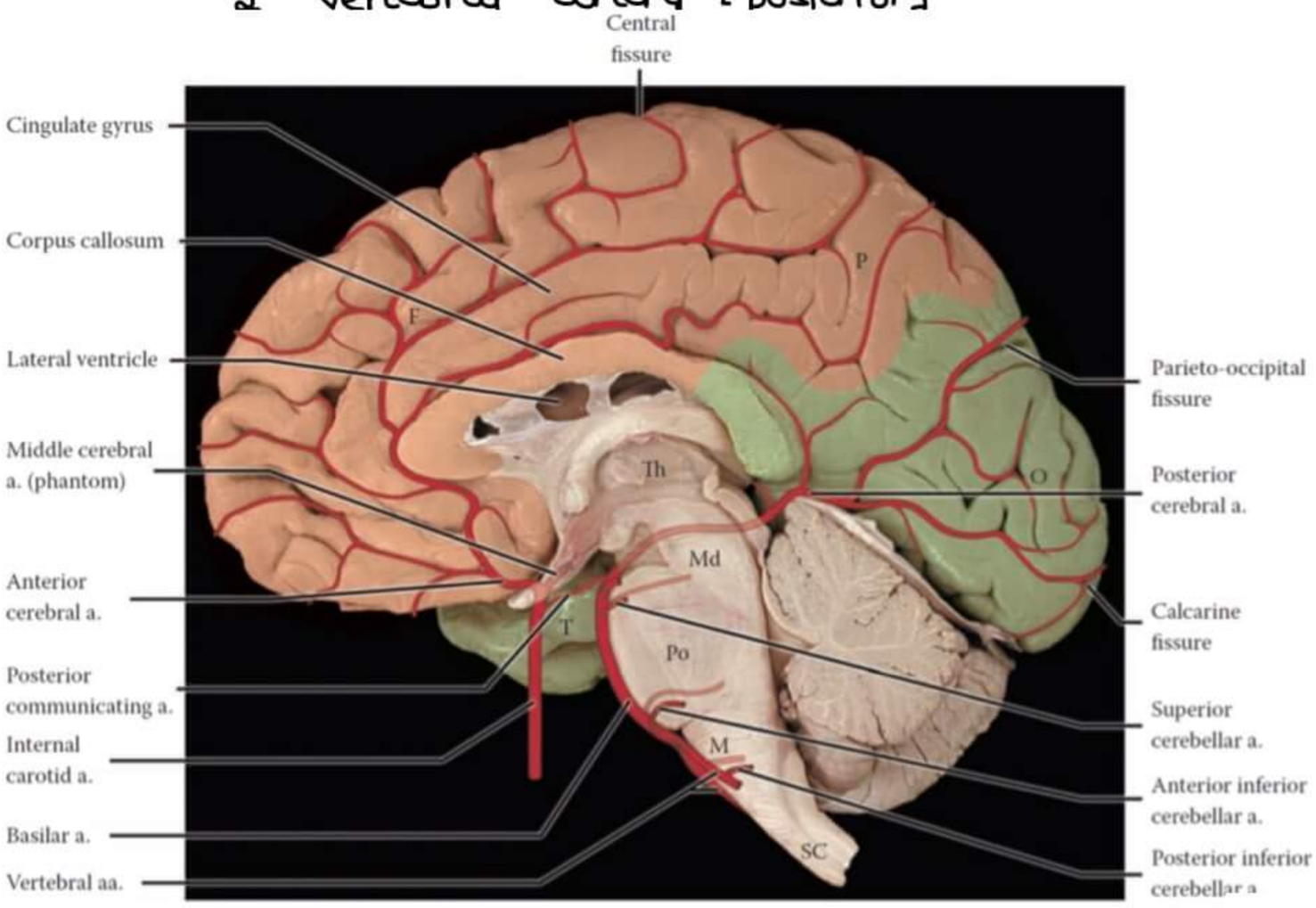
CIRCLE OF WILLIS

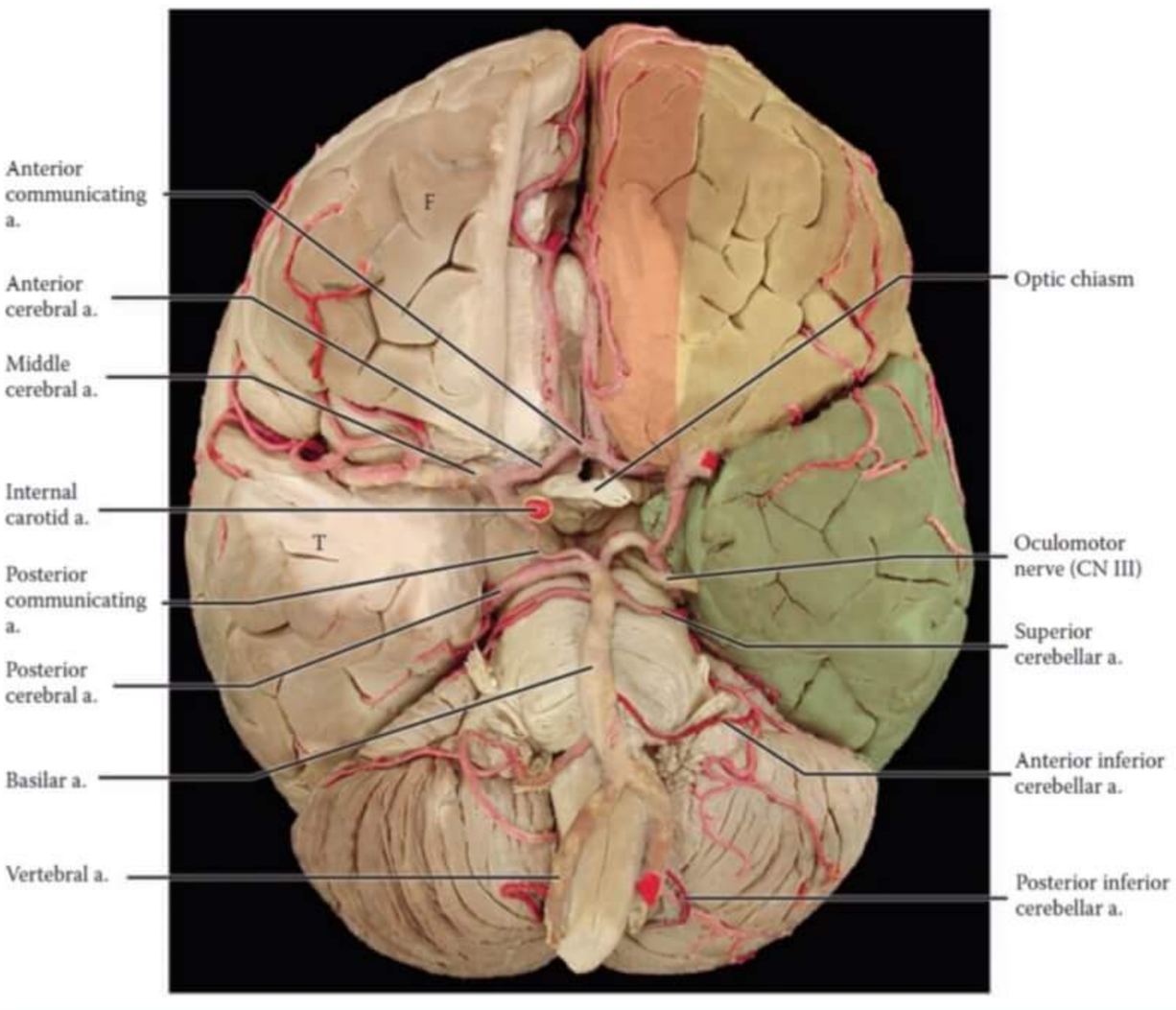
→ at base of brain in Interpeduncular (cerebral) area at subarachnoid space

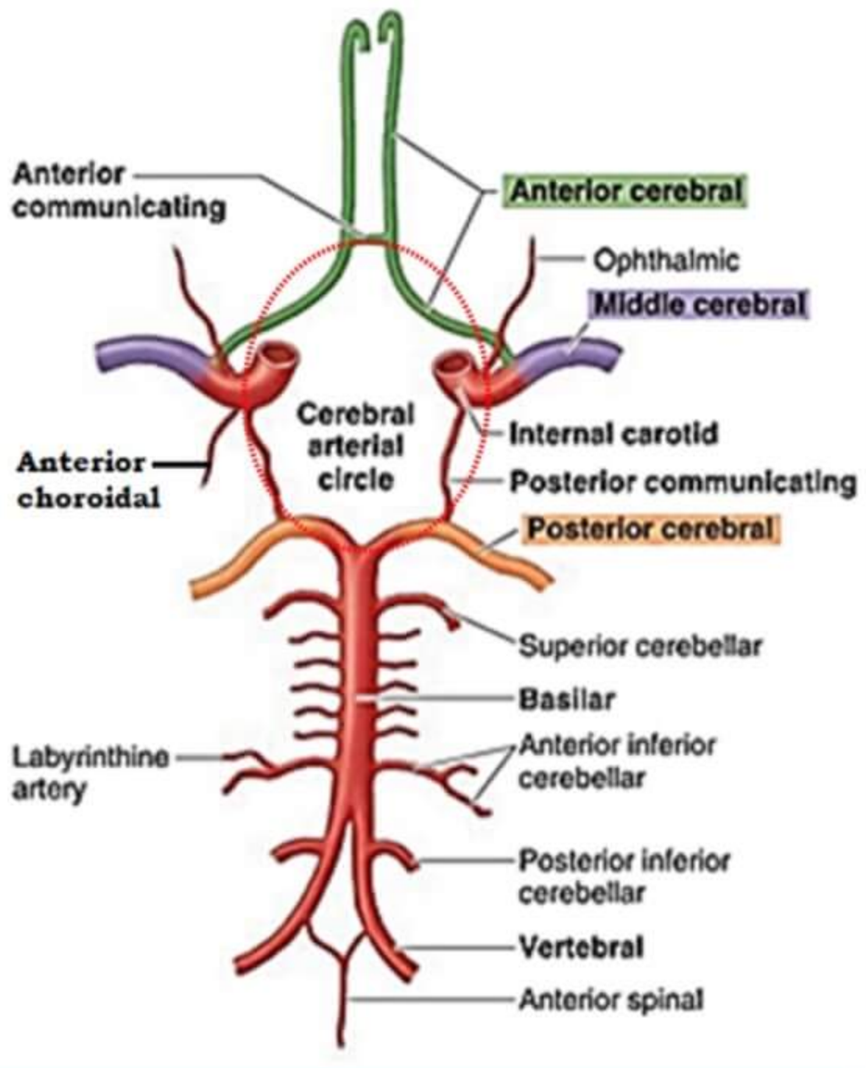
→ contributed by

1 Internal carotid artery [anterior]

2 vertebral artery [posterior]







VERTEBRAL ARTERIES

→ enter the cranial cavity by passing foramen magnum

→ 2 vertebral arteries joins to form → Basilar artery at base of Pons

→ BRANCHES

1. @ Posterior Inferior cerebellar artery [PICA] One on each side
2. @ Anterior Spinal arteries ——later——→ ① anterior Spinal artery in midline supplies ant. 2/3 rd of Spinal Cord
3. @ Posterior Spinal arteries → supplies post. 1/3 rd of Spinal Cord

BASILAR ARTERY

→ Supplies the pons, upper medulla, mid Brain

→ 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 arartery → supplies posterior cerebrum & communicates ĩ post. communicating br. of ICA & forms CIRCLE OF WILLIS

→ In Berry aneurysm on posterior communicating artery, the most commoly damaged nerve is OCCULOMOTOR NERVE

BERRY ANEURYSM

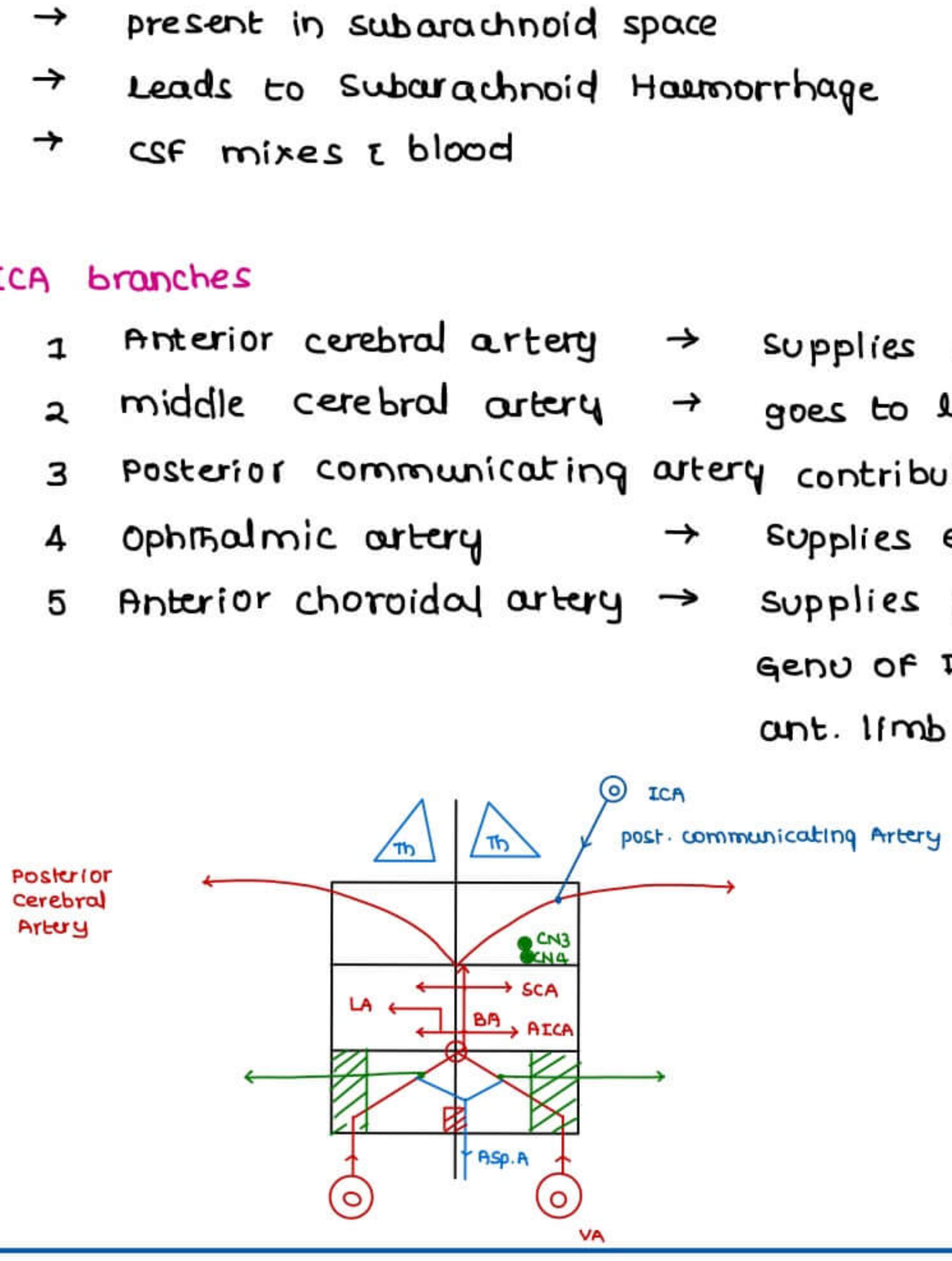
→ present in subarachnoid space

→ Leads to Subarachnoid Haemorrhage

→ CSF mixes ĩ blood

ICA branches

1 Anterior cerebral artery → supplies ant. cerebrum
2 middle cerebral artery → goes to lateral sulcus of brain
3 Posterior communicating artery contributes to CIRCLE OF WILLIS
4 Ophthalmic artery → supplies eye ball
5 Anterior choroidal artery → supplies post. limb of Internal capsule
Genu of IC supplied by direct br. of ICA
ant. limb of IC supplied by



1 BASILAR ARTERY	PONS Upper medulla Mid Brain
2 PICA	Posterior cerebellum Lateral medulla
3 Posterior cerebral artery	Posterior cerebrum occipital visual cortex / Striate cortex calcarine sulcus Mid Brain thalamus
4 Posterior communicating artery	Thalamus
5 Ant. cerebral Artery	Ant. cerebrum Medial cerebrum [major contribut^{n}] Paracentral lobule Lateral cerebrum (pelvis, perineum]
6 Middle cerebral Artery	Lateral cerebrum [major contribut^{n}] Wernike's, Broca's areas macular area

PICA occlusion Leads to → Lateral medullary / wallenberg Syndrome

WALLENBERG SYNDROME resulted from

vertebral artery occlusion [more often] > PICA occlusion

Medial medullary syndrome is dlt occlusion of Ant. Spinal Artery

MEDULLA OBLONGATA Supplied by 11 Arteries ; SUPERIOR CEREBELLAR ARTERY DO NOT SUPPLY

→ Basilar artery → upper medulla

→ 2 AICA

→ 2 PICA

→ 2 vertebral arteries

→ 2 Ant. Spinal arteries

→ 2 Post. Spinal arteries

In Berry aneurysm on posterior communicating artery, the most commonly damaged nerve is OCCULOMOTOR NERVE

OCCULOMOTOR NERVE & TROCHLEAR NERVE

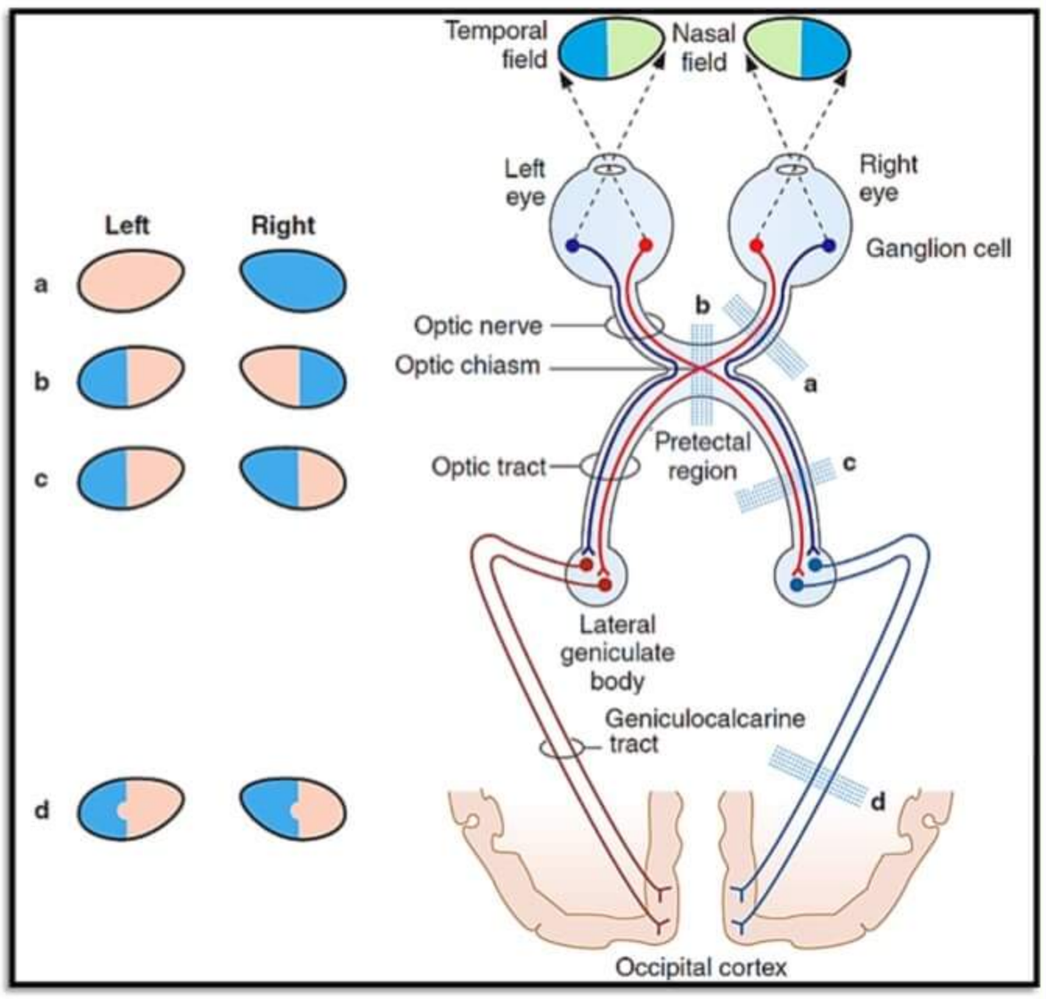
→ comes from midbrain

→ sandwiched b/w Posterior cerebral artery & Superior cerebellar artery

→ Mid brain has dual blood supply

CORTICAL BLINDNESS

→ dlt block in the rt sided posterior cerebral artery
→ C/L Homonymous Hemianopia
→ Left temporal & Rt nasal vision lost
→ Left visuval field lost
→ macular area spared



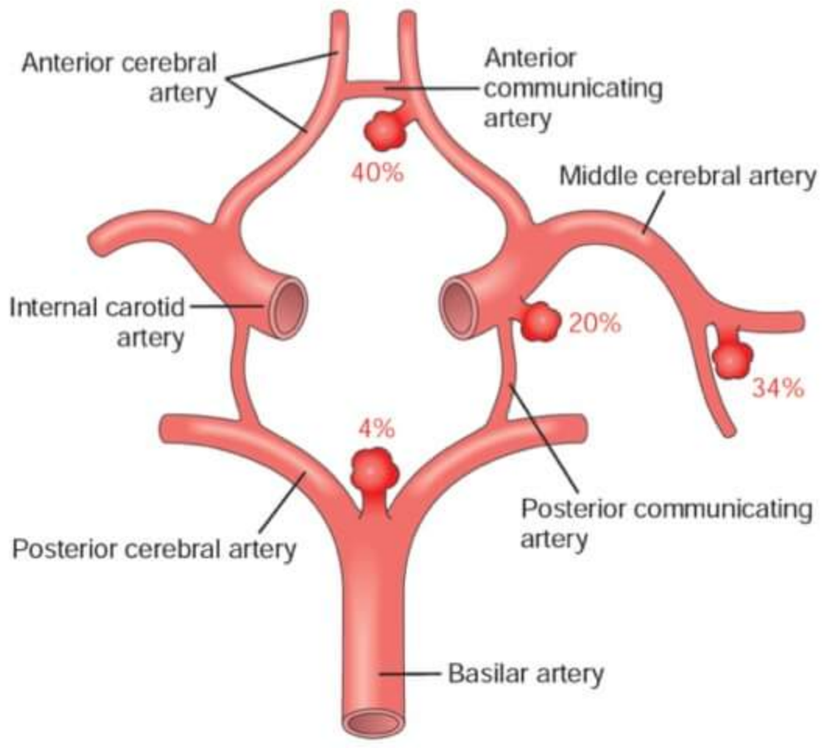
NORMALLY

Lt temporal	Rt Nasal
vision	vision
↓	↓
Nasal Retina	temporal Retina
↓	↓
cross midline in optic chiasma	Same side Brain
↓	
opposite side Brain	

a Rt. Optic Nerve Injury → Rt. Eye is blind
b Pituitary midline tumor → Bitemporal hemianopia → Tunnel vision
c Optic tract injury → C/L Homonymous Hemianopia

CIRCLE of WILLIS → 9 Arteries

2 Posterior cerebral arteries
2 posterior communicating arteries
2 Internal carotid arteries
2 Anterior cerebral arteries
1 Anterior communicating arteries



BERRY ANEURYSM INCIDENCE

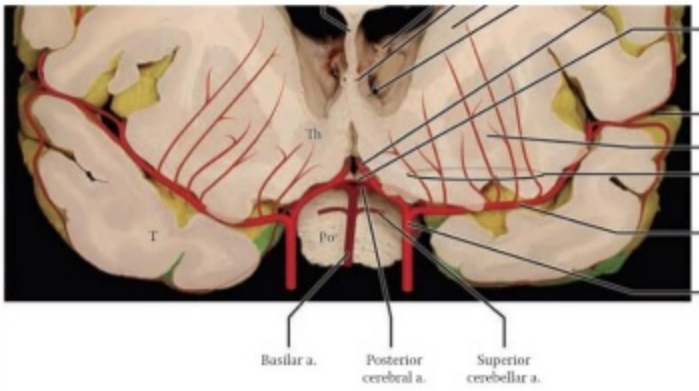
→ Ant. communicating artery → 40%
→ Post. communicating artery → 20%.

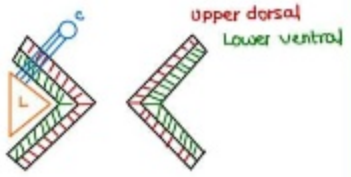
INTERNAL CAPSULE - ARTERIAL SUPPLY

Post. limb → Ant. choroidal artery of middle cerebral artery
Ant. limb → Ant. Cerebral artery by Recurrent br. of Heubner
Genu → Direct branch of ICA

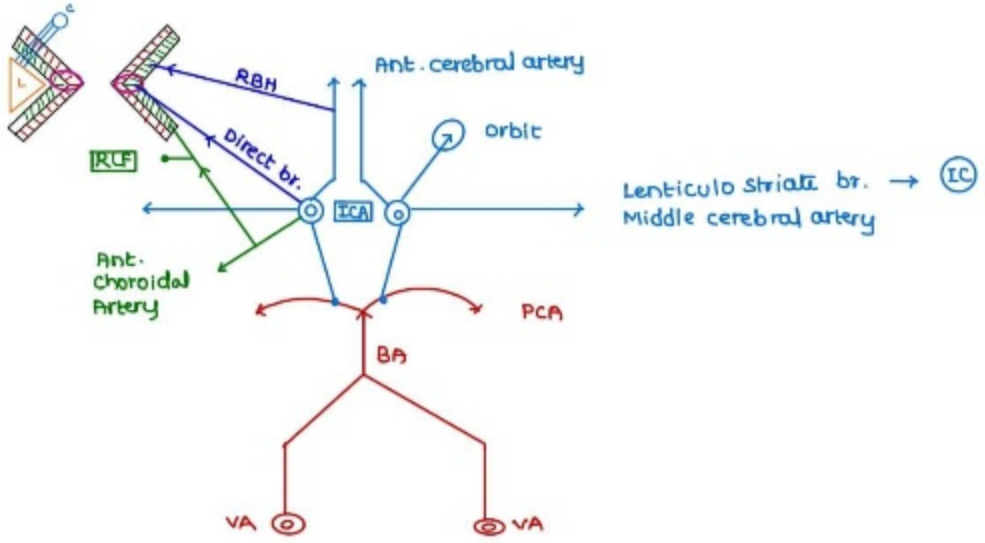
major supply by → Middle cerebral artery

UPPER DORSAL PART → Middle cerebral artery by lenticulo striatal branches





BASAL GANGLIA
UPPER DORSAL IC
} Supplied by Lenticulo striati 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 arterty [ICA Branch]
  - also supplies retrolentiform fibres

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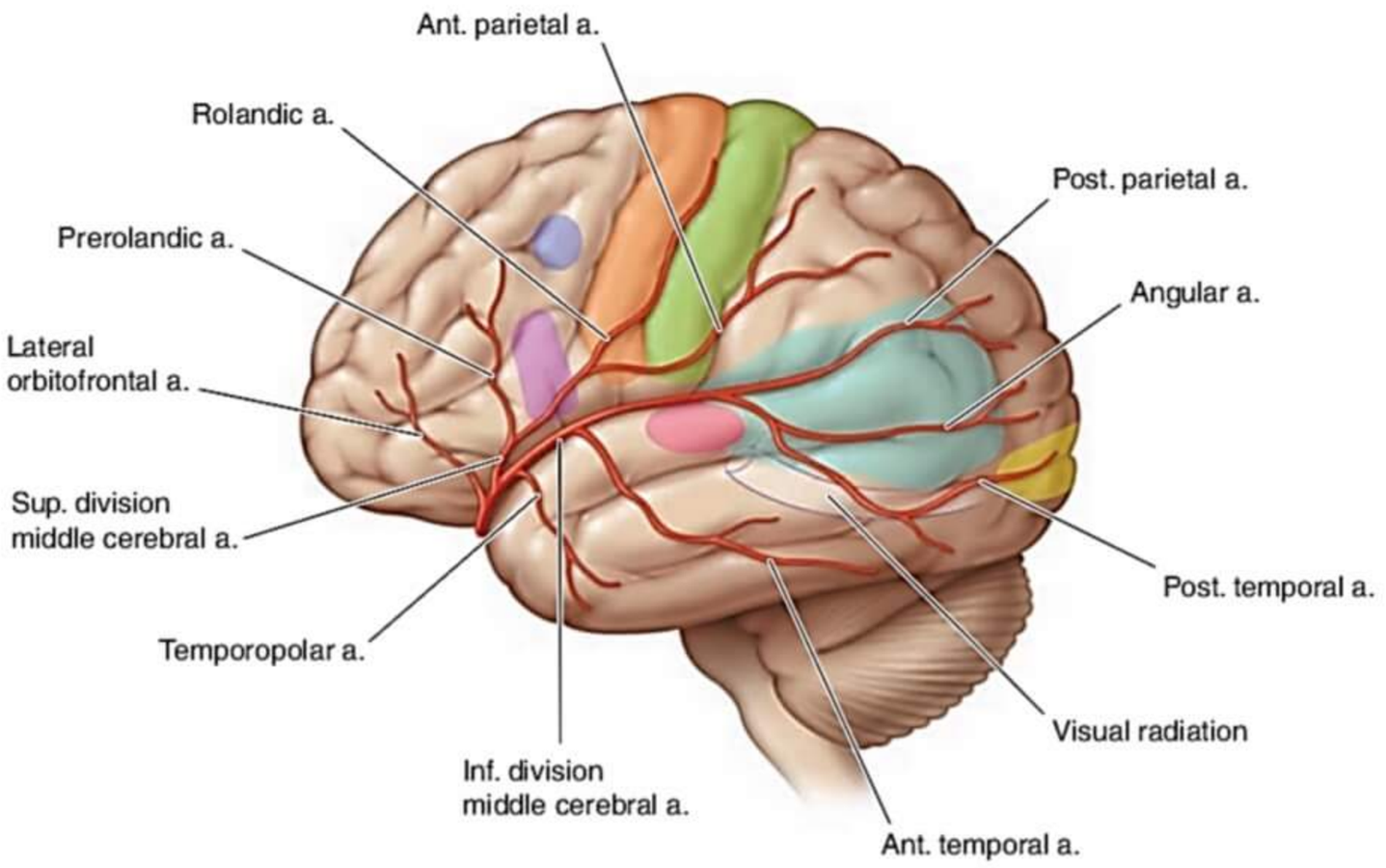
Q All of the following pairs are correct for the artery supply to the lower parts of internal capsule EXCEPT

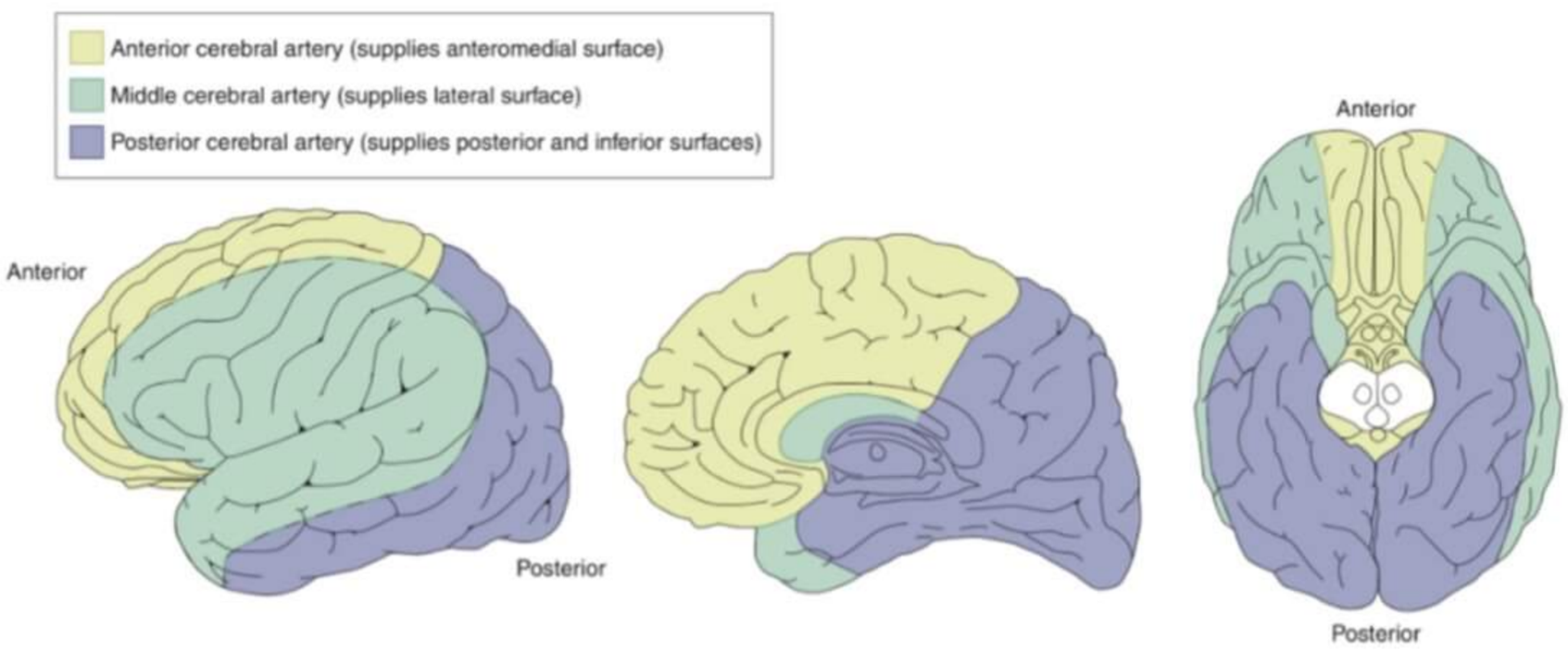
a Anterior Limb → Recurrent branch of anterior cerebral artery
b Genu → Internal carotid artery
c Posterior Limb → Anterior choroidal artery
d Sublentiform part → Heubner's artery

Anterior choroidal Artery supplies the Sublentiform / posterior limb of IC



- Broca's area
- Sensory corter
- Auditory area
- Motor corter
- contraversive eye centre
- Wernicke's aphasia area
- visual corter

Cerebral arteries—cortical distribution



Q Primary motor area [Area no. 4] of brain supplied by

a Anterior cerebral artery

b Middle cerebral artery

c Anterior & middle cerebral artery

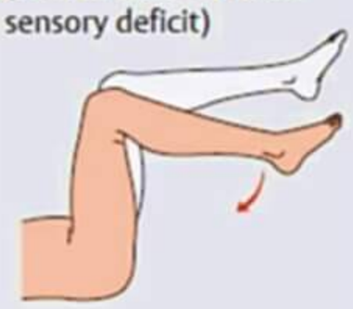
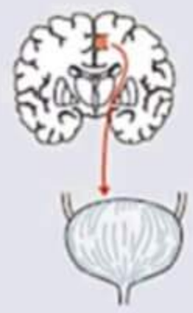
d Anterior & posterior cerebral artery

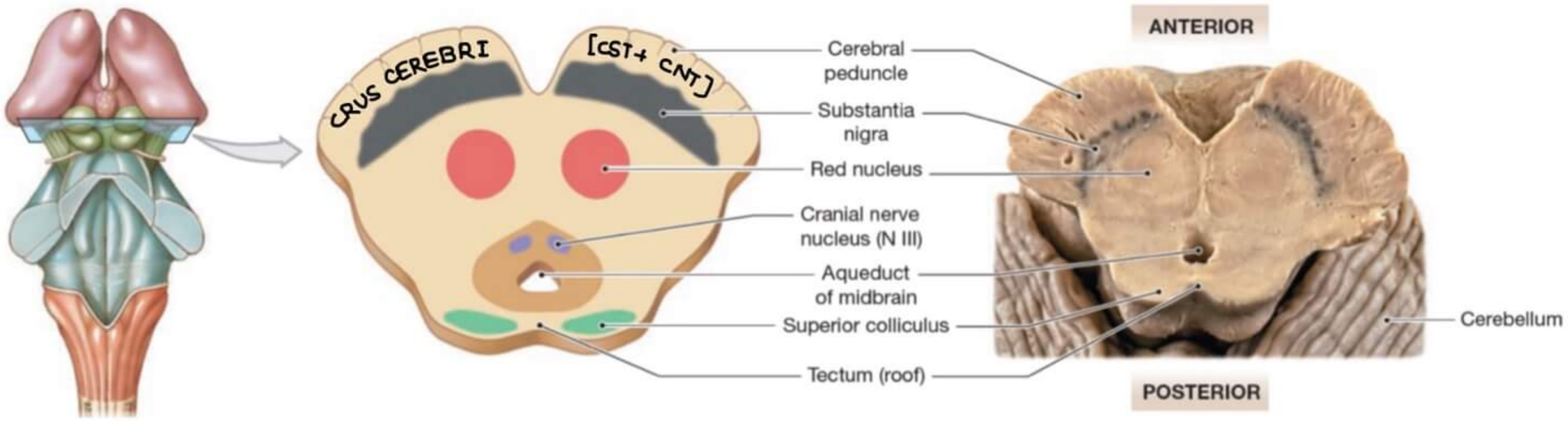
AREA NO. 4

present in

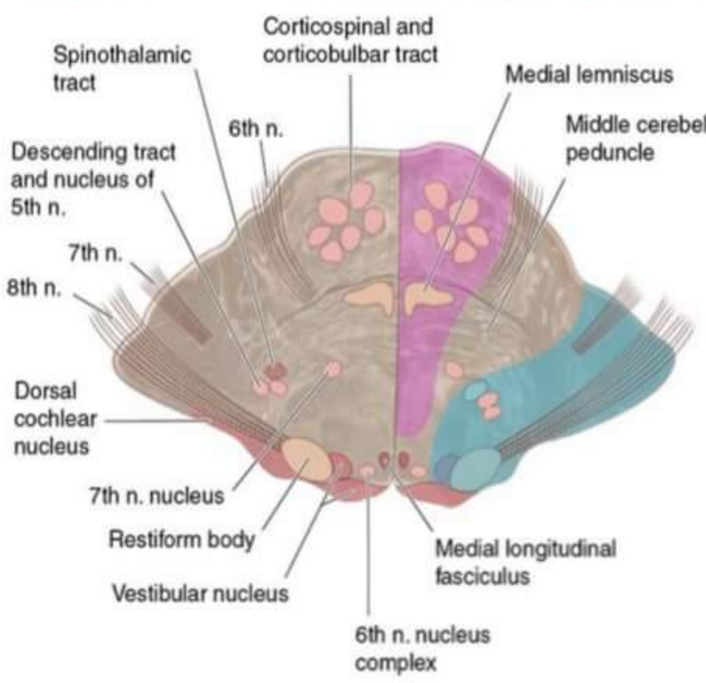
Lateral cerebrum → supplied by MCA
[upper body Homnculus]

medial cerebrum → supplied by ACA
[Lower body Homunculus]

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 



PONS - TRANSVERSE SECTION



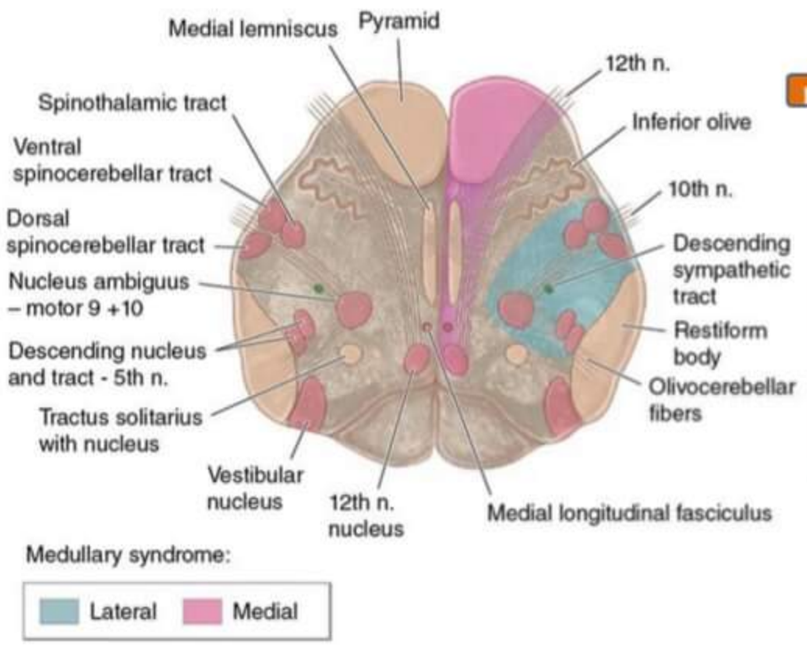
→ 6th, 7th, 8th nerves exit at ponto medullary junctions

most medial → 6th nerve

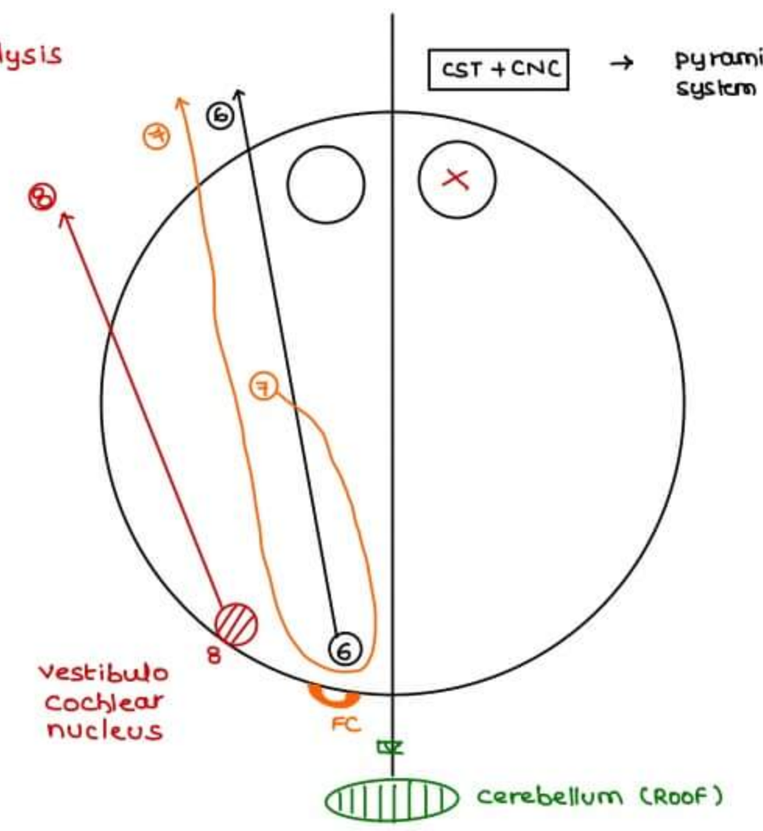
most Lateral → 8th nerve

→ 7th Nerve nucleus sends axons, making a winding around abducent nucleus (6th) produces rounded elevation [FACIAL COLLICULUS] posteriorly at the floor of 4th Ventricle at lower pons & exits at ponto medullary junction

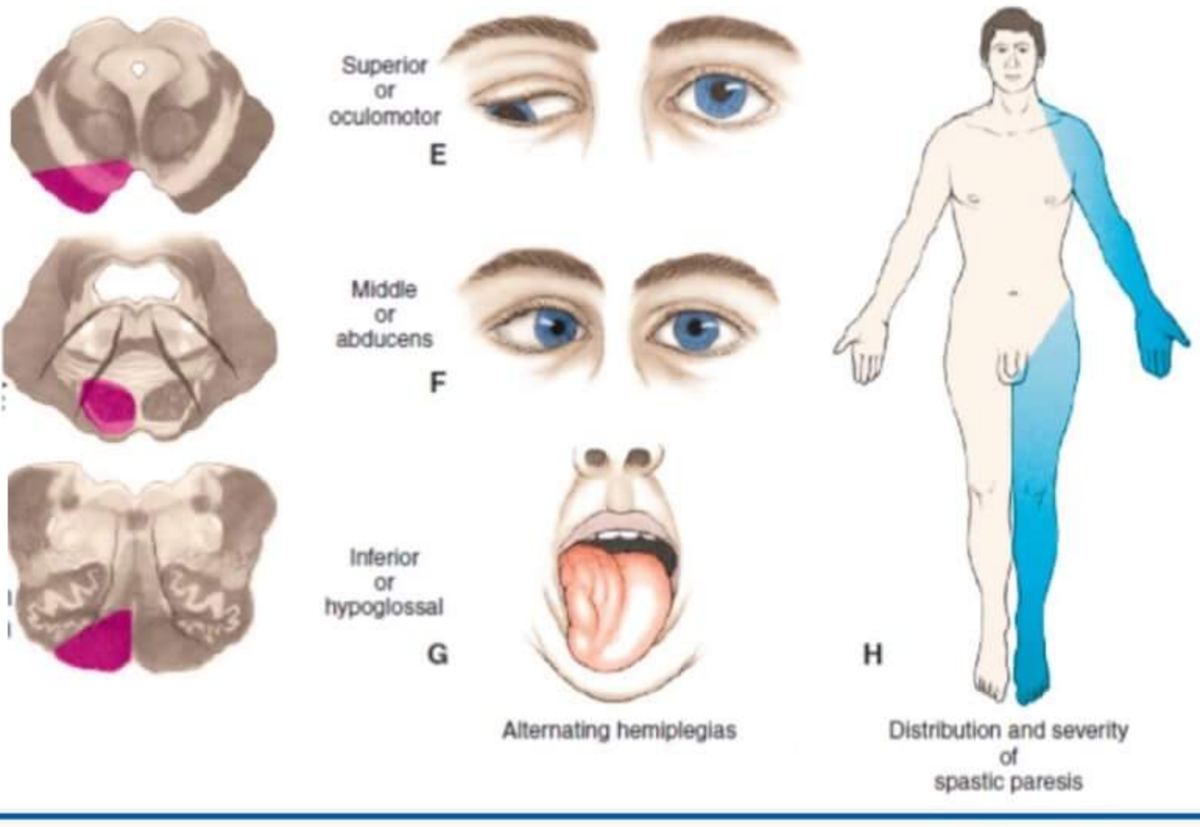
MEDULLA OBLONGATA - TRANSVERSE SECTION

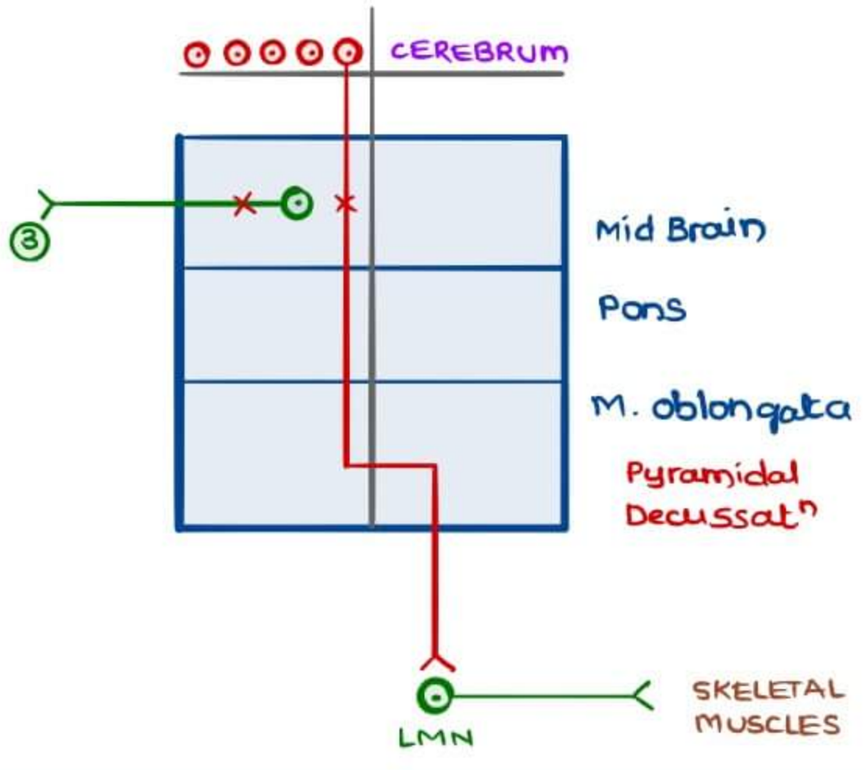


Spastic paralysis



MEDIAL BRAIN STEM LESIONS (ALTERNATING HEMIPLEGIA)





PONS LESION → 6th nerve involved → Lateral Rectus compromised → SQUINT

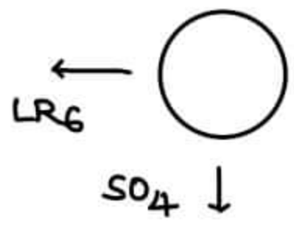
Medullary lesion [Medial Medullary syndrome]

→ 12th nerve involved → Tongue palsy

WEBER SYNDROME [Rt sided]

→ Down & out eye [Action of Superior oblique → Down, out, Intorsion]

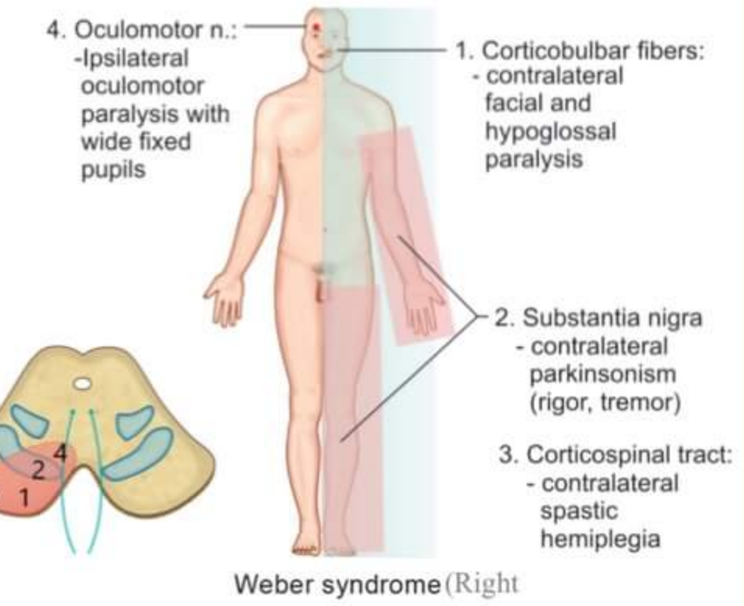
$LR_6\ SO_4\ \overset{3}{x}$



Fixed Dilated pupil

Fixed – sphicter pupillae not working

Dilated – Dilator pupillae more powerful



Weber syndrome (Right

Rt occulomotor nerve injured → rt sided down & out eye

partial ptosis

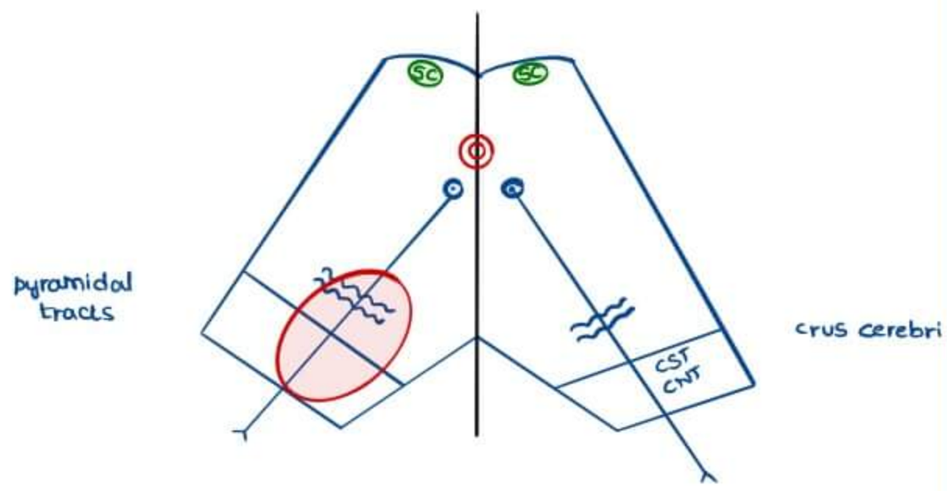
→ Pyramidal tract injured → C/L spastic paralysis

→ C/L facial & hypoglossal paralysis

INJURY OF MIDBRAIN

→ Branches of Basilar artery and Posterior

→ cerebral arteries are injured



→ Anterior mid brain syndrome

→ medial mid brain syndrome

→ CN 3 injured on same side

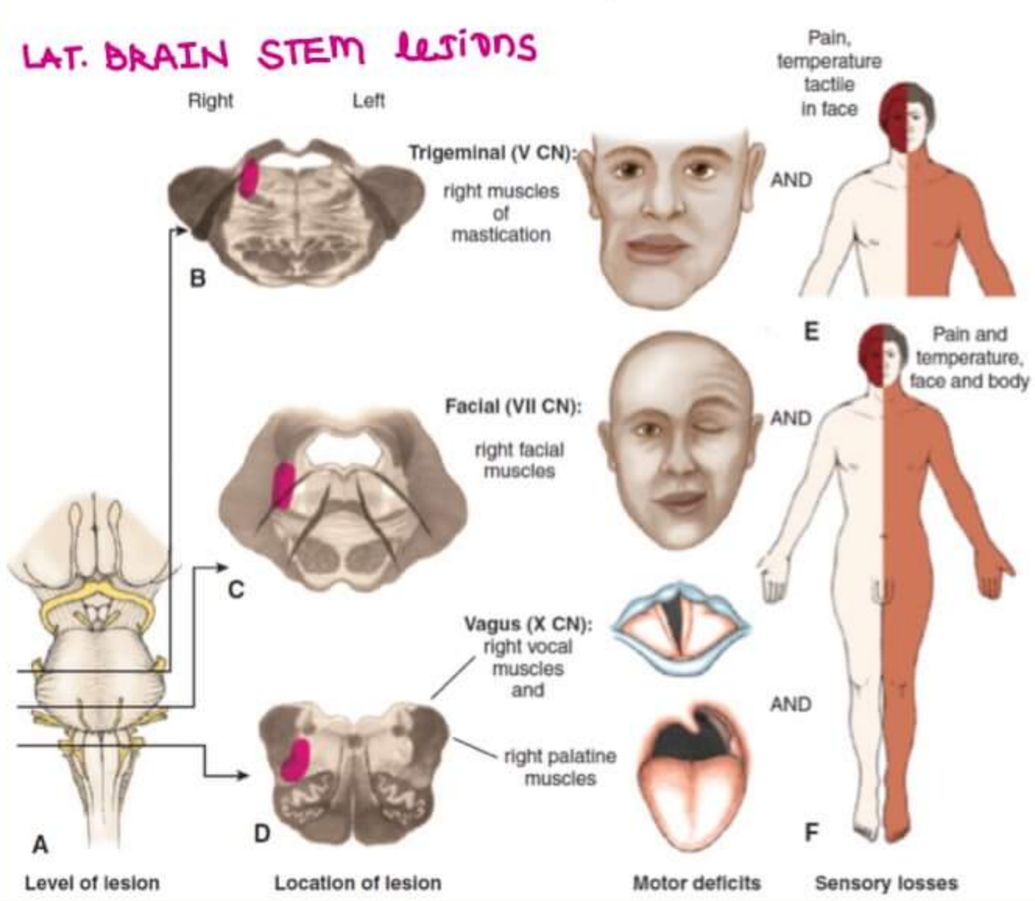
→ CST + CNT tract injured → C/L Paralysis

CN 5, 7, 12 injured C/L

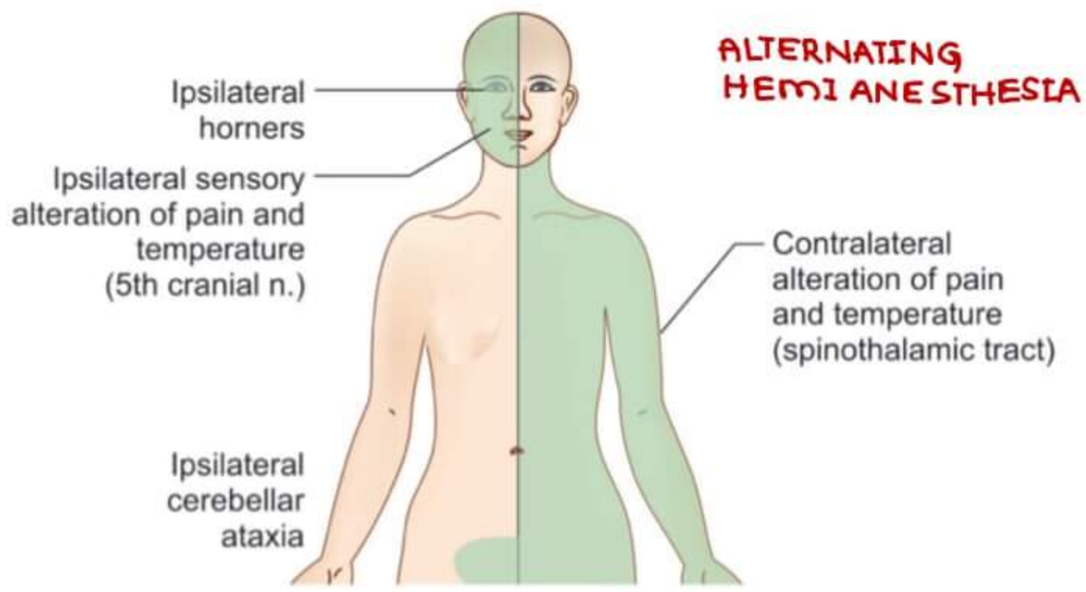
Body C/L involved

→ Substantia nigra involved → C/L Parkinsonism

LAT. BRAIN STEM lesions



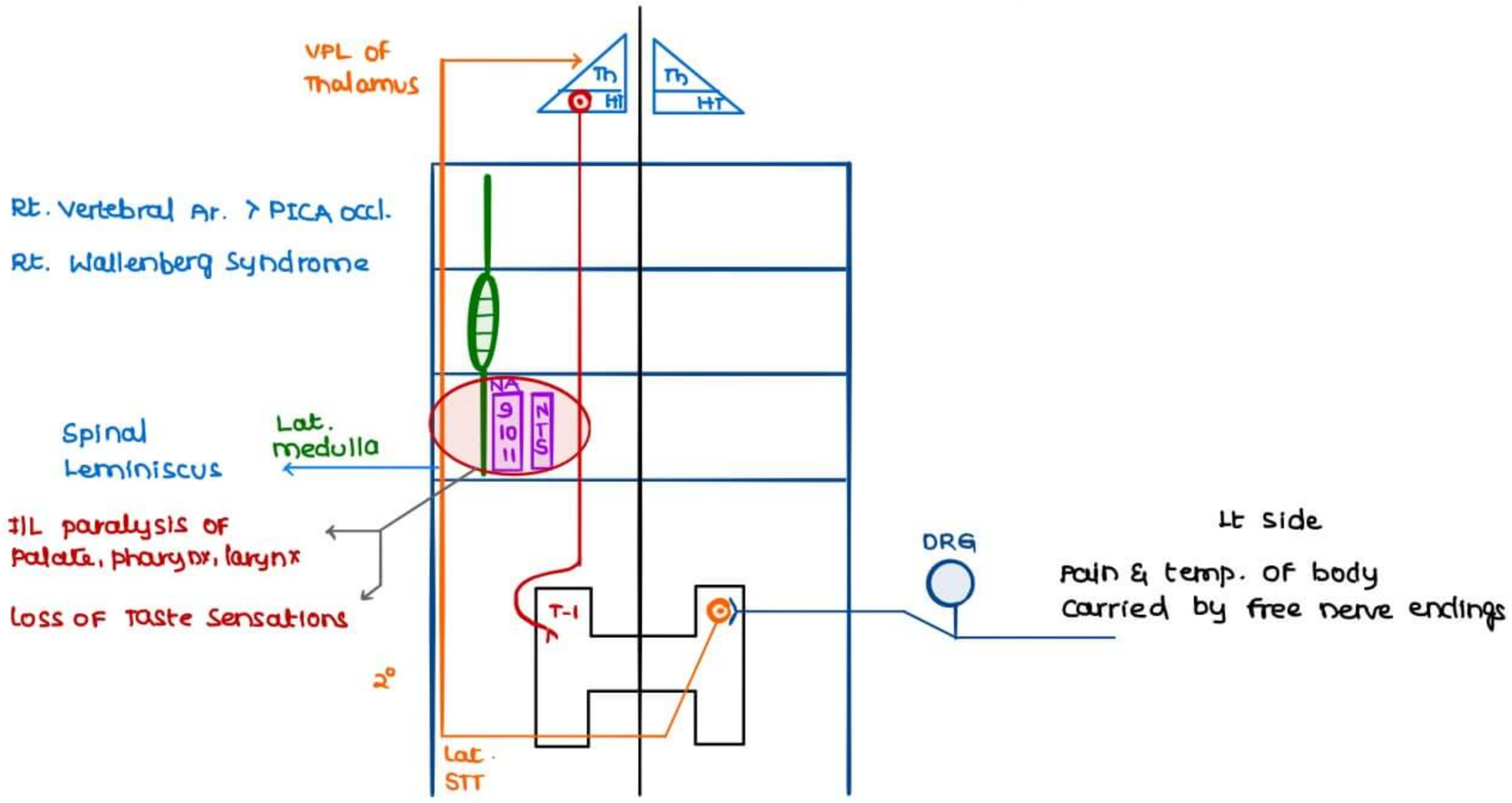
WALLENBERG SYNDROME



Right sided Wallenberg syndrome: Clinical features.

WALLENBERG SYNDROME

→ Hypothalamo spinal pathway compromised in Lateral medulla
→ Ipsilateral sensory loss of pain & temperature [Spinary sensory nucleus of CN 5]
→ C/L Loss of pain & temperature [Spinothalamic tract injury]
→ I/L cerebellar ataxia [dorsal spino cerebellar tract injury]



→ Rt sided horner syndrome
→ difficulty in speech & Swallowing
→ I/L Loss of taste
→ Vertigo
→ Descending sympathetic tract Injury
→ NA injury
→ NTS injury
→ Vestibular nucleus injury

MEDIAL MEDULLARY SYNDROME

→ Tongue muscle palsy → 12 th nerve involved
→ Dorsal column medial Lemniscal system involved
→ Pressure, vibratⁿ, Tactile Discriminatⁿ, stereognosis, concious proprioceptⁿ
→ C/L spastic paralysis → Pyramidal tract involved

→ Pyramid
→ 12th Nerve
→ Olive
→ Inferior olive nucleus
→ Nucleus Ambigus → 9,10,11
→ posteromedial to olive

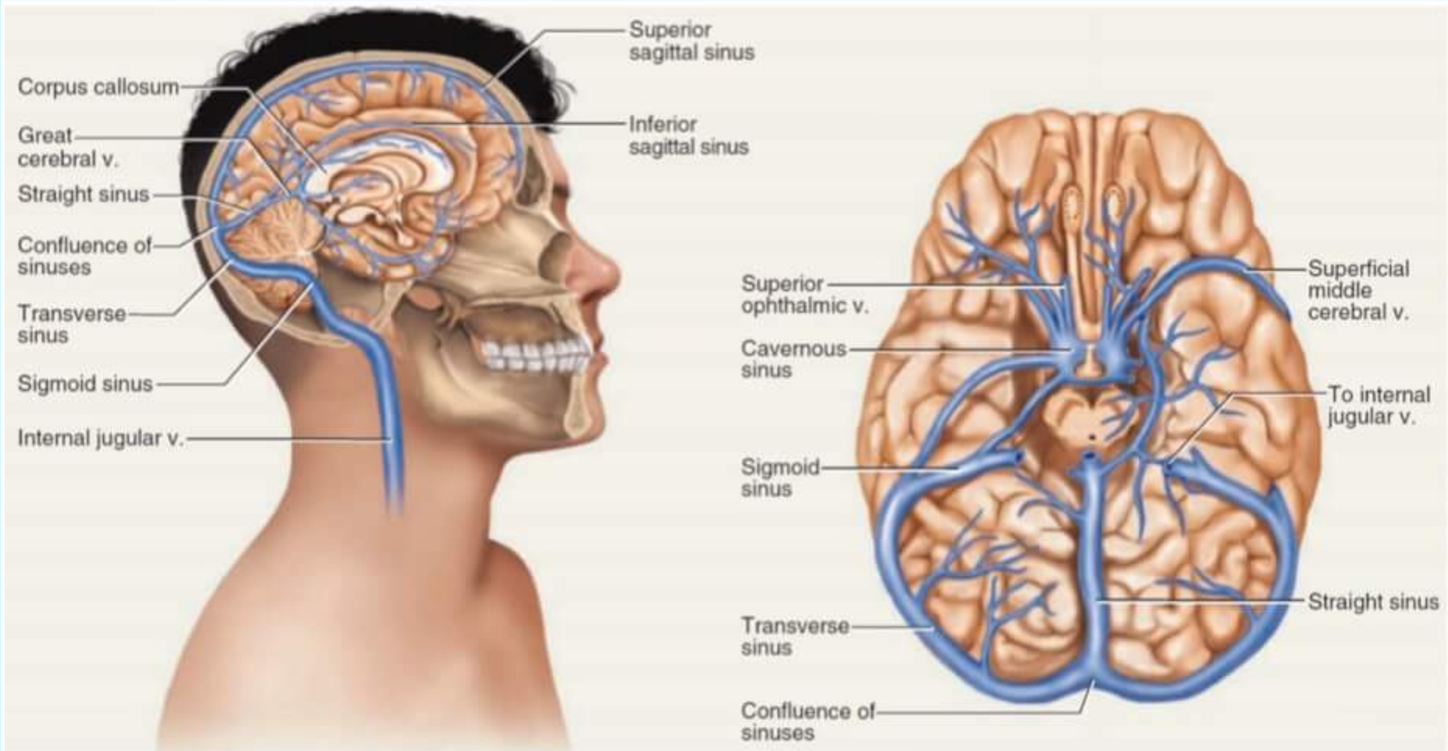
Q Position of nucleus ambigus is
a Anteromedial to olive
b Anterolateral to olive
c Posteromedial to olive
d Posterolateral to Olive

VENOUS DRAINAGE OF CRANIAL CAVITY

DURAL VENOUS SINUSES

→ Intra dural → b/w double fold of duramater
→ Duramater has
Meningeal layer
Endosteal layer

→ venous blood is present



SUPERIOR SAGITAL SINUS

INFERIOR SAGITAL SINUS

STRAIGHT SINUS

CONFLUENCE OF SINUS

TRANVERSE SINUS

SIGMOID SINUS

INTERNAL JUGULAR VEIN

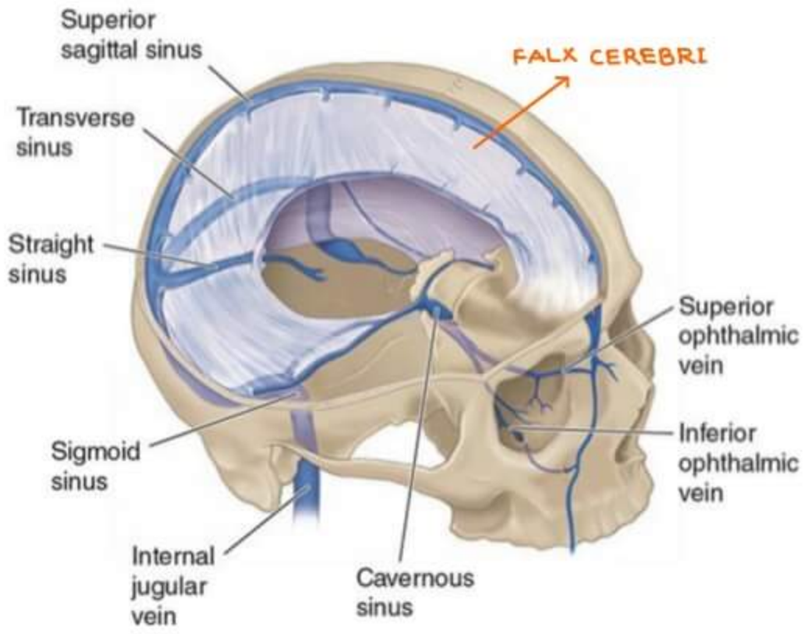
→ Superficial middle cerebral vein drains into cavernous sinus
cavernous sinus drains into petrosal sinus
superior petrosal sinus drains into transverse sinus
Inferior petrosal sinus drains into Int. Jugular vein

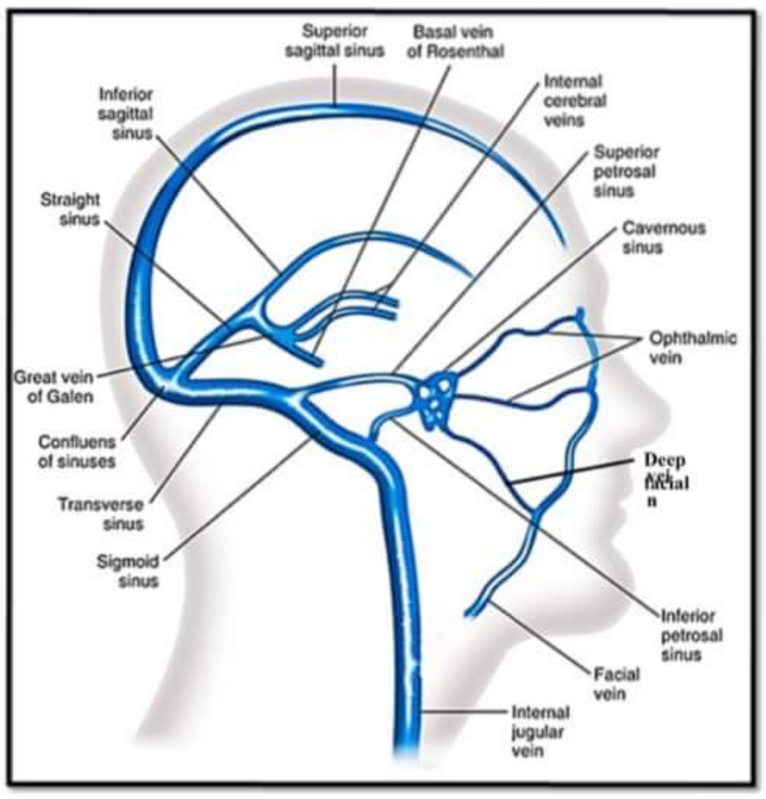
→ Straight sinus is deep circulation
→ Straight sinus drains into confluence of sinus
→ confluence of sinuses drains into Transverse sinus
→ Transverse sinus drain into sigmoid sinus
→ Sigmoid sinus drains into Internal jugular vein

Q Internal cerebral veins joint to form
a Inferior 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 TRIBUITARIES [CONFLUENCE OF SINUS]
S → Straight sinus
O → Occipital sinus
S → Superior sagittal sinus





Q Falx cerebri contains
a Straight sinus
b occipital sinus
c Transverse sinus
d Sigmoid sinus

FALX CEREBRI contains
1. Superior sagittal sinus
2. Inferior sagittal sinus
3. Straight sinus at base

DURAL VENOUS FOLDS & SINUSES

SUPERIOR OPHTHALMIC VEIN
INFERIOR OPHTHALMIC VEIN
} Tributaries

CAVERNOUS SINUS

SUPERIOR PETROSAL SINUS
TRANSVERSE SINUS

INFERIOR PETROSAL SINUS
INTERNAL JUGULAR VEIN

PTERYGOID PLEXUS
DEEP FACIAL VEIN
FACIAL VEIN

DANGEROUS AREA OF FACE

→ Infections [staph. aureus] can access cavernous sinus 2ºut proper Rx

NOSE [Nasal pistule]
↓
FACIAL VEIN [mostly]
↓
ANGULAR VEIN
↓
SUPERIOR OPHTHALMIC VEIN [mostly]
INFERIOR OPHTHALMIC VEIN
↓
CAVERNOUS SINUS

DEEP FACIAL VEIN
↓
PTERYGOID PLEXUS
↓
CAVERNOUS SINUS

Q Septic emboli in facial vein can cause cavernous sinus thrombosis b'coz facial vein makes clinically important connections ε cavernous sinus. the most commonly involved communicating vein is
a Superior ophthalmic
b Deep facial
c Inferior ophthalmic
d Pterygoid plexus of veins

Inferior petrosal vein is the 1st tributary of Internal Jugular vein
Superior ophthalmic vein has bidirectional flow
→ acts as tributary & draining channel for cavernous sinus

PHARYNGEAL ARCHES

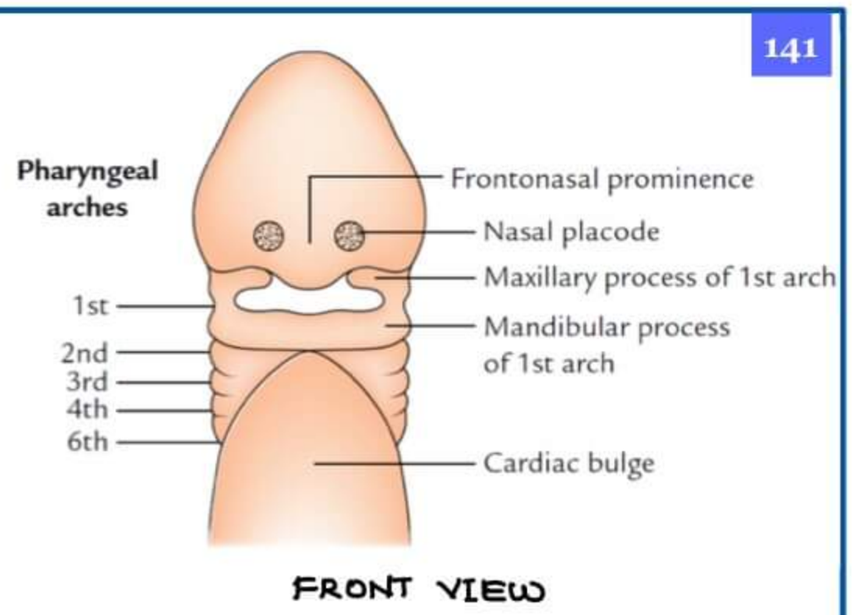
Q Epiglottis develops from which branchial arch ?

a Third

b fourth

c Fifth

d Sixth



FRONT VIEW

PHARYNGEAL ARCHES

→ 6 U shaped arches

→ around pharynx

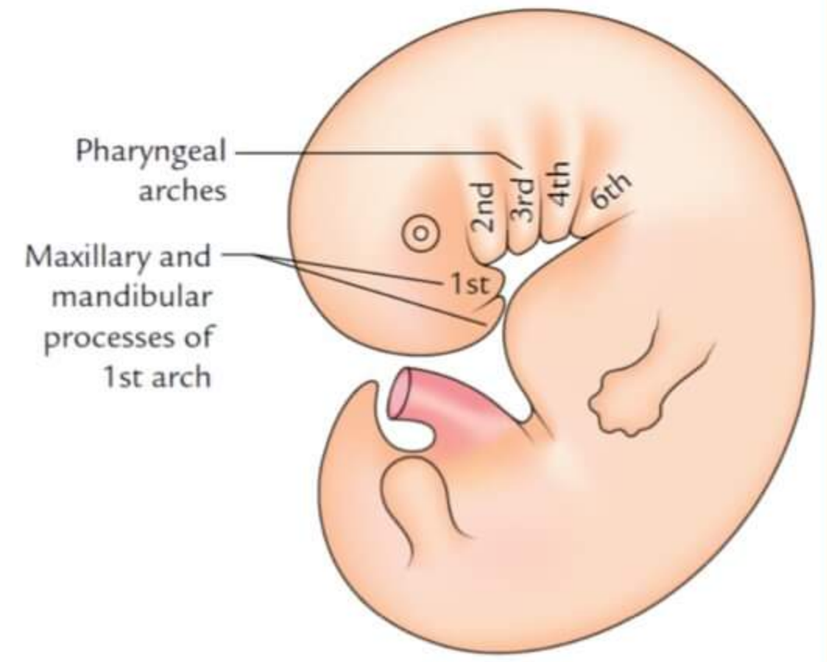
→ develops from Neural crest cells

→ 5th Arch become rudimentory in Humans

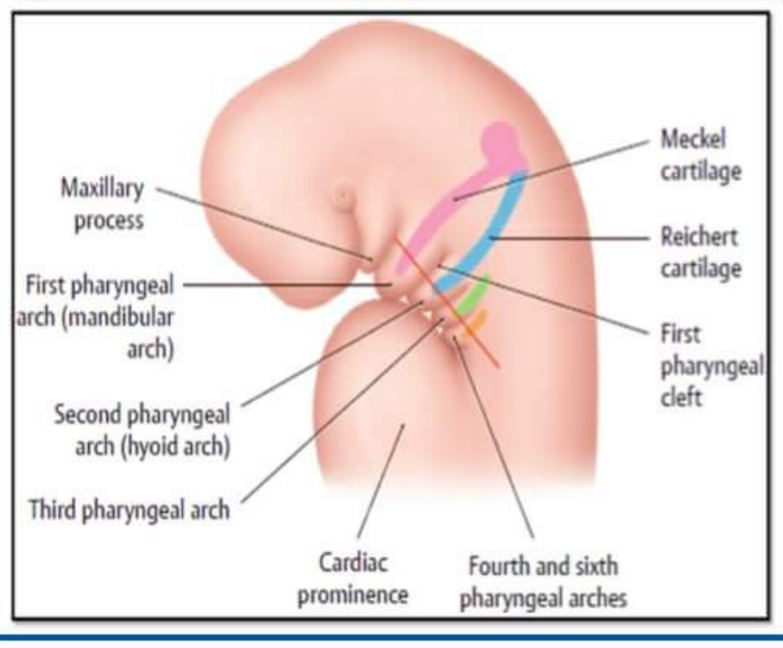
→ 1 arch has

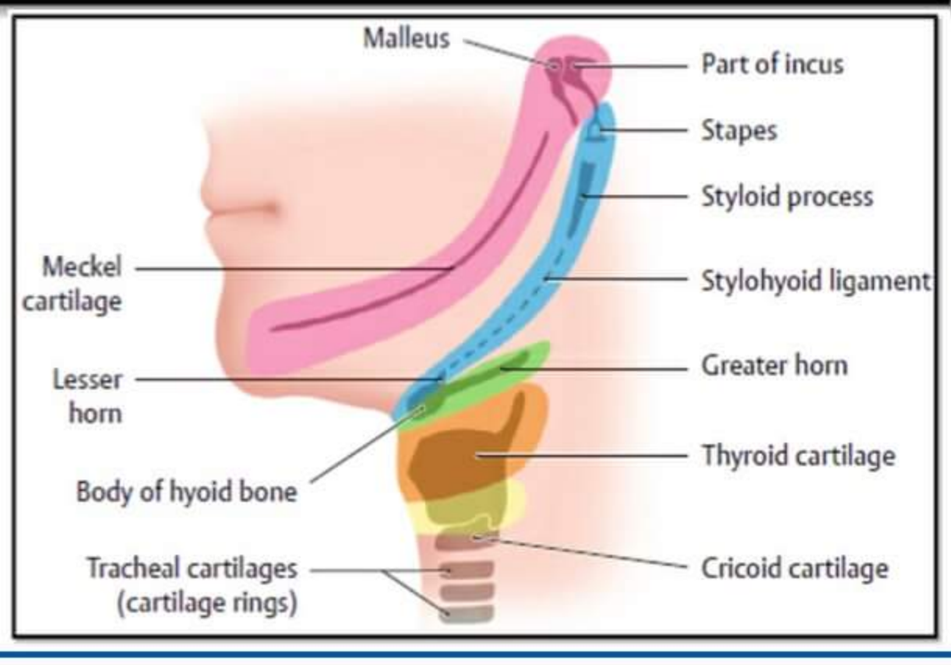
upper maxillary process

Lower mandibular process



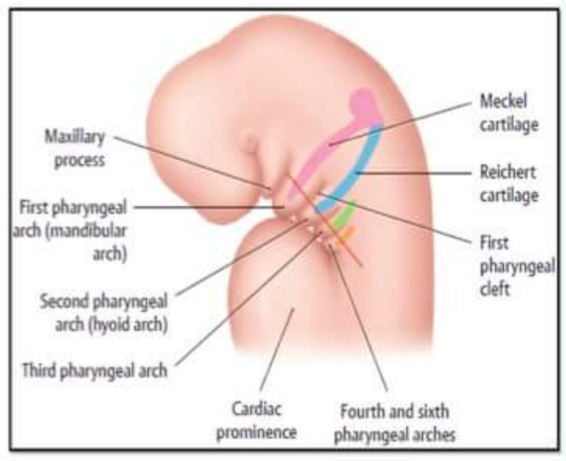
Derivatives of the pharyngeal arches						
Arch No.	Nerve	Embryonic cartilage	NCCs/Mesoderm	Mesoderm (Muscles)	Misc	Artery
1.	CNV_3	Quadrate/ Meckel's	Maxilla Mandible (GT) Incus Malleus Anterior ligament of malleus Sphenomandibular liga-ment	Tensor tympani Tensor veli palatini Muscles of mastication 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. Buccinatory/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 caroitd artery Internal carotid artery (first part)
4.	CN X Pharyngeal branch superior laryngeal branch		NCSs: none Thyroid Cartilage Epiglottis	Palate (Levator, etc.) Pharynx Cricothyroid	Root of tongue	Right subclavian artery (proximal part) Arch of aorta (between origins of left common carotid and left subclavian arteries)
6	CN X Recurrent laryngeal branch		NCCs: none Cricoid Arytenoid cartilages	Larynx		Pulmonary arteries D arteriosus

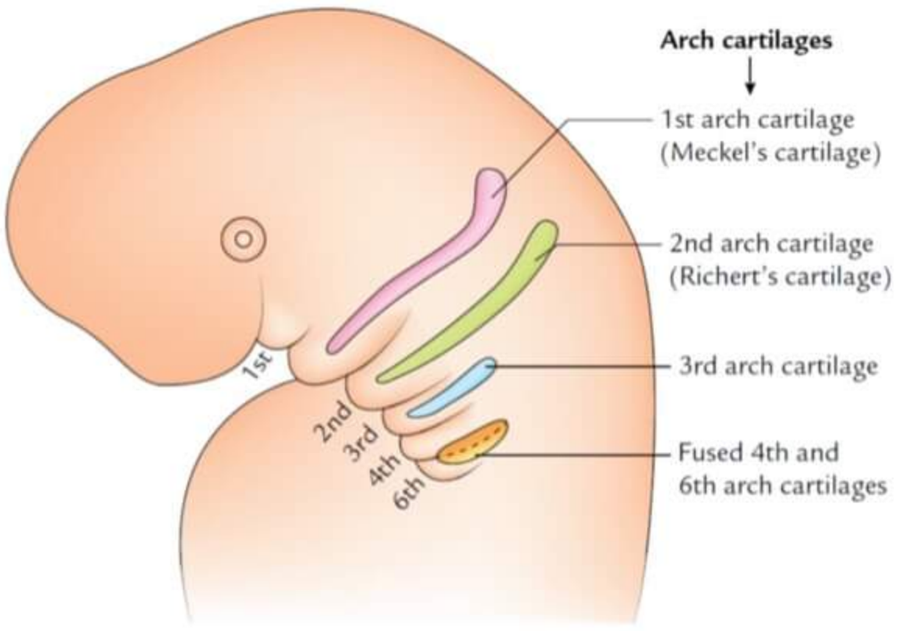


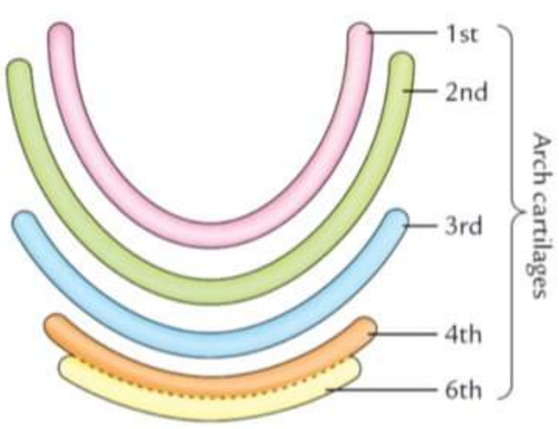


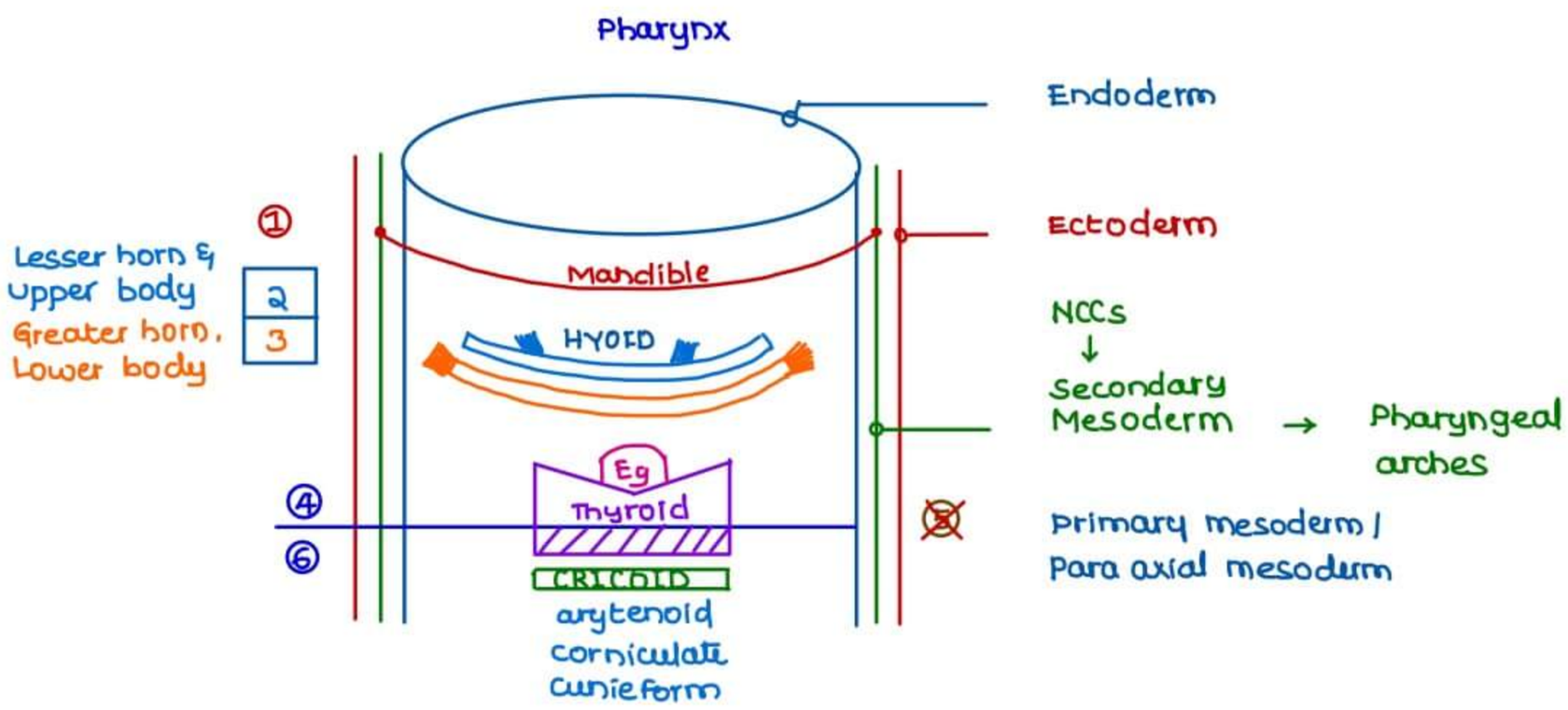
SKELETAL ELEMENTS

1st ARCH	Meckel's cartilage	Mandible bone
2nd ARCH	Reichert's cartilage	Upper Hyoid bone
3rd ARCH		Lower Hyoid bone
4th ARCH	}	Laryngeal cartilages
6th ARCH	}	









NCCs → Mandible, Hyoid

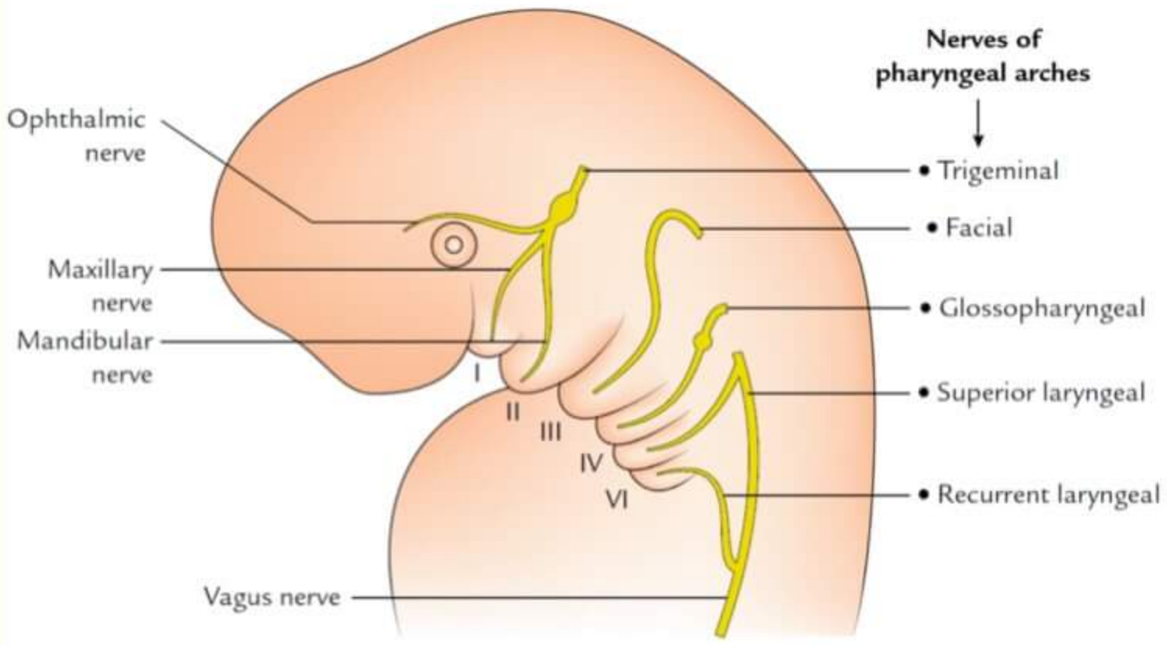
Para axial mesoderm → PAMs (pharyngeal arch muscles). Eg. muscles of mastication

4th Arch → Thyroid cartilage
Epiglottis cartilage

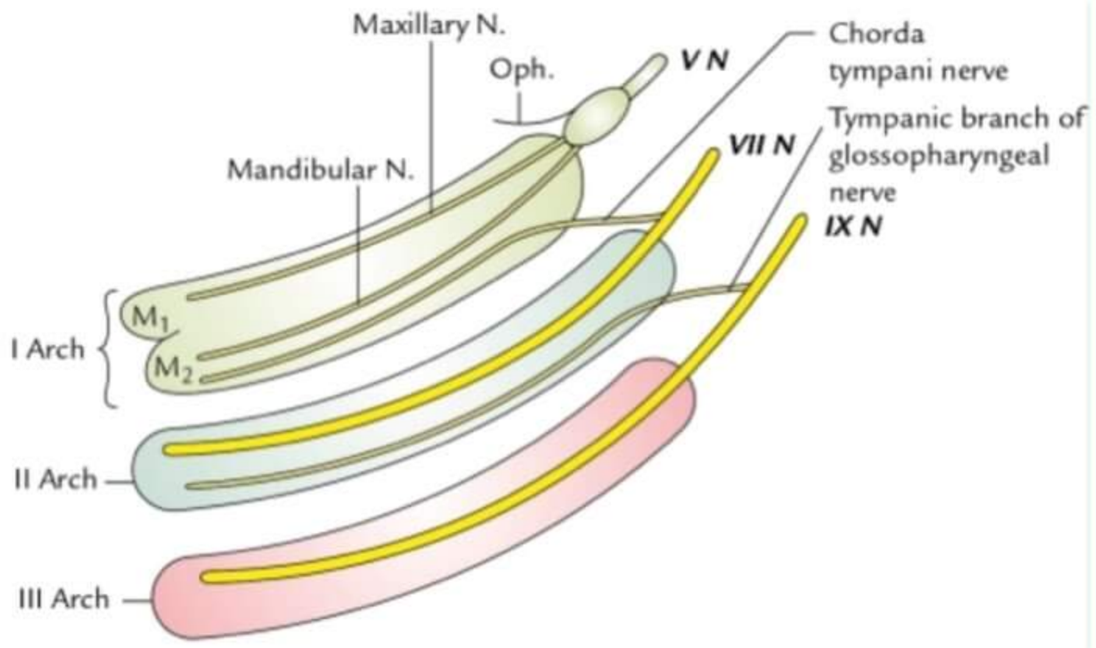
6th arch → Cricoid
arytenoid
Corniculate
Cuneiform

PHARYNGEAL ARCH NERVES

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



NERVES OF PHARYNGEAL ARCHES



PRE TREMATIC NERVES

PRE TREMATIC NERVES

1st ARCH → 5_3
→ chorda tympani nerve of Facial nerve

2nd ARCH → Tympanic branch of Glossopharyngeal nerve

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

Q Para follicular C cells are derived from

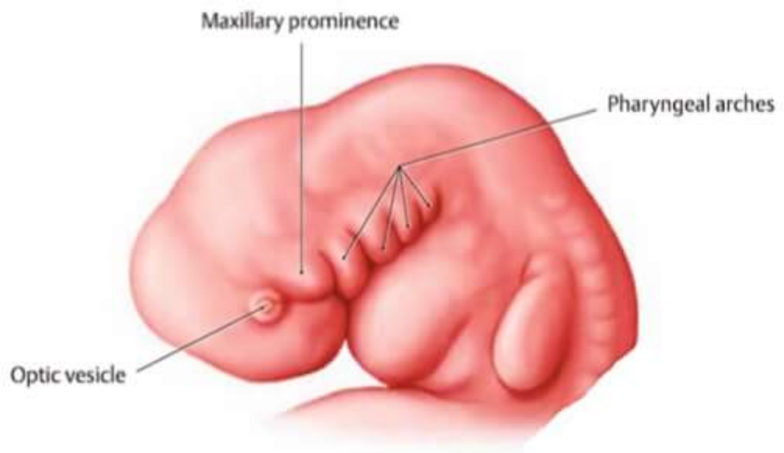
a Ultimo-branchial body

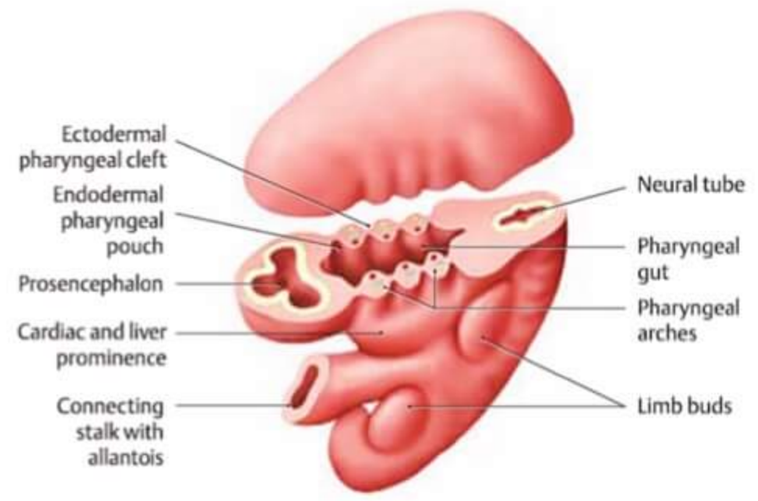
b Pharyngeal pouch 4

c Pharyngeal pouch 5

d Neural crest cells

d > a > b > c



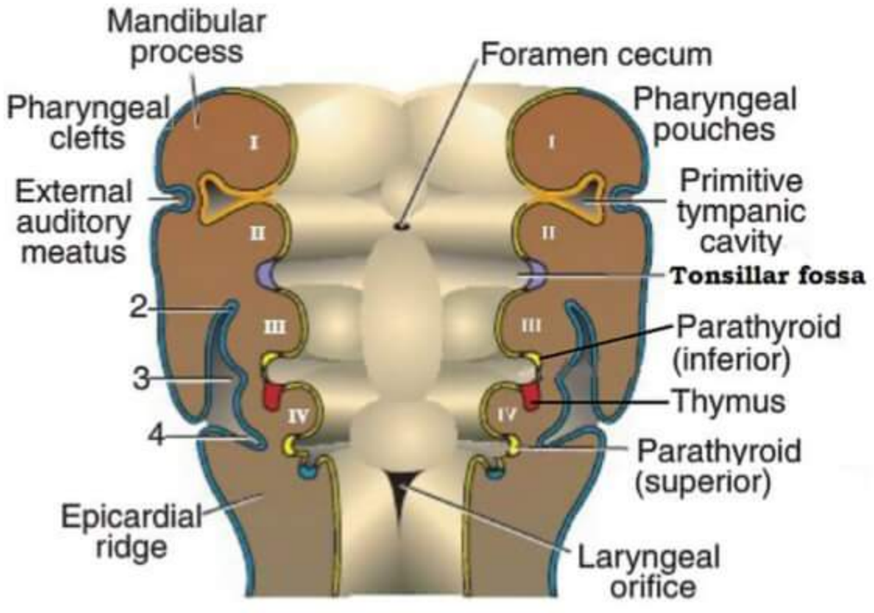


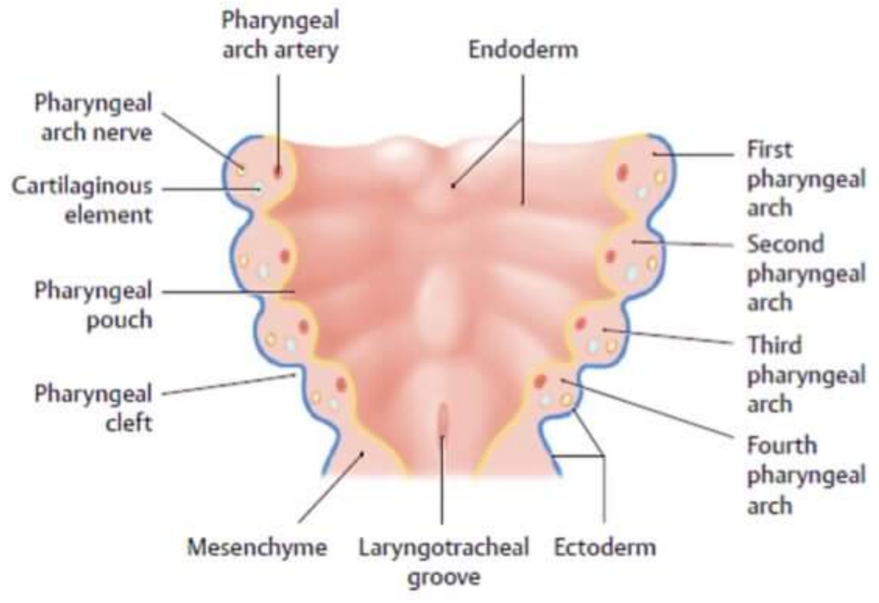
coronal section

LATERAL WALL

→ pouches inside lined by Endoderm

clefts outside lined by Ecroderm





Front view of pharynx

CLEFT 1 → External auditory meatus → Surface ectoderm

CLEFT 2,3,4 → obliterated
mesoderm of 2nd arch covered them

→ CIRVICAL SINUS (remanant of cleft 2,3,4)
SINUS – Blind sac ± one opening
– Opening disappears to form cyst [Brachial cyst]

POUCH 1 → middle ear cavity
Eustachian tube (opens into nasopharynx)

POUTCH 2 → forms Endodermal epithelium for tonsil
Lines 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 → ↓ CMI → Severe bacterial Infection
hypocalcemia (Tetany) → causes cardiac anomalies

IPT defect ↓ PTH ↓ Ca^{2+}

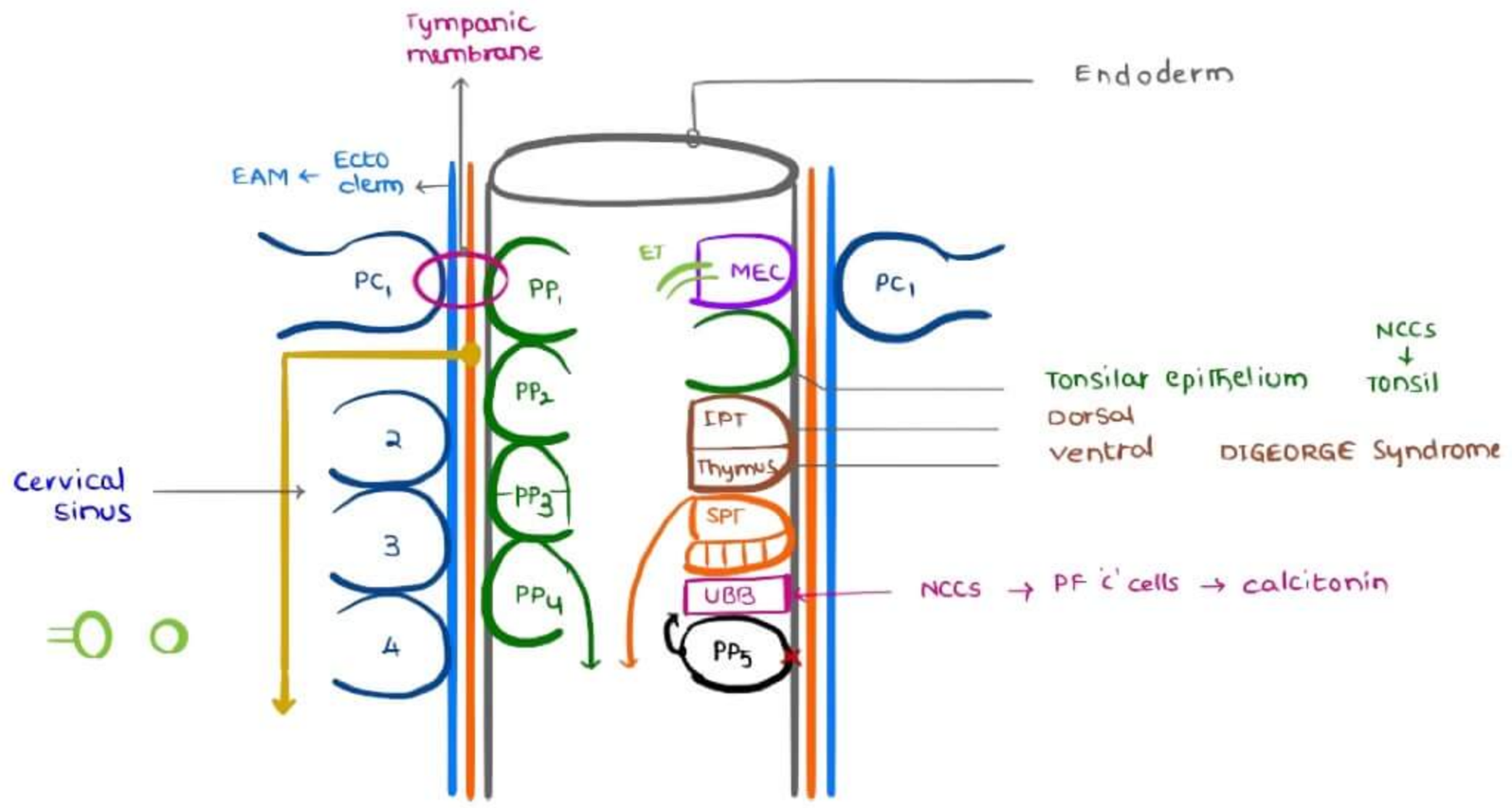
→ mc cause of death → AP Septum anomalies

POUCH 4 → Superior Parathyroid

POUCH 5 → Ultimate Bronchial Body [vestigeal remnant]
→ Fuse ± 4th pouch
→ recieves NCCs & changes to Para follicular '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

Q Thymus develops from
a 2nd PP (ventral portion)
b 3rd PP (ventral portion)
c 3rd PP (Dorsal portion)
d 4th PP (ventral portion)



Q Which of these is correct about the development of tonsil

a Is a derivative of 1st pharyngeal arch

b develops from 2nd pharyngeal pouch

c develops from 3rd pharyngeal pouch

d Is a derivative of neural crest cells [Better answer]

THYROID DEVELOPMENT

→ Endodermal

→ at Floor of pharynx → Tongue development

↓

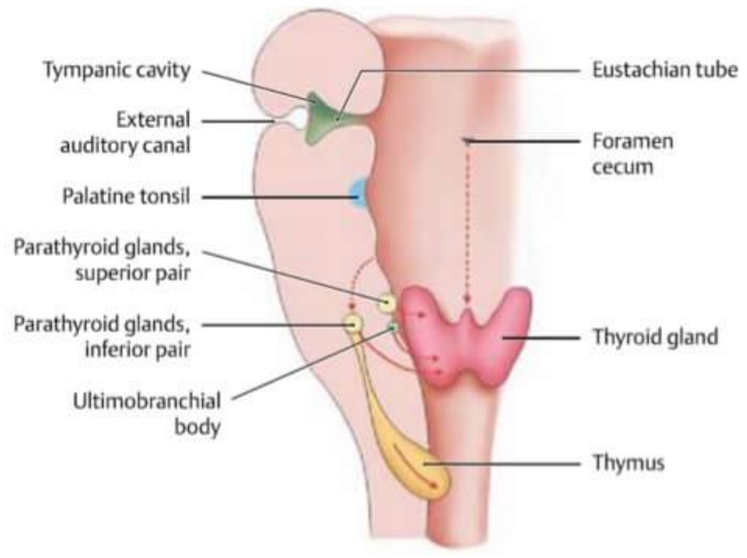
Foramen caecum

↓

Thyroglossal duct

↓

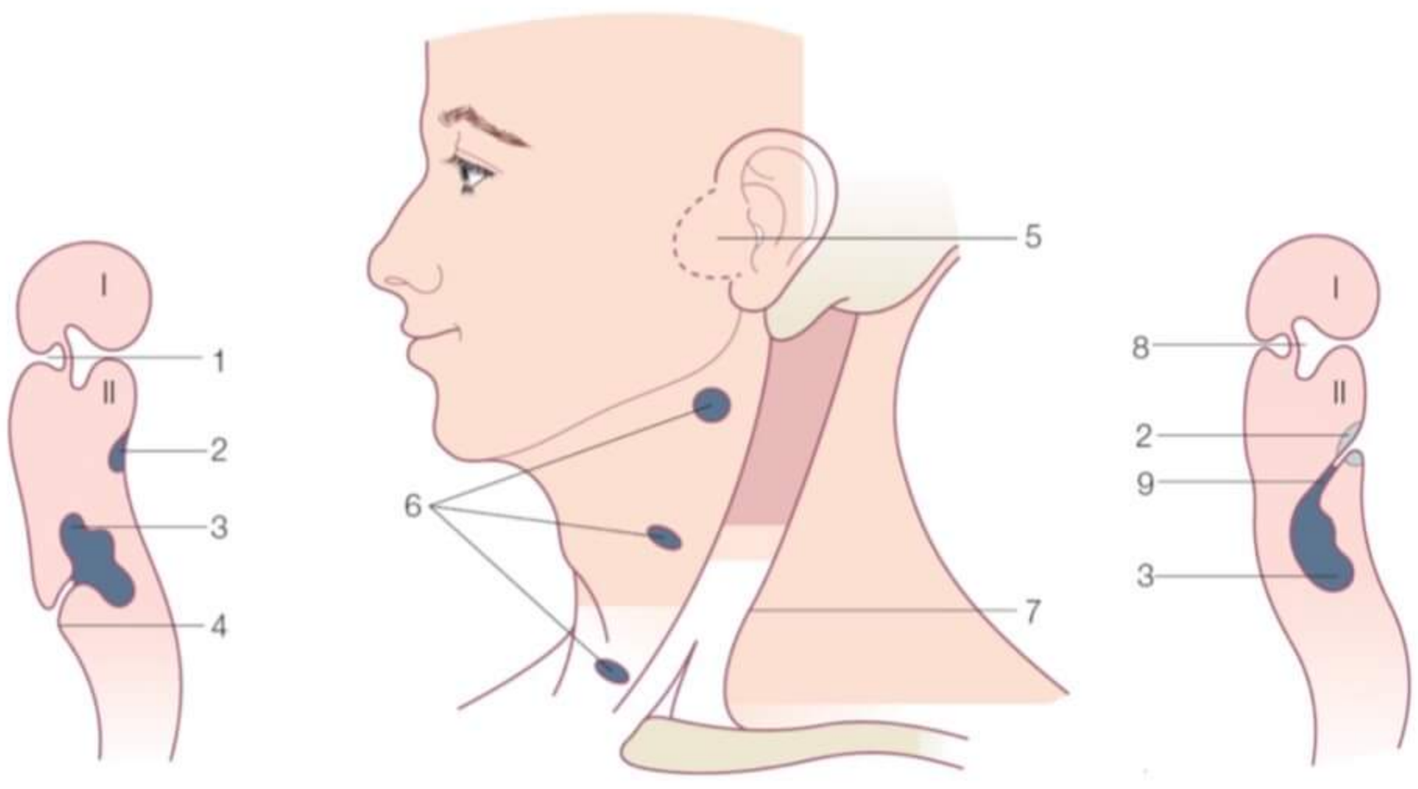
Thyroid



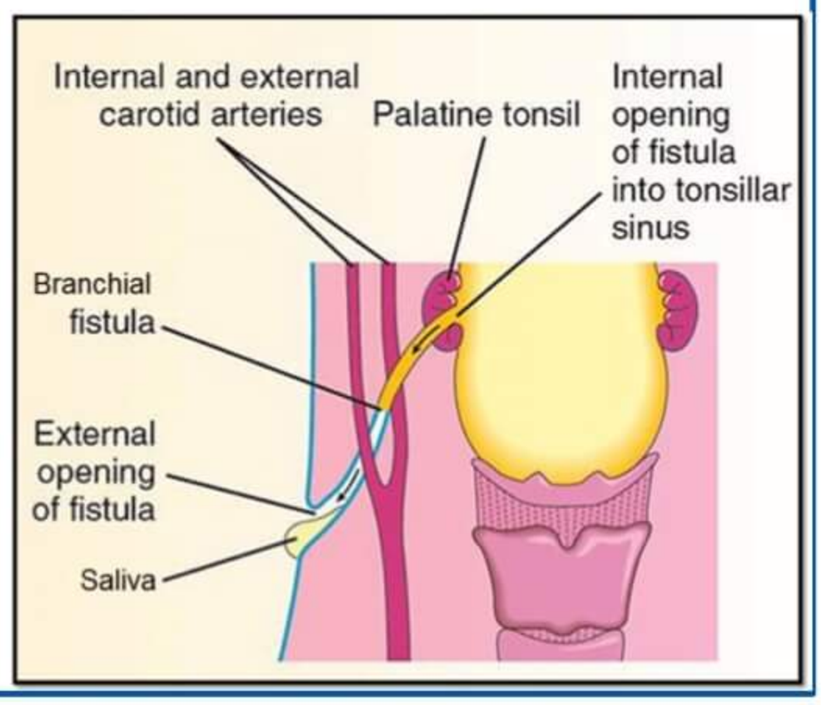
UBB → NCCs comes here → Parafollicular 'C' cells

BRANCHIAL ARCH ANOMALIES

→ 95% are from 2nd Arch



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

→ vestigeal remnant of cleft 2,3,4
mainly from cleft 2 → cyst near angle of mandible

→ If cyst opens outside on skin → Branchial Sinus | fistula

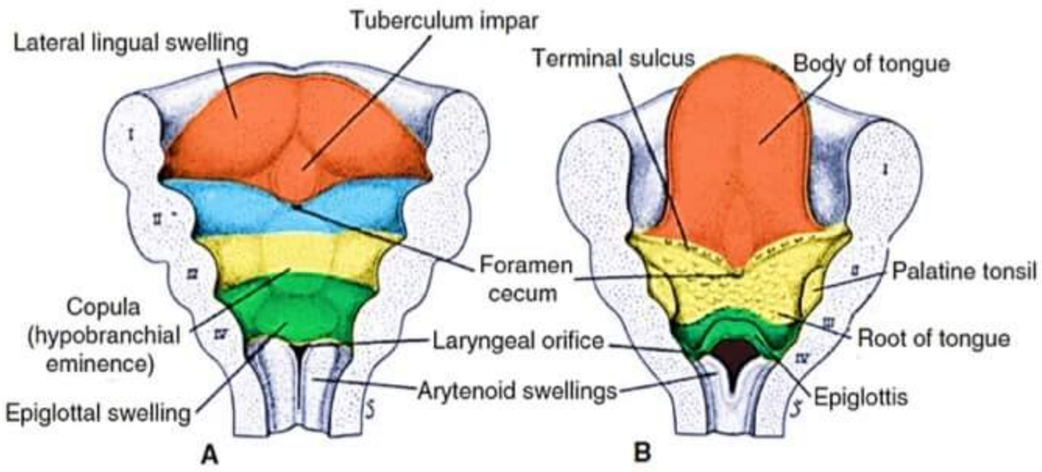
→ Branchial cyst is in → upper neck region
Branchial Sinus | fistula is in → Lower neck region

→ All are at anterior border of sternomastoid → ant. triangle of neck

→ INTERNAL BRANCHIAL SINUS → opens into tonsillar fossa
EXTERNAL BRANCHIAL SINUS → Opens into skin of Lower neck
EXTERNAL + INTERNAL SINUS → FISTULA
- brings saliva from tonsillar fossa into skin of Lower neck
- passes b/w Internal & External carotid Artery → care should be taken while removing fistula

TONGUE DEVELOPMENT

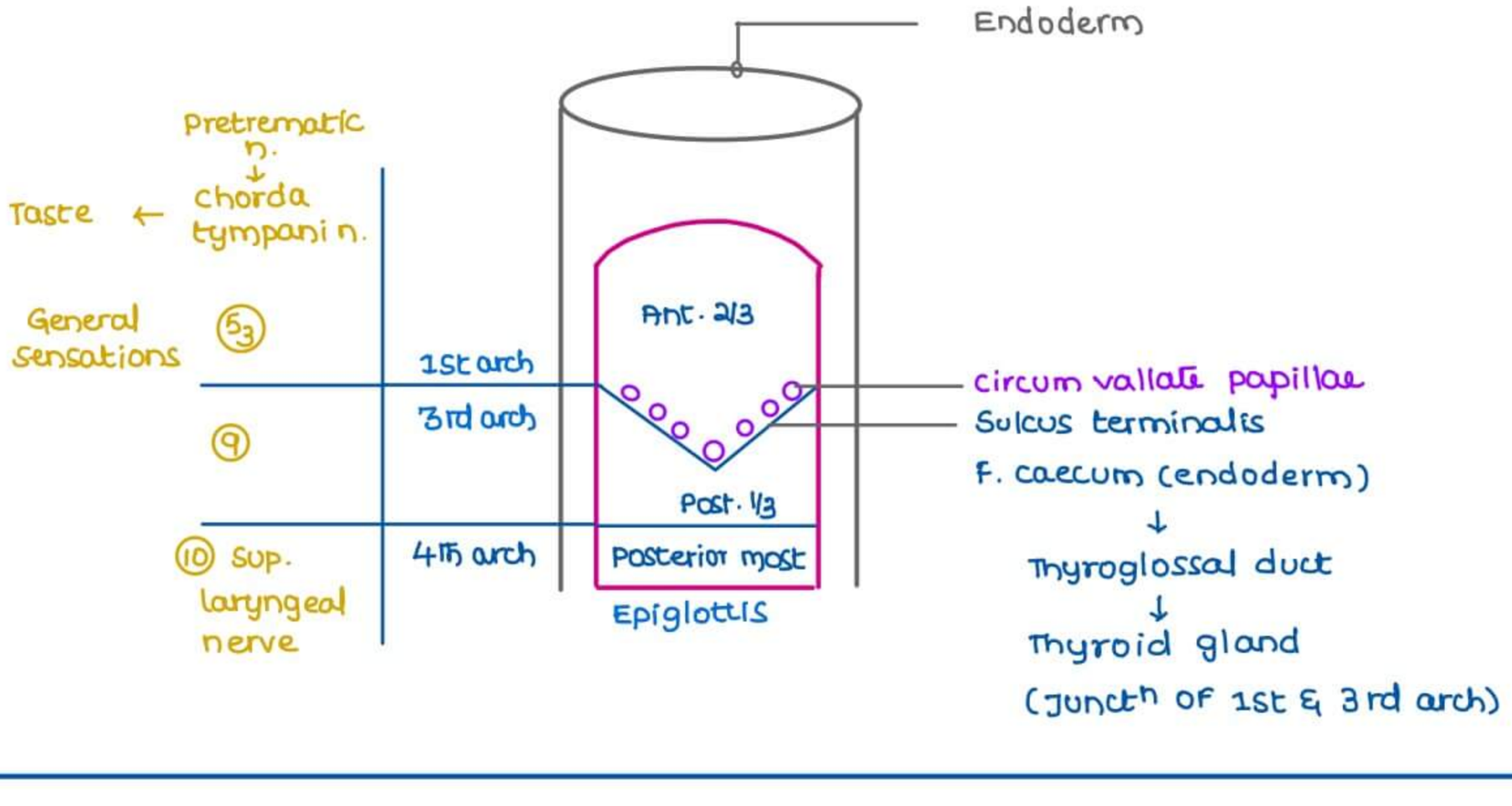
Q Tongue develops from all except
a Tuberculum impar
b Hypobronchial eminence
c Second arch → minimal contribution
d Lingual swellings



FLOOR OF PHARYNX

2 LINGUAL SWELLINGS
TUBERCULUM IMPAR

1. pharyngeal arch → anterior 2/3 rd of Tongue
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 1/3 rd of tongue
later migrate anterior to Sulcus terminalis

→ 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 terminalis → Ectoderm & endodermal junct^{n}

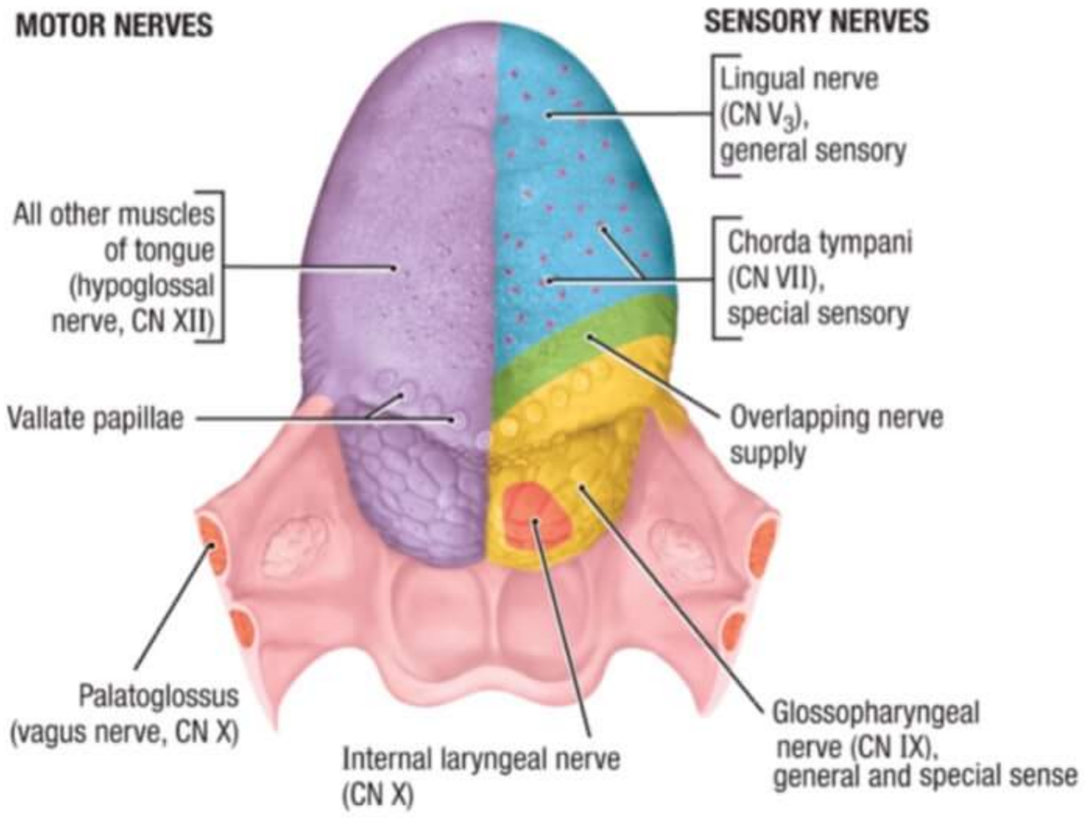
post. 1/3 rd → Endodermal

TONGUE DERIVED FROM 3 GERM LAYERS

Tongue → connective tissue & muscles → mesodermal origin
tongue muscles come from occipital somites [post ottic 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



MOTOR NERVES

All muscles of tongue derived from Hypoglossal Nerve (12) EXCEPT

Palatoglossal

- supplied by Superior laryngeal nerve
- VAGUS ACCESSORY COMPLEX
  - Supplies Palate, pharynx larynx

SENSORY NERVES

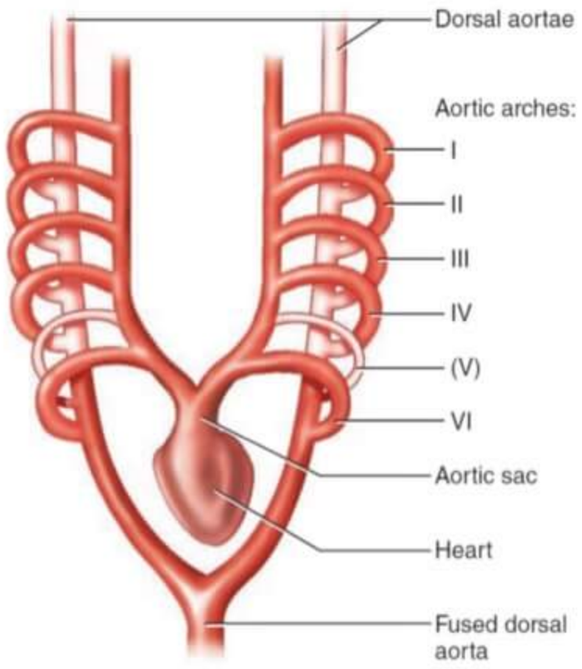
General sensations of ant. 2/3 rd of Tongue → Lingual nerve [5 3]
br of mandibular nerve
br of Trigeminal nerve

Posterior 1/3 rd & Circumvallate papillae → Glossopharyngeal nerve

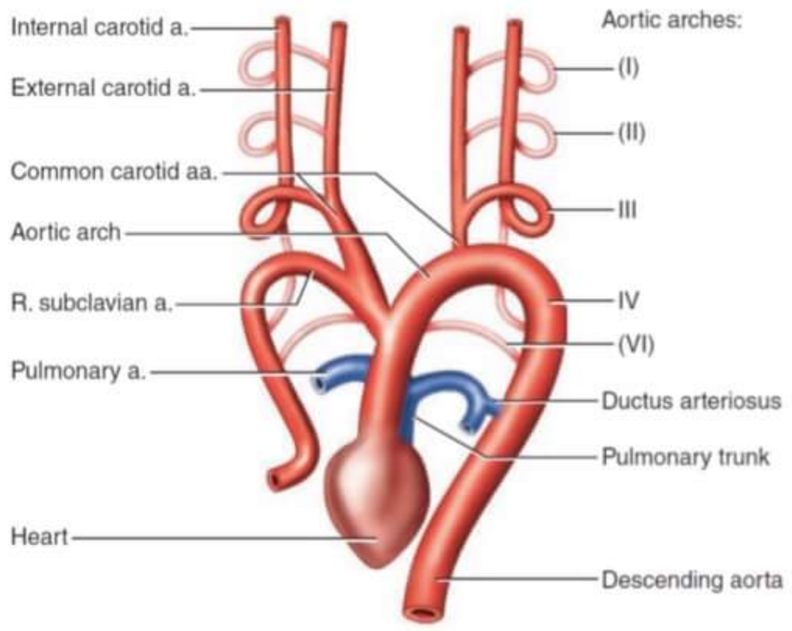
Posterior most tongue & Epiglottis → Internal laryngeal nerve
br. of superior laryngeal nerve
br. of vagus nerve

Q Taste pathway from circumvallate papillae of tongue goes through
a Chorda tympani br. of facial nerve
b Greater petrosal br. of facial nerve → carry taste from palate
c Superior laryngeal br. of vagus nerve → carry taste from Eg & post. most. T
d Lingual branch of Glossopharyngeal nerve

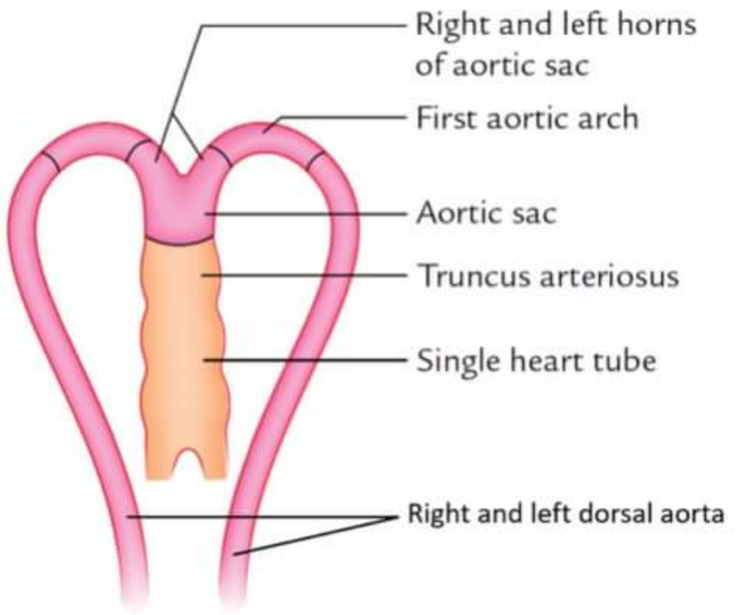
PHARYNGEAL ARCH ARTERIES

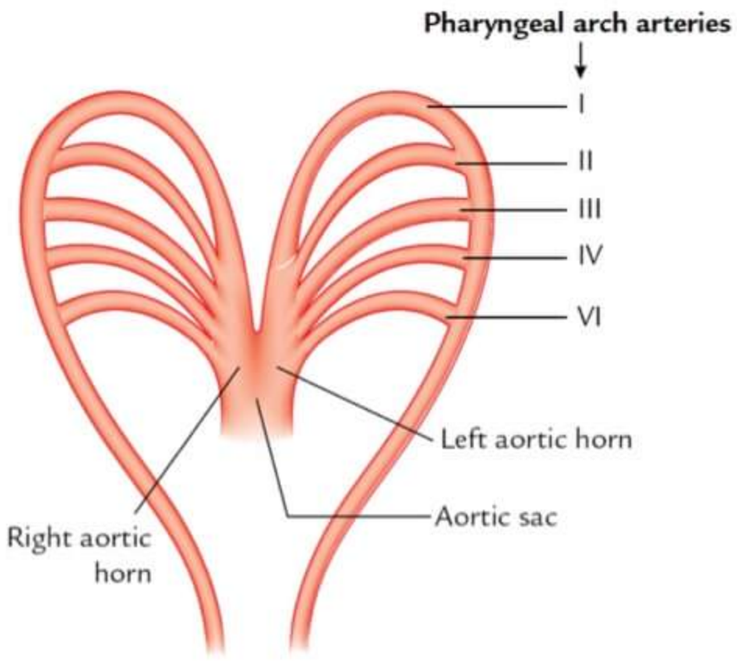


(a) 3–4 weeks



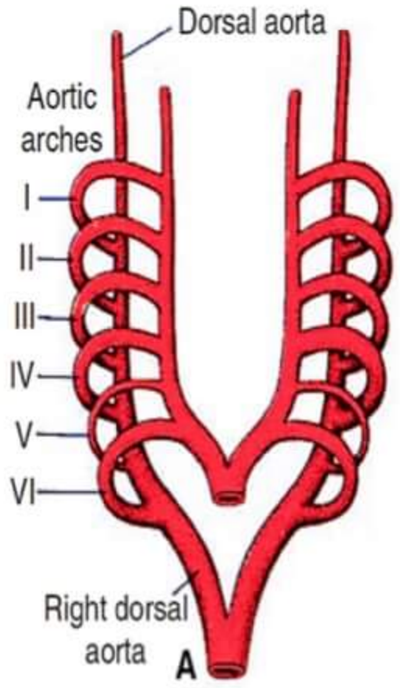
(b) 7 weeks

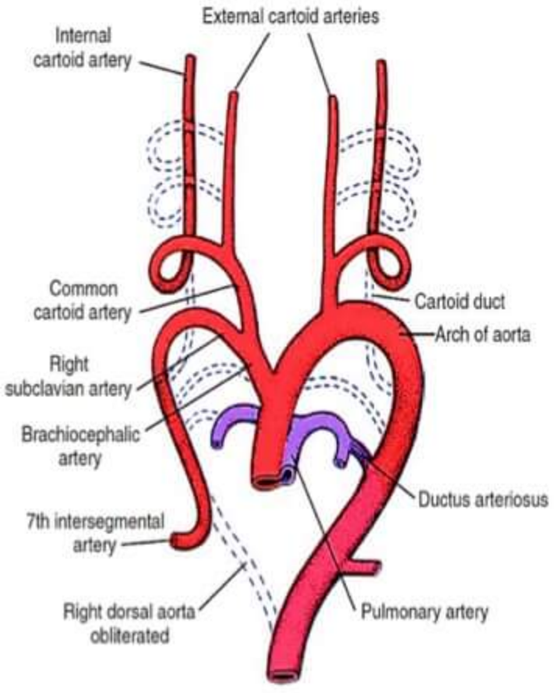




BLOOD CIRCULATION

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





ARCHES 1, 2, 5 disappears

ARCHES 3, 4, 6 Persists

REMNANTS

1st ARCH → MAXILLARY ARTERY [part]

2nd ARCH → STAPEDIAL ARTERY [part]

5th ARCH → no remnants

ARCH 3	→	Rt & Lt	COMMON CAROTID ARTERIES [portion of]
		Rt & Lt	INTERNAL CAROTID ARTERIES [portion of]
ARCH 4			
Rt. Side	→	Rt. SUBCLAVIAN ARTERY [portion of]	
Lt Side	→	ARCH OF AORTA [part blw Lt Subclavian & Lt com. carotid Ar.]	
ARCH 6	→	PULMONARY ARTERY [Rt & Lt]	
		DUCTUS ARTERIOSUS [Left is left, Rt disappears]	

EXTERNAL CAROTID ARTERY → DENOVO BRANCH

Rt SUBCLAVIAN ARTERY CONTRIBUTED BY → Rt 4th Arch
→ Rt dorsal aorta (part of)
→ Intersegmental artery no. 7

Lt SUBCLAVIAN ARTERY contributed by → Intersegmental artery no. 7

Q Rt fourth arch artery gives rise to

a Rt subclavian artery

b common carotid artery

c Internal carotid artery

d External carotid artery

Embryonic	Adult
Aortic arch arteries	
1	Maxillary artery (portion of)
2	Stapedial artery (portion 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

Q Double aortic arch 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 aorta

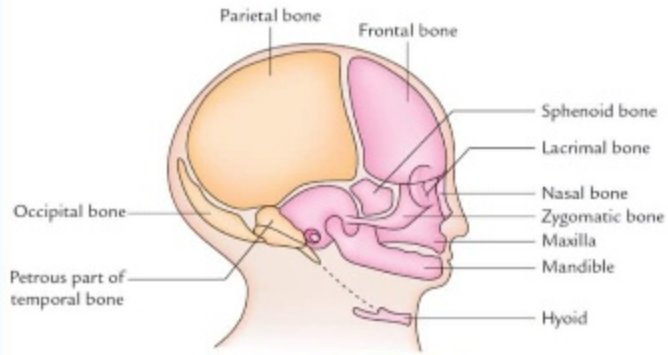
DOUBLE AORTIC ARCH

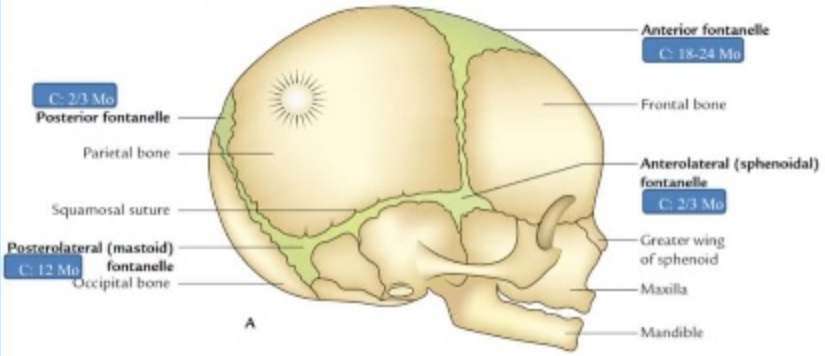
→ Persistent distal portion of Rt dorsal aorta

→ Difficulty in breathing & swallowing dlt compression by Rt aortic arch

Ima
+14

DEVELOPMENT OF SKULL





FONTANELLE FUSION

1 Posterior → 2/3 m

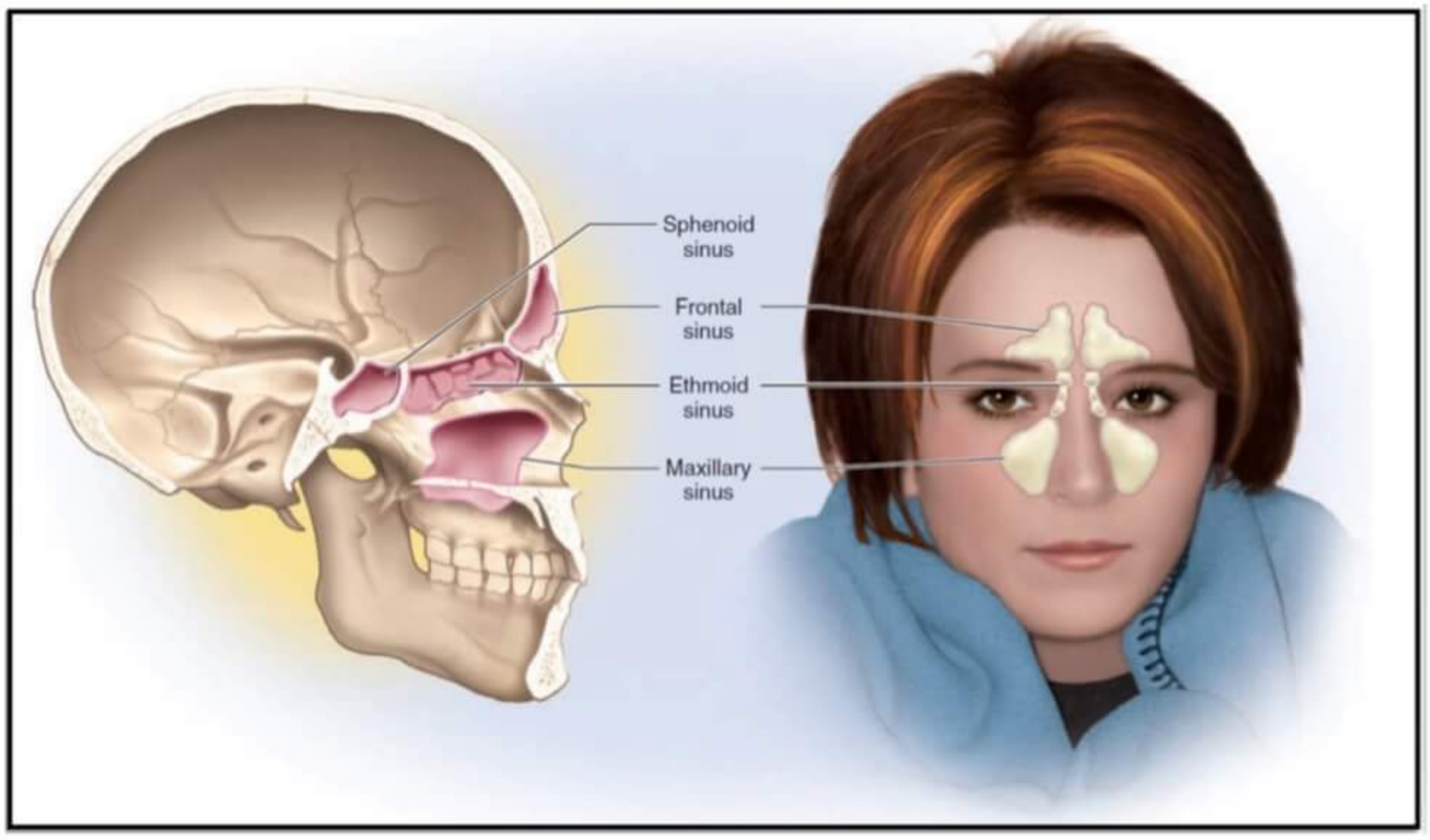
2 Sphenoidal → 2/3 m

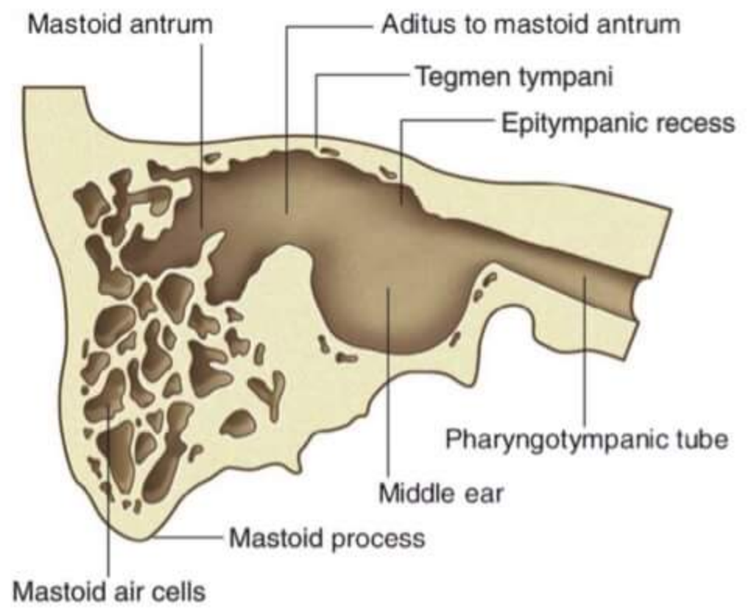
3 mastoid → 12 m

4 Anterior → 18-24 m

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

PNEUMATIC BONES





FRONTAL SINUS → in frontal bone

ETHMOID SINUS → in Ethmoid bone [nose]

SPHENOID SINUS → in Sphenoid bone

→ pituitary gland is present

MAXILLARY SINUS → Largest sinus

MASTOID AIR CELLS → in Temporal bone

MASTOID PROCESS

- comes around 2 yrs of age
- Traction epiphysis

CRANIAL CAVITY

INTRODUCTION

Q Which of the following nerves are present in posterior cranial fossa

a 3rd to 12 ⫫

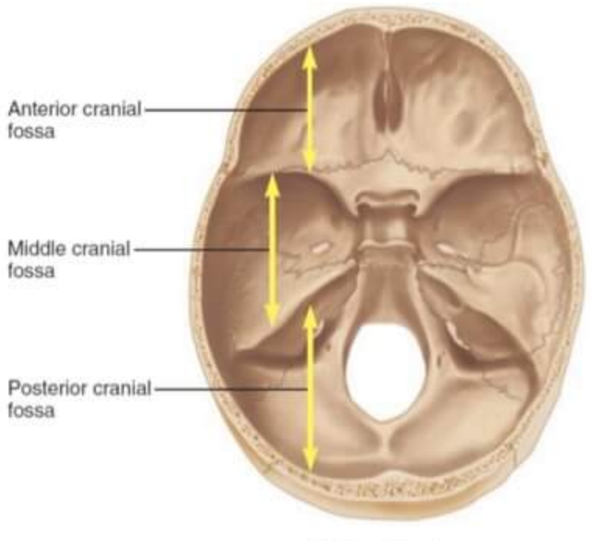
b 4⫫ to 12 ⫫

c 5 ⫫ to 12 ⫫

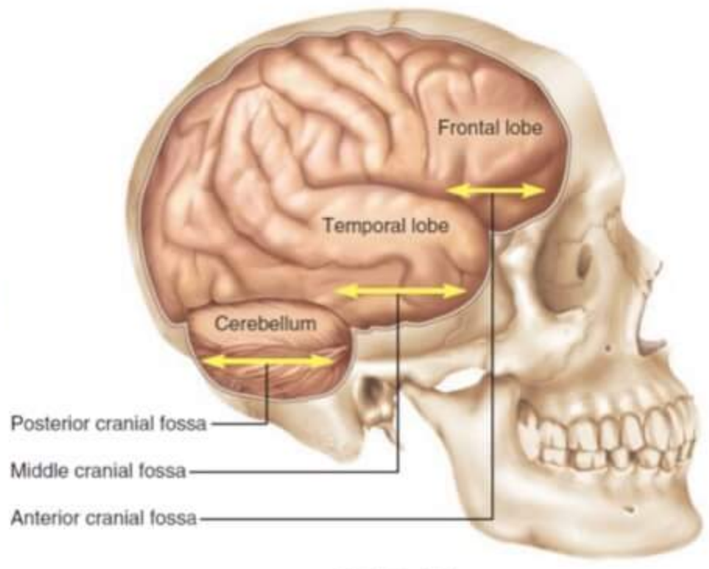
d 6⫫ to 12⫫

Posterior cranial fossa contains Brain stem

Brain stem has 3 - 12 CN.



(a) Superior view

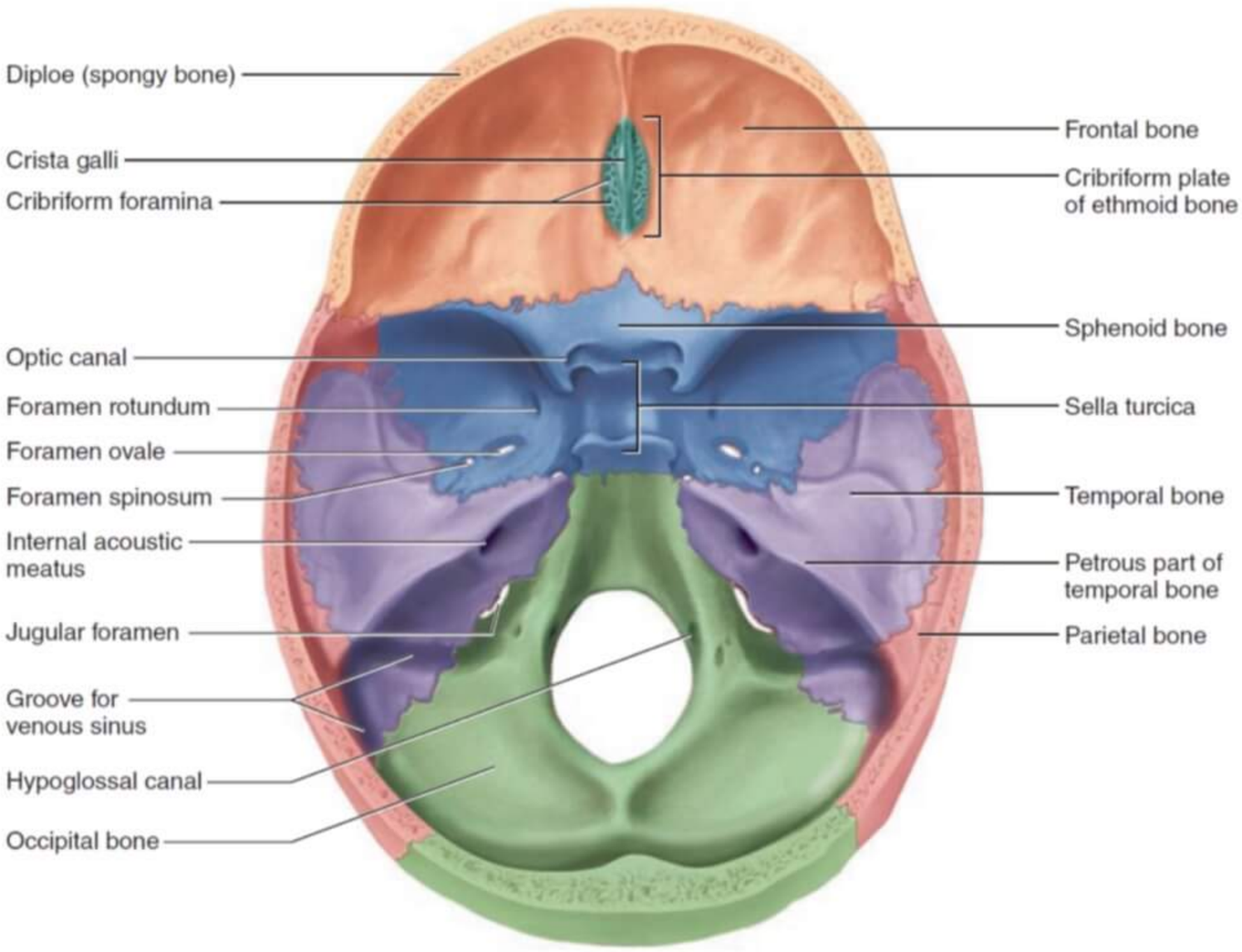


(b) Lateral view

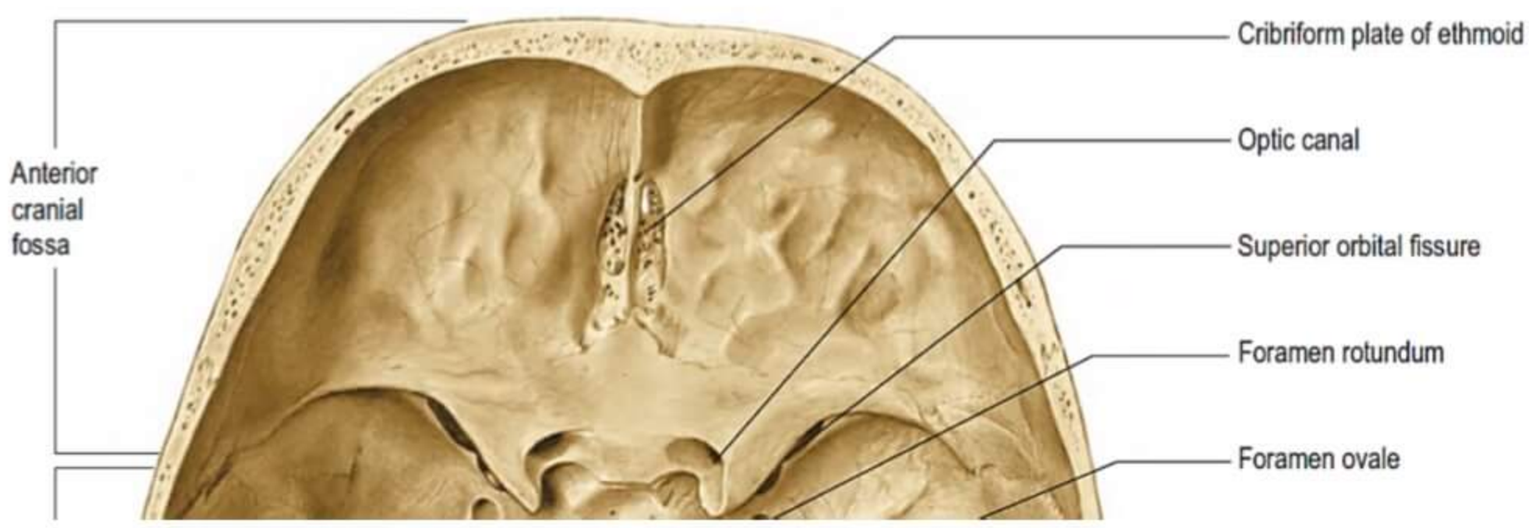
ACF contains Frontal lobe

MCF contains Temporal lobe

PCF contains Brain stem & Cerebellum



FLOOR OF ANTERIOR CRANIAL FOSSA



1 CRIBRIFORM PLATE OF ETHMOID BONE

→ Roof of nasal cavity

→ contains multiple openings for olfactory nerve axons from nasal cavity to olfactory bulb in Brain

2 FRONTAL BONE
3 LESSER WING OF SPHENOID
} ROOF OF Orbit

LESSER WING OF SPHENOID

→ Contains optic canal for passage of optic nerve coming from eyeball

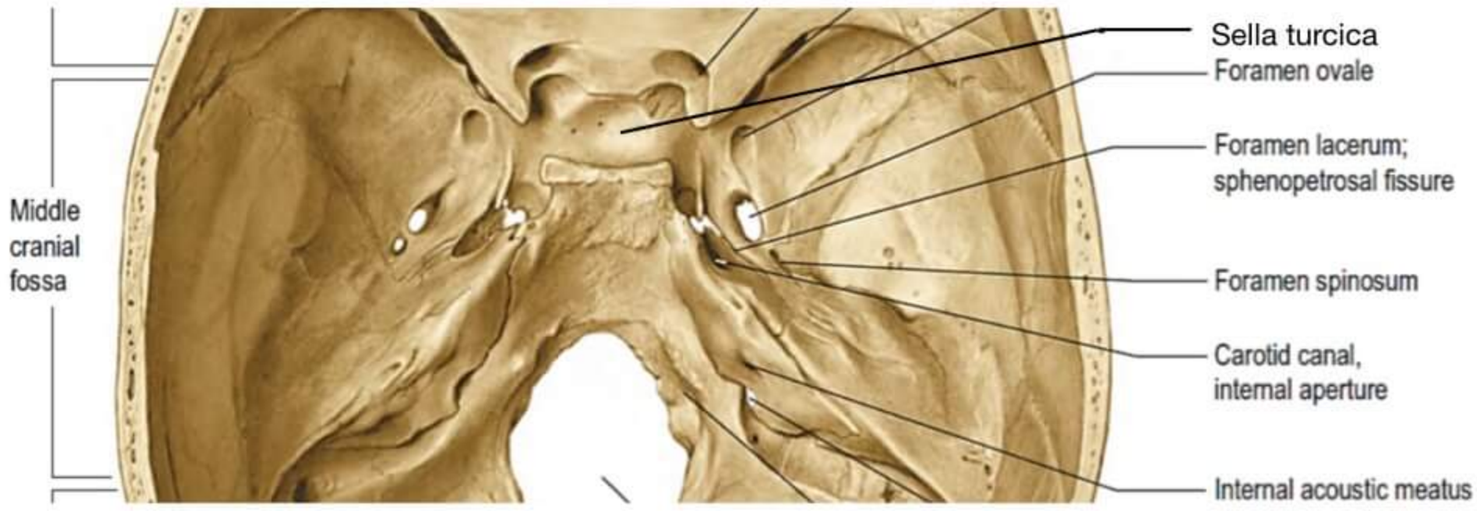
SPHENOID BONE → Butterfly shaped Bone

LESSER WING → present at floor of anterior cranial fossa

GREATER WING → present at floor OF middle cranial fossa

SUPERIOR ORBITAL FISSURE → present blw Lesser wing & greater wing

FLOOR OF MIDDLE CRANIAL FOSSA



1 GREATER WING OF SPHENOID

OPENINGS

1 Foramen Rotandum
2 Foramen ovale
3 foramen Spinosum

2 SUPERIOR ORBITAL FISSURE → Gap blw lesser wing & greater wing

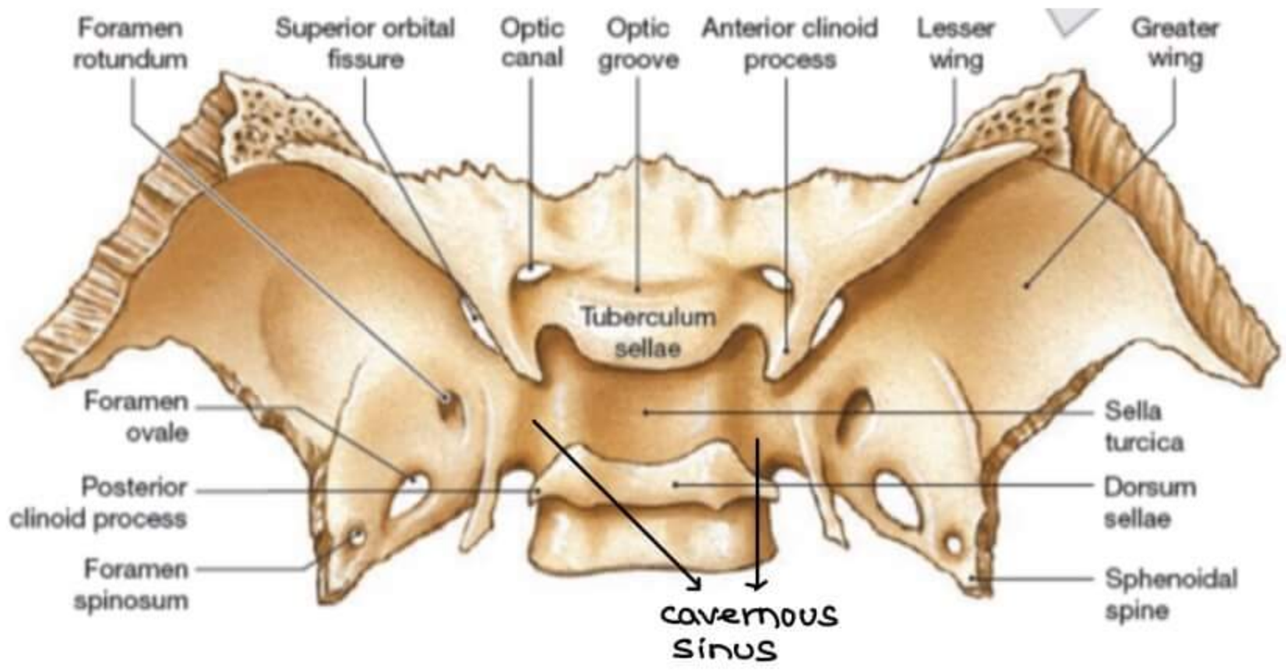
3 BODY OF SPHENOID

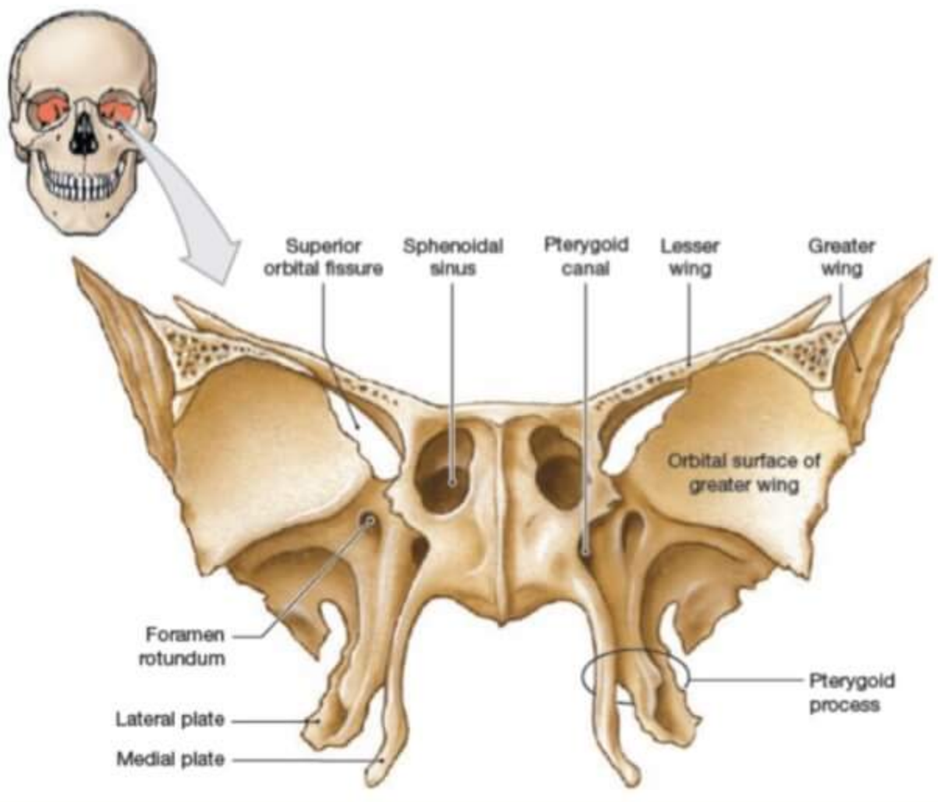
→ Present in

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

Pterygoid muscles insert on mandibles

CAVERNOUS SINUS

→ lateral to Sella turcica (pituitary gland)

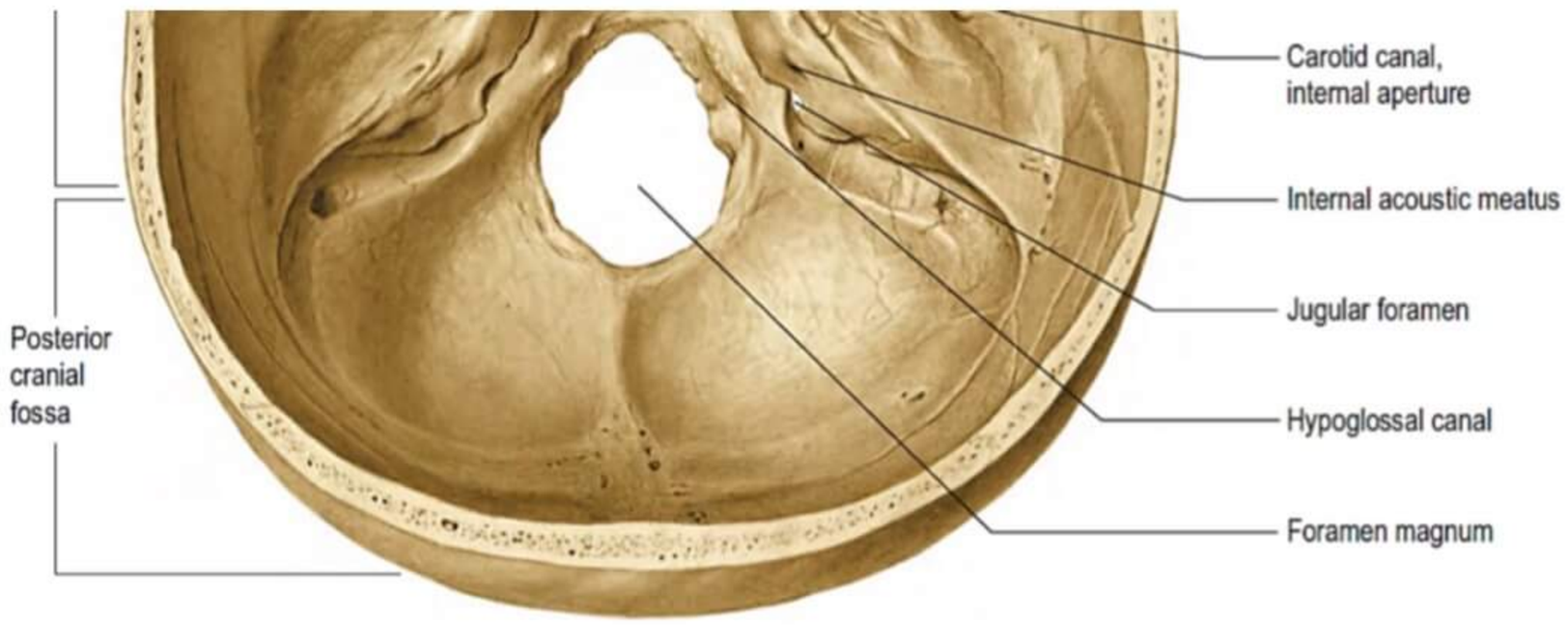
→ Internal carotid artery passing at Floor of foramen lacerum before entering into cavernous sinus

FORAMEN LACERUM

→ has lacerated margins

→ medial to f. ovale

FLOOR OF POSTERIOR CRANIAL FOSSA



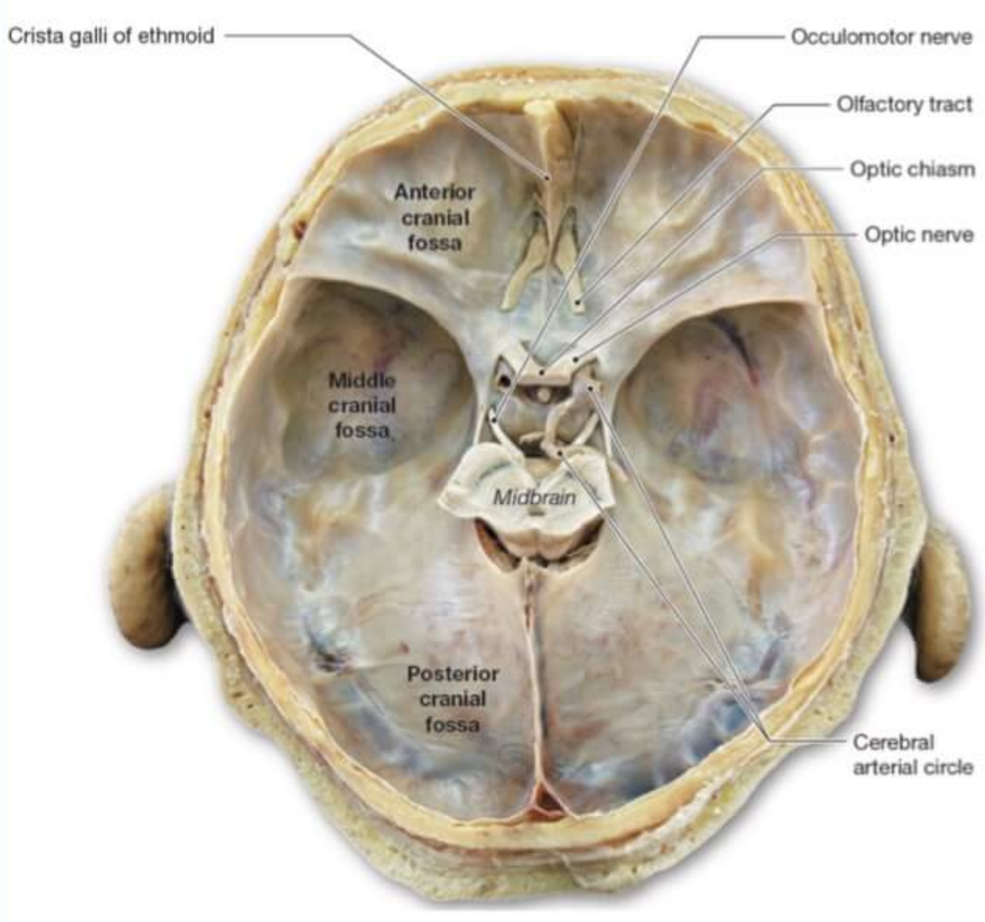
1. INTERNAL AUDITORY MEATUS
   - in petrous temporal bone
   - facial nerve enter through it

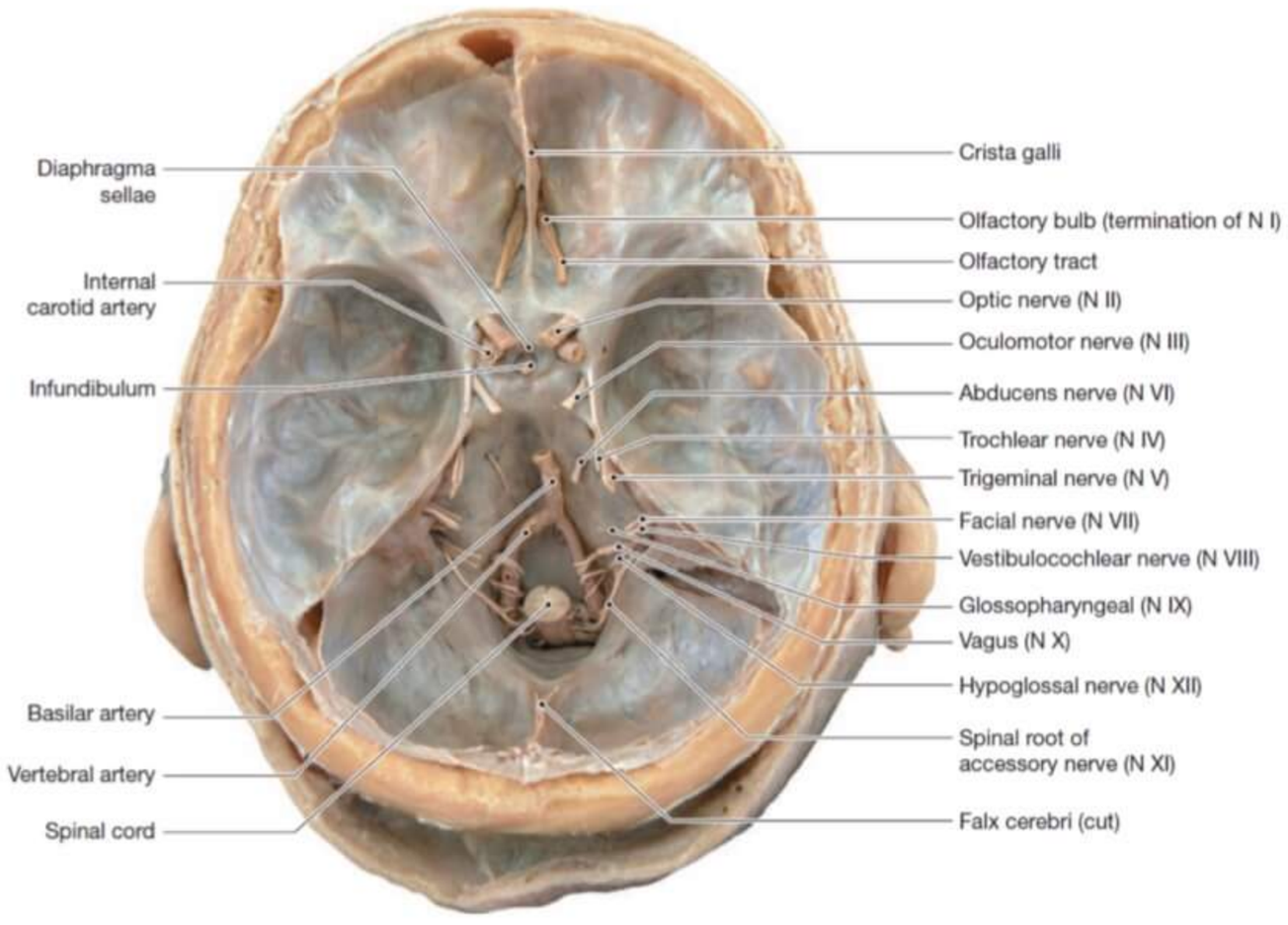
2 JUGULAR FORAMEN → present below IAm

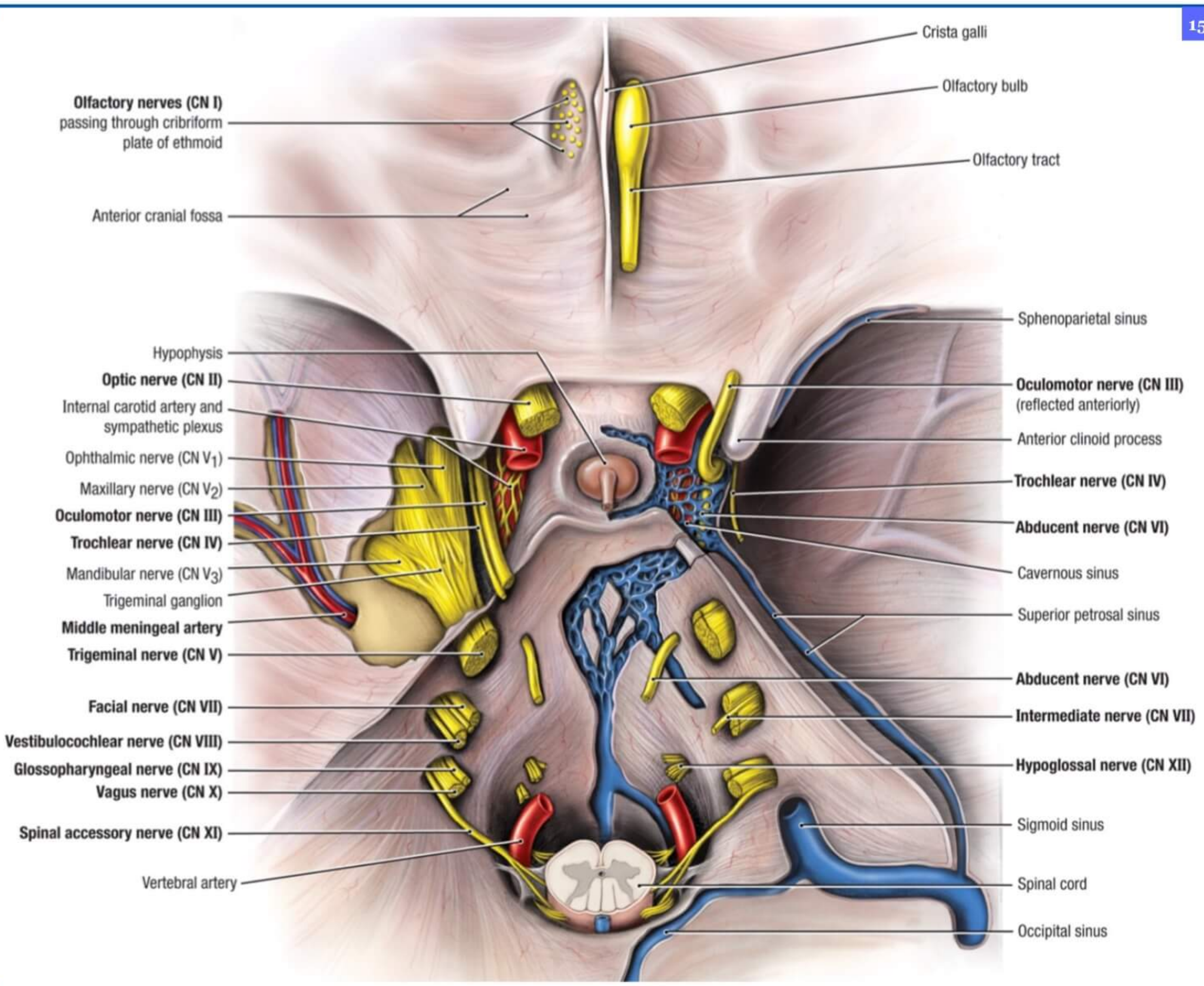
3 HYPOGLOSSAL CANAL → for CN XII

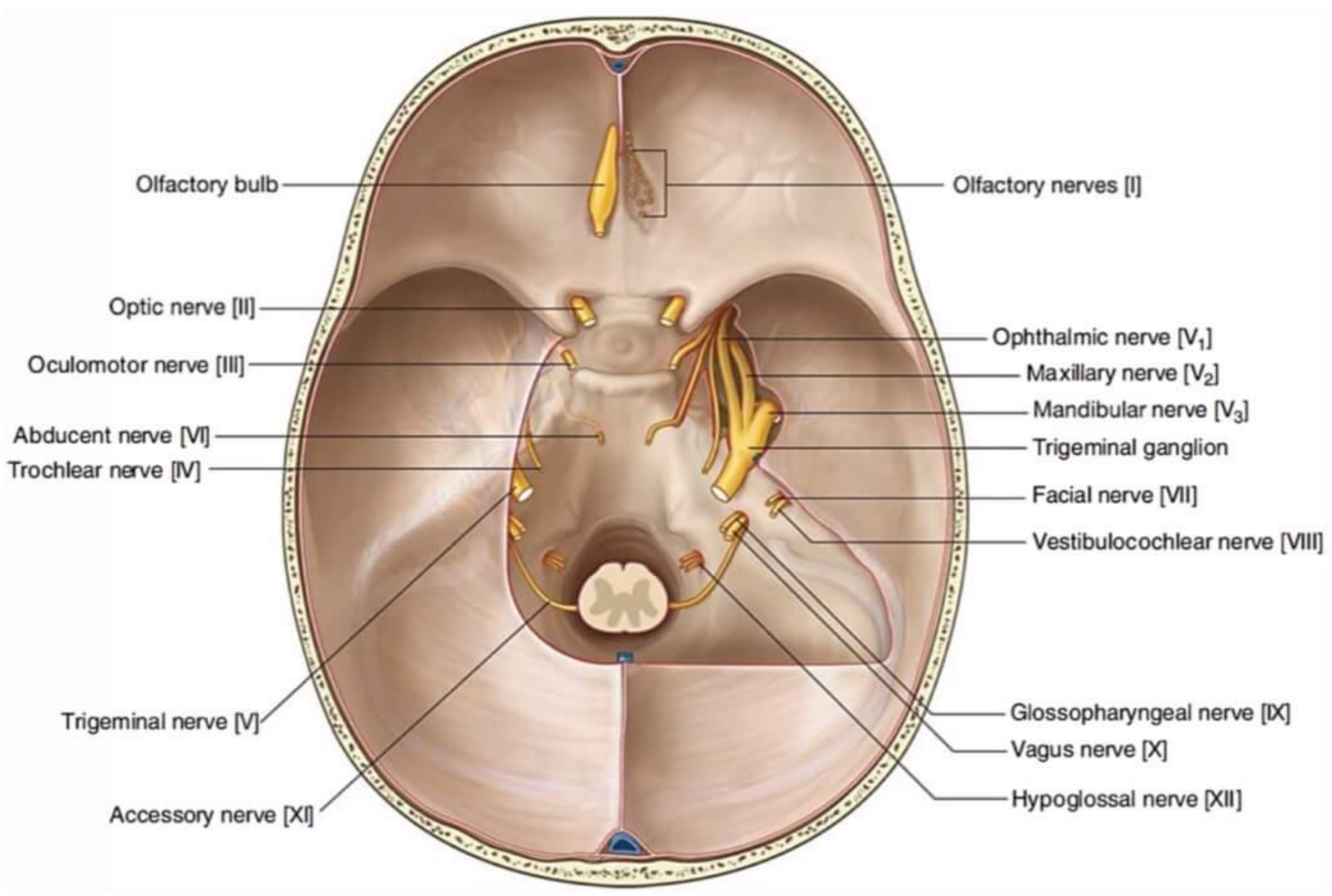
4 FORAMEN MAGNUM → present in occipital bone

CRANIAL NERVES & RELATED SKULL FORAMINA









ANTERIOR CRANIAL FOSSA — FORAMINA OF SKULL

1. OLFACTORY NERVE → Cribriform plate of Ethmoid
2. OPTIC NERVE → Optic canal

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 (3) → most medial

3 ABDUCENT NERVE (4) → puncture dura matter at floor of post. cranial fossa & becomes intradural [has longest intra dural course] & enter cavernous sinus

4 TROCHLEAR NERVE (6) → most lateral
→ thinnest cranial nerve

5 OPHTHALMIC DIVISION OF TRIGEMINAL NERVE
→ gives 3 sensory branches & passes throug Superior orbital fissure

6 MAXILLARY DIVISION OF TRIGEMINAL NERVE (±)
→ passes through foramen rotandum & 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
→ 5_1 → Ophthalmic nerve
5_2 → maxillary nerve
5_3 → 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

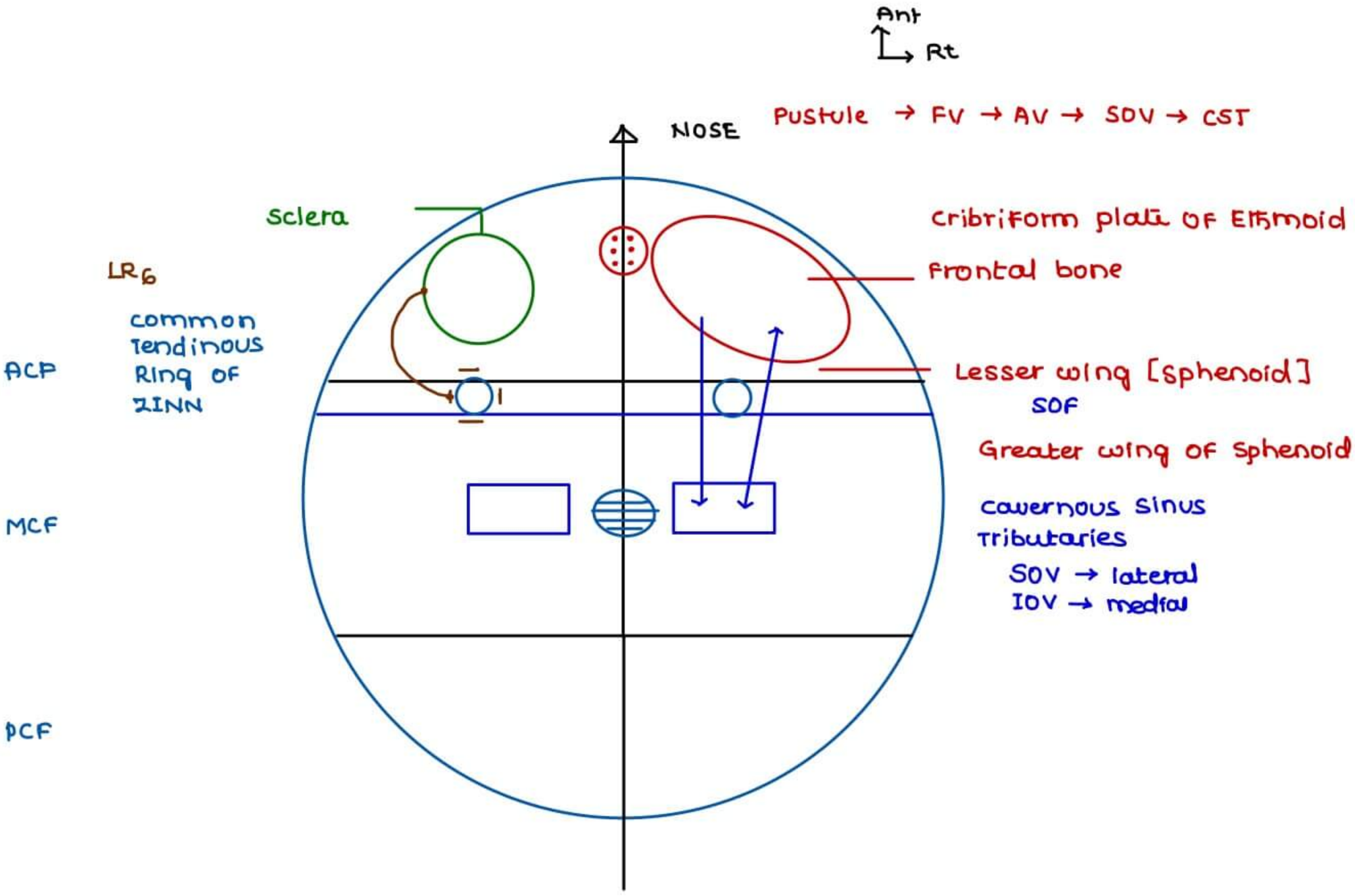
→ present in mid brain in posterior cranial fossa
→ occulomotor Nerve comes anterior to it at the level of Superior colliculus

FORAMEN MAGNUM contains Lower part of M. oblongata

SPINAL CORD → present below foramen magnum

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

MR more powerful

LR affected

earliest nerve involved → CN6

External Ophthalmoplegia

Later onset

Eye ball becomes still

all nerves are affected

LR6

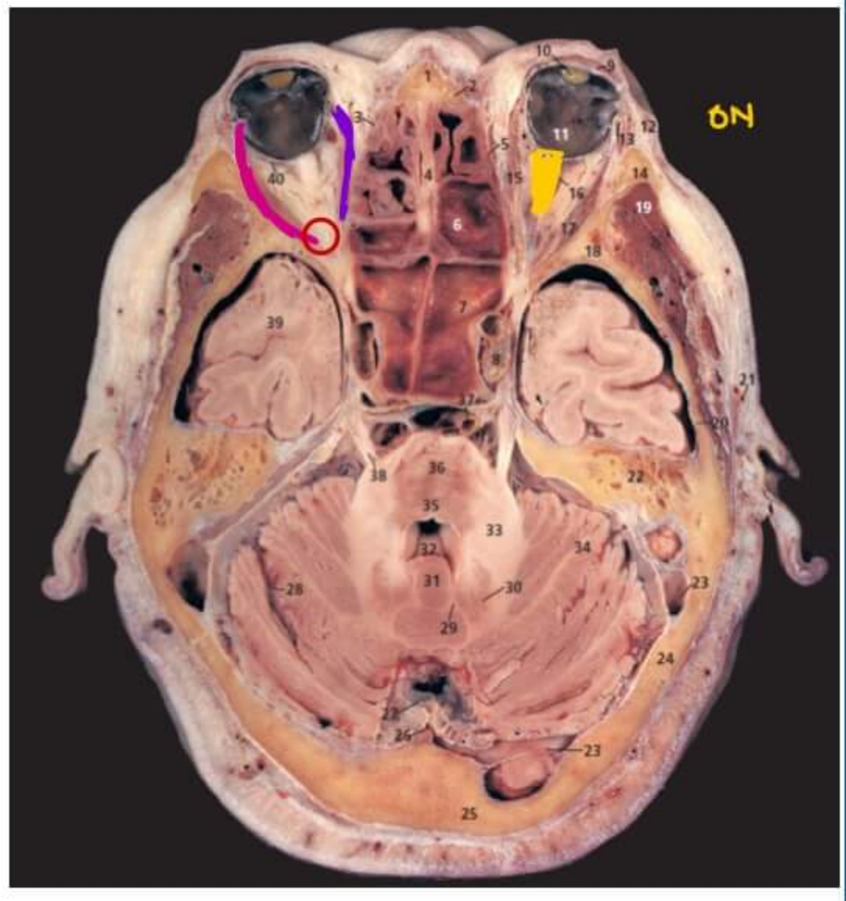
MR3

Ethmoid air Sinus

at floor of ACF (roof of nasal cavity) →

CSF Rhinorrhea

Sphenoid air Sinus



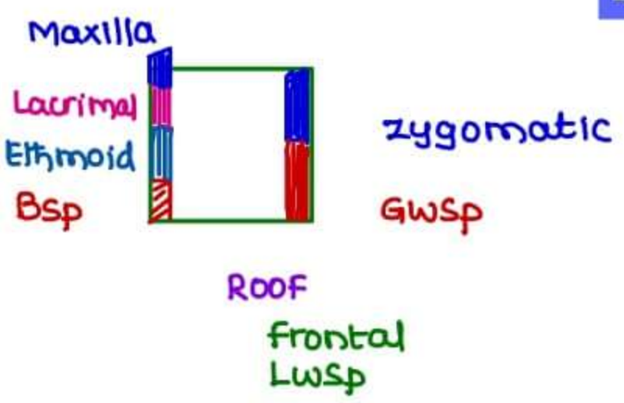
MEDIAL WALL OF ORBIT

Body OF SPHENOID [more posterior]

ETHMOID BONE

LACRIMAL BONE

MAXILLA BONE [more anterior]



LATERAL WALL OF ORBIT

Greater wing OF SPHENOID

ZYGOMATIC BONE

Q Choose wrong statement concerning the wall of the orbit

a ROOF → frontal bone

b ROOF → Greater wing of Sphenoid

c medial wall → Ethmoid bone

d Medial wall → Sphenoid bone

Q Thinnest area of Sclera

a Limbus

b behind rectus insertion

c Equator

d Infront of rectus insertion

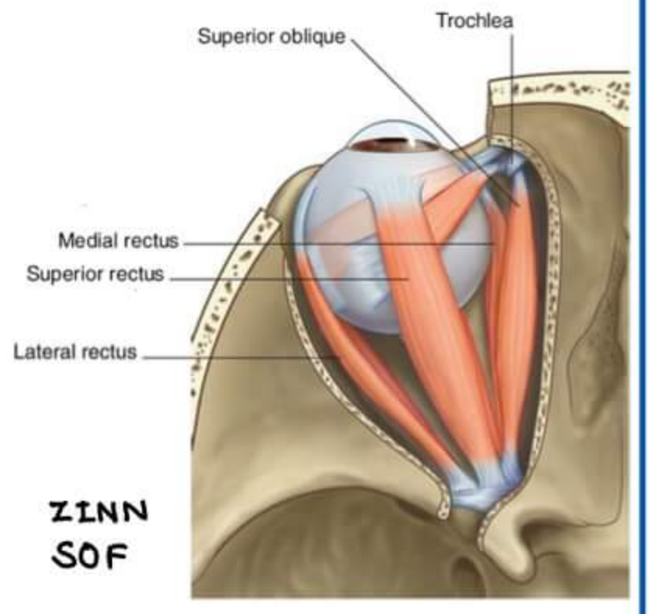
Q Which of the following is a tributary as well as drainage channel to cavernous sinus

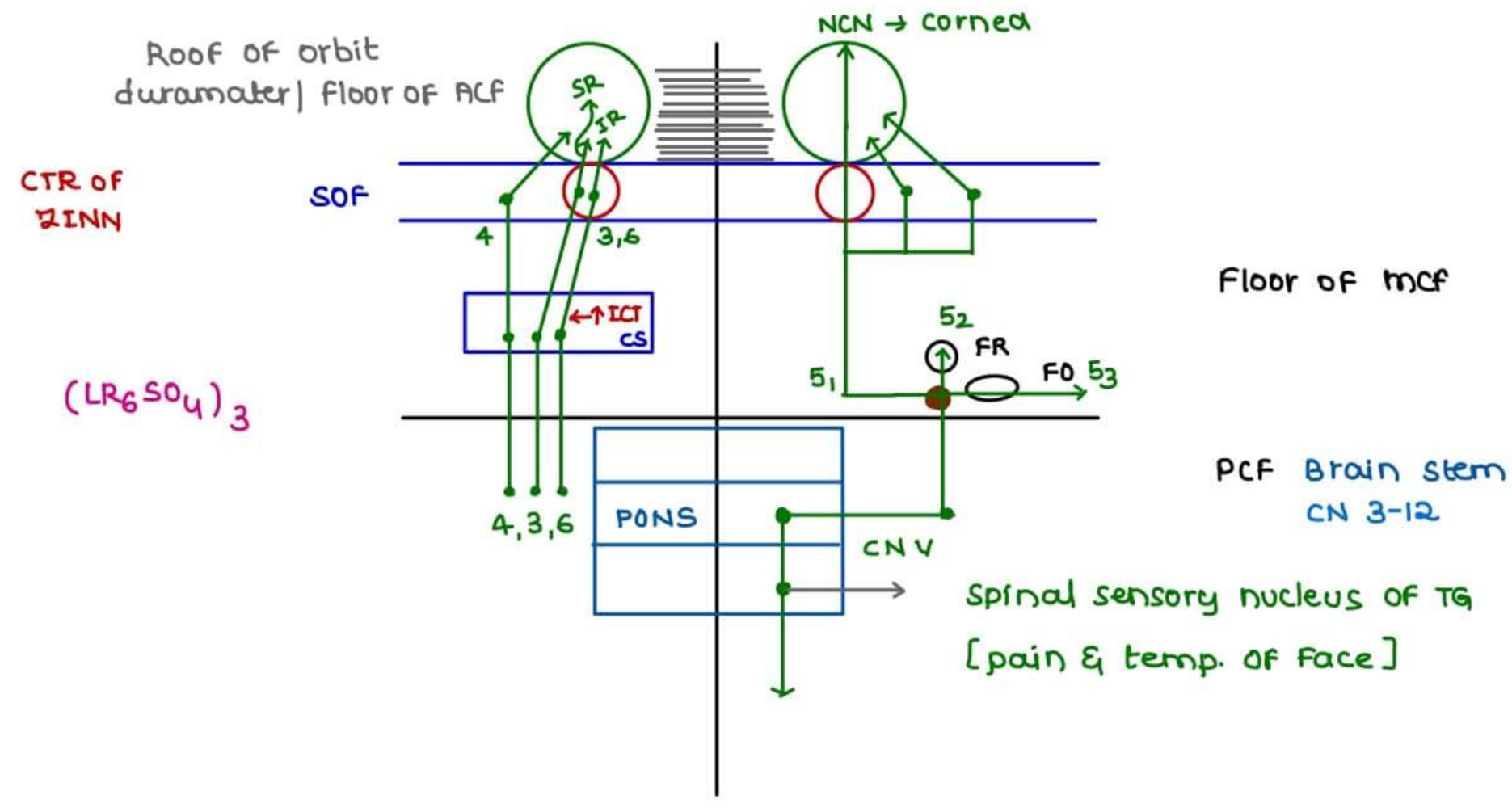
a Superior ophthalmic vein

b Inferior Ophthalmic vein

c Sphenoparietal sinus

d Superficial middle meningeal vein





Superior veiw OF cranial cavity

OPHTHALMIC DIVISION OF CN V

→ Gives 3 sensory Branches & passes SOF

Nasociliary Nerve [most med] → passes th CTR of Zinn → Supplies cornea (Corneal reflex)

Frontal Nerve [middle]

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 Naso ciliary nerve

→ COURSE

Given in orbit by Nasociliary Nerve

Exits Orbits by passing through Ethmoidal foramen

Comes to Floor OF ACF

Supplies

Duramatter at floor OF ACF

NOSE (inside & outside), Ethmoid bone & Ethmoid air sinus [carries pain]

PAIN OF ETHMOID SINUSITIS

PAIN → Ant. Ethmoidal nerve → Naso ciliary nerve → ophthalmic division of TG nerve → TG Nerve → Spinal sensory nucleus OF TG Nerve

Q Anterior ethmoidal nerve, branch of Nasociliary nerve supplies all Except

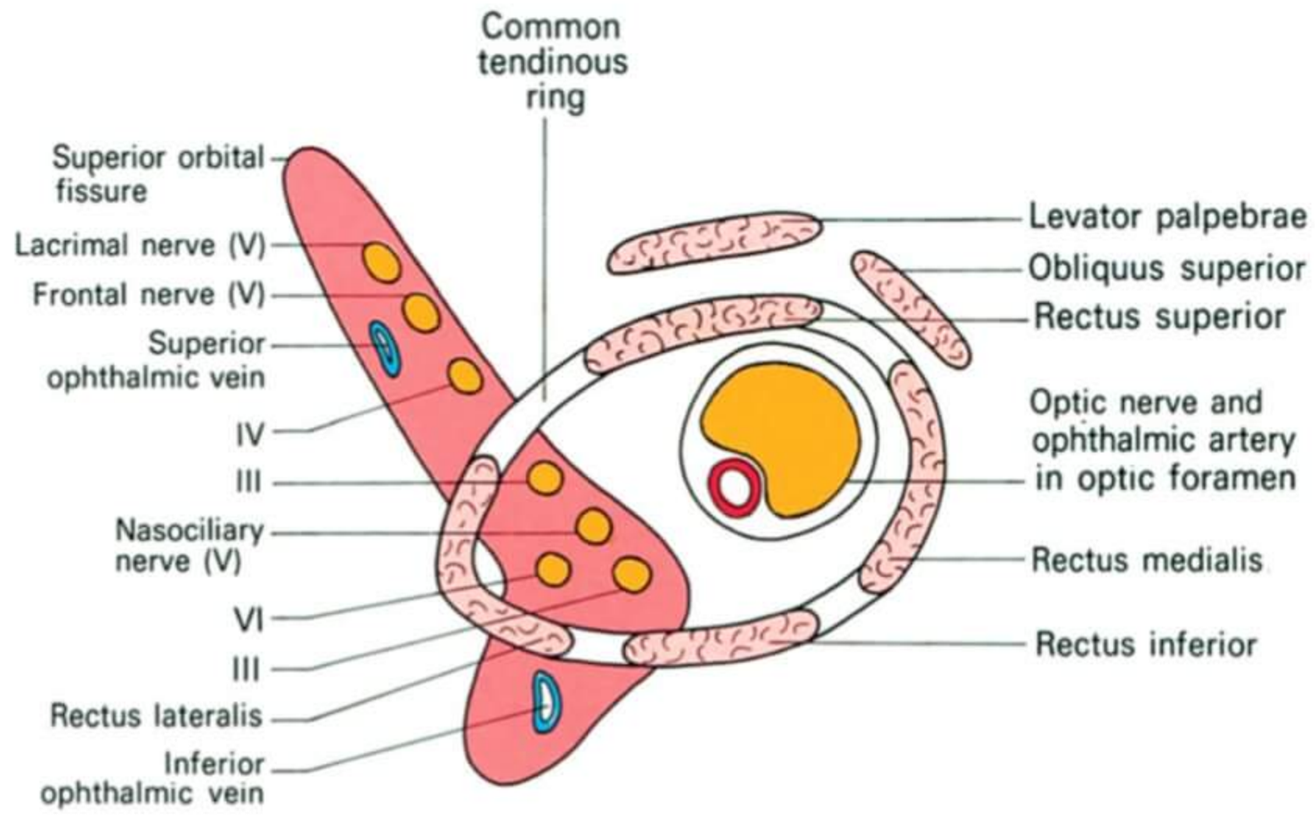
a Dura matter in anterior cranial fossa

b Ethmoidal cells

c Internal nasal cavity

d maxillary sinus lining → carries by branches of maxillary nerve

SUPERIOR ORBITAL FISSURE



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 (Supplie Sup. rectus) & Inferior division (supplies Inf. rectus)]

CN 6

Naso ciliary Nerve

Q Structures passing through the tendinous ring of Zinn

a Superior Ophthalmic vein

b Trochlear nerve

c Naso ciliary nerve

d Lacrimal nerve

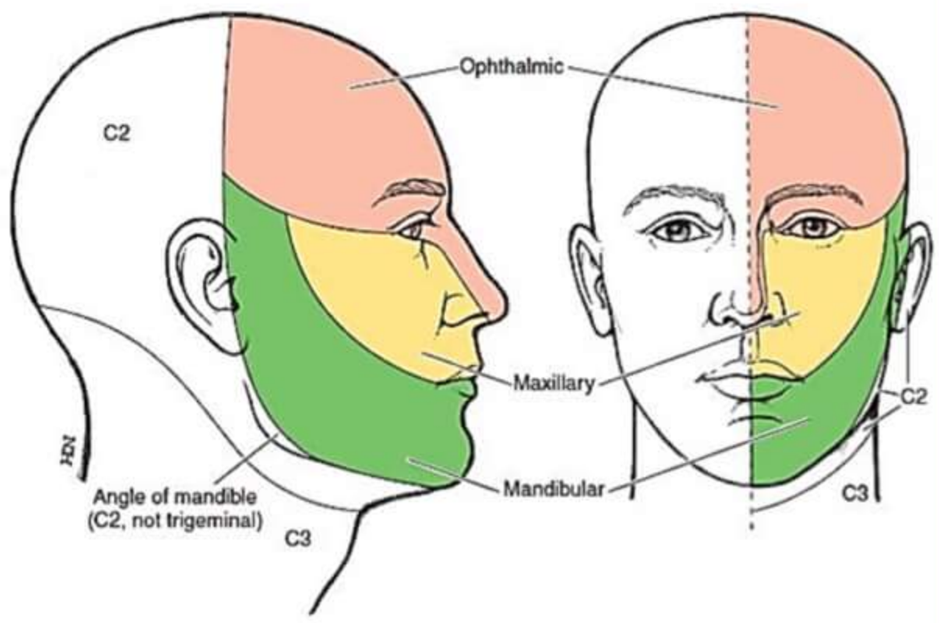
TRIGEMINAL NERVE

OPHTHALMIC BRANCH [5_1]

→ Supplies skin of Fore head & tip of nose

→ In Herpes zoster (vesicles at tip of nose)

→ Ophthalmic branch is involved

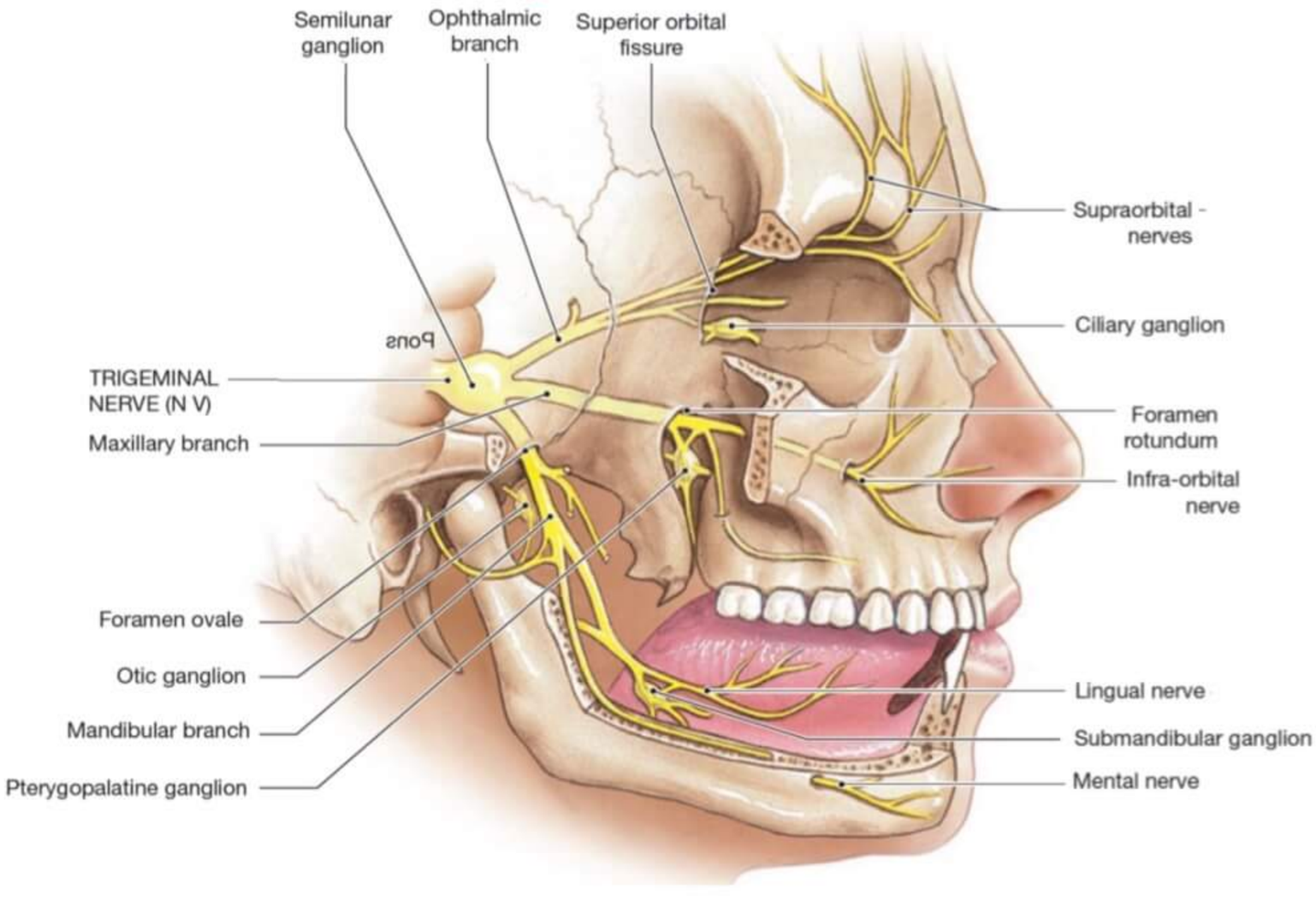


MAXILLARY BRANCH [5_2]

→ Supplies skin on lower eye lid, upper lip & maxilla bone

MANDIBULAR BRANCH [5_3]

→ 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 fibres,
   carried by Occulomotor Nerve (3) [Functional nerve] &
   Synapses in CILIARY GANGLION

2 Post ganglionic fibres carried by Trigeminal nerve [NCN] [Topographic n.]
& Supplies

CILIARIS → ↑ lens convexity [Accomodat^{n} reflex]
SPHINCTER PUPILLAE → Miosis [Light reflex]

MAXILLARY NERVE

→ passes foramen Rotundum
→ PTERYGOPALANTINE 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
carries pain of upper teeth [pain of Lower teeth by mandibular nerve]
pain of maxillary sinusitis

MANDIBULAR NERVE (5_3)

→ Supplies madible bone, mandibular teeth (carries lower teeth pain)
→ passes through foramen Ovale & related topographically ε OTIC Ganglion
→ OTIC GANGLION
→ Functional nerve → Glossopharyngeal nerve
Topographic nerve → Mandibular nerve OF CN V

→ Supplies → Parotid Salivary gland

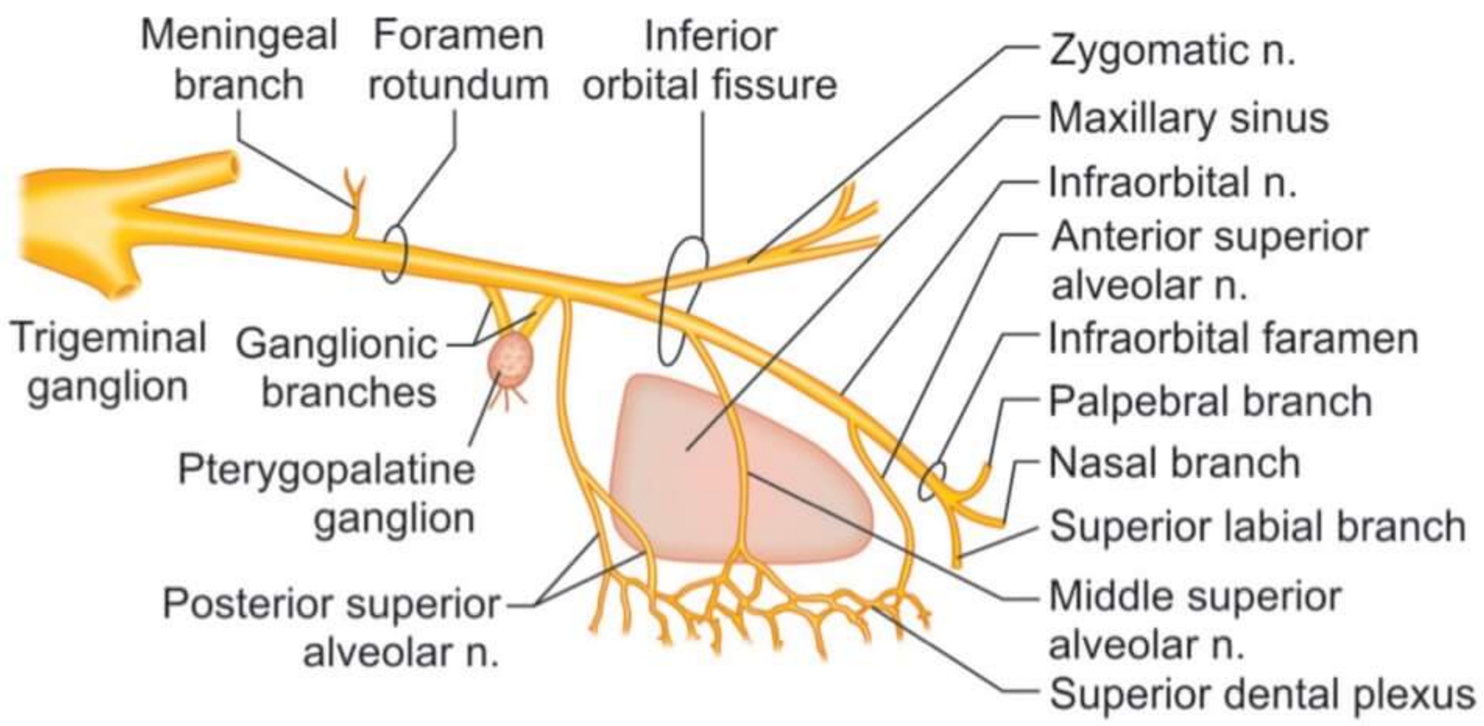
→ Otic ganglion is more medial & deeper to Mandibular Nerve

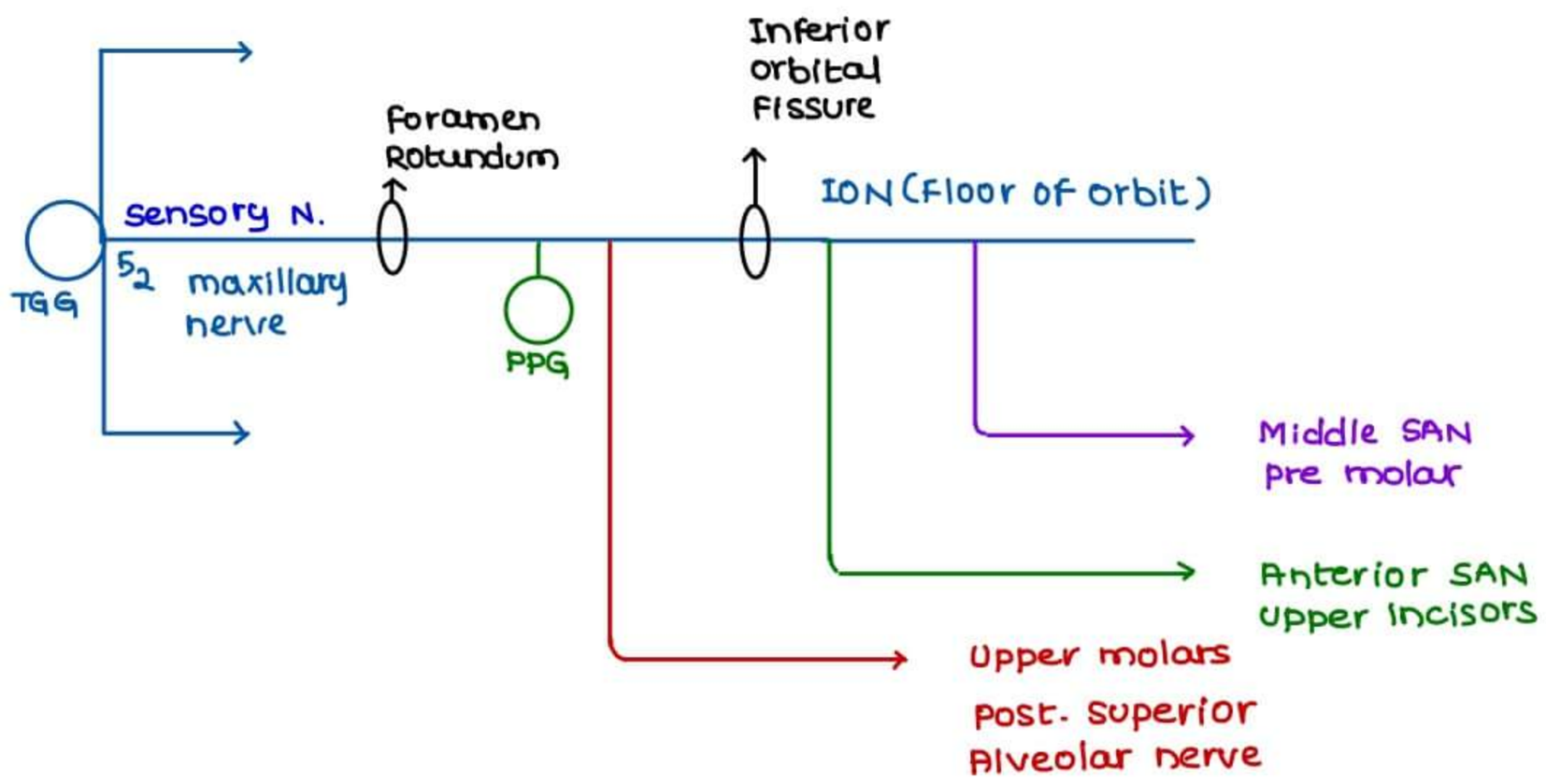
→ SUB MANDIBULAR GANGLION

→ Supplies — Submandibular salivary gland
Sublingual salivary gland

→ Functional nerve → Facial nerve
Topographical nerve → Lingual branch of Mandibular br. of CN V

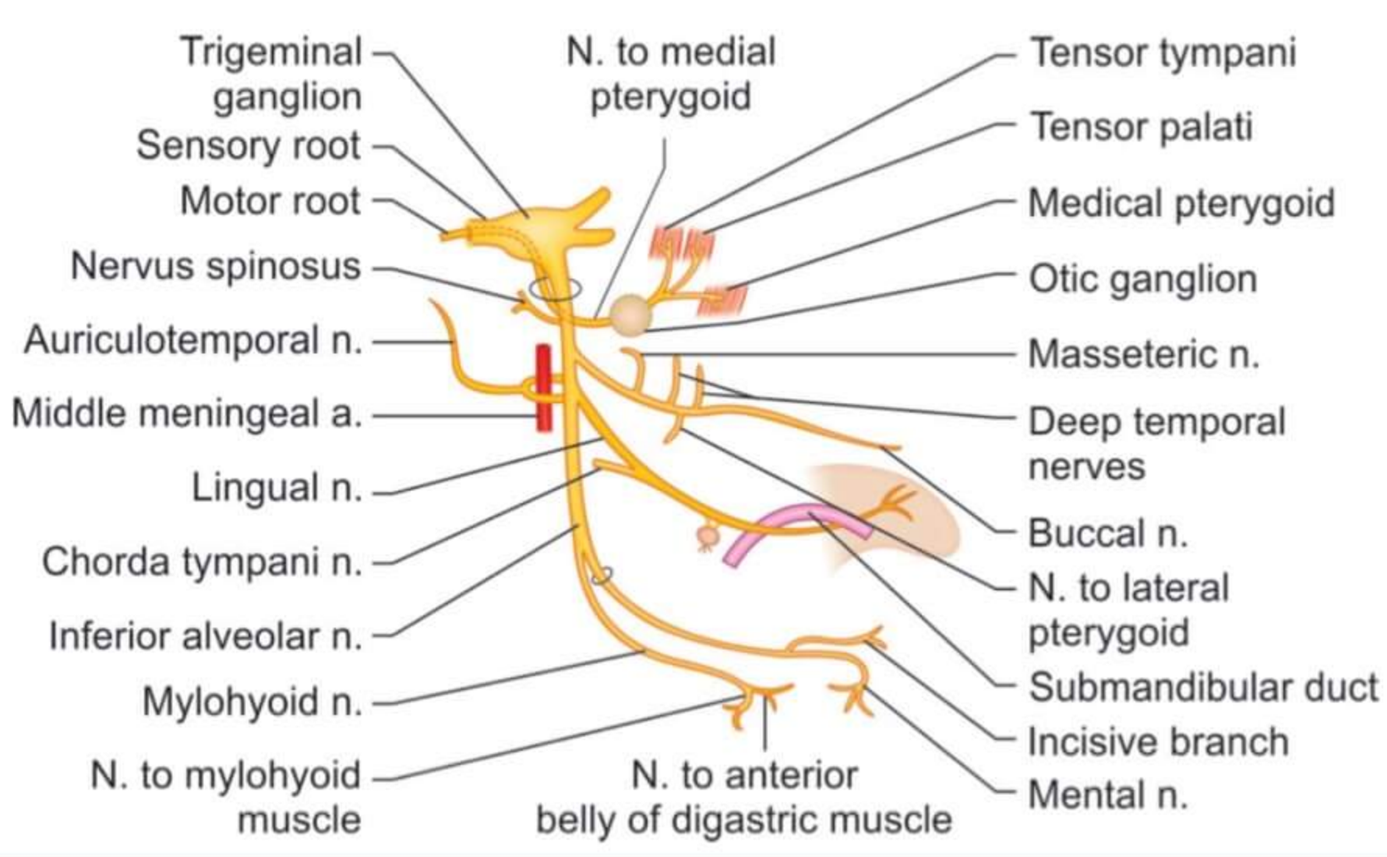
MAXILLARY NERVE

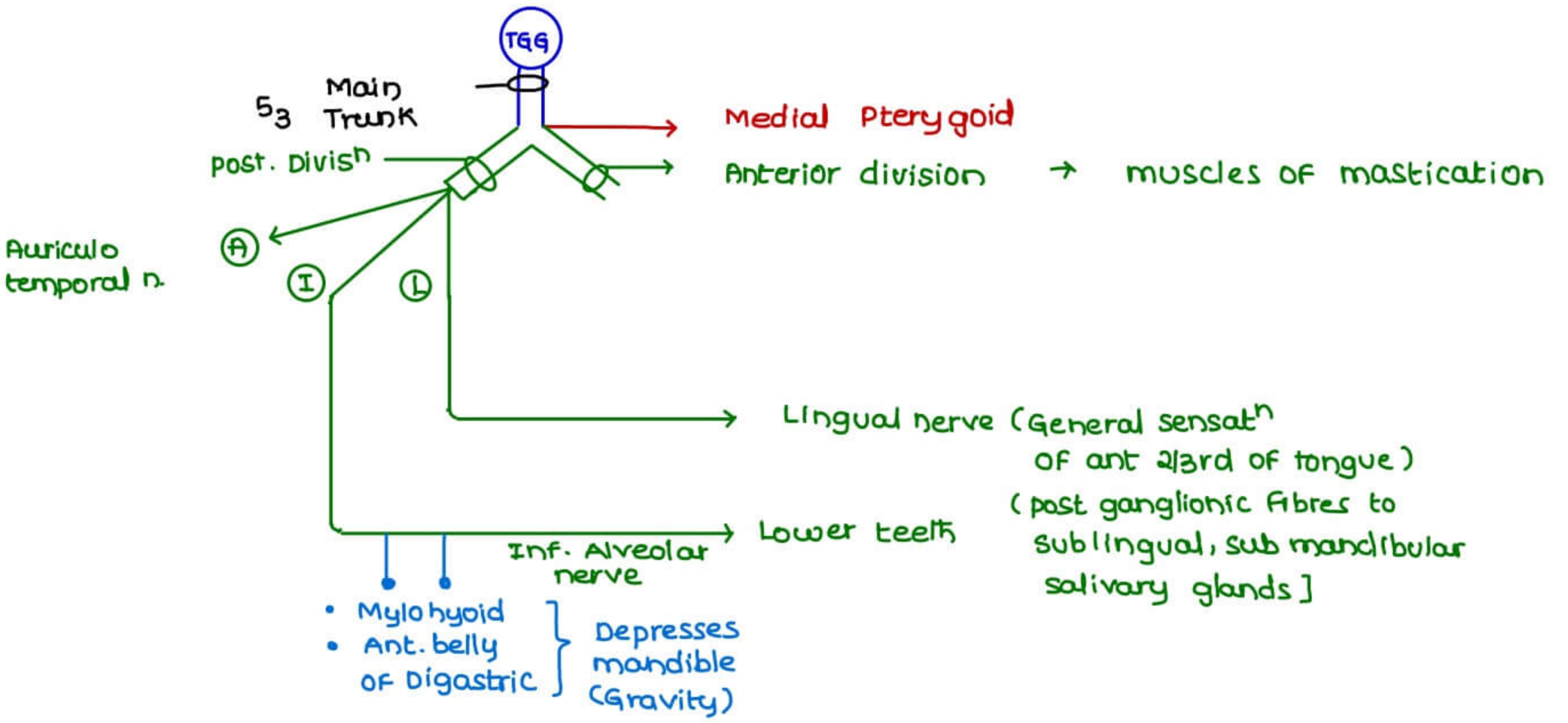




MANDIBULAR NERVE [MIXED NERVE]

→ MIXED → SENSORY [mandible]
MOTOR [muscles of masticatn]





Auriculotemporal nerve Supplies → Skin of Tragus & temporal skin

MUSCLES OF MASTICATION

→ 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

Mylo Hyoid [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

Opens the Eustachean tube

→ ELEVATORS & DEPRESSORS

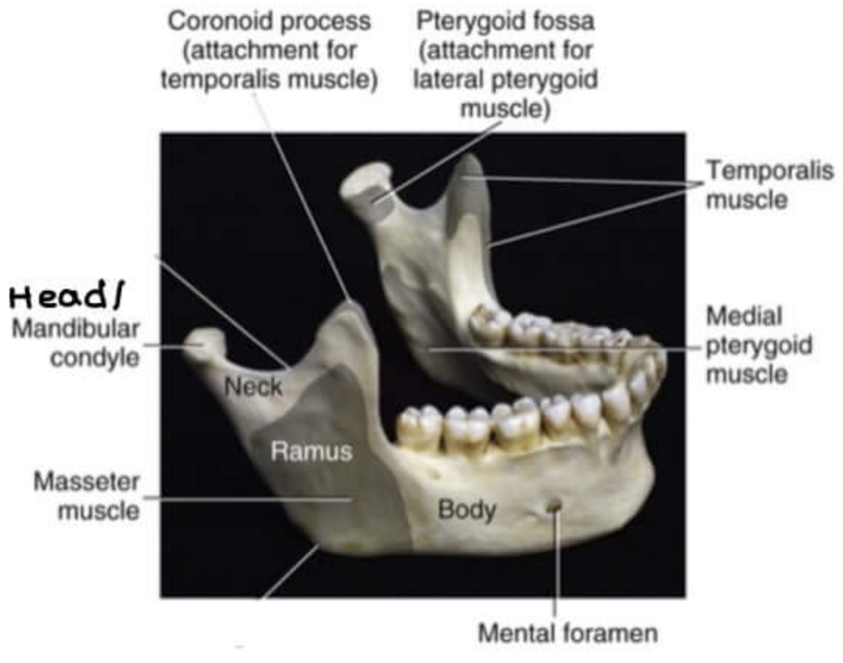
INSERTION → Mandible

MANDIBLE

TEMPORO MANDIBULAR JOINT → Condylar joint

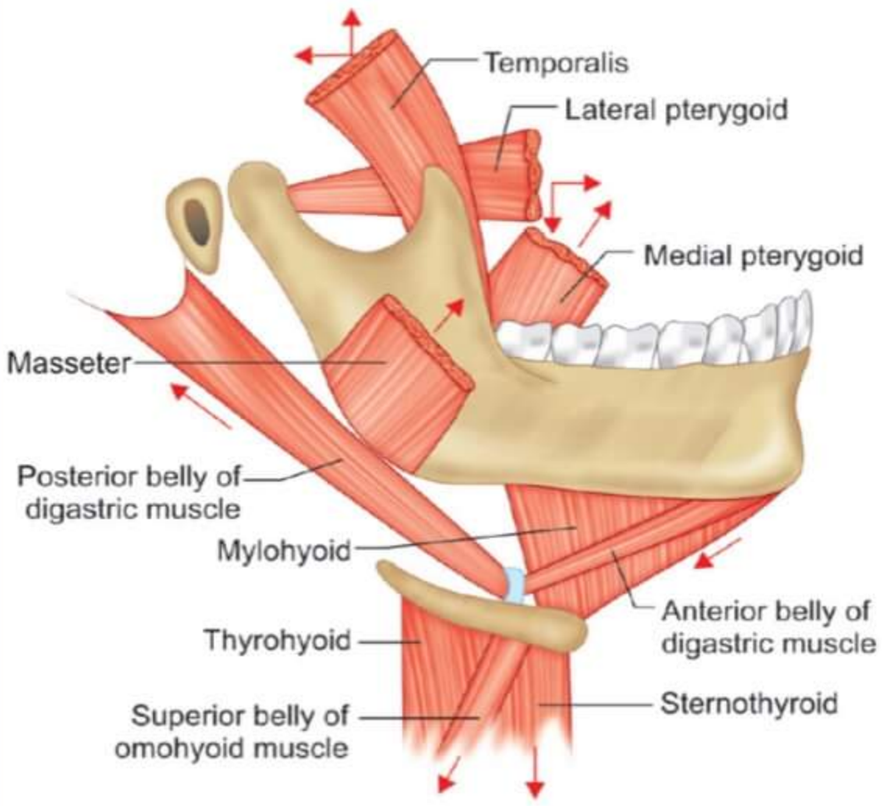
Lateral pterygoid muscle inserted on pterygoid fossa

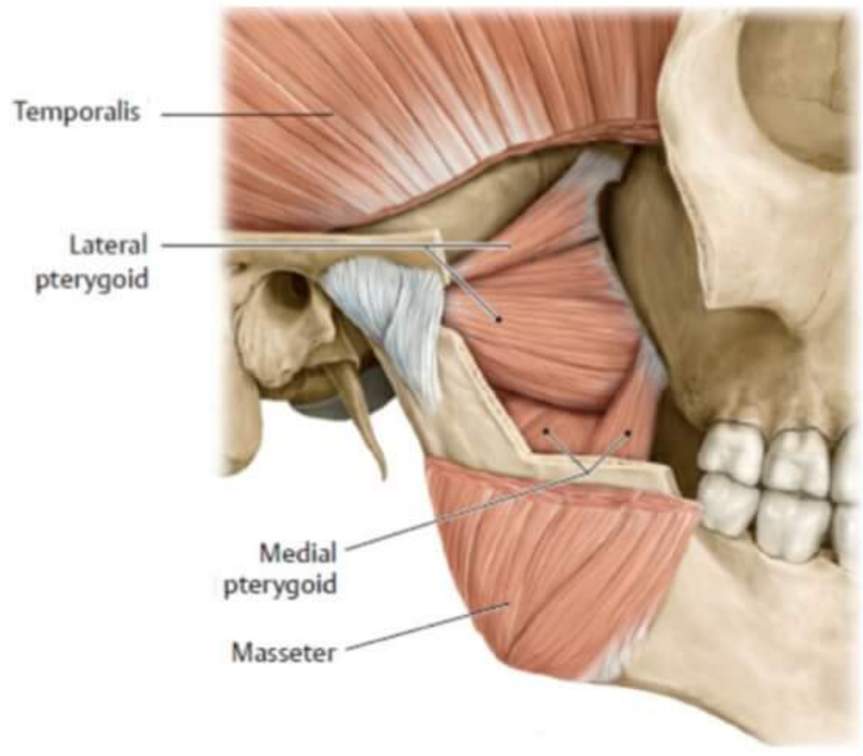
– helps in protrusion (chief Action) depression

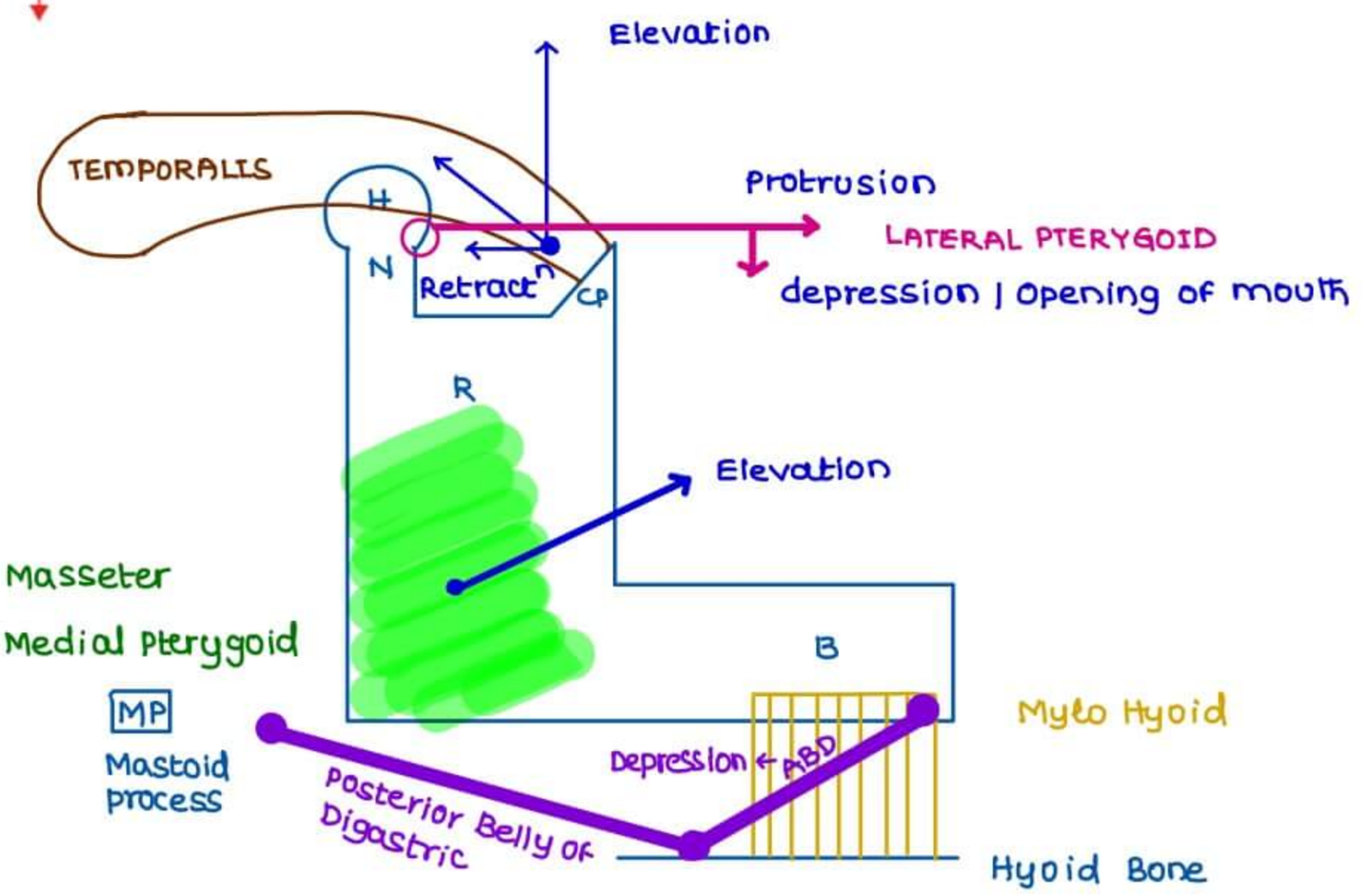


masseter inserted on ramus & angle of mandible on lateral side
medial pterygoid inserted on ramus & angle of mandible on medial side

Temporalis inserted into coronoid process
- helps in Retraction, elevation
- orgin of Temporalis → Temporal bone







DIGASTRIC MUSCLE (HYBRID MUSCLE, Dual motor nerve supply)

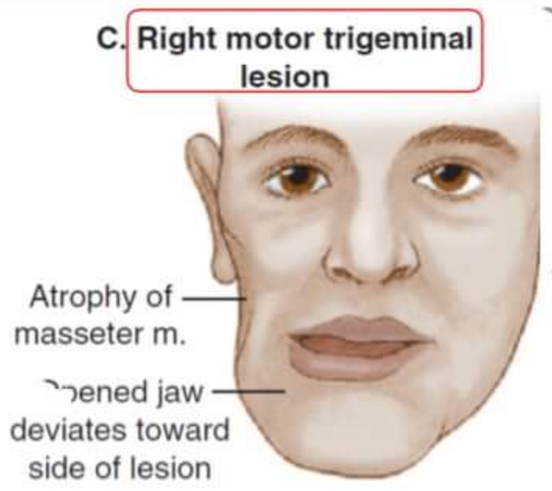
ANTERIOR BELLY → attaches to mandible bone & hyoid bone
→ develops from 1st pharyngeal arch
→ depressor of mandible
→ Both mylohyoid & anterior belly supplied by Mandibular N (5_3)

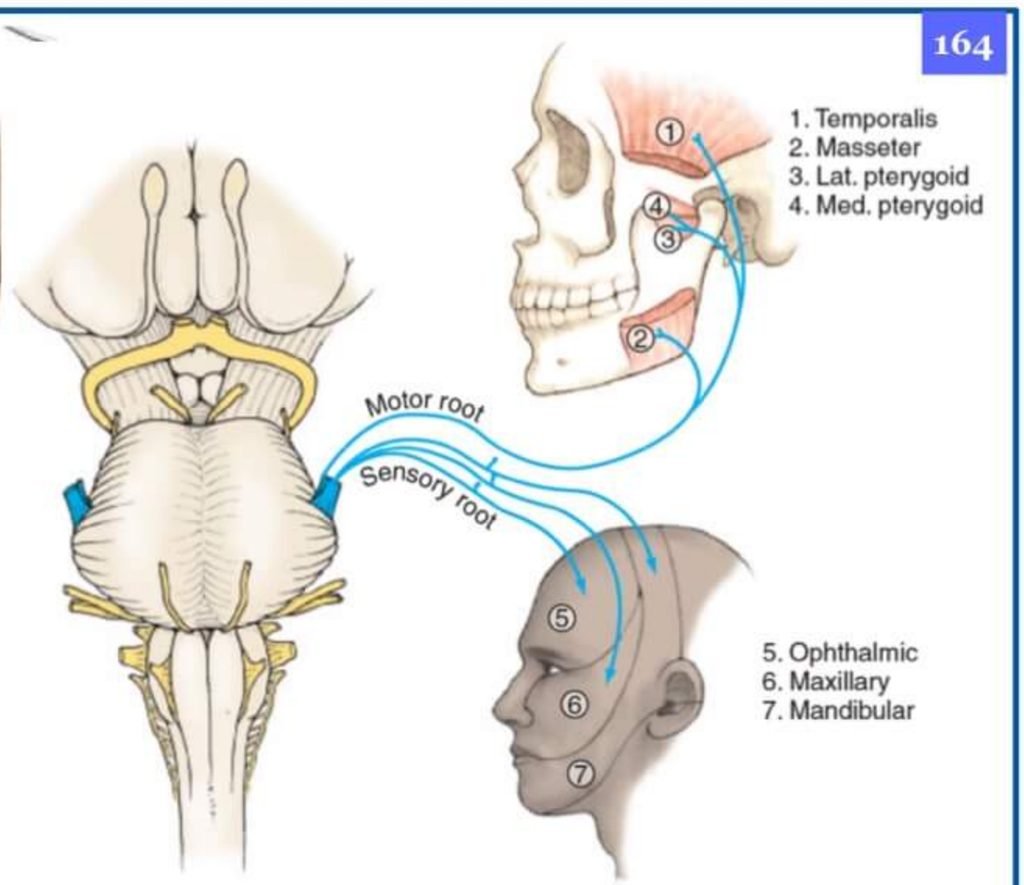
POSTERIOR BELLY → attaches to hyoid bone & mastoid bone
develops from 2nd pharyngeal arch
Supplied by Facial nerve

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 movements (grinding and chewing)	pterygoids of opposite side

LATERAL PTERYGOID ACTIONS

A → Anterior
I → Inferior
M → Medial





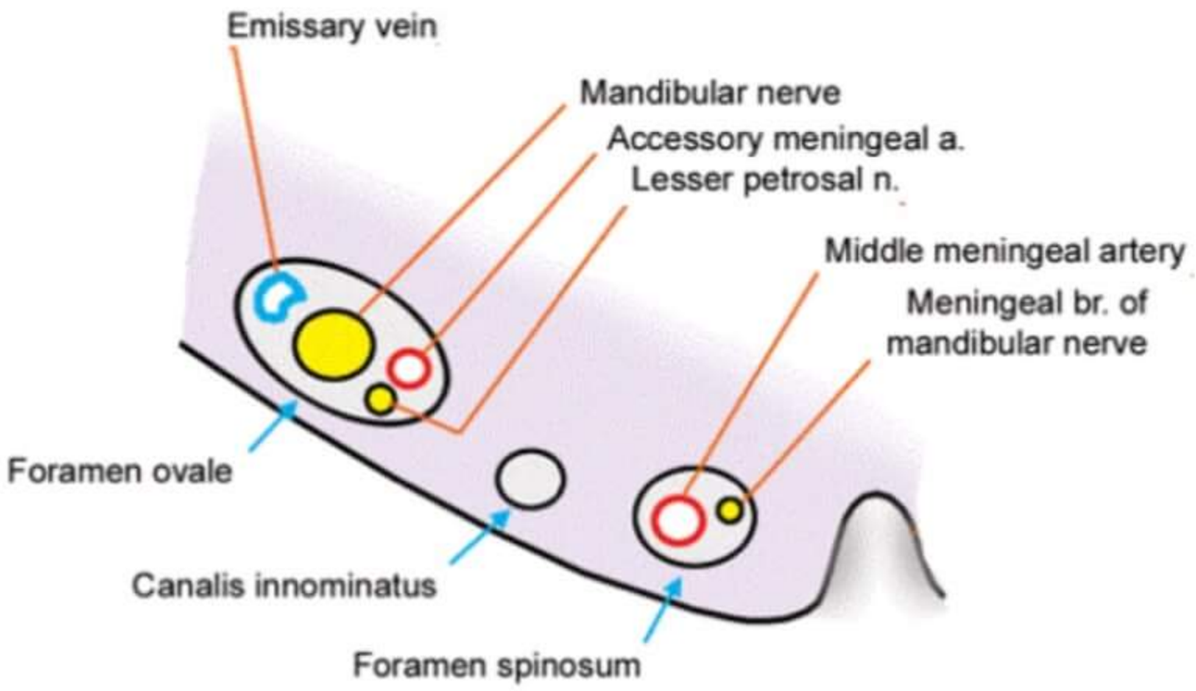
CRANIAL CAVITY III

MIDDLE CRANIAL FOSSA

STRUCTURES PASSING THROUGH FORAMEN OVALE

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

Q All structures pass through foramen ovale EXCEPT
a Accessary Meningeal artery
b Middle meningeal artery
c Lesser petrosal nerve
d Emissary vein



→ In some Lesser petrosal nerve found in canalis innominatus

FORAMEN SPINOSUM - STRUCTURE PASSING

1 Middle meningeal Artery
2 Nervous Spinosus (br. of mandibular nerve) → Supplies mening. on floor of MCF

MIDDLE MENINGEAL ARTERY

→ bleeds deep to Pterion during injury
→ causes Epidural/Extradural haemorrhage → EMERGENCY
→ LUCID INTERVAL
  → Short period of conciousness blw 2 periods of unconciousness
  → Patient appears normal

→ comes from 1 st part of maxillary artery
pass through foramen spinosum

PTERION

→ H Shaped Suture

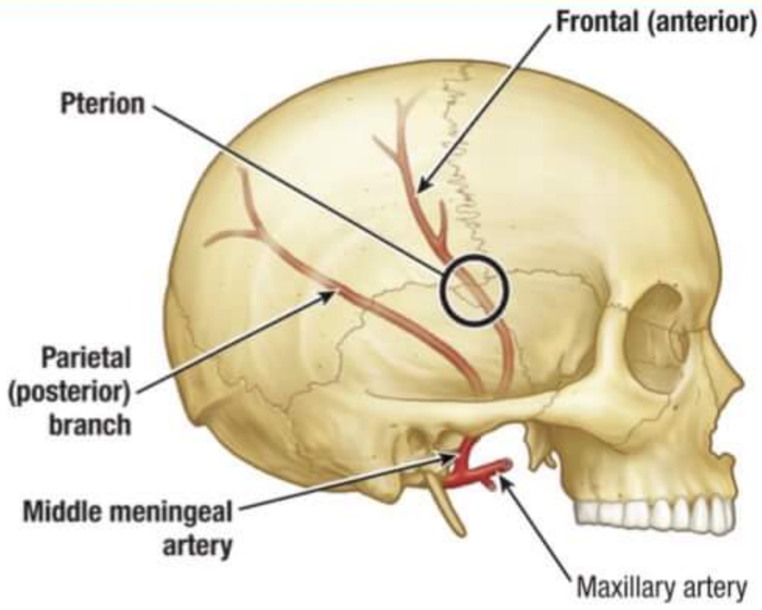
→ Contributing bones

1 Frontal bone (Front)

2 Parietal bone (posterior)

3 Temporal bone (inferior)

4 Greater wing of Sphenoid



→ Sphenoidal / Antero lateral fontanelle is present earlier

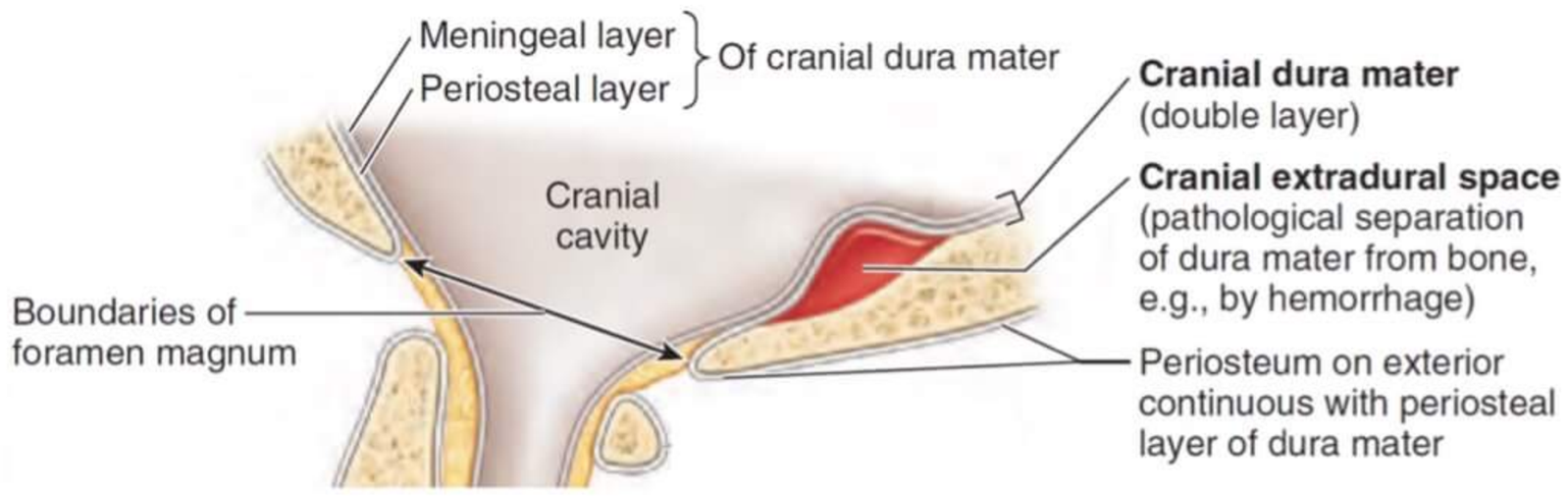
Mastoid Fontanella → present at ASTERION earlier

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

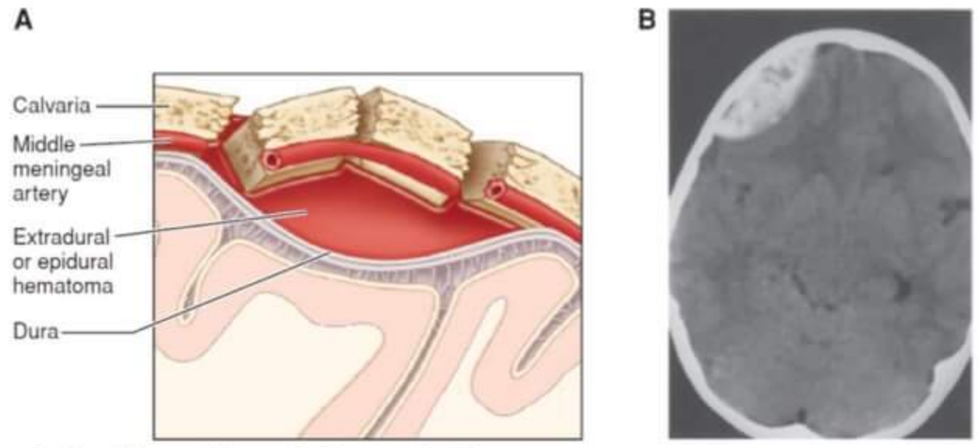
→ Lateral Sulcus / sylvian Sulcus of cerebrum begins at Pterion



EXTRA DURAL / EPIDURAL HAEMORRHAGE

→ dlt bleeding of middle meningeal arteries

→ CT scan shows BICONVEX SHADOW



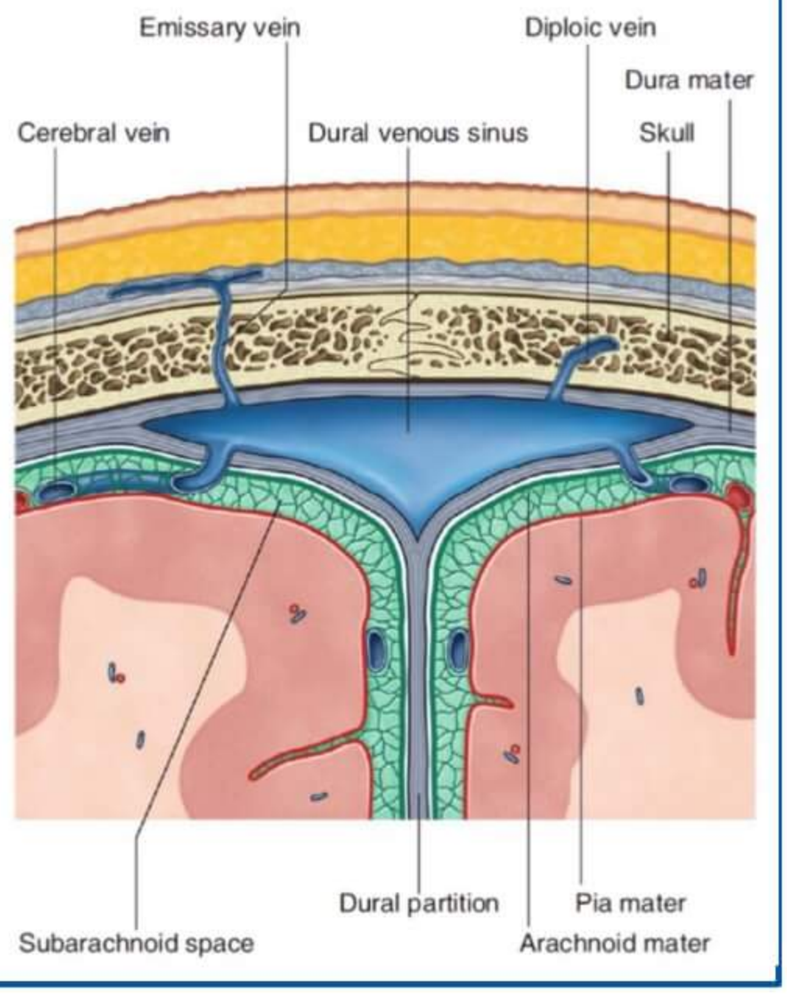
Epidural hemorrhage. A: Diagram. **B:** CT scan.

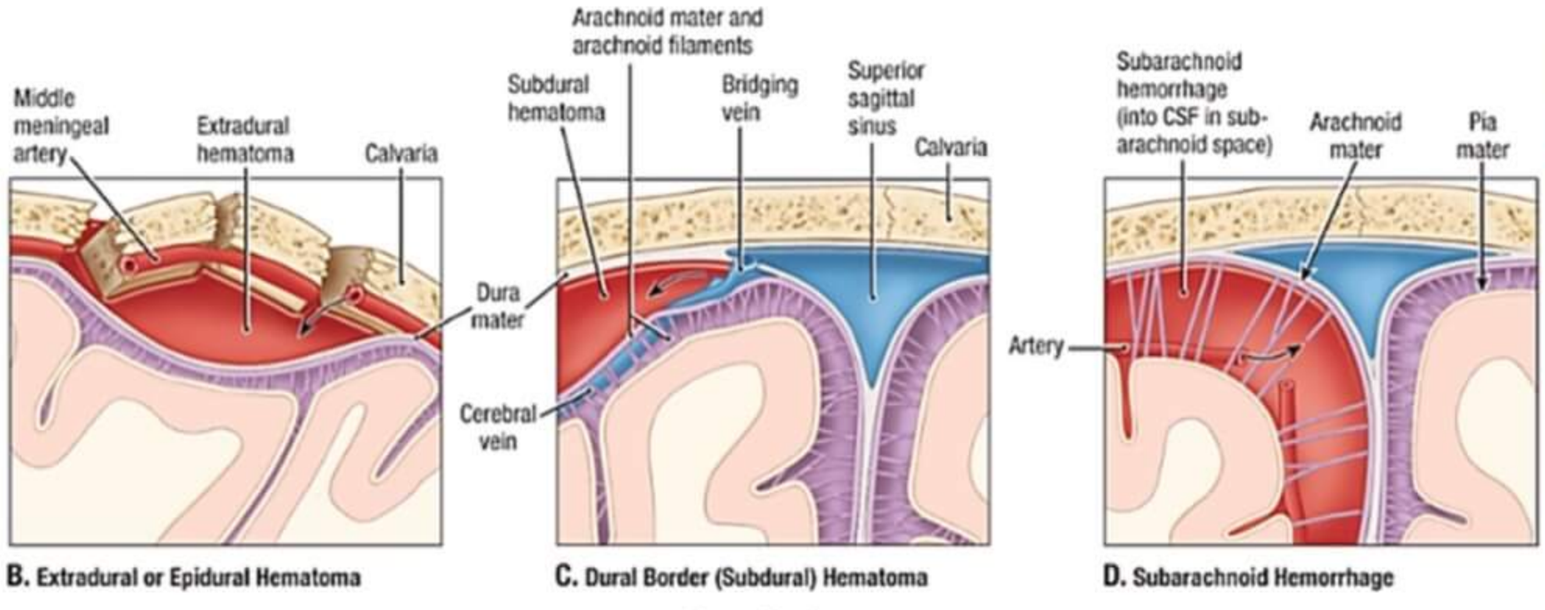
DURA MATER

→ Double layered Split to enclose dural venous sinuses

meningeal layer

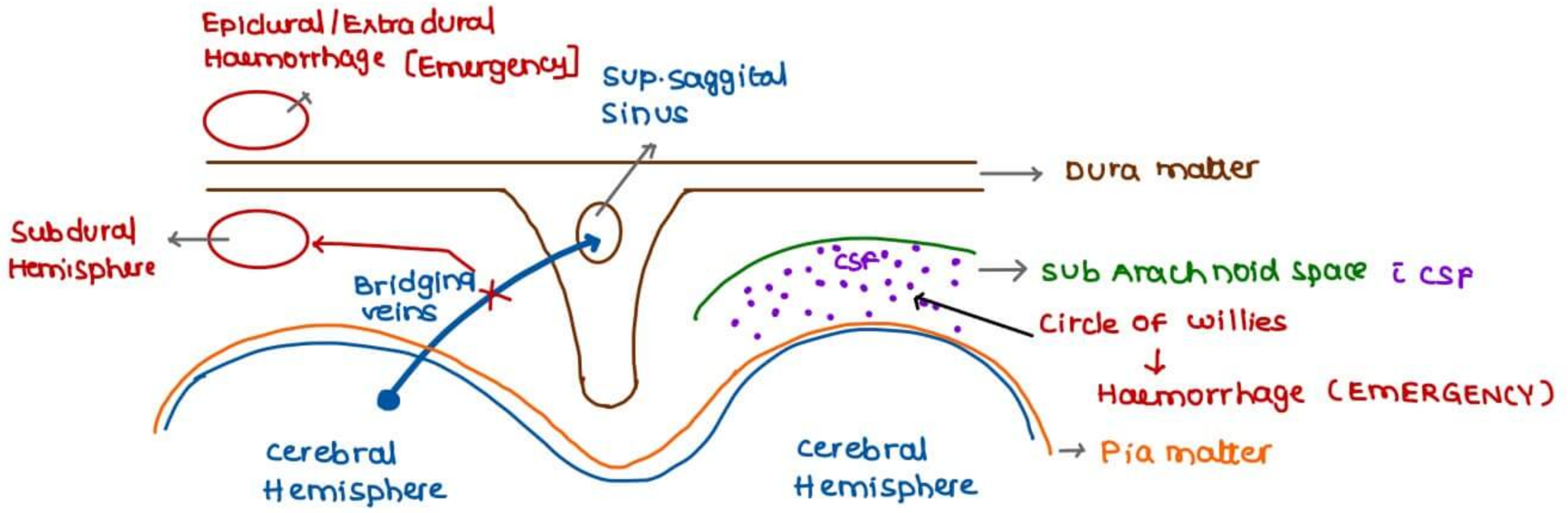
Endosteal layer





B. Extradural or Epidural Hematoma **C. Dural Border (Subdural) Hematoma** **D. Subarachnoid Hemorrhage**

Coronal Sections



EXTRA DURAL HAEMORRHAGE → outside dura matter

SUB DURAL HAEMORRHAGE → under dura matter
dlt rupture OF bridging veins

SUB ARACHNOID HAEMORRHAGE → under arachnoid
dlt berry aneurysm
blood stained ī CSF

CAVERNOUS SINUS THROMBOSIS

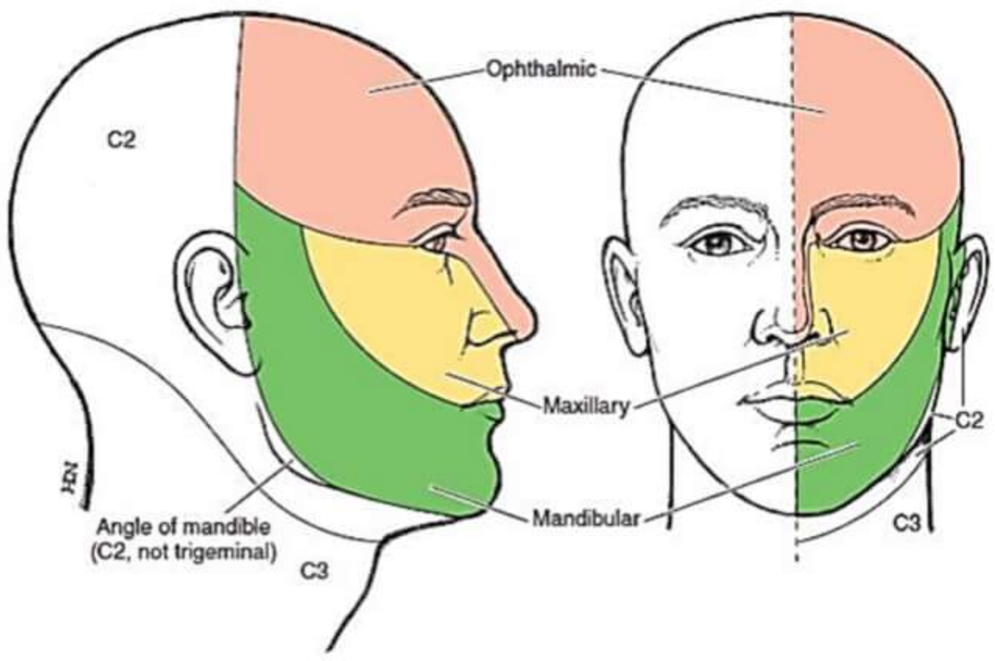
Q All are features of cavernous sinus Thrombosis EXCEPT

a Papilloedema

b Proptosis

c Sensory deficit on face dlt involvement of 3 branches of trigeminal nerve

d External Ophthalmoplegia dlt compression of 3 motor nerves to eye ball muscles



CIF

→ 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 IS 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 → C_2

NO C1 dermatome in Body → C1 spinal cord do not supply skin

Q Dermatome at angle of Jaw is

a V_3

b C - 1,2

c C - 2,3

d C - 3,4

CAVERNOUS SINUS

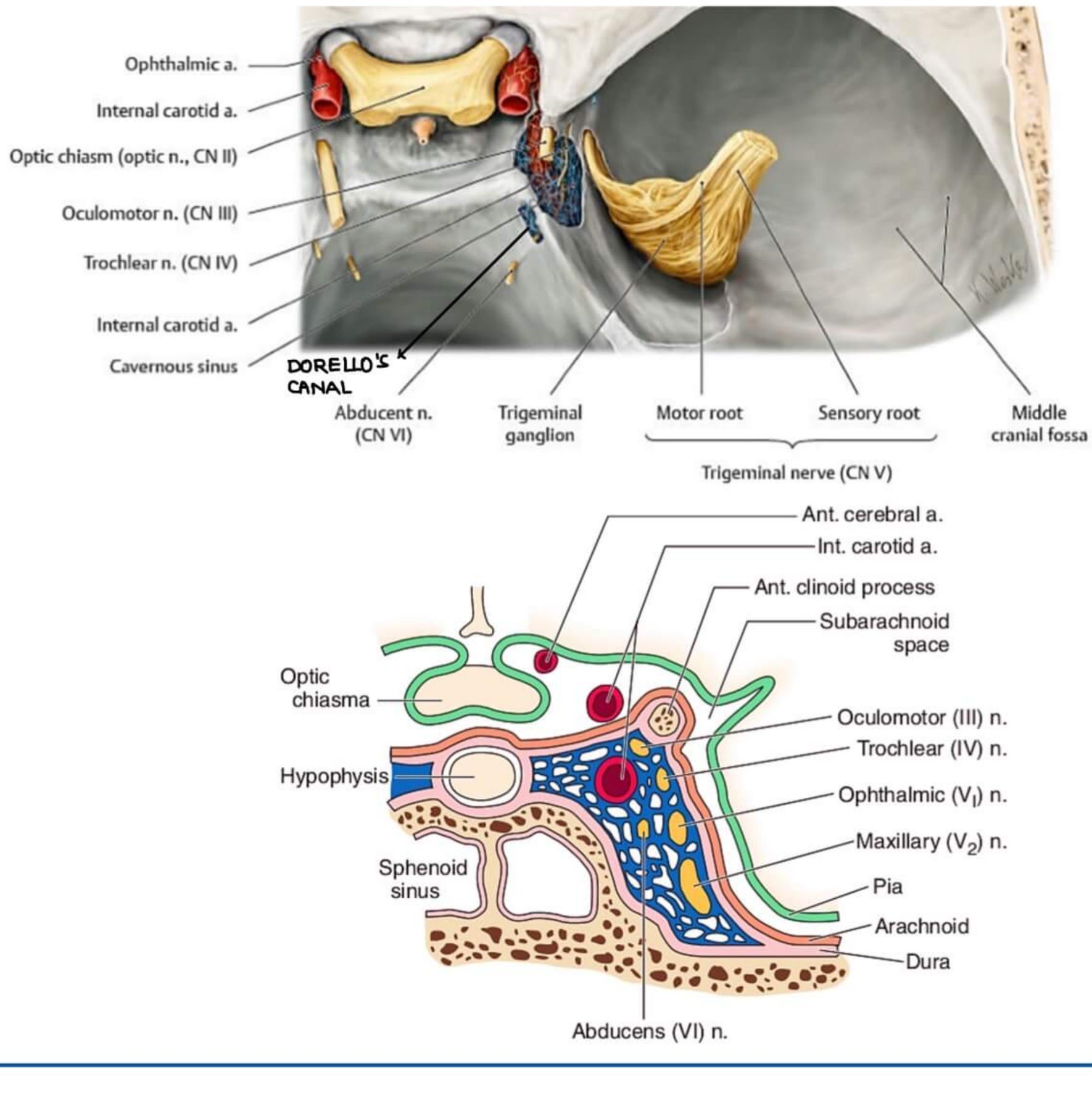
Q Which of the following is a direct content of cavernous sinus

a Occulomotor nerve

b Trochlear nerve

c Maxillary branch of Trigeminal

d Abducent nerve



Abducens nerve enters CS through DORELLO'S CANAL

CONTENTS

1 INTERNAL CAROTID ARTERY (Direct content)

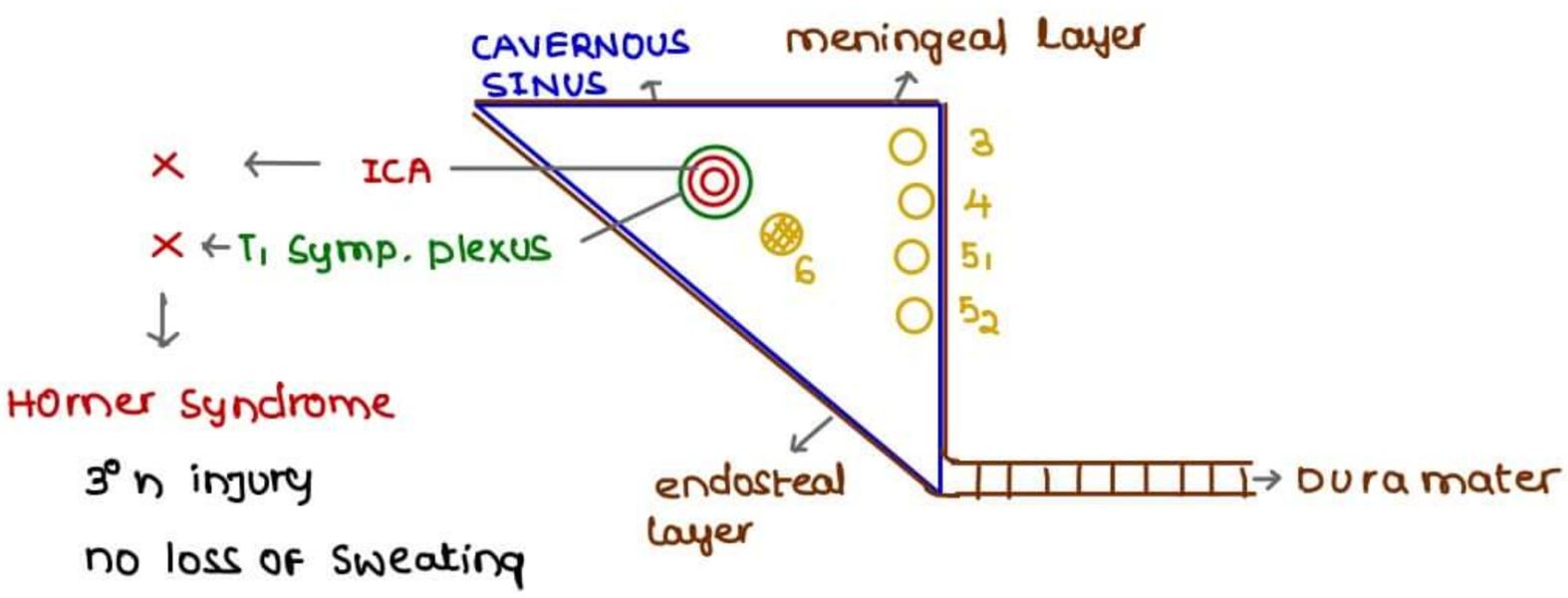
2 T1 SYMPATHETIC PLEXUS (Surrounds ICA)

3 ABDUCENS NERVE → Direct content

4 OCCULOMOTOR
5 TROCHLEAR
6 OPHTHALMIC (V_1) NERVE
7 MAXILLARY (V_2) NERVE
} Present on Lateral wall

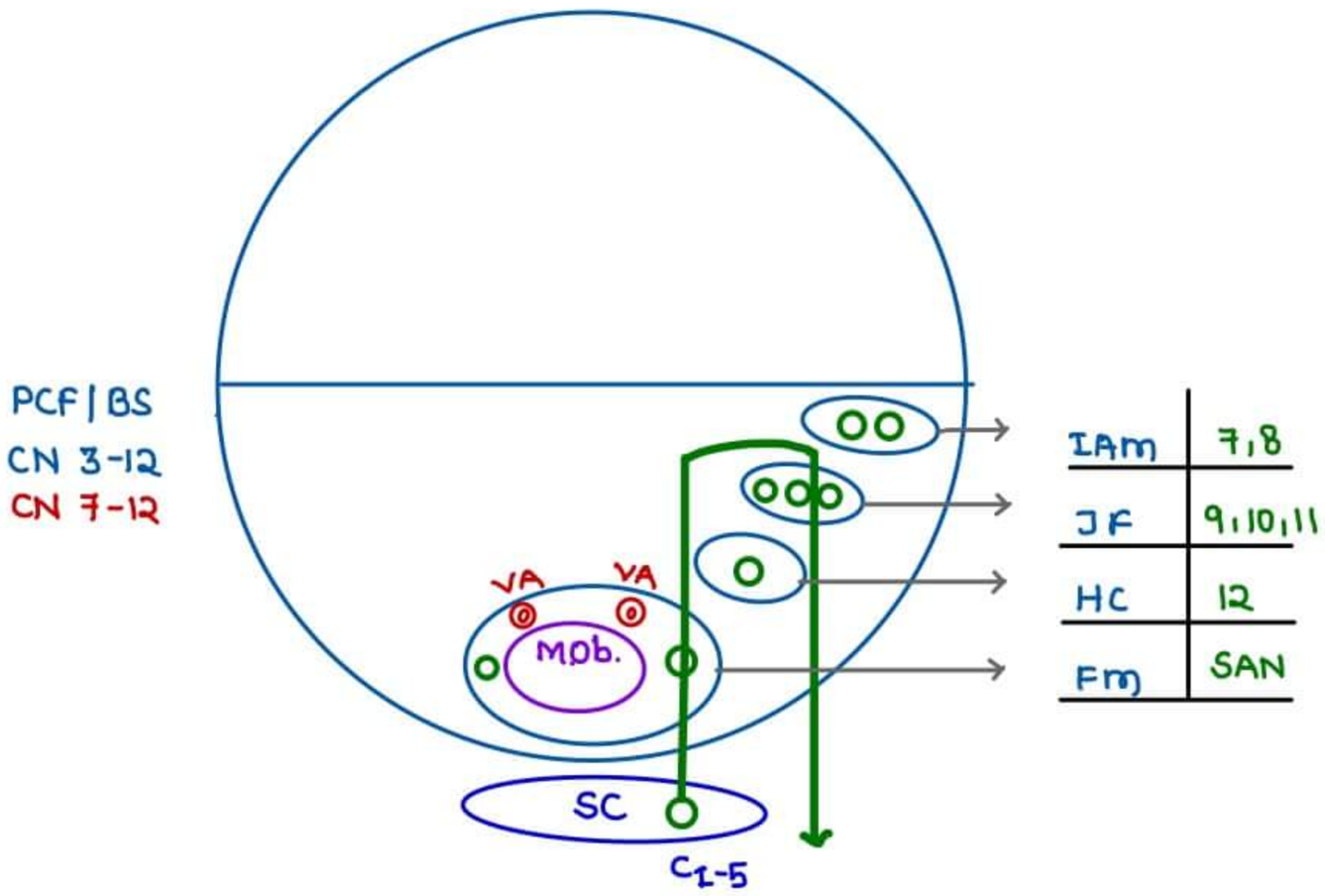
→ Intra dural sinus [b/w endosteal & meningeal layer of dura mater

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



CRANIAL CAVITY IV | POSTERIOR CRANIAL FOSSA

Q Mass in jugular foramen may result in all except
a Difficulty in swallowing
b Hoarsness
c Difficulty in turning the neck to Opposite side
d Tongue deviates to same side → CN 12 not present in Jugular foramen



IAM → Int. Auditory meatus
JF → Jugular foramen
HC → Hypoglossal canal
Fm → Foramen magnum

SPINAL ACCESSORY NERVE

→ comes from C_{1-5} 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

1 SPINAL ACCESSORY NERVE COMPROMISED

→ difficulty in turning the head to opposite side
→ difficulty in shrugging shoulder

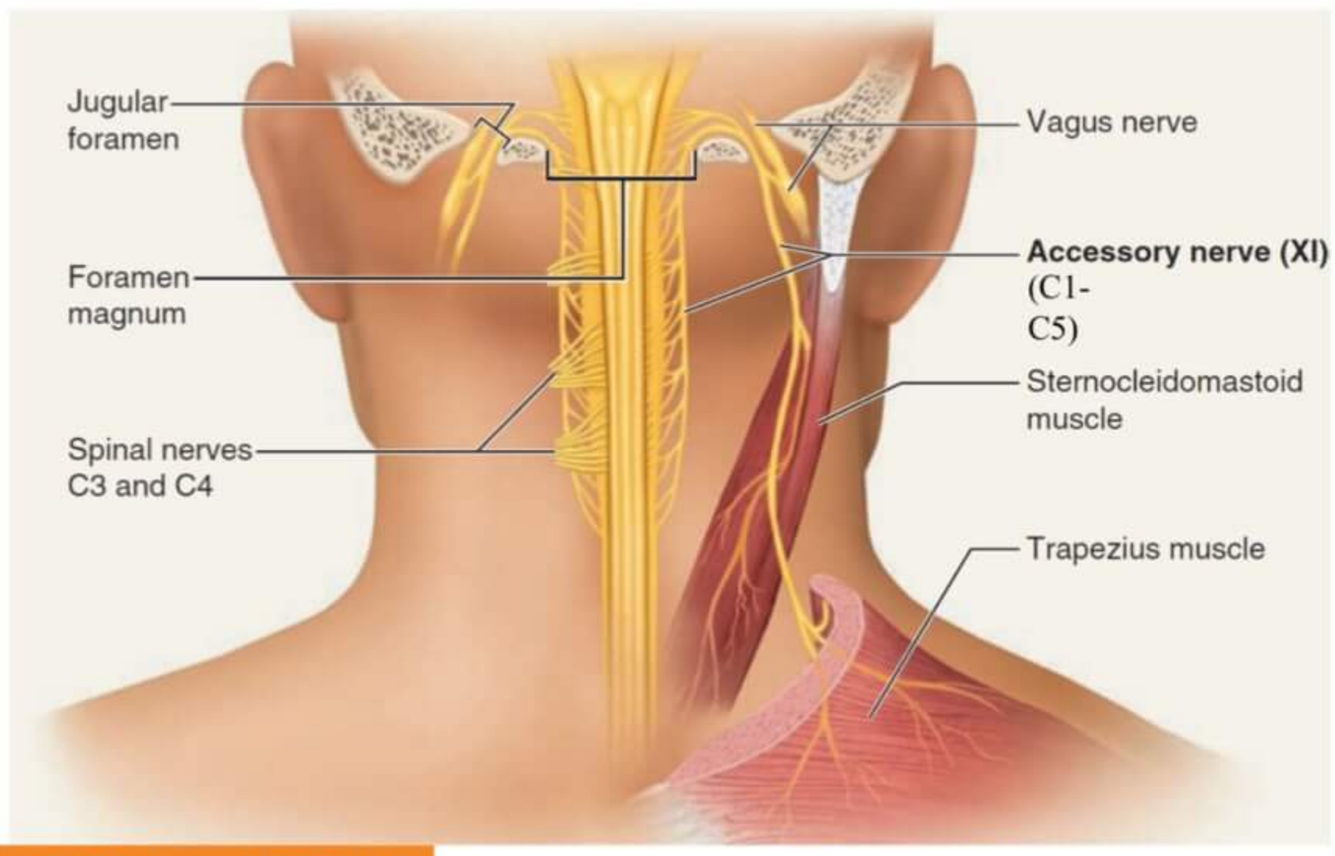
2 NUCLEUS AMBIGUS COMPROMISED

→ CN 9, CN 10, CN 11 (cranial part) compromised
→ difficulty in speech & swallowing

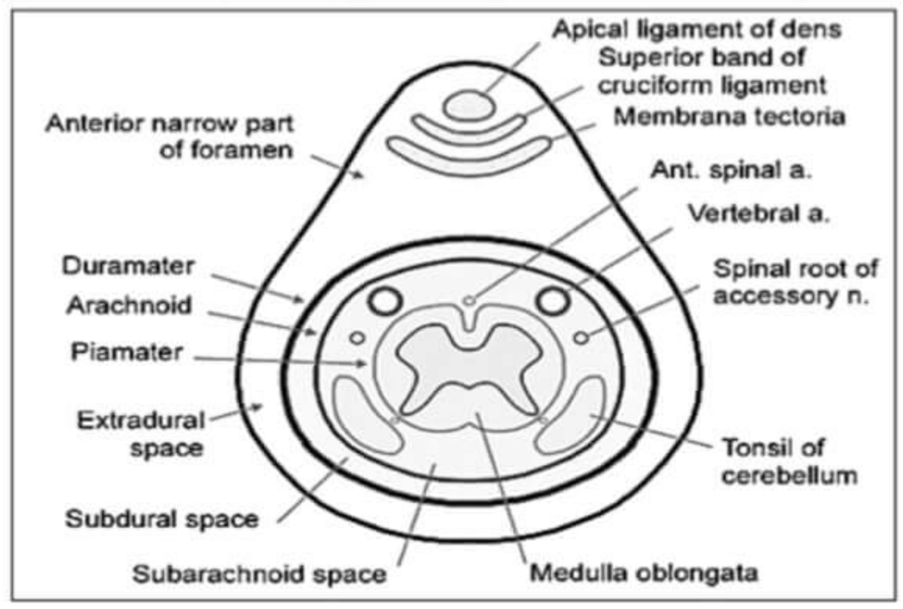
FORAMEN MAGNUM CONTENTS

Medulla oblongata
SAN on each side
Vertebral Arteries on each side
} present under Arachnoid meatus surrounded by CSF

Tectorial membrane → continuation of Posterior Longitudinal ligament & enters Foramen magnum & attaches to occipital bone



Structures passing through foramen magnum



FACIAL NERVE

Q A patient ī crocodile tear syndrome has spontaneous lacrimation during eating due to misdirectⁿ of regenerating autonomic nerve fibres. which of the following nerves has been injured

a Facial nerve proximal to geniculati ganglion
b chorda tympani in the infratemporal fossa
c facial nerve at the Stylomastoid foramen
d Lacrimal nerve

CROCODILE TEAR SYNDROME

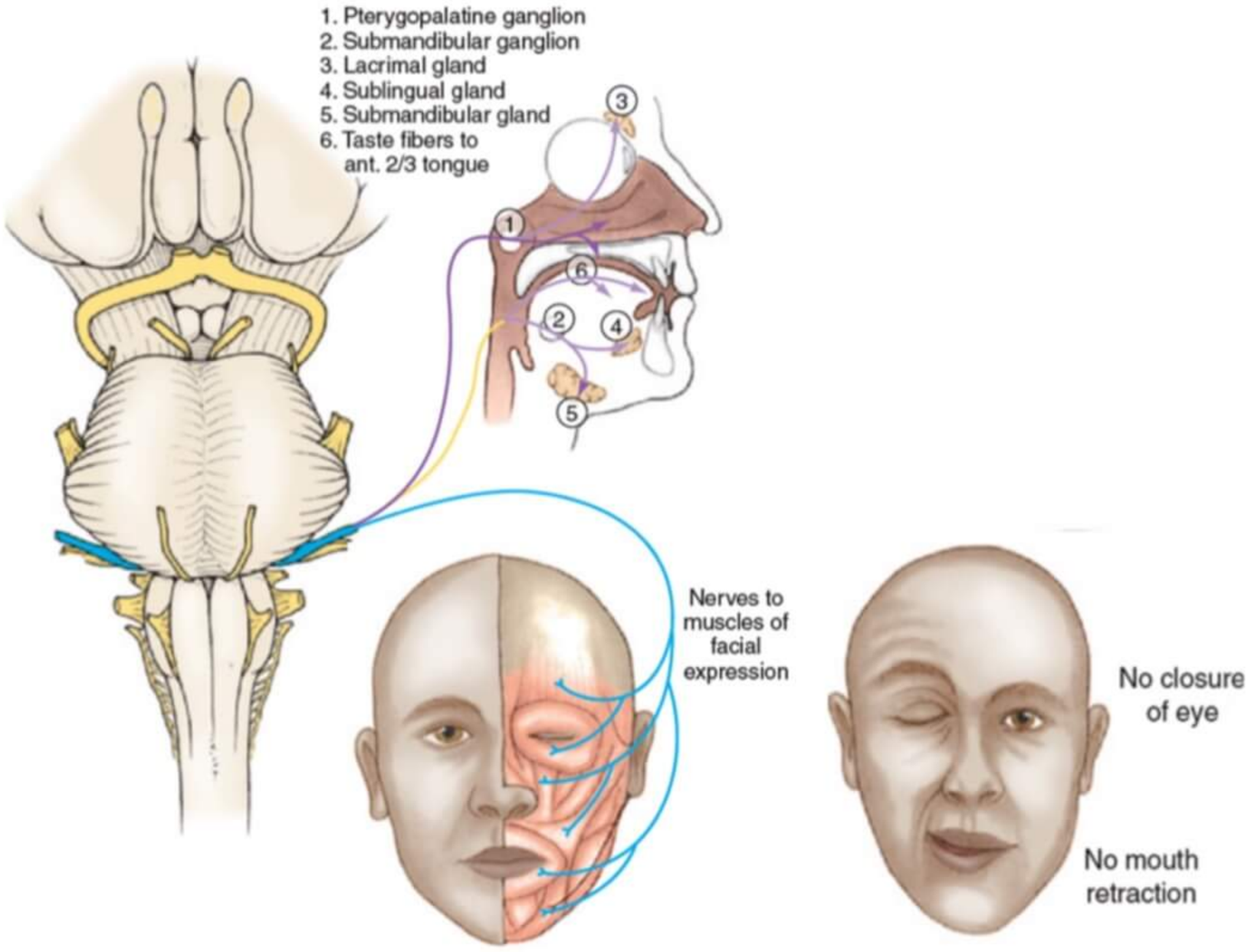
→ Viral Exposure / Bell's palsy

→ Lacrimatory nucleus (part of Superior Salivatory nucleus) → control lacrimal gland

→ Facial Nerve (Salivary) fibres regenerating,

- only 8 reaches Salivary gland
- other 2 misdirected lacrminal gland

During taking food, tears comes along ṯ Saliva



→ Facial nerve comes from ponto medullary junction

Nuclei are in the pons

Supplies

1. Pterygopalatine ganglion
2. Submandibular ganglion
3. Lacrimal gland
4. sublingual gland
5. sub mandibular gland &
6. carries taste from ant. 2/3rd of tongue
7. supply muscles of facial expression
   - orbicularis oculi
   - Orbicularis ori
   - Zygomaticus major (Smile muscle)
   - Buccinator

BELL'S PALSY

→ Failure to close lt. eye

→ can't Smile, collection of food

→ dribbling of saliva

BRANCHES

Ant. 2/3rd of Tongue taste 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
Palatine gland
} controlled by Pterygopalatine ganglion
Sublingual gland
Sub mandibular gland

Submandibular ganglion

Greater Petrosal nerve controls pterygopalatine ganglion
chorda tympani nerve Control sublingual & Submandibular glands

Functional nerves → Greater Petrosal nerve
chorda tympani nerve

Topographical nerves → Trigeminal nerve

Linqual nerve of Mandibular nerve joins ε chorda tympani nerve in infra temporal fossa

→ Deep petrosal nerve of T_1 sympathetic plexus joins ε greater petrosal nerve (para sympathetic nerve) Form VIDIAN NERVE OF PTERYGOID CANAL
→ vasomotor rhinitis ε intractable rhinorrhea R_t by VIDIANECTOMY

→ Facial Nerve exits cranial cavity passing stylomastoid foramen & passes through Parotid gland (do not supply) & supplies muscles of facial expression

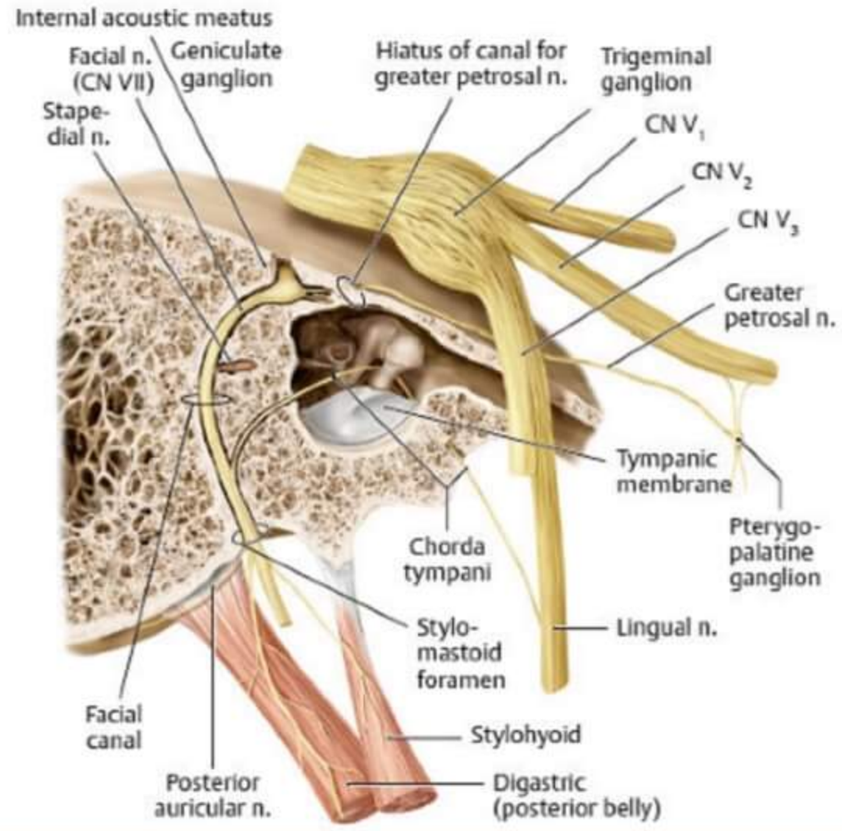
MIDDLE EAR CAVITY

GENU OF FACIAL NERVE

→ contains Geniculate ganglion
→ gives Greater Petrosal Nerve which is topographically related ε maxillary nerve

FACIAL CANAL

→ present in posterior wall
→ contains facial nerve



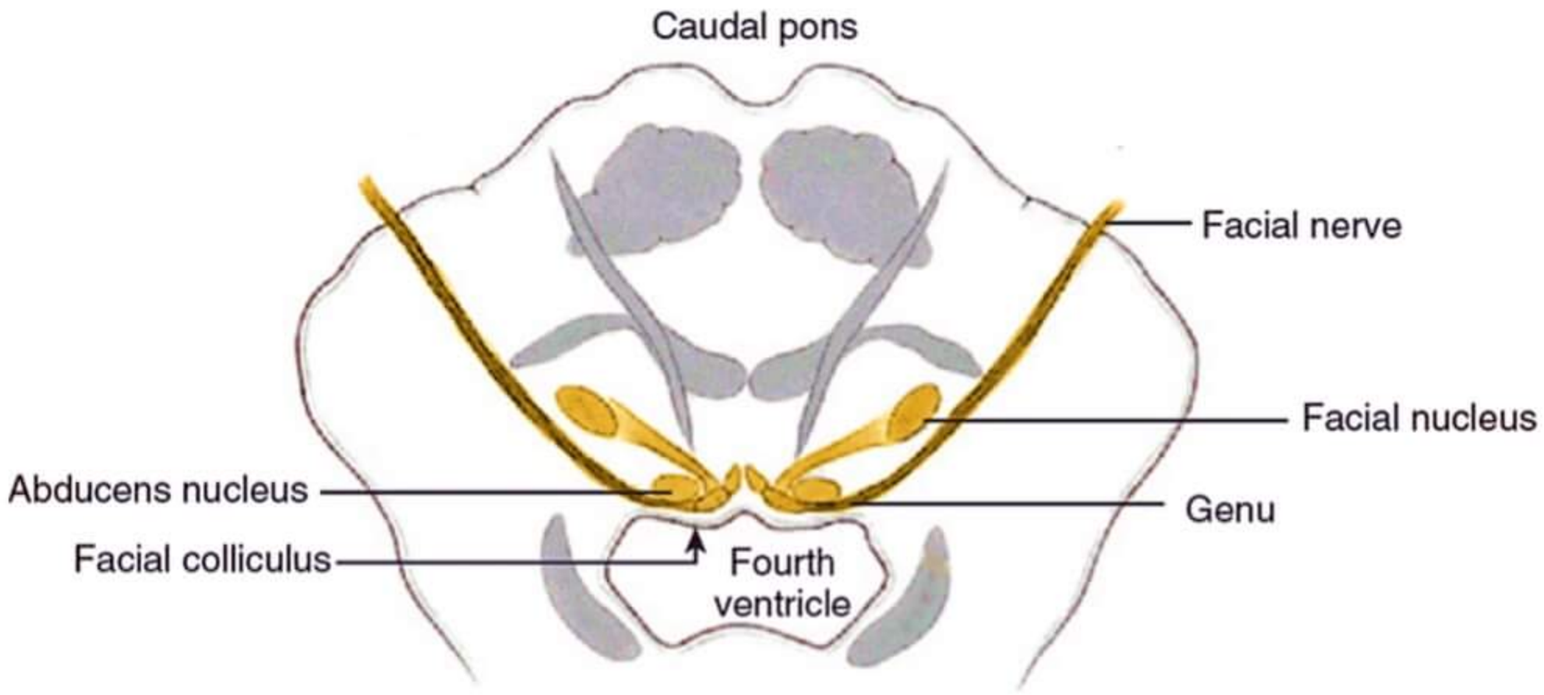
→ Gives 3 branches

1. Greater Petrosal nerve
2. Nerve to Stapedius
3. Chorda tympani nerve (present on TM & related to malleus bone) joins ī lingual nerve in infra temporal fossa

Facial Nerve EXITS Cranial cavity by passing through stylomastoid foramen

MIDDLE EAR CAVITY

ROOF	→	Tegmen tympani
Posterior wall	→	Facial N
Lateral wall	→	Tympanic membrane ī chorda tympani
Anterior wall	→	Eustachian tube (bony part)



LOWER PONS

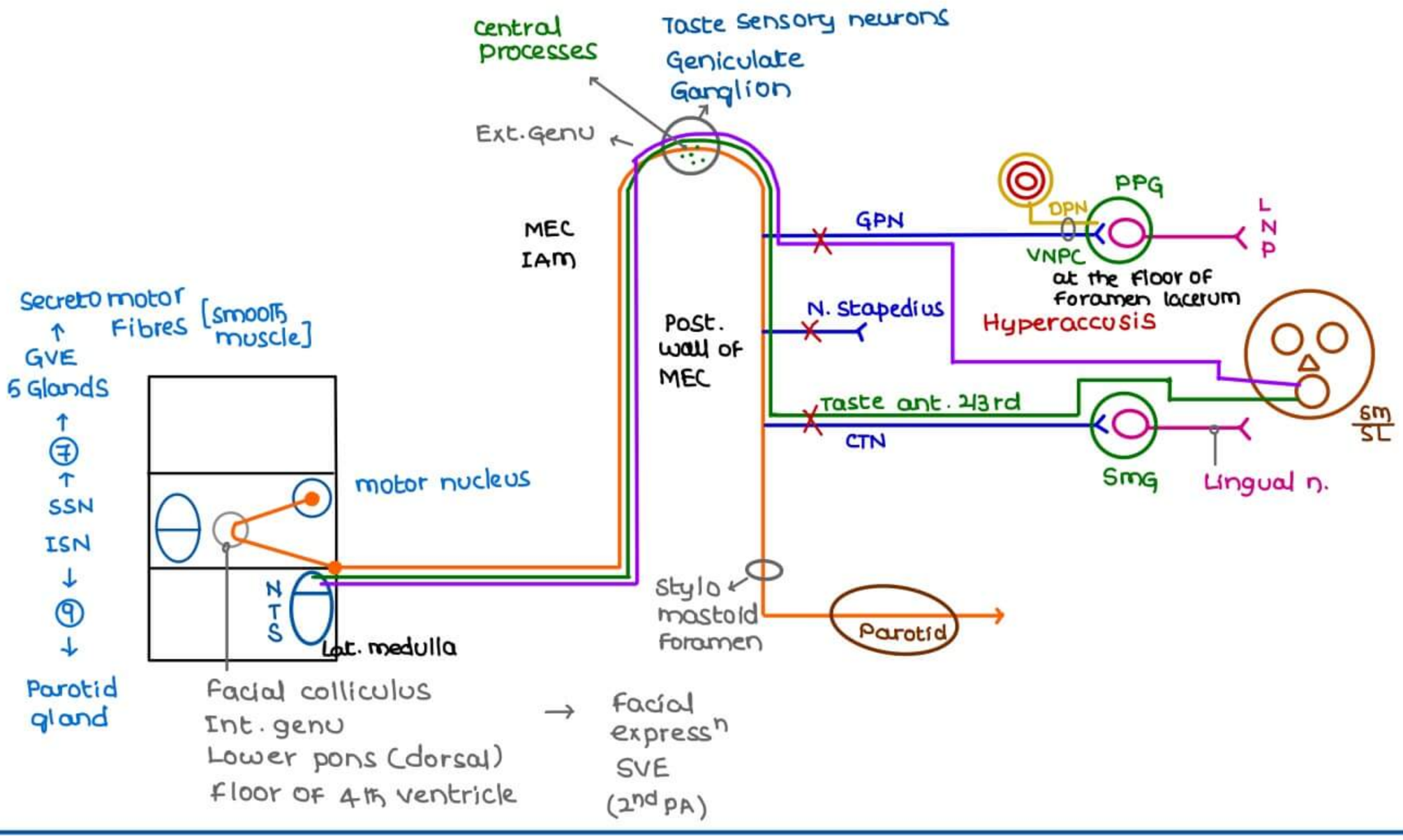
→ FACIAL COLLICULUS

→ Rounded elevation dlt internal genu of facial nerve (axons) from facial nucleus at the floor of ▽ ventricle

→ Abducens nucleus present deep to facial colliculus

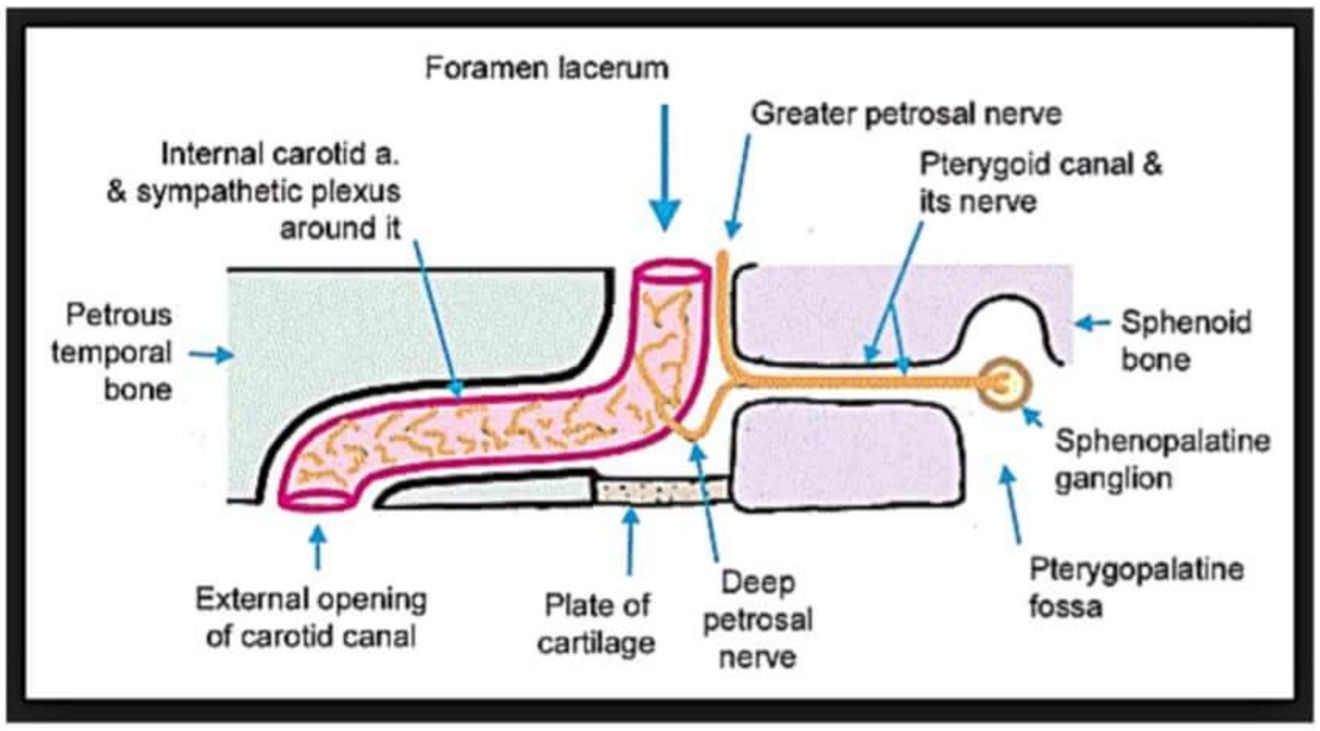
→ IF facial colliculus damaged, muscles paralysed are

→ Risoreus > Lateral rectus



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 upper pons

FORAMEN LACERUM



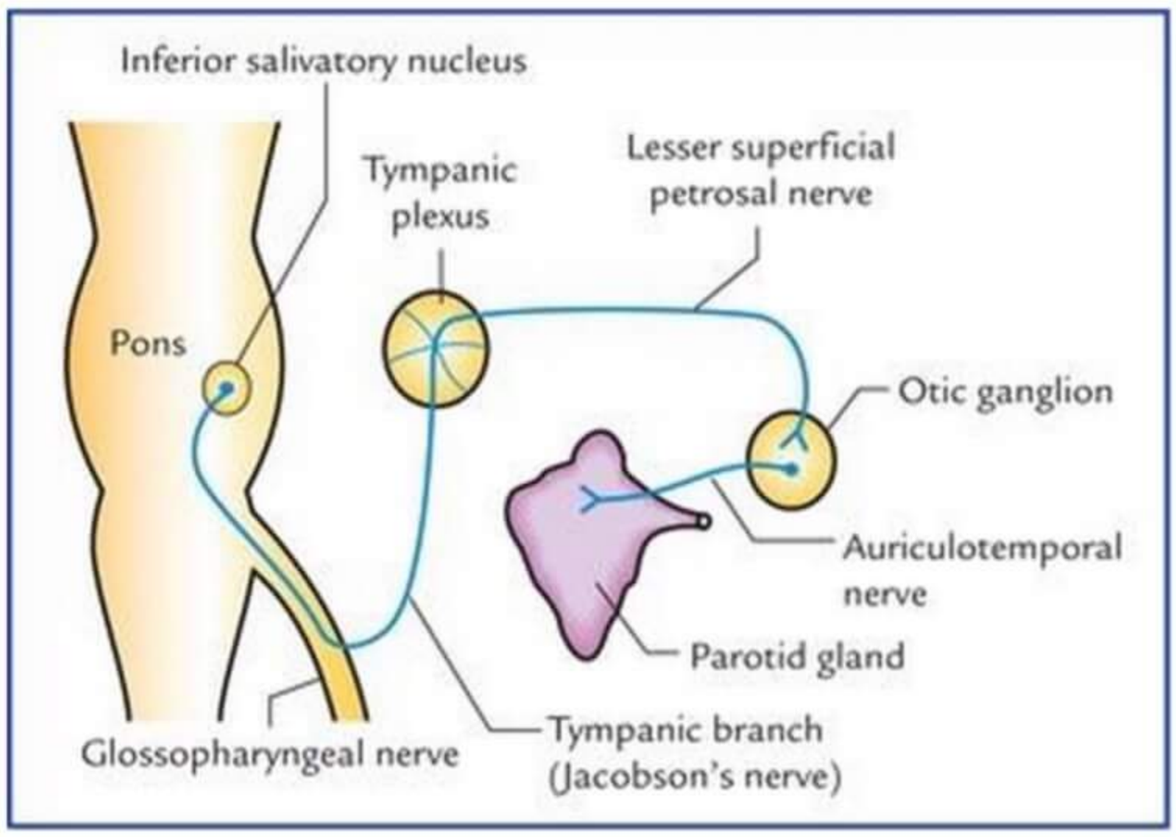
→ closed by plate of fibro cartilage
→ ICA enter at carotid canal at the base of the skull & passing at floor of foramen lacerum
→ vidian nerve of pterygoid canal formed at floor of FL & goes towards Sphenopalatine ganglion

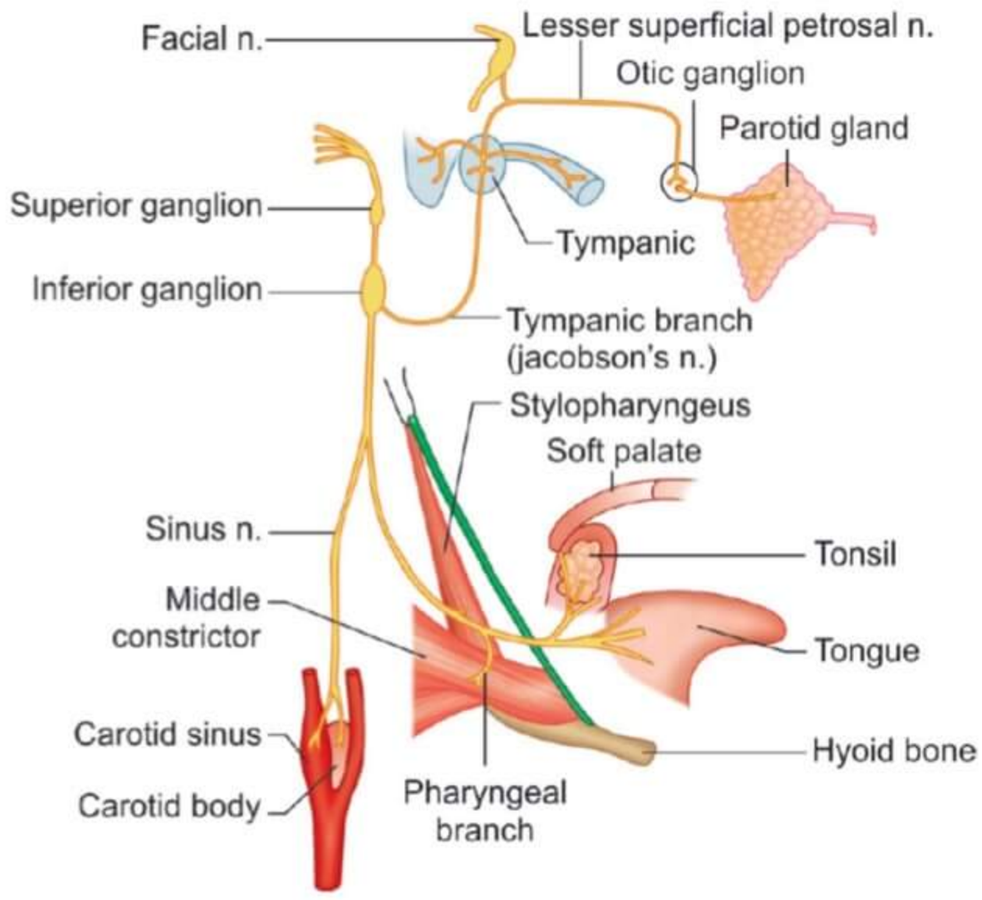
5 STRUCTURES AT THE FLOOR OF FORAMEN LACERUM

1. Vidian nerve
2. ICA
3 T, Sympathetic plexus
4 Deep petrosal nerve
5 Greater petrosal nerve

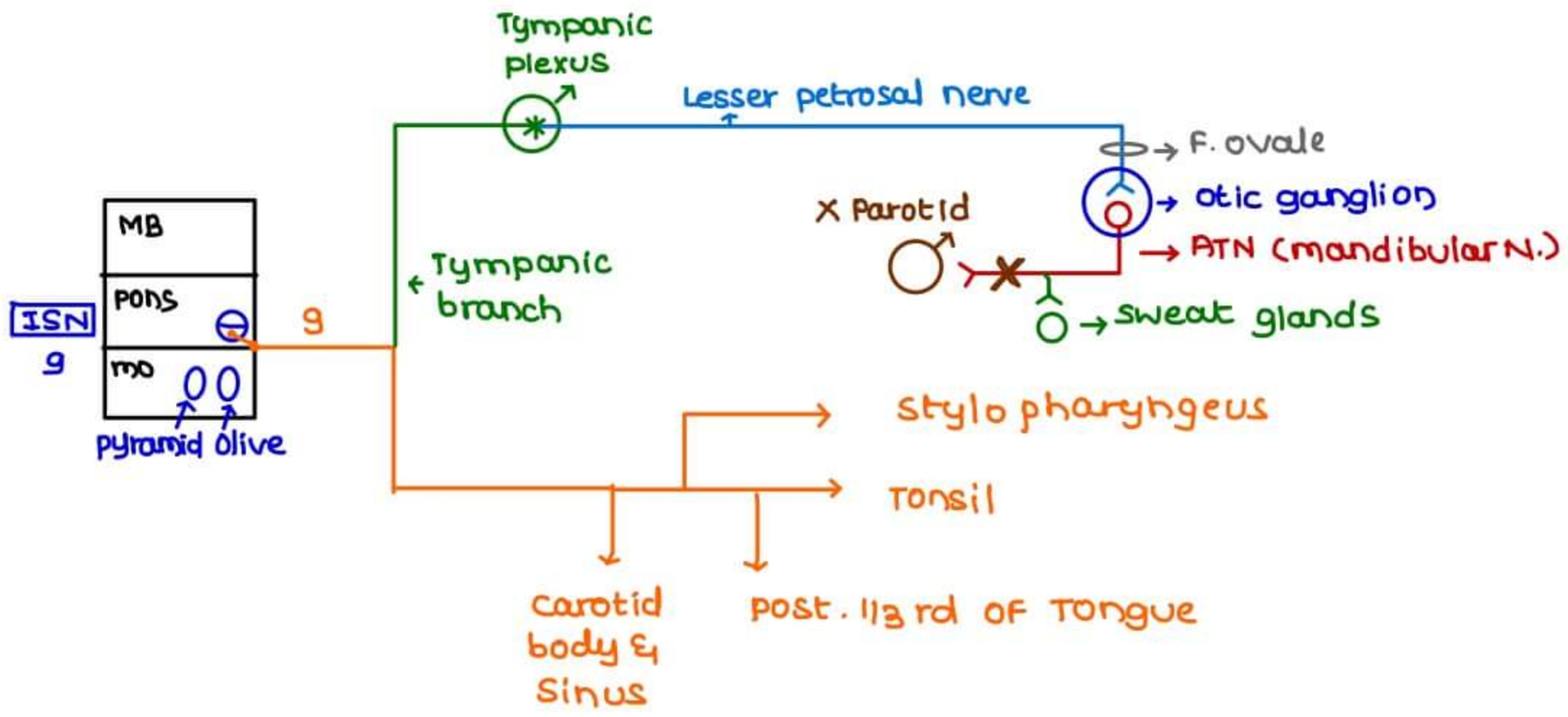
Q Facial nerve has all the following neural columns EXCEPT
a GVE
b SVE
c SVA
d SSA

GLOSSOPHARYNGEAL NERVE





NEURAL PATHWAY



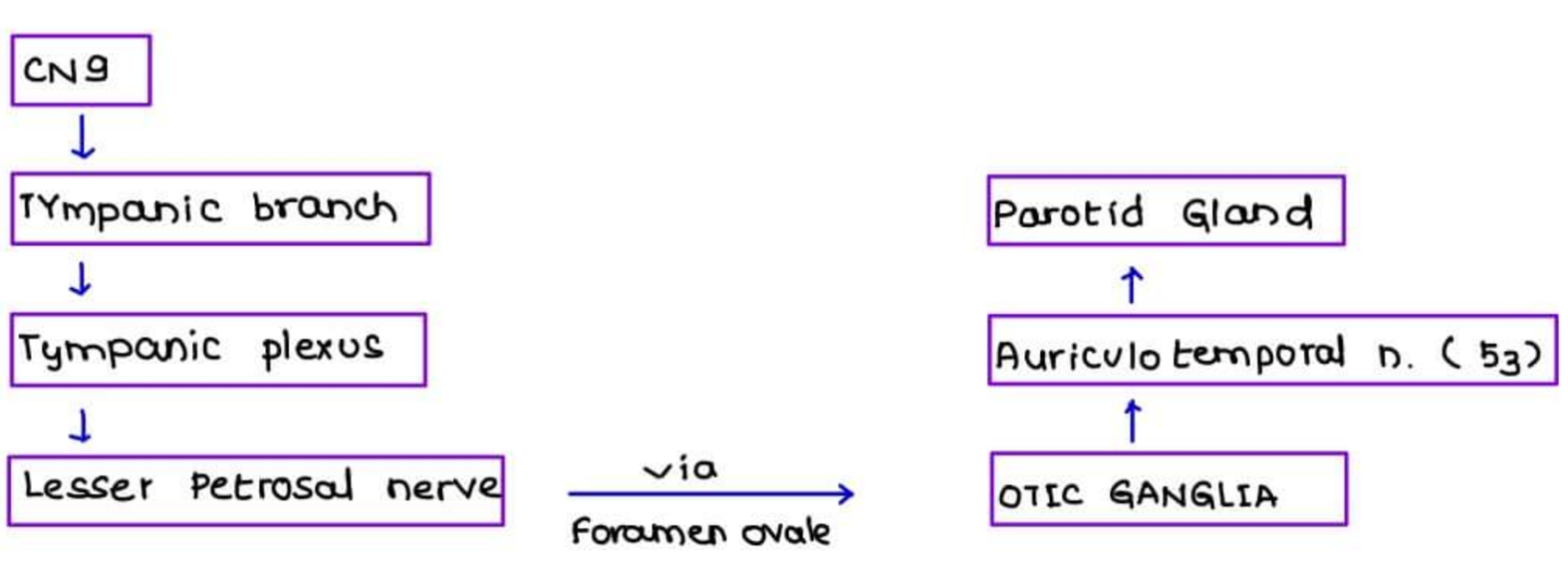
→ CN 9 comes from medulla oblongata behind the olive

→ SUPPLIES

1. Carotid Body & Sinus
2. Posterior 1/3rd of tongue
3. Tonsil
4. Stylopharyngeus

} REFERRED OTALGIA occurs in these pathology

→ PAROTID PATHWAY



→ FREY'S SYNDROME / AURICULO TEMPORAL NERVE SYNDROME

→ dlt injury to Auriculotemporal nerve during Parotidectomy

→ Gustatory sweating occurs while taking food

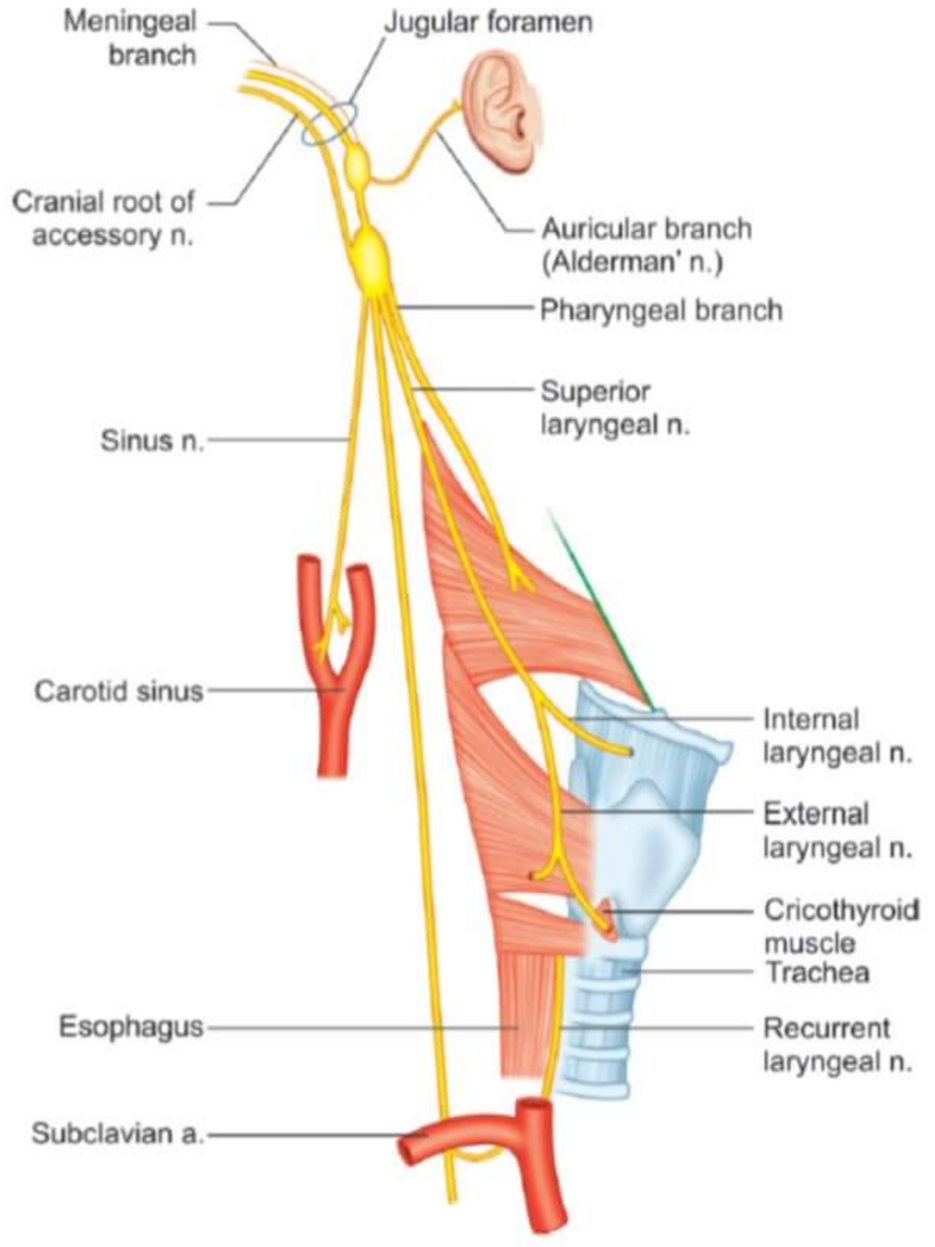
VAGUS NERVE

- → Longest
- → widest distribution in the body
- → Supplies
  - → Head & neck region
  - → Thorax
  - → Larynx (sensory & motor supply)

VAC (VAGUS ACCESSORY COMPLEX)

- → vagus nerve + Cranial Accessory nerve
- → controls muscles of
  - palate
  - pharynx
  - larynx

  - → Abdomen till midgut
  - → Pelvis till upper ureter



VAGUS NERVE

↓

Meningeal Branch

→ Supplies dura mater in PCF

↓

Jugular foramen

Followed by Cranial Accessory Nerve

VAGAL ACCESSORY COMPLEX

↓

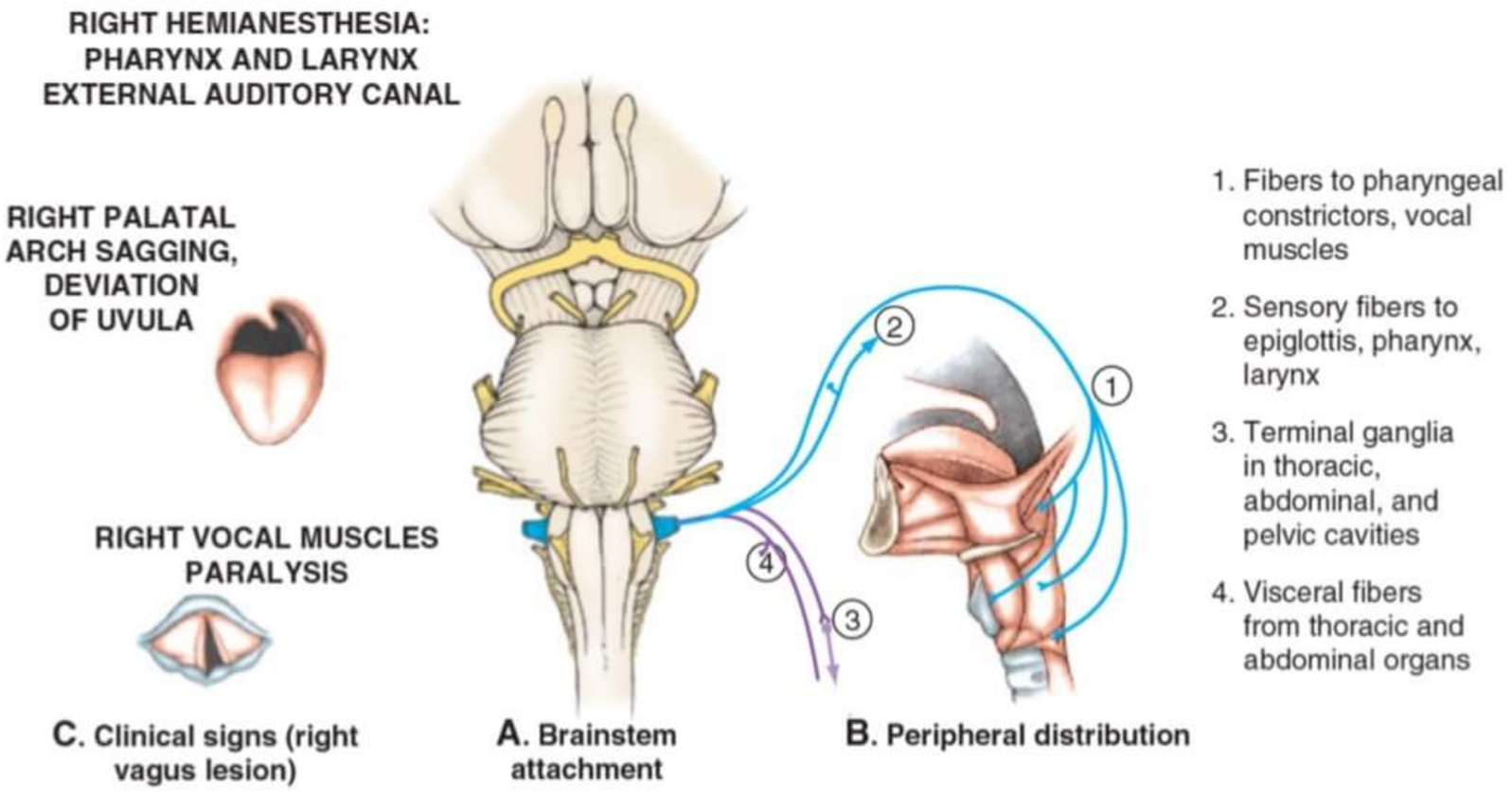
Auricular branch [ALDERMAN'S NERVE] →

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 deglutit^{n})



Vagus & Glossopharyngeal nerves comes from M.oblongata (postero 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

→ Right Hemianesthesia (Pharynx, larynx, tongue, External auditory canal)

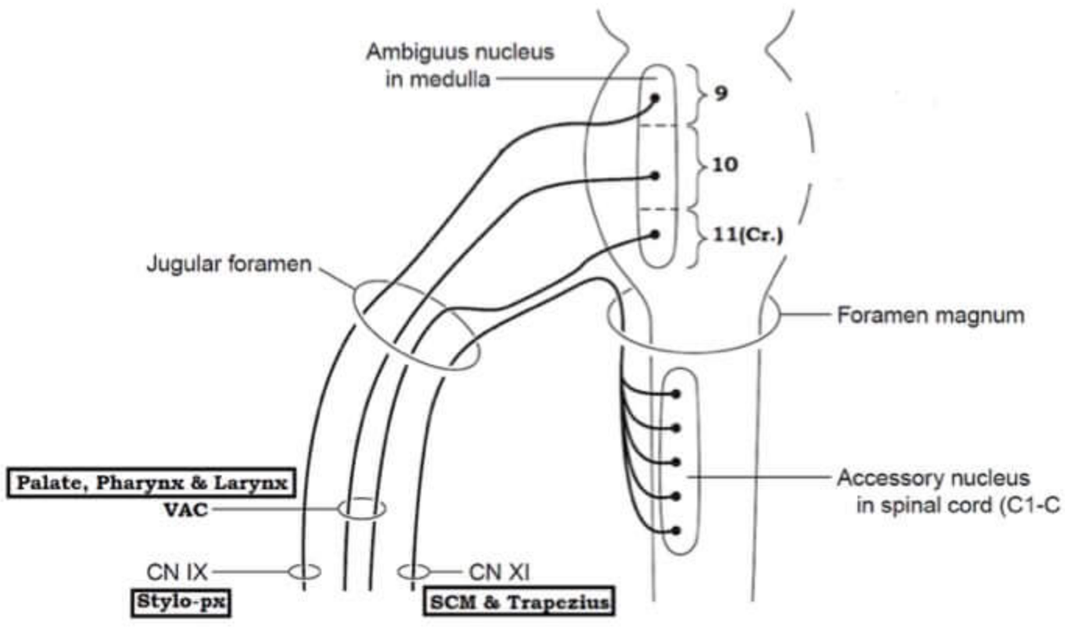
→ Right palatal Arch sagging

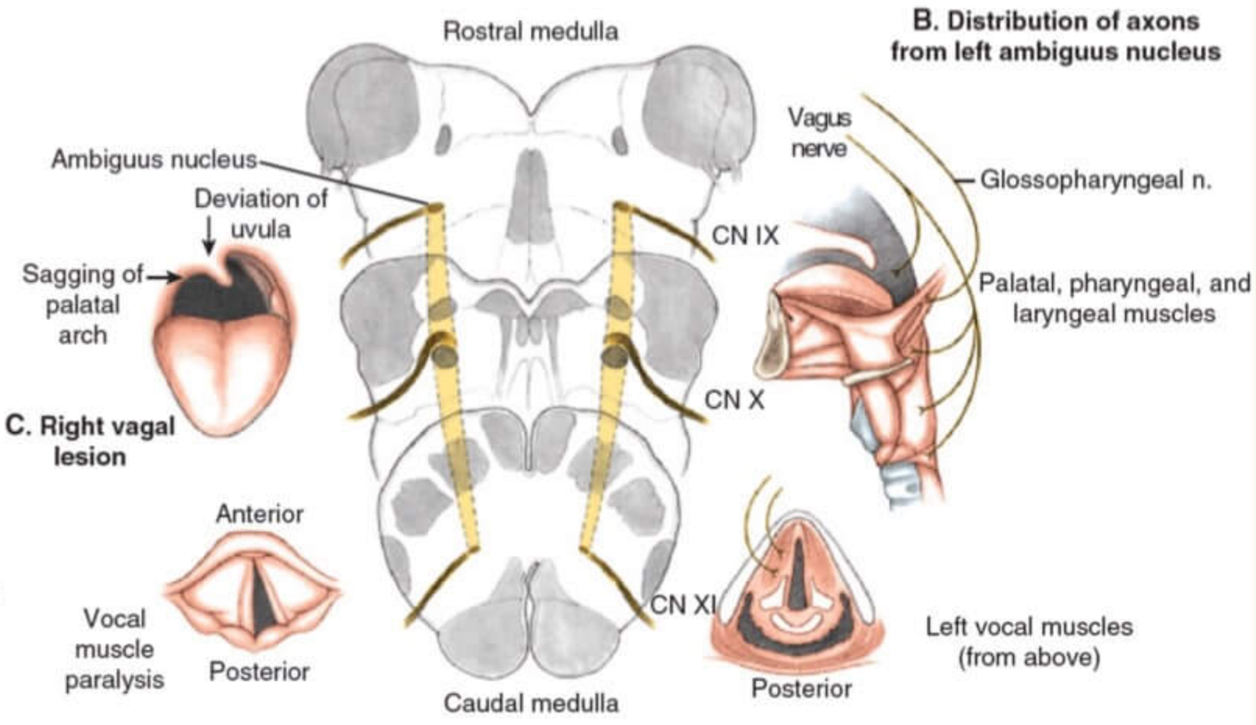
→ CIL deviation OF Uvula

→ Right vocal muscle paralysis

- abduction possible on normal side
- abduction not possible on affected side

VAGUS ACCESSORY COMPLEX





→ vagus nerve carries (vehicle) axons of cranial accessory nerve but do not supply muscles of Palati, pharynx & larynx

→ cranial accessory nerve supplies muscles of palate, pharynx, larynx EXCEPT

1. Stylopharyngeus → supplied by CN IX
2. Tensor palati → Supplied by 53

All the muscles of Tongue are Supplied by hypoglossal nerve (12) EXCEPT Palatoglossus (Supplied by cranial accessory nerve)

Rt. NUCLEUS AMBIGUS LESION / WALLEN BERG SYNDROME

→ CN 9, 10, 11 compromised

→ difficulty in speech & swallowing

→ CIL deviation of Uvula

→ Right vocal muscle paralysis

abduction possible on normal side

abduction not possible on affected side (cadaver posith in midline)

ARCH	NERVES	CONTROLS
III	CN 9	Stylo Pharyngeus
IV	Superior laryngeal nerve	muscles of Palate EXCEPT Tensor palati muscles of Pharynx EXCEPT Stylopharyngeus cricothyroid (muscle of larynx, Tensor of vocal cord)
VI	Recurrent laryngeal Nerve	muscles OF Larynx EXCEPT Cricothyroid

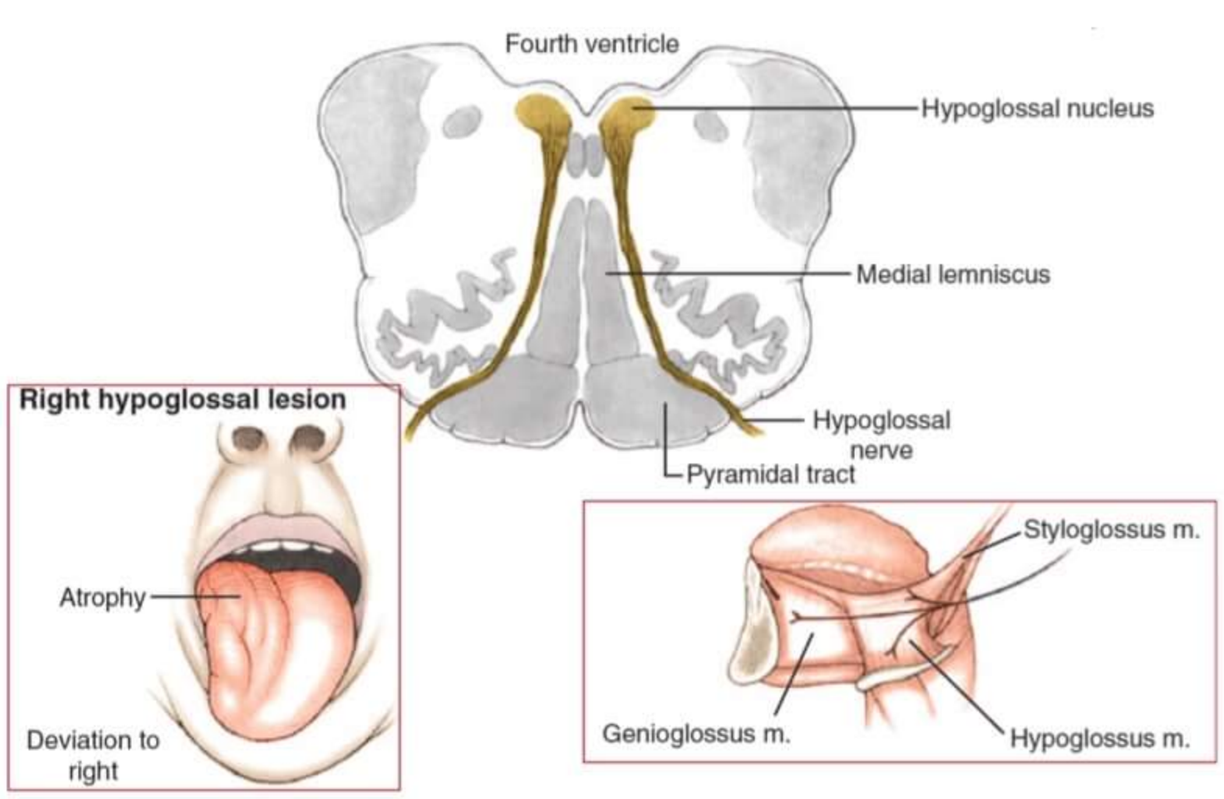
NUCLEUS AMBIGUUS

9
10
11 cranial part

} controls muscles of speech & swallowing

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 toward the opposite side during swallowing



HYPOGLOSSAL NERVE [CN 12]

→ Pure motor nerve
→ CN 12 Nucleus present at the Floor of 4th Ventricle in upper medulla near the midline
→ gives CN12 → exits b/w pyramid (anteriorly), Olive (posteriorly) & Supplies tongue muscles EXCEPT Palatoglossus (Supplied by VAC)

Rt SIDED HYPOGLOSSAL NERVE INJURY

→ Tongue deviates to Rt. Side (IL side)
→ Pharynx deviates to Lt. Side (CL Side)

GENIOGLOSSAL MUSCLE

→ Genioglossal muscle 'AIm' the tongue

A	Anterior	→	Protrusion of tongue
I	Inferior	→	depression of tongue
m	Medial		

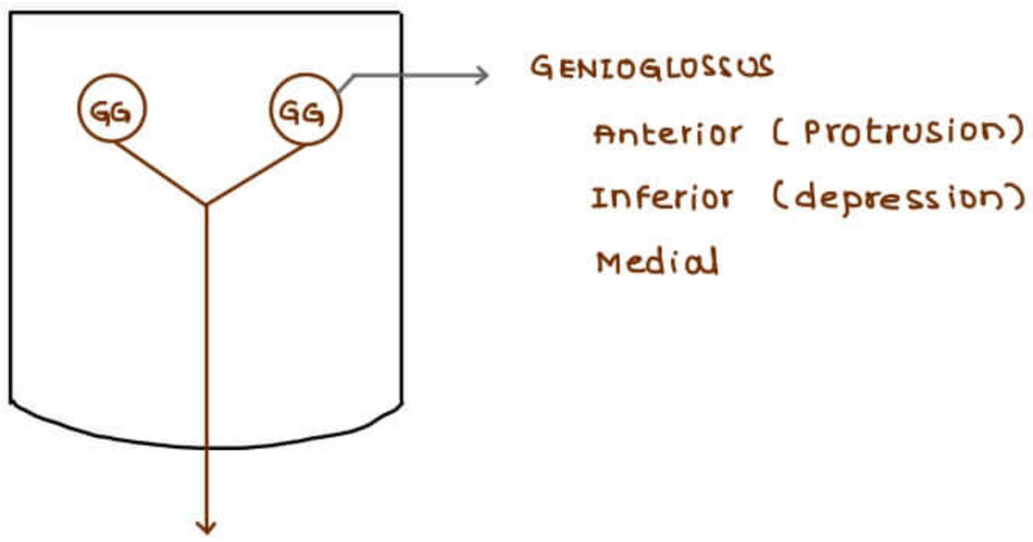
→ In Rt. sided lesion → Balance lost, Lt. Genioglossus is more powerful
→ Tongue deviates to rt. side (same side of lesion)

→ Skeletal muscle

→ SAFETY MUSCLE OF TOUNGE

Respiratory Tube

→ prevents back falling of Tongue into the Resp. tube



→ IN POST EPILEPSY UNCONCIOUSNESS

1 Turn the patient to one side
2 pull the tongue outside

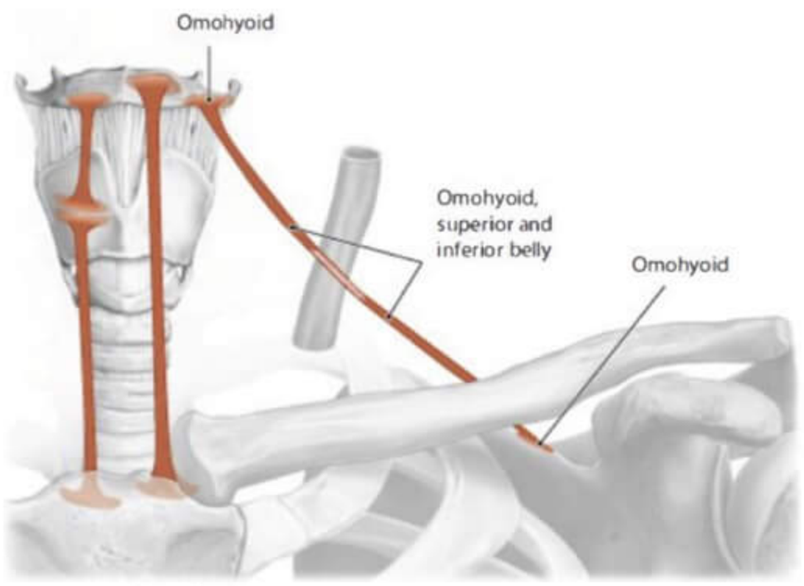
Because drive to Genioglossal muscle is lost (Deep unconsciousness)
During sleep drive is maintained (no deep unconcious ness)

→ In SLEEP APNEA SYNDROME

culprit muscle → Genioglossus
brives reduced → Tongue fall backwards → Wakes up
Rx by prosthetic Sx to be done to enlarge respiratory tube
pacemaker for Genioglossal muscle [future option]

ANSA CERVICALIS

→ Nerve loop in ant. neck supplies ant. neck muscles



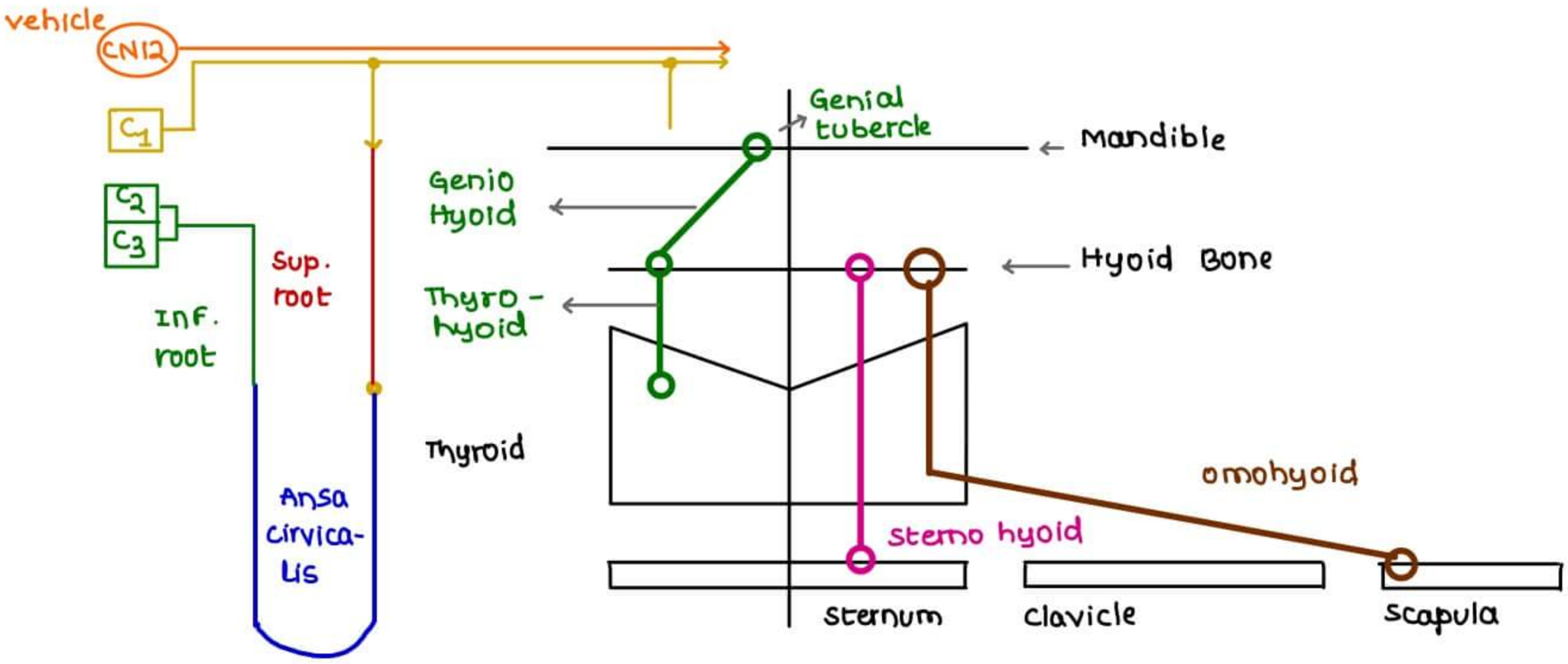
ANTERIOR NECK MUSCLES

Supplied by ANSA CERVICALIS

1 Inferior & Superior belly OF OMOHYOID
2 STERNOHYOID

Supplied by CN12 carrying C_1 fibres

3. THYROHYOID
4. GENIOHYOID



→ Superior Root of AC contributed by C_1
Inferior Root of AC contributed by C_2 & C_3

→ CN 12 acts as vehicle to carry C_1 fibres
C_1 Fibres Supplies Geniohyoid & Thyrohyoid & contributes to superior root of Ansa cervicalis

→ Ant. neck muscles stabilize larynx by attaching to larynx cartilages
On 12th Nerve Right side injury (C_1 Fibres)
Tongue muscles are deviated to same side
larynx destabilized → larynx deviates to lt side while swallowing
dlt some ant. neck muscle paralysed

CERVICAL PLEXUS

CERVICAL PLEXUS BRANCHES

→ At posterior border of sternocleido mastoid mid point cervical plexus gives branches

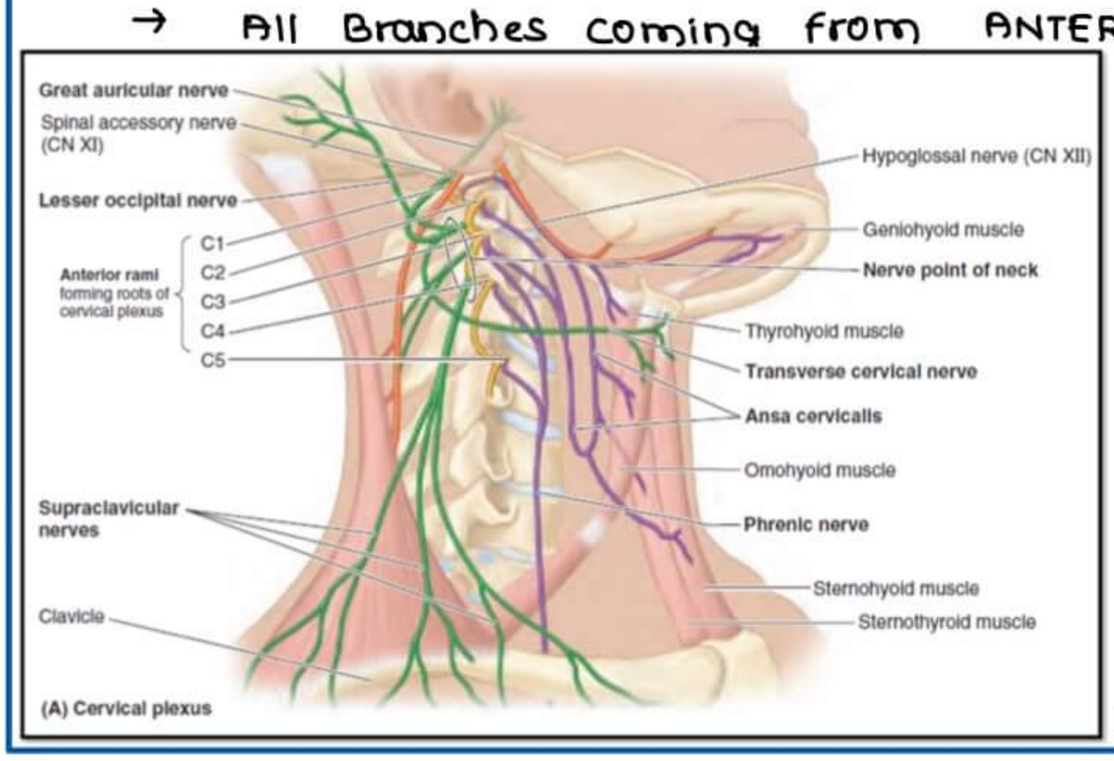
1 GREATER AURICULAR NERVE → Supplies Greater part of auricle
→ skin on the angle of mandible

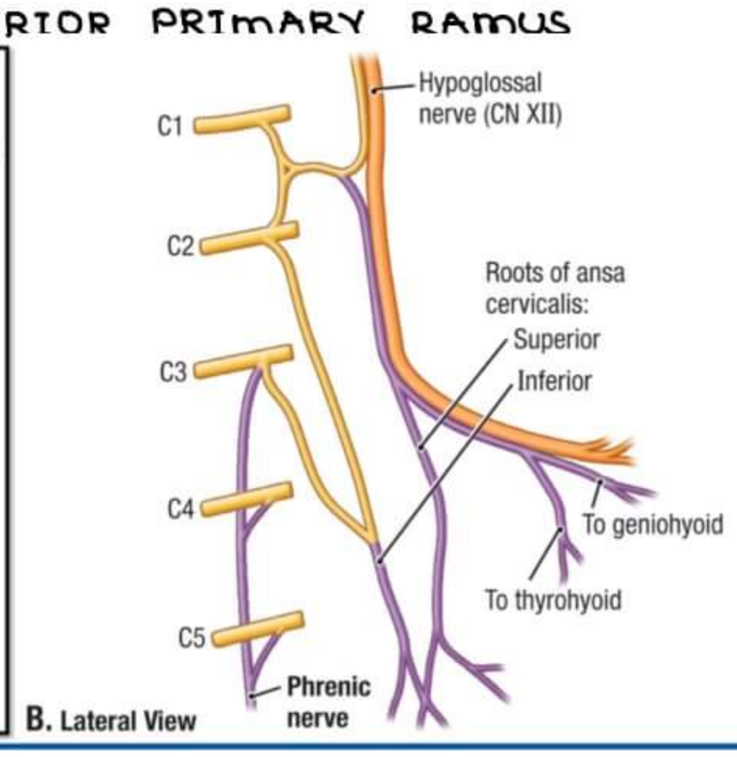
2 LESSER AURICULAR NERVE → behind the auricle

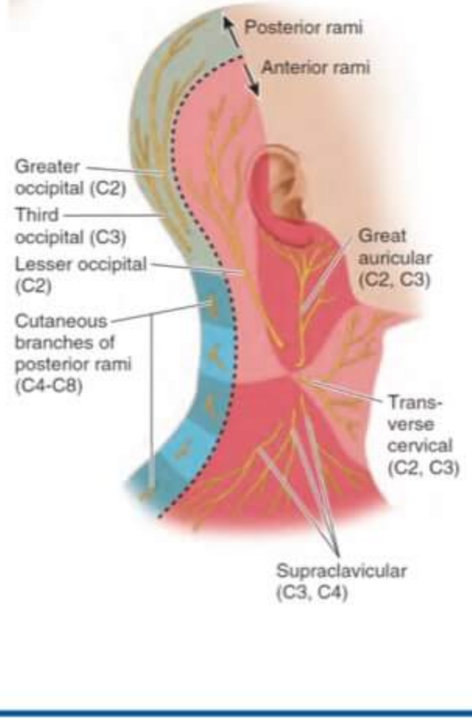
3 TRANSVERSE CERVICAL NERVE → Supplies neck region transversly

4 SUPRA CLAVICULAR NERVE → goes to supra clavicular region

→ All Branches coming from ANTERIOR PRIMARY RAMUS

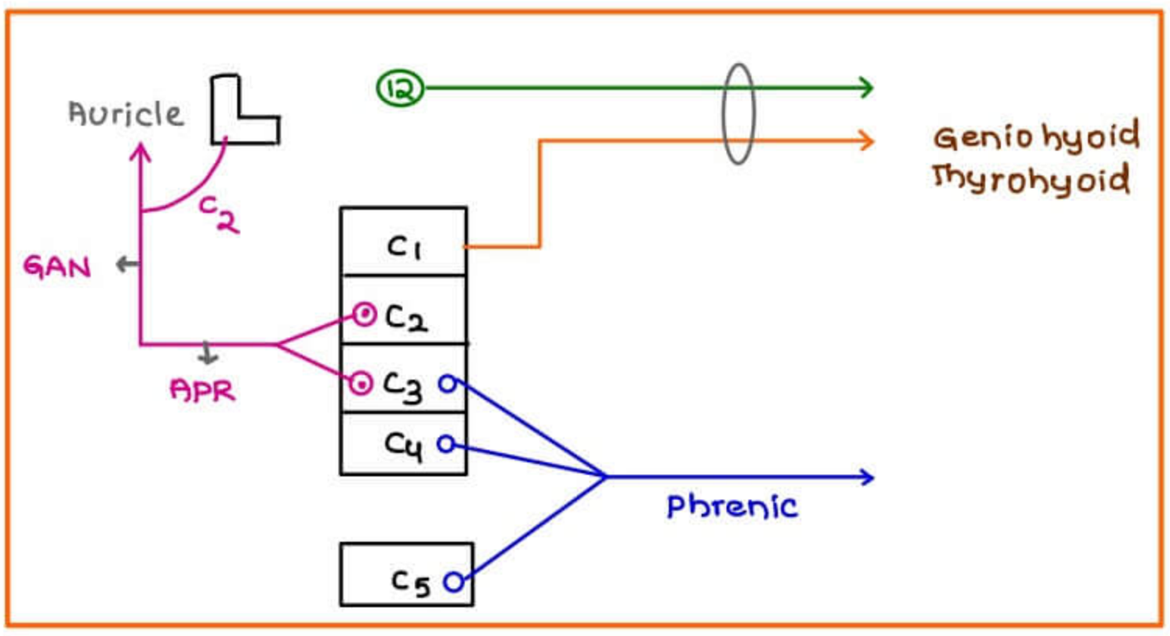






C_1 FIBRES → carried by CN 12 & supplies Thyrohyoid & Geniohyoid
→ contributes to superior root of ansa cervicalis

C_2, C_3 FIBRES → Contributes to inferior root of ansa cervicalis
Supplies omohyoid, sternohyoid & stabilizes larynx



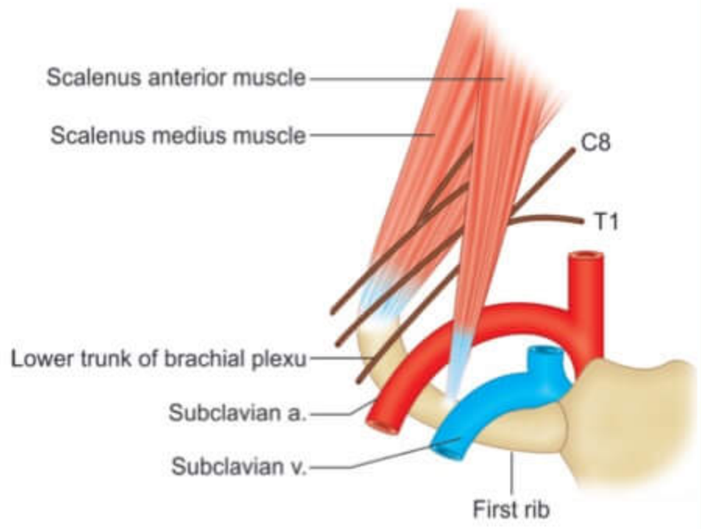
PHRENIC NERVE

→ comes from cervical plexus (C_3, C_4) & C_5
→ major root value C_4
→ Sensory motor nerve
motor to → diaphram
Sensory to → central portⁿ of diaphragm
carry sensations from Pleura, Pericardium, Peritoneum near midline
responsible for referred pain on shoulder (C_4 dermatome)

SCALENUS ANTERIOR MUSCLE

RELATIONS IN NECK REGION

Origin → from cervical vertebra
Insertⁿ → on the inner border of 1st rib
(Scalenus medius attaches on the superior surface of 1st rib)



INTER SCALENI TRIANGLE

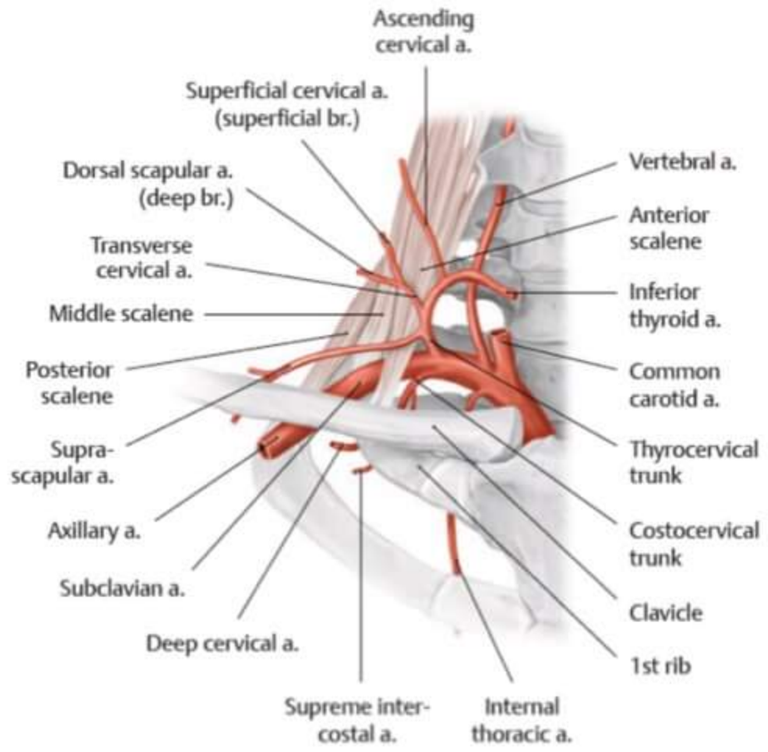
→ present blw scalenus anterior & scalenus medius
→ Brachial plexus block given here for multiple # pain
→ Block given lateral to S. anterior muscle

→ SUB CLAVIAN ARTERY crosses the outer border of 1st rib to enter axilla to become AXILLARY ARTERY
→ AXILLARY VEIN in axilla crosses the outer border of 1st rib to enter and become SUBCLAVIAL 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

→ 3rd part of subclavian artery block can be given by compressing 1st rib

→ Scalenus anterior divides SUBCLAVIAN ARTERY into

1st part → Proximal to muscle
2nd part → Deep to muscle
3rd part → Distal to muscle



HEAD & NECK : ARTERIAL SUPPLY

SUB CLAVIAN ARTERY - BRANCHES

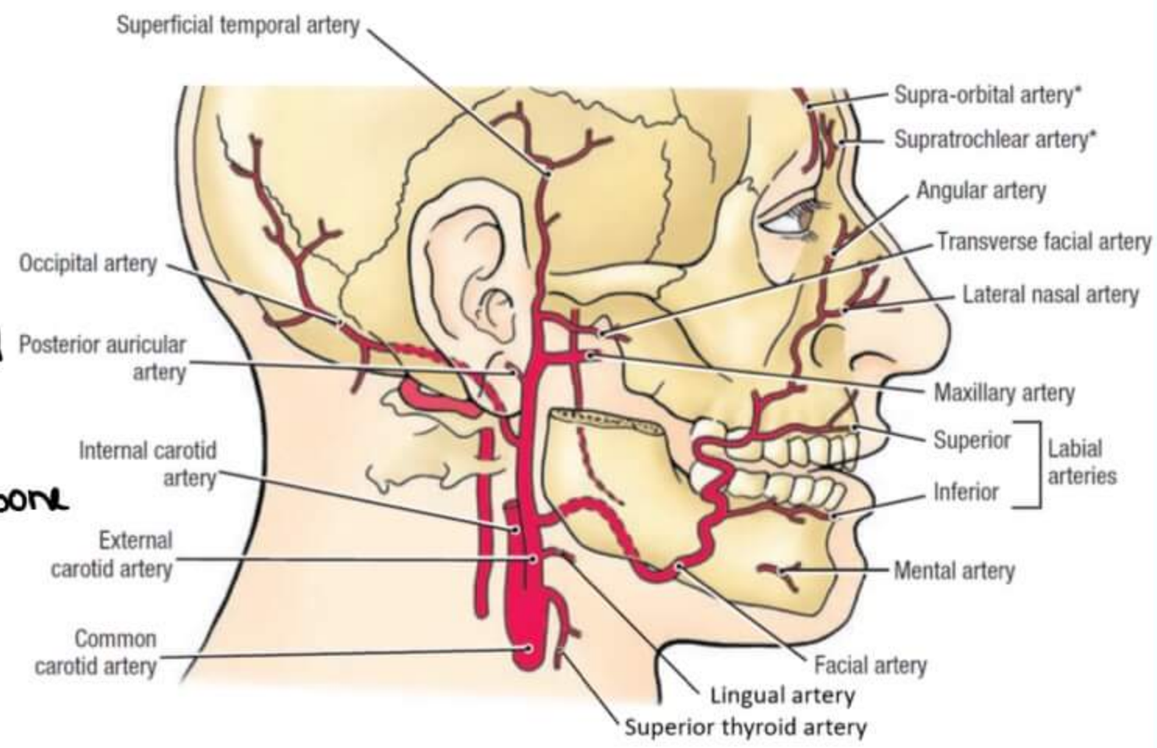
1st PART BRANCHES

V → VERTEBRAL ARTERY → Supply Circle of Willes
I → INTERNAL THORACIC A. → Supply Thorax
T → THYROCERVICAL TRUNK → Supply Thyroid

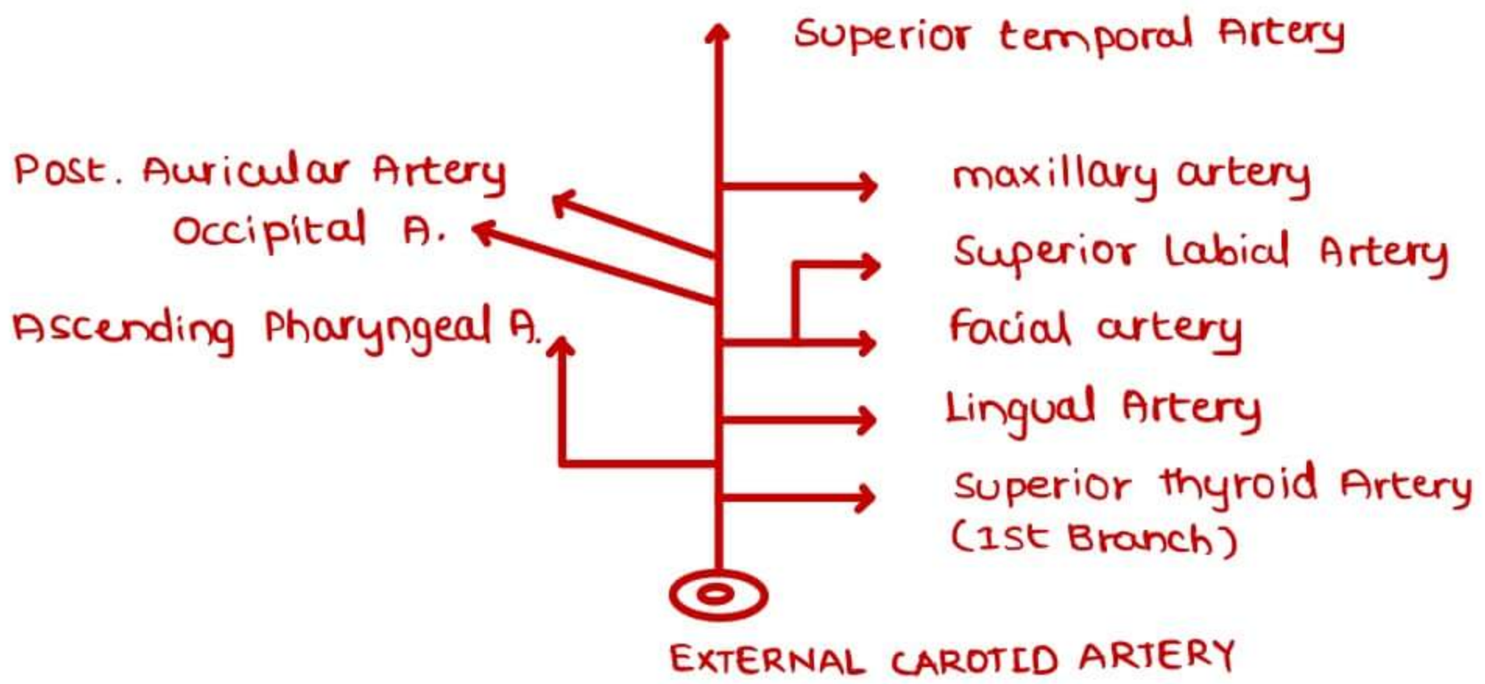
EXTERNAL CAROTID ARTERY BRANCHES

→ 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 a. → 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

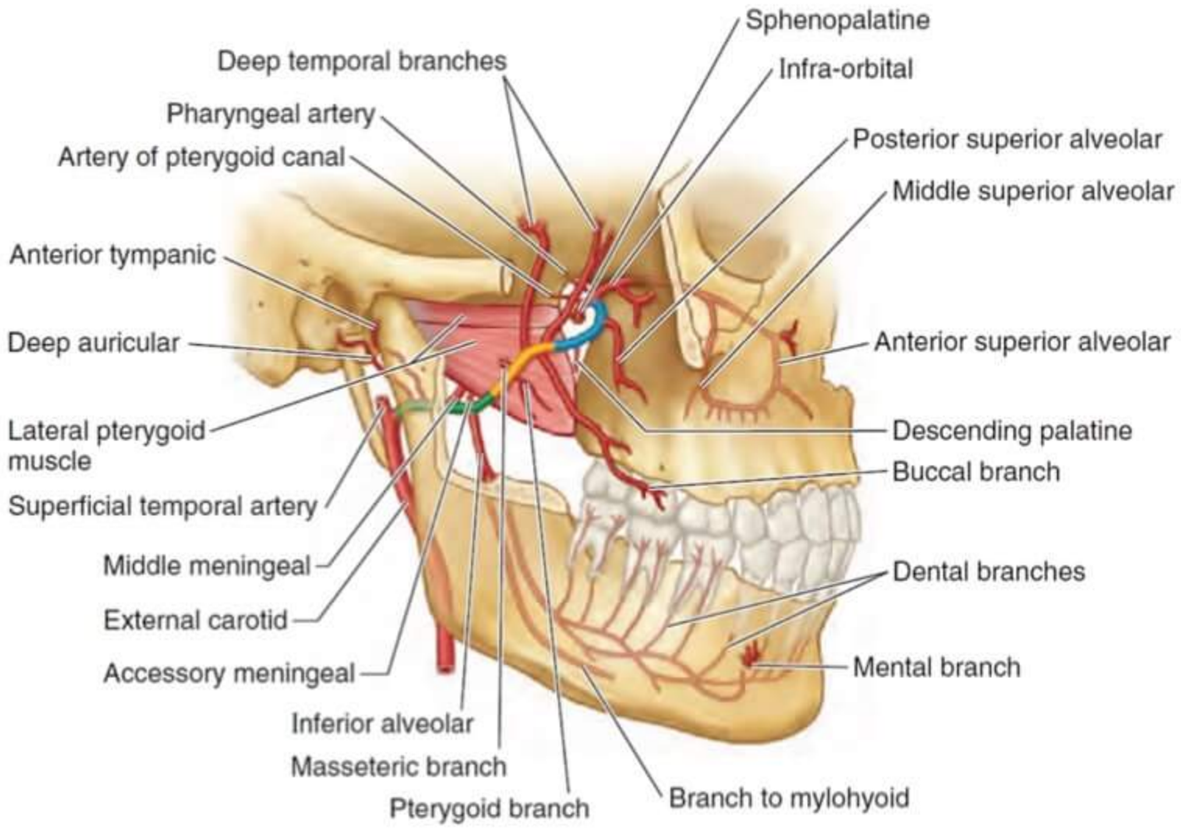


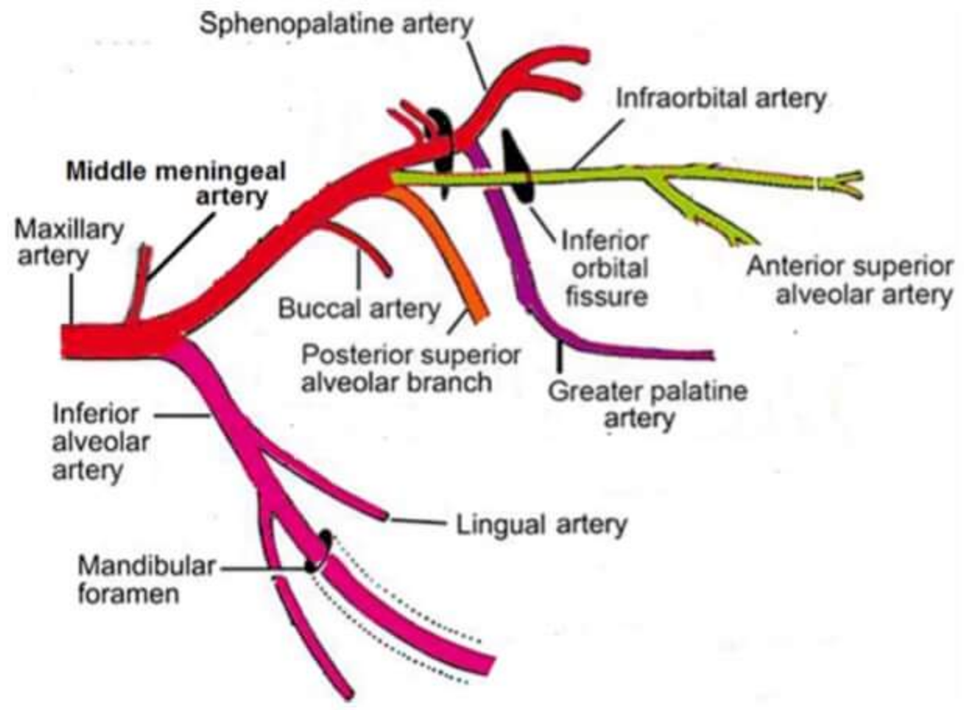
Superior labial artery → Supplies Kiesselbach area of Little's plexus
(Br. of Facial artery)



Tonsil Supply

→ highly vascular
→ major supply → facial
Lingual artery
Asc. pharyngeal artery
maxillary artery





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 a → Greater palatine a.

} supplies Little's area

middle meningeal Artery (Deep to pterion)

FS

Sphenopalatine A.

DPA

Inf. Orbital Fissure

Inferior Orbital Artery [at the floor of orbit]

middle SAA

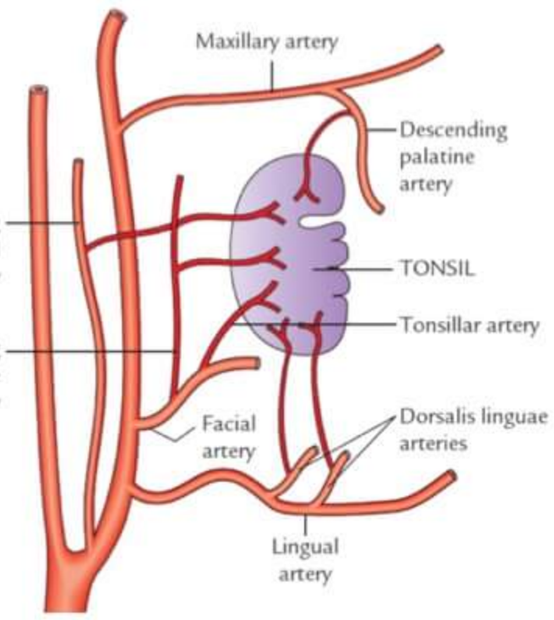
Greater Palatine Artery

post. SAA

Anterior Superior Alveolar Artery

Inferior Alveolar A.

MAXILLARY ARTERY



TONSIL ARTERIAL SUPPLY

FACIAL ARTERY → ASC. palatine artery also
MAXILLARY → Des. palatine Artery
LINGUAL → Dorsal Lingual Artery
ASC. Pharyngeal A.

maxillary Artery

Des. palatine A

Asc. Palatine A

Facial A

Tonsil

APA

Lingual

Dorsal lingual Artery

ECC

NOSE : KIESSELBACH'S PLEXUS / LITTLE'S AREA OF EPISTAXIS

→ present at antero inferior aspect of nasal septum

→ provided by Br. of ECA & ICA

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 → Br. of ICA

c Greater palatine artery

d Septal branch of superior labial artery

Sphenopalatine artery → br. of 3rd part of maxillary artery of ECA

Greater Palatine artery → br. of Des. palatine artery of 3rd part of maxillary a.

Superior labial artery → br. of facial artery of ECA

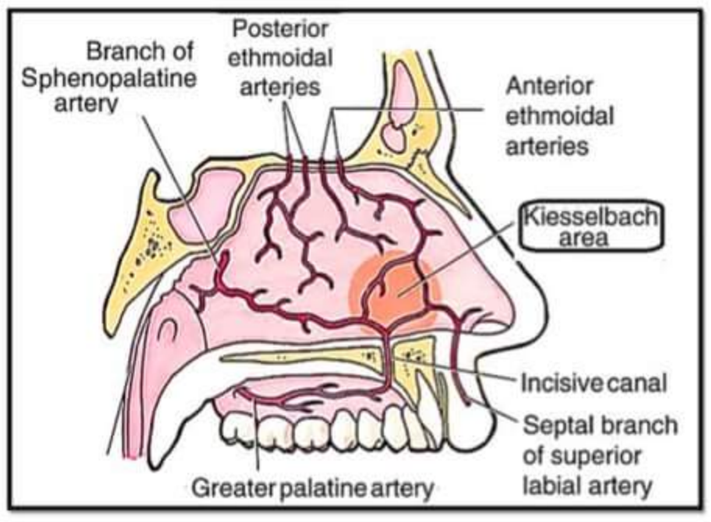
Ant. Ethmoidal artery → br. of ophthalamic artery of ICA

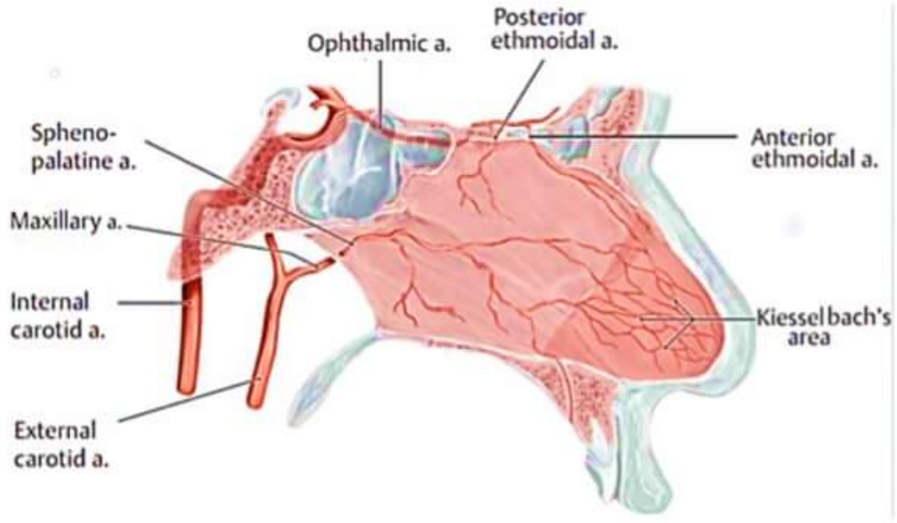
Post. Ethmoidal artery → br. of ophthalamic artery of ICA

major contribut^{n} from ICA is by Ant. Ethmoidal artery

Sphenopalatine artery is mostly resp. for severe Epistaxis

→ For Embolism, ECA branches to be approached, not ICA branches





SUB CLAVIAN STEAL SYNDROME

→ sub clavian artery steals blood from circle of willis to supply upper limb

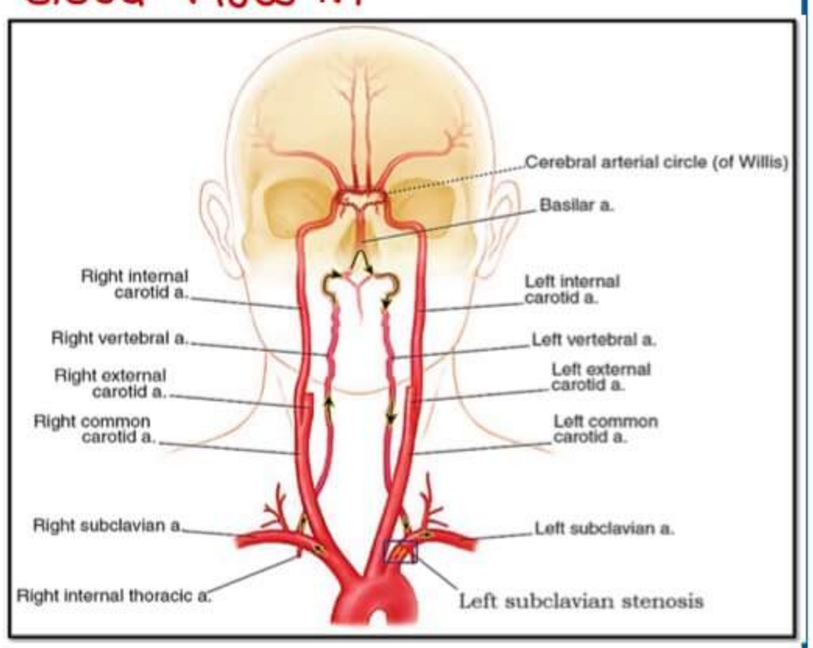
Q In subclavian steal syndrome there is reversal of blood flow in

a Ipsilateral vertebral artery

b contralateral vertebral artery

c I/L subclavian artery

d C/L subclavian artery



LEFT SUBCLAVIAN STENOSIS

→ can lead to left upper limb ischemia

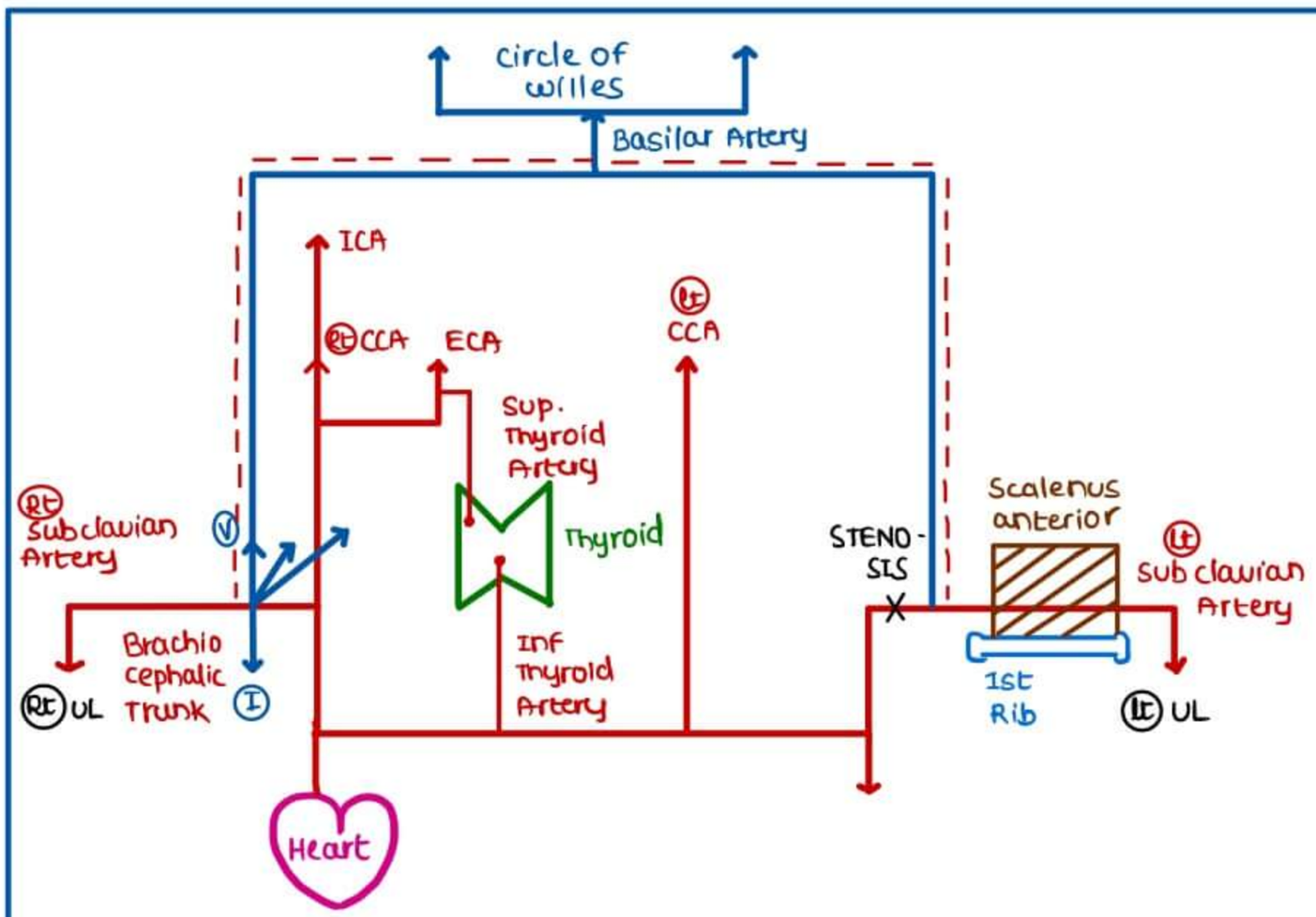
→ prevented by Rt Subclavian Steal syndrome

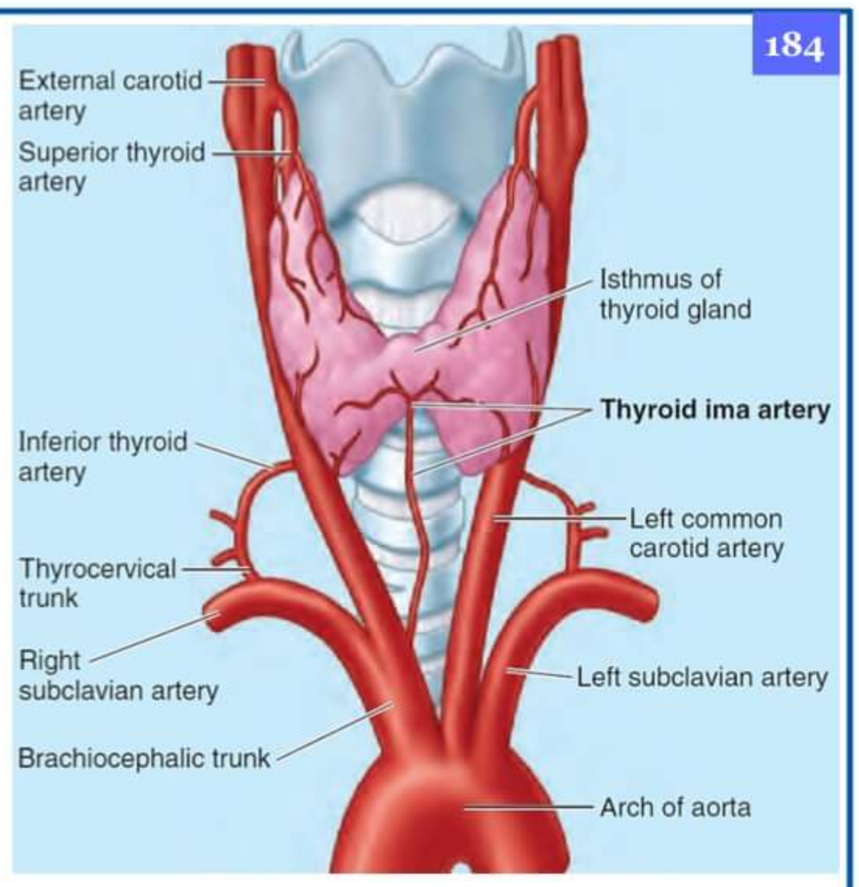
→ Ipsilateral vertebral artery has reversal blood flow

→ Subclavian artery steals blood from circle of willis

→ Circle of willes supplied by ICA

→ Advised not to do heavy work on affected side





10%. have THYROID IMA ARTERY → Br. of Variable Origin

1. Arch of Aorta
2. Brachioceph. Trunk
3. Subclavian artery
4. ECA

→ midline artery

→ Prone to injury during Isthmectomy

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

HEAD & NECK : VENOUS DRAINAGE

THYROID GLAND VENOUS DRAINAGE

1 SUPERIOR THYROID VEIN
2 MIDDLE
} drains into Internal jugular vein

3 INFERIOR → drains in Brachiocephalic veins → SVC

During Emergency tracheostomy, the veins prone to injury are

→ Inferior Thyroid vein (present near mid line)

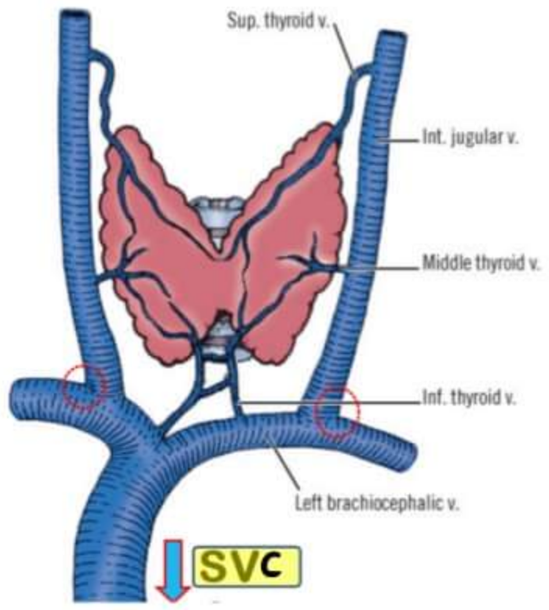
→ Lt Brachiocephalic vein crosses midline to enter SVC

LYMPHATIC DRAINAGE OF HEAD & NECK

→ Lymphatic follows veins

Lt Lymphatics
↓
Lt Jugular trunk
↓
Lt Thoracic duct
↓
Lt Jugulo subclavian angle
(beginning of Lt brachio cephalic vein)

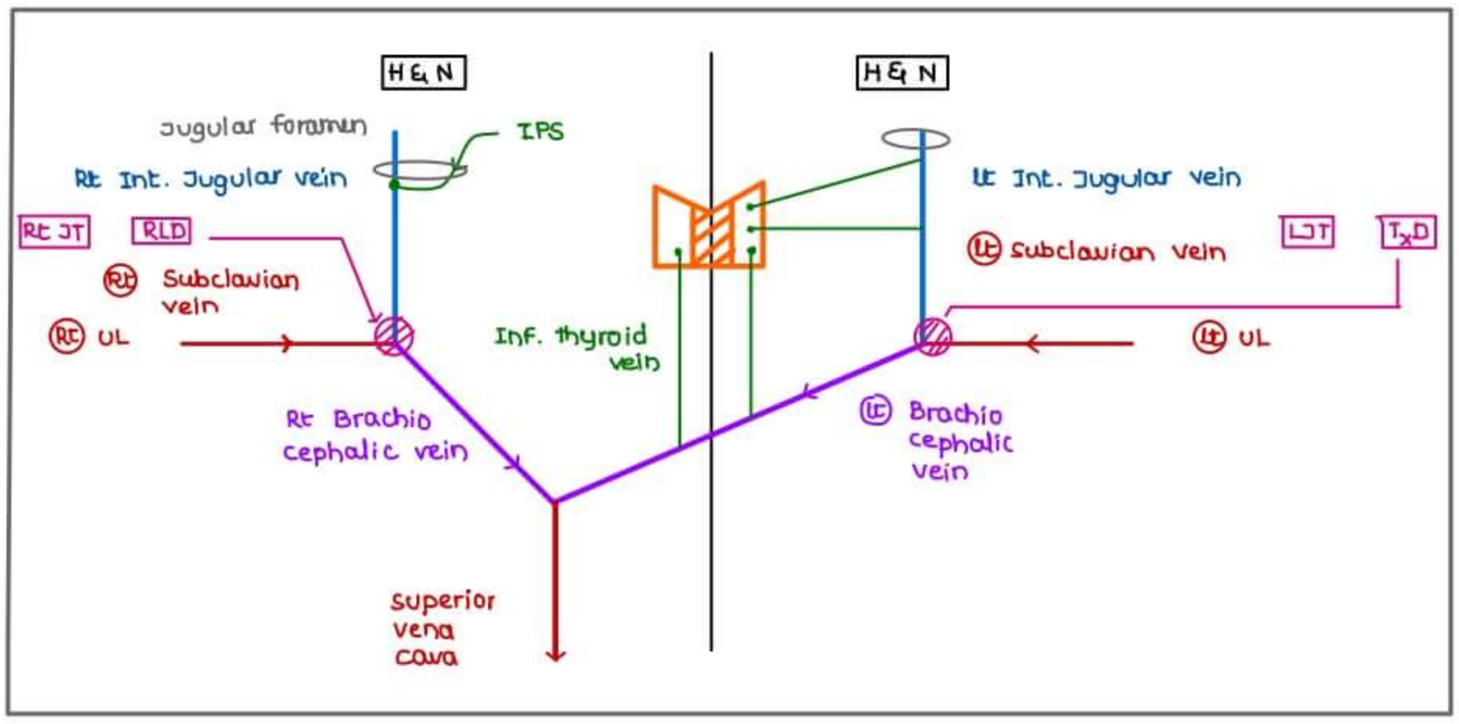
RLD

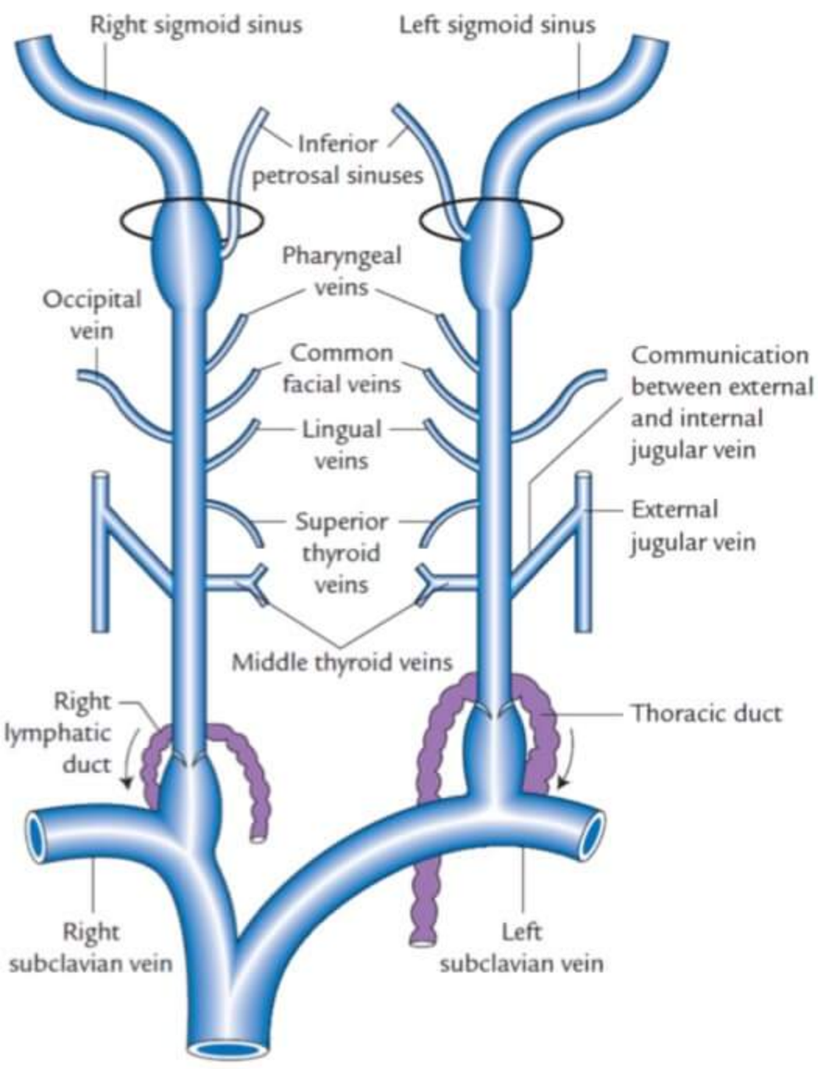


TxD

Rt Lymphatics
↓
Rt Jugular trunk
↓
Rt lymphatic duct
↓
Rt Jugulo subclavian angle
(beginning of Rt brachiocephalic vein)

HEAD & NECK VENOUS DRAINAGE





JUGULAR FORAMEN

Consists of

CN 9, 10, 11

beginning of Internal Jugular vein

Inferior petrosal Sinus (1st tributary of Internal Jugular vein]

HEAD & NECK - LYMPHATIC DRAINAGE

CIRCLES

INNERMOST CIRCLE [MALT]

→ present at entry point of tube
- Respiratory Tube
- Gut tube

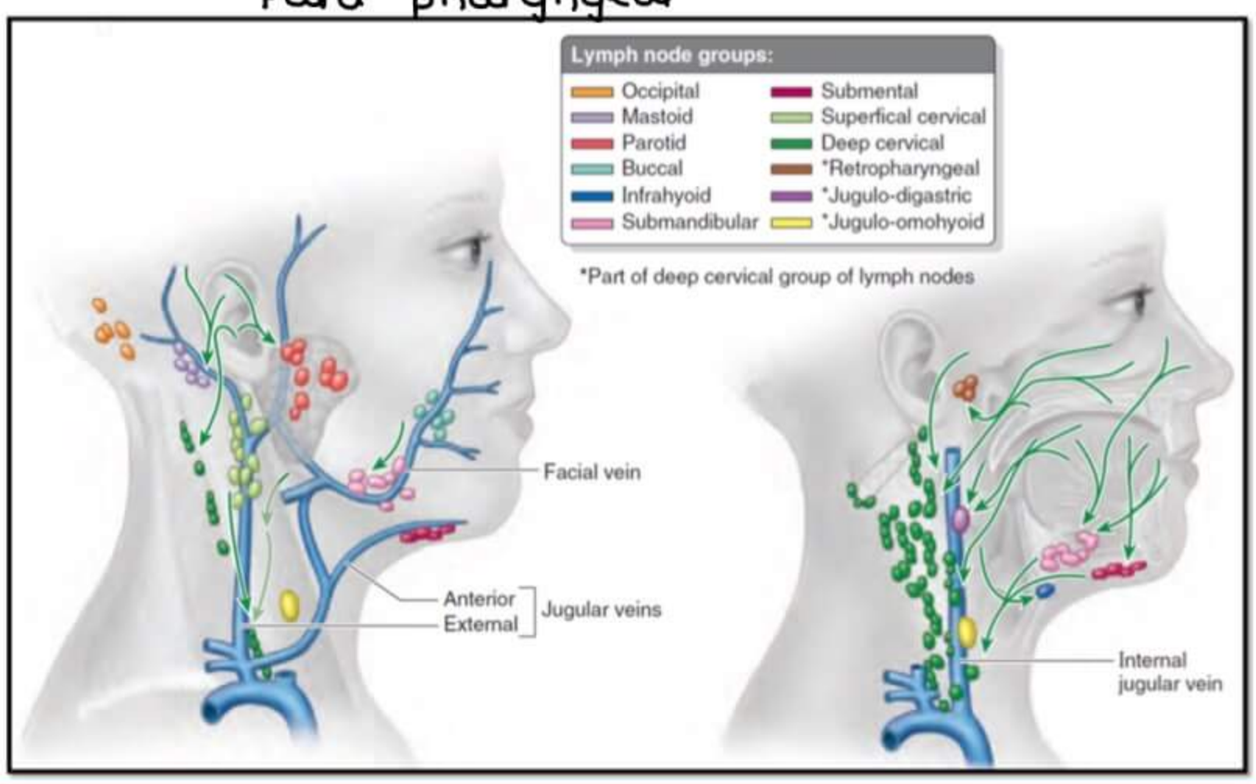
→ Tonsils

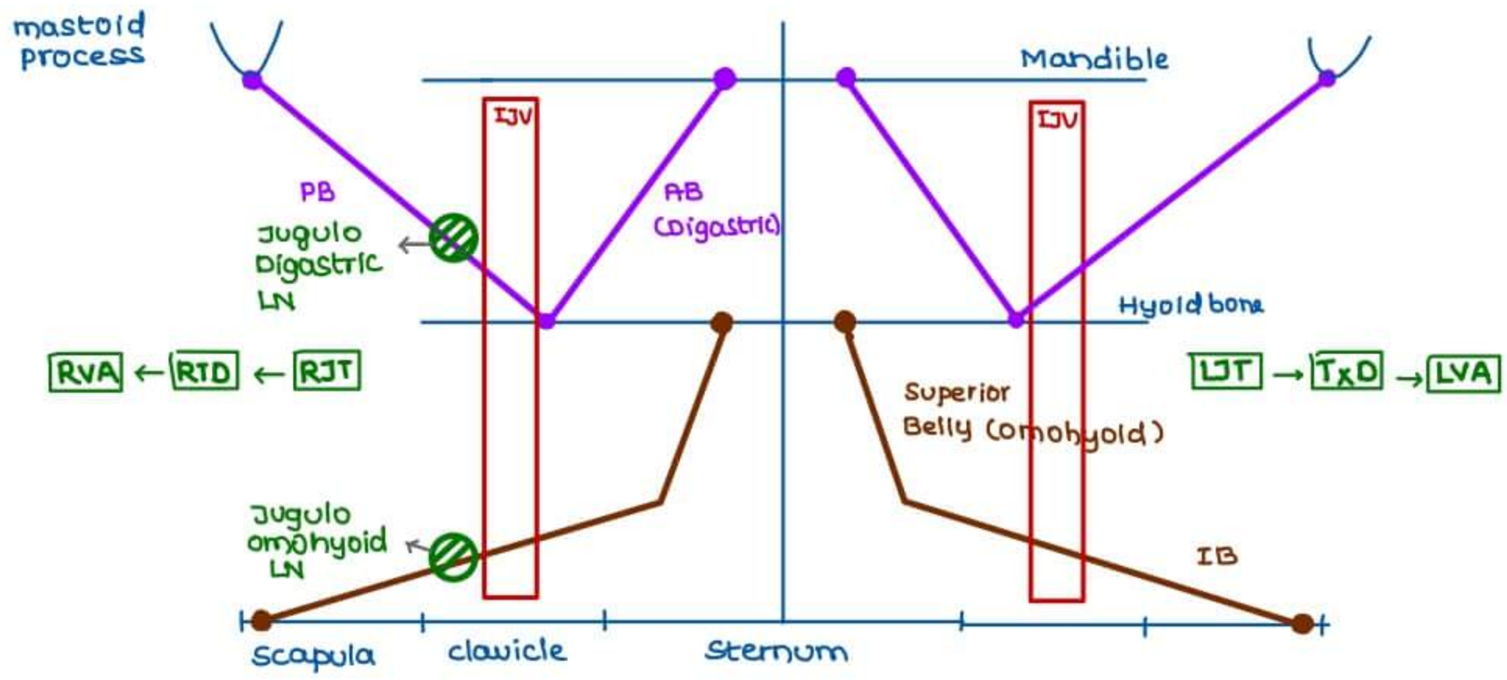
OUTER CIRCLE

→ Sub mental Lymph node
→ Sub mandibular LN
→ Pre auricular LN
→ Post auricular LN
→ Occipital LN

INNER CIRCLE

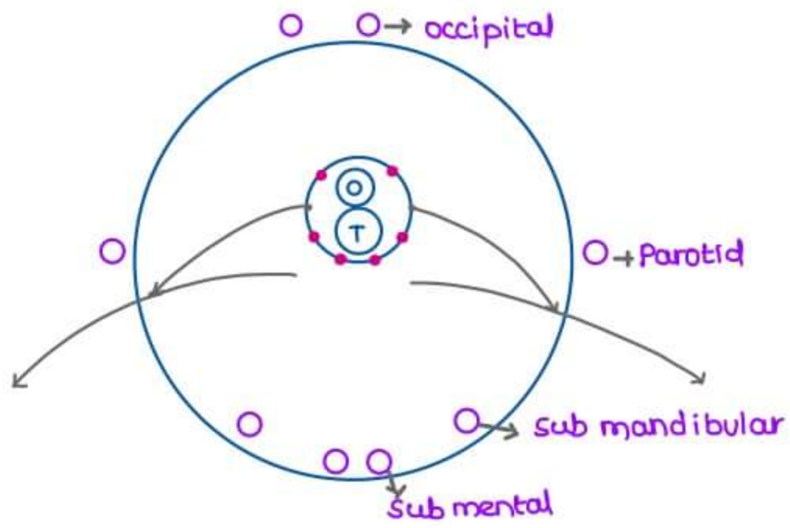
→ Para tracheal
→ Pre tracheal
→ Para pharyngeal





CERVICAL LYMPH NODES

SUPERFICIAL	DEEP
Submental	Retropharyngeal
Sub mandibular	Jugulo digastric
Preotic | pre auricular	Jugulo - omohyoid
Parotid	
Postotic	
occipital	



DEEP LYMPHATICS

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

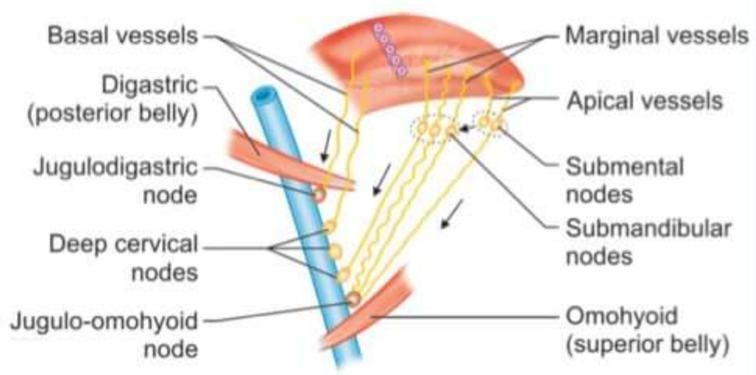
TONGUE LYMPHATIC DRAINAGE

TIP → Sub mental LN → Lower deep Cx LN } Jugulo omohyoid LN

MIDDLE PORTION → Sub mandibular LN → Lower deep Cx LN }

ROOT → Upper deep cervical LN (Jugulo digastric LN)

Some Submental LN drains into Sub mandibular LN



MIDLINE OF TONGUE

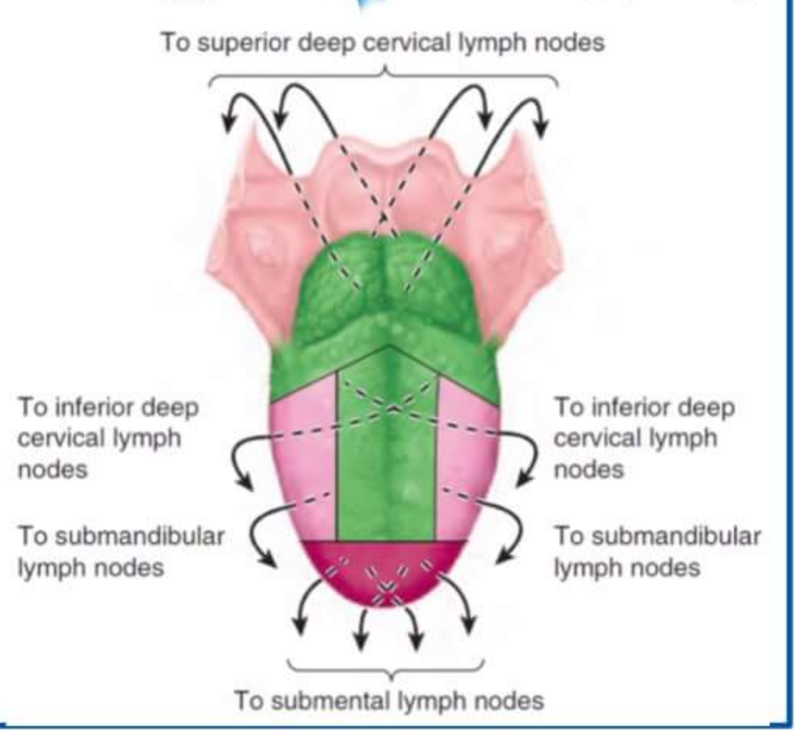
→ has bilateral drainage (crossing of lymphatics)

LATERAL TONGUE → drained by I/L LN.

ROOT OF TONGUE → drained has BIL drainage

Tumor on Lateral side → I/L LN enlarged

Tumor on midline | root → BIL LN enlarged



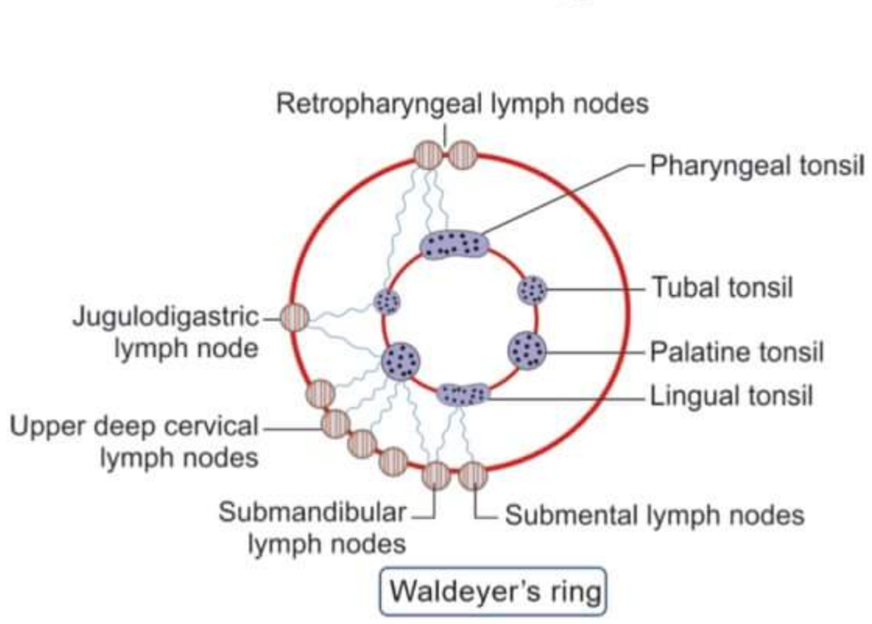
LYMPHATIC DRAINAGE AROUND PHARYNX

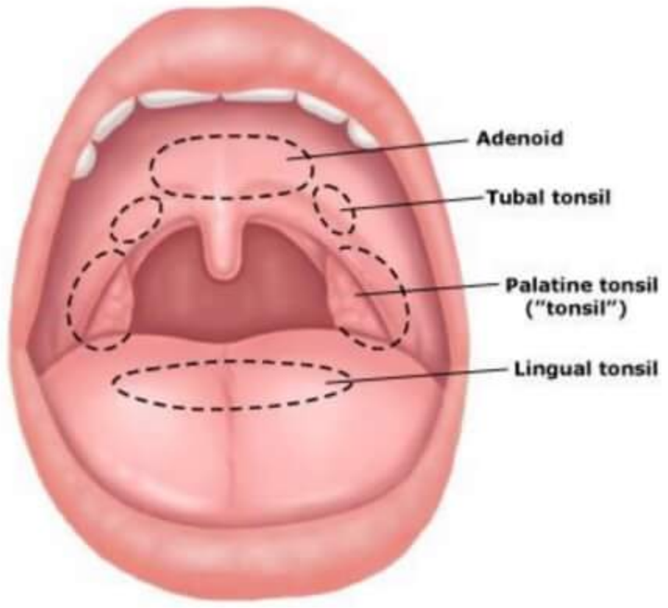
MALT → WALDEYER'S → inner ring & outer ring

INNER WALDEYER'S RING / WALDEYER'S RING

TONSILS

- → Lingual tonsil
- → Palatine tonsil (Tonsil)
- → Pharyngeal tonsils / adenoid
- → Tubal tonsil





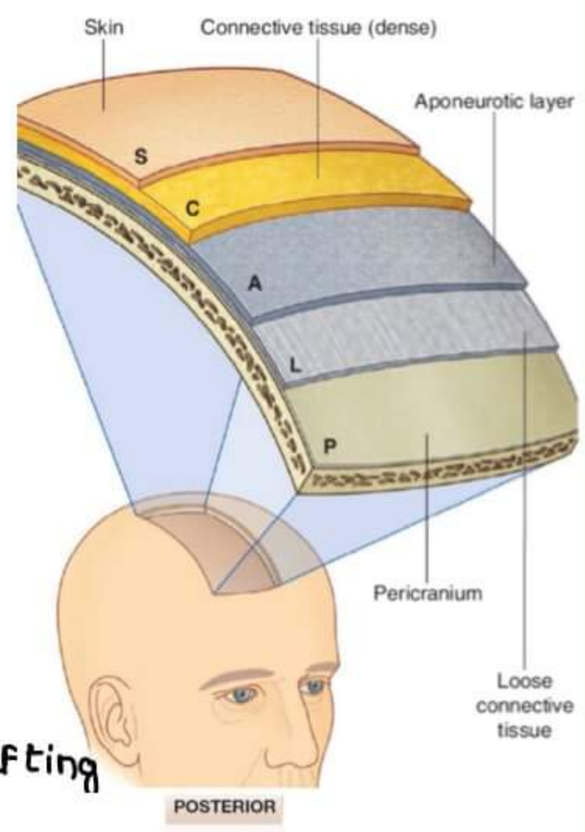
INNER WALDEYER'S RING		OUTER WALDEYER'S RING
Pharyngeal Tonsils	→	Retro pharyngeal LN
Palatine Tonsil	}	Jugulo digastric LN
Tubal Tonsil	}	
Palatine Tonsil	→	Other upper Deep cervical LN
Lingual Tonsil	→	Submental & Submandibular LN

SCALP

- S → SKIN
- C → CONNECTIVE TISSUE (Dense)
- A → APONEUROSIS (occipito frontalis)

} TRUE SCALP

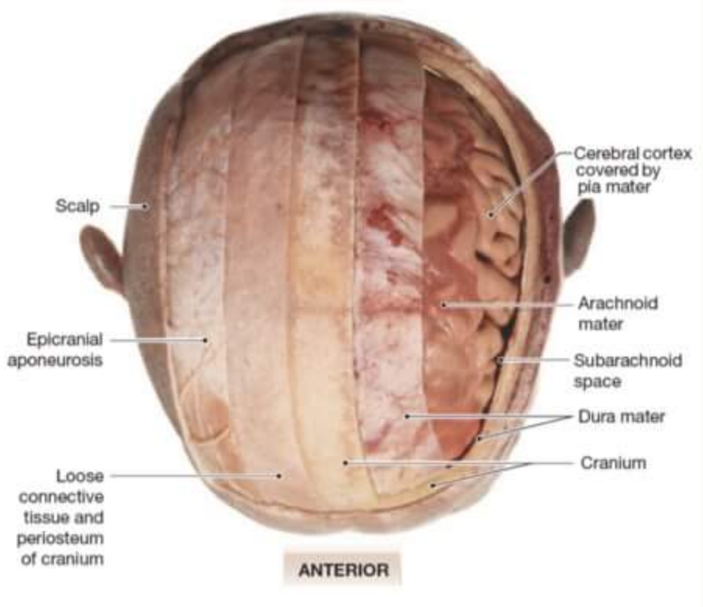
- L → LOOSE CONNECTIVE TISSUE
- P → PERICRANIUM / PERI OSTEUM



SURGICAL PLANE (LOOSE CONNECTIVE TISSUE)

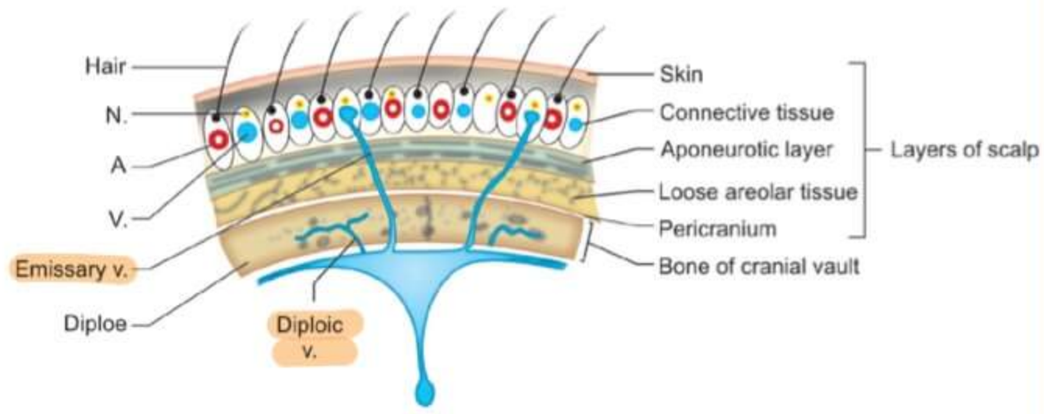
- → present below true scalp
- → tissue expanders can be inserted here for surgical grafting
- → DANGER AREA OF SCALP
  - blood & pus accumulate here
  - can spread infections into dural venous sinuses → Meningitis → Thrombosis

APONEUROSIS → Flat tendon of occipitofrontalis

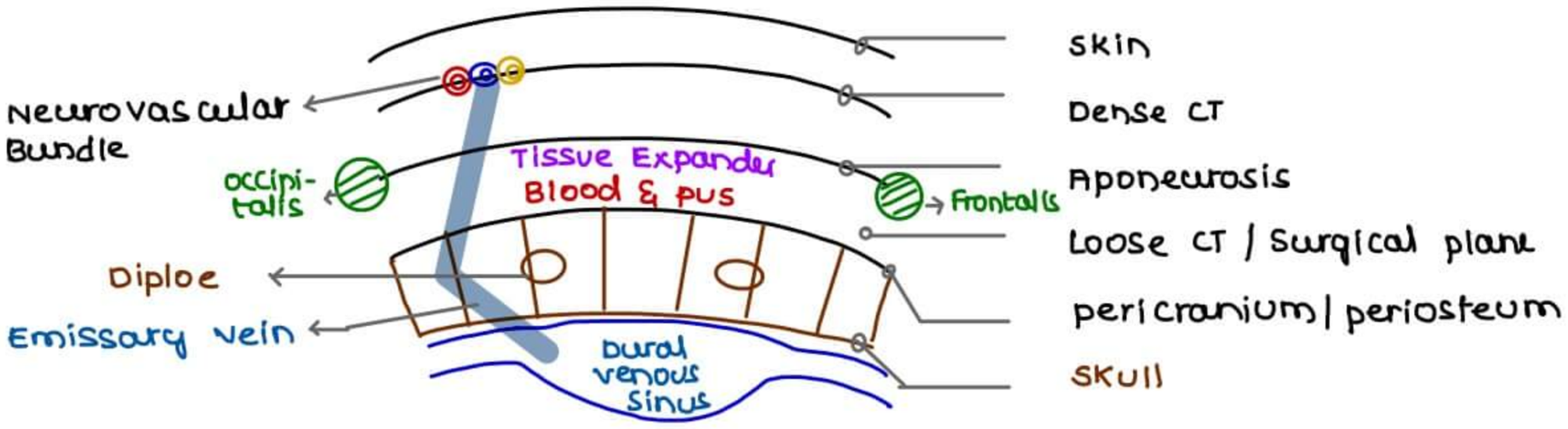


DEEP STRUCTURES TO SCALP

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

DIPLOE → Skull (flat bone) ↑ Bone marrow

NECK TRIANGLES

Q All of the following are in the anterior triangle of neck Except

a digastric

b Subclavian

c Muscular

d Submental

STERNOCLEIDO MASTOID

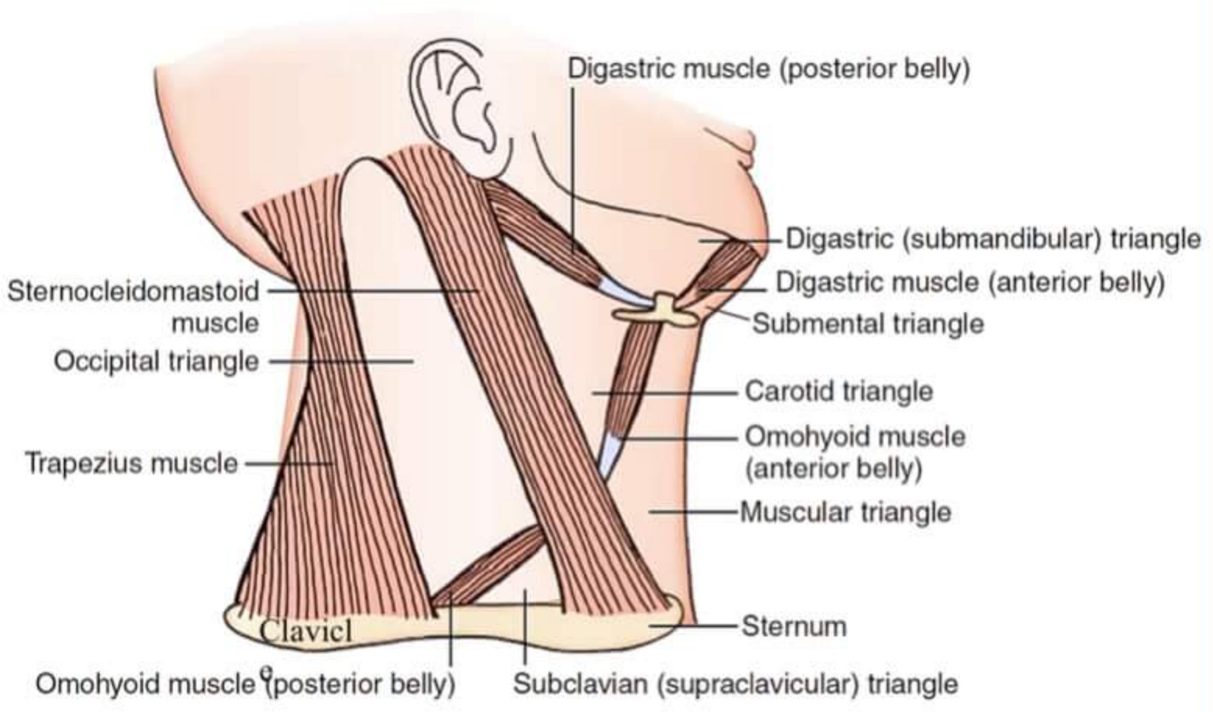
→ boundary line blw ant & post. triangles

→ Origin → sternum, clavicle

Insert^{n} → mastoid

POSTERIOR TRIANGLES

→ Pre vertebral fascia covers the floor of posterior triangle covers muscles Extends as Axillary sheath into axilla



→ Boundaries

→ Anteriorly → SCM

→ posteriorly → Trapezius

→ Base → middle 1/3 rd of Clavicle

→ Inferior belly of OMO HYOID Divides posterior Ale into 2 parts

1. Occipital triangle (larger)
2. Subclavian triangle (Smaller)

→ Brachial plexus block given in Subclavian triangle for multipe fracture pain

– 3rd part of Subclavian artery blocked here

ANTERIOR TRIANGLES

1 CAROTID TRIANGLE (bounded by Sup. belly of OH)
common carotid artery bifurcatn occurs here

2 DIGASTRIC TRIANGLE bounded by Digastric
Base → mandible

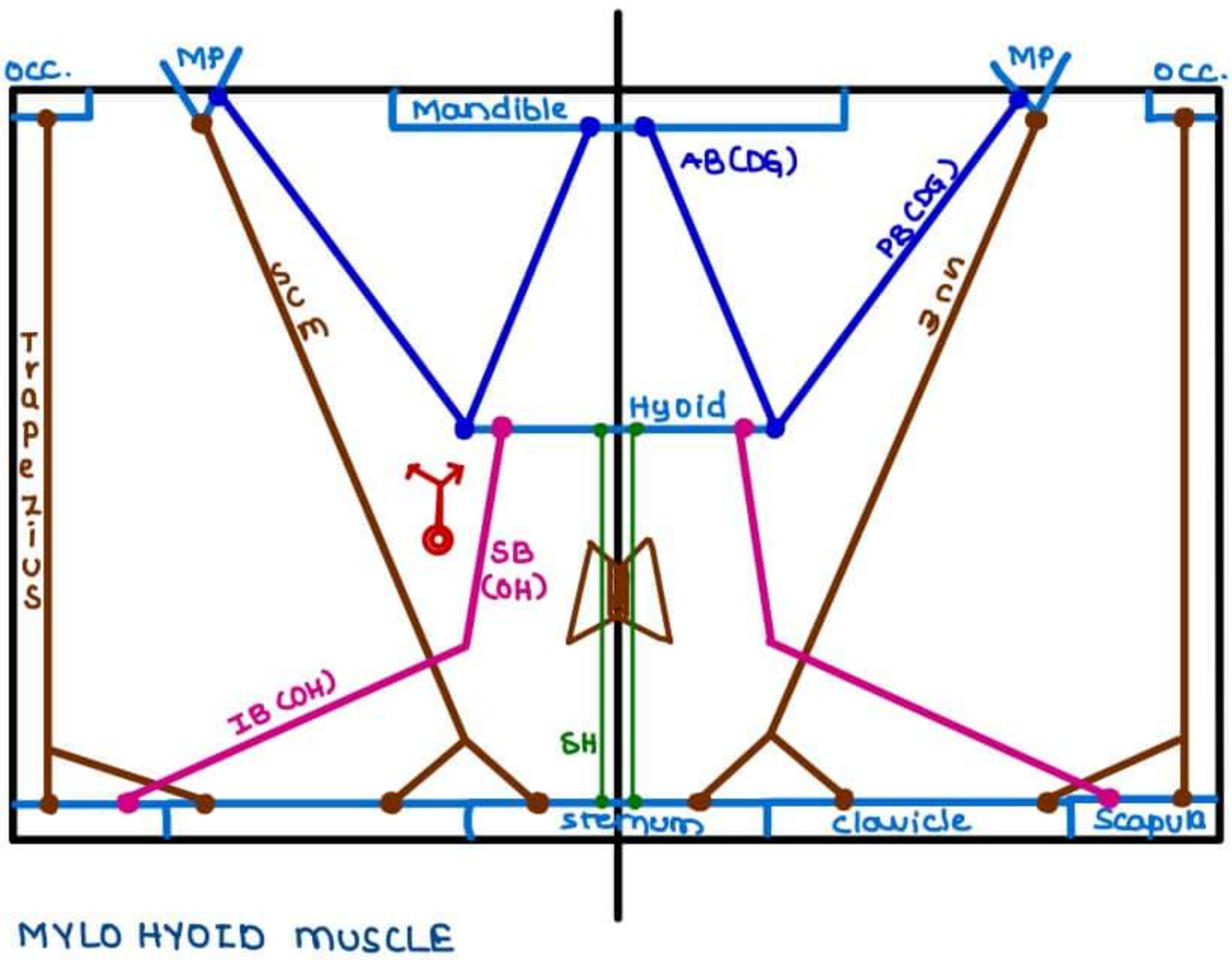
3 MUSCULAR TRIANGLE → Strap muscles (Anterior neck muscles) → Sternohyoid
Thyroid gland covered by strap muscles

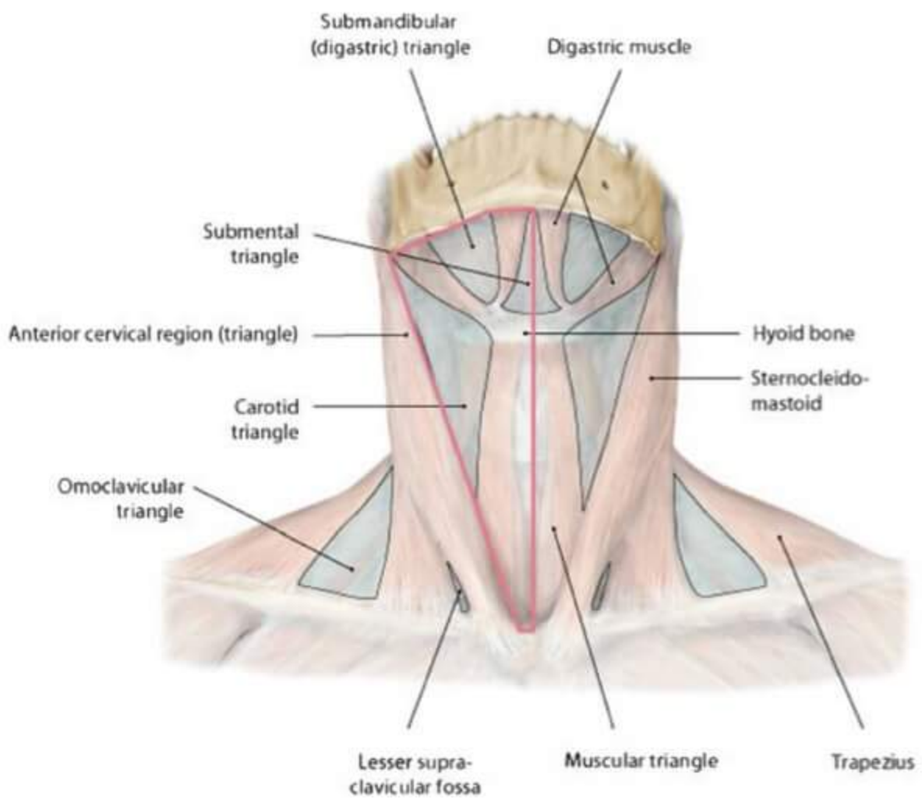
4 SUB MENTAL TRIANGLE → midline triangle under mentum of mandible
→ Boundaries – anterior belly of digastric on both sides
Base → Hyoid bone
→ Tip of Tongue drains into Sub mental LN
Submental LN can drain directly to Lower deep Cx or Submandibular LN

STERNOCLEIDOMASTOID

→ Origin → sternum, clavicle
Insertn → mastoid

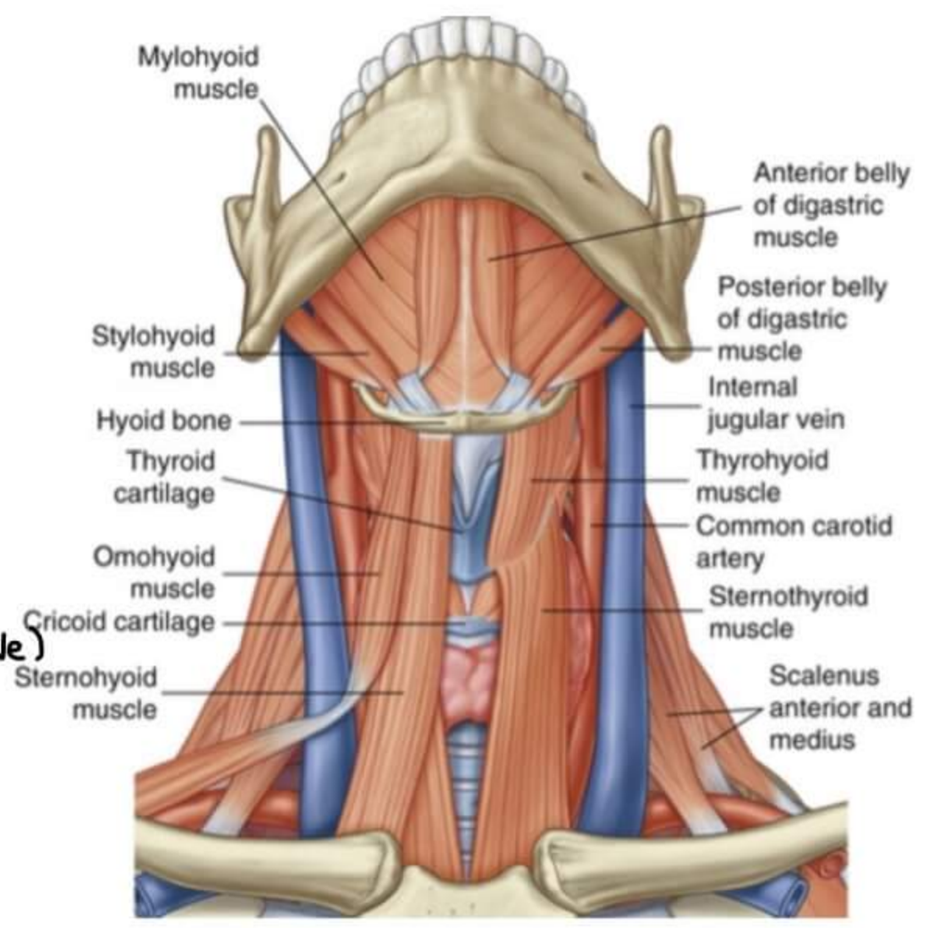
→ boundary line blw ant & post. triangles





MYLOHYOID MUSCLE

→ coming from mandible to hyoid bone
→ present at the floor of Mouth (Floor of DG Ale)
→ Depressor of mandle along ↑ AB of digastric



SUB MENTAL TRIANGLE

Base → Hyoid bone
Ant & post. belly of Digastric on either side

THYROID GLAND

→ Covered by STRAP MUSCLE (Sternohyoid)
→ present in ant. muscular Ale

CAROTID TRIANGLE

→ common cartoid artery bifurcuates into 2 branches
→ CCA Followed by Int. Jugular vein Outside
→ carotid Sheath covers Int. Jugular vein laterally, CCA & ICA medially & vagus nerve between & behind the vessels. Ansa cervicalis embeded anteriorly

→ Bounded by
- Superior belly of Omohyoid
- posterior belly of Digastric
- Sternomastoid

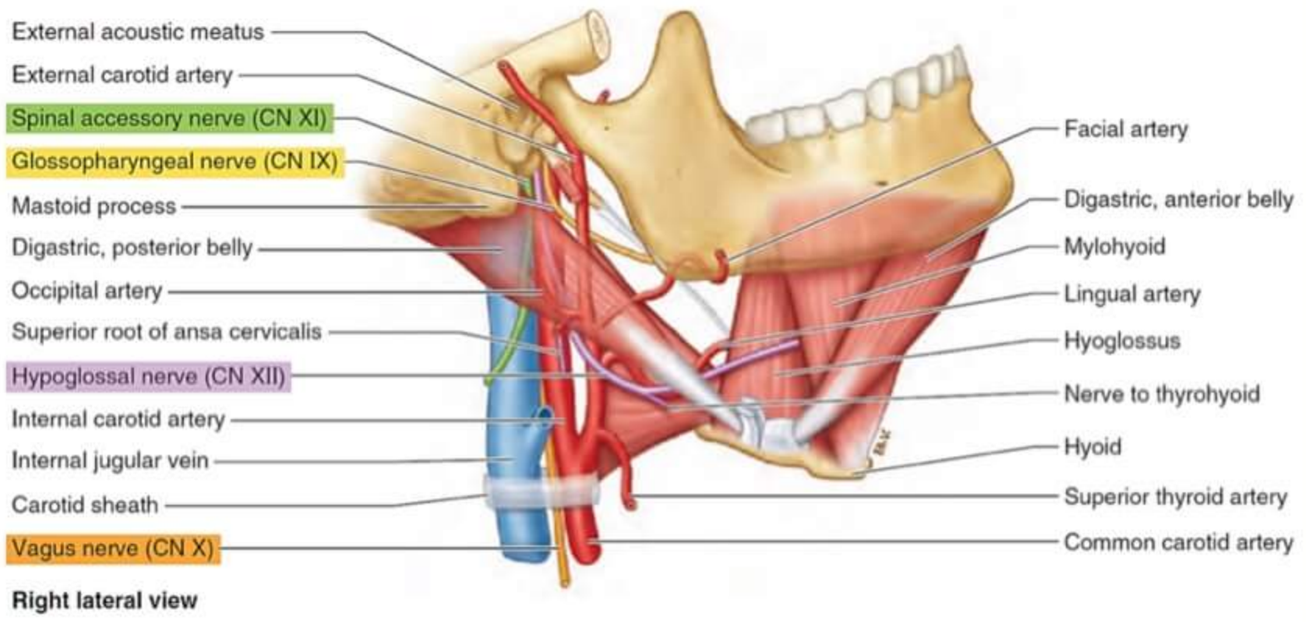
SUB CLAVIAN TRIANGLE

→ 3rd part of Subclavian artery can be blocked here Lateral to Scalenus ant.

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 floor is formed by hyoglossus muscle
d contains mylohyoid nerve & vessels

DIGASTRIC TRIANGLE

→ DIGASTRIC MUSCLE
- → Anterior belly
  - depressor of mandible
  - Origin → mandible
  - Insertn → hyoid
- → Posterior belly
  - attaches to hyoid & mastoid



Right lateral view

→ 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 Ale & goes to digastric Ale & supplies hyoglossus

CAROTID TRIANGLE

→ common cartoid artery bifurcuates into 2 branches
→ CCA Followed by Int. Jugular vein Outside
→ Bounded by
- Superior belly of Omohyoid
- posterior belly of Digastric
- Sternomastoid

→ CAROTID SHEATH

→ covers Int. Jugular vein laterally, CCA & ICA medially & vagus nerve between & behind the vessels

External carotid Artery present outside the sheath

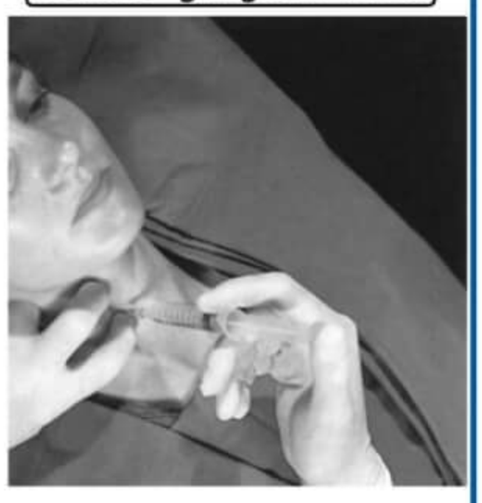
→ Ansa cervicalis embeded in anterior wall

→ Sympathetic chain present behind carotid sheath

→ Stellate ganglion block can be given here for Raynaud's phenomenon

STELLATE GANGLION BLOCK

Stellate ganglion block



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

POSTERIOR (OCCIPITAL) TRIANGLE

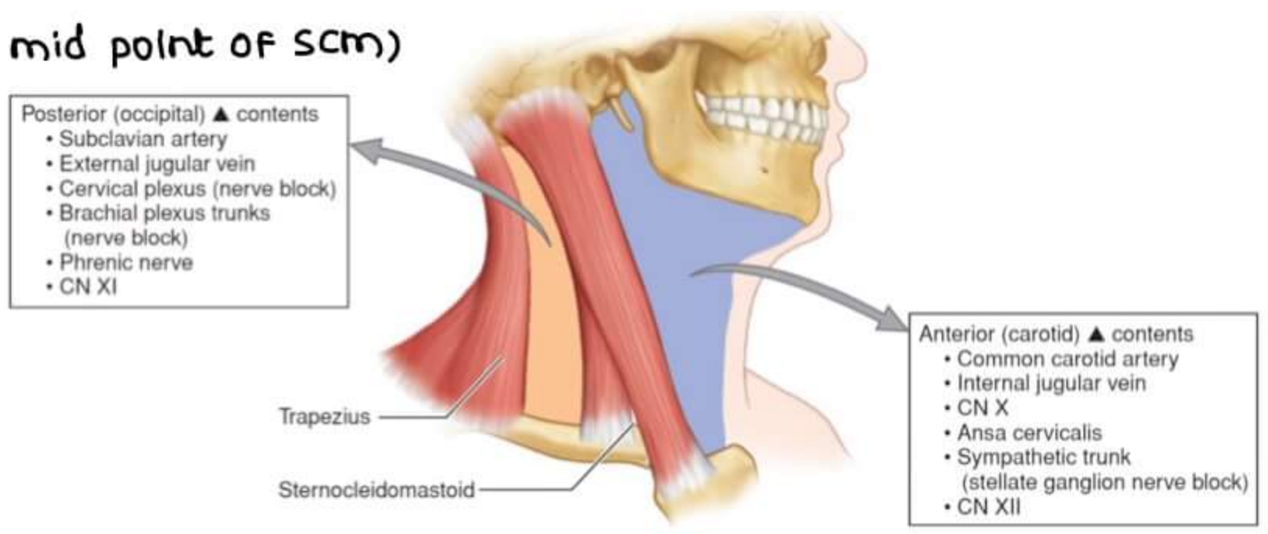
→ Brachial plexus trunks

→ Subclavian arterty

Brachial plexus block & Subclavian artery 3rd part block given in subclavian ab

→ cervical plexus (nerve block) (at mid point of SCM)

1. Greater Auricular Nerve
2. lesser occipital Nerve
3. Transverse nerve of neck
4. Supra Clavicular neck

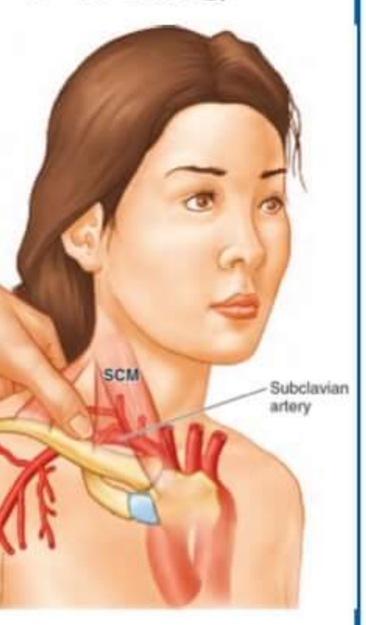


→ Spinal accessory nerve (CNXI)

→ supplies scm & Trapezius

→ In iatrogenic injury, Trapezius is paralysed (DIFFICULTY in shrugging of shoulder

(in nerve injury, distal area is involved)



→ External jugular vein

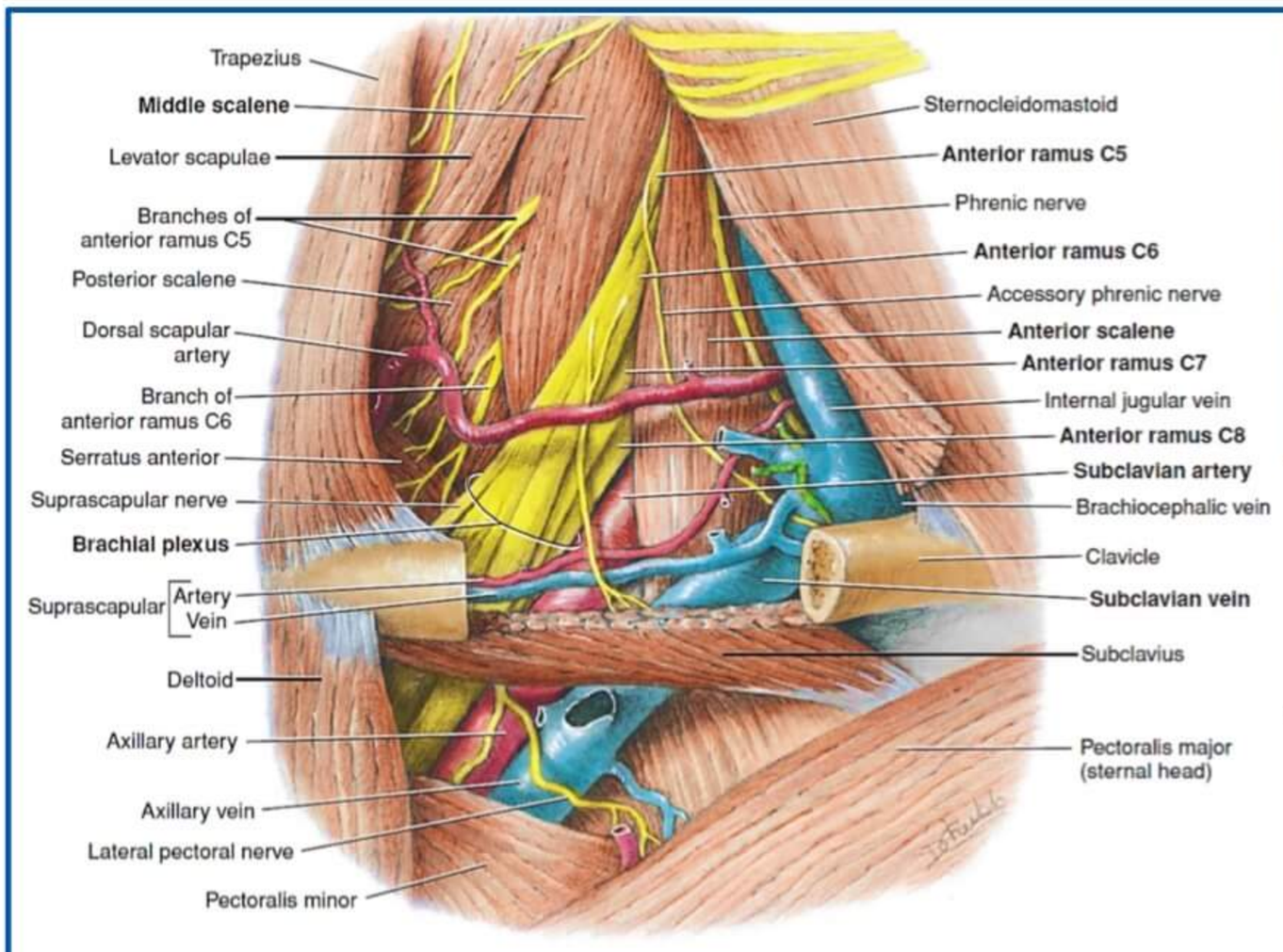
→ Phrenic nerve

→ don't block (risk of diaphragmatic paralysis)

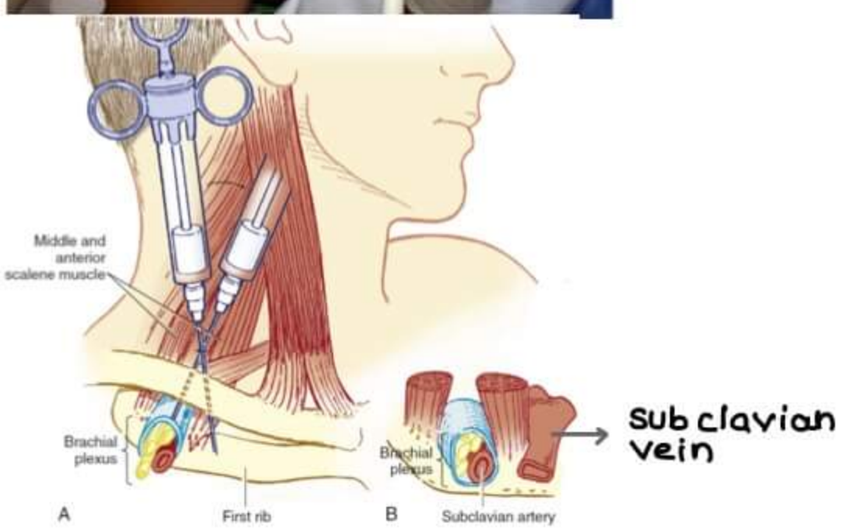
SUBCLAVIAN ARTERY (3rd part) BLOCK

→ runs on superior surface of 1st rib

→ Lateral to scalenus anterior & scm pressure given by thumb



Supra clav - icular Block



Sub clavian vein

AXILLARY SHEATH

→ Continuatⁿ of prevertebral fascia into axilla

→ CONTENTS

- Brachial plexus
- Axillary Artery

→ Axillary vein is outside the axillary sheath

Cervical plexus nerve block

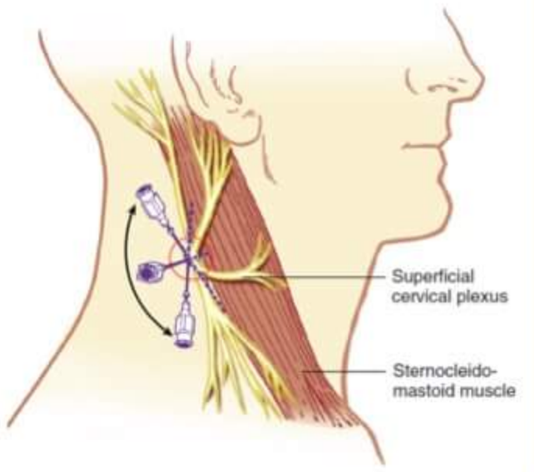


Figure 57-1. Anatomic landmarks and method of needle placement for a superficial cervical plexus block.

PHRENIC NERVE

→ Br. of cervical plexus

→ coming from posterior border of sternomastoid to ant. border of sternomastoid

→ runs on ant. surface of Scalenus anterior

→ Supplies Diaphragm

→ carries sensation from central portion of Diaphragm

central pleura
central pericardium
central peritoneum
} mediastinal portion

Q IF there is a superficial cut in the region of middle part of posterior Δle of neck, patient will experience problem in

a Adduction of arm

b Protractⁿ of Scapula

c Shrugging of Shoulder (BETTER ANSWER)

d Overhead abduction of arm (along ī Serratus anterior)

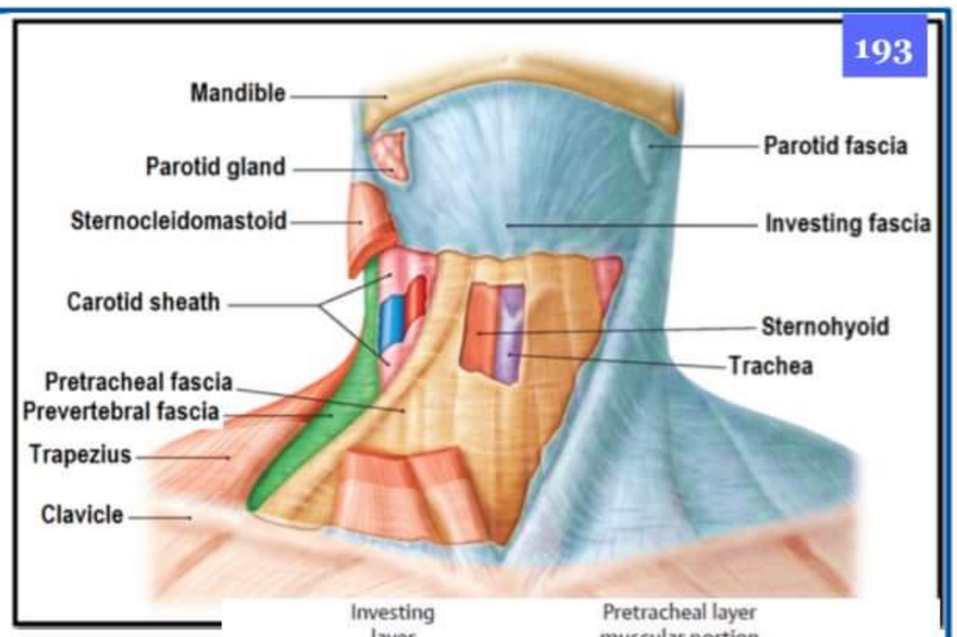
NECK FASCIA & SPACES

CERVICAL FASCIA

DEEP CERVICAL FASCIA

1. INVESTING FASCIA [most superficial]
2. PRE TRACHEAL FASCIA
3. PRE VERTEBRAL FASCIA [at floor of post. Δle]

All 3 fascia contributes to CAROTID SHEATH



INVESTING FASCIA

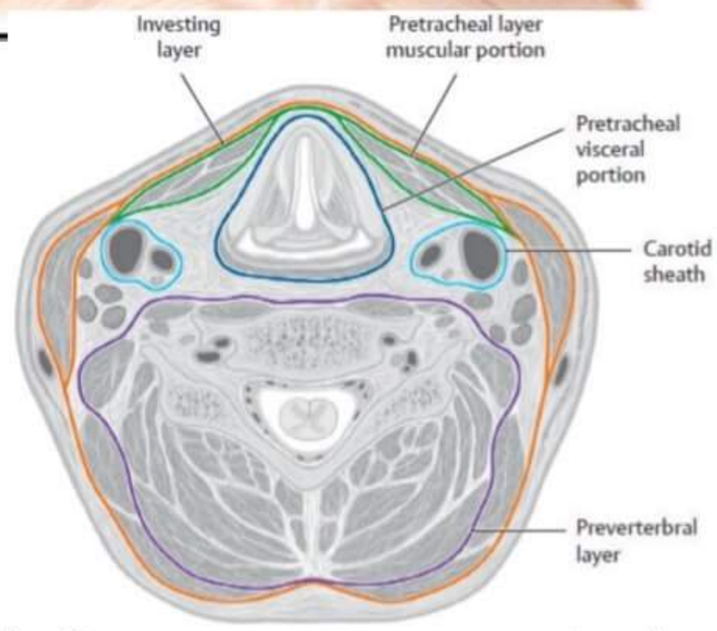
→ Forms roof of post. Δle

→ Bounded by

SCM (anterior)

Trapezius (posterior)

→ Split & enclose scm & Trapezius and goes all around the neck circumferentially



PRE VERTEBRAL FASCIA

→ Forms floor of post. Δle & covers Scalenus medius

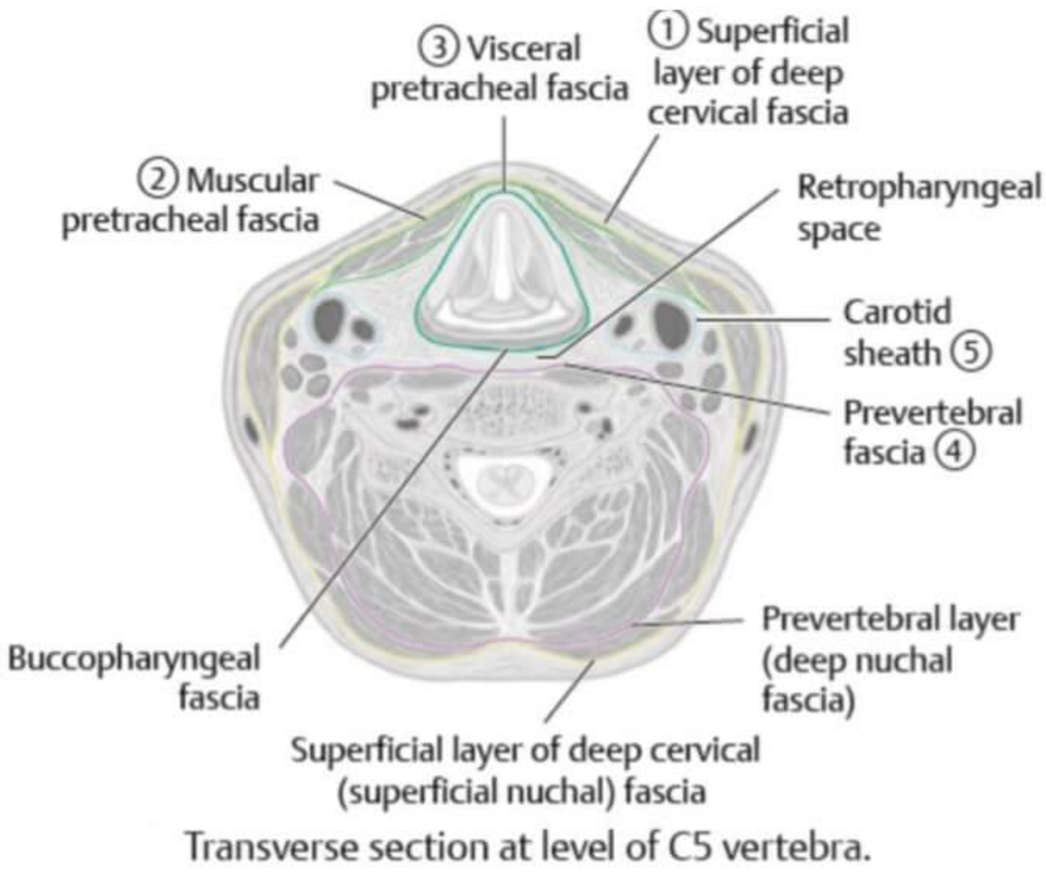
PRE TRACHEAL FASCIA

→ goes behind pharynx & oesophagus → Circumferential → BUCCOPHARYNGEAL FASCIA

→ has multiple layers

→ encloses trachea & oesophagus
ant. neck muscles
thyroid gland

→ carotid sheath contributed by
Pre vertebral (posterior)
Pre tracheal (anterior)
Investing fascia (lateral)



Transverse section at level of C5 vertebra.

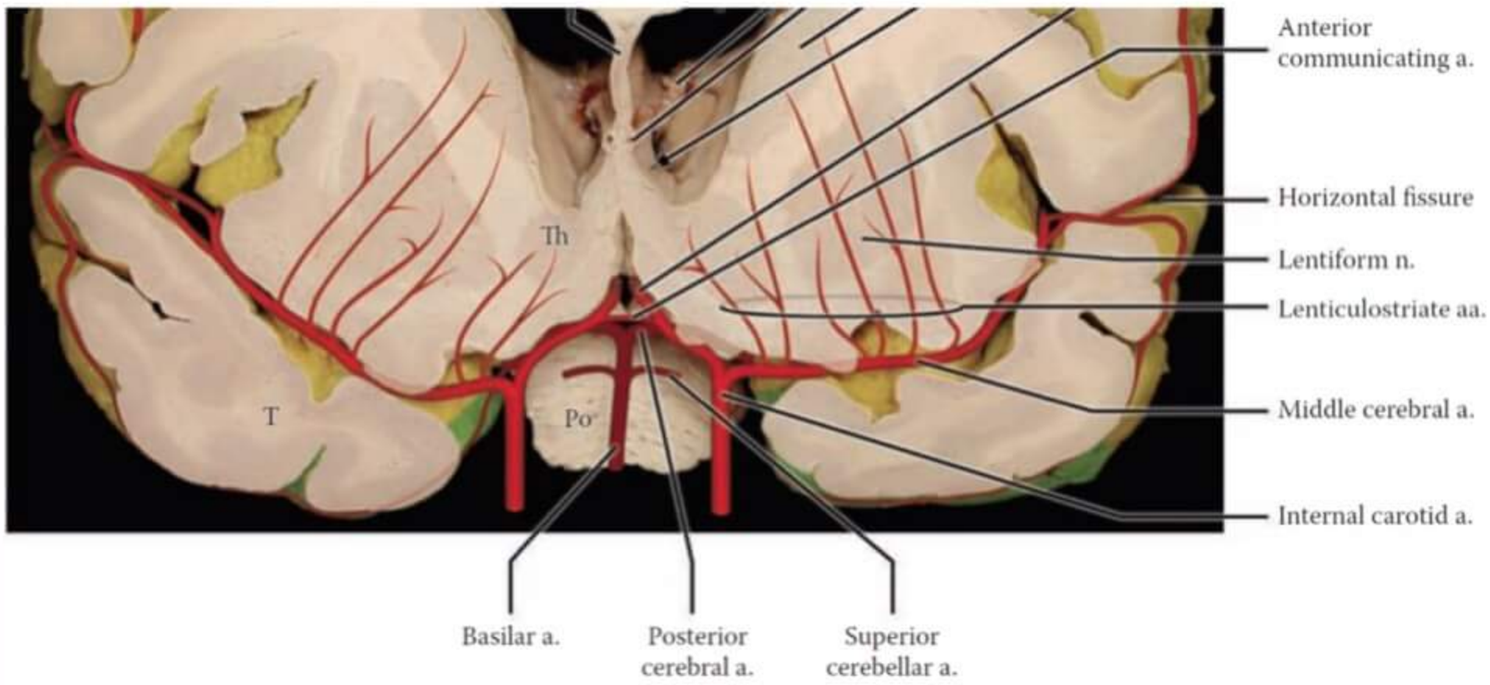
INVESTING FASCIA

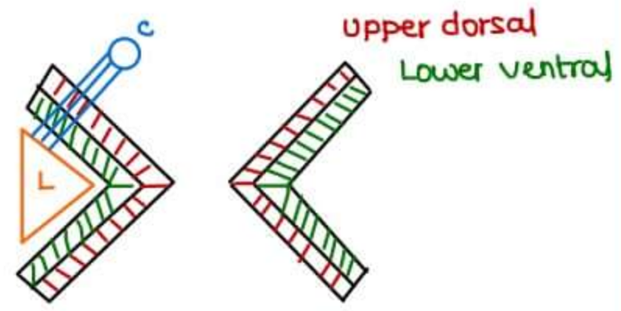
PREVERTEBRAL FASCIA

PRE TRACHEAL FASCIA

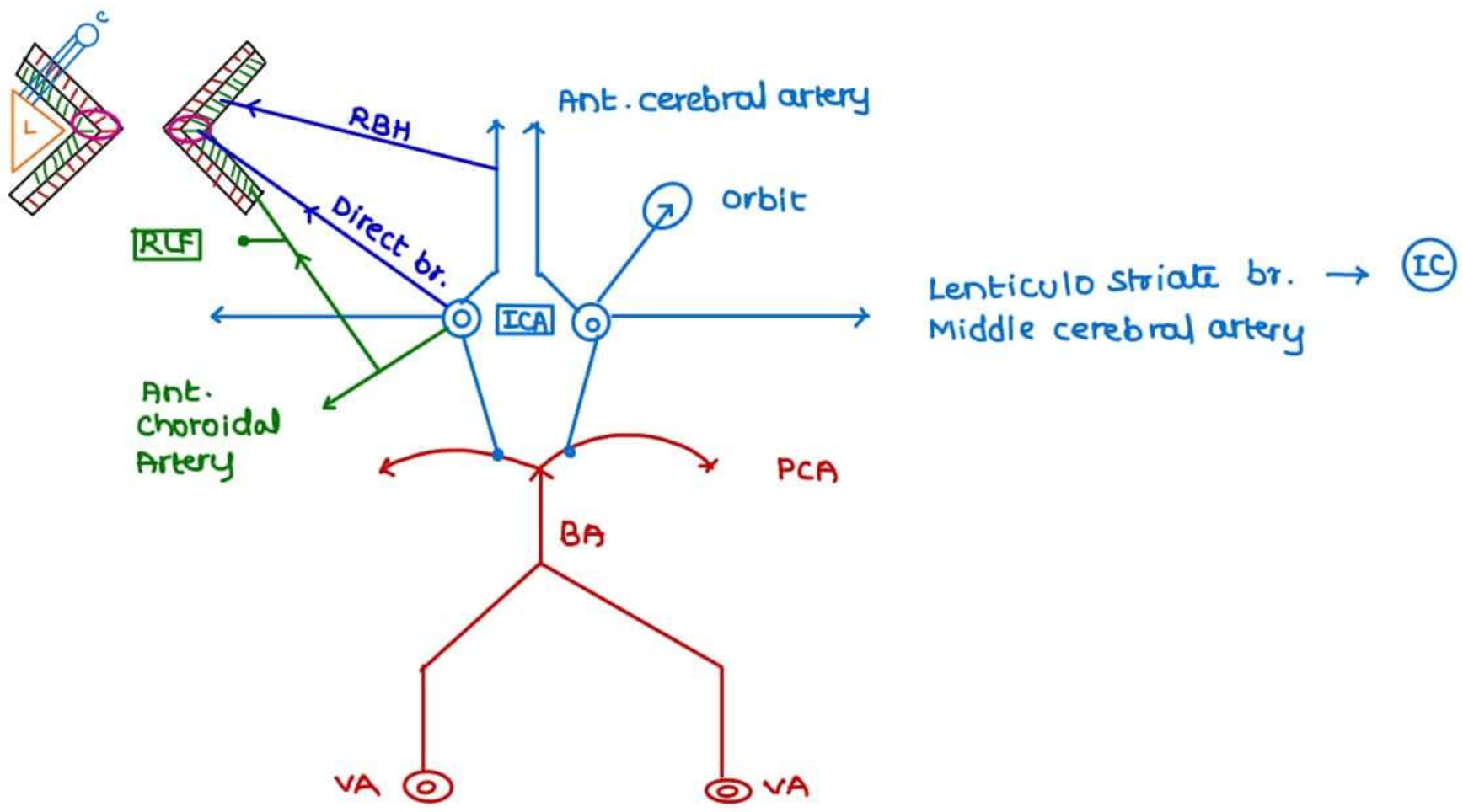
→ Goes antero lateral to trachea

→ Continues posteriorly around pharynx & oesophagus as BUCCOPHARYNGEAL FASCIA





BASAL GANGLIA
UPPER DORSAL IC
} Supplied by Lenticulo striati branches



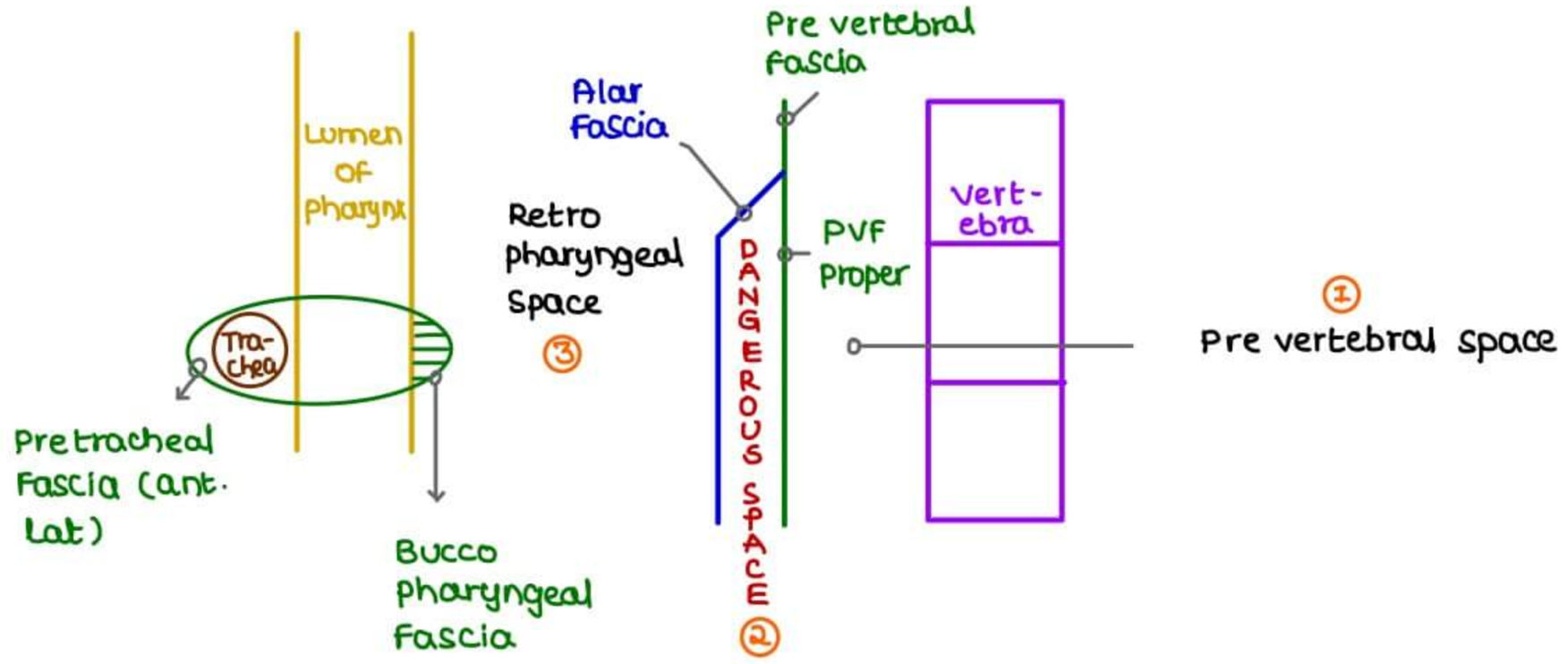
LOWER VENTRAL PART OF IC Supplied by

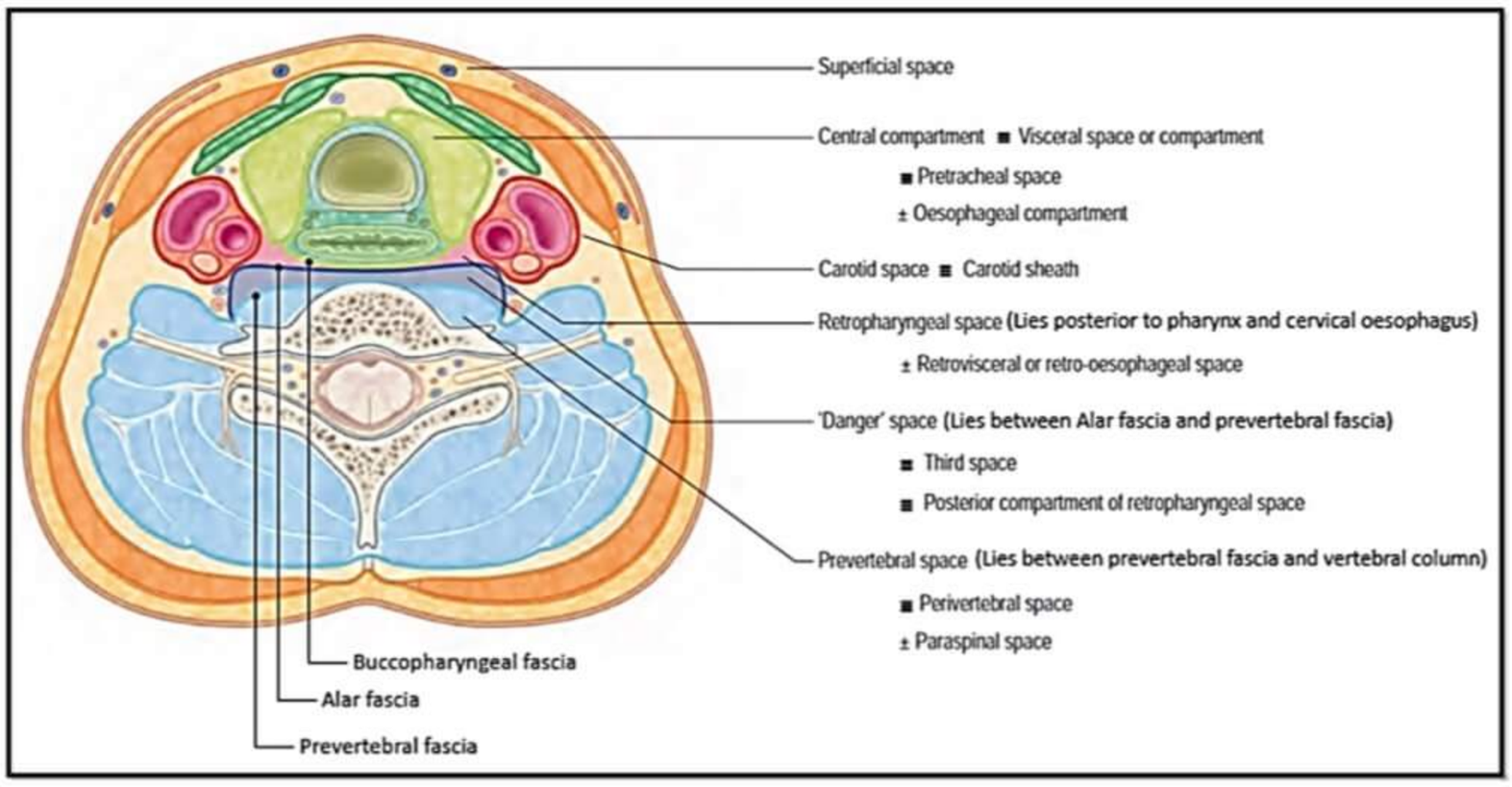
- Anterior Limb → Recurrent branch of Heubner [Ant. cerebral artery branch]
- Genu → Direct branch from ICA
- Posterior Limb → ant. choroidal arterty [ICA Branch]
  - also supplies retrolentiform fibres

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 Sublentiform part → Heubner's artery

Anterior choroidal Artery supplies the Sublentiform / posterior limb of IC





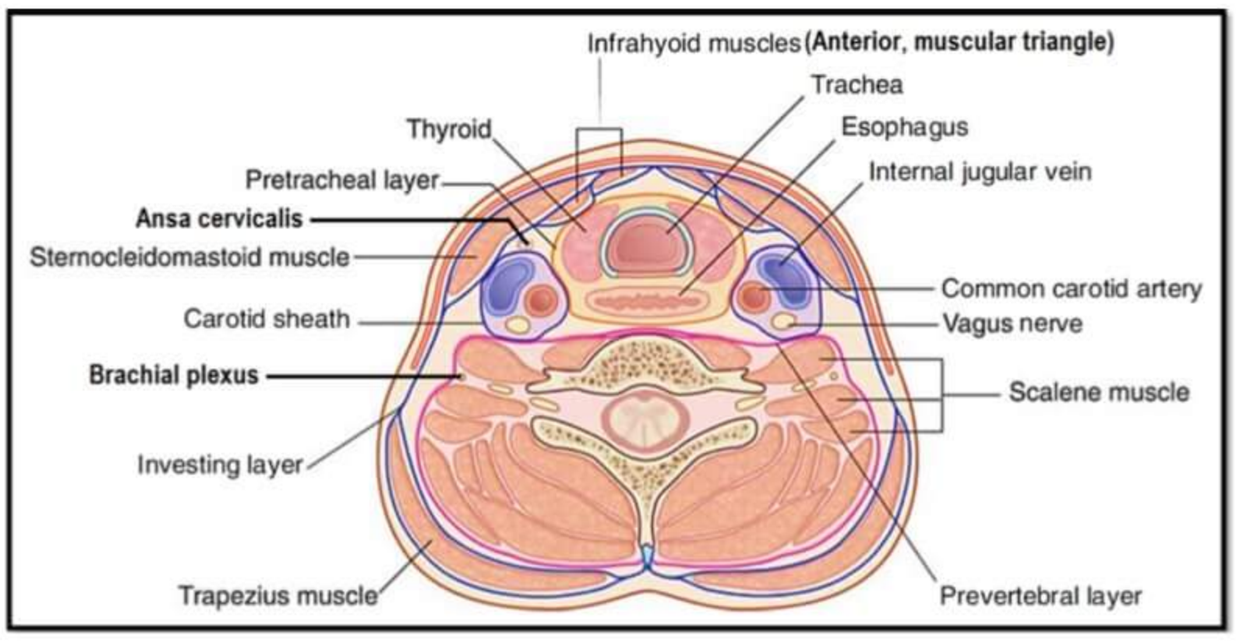
Q Dangerous Space situated b/w

a Pre vertebral & Bucco pharyngeal fascia

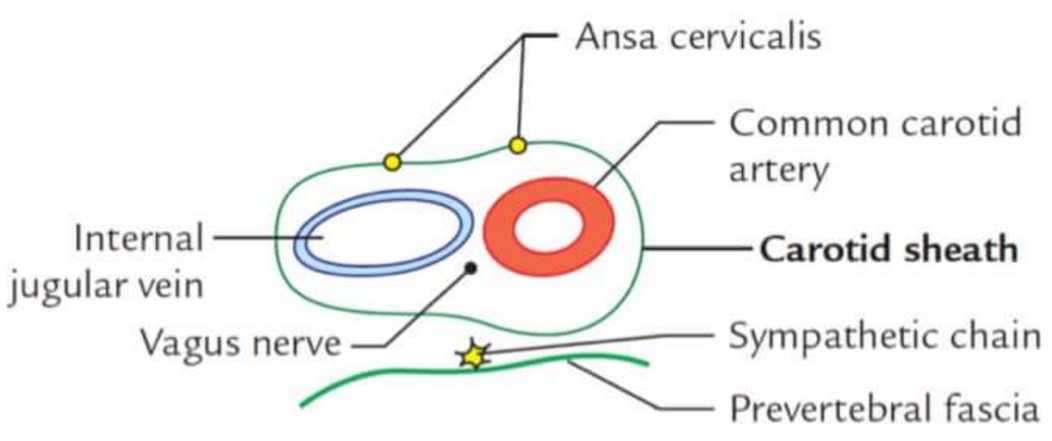
b Pre vertebral & Pharyngo basilar fascia

c Pre vertebral & alar fascia

d Bucco pharyngeal & pharyngo basilar fascia



CAROTID SHEATH CONTENTS



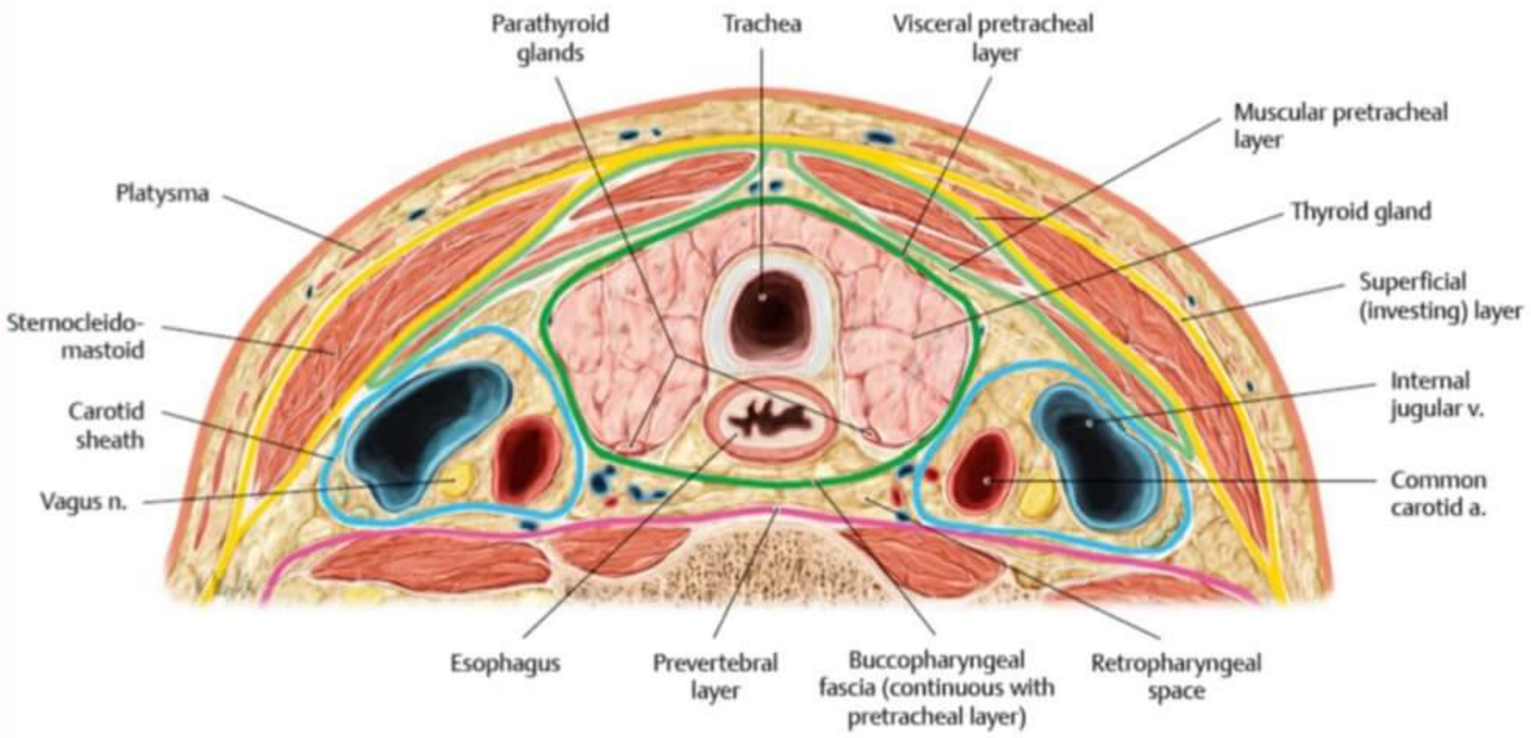
BRACHIAL PLEXUS

→ present at floor of post. Axle

→ present in interscaleni triangle (b/w Sc.anterior & Sc. medius)

→ pulls the prevertebral fascia into axilla → AXILLARY SHEATH

→ present behind & lateral to Scalenus anterior (most posterior)



VAGUS NERVE

→ content of carotid sheath

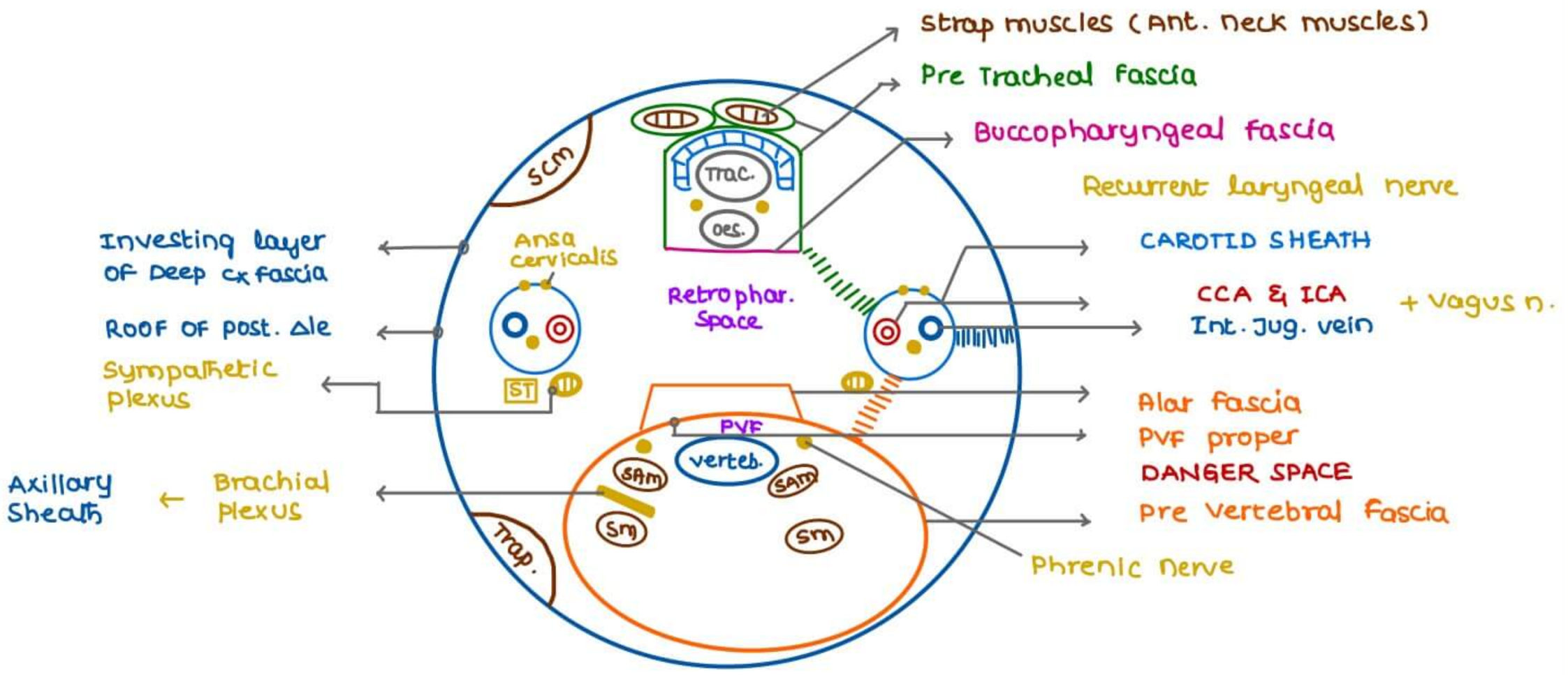
→ Gives recurrent laryngeal nerve, which runs in tracheo-oesophageal groove

PHRENIC NERVE

→ ant. to Scalenus anterior

→ Sclanenus anterior covered by prevertebral fascia

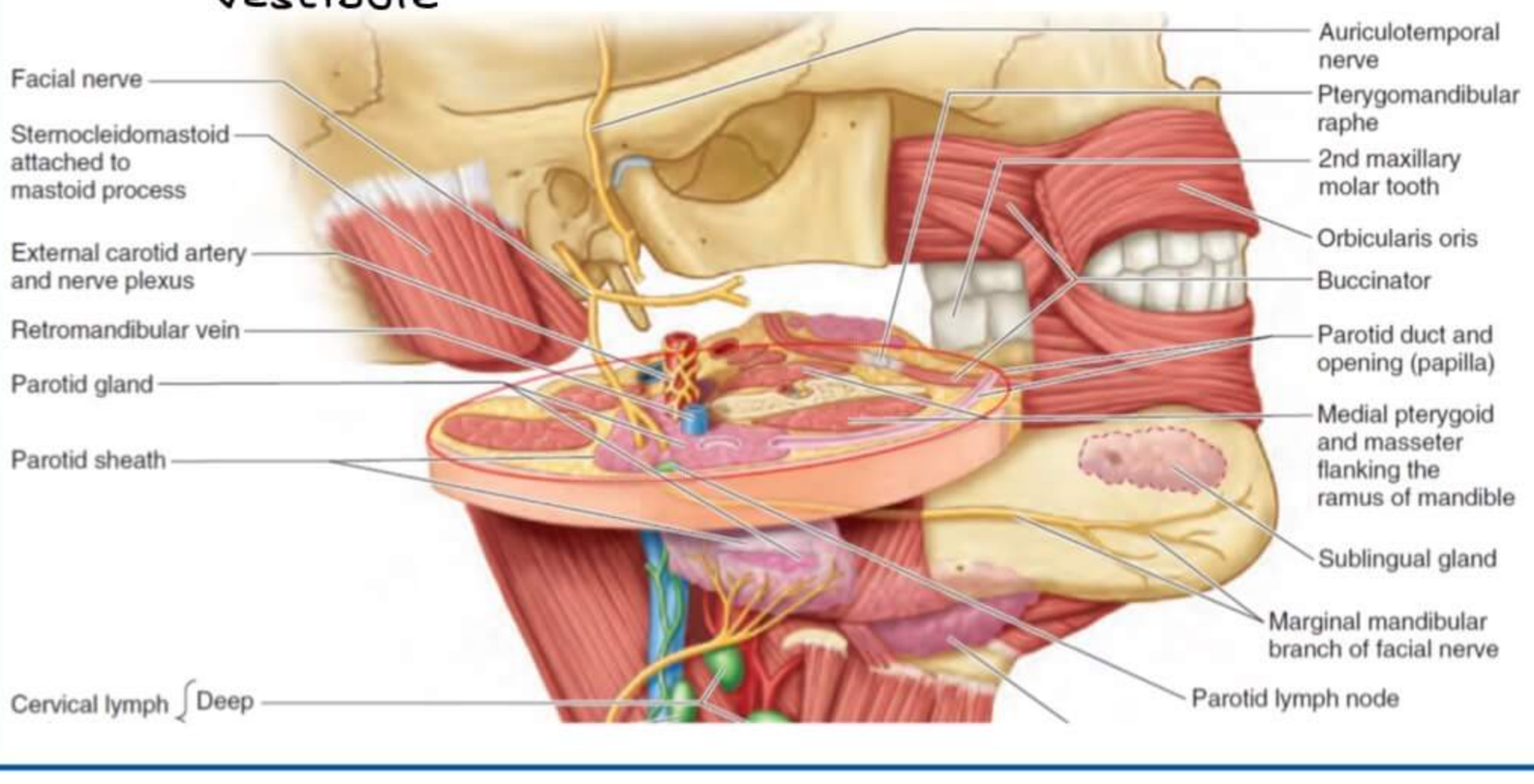
SYMPATHETIC CHAIN → present behind carotid sheath



PAROTID GLAND

→ Largest salivary gland

→ Stenson's duct of parotid gland opens opposite the upper 2nd molar in vestibule



RELATIONS

Deeper → Pharynx

Anterior → mandible

Behind → Mastoid

ANTERIOR → ramus of MANDIBLE

→ Masseter inserted on lateral surface

→ Medial pterygoid inserted on medial surface

POSTERIOR → MASTOID BONE

→ Scm inserted on lateral side

→ Post. Belly of Digastric inserted on medial surface

STRUCTURES PASSING THROUGH PAROTID GLAND

RETROMANDIBULAR VEIN → passes through parotid gland

EXTERNAL CAROTID ARTERY

SYMPATHETIC PLEXUS (alw ECA)

FACIAL NERVE

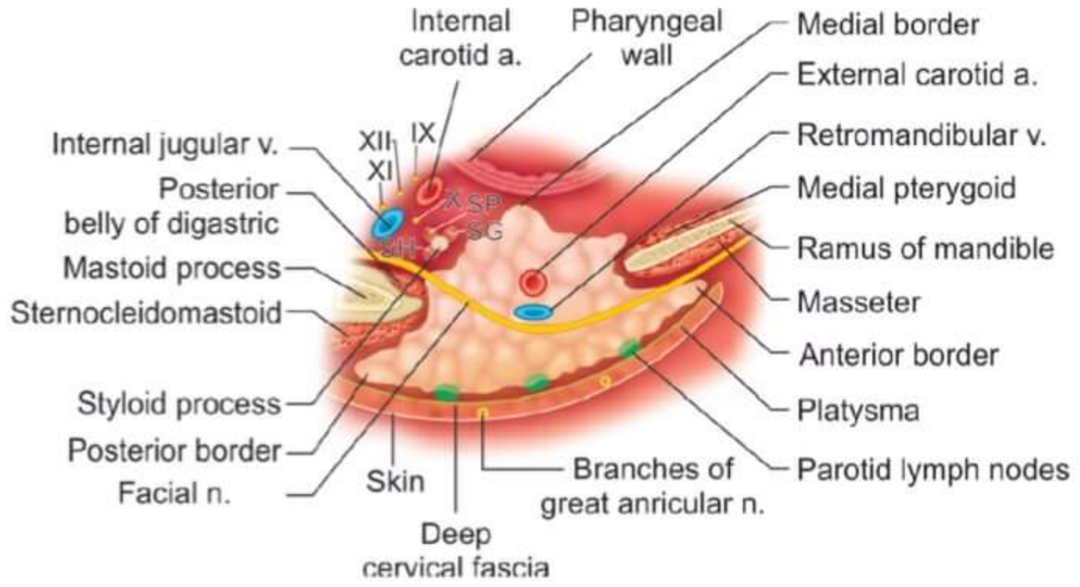
→ passes in the middle of gland

→ do not supply parotid gland

→ creates a Surgical plane

→ Deep → LN are less

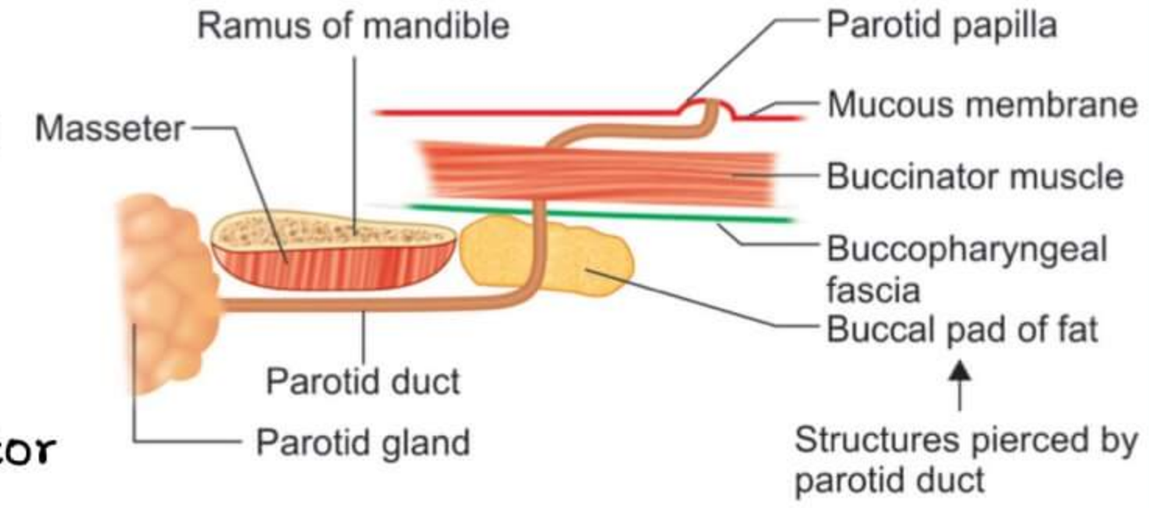
→ Superficial → LN are more

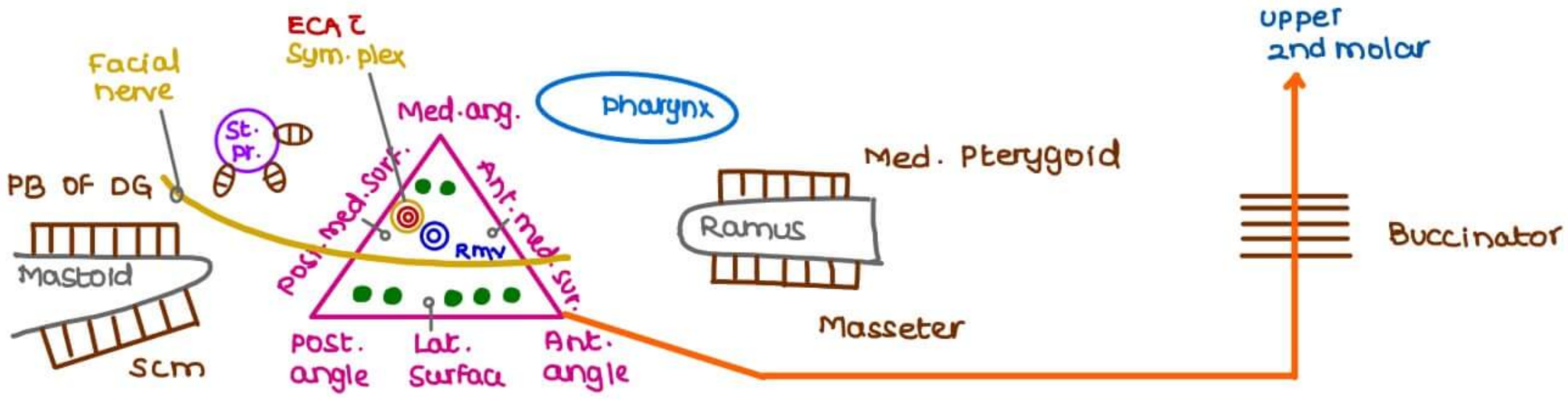


MEDIAL → PHARYNX

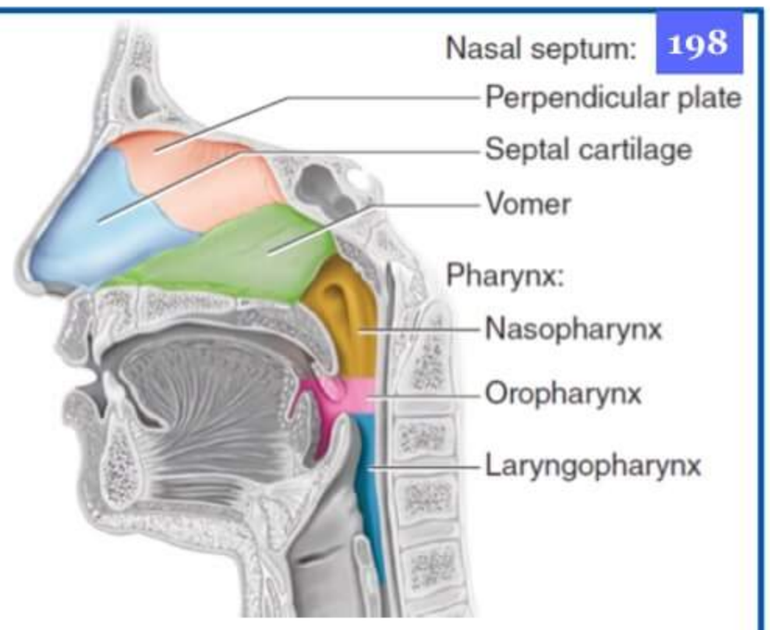
→ Styloid process related to Parotid gland

→ Stenson's duct of parotid passes lateral to masseter & pierces buccinator to open opp. the upper 2nd molar





PHARYNX



NASOPHARYNX CONTENTS

- → opening of ET
  - → present behind the inferior turbinate in lateral wall of nose
- → Fossa of Rosenmuller
  - → behind opening of ET
- → Adenoids

OROPHARYNX CONTENTS

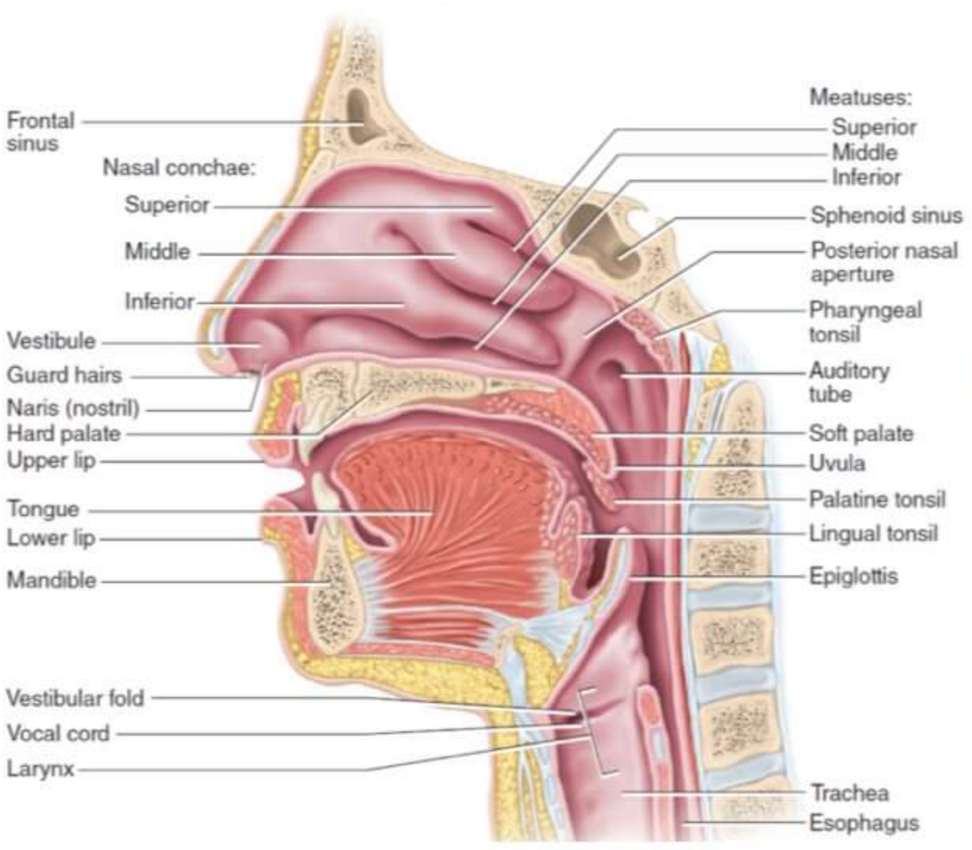
PALATINE TONSIL

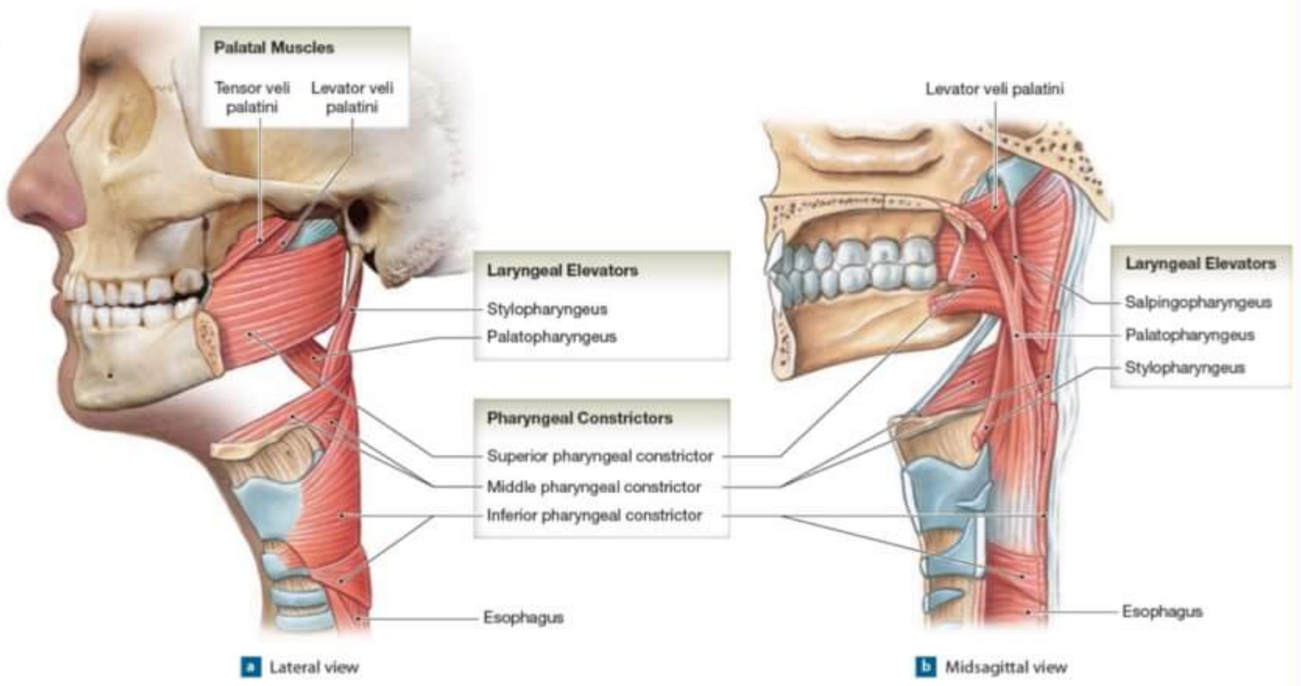
PASSAVANT'S RIDGE

- → closing mechanism of oropharynx from nasopharynx
- → formed from superior pharyngeal constrictor ĩ Palatopharyngeus muscle
- → avoids food entering into nasopharynx

LARYNGOPHARYNX

- → PYRIFORM fossa
  - → present lateral to aryepiglottic fold
  - → Filled ĩ saliva in painful situations (Tonsilitis)
  - → Lateral to midline
  - → entry point of Larynx





PHARYNGEAL CONSTRICTORS

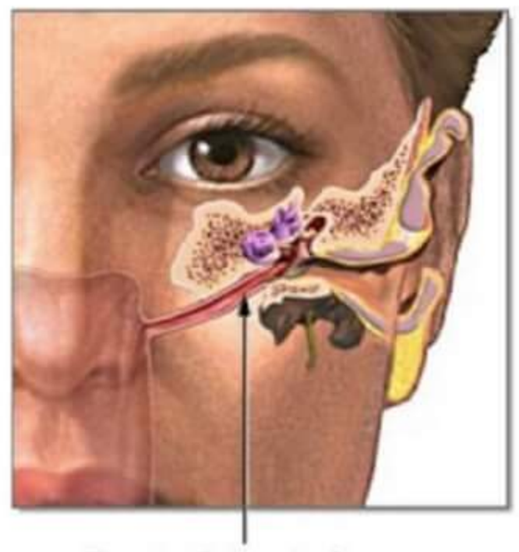
SUPERIOR PHARYNGEAL CONSTRICTOR

MIDDLE PHARYNGEAL CONSTRICTOR

INFERIOR PHARYNGEAL CONSTRICTOR

LEVATOR VELI PALATINI

- → elevates palati
- → opens Eustachian tube
- → comes along ĩ ET in Sinus of morgagni

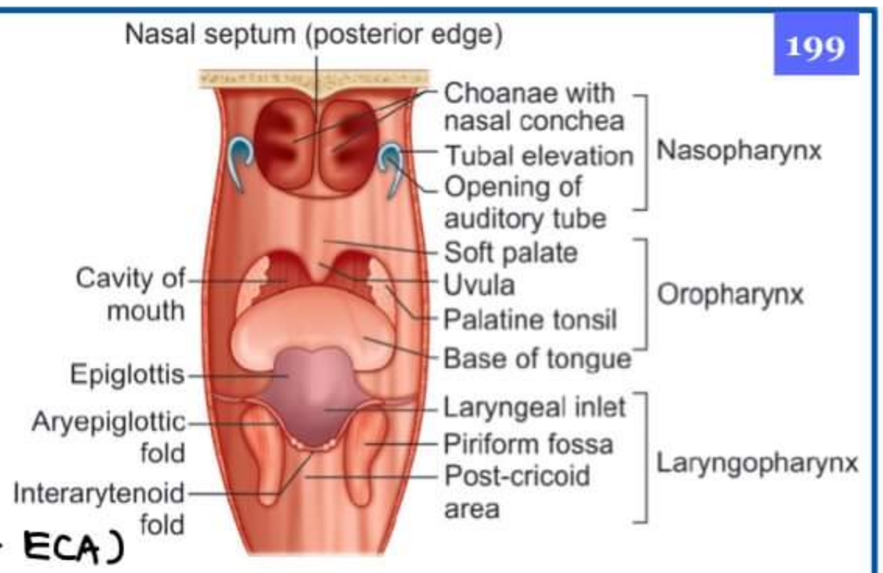


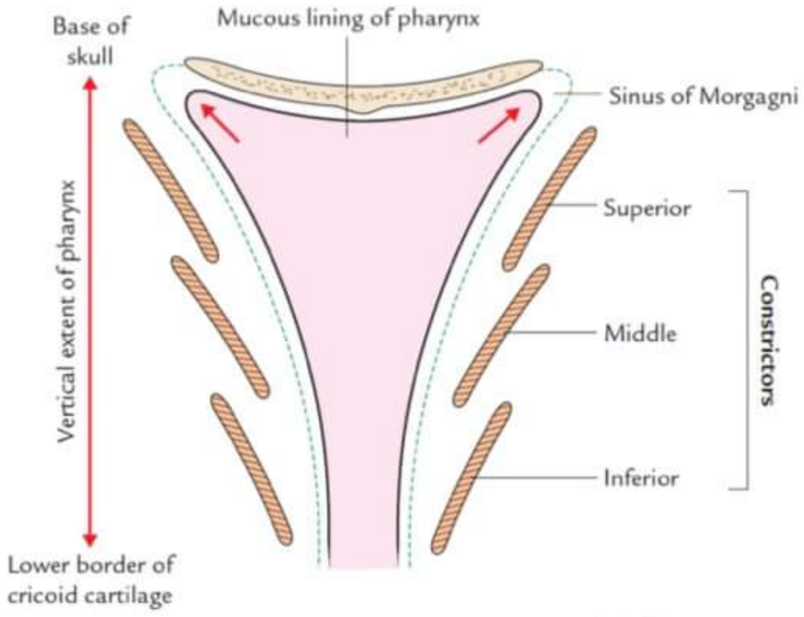
SINUS OF MORGAGNI

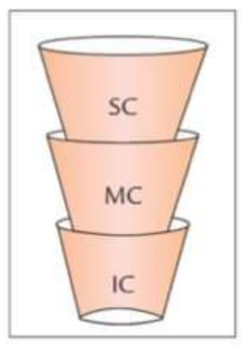
→ Space blw Base of skull & Superior pharyngeal constrictor

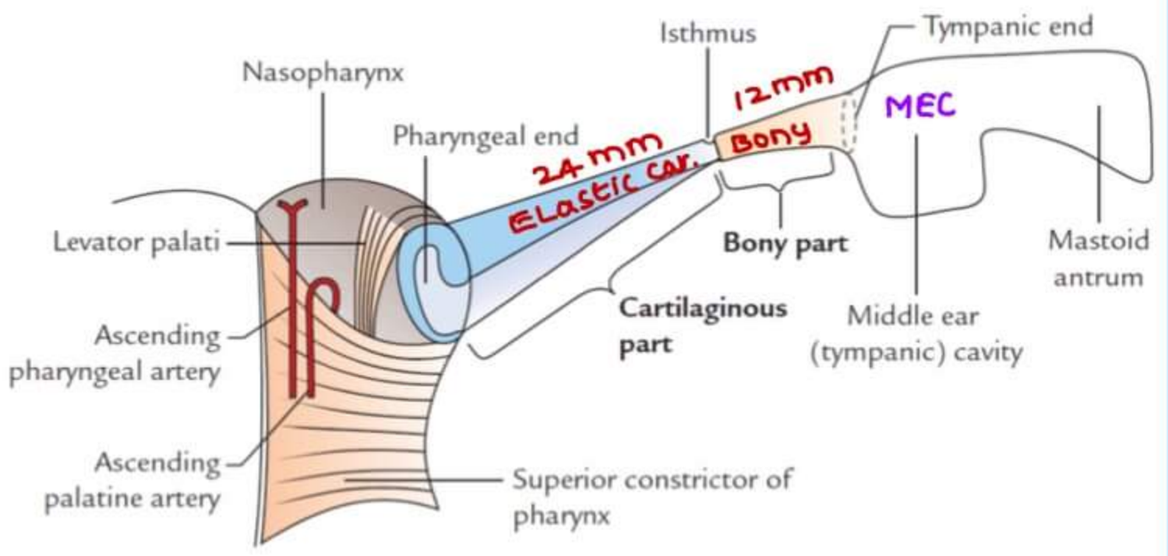
→ STRUCTURES PASSING THROUGH SOM

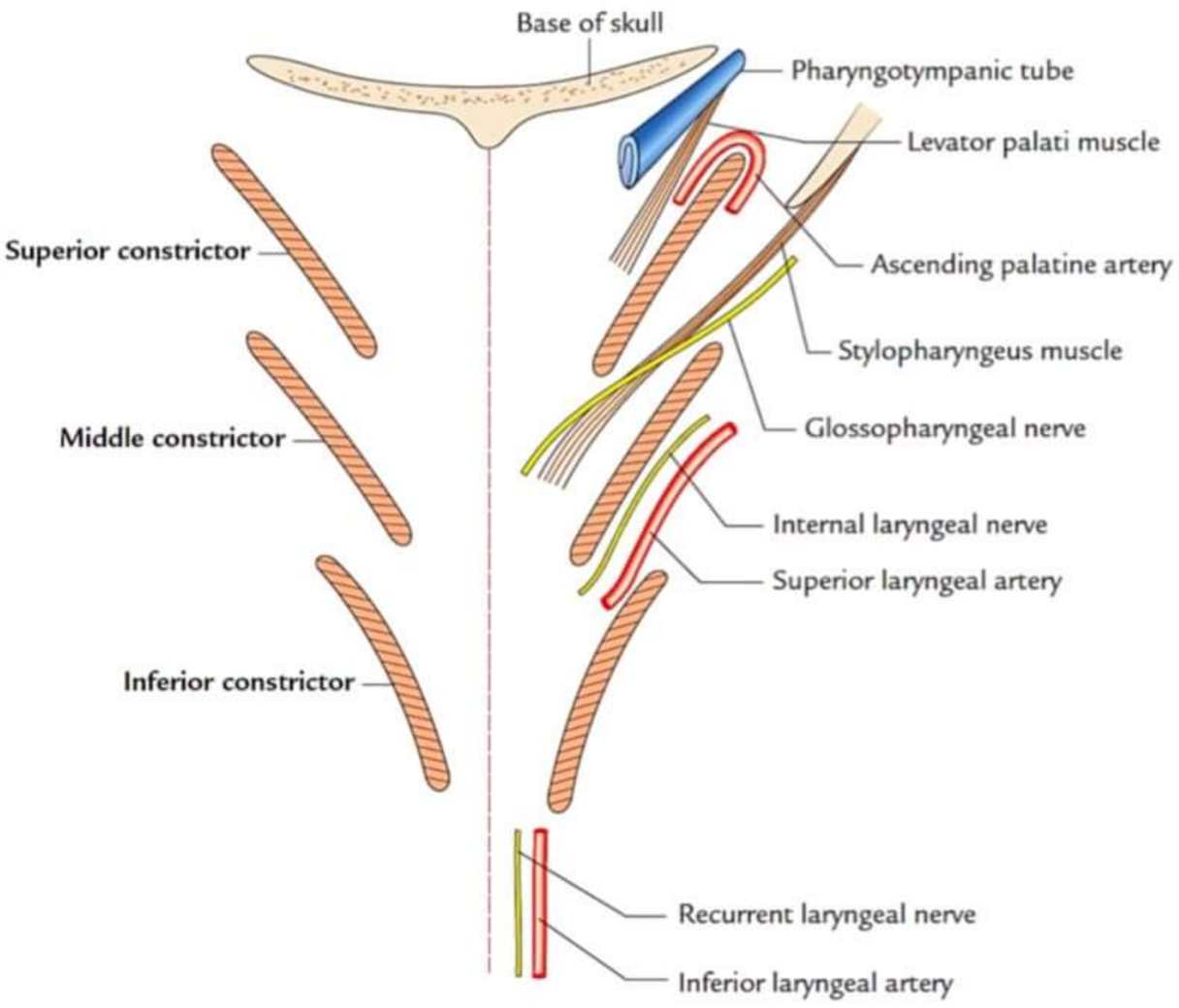
1. Eustachian tube
2. Tensor veli palati
3. Ascending pharyngeal artery (medial br. of ECA)
   → Supplies ET & pharynx and tonsil
4. Ascending Palatine artery (br. of facial artery)











STYLOPHARYNGEUS MUSCLE

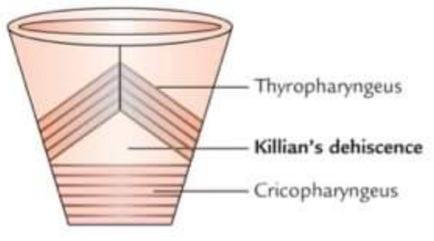
→ elevator of pharynx
→ Supplied by Glossopharyngeal n.
→ Only musle developed from 3rd arch
→ passes blw Sup & mid. Constrictor

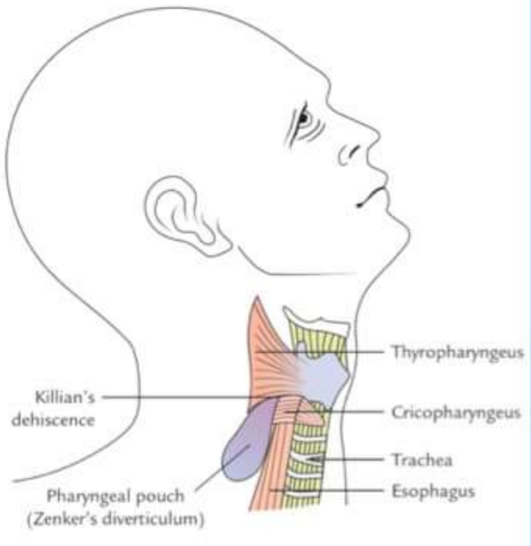
INTERNAL LARYNGEAL NERVE
SUPERIOR LARYNGEAL ARTERY
} present blw middle & inf. constrictor

Blw Esophagus & Larynx
→ Recurrent Laryngeal Nerve in tracheo oesophageal groove
→ Inferior laryngeal artery

ZENKER'S DIVERTICULUM

→ pharyngeal pouch coming from Killian dehiscence
→ INFERIOR PHARYNGEAL CONSTRICTOR
   → Thyropharyngeus muscle
   → Cricopharyngeus muscle
   → KILLIAN DEHISCENCE
      → post. deficiency present blw above 2 muscles





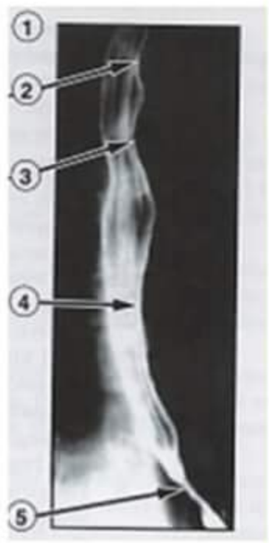
Q Marker 4 in the following diagram shows oesophageal narrowing produced by

a Cricopharyngeal Sphincter

b Arch of Aorta

c Left principal Bronchus

d Left atrium



BARIUM RADIOGRAPHY → NARROWINGS

Marker 1 → at Beginning of oesophagus d/t cricopharyngeus Sphincter

→ Narrowest lumen of oesophagus

Marker 2 → d/t arch of aorta passing infront of oesophagus

Marker 3 → d/t Lt principal bronchus infront of oesophagus

Marker 4 → d/t Lt atrium of the heart lying infront of Oesophagus

→ seen d/t Lt atrial hypertrophy

Marker 5 → While oesophagus is passing through diaphragm

TRANSESOPHAGEAL ECHOCARDIOGRAPHY → Lt atrium seen first

→ mcly evaluated is LA

LEVELS FROM UPPER INCISIOR

15 cm (C_6) → d/t cricopharyngeus Sphincter

23 cm → d/t aortic arch

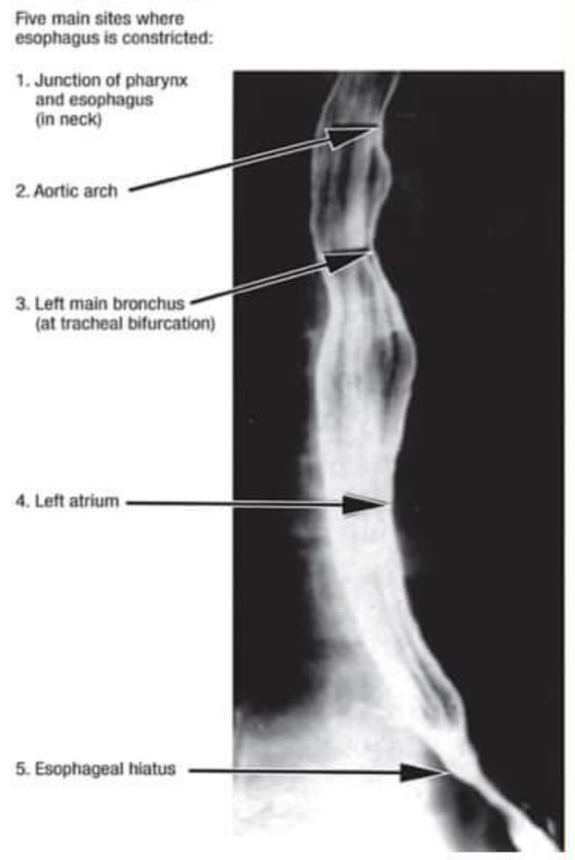
28 cm → Lt main Bronchus

25 cm (b/w T_4 & T_5) → BRONCHO AORTIC CONSTRICTION

– → Lt atrium

40 cm (T_{10}) → While passing through diaphragm

at T_{11} continues as Stomach



OESOPHAGUS

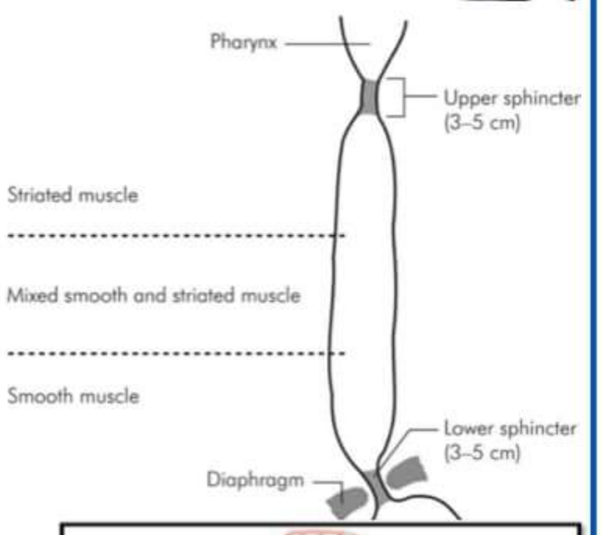
Divides into

Cervical part

Thoracic part

Abdominal part

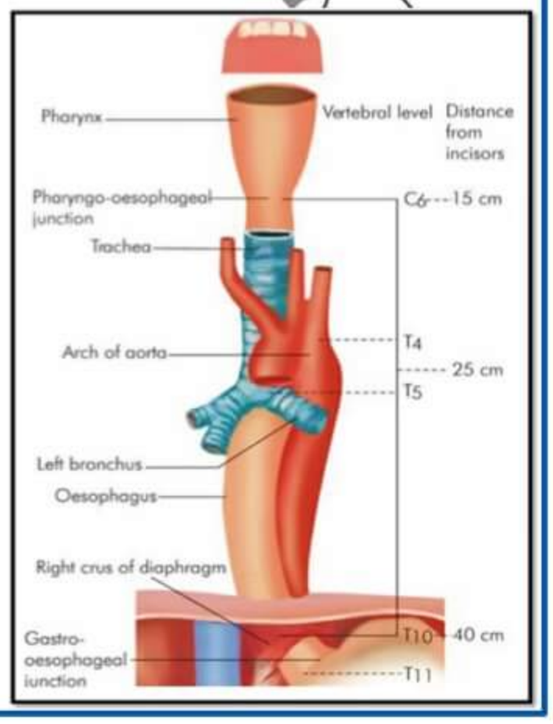
Site of constriction	Vertebral level	Distance from upper incisor
Beginning (pharyngo-oesophagus junction)	C6	15 cm
Aortic arch	T4	23 cm
Left principal bronchus	T6	28 cm
Esophageal hiatus in diaphragm	T10	40 cm



SPHINCTERS

UPPER OESOPHAGEAL SPHINCTER (3-5 cm)

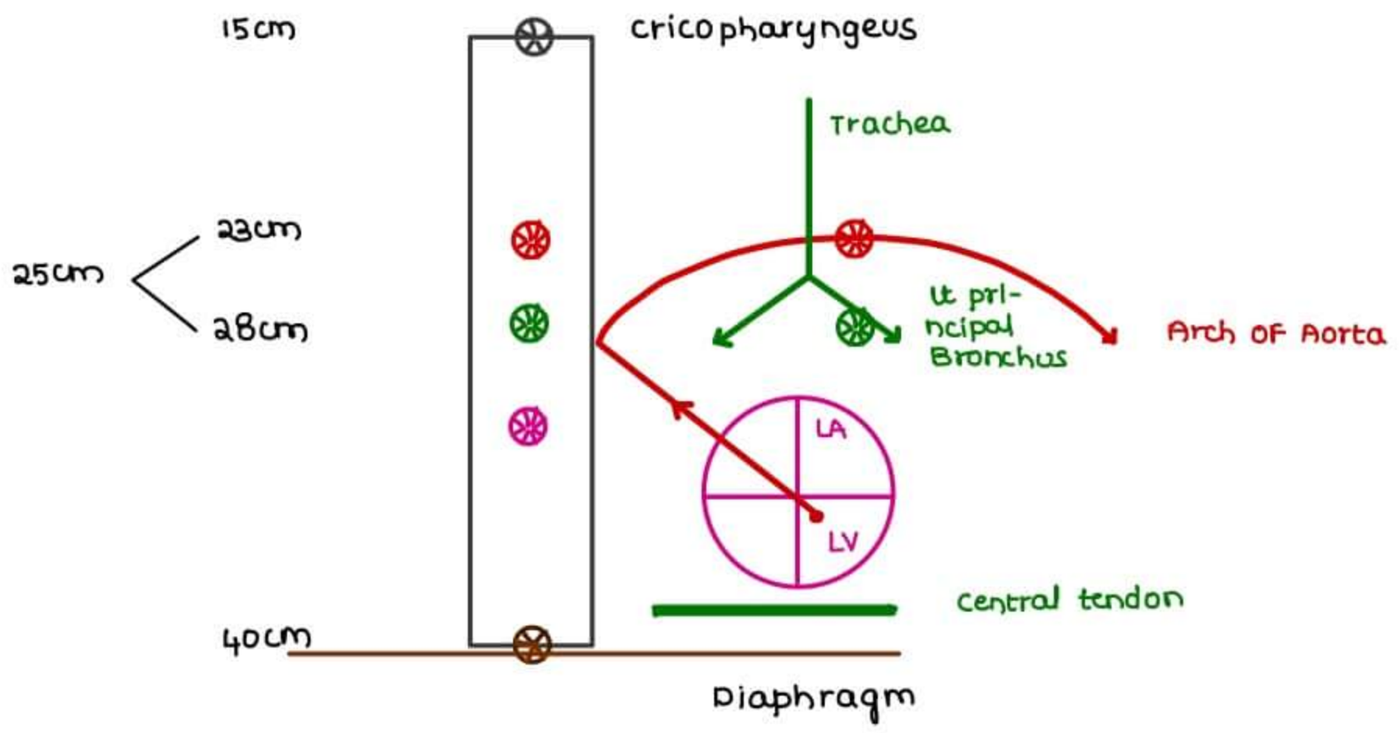
LOWER OESOPHAGEAL SPHINCTER (3-5 cm)



Upper 1/3 rd → Striated muscle

Middle 1/3 rd → Smooth & Striated muscle

Lower 1/3 rd → Smooth muscle



Q Venous drainage of oesophagus

a Azygous vein, Inferior thyroid vein, right gastric vein

b Azygous vein, Inferior thyroid vein, lt gastric vein

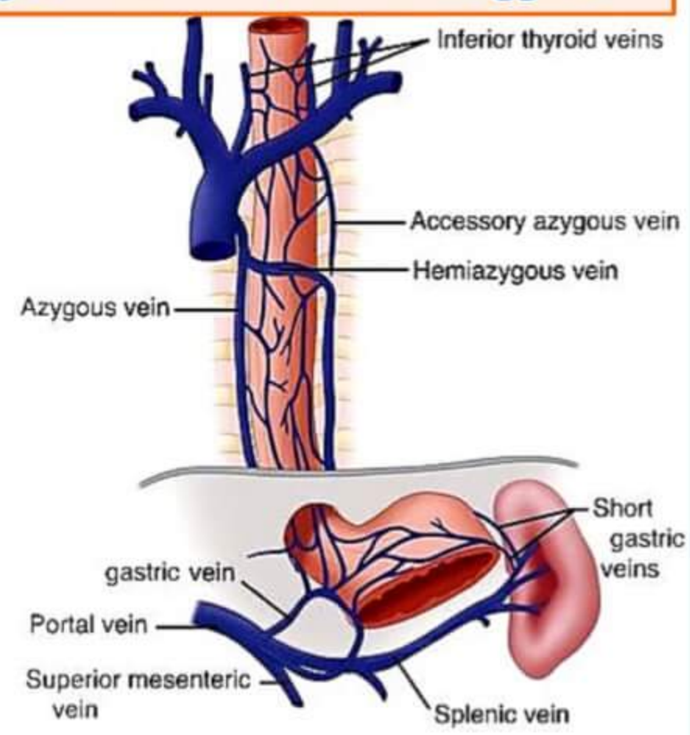
c Azygous vein, rt gastric vein, lt gastric vein

d Superior thyroid vein, Inferior thyroid vein, azygous vein, hemi azygous v.

OESOPHAGUS VENOUS DRAINAGE

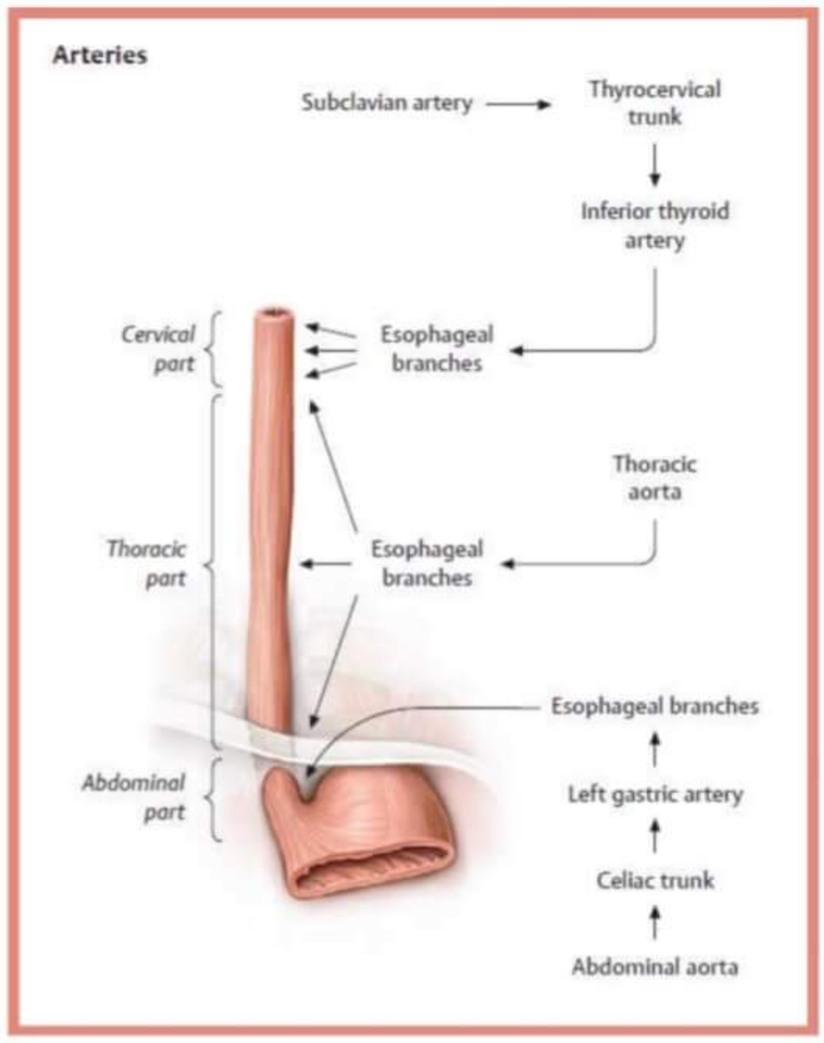
THORACIC PART

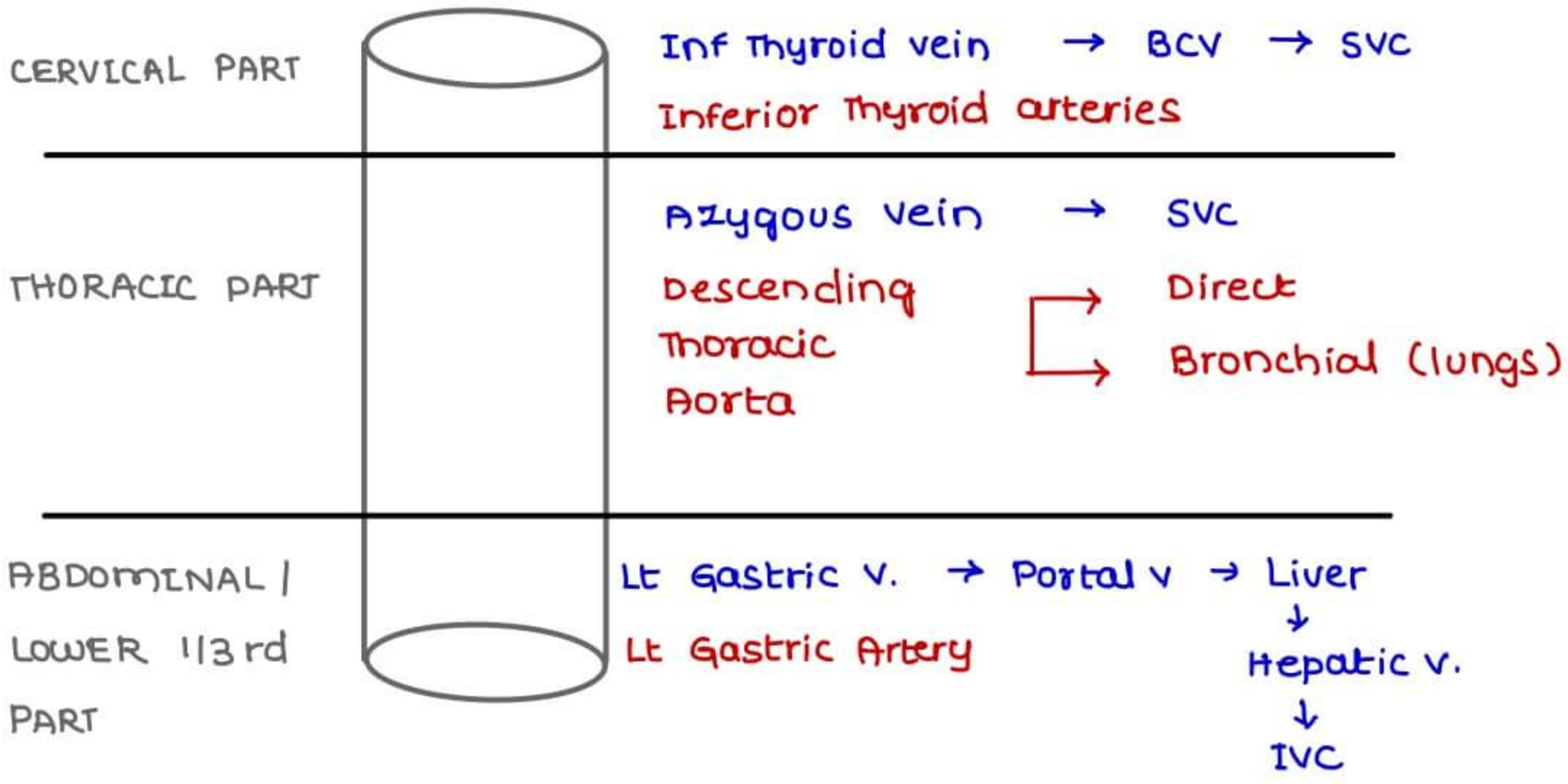
- Rt side → Azygous V → SVC
- Lt side → HemiAzygous v / Accessory Azygous V. → AZYGOUS VEIN → SVC



CERVICAL PART → Inf. Thyroid vein → Brachiocephalic vein → Sup. venous cava

ABDOMINAL | LOWER 1/3rd PART → Lt Gastric vein → Portal vein → Liver → Hepatic vein → IVC





Q What is the blood supply of thoracic oesophagus
a Inferior thyroid artery
b Inferior phrenic artery
c Bronchial artery
d Left gastric artery

LARYNX

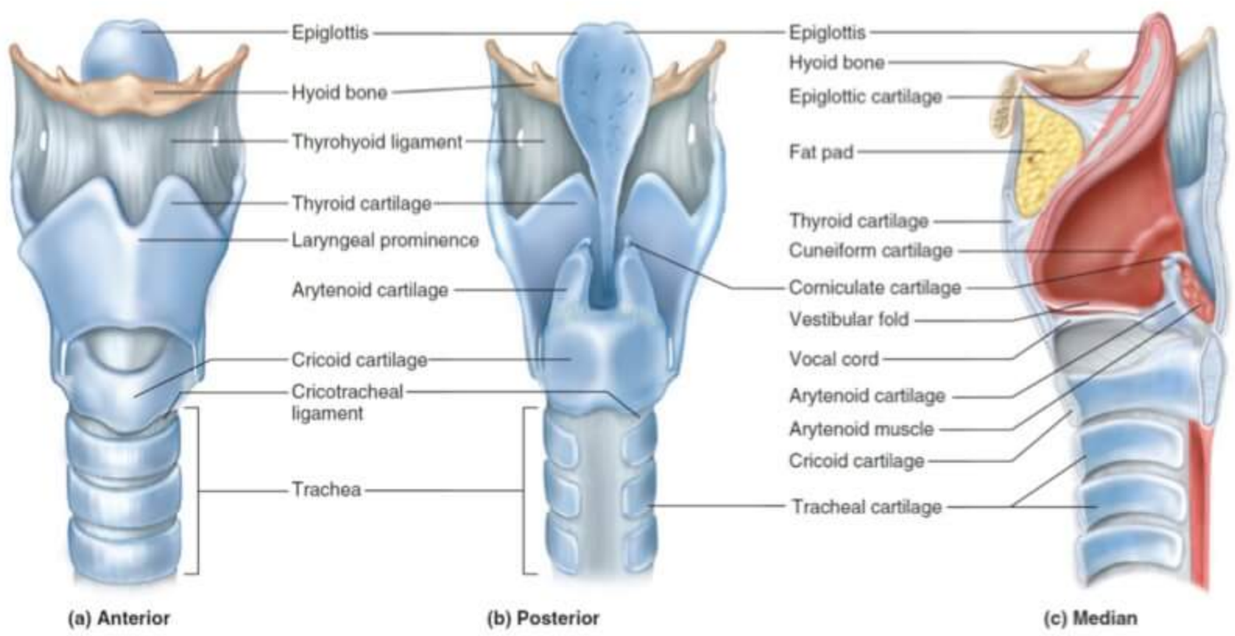
Q False about larynx
a 9 cartilages : 3 paired & 3 unpaired cartilages
b Extends from C_3 to C_6 vertebrae
c External laryngeal nerve supply all larynx muscles except cricothyroid
d cricothyroid is a tensor of vocal cord

All larynx muscles supplied by Recurrent Laryngeal n. except Cricothyroid

LARYNX

→ 3 UNPAIRED MIDLINE CARTILAGES
1 Epiglottis
2 Thyroid (largest)
3 cricoid (ring shaped)

→ 3 PAIRED CARTILAGES
1 Arytenoid
2 corniculate
3 cunieform



ELASTIC CARTILAGES
1. Epiglottis
2. Tip of Arytenoid
3 Cunieform
4 Corniculate

HYALINE CARTILAGES
1 Thyroid
2 cricoid
3 most of Arytenoid

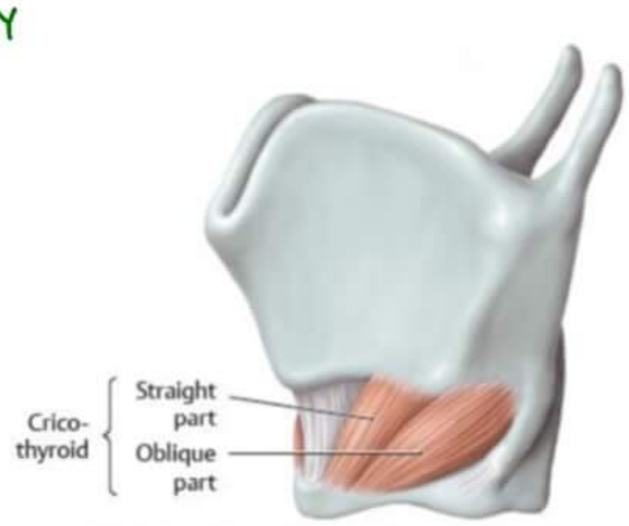
CARTILAGES SEEN POSTERIORLY

1. Cricoid
2. Arytenoid
3. corniculate
4. cuneiform

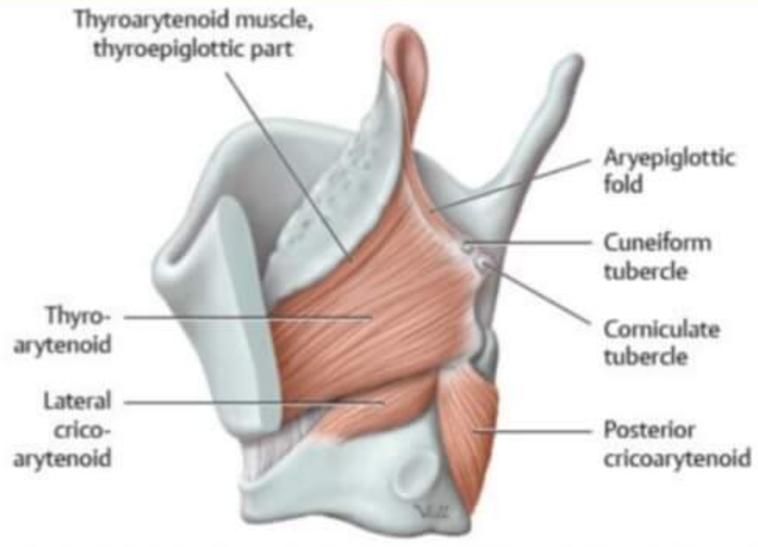
LARYNX MUSCLES

CRICOTHYROID

→ Tensor of vocal cord
→ ↑ pitch of voice



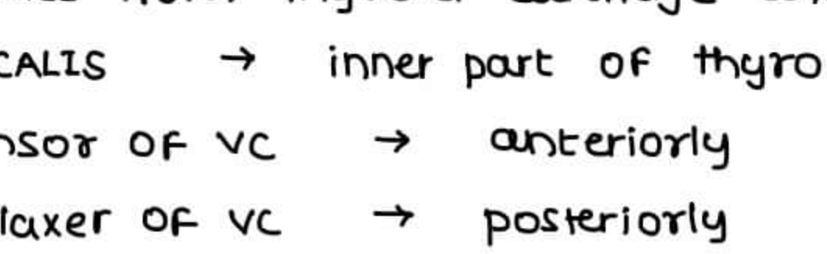
A Extrinsic laryngeal muscles, left lateral oblique view. *Removed:* Epiglottis.



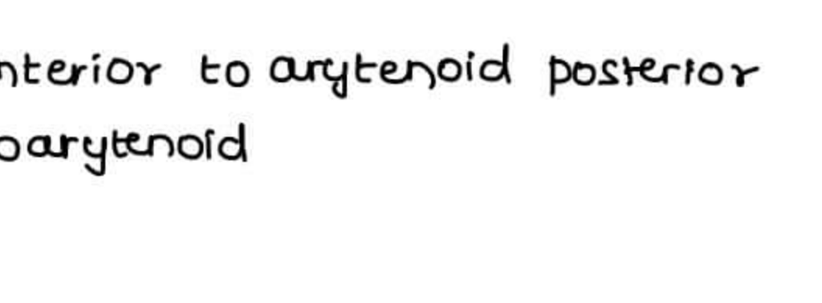
B Intrinsic laryngeal muscles, left lateral view. Removed: Thyroid cartilage (left lamina). *Revealed:* Epiglottis and external thyroarytenoid muscle.

POSTERIOR CRICOARYTENOID

→ most posterior muscle of larynx
→ SAFETY MUSCLE



C Left lateral view. *Removed:* Thyroid cartilage (left lamina) and epiglottis.



D Posterior view.

→ only abductor of vocal cord

THYROARYTENOID

→ comes from thyroid cartilage anterior to arytenoid posterior
→ VOCALIS → inner part of thyroarytenoid
→ Tensor of VC → anteriorly
→ Relaxer of VC → posteriorly

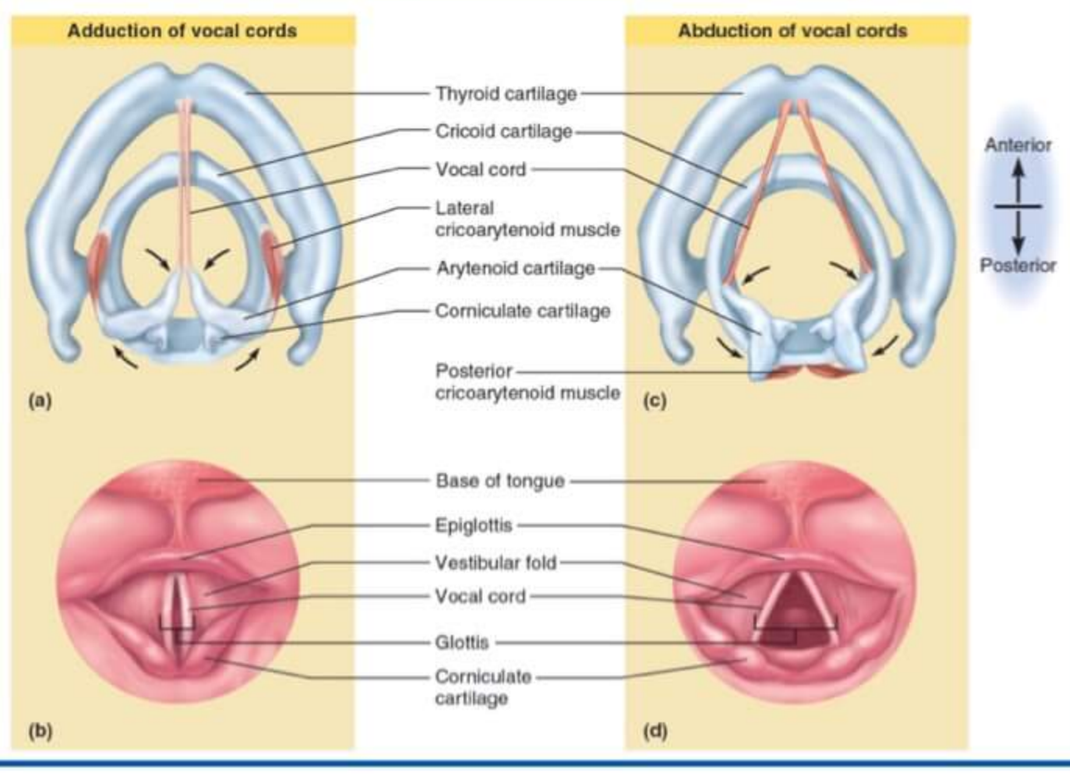
LATERAL CRICOARYTENOID

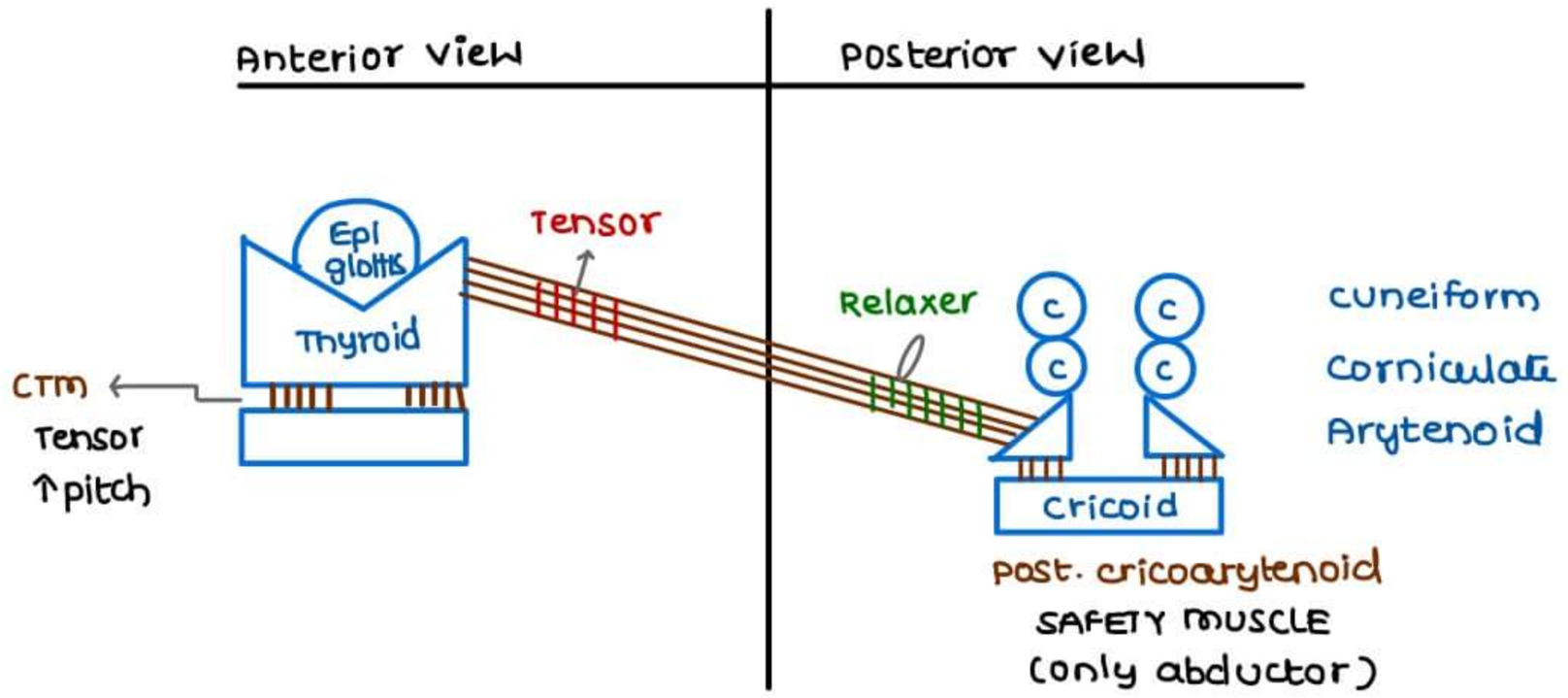
→ Adductor of VC

Anterior most cartilage	→	Thyroid
Ring shaped cartilage	→	Cricoid
Adductor of VC	→	Arytenoid

BIL Paralysis of Post. cricoarytenoid
→ VC in cadveric posit^{n}
→ difficulty in breathing
→ may require tracheostomy
→ During general anesthesia, Endotracheal intubat^{n} should be done

Q Relaxor of vocal cord is the muscle
a Thyro arytenoid (Posterior)
b Cricothyroid
c Posterior crico arytenoid
d Lateral crico arytenoid





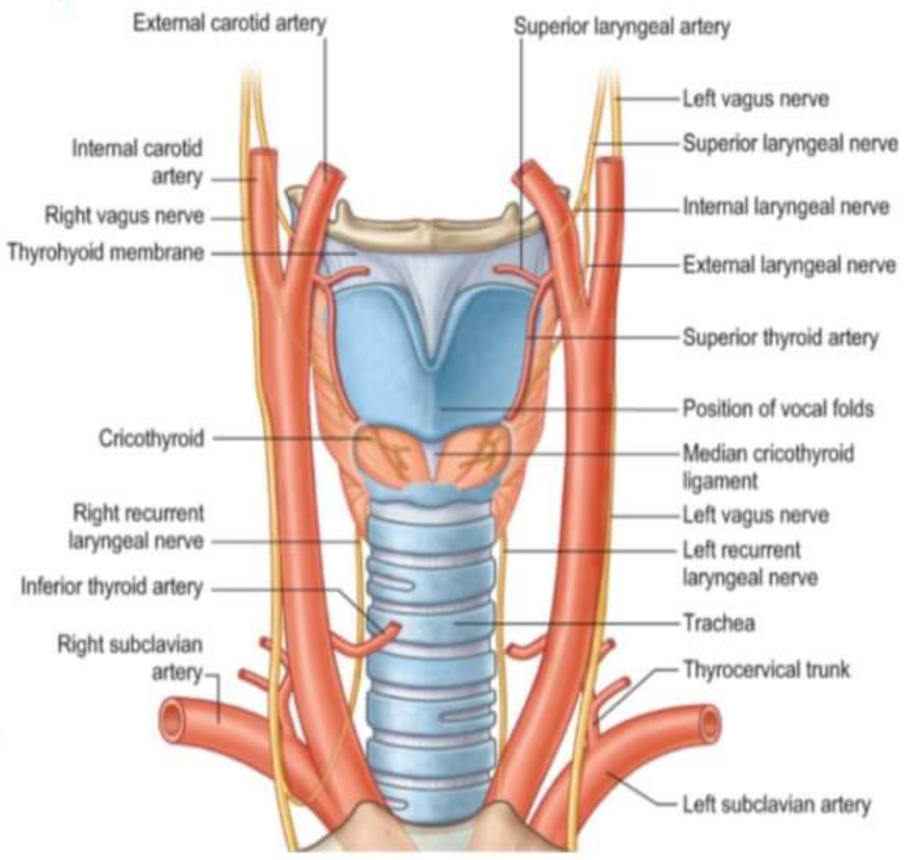
Q Damage to External Laryngeal nerve during thyroid Sx could result in the inability to

a Relax the VC

b Tense the VC

c Widen the rima glottidis

d Abduct the VC



EXTERNAL LARYNGEAL NERVE INJURY

→ Supply cricothyroid (Tensor of VC)

→ produce weak voice

→ Br. of Sup. laryngeal nerve (Br. of vagus n)

→ follows superior thyroid artery

→ To prevent injury, Sup. thyroid artery should be ligated close to thyroid gland

INF. THYROID ARTERY (Br. of Thyrocervical trunk) accompanied by RLN

→ Supplies thyroid gland, RLN, Parathyroid glands (major supply)

→ Ligate the artery as close as possible to thyroid gland

VAGUS NERVE

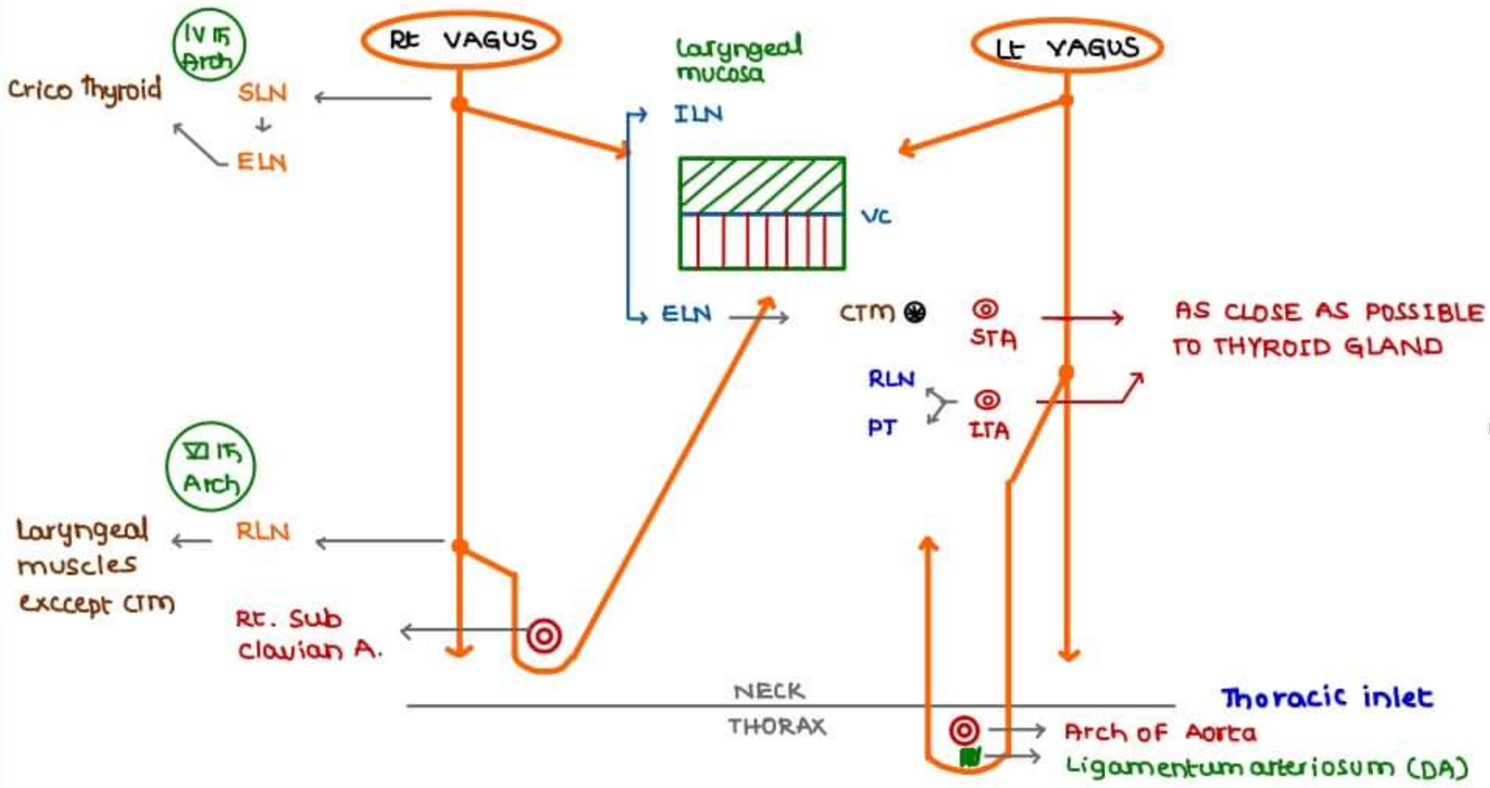
Branches

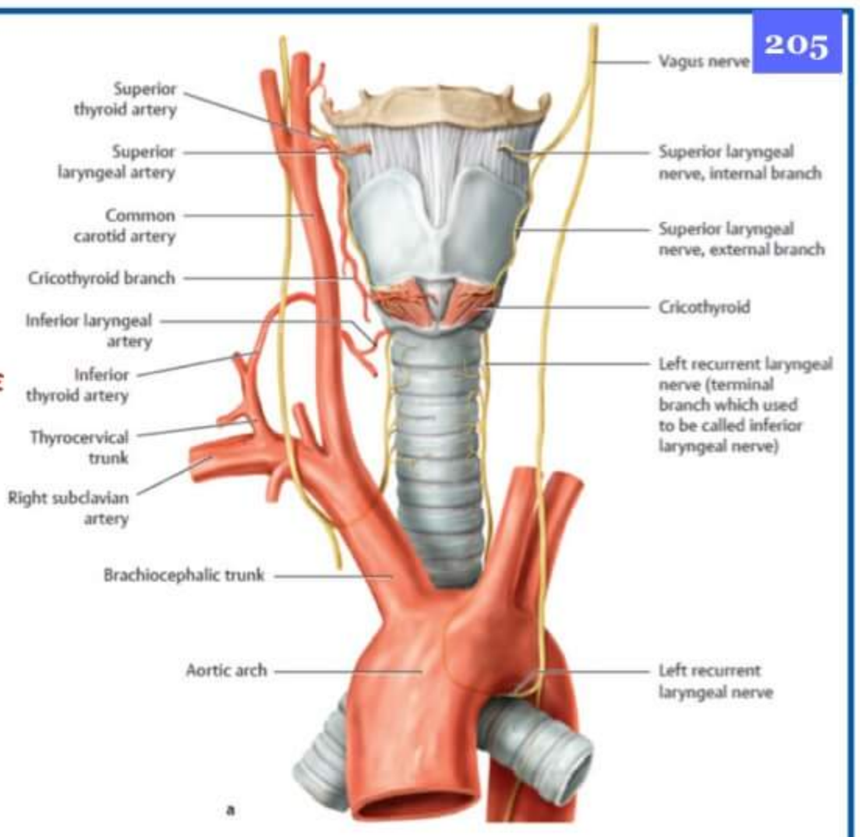
Superior Laryngeal nerve (on both sides)

Recurrent Laryngeal nerve (on both sides)

→ Rt branch is longer
hooks under ligamentum arteriosum under arch of aorta
goes back into tracheo oesophageal groove &
supplies Larynx muscles & laryngeal mucosa below VC

→ Rt branch is short & stays in neck





LARYNGEAL MUCOSA SUPPLY

→ Till the vocal cord / upper surface of VC → Internal laryngeal nerve
→ below vocal cord / from lower surface of VC → Recurrent laryngeal nerve

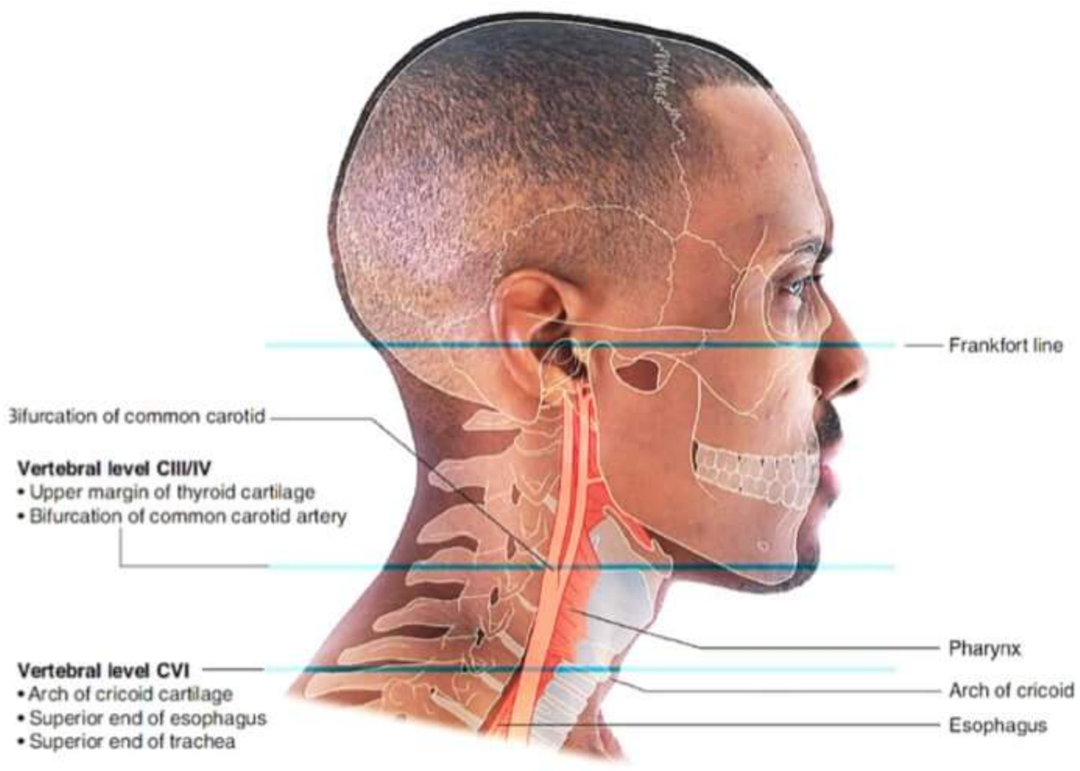
LARYNGEAL MUCOSA ON VOCAL CORD SUPPLIED BY → INTERNAL LARYNGEAL NERVE

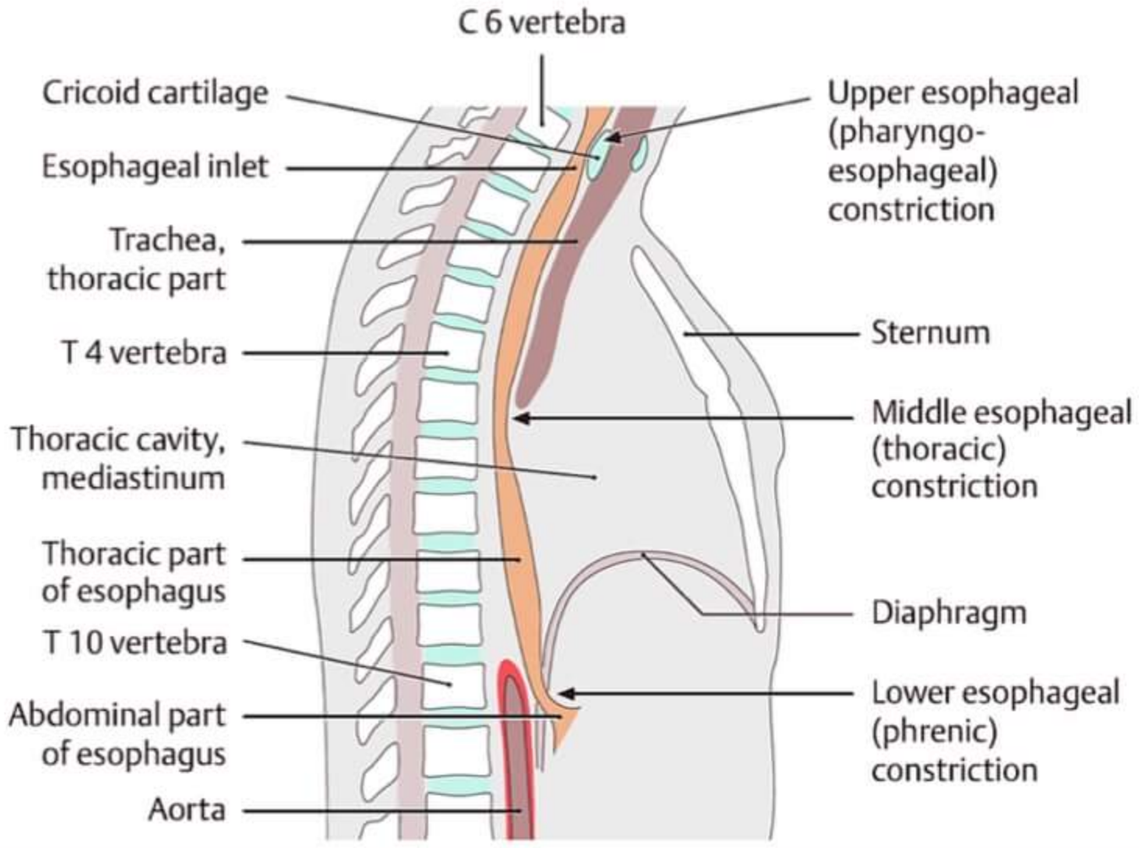
IN Thoracic inlet syndrome → It recurrent laryngeal nerve is involved

VERTEBRAL LANDMARKS

→ COMMON CAROTID ARTERY bifurcates at Sup. border of the Lamina of the Thyroid cartilage of Larynx
  → CCA bifurcation → C_3
  → carotid body & carotid sinus → C_3
    - Carotid Body tumor present here
    - CB Massage done here

→ C_6 LOWER BORDER
  → Cricoid cartilage
  → Cricopharyngeal Sphincter
  → Ending of Larynx, pharynx
  → Beginning of Trachea & oesophagus



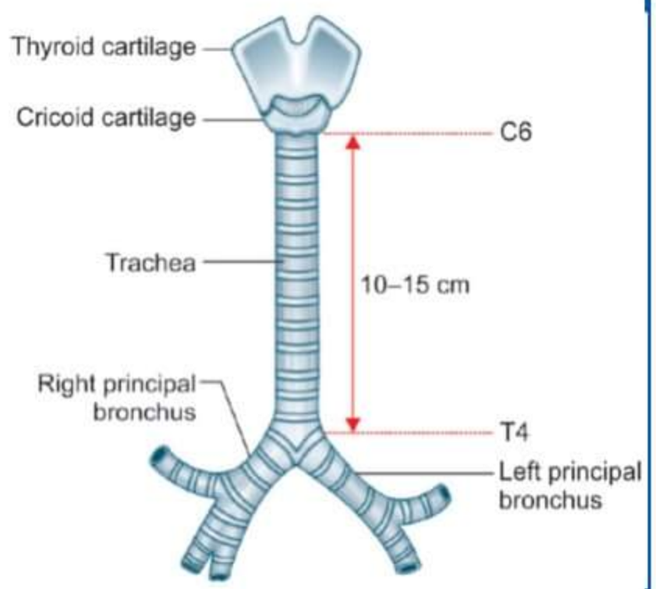


LARYNX EXTENT

→ Adult male → $C_3 - C_6$
→ Adult Female → Still higher
→ Infant while swallowing → reaches upto Atlas vertebra

TRACHEA

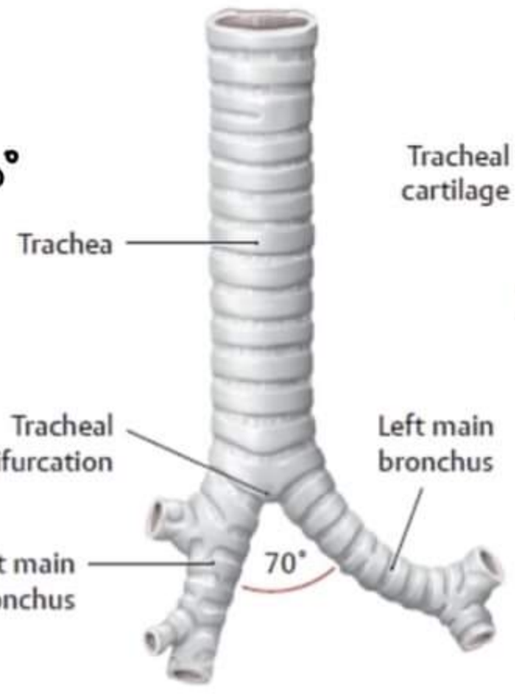
→ length → approx. 11 cm
→ Bifurcatⁿ → disc blw T_4, T_5 vertebra >
upper border of T_5 >
upper border of T_6 (deep inspiratⁿ)
Lower border of T_4 (cadaver)

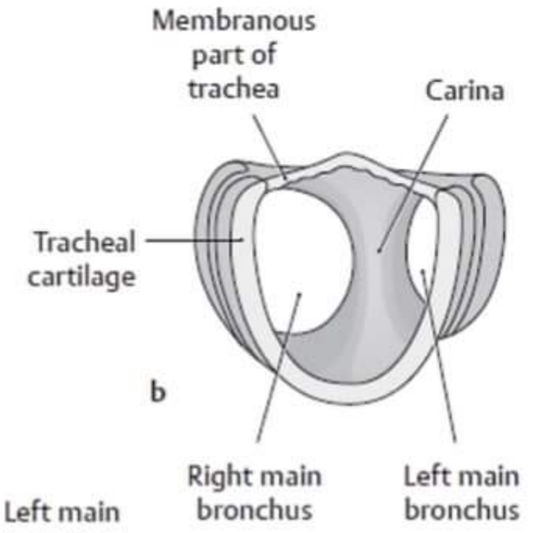


→ 16 - 20 C - shaped tracheal rings present in trachea

IN TRACHEOSTOMY
→ Isthmus thyroid gland to be cut (infront of 2,3,4 > 2,3 > 3 trac. rings)
→ 'C' 2 & 3 rings cut

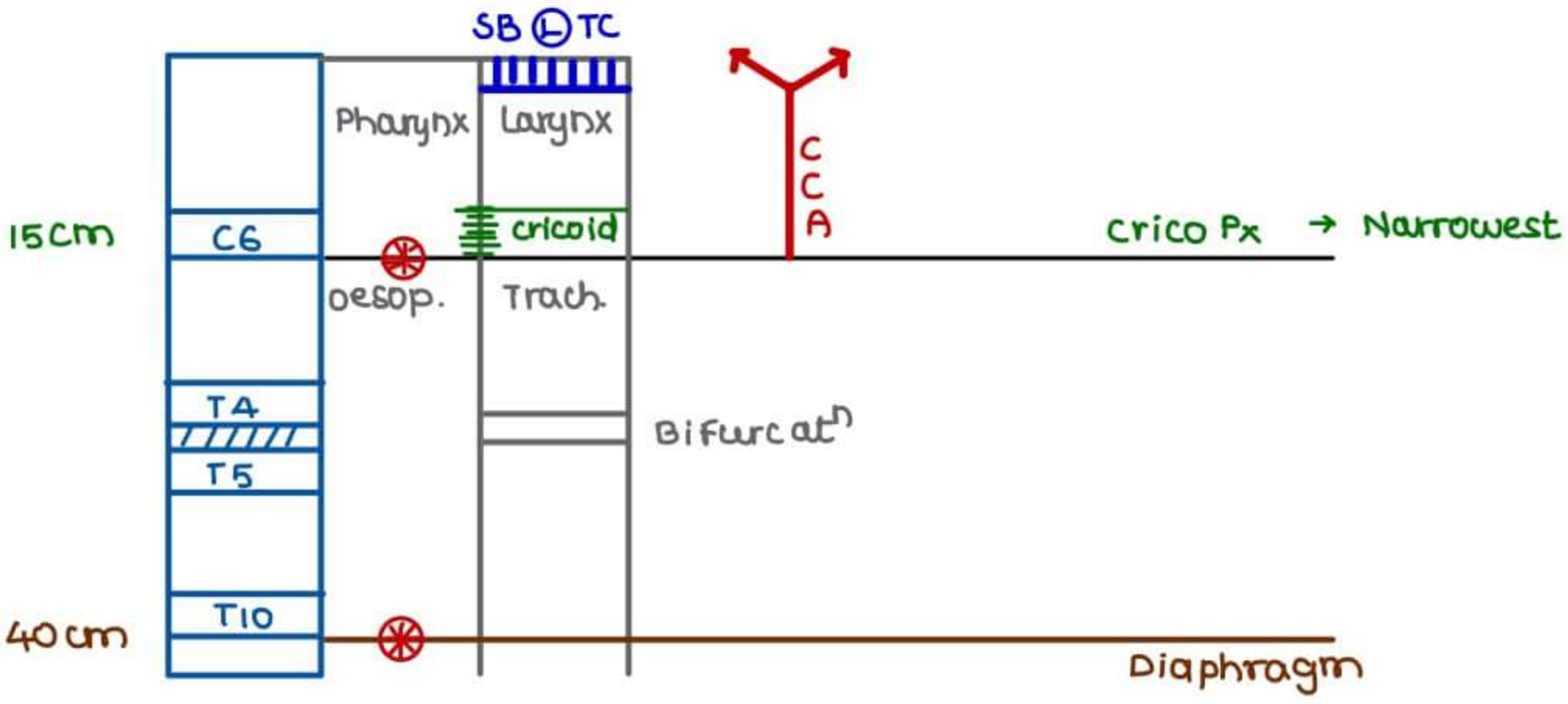
→ CARINA → present at bifurcatⁿ
→ Angle b/w rt & lt principal bronchus → 70°





OESOPHAGUS

→ Length → 25 cm
→ beginning → C_6 Lower vertebra
passing (th) Diaphragm → T_{10}



Foreign Body

→ most of foreign bodies found at cricopharyngeal sphincter level
- common in children & psychiatric patients
- length of oesophagoscope required is → 15cm

Q Isthmus of thyroid gland overlies the
a 1st tracheal ring
b 1st & 2nd tracheal ring
c 2nd, 3rd & 4th tracheal ring
d 3rd & 4th tracheal cartilage

EMBRYOLOGY

Neural plate Ectoderm → CNS

NCCs → PNS

Ectodermal Placodes

→ Distributed among surface ectoderm cell

→ Forms some Ganglia

→ Forms OTIC PLACODE on D_{20}

OTIC PLACODE → OTIC PIT → OTIC VESICLE → INNER EAR

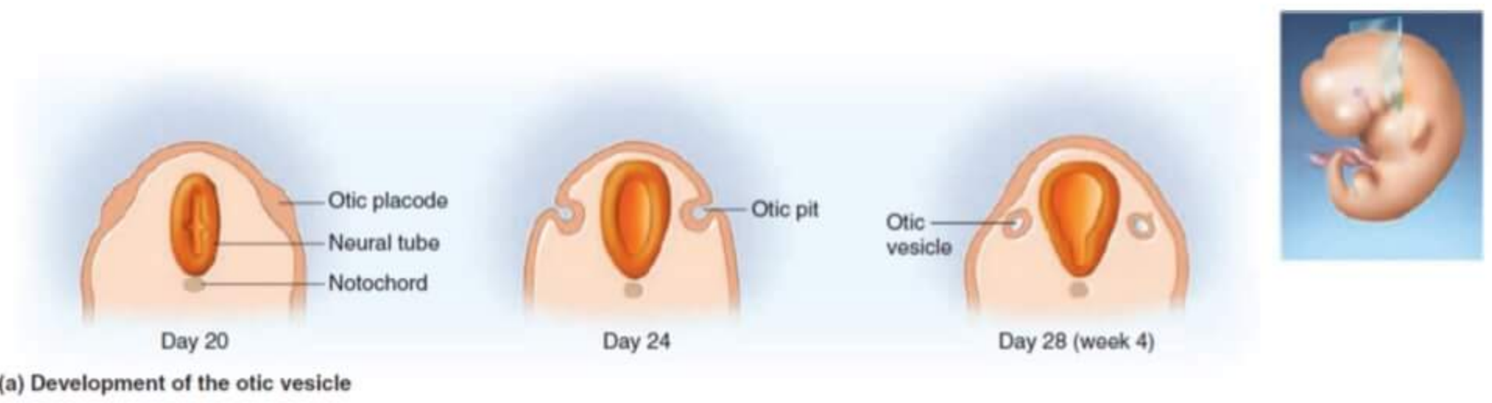
→ INNER EAR

→ Formed in territory of Hind brain (Rhombencephalon)

a. VESTIBULE — Utricle, Saccule

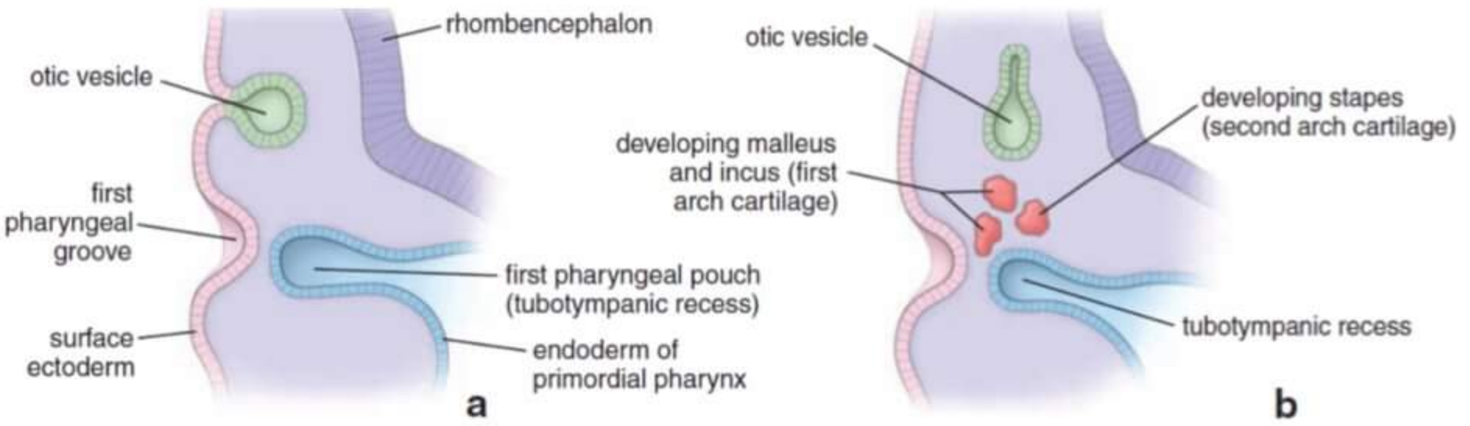
b. 3 SEMICIRCULAR CANALS

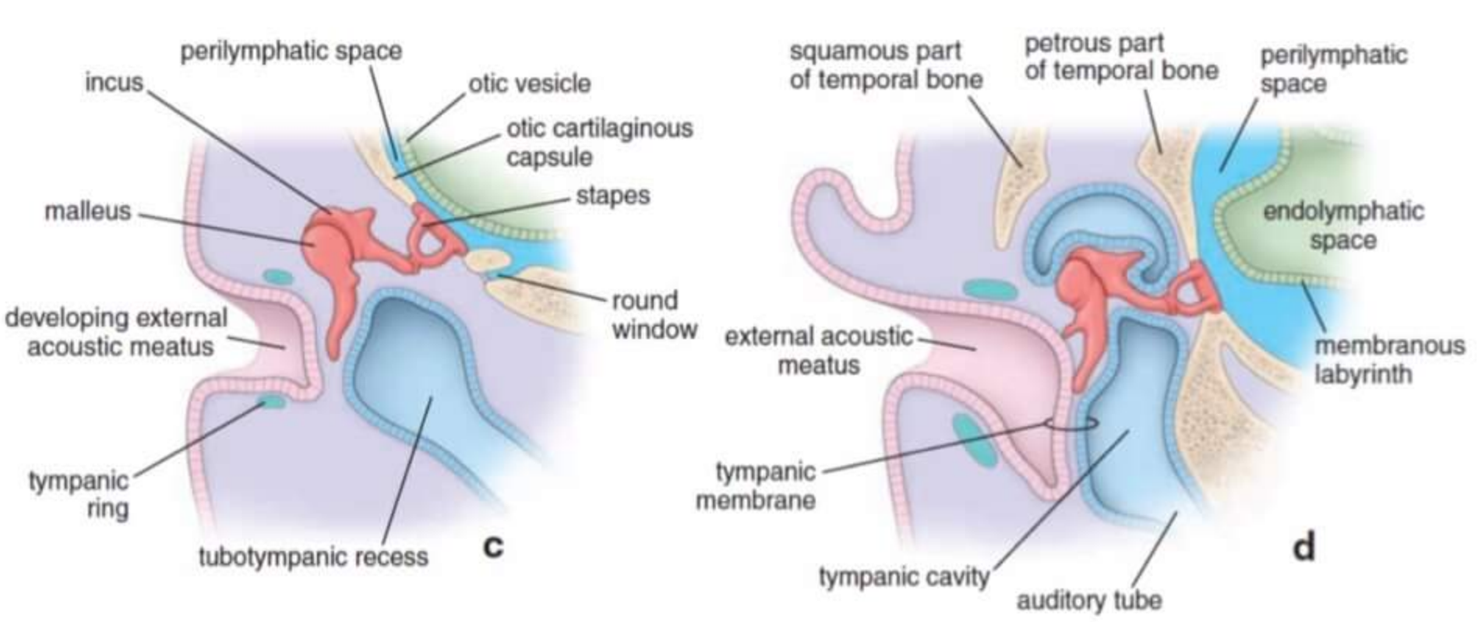
c. COCHLEA



(a) Development of the otic vesicle

(b) Development of the membranous labyrinth from the otic vesicle





→ Pharyngeal cleft 1 lined by surface ectoderm
  → forms External Auditory meatus

→ Middle Ear cavity formed by Endoderm of pouch 1 (mainly) & 2 (partly)
  → forms middle ear cavity & ET epithelium

→ Malleus, Incus } comes from 1st arch (Meckel cartilage) (sec. mesenchyme)
  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

→ Ossicles are of Adult size at birth

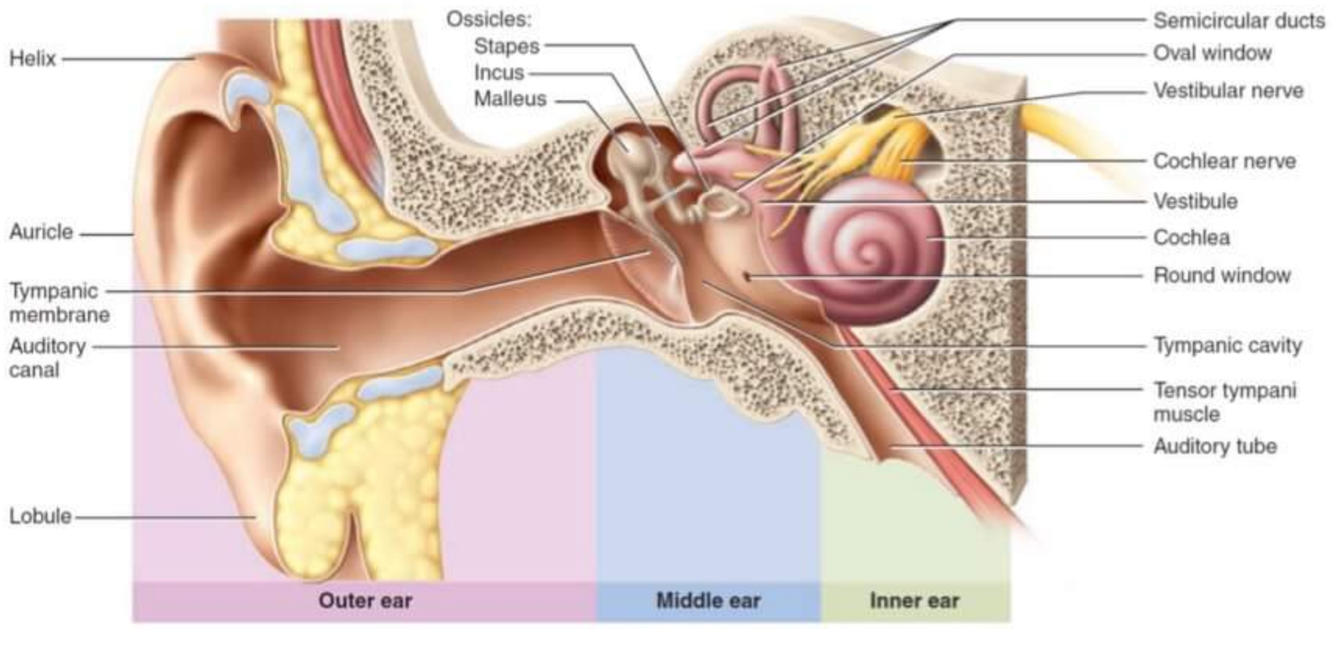
TYMPANIC MEMRANE

→ Outer epithelium → Ectodermal
  Inner epithelium → Endodermal
  Connective tissue → mesodermal

ENDOLYMPH

→ ultra filtrate of blood
→ drains into CSF
→ present inside membranous Labyrinth

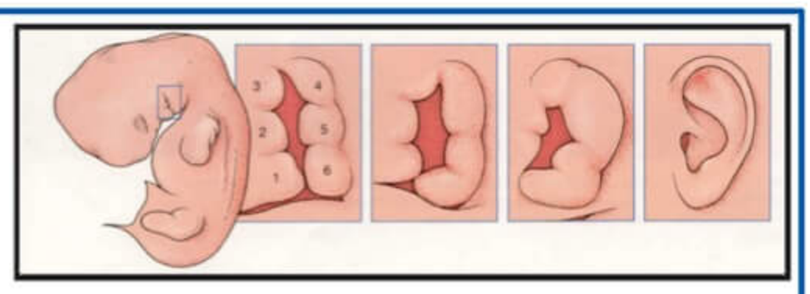
PERILYMPH → present b/w membranous & bony Labyrinth



MIDDLE EAR CAVITY BOUNDARIES

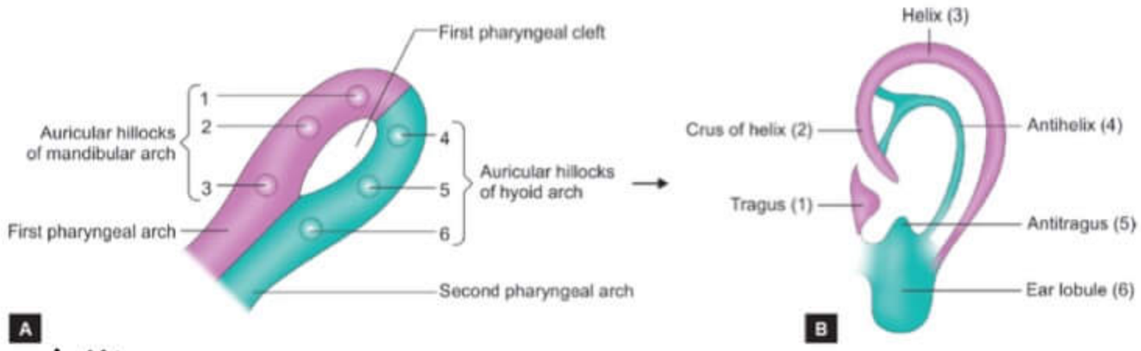
→ Lateral wall → Tympanic membrane
→ Roof → Tegmen tympani
→ Ant. wall → ET
→ Medial wall → Inner ear

INNER EAR



- → Cochlear Nerve → For hearing
- → vestibule → For balance
- → SCC → For angular motion
- → vestibulo cochlear Nerve
  - → passes internal auditory meatus
  - → For balance

AURICLE DEVELOPMENT



6 AURICULAR HILLOCKS

Arch 1 → gives 1st 3 auricular hillocks

Arch 2 → gives next 3 auricular hillocks

1st 3 HILLOCKS → Anterior part of auricle includes Tragus

next 3 HILLOCKS → major portⁿ of Auricle

outer part / peripheral part

ear Lobule

AURICLE NERVE SUPPLY

GREATER AURICULAR NERVE

→ Greater part of Auricle Laterally & medially (Lobule)

LESSER OCCIPITAL NERVE

→ Supplies medial part of upper auricle

AURICULO TEMPORAL NERVE → Supplies tragus

EXT. AUDITORY MEATUS → Auricular br. of vagus

→ Facial n. carries it

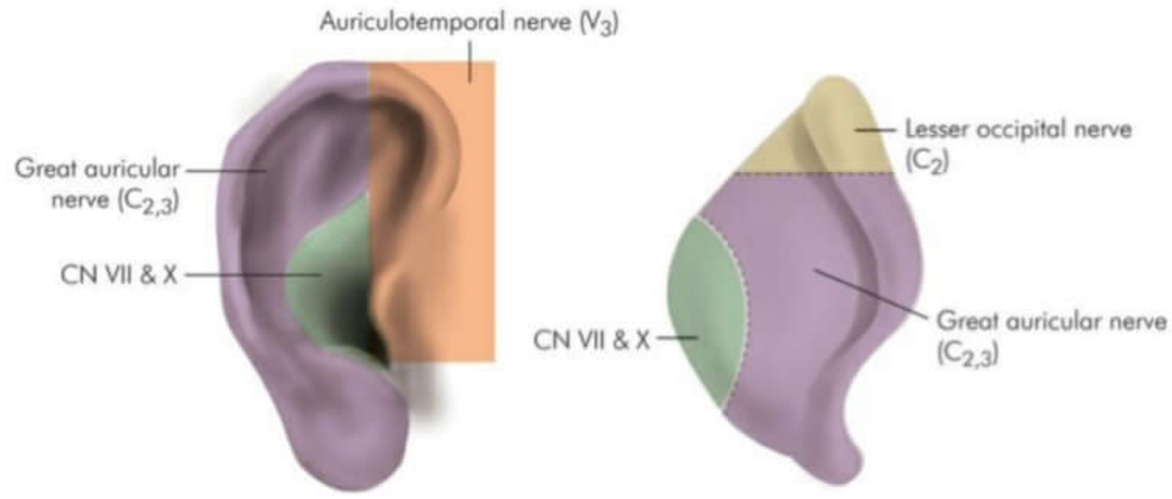
- facial n. injury causes loss of sensatⁿ here

AURICULOTEMPORAL NERVE (V_3) Supplies

Tragus

ant. part of auricle

Temporal area



GREATER AURICULAR NERVE Supplies

Greater part of auricle

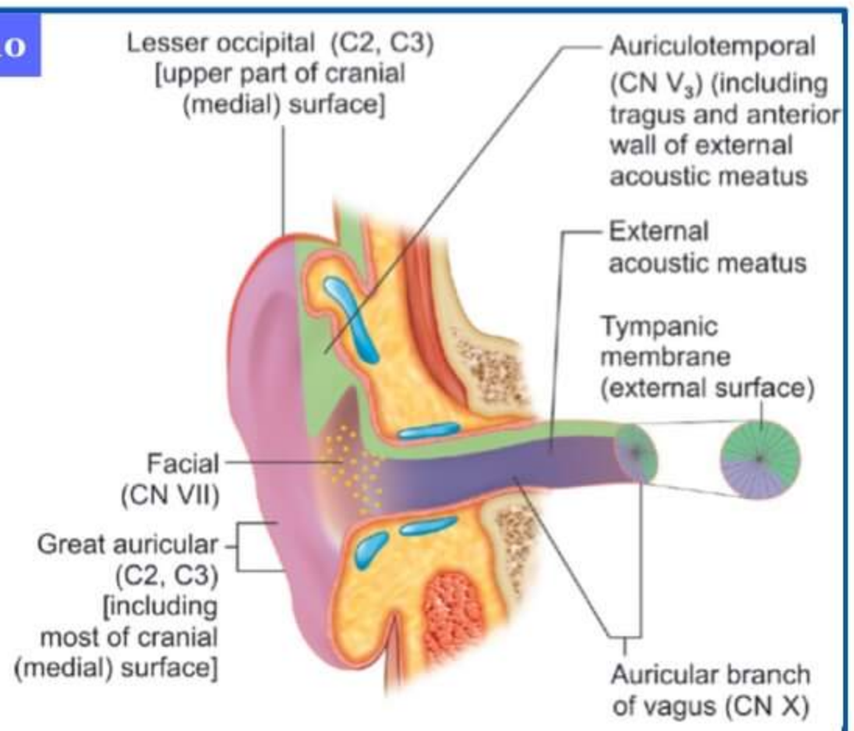
Laterally

medially (Lobule) (medial upper part by Lesser auricular nerve)

Vagus Supplies root

EXTERNAL AUDITORY MEATUS

Posterior wall & floor → auricular br. of vagus
Anterior wall & roof → Auriculo temporal n.

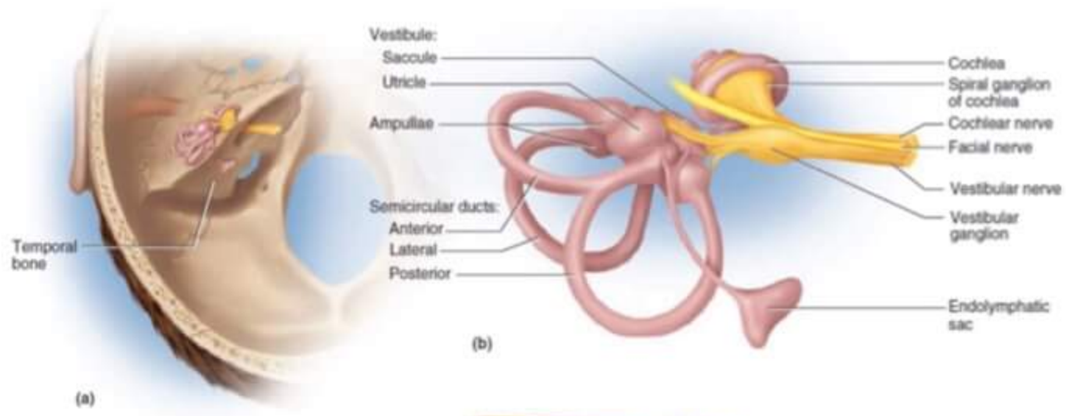


TYMPANIC MEMBRANE

Posterior wall & floor → auricular br. of vagus
Ant. wall & roof → Auriculo temporal n.

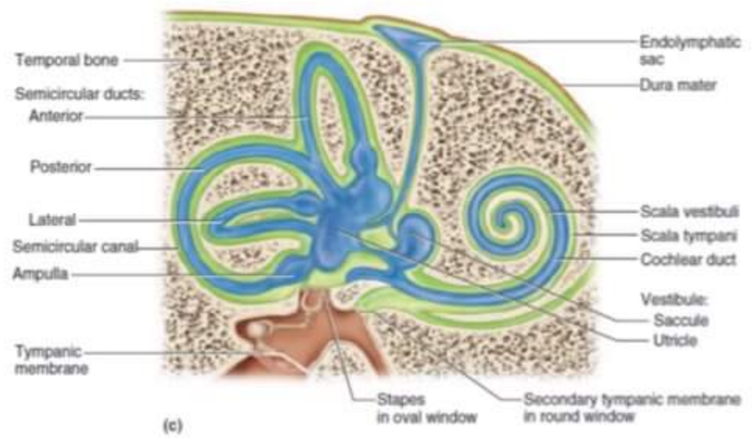
INNER EAR

→ present inside the petrous temporal bone
→ vestibule → for linear accelaratⁿ



ENDOLYMPHATIC SAC

→ stores & distributes Endolymph
→ present in subdural space



COCHLEA

→ 2.5 turns
→ contains
- V → Scala Vestibuli
- M → Scala Media
- T → Scala Tympani

→ cochlear duct / Scala media → have Endolymph
Scala vestibuli & tympani → have perilymph

MIDDLE EAR CAVITY

→ contains ossicles
→ Divided into
- Epitympanum (superior)
- Mesotympanum (middle)
- Hypotympanum (inferior) → towards auditory tube

→ EPITYMPANUM → contains ossicles (most part) & Tympanic membrane
→ Tensor tympani → dampens sound
Stapedius → dampens sound (pulls stapes back)
Injury to above muscles cause → HYPERACUSIS

→ BOUNDARIES
- Roof → Tegmen tympani
- Posterior → mastoid antrum
- anterior → ET (nasopharynx)
- medial → cochlea (inner ear)

ROOF

→ by Tegmen tympani

→ Separates MEC from cerebrum (Temporal lobe)

→ Anterior/superior Semi circular canal produces eminence

→ ARCUATE EMINENCE at floor of cranial cavity

→ Lateral SCC produces impression over medial wall of MEC, just above the course of facial nerve

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 for a brief distance & then runs on post. wall of MEC & Exits cranial cavity at stylomastoid foramen

→ In MEC, it gives Greater Petrosal nerve

→ runs at Floor of cranial cavity towards foramen lacerum and joins ℓ Deep petrosal nerve (br of T_1 Sympathetic plexus) & forms vidian nerve of Pterygoid canal

→ Lesser Petrosal nerve

→ accompanies greater petrosal nerve

→ carries preganglionic Fibres towards the 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 Glossopharyngeal nerve (main)

T_1 Sympathetic plexus around ICA

Branch from Geniculate ganglion

ANTERIOR WALL STRUCTURES

→ ICA

→ ET

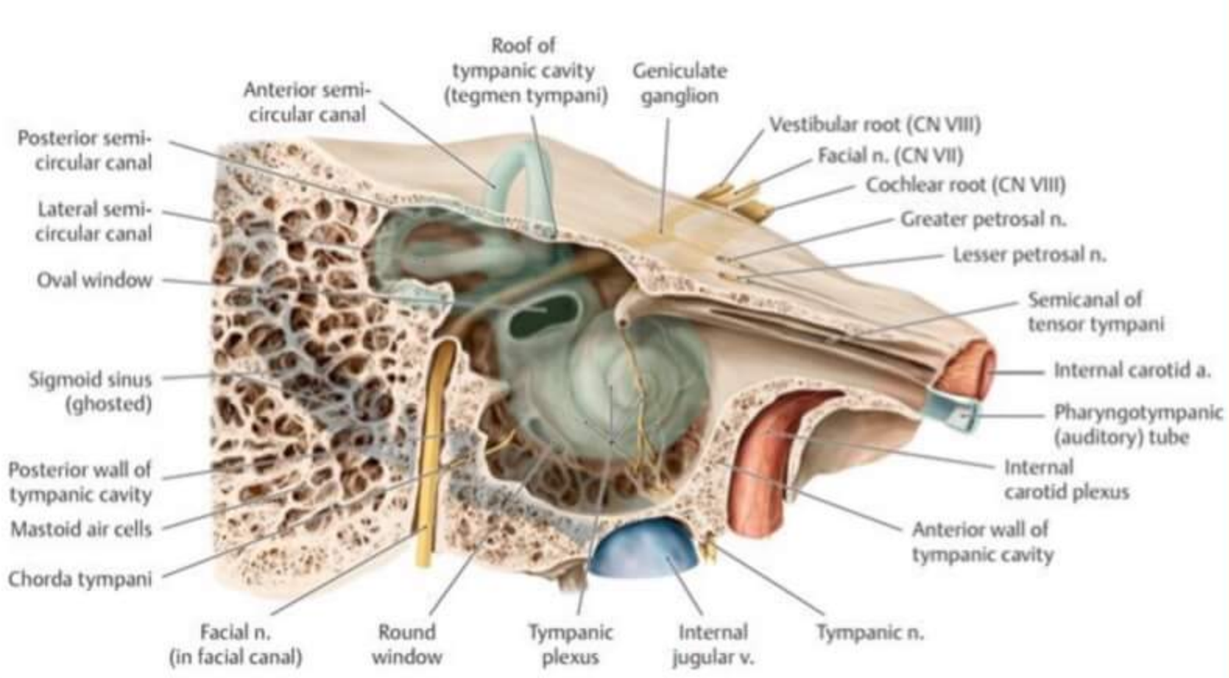
→ Tensor tympani

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 t round window (covered by Tympanic membrane)

→ Slight course of facial nerve

→ Raised elevat^{n} by lateral SCC

POSTERIOR WALL STRUCTURES

→ Mastoid antrum | Aditus

→ Facial nerve course

→ Pyramid

→ tendon of stapedius muscle attaches here

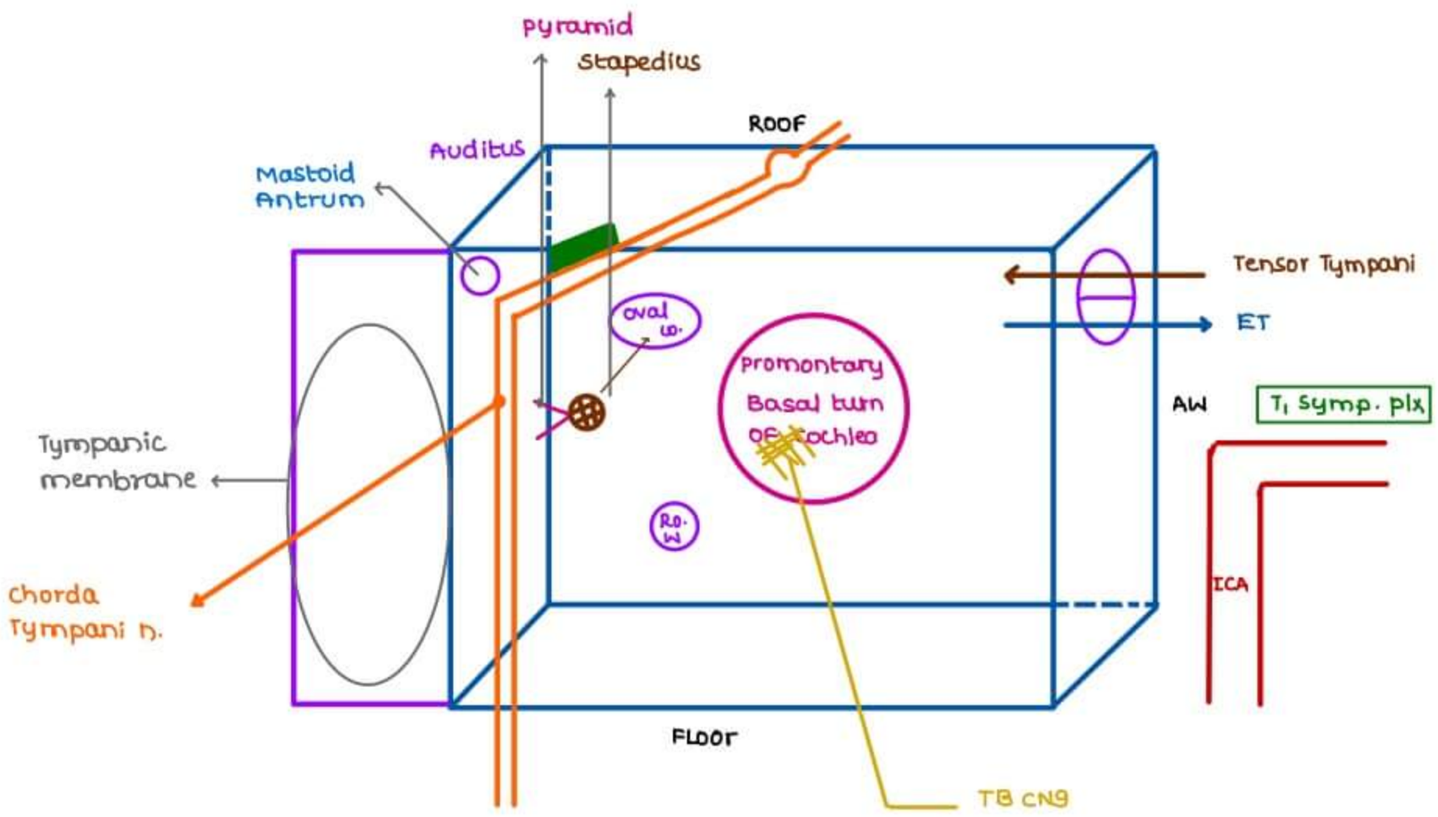
Stapedius pulls stapes posteriorly (stapedeal reflex) (prevents damage)

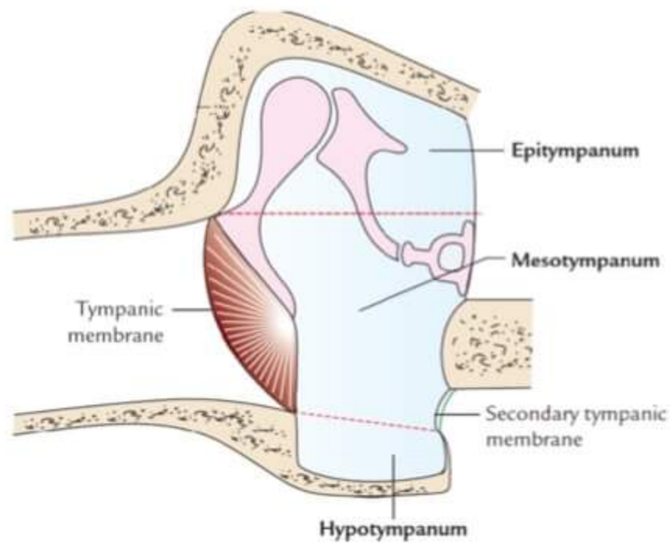
LATERAL WALL STRUCTURE → tympanic membrane

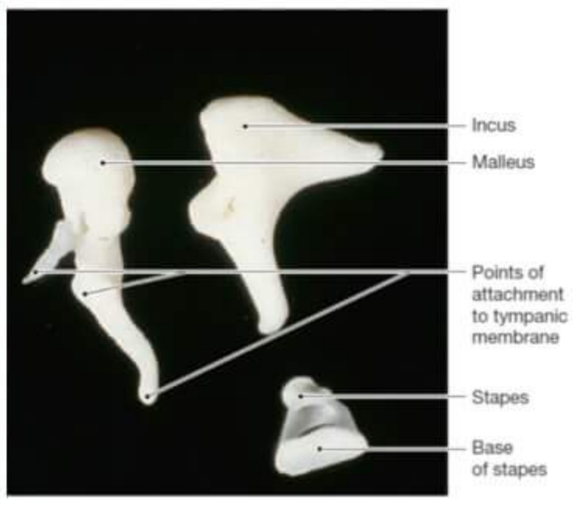
FLOOR STRUCTURES

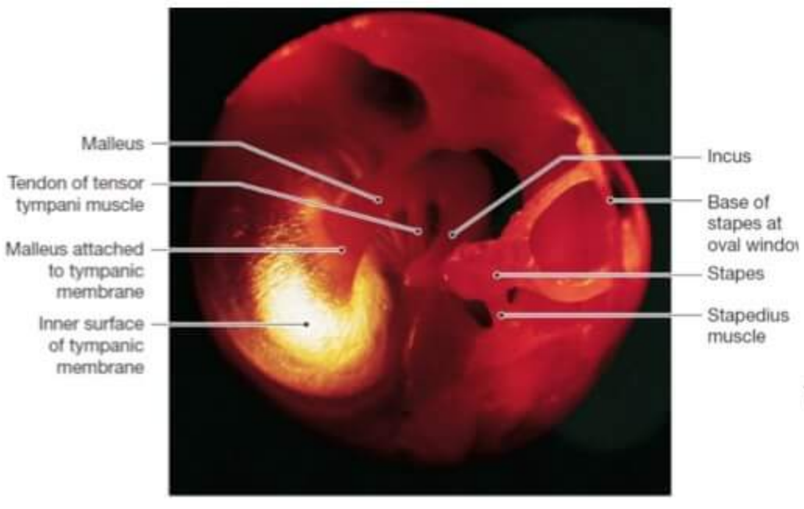
→ Br. of CN IX

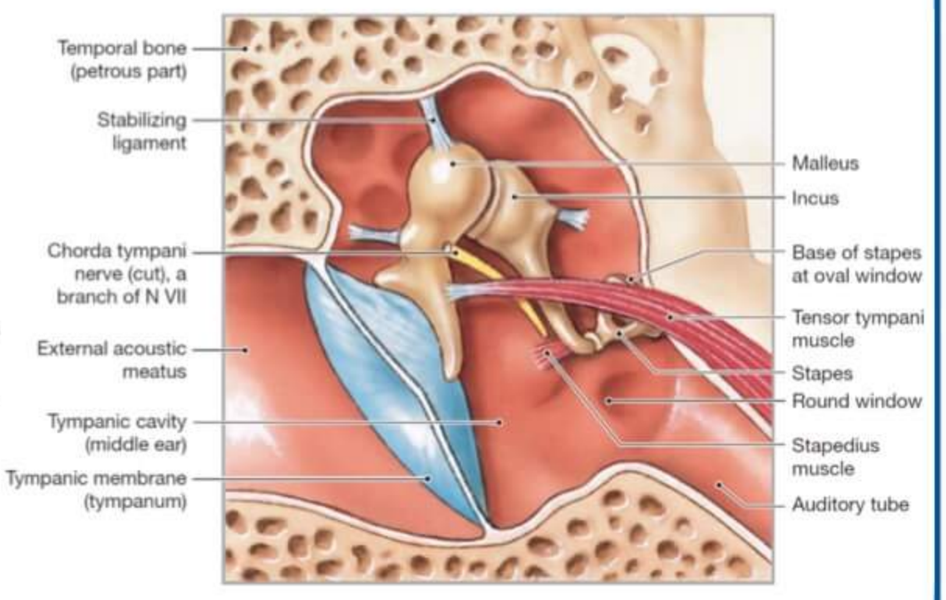
→ Internal jugular vein (continuat^{n} of Sigmoid sinus (ghosted)]











OSSICLES

MALLEUS → most lateral

INCUS

STAPES → most medial

MESOTYMPANUM

→ Narrowest part (2mm)

→ contains stapes, Pars tensa of TM

EPITYMPANUM

→ Largest part (6mm)

→ contains most of Malleus & Incus

HYPOTYMPANUM (4 mm)

Malleus → attaches to TM

Stapes → attaches to medial wall of MEC

→ Stapes foot plate attaches to oval window

Bony Labyrinth	Membranous Labyrinth (within bony labyrinth)
Cochlea	Cochlear duct
Vestibule	Utricle and Saccule
Semicircular canals	Semicircular ducts

INNER EAR

LABYRINTH

OUTER BONY LABYRINTH

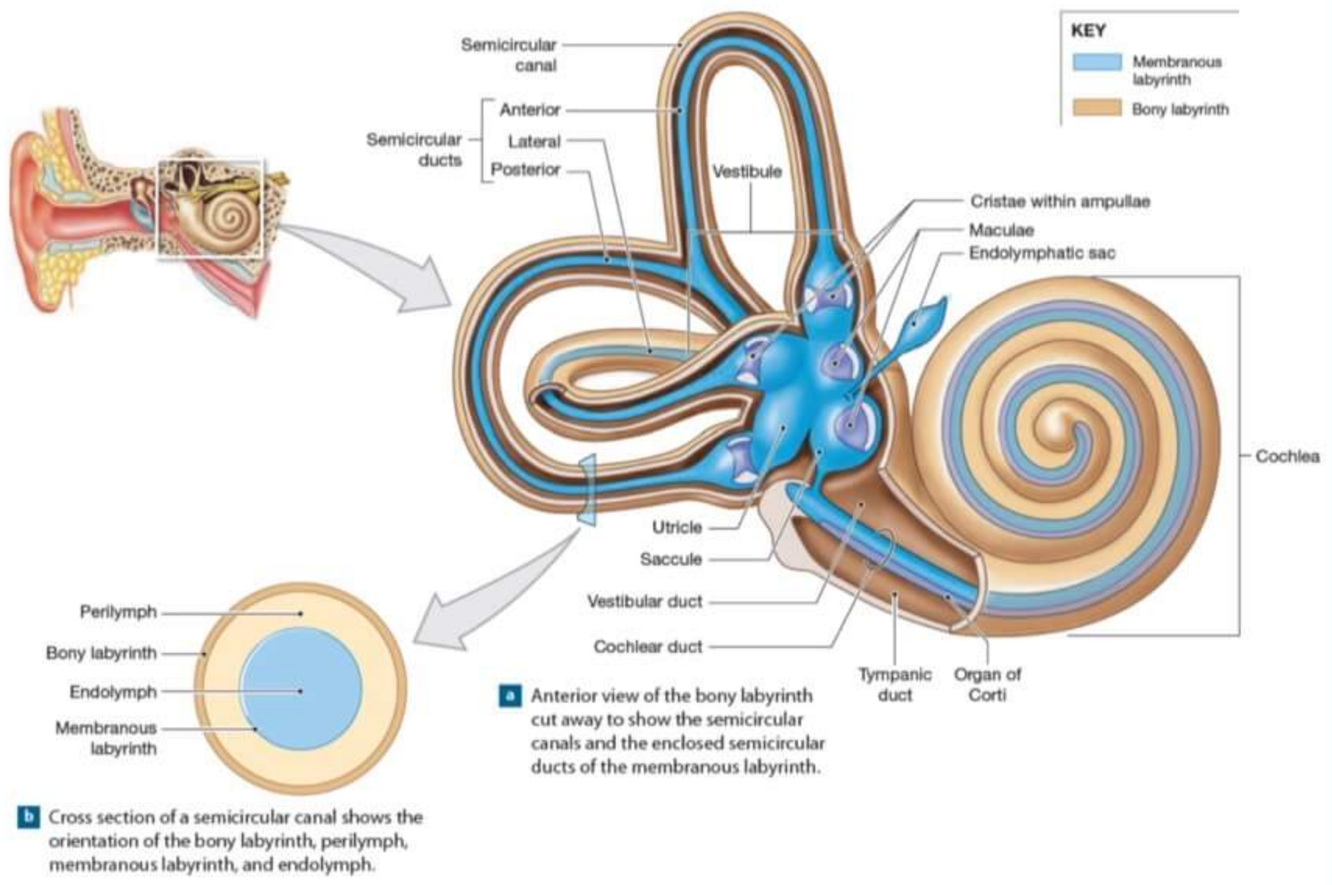
INNER MEMBRANOUS LABYRINTH

BONY LABYRINTH

→ includes cochlea (anteriorly)

vestibule (middle)

SCC (posterior)

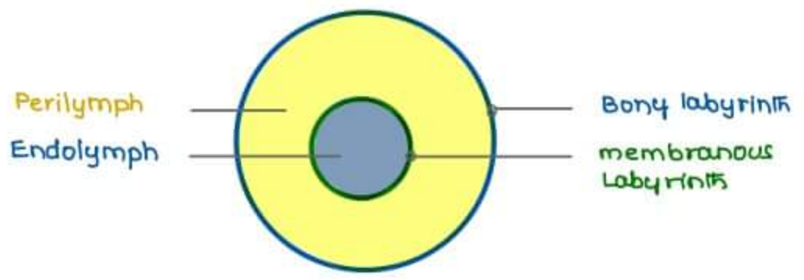


COCHLEA

→ has 2.75 turns

- Basal turn → receives high frequency sound
- Apical turn → receives low frequency sound

→ Spiral Ganglion → Cochlear ganglion



VESTIBULE

→ membranous labyrinth → Utricle & Saccule

→ Saccule connecting ↄ cochlear duct

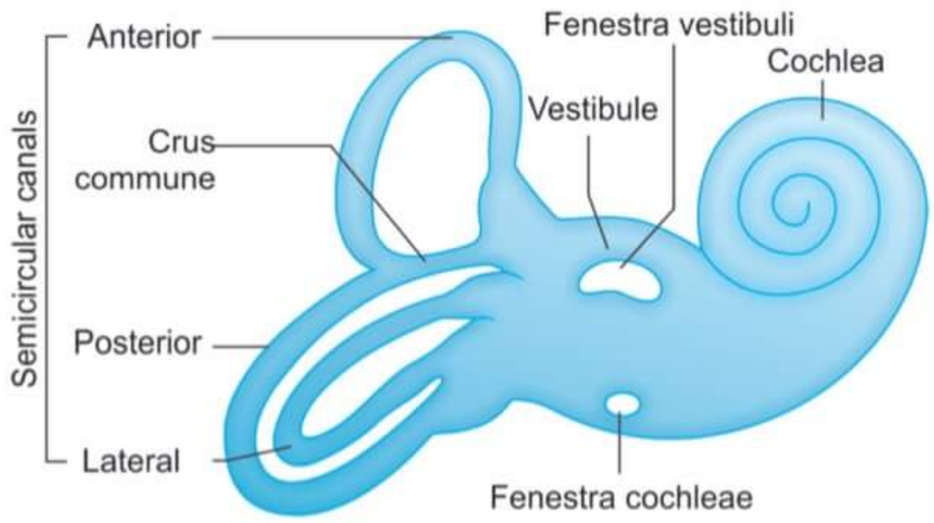
Utricle Connecting ↄ SCC

ENDOLYMPH & PERILYMPH

→ Ultra filtrate of blood

→ formed by capillary plexus

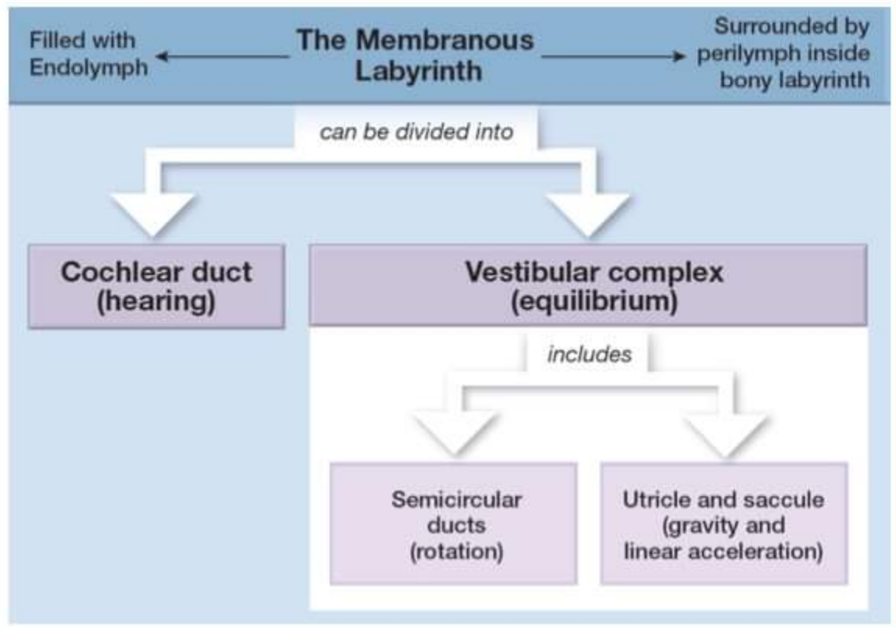
→ drains into extra dural venous plexus



FUNCTION

1 EQUILIBRIUM → by Vestibule → Linear acceleratⁿ
Scc → Angular acceleratⁿ

2 HEARING → by Cochlear nerve



MEMBRANOUS LABYRINTH

→ cochlear duct
→ Utricle
→ Saccule

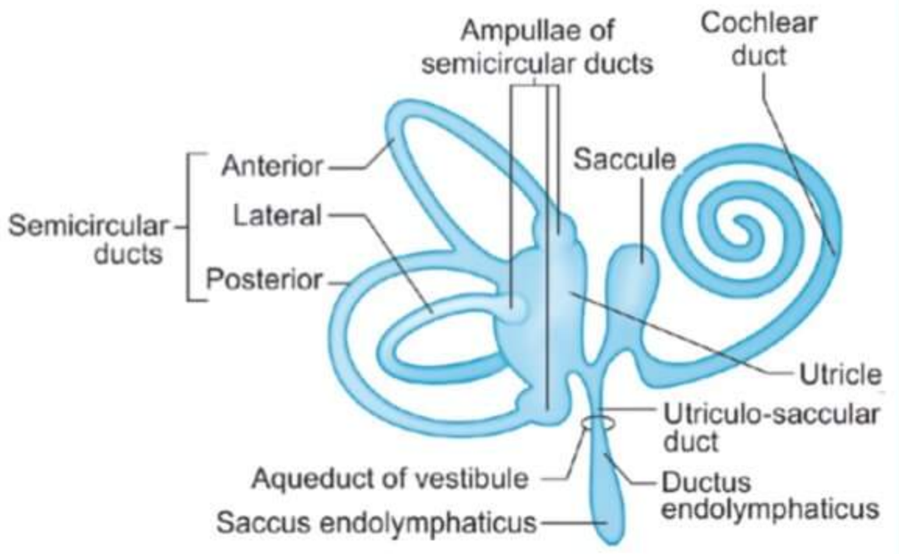
DUCTUS REUNION

→ cochlear duct communicating ī saccule

DUCTUS ENDOLYMPHATICUS

→ utricle communicating ī saccule

SACCUS ENDOLYMPHATICUS → Sub dural >
intra dural >
Extra dural



SEMI CIRCULAR CANAL

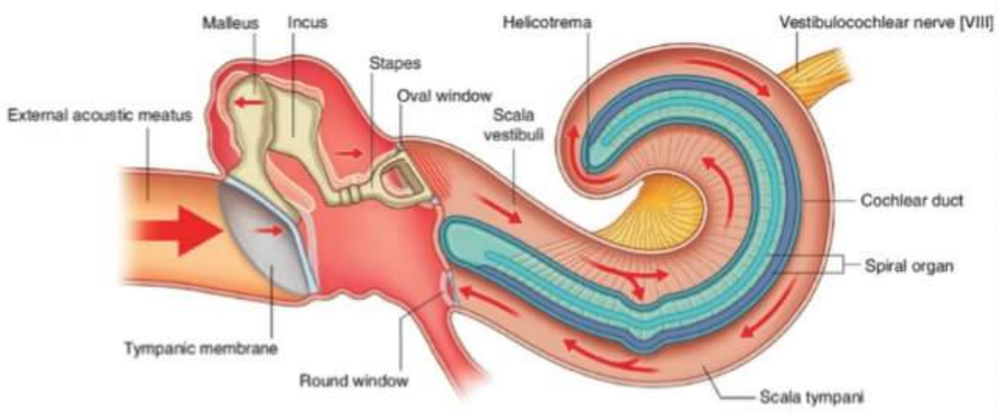
L → Lateral
A → Anterior
P → Posterior

communicate ī Utricle ī 5 openings (ampulla)
ampulla have crista angularis (receptor for angular rotation)

MACULA Receptor present in Utricle & Saccule for linear/static balance

INNER EAR - SOUND CONDUCTION

Foot plate of stapes fixed to Oval window
↓
Vibrations OF footplate OF stapes
↓
Perilymph vibrations in scala vestibuli
↓
continues as scala tympani
↓
continues ī round window (covered by Tympanic membrane)



SCALA MEDIA

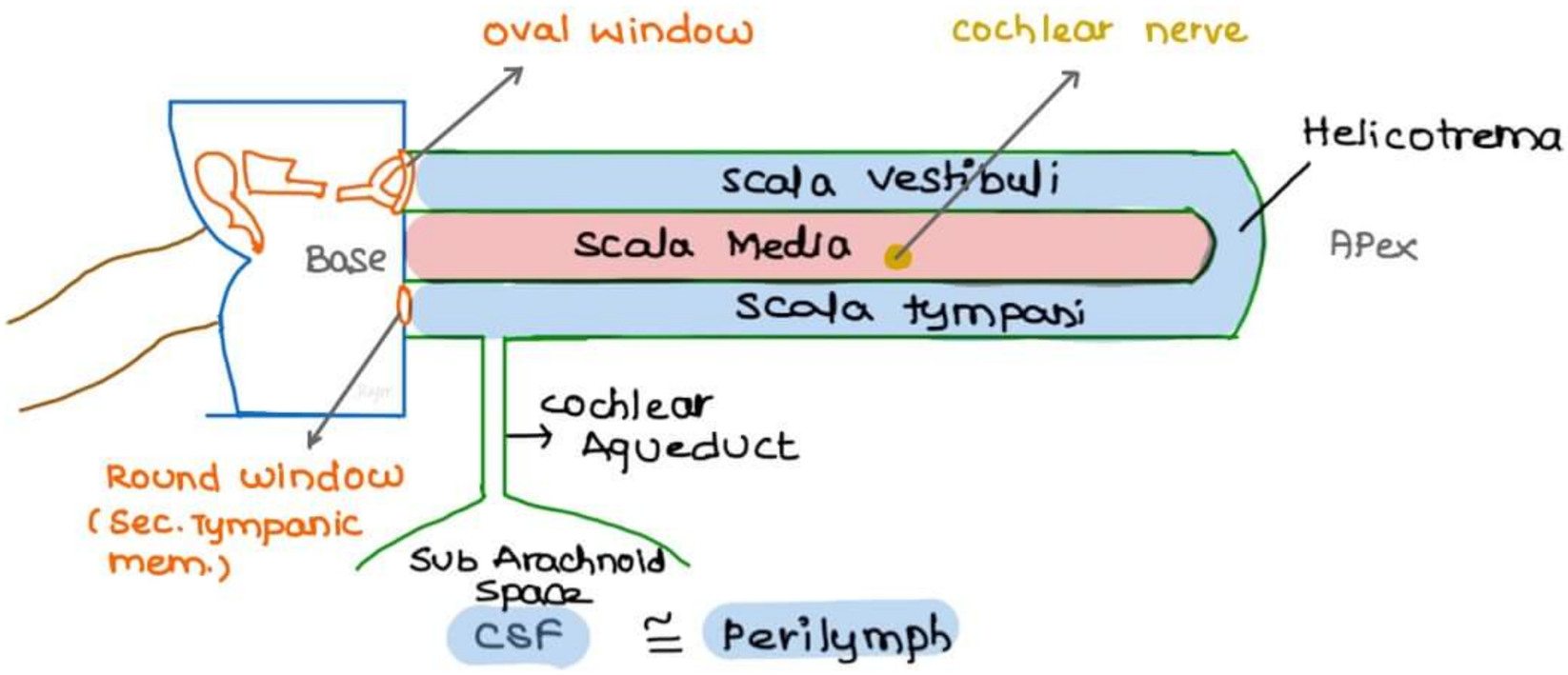
→ filled ī endolymph
→ Hair cells present here detects vibratⁿ & passes informatⁿ to cochlear nerve

ORGAN OF CORTI

→ Located at cochlear duct area

→ Transducer

- changes mechanical energy → Electrical energy



→ contain HAIR CELLS

→ contains STEREO CILIA

- acts as transducers
- converts mechanical energy into electric energy

→ TYPES

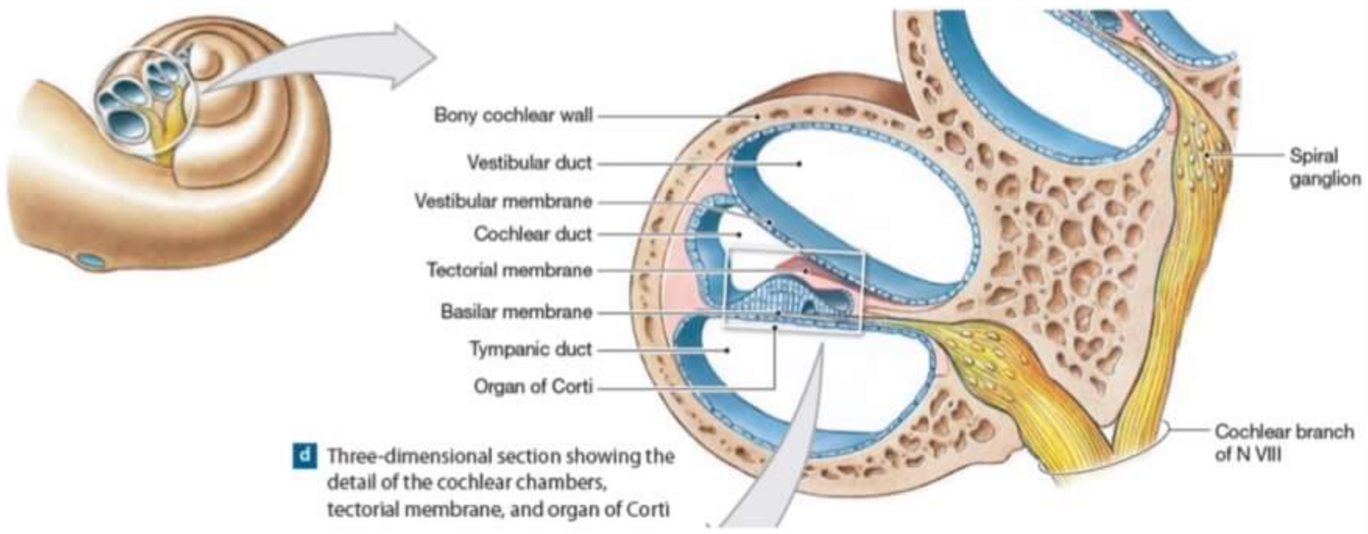
- Inner cells for sound productⁿ
- Outer cells modulates the activity of inner cells

COCHLEAR NERVE

→ carry 95% of contributⁿ from inner cells
carry 5-10% of contributⁿ from outer cells

STRIA VASCULARIS

- Secretes endolymph
- Endolymph receives vibration and moves tectorial membrane Which Stimulates hair cells



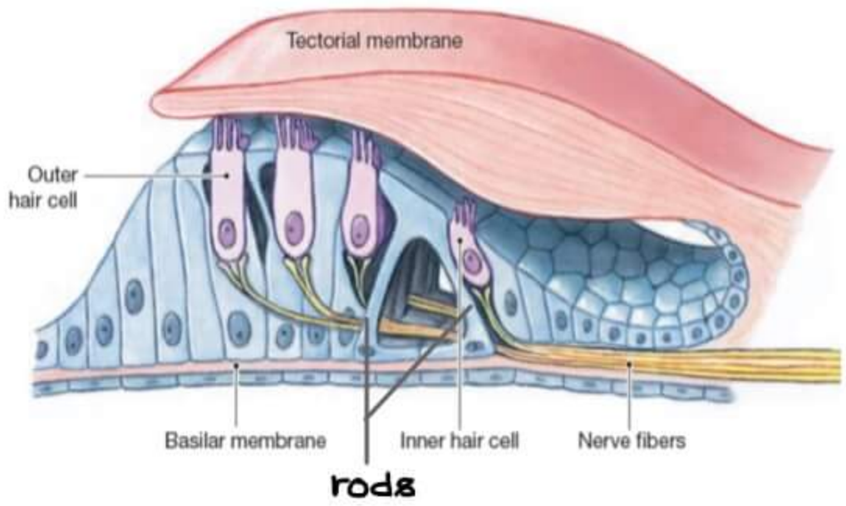
VESTIBULAR / REISSNER MEMBRANE → Separates Scala vestibuli & Scala media

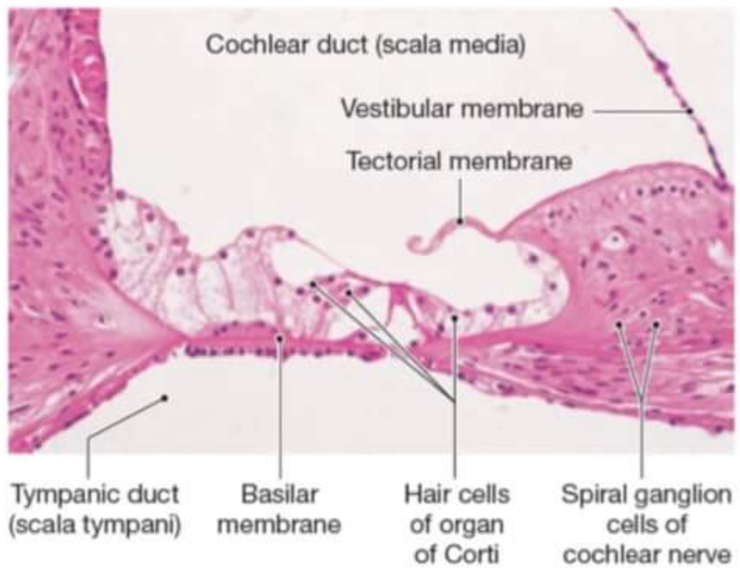
BASILAR MEMBRANE → Separates Scala media & Scala tympani

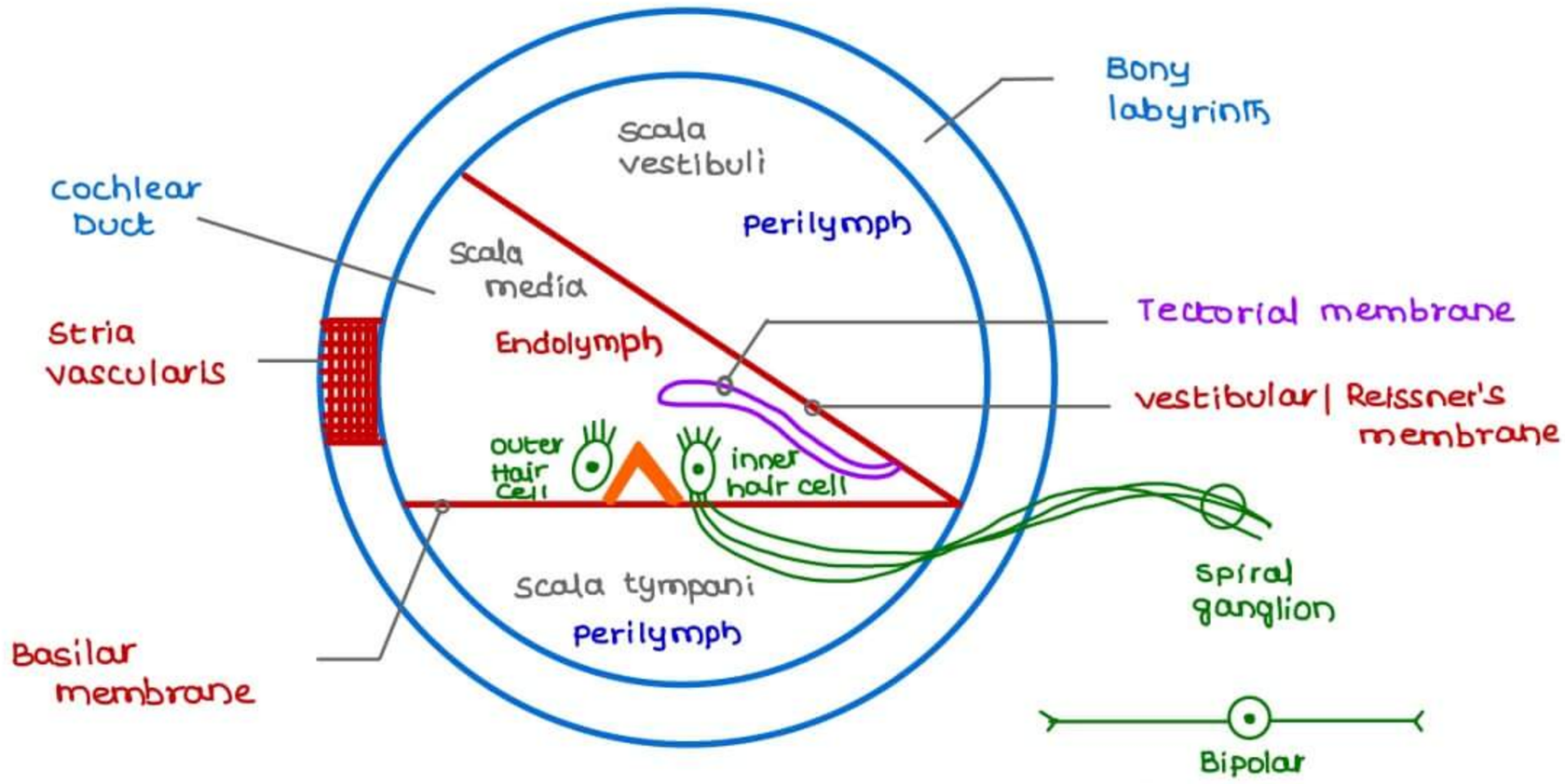
TECTORIAL MEMBRANE

→ present inside Scala media

→ Endolymph vibration → vibrates tectorial membrane → STEREOCILIA deviated → Sound Production

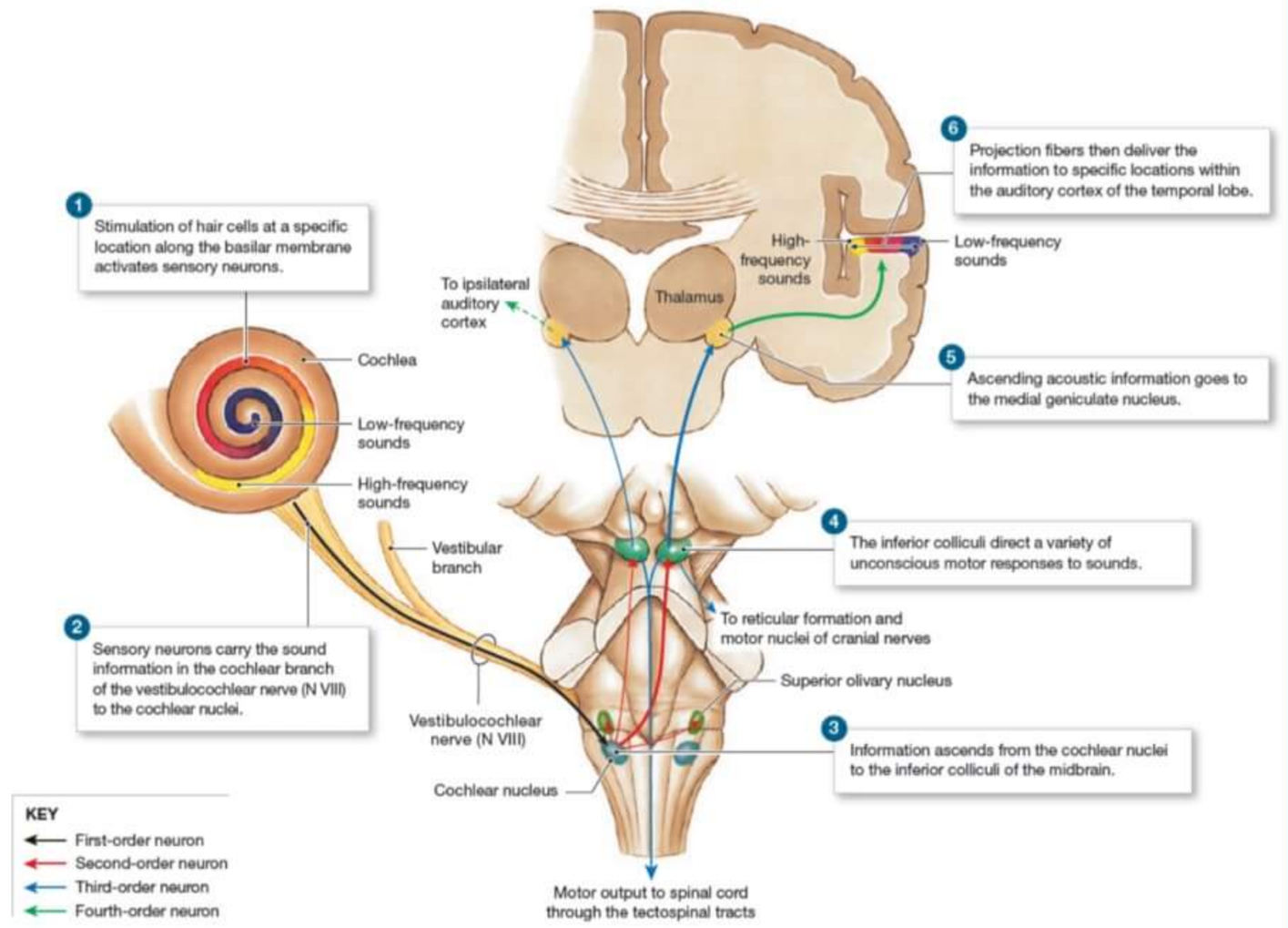


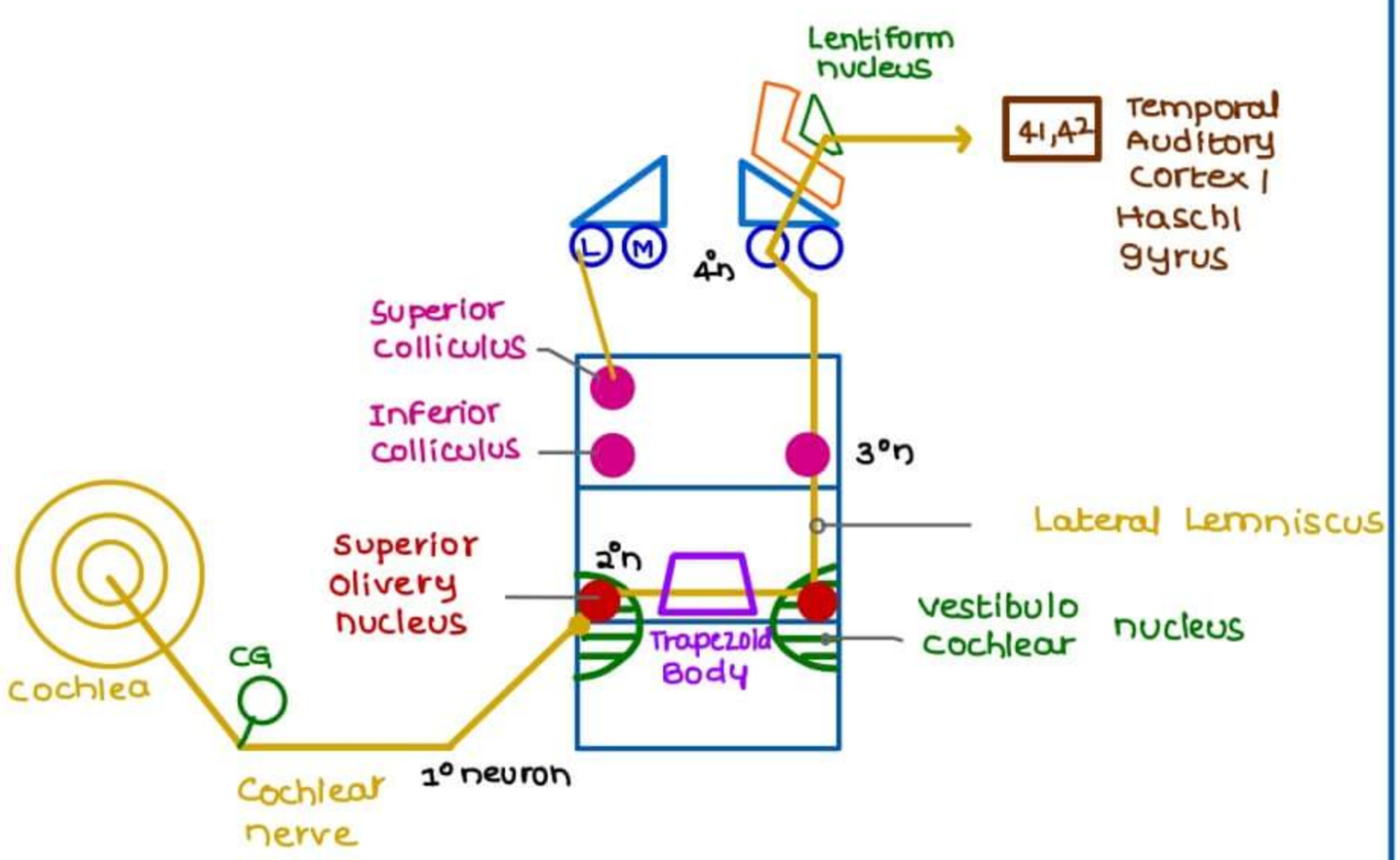




AUDITORY PATHWAY

COCHLEA
↓
Spiral Ganglion
↓
cochlear nerve
↓
Superior olivary N. in MO
↓
Lateral 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

ETHMOID BONE

→ hollow from inside

→ Ethmoid air sinus present

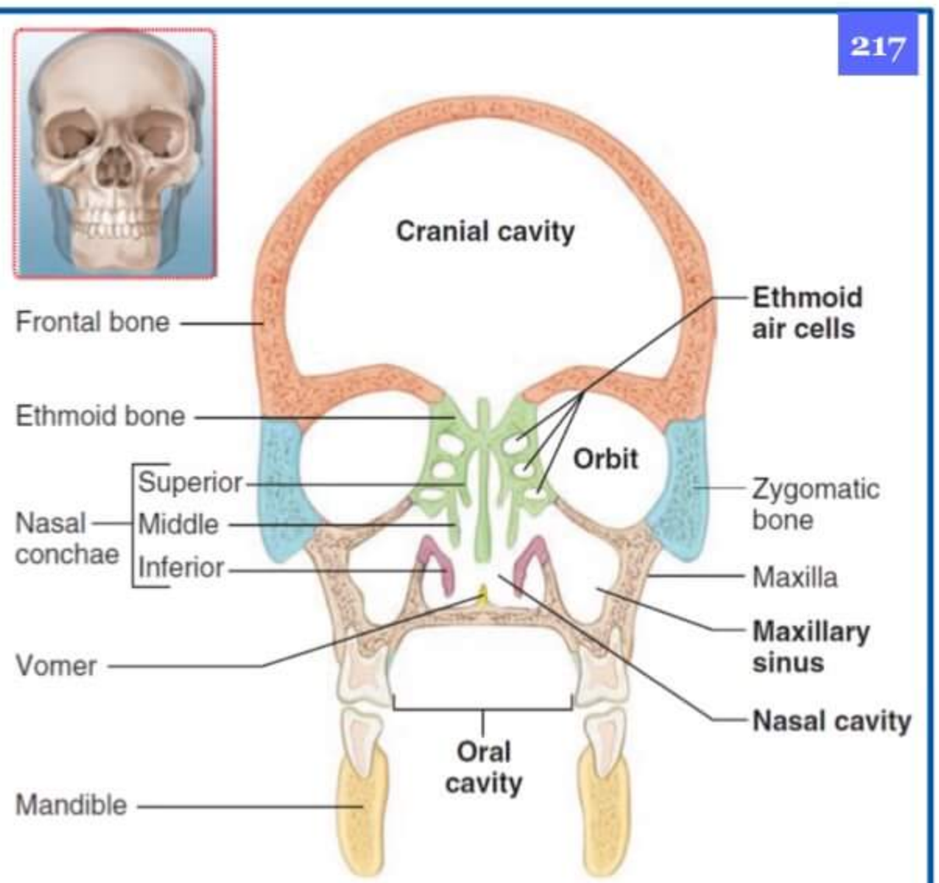
forms medial wall of Orbit (papery thin)

ORBIT

ROOF formed by frontal bone

Lateral wall by zygomatic bone

Floor by maxilla bone



→ NASAL CONCHA / TURBINATE

Superior & middle turbinate

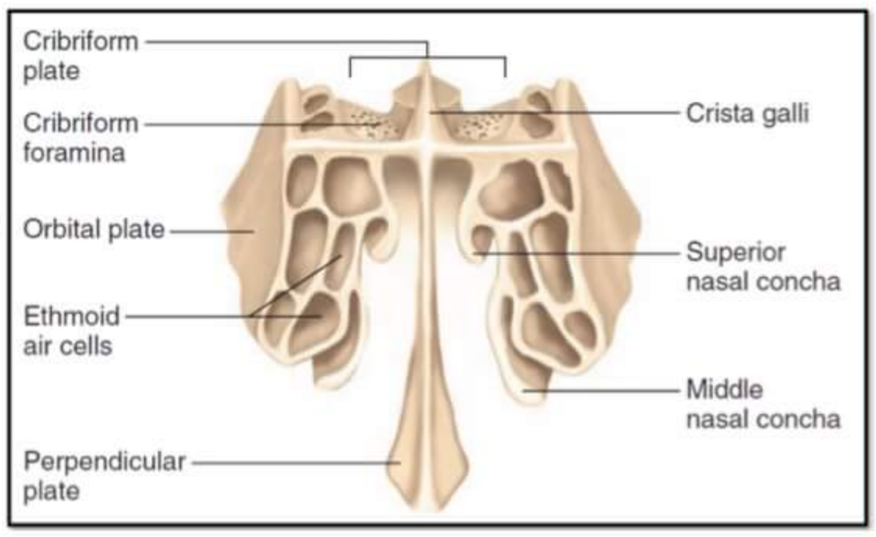
present in lateral wall of nose

→ cribriform of plate of ethmoid

→ # at the floor of ACF → CSF Rhinorrhea

→ passage of axons of olfactory nerve at the floor of ACF

→ Forms roof of nose



→ CRISTA GALLI

→ midline projection at the floor of ACF

→ INFERIOR CHONCHA

→ Separate bone

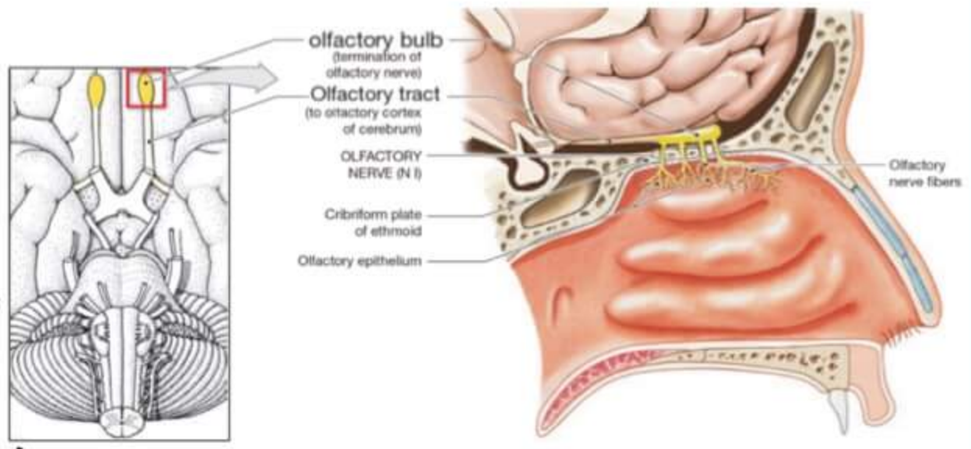
→ articulate ɪ maxilla bone

- forms Floor & medial wall of orbit
- forms roof of oral cavity
  - Palate is formed by palatine & maxilla bone
- forms floor of nasal cavity

→ PERPENDICULAR PLATE OF ETHMOID

→ forms nasal septum from above

(vomer forms nasal septum from below)



→ ETHMOID AIR SINUSES (Pneumatic bone)

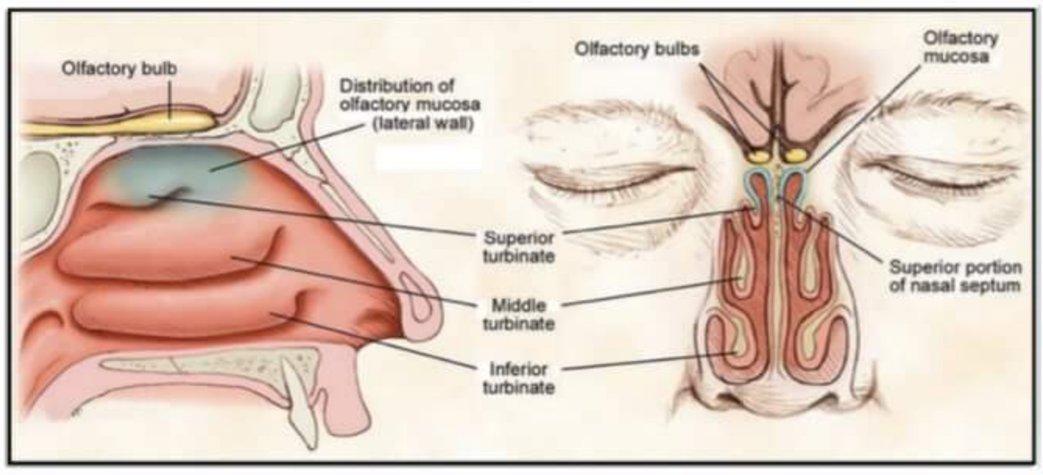
OLFACTORY MUCOSA

→ Nasal mucosa above the superior turbinate

→ Olfactory neuron bodies present here

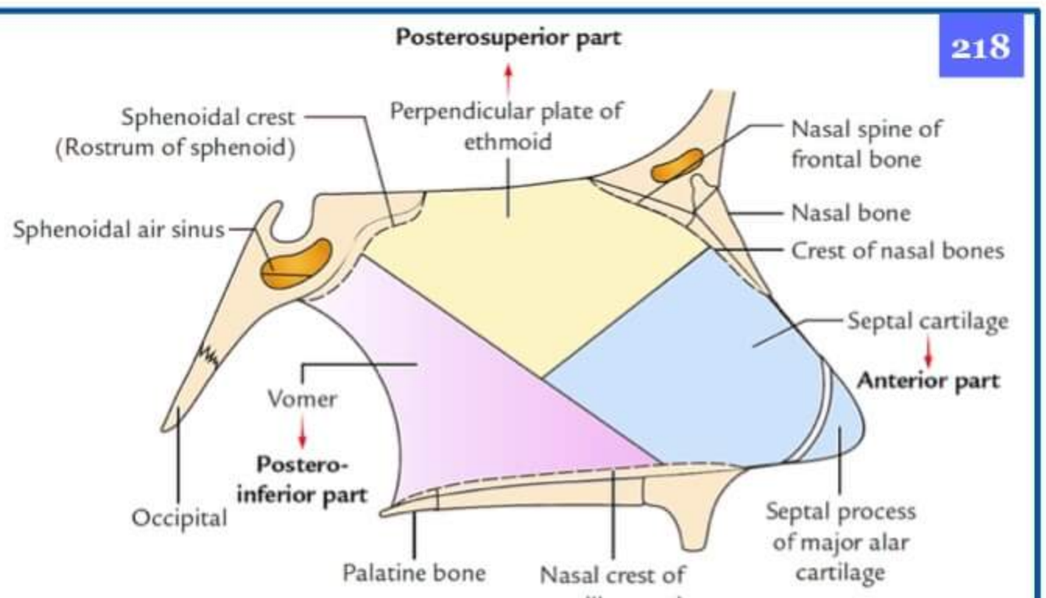
Shortest cranial n → Olfactory n.

Longest cranial n → Vagus



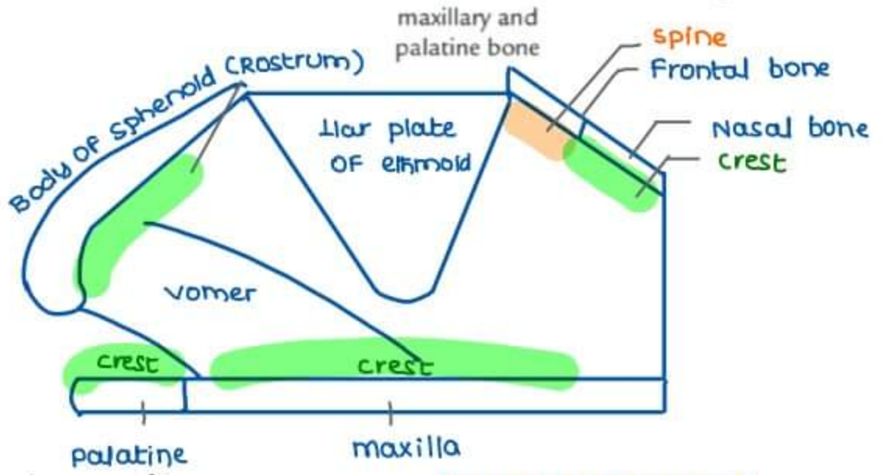
NASAL SEPTUM

Q Bony nasal septum is formed by all Except
a Vomer
b Sphenoid
c Ethmoid
d Nasal spine of nasal bone



FORMED BY

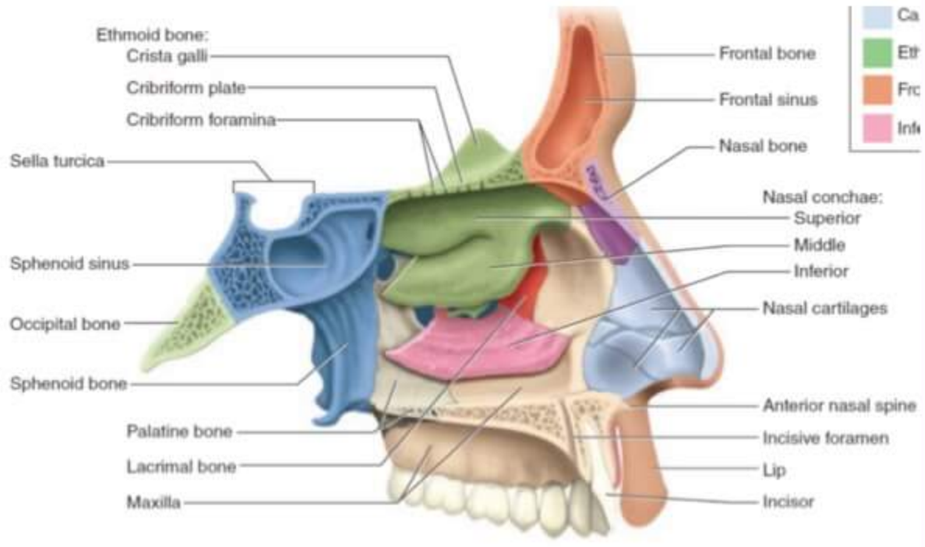
1. Perpendicular plate of Ethmoid from above
2. Vomer from below
3. Nasal spine of frontal bone
4. Crest of Nasal bone
5. Crest / Rostrum of Sphenoid at the roof of nasal cavity
6. Nasal crest of maxillary & palatine bone



NASAL SEPTUM

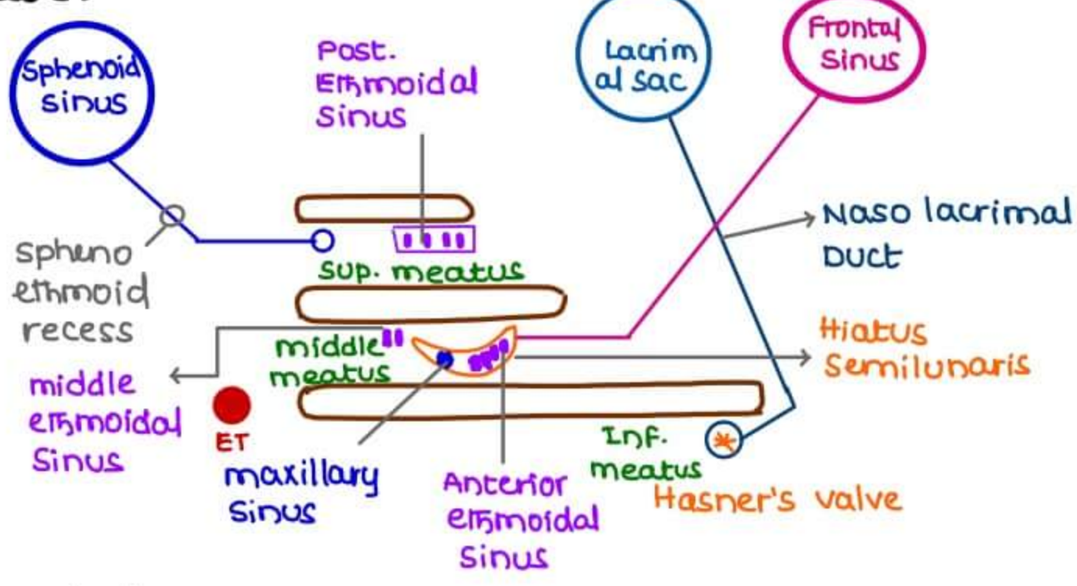
Schindylesis → Suture at the roof of nasal cavity
→ Sphenovomerine joint
Rostrum of Sphenoid & Ala of vomer

LATERAL WALL



BONES

1. MIDDLE TURBINATE
2. SUPERIOR TURBINATE
   } comes from Ethmoid bone
3. INFERIOR TURBINATE
   - separate bone
   - articulate & maxilla & Lacrimal bone
4. LACRIMAL BONE
5. ETHMOID BONE (labyrinth)
6. MAXILLA BONE
7. PALATINE BONE (Ilar plate)
8. SPHENOID BONE (medial pterygoid plate)
9. NASAL BONE
10. UNCINATE PROCESS OF ETHMOID



Largest turbinate → Inferior turbinate
Largest meatus → Inferior meatus

OPENINGS

1. at ant. end of inf. 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

Q All are true about the openings in the lateral wall of nasal cavity & nasopharynx Except

a Nasolacrimal duct opens in the inferior meatus

b Post. ethmoidal sinus open in the superior meatus

c Inferior turbinate is a part of ethmoid bone

d Eustachian tube opens in nasopharynx behind the inferior turbinate

DIRECTION OF NASOLACRIMAL DUCT

→ Downward

Backward

Lateral

EYEBALL

Q Ciliaris muscle is derived from

a Neural crest cells (BETTER ANSWER)

b Neural Plate ectoderm

c Surface ectoderm

d Mesoderm

DEVELOPMENT

EPIBLAST

3 Germ layers

ENDODERM

MESODERM (Primary)

ECTODERM

NEURAL PLATE ECTODERM

CNS → Diencephalon → ① Retina, ② Optic nerve

EPITHELIUM OF DIENCEPHALON

③ Epithelium of Ciliary Body

④ Epithelium of IRIS

⑤ Muscles

Sphincter pupillae

Dilator pupillae

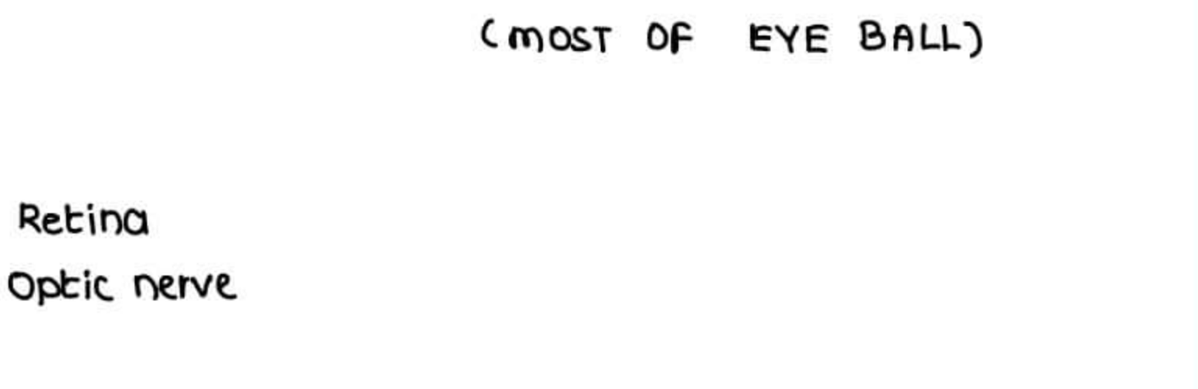
NCCs (4th Germ layers)

SEC. MESODERM OF EYE BALL

(MOST OF EYE BALL)

SURFACE ECTODERM

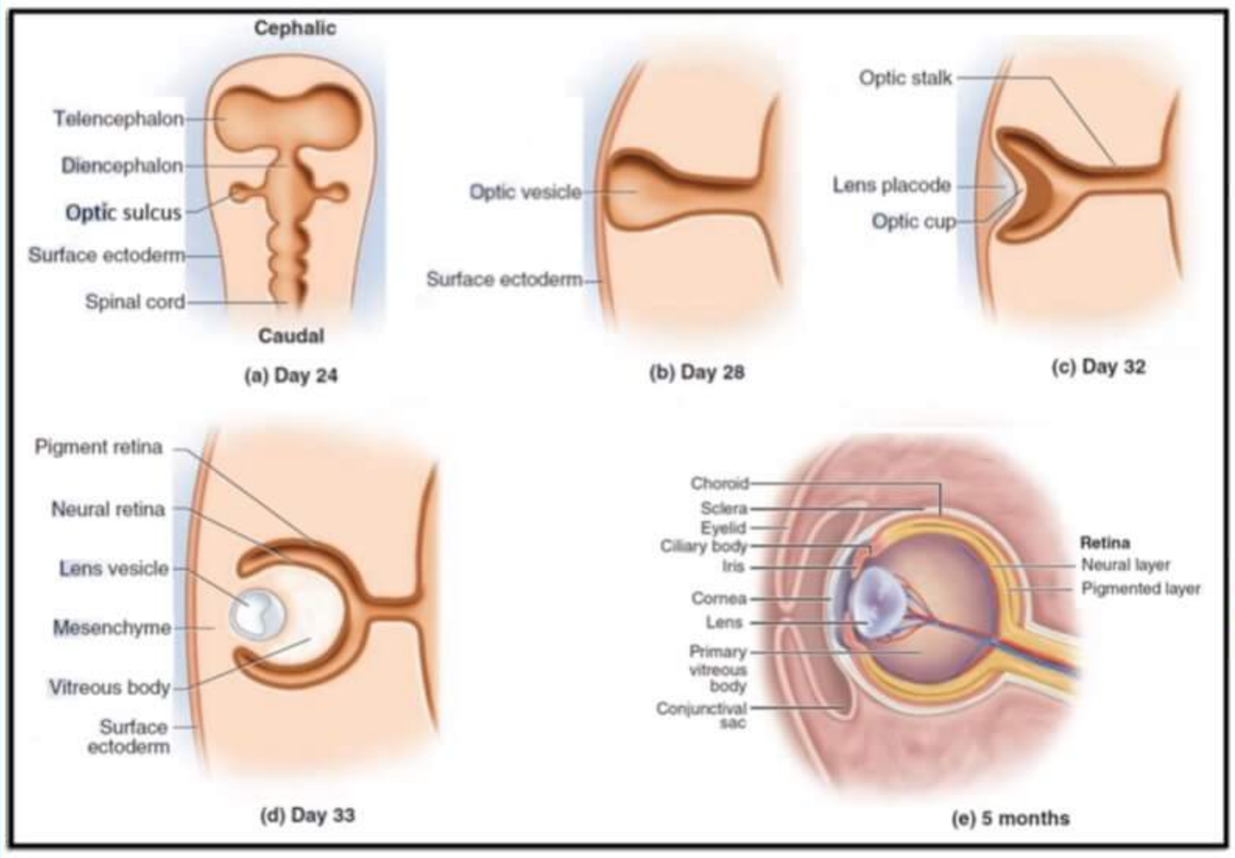
1. Cornea (1st layer)
2. Eye lens

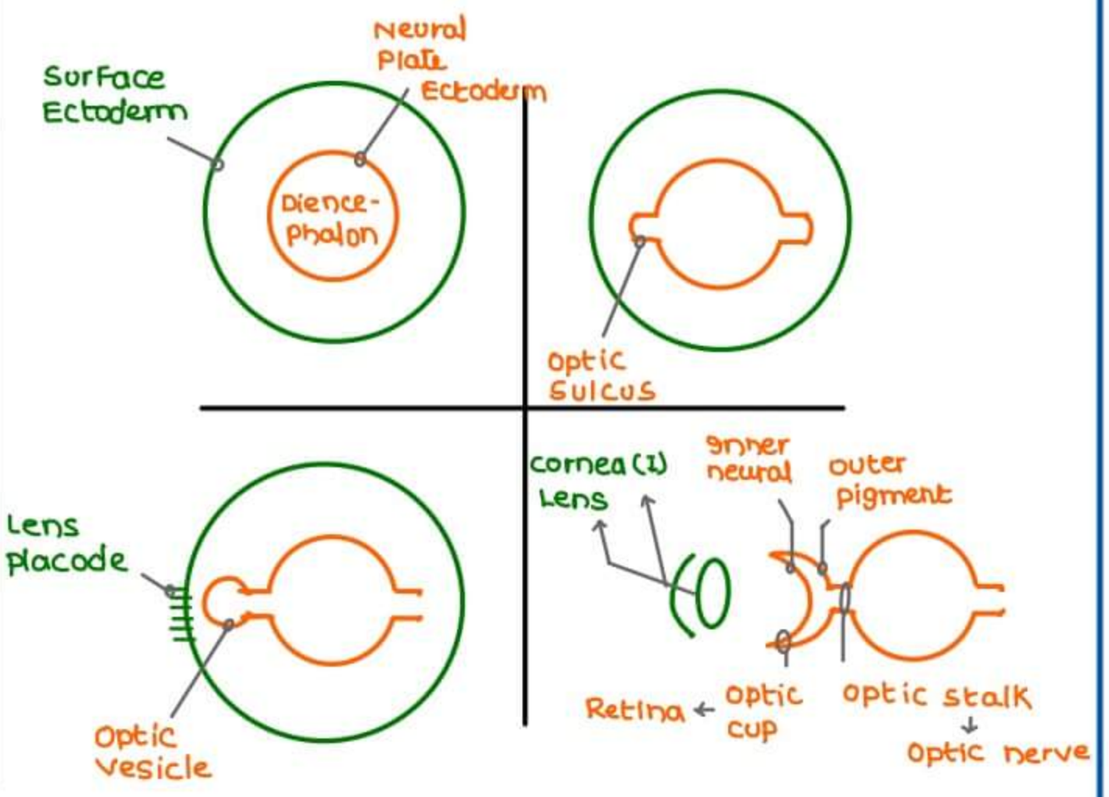


DIENCEPHALON

Optic Groove | Sulcus → Optic vesicle → Optic cup → Retina, Optic nerve

SURFACE ECTODERM → cornea (1) & Eye lens

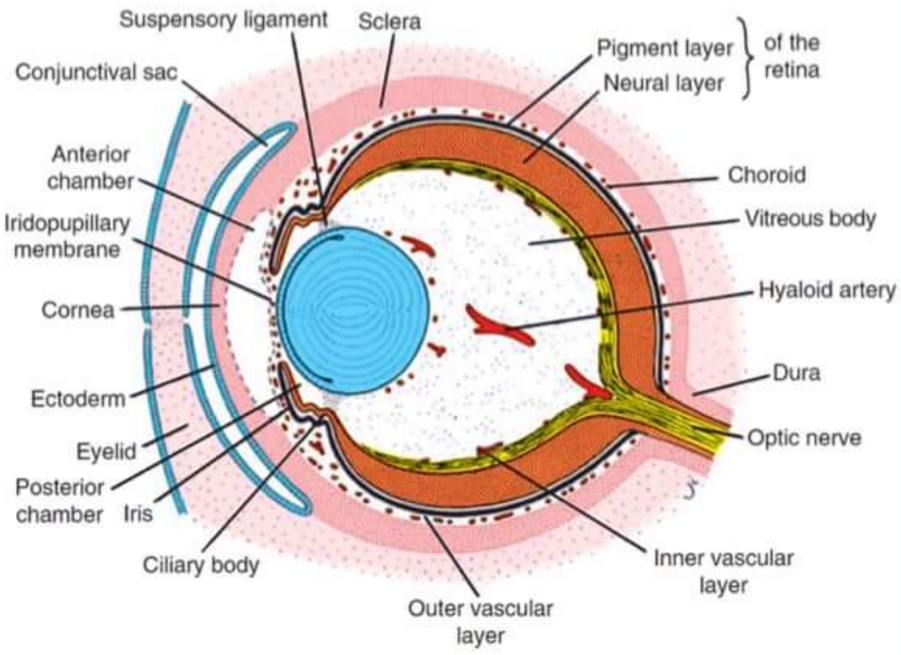




ORA SERRATA → Here neural layer becomes non neural

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

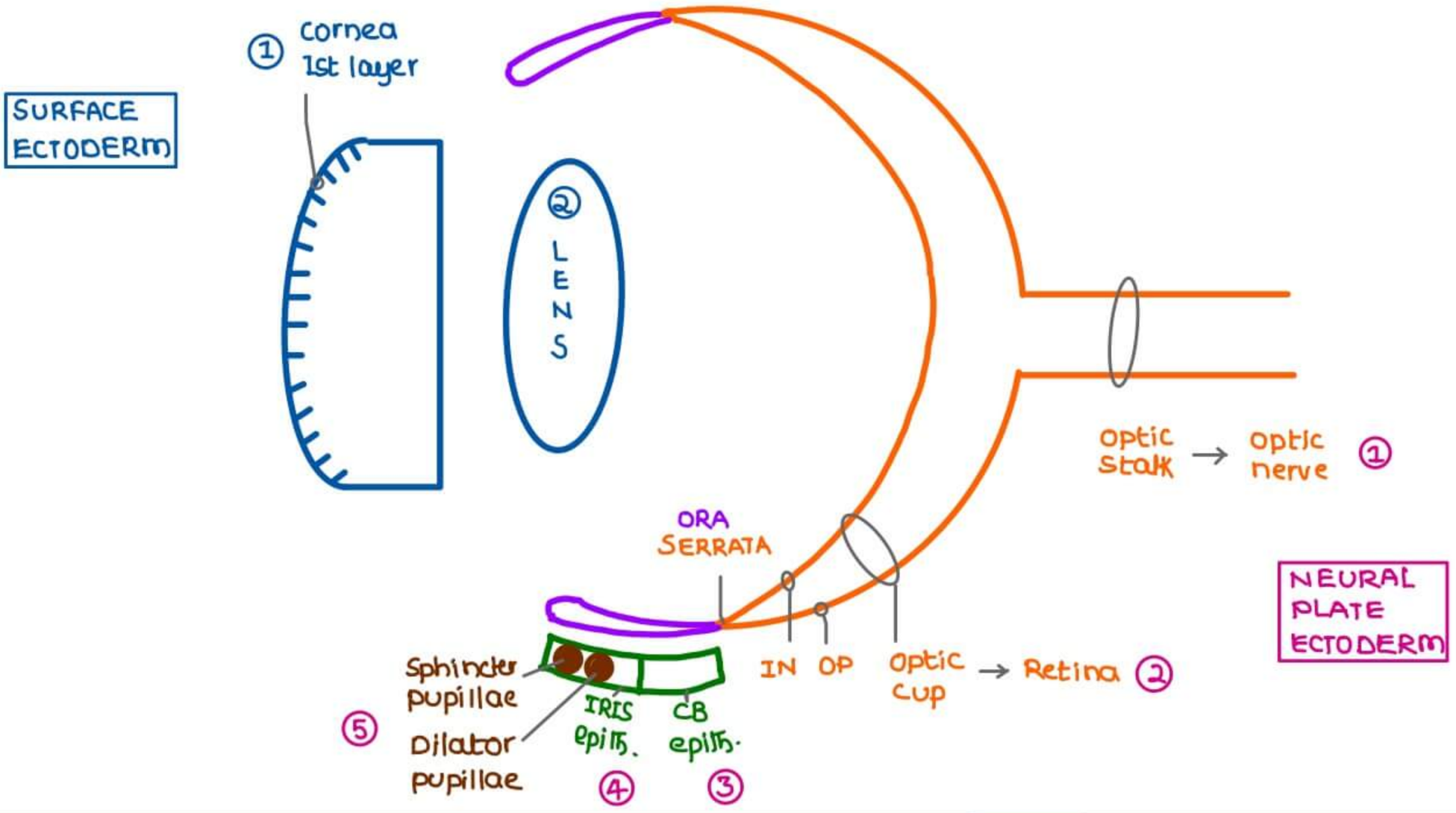
CONNECTIVE TISSUE

All layers of cornea Except 1st layer

vitreous

Sclera, choroid

Dura mater



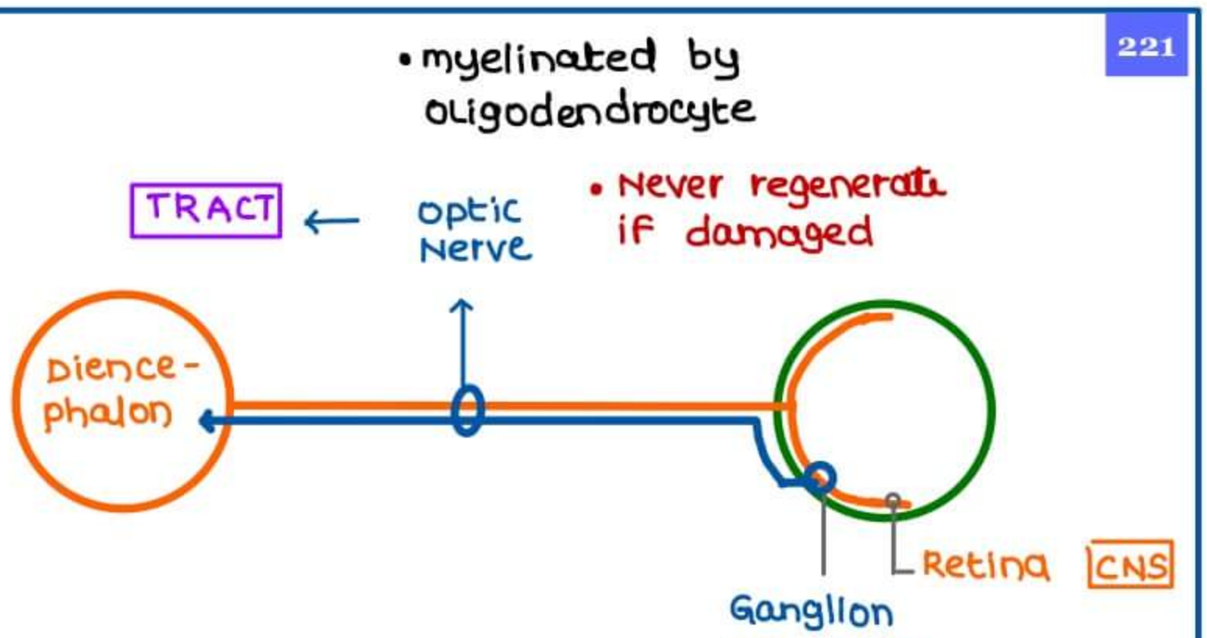
Q corneal Endothelium develops from

a Neural crest cells

b Neural plate ectoderm

c Surface ectoderm

d Mesoderm



OPTIC NERVE

→ Not a true nerve . It is a TRACT

→ MULTIPLE SCLEROSIS

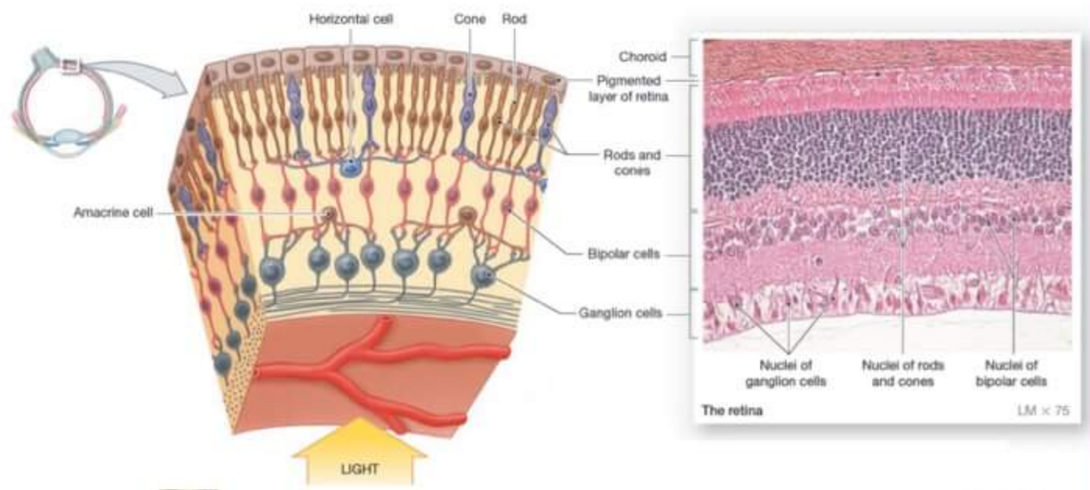
→ defect in oligodendrocytes (myelination affected)

→ Optic nerve affected

→ Peripheral Nerves Spared (myelinatn by Schwann cells)

→ 3° Neuron

rods & cones	→	1° neurons
Bipolar cells	→	2° neurons
Ganglion cells	→	3° neurons
Optic nerve	→	3° neurons



ORBIT

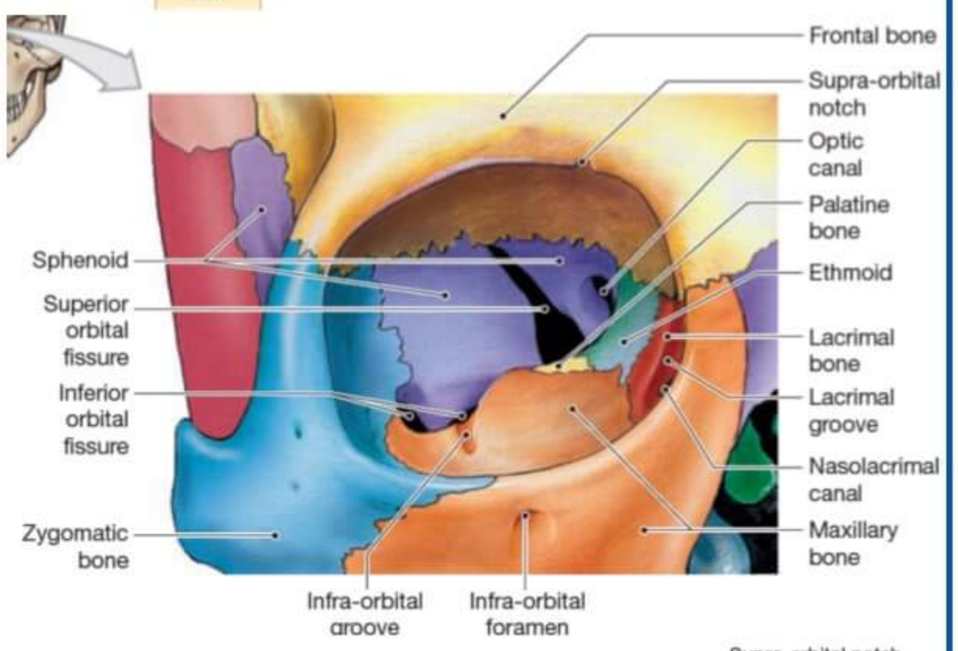
BONY BOUNDARIES

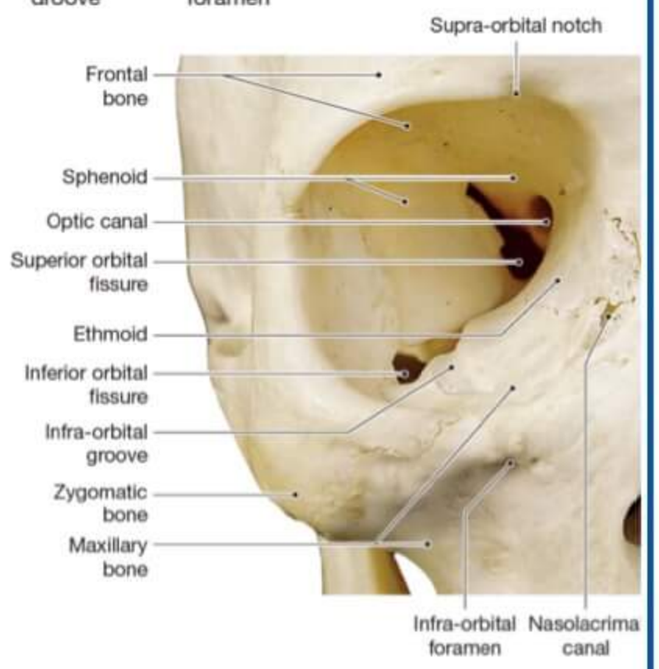
ROOF → Frontal bone
Lesser wing of Sphenoid
ī Optic canal

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



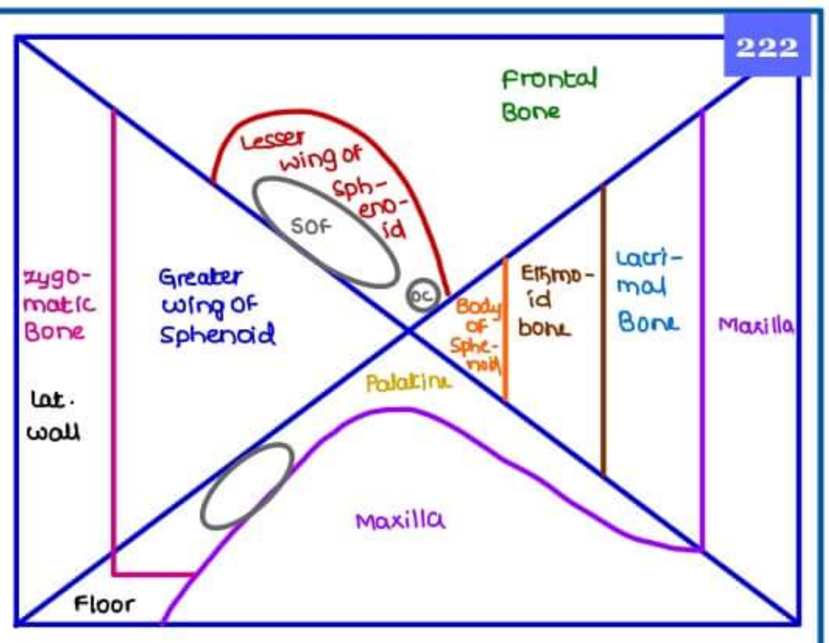


INFERIOR ORBITAL FISSURE → Junctn of lateral wall & Floor

SUPERIOR ORBITAL FISSURE → Gap blw Lesser wing , Greater wing OF Sphenoid

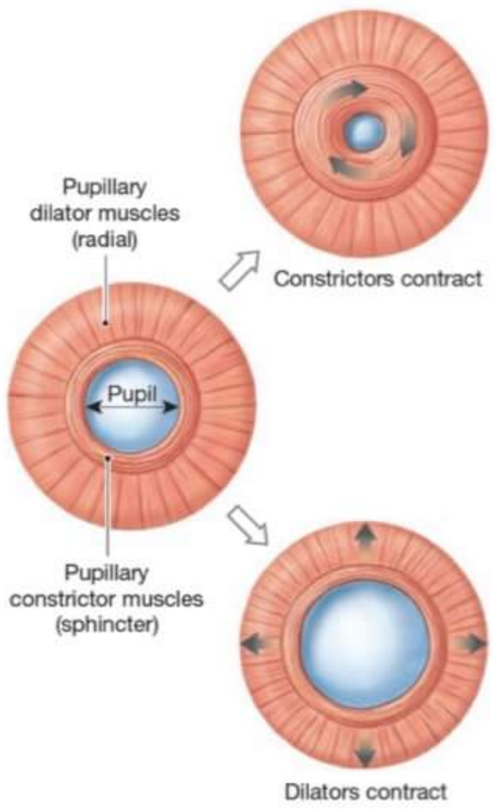
OPTIC CANAL → present blw less wing & Body of Sphenoid

BLUNT TRAUMA TO ORBIT (BLOWOUT FRACTURE OF ORBIT)



- → Floor damaged
  - → Maxilla broken
  - → Protrusn of contents in maxillary sinus occurs
- → Medial wall damaged
  - → Ethmoid bone also damaged

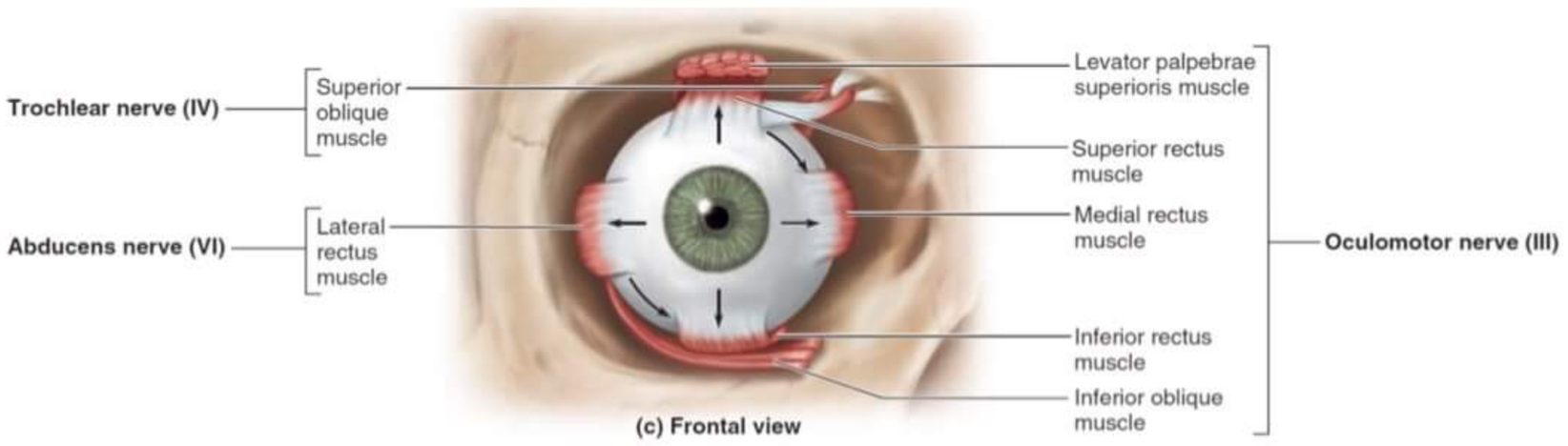
IRIS MUSCLES



- → Smooth muscles controlled by ANS
- → DILATOR PUPILLAE
  - → Fibres are arranged radially
  - → controlled by T_1 sympathetic fibres
  - → Adrenergic muscle → causes Mydriasis
- → SPHINCTER PUPILLAE
  - → concentric fibres
    controlled by Parasympathetic System
    Cholinergic muscles → causes miosis

EYE BALL MUSCLES

- → Skeletal muscles controlled by somatic nervous system
- → All muscles are inserted on sclera



SUPERIOR OBLIQUE MUSCLE

INFERIOR OBLIQUE MUSCLE

- → Origin → Floor of orbit
- → Insertn → Sclera
- → passing under Inferior rectus & inserts on Sclera

RECTI MUSCLES

MEDIAL RECTUS	→	Adduction
LATERAL RECTUS	→	Abduction
SUPERIOR RECTUS	→	Elevation
INFERIOR RECTUS	→	Depression

LEVATOR PALPEBRAE SUPERIORIS

Skeletal part

→ Supplied by CN 3

→ injury leads to complete ptosis

Muller muscle (SUPERIOR TARSAL MUSCLE)

→ Smooth muscle

→ Elevates the eye lid

→ Supplied by T_1 Sympathetic fibres

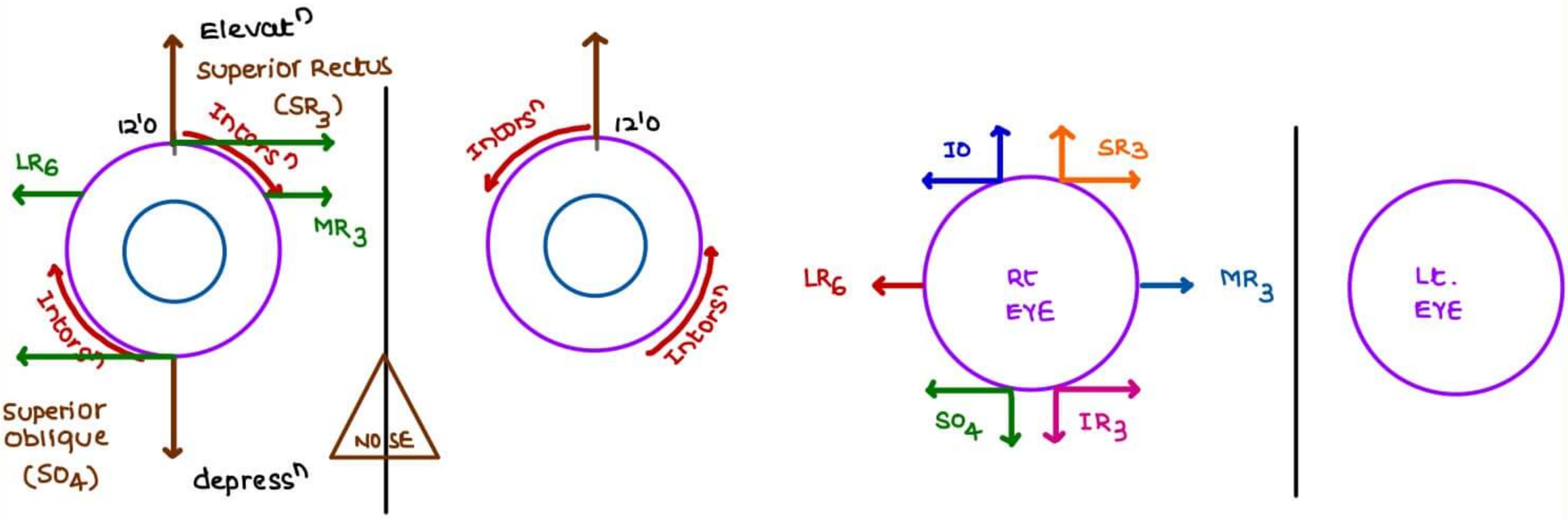
→ Compromised in Horner Syndrome (partial ptosis)

SIN → only Superior muscles can do INtorsion

→ Superior muscles

1. Superior Oblique
2. Superior Rectus

→ INTORSION → inward rotation

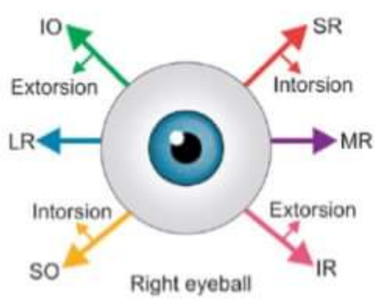


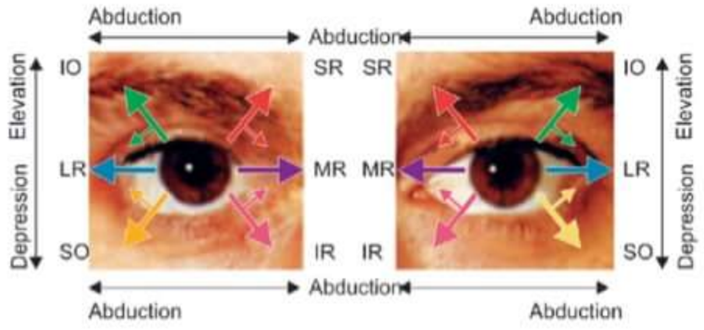
→ SUPERIOR RECTUS ACTIONS → Elevatⁿ, adductⁿ, Intorsⁿ → Up, Inside & Intorsⁿ

→ SUPEROR OBLIQUE ACTIONS → Depressⁿ, abductⁿ, Intorsⁿ → Down, out & Intorsⁿ

Superior Rectus & Superior Oblique are antagonistics except for intorsⁿ

→ Superior Oblique muscle Synergestic ī
Superior Rectus in Intortⁿ
Lateral Rectus in abductⁿ





→ Superior Rectus muscle Synergestic ī
Medial rectus in Adductⁿ

→ Superior Rectus & Superior Oblique are antagonistics except for intorsⁿ

→ Superior Oblique & Inferior Oblique are antagonistics except for abduction

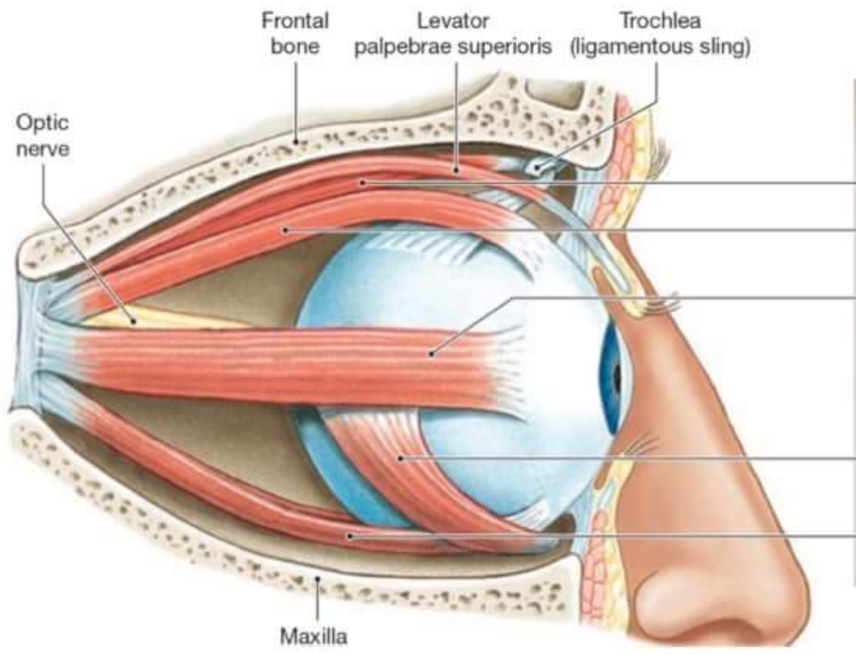
→ Superior rectus & Inferior rectus are antagonistics except for adductⁿ

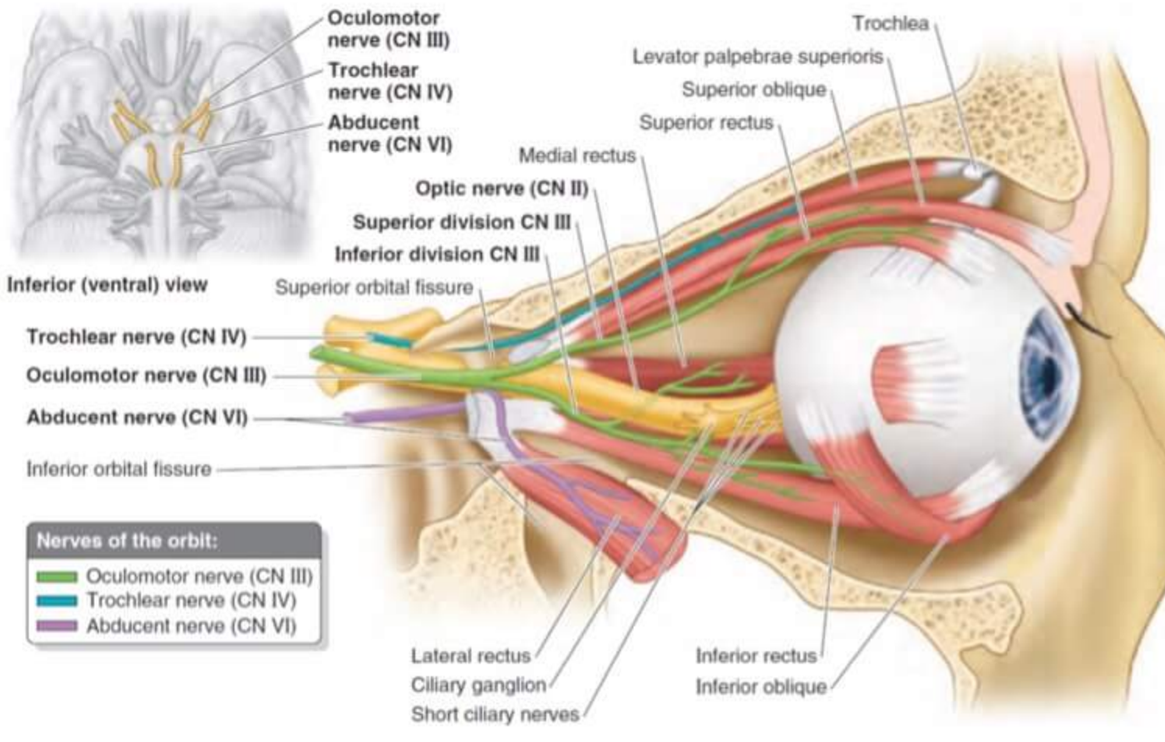
→ Both Obliques are abductors

→ All recti are adductors except lateral rectus (abductors)

→ 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 Mid Brain

→ 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

CN 3, 6 passes inside the ring of zinn

CILIARY GANGLION → Gives short ciliary nerves & Long Ciliary nerves

INFERIOR DIVISION OF CN3 is connected to Ciliary ganglion & topographically connected to Trigeminal nerve (post ganglionic fibres/ Short Ciliaryn.) & Supplies Sphincter pupillae & Ciliaris

Long Ciliary Nerves

→ carries T_1 Sympathetic Fibres From Superior Cervical ganglion & Supplies Dilator pupillae & Superior tarsal muscles

→ compromised in Horner Syndrome

ABDUCENT NERVE has longest intradural course

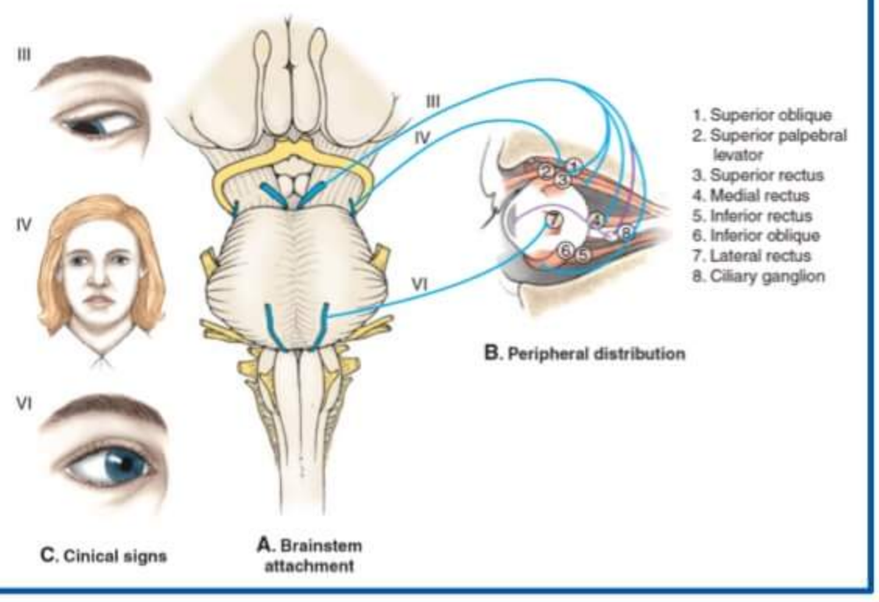
TROCHLEAR NERVE has longest intracranial course

LESIONS

CN 3 → Down & out eye

CN 4 → Head tilt opp. to side of lesion

CN 6 → Medial squint



OCCULO MOTOR NERVE (CN3)

COURSE

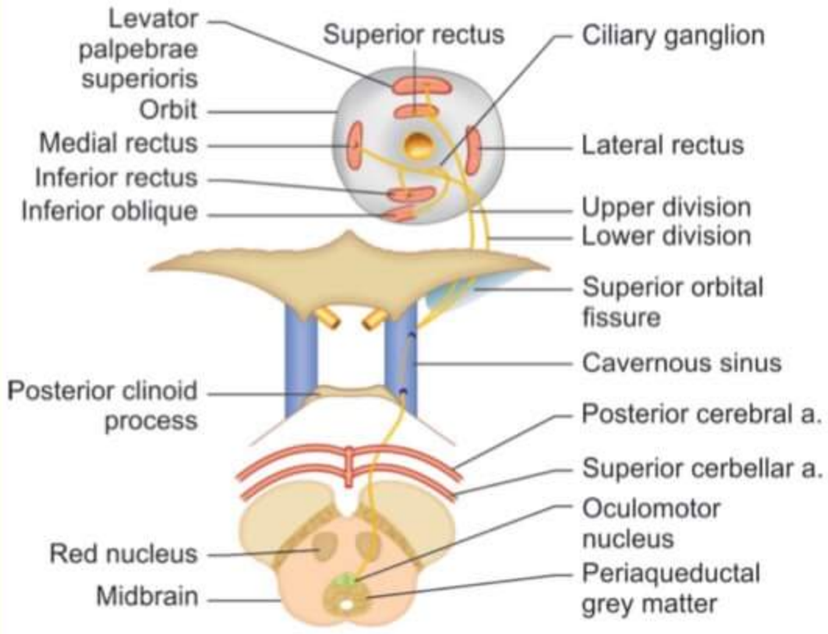
→ comes from midbrain at the level of superior colliculus (periaquiductal grey)

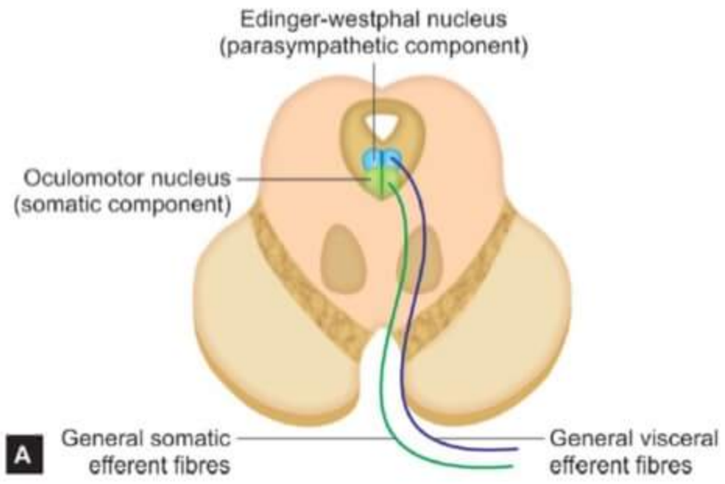
→ passes b/w superior cerebellar & post. cerebral arteries

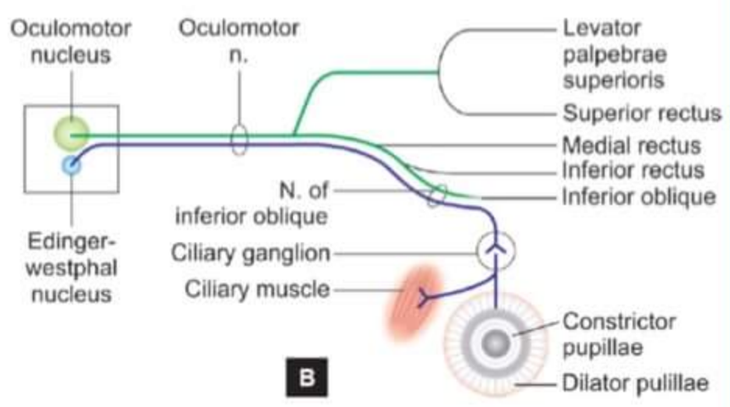
→ becomes content of cavernous sinus (lateral wall)

→ Exits through superior orbital fissure (2 divisions)

→ reaches orbit & supply eyeball muscles (except sup. oblique & lat. rectus)







EDINGER WESTPHAL NUCLEUS

→ para sympathetic component

→ controls Sphincter pupillae (light reflex)
ciliaris (accomodatn reflex)

→ GVE

→ sends pre ganglionic fibres to ciliary ganglion & post ganglionic fibres carried by br. of Trigeminal Nerve & supply sphincter pupilla and ciliaris

OCCULOMOTOR NUCLEUS $[LR_6SO_4]_3$

→ Somatic components

→ controls all skeletal muscles of EB except Superior Oblique & Lat. rectus

→ GSE

→ Occulomotor Nerve has Sup & inf. divisn in common tendinous ring of Zinn & passes SOF

→ Inferior division is related to ciliary ganglion & Supplie inf. rectus

Rt CN3 LESION

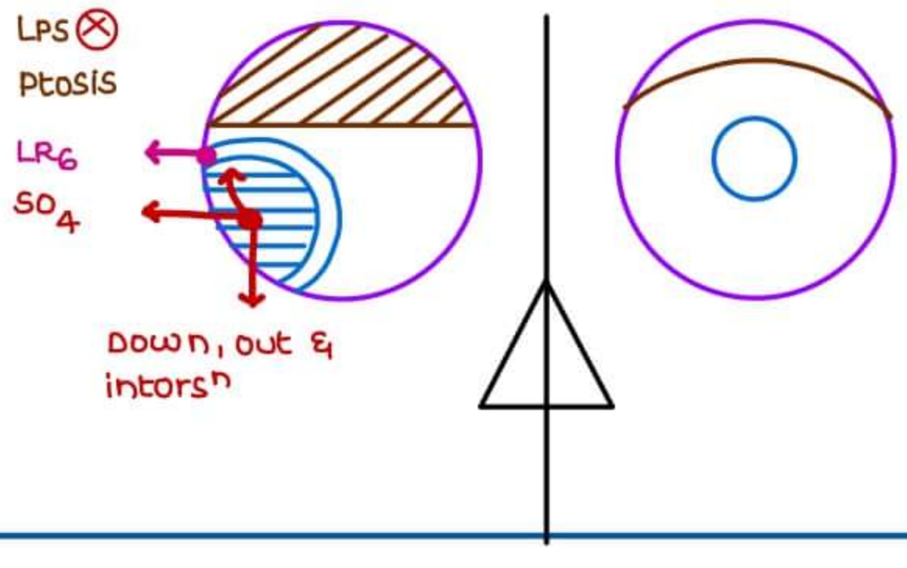
1. Down & out eye → CN 4 & 6 are unopposed
2. Ptosis → LPS compromised
3. Fixed & Dilated pupil → Dilator pupillae unopposed (CT_1 symp. fibres)

Rt CN 3 LESION

Sphincter pupillae ⊗ → Dilator pupillae unopposed (CT_1 Sym. fibres) ↓ Mydriasis

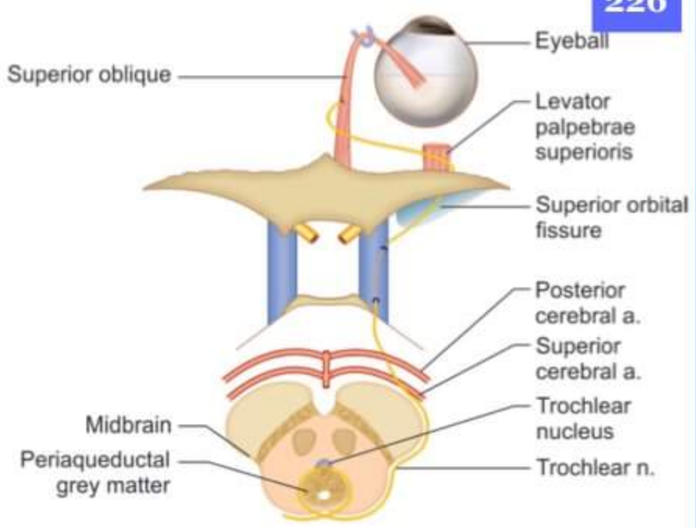
Fixed & dilated pupil

(no response to light R_t → Fixed)



TROCHLEAR NERVE COURSE

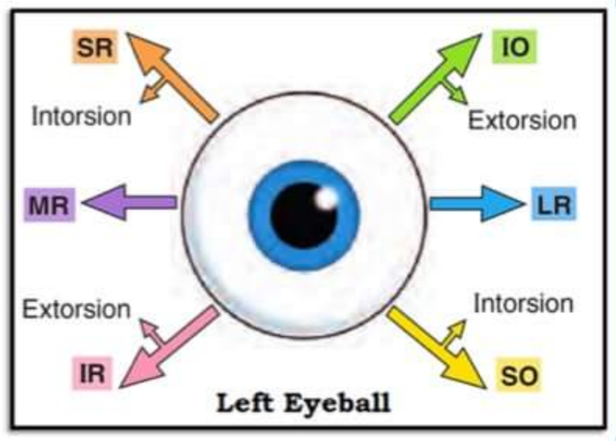
1. Thinnest / smallest / slimmest CN → very few axons
2. Longest intra cranial course
3. Only nerve ī dorsal exit
4. Internal decussation + nt (in mid Brain)



COURSE

→ Trochlear nucleus present at inferior colliculus level
→ Trochlear nerve → only nerve ī dorsal exit
→ passes blw post. cerebellar & superior cerebral artery
→ becomes the content of cavernous sinus (lateral wall)
→ passes SOF, left outside the ring of zinn
→ enters orbit & supplies superior oblique muscle

→ superior oblique hooks under trachlea under orbit



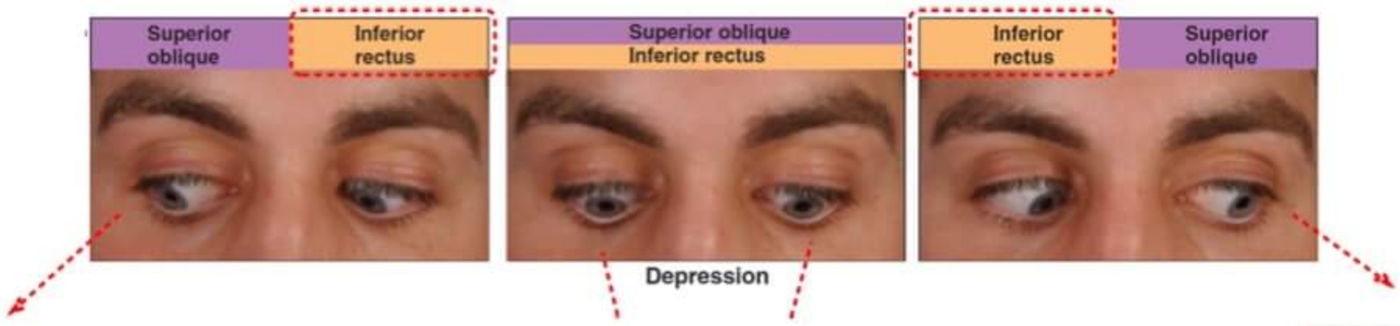
CIL INNERVATION

→ Rt Trochlear nucleus gives Lt trochlear nerve & supplies Lt. Sup. Oblique
→ Lt Trochlear nucleus gives Rt Trochlear nerve & supplies Rt. Sup. Oblique

→ In Lt trochlear nerve injury → Lt Superior oblique is paralysed
→ In Rt trochlear nucleus injury → Lt Superior oblique is paralysed

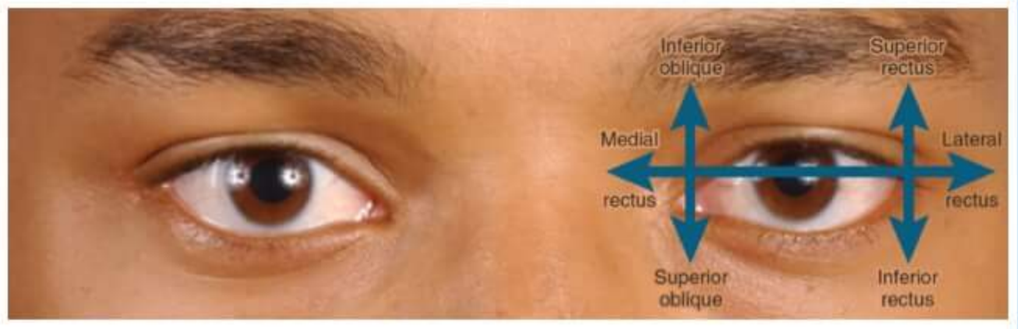
→ INTERNAL DECUSSATION occurs at Superior medullary velum at the roof of IV ventricle behind the brain stem

→ Superior Oblique muscle
  → Actions → Intorsⁿ > Depressⁿ > Abductⁿ
  → COPYING MUSCLE
  → CLINICAL TESTING → Ask the patient to look at his tip of nose



→ In adducted eye
  Strong depressor → SO
  Weak depressor → IR

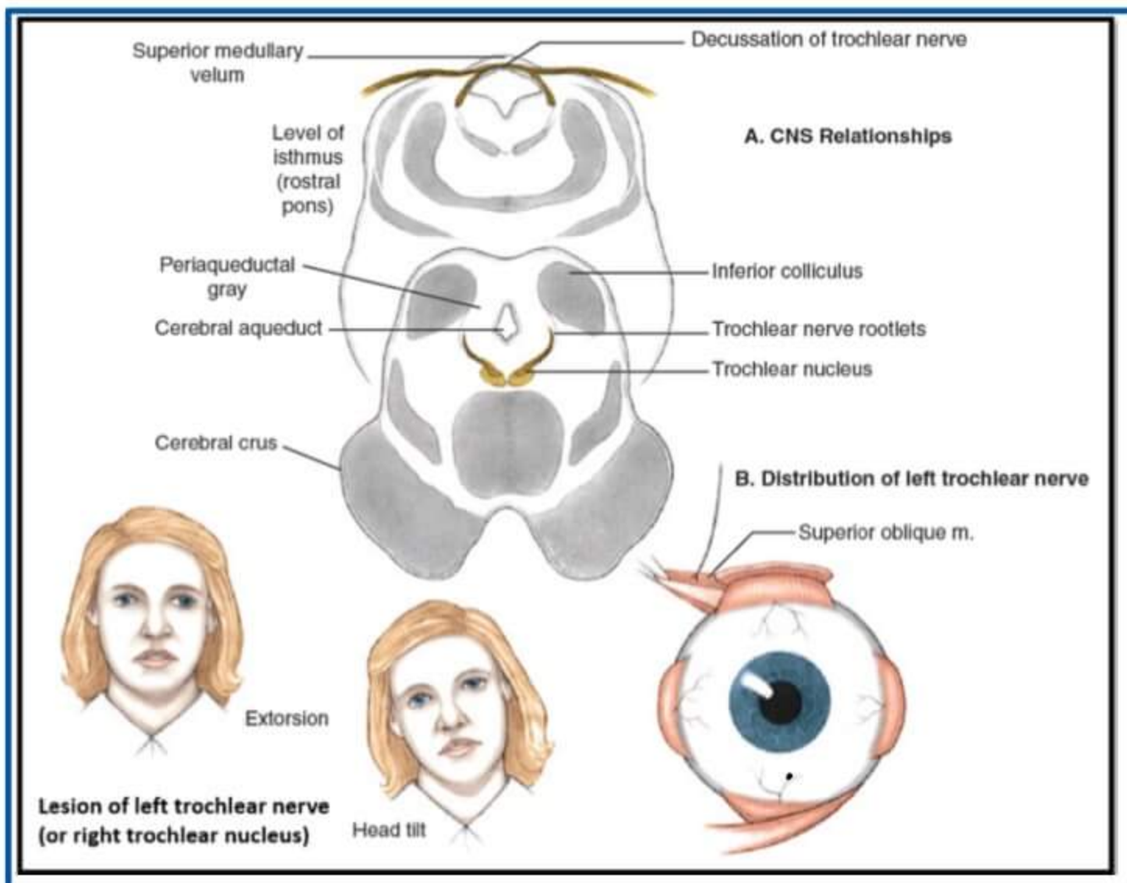
→ In Abducted eye
  Strong depressor → Inferior rectus
  Weak depressor → Superior Oblique



→ To check Inferior rectus, ask the patient to do depression in abducted eye

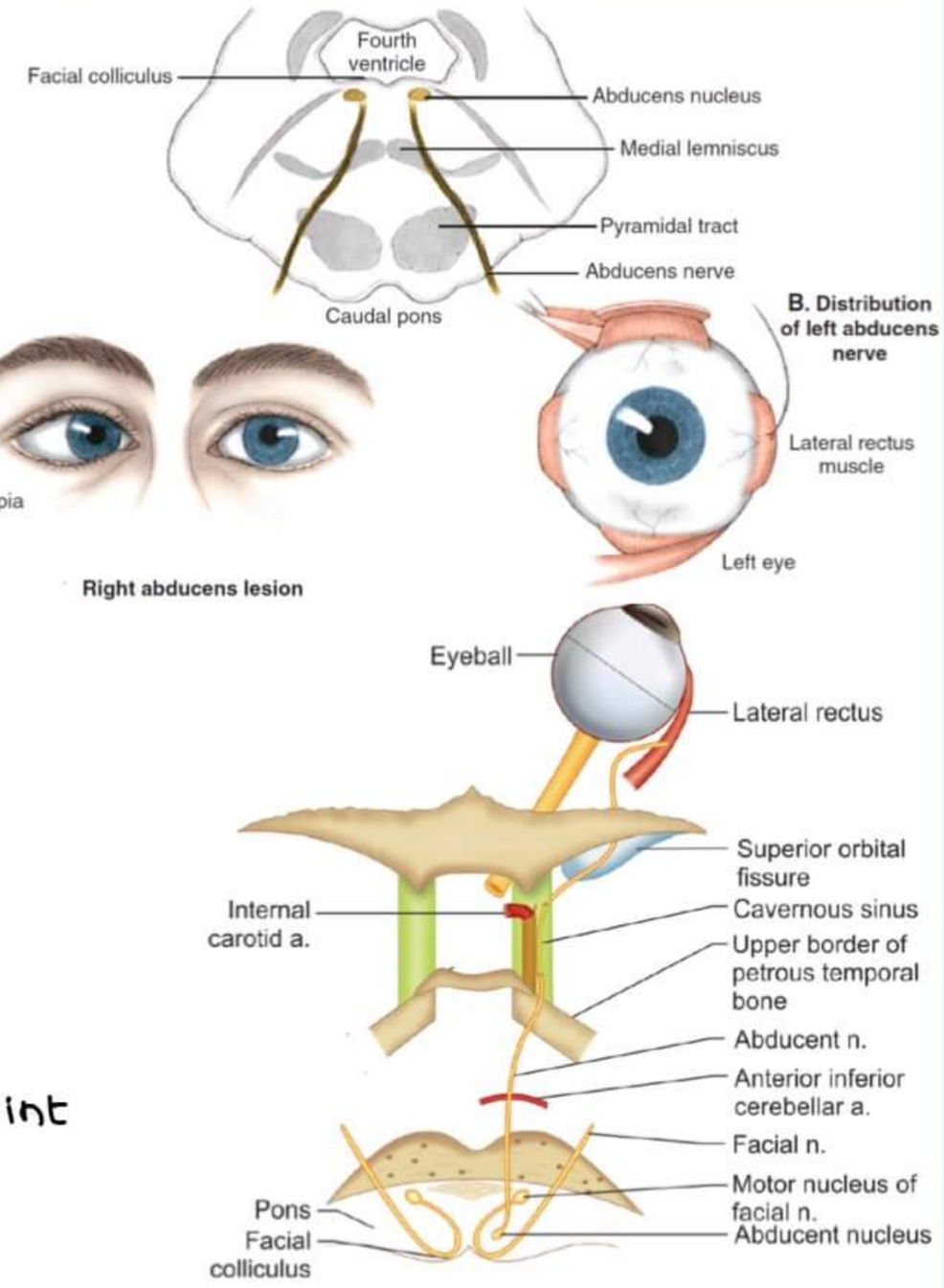
IN TROCHLEAR LESION

→ Superior Oblique muscle affected → vertical diplopia, while reading
→ CIL head tilting (to counteract extorsion)



Q All is true about trochlear nerve EXCEPT
a innervates C/L superior oblique
b causes depression of eye ball in adducted position
c Lies outside the ring of Zinn
d Patient attains I/L head tilt, in lesion BETTER ANSWER

Q All is true about trochlear nerve EXCEPT
a Slender most CN
b has longest intradural course BETTER ANSWER
c innervates C/L Superior Oblique
d Shows internal decussation



ABDUCENT NERVE (CN6)

COURSE

→ comes from Pons
→ infero lateral to ICA running through the cavernous sinus
→ passes inside the ring of Zinn throug Superior Orbital fissure & Supply the Lateral rectus muscle

RIGHT CN6 LESION

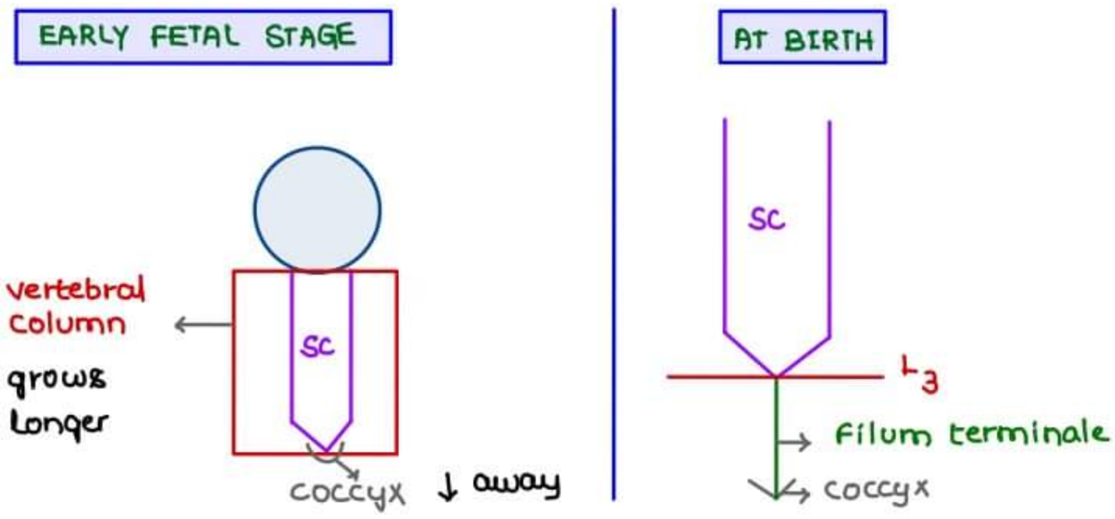
→ Rt Lateral Rectus paralysis
→ Medial Rectus unopposed → Medial squint

Q choose the incorrect statement about cranial nerves
a Abducent has the longest intracranial course
b Trochlear shows internal decussatⁿ
c Olfactory is the shortest (length)
d vagus has the largest distributⁿ

CN 4 Thinnest & Smallest (size)
CN 5 Thickest & Largest (Size)
CN 1 Shortest (length)
CN 10 Longest (length) & largest Distribution
CN 7 Longest intra osseous course (sup. & post. wall of MEC)

SPINAL CORD TERMINATION

Q In a neonate spinal cord ends at
a Lower border of T_{12}
b Lower border of L_1
C Lower border of L_3
d Upper border of L_3

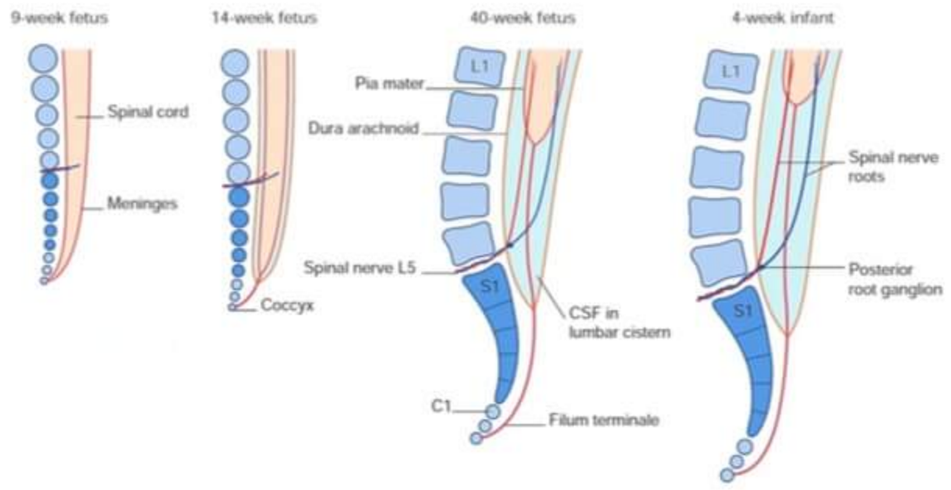


STAGES OF SPINAL CORD TERMINATION

EARLY FETAL STAGE

→ Length of spinal cord = Length of vertebral column
→ Spinalcord fuse ṯ coccyx bone

→ relative faster growth of vertebral column
→ vertebral column attains → 60 cm
spinal cord attains → 45 cm



AT BIRTH

→ Spinal cord level is at → upper border of L_3 vertebra
→ coccyx bone attaches spinal cord ṯ filum terminale (collagen fibres)

ADULT LEVEL

→ Trans pyloric plance → Lower border of L_1
→ < 2 yrs after birth, it reaches adult level

ENLARGEMENTS & SPACES

ENLARGEMENTS

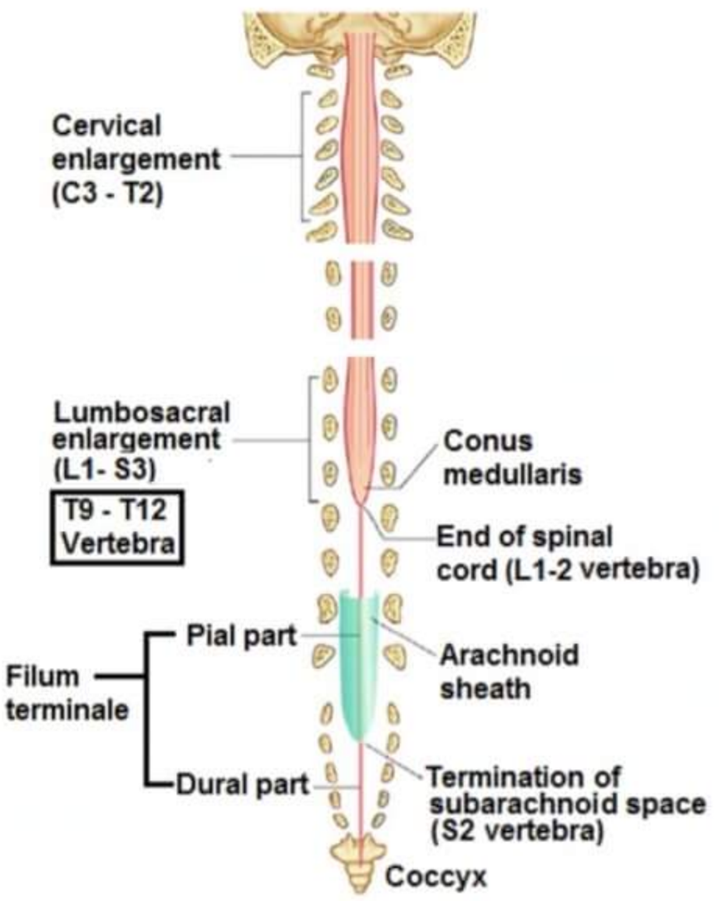
CERVICAL ENLARGEMENT

→ collectⁿ of neural bodies that gives Brachial plexus
→ Root value
Brachial plexus → $C_5 - T_1$
cervical enlargement → $C_3 - T_2$

LUMBOSACRAL ENLAGEMENT

→ Root value
Lumbosacral Enlargement → $L_1 - S_3$
Sciatic Nerve → $L_4 - S_3$

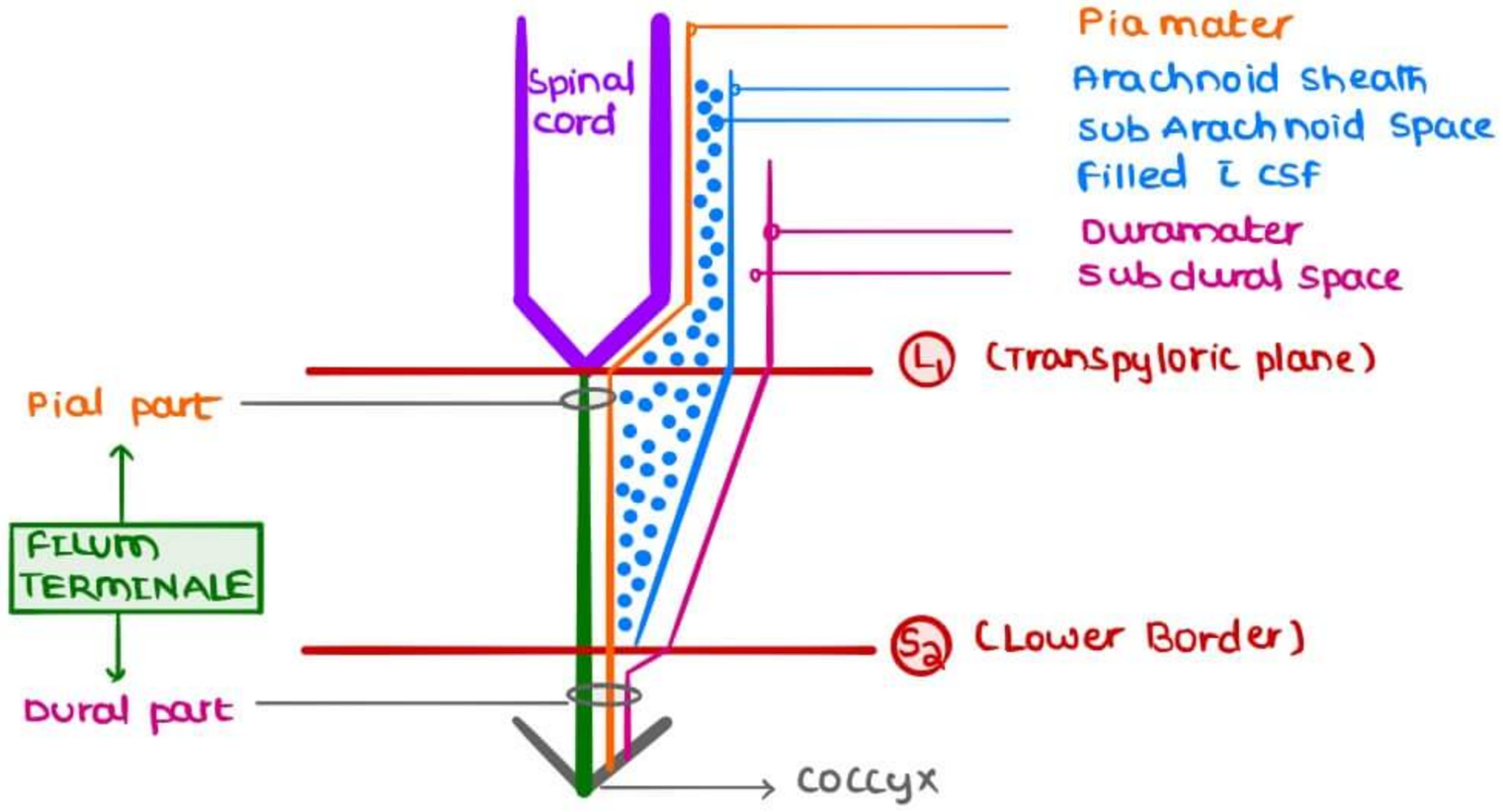
→ vertebrae surrounding LSE → $T_9 - T_{12}$



FILUM TERMINALE

→ collagen fibres connecting tip of Spinal cord ṯ coccyx
→ PIAL PART → present above S_2, Longer, covered by pia mater
DURAL PART → present below S_2, shorter, covered by both pia & Duramater

Terminatⁿ of subarachnoid 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)

Q Following are the various structures related to spinal cord & their respective terminal extent. Choose the WRONG PAIR

a Adult spinal cord : Transpyloric plane
b Pia mater : Coccyx
c Dura mater : S_2 vertebra
d Arachnoid sheath : S_2 vertebra

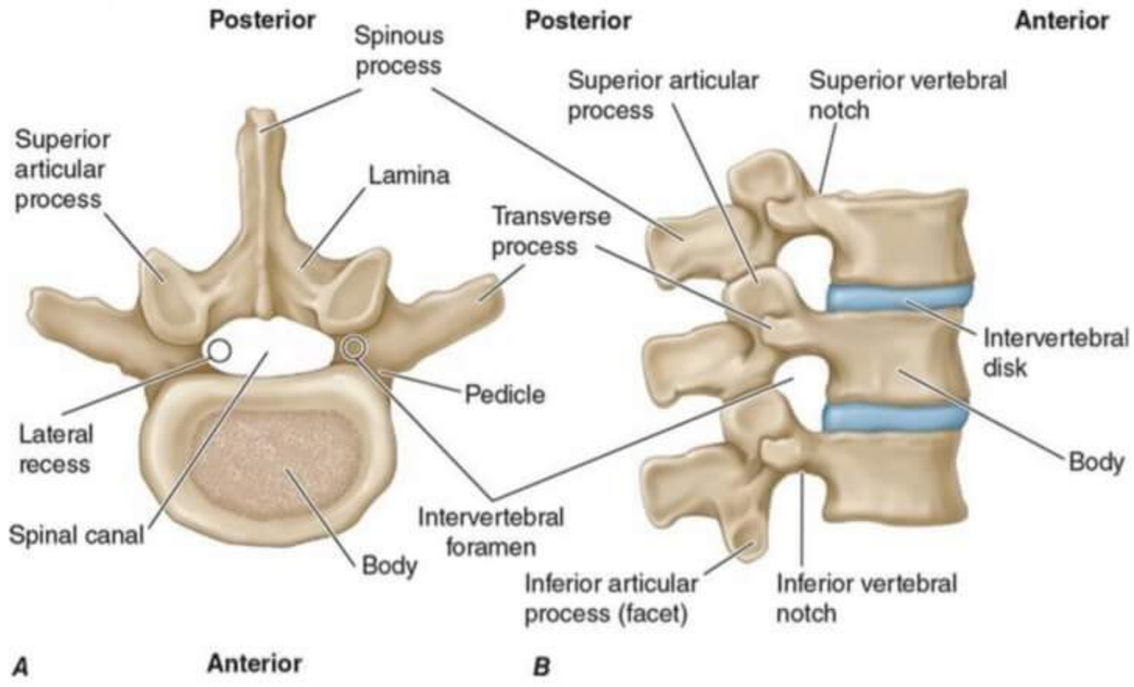
VERTEBRAE

BODY

- → Large & oval → Lumbar vertebra
- → Small & oval → Cervical vertebra
- → Heart shaped } Thoracic vertebra
- → Triangular }

VERTEBRAL CANAL

- → Oval → Thoracic vertebra
- → Triangular → Lumbar & cervical



TRANSVERSE PROCESS

- → Foramen transversarium → present in cervical vertebra
  → for the passage of Vertebral artery
- → costal / Rib facet → present in Thoracic vertebra

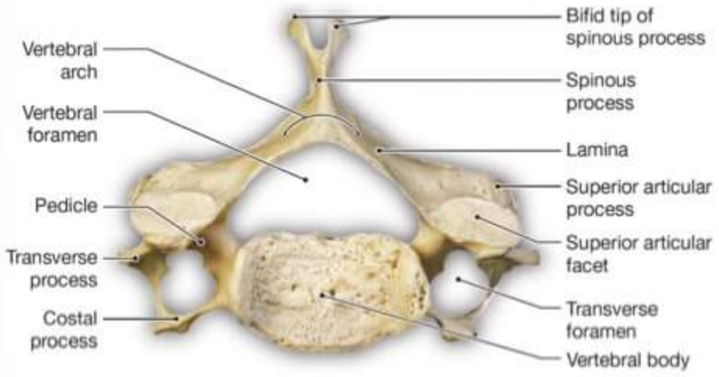
INTERVERTEBRAL DISC → Fibrocartilage, acts as SHOCK ABSORBER

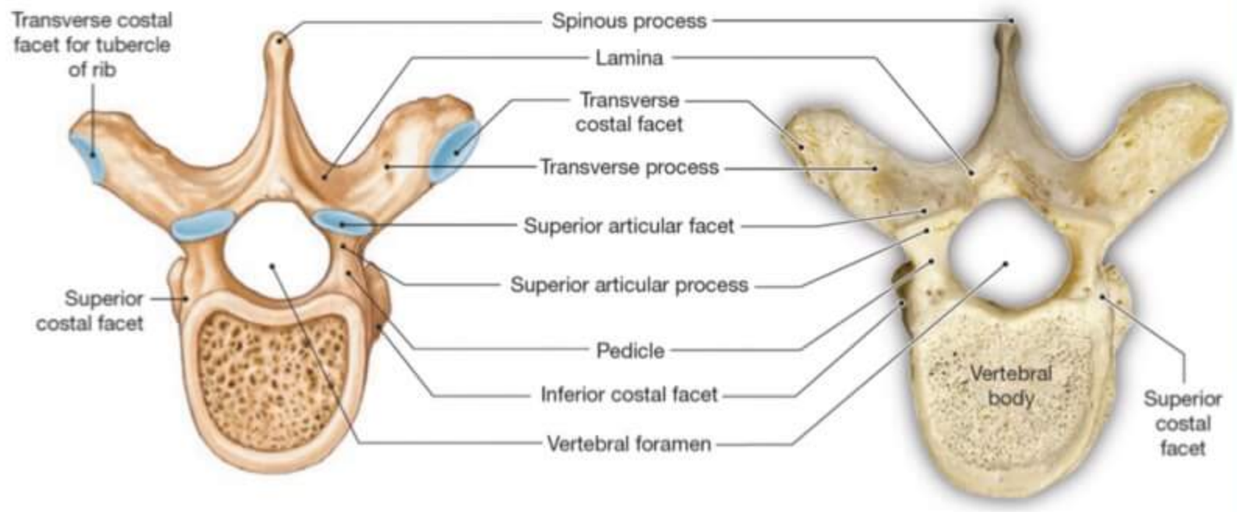
SPINE → directed posteriorly
- Blunt → Lumbar

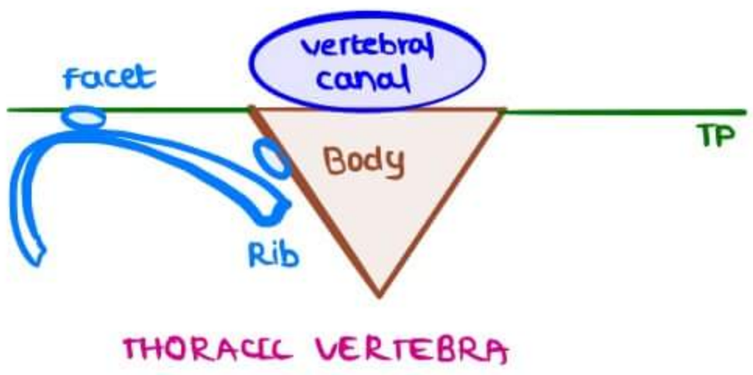
INTERVERTEBRAL FORAMEN → for the passage of Spinal nerves from spinal cord

SUPERIOR ARTICULA FACET DIRECTION

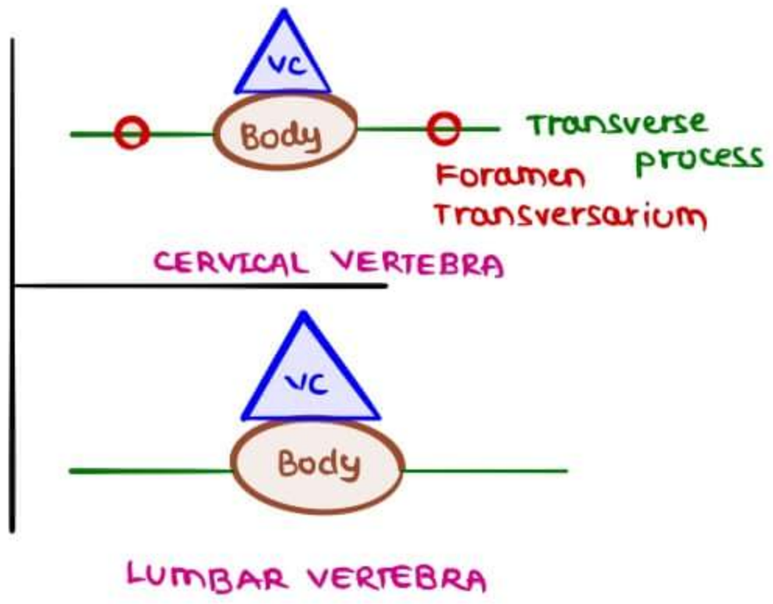
Cervical vertebra → Backward, upward
Thoracic vertebra → Backward, upward, Lateral T-BUL
Lumbar vertebra → Medial



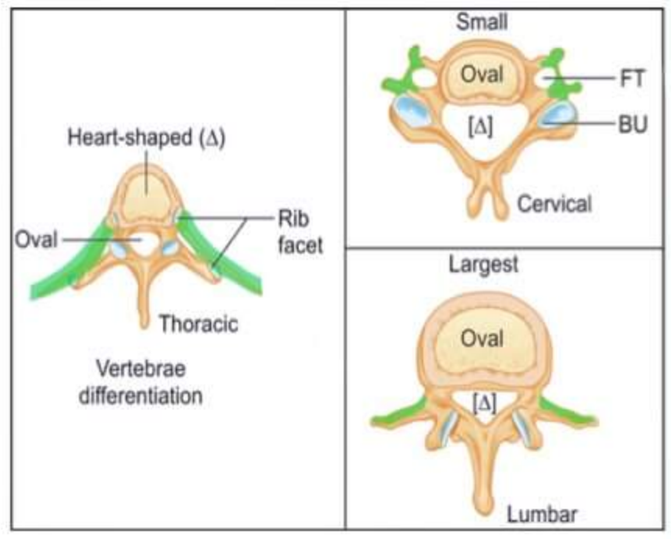




THORACIC VERTEBRA



LUMBAR VERTEBRA



FORAMEN TRANSVERSARIUM

→ present in transverse process of CERVICAL VERTEBRA
→ vertebral artery pass through it
→ $C_1 - C_6$ vertebra carries vertebral artery, but not C_7

VERTEBRAL CURVATURE & SLIP DISC

VERTEBRAE

1. cervical	→	7
2. Thoracic	→	12
3. Lumbar	→	5
4. sacral	→	5
5. coccygeal	→	4
		33

SPINAL NERVES

1. cervical	→	8 pairs
2. Thoracic	→	12 pairs
3. Lumbar	→	5 pairs
4. sacral	→	5 pairs
5. coccygeal	→	1 pair
		31 pairs

CURVATURES

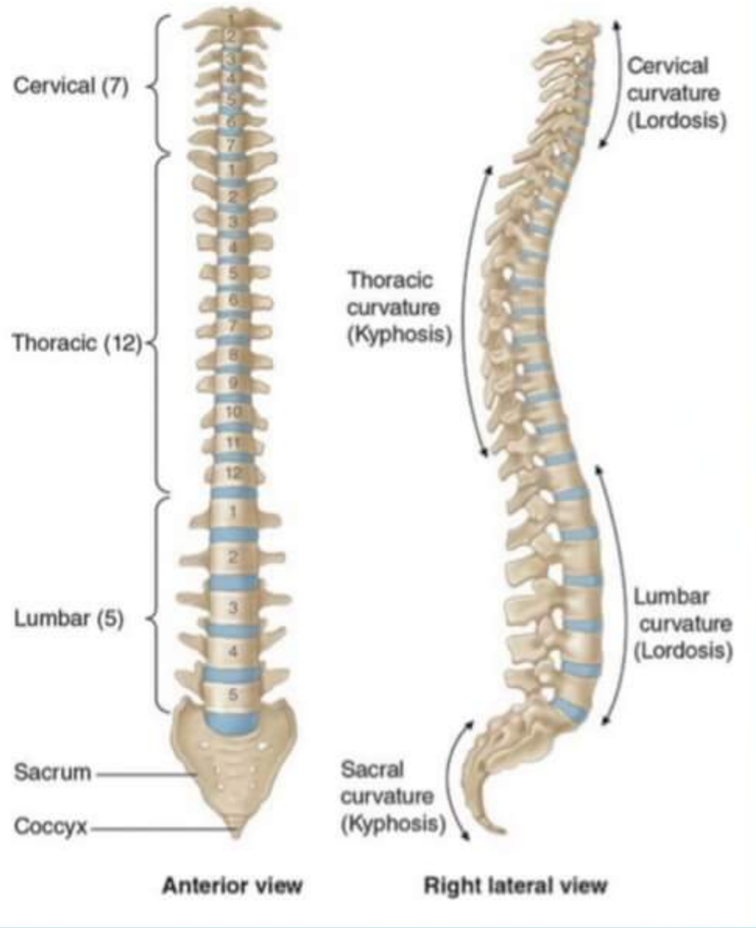
PRIMARY / FETAL CURVATURE

→ universal attitude of flexion
→ 1° primary → Thoracic
Sacral

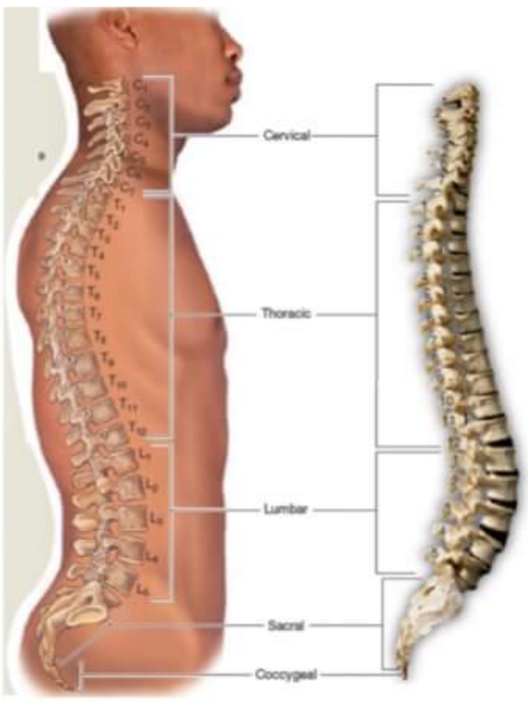
Concave anteriorly
Convex posteriorly (KYPHOSIS)

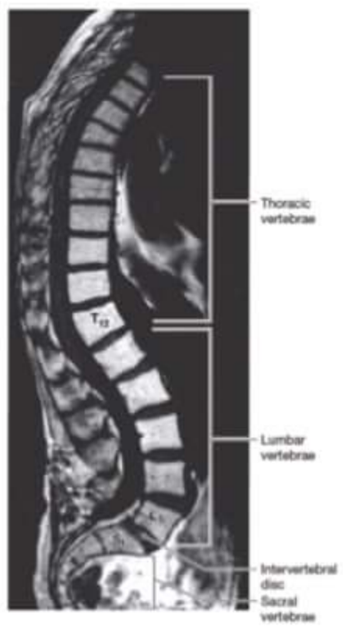
SECONDARY CURVATURES

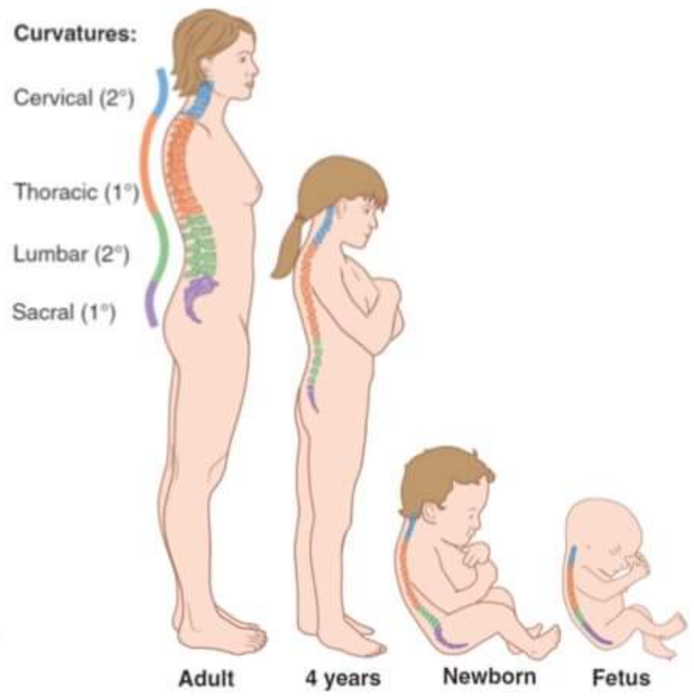
→ At 2 months (holding of neck) → cervical LORDOSIS +nt
→ At 1 yr, Lumbar Lordosis +nt (Lordosis - ant. convexity)

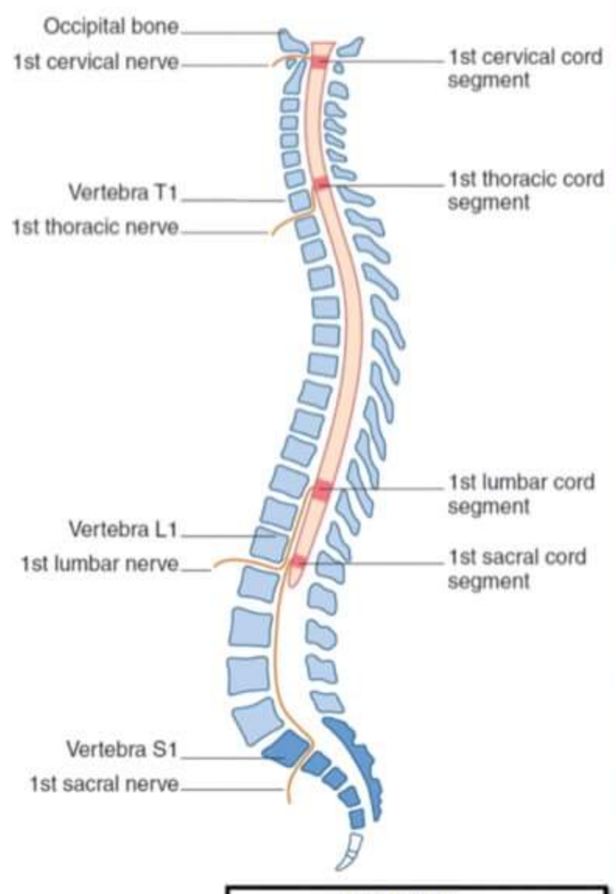


→ Cervical Lordosis is dlt → neck holding
→ Lumbar Lordosis is dlt → Sitting, standing, walking
→ During pregnancy → Exaggerated Lumbar Lordosis

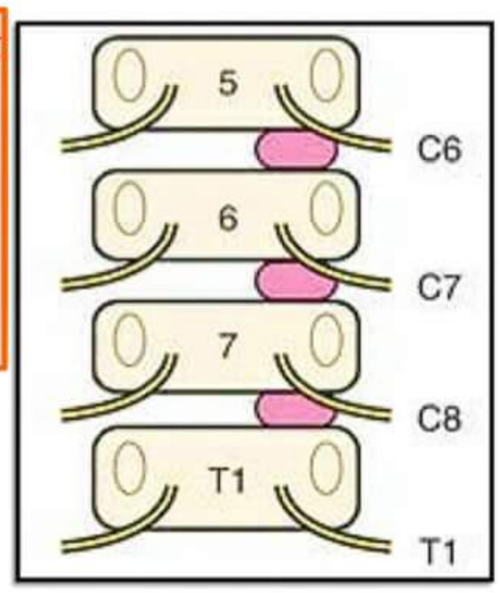


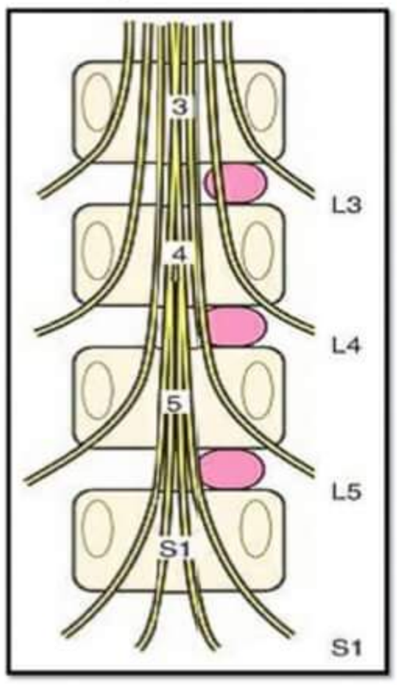






Q Disc herniation blw L_4 & L_5 involves nerve root
a L - 2
b L - 3
c L - 4
d L - 5





TRICK → Go to upper vertebra & add 1 (next nerve)
SLIPDISC, usually C_x (10%) or Lumbo sacral (90%)

→ In cervical Region, Each spinal nerve reach superior to corresponding vertebra
→ In cervico thoracic region, each Spinal n. passes below corresponding vertebra
→ In Thoracic & lumbar region, each Spinal n. passes below corresponding vertebra

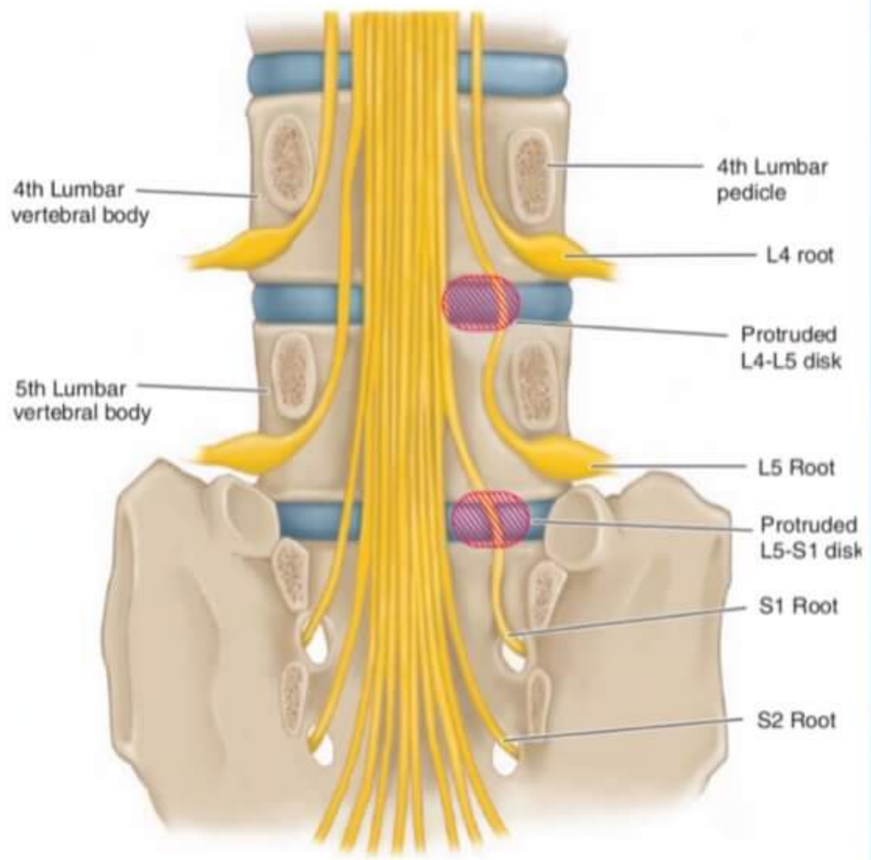
→ Nerves are short & straight in cervical region
→ Nerves are long & oblique in Thoraco lumbar region

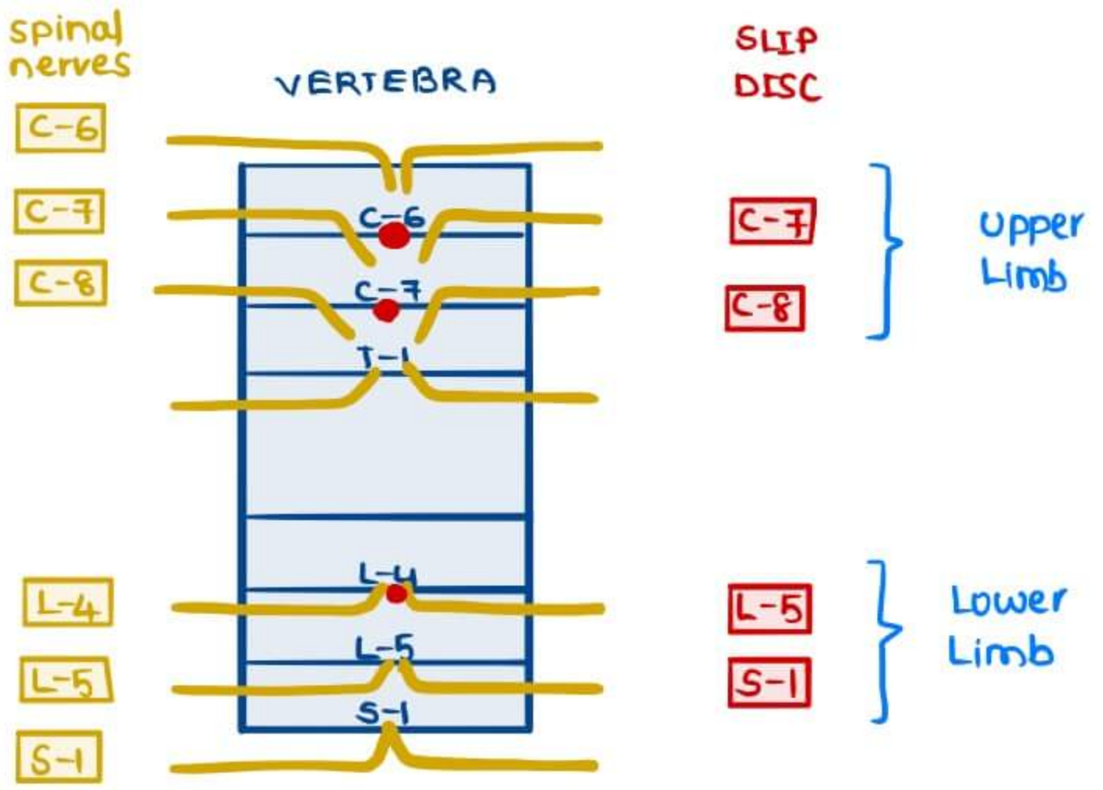
→ In Slip disc in cervical region, corresponding nerve is involved
→ In Slip disc in thoraco lumbar region, next nerve below is involved

SLIP DISC b/w L_4 & L_5
→ L_4 root not involved (postero lateral herniath) of Nucleus pulposus
→ L_5 Nerve involved

SLIP DISC b/w L_5 & S_1
→ L_5 nerve not involved
→ S_1 nerve involved

Herniated Disc between	Compressed Nerve Root
C4 and C5	C5
C5 and C6	C6
C6 and C7	C7
L3 and L4	L4
L4 and L5	L5
L5 and S1	S1

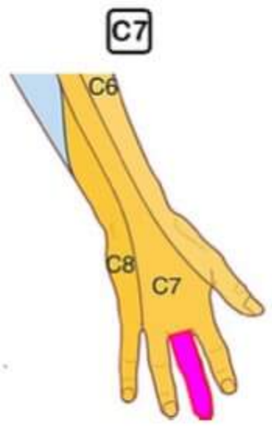




CASE 1

Burning sensatⁿ in middle finger (C_7 dermatome)
Triceps reflex is weak (C_7 myotome)
SLIP DISC ?

→ Slip Disc → C-6 & C-7

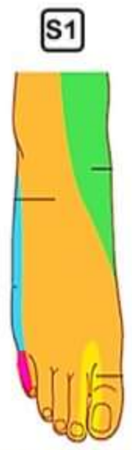


Herniated Disc between	Compressed Nerve Root	Dermatome Affected	Muscles Affected	Movement Weakness	Nerve and Reflex Involved
C6 and C7	C7	C7 Middle finger	Triceps Wrist extensors	Extension of for arm Extension of wrist	Radial nerve ↓triceps jerk

CASE 2

Burning sensatⁿ in Little toe (S_1 Dermatome) Lat. margin
Ankle reflex is weak (S_1 myotome)
SLIP DISC ?

→ Slip Disc → L-5 & S-1



Herniated Disc between	Compressed Nerve Root	Dermatome Affected	Muscles Affected	Movement Weakness	Nerve and Reflex Involved
L5 and S1	S1	S1 Heel Little toe	Gastrocnemius Soleus	Plantar flexion of ankle(patient cannot stand on toes) Flexion of toes	Tibial nerve ↓ankle jerk

CRANIO - VERTEBRAL JOINTS

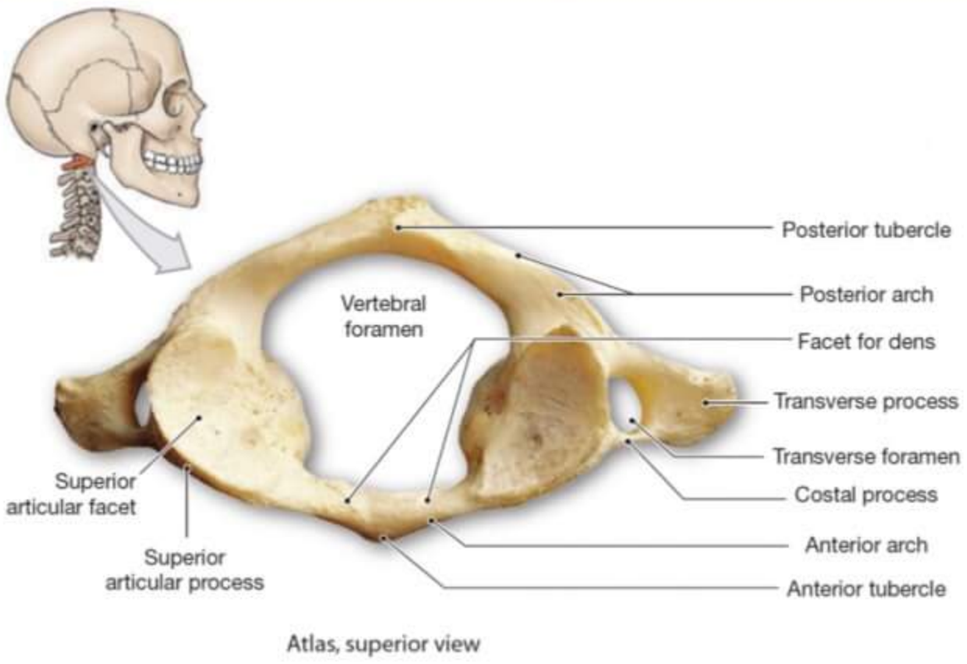
ATLAS (C-1) VERTEBRA

→ Atlas vertebra don't have body
→ Atlanto - occipital joint
  → for head noding
  → Ellipsoid Synovial | condylar joint

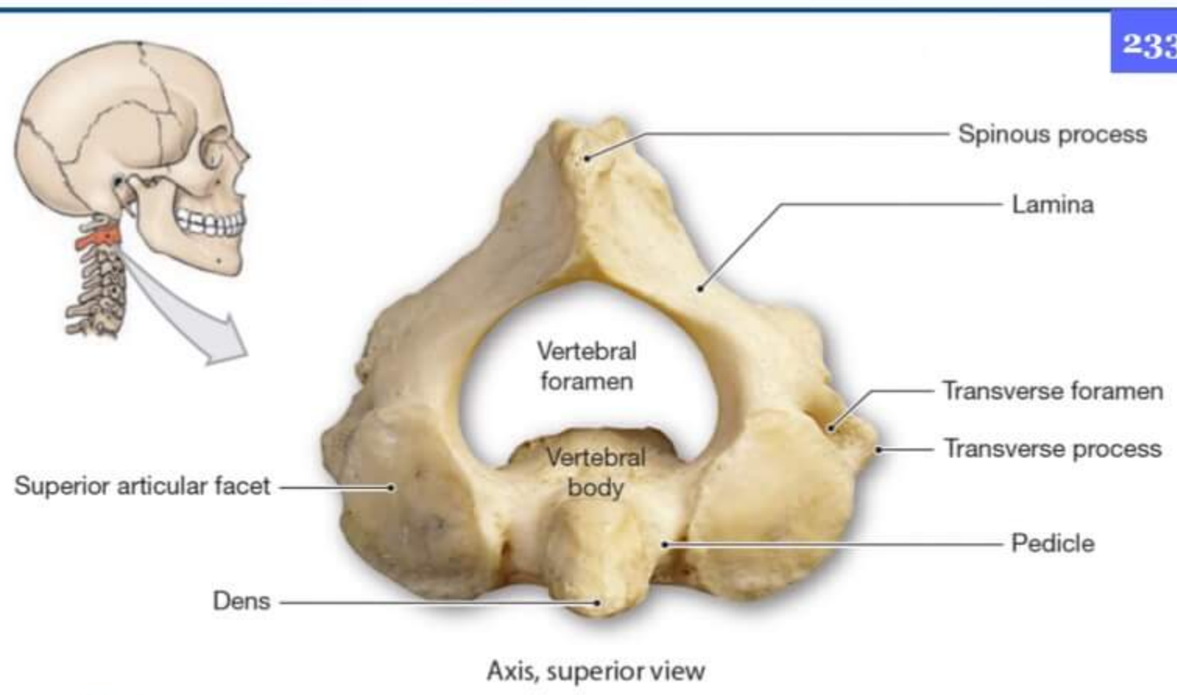
→ vertebral Artery comes from foramen transversarium & arches over Superior surface of atlas vertebra (POSTERIOR ARCH) & enters cranial cavity by passing through foramen magnum Upwards

AXIS VERTEBRA

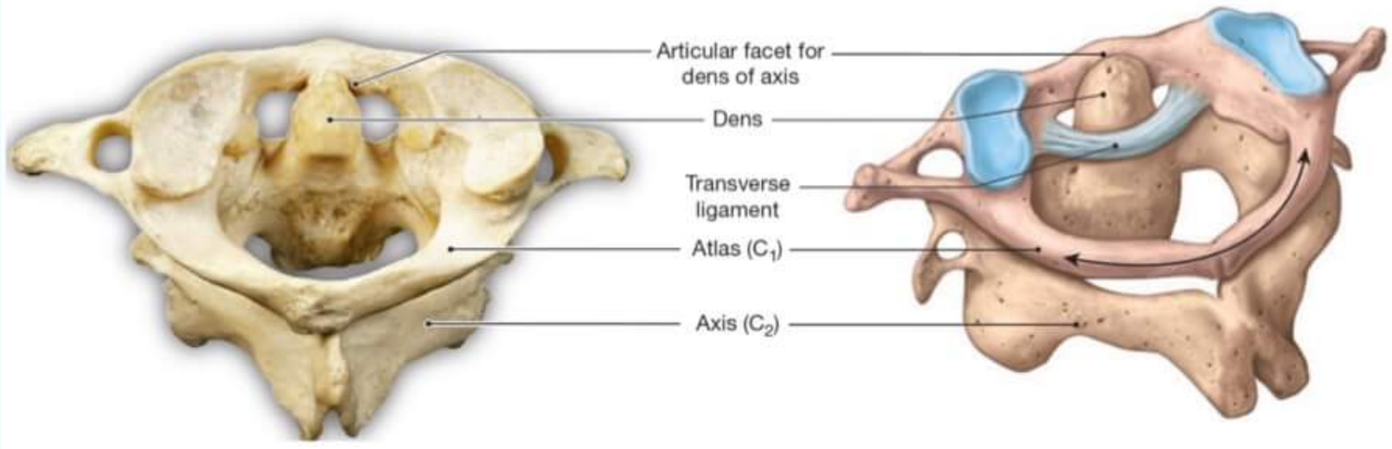
→ ODONTOID PROCESS / DENS OF AXIS
  → body of C_1 vertebra fusing ī body C-2
  → Goes to ant. arch of atlas & held by transverse ligament of C-1



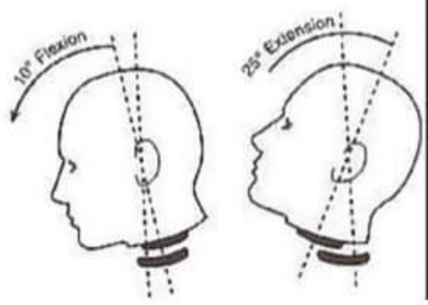
Atlas, superior view



Axis, superior view



HEAD NOD



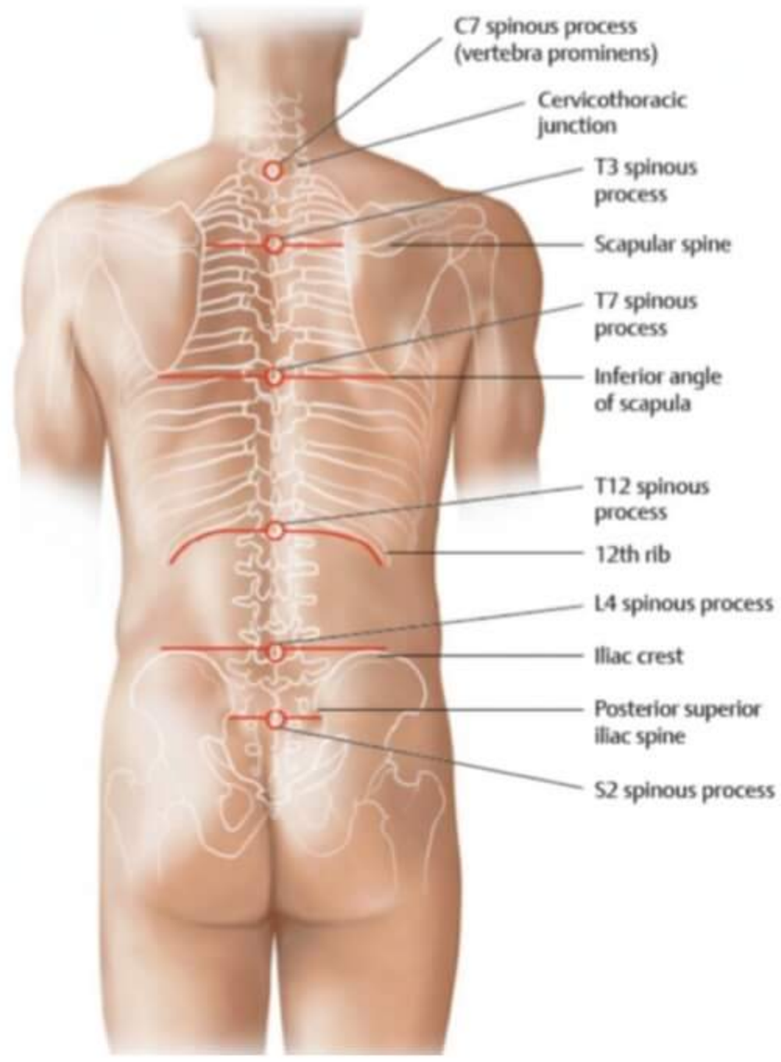
ATLANTO AXIAL JOINT

- → rotatory joint
- → Trochoid / Pivot joint
- → Skull & atlas became 1 unit and rotates on axis joint

VERTEBRAL LANDMARKS & TRIANGLES

SCAPULA

Superior angle	→	T-2
Spine	→	T-3
Inferior angle	→	T-7



ILIAC BONE

- → Highest point of Iliac crest → L-4 Spine

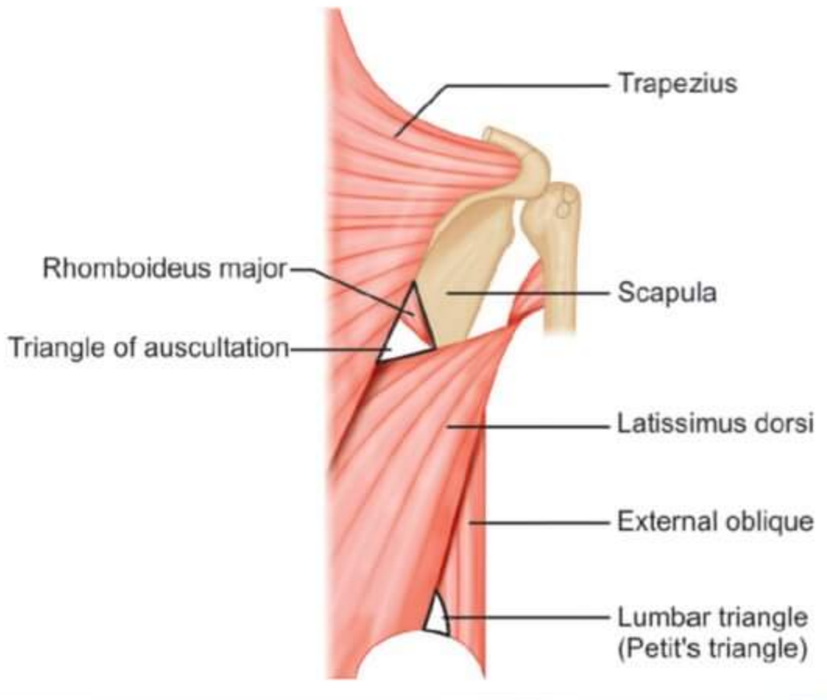
TRIANGLES

TRIAGLE OF ASCULTATION

BOUNDARIES

Medial border of scapula	→	Lateral
Trapezius (triangular muscle)	→	Supero medi
Lattissimus dorsi	→	Inferior
Rhomboid major	→	Floor

Sounds of Peristalsis of stomach
Sounds of Lower Lobes of Lungs
} Listened here



LOWER LUMBAR/ PETIT'S TRIANGLE

BOUNDARIES

Latissimus dorsi	→	posterior
Iliac crest of hip bone	→	Base
External oblique muscle	→	Anterior

Deficiency of thick muscular coat here, prone to hernias

CVS EMBRYOLOGY

→ **TWO Heart tubes**

↓ Fuse

One Heart tube (straight initially)

→ contains 5 parts, Lower venous end & Upper Arterial end

→ TRANSVERSE PERICARDIAL SINUS

→ upper arterial end comes anterior

→ Lower venous end goes posterior

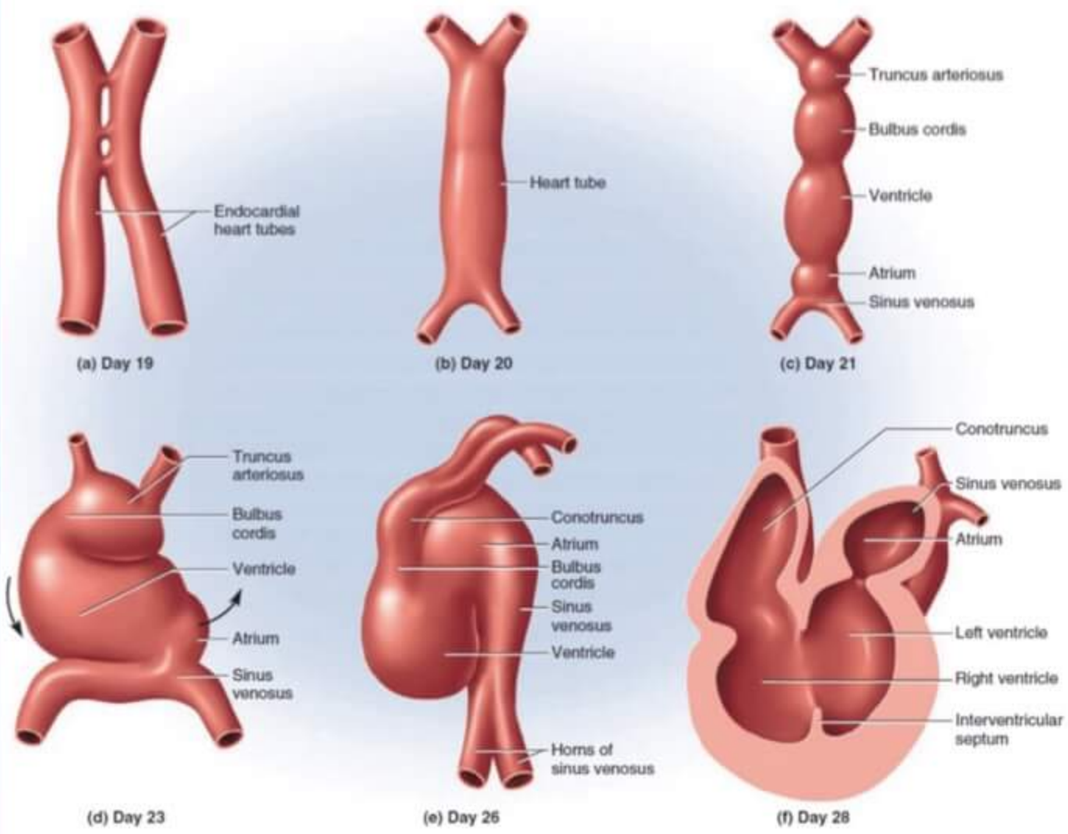
→ Transverse pericardial sinus is present b/w the two

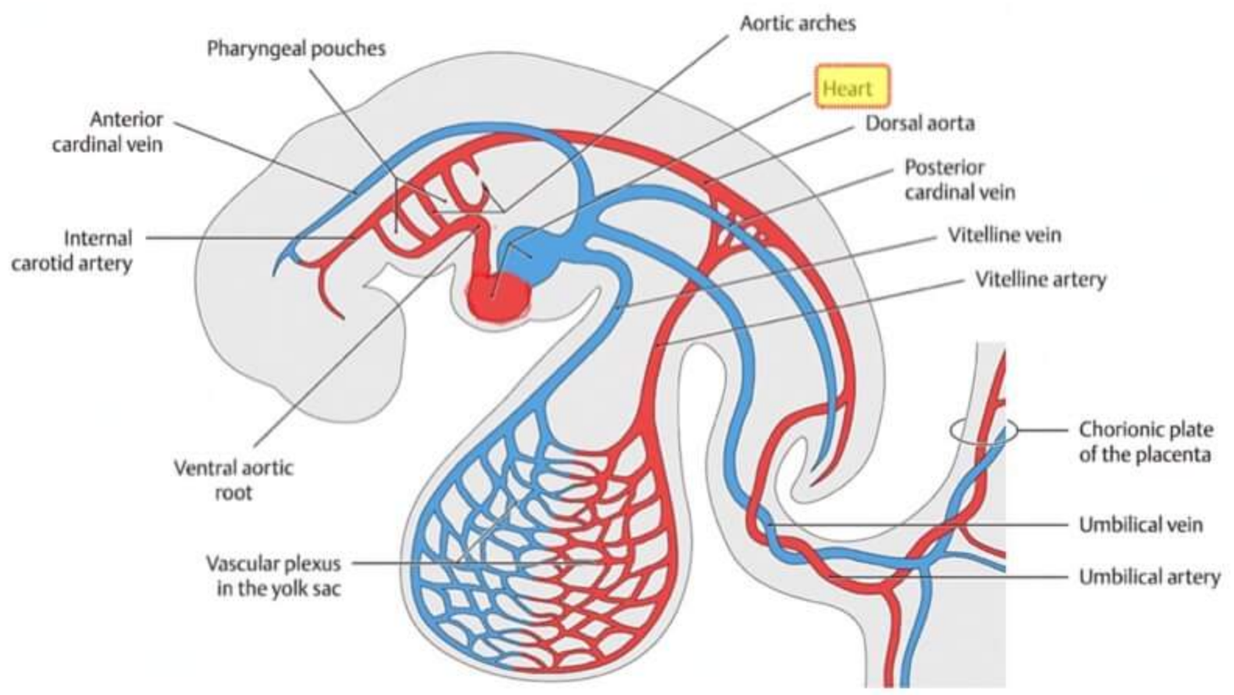
→ 4 CHAMBERS

→ 2 Atria (superior)

→ 2 ventricles (inferior)

AV Groove (Rt & lt) / Coronary sulcus b/w the two on outside

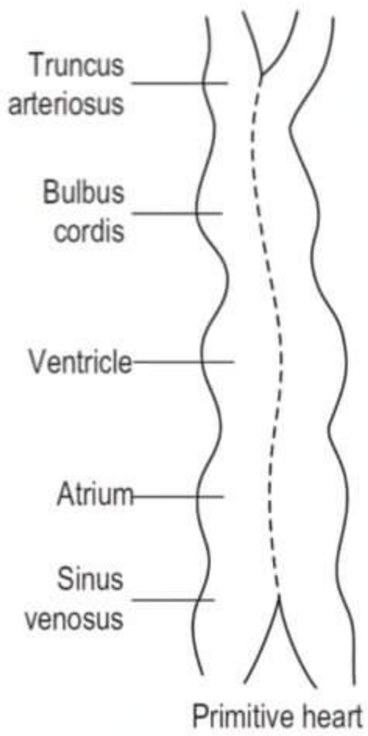




EMBRYONIC VEINS

Placenta	→	① UMBILICAL VEINS	→	degenerate
Yolk sac	→	② VITELLINE VEINS	→	PORTAL VEIN
Body wall	→	③ CARDINAL VEINS	→	SVC & IVC

→ SVC & IVC are present on rt. side, lt side regressed



HEART TUBE

5 PARTS

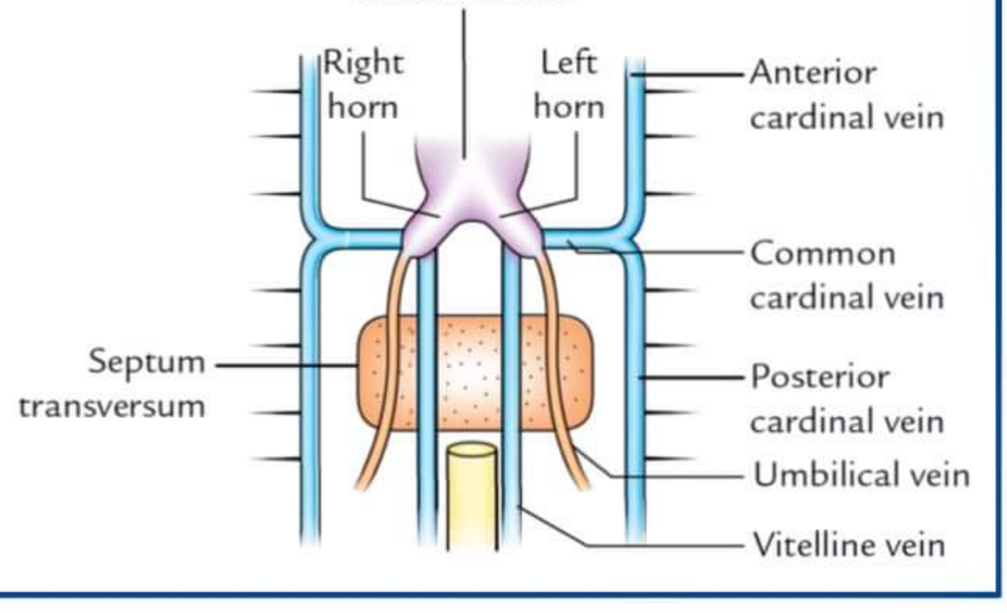
1. SINUS VENOSUS → smooth inflow tract
2. PRIMITIVE ATRIUM } rough trabeculated portⁿ of 4 chambers
3. PRIMITIVE VENTRICLE }
4. BULBUS CORDIS → smooth outflow tract
5. TRUNCUS ARTERIOSUS

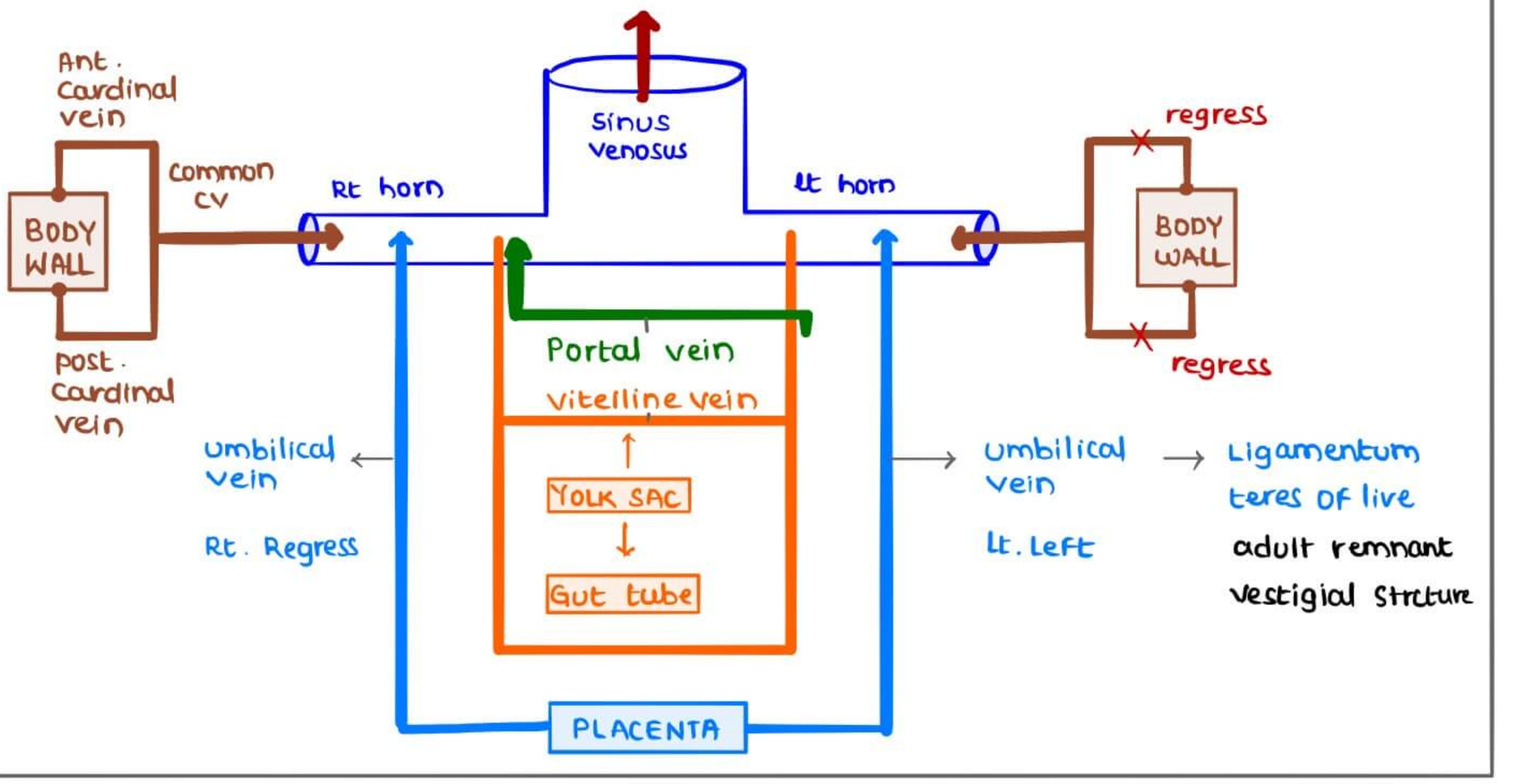
SINUS VENOSUS

→ contain rt & lt horns

→ receives venous blood from 3 set of veins

1. Ant. cardinal vein, Post. cardinal vein } common cardinal vein
2. Umbilical veins
3. Vitelline veins





VITELLINE VEIN

→ derived from Yolk sac

→ forms PORTAL VEIN
- major contribut^{n} from rt vitelline vein
- minor contribut^{n} from lt vitelline vein
- Anastamosis blw lt. & rt vitelline vein
- Portal vein present towards rt. side

→ rest of vitelline vein regresses

CARDINAL VEINS

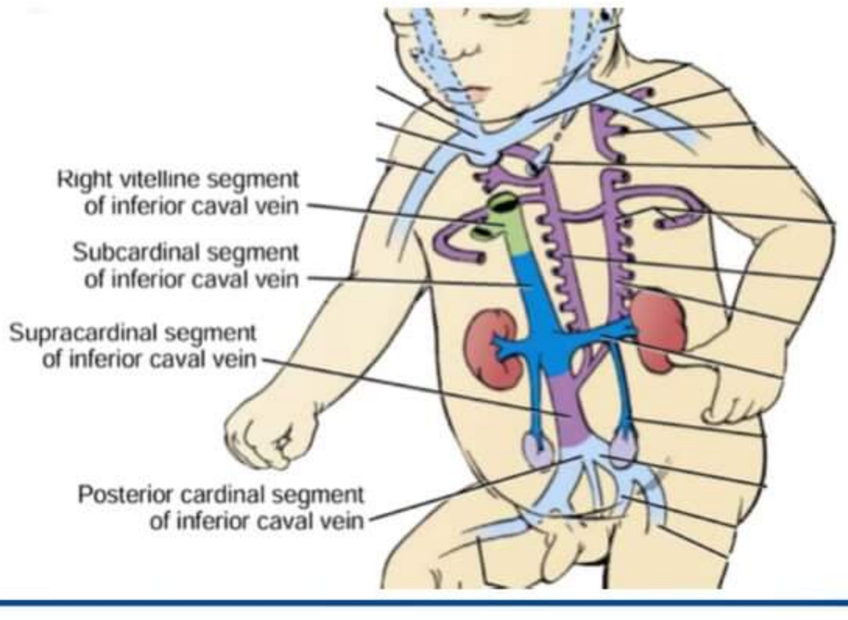
→ Ant. cardinal vein contributes to superior vena cava
Post. cardinal vein contributes to IVC (partly)

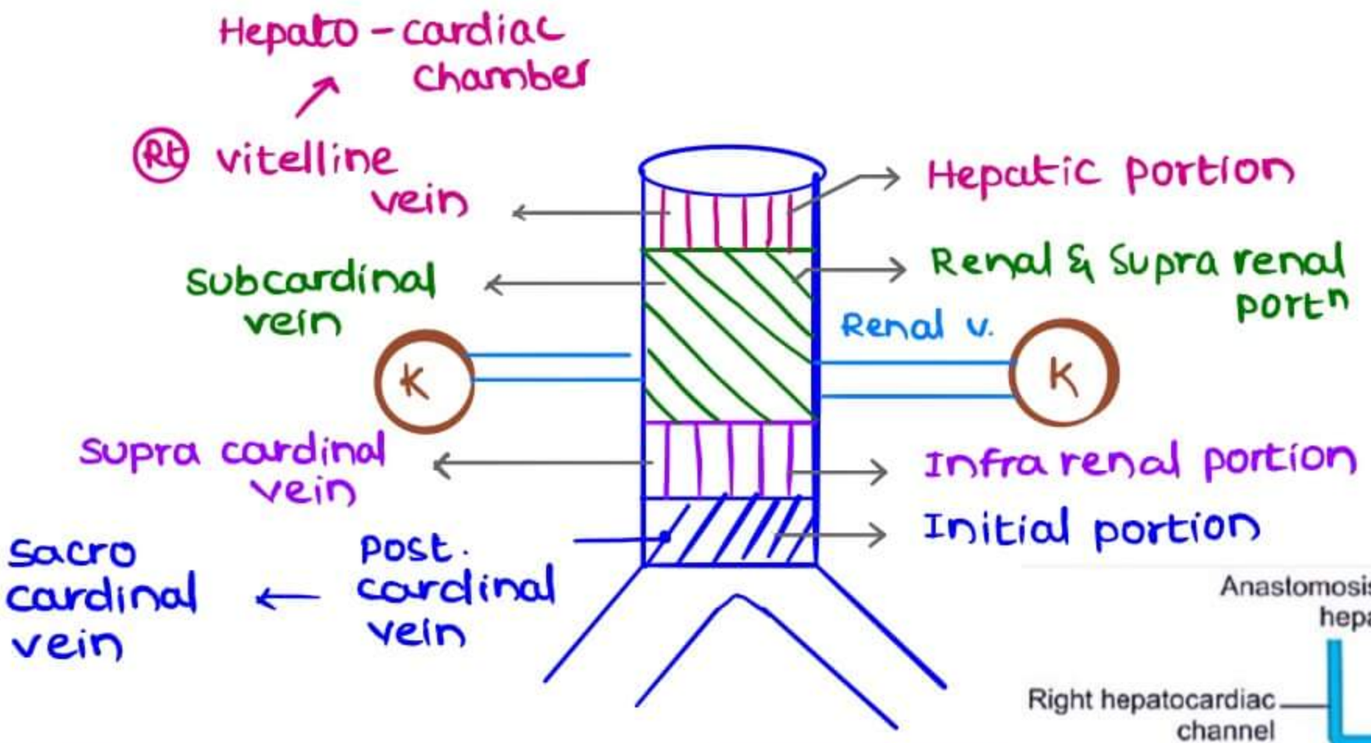
→ lt. ant & lt. post. cardinal veins regress

Embryonic	Adult
Vitelline veins	
Right and left	Portion of the IVC,[a] hepatic veins and sinusoids, ductus venosus, portal vein, inferior mesenteric vein, superior mesenteric vein, splenic vein
Umbilical veins	
Right	Degenerates early in fetal life
Left	Ligamentum teres
Cardinal veins	
Anterior	SVC, internal jugular veins
Posterior	Portion of IVC, common iliac veins
Subcardinal	Portion of IVC, renal veins, gonadal veins
Supracardinal	Portion of IVC, intercostal veins, hemiazygos vein, azygos vein

INFERIOR VENA CAVA CONTRIBUTED BY

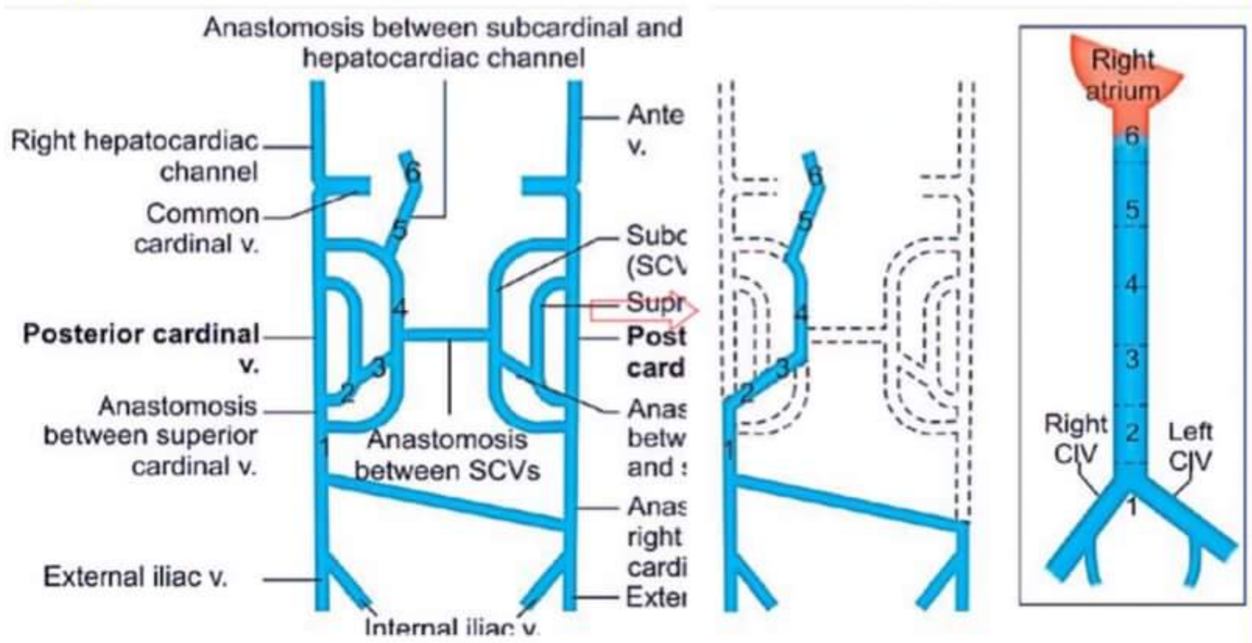
1. Rt. vitelline vein (hepatic portion)
2. post. cardinal vein (Beginning of IVC)
3. sub cardinal vein (renal & supra renal port^{n})
4. supra cardinal vein (infra renal portion)



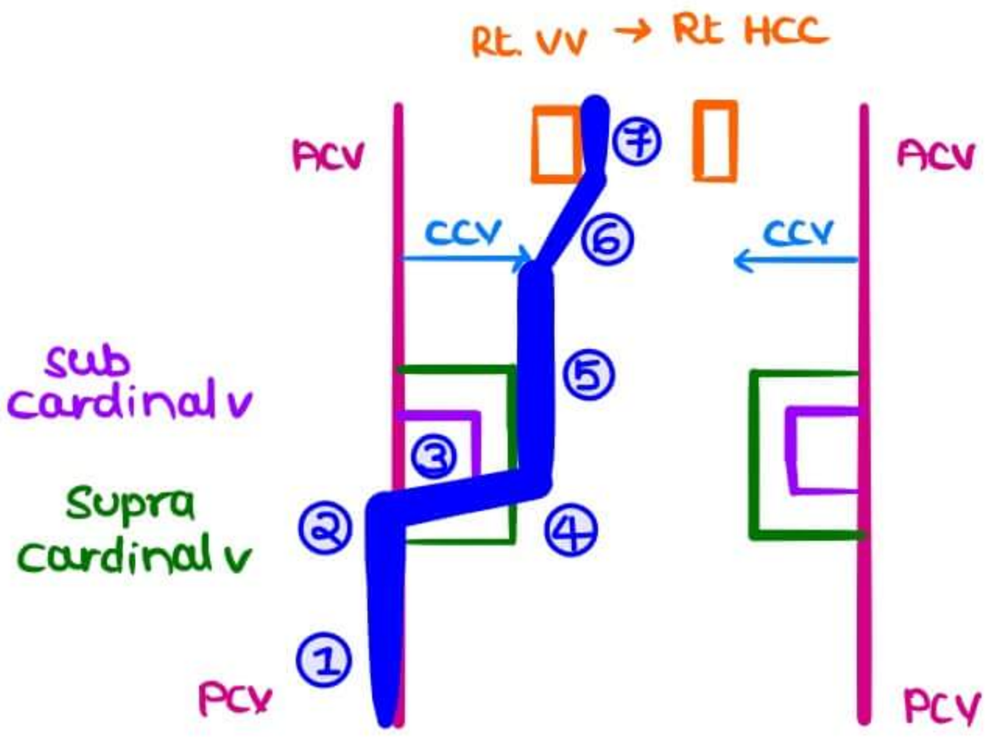


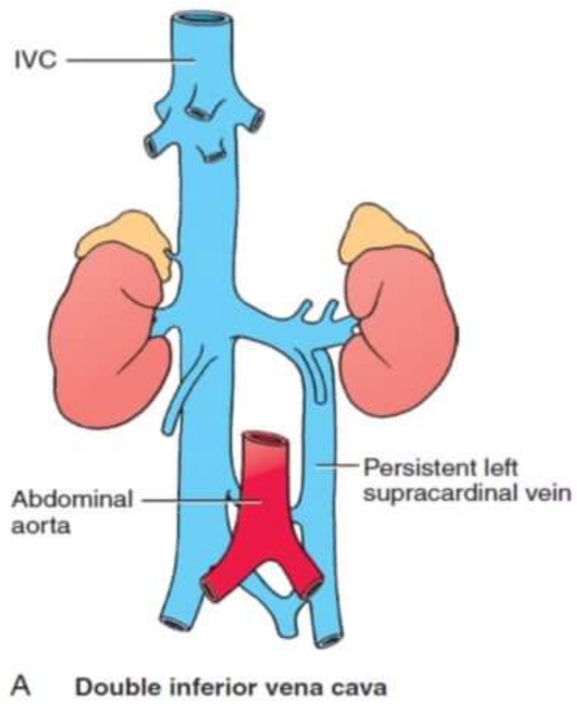
DOUBLE IVC

- persistence of lt. sided IVC
- infra renal portn persistance (lt supracardinal vein)



Q Superior part of IVC develops from
a Anterior cardinal vein
b Post. cardinal vein
c Vitelline vein (rt)
d Umbilical vein

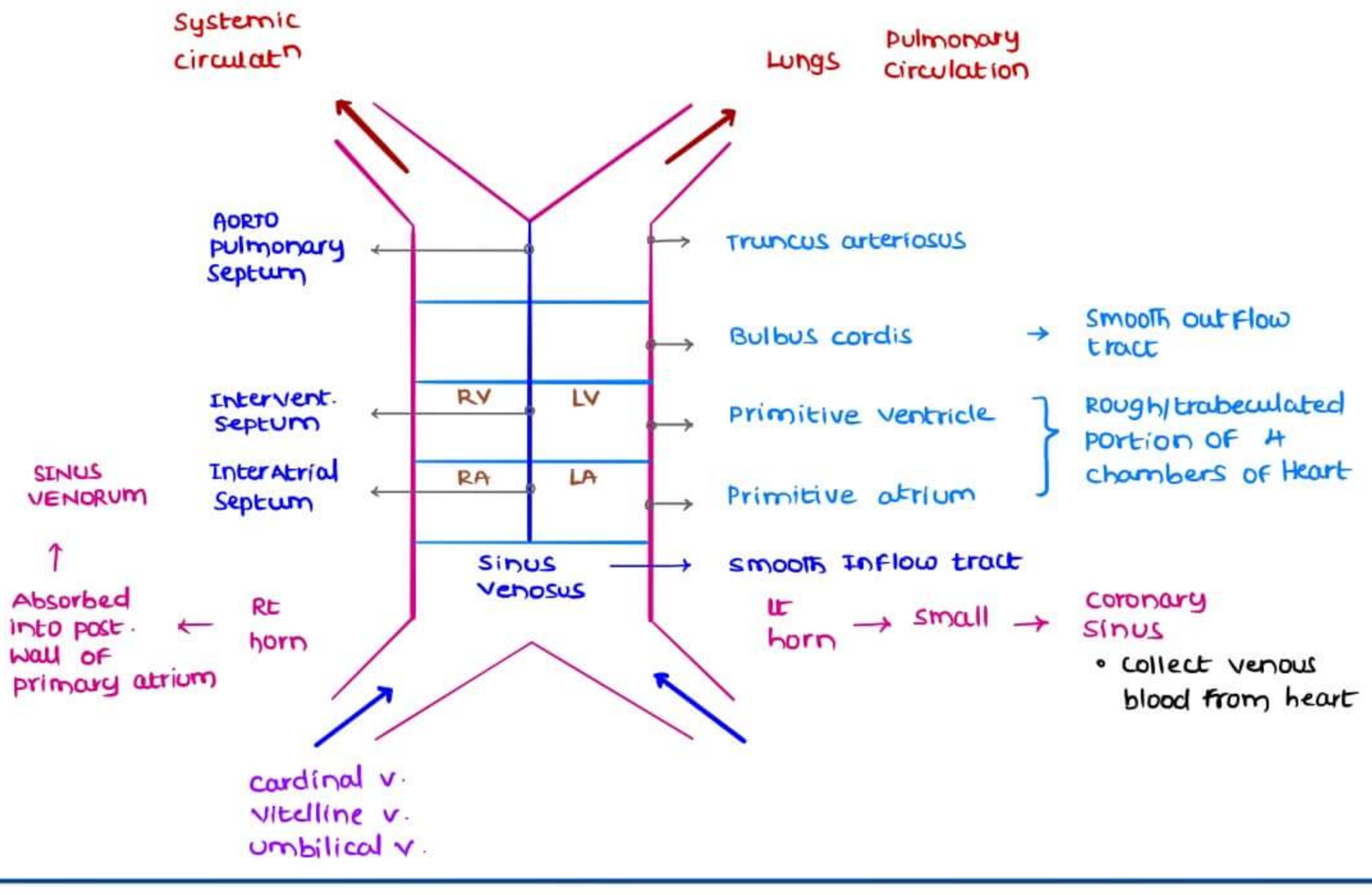




A Double inferior vena cava

Q Double IVC due to non-regression of left
a posterior cardinal vein
b Sacro cardinal vein
c Sub cardinal vein
d Supra cardinal vein d > b > a

HEART TUBE



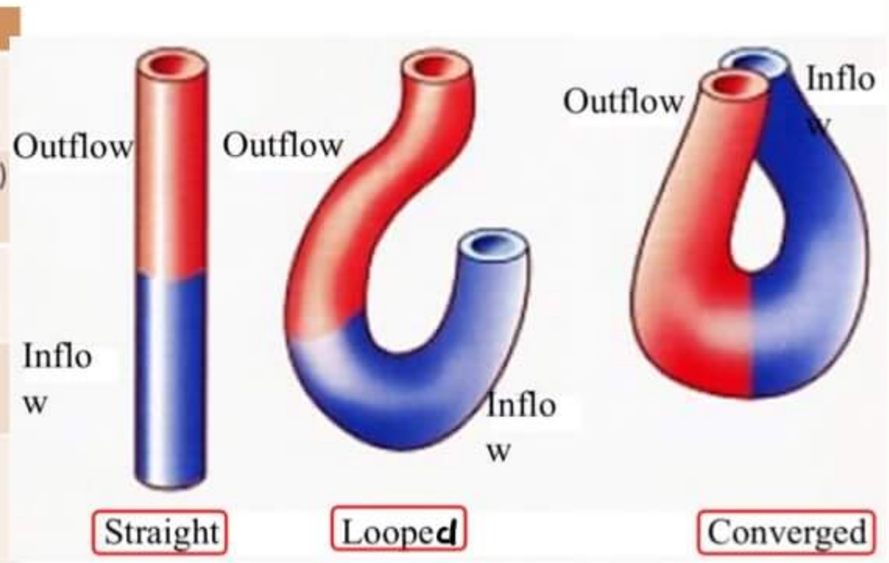
AP SEPTUM [AORTO PULMONARY SEPTUM]

→ derived from NCCs
→ divides TA into Ascending Aorta & Pulmonary septum
→ Ascending Aorta contributes to systemic circulatⁿ
→ Pulmonary trunk contributes to pulmonary circulatⁿ
→ Spiral septum
  → Ascending Aorta ⟶ Pulmonary trunk interchanges positⁿ
  → RA → RV → Pulmonary trunk → pulm. circulatⁿ
    LA → LV → Ascending Aorta → systemic circulatⁿ

  → TRANSPOSITION OF GREAT VESSELS
    → Straight AP Septum

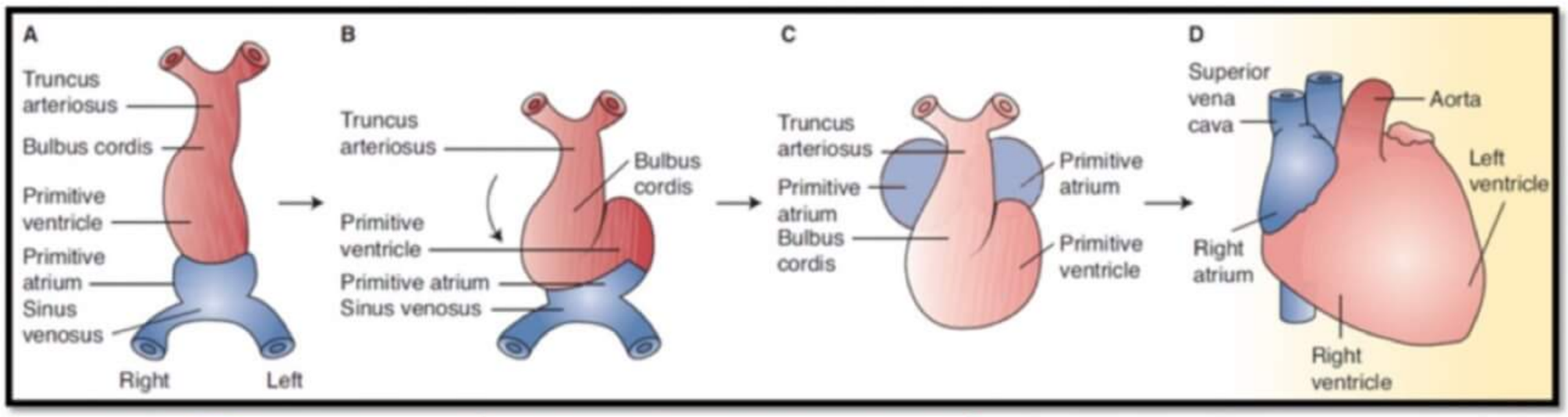
RA → RV → Asc. Aorta → Syst. circulatⁿ
LA → LV → Pulm. Trunk → pulm. circulatⁿ

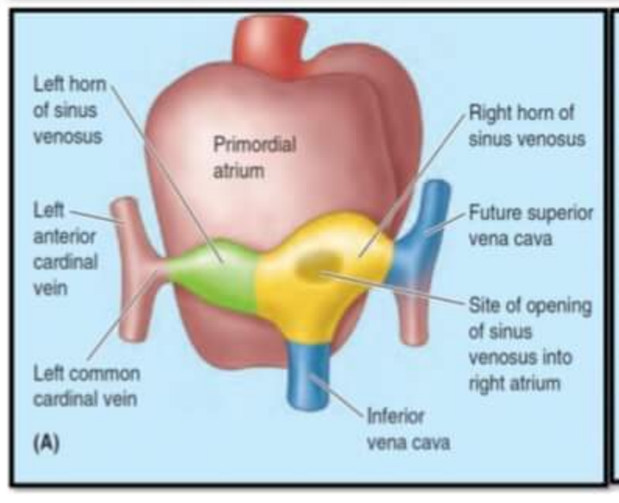
Embryonic dilatation	Adult derivatives
1. Truncus arteriosus	Ascending aorta Pulmonary trunk
2. Bulbus cordis	Smooth upper part of the right ventricle (Conus arteriosus) Smooth upper part of the left ventricle (aortic vestibule)
3. Primitive ventricle	Trabeculated part of the right ventricle Trabeculated part of the left ventricle
4. Primitive atrium	Trabeculated part of the right atrium Trabeculated part of the left atrium
5. Sinus venosus	Smooth part of the right atrium (sinus venarum) Coronary sinus Oblique vein of the left atrium

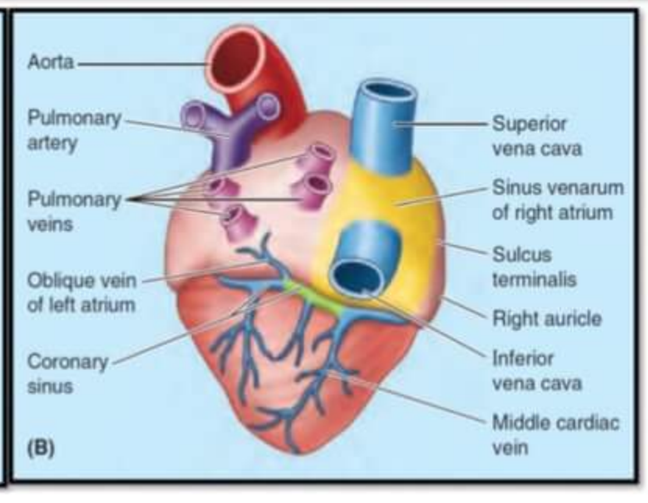


FOLDING OF HEART TUBE

→ upper arterial end comes anterior
→ Lower venous end goes posterior
→ Transverse Pericardial sinus → space blw the two







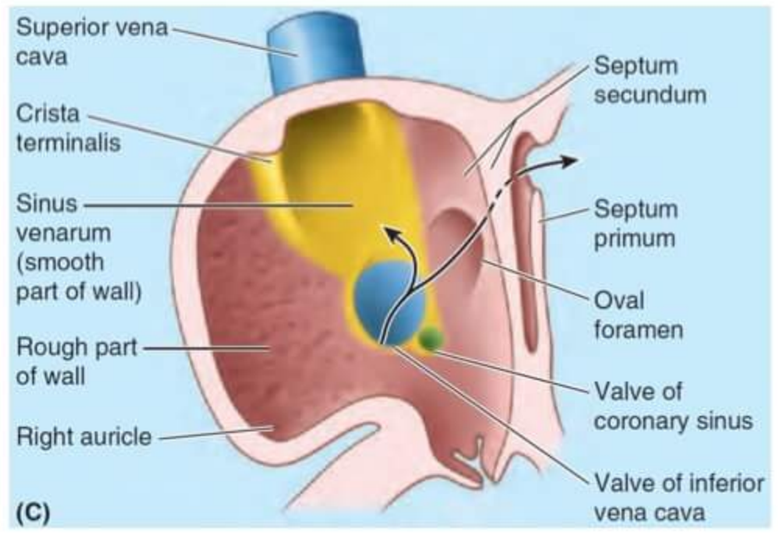
Sulcus Terminalis → boundary line blw rough & smooth part of rt atrium from outside
Crista terminalis → boundary line blw rough & smooth part of rt atrium from inside
→ SA Node develops at upper end of crista terminalis in Sub Epicardial region > Mycardium

CORONARY SINUS → receives venous blood from heart & drains into post. wall of RA

POST. WALL OF RA / SINUS VENARUM (smooth portion)

→ veins opening here

1. Coronary sinus
2. Post. cardinal vein → IVC
3. Ant. Cardinal vein → SVC



POST. WALL OF LA

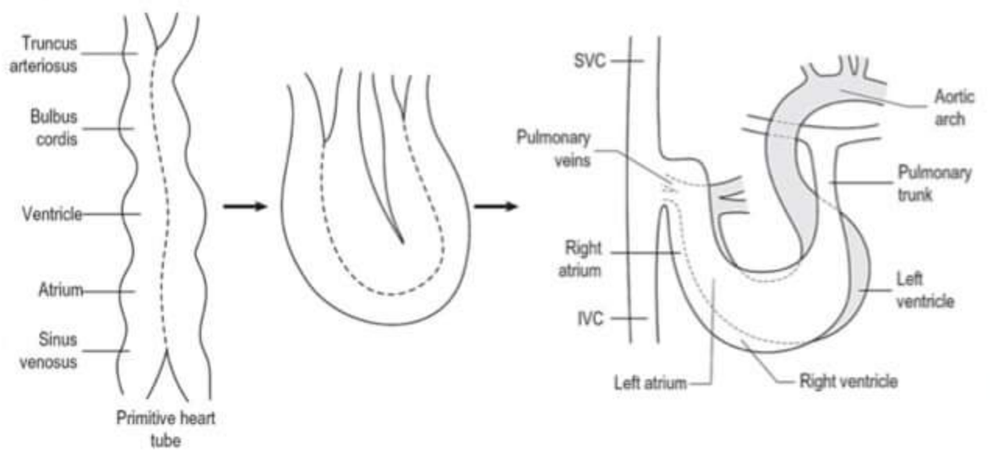
→ 4 pulmonary veins opens here

→ contributed by the partial absorpth of 4 pulmonary veins

1 pulmonary vein → 4 pulmonary veins → Post. wall of LA

→ Lt atrial wall → 1 pulm. veins → 4 pulmonary veins

Q What is true about Sinus venosus
a forms rough wall of rt. atrium
b forms smooth wall of rt. atrium
c forms right coronary sinus
d forms left leaflet of coronary sinus



TRANSVERSE PERICARDIAL SINUS

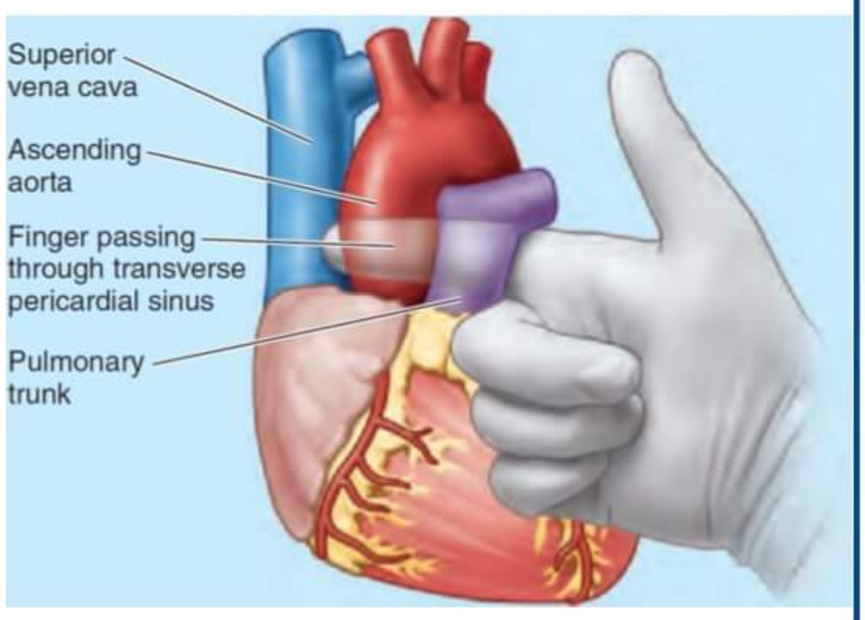
CARDIAC LOOPING / FOLDING

→ upper arterial end comes anterior

→ Lower venous end goes posterior

→ Transverse pericardial sinus present blw the two

→ TA → Ascending Aorta
→ Pulmonary Trunk

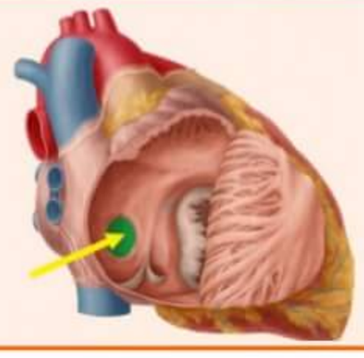


Pulm. artery & Ductus Arteriosus comes from 6th Pharyngeal Arch Artery

→ On Heart Lung machine Sx,
- pull Ascending Aorta & pulmonary trunk anterior & finger placing in Transverse pericardial sinus
- SVC present behind the finger

INTERATRIAL SEPTUM FORMATION

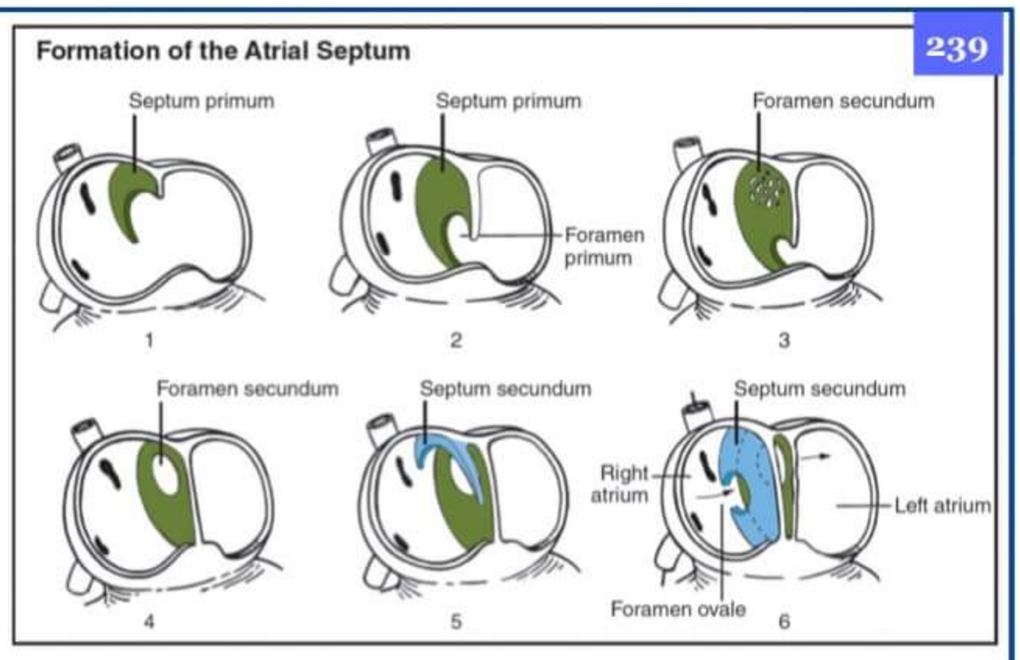
Q The marked area develops from
a Septum primum
b Septum Secondum
c Ostium primum
d Ostium Secondum



Q Limbus fossa ovalis and floor of fossa ovalis represents
a Septum primum
b Septum Secondum
c Septum primum & Septum Secondum
d Septum Secondum & Septum primum

ATRIOVENTRICULAR CUSHION

→ forms
  → tricuspid valve on rt. side
  → mitral valve on lt side



SEPTUM PRIMUM fuses ī AV cushion

FORAMEN PRIMUM

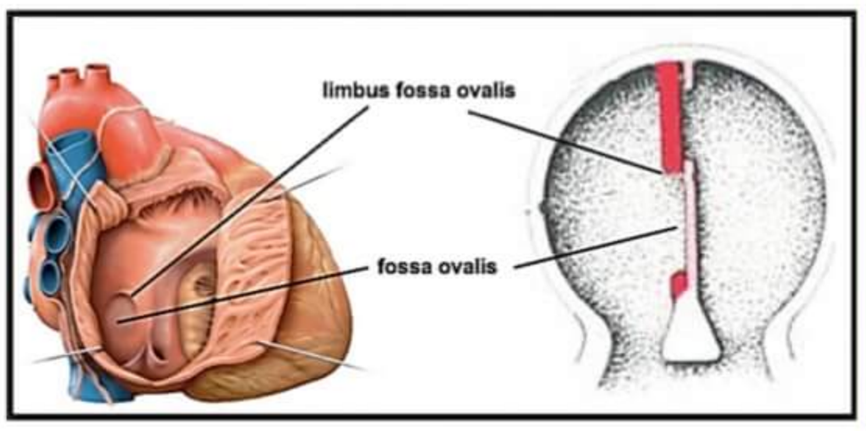
→ present in septum primum
→ Blood from RA to LA passes through this initially
→ Gradually it disappears

FORAMEN SECONDUM

→ present in septum primum
→ now blood from RA passes LA through foramen secondum

SEPTUM SECONDUM

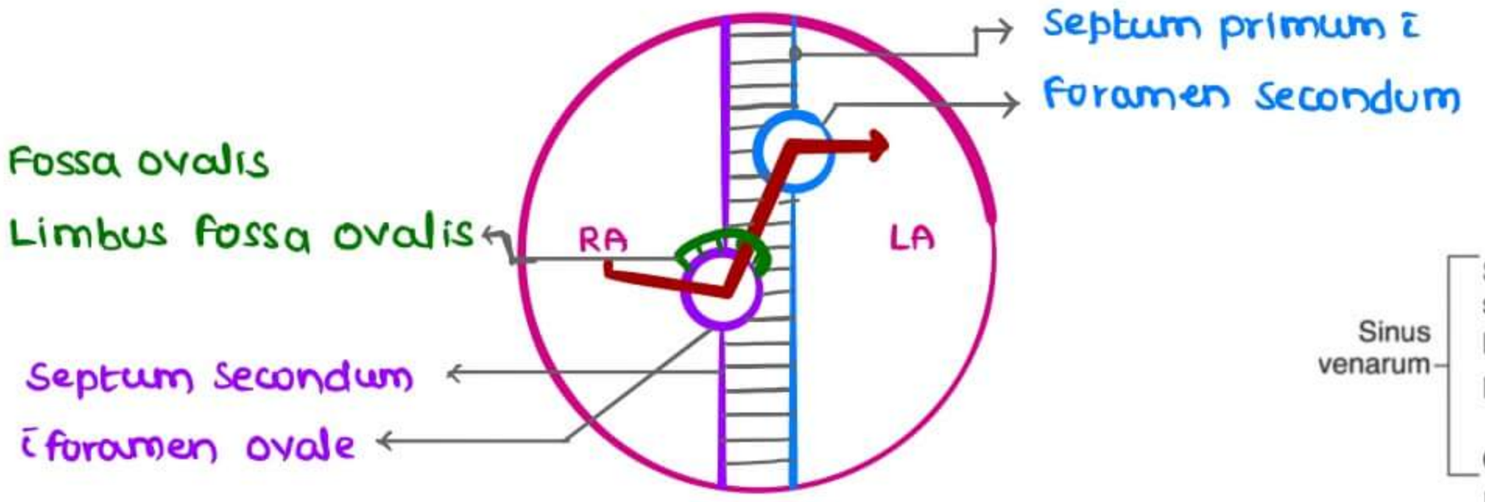
→ present right side of septum primum
→ contains FORAMEN OVALE, for the passage of blood from RA to LA
→ NOW Blood from RA passes an oblique course (from foramen ovale to foramen secondum) to reach LA
  foramen ovale is inferior
  foramen secondum is superior

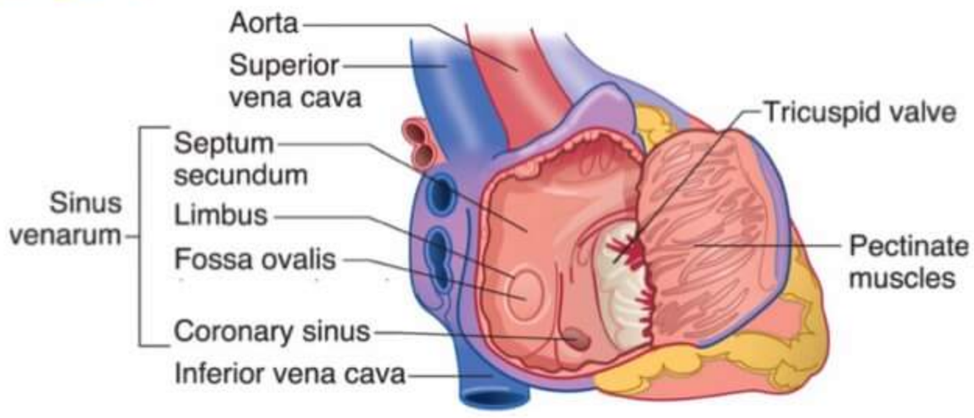


AFTER BIRTH

→ LA pressure is high
→ Two septa will fuse
→ foramen ovale fuses ī septum Primum & close
→ foramen secondum fuses ī septum secondum & close
→ FOSSA OVALIS → vestigeal remnant of foramen ovale
  → septum primum seen on floor on lt side

LIMBUS FOSSA OVALIS → Thickened margin on foramen ovale
  → present right side interatrial septum
  → comes from septum secondum





AP SEPTUM FORMATION & ANOMALIES

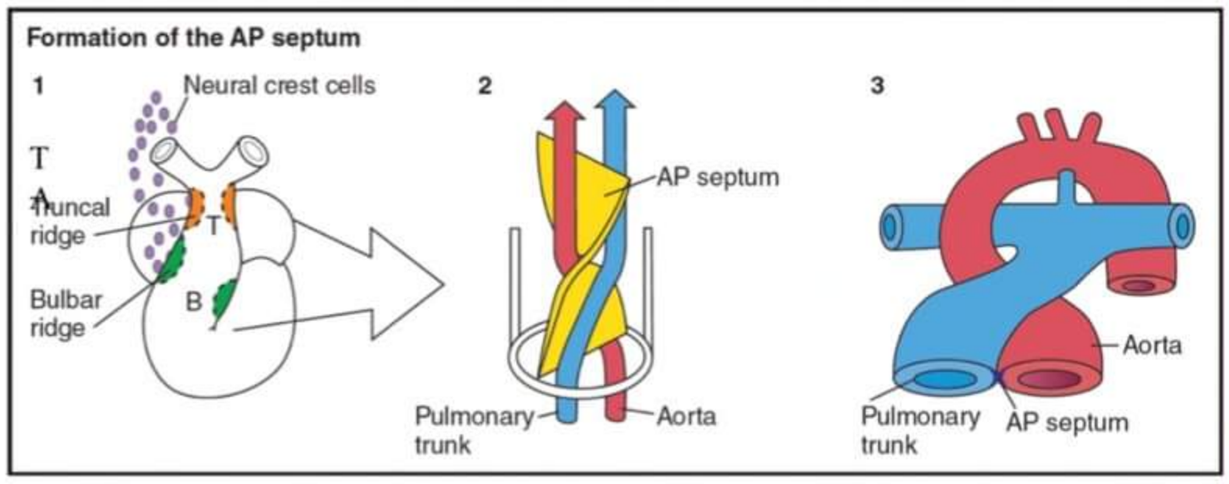
1. PERSISTING TRUNCUS ARTERIOSUS
2. TRANSPOSITION OF GREAT VESSELS
3. TETROLOGY OF FALLOT

} congenital cyanotic Heart Diseases

CYANOTIC

→ Rt → Lt shunt
Pulm → Systemic
circulatⁿ circulatⁿ

CONGENITAL → present since birth



AORTO PULMONARY SEPTUM FORMATION

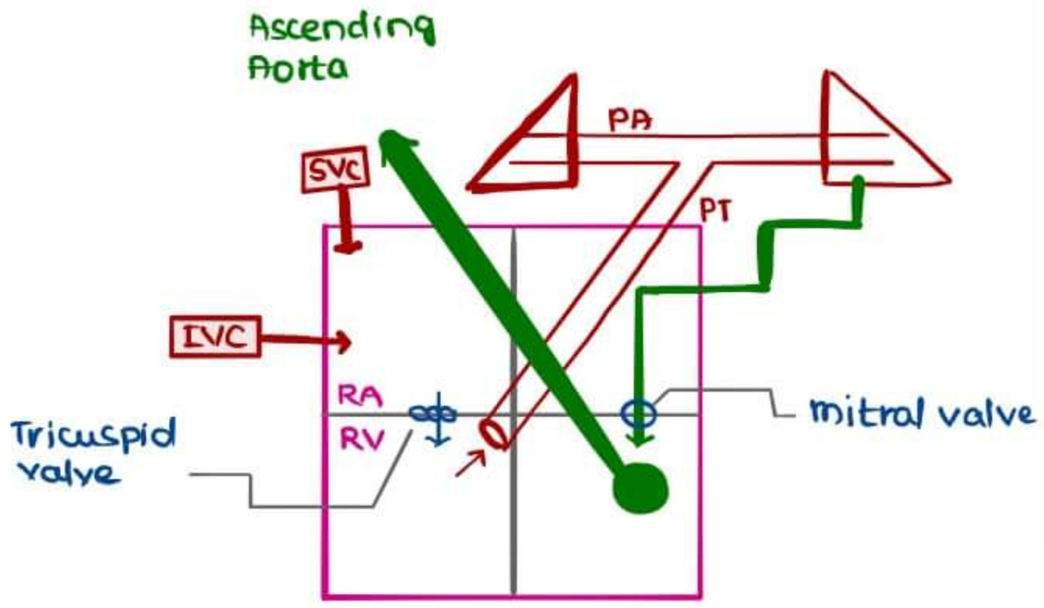
→ NCCs comes towards TA region &
develop Truncal Bulbar / conotruncal ridges
Ridges will grows & fuses ĩ each other forming Septum Separating TA
into Ascending Aorta (posterior), pulmonary trunk (posterior)

→ AP Septum is SPIRAL SEPTUM

NORMAL HEART

RV → PULMONY TRUNK → PULMONARY CIRCULATION

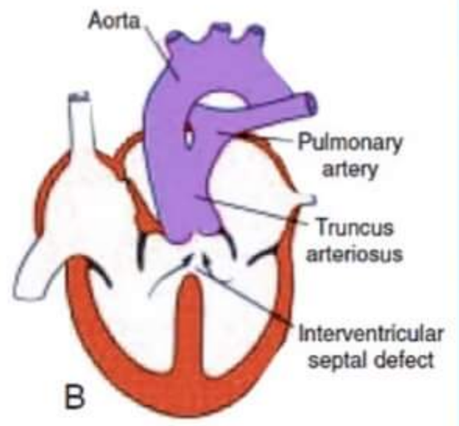
LV → ASCENDING AORTA → SYSTEMIC CIRCULATION



AP SEPTUM ANOMALIES

PERSISTING TRUNCUS ARTERIOSUS (PTA)

→ Absence of migratⁿ of NCCs to TA region / absence OF NCCs → No AP Septum
→ Truncus Arteriosus persists
→ NO Asc. Aorta & No pulm. trunk
→ mixing of blood occurs → cyanosis
→ AP septum absent

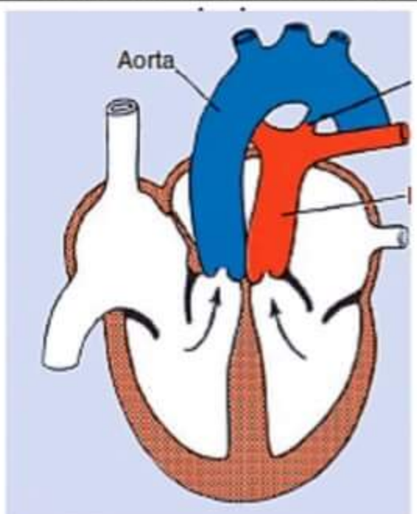


TGVs: AP septum is not

TRANSPOSITION OF GREAT VESSELS (TPGVs)

→ AP Septum is not spiral
→ vessels are straight & opens into opp. chambers

Rt ventricle → Ascending Aorta
Lt ventricle → Pulmonary Trunk
} cyanosis

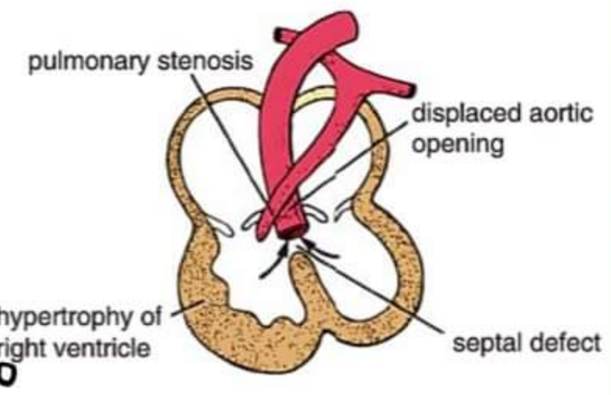


→ Babies do not survive
→ PDA (Patent ductus Arteriosus) is essential require-
ment for survival
→ ASD & VSD also develop as compensatory mechanisms

TOF (TETROLOGY OF FALLOT)

→ Ant. migratⁿ of AP septum
→ causes pulmonary stenosis
→ Aorta becomes larger & Overrides inter ventricular septum
  → VSD present in membranous part
→ Rt ventricular hypertrophy occurs dlt sending blood into
  1. Narrow vessels (Pulm. trunk)
  2. Asc. Aorta (high pressure)

Rt ventricle is 3 times thicker than Lt ventricle



PENTOLOGY OF FALLOT → TOF + ASD

Q Transposition of great vessels occurs dlt
a failure of cono-truncal ridge to fuse & descend towards the ventricles (PTA)
b Ant. displacement of Aortopulmonary septum (TOF)
c Aortico pulmonary septum not following its spiral course (TGV)
d migratⁿ of NCCs towards truncal & bulbar ridges (Normal)

FETOPLACENTAL CIRCULATION

UMBILICAL CORD

→ contains 2 umblical Arteries & 2 umbilical veins initially
→ Rt umbilical vein regress & Lt umbilical vein left

→ umbilical Arteries carries deoxygenated blood
→ umbilical vein carries Oxygenated blood

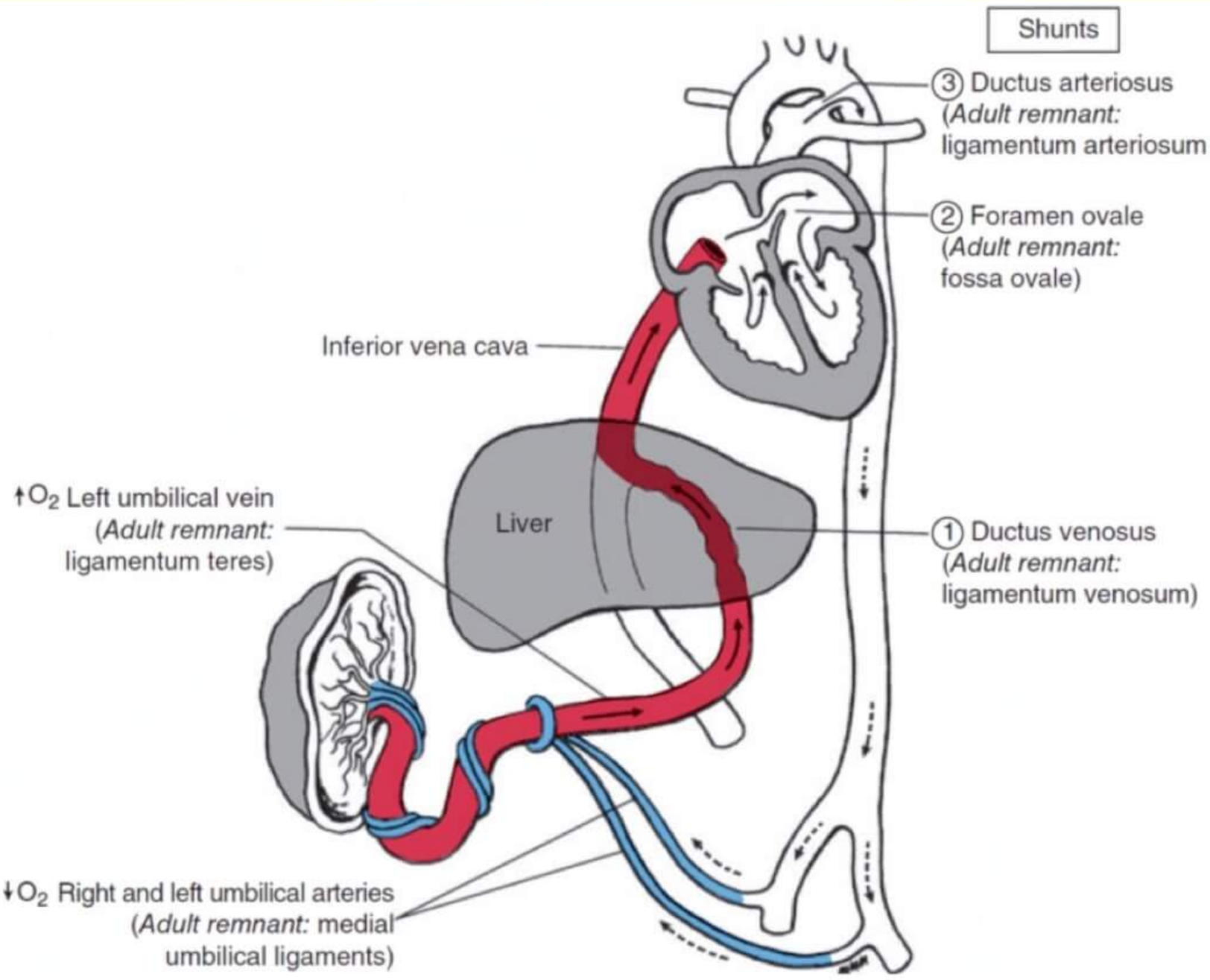
→ Ductus venosus, takes Oxygenated blood & bypasses Liver & passes to IVC & Rt. Atrium of fetus

→ RA blood bypasses lung & sends blood to LA through Foramen ovale
→ some blood in Rt ventricle, sends to pulmonary trunk
Pulmonary trunk bypasses Lungs by Ductus Arteriosus & sends blood to ascending aorta

→ Deoxygenated blood in fetus collects into AORTA into ILIAC ARTERY
Iliac Artery sends blood to Rt & lt UMBILICAL ARTERIES

AFTER BIRTH

→ Lt umblical vein	→	Obliterated & forms LIGAMENTUM TERES
→ Ductus venosus	→	closed & becomes LIGAMENTUM VENOSUM
→ Foramen ovale	→	closed & becomes FOSSA OVALIS
→ Ductus arteriosus	→	Physiological closure (immediate vasospasm after birth) Anatomical closure (dlt tunica intima proliferatⁿ & fibrosis) vasospasm occurs in 1-4 Days if it is >96 hrs, Rᵧ by Prostaglandins Anatomical closure completed in 1-3 months if >12 wks, Rᵧ by Sx Repair
→ Umbilical Arteries	→	MEDIAL UMBILICAL LIGAMENTS

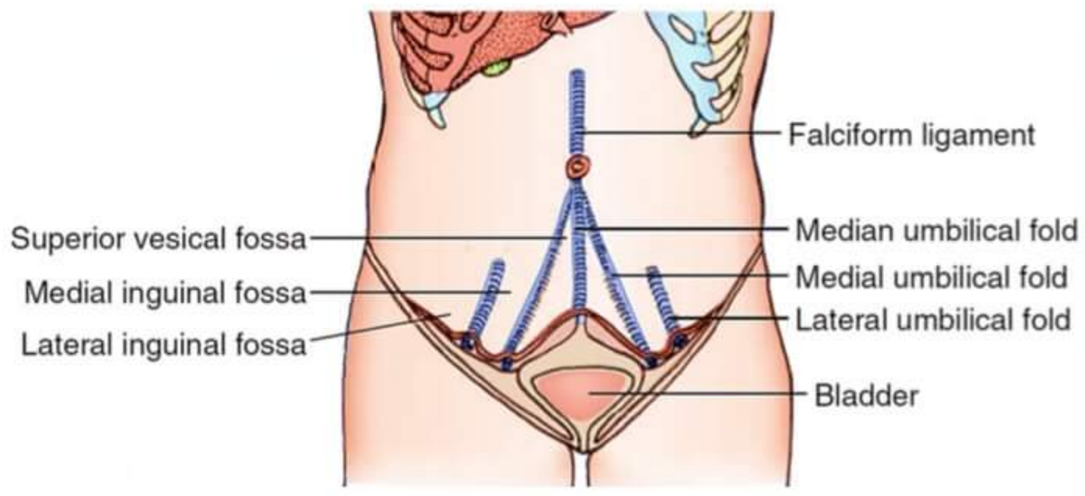


Q All of the following pairs for adult derivatives of embryonal structures is correct EXCEPT

a umbilical artery : Lateral umbilical ligament
b umbilical vein : Ligamentum teres
c Ductus venosus : Ligamentum venosum
d foramen ovale : fossa ovalis

PERITONEAL FOLDS

→ on Ant. Abdominal wall



FALCIFORM LIGAMENT

→ Double fold of peritoneum
→ coming from umbilicus region
→ Going towards Liver
→ carries lt umbilical vein in fetus towards liver
carries ligamentum teres in adult towards liver

MEDIAL UMBILICAL FOLD → peritoneal fold on medial umbilical ligament

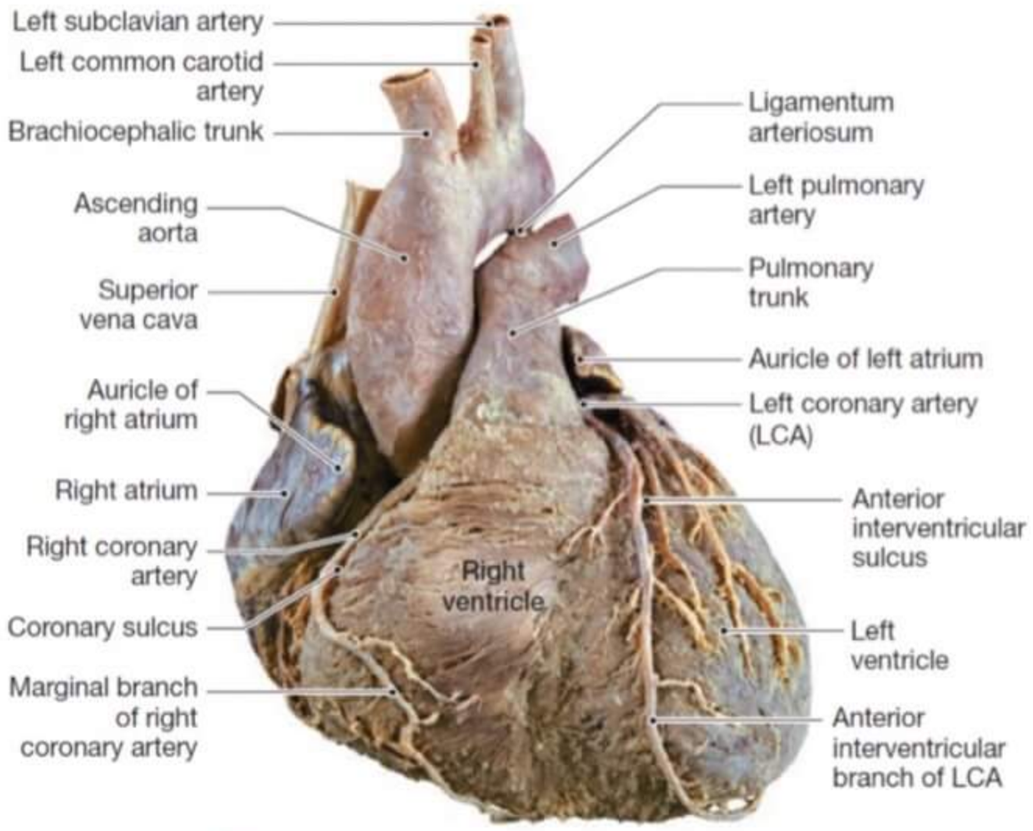
LATERAL UMBILICAL FOLD

→ produced by Inf. Epigastric vessels running towards the rectus sheath & enters rectus sheath

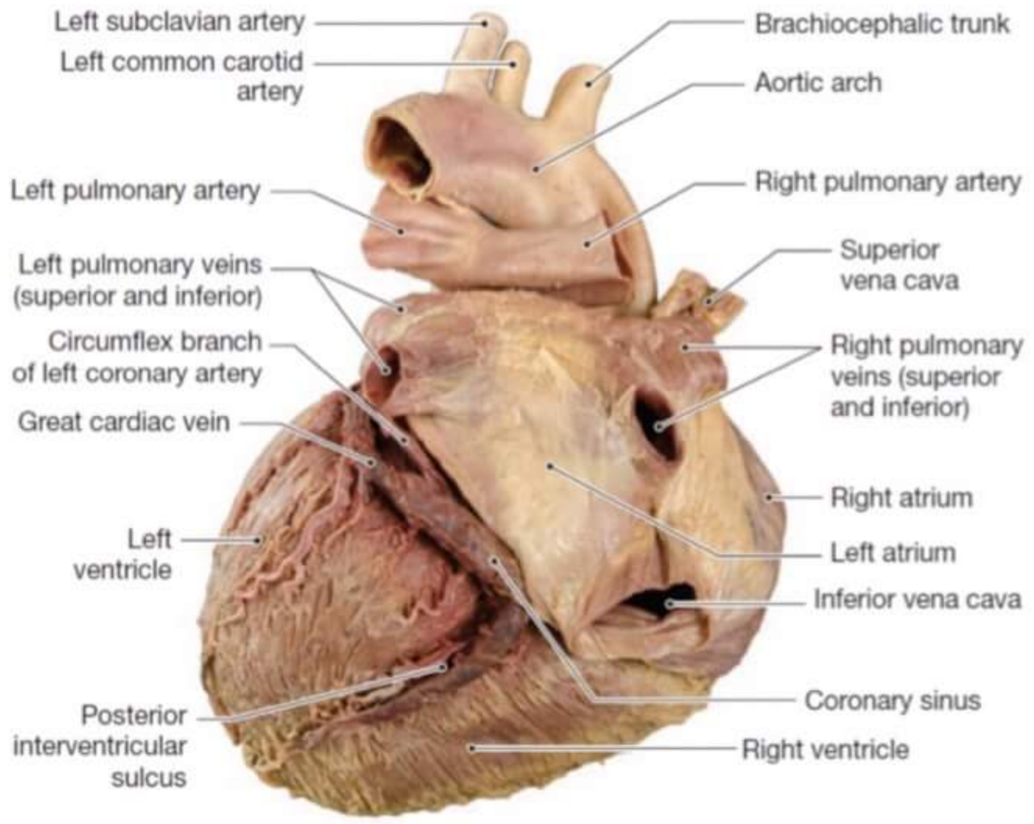
MEDIAN UMBILICAL FOLD

→ one in midline
→ covers ALLANTOIS
→ hind gut diverticulum attaching to tip of apex of urinarybladder in fetus
→ contains lumen, which is obliterated to become URACHUS in adults

SURFACES & GROOVES



a Anterior view of a dissected heart and great vessels

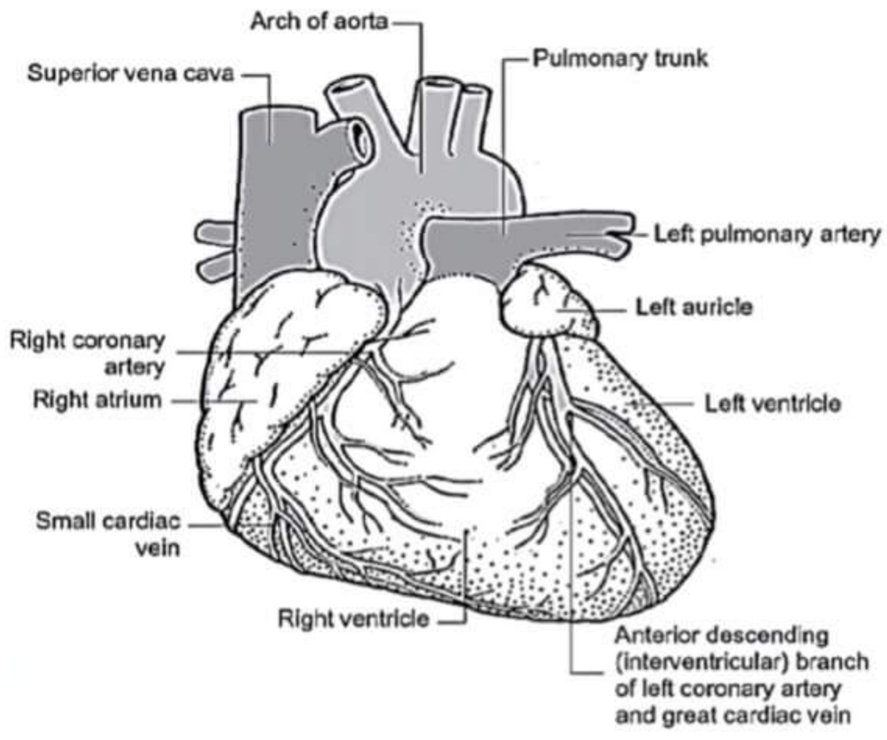


b Posterior view of the heart and great vessels

ANTERIOR VIEW

ARCH OF AORTA BRANCHES

1. Brachiocephalic trunk
2. Left common carotid Artery
3. Left subclavian Artery



PULMONARY TRUNK → Gives Pulmonary Arteries

ANTERIOR STERNO COSTAL SURFACE

CONTRIBUTORS

1. Rt ventricle (major contributor)
2. Rt Atrium
3. Lt ventricle
4. Lt auricle

RT. CORONARY SULCUS / RT AV GROOVE

→ contains Rt. coronary Artery (Br. of Descending aorta)
  → runs anteriorly & posteriorly
  → Small cardiac vein follows it posteriorly
    → drains coronary sinus posteriorly

INTERVENTRICULAR SEPTUM / GROOVE

→ Anterior Interventricular Artery
  → present in Anterior Interventricular groove
  → Supplies ant. 2/3rd OF IV septum
  → Greater cardiac vein
    – forms at cardiac apex & accompany AIVA & runs posteriorly
    – drains coronary sinus posteriorly

POSTERIOR VIEW

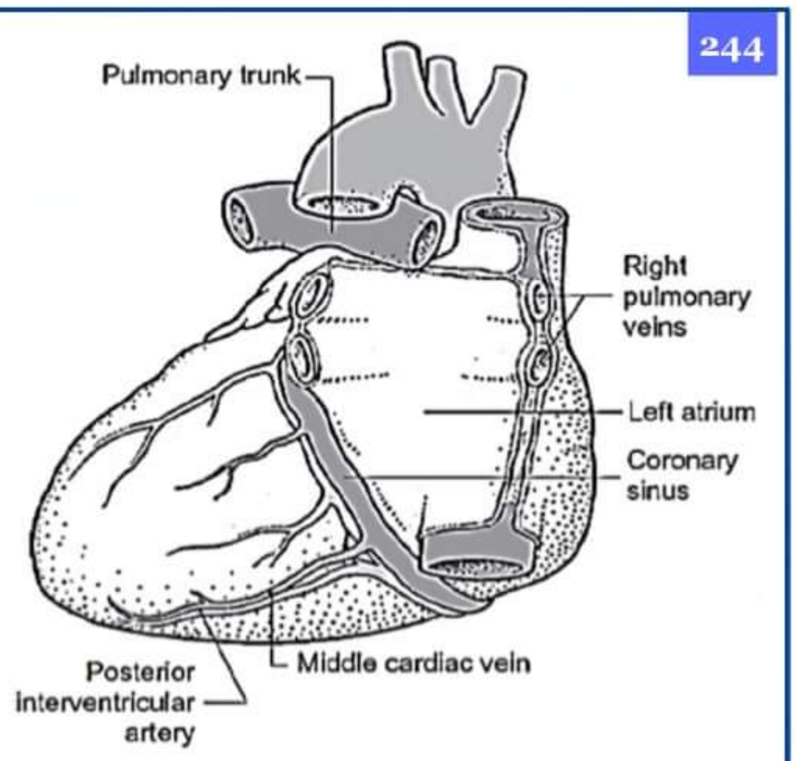
1. Coronary sinus in coronary sulcus posteriorly
   → Coronary Sulcus / AV groove → Separates atria & ventricles

2. Rt Atrium ← SVC & IVC opening into it
3. Lt Atrium ← 4 pulmonary veins opens into it

POSTERIOR SURFACE / BASE OF HEART formed by

1. Rt Atrium (partly contributory)
2. Lt Atrium (major contribution)

Rt ventricles & lt ventricle are sitting on Diaphragm
→ DIAPHRAGMATIC SURFACE



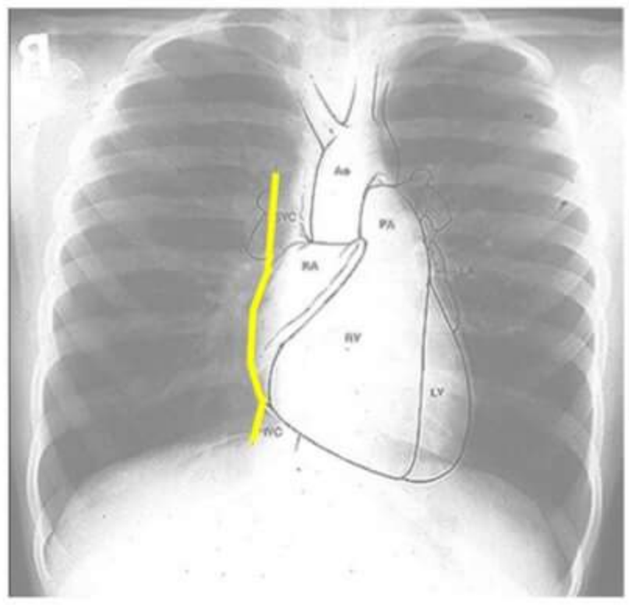
POSTERIOR INTERVENTRICULAR GROOVE / SEPTUM

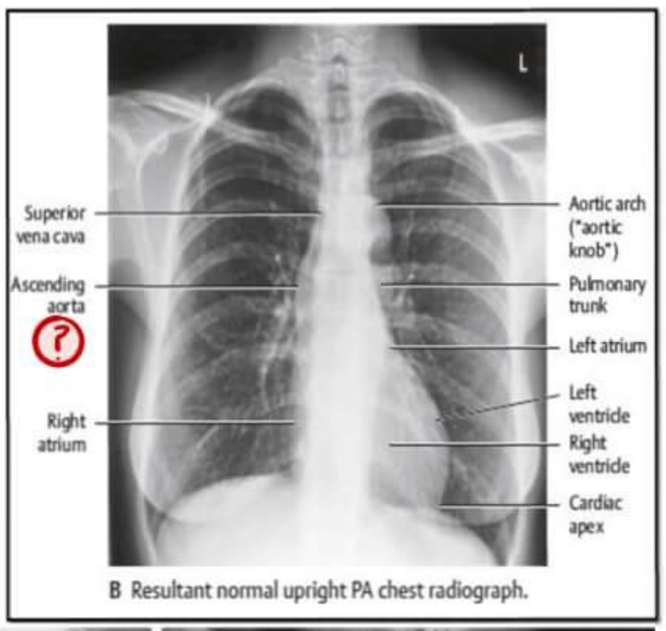
→ Contains POSTERIOR INTERVENTRICULAR ARTERY
  → Supplies post. 1/3 rd of IV septum
  → accompanied by MIDDLE CARDIAC VEIN
    → drains coronary sinus

CORONARY SINUS → drains into post. wall of rt. atrium along ī SVC & IVC

Q The base of the heart formed by
a Lt & rt ventricle
b lt atrium & ventricle
c Rt atrium & ventricle
d Lt atrium & rt. Atrium

Q In PA view CXR, right border of the heart contributed by
a Pulmonary trunk
b Ascending aorta
c Right auricle
d Right Ventricle





B Resultant normal upright PA chest radiograph.

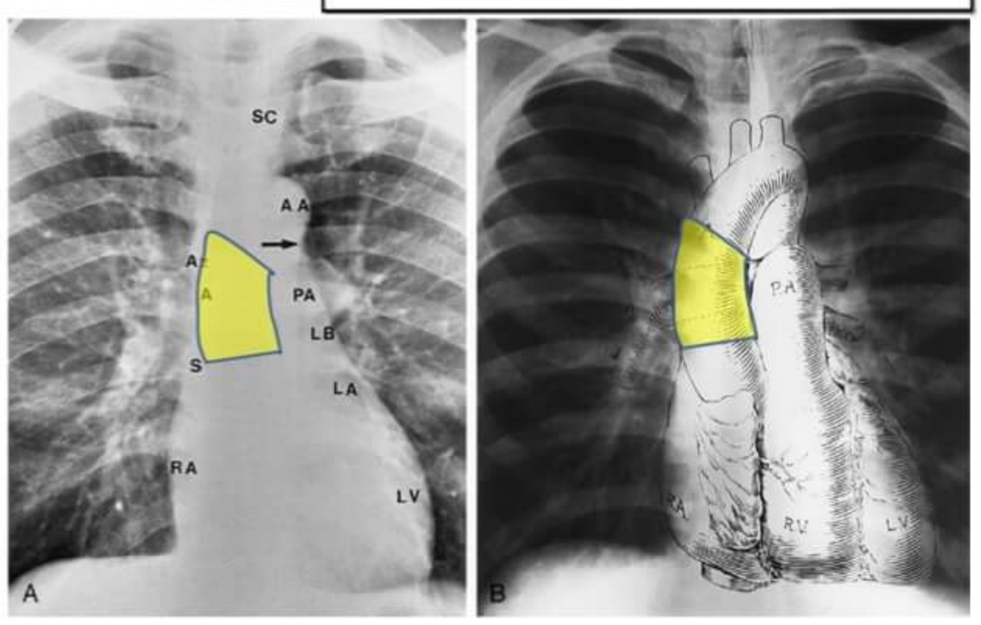


FIGURE 15-3 Frontal projection of the heart and great vessels. **A,** Left and right heart borders in the frontal projection. **B,** A line drawing in the frontal projection demonstrates the relationship of the cardiac valves, rings, and sulci to the mediastinal borders. A = ascending aorta; AA = aortic arch; Az = azygous vein; LA = left atrial appendage; LB = left lower border of the pulmonary artery; LV = left ventricle; PA = main pulmonary artery; RA = right atrium; RV = right ventricle; S = superior vena cava; SC = subclavian artery.

RT. BORDER OF HEART

1. SVC
2. Rt. Atrium
3. IVC
4. Ascending aorta ?

VENOUS DRAINAGE

Small cardiac vein
Great cardiac vein
Middle cardiac vein
} drains into → Coronary sinus → drains into → Post. wall of Rt. Atrium

ANTERIOR CARDIAC VEINS → drains into → Ant. wall of Rt. atrium

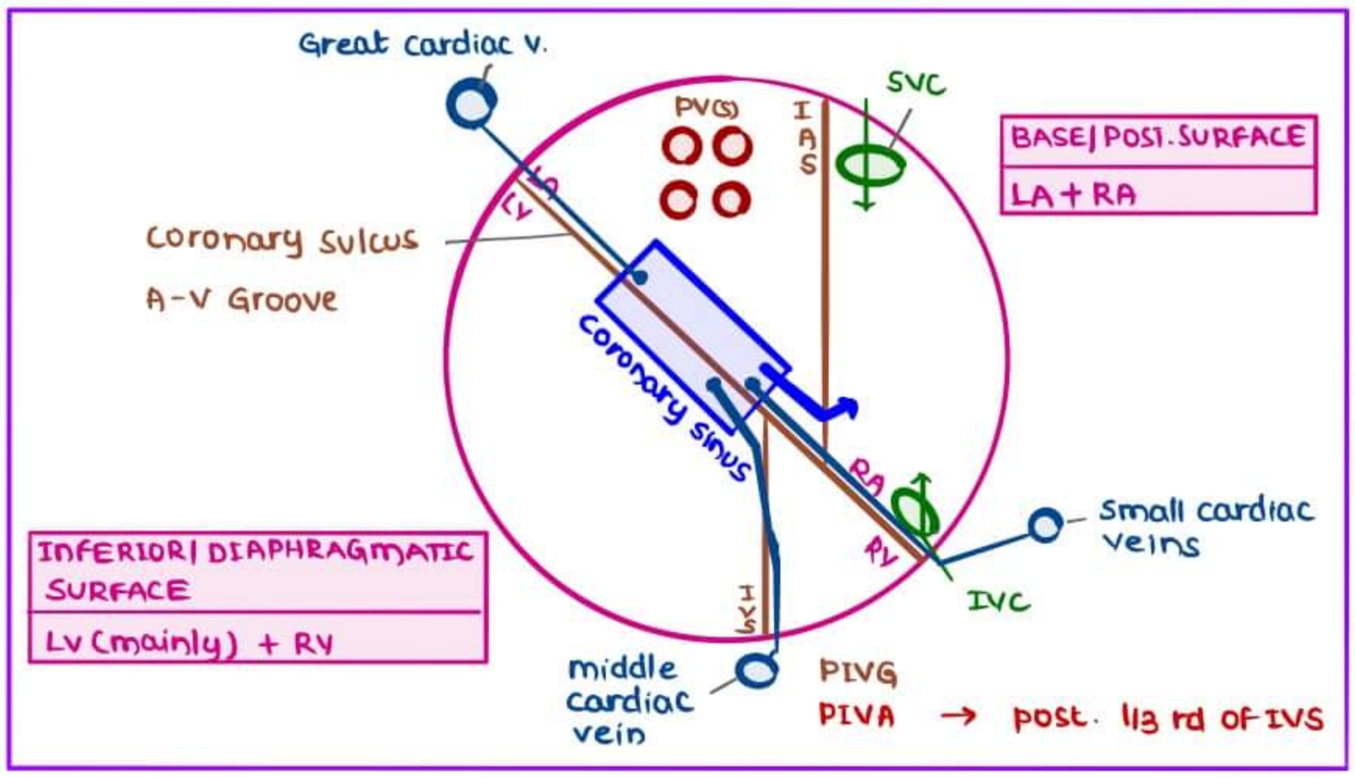
Great cardiac vein
running in AIVG ī AIVA anterior to the heart
Goes circumferentially around, goes behind the heart
& drains into lt end of coronary sinus posteriorly

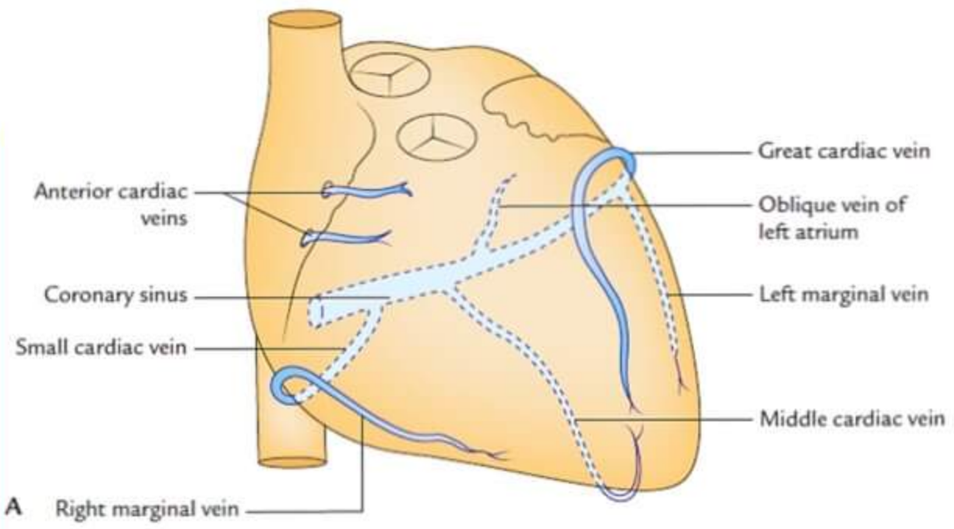
Small cardiac vein → drains into coronary sinus posteriorly
→ continuation of Rt. marginal vein

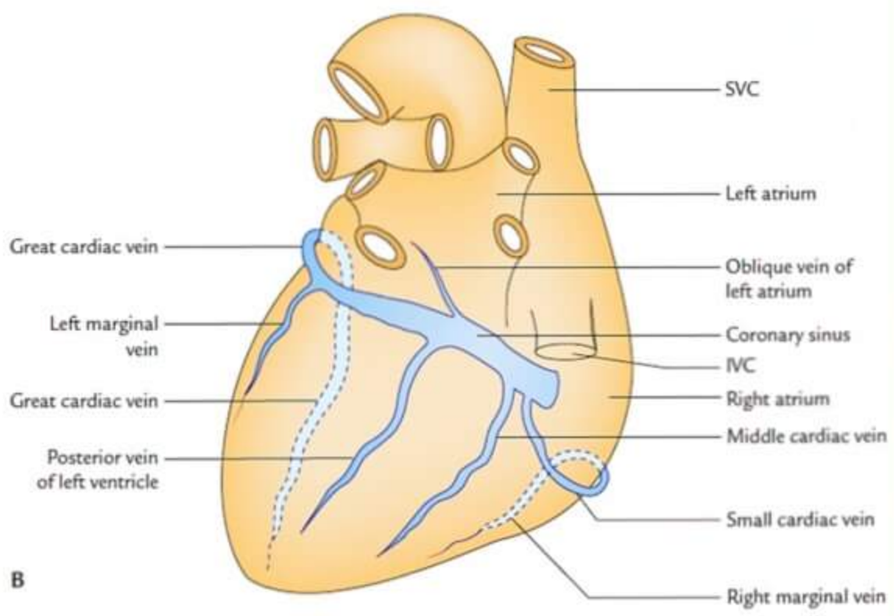
Middle cardiac vein → runs in PIVG & PIVA
→ drains into coronary sinus

coronary sinus drains into Post wall of Rt. Atrium

POSTERIOR VEIW







Q The Great cardiac vein lies in which groove
a anterior part of Rt. coronary sulcus
b Post. part of Rt. coronary Sulcus
c Anterior interventricular groove
d Posterior interventricular groove

Q Bleeding comes from the vein that is accompanied by the posterior interventricular artery. which of the following veins is most likely to be ruptured
a Great cardiac vein
b middle cardiac vein
c Small cardiac vein
d Oblique veins of the left atrium

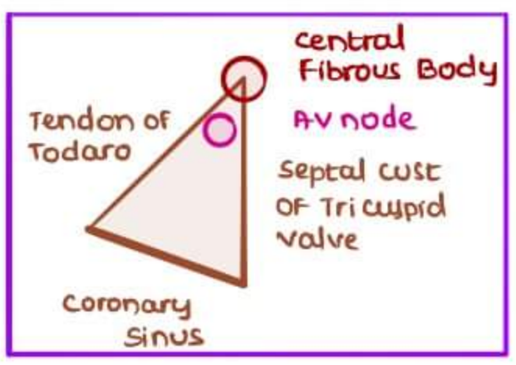
INTERIOR

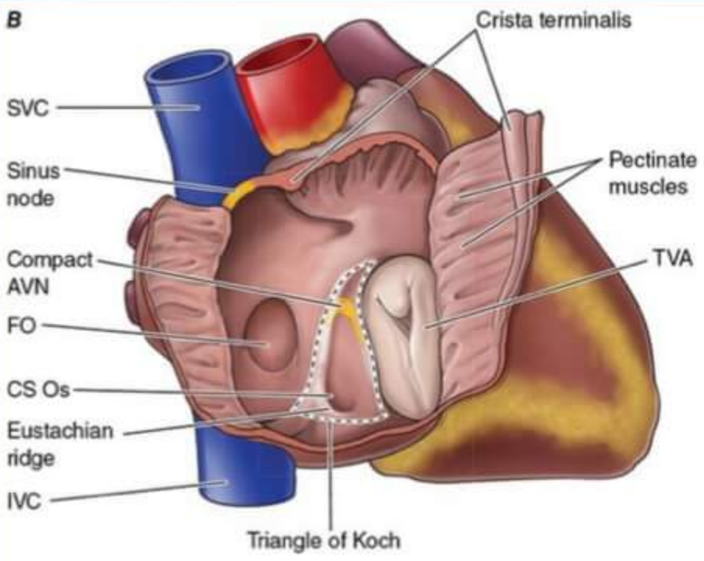
Q Which of the following is NOT a boundary of the KOCH'S Δle
a Tendon of Todaro
b IVC opening
c Coronary Sinus Ostium
d Septal Cusp of tricuspid valve

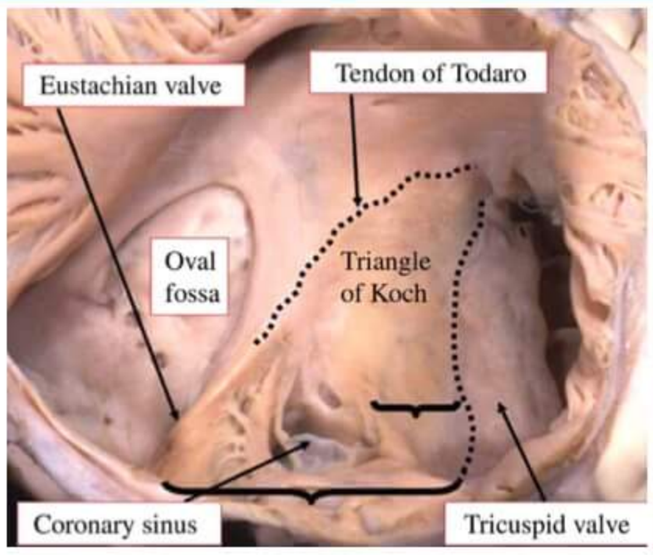
KOCH'S TRIANGLE

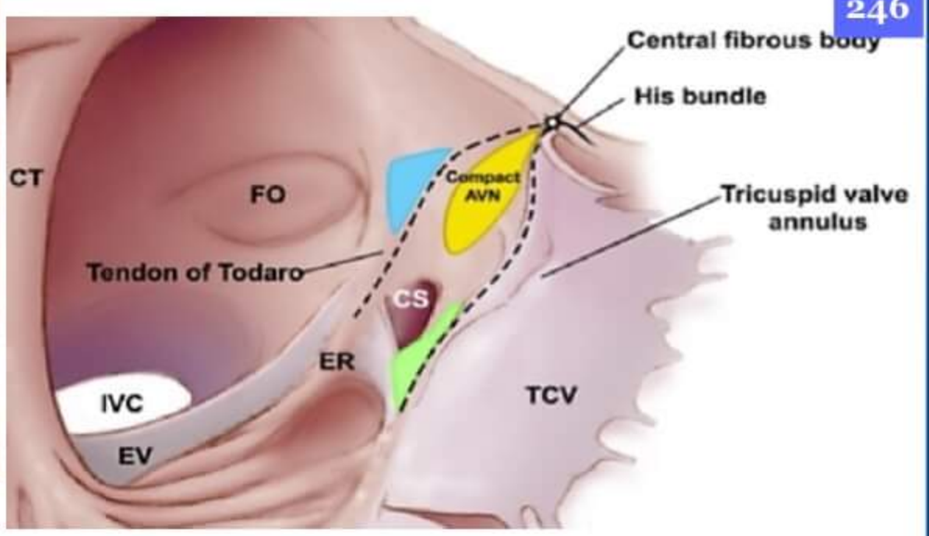
BOUNDARIES

1. TENDON OF TODARO
2. Opening of CORONARY SINUS at the base
3 Septal Cusp OF TRICUSPID VALVE (Rt. ATRIO VENTRICULAR VALVE)
4 AV Node at apex









TENDON OF TODARO

→ Sub endocardial collagen fibres

→ connected to CENTRAL FIBROUS BODY

CENTRAL FIBROUS BODY

→ component of fibrous skeleton of heart

→ Septal cusp of Tricuspid valve also attaches here

CLINICAL IMPORTANCE

PSVT → AV NODAL REENTRY TACHYCARDIA

→ Rx by Radio frequency ablatⁿ of Koch's Δle

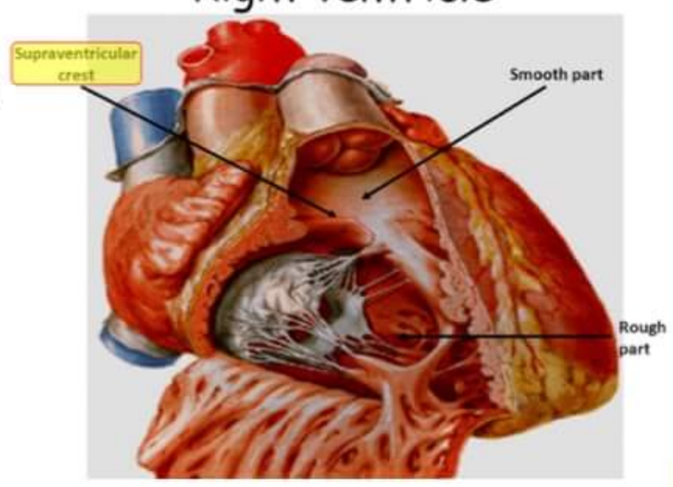
SUPRA VENTRICULAR CREST

→ lies blw rt. ventricular 'inlet (Rough) & outlet (smooth)

→ Rough inflow tract derived from Primitive ventricle

→ smooth outflow tract derived from Bulbus cordis

Right ventricle



CONUS ARTERIOSUS (smooth portⁿ)

Papillary Muscle

→ present in rough trabeculated portion of ventrick

→ contains chordae tendinae attaching to cusp of Tricuspid valve

ARTERIAL SUPPLY

RIGHT CORONARY ARTERY

→ Br. of Ascending Aorta

→ runs in rt. coronary sulcus anteriorly gives SA Nodal Artery

→ runs in coronary sulcus posteriorly gives AV Nodal Artery & Posterior Interventricular Artery

→ CARDIAC DOMINANCE

decided by PIVA

→ 65% has Rt cardiac Dominance (br. of Rt. coronary Artery)

→ 10% has lt cardiac Dominance (br. of circumflex artery)

→ 25% has CO DOMINANCE (multiple PIVA, one from rt. side & other from lt. side)

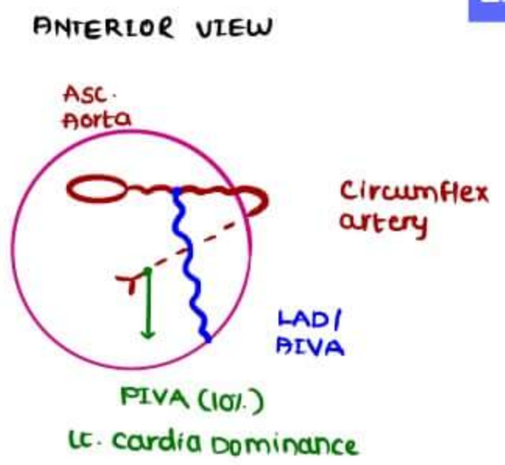
ANTERIOR VIEW

LT. CORONARARY ARTERY

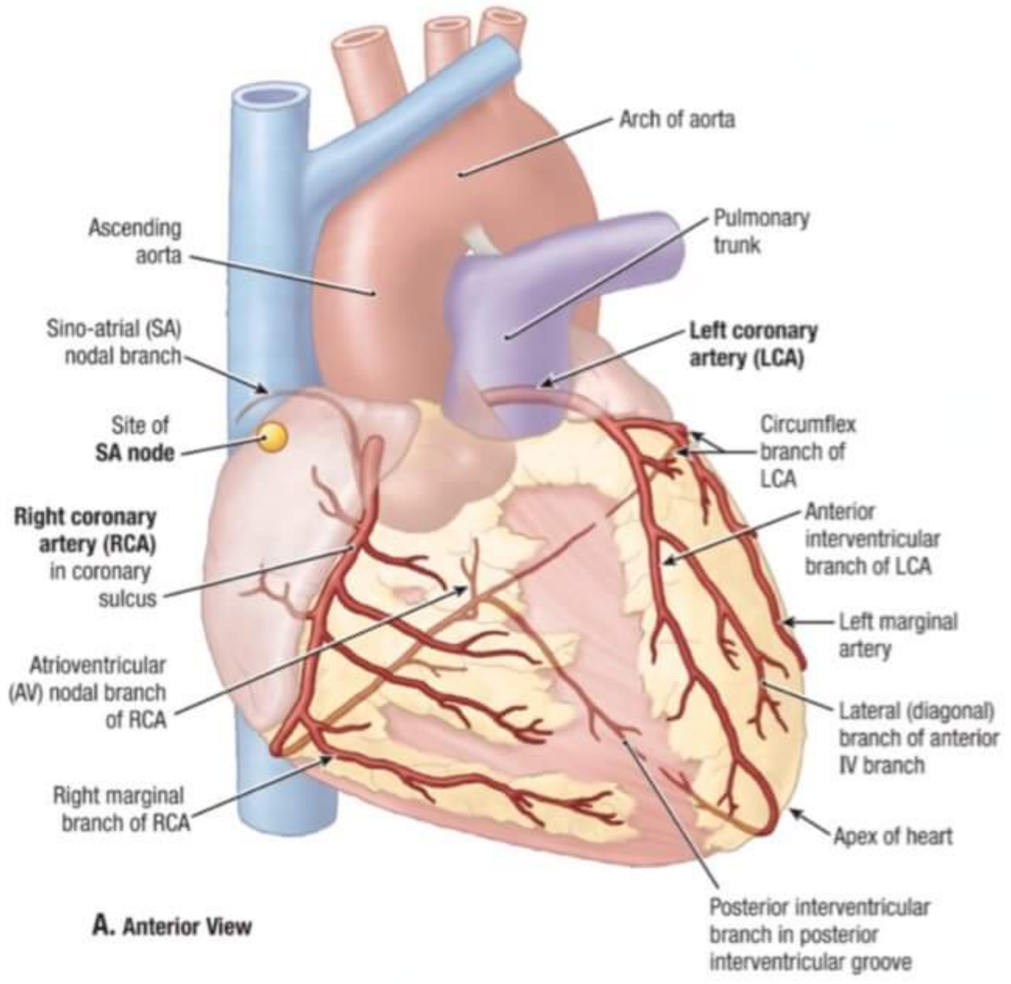
BRANCHES

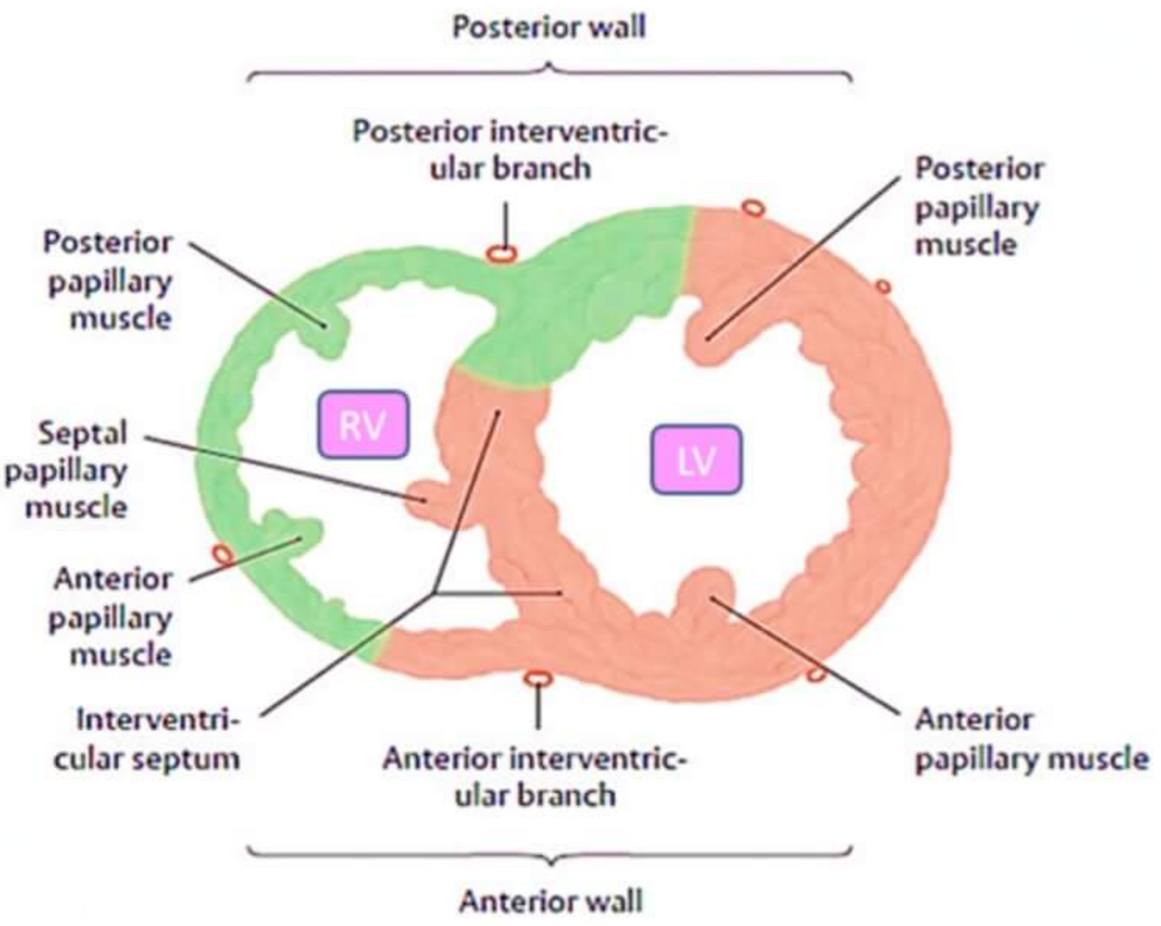
1. LEFT ANTERIOR DESCENDING ARTERY | AIVA (in AIVG)
   → Supplies ant. 2/3 rd of IV septum

2. CIRCUMFLEX ARTERY
   → continuatⁿ of lt coronary artery
   → goes circumferentially around & behind the heart in Lt. coronary sulcus



ARTERIAL SUPPLY TO CONDUCTION SYSTEM



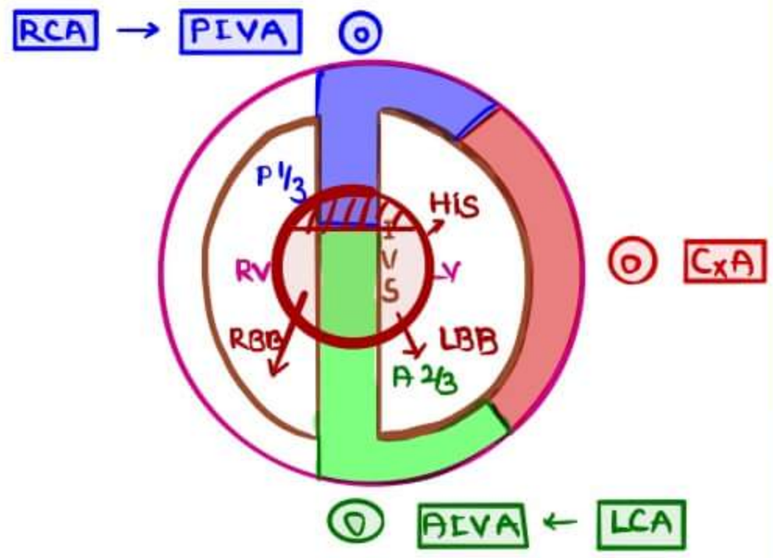


INTERVENTRICULAR SEPTUM

Posterior 1/3rd → PIVA (br. of Rt coronary Artery)
Anterior 2/3rd → AIVA (br. of lt coronary Artery)

LEFT VENTRICLE

Ant. wall → AIVA
post. wall → PIVA
Lat. wall → Circumflex artery



Rt. CORONARY ARTERY SUPPLY

Proximal conducting system
- SA Node
- AV Node

Lt. CORONARY ARTERY SUPPLY

Distal part of conducting System
→ AV Bundle of HIS
→ Rt. Bundle Branch
→ Lt. Bundle Branch

AV Bundle of His

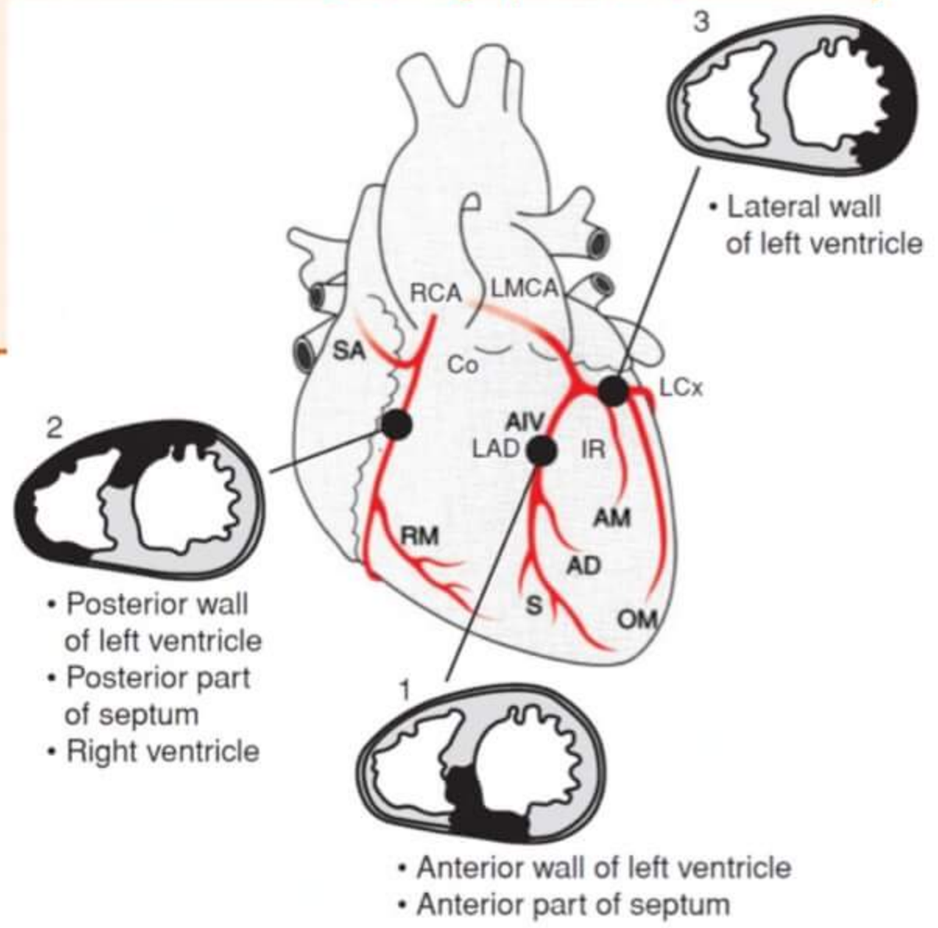
- present on IV septum
- supplied by
  - AIVA (major supply)
  - PIVA (partly)

Rt & Lt Bundle Branches

- present on IV Septum
- supplied by AIVA

Q The right coronary artery is the main supply to all of the following parts of conducting system in the heart EXCEPT

a SA Node
b AV Node
c AV Bundle
d Right Bundle Branch



TRIPLE VESSEL DISEASE (Relative incidence of vessels)

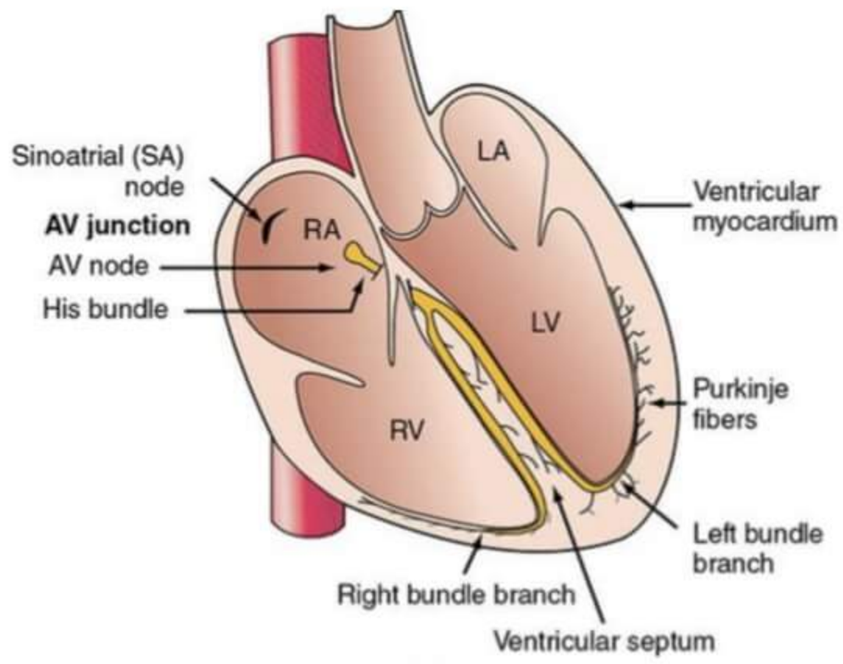
→ 50% → Lt Ant. Descending Artery
→ 30% → Rt. coronary artery
→ 15% → Circumflex Artery

Q Occlusion of left Anterior descending artery will lead to infarctn in which area of heart

a Posterior part of Interventricular septum
b Ant. wall of lt. ventricle
c Lateral part of heart
d Inferior surface of right ventricle

Q Artery supply to Koch's Δle is from

a Rt coronary Artery (80%) BETTER ANSWER
b Lt coronary Artery (20%)
c Lt Ant. descending Artery
d Artery from Ant. Aortic Sinus



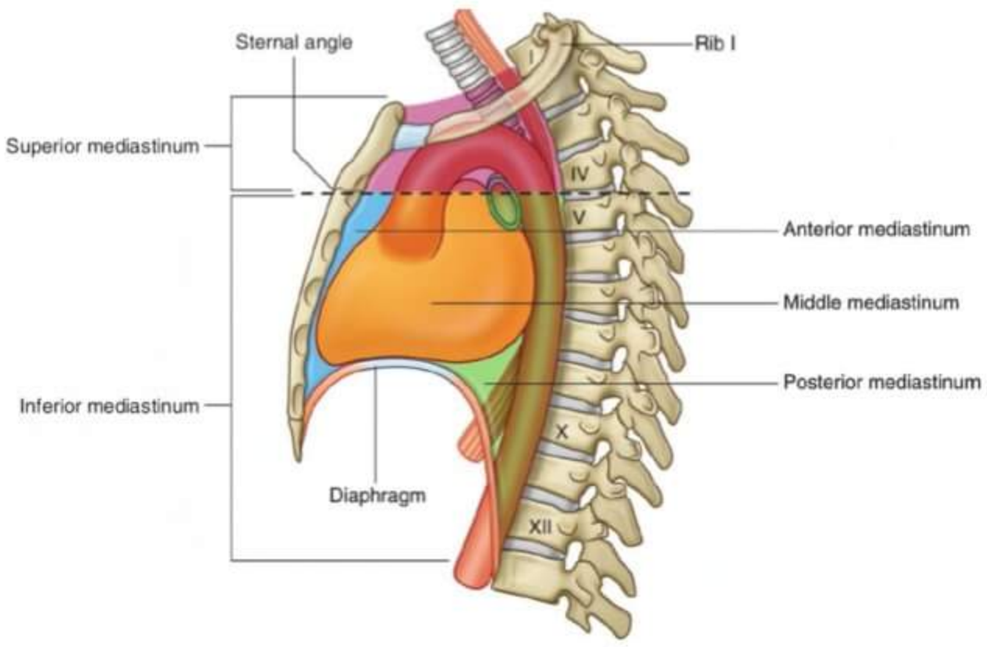
STERNAL ANGLE & MEDIASTINUM

MEDIASTINUM

→ Middle septum, separating Rt & Lt Lung

Q Arch of Aorta begins at vertebra level

a T_2
b T_3
c T_4
d T_5



STERNAL PLANE

→ Disc blw T-4 & T-5 vertebra & touching the sternum at manubrio sternal Junctn
→ 2 costal cartilage, 2nd rib attach here
→ Separates Superior mediastinum & Inferior mediastinum

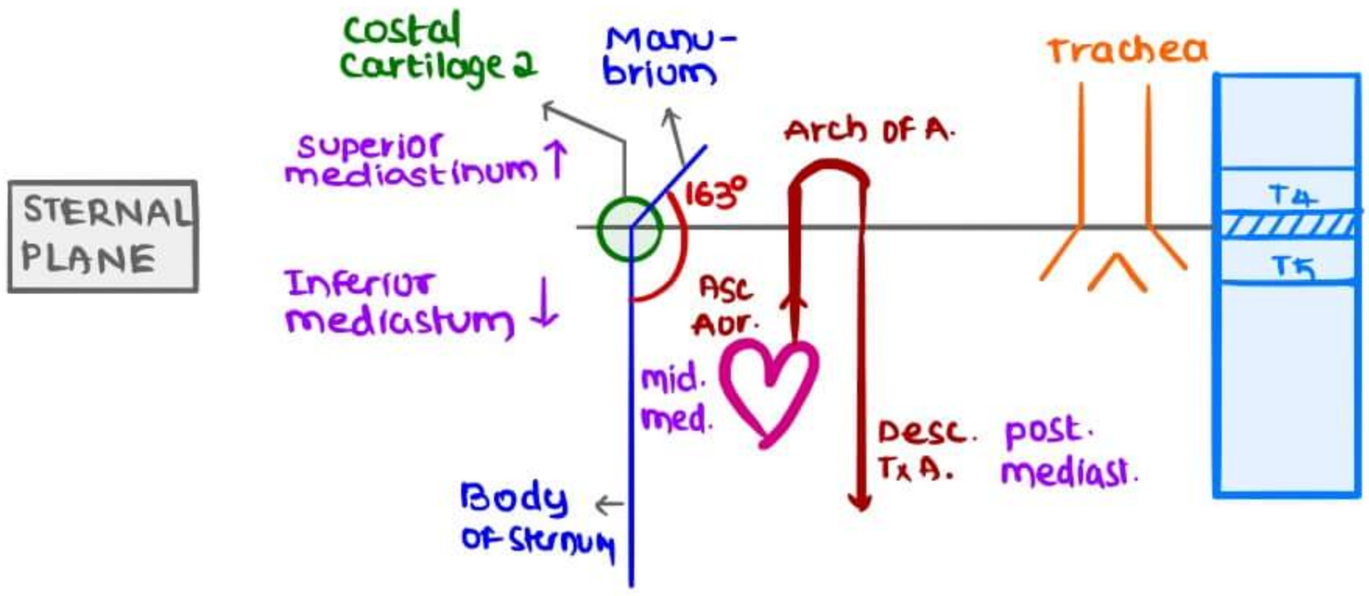
INFERIOR MEDIASTINUM

3 DIVISIONS

→ middle mediastinum → Heart & Ascending Aorta present
→ Anterior mediastinum → Space infront of Heart
Posterior Mediastinum → Space behind the Heart
→ Longer than ant. mediastinum (upto T-12 level)

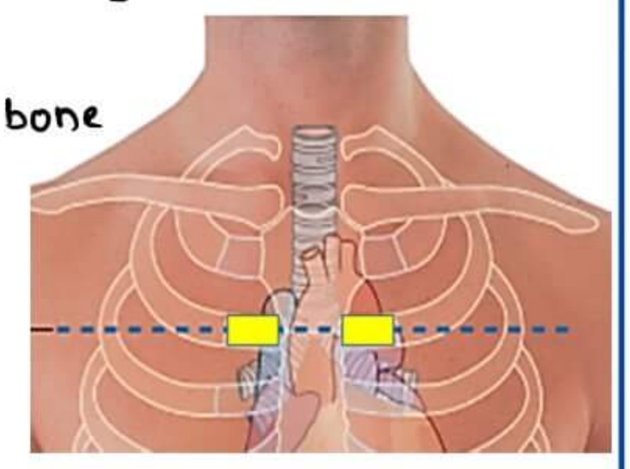
→ Descending thoracic aorta present in Posterior mediastinum

→ oesophagus → Superior mediastinum
blw trachea anterior & vertebra posterior
→ posterior mediastinum



STERNAL ANGLE OF LOUIS (163°) → Angle blw manubrium & body of sternum

ARCH OF AORTA



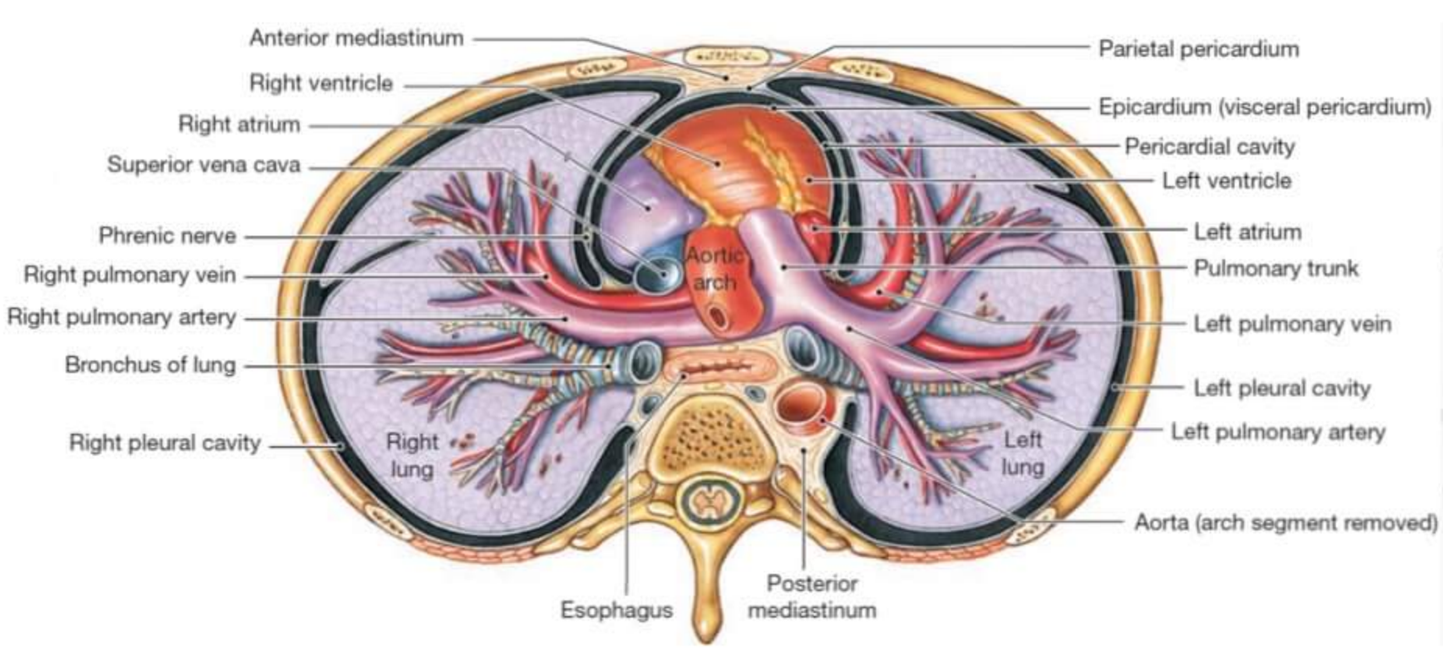
→ present in Superior mediastinum behind the manubrium bone
→ begins & ends at the level of T-4 (Sternal Plane)
→ begins at costal cartilage - 2
→ comes from Rt. to lt. side

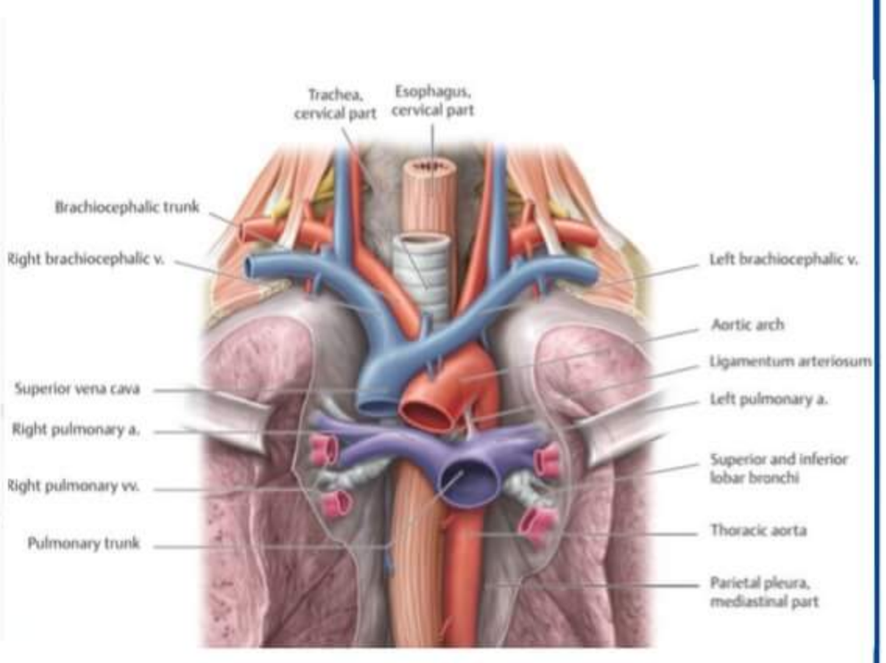
T-5 VERTEBRA LEVEL & STRUCTURES

→ CARINA → cartilage at the bifurcatn of trachea
→ Lt PRINCIPAL BRONCHUS
→ Rt PRINCIPAL BRONCHUS
→ ASCENDING AORTA (anterior)
→ DESCENDING AORTA (posterior)
→ PULMONARY TRUNK dividing into Rt. & lt PULMONARY ARTERIES

Q	Trachea bifurcates at the vertebral level
a	T 2
b	T 3
c	T 4
d	T 5

HILUM



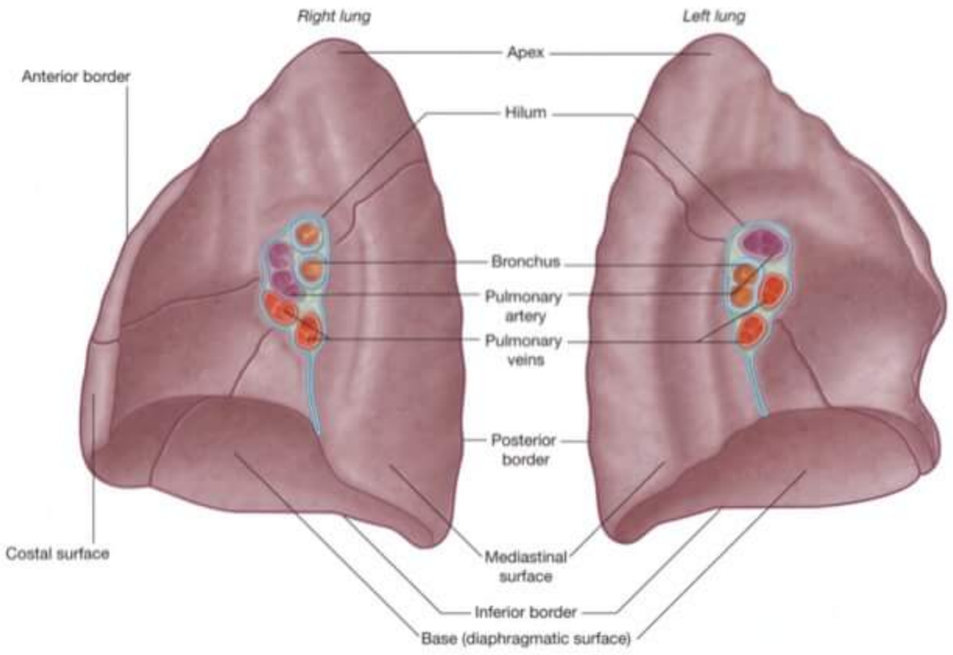


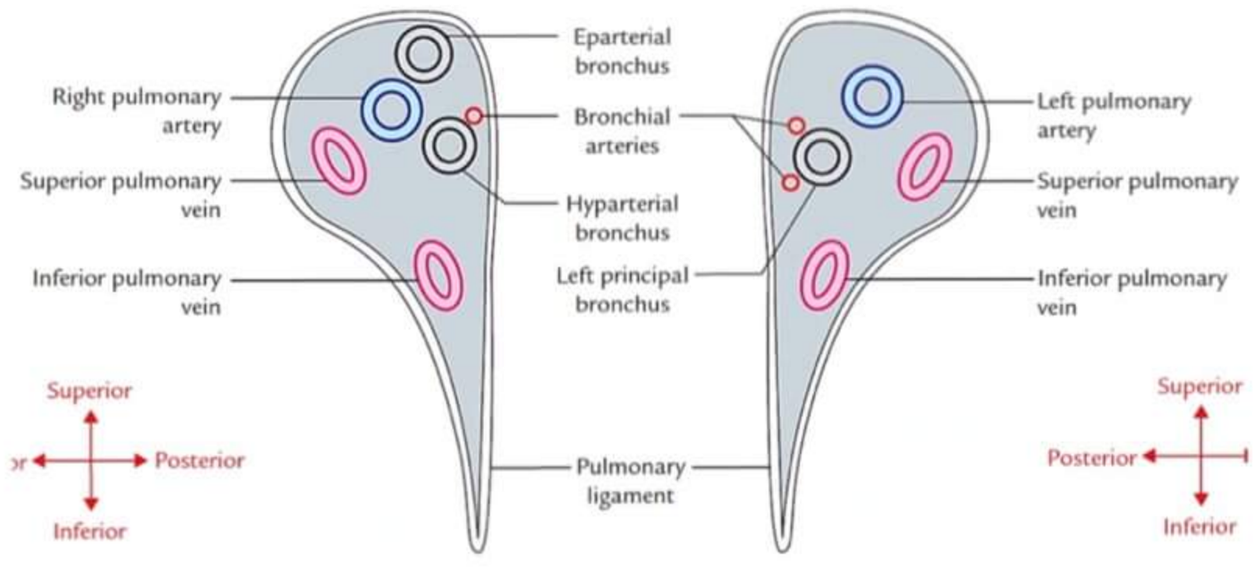
HILUM

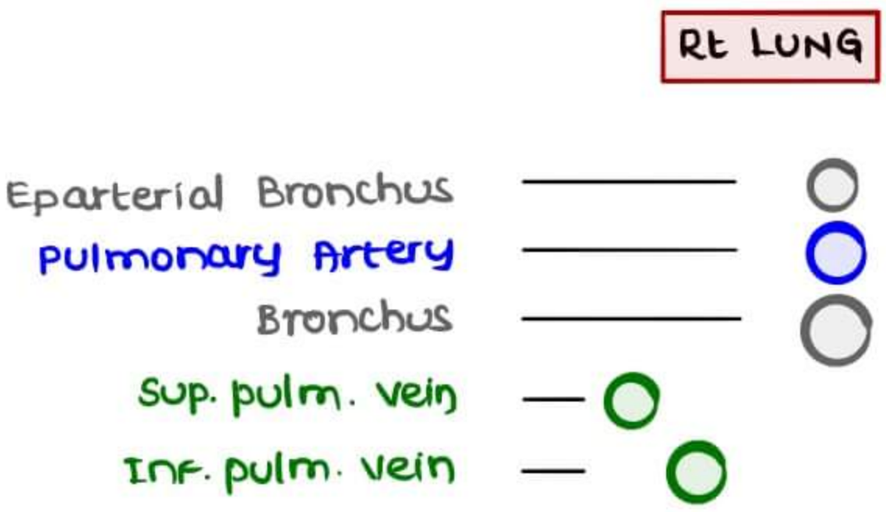
→ Bronchus is most posterior

→ Pulmonary veins are most anterior (2 superior & 2 inferior

→ Pulmonary artery is blw Pulmonary veins & Bronchus (most Superior)







Superior to Inferior

Atal → Pulmonary Artery

Bihari → Bronchus

Vajpayee → Pulmonary Vein

Q Which is the most superior structure at hilum of left lung

a Pulmonary vein

b Pulmonary Artery

c Bronchus

d Bronchial artery

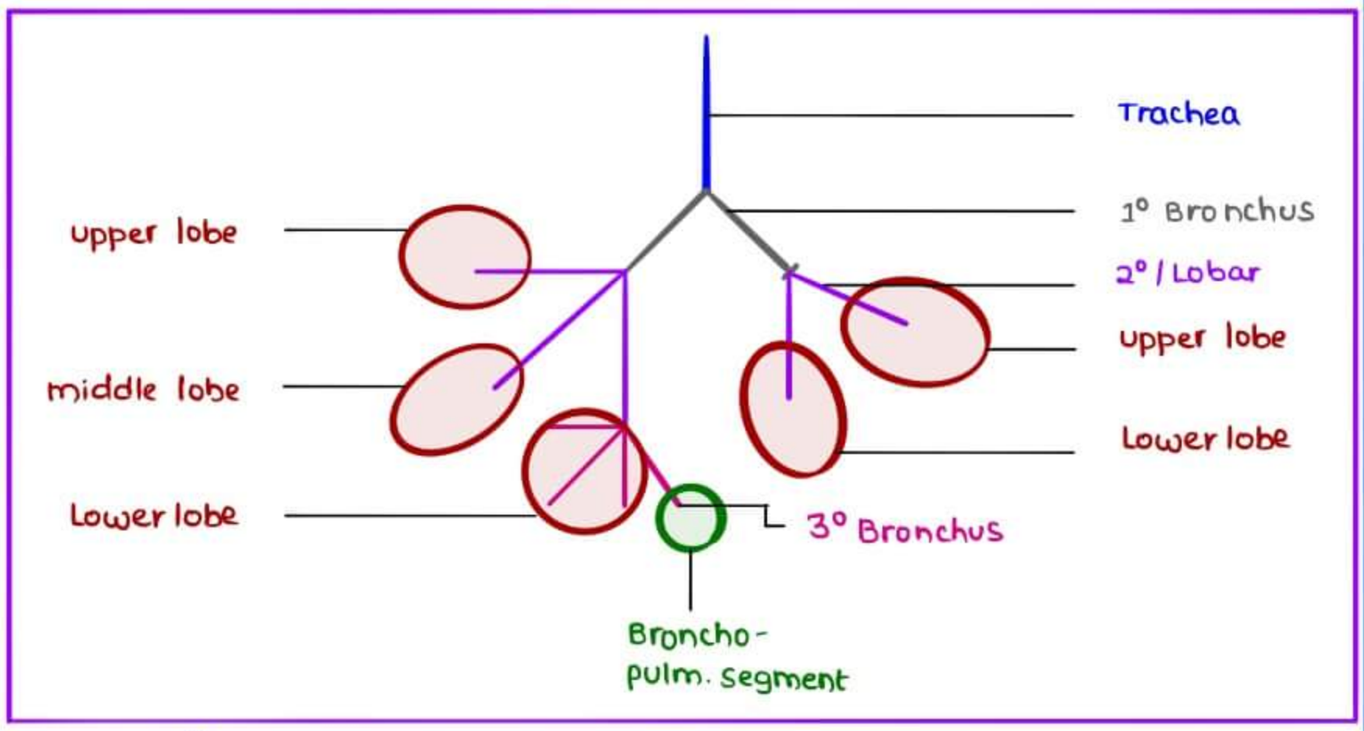
BRONCHOPULMONARY SEGMENTS

→ Aerated by Tertiary bronchus

→ No. of BPS

Rt Lung → 10

Lt Lung → 8-10



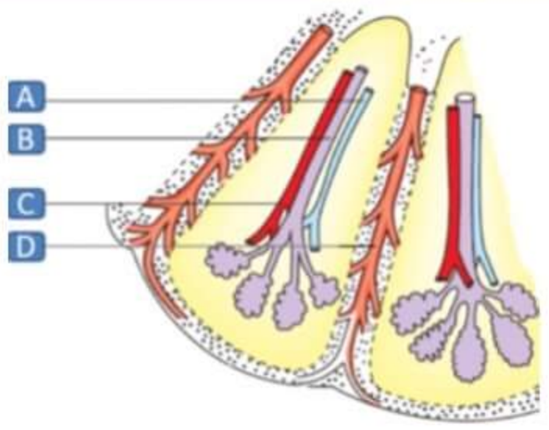
Q In the following diagram of BPS, identify the marker 'D'

a Segmental bronchus

b Segmental branch of pulmonary artery

c Segmental branch of pulmonary vein

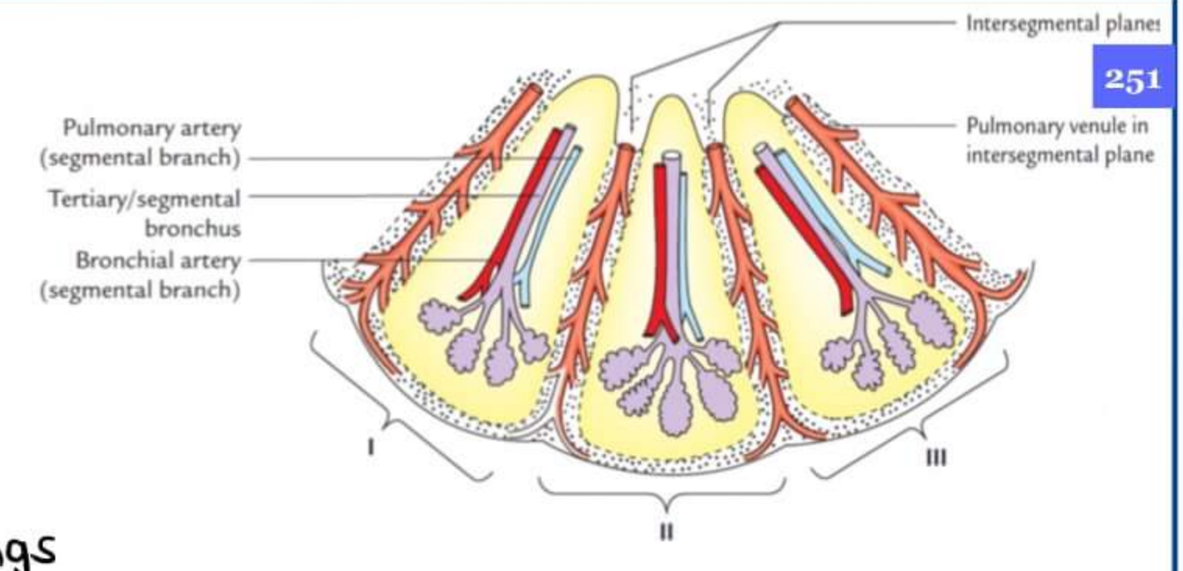
d Segmental branch of bronchial artery



PULMONARY VEIN BRANCHES

→ intersegmental

→ used for surgical planes



BPS INSIDE STRUCTURES

Pulmonary Artery Br.

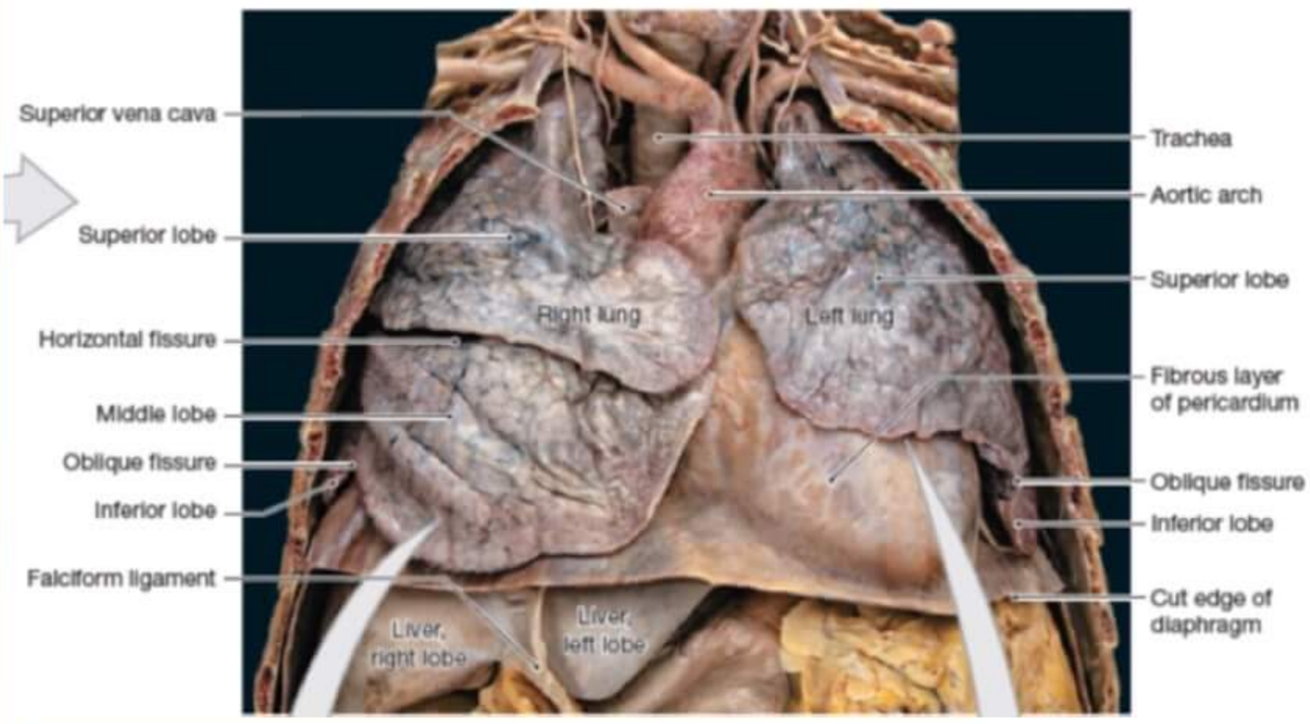
Bronchial Artery

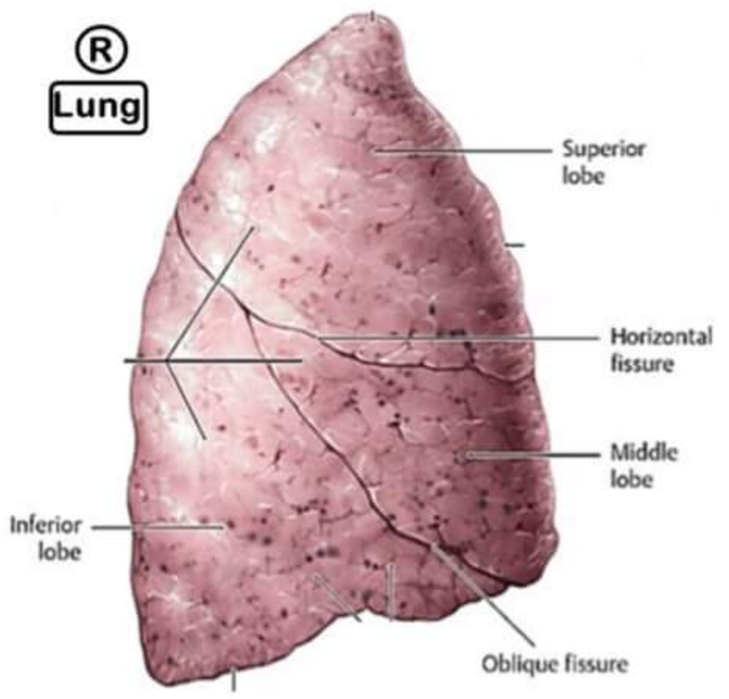
3° bronchus → brings O_2 into lungs

Lung has DUAL CIRCULATION

Bronchial artery → supply oxygenated blood to lung

Pulm. artery Branchy → carry deoxygenated blood to lung





	Right lung	Left lung
Lobes	Superior, middle, inferior	Superior, inferior
Fissures	Oblique, horizontal	Oblique
Bronchopulmonary Segments	10	8–10
Unique Features	Larger and heavier than the left, but shorter and wider due to higher right hemidiaphragm	Superior lobe characterized by the lingula and a deep cardiac notch

PRINCIPAL BRONCHUS

RIGHT PRINCIPAL BRONCHUS

→ Short in length

→ has wide lumen

→ more vertical

→ has more chances of FB lodging

→ Angle blw Rt & lt principal bronchi → 70°

→ Rt PB has 3 lobar bronchi

BRONCHO PULMONARY SEGMENTS

RT. LUNG

UPPER LOBE BPS

APICAL

ANTERIOR

POSTERIOR

MIDDLE LOBE BPS

MEDIAL

LATERAL

LOWER LOBE BPS

1 APICAL

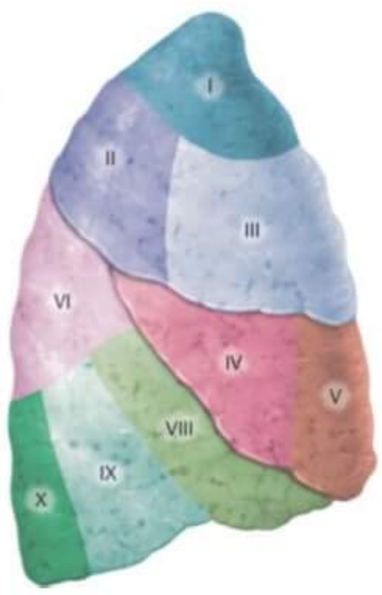
4 BASAL

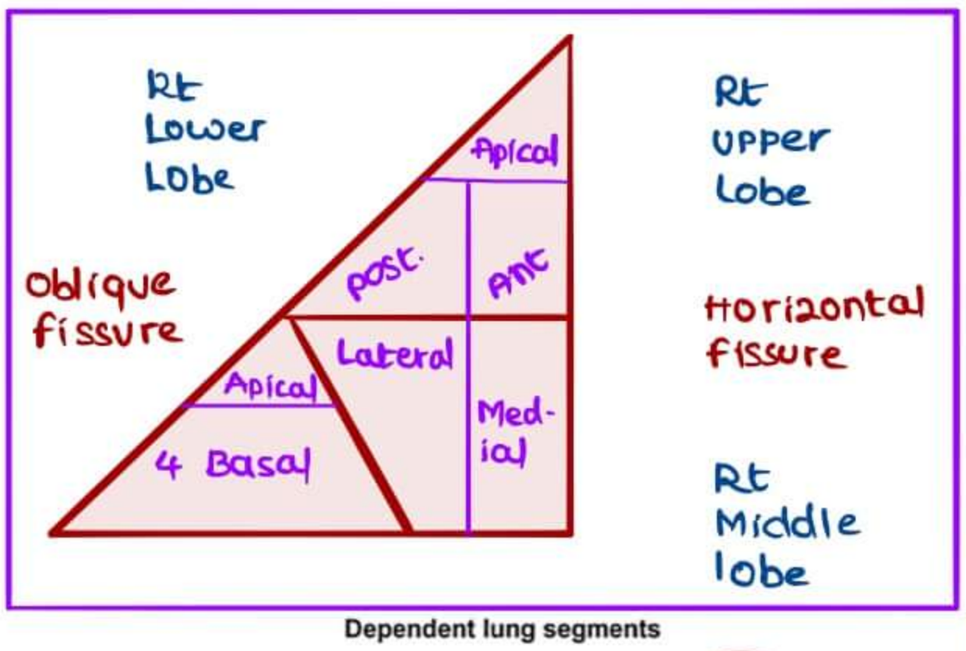
Ant. Basal

Post Basal

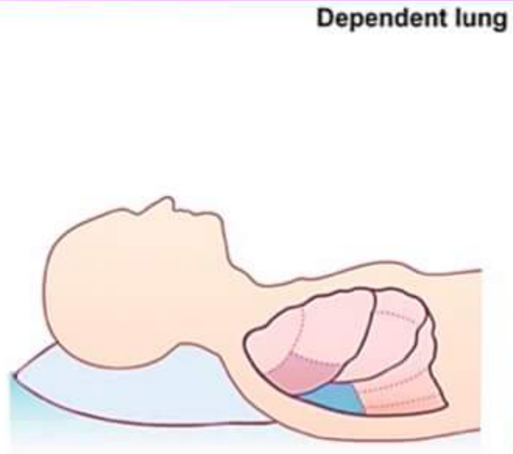
Medial Basal

Lateral Basal

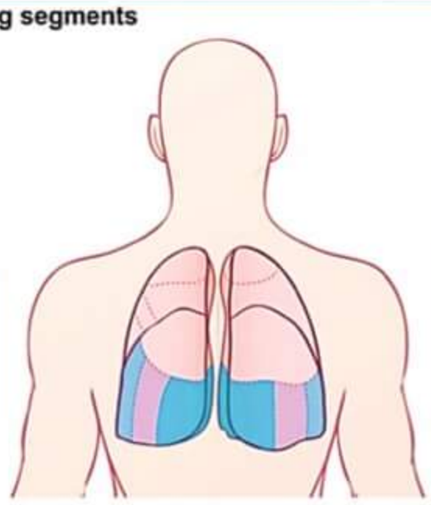




Dependent lung segments



Supine
Posterior segments of upper lobes and superior segments of lower lobes most dependent



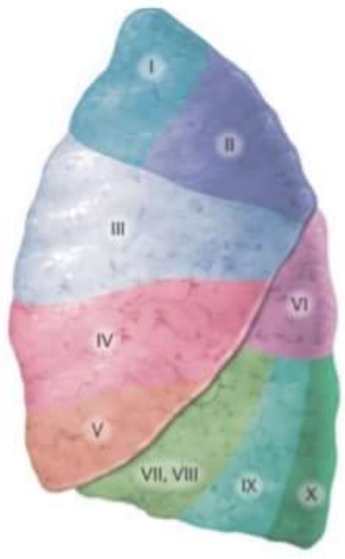
Upright
Basilar segments most dependent

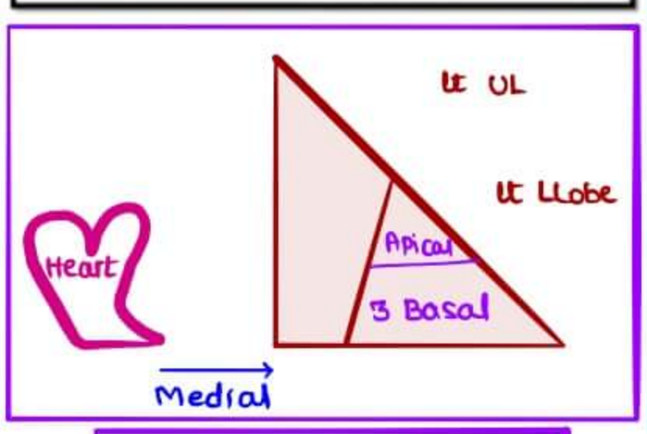
→ most dependent location in Erect/sit/stand posture } Postero Basal BPS of Lower Lobe of Rt Lung
∴ aspiration pneumonitis

→ most of aspiratⁿ occur in SUPINE Posture
→ B'coz most pt. are unconcious (coma or post anaesthetesia patients)
→ most dependent Location → Post. BPS of Rt. upper Lobe or Apical BPS of Rt. Lower Lobe (Better answer)

Q A bed ridden patient on liquid diet develops aspiratⁿ pneumonia. which of the following BPS is most likely affected

a Posterior of Rt UL
b Inferior Lingular of lt UL
c Apical of Rt LL BETTER ANSWER
d Posterior of Rt. LL



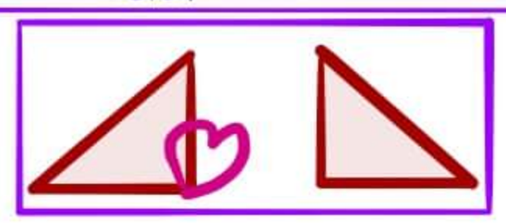


LEFT LUNG BPS

LOWER LOBE

1 APICAL
3 BASAL → dlt combinatⁿ of 2 BPS as one to provide space for heart
- Antero medial/Ant. Basal
- Post. basal
- Lateral basal
- Medial basal/cardiac BPS is missing

IN DEXTROCARDIA (SITUS INVERSUS)
- Medial basal of Rt. Lower lobe is absent
- Rt lung has 9 BPS & lt lung has 10 BPS (Rare)



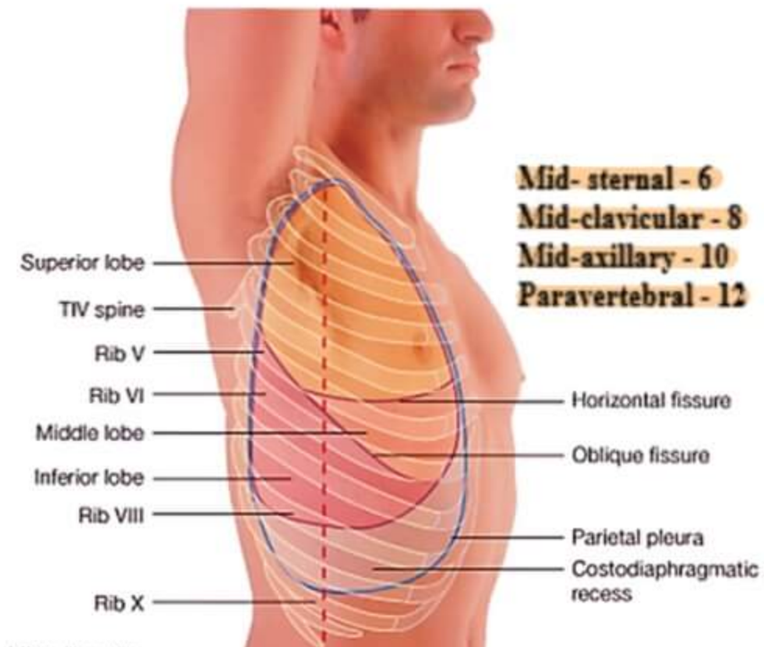
PLEURA-SURFACE MARKINGS

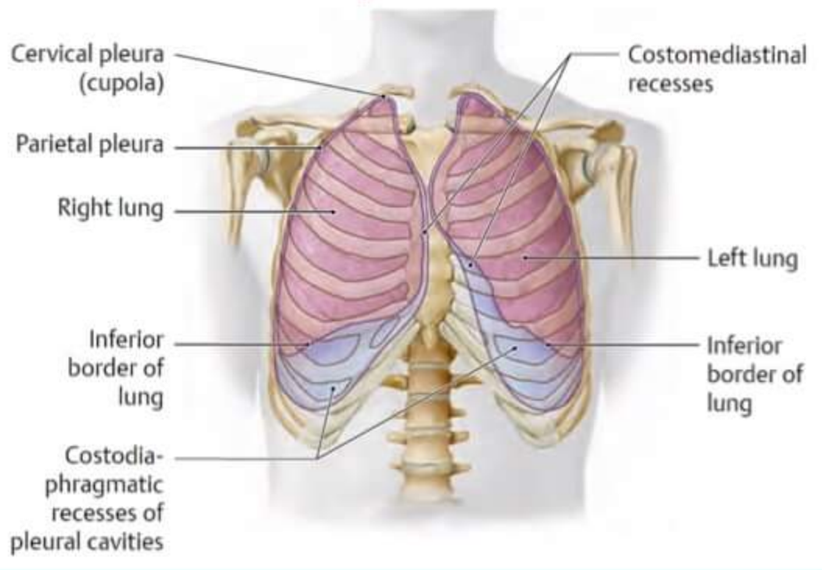
6, 8, 10, 12 → INFERIOR DIAPHRAGMATIC PLEURAL BORDER OF LUNG

Lung & pleura on rt. side begins at mid sternal 6th rib
Then Lung stays 2 rib higher than pleura

Mid clavicular → 6
Mid axillary → 8
Paravertebral → 10

Rt & lt lung surface markings are same,
Except for mid sternal marking
→ Rt lung leaves sternum at 6th rib
lt lung leaves sternum at 4th rib
(to accommodate cardiac notch)
→ Mid sternal → 6
Mid clavicular → 8
Mid axillary → 10
Paravertebral → 12





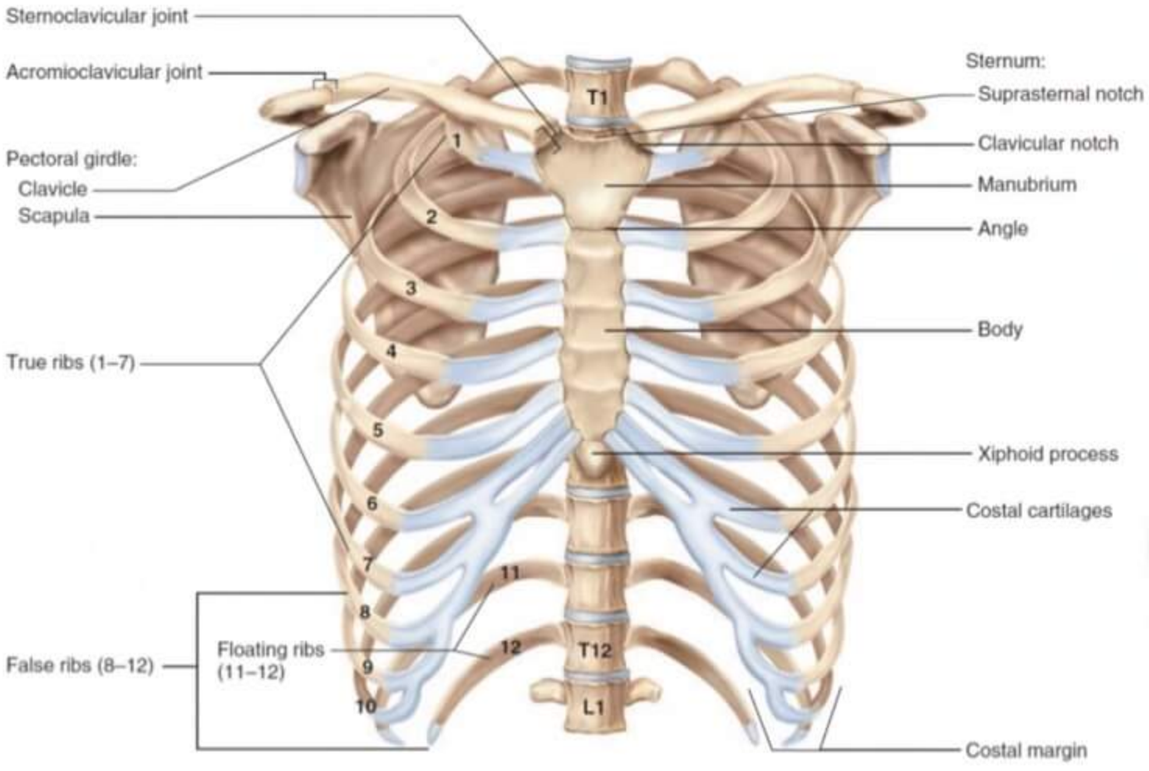
Q Pleural reflectⁿ on midaxillary line in space
a. 5 c. 8
b. 6 d. 10

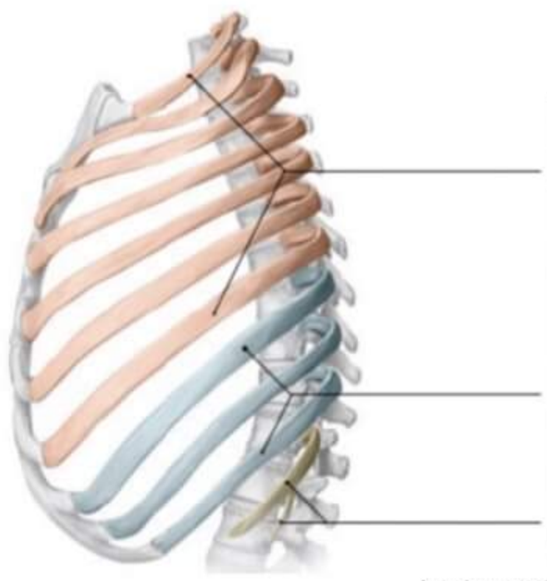
THORAX JOINTS

TRUE RIBS → attaches to Sternum directly
Ribs – 1, 2, 3, 4, 5, 6, 7
came from vertebral → VERTEBRO STERNAL RIBS

FALSE RIBS → attaches to sterum indirectly ī costal margin
COSTAL MARGIN – made by Rib 8, 9, 10

FLOATING RIBS → don't attach to Sterum
→ Ribs 11, 12





Rib type	Ribs	Anterior articulation
True ribs	1–7	Sternum (costal notches)
False ribs	8–10	Rib above
Floating ribs	11, 12	None

MANUBRIOSTERNAL JOINT

→ midline joint
→ Symphysis

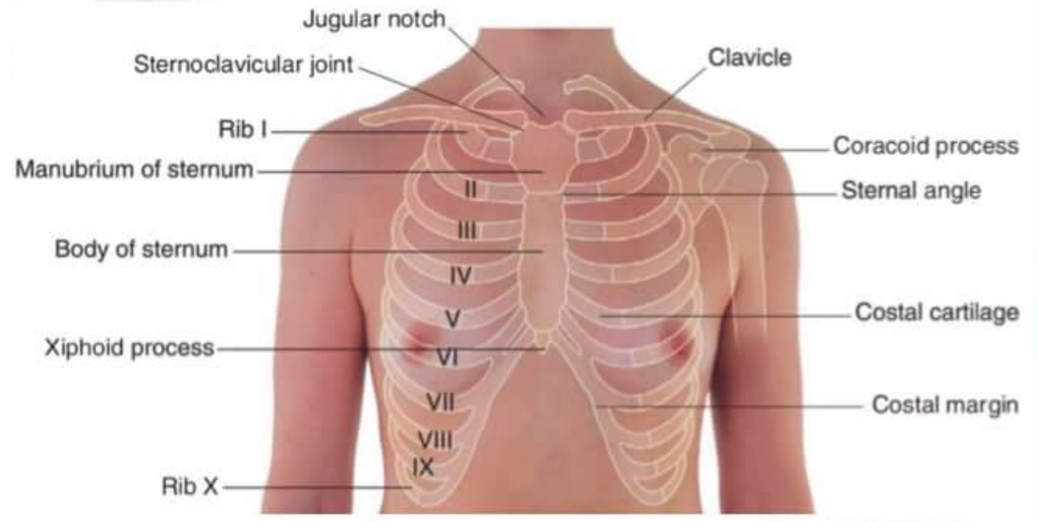
XIPHISTERNAL JOINT

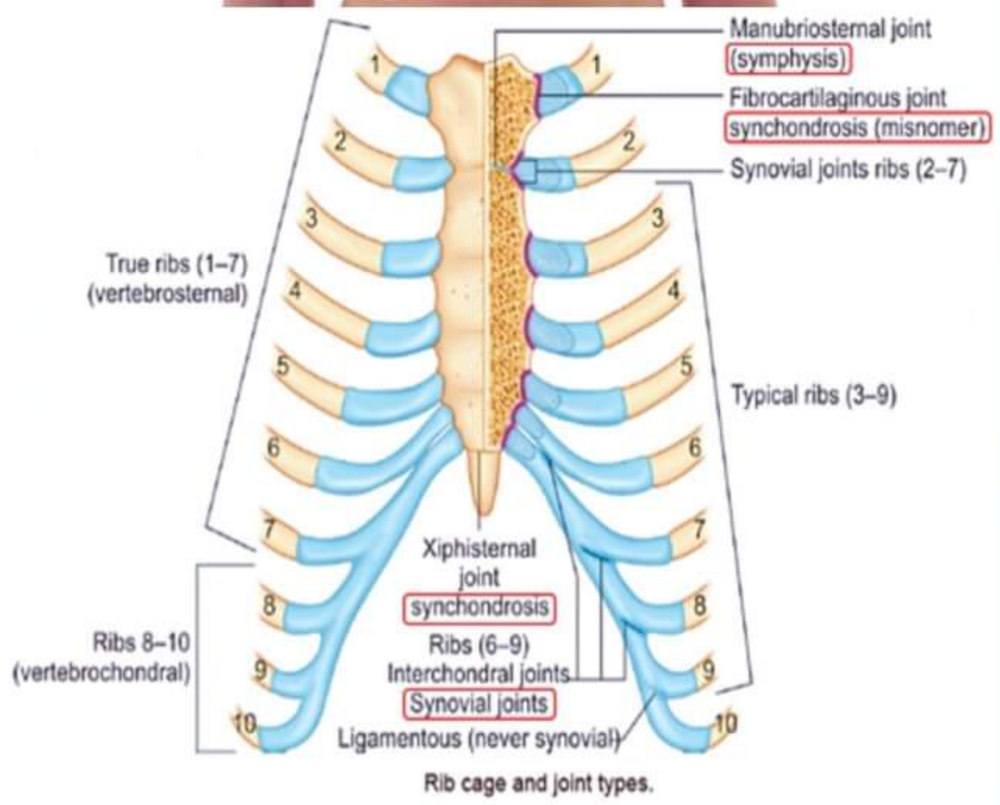
→ midline joint
→ Primary cartilage joint (Synchondrosis)
→ Synchondrosis > Symphysis

SYNCHONDROSIS

→ Joint of Rib 1 ī sternum
→ Atypical joint, not synovial
→ MISNOMER
→ not a 1° cartilagenous joint

Rib 2 – 9 ī Sternum → Synovial joints
Rib 10 ī Sternum → Fibrous joint (ligamentous)





Rib cage and joint types.

Joints b/w Rib 1 & Rib 10 ī sternum → not Synovial joints
→ not freely movable

TRUE RIBS (1–7) → Vertebro Sternal
FALSE RIBS (8–10) → Vertebro Chondral
Ribs 6–9 → Interchondral joints → Synovial joints
Ribs 11–12 → floating Ribs

RESPIRATORY MOVEMENTS

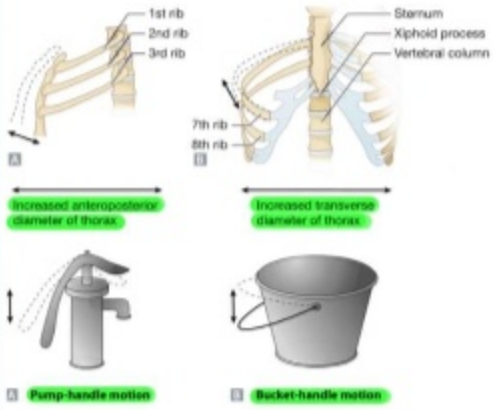
→ Upper ribs helps in PUMP HANDLE movements
→ Lower ribs helps in BUCKET HANDLE movements

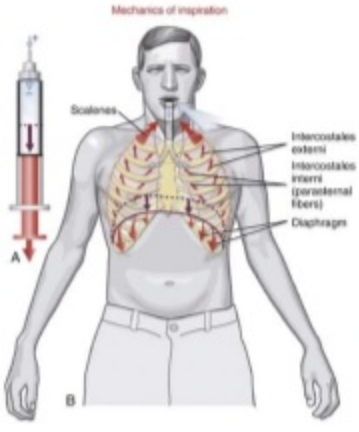
INSPIRATION

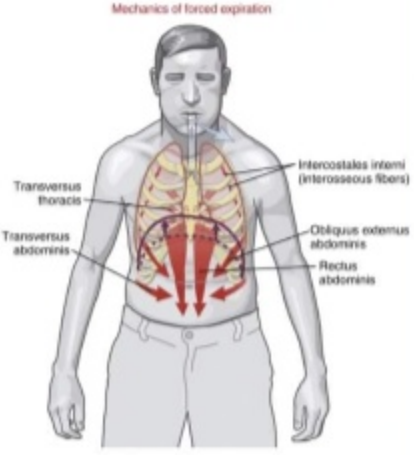
→ Chief muscle → Diaphragm → descends down in Deep inspiratⁿ
→ Lungs expand VERTICALLY

→ Other muscles → External Intercostal muscles
Interchondral portⁿ of Int. Intercostal muscles

→ Internal Intercostal muscles helps in expiratⁿ





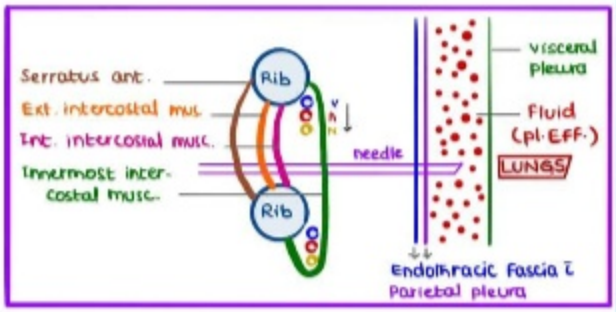


EXPIRATION

→ Passive process d/t elastic recoil of lung
→ Forceful expiration (while coughing, sneezing, urinating, defecating, hiccups & during parturition) uses ANTERIOR ABDOMINAL MUSCLES (like Rectus abdominis, oblique external abdominis, Transverse abdominis) & Transversus thoracis (Thorax muscle)

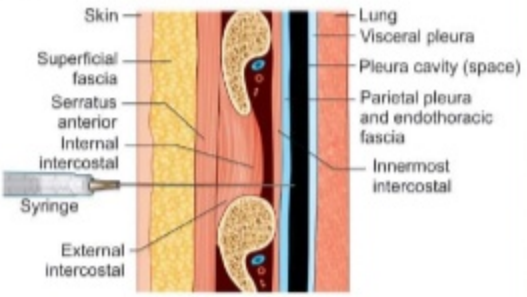
INTERCOSTAL DRAINAGE & BLOCK

Q In pleural tap in mid axillary line, muscle not pierced is
a External Intercostal
b Serratus anterior
c Innermost Intercostal
d Transversus thoracis (anteriorly present)



PLEURAL ASPIRATION → done in mid axillary or post. axillary line

→ Sequence of layers punctured
1. Skin
2. Superficial facia
3. Serratus anterior (1st muscle)
4 External Intercostal muscle
5 Internal Intercostal muscle
6 Innermost Intercostal muscle
7 Endothoracic fascia
8 Parietal pleura



→ Neurovascular bundle present in intercostal groove of rib, between internal & innermost intercostal muscles

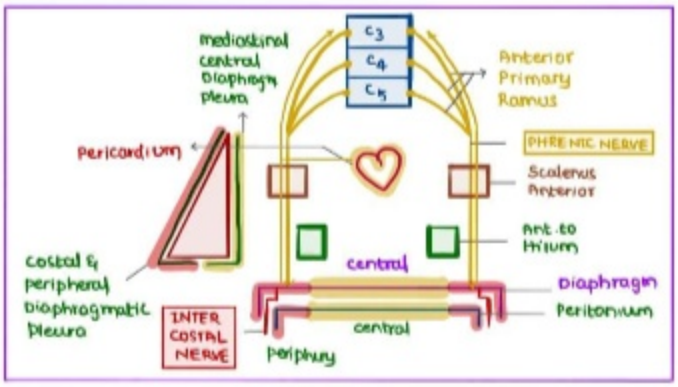
- → During Aspiratⁿ, needle should be placed above the rib (avoids damage to NVB)
- → Needle should be in lower part of Intercostal space & above the rib upper border
- → Serratus anterior takes origin from upper 8 ribs
- → DO NOT DAMAGE VISCERAL PLEURA

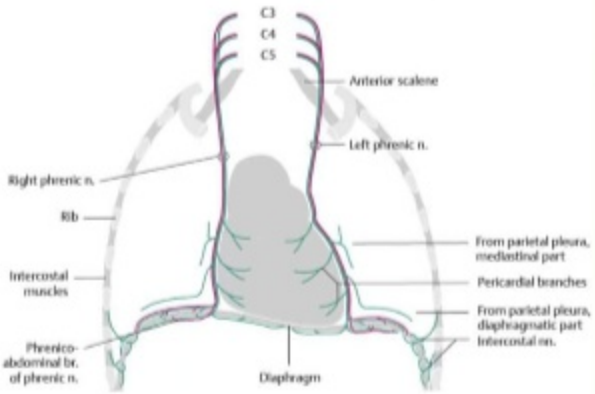
INTERCOSTAL BLOCK

- → given for multiple rib fractures
- → collateral branches of NVB may present above the rib
  - → care to be taken not to damage them
- → Block given below the rib first & then above the rib (for collateral branches)

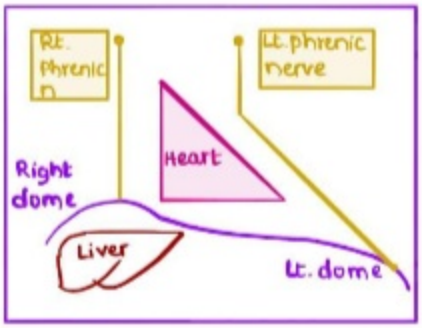
PHRENIC NERVE

- → comes from cervical plexus, Root value → C - 3, (4), 5
- → Diaphragm develops from cervical somites, Root value → C - 3,4,5





- → Comes from Anterior Primary ramus of Spinal nerves 3,4,5
- → runs anterior to Scalenus anterior & hilum continues in thorax region on the side & reaches diaphragm
- → only motor nerve to diaphragm
- → sensory to central portion of diaphragm
  peritoneum under central diaphragm
  pericardium on mediastinum
  pleura towards the mediastinum



- → INTER COSTAL NERVE carries sensations from
  - → Periphery of Diaphragm
  - → periphery of peritoneum
  - → costal & peripheral diaphragmatic pleura

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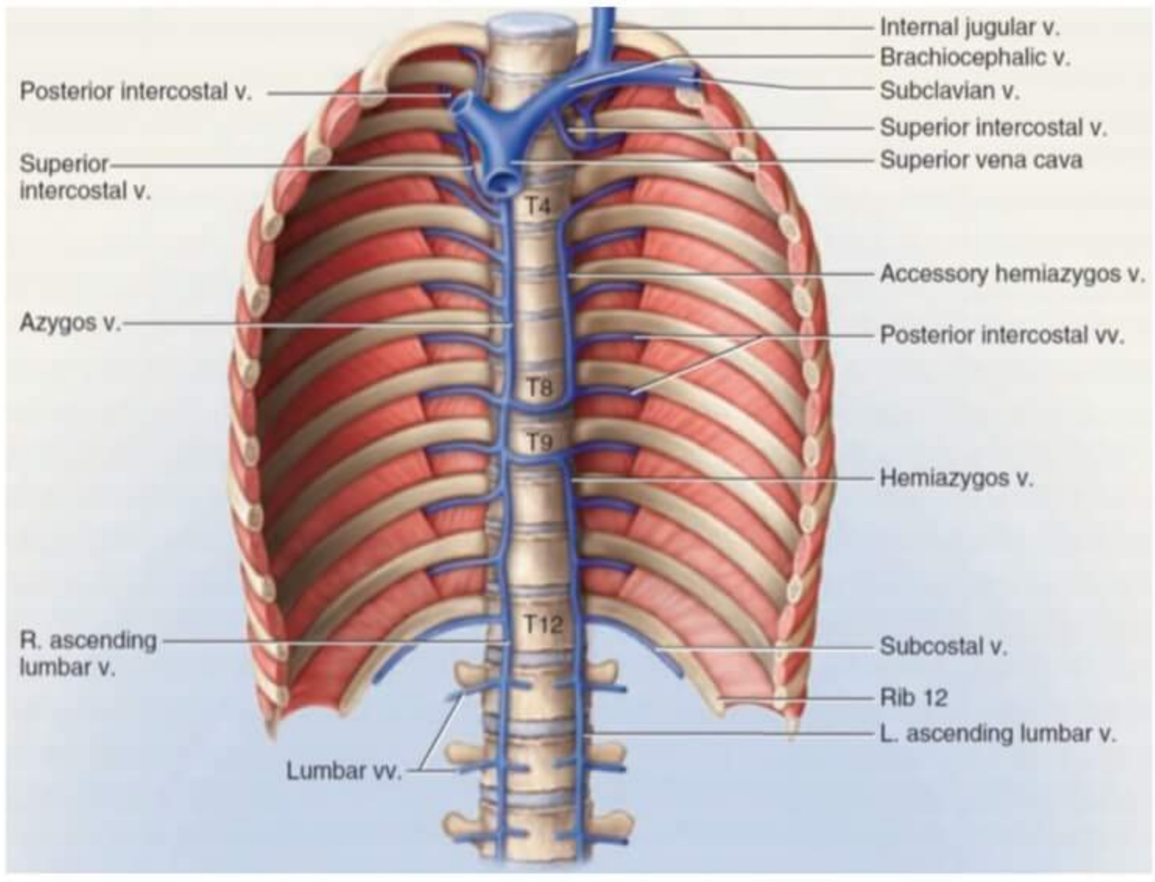
+14386004539

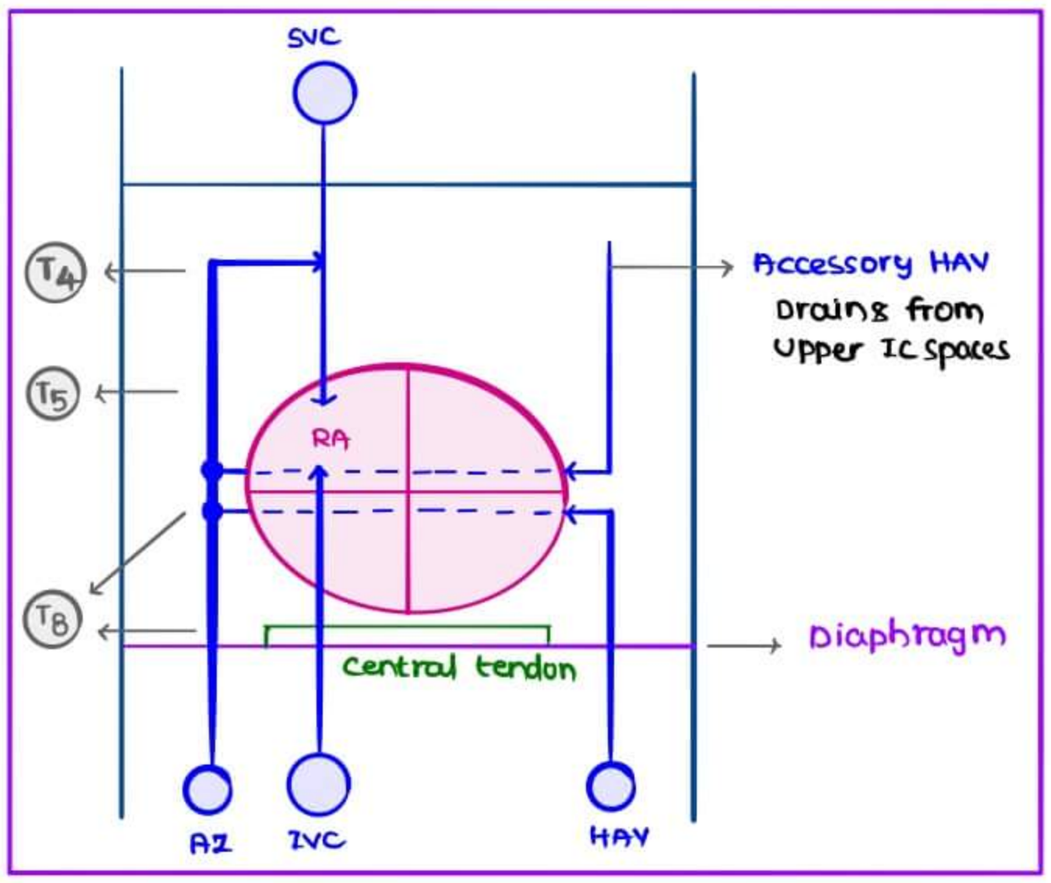
- → Rt Phrenic nerve is short & Straight (dome of diaphragm pushed up by liver)
  Lt phrenic nerve is long & Oblique (dome of diaphragm pushed down by heart)

Q	All are true about phrenic nerve EXCEPT
a	Rt is shorter & more vertical
b	Sole motor supply to diaphragm
c	Passes anterior to Scalenus anterior
d	Passes posterior to hilum of Lung

Hilum of Lung present b/w hilum of lung anteriorly & vagus Nerve posteriorly

VENOUS DRAINAGE





VENOUS DRAINGE

FROM BODY BELOW THE DIAPHRAGM → LIVER → HEPATIC VEINS → IVC → RIGHT ATRIUM ← SVC ← From body above diaphragm

→ SVC enters the RA at T-5 level

→ IVC pierces the central tendon of diaphragm at T-8 level & enters RA

→ Extent of Heart

Supine → T-5 to T-8

Standing → T-6 to T-9

→ AZYGUOS VEIN

→ formed in abdomen region

→ puncture (rt) crus of diaphragm & enters the thorax & enters SVC at T-4 level

→ LEFT THORAX

HEMI AZYGOUS VEIN

→ Formed in abdomen & puncture the left crus of diaphragm to enter the thorax & drains the Lower intercostal Spaces

ACCESSORY HEMIAZYGOUS VEIN → drains upper intercostal Spaces

Both HemiAzygous vein & Accessory HemiAzygous vein turns towards right in thorax & pass behind the heart & drain into Azygous vein
Both veins cross at T-8 Level

BLOCK IN INFERIOR VENA CAVA

→ COLLATERALS from IVC joins Azygous veins & drains into SVC

BLOCK IN SVC → collaterals from SVC joins Azygous veins & drains into IVC & finally into RA

In both cases Azygous vein is dilated

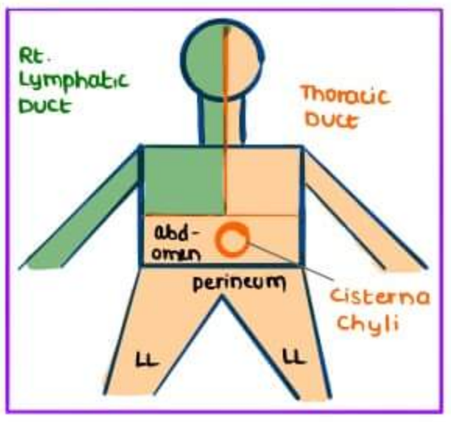
LYMPHATIC DRAINAGE

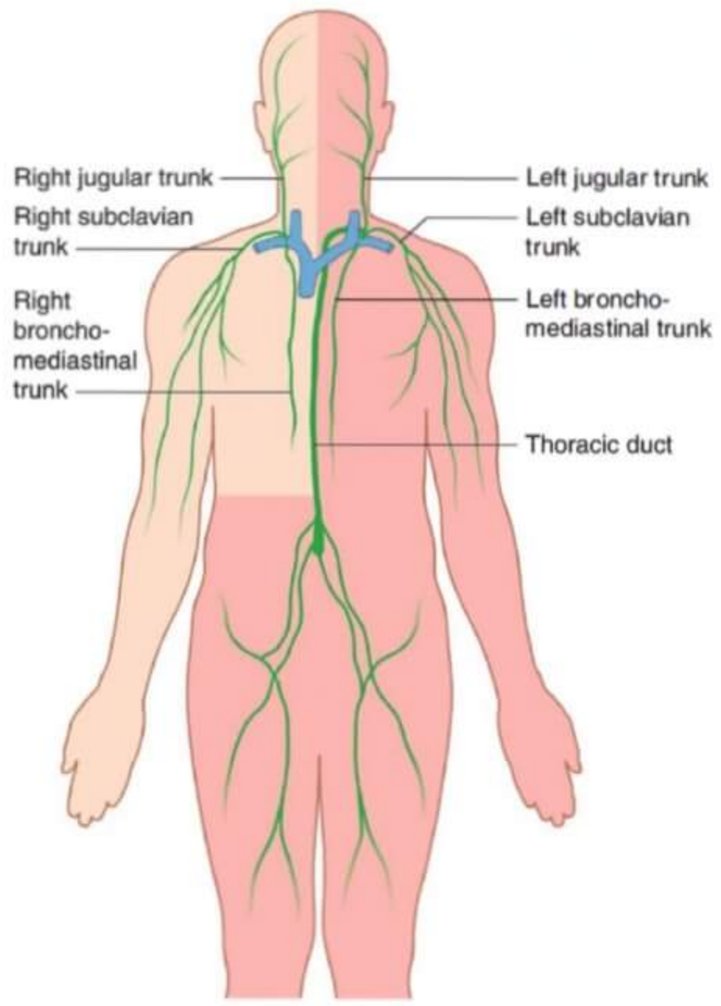
→ Rt. HALF OF BODY ABOVE DIAPHRAGM

→ Rt. Side of Head & Neck
Rt. Side of Thorax
Rt. Upper Limb
} ⟶ Rt. LYMPHATIC DUCT

→ All other Body ⟶ THORACIC DUCT

Rt Bronchomediastinal trunk (thorax)
Rt Sub clavian trunk (UL)
Rt Jugular trunk (Head & neck)
↓
Rt LYMPHATIC DUCT
↓
Rt. JUGULO SUBCLAVIN VENOUS ANGLE



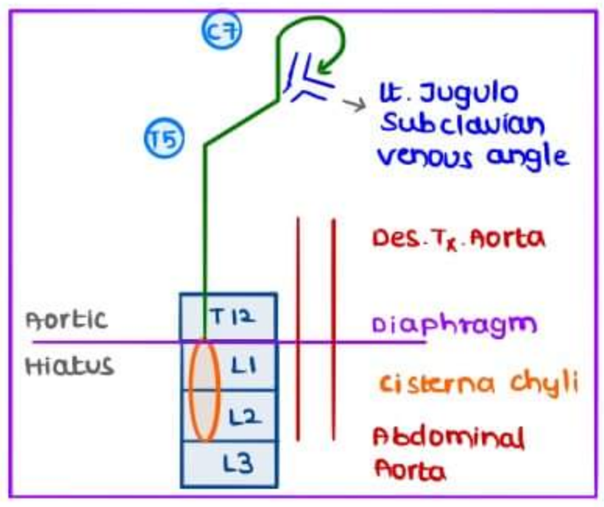


Lt Bronchomediastinal trunk (Thorax)
Lt Sub clavian trunk (UL)
Lt Jugular trunk (Head & neck)
↓
Thoracic DUCT ← CISTERNA CHYLI
↓ ↑
Left Jugulo subclavian venous Angle ← Body Below the Diaphragm (Abdomen, LL, Perineum)

THORACID DUCT COURSE

CISTERNA CHYLI → present at the level of L-1 & L-2

AORTIC HIATUS
→ passage present in diaphragm at lower border of T-12 from which Descending thoracic aota passes & continues as Abd. Aorta

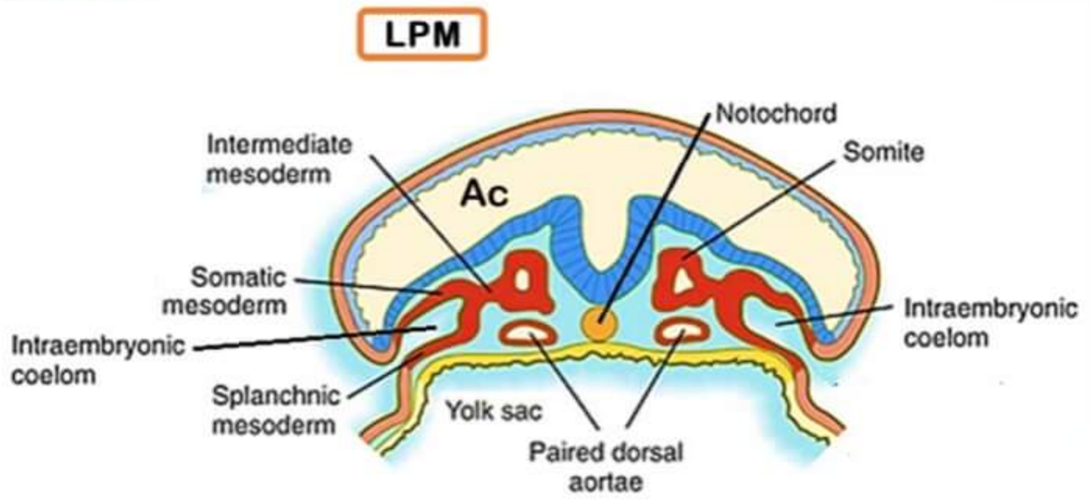


THORACIC DUCT → Continuat^{n} of Cisterna chyli passes through Aortic Hiatus
→ begins at lower border of T12, rt to Aorta
→ at T-5, crosses to left side & and drains Lt. Jugulo Sub-clavian venous angle at C-7

UPPER LIMB

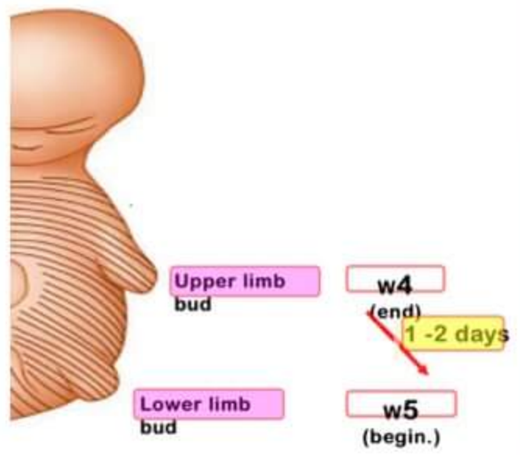
EMBRYOLOGY

Q	Limb buds appear at week
a	3
b	4
c	5
d	6



→ UPPER LIMB Bud appear by the end OF 4 WEEKS
→ LOWER LIMB BUD appears at beginning OF 5 th week

Q	During development, humerus & Biceps brachii develops from
a	Lateral plate mesoderm
b	Para - axial mesoderm
c	Lat. plate mesoderm & Para axial mesoderm
d	Intermediate mesoderm



→ UL, LL bones develop in Lateral plate mesoderm (Dorsal Somatic LPM)
→ Skeletal muscles derived from para axial mesoderm (from somites)
→ Intermediate mesoderm gives major portⁿ of Genito Urinary System

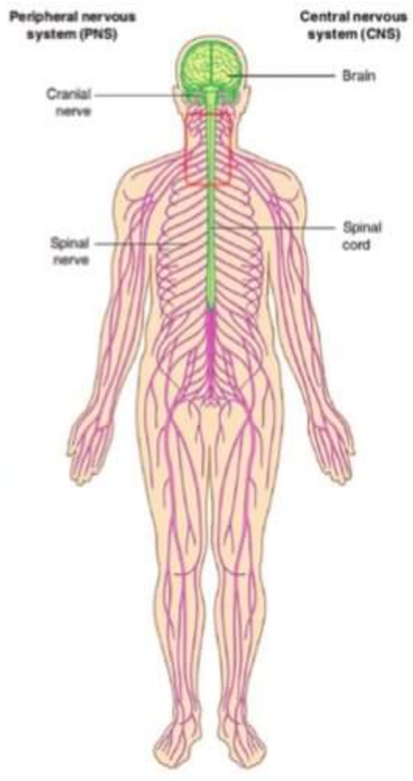
NERVE SUPPLY

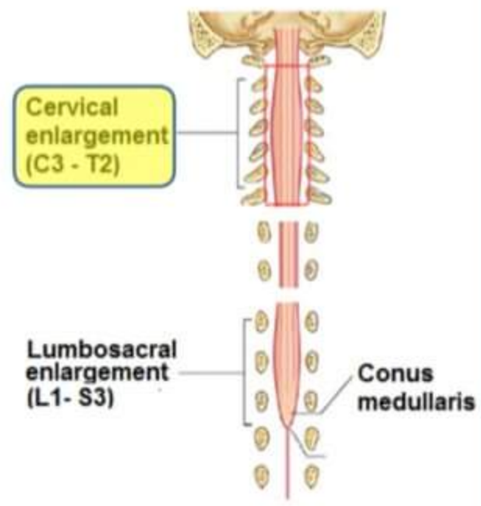
Q	Root value of Radial nerve is
a	C 3,4,5,6,7
b	C 4,5,6,7,8
c	C 5,6,7,8 ; T1
d	C 6,7,8 ; T1,2

BRACHIAL PLEXUS

→ cervical Enlargement of Spinal cord gives Brachial Plexus
→ ROOT VALUES → C 5,6,7,8 ; T_1
→ C 5,6,7,8 ; T_1 Anterior primary ramus gives brachial plexus

→ Roots & trunks present in neck region
→ Divisions pass behind the clavicle bone
→ cords & terminal branches present in axilla





TRUNKS

→ Upper trunk
→ middle trunk
→ Lower trunk

→ Each trunk has anterior & posterior Divisions

CORDS

1. LATERAL → Ant. Divisions of Upper & middle trunks Joins to form LC
2. POSTERIOR → Post. division of Upper, middle, Lower trunk Joins to form PC
3. MEDIAL → ant. division of Lower trunk continuous as MC

→ Lateral cord continues as MUSCULO CUTANEOUS NERVE
→ Posterior cord continues as RADIAL NERVE (Post. compartment of UL)
→ Medial cord continues as ULNAR NERVE (medial nerve)
→ MEDIAN NERVE formed by Lateral cord & medial cord in midline

LONG THORACIC NERVE
→ supplies serratus anterior
→ Given directly by ROOTS (C 5,6,7) in neck

DORSAL SCAPULAR NERVE
→ present in neck region
→ Supplies Scapular muscles in neck
→ given directly from C5 ROOT

SUPRA SCAPULAR NERVE
→ supplies Scapular muscles
→ comes from upper trunk in neck

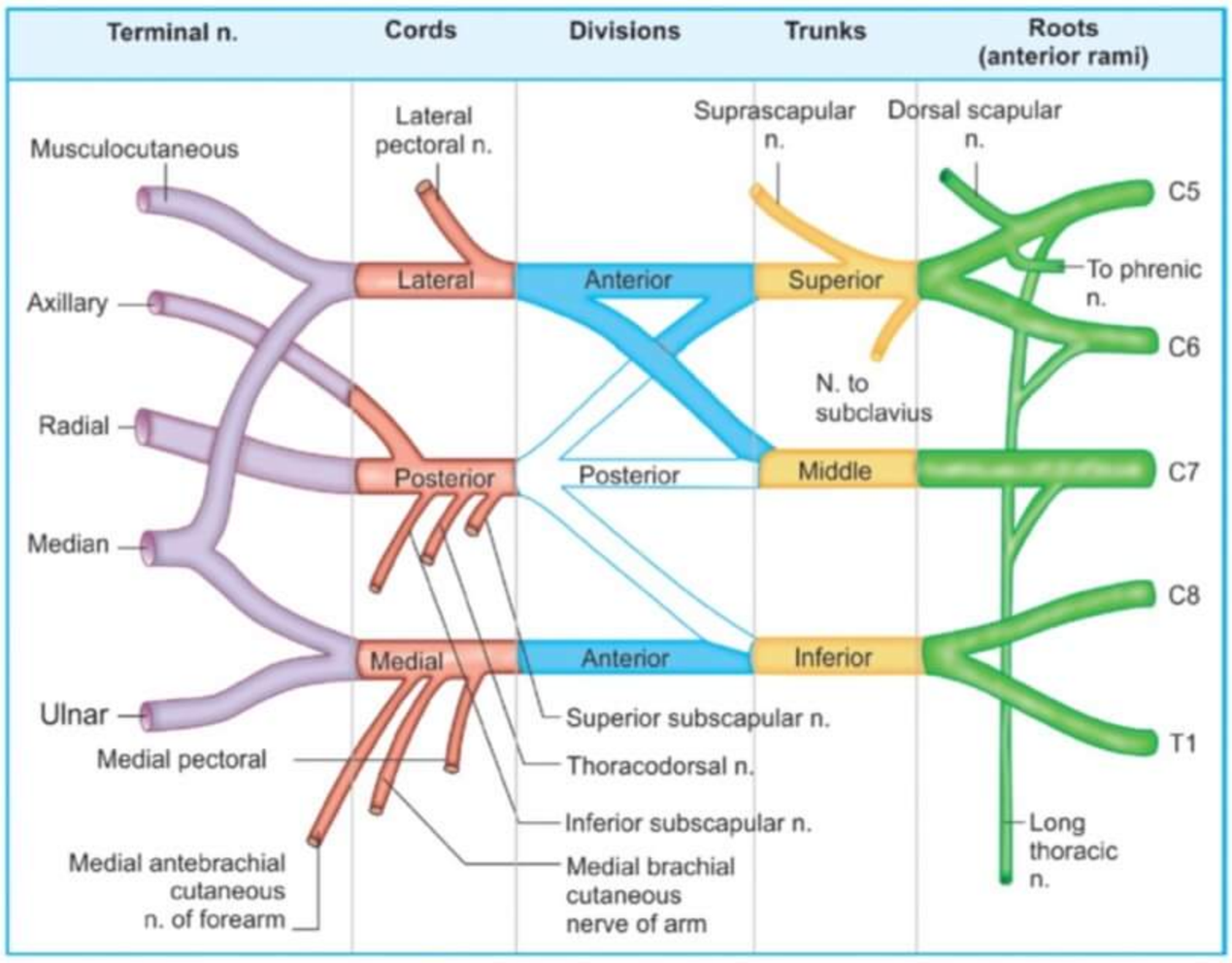
RADIAL NERVE has all 5 root value

AXILLARY NERVE
→ proximal nerve
→ Root value → C 5,6

ULNAR NERVE
→ C 8, T1
→ distal nerve

MEDIAN NERVE has 5 root values

Nerves ∴ all 5 root values
→ Radial Nerve > Median nerve

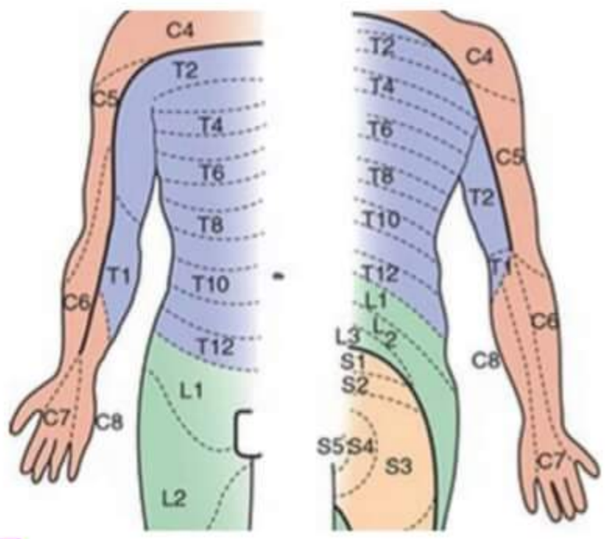


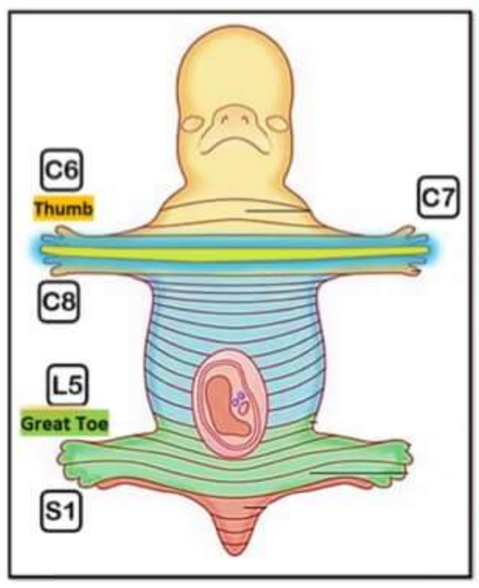
DERMATOMES & MYOTOMES

GENERAL RULE
UPPER BODY WILL HAVE UPPER ROOT VALUE / UPPER DERMATOMES
LOWER BODY WILL HAVE LOWER ROOT VALUE / LOWER DERMATOMES

Axillary Nerve → proximal nerve
Ulnar Nerve → Distal nerve

Great toe (proximal) → L5
Little toe (Distal) → S1





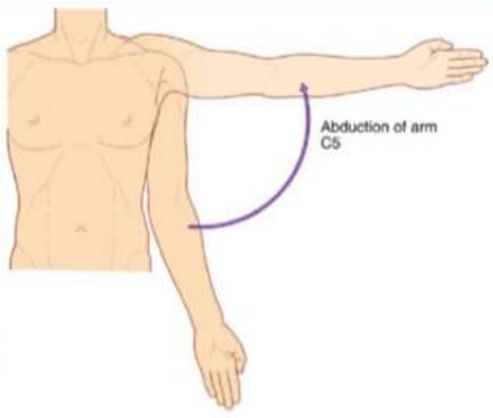
Q Dermatome of thumb & index finger is
a C5 ; C6
b C6 ; C6
c C6 ; C7
d C7 ; C7

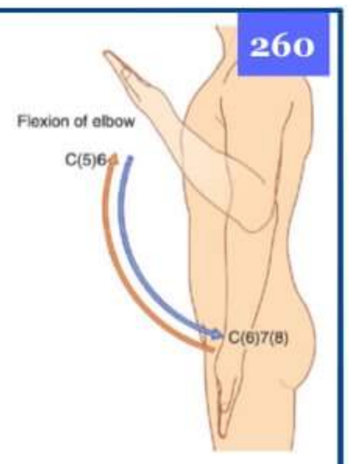
MYOTOMES

GENERAL RULE

PROXIMAL MUSCLES HAVE PROXIMAL ROOT VALUE

DISTAL MUSCLES HAVE DISTAL ROOT VALUE



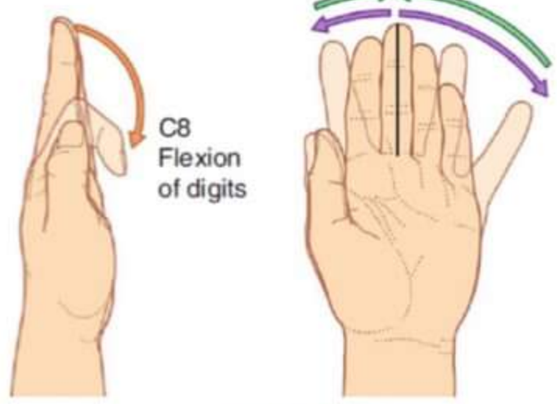


Hand muscles → C8 > T1

shoulder Abduct^{n} → C5

Elbow Flex^{n} (Biceps) → C5,6

Elbow Extens^{n} (triceps) → C7,8



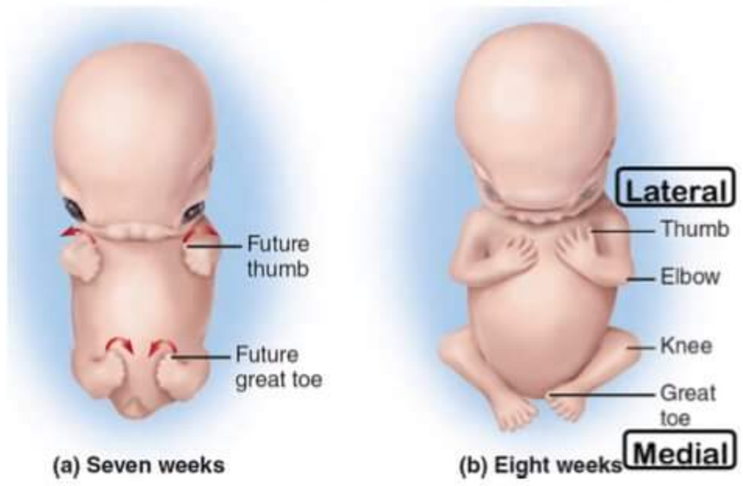
Finger flexion (flexor digitorum) → C8

Spread & close the fingers (interossei) → T1

LIMB ROTATION

→ Upper limb rotates laterally by 90°
In anatomical posit^{n}, thumb is Lateral
Flexor / folding compartment is anterior

→ Lower Limb rotates medially by 90°
In anatomical posit^{n}, Great toe is medial
flexor/folding compartment is posterior



→ Difference of rotat^{n} blw upper & Lower Limb → 180°

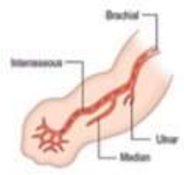
DERMATOMES

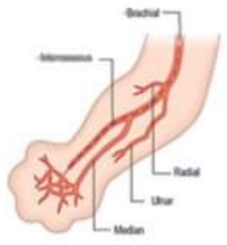
UPPER LIMB

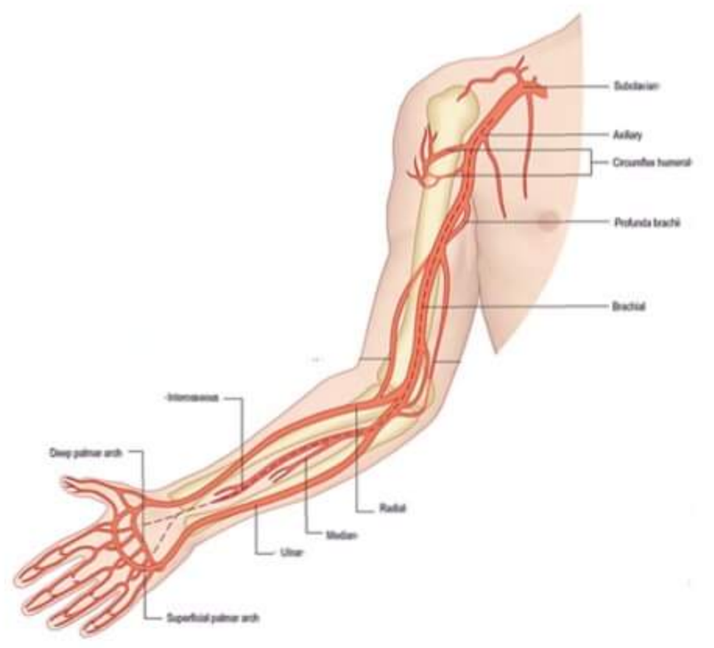
Thumb → C6

middle 3 fingers → C7

Little finger → C8





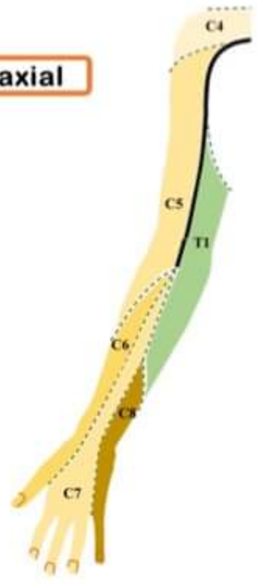


Ant. Axial line → reaches wrist joint

Post. Axial line → reaches elbow joint

Pre axial Bone → Thumb side | radial Bone

Post axial Bone → Little finger side | ulnar Bone



DEVELOPMENT OF UPPER LIMB ARTERIES

Pre axial artery → Thumb side | Radial artery

Post axial artery → little finger side | ulnar artery

Axial artery → Anterior inter osseous artery

Pre axial vein → Thumb side | cephalic vein at snuff box

Post axial vein → little finger side | Basilic vein at base of fore arm

Lateral Elbow → C5

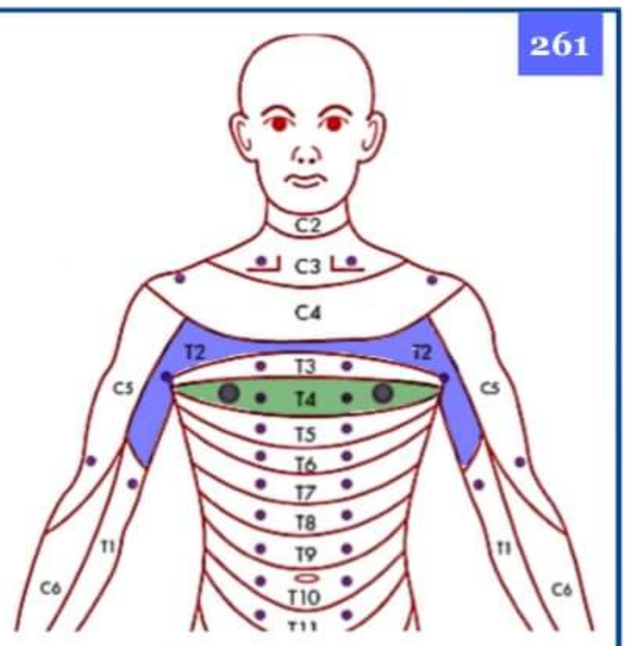
Distal medial Elbow → T1

Shoulder Tip → C4

Phrenic nerve → C4

referred pain of Acute Cholecystitis to rt. Shoulder tip

Spleen rupture (blunt trauma), referred pain to lt. Shoulder tip

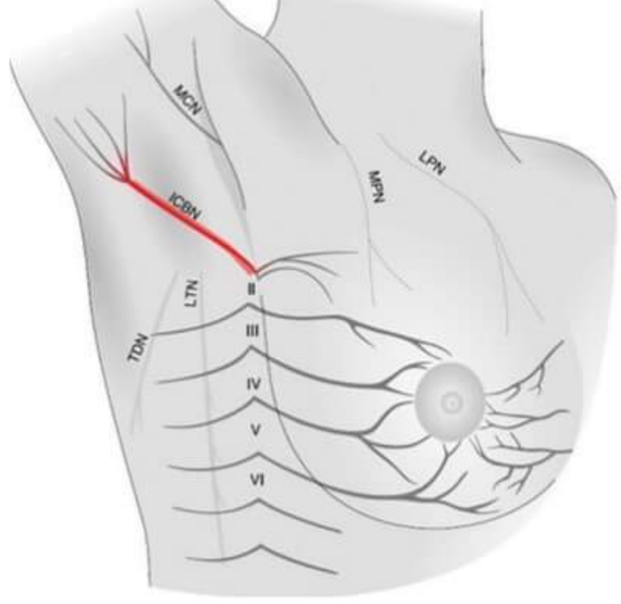


Nipple level → T4

Intercostal Brachial nerve → T2

→ Dermatome of chest wall & upper inner arm

→ At risk of injury during sentinel LN Biopsy



BRACHIAL PLEXUS

TRUNKS

UPPER TRUNK → formed by C5 & C6 Root

MIDDLE TRUNK → C7 root continues as middle trunk

LOWER TRUNK → C8 & T_1 roots join to form Lower Trunk

BRANCHES

UPPER TRUNK

1. SUPRA SCAPULAR NERVE
2. NERVE TO SUB CLAVIUS

Q Which of the following is a branch of Brachial plexus

a Dorsal scapular Nerve

b Long thoracic Nerve

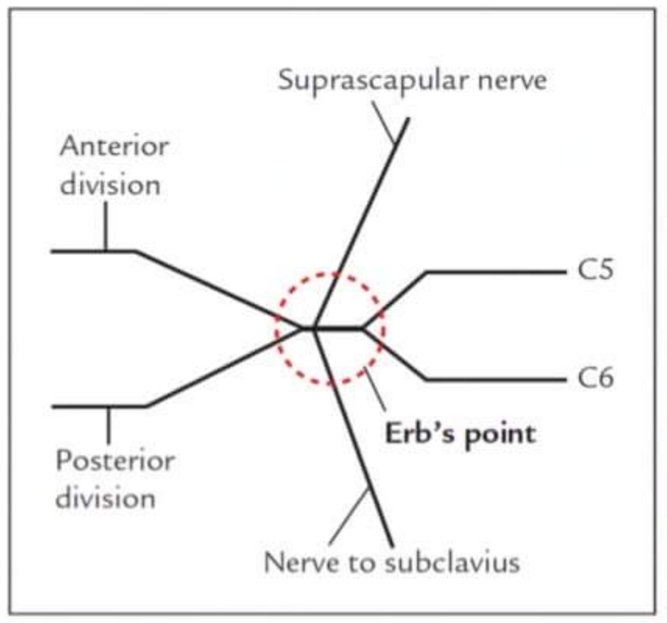
c Nerve to Subclavius BETTER ANSWER

d Supra scapular Nerve

ERB'S POINT

→ Meeting point of 6 nerves in the territory of upper trunk

1. Root of C5
2. Root of C_6
3. Supra scapular nerve
4. Nerve to subclavius
5. Ant. Division of upper trunk
6. Post. Division of upper trunk



→ injury leads to ERB'S PALSY

→ C5,6 Injury

→ muscles supplied by C5,6 are compromised (shoulder & scapula muscles)

→ Nerves involved

Supra scapular nerve

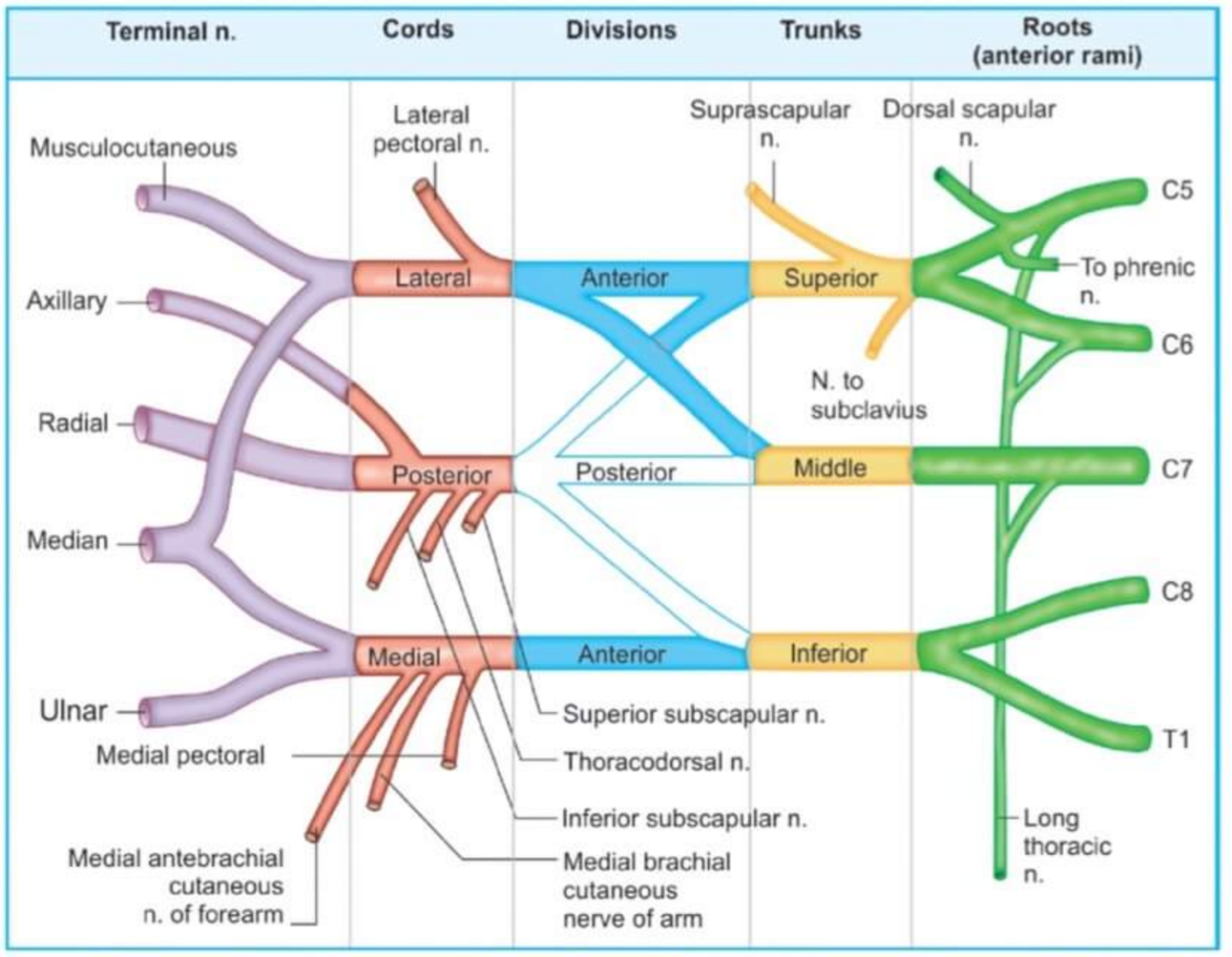
Nerve to subclavius

Musculocutaneous nerve

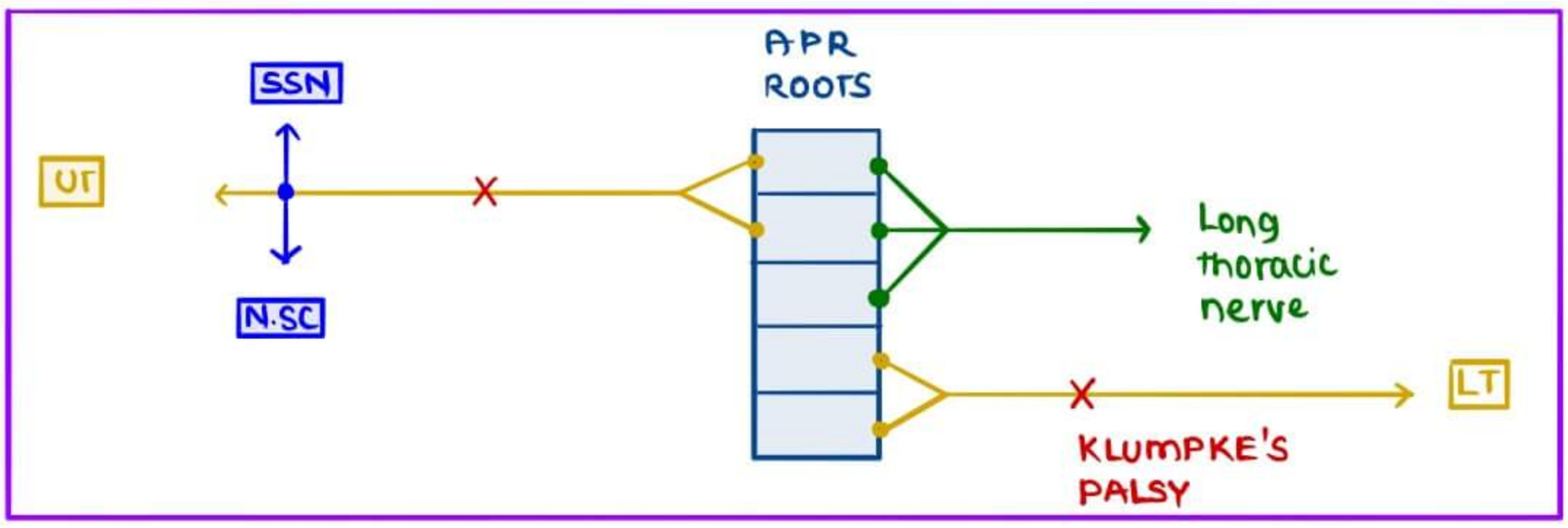
Axillary nerve

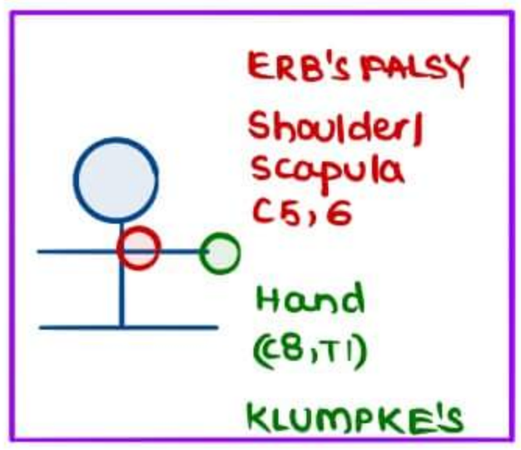
Radial nerve

Median nerve

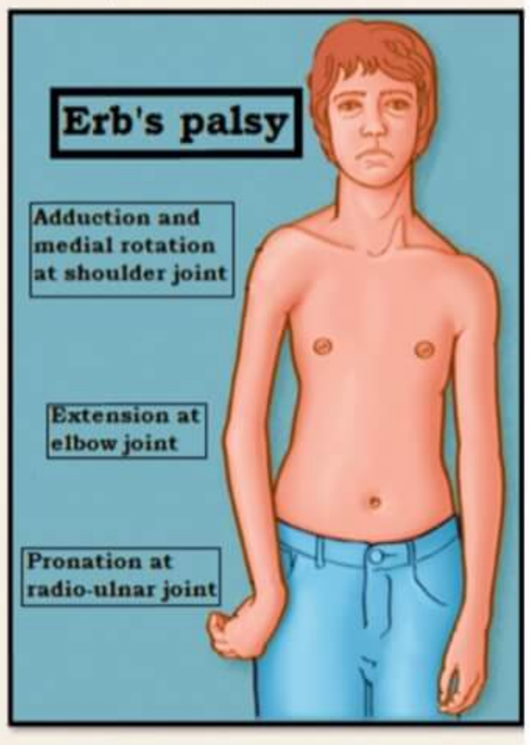


→ Distal area to injury is involved
proximal to injury is not involved
→ Long thoracic nerve (C5,6,7 to serratus anterior) in neck spared
→ supplies to serratus anterior
→ In injury → WINGING OF SCAPULA occurs





Nerves involved	Cause of injury	Clinical features
Erb-Duchenne palsy (upper turnk; C-5L, 6 injury) ▪ Supra-scapular nerve ▪ Axillary nerve ▪ Musculocutaneous nerve ▪ Radial	Undue separation of head and neck ▪ Fall on shoulder ▪ Birth injury	Policeman tip hand deformity



ERB'S PALSY - CLINICAL FEATURES
→ Policeman Tip hand deformity
→ Sensory loss on the Lat. aspect of upper limb
→ REGIMENTAL BATCH ANESTHESIA
- Root value → C5
- Axillary nerve involved
- Skin on upper part of deltoid muscle has sensory loss

NERVES INVOLVED IN C5, C6 INJURY
1. Axillary nerve (Total injury) → C5,6
2. Musculocutaneous (partial injury) → C5,6,7
3. Radial nerve (partial injury) → C5,6,7,8 ; T1

AXILLARY NERVE
→ Supplies Deltoid → Powerful abductor
Teres minor → Lateral rotator
} at shoulder joint

MUSCULO CUTANEOUS NERVE
→ Supplies Coraco-Brochialis → may not be paralysed
Biceps brachii
Brachialis
} paralysed
- Difficulty in supination
- Difficulty in elbow flexion
- Biceps reflex is lost (C5,6)

RADIAL NERVE
→ Brachio radialis paralysed
Action → elbow flexn in mid prone position
→ Difficulty in elbow flexion seen
→ Supinator reflex lost

POLICE MAN TIP HAND DEFORMITY

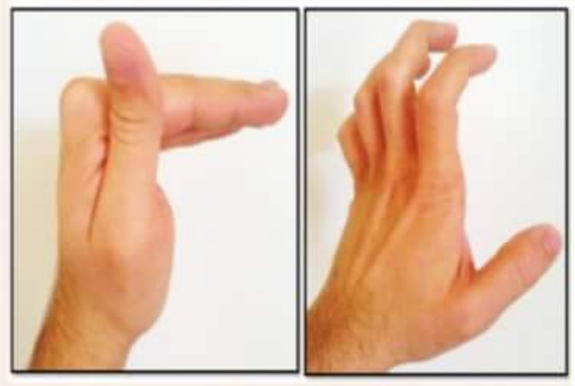
1. SHOULDER JOINT → Difficulty in abduct^{n} & lat. rotation
2. ELBOW JOINT → Difficulty in Flexion
3. RADIO ULNAR JOINT → Difficulty in Supination

→ shoulder → adduction & medial rotation
Elbow → Extension
Radio ulnar joint → pronation
} Police Man Tip Hand Deformity

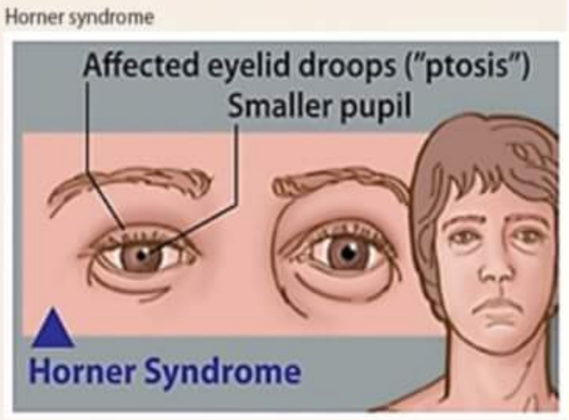
KLUMPKE'S PALSY

→ C_8, T_1 Injury (chiefly T1)
→ claw hand deformity
→ Hand muscles involved
– Lumbricals & interossei compromised
→ Horner Syndrome
→ Ptosis dlt paralysis of Superior tarsal muscle (muller muscle)
→ Miosis dlt paralysis of Dilator pupillae

Nerves involved	Cause of injury	Clinical features
(**Lower trunk**; C-8; T-1 injury) ▪ Median nerve ▪ Ulnar nerve ▪ T-1 Sympathetic fibres	**Hyper-abduction** of arm ▪ Holding a branch while fall from a tree ▪ Birth injury	**Claw hand deformity**



Horner syndrome

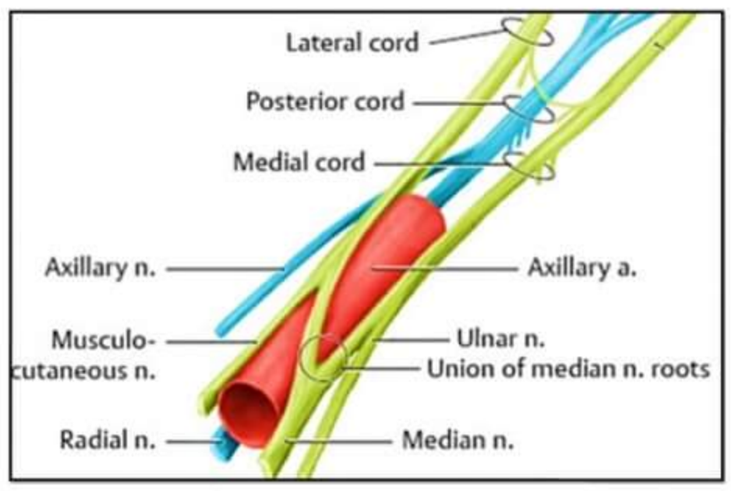


→ CLAW HAND DEFORMITY
→ LUMBRICALS & INTEROSSEI ACTIONS
→ MCP flexion
→ IP Extension
→ In injury
→ MCP Extension
→ IP flexion
} claw Hand

Q Injury to the upper trunk of brachial plexus results in (PGI 2012)
a Supination of fore arm
b External rotation of arm
c Inability to initiate abduction
d Decreased sensation on medial side of hand
e Paralysis of deltoid muscle

CORDS

→ present in Axilla
→ FORMATION
1. LATERAL → Ant. Divisions of upper & middle trunks joins to form LC
2. POSTERIOR → Post. division of upper, middle, Lower trunk joins to form PC
3. MEDIAL → ant. division of Lower trunk continuous as MC (ulnar N.)



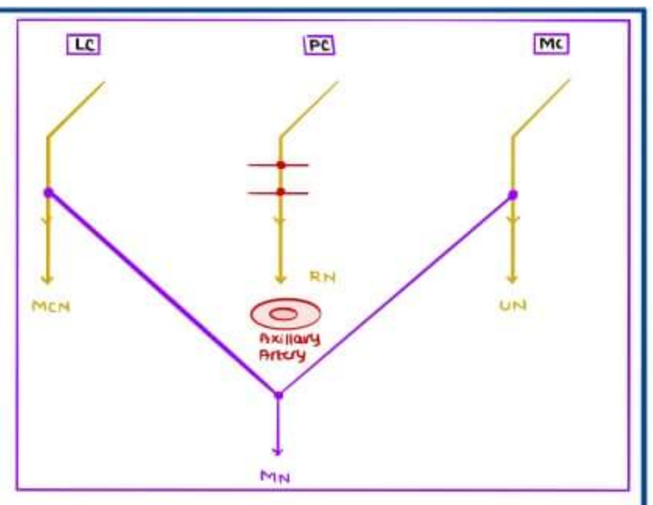
→ Named ↕ respect to axillary artery
→ Continuation in axilla
Lateral cord → Musculo Cutaneous Nerve
Post. Cord → Radial nerve
Medial cord → Ulnar nerve

MEDIAN NERVE → contributed by Lateral & medial cord

BRANCHES

POSTERIOR CORD

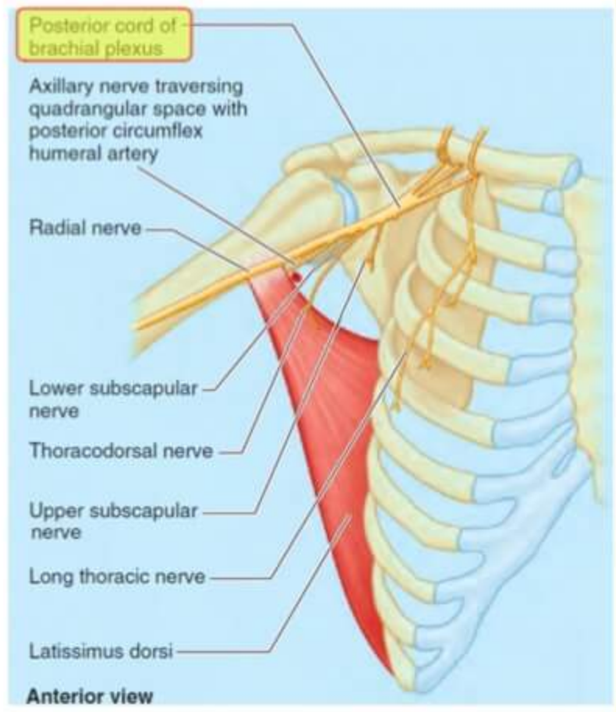
S → Upper Subscapular N. → Sub scapularis
T → Thoraco-dorsal N. → L. dorsi
A → Axillary Nerve → Deltoid, T.minor
R → Radial Nerve → N. of Extension
S → Lower Subscapular N. → Sub scapularis (Hybrid muscle)



RADIAL NERVE

→ Nerve of extension, present in radial groove
→ Nerve of posterior compartment

Latissimus dorsi → comes from Lower back
inserts on floor of bicepital groove in humerus



AXILLARY NERVE

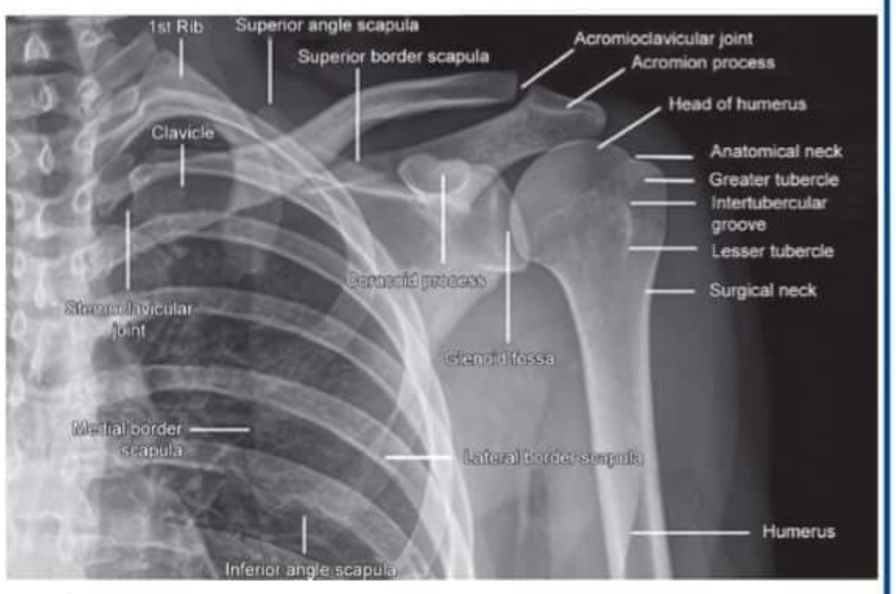
→ Given in axilla
→ passes quadrangular space ⊂ posterior circumflex humeral artery (br. of axillary artery)
→ goes to surgical neck of humerus
→ ∃n # of surgical neck of humerus Deltoid & Teres minor are paralysed

UPPER LIMB BONES & MUSCLES (PROXIMAL REGION)

BONES

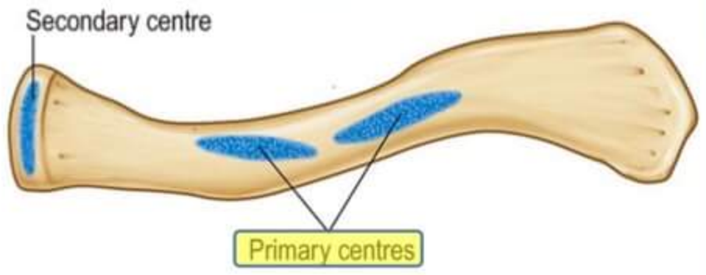
SHOULDER JOINT

CLAVICLE



→ Long bone in horizontal direct^{n}
→ no bone marrow
→ Subcutaneous through out
→ # at
→ at junct^{n} of Lateral 1/3rd & middle 1/3rd
→ at junction of Lateral 1/3rd & intermediate 1/3rd
→ at junction of lateral 1/3rd & medial 2/3rd

→ has two 1° centres of ossificat^{n}
→ Long bone ⊂ two 1° centres of ossificat^{n}
→ 2° centre of ossificat^{n} present on medial side at sternoclavicular joint



COROCOID PROCESS OF SCAPULA → seen below the clavicle in infraclavicular fossa

ACROMIOCLAVICULAR JOINT

→ Joint b/w acromion of scapula & clavicle
→ helps in shoulder abduction along ⊂ sterno clavicular joint

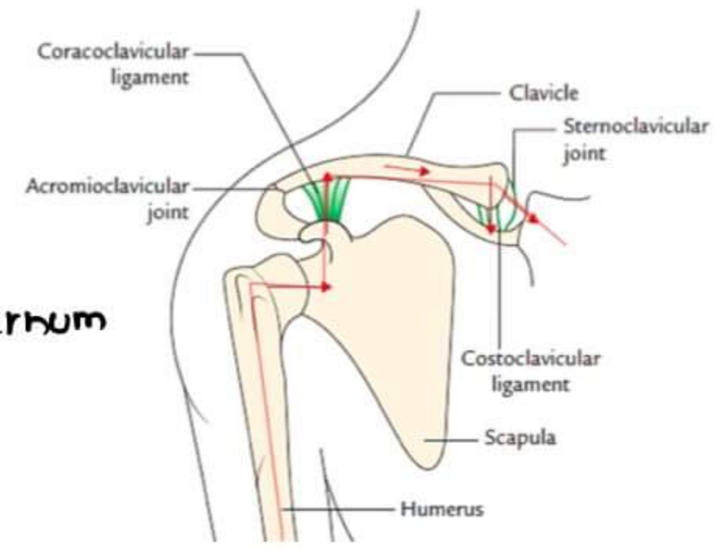
HUMERUS → head
→ lesser tubercle
→ Greater tubercle (most lateral)

Q All are true about clavicle EXCEPT
a No marrow cavity
b Long bone in horizontal disposition
c two 2° centres of ossificatⁿ
d # at the junctⁿ of lateral & intermediate 3rd

Q Weight transmission from UL to axial skeleton is done by all EXCEPT
a costo - clavicular ligament
b coraco - acromial ligament
c coraco - clavicular ligament
d Inter - clavicular ligament

→ Thrust produced by fall on outstreched hand, carried by humerus to scapula to clavible (by coraco clavicular ligament) to ribs & Sternum

→ LIGAMENTS HELPING IN WEIGHT TRANSMISSION
1. coraco clavicular ligament (most imp)
2. costo clavicular ligament (2nd most imp)
→ Transmits wt from clavicle to 1st Rib & Sternum
3. Inter clavicular ligament
→ attaches to clavicle & Sternum

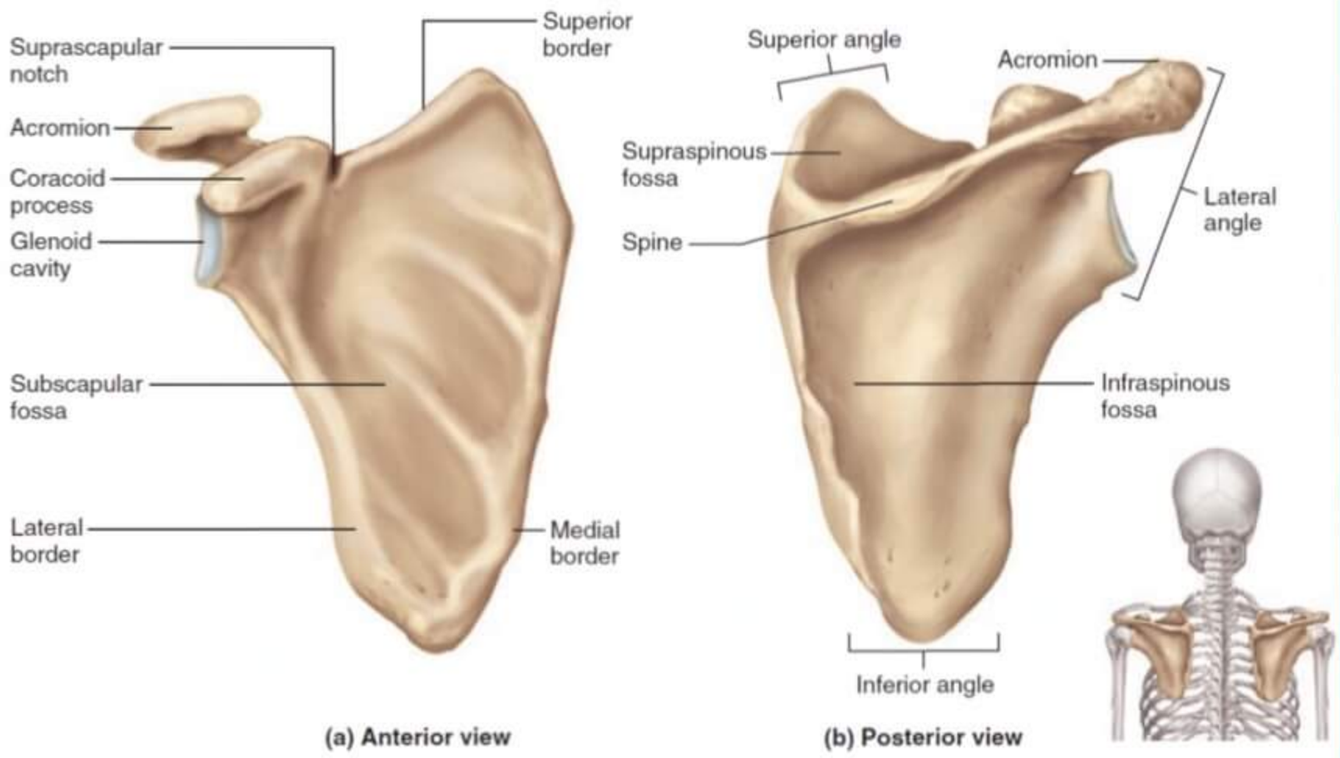


Coraco Acromial ligament
→ attaches to scapula at 2 points
1. corocoid process 2. Acromian process
→ does n't help in wt. transmission

Q All the pairs about bony attachments around shoulder joints are correctly matched EXCEPT
a Latissimus dorsi : floor of intertubercular sulcus
b short head of biceps : Tip of coracoid process
c Subscapularis : Lesser tubercle
d Teres major : Greater tubercle → Teres minor attaches to Greater tubercle

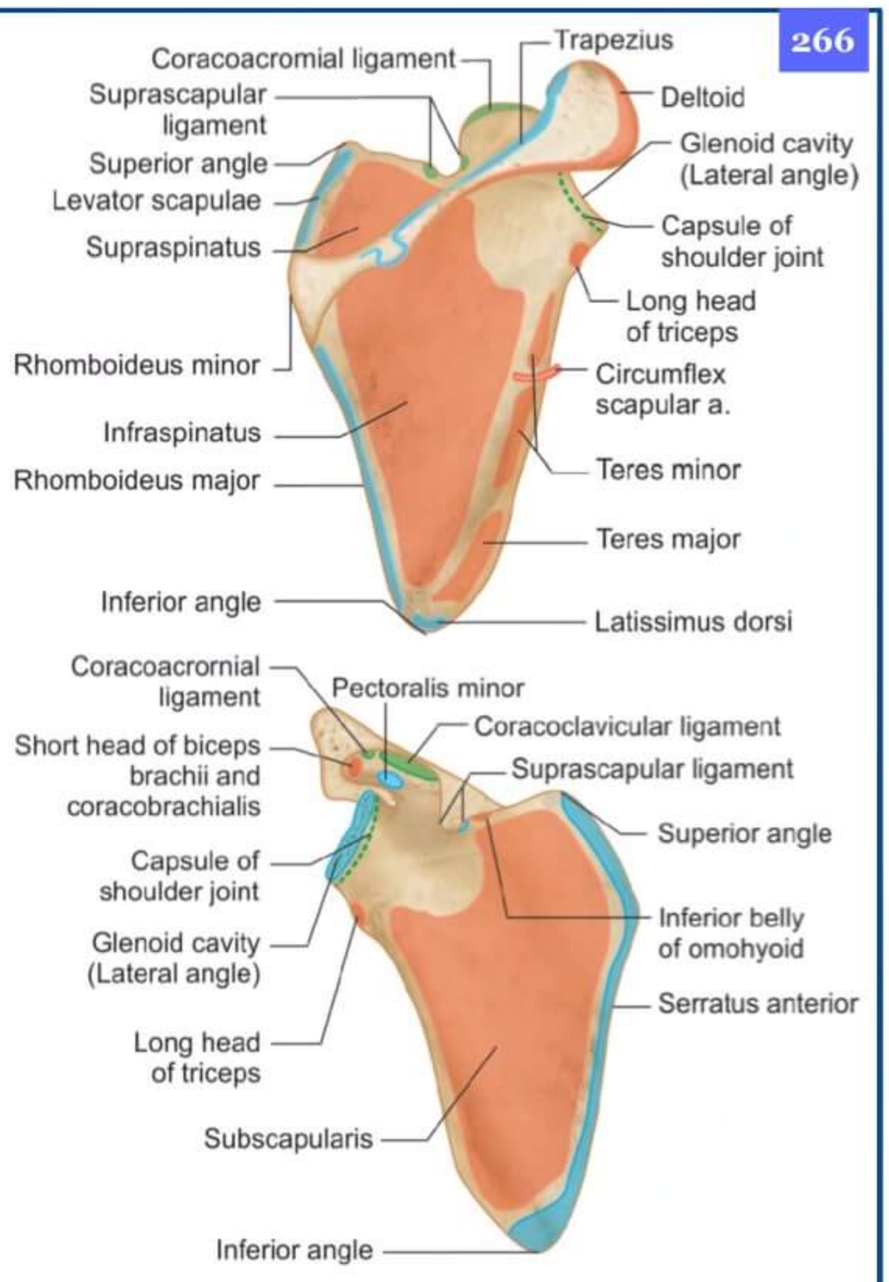
→ Teres major attaches to medial lip of bicepital groove on humerus

SCAPULA
→ corocoid process
→ Acromian process
→ Inferior angle / Glenoid cavity
→ superior angle
→ Inferior bordur
→ Superior border
→ Lateral border
→ medial border
→ Spine



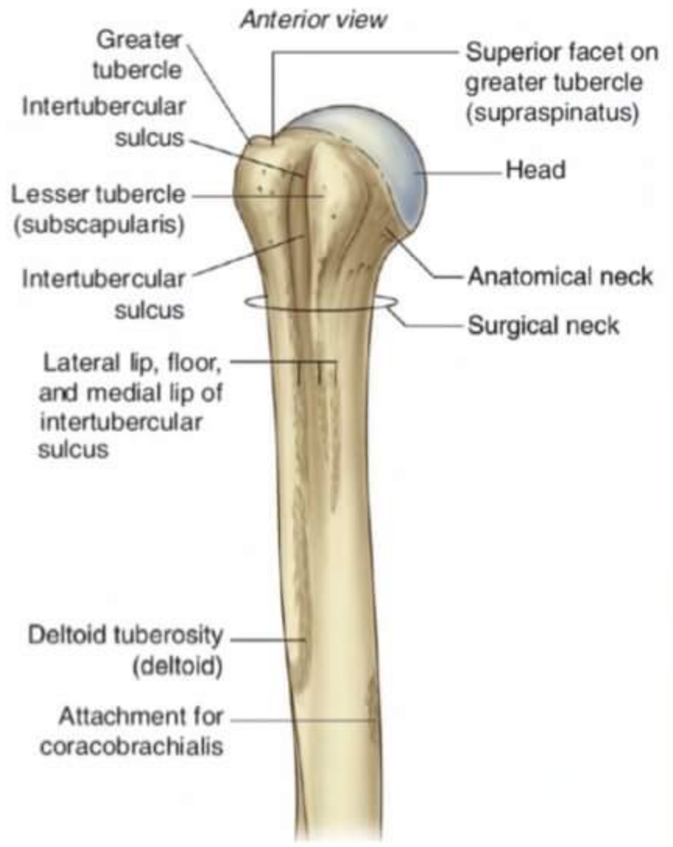
SCAPULA	ATTACHMENTS
Tip of corocoid process	Biceps brachii coraco brachialis
Medial border on front side Under the scapula	Serratus anterior sub scapularis

DORSAL SIDE	ATTACHMENTS
Later border	Teres major & minor
medial border	Rhomboid major & minor Levator scapulae
Spine	Deltoid (posterior border) Trapezius (upper border)
Acromian process	Deltoid (lateral border) Trapezius (medial border)
Above the spine	Supra spinatus
Below the spine	Infra Spinatus
Infra glenoid tubercle	Long head of triceps



HUMERUS

UPPER END	ATTACHMENTS
Deltoid tubercle (on mid shaft)	Deltoid insertn (Laterally)
Lesser tubercle	Subscapularis
Greater tubercle	S → Supra Spinatus I → Infra Spinatus T → Teres minor



→ SIT muscles comes from dorsum of scapula

INTERTUBERCULAR/BICEPITAL GROOVE

→ Tendon of Long head of biceps brachii present here

	ATTACHMENTS
at floor	Latissimus dorsi from lower back
medial lip	Teres major from posterior side
latera lip	Pectoralis major anteriorly

→ Latissimus dorsi
Pectoralis major
} has spiral fibres

AXILLA

Posterior wall	Latissimus dorsi Pectoralis major Subscapularis
Anterior wall	Pectoralis major Pectoralis minor
Lateral wall	Bicepital groove & tendon Humerus

LOWER END

MEDIAL CONDYLE / TROCHLEA → pully shaped
LATERAL CONDYLE /CAPITULUM → head shaped
CORONOID FOSSA → receives coronoid process of ulna
RADIAL FOSSA → receives head of radius
OLECRANON FOSSA → receives olecranon process of ulna

} Intra capsular

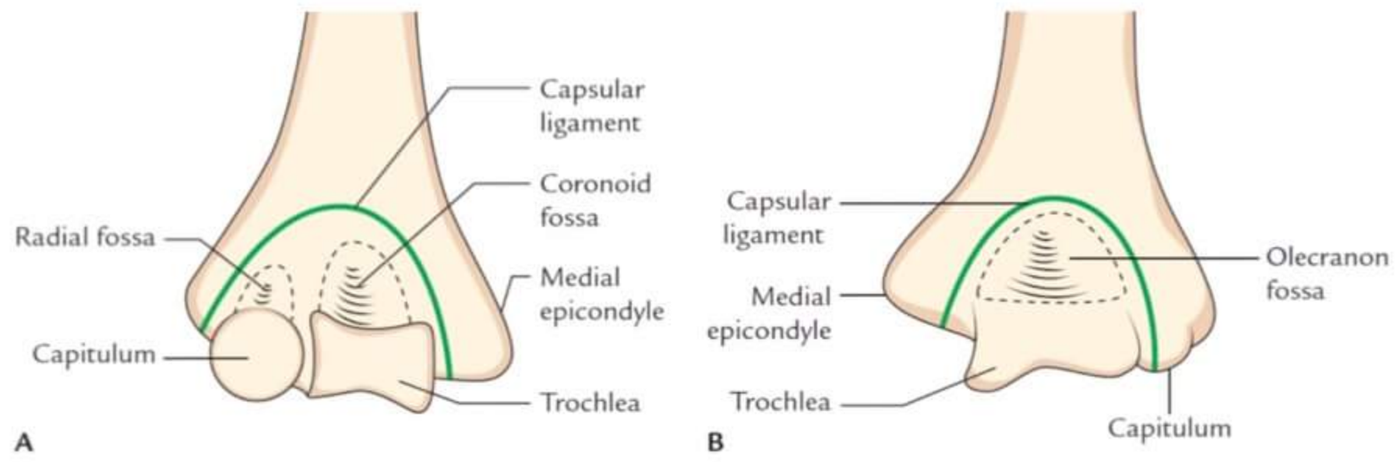
EPICONDYLES

→ extra capsular
→ medial epicondyle gives origin to common flexors of fore arm
→ Lateral epicondyle gives origin to common extensors of fore arm

→ In Lateral Epicondylitis / Tennis Elbow → Extensor muscles compromised
→ In Medial Epicondylitis / GOLFER Elbow → Flexor muscles compromised

→ Traction Epiphysis → Epicondyles
→ Pressure Epiphysis → Trochlea & Capitulum

→ TENDONS ARE EXTRACAPSULAR EXCEPT Tendon of Long head of Biceps



NERVES RELATED TO HUMERUS BONE

ULNAR NERVE

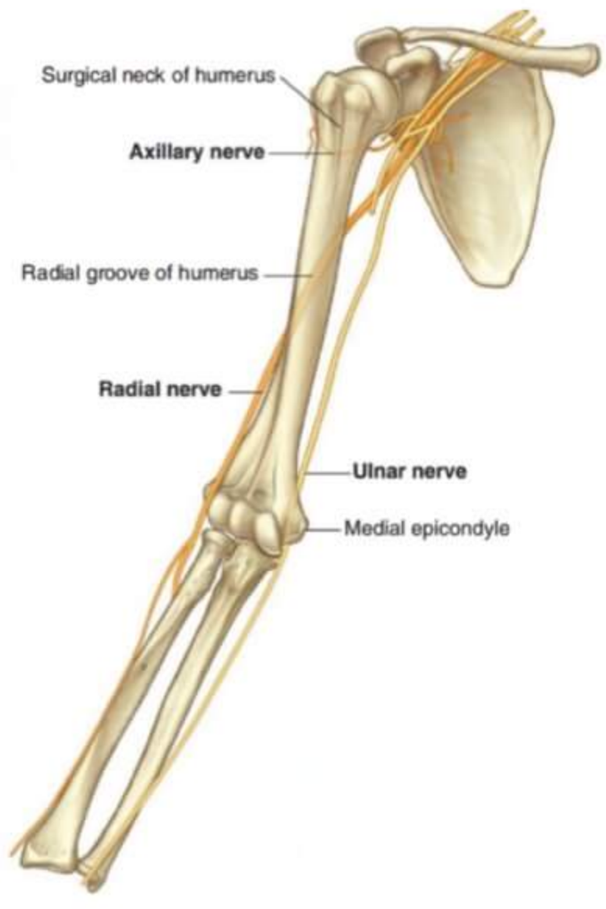
→ runs on ulnar side, passes behind medial epicondyle & running towards ulnar bone & medial side of hand

RADIAL NERVE

→ Goes behind humerus bone in radial groove & runs toward the radial bone
→ comes anterior to lateral epicondyle

AXILLARY NERVE → related to Sx neck of humerus

In # of Surgical neck → Axillary nerve is injured
In # of mid shaft → Radial nerve is injured
medial epicondyle → Ulnar nerve is injured



MEDIAN NERVE

→ runs in midline at lower end of Humerus

Muscles of the Anterior Axioappendicular Region

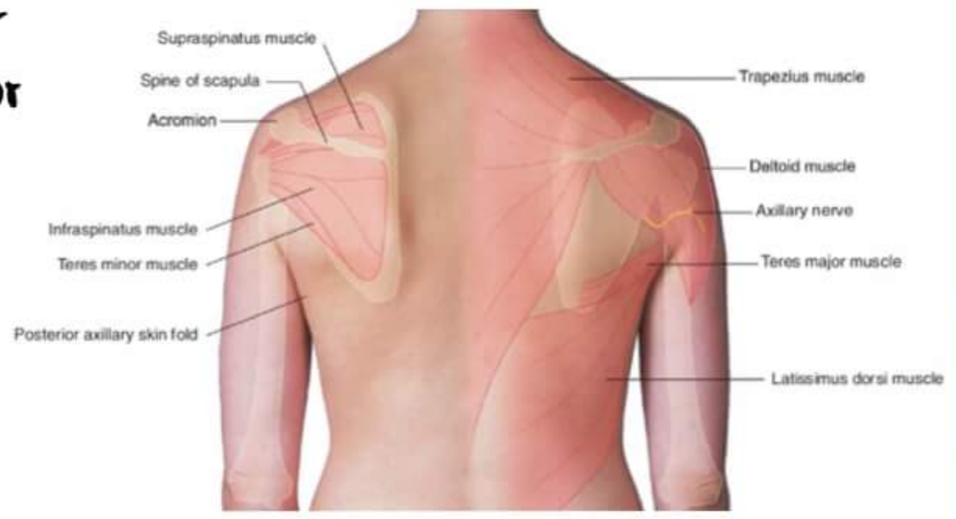
Muscle	Innervation	Action
Pectoralis major	Lateral and medial pectoral nerves (C5, C6)	Adducts and medially rotates the arm
Pectoralis minor	Medial pectoral nerve (C8, T1)	Stabilizes the scapula
Subclavius	Nerve to subclavius (C5, C6)	Anchors and depresses the clavicle
Serratus anterior	Long thoracic nerve (C5, C6, C7)	Protracts the scapula and holds it against the thoracic wall Rotates the scapula

PECTORALIS MAJOR

ORIGIN
- Ant. Sternum
- Ant. Clavicle
- Ant. ribs
- Ant. Costal cartilages

INSERTION
- Lateral Lip of Bicepital groove

- → contains SPIRAL FIBRES (180°)
  - → Inferior fibres going to attach superior
  - → superior fibres going to attach inferior



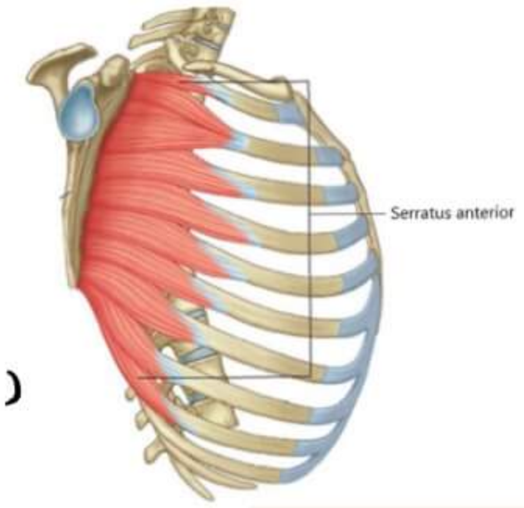
- → CONVERGENT MUSCLE
- → ACTIONS
  1. Shoulder flexion
  2. Medial rotation

ANY MUSCLE CROSSING THE HUMERUS ANTERIORLY, CAUSE
- Shoulder flexion
- Medial rotation

Eg. Ant. fibres of DELTOID

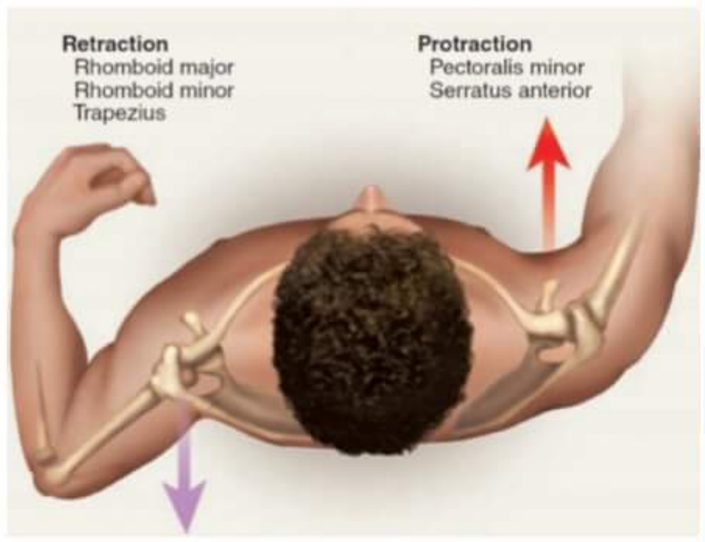
SERRATUS ANTERIOR

- → ORIGIN → Upper 8 ribs on anterolateral surface
- → INSERTION → Scapula (posteriorly on medial border & anterior surface)



PROTRACTION OF SCAPULA (pulling scapula forward)
- → Serratus anterior
- → Pectoralis minor

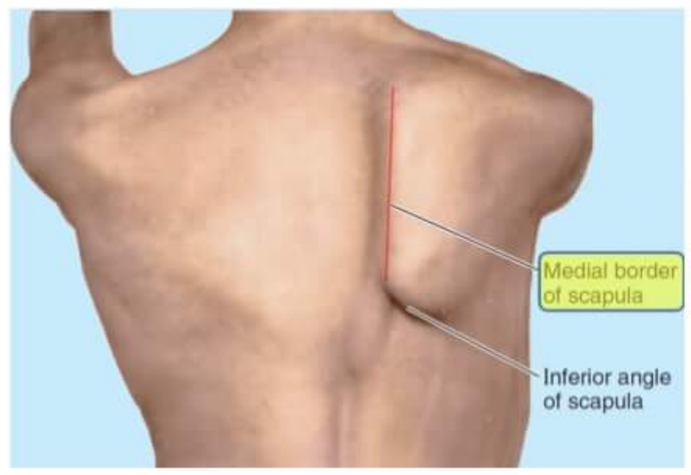
RETRACTION OF SCAPULA (pushing scapula backwards)
- → Rhomboid major
- → Rhomboid minor
- → Trapezius



WINGING OF SCAPULA

Medial border of scapula becomes prominent

Serratus anterior is paralysed



Muscles of the Posterior Axioappendicular and Scapulohumeral Region

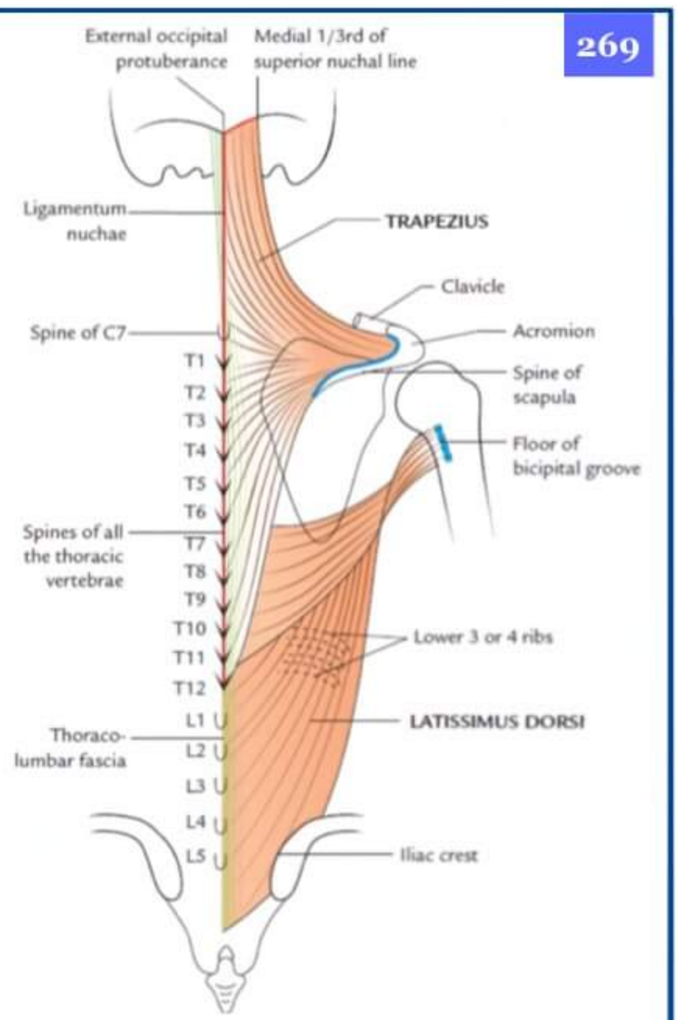
Muscles	Innervation	Action
Trapezius	Accessory nerve (CN XI)	Elevates, depresses, and retracts the scapula Rotates glenoid cavity superiorly
Latissimus dorsi	Thoracodorsal nerve (C6, C7, C8)	Extends, adducts, and medially rotates the arm
Levator scapulae	Dorsal scapular nerve (C5) Cervical nerves (C3, C4)	Elevates the scapula Rotates glenoid cavity inferiorly
Rhomboid major and minor	Dorsal scapular nerve (C4, C5)	Retracts and rotates the scapula to depress glenoid cavity
Deltoid	Axillary nerve (C5, C6)	Flexes and medially rotates the arm Abducts the arm Extends and laterally rotates the arm
Supraspinatus	Suprascapular nerve (C4, C5, C6)	Abducts the arm (1st 15°) Acts with rotator cuff muscles
Infraspinatus	Suprascapular nerve (C4, C5)	Laterally rotates the arm Holds humeral head in glenoid cavity
Teres minor	Axillary nerve (C5, C6)	Laterally rotates the arm Holds humeral head in glenoid cavity
Teres major	Lower subscapular nerve (C5, C6)	Adducts and medially rotates the arm
Subscapularis	Upper and lower subscapular nerve (C5, C6, C7)	Adducts and medially rotates the arm Holds humeral head in glenoid cavity

TRAPEZIUS

- → Triangular muscle
- → muscle of upper back

- → ORIGIN
  - → vertebra
  - → occipital bone

- → INSERT^{n}
  - → Spine of scapula (upper border)
  - → Acromian process of scapula (median border
  - → clavicle (post. border)
  - → J shaped Insertion (INNER J)

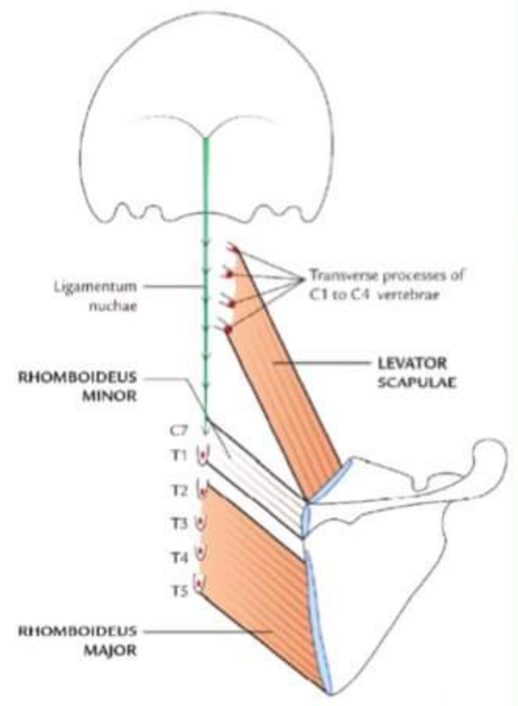


LATISSIMUS DORSI

- → Muscle of Lower back
- → ORIGIN → Thoraco lumbar fascia
  Iliac crest of hip bone
  Lower vertebra
  Inferior angle of scapula

- → INSERT^{n} → Floor of Bicepital groove (on ant. side of humerus)
  → convergent & Spiral muscle

- → helps in Scratching the back



LEVATOR SCAPULAE

- → INSERT^{n} → Medial border of scapula
- → Origin → cervical vertebrae

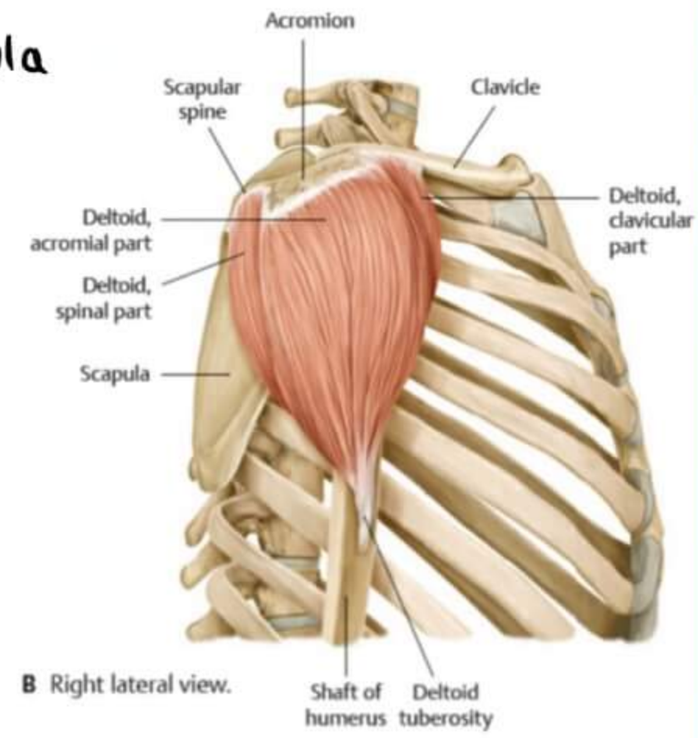
RHOMBOID MAJOR & MINOR

- → INSERT^{n} → Medial border & dorsal surface of scapula
- → ORIGIN → vertebrae

DELTOID MUSCLE

- → Multipinnate muscle

Anterior fibers → Flexors & medial rotators
Posterior fibers → Extensors & lateral rotators
middle fibers → powerful abductors (beyond 15°)



B Right lateral view.

- → INSERTION
  - → on Deltoid tuberosity on humerus (v Shaped)

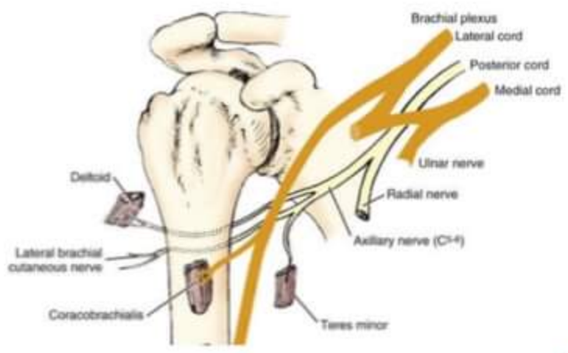
- → ORIGIN
  - → J Shaped insertion (OUTER J)
    Spine (posterior border)
    Acromian process (lateral border)
    Clavicle (anterior border)

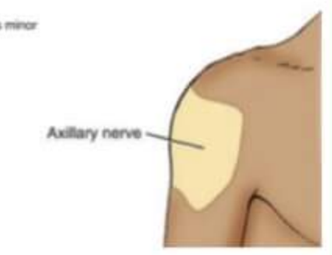
- → supplied by axillary nerve

Axillary nerve C5-6

Deltoid
Teres minor

Abduct shoulder—15°-110°
Lateral rotation of shoulder





Regimental Batch

SIT MUSCLES

S → Supra Spinatus
I → Infra Spinatus
T → Teres minor

→ Sits on Greater tubercle on humerus
→ contributes to rotatory cuff postero superiorly
→ ORIGIN → Scapula
→ Lateral rotators
Supra spinatus → initiate abduct^{n}

SUBSCAPULARIS

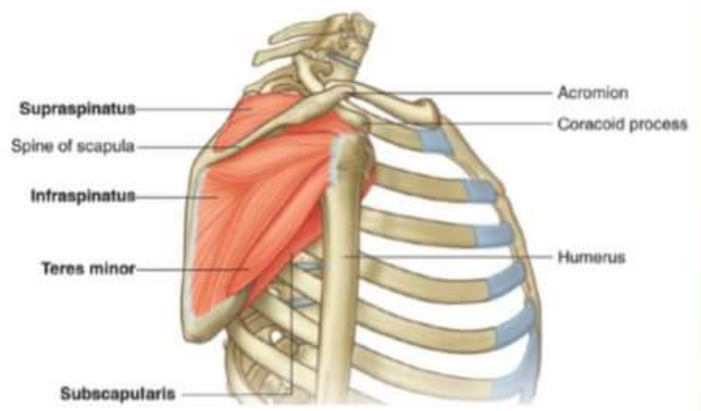
→ INSERT^{n} → Lesser tubercle
→ also contributes to rotatory cuff
FORGOTTEN MUSCLE

ROTATOR CUFF

→ posterior, Superior, anteriorly stabilizes shoulder joint
→ Inferiorly deficient → Inf. dislocat^{n} are more common
→ Musculo Tendinous Rotatory Cuff

→ Anteriorly by → Subscapularis (weak supporter)
Inferiorly → Deficient

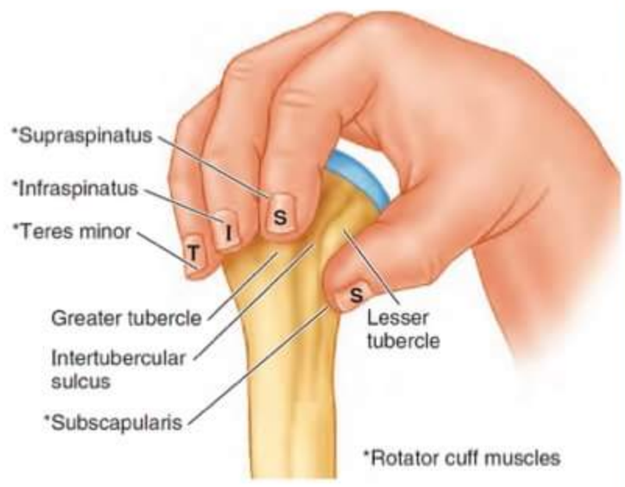
→ Antero Inferior dislocations are more common



→ ROTATORY CUFF MUSCLES

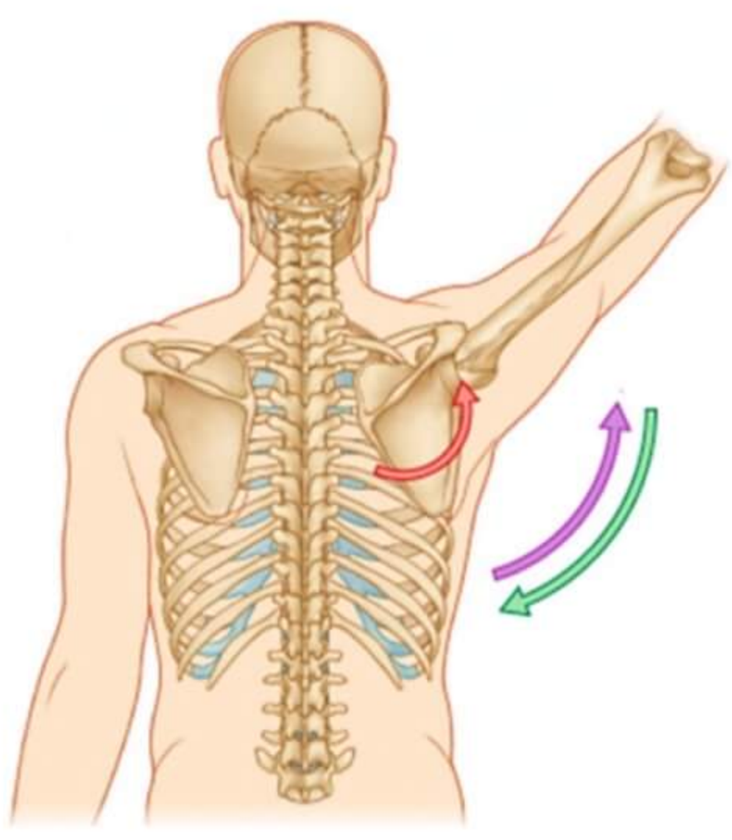
S → Supra spinatus
I → Infraspinatus
T → Teres minor
} Sits on Greater tubercle

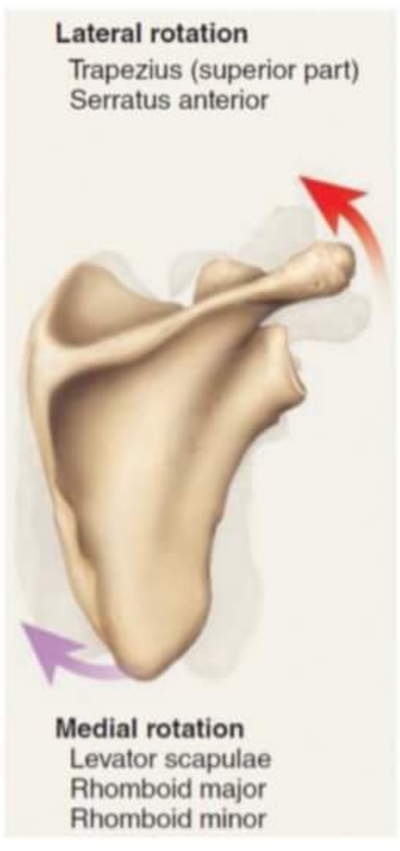
S → Sub scapularis → Sits on lesser tubercle

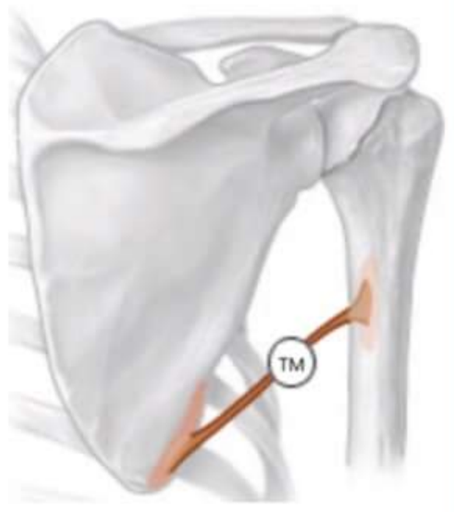


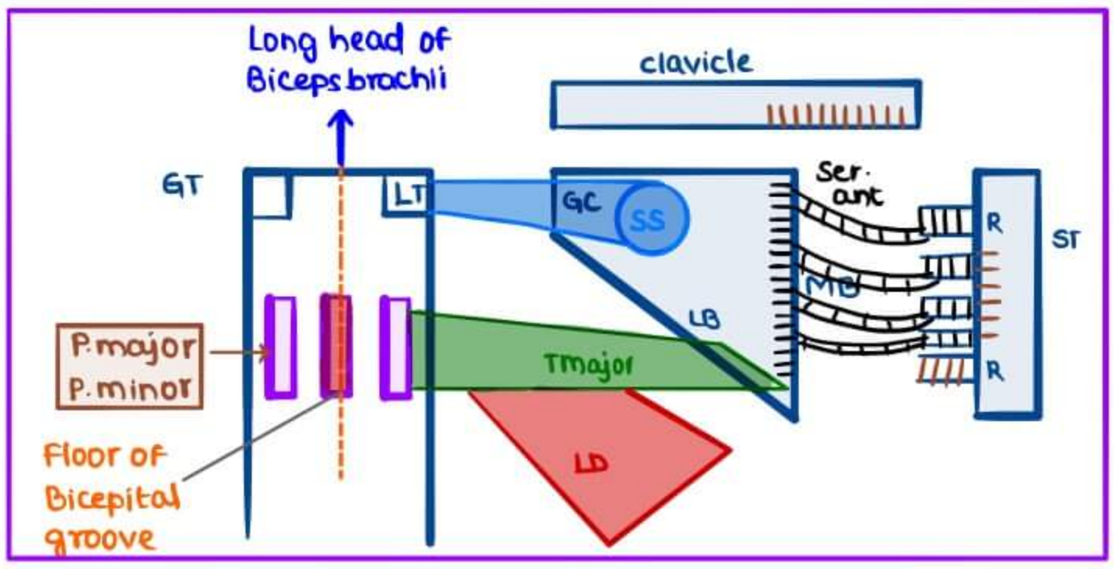
TERES MAJOR

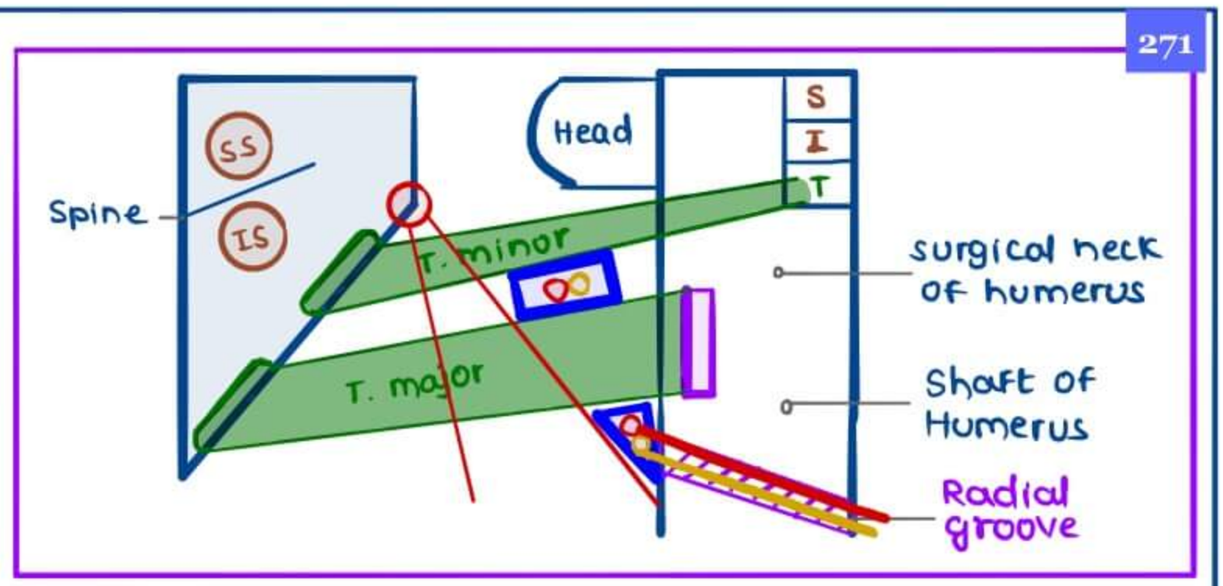
→ Comes from Lateral border of dorsal scapula
→ INSERT^{n} → medial lip of bicepital groove, anteriorly on humerus
→ Forms post. wall of axilla











LONG HEAD OF TRICEPS

→ ORIGIN → infraglenoid tubercle

INSERTⁿ → ulnar bone inferiorly

TERES MINOR

→ attaches to dorsal surface of scapula on the lateral wall of scapula

→ Insertⁿ → Greater tubercle

QUADRANGULAR SPACE

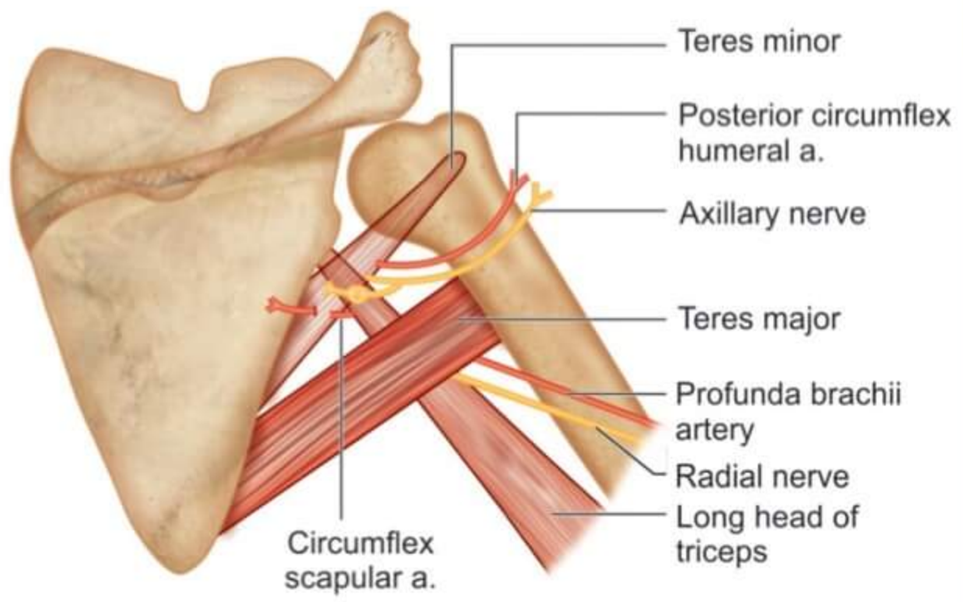
BOUNDARIES

Superior → Teres minor

Inferior → Teres major

medial → Long head of triceps

Lateral → surgical neck of humerus



CONTENTS

Axillary nerve
Posterior circumflex Humeral Artery
} goes to surgical neck of humerus

LOWER TRIANGULAR SPACE - BOUNDARIES

Superior → Teres major

Medial → Long head of Triceps

Lateral → Shaft of humerus

CONTENTS → Radial nerve, Profunda Brachial artery (deep artery of arm)

RADIAL GROOVE

→ present on midshaft of humerus posteriorly

→ Radial nerve coming from Lower Δlar spaces passes in radial groove

Q The accompanying artery [axillary nerve in the quadrangular space

a anterior circumflex humeral artery

b Posterior circumflex humeral artery

c Profunda brachii artery

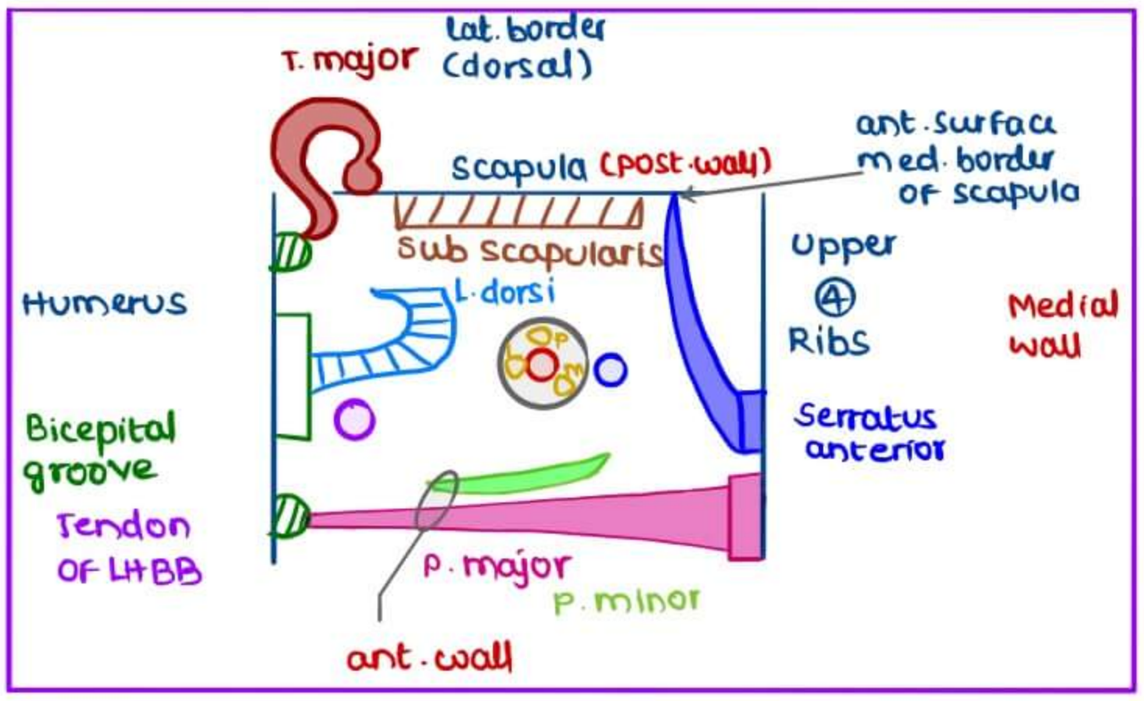
d circumflex scapular artery

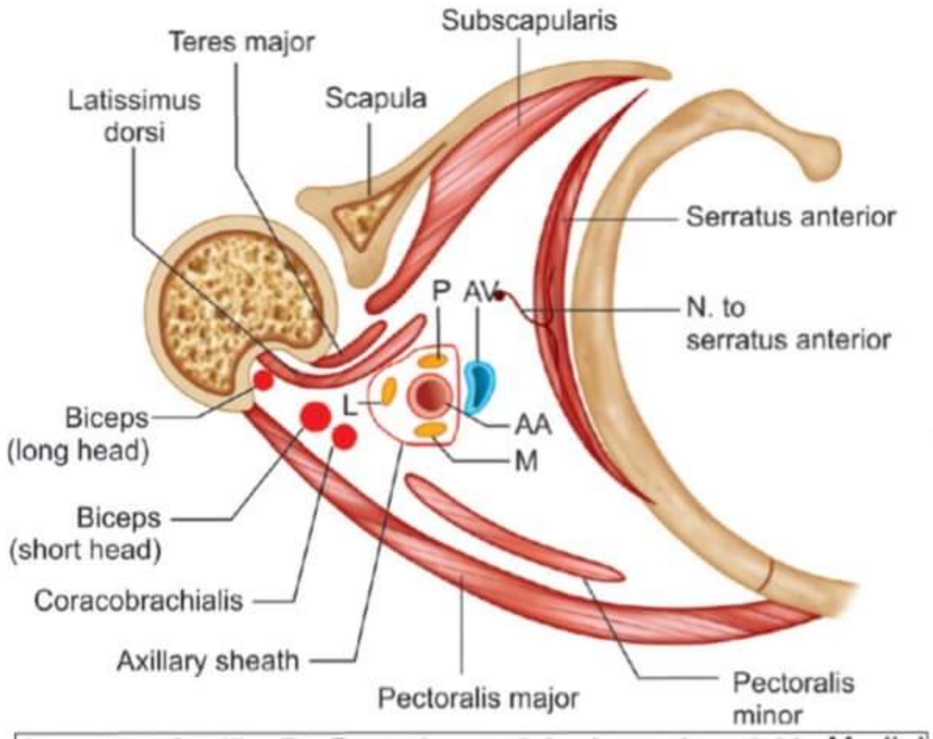
AXILLA

Anterior wall	pectoralis major & minor
Posterior wall	latissimus dorsi Teres major Sub scapularis
Lateral wall	Humerus Long head of Biceps tendon
Medial wall	upper 4 ribs Origin of Serratus anterior

CONTENTS

1. Axillary Artery
2. Axillary Vein
3. ③ cords of Brachial plexus





Contents of axilla. P - Posterior cord, L - Lateral cord, M - Medial cord of brachial plexus; AA - Axillary artery; AV - Axillary vein

SCAPULAR MOVEMENTS

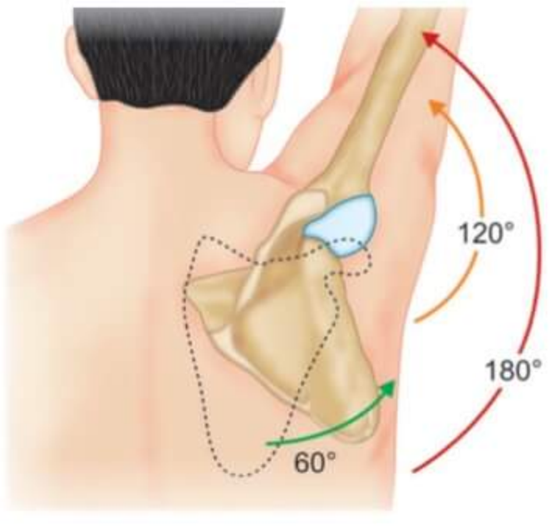
SHOULDER ABDUCTION

SHOULDER ABDUCTION (180°) → HUMERUS ELEVATION (120°) → SCAPULA LATERAL ROTATION (60°)

Initiation (0°–15°)	Supraspinatus
15° – 90°	Deltoid
Over Head abduct^{n} (90°–180°)	Serratus anterior Trapezius

→ During lateral rotat^{n} of scapula, laterally facing glenoid cavity faces Superiorly

Q Which of the following movements DOESN'T happen in abduction of Shoulder
a Medial Rotat^{n} of Scapula
b Elevat^{n} of humerus
c Rotat^{n} of clavicle at sternoclavicular joint
d Rotat^{n} at the axis of acromioclavicular joint



DEGREE	MUSCLE	NERVE
0°–15°	Supraspinatus	Suprascapular
15°–100°/90°	Deltoid	Axillary
> 90° } 90°-180°	Trapezius	Accessory
> 100° }	Serratus Anterior	Long Thoracic

MUSCLES OF ARM REGION

Muscles of the Anterior (Flexor) Compartment of the Arm

Muscle	Innervation	Action
Biceps brachii	Musculocutaneous nerve (C5, C6)	Flexes and supinates the forearm
Brachialis	Musculocutaneous nerve (C5, C6)	Flexes the forearm in all positions
Coracobrachialis	Musculocutaneous nerve (C5, C6, C7)	Flexes and adducts the arm

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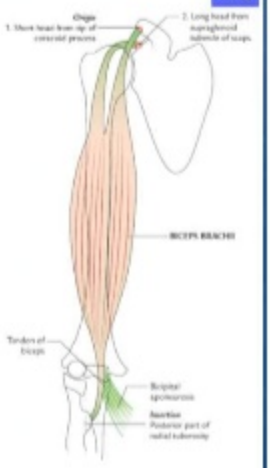


BICEPS BRACHII

ORIGIN

LONG HEAD → Supra glenoid tubercle of scapula

SHORT HEAD → Tip of coracoid process

INSERTION → Behind the radial tuberosity

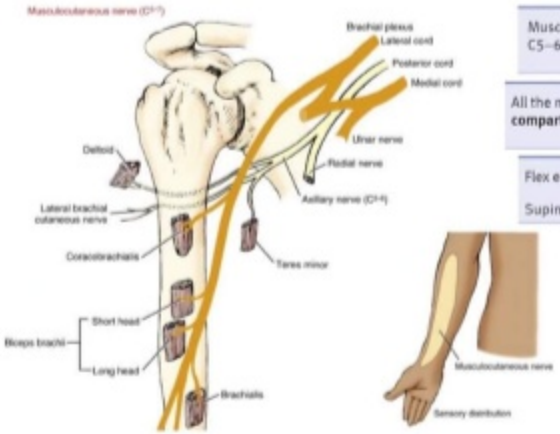
MUSCLES OF FORE ARM REGION

SUPERFICIAL MUSCLES

1. Pronator teres
2. Flexor carpi Radialis
3. Palmaris longus
4. Flexor Digitorum superficialis
5. Flexor carpi ulnaris

DEEP MUSCLES

1. FLEXOR POLLICIS LONGUS
2. FLEXOR DIGITORUM PROFUNDUS
3. PRONATOR QUADRATUS



Musculocutaneous nerve C5–6

All the muscles of the **anterior compartment** of the arm

Flex elbow

Supination (biceps brachii)

Muscles of the Anterior (Flexor) Compartment of the Forearm

Muscle	Innervation	Action
Pronator teres	Median nerve (C6, C7)	Flexes and pronates the forearm
Flexor carpi radialis	Median nerve (C6, C7)	Flexes and abducts the hand
Palmaris longus	Median nerve (C7, C8)	Flexes the hand
Flexor digitorum superficialis	Median nerve (C7, C8, T1)	Flexes proximal phalanges at meta-carpophalangeal joints Flexes middle phalanges at proximal interphalangeal joints
Flexor carpi ulnaris	Ulnar nerve (C6, C7)	Flexes and adducts the hand
Flexor digitorum profundus Medial part Lateral part	 Ulnar nerve (C8, T1) Anterior interosseous nerve (C8, T1)	 Flexes distal phalanges at distal interphalangeal joint
Flexor pollicis longus	Anterior interosseous nerve (C8, T1)	Flexes phalanges of the thumb
Pronator quadratus	Anterior interosseous nerve (C8, T1)	Pronates the forearm

COMMON FLEXOR ORIGEN → Medial epicondyle of Humerus

PRONATOR TERES

ORIGIN → Humero ulnar head

INSERTN → Radius

FLEXOR CARPI RADIALIS

INSERTN → Base of meta carpals

PALMARIS LONGUS

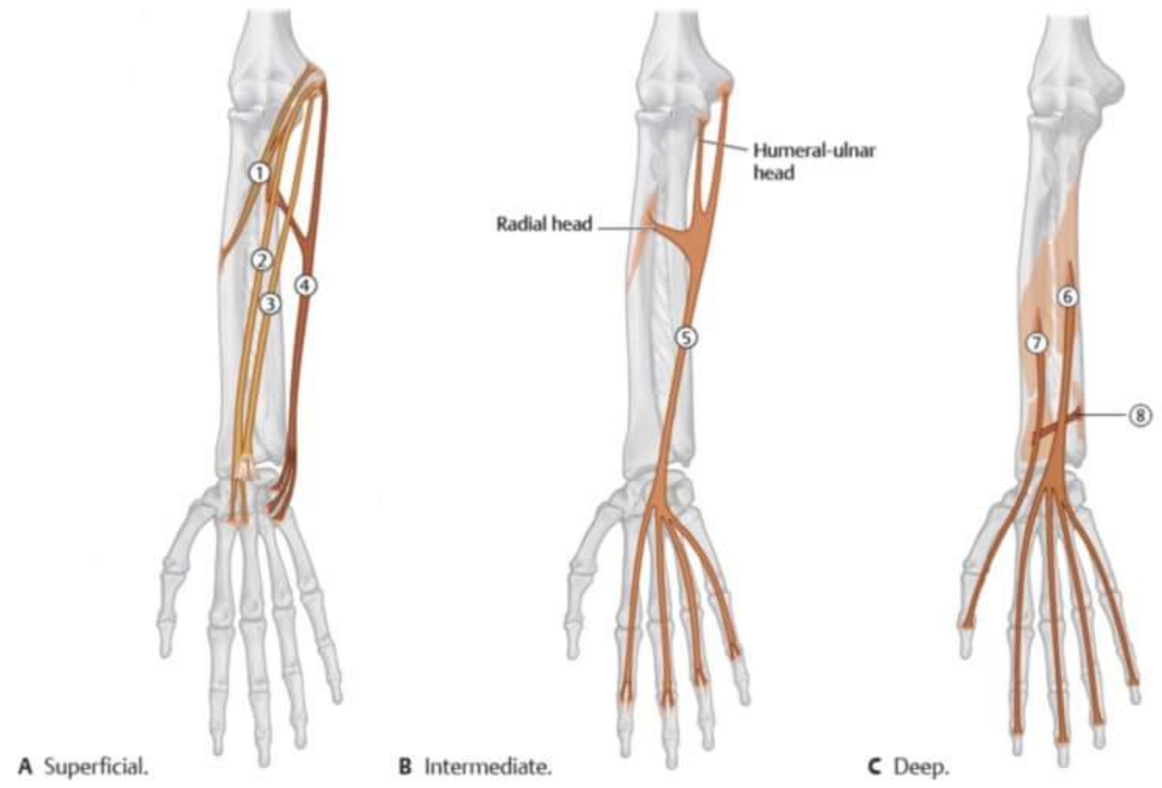
INSERTⁿ → Flexor retinaculum
continues as palmaris aponeurosis

FLEXOR DIGITORUM SUPERFICIALIS

→ has 4 tendons
→ ORIGIN → Humero Radio ulnar
INSERTⁿ → middle phalanx

FLEXOR CARPI ULNARIS

ORIGIN → Humero ulnar head
→ common flexor origin
INSERTⁿ → Pisiform
Base of metacarpals

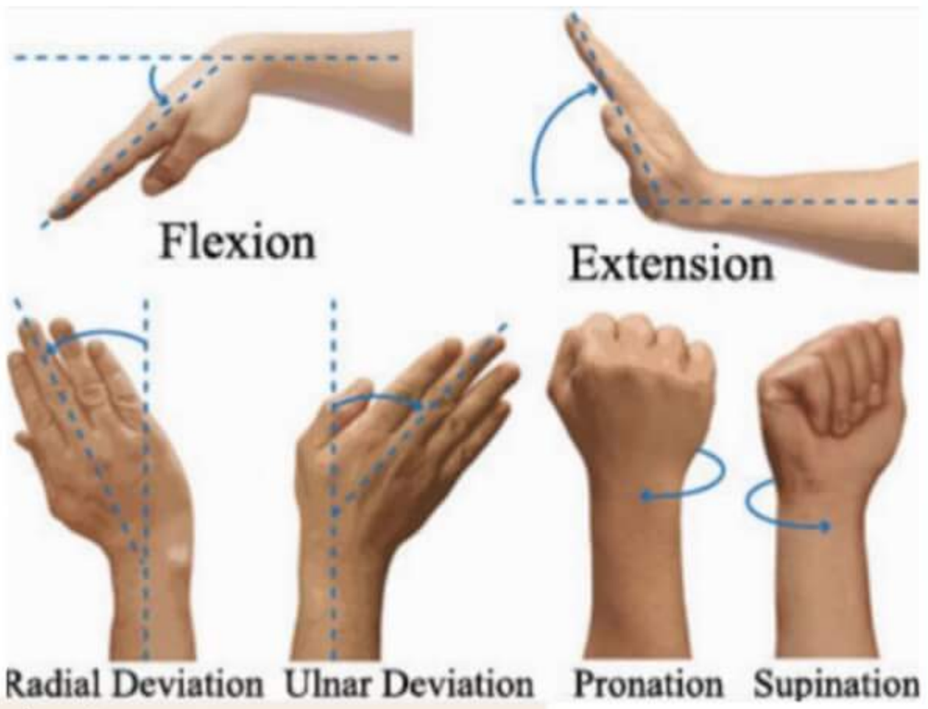


② pronators

Pronator teres (Superficial)
Pronator quadratus (Deep)

② Supinators

Biceps brachii
Supinator



Adduction (Ulnar deviation)	Flexor carpi ulnaris and extensor carpi ulnaris
Abduction (Radial deviation)	Flexor carpi radialis, extensor carpi radialis longus and brevis, abductor pollicis longus and extensor pollicis brevis

DEEP muscles

FLEXOR POLLICIS LONGUS → Insertⁿ → Base of thumb
FLEXOR DIGITORUM PROFUNDUS → INSERTION → Base of distal phalanx
PRONATOR QUADRATUS → WRIST BAND MUSCLE

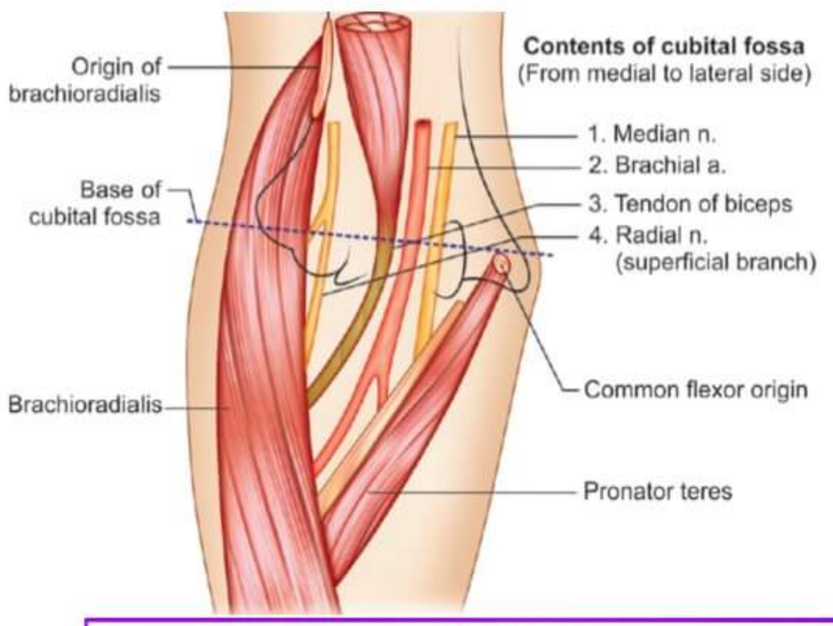
CUBITAL FOSSA

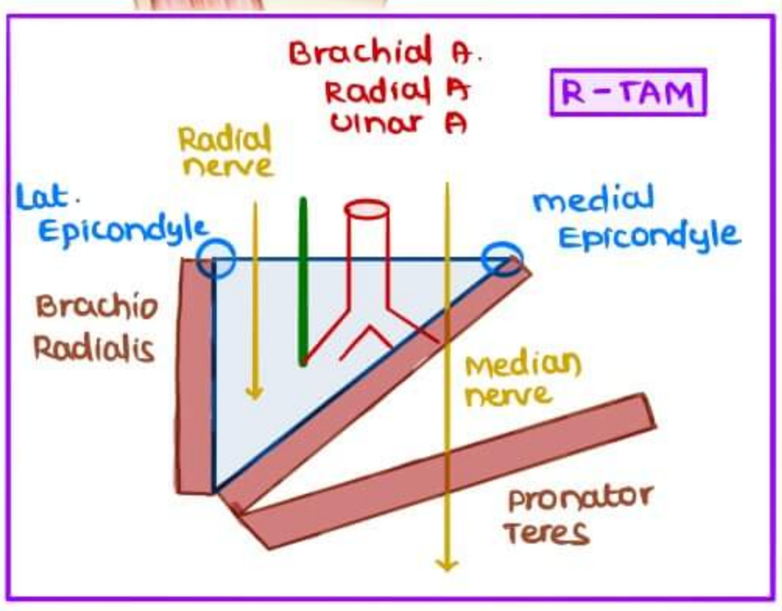
BOUNDARIES

Lateral → Brachio Radialis
Medial → Pronator terer
Base → imaginary line b/w medial & lateral Epicondyles

BRACHIORADIALIS

ORIGIN → Humerus Lower end
INSERTⁿ → Tip of Styloid process of Radius
ACTION → Elbow flexion in mid prone position





CONTENTS

→ Biceps tendon
→ Brachial Artery → Radial artery
→ Ulnar artery
→ Median nerve } at periphery
→ Radial nerve }

PRONATOR TERES SYNDROME → compression of Median nerve b/w the heads of pronator teres

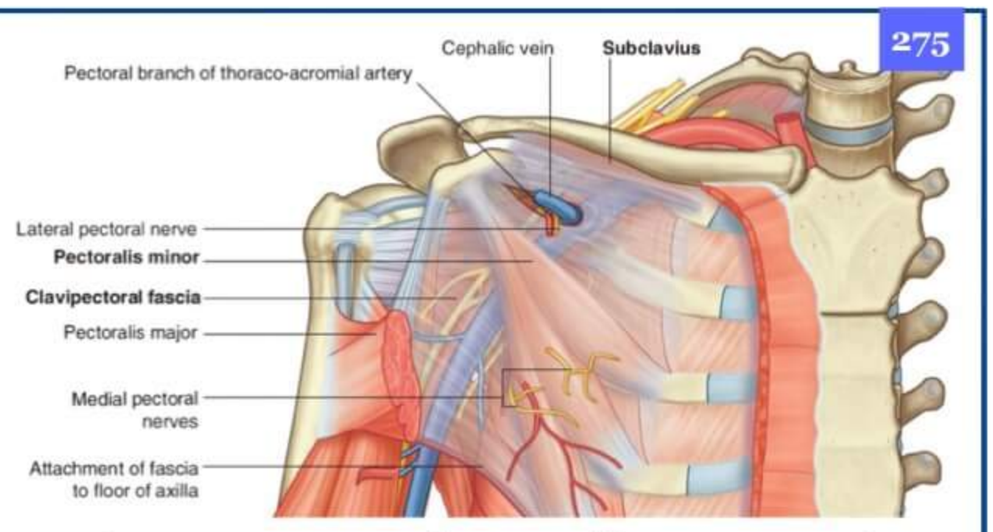
CLAVIPECTORAL FASCIA

→ Fascia blw clavicle & pectoralis minor

→ PECTORALIS MINOR

→ ORIGIN → Ribs 3,4,5

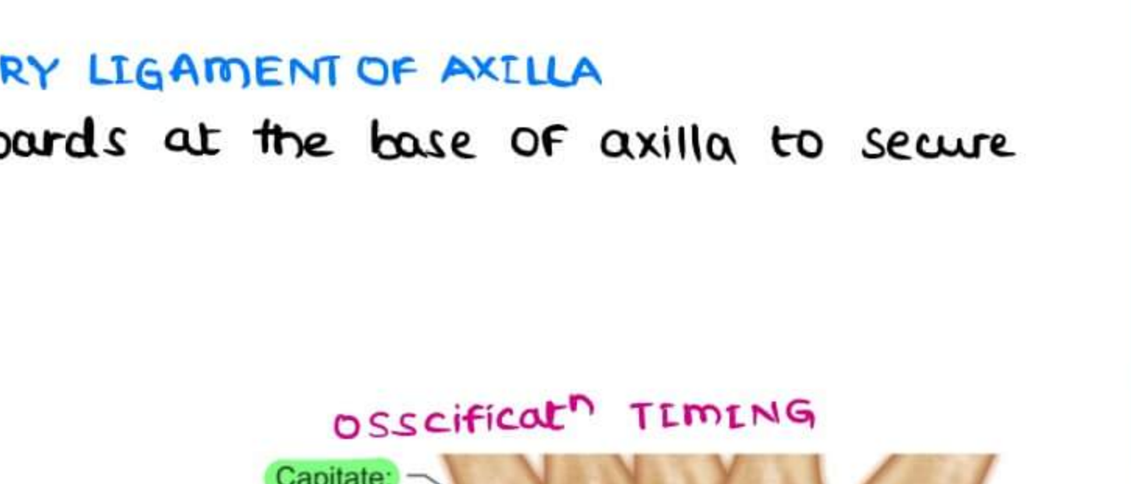
INSERTⁿ → superior surface of coracoid process



→ Splits & encloses pectoralis minor & continue down towards Axillary fascia & merge ⊂ it

→ STRUCTURES PIERCING CPF

1. cephalic vein
2. Lateral pectoral Nerve
3. Thoraco acromian artery (br. of axillary artery)
4. Lymphatics



→ Down ward extension of CPF towards axillary fascia is SUSPENSORY LIGAMENT OF AXILLA

→ helps in pulling the skin upwards at the base of axilla to secure contents of axilla

CARPAL & METACARPAL BONES

CARPAL BONES

→ 8 in number

→ Proximal row (lateral to medial)

She → Scaphoid

LOOKS → Lunate

TOO → Triquetrum

Pretty → Pisiform (smallest)

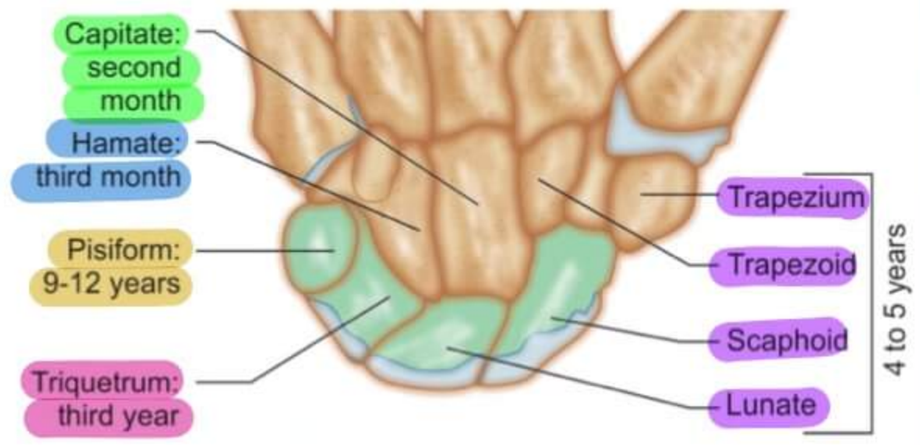
→ Distal row (lateral to medial)

Try → Trapezium

TO → Trapezoid

catch → capitate (largest & centre)

Her → Hamate



→ CAPITATE

→ caput → Head

→ Largest & Central bone

→ 1st bone to ossify

Q WRONG about the first metacarpal is

a Epiphysis is at the head

b Base is convexo - concave for sellar synovial joint

c Doesn't articulate ⊂ other metacarpals

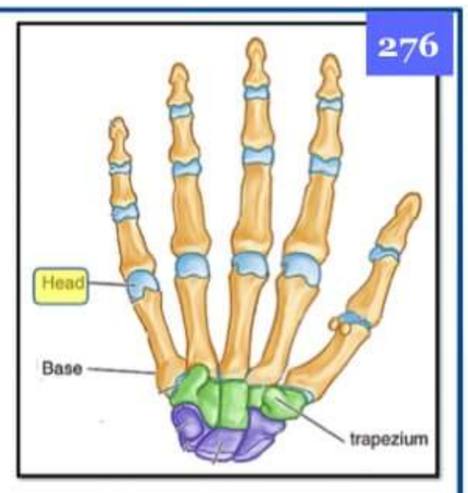
d more anterior & medially rotated

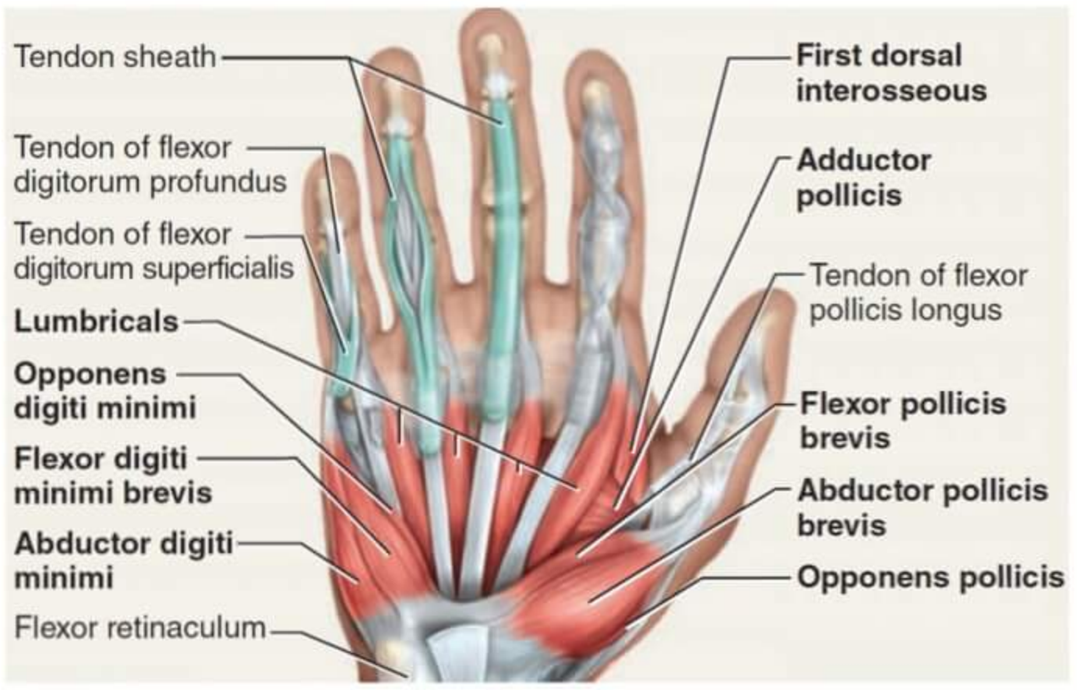
METACARPALS

→ Each metacarpal has 1 centre of ossificatⁿ at head EXCEPT for

1ST METACARPAL

→ present at Base
→ more anterior & medially rotated
→ if present at Head → ABERRANT EPIPHYSIS
→ doesn't articulate ī any other metacarpals
→ articulates ī carpal bone (Trapezium) →
SADDLE SYNOVIAL JOINT
– for thumb opposition





MUSCLES OF HAND

→ 20 muscles
→ THENAR
HYPOTHENAR

THENAR MUSCLES

1. Abductor Pollicis Brevis
2. Flexor Pollicis Brevis
3. Opponens pollicis

} supplied by Median Nerve

HYPOTHENAR MUSCLES

1. Abductor digiti minimi
2. Flexor digiti minimi
3. Opponens digiti minimi

} Supplied by Ulnar nerve

→ Adductor Pollicis Brevis
→ supplied by ulnar nerve
→ not a thenar muscle

→ Abductor Pollicis Brevis purely supplied by median nerve
→ Flexor Pollicis Brevis
Opponens pollicis
} HYBRID MUSCLES → supplied by median & ulnar nerves

8 INTEROSSEI

④ Palmar Interossei → for adduction
④ Dorsal Interossei → for abduction

4 LUMBRICALS

→ ORIGIN → Flexor Digitorum profundus Tendon
→ 1st 2, unipinnate & 3,4 are bipinnate

8 Interossei
4 lumbricals
} flex MCP (metacarpophallangeal joints)
Extend IP (Interphallangeal joints

→ Injury leads to CLAW HAND → Extensⁿ of MCP
IP Flexion

INTEROSSEI

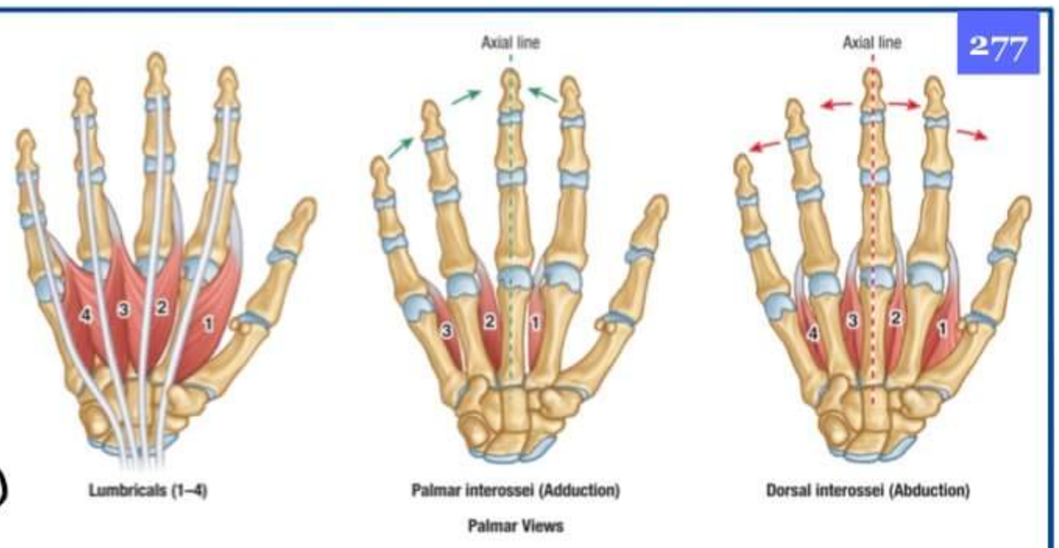
PAD → Palmar for ADduct^{n}

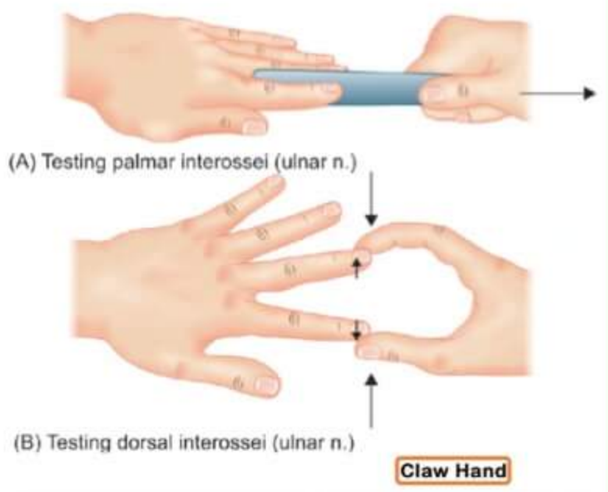
DAB → Dorsal for ABduct^{n}

Middle finger
- → has 2 dorsal interossei
- → has no palmar interossei (in midline)

Palmar Interossei → unipinnate

Dorsal Interossei → Bipinnate





GLASS HOLDING POSTURE

- → MCP flexion
- → IP Extension [Dorsal Digital Extension]

KLUMPKEY'S PALSY

- → Post. fore Arm muscles → MCP Extension
- Ant. fore Arm muscles → IP flexion

} CLAW HAND

Q Identify the function of shown muscle in the diagram

a Flexion at IP Joint

b Extension at MCP Joint

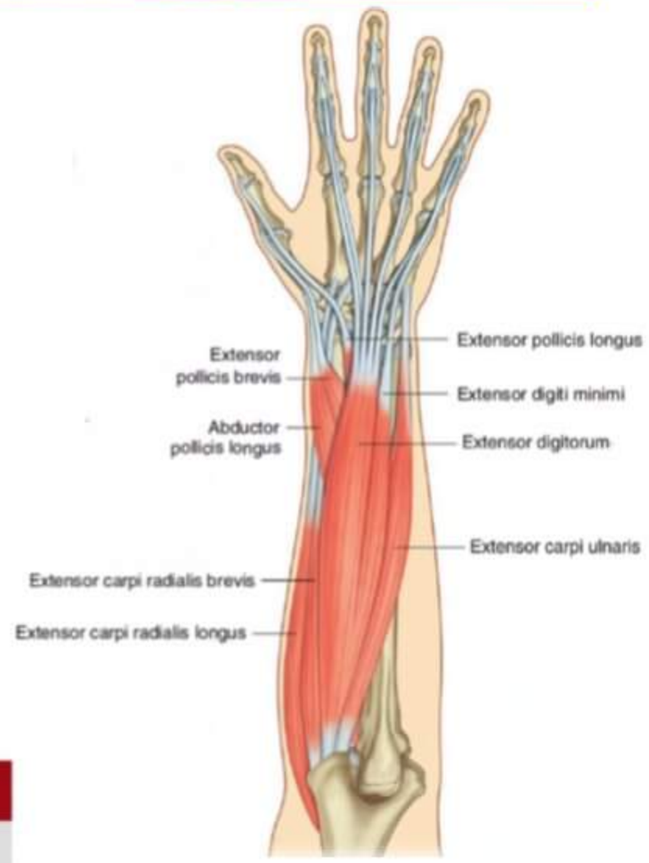
c Flextion at MCP Joint

d Abduction at MCP Joint

POSTERIOR FOREARM MUSCLES

EXTENSOR MUSCLES

1. Extensor Digitorum → for 4 fingers
2. Extensor Pollicis → for Thumb
3. Extensor Digiti minimi → for Little finger
4. Extensor carpi radialis Longus
5. Extensor carpi radialis Brevis
6. Abductor Pollicis longus



Muscles of the Posterior (Extensor) Compartment of the Forearm

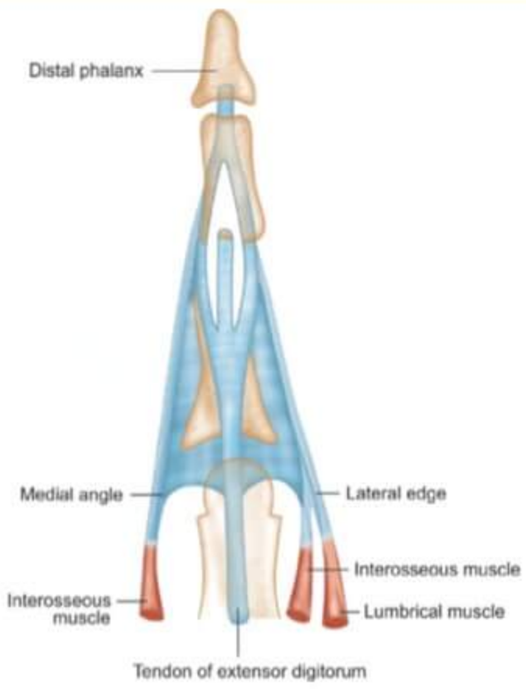
Muscle	Innervation	Action
Brachioradialis	Radial nerve (C5, C6, C7)	Flexes the forearm when in midpronated position
Extensor carpi radialis longus	Radial nerve (C6, C7)	Extends and abducts the hand
Extensor carpi radialis brevis	Deep branch of radial nerve (C7, C8)	Extends and abducts the hand
Extensor digitorum	Posterior interosseous nerve (C7, C8)	Extends the fingers at the metacarpophalangeal joints
Extensor digiti minimi	Posterior interosseous nerve (C7, C8)	Extends the fifth finger at the metacarpophalangeal joints
Extensor carpi ulnaris	Posterior interosseous nerve (C7, C8)	Extends and adducts the hand
Supinator	Deep branch of radial nerve (C7, C8)	Supinates the forearm
Extensor indicis	Posterior interosseous nerve (C7, C8)	Extends the second finger
Abductor pollicis longus	Posterior interosseous nerve (C7, C8)	Abducts the thumb Extends the thumb at the carpometacarpal joint
Extensor pollicis longus	Posterior interosseous nerve (C7, C8)	Extends the thumb at carpometacarpal, metacarpophalangeal, and interphalangeal joints
Extensor pollicis brevis	Posterior interosseous nerve (C7, C8)	Extends the thumb at carpometacarpal and metacarpophalangeal joints

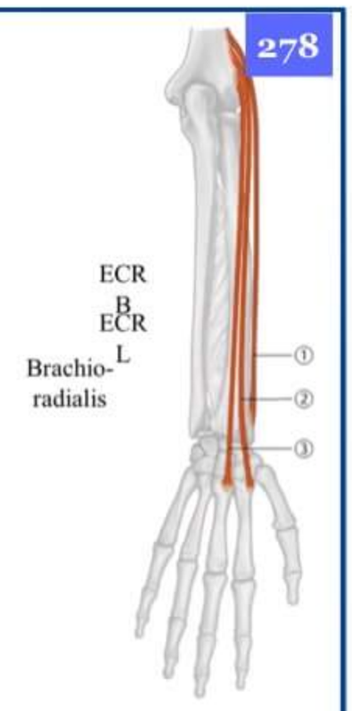
BRACHIO RADIALIS
ECRL
ECRB

} Origin
Lower end of Humerus

INSERTn

Brachio Radialis → Tip of Styloid process of Radial bone
ECRL → Base of meta carpal
ECRB → Base of meta carpal

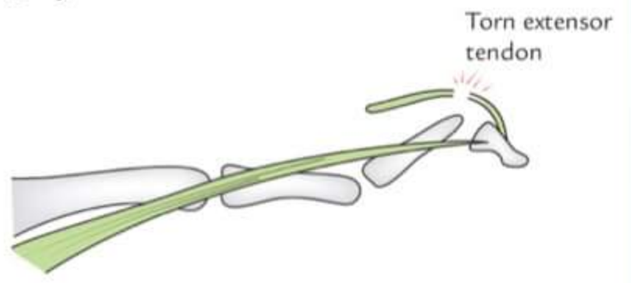




EXTENSOR DIGITORUM

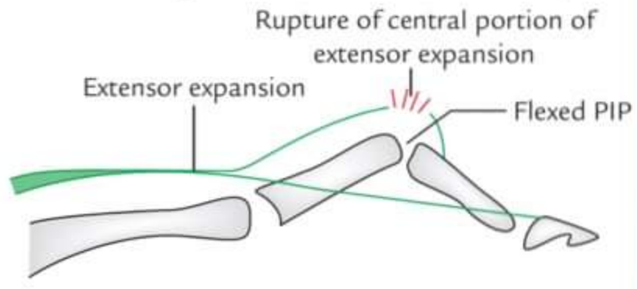
→ has dorsal digital / Interphallangeal Extension
→ Tendon has 3 slips
middle slip insert on middle phalanx
The Lateral slips fuse & insert on base of distal phalanx

→ MALLET FINGER
→ digital slip broken
→ swan neck Deformity



Mallet finger with swan neck deformity.

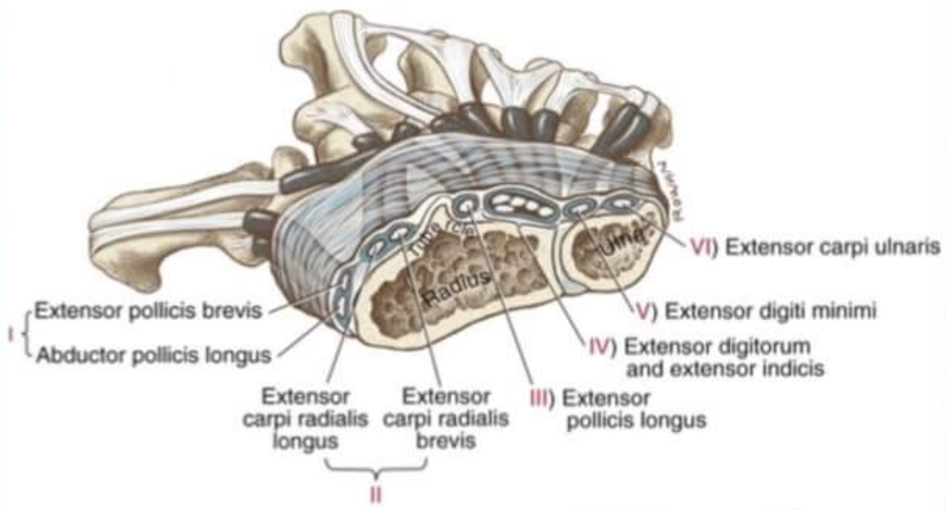
→ BOUTONNIERE (BUTTON HOLE) DEFORMITY
→ middle slip to middle phalanx broken
→ Flexion at PIP
→ Extension at DIP



Boutonniere (button-hole) deformity

EXTENSOR RETINACLUM & COMPARTMENTS

COMPARTMENTS	TENDONS
ANATOMICAL SNUFF BOX	
ANTERO LATERAL WALL 1st compartment	Extensor Pollicis Brevis Abductor pollicis longus
Floor 2nd compartment	ECRL ECRB
3rd compartment	Extensor digitorum
4th compartment	Extensor digitorum minimi
5th compartment	Extensor carpi Ulnar

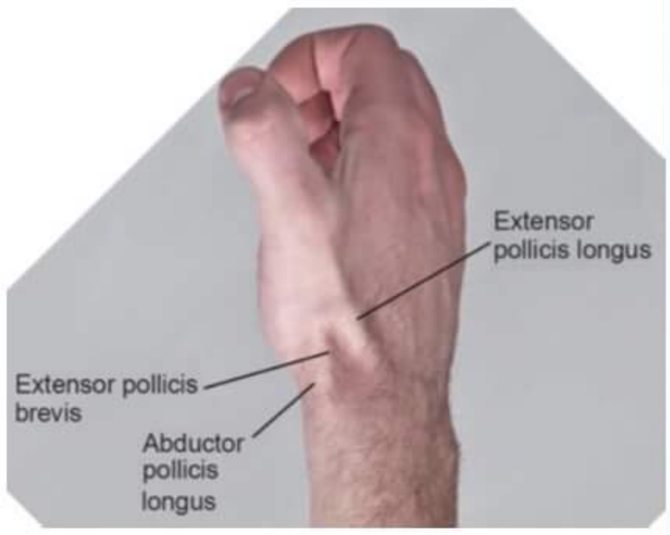


ANATOMICAL SNUFF BOX

BOUNDARIES

ANTERO LATERAL → Extensor Pollicis Brevis
Abductor Pollicis longus

POSTERO MEDIAL → Extensor pollicis longus

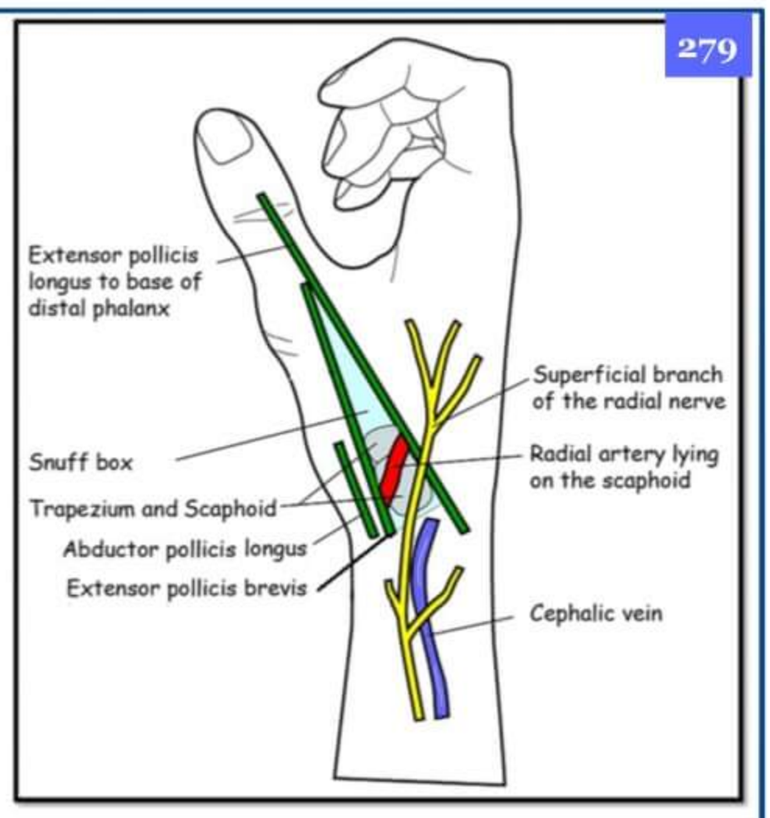


CONTENTS

1. Radial Artery
→ Radial pulse can be felt by compressing Radial artery against Scaphoid
→ Tenderness in anatomical SNUFF box → # of Scaphoid

2. Radial nerve superficial branch
   - → supplies 3 ½ fingers on dorsum of the hand
   - → Present at ROOF

3. Cephalic vein
   - → present at roof
   - → coming from dorsal venous arch



Q Content of Anatomical Snuff Box
a Radial nerve
b Radial artery
c Cephalic vein
d Abductor pollicis longus

Finkelstein-Test

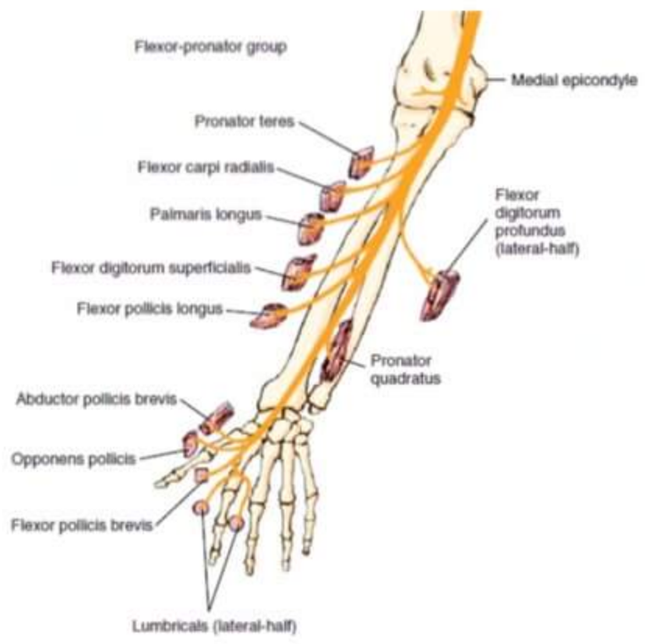
De Quervain's Tenosynovitis

Abductor pollicis longus
- → not an actual boundary
- → Additional boundary
- → more anterior

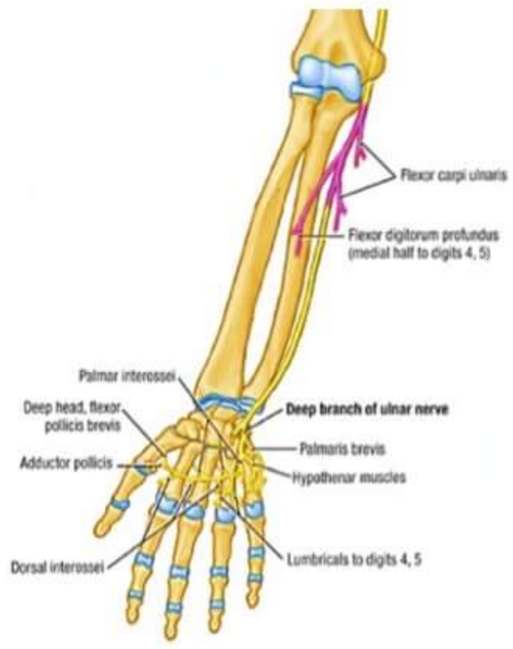
DE QUERVAIN'S TENOSYNOVITIS
- → Extensor Pollicis Brevis, Abductor Pollicis longus inflammed
- → FINKELSTEIN TEST → Sudden ulnar deviat^{n} → painful

NERVE SUPPLY: ANTERIOR FOREARM & HAND MUSCLES

FOREARM → ULNAR NERVE → Flexor carpi ulnaris
Medial half of flexor digitorum profundus



Median Nerve



Ulnar Nerve

→ Palmaric brevis of Hand → Ulnar nerve
→ MEDIAN NERVE → purely Supply Abductor pollicis brevis & 2,3 Lumbricals

	Median nerve C5–T1
A. Forearm	
• **Anterior compartment** except 1.5 muscles by ulnar nerve (flexor carpi ulnaris and the ulnar half of the flexor digitorum profundus)	Flex wrist and all digits Pronation
B. Hand	
• **Thenar compartment**	Opposition of thumb
• **Central compartment** Lumbricals: Digits 2 and 3	Flex metacarpophalangeal (MP) and extend interphalangeal (PIP and DIP) joints of digits 2 and 3

	Ulnar nerve C8–T1
A. Forearm	
Anterior Compartment: 1 [1/2] muscles not innervated by the median nerve	Flex wrist (weak) and digits 4 and 5
B. Hand	
• Hypothenar compartment	
• **Central compartment** – Interossei muscles: Palmar and Dorsal	Dorsal – Abduct digits 2-5 (DAB) Palmar – Adduct digits 2-5 (PAD) Assist Lumbricals in MP flexion and IP extension digits 2–5
• Lumbricals: Digits 4 & 5	Flex MP and extend PIP & DIP joints of digits 4 and 5
• Adductor pollicis	Adduct the thumb

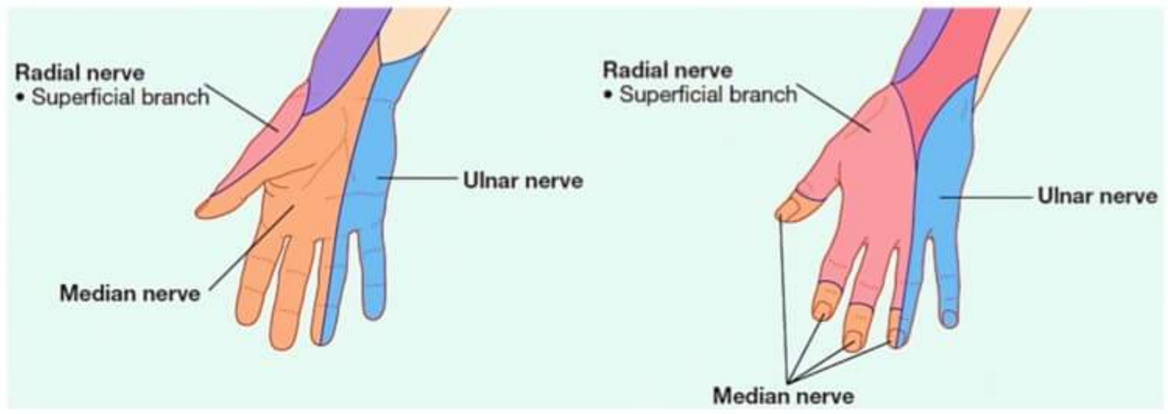
Q Which of the following muscle has dual nerve supply

a Flexor digitorum profundus

b Interossei

c Palmaris brevis

d Flexor carpi ulnaris



CUTANEOUS SUPPLY OF HAND

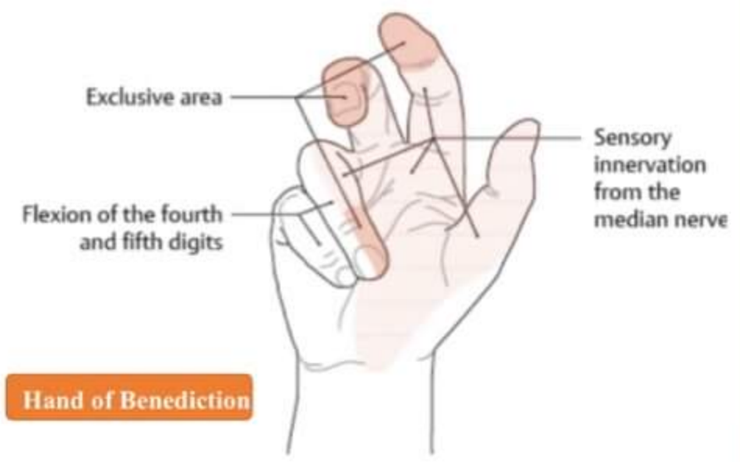
MEDIAN NERVE → 3½ finger anteriorly & 3½ Nail beds posteriorly

RADIAL NERVE → 3½ of fingers except nail beds of dorsum of Hand

ULNAR NERVE → medial 1½ fingers anteriorly & posteriorly

MEDIAN NERVE LESIONS

Nerve involved	Cause of injury	Clinical features
Median nerve	**Supracondylar fracture** (humerus); **wrist slash injury**; **carpal tunnel syndrome**	**Ape thumb deformity**; **Benediction hand**; Weakness in wrist flexion; hand deviates to ulnar side on flexion; flexion of index and middle finger is lost; anterior abduction, opposition and flexion of thumb is compromised; sensory loss on the lateral 3 & 1/2 fingers; difficulty in making an 'O' with thumb and index finger;  **Hand of Benediction**



HAND OF BENEDICTION

→ high median nerve injury
→ Lateral half of FDP paralysed
→ unable to fold& digits& 2, 3 while making fist
→ flexion OF 4 th & 5 th digits
→ Sensory loss over 3 ½ fingers& anteriorly & 3 ½ nail beds posterrorly

Q A patient is trying to make a fist, but can only partially flex index & middle finger. which nerve is damaged most probably

a Median

b Ulnar

c Radial

d Ant. interosseous nerve

Q Most common nerve damaged in supra condylar # is

a Median

b Ant. interosseous

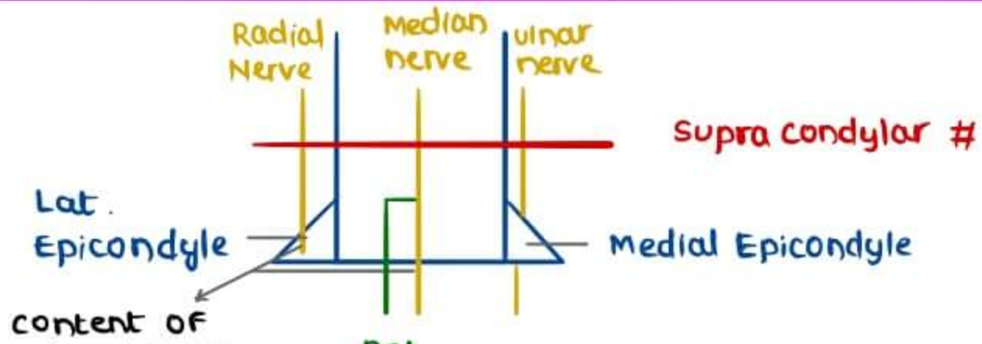
c. Radial

d Ulnar

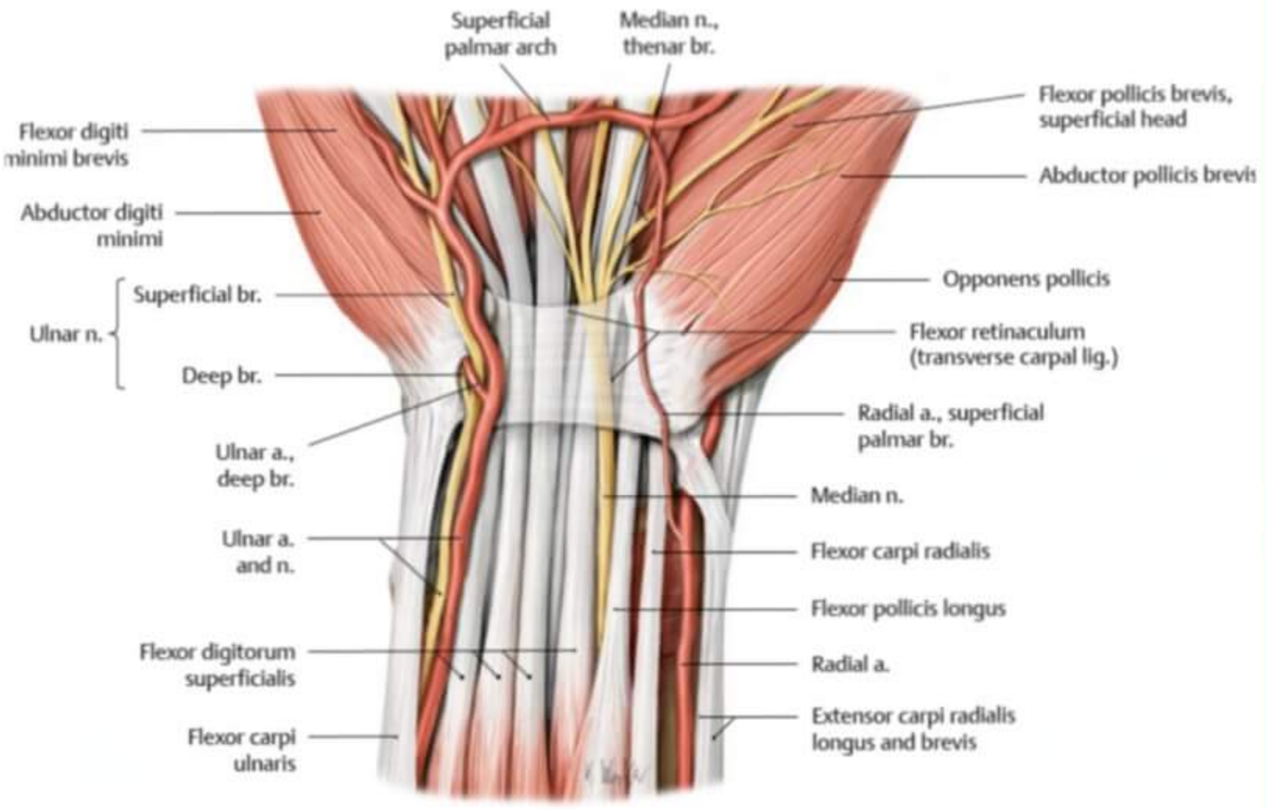
b > a > c > d

SUPRACONDYLAR

→ Nerve passing ant. to lat. epicondyle → Radial Nerve
Nerve passing post. to med. epicondyle → Ulnar nerve



- Supply deep muscles of ant. fore arm
- 2.5 muscles
  - Flexor Pollicis longus
  - Pronator Quadratus
  - FDP (Lateral half)



→ mc damaged nerve → Ant. Interosseous nerve (br. of median nerve)
Partial median nerve injury
Less often Radial nerve injured
Ulnar nerve rarely injured

WRIST SLASH INJURY

NERVES DAMAGED ARE

Median nerve → mc injured
dlt superficial presence
Flexor reticulum can't protect here

Ulnar nerve → less often

MEDIAN NERVE

→ before passing flexor retinaculum, gives Palmar cutaneous branch & supplies Palm area
→ under retinaculum, gives recurrent branch & supplies to thenar muscles & supply to skin of 3½ fingers anteriorly & nail beds of 3½ Fingers posteriorly
→ In carpal tunnel syndrome, palm sensatn is intact, fingers have tingling

ULNAR NERVE

→ passes in GUYON'S CANAL, superficial to Flexor retinaculum & gives deep branch

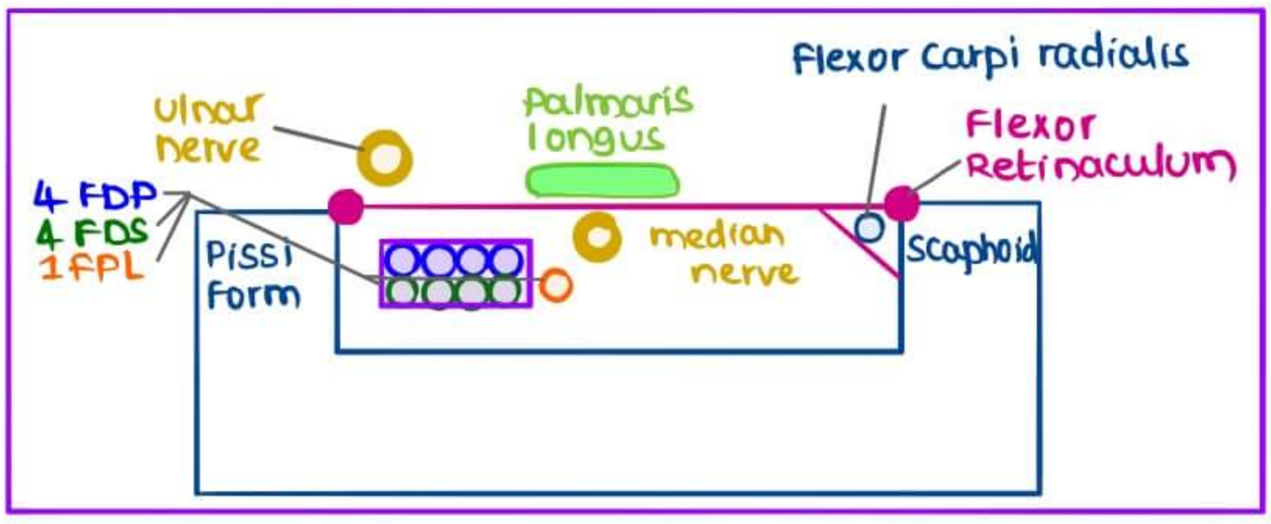
Q Which of the following is mc damaged nerve in wrist slash injury
a Median
b Ulnar
c Radial
d Ant. interosseous

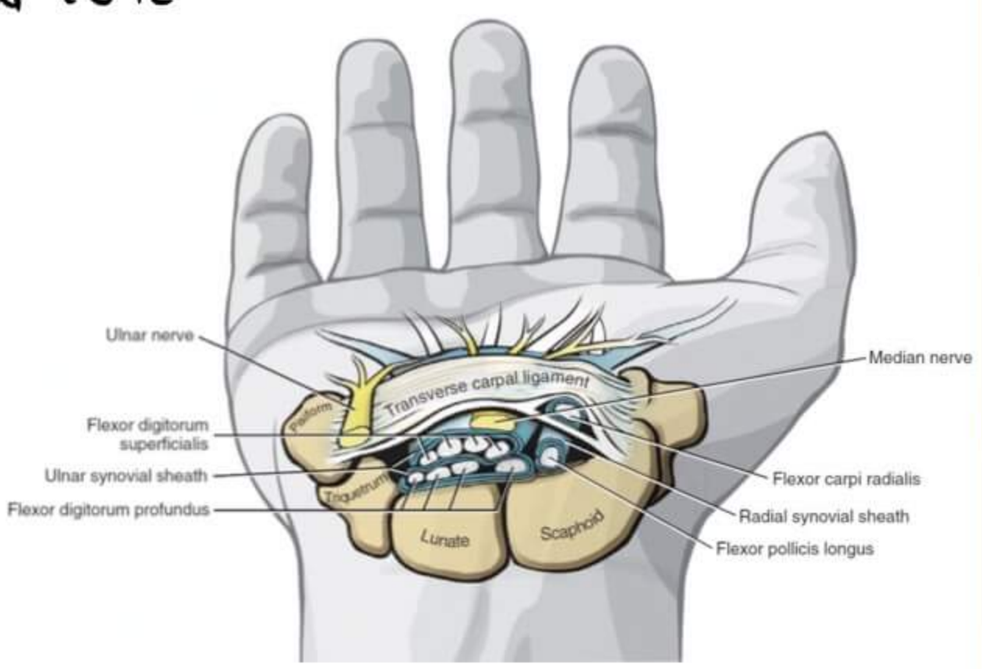
Q Which of the following nerve is damaged in wrist slash injury
a Median
b Ulnar
c median & ulnar
d median & radial

CARPAL TUNNEL SYNDROME

→ computer operator ī repeat stress injury

→ FLEXOR RETINACULUM
  → attaching to scaphoid & pisiform
  → 4 tendons of FDS & 4 tendons of FDP & 1 tendon of FPL passes behind it along ī median nerve
  → Flexor carpi radialis EMBEDED in flexor retinaculum
  → ulnar nerve is passing superficial to it





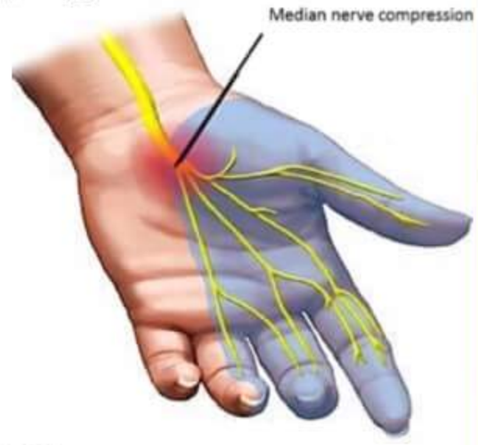
→ tendon of palmaris longus passes superficial & fuses ī flexor retinaculum

REPEAT STRESS INJURY

→ Leads to carpal tunnel syndrome

→ compression of median nerve ī inflammatⁿ of g flexor tendons

→ Tingling sensatⁿ in 3 ½ fingers including nail bed
  Palm area spared (dlt patency of palmar cutaneous branch)

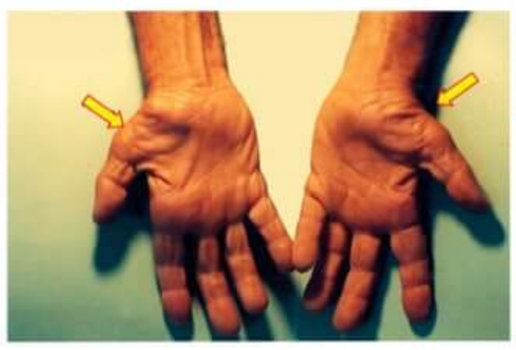


→ PHALEN'S TEST
  → Tests the compression of median nerve
  → On compression of median nerve, more tingling occurs

→ TINEL'S TEST
  → hit regenerating nerve (median nerve), if ↑ Tingling sensatⁿ → Good sign

→ APE THUMB | HAND DEFORMITY
  → dlt prolonged carpal tunnel syndrome (median nerve injury)
  → Thenar atrophy
  → Thumb in adductⁿ deformity dlt overactive adductor pollicis supplied by ulnar nerve
  → PEN TEST is positive (not able to touch the pen)

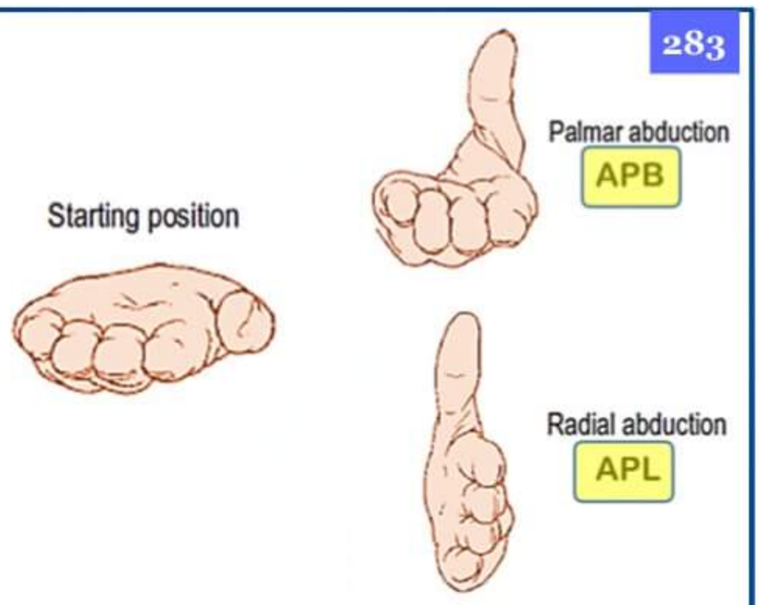
Ape Hand deformity



MOVEMENTS OF THUMB

FLEXION → Folding the thumb

EXTENSION → Unfolding the thumb



THUMB OPPOSITION → 3 movements

- Ant. abduction → by Abd. pollicis brevis
- medial rotation → by Opponens pollicis
- Flexion → by Flexor pollisis brevis

ANTERIOR/PALMAR ABDUCTION → carried by Abductor pollicis brevis
ANTERIOR ADDUCTION

LATERAL/RADIAL ABDUCTION

→ by Abductor pollicis longus

→ supplied by Posterior interosseous n. (br. of Radial n

LATERAL ADDUCTION

→ by adductor pollicis

→ supplied by Ulnar nerve

In REPEAT STRESS INJURY | MEDIAN NERVE INJURY / CARPAL TUNNEL SYNDROME

→ Ant. abduct^{n} is lost

→ Thumb opposit^{n} lost (clt paralysis of Abductor pollicis brevis)

→ Lat. abduct^{n} possible

→ Thumb Flexion not affected

→ carried by Flexor pollicis is longus from ant. forearm

→ Supplied by Ant. Interosseous N. (Br. of MEDIAN NERVE)

→ Medial nerve is injured at carpal tunnel

→ proximal area to the injury is spared

→ Thumb Extens^{n} not affected

→ carried by Extensor pollicis longus

→ supplied by Post. interossious nerve (br. of Radial n.)

→ Thumb adduct^{n} not affected

→ carried by adductor pollicis

→ supplied by Ulnar nerve

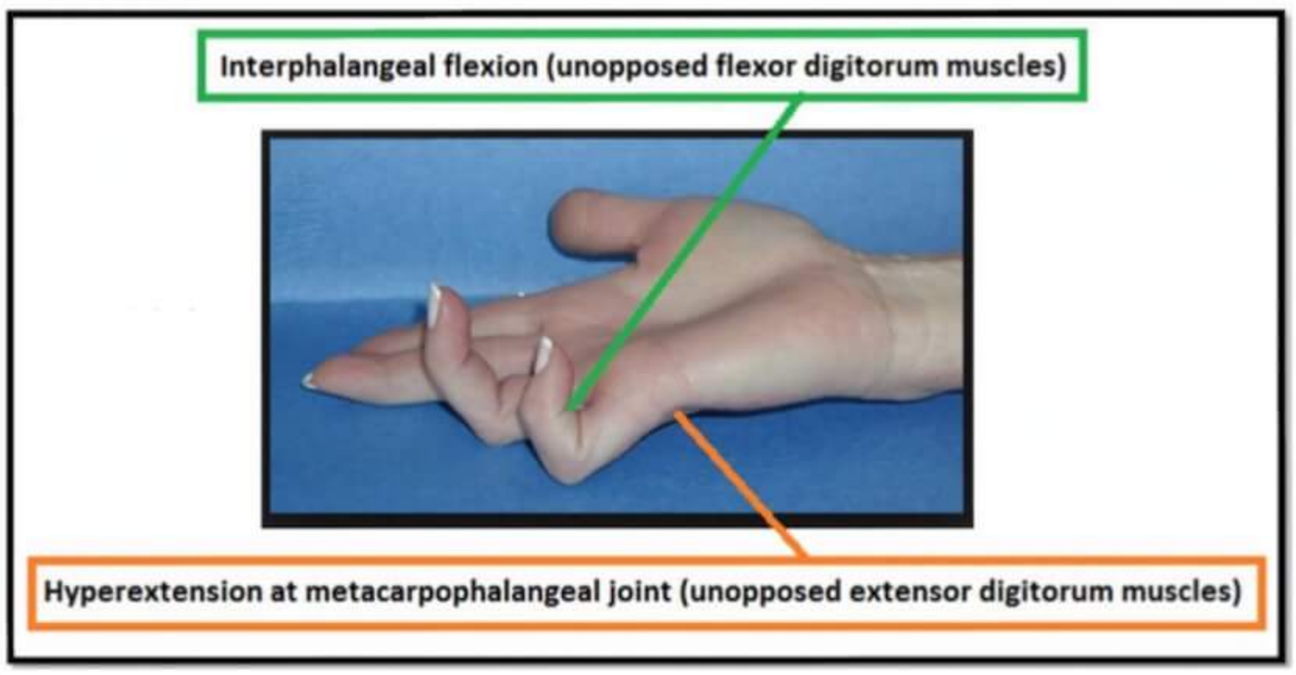
Q Carpal tunnel syndrome produces inability to
a Adduct the thumb
b Abduct the thumb
c Flex the distal phallanx of thumb
d oppose the thumb

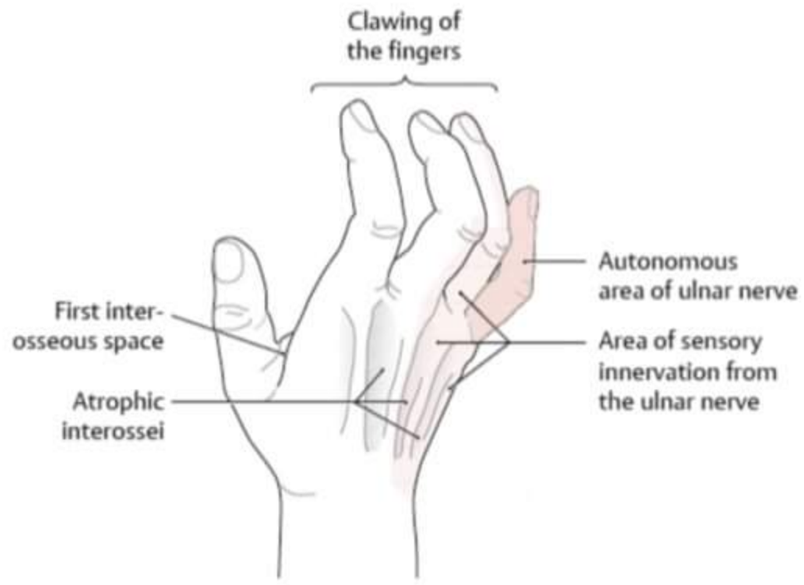
→ Rx by cutting the flexor retinaculum in zigzag fashion & releive the pressure

ULNAR NERVE LESIONS

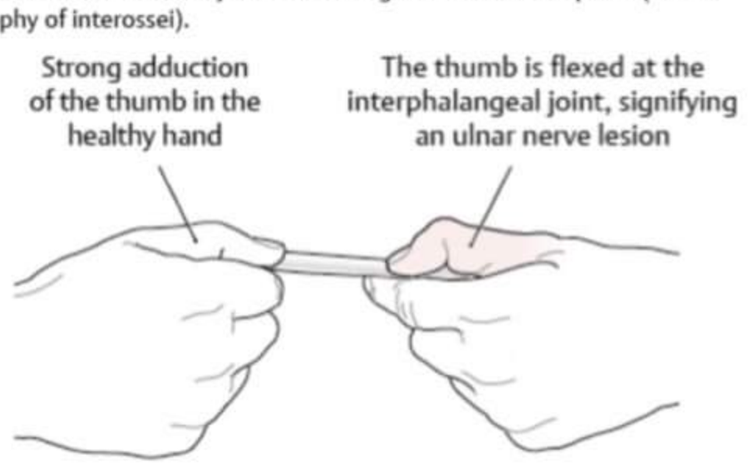
CLAW HAND

Ulnar Claw Hand (Paralysed lumbricals for ring & little fingers)





A "Claw hand" deformity with hollowing of interosseous spaces (due to atrophy of interossei).



B Positive "Froment sign" indicating palsy of the adductor pollicis muscle.

→ Ulnar FDP compromised
→ Ulnar lumbricals, interossei compromised
→ IP flexion
→ MCP hyperextension

ULNAR PARADOX

→ Normally, Higher level nerve injury causes more problems & vice versa
In Ulnar nerve injury, Lower level injury causes more problems & vice versa

→ Supplies FDP medial half
→ Supplies lumbrical & interossei

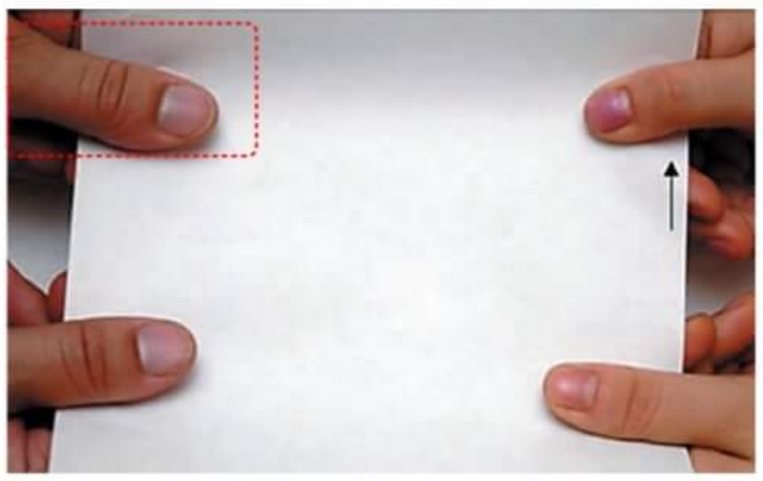
→ Ulnar nerve injury at wrist → more clawing
→ Lumbrical, interossei paralysed } IP Flexn
→ unopposed action of FDP

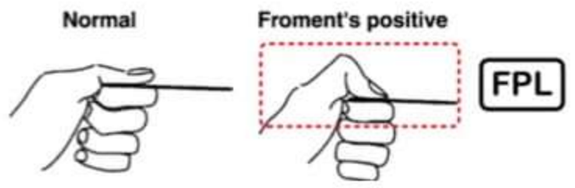
→ Ulnar nerve injury at elbow → less clawing
→ Lumbrical, interossei & FDP paralysed

→ HIGH ULNAR NERVE INJURY → LESS CLAWING

Simply put, as reinnervation occurs along the ulnar nerve after a high lesion, the deformity will get worse (FDP reinnervated) as the patient recovers—hence the use of the term 'paradox'

Q Froment test is to check which muscle
a Opponens pollicis
b Flexor pollicis brevis
c Flexor pollicis longus
d Adductor pollicis





FROMENT TEST

→ hold the paper, ask the patient to pull it
→ NORMAL,
Adductor pollicis holds the paper

→ FROMENT POSITIVE
Thumb Flexion (Flexor pollicis longus) to hold the paper
Ulnar nerve injured → Adductor pollicis paralysed

RADIAL NERVE LESIONS

Radial nerve C5–T1	**Posterior compartment** muscles of the arm and forearm	Extend MP, wrist, and elbow Supination (supinator muscle)

WRIST DROP → loss of wrist extension

FINGER DROP → loss of finger extension

→ Metacarpophalangeal joint Lost

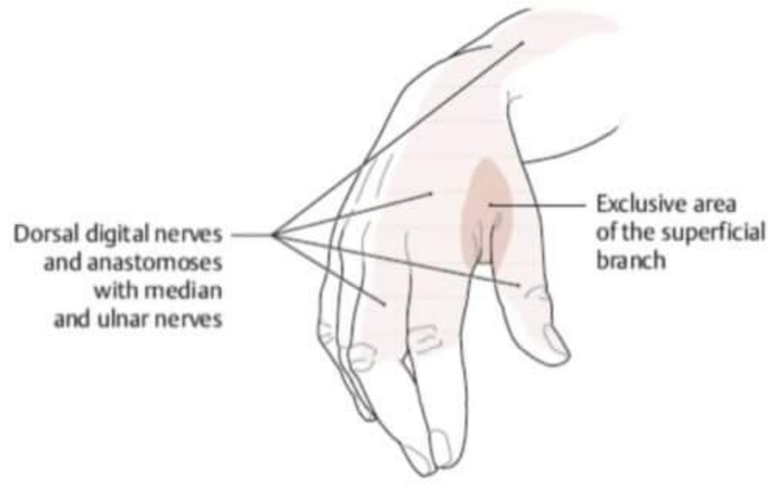
→ Interphalangeal joint not affected

– lumbricals & interossei supplied by Ulnar nerve

Radial Nerve Injuries

Nerve involved	Cause of injury	Clinical features
Radial nerve	Crutch palsy; Saturday night palsy; Fracture mid-shaft humerus	Loss of extension at multiple joints; Wrist drop (loss of wrist extension); weakness of supination and finger extension; sensory loss on arm, forearm and dorsum of hand

Wrist drop



WRIST DROP

→ Feature of Radial nerve injury

→ RADIAL NERVE

→ Supplies Dorsum of medial 3 ½ fingers (excluding nail beds)

→ Sensory loss of middle phalanx, proximal phalanx & dorsum of 1st web space

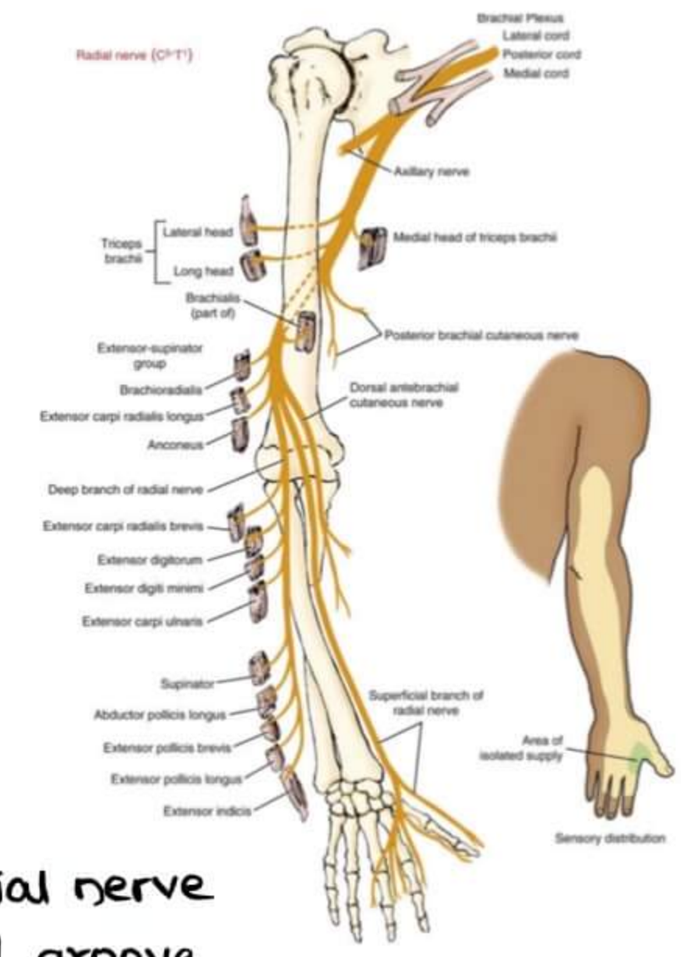
Q Finger drop i no wrist drop is caused by lesion of

a Radial nerve in radial groove

b Posterior interosseous nerve

c Anterior interosseous nerve

d Ulnar nerve behind medial epicondyle



POSTERIOR INTEROSSEOUS NERVE

→ Branch of Radial nerve

→ pure motor nerve (no sensory loss)

RADIAL NERVE COURSE

→ Posterior cord of Brachial plexus in axilla gives Radial nerve

→ Radial nerve passes behind the humerus in radial groove

→ reach front of lateral epicondyle & supplies

Triceps, Anconeus } in the groove

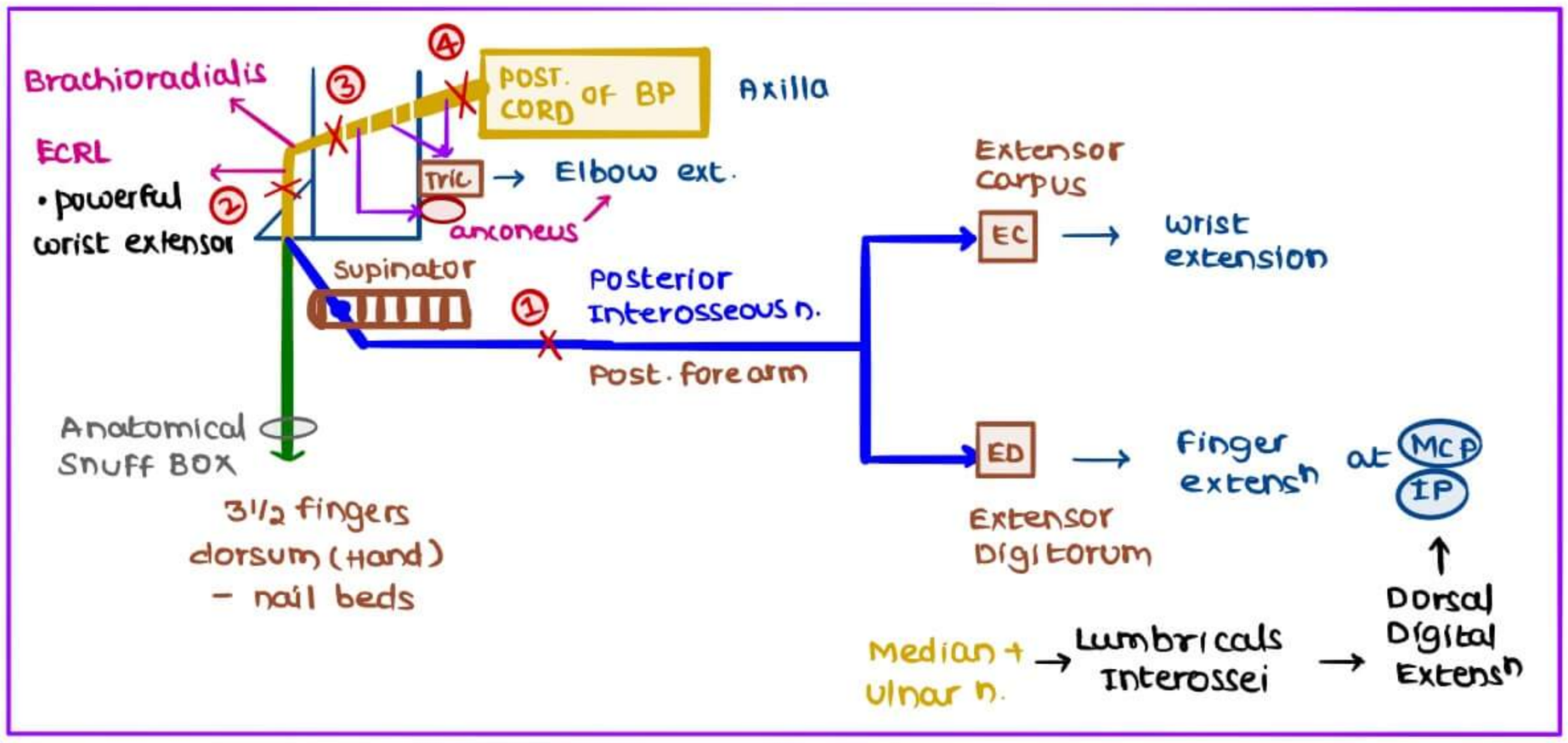
→ comes out of the groove & Supplies

Extensor carpi radialis

Brachioradialis

→ then divides into

1. Posterior Interosseous nerve (motor branch) → supplies post. fore arm extensor muscles
2. cutaneous branch → passes the roof of anatomical snuff box & supplies dorsum of 1st web space & skin of 3 ½ fingers (excluding nail beds)



① Poster Interosseous Nerve Entrapment injury
- → Finger drop at MCP Joint
- → IP extension not affected
- → NO sensory loss
- → NO wrist drop (ECRL is not affected)

② SUPRA CONDYLAR #
- → Low radial nerve injury
- → No wrist drop (ECRL not affected)
- → Finger drop at MCP joint
- → sensory loss at dorsum of hand
- → weakness of supination (supinator is paralysed)

③ # mid shaft humerus
- → Radial nerve injured in radial groove (L3)
- → wrist drop
- → only triceps is spared
- → sensory loss of dorsum of 3½ fingers of hand
- → weakness in supination
- → finger drop at MCP JOINT
- → IP extensn not affected
- → Br. to anconeus injured some times
  - → still elbow extension is possible (Triceps Spared)

Ⓐ CRUTCH PALSY
- → Radial nerve injured in axilla
- → Elbow extension Lost
- → IP Extension not affected (L&I spared)

→ Nerve supply to supinator is similar to : Extensor digitorum

Q All are affected In low radial nerve palsy EXCEPT
a Extensor carpi radialis longus
b Extensor carpi radialis brevis
c finger Extensors
d sensatn on dorsum of hand

Q Injury to radial nerve in lower part of spiral groove may result in all EXCEPT

a Spare nerve supply to extensor carpi radialis longus

b results in paralysis of anconeus muscle

c Leave extension at elbow joint intact

d weakens supinatn movement

→ Dynamic cock up Splint is indicated in high radial nerve injury
  → to keep MCP Joint into extension
  → to keep wrist joint into extension

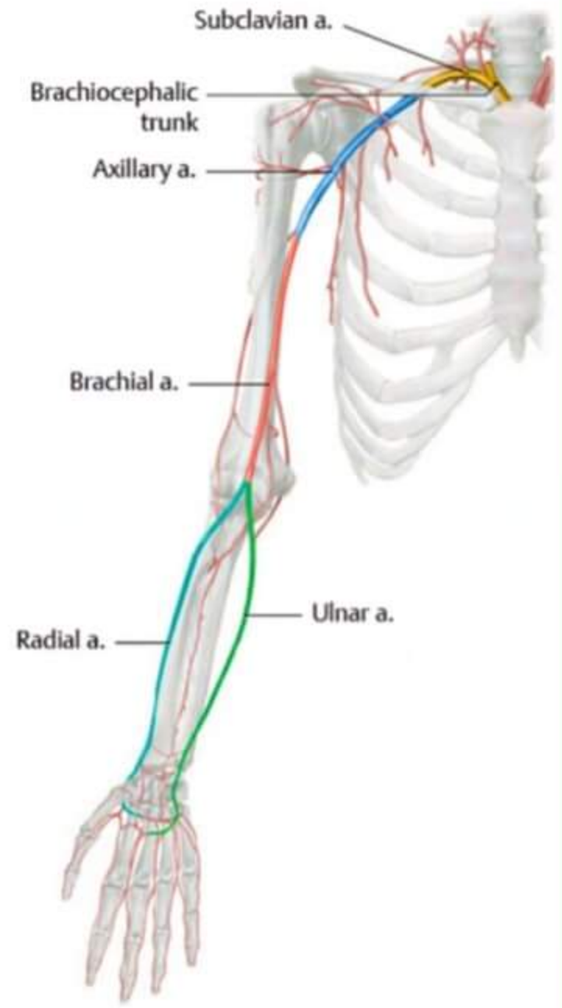
NERVE LESIONS: COMPARATIVE ANALYSIS

NERVE INJURIES

"Hand of benediction"
(a) Median nerve injury in elbow region

Clawhand
(b) Ulnar nerve injury

Wrist-drop
(c) Radial nerve injury



ARTERIAL SUPPLY

SUB CLAVIAN ARTERY

→ comes from neck region, under clavicle & cross outer border of 1st rib to enter axilla to become AXILLARY ARTERY & after crossing lower border of Teres major to enter arm & become BRACHIAL ARTERY

AXILLARY ARTERY

1st PART → 1 Branch
2nd PART → 2 Branches
3rd PART → 3 Branches

→ Brachial artery comes down & become a content of cubital fossa & divides into RADIAL ARTERY & ULNAR ARTERY

→ Radial Artery becomes DEEP PALMAR ARCH
  Ulnar Artery becomes SUPERFICIAL PALMAR ARCH

ARCH OF AORTA gives

1. BRACHIO CEPHALIC TRUNK
2. Lt. COMMON CAROTID ARTERY
3. Lt. SUBCLAVIAN ARTERY

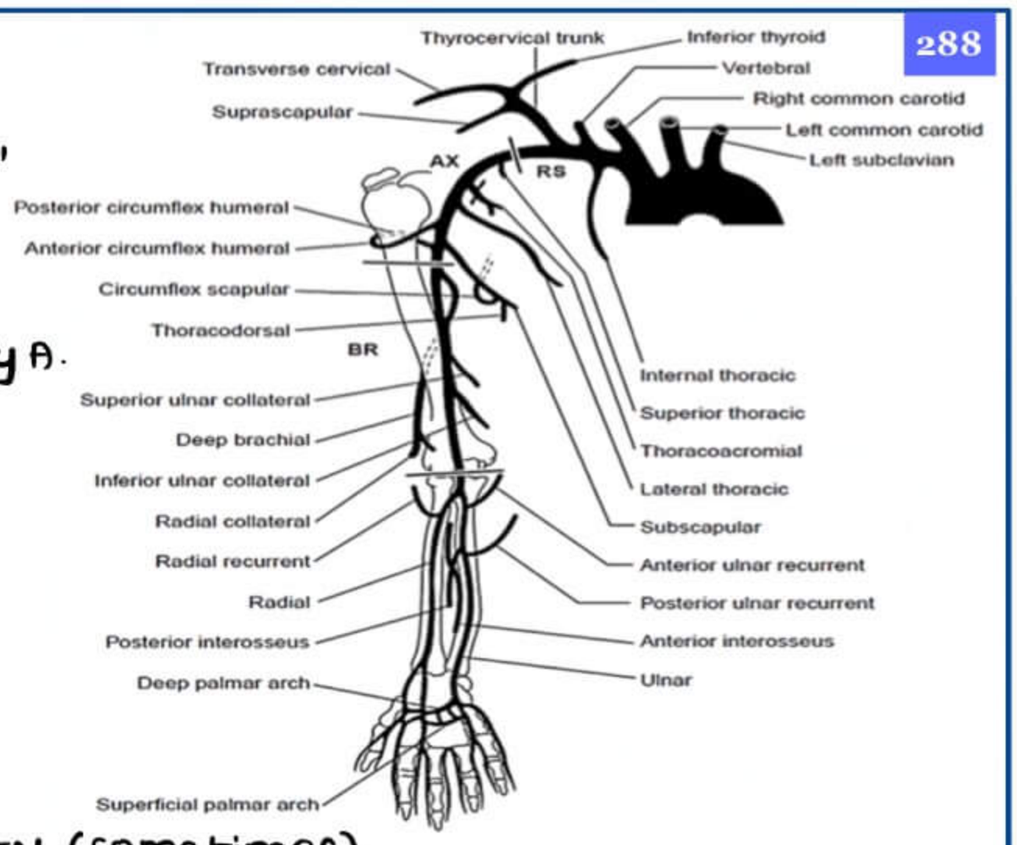
BRACHIOCEPHALIC ARTERY

→ Divides into
  1. Rt Subclavian artery (to UL)
  2. Rt. Common carotid artery (to head & neck)

SUBCLAVIAN ARTERY

→ Before crossing the outer border of 1st rib, gives 3 branches (from 1st PART)

- V → Vertebral Artery
- I → Internal thoracic / Int. mammary A.
- T → Thyrocervical Trunk



→ THYROCERVICAL TRUNK Gives

- S → Supra Scapular artery
- I → Inferior thyroid artery
- T → Transverse cervical artery
  - → Gives Dorsal Scapular Artery (sometimes)
  - → usually a branch of 3rd part

→ After passing outer border of 1st rib, enter Axilla as AXILLARY ARTERY

AXILLARY ARTERY

→ Extent → from outer border of 1st Rib to Lower border of Teres major

→ divides into 3 parts by Pectoralis minor

- 1st part → proximal to muscle
- 2nd part → deep to muscle
- 3rd part → distal to muscle

→ PART 1 – BRANCHES

1. SUPERIOR THORACIC ARTERY
   - → Supplies mammary gland
   - → do not contribute to Scapular anastomosis

→ PART 2 - BRANCHES

1. THORACO ACROMIAL
2. LATERAL THORACIC

} Supply mammary gland & thorax

→ PART 3 – BRANCHES

1. ANTERIOR CIRCUMFLEX HUMERAL ARTERY
2. POSTERIOR CIRCUMFLEX HUMERAL ARTERY

} anastomose at surgical neck of Humerus

3. SUB SCAPULAR ARTERY
   - → contributes to scapular anastomosis

MAMMARY GLAND SUPPLY

1. Internal Thoracic A.
2. Superior Thoracic A.
3. Lateral Thoracic A.
4. Sub scapular A.
5. PICA branches of Descending Thoracic Aorta
   PICA → Post. Inter Costal Arteries

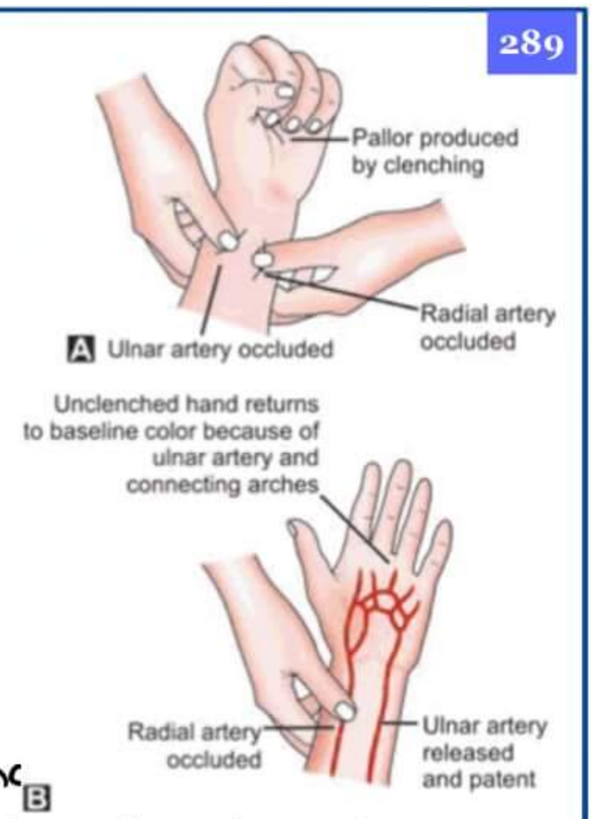
Axillary artery continues as BRACHIAL ARTERY at Lower border of Teres major & becomes a content of cubital fossa

BRACHIAL ARTERY

→ divides into 2 branches in cubital fossa
1. RADIAL ARTERY
2. ULNAR ARTERY

→ Radial Artery becomes DEEP PALMAR ARCH
Ulnar Artery becomes SUPERFICIAL PALMAR ARCH

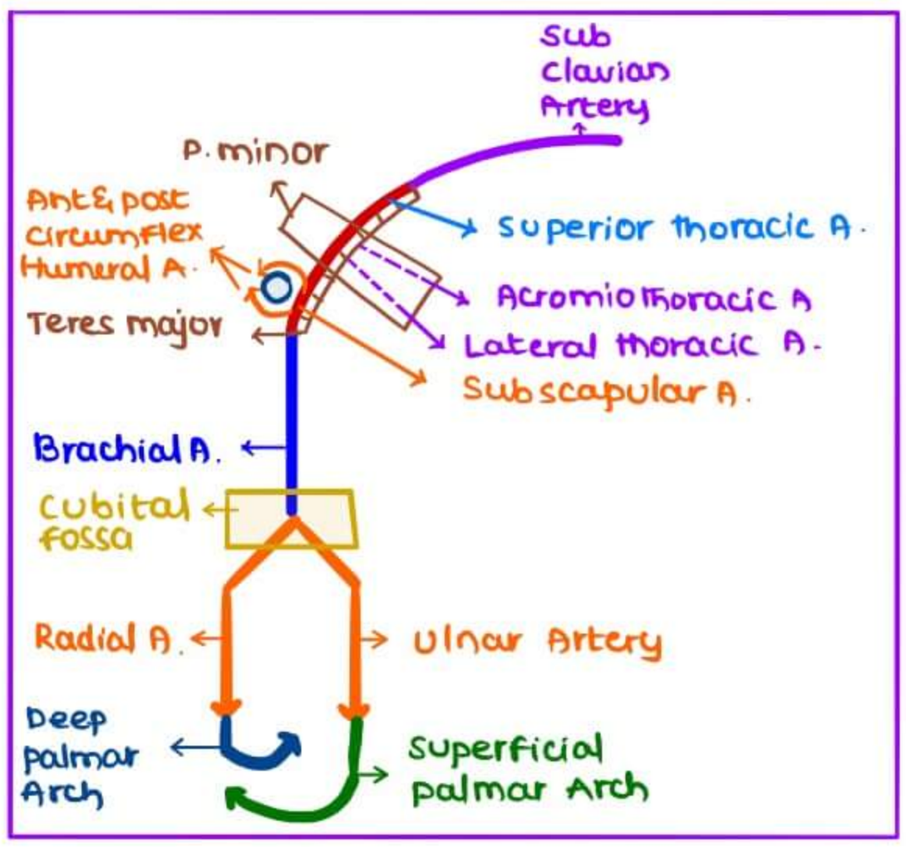
→ ALLEN'S TEST
→ checks the communication b/w deep & superficial palmc
→ done before taking radial artery blood sampling to check the thrombus
→ PROCEDURE
→ Block both arteries asking the patient to make a fist, on opening the hand pallor observed
→ release ulnar artery, to chect the patency of ulnar artery whether it is capable of supplying thumb or not.

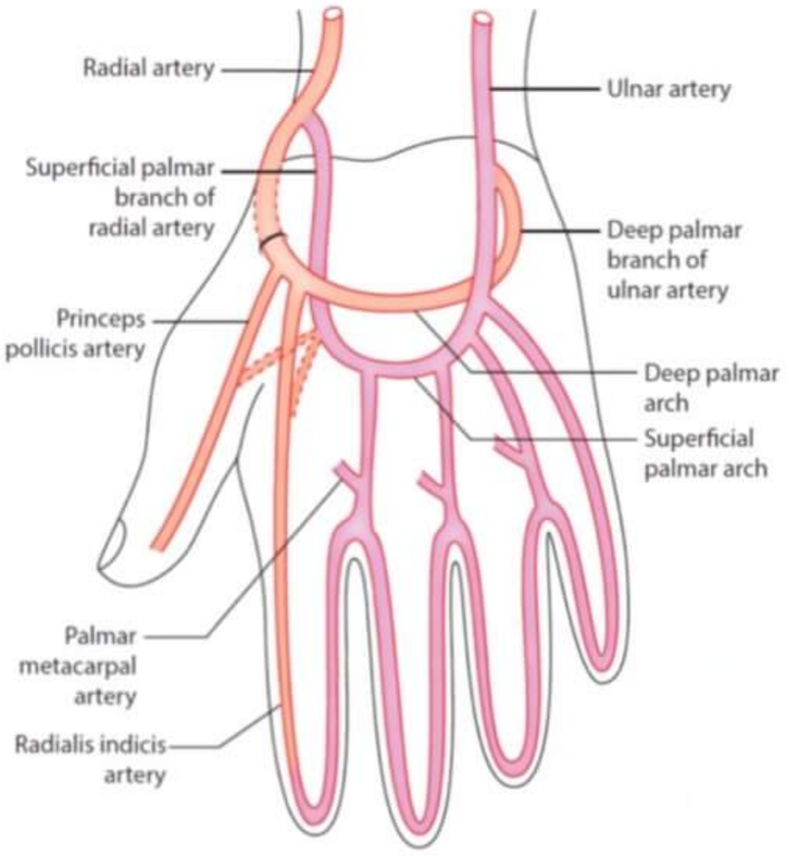


PALMAR ARCHES

→ Ulnar artery
→ supply 3½ fingers (skin & deeper aspects also)

→ Radial artery gives
Princeps pollicis artery → supplies the thumb (lateral & medial side)
Radialis indices artery → Lateral side of index finger





Q In a subclavian artery block at the outer border of 1st rib all of the following arteries help in maintaining the circulatn to upper limb EXCEPT
a Thyrocervical trunk
b Supra scapular
c Subscapular
d Superior thoracic

SCAPULAR ANASTOMOSIS

→ Branches of AXILLARY ARTERY anastamose ī Branches of SUBCLAVIAN ARTERY
→ AXILLARY ARTERY BRANCHES
→ Subscapular artery
→ Circumflex Scapular A. (br. of Subscapular A.)
→ Thoraco dorsal artery (continuatn of Subscapular A.)

→ SUB CLAVIAN ARTERY BRANCHES

→ Thyro cervical Trunk

→ Supra scapular artery

→ Transverse cervical artery → Dorsal scapular artery (rare)

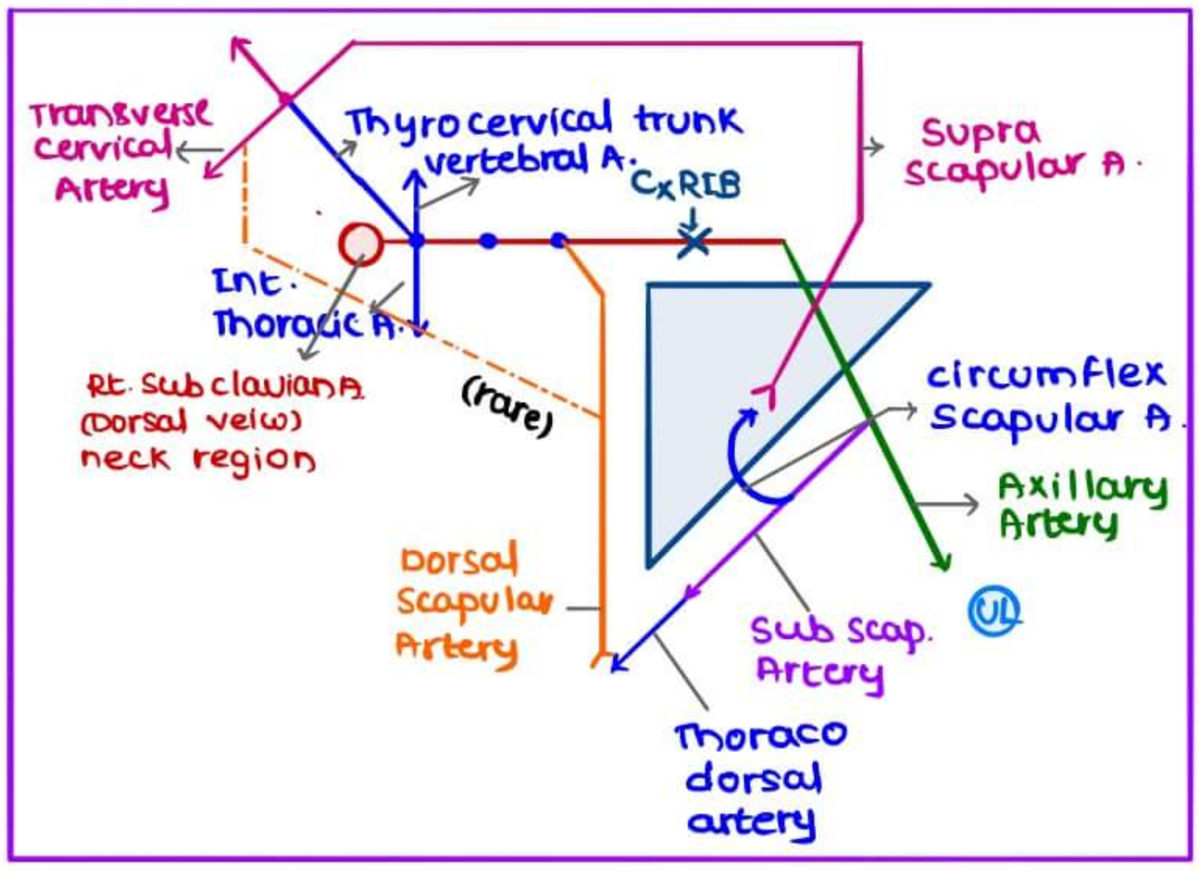
→ Dorsal scapular artery

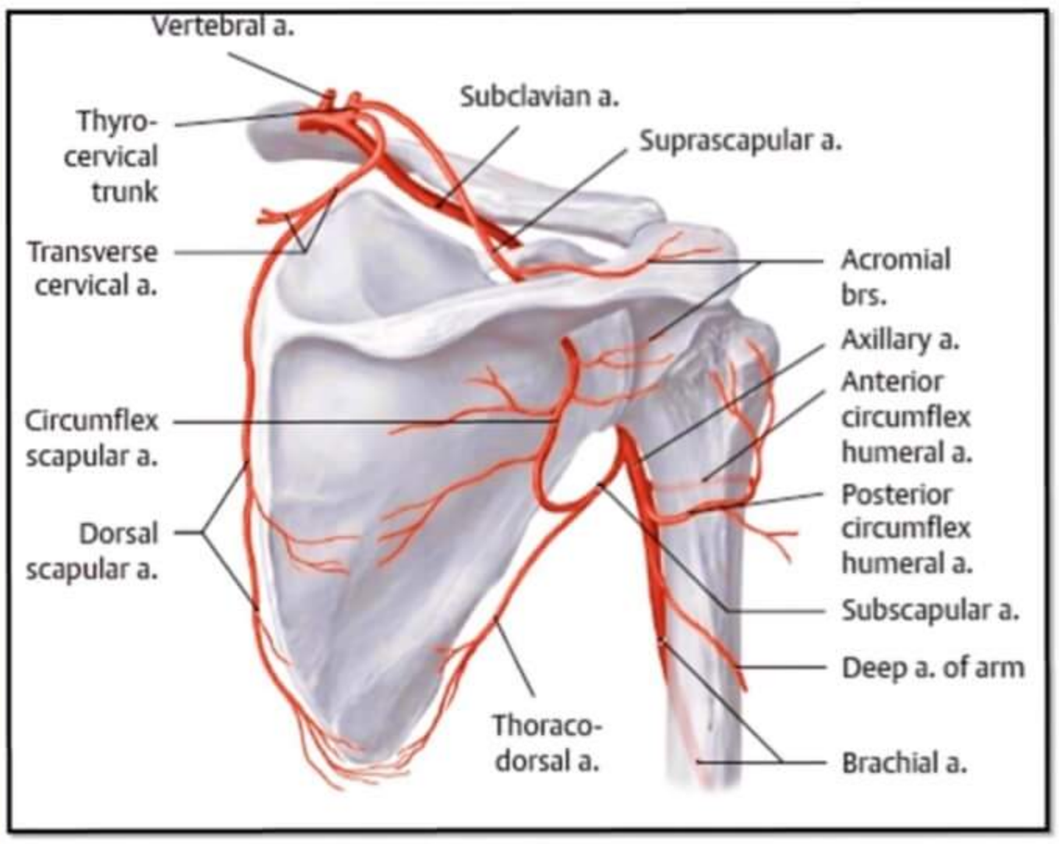
→ ANASTOMOSES

→ Supra scapular artery + Circumflex scapular artery

→ Dorsal scapular artery + Thoraco dorsal artery

→ Dorsal scapular artery (from Trans. cervical artery) + Thoraco dorsal artery (Rare)





Q Which branch of subclavian contributes to scapular anastomosis

a Vertebral

b Internal thoracic

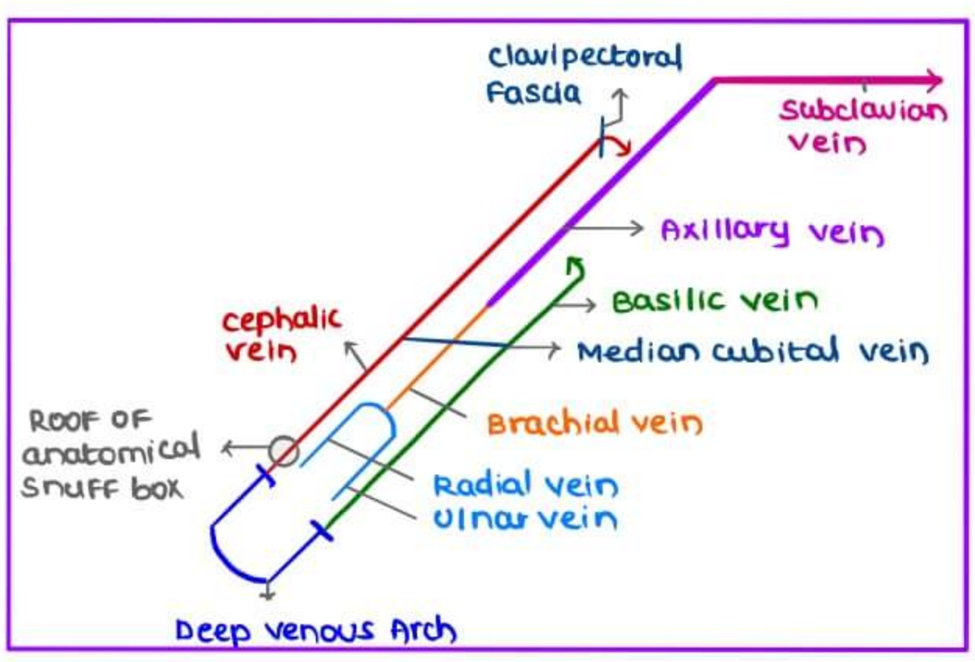
c Thyrocervical Trunk

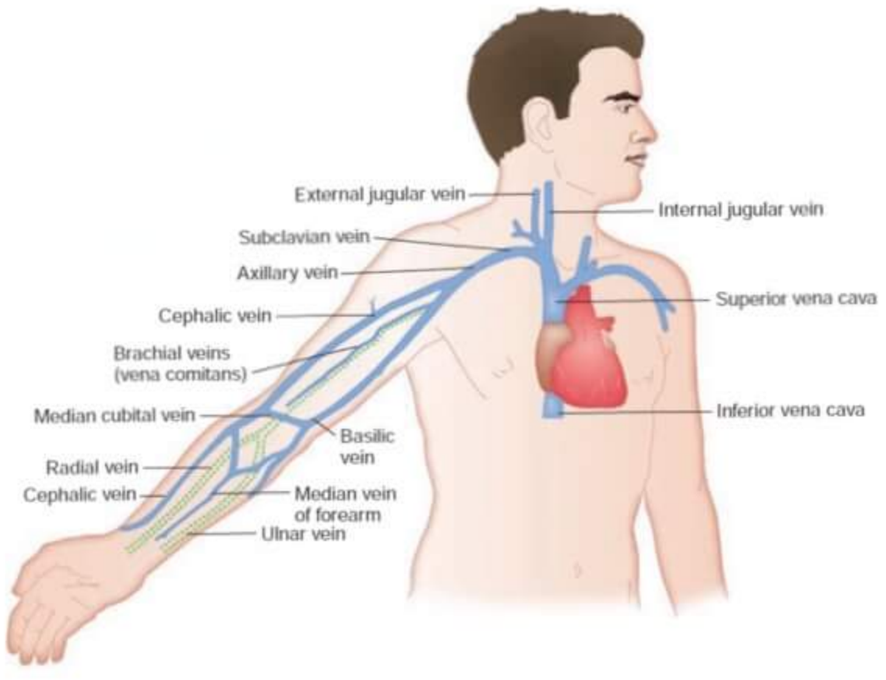
d Dorsal scapular Better Answer

VENOUS DRAINAGE

AXILLARY VEIN
↓
SUB CLAVIAN VEIN ⊕ INTERNAL JUGULAR VEIN
↓
Rt BRACHIOCEPHALIC VEIN ⊕ Lt BRACHIOCEPHALIC VEIN
↓
SUPERIOR VENA CAVA
↓
Rt ATRIUM

CEPHALIC VEIN → clavipectoral fascia → AXILLARY VEIN
↓
MEDIAN CUBITAL VEIN
↓
BASILIC VEIN → AXILLARY VEIN





→ cephalic vein runs on lateral side of radius bone

LYMPHATIC DRAINAGE

RULE → Lymphatic ⟶ Veins ⟶ Arteries

MAMMARY GLAND

→ Internal Thoracic vein ⟶ Subclavian vein
→ Lateral thoracic vein } Axillary vein ⟶ Subclavian vein
→ Sub scapular vein }

LYMPHATIC DRAINAGE

1. Anterior Axillary / PECTORAL Lymph nodes
   → along the lateral thoracic vein
   → on anterior wall of axilla on pectoral muscle
   → drains the lateral aspect of mammary gland

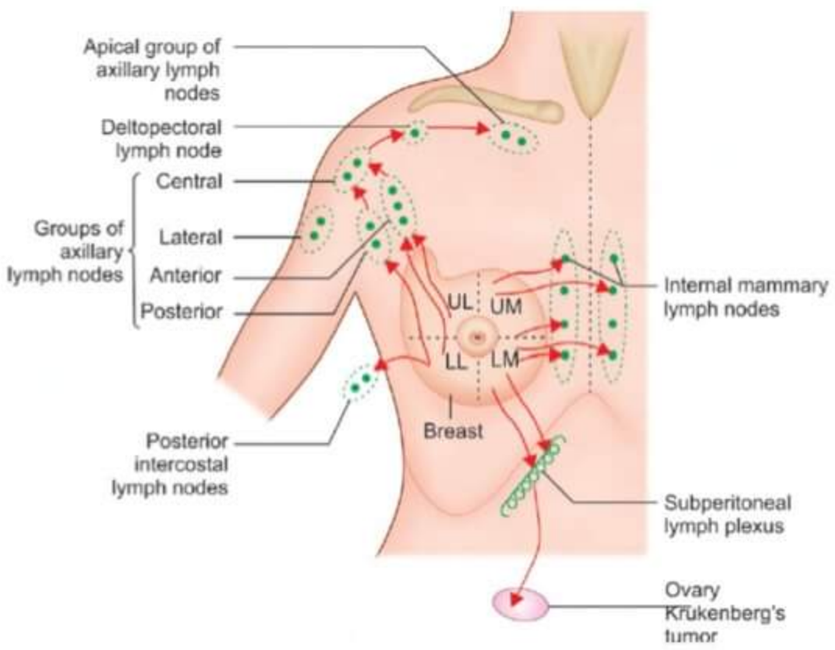
2. Posterior Axillary / SUB SCAPULAR Lymph nodes
   → along the subscapular vein
   → on post. wall of axilla on subscapularis

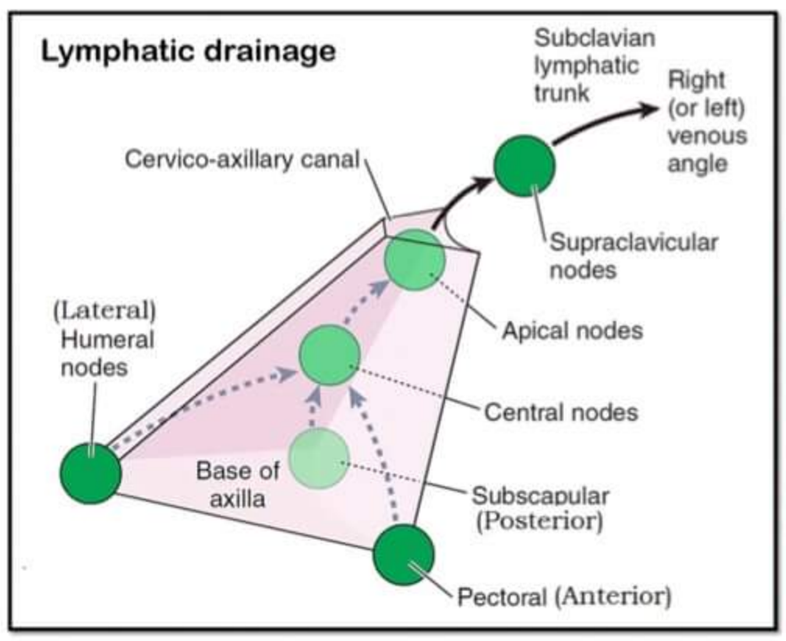
3. Lateral Axillary / HUMERAL Lymph nodes
   → follows axillary vein in axilla on humerus

4. Parasternal LN
   → follows Internal thoracic vein
   → drains medial aspect of mammary gland
   → cross midline (metastasis can occur rarely)

→ rarely mammary gland sends lymphatics to ovary & abdominal viscera
[RETRO GRADE COURSE] → SUB PERITONEAL LYMPHATIC PLEXUS

ANT. AXILLARY LN
POST. AXILLARY LN
LAT. AXILLARY LN
→ CENTRAL AXILLARY LYMPH NODE → APICAL AXILLARY LYMPH NODE → INFRA CLAVICULAR LYMPH NODE → SUPRA CLAVICULAR LYMPH NODE → Rt. JUGULAR TRUNK → Rt. LYMPHATIC DUCT → Rt. JUGULO SUBCLAVIAN VENOUS ANGLE

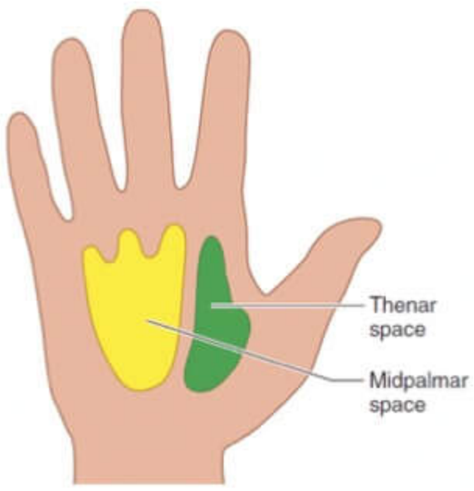


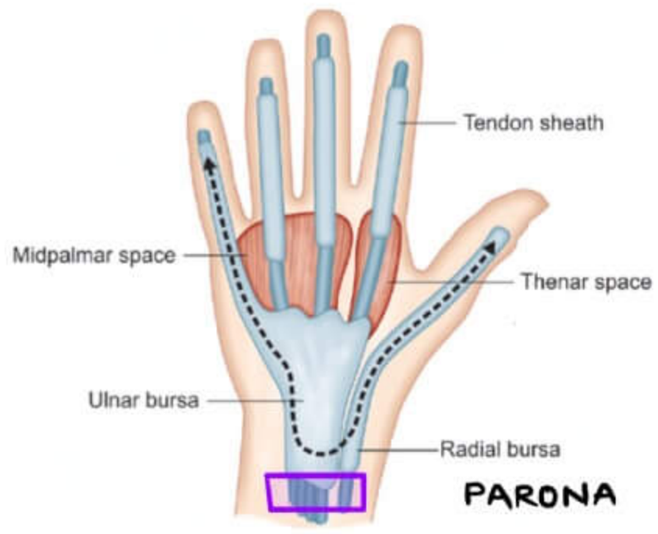


Peau d' orange: classic sign of carcinoma breast

This is due to blockage of **subcuticular lymphatic's** with edema of skin which deepens the mouth of sweat gland & hair follicles giving an orange peel appearance

HAND SPACES





→ Lumbrical canal - 1 communicates ī → Thenar space

→ Lumbrical canal - 2,3,4 communicates ī → Mid palmar space

ABDOMEN

UMBILICAL CORD CONTENTS & ANOMALIES

MECKEL'S FISTULA → Baby born ī fecal matter at umbilicus

URACHUS FISTULA → Baby born ī urine at umbilicus

UMBILICAL CORD - CONTENTS

→ Yolk sac develops into gut tube

→ mid gut temporarily herniating inside the umbilical cord

→ to accomadate fast growing gut tube ī respect to abdominal cavity

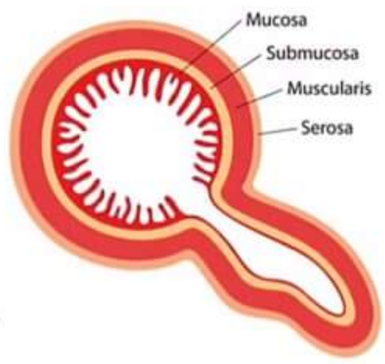
→ vitello - intestinal duct is mid gut diverticulum

→ Allantois is hind gut diverticulum

→ vitello - intestinal duct & Allantois are contents of umbilical cord

→ Allantois is surrounded by 2 umbilical arteries & 1 umbilical vein

→ umbilical cord is covered by amnion



MECKEL'S DIVERTICULUM

→ remnant of vitello - intestinal duct

→ MD is towards ant. abdominal wall (ANTE MESENTERIC BORDER)

→ Mesentery is towards posterior abdominal wall

→ Mid gut diverticulum attaching to terminal ileum

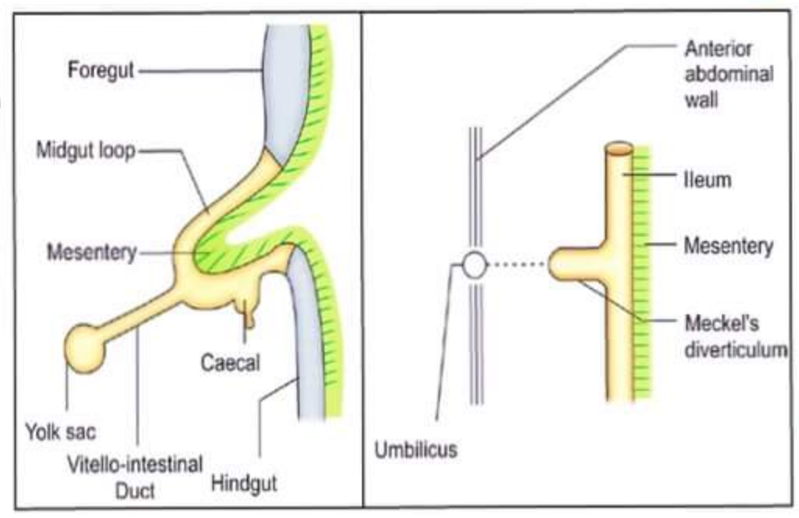
→ True diverticulum → contains all 3 layers

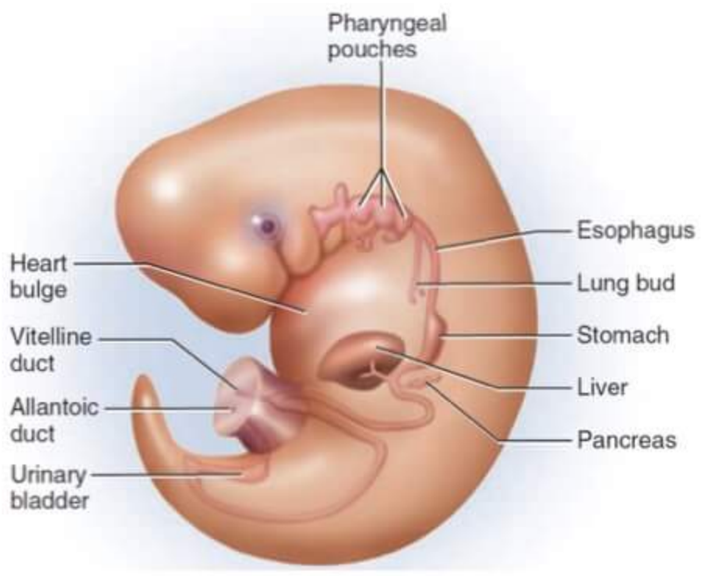
→ RULE OF 2

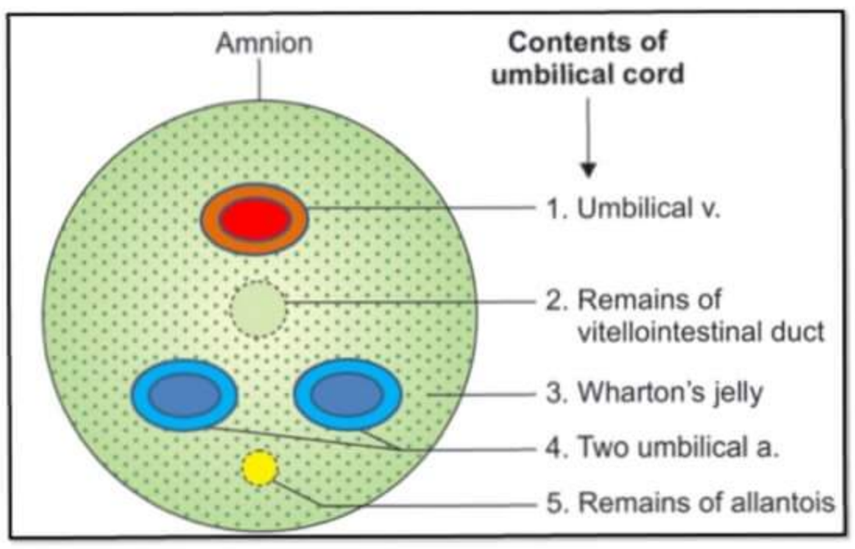
→ 2 inches long

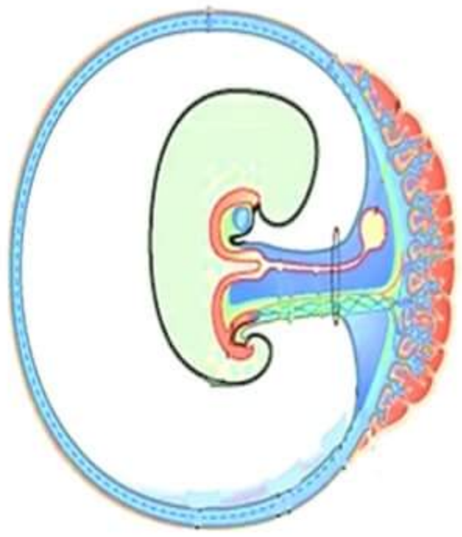
→ 2 feet away from ileocecal junction

→ present in 2% population







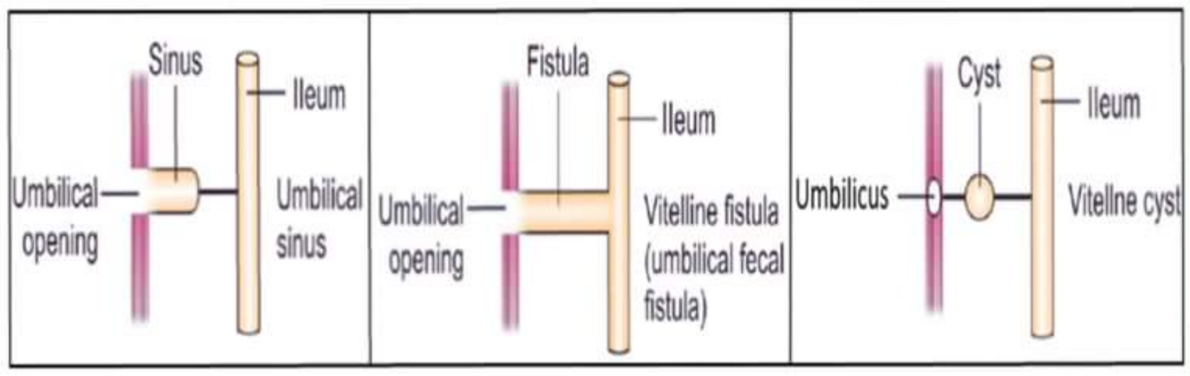


MECKEL'S ANOMALIES

MECKEL'S SINUS

→ Blind sac ī one opening (sinus)

→ adherent to terminal ileum



MECKEL'S FISTULA

→ lined by 4 layers of gut tube

→ brings fecal matter from terminal ileum to the umbilicus

MECKEL'S CYST → cyst attaches to ileum one side & umbilicus to other side

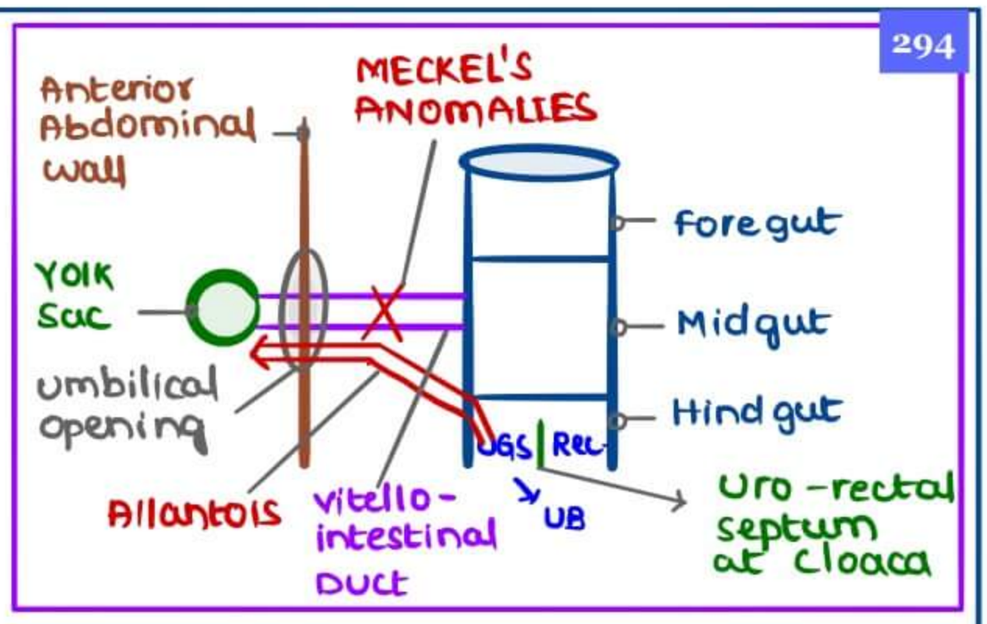
URO - RECTAL SEPTUM

→ Septum developing in cloaca region of hind gut

→ Front → uro genital sinus develops

behind → rectum develops

→ Allantois attaches to the apex of urinary bladder in fetus



URACHUS → obliteration of allantois

URACHUS FISTULA

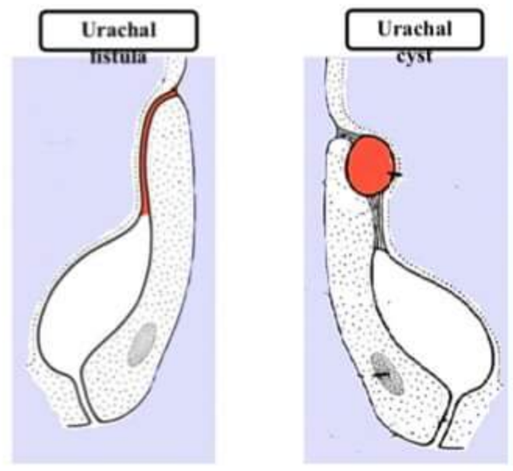
→ patency of lumen in urachus

→ urine present at umbilicus at birth

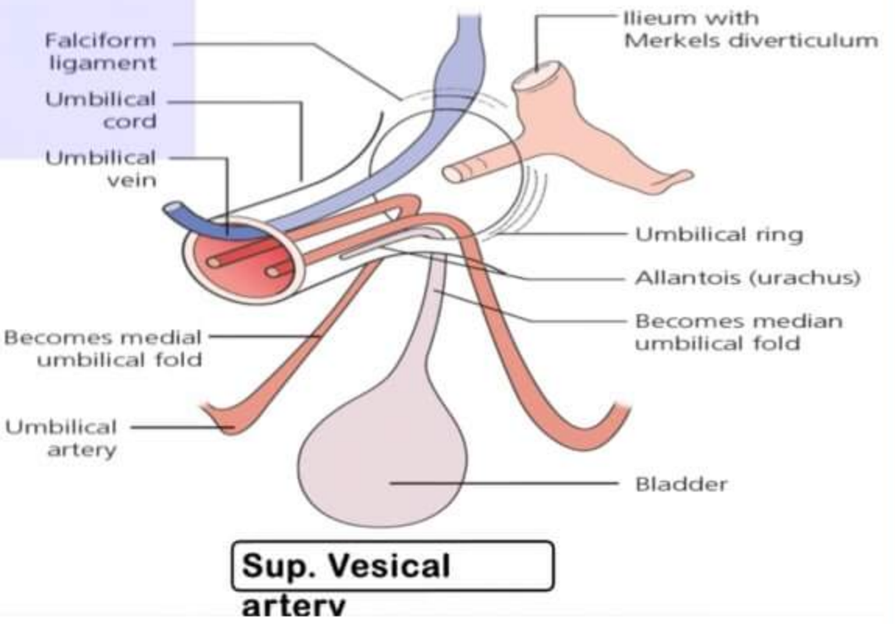
URACHAL CYST

→ has fibrous attachment to ant. abdominal wall & urinary bladder

Q Which is not associated ε vitello-intestinal duct
a Ileal diverticulum
b umbilical fistula
c Enterocystoma
d Mesenteric cyst



Q Regarding meckel's diverticulum all are true EXCEPT
a At anti-mesenteric border
b vitello-intestinal duct remnant
c 3" long → 2-3"
d Pain at umbilicus



Q Identify the clinical condition
a Omphalocele
b Gastroschisis
c Morganian hernia
d Bochdalek hernia

UMBILICUS

→ 2 umbilical arteries covered by MEDIAL UMBILICAL FOLD (peritoneal fold)

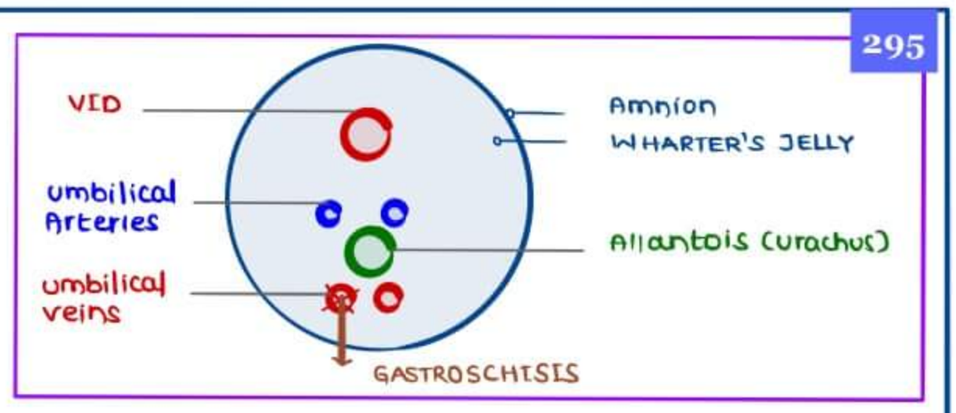
→ SUPERIOR VESICAL ARTERY
proximal parts of umbilical arteries persists in adults to supply urinary bladder

→ Distal part obliterated & becomes medial umbilical ligaments covered by MEDIAL UMBILICAL FOLD (peritoneal fold)

→ LEFT UMBILICAL VEIN IS LEFT
→ goes to liver & carried by FALCIFORM LIGAMENT (double peritoneal fold)
→ later it becomes LIGAMENTUM TERES & carried by falciform ligament

→ ALLANTOIS becomes URACHUS in adults
→ urachus connects the apex of urinary bladder to umbilicus
→ urachus forms medial umbilical ligament &
→ covered by MEDIAL UMBILICAL FOLD (peritoneal fold)

Q Median umbilical ligament is derived from
a proximal part of umbilical artery
b distal part of umbilical artery
c Urachus
d umbilical vein

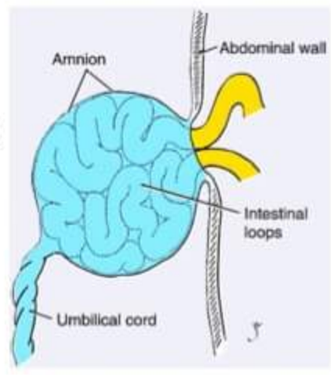


GASTROSCHISIS

→ Intestinal Herniation from a weak spot Where umbilical vein regressess
→ usually on Right side
→ comes out of the amnion → Intestine is not lined by amnion
→ umbilical cord is normal

OMPHALOCELE

→ Physiological umbilical hernia (temporarily)
→ intestine is covered by amnion
→ PATHOLOGICAL OMPHALOCELE
  → physiological hernia not regressing
  → also pulls liver inside umbilicus lined by amnion



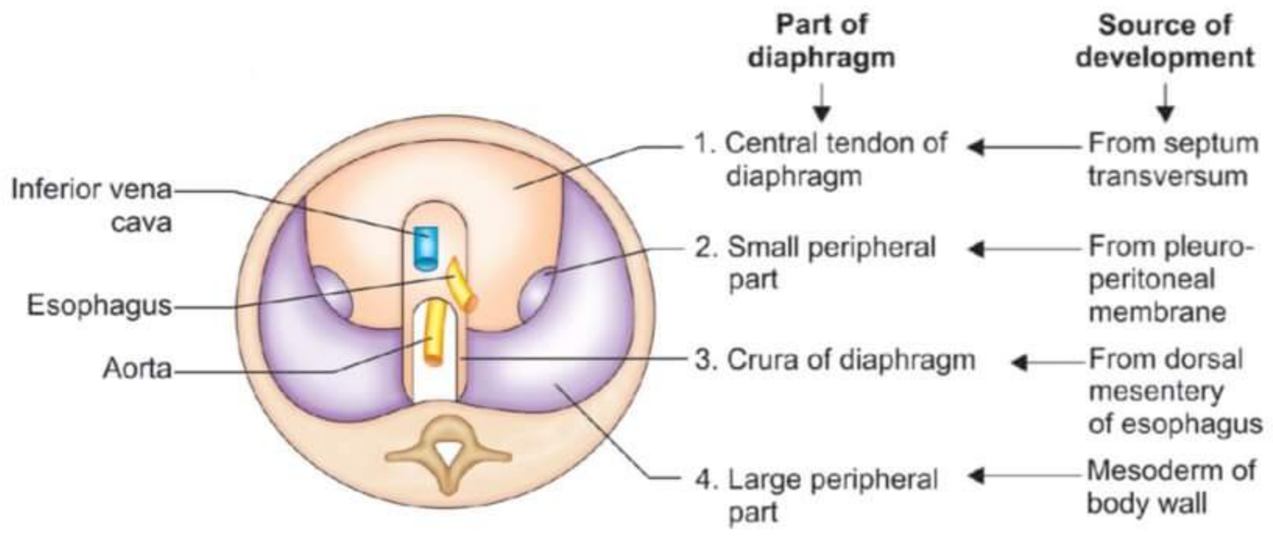
GASTROSCHISIS	OMPHALOCELE
→ Rt sided	→ Midline
→ umbilical cord is normal	→ uc contains intestine & Liver
→ Intestine is not lined by amnion	→ contents are lined by amnion
→ Recurrent intestinal obstruct^{n} is a complicat^{n} after Rt dlt long mesentery volvulus	→ Multiple congenital anomalies Neural tube defects cardio vascular defect Chromosomal defect Leads to DEAD BABIES

Q Regarding gastroschisis & omphalocele, which one is FALSE
a Intestinal obstruction is common in gastroschisis
b Liver is the content of omphalocele
c Gastroschisis associated t multiple anomalies
d umbilical cord is attached in normal position in gastroschisis

DIAPHRAGM:DEVELOPMENT OF DIAPHRAGM

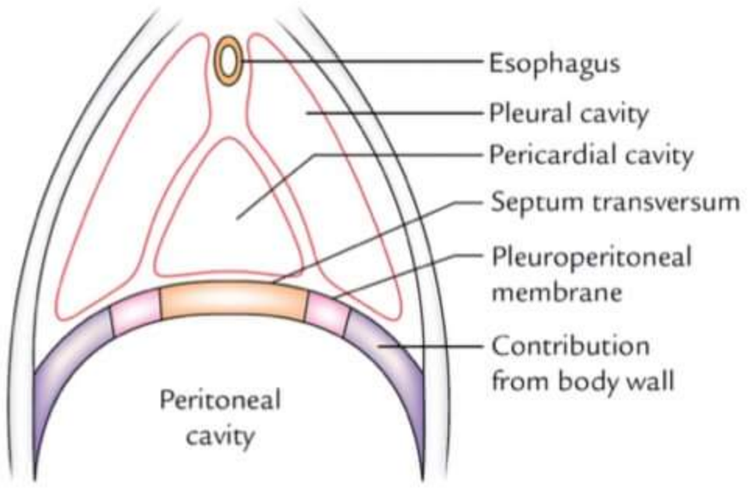
→ 4 COMPONENTS
1. Cervical somites (Myotomes) → C-3,4,5 (Phrenic nerve)
2. Septum transversum → forms central tendon
3. Dorsal mesentery of oesophagus
4. Pleuro peritoneal membrane

Q All are derivatives of Septum transversum Except
a Falciform ligament
b Ligamentum teres
c coronary ligament
d Lesser omentum



SEPTUM TRANSVERSUM / PERICARDIO PERITONEAL MEMBRANE

→ forms VENTRAL MESENTERY → forms 3 liver ligaments
→ separates heart above & stomach & liver below
→ forms central tendon of diaphragm separating pericardial cavity from peritoneal cavity



PLEURO PERITONEAL MEMBRANE

→ present on Rt & lt sides
→ Separates pleural cavity & peritoneal cavity
→ Bochdalek hernia
  → deficiency in lt. pleuroperitoneal membrane
  → intestine enters into lt. chest cavity
  → Congenital Diaphragmatic hernia
  → present since birth

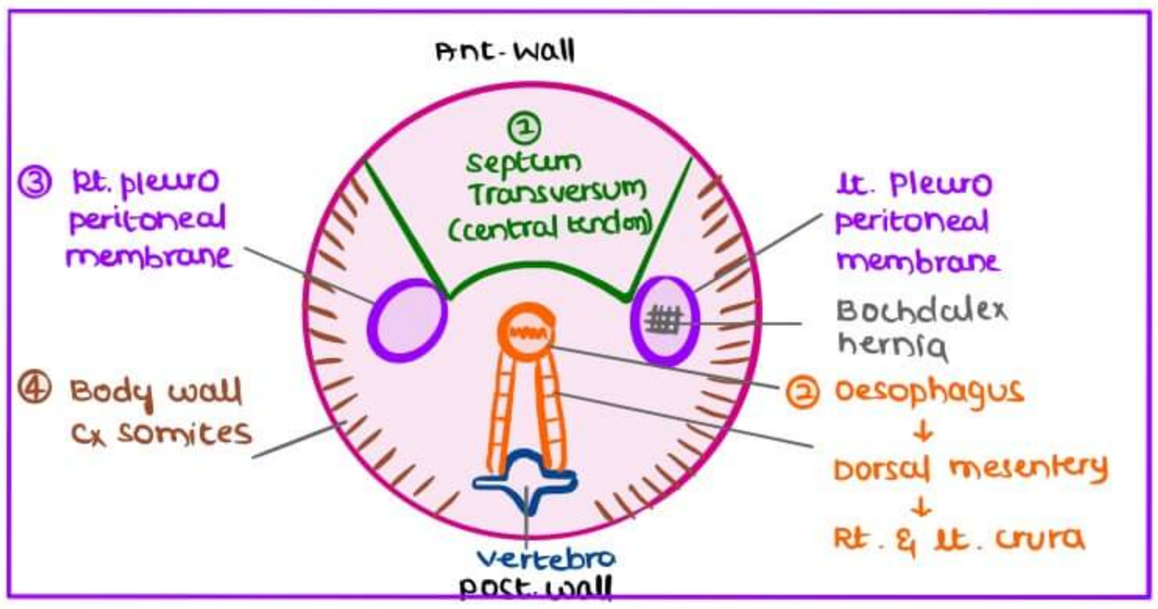
CERVICAL SOMITES (MYOTOMES)

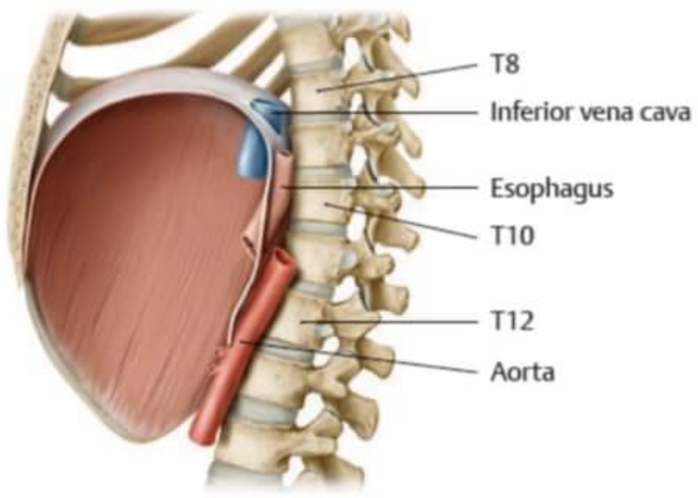
→ C - 3, 4, 5 → contributes to skeletal muscles of diaphragm

DORSAL MESENTERY OF OESOPHAGUS

→ Forms right crus & lt crus of diaphragm
→ OESOPHAGUS
  → has dorsal mesentery, going to post. abd. wall & attaches to lumbar vertebra posteriorly
  → passes crura of diaphragm at T-10 level
  → Aorta passes crura of diaphragm at T-12 level by Aortic hiatus

→ Median Arcuate ligament connect the two crura



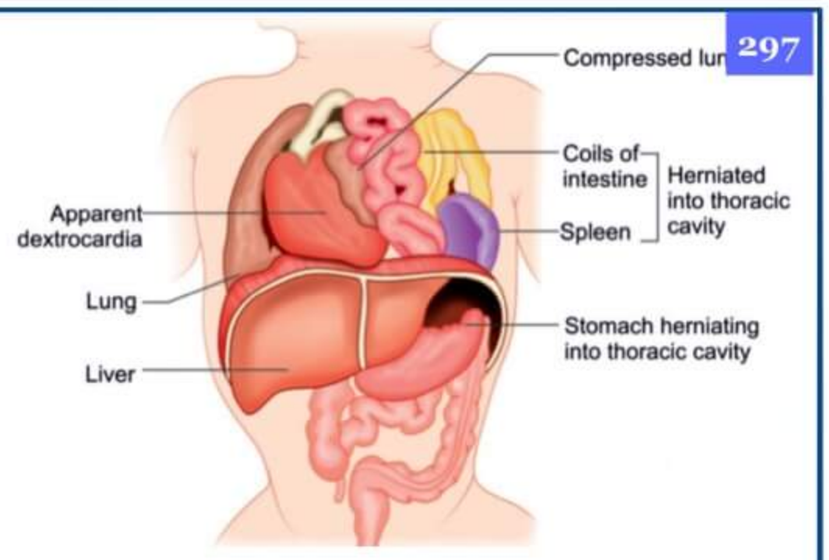


STRUCTURES PASSING THROUGH DIAPHRAGM

1. IVC pierces central tendon at T-8 in adults
2. Esophagus pierces through fibres of crus of diaphragm at T-10
3. Aortic Hiatus
   → not passing through diaphragm
   → present behind the diaphragm infront of T-12 vertebra

Q Bochdalek hernia occurs in
a Antero - lateral part of diaphragm
b Postero - lateral part of diaphragm
c Retrosternal area
d Posterior to diaphragm

BOCHDALEK HERNIA

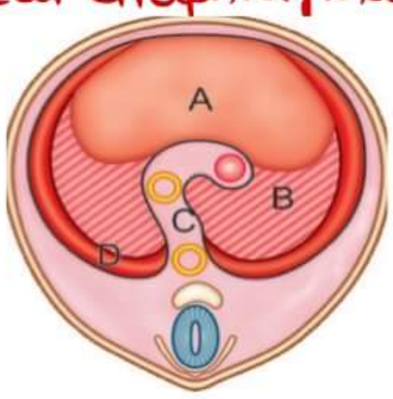


→ usually on lt. side
→ congenital diaphragmatic hernia
→ deficiency of lt. pleuroperitoneal cavity
→ lt lung hypoplasia
→ Rt lung also compressed
→ cyanosis at birth → NEONATAL EMERGENCY

MORGAGNI HERNIA

→ mostly on rt. side
→ Antero - medial
→ Retrosternal
→ Transverse colon herniates infront of heart
→ less common than Bochdalek hernia

Q In the following diagram for diaphragm development, congenital diaphragmatic hernia occurs usually dlt defect in

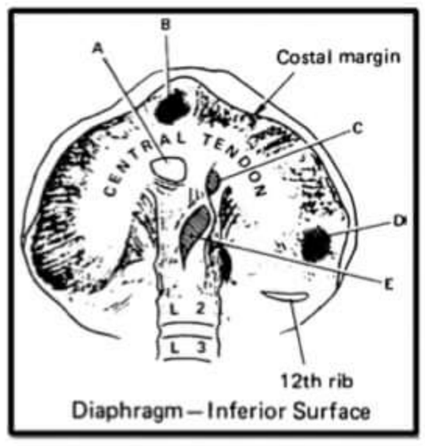


a A
b B
c C
d D

Q Structures passing through marker B

a IVC → A
b Oesophagus → C
c Aorta → E
d Morgagni hernia

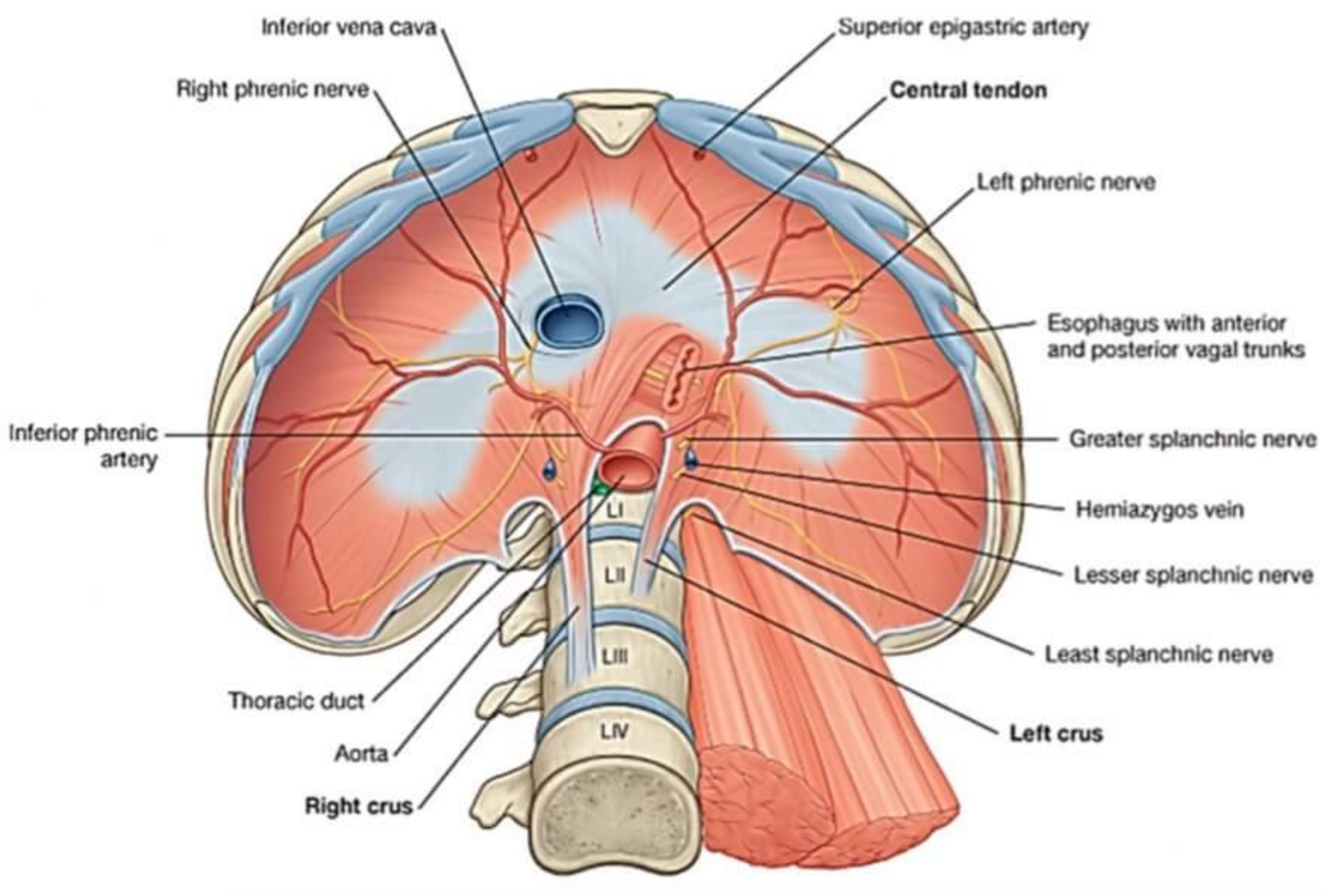
Bochdalek foramen → D



DIAPHRAGM

→ Skeletal muscle ↄ circumferential Bony origin
→ Origin → 1. anterior surface of L - 1, 2, 3
2. inner surface of Lower 6 Ribs
3. inner surface of xiphi sternum

→ Insertⁿ → central tendon
→ muscle of inspiratⁿ



DIAPHRAGM – OTHER OPENINGS

1. Few branches of Rt. PHRENIC NERVE coming along ī IVC & passing through central tendon at T-8

2. Anterior (Lt) & Posterior (Rt) Vagal trunks comes ɛ oesophagus at T-10 in muscular part of diaphragm

3. THORACIC DUCT passes ī aorta through aortic hiatus at T-12
4. AZYGOUS VEIN
   - → punctures rt. crus of diaphragm & enters thorax
   - → usually not passes through aortic hiatus
   - → some times passes through Aortic hiatus,
     - → Thoracic duct present blw vein on right side & aorta on left side
5. HEMI AZYGOUS VEIN → punctures left crus of diaphragm & enters thorax
6. GREATER & LESSER SPLANCHNIC NERVES
   - → punctures the crus of diaphragm & enters abdomen & supplies abdominal viscera
   - → comes from thoracic sympathetic chain → thoracic splanchnic nerve

Rt crus is Longer than Left crus

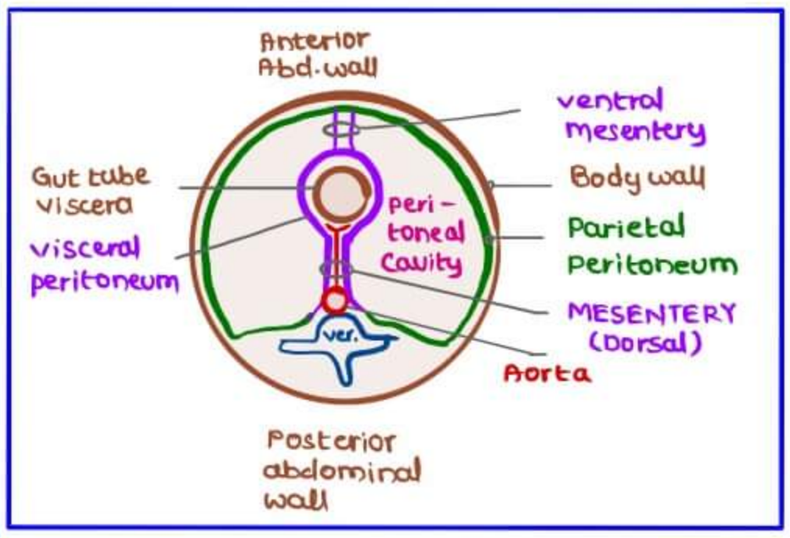
- → Rt crus attaching to L-1,2,3 anteriorly
- → Lt crus attaching to L-1,2 only
- → Rt crus connected to lt crus by MEDIAN (midline) ARCUATE LIGAMENT
- → oesophagus passes through muscular fibres of Rt crus of diaphragm at T10

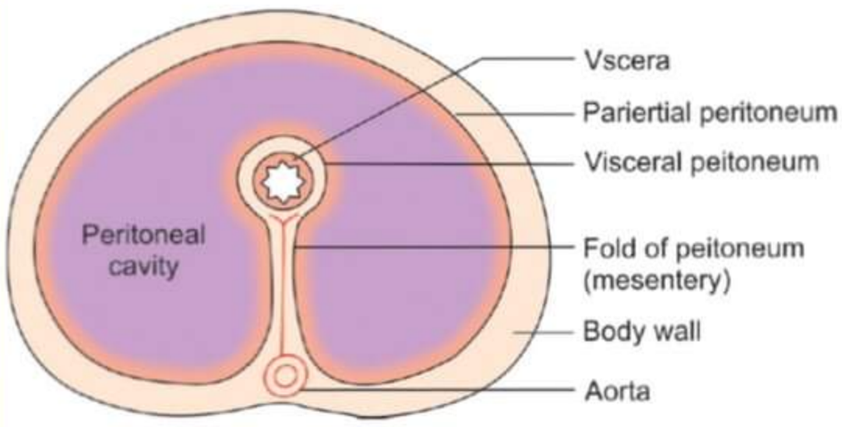
DEVELOPMENT OF MESENTRY

MESENTERY

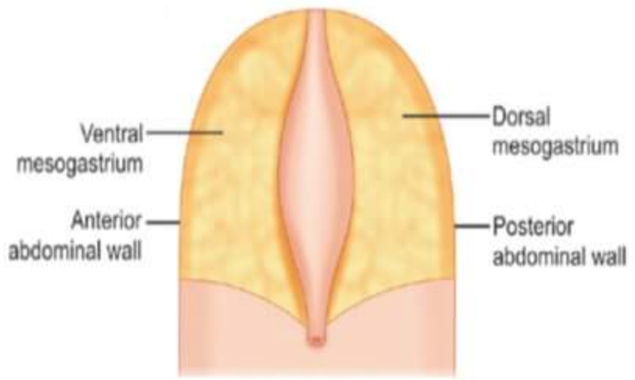
- → Double fold of Peritoneum to carry NVB (Neuro vascular Bundles) & ducts
- → NVB → Nerve, artery, vein, lymphatics
- → Gut tube is suspended in peritoneal cavity by PERITONEUM

- → PARIETAL PERITONEUM → Peritoneum covering body wall
  VISCERAL PERITONEUM → Peritoneum covering viscera
  PERITONEAL CAVITY → present blw the above 2 layers





Schematic transverse section of the abdomen showing arrangement of the peritoneum



- → Gut tube acts as AXIS
  - DORSAL MESENTERY → present behind the gut tube
  - VENTRAL MESENTERY → present infront of gut tube
- → MESENTERY – SUB DIVISIONS
  - Meso Enteron, Meso Duodenum, Meso colon,
  - Meso Gastrium, Meso Appendix

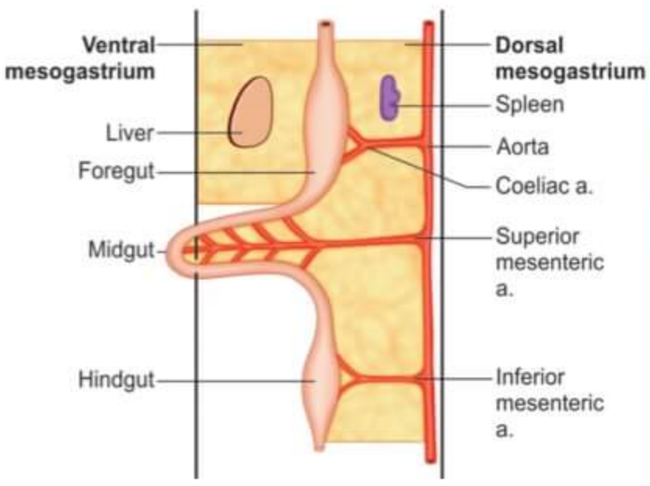
→ In the begining, Lesser curvature of stomach is anterior & Greater curvature of stomach is posterior

Later, Lesser curvature comes to right side & greater curvature comes to left side

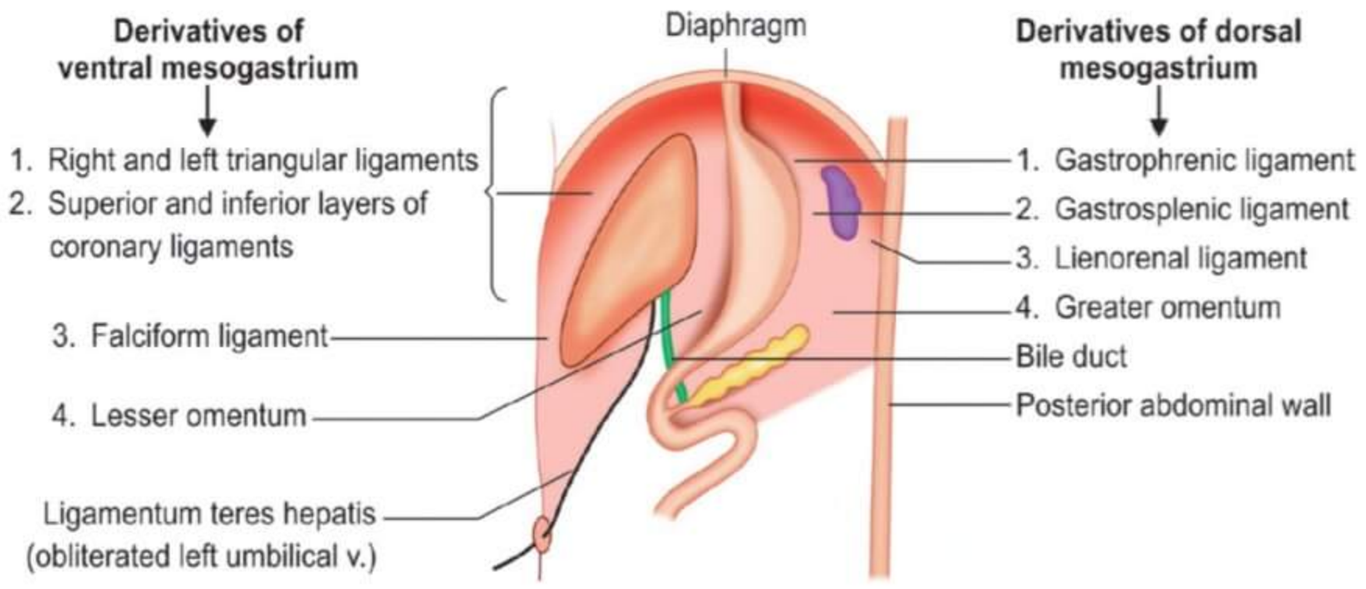
→ Liver develops in ventral mesentery, Spleen develops in dorsal mesentery
Pancreas develops in ventral (head), & Dorsal (body, tail) mesentery

→ ABDOMINAL AORTA & ANTERIOR BRANCHES

Foregut	→	Coeliac Trunk
Midgut	→	Superior mesenteric artery
Hindgut	→	Inferior mesenteric artery



→ Gut tube develops in midline infront of Aorta



LIVER ATTACHMENTS (Septum transver.)

FALCIFORM LIGAMENT (anterior & superior)

↓

CORONARY LIGAMENT (more superior)

↓

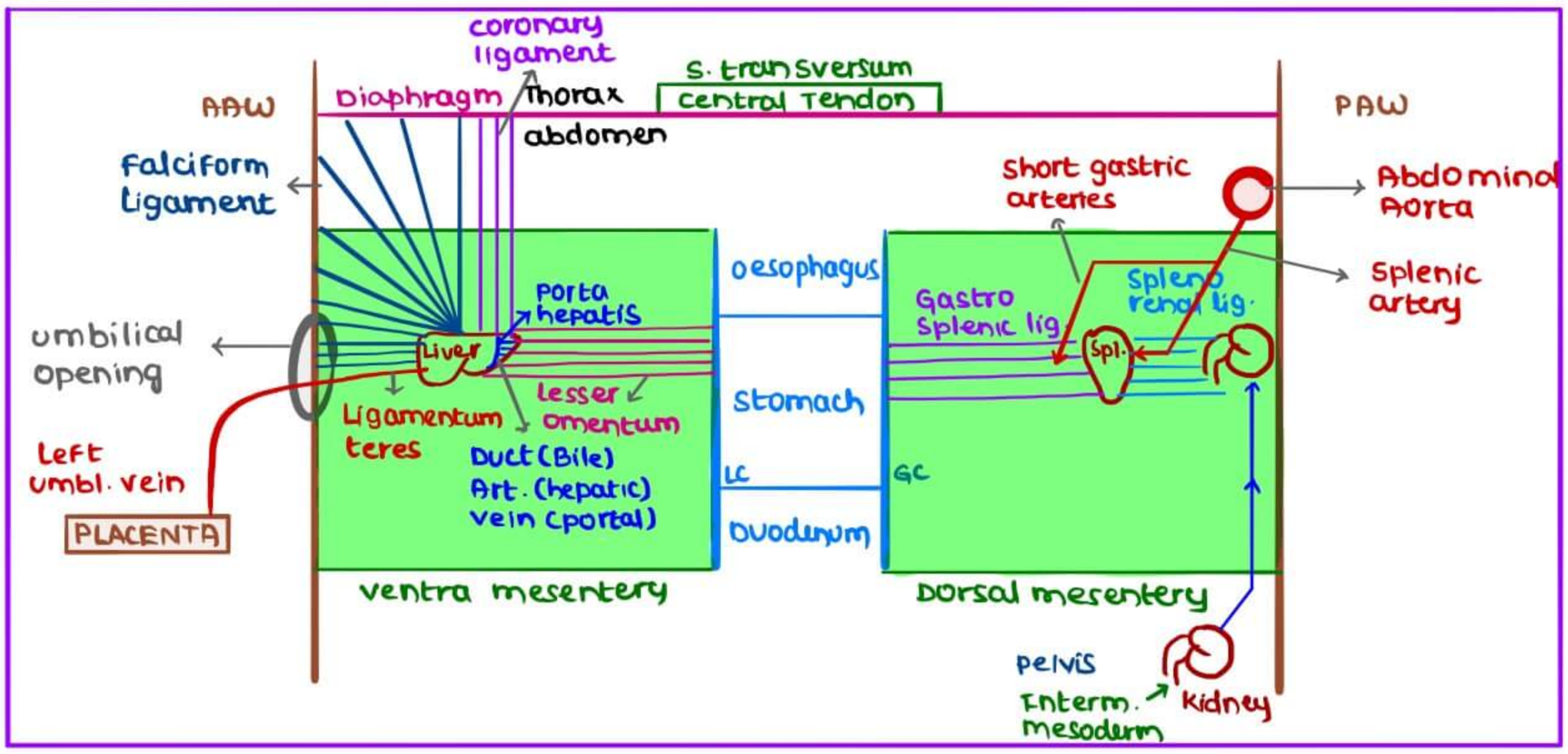
LESSER OMENTUM (posterior)

VENTRAL MESOGASTRIUM - DERIVATIVES

LIGAMENTUM TERES	→	Obliterated left umbilical vein
	→	carried by double fold of Peritoneum → FALCIFORM LIGAMENT to liver

DORSAL MESOGASTRIUM - DERIVATIVES

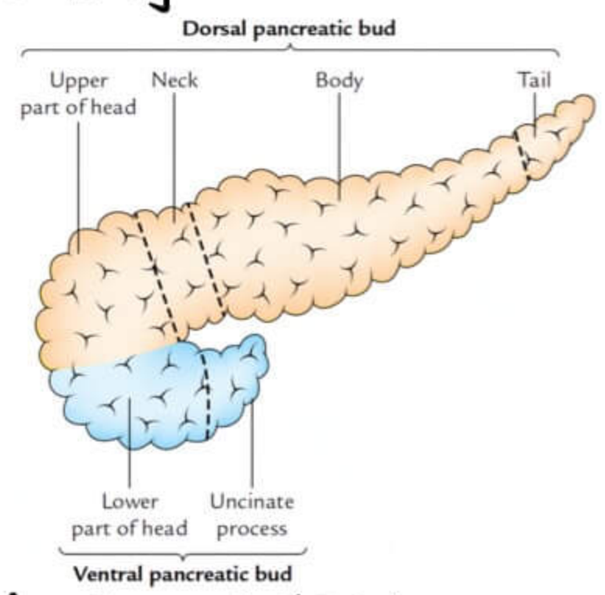
→ Kidney develops in pelvis at first, later ascends in abdomen behind the spleen
→ SPLENORENAL LIGAMENT → connects Spleen & Kidney
→ Gastrosplenic ligament → connects Stomach & Spleen



→ Splenogastric ligament develops ventrally in dorsal mesentery
→ Splenorenal ligament develops dorsally in dorsal mesentery

→ Falciform ligament develops more ventrally in ventral mesentery
Lesser omentum develops more dorsally in ventral mesentery

→ Kidney & Aorta are retroperitoneal
→ Part of pancreas not developing in dorsal mesentery → UNCINATE PROCESS
→ Uncinate process of pancreas develops in ventral mesentery



PANCREAS

→ VENTRAL PANCREATIC BUD → in ventral mesentery
→ DORSAL PANCREATIC BUD → in dorsal mesentery

→ small pancreatic duct → ventral pancreatic bud
Long pancreatic duct → Dorsal pancreatic bud

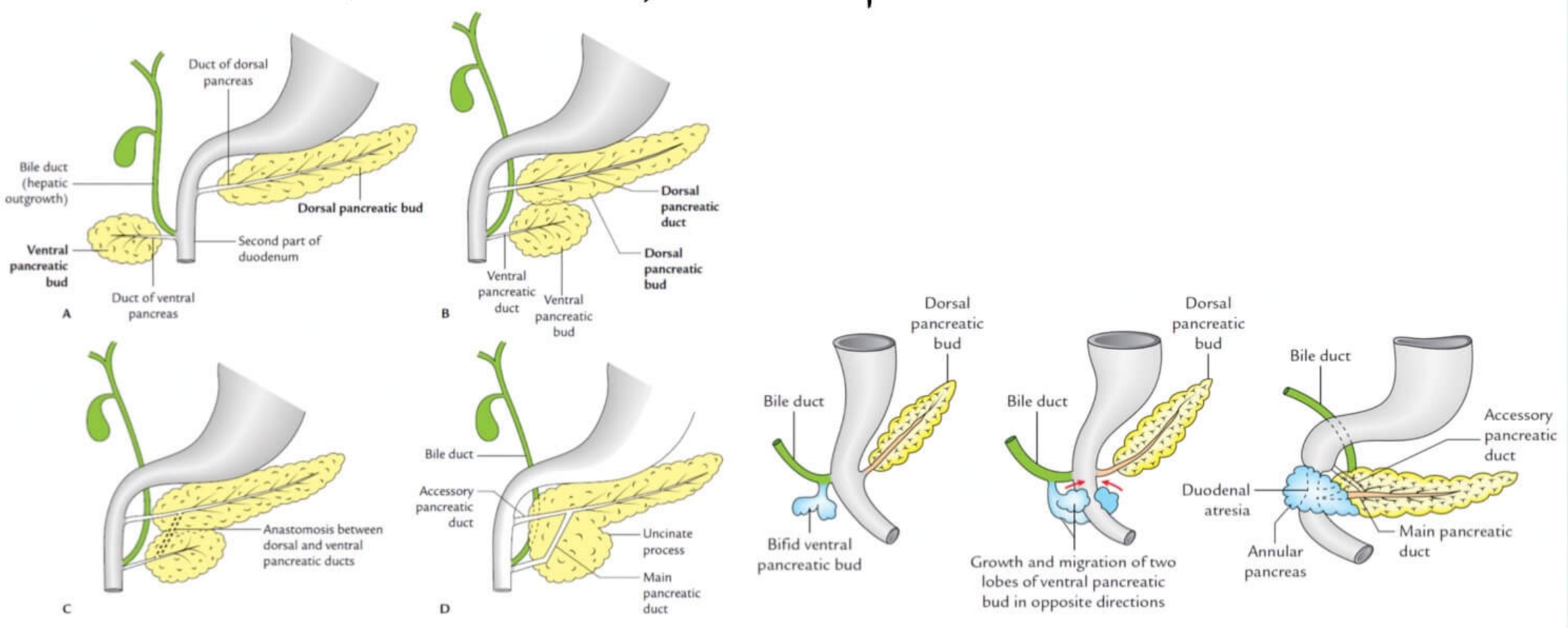
→ DIt rotation, ventral pancreatic bud going to right side & posterior to & comes below dorsal pancreatic bud in dorsal mesentery

→ ventral pancreatic bud going to form uncinate process & head in dorsal mesentery & fuses ī body & tail of pancreas

→ Duct of dorsal pancreatic bud is going to merge ī ventral pancreatic bud
Distal part of dorsal pancreatic bud & proximal part of ventral pancreatic bud form DUCT OF WIRSUNG (main pancreatic duct)

→ Duct of wirsung & accessory pancreatic duct opens into 2nd part of duodenum
→ Distal part of Dorsal pancreatic bud forms ACCESSORY PANCREATIC DUCT OF SANTORINI

→ ANNULAR PANCREAS → encloses 2nd part of duodenum



ventral pancreatic bud divides into 2 → BIFID VENTRAL PANCREATIC DUCT
During rotation, it goes around 2nd part of duodenum in opposite directions

→ causes Duodenal atresia & obstruction

Q The umbilical vein carries
a Oxygenated blood towards the placenta
b Deoxygenated blood towards the placenta
c Oxygenated blood away from the placenta
d deoxygenated blood away from placenta

Q ventral mesogastrium derivatives include all EXCEPT
a Falciparum ligament
b coronary ligament
c Lesser omentum
d Gastrosplenic ligament

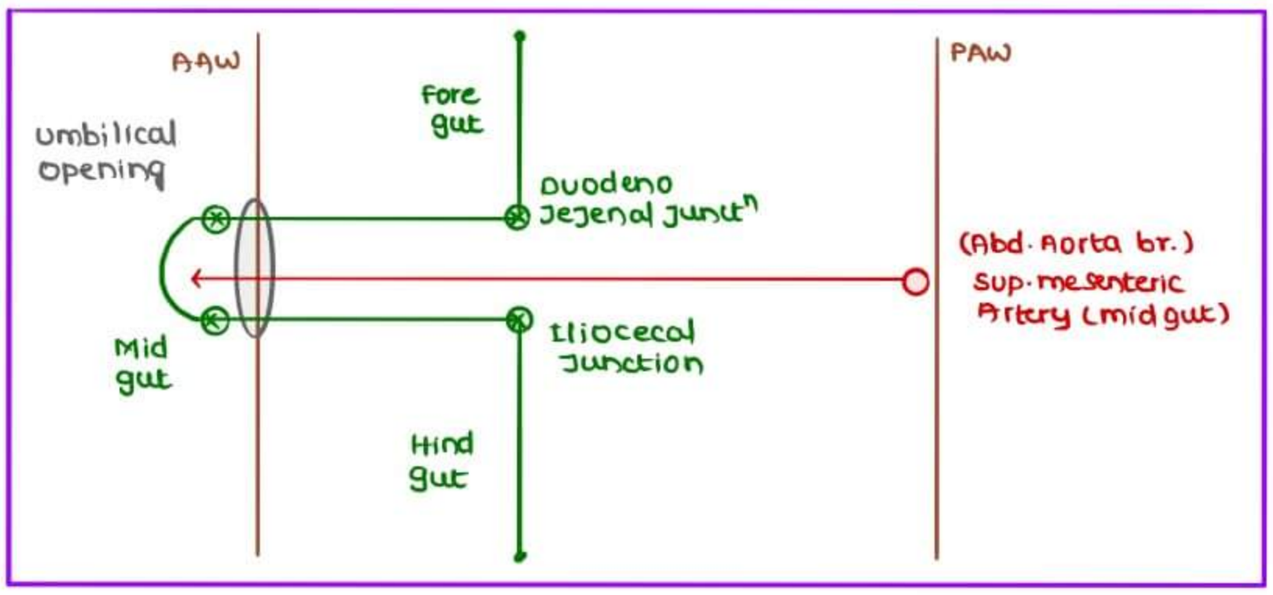
Q Which OF Following structure doesn't develop in mesentery OF stomach
a Liver
b Kidney
c Spleen
d Pancreas

Q Which of the Following ligaments contain Splenic artery
a Gastrosplenic ligament → carries short gastric arteries to Greater Curvature
b Splenocolic ligament
c Splenorenal ligament
d Splenophrenic ligament

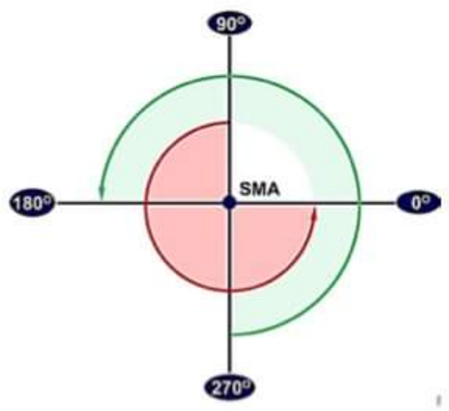
Q Which of the following structure develop in ventral part of ventral mesentery of stomach
a Falciform ligament
b Hepatogastric ligament
c Lesser omentum
d Splenogastric ligament

GUT ROTATION

→ Physiological umbilical hernia occurs at week 6 IUL
→ Regression of hernia occurs at week 10



→ Superior mesenteric artery going out side the umbilical opening to enter umbilical cord temporarily
  → It follows midgut as gut tube growing faster compared to Smaller cavity
  → later regression occurs at week 10
  → defect in regression causes OMPHALOCELE



→ Duodeno jejenal junction & Iliocecal junction

- → Both are part of mid gut
- → They comes out through umbilical opening at the time of PUH
- → Inside the umbilical cords, they start rotating anticlockwise (90°)
  axis of rotation → Superior mesenteric artery
- → 180° of anticlockwise rotatn occurs during regression
- → Total of 270° anti clock wise rotation occurs

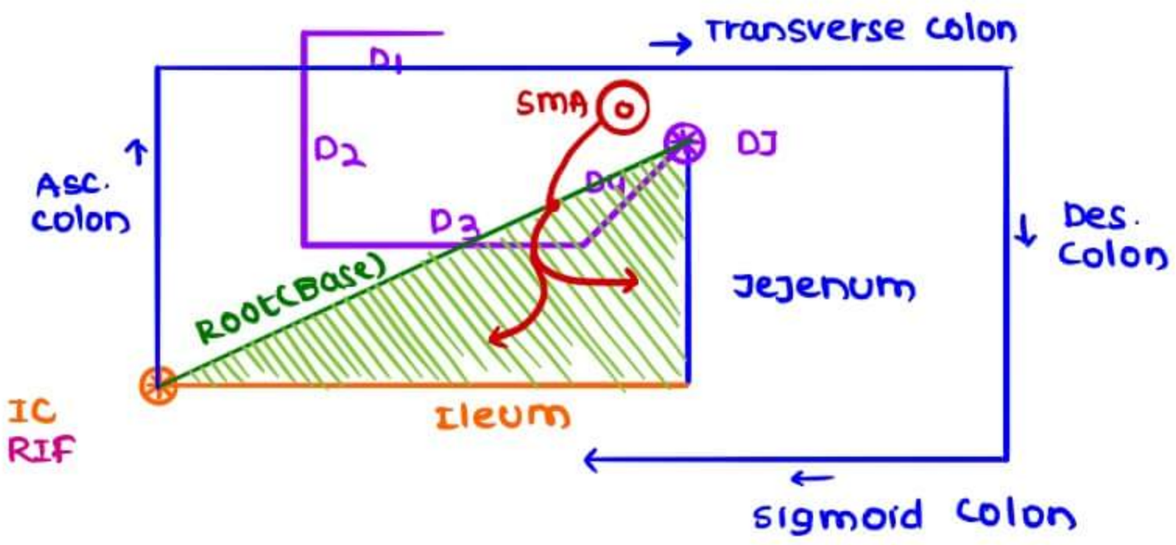
Q Physiological umbilical hernia reduces at month

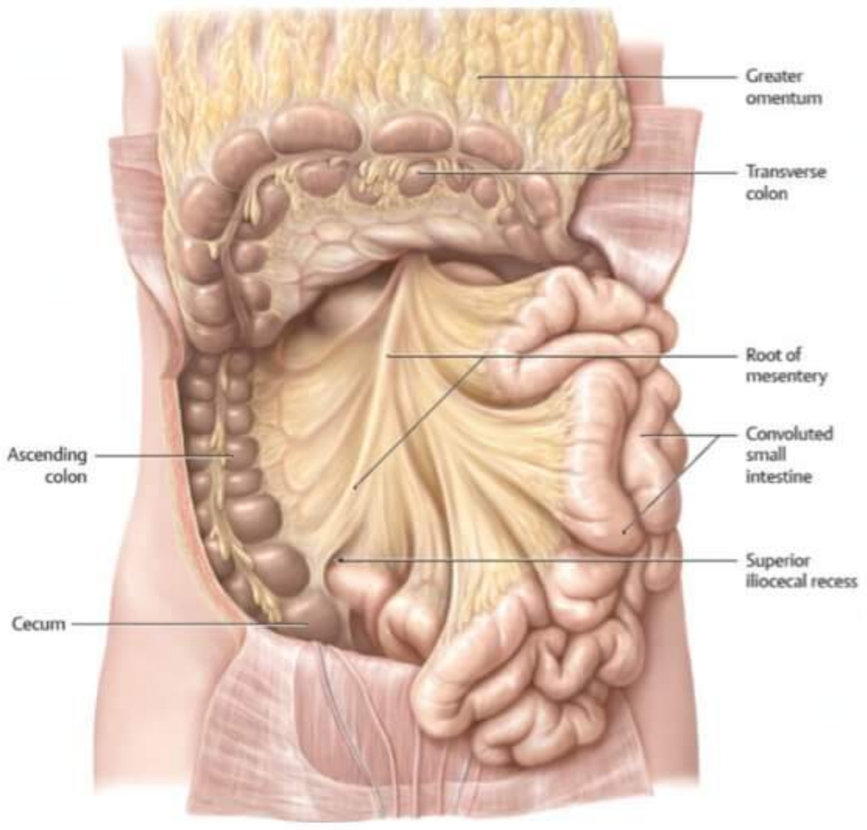
a one
b two
c three
d four

- → After 270° anti clockwise rotatn,
  DJ Junction is BELOW & LEFT of SMA in adult, fixed by ligament of TREITZ
  IC Junction is drops down into Rt. iliac fossa

- → After rotatn, colon has 4 parts
  1. Ascending colon
  2. Transverse colon
  3. Descending colon
  4. Sigmoid colon

- → After rotatn, Duodenum has 4 parts, & becomes c shaped structure
  1. 1st part (horizontal)
  2. 2nd part (vertical)
  3. 3rd part (horizontal)
  4. 4th part (superior & lt side)





- → DJ present almost at midline, slightly to left

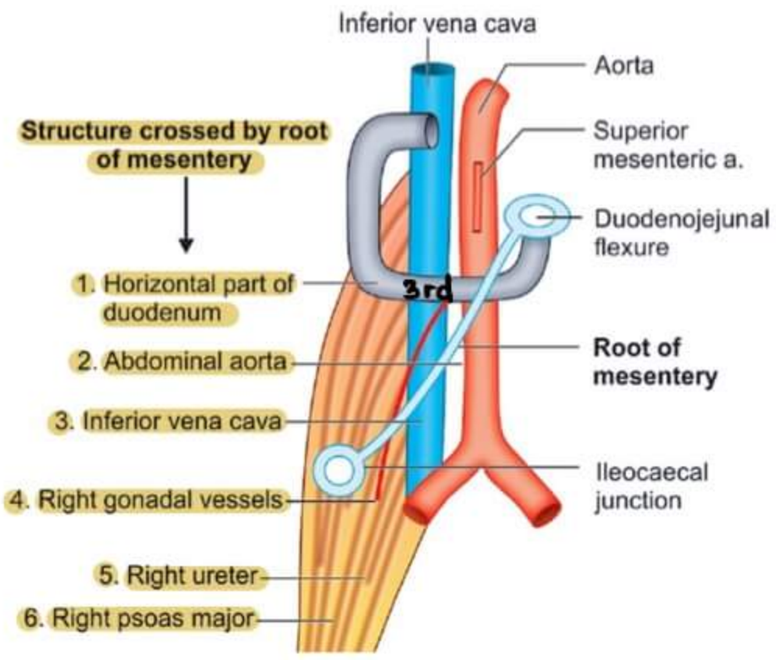
SMALL INTESTINE

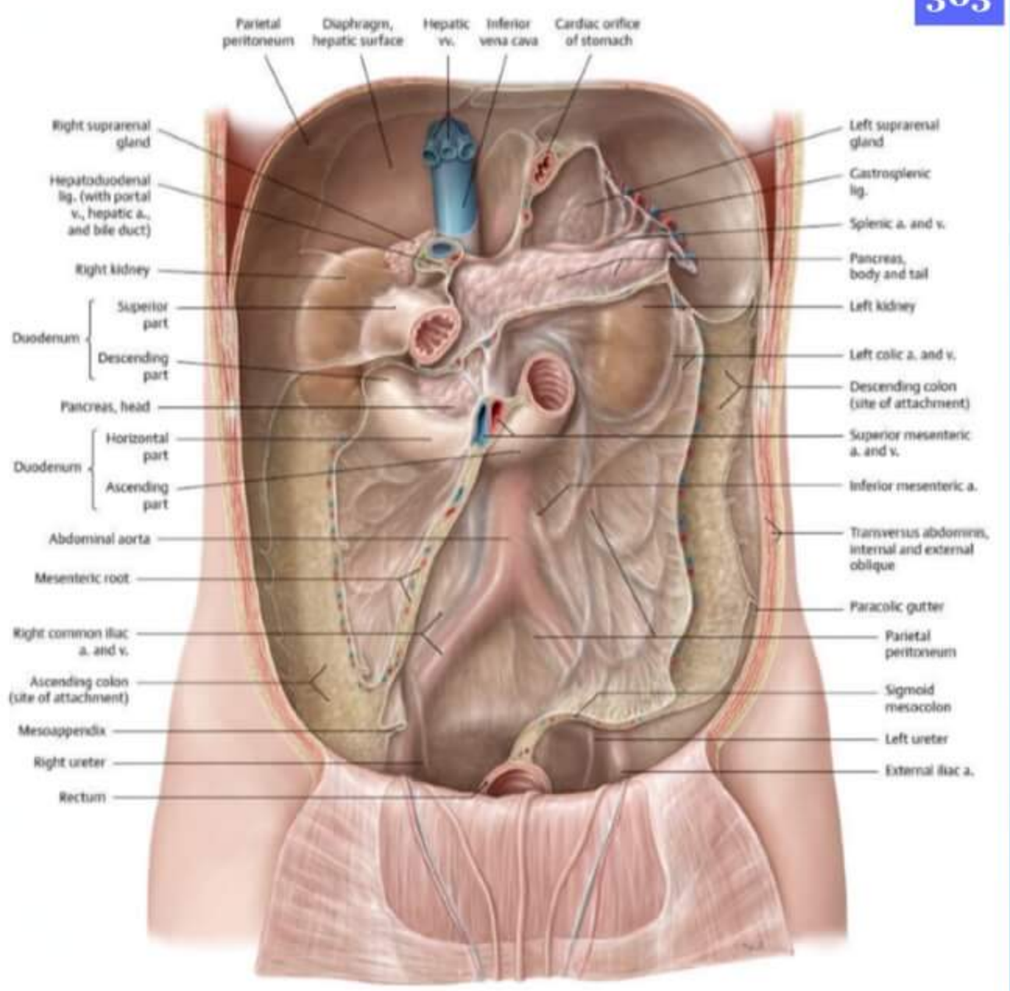
- → In the beginning, SI all is having mesentery
- → Later, Duodenum becomes retroperitoneal & looses mesentery
- → Mesentery attaches to jejenum & ileum

ROOT / BASE OF MESENTERY

→ attaching between DJ Junct^n & IC junction

→ STRUCTURES CROSSED BY ROOT OF MESENTERY



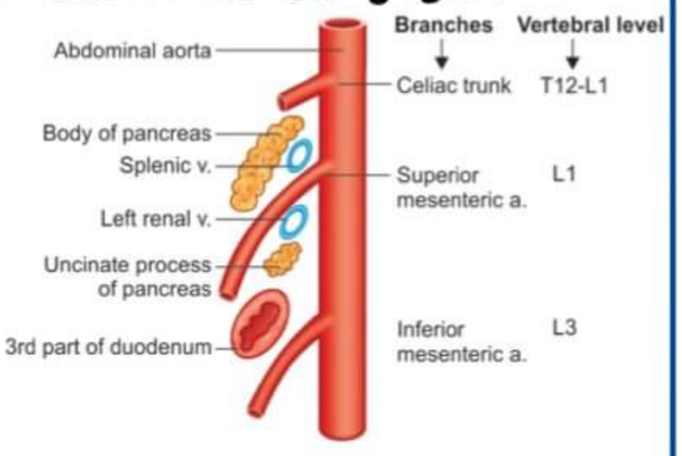


→ From the root, double fold of peritoneum cover Ileum & jejenum

→ Sup. mesenteric artery enter the root of mesentery & gives branches to jejenum & ileum

→ STRUCTURES BEHIND THE ROOT OF MESENTRY

1. Duodenum (4 parts)
2. Begining of jejenum
3. Ligament of TREITZ
4. Superior mesenteric Artery & vein
   → SMA goes anterior to 3rd part of duodenum & compresses it



Q Dilation of which of the following artery, causes compression of 3rd part of duodenum

a Gastroduodenal artery
b Superior mesenteric artery
c Inferior mesenteric artery
d celiac artery

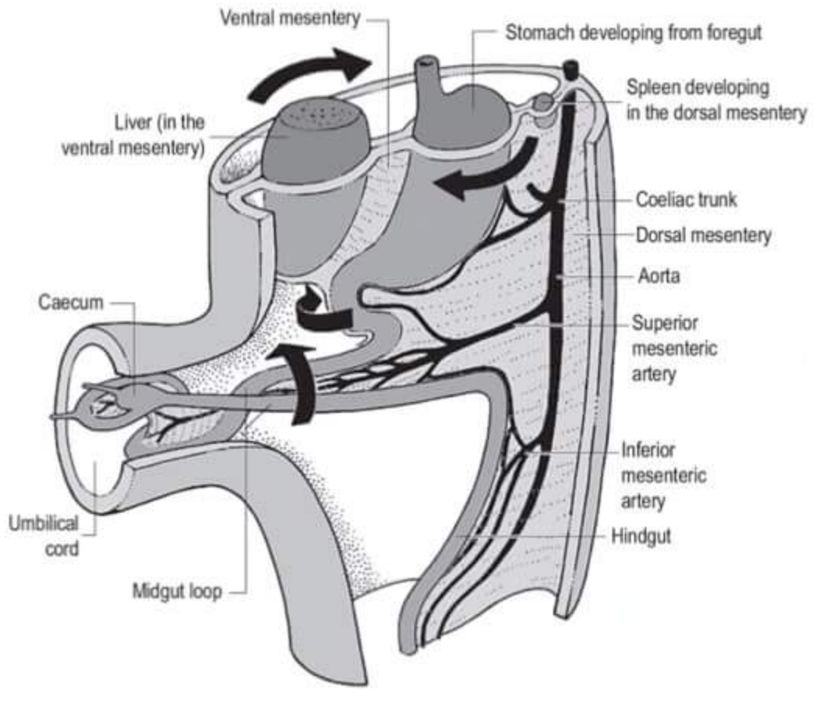
Q The mesentery of small intestine, along its attachment to the posterior abdominal wall, crosses all of the following structures EXCEPT

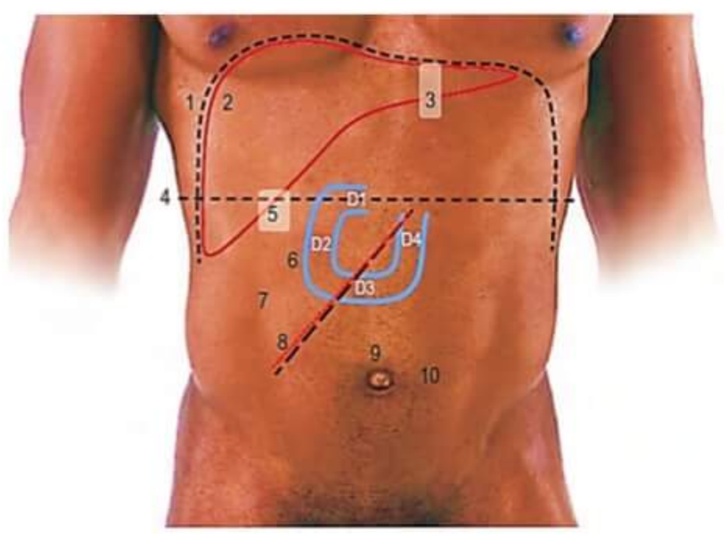
a Left gonadal vessels
b Third part of duodenum
c Aorta
d Rt. ureter

COLON

→ Transverse (and part) of colon passes anterior to 2nd part of duodenum

→ During regression, small Intestine comes back earlier than large intestine (more anterior) (LL → Large intestine, Later)



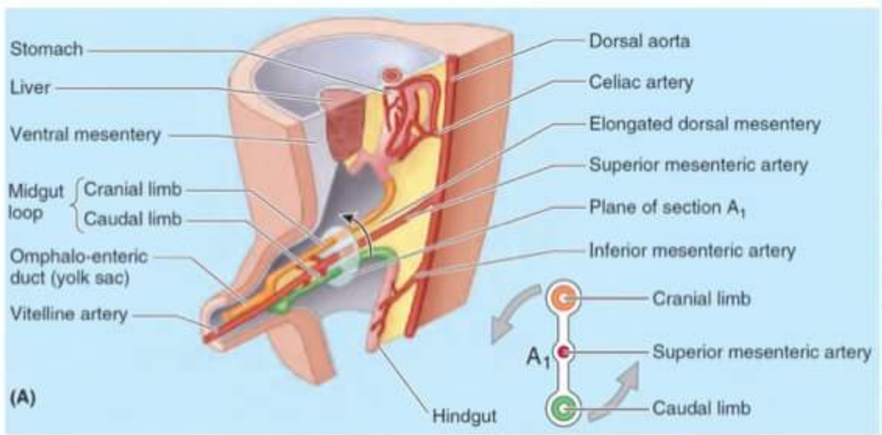


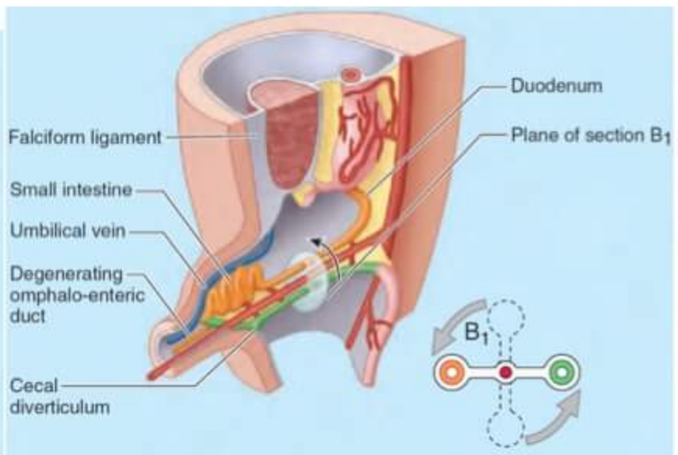
STOMACH

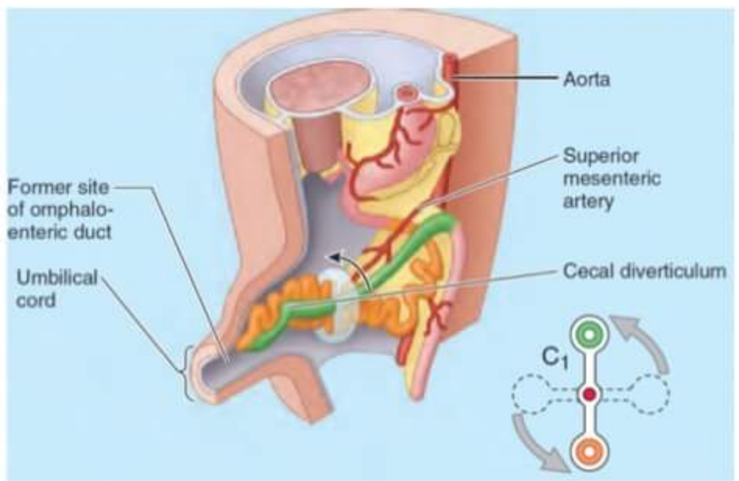
→ Stomach rotates to right side by 90°

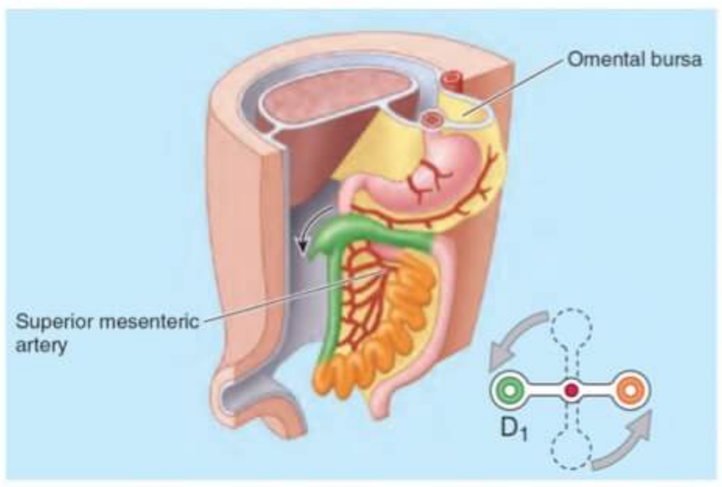
→ Earlier, LC is anterior & greater curvature is posterior
Liver is present infront of lesser curvature, & Spleen behind greater curvature

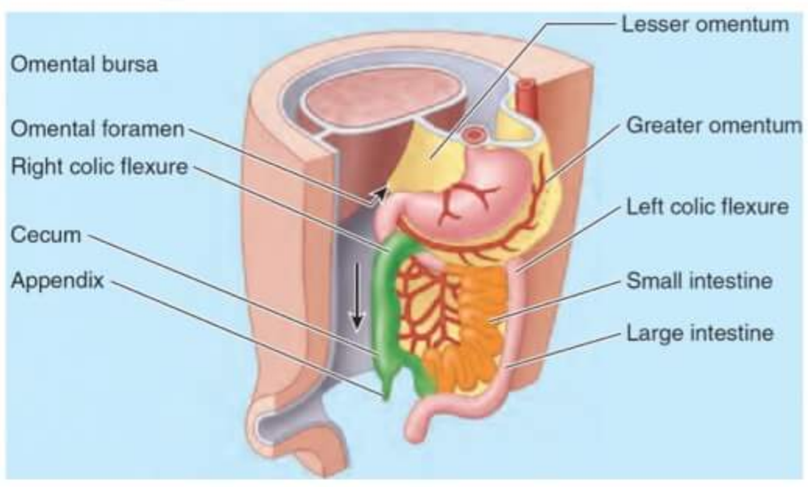
→ Later, Liver pulled to rt. side along ↑ lesser curvature
Spleen pulled to lt side along ↓ greater curvature











OMENTAL BURSA / LESSER SAC

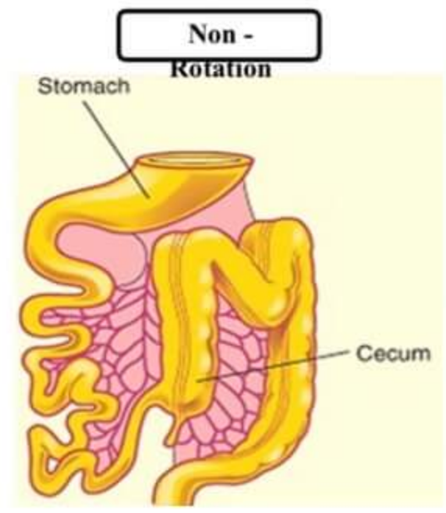
→ peritoneal space developed behind stomach d/t rotatn

→ In posterior perforation of gastric ulcer, gastric contents will be found in lesser sac

Iliocecal junction comes down to Rt iliac fossa d/t DIFFERENTIAL GROWTH
Greater omentum attaching to greater curvature develops from dorsal mesentery
Lesser omentum attaching to lesser curvature develops from ventral mesentery

MALROTATIONS

1. NON ROTATION
2. MIXED/INCOMPLETE ROTATION
3. REVERSE ROTATION



NON ROTATION

→ Small Intestine is on rt. side of midline

→ Large Intestine is on lt. side of midline

→ only first 90° anticlockwise rotation occurs ↑ in umbilical cord

→ volvulus & obstructⁿ occur

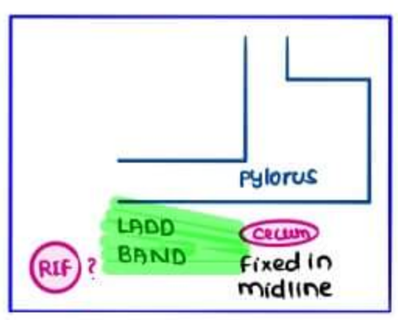
MIXED/INCOMPLETE ROTATION

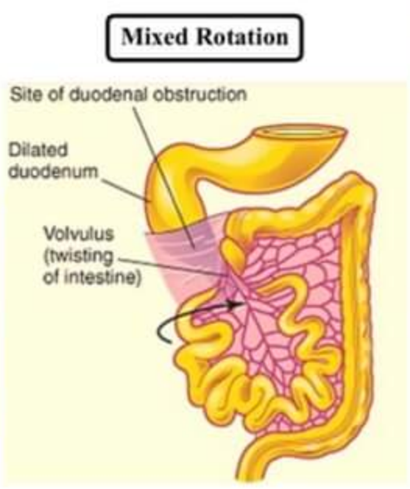
→ Iliocecal junction missing from rt. iliac fossa

→ IC junction present in midline below the pylorus

→ LADD BAND → abnormal peritoneal adhesion fixing the caecum below the pylorus in midline
→ Diagnostic of mixed rotation

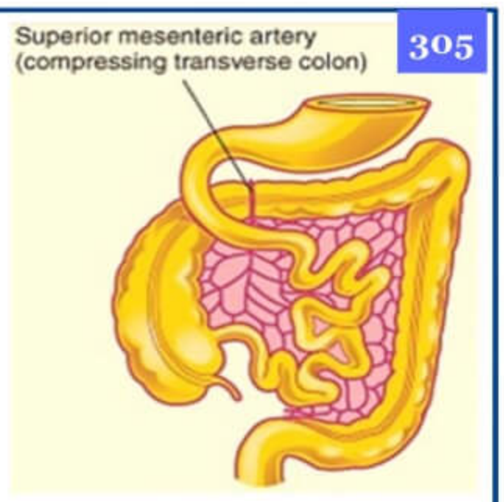
→ volvulus & obstrction occurs





REVERSE ROTATION

→ Rotation becomes clockwise
→ Large intestine comes earlier & passes between duodenum & Sup. mesenteric artery
→ colon obstruction occurs



ABDOMINAL PLANES

Abdomen divided into 4 quadrants by
→ MIDLINE → from suprasternal notch to pubic symphysis
→ TRANSUMBILICAL PLANE → Transverse plane in umbilical region
→ 4 QUADRANTS

Rt. UPPER	Lt. UPPER
Rt. LOWER	Lt. LOWER

Abdomen is divided into 9 Quadrants by
→ MIDCLAVICULAR PLANE → from mid clavicle point to mid inguinal point
→ SUB COSTAL RIB → touching 10th rib
→ INTERTUBERCULAR PLANE
→ THORACO ABDOMINAL DIAPHRAGM (superiorly)
→ PELVIC DIAPHRAGM (Inferiorly)
→ 9 QUADRANTS

1. Epigastrium
2. Rt. Hypochondrium
3. Lt. Hypochondrium
4. Umbilical quadrant
5. Rt. Lumbar quadrant
6. Lt. Lumbar quadrant
7. Rt. Iliac fossa
8. Lt Iliac fossa
9. hypogastrium / suprapubic region

NEUROVASCULAR BUNDLES

ABDOMINAL AORTA

→ EXTENT → T-12 to L-4

→ At T-12 level, thoracic aorta enters abdomen via aortic hiatus in diaphragm

→ At L-4, it bifurcates into 2 branches, common iliac arteries

→ common iliac arteries further divides into internal, external iliac arteries

→ CILIAC ARTERY → b/w T-12 & L1

→ superior mesenteric artery & Renal Artery given at L-1 Lower border (TRANSPYLORIC PLANE)

→ superior mesenteric artery is superior to renal artery

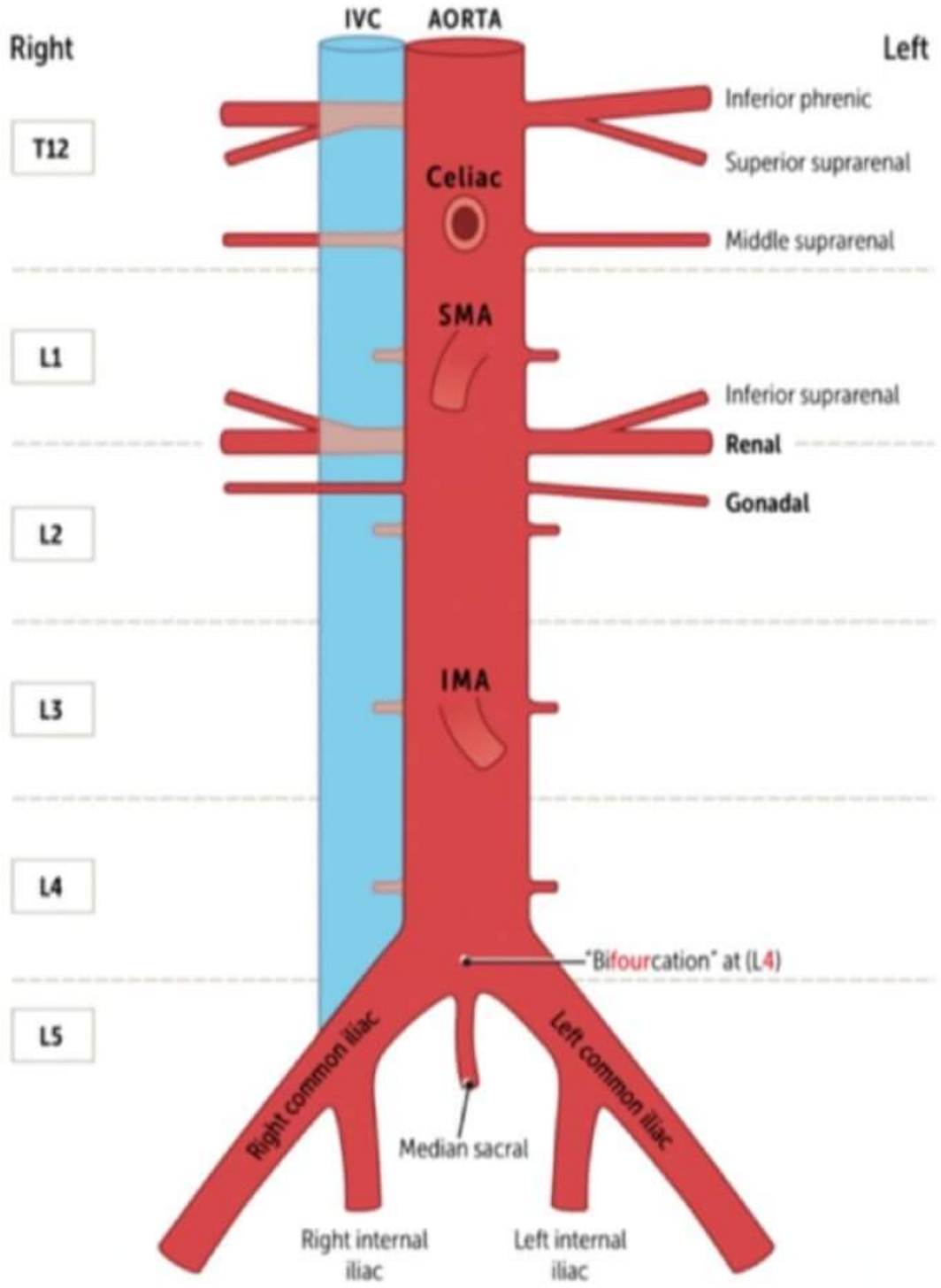
→ Inferior mesenteric artery comes at L-3 level

→ External Iliac artery passes under the inguinal ligament to enter thigh region to become femoral Artery

→ Internal Iliac artery

- supplies pelvic viscera
  - vesical a. → urinary bladder
  - uterine a. → uterus
  - Rectal a. → Rectum

- UB (most anterior)
  Uterus (middle)
  Rectum (posterior)

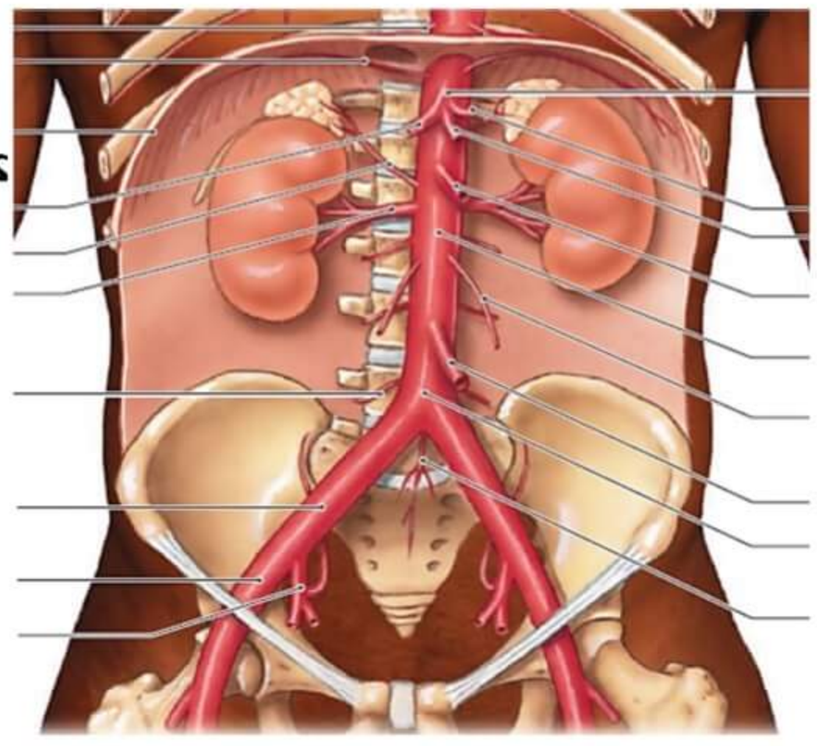


→ Ovaries & Testes are supplied by GONADAL A. (br. of Abdominal aorta)

→ Testicular arteries are longer than ovarian arteries

→ KIDNEY Supplied by Renal artery
  → Earlier they are br. of common iliac artery (when Kidney is a pelvic organ)
  → Later they are br. of Abdominal Aorta (when Kidney is abdominal organ)

→ Gut arteries are → anterior branches
  Gonadal arteries are → antero lateral branches
  Renal arteries are → Lateral branches



→ Gut Lymphatics → pre aortic LN
  Gonadal lymphatics → pre & para aortic LN
  Renal lymphatics → para aortic LN

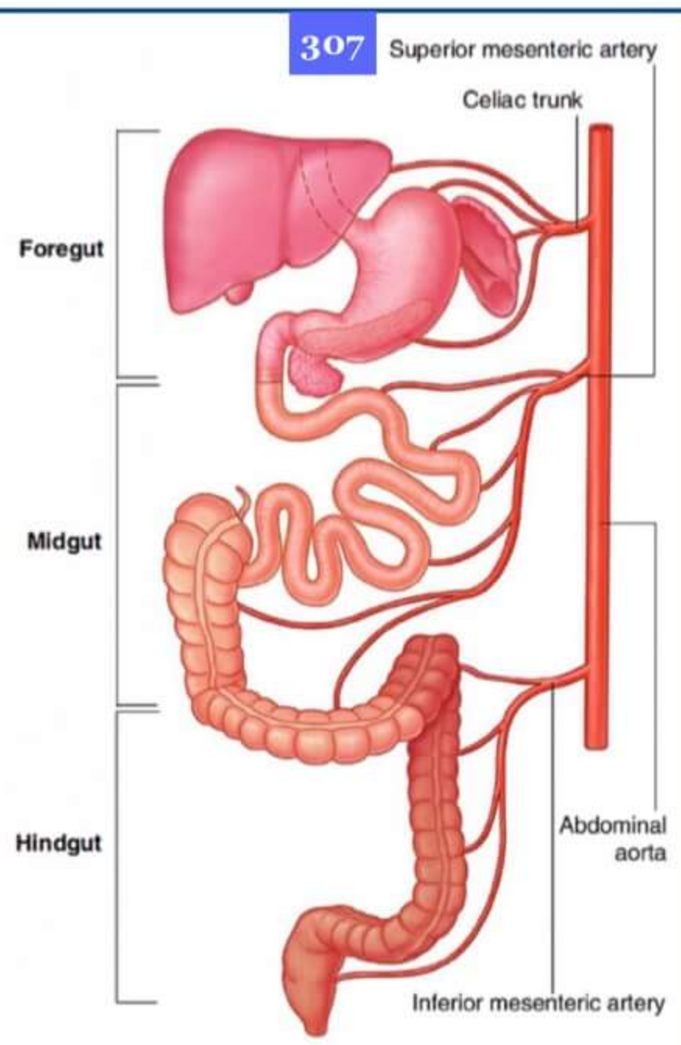
→ CELIAC ARTERY Supplies → foregut derivatives
→ SMA Supplies → Midgut derivatives
→ IMA Supplies → Hindgut derivatives

JUNCTION OF FOREGUT & MID GUT

→ present at 2nd part of Duodenum
→ Liver & pancreas develops here
→ Hepato pancreatic duct opens here
→ proximal half of duodenum (fore gut) Supplied by celiac trunk branches
→ distal half of duodenum (mid gut) Supplied by Superior mesenteric artery (SMA) branches

JUNCTION OF MID GUT & HIND GUT

→ present on transverse colon
→ vagus nerve supply till rt. 2/3rd of Transverse colon
→ Rt. 2/3rd of Transverse colon (mid gut) Supplied by Superior mesenteric artery (SMA) branches
→ Splenic flexure & rectum part of hind gut Supplied by Nervi Erigentes (S-2,3,4)
→ Splenic flexure & rectum part of hindgut supplied by Inferior Mesenteric Artery (IMA) branches



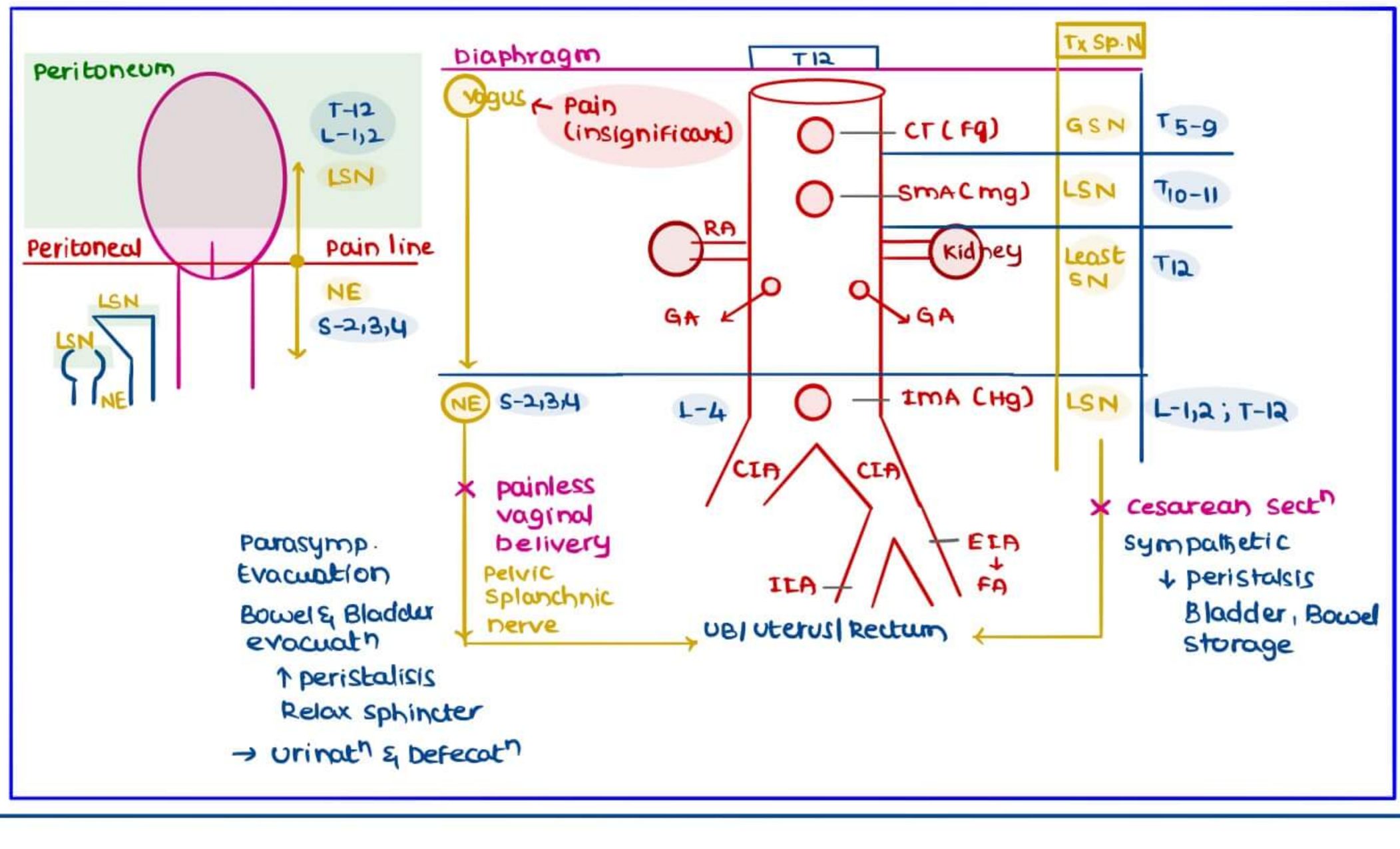
Structures	Foregut	Midgut	Hindgut
Organs	Esophagus, stomach, liver, gall bladder, pancreas, 1/2 of duodenum	1/2 of duodenum, jejunum, ileum, cecum, ascending colon, 2/3 of transverse colon	1/3 of transverse colon, descending and sigmoid colon, rectum, and 2/3 of anal canal
Arteries and branches	**Celiac** splenic, left gastric, short gastric, common hepatic, right gastric, gastroduodenal	**Superior Mesenteric** inferior pancreatico-duodenal, intestinal middle colic, right colic, ileocolic	**Inferior Mesenteric** left colic, superior rectal
Veins	Portal vein	Portal vein	Portal vein
Lymph	Celiac nodes (supracolic compartment)	Superior mesenteric nodes (infracolic compartment)	Inferior mesenteric nodes (infracolic compartment)
Nerves: Parasympathetic	Vagus	Vagus	Pelvic splanchnic, (S2-S4)
Sympathetic	Greater thoracic splanchnic (T5-T9)	Lesser thoracic splanchnic (T 10, T11)	Least thoracic splanchnic (T12), upper lumbar splanchnic (L1, L2)
Pain refers to:	**Epigastric region**	**Umbilical region**	**Suprapubic region**

KIDNEY NERVE SUPPLY

→ Root value
T-10,11,12 & L-1,2

ROOT VALUE T-10,11,12 & L-1,2
6 Viscera
Kidney
Testes
Ovary
Uterus
Uterine tube
Urinary Bladder

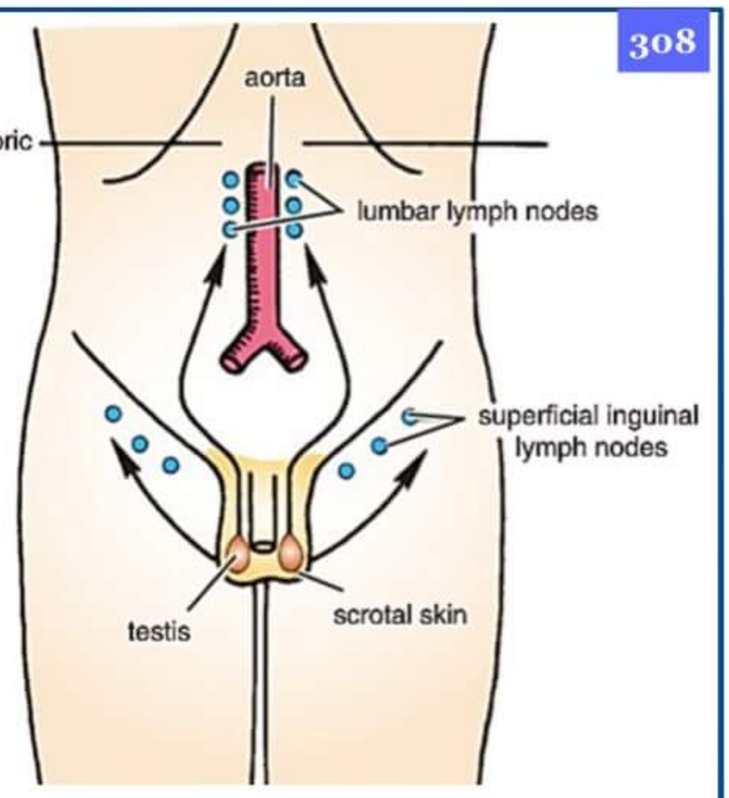
T12 ±2



LYMPHATICS

→ Gut Lymphatics → pre aortic LN
Gonadal lymphatics → pre & para aortic LN
Renal lymphatics → para aortic LN

→ In Seminoma, lymphatics involved
→ Para aortic > Pre aortic LN



Q Which of the following is terminal group of LN in colonic drainage

a Pre aortic
b Para aortic
c Para colic
d Epicolic

Q Testicular lymphatics drain into which lymph nodes

a Superficial inguinal
b Internal Iliac
c Preaortic
d Paraaortic Better Answer

NERVE SUPPLY

→ Greater Splanchnic nerve, Lesser Splanchnic nerve & least Splanchnic nerve comes from thoracic sympathetic chain & puncture the crus of diaphragm, enter the abdomen & supply abdominal viscera

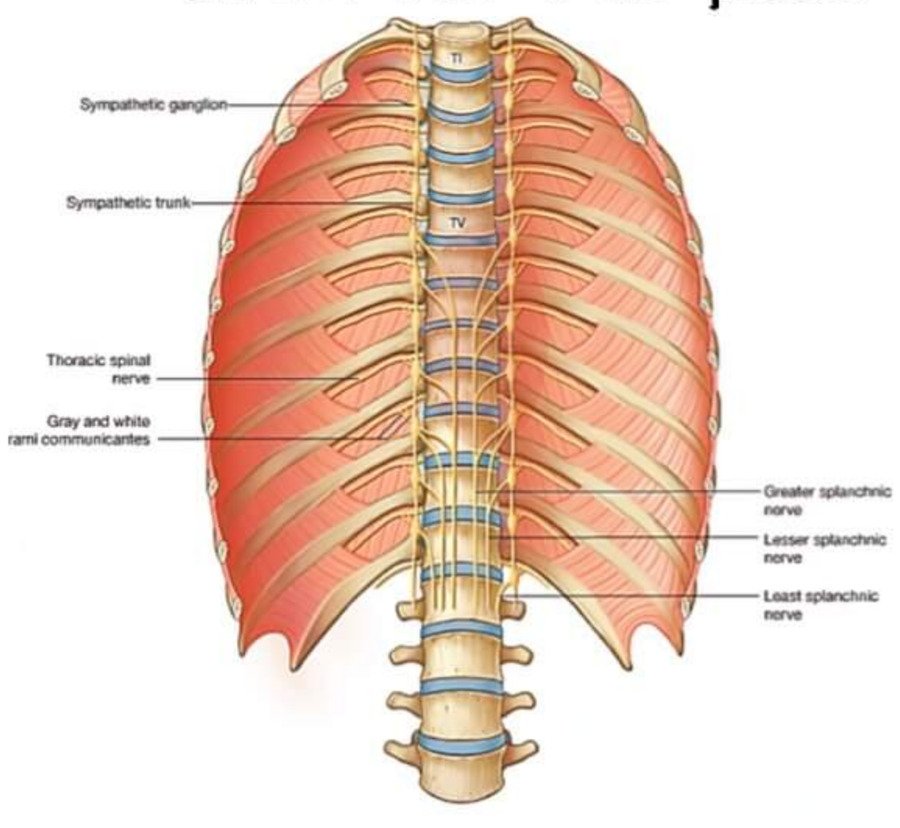
→ At puncturing crus of diaphragm, they contributes to

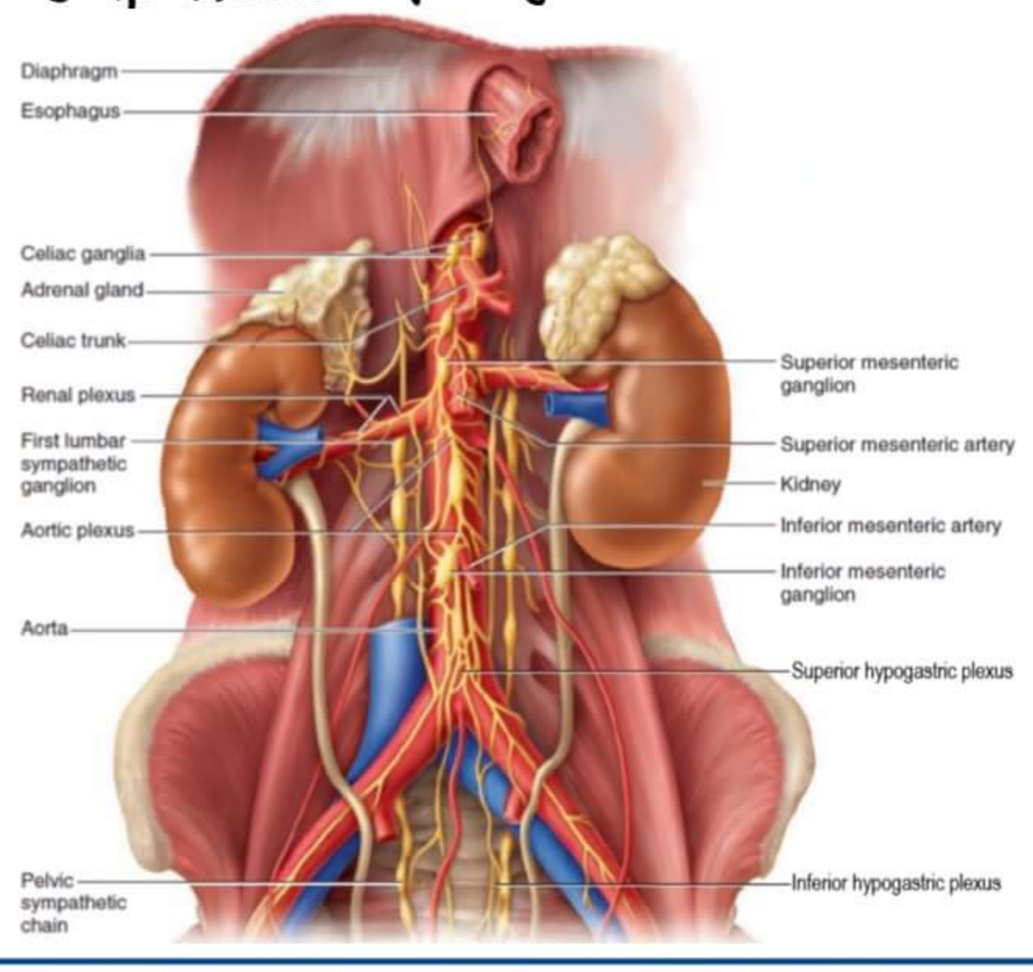
Celiac plexus
Superior mesenteric plexus
Renal plexus
Inferior mesenteric plexus
} sympathetic & parasympathetic

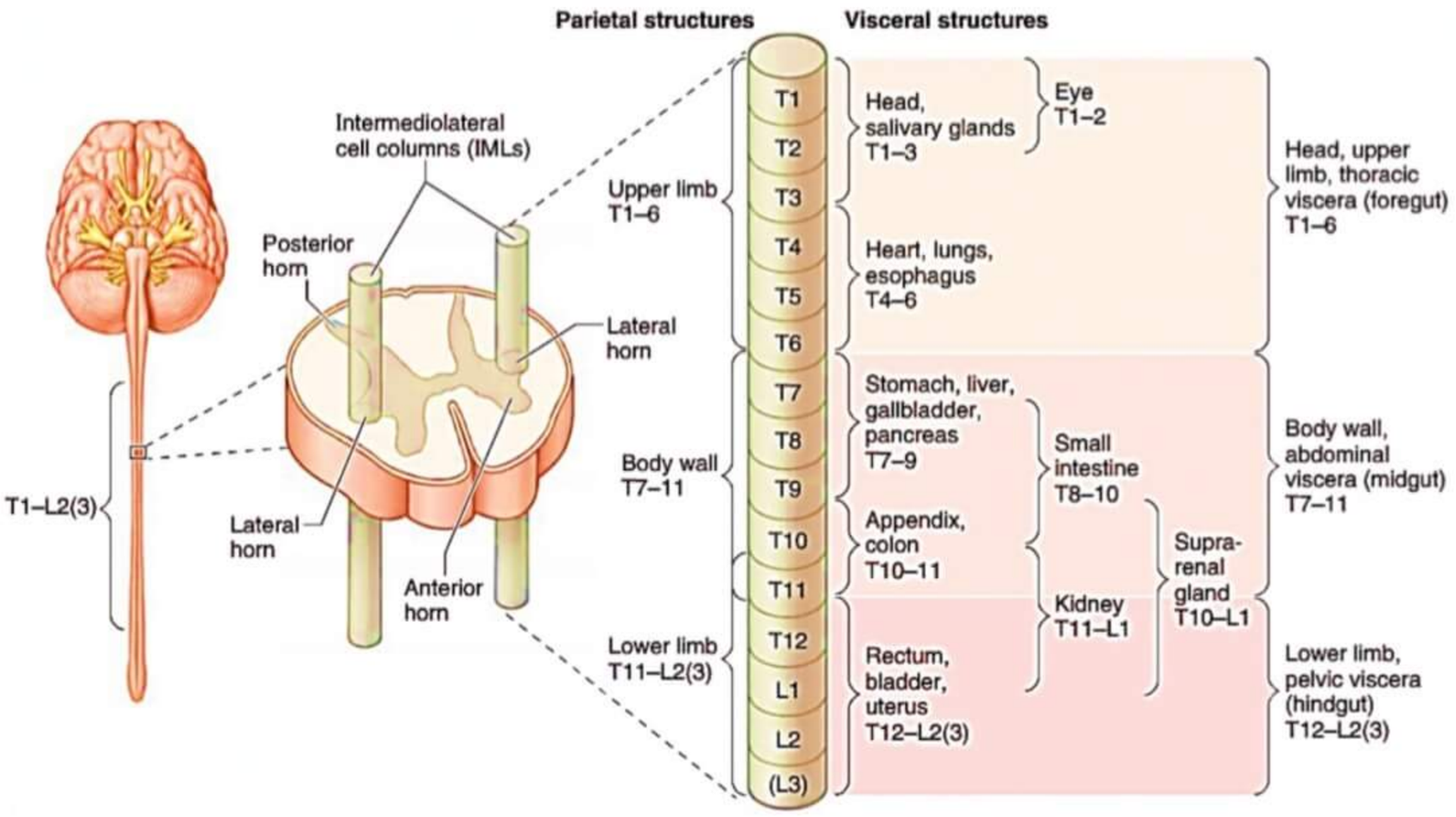
superior hypogastric plexus → Sympathetic mostly

→ Inferior hypogastric plexus supplies pelvic viscera
Sympathetic → by Lumbar Splanchnic nerve
Parasympathetic → by Nervi Erigentes

→ Celiac plexus
Superior mesenteric plexus
Renal plexus
Inferior mesenteric plexus
} sympathetic by Thoracic sympathetic chain
parasympathetic by vagus nerve





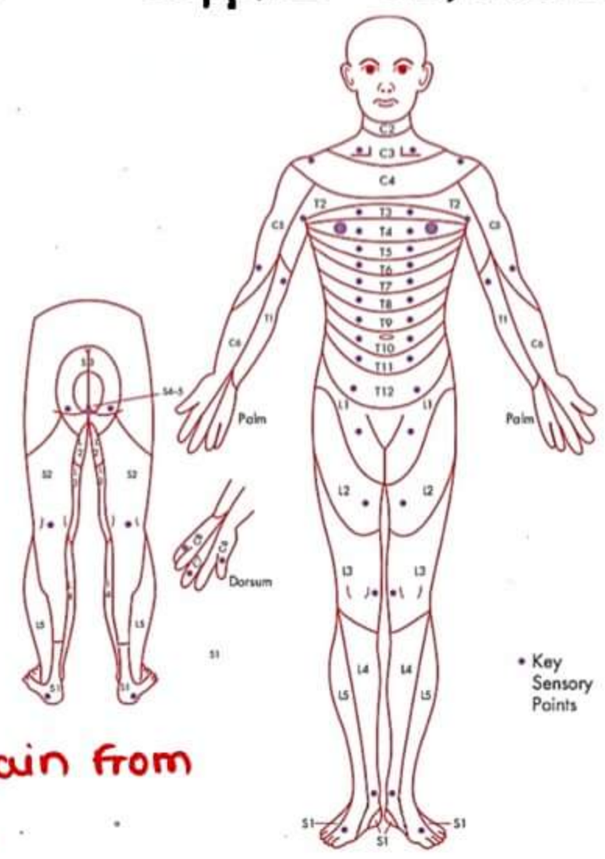


THORACO LUMBAR FLOW

- → Starting at T-1 & ending at L-2
- → Sympathetic neurons present in Lateral horn cells
- → GREATER SPLANCHNIC NERVE (T_{5-9}) → Supplies foregut derivatives
- → LESSER SPLANCHNIC NERVE (T-10,11) → Supply midgut derivatives
- → LEAST SPLANCHNIC NERVE (T-12) → Supplies Kidney
- → LUMBAR SPLANCHNIC NERVE (T_{12}, L-1,2) → Supplies UB, uterus, rectum

DERMATOMES

- → Shoulder tip dermatome → C-4
- → Nipple level → T-4
- → Epigastrium (foregut) → T-7
- → Midgut (peri umbilical) → T-10
- → Supra pubic region → L-1
- → Lower Limb (inguinal region) → L-1
- → Little toe → S-1



Dermatomal Landmarks	
Dermatome	Region
T4	Nipple
T7	Xiphoid process
T10	Umbilicus
L1	Inguinal ligament

Q In first stage of labour the referred pain from uterus is carried to the dermatome

a T-10,11
b T-12 ; L-1 (Better answer)
c L-1,2
d S-2,3

Q To provide pain releif during 1st stage of labour Which sensory level should be blocked

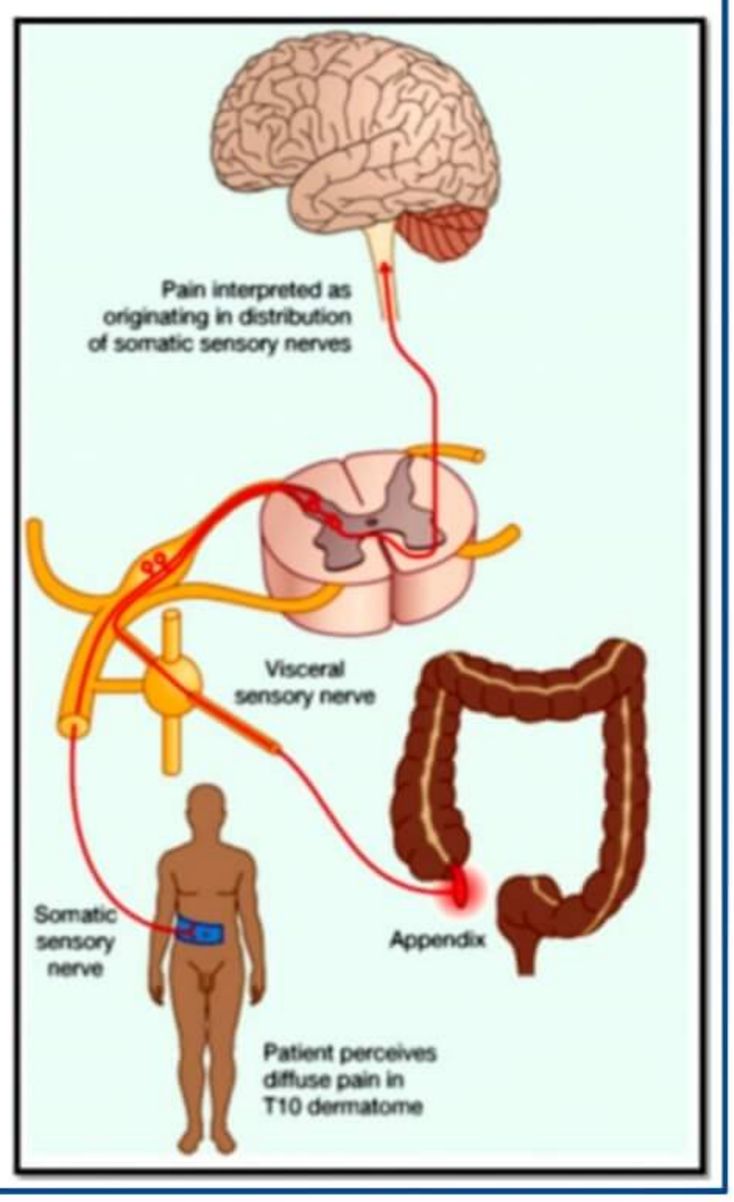
a T8 to L1
b T9 to L2
c T10 to L1
d T11 to L2

REFERRED PAIN

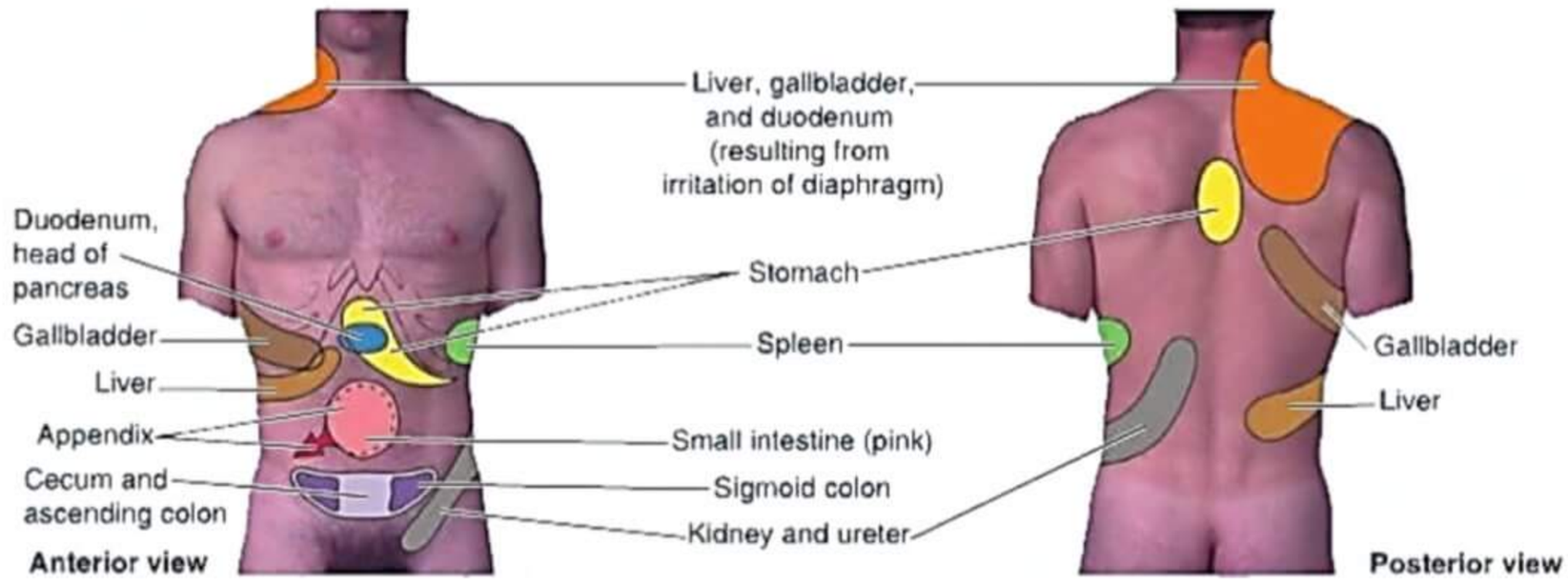
CONVERGENCE PROJECTION HYPOTHESIS

→ visceral pain is dull pain

visceral pain → Dorsal root ganglion → Post. Horn cell → Lateral spinothalamic tract → Brain



→ Brain perceives the visceral pain as pain from skin ∵ same root value because skin innervatn & gut innervation is projecting on same neuron



→	Acute cholecystitis	→	Rt. shoulder tip	→ Phrenic nerve (C-4)
→	Splenic rupture	→	Lt. Shoulder tip	→ Phrenic nerve (C-4)
→	Gut Pain	→	midline	
	foregut	→	Epigastrium	→ T-7
	mid gut	→	Periumbilical	→ T-10
	hind gut	→	Supra pubic	→ L-1

→ Gut pain is always in midline unless local area involvement
Acute Appendicitis → Rt Iliac fossa
→ dlt local peritonitis

→ Kidney & Liver pain → Radiating pain from loin to groin
→ kidney pain → start at renal angle (T12 ±2 → T10,11,12; L1,2]

LIVER

Q Liver is divided into anatomical segments by following all EXCEPT
a Hepatic vein
b Portal vein
c Bile duct
d Hepatic artery

D → Duct (Bile duct)
A → Artery (Hepatic Artery)
V → Vein (Portal vein)
} goes to PORTA HEPATIS

LIVER SEGMENTS

COUINAUD'S CLASSIFICATION (for hepatic resectn)

→ follows Portal vein & hepatic vein (portal vein > Hepatic vein)

→ Portal vein & Hepatic vein } Intersegmental & create Sx planes

→ 8 Segments

LIVER TRANSPLANTATION

RIGHT LOBE & LEFT LOBE

→ divided on basis of Middle Hepatic vein

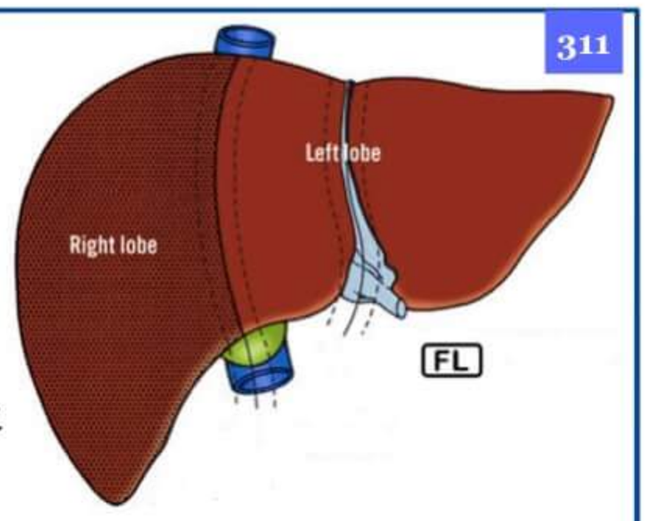
→ CANTLIE'S LINE / SURGICAL DIVISION

→ surface marking of middle Hepatic vein

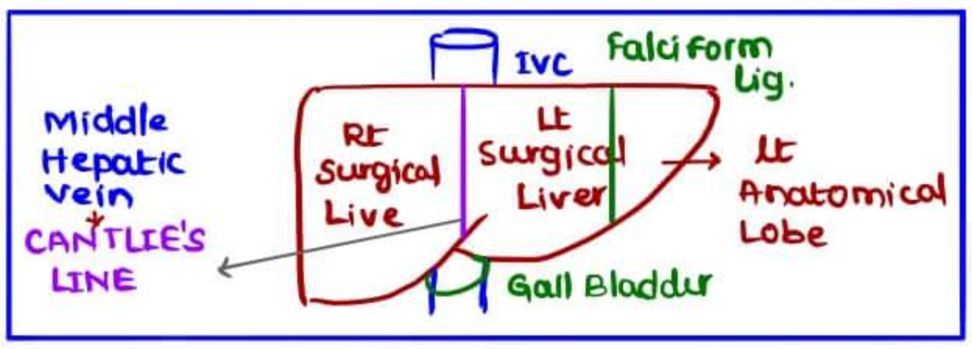
→ Line joining mid point of Gall bladder & mid point of IVC

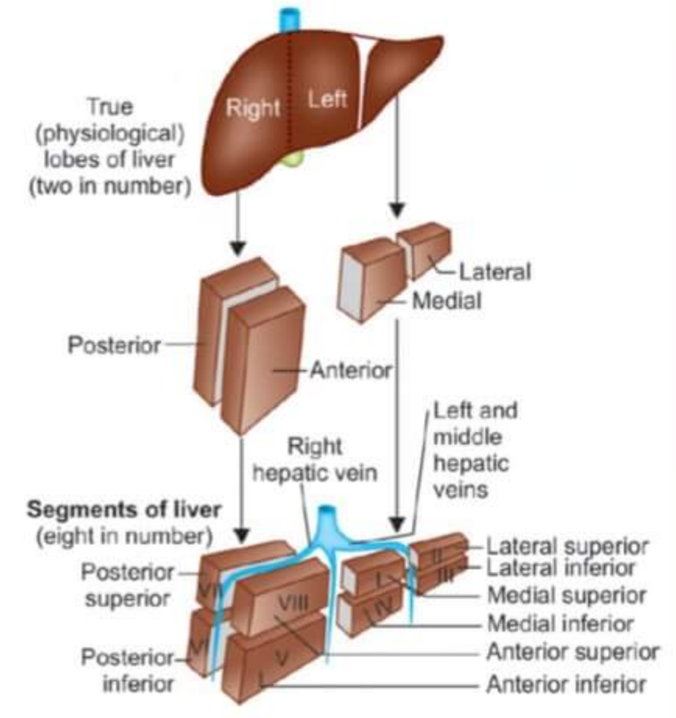
→ 60-70% Rt Surgical liver is given to recipient

→ 30-40% Lt Lobe is left Surgical liver left ĩ donar



→ ANATOMICAL DIVISION → Liver to falciform ligament is the left anatomical lobe



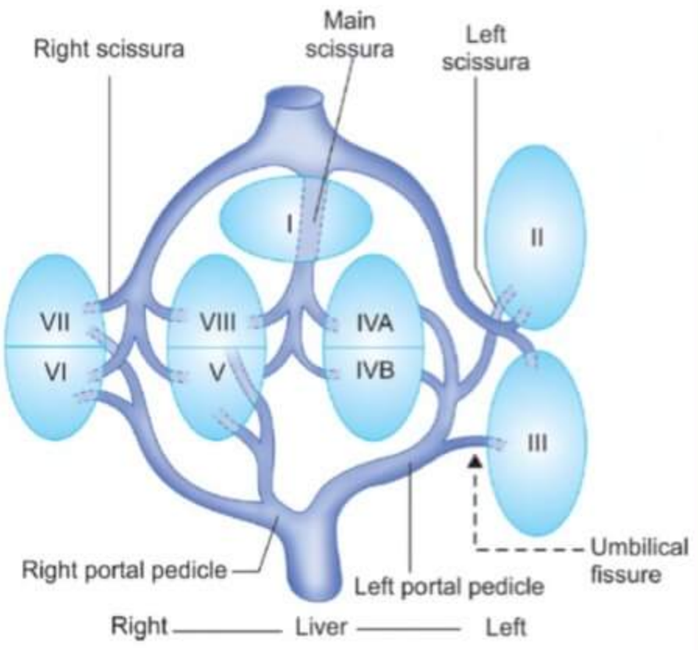


8 SEGMENTS OF LIVER

3 HEPATIC VEINS

1. Middle Hepatic vein
2. Rt. hepatic vein
3. Lt. hepatic vein

} - drain the liver metabolites into IVC
- Intersectorial in nature
- divides liver into 4 sectors



PORTAL VEINS

→ Portal vein brings blood into the liver

→ divides Liver into 8 SEGMENTS

caudate lobe

→ smallest hidden by Segment 4 posteriorly

→ peculiar → drain directly into IVC

→ IN BUDD CHIARI Syndrome / hepatic vein thrombosis, caudate lobe escapes injury

→ aka 3rd surgical lobe

SEGMENT 4

→ Large segment hides caudate lobe (4a)

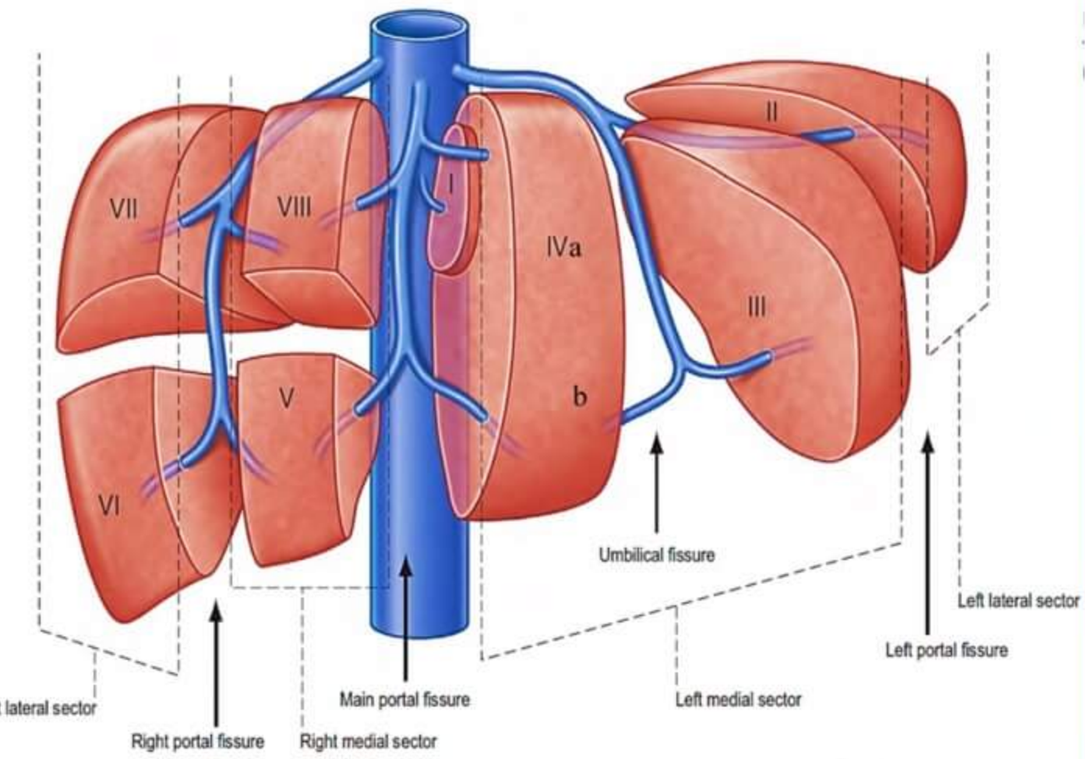
→ 4a → superior
4b → inferior

→ QUADRATE LOBE

→ quadrangular lobe

→ present behind 4b

→ not seen anteriorly



POSTERIOR VEIW

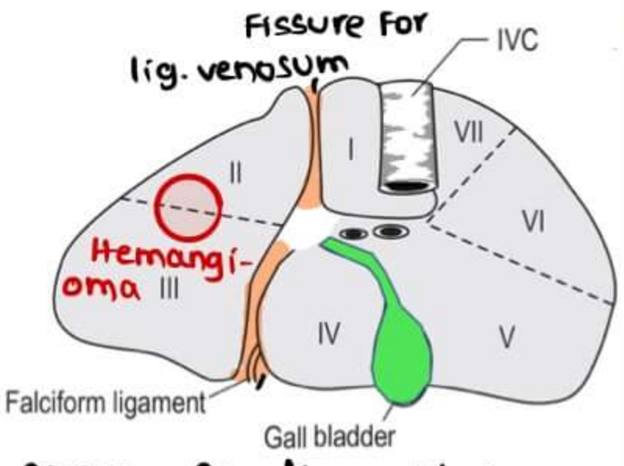
→ fissure for ligamentum venosum separates segments 1&2

→ Fissure for ligamentum teres, separates segments 3&4

→ caudate lobe

→ comma shaped

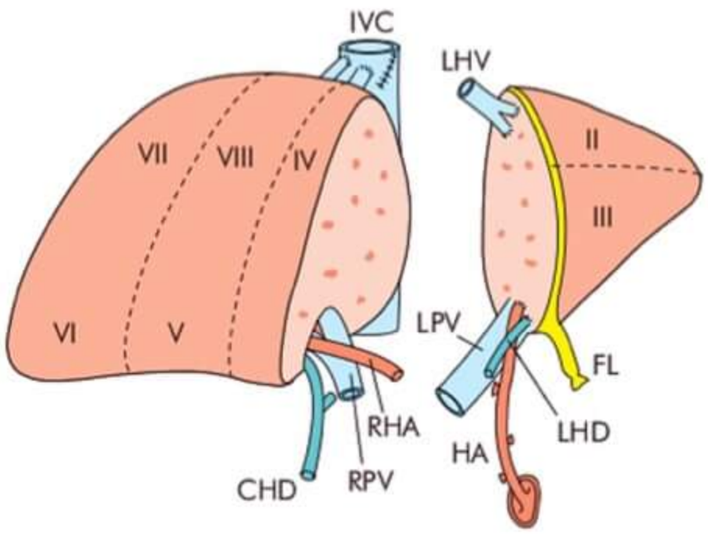
→ sandwiched blw IVC on rt side & fissure for lig. venosum on lt side



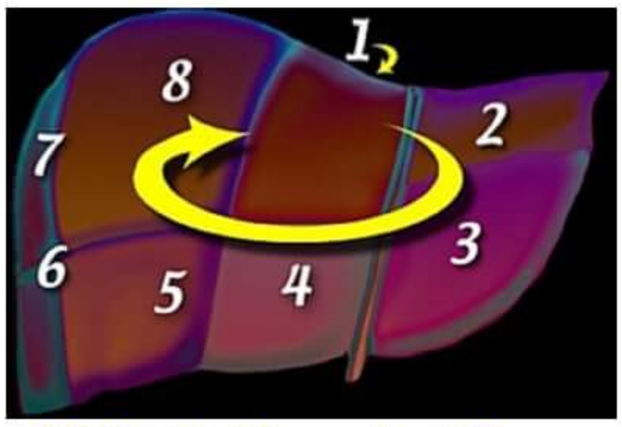
fissure for ligamentum teres

→ Quadrate lobe sandwiched blw Gall bladder on rt. side, fissure for ligamentum teres to left side

→ IN HEMANGIOMA, on left side of falciform ligament,
  → resect segments 2 & 3 & preserve segments 1 & 4
  → scalpel should be in fissure for ligamentum venosum & fissure for ligamentum teres (Avascular plane - can minimise bleeding)



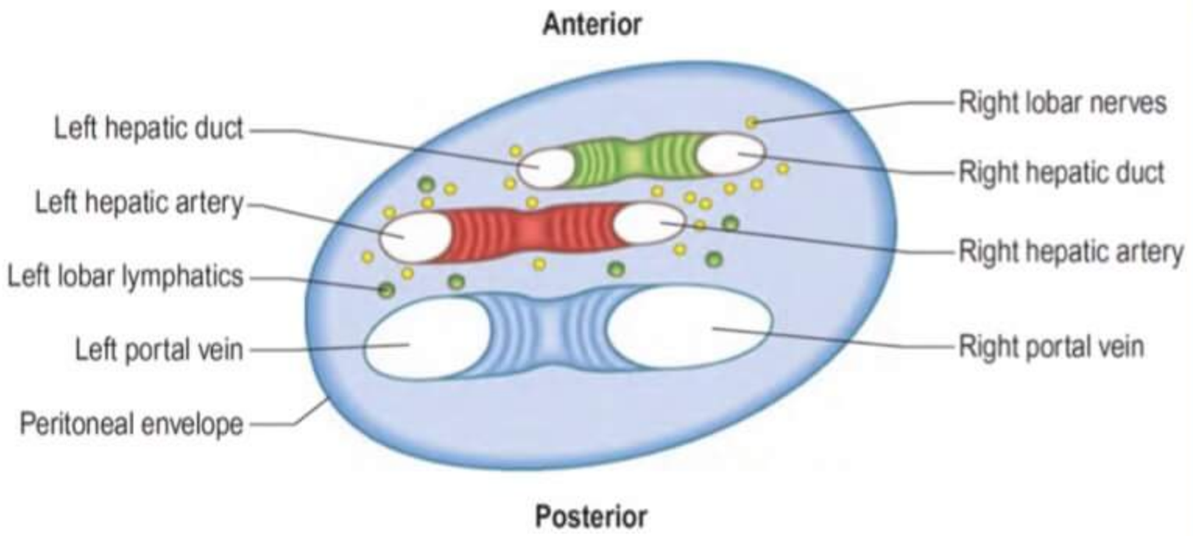
Post Op. Diagram (Hemangioma)

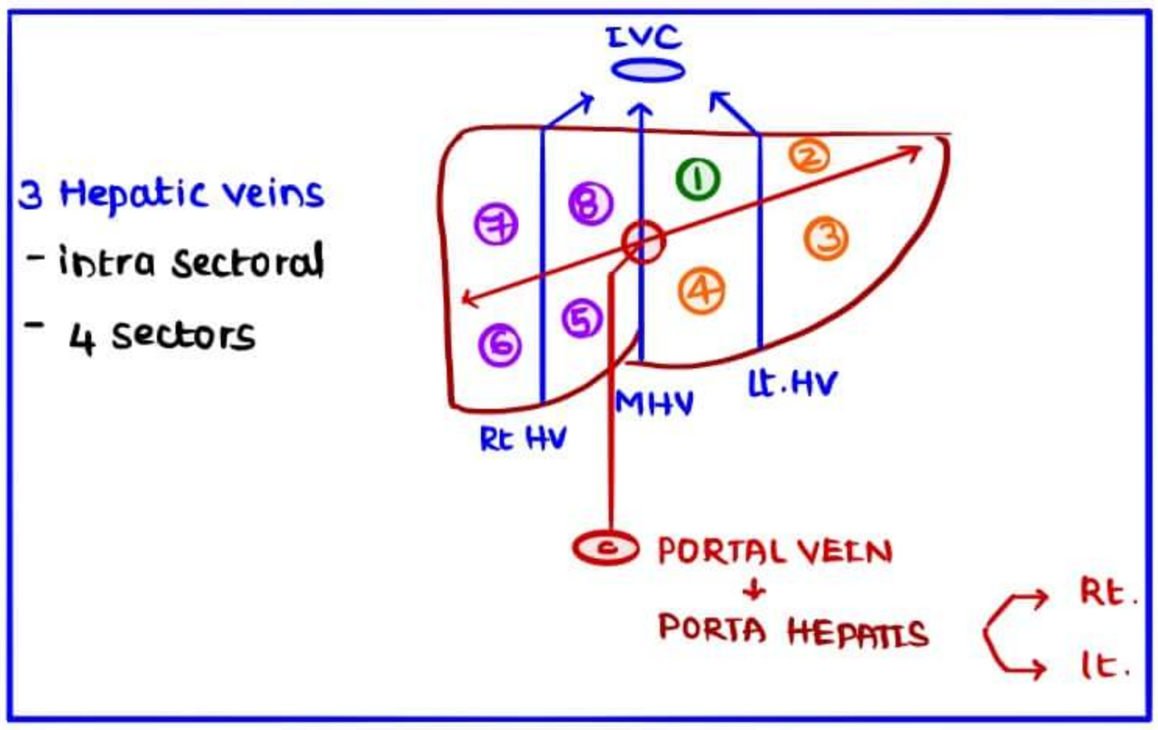


SEGMENTS OF LIVER

SEGMENTS OF LIVER
Lt. Surgical Liver - Seg 2,3,4
Rt. Sx liver - Seg 5,6,7,8
3rd Sx liver - Seg 1 (caudate)

CAUDATE LOBE (SEGMENT 1)
→ aka 3rd surgical liver
  - has double duct supply
    double artery supply
    double vein supply
  - directly drain into IVC





Rt surgical Liver → 5,6,7,8
→ secretes Bile in to Rt. hepatic duct

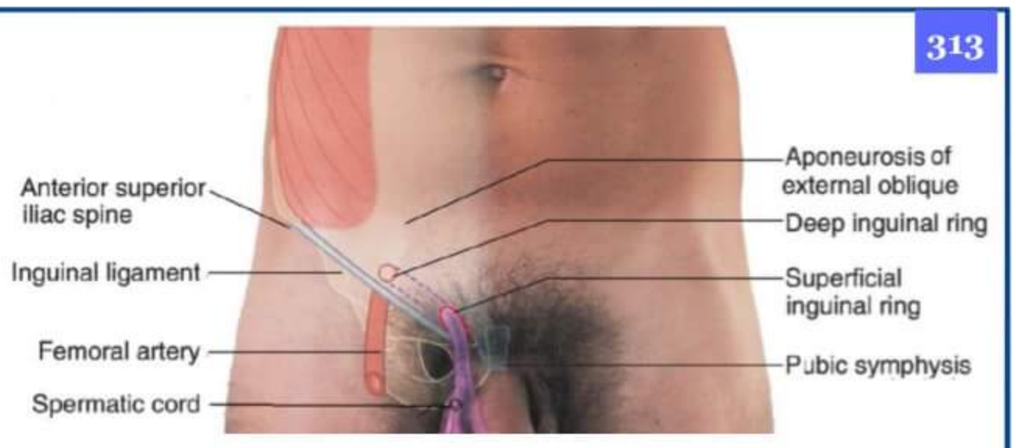
Rt Hepatic Duct (5,6,7,8,1) ↓ Common Hepatic Duct ↓ Lt. Hepatic Duct (1,2,3,4)

BUDD CHIARI SYNDROME / HEPATIC VEIN THROMBOSIS
→ HVT → Reversal of Blood flow → Portal HTN → Cirrhosis → DIE
→ caudate lobe is spared & compensatory hypertrophy (20 times larger) occurs

Q The rt. lobe of liver consists of which segments
a 5,6,7,8
b 4,5,6,7,8
c 1,5,6,7,8
d 1,4,5,6,7,8

Q All of the following segments of Liver which drains into rt. hepatic duct EXCEPT
a 1
b 3
c 5
d 8

INGUINAL REGION & FEMORAL REGION



INGUINAL LIGAMENT

→ from anterior superior iliac spine to pubic tubercle

FEMORAL PULSE can be felt on mid inguinal point

MID INGUINAL POINT → mid point of line from ASIS to pubic symphysis

DEEP INGUINAL RING

→ present above the mid inguinal point

→ Testis will enter inguinal canal here & runs 3.75 cm long & enters scrotum through SUPERFICIAL INGUINAL RING

Q Gubernaculum is attached to
a cranial pole of testis
b caudal pole of testis
c Body of testis
d Epididymus

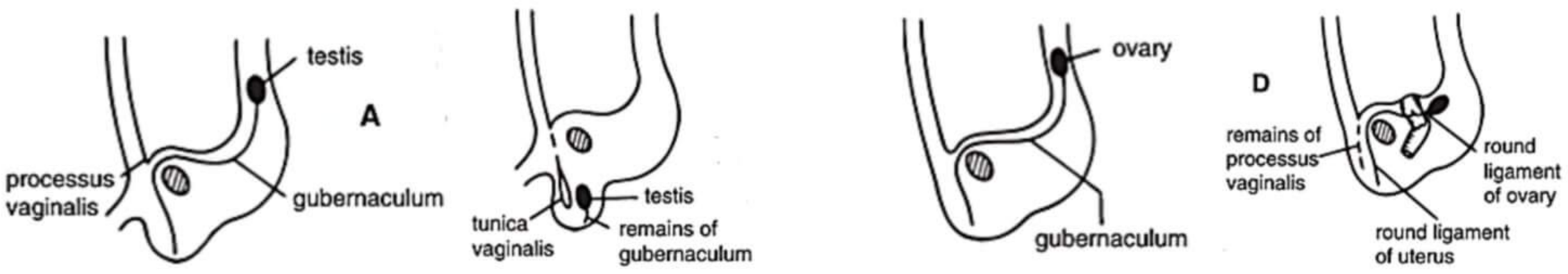
DESCENT OF TESTIS

→ Testis is retroperitoneal structure in the beginning

→ Testis being pulled by GUBERNACULUM at the caudal pole of gonads

→ Testis require 2°C less temp. than the body to form Sperms

→ In inguinal region, it passes infront of pubis bone
During passing it is followed by PROCESS VAGINALIS (double fold of peritoneum)



→ PROCESSUS VAGINALIS

→ Later becomes TUNICA VAGINALIS & covers the Scrotum

→ PV becomes obliterated

→ PERSISTENT PROCESSUS VAGINALIS

→ causes Indirect Inguinal hernia

→ more common in young male

→ less common in elderly male

→ least common in FEMALE

DESCENT OF OVARY

→ ovary is retroperitoneal earlier

→ at caudal pole it is pulled by Gubernaculum towards the labia major

→ Factors preventing the ovary to reach labia majora

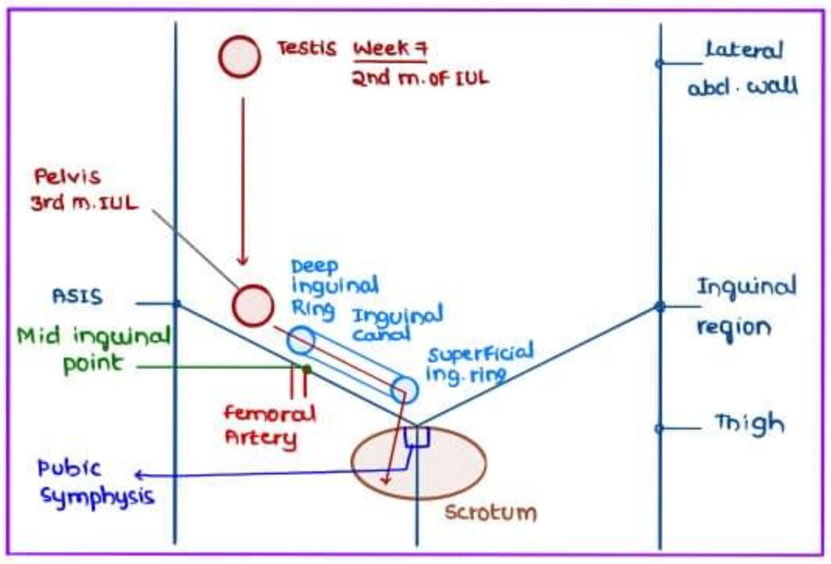
Uterus → divides gubernaculum into 2 ligaments

→ Round ligament of ovary
Round ligament of uterus
} remnants of Gubernaculum

→ Round ligament comes to labia majora passing infront of pubis
→ Few lymphatics of uterus follow round ligament & drain into superficial inguinal LN

PROCESSUS VAGINALIS

→ normally obliterated
→ PERSISTENT PROCESS VAGINALIS
→ follows round ligament of uterus
→ pulls contents of intestine into labia majora
→ Indirect Inguinal Hernia



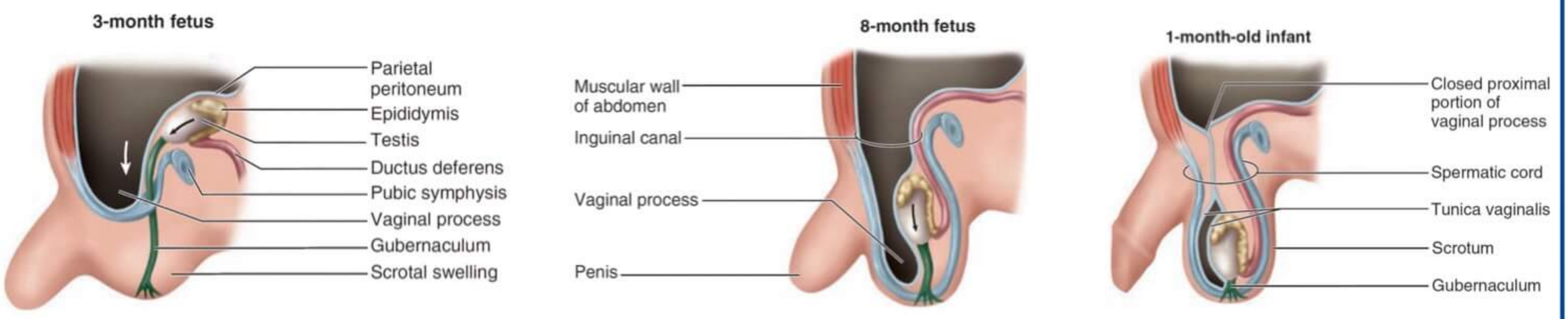
Q Testes completely descend in the scrotum by the age of
a End of 7th month of IUL
b End of 8th month of IUL
c End of 9th month of IUL Better answer
d After birth

DESCENT OF TESTIS - TIMING

→ Testis is intra abdominal at week 7 / 2nd month of IUL
→ descend down to pelvis at 3rd month of IUL,
stays near the deep inguinal ring till 7th month of IUL
→ enter the deep inguinal ring at 25-28 week / 7th month of IUL
→ passes the inguinal canal in 3-4 days
→ Takes 1.5 months to reach the Scrotum from Superficial inguinal ring
→ Before birth, testis is at base of scrotum

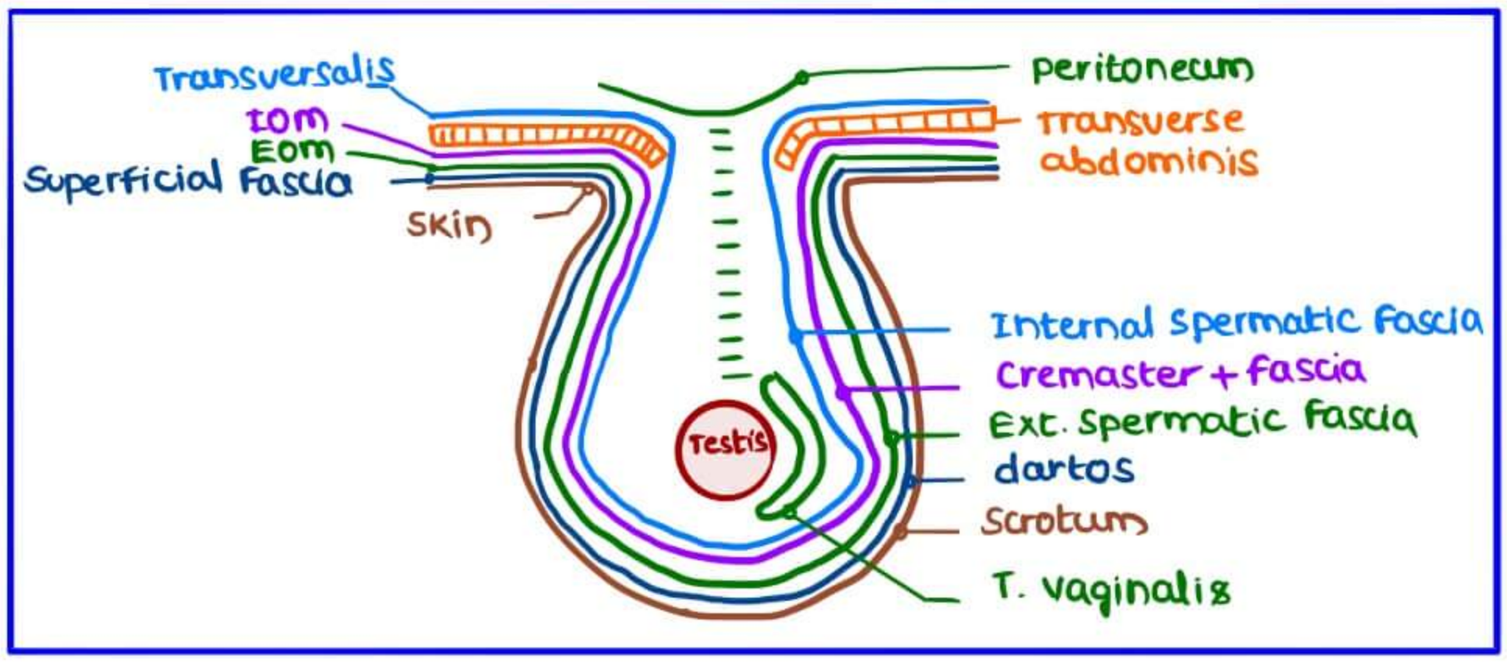
ABDOMINAL WALL LAYERS

Descending Testis carries the double fold of Peritoneum → PROCESSUS VAGINALIS



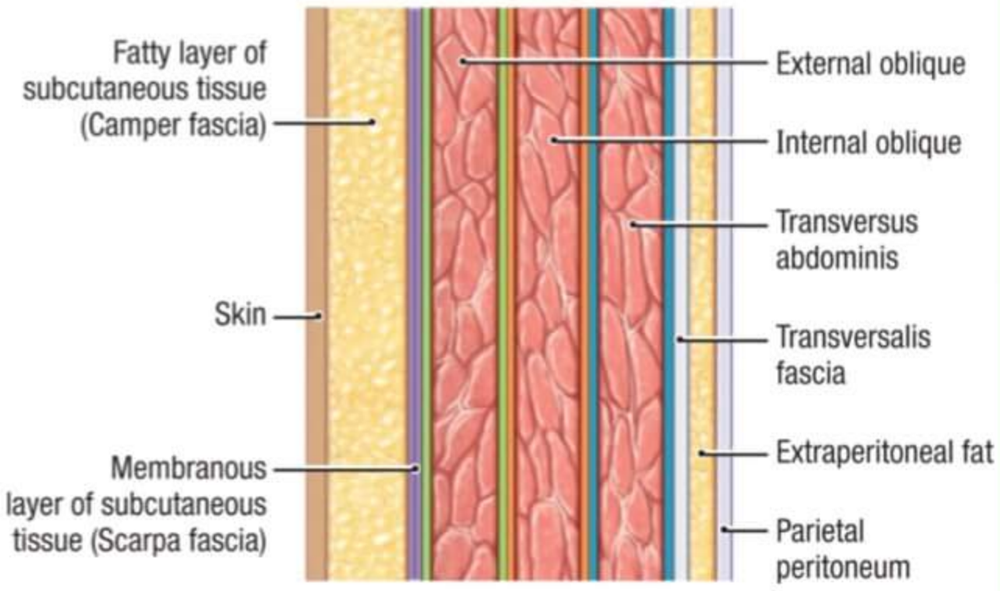
→ as the testis pulled by gubernaculum, small part of peritoneal cavity follows the testis towards the scrotum
→ Processus vaginalis forms tunica vaginalis & Obliterated
→ While descending, testis brings anterior abdominal wall to scrotum

Skin of ant. abd. wall	→	Skin of Scrotum
Superficial fascia of abd. wall	→	DARTOS MUSCLE
External oblique muscle	→	External Spermatic fascia
Internal oblique muscle	→	cremasteric fascia & muscle
Transversalis fascia	→	Internal spermatic fascia



ANTERIOR ABDOMINAL LAYERS

1. SKIN
2. SUPERFICIAL FASCIA
   a. camper fascia (fatty)
   b. Scarpa fascia (membranous)
3. EXTERNAL OBLIQUE
4. INTERNAL OBLIQUE
5. TRANSVERSUS ABDOMINIS
6. TRANSVERSALIS FASCIA
7. PARIETAL PERITONEUM

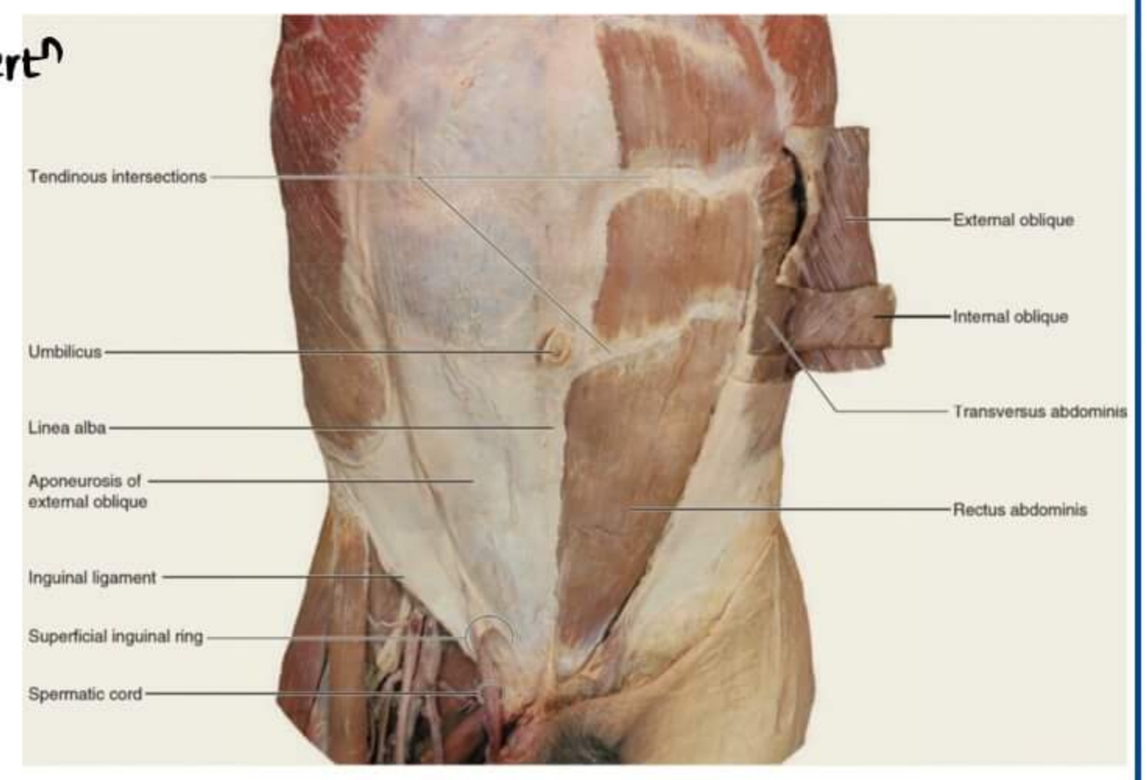


RECTUS SHEATH

→ covers Rectus abdominis i tendinous insertn

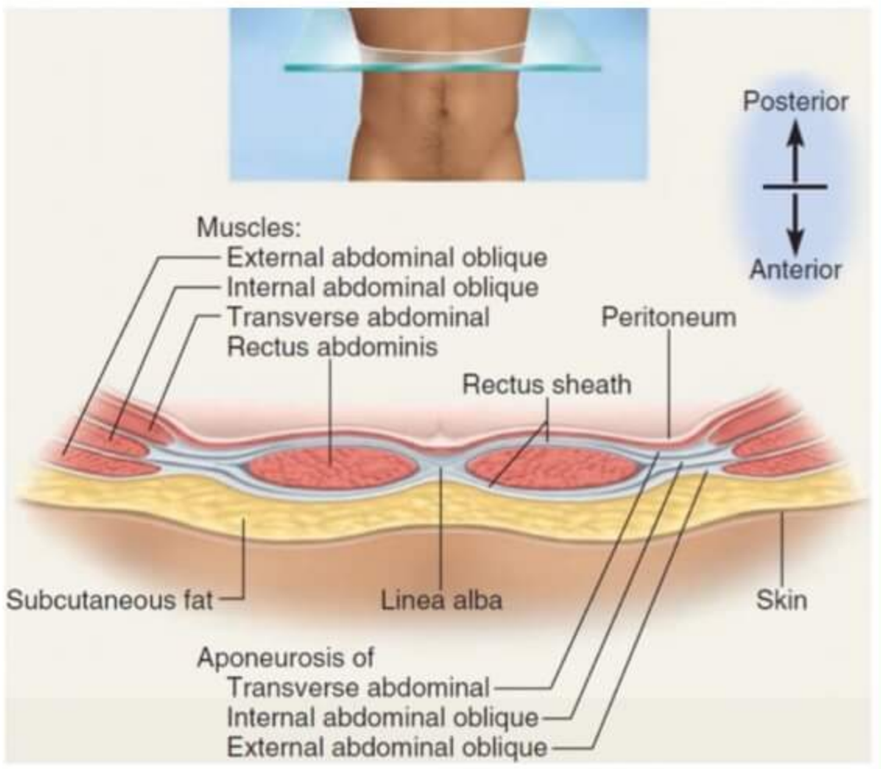
→ **LINEA ALBA**
   → present at midline
   → more prominent in upper part
   → less prominent in lower part
   → White in colour

→ **LINEA SEMILUNARIS**
   → present at Lateral border of rectus abdominus



→ **EXTERNAL OBLIQUE APONEUROSIS**
   → Forms inguinal ligament
   → Froms anterior wall & floor of inguinal canal
   → Superficial Inguinal Ring (defect in Ext. Oblique aponeurosis)

→ **SPERMATIC CORD**
   → follows testis in inguinal canal
   → contains
      artery of testis
      vein of testis
      Ductus deferens (carries Sperms)



CONTRIBUTED BY

External oblique
   → most superficial muscle
   → gives ant. Layer & fuse in mid line ī Linea alba

Transverse abdominis

→ deepermost muscle

→ gives posterior layer

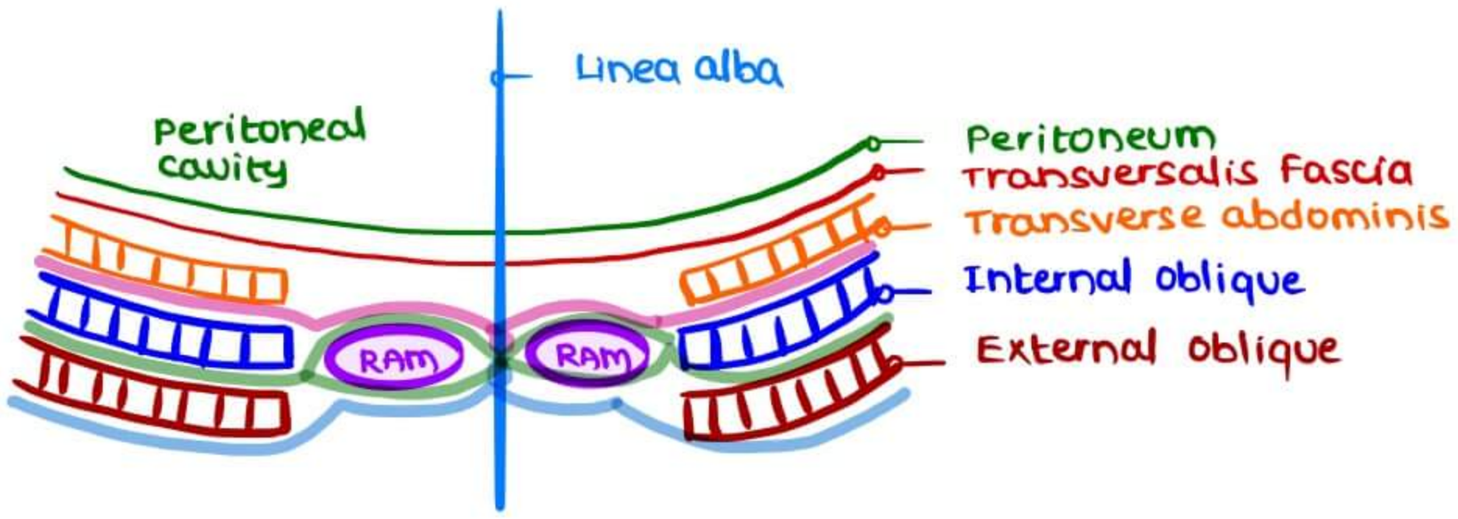
Internal oblique

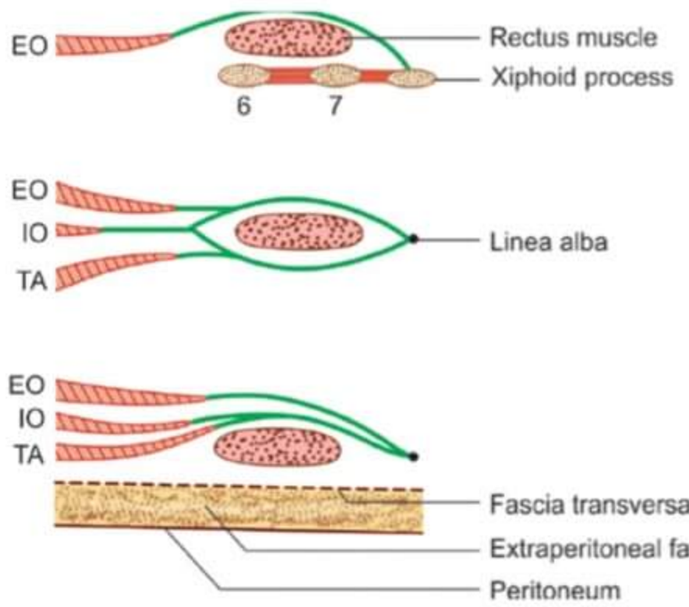
→ present b/w External oblique & Transverse abdominis

→ splits into 2 layers

anterior & posterior & contributes to anterior & posterior wall of rectus sheath & fuses ⊥ linea alba

Transversalisis Fascia → present deeper





AT XIPHOID PROCESS LEVEL

→ only External oblique contributes to rectus sheath

→ Rectus abdominus muscle directly sitting on ribs & costal cartilage

BELOW ARCUATE LINE

→ Rectus abdominus muscle directly sits on fascia transversalis

→ All muscles contribute to ant. layer

INGUINAL CANAL & SPERMATIC CORD

INGUINAL CANAL

→ External oblique runs antero inferiorly forms ant. wall inturned tendon forming Inguinal ligament to form floor

→ Superficial Inguinal ring → defect in Ext. Oblique aponeurosis

→ Spermatic cord comes from Superficial inguinal ring towards testis

→ Inguinal ligament

→ attaches to anterior Superior Iliac spine to pubic tubercle

→ modificatⁿ of External oblique aponeurosis

→ Internal oblique forms Arching fibres which form anterior wall, roof & post. wall of inguinal canal in medial aspect

→ Transversus abdominis

→ more lateral & do not contribute to ant. wall

→ sends arching fibres to form roof & posterior wall in medial aspect

→ merges ⊥ fibres of Internal oblique forming CONJOINT TENDON

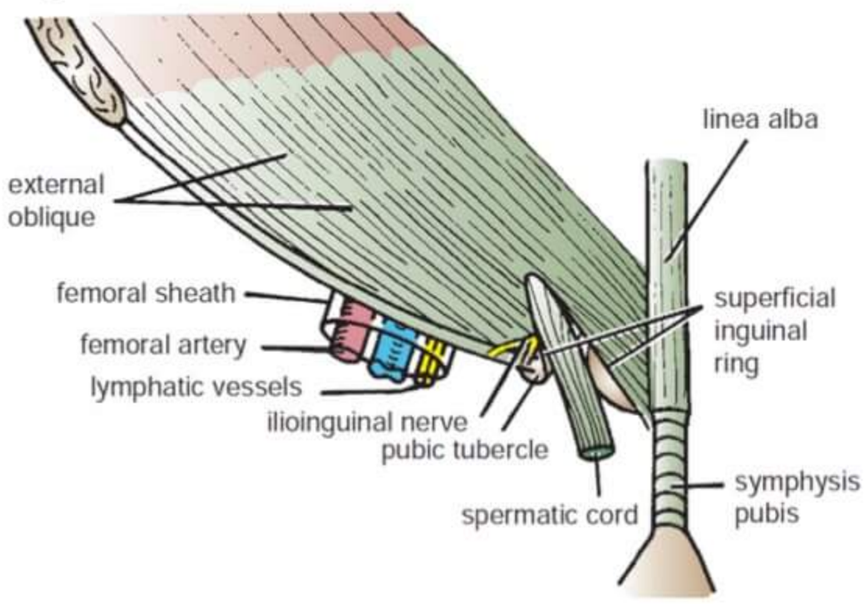
→ Transversalis fascia

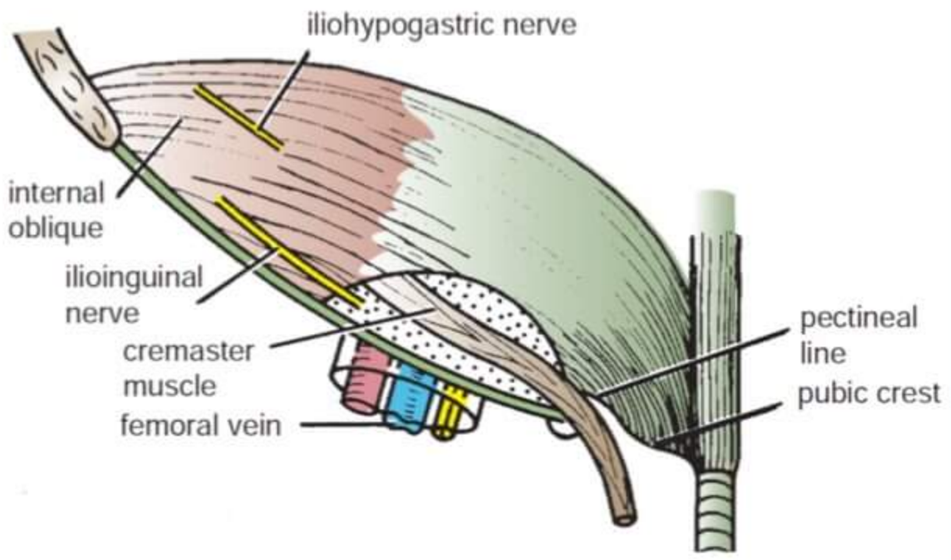
→ present deep to transversus abdominus

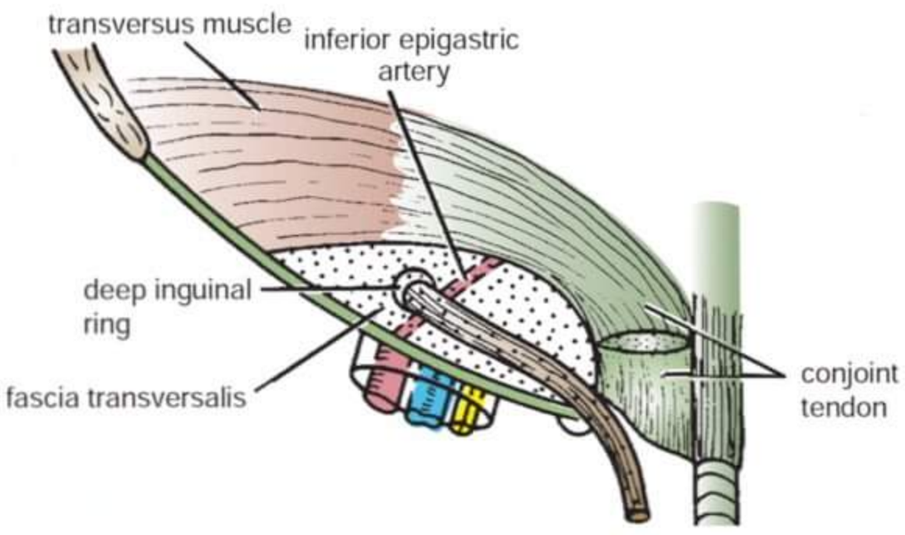
→ defect in trasversalis fascia → DEEP INGUINAL RING

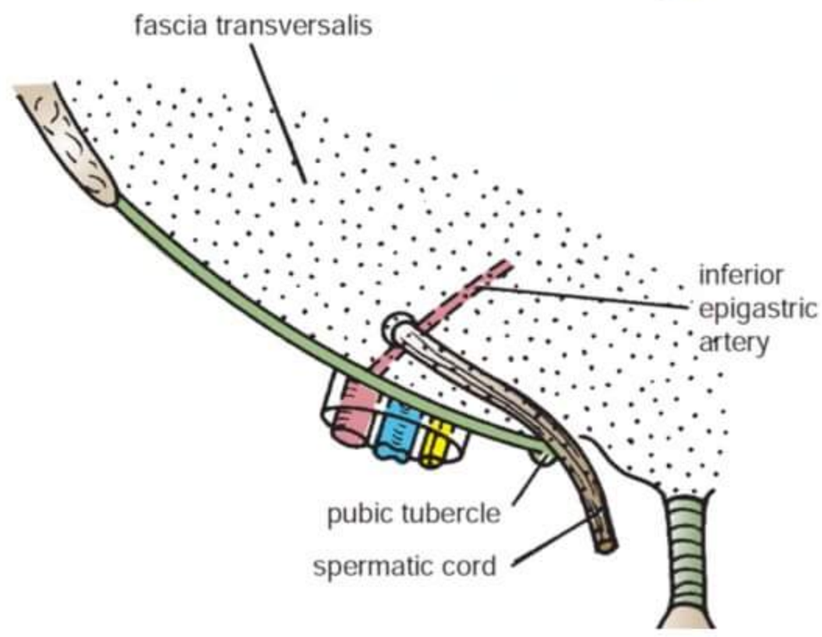
→ Inferior Epigastric artery
  → present at the medial wall of deep inguinal ring
  → br. of External Iliac artery
  → enters the rectus sheath
  → follows Inferior Epigastric vessels
  → Inf. epigastric vessels forms LATERAL UMBILICAL FOLD (peritoneal fold]
    Indirect inguinal Hernia → Hernia coming lateral to these vessels
    Direct inguinal Hernia → Hernia coming medial to these vessels

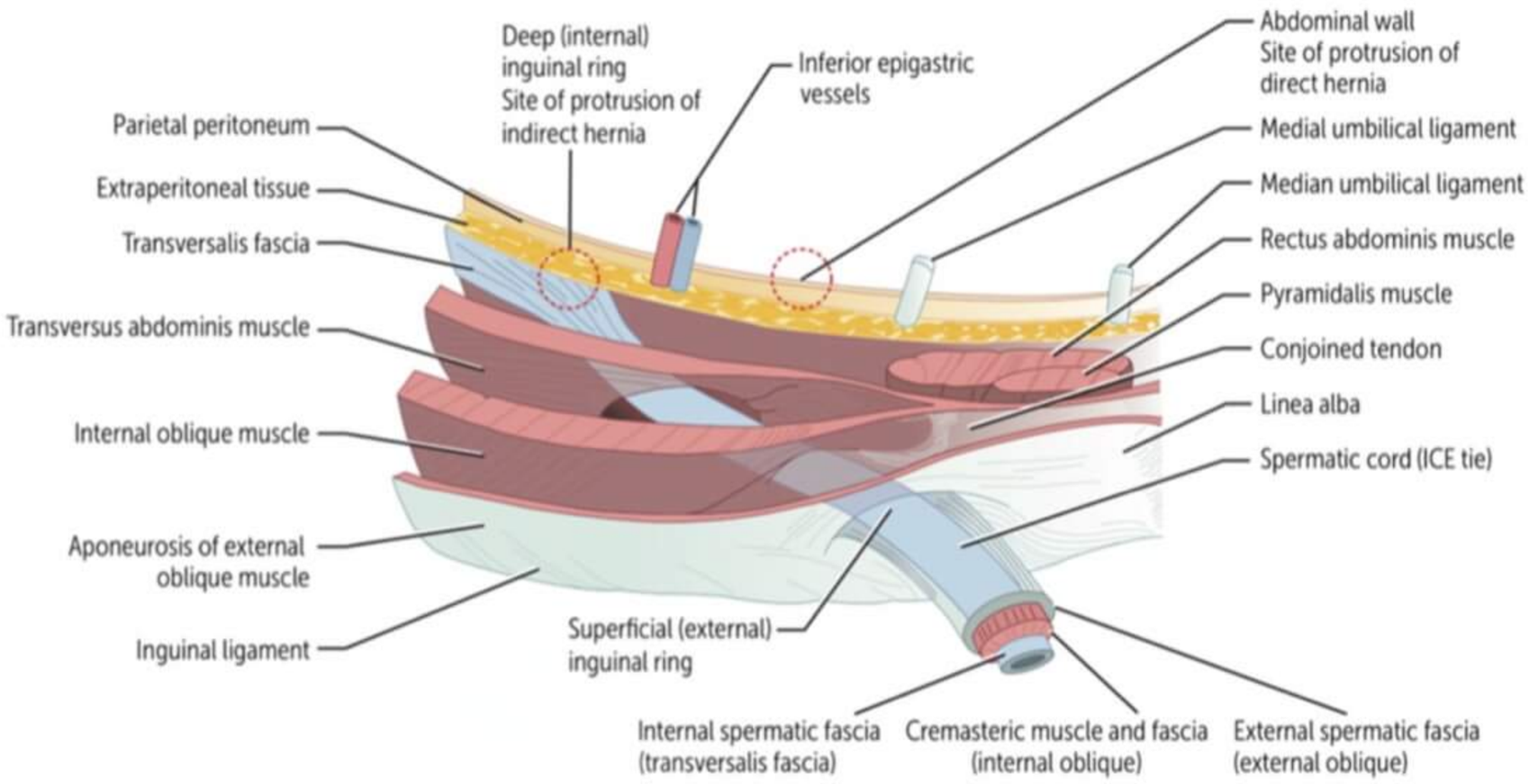
→ External Iliac Artery becomes femoral artery after passing the inguinal ligament

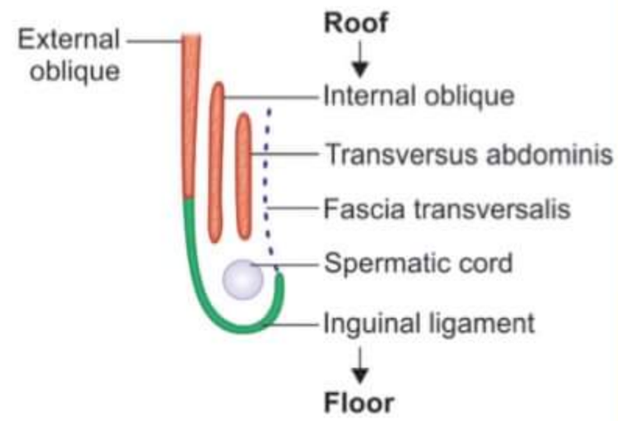






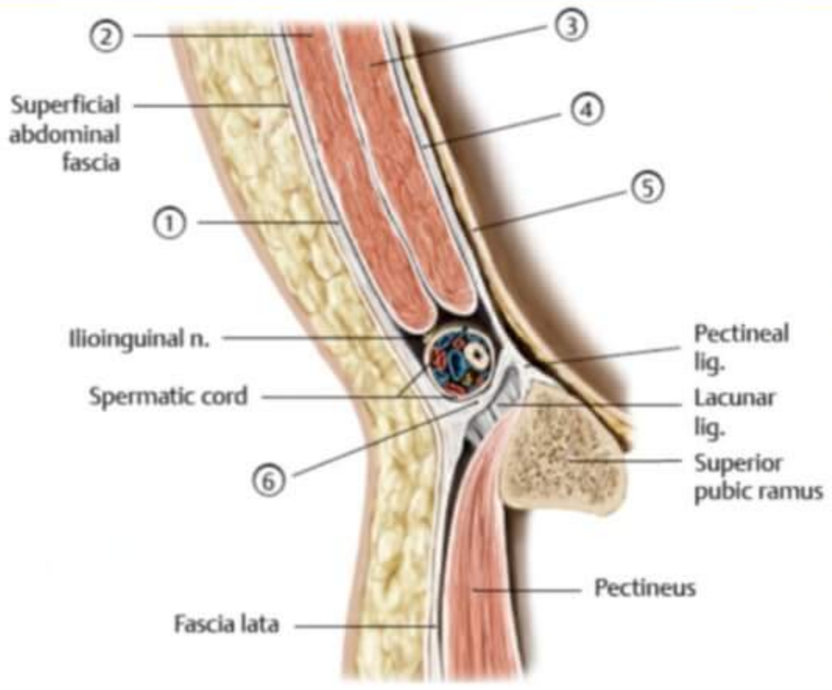


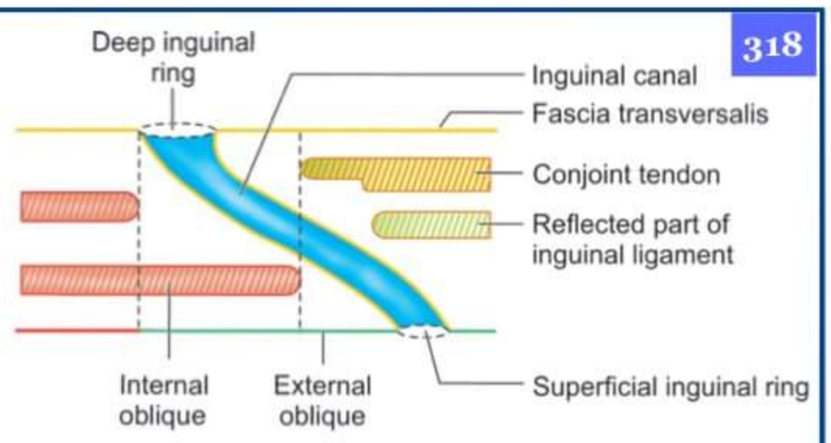




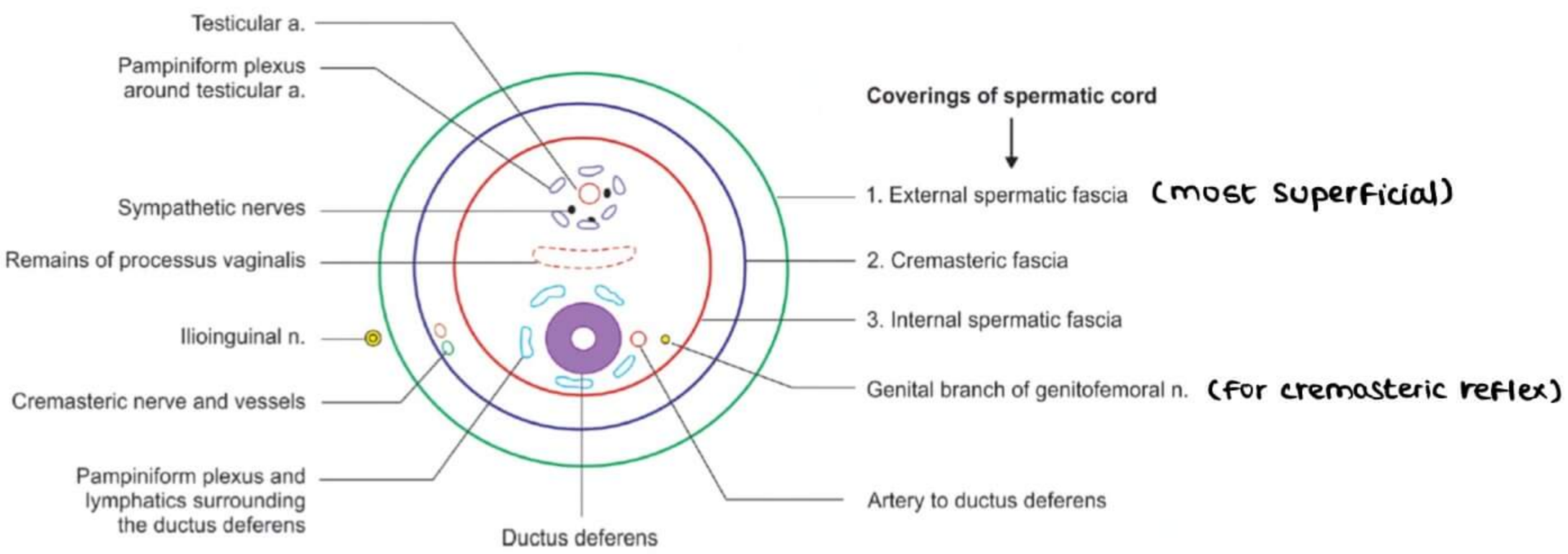
PYRAMIDALIS MUSCLE
→ small muscle near the pubis bone attaching to it
→ pyramidalis & Rectus abdominus both covered by rectus sheath
→ supplied by T_{12} nerve (subcostal nerve)

Anterior wall	①	External oblique aponeurosis
Roof	②	Internal oblique muscle
	③	Transversus abdominis
Posterior wall	④	Transversalis fascia
	⑤	Parietal peritoneum
Floor	⑥	Inguinal lig. (densely interwoven fibers of the lower external oblique aponeurosis and adjacent fascia lata of thigh)





SPERMATIC CORD



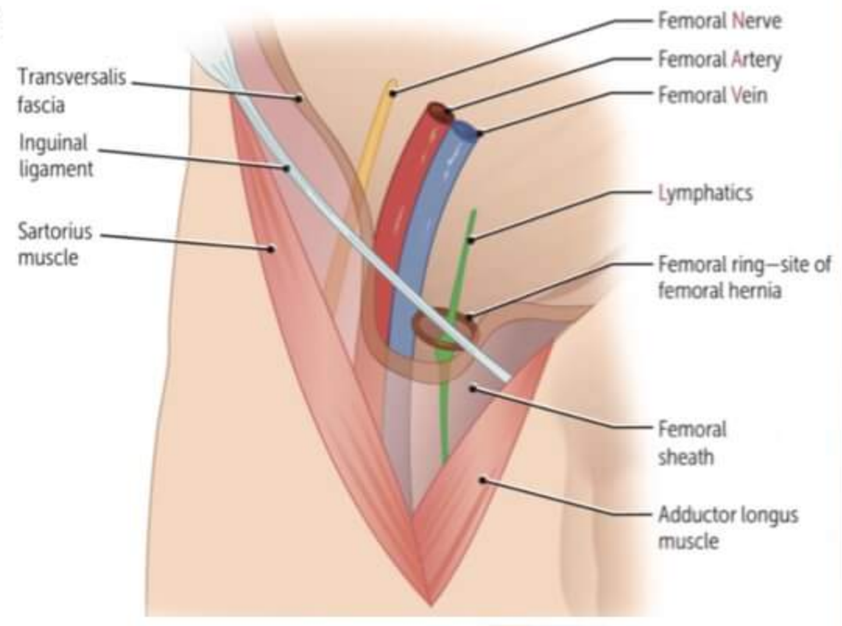
INGUINAL AND FEMORAL REGION & ASSOCIATED HERNIAS

FEMORAL TRIANGLE

BOUNDARIES

1. Base → Inguinal ligament
2. Lateral → medial margin of sartorius (longest muscle) (origin - ASIS)
3. Medial → medial margin of adductor longus

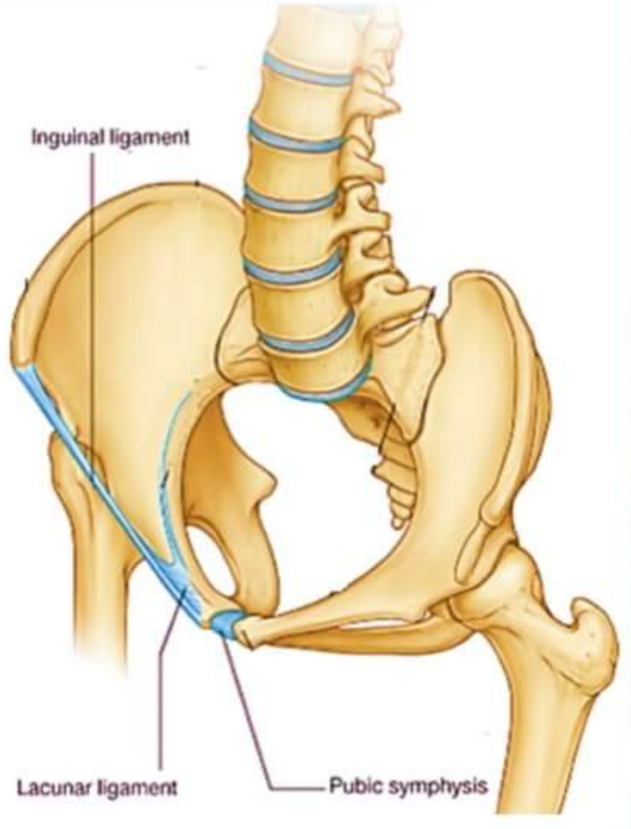
→ sartorius is outside of femoral Δle
adductor longus is at floor of femoral Δle.



FEMORAL RING

→ cooper ligament
→ Posterior extent^n of Inguinal ligament
→ attaches to pectineal line on hip bone

→ Lacular ligament
→ runs blw inguinal & cooper ligaments antero posteriorly
→ Forms medial boundary for femoral ring



→ BOUNDARIES

Anterior → inguinal ligament
Posterior → cooper ligament
Medial → Lacunar ligament
Lateral → femoral vein
separated by septum

Adductor longus MUSCLE

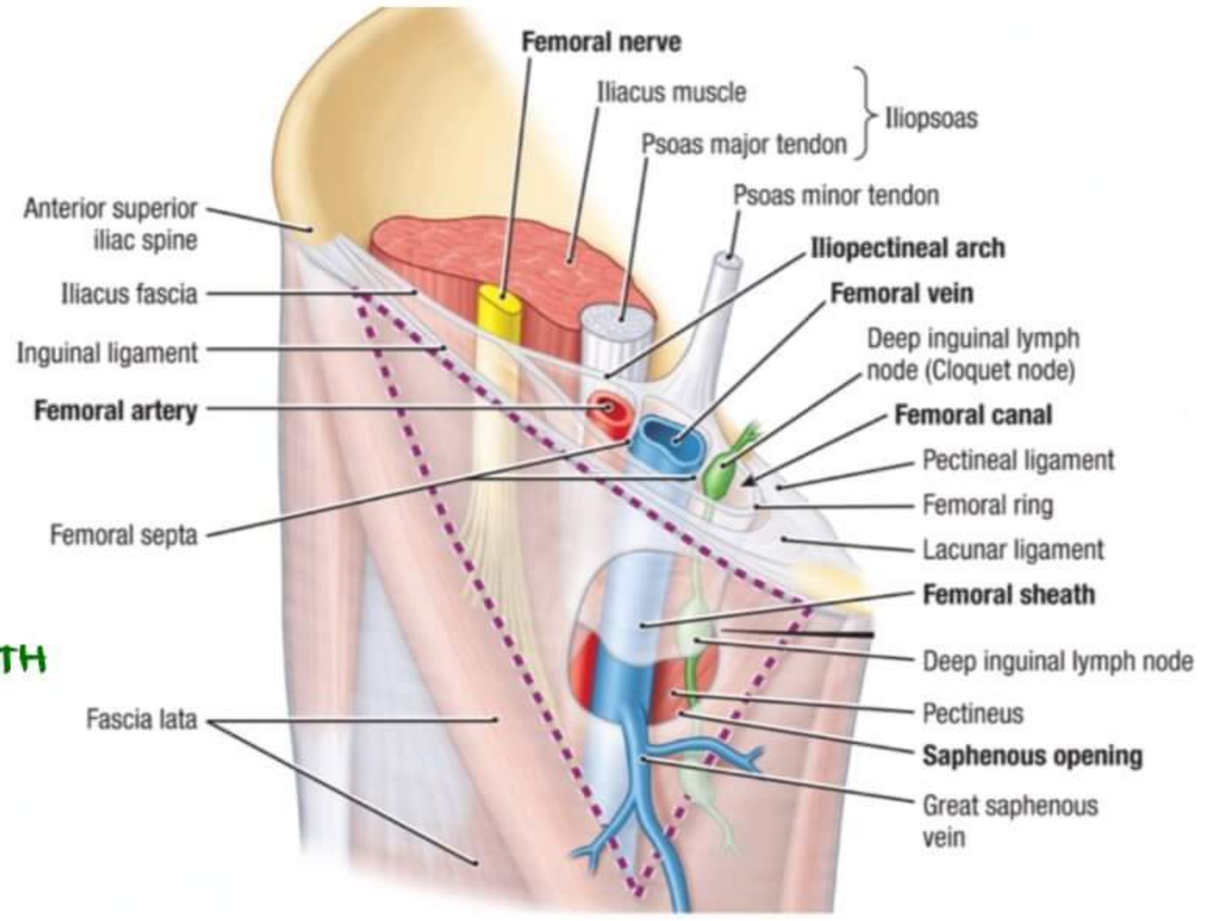
Origin → pubis bone
Insertn → femur bone

FEMORAL HERNIA

→ Intestine in pelvis follow lymphatics and enter the femoral ring & enters the femoral canal & will be inferolateral to pubic tubercle
→ TO reduce hernia, Lacunar ligament to be cut to enlarge femoral ring

CONTENTS OF FEMORAL TRIANGLE

Femoral vein
Femoral Artery
femoral nerve
→ most lateral
→ present outside the femoral sheath



STRUCTURES PRESENT INSIDE FEMORAL SHEATH

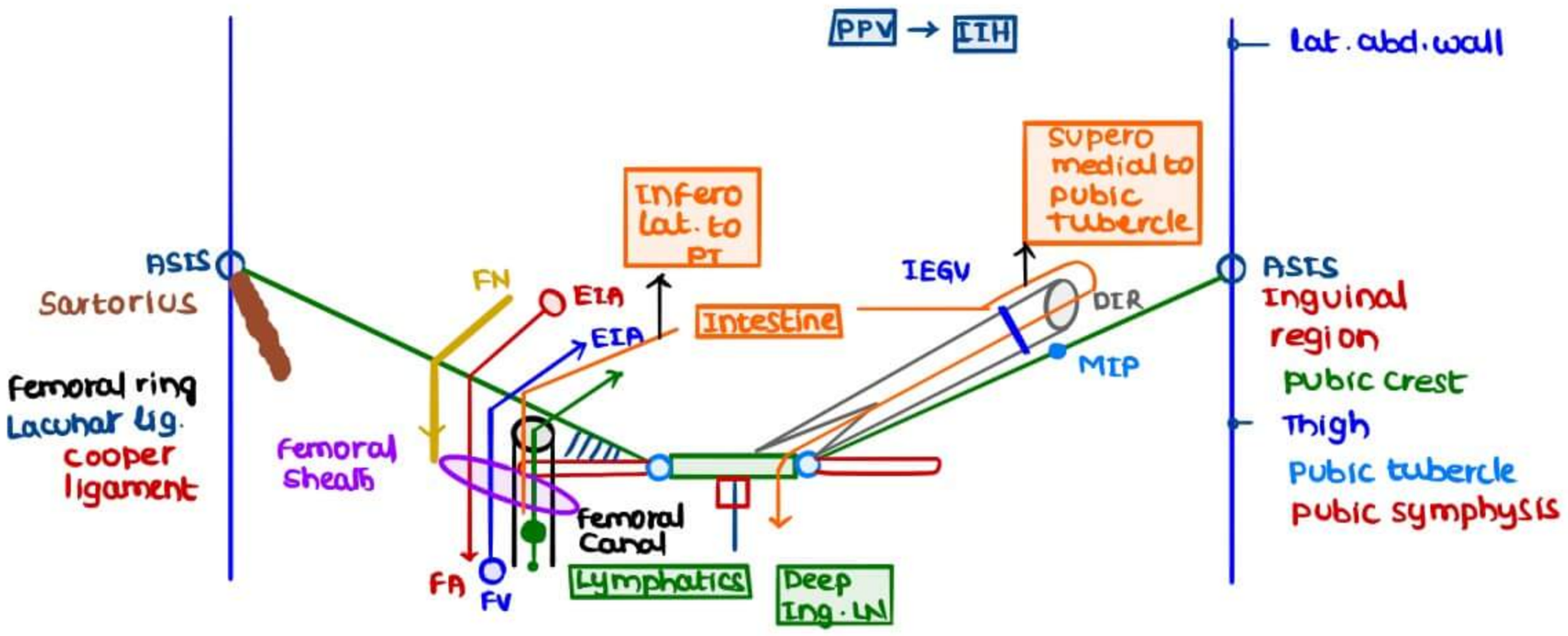
Lymphatics (most medial)
passes femoral ring & femoral canal in the thigh, Some times intestines will follow them

Femoral vein & femoral arteries are lateral to lymphatics

→ During Hernial repair, care is taken not to damage ABERRANT OBTURATOR ARTERY
→ ABERRANT OBTURATOR ARTERY
→ br. of Inferior epigastric artery (br. of Ext. iliac artery)
→ running on lacular ligament
→ present in some people

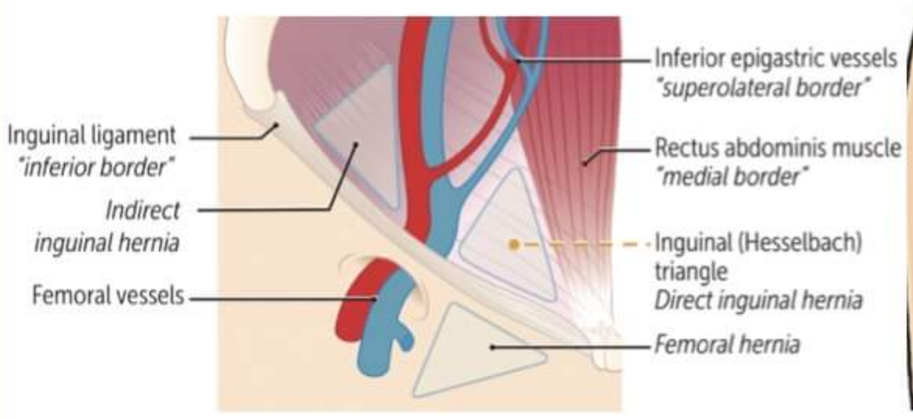
→ Inferior epigastric vein drains into External Iliac vein

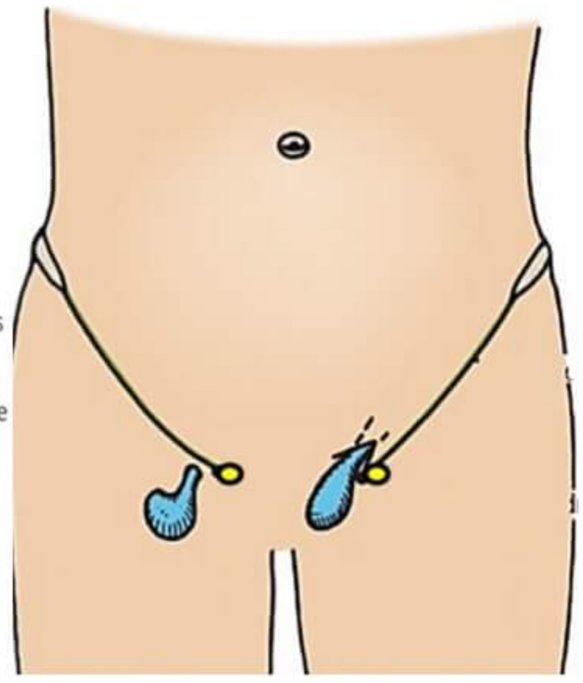
Q Accessory obturator artery is a branch of
a Inferior epigastric
b External Iliac
c Internal Iliac
d obturator

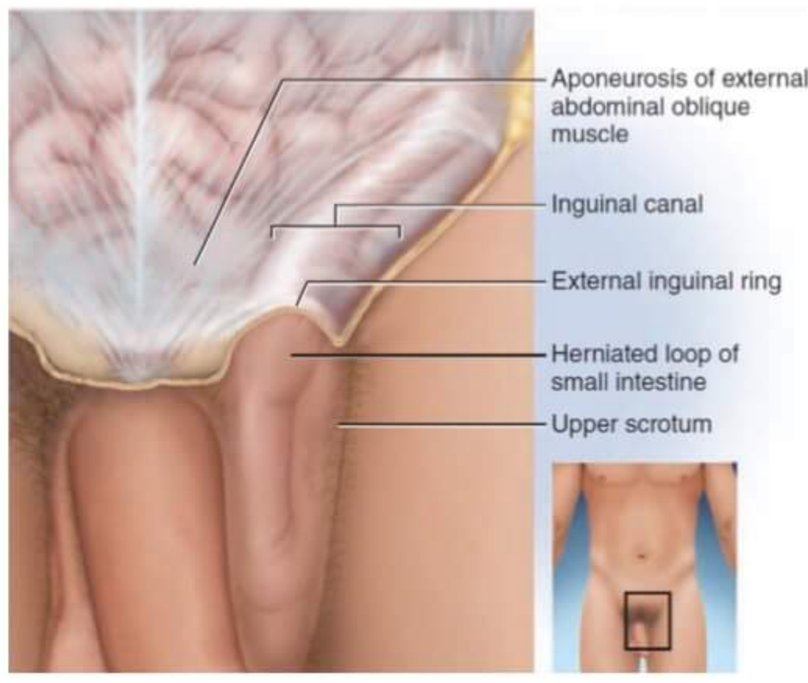


→ Deep Inguinal LN → drains clitoris (in female) & Glans penis (in male)
→ present inside the Femoral canal

→ Inguinal hernia → Supero medial to pubic tubercle
→ Femoral hernia → Infero Lateral to pubic tubercle
Superficial Inguinal ring → Supero Lateral to pubic tubercle







HESSELBACH TRIANGLE

Lateral border of Rectus abdominis → Medial
Inferior epigastric vessels → Lateral
Inguinal Ligament → Base

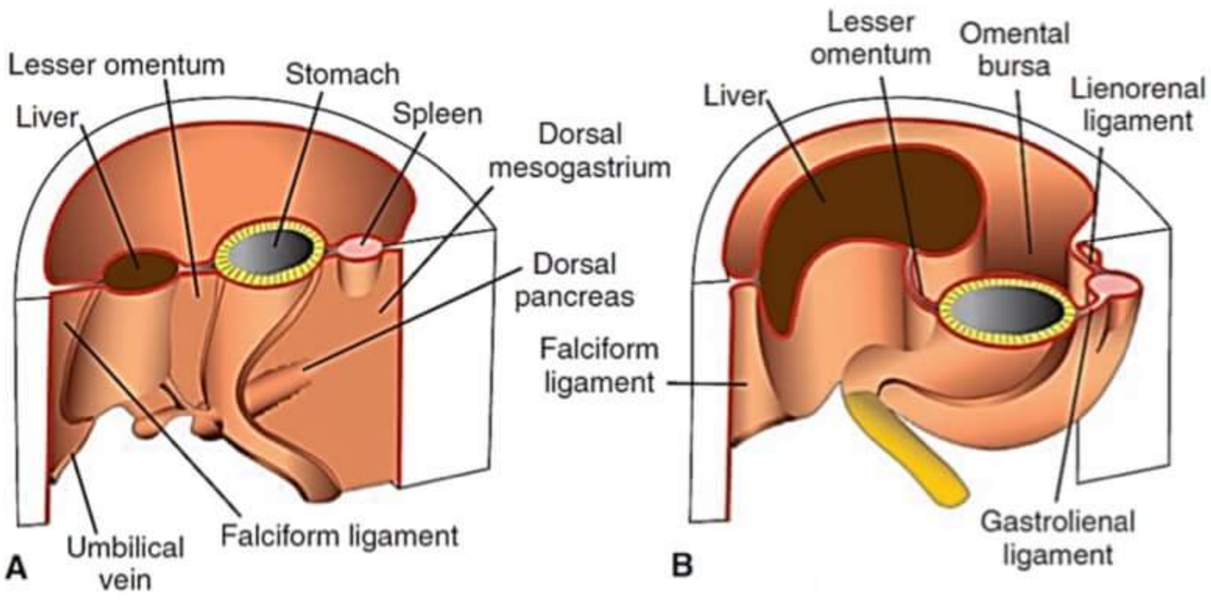
Direct & Indirect inguinal hernias more common in males
Femoral hernia more common in males

PERITONEAL CAVITY: SACS & SPACES

LESSER SAC / OMENTAL BURSA FORMATION / LT. SUB HEPATIC SPACE

→ At beginning, Lesser curvature is anterior, greater curvature is posterior
Liver develops in ventral mesentery anteriorly,
Spleen develops in dorsal mesentery posteriorly

→ Due to stomach rotatⁿ by 90°
Liver ⊂ portahepatic & lesser omentum comes to Rt. side
Spleen ⊂ gastrosplenic ligament comes to Lt. side



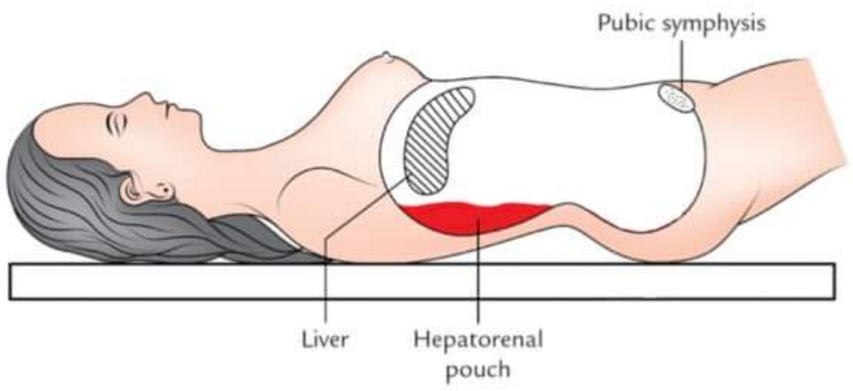
→ Space on rt. side of stomach goes behind the stomach forming LESSER SAC
→ Rest of peritoneal cavity forms Greater sac
→ EPIPLOIC FORAMEN OF WINSLOW forms communicatⁿ b/w greater & lesser sac ⊂ Lesser Omentum as its anterior boundary
→ During posterior perforation of stomach, gastric contents are aspirated throug this

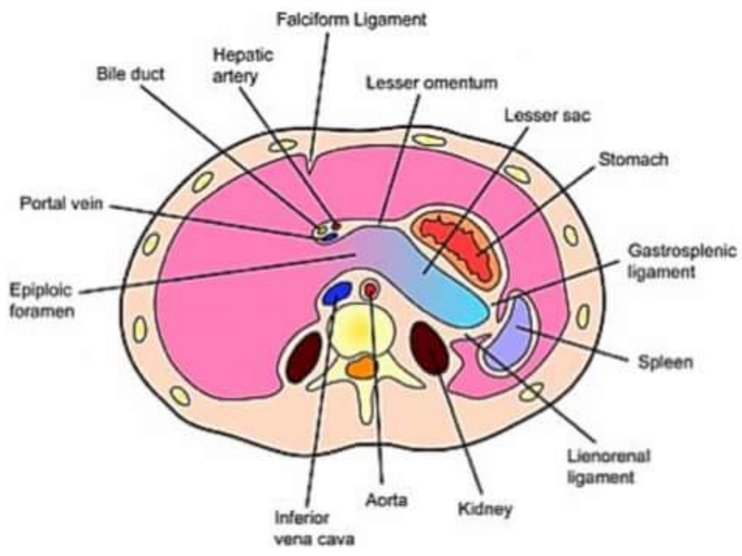
Q A 32 yr old computer operator ♀ h/o heart burn, develops severe excruciating pain in the epigastric region. She is taken for immediate surgical exploratⁿ, which reveals evidence of ruptured gastric ulcer. Where will the surgeon find the stomach contents

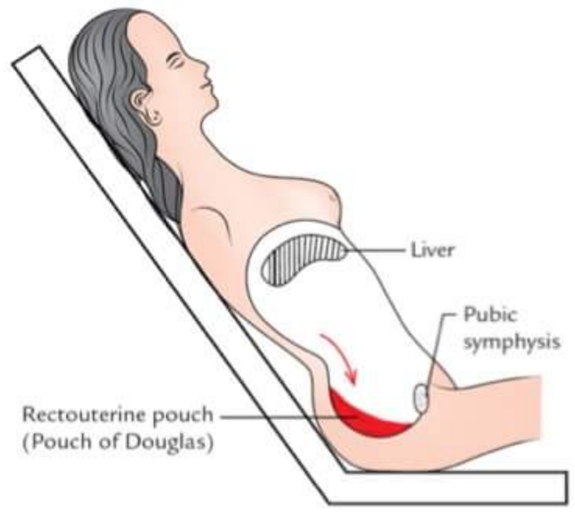
a Omental bursa
b Hepatorenal pouch of morrison
c Paracolic gutter
d Pouch of douglus

→ In a patient in Supine position post operatively, pus found at } Hepatorenal Pouch of Morrison
most dependent location in supine position

→ most dependent location in Erect posture → Pouch of Douglas
→ Pelvic abscess in Female drained trans vaginally
Pelvic abscess in male drained per rectally

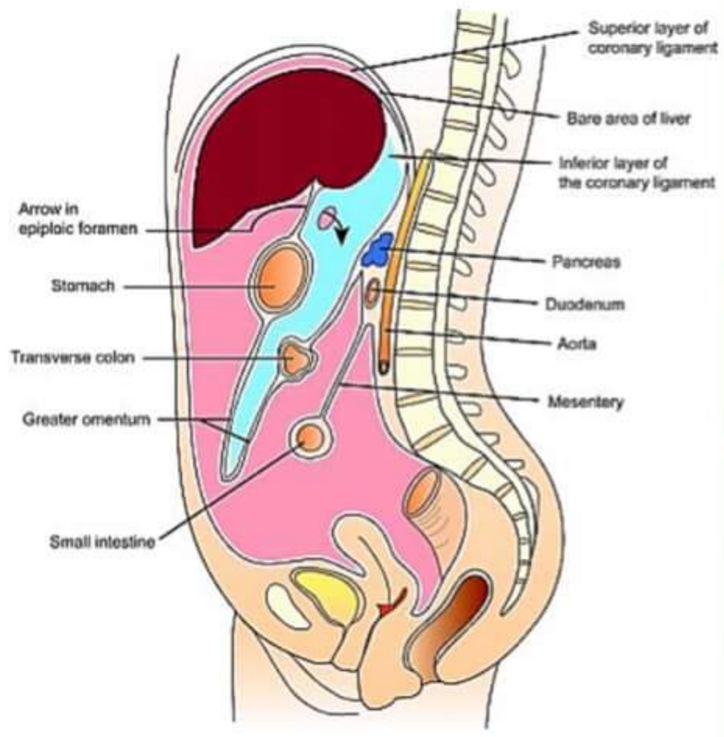






GREATER SAC INCLUDES

1. Hepato renal pouch of Morrison
2. Recto uterine pouch of Douglas

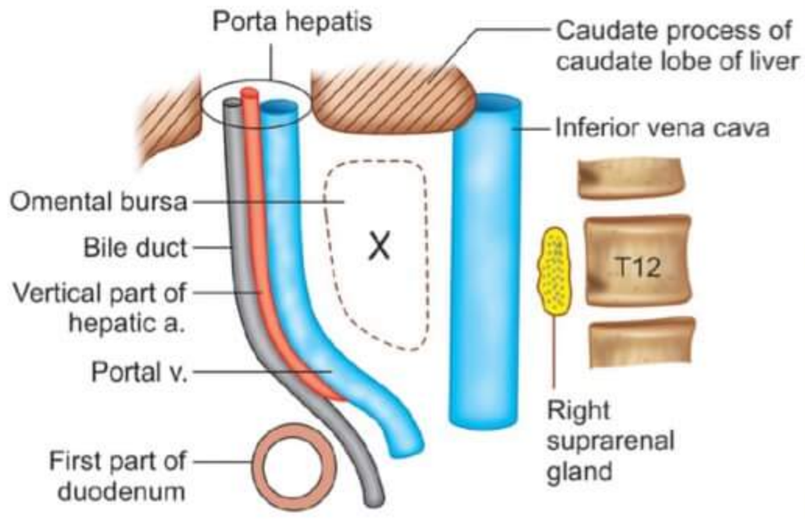


EPIPLOIC FORAMEN OF WINSLOW BOUNDARIES

Anterior border → Lesser Omentum i
D → Bile Duct
A → Hepatic Artery
V → Portal vein

Posterior border → T-12 vertebra
IVC
Rt Supra renal gland

Superior → caudate lobe of Liver
Inferior → 1st part of Duodenum

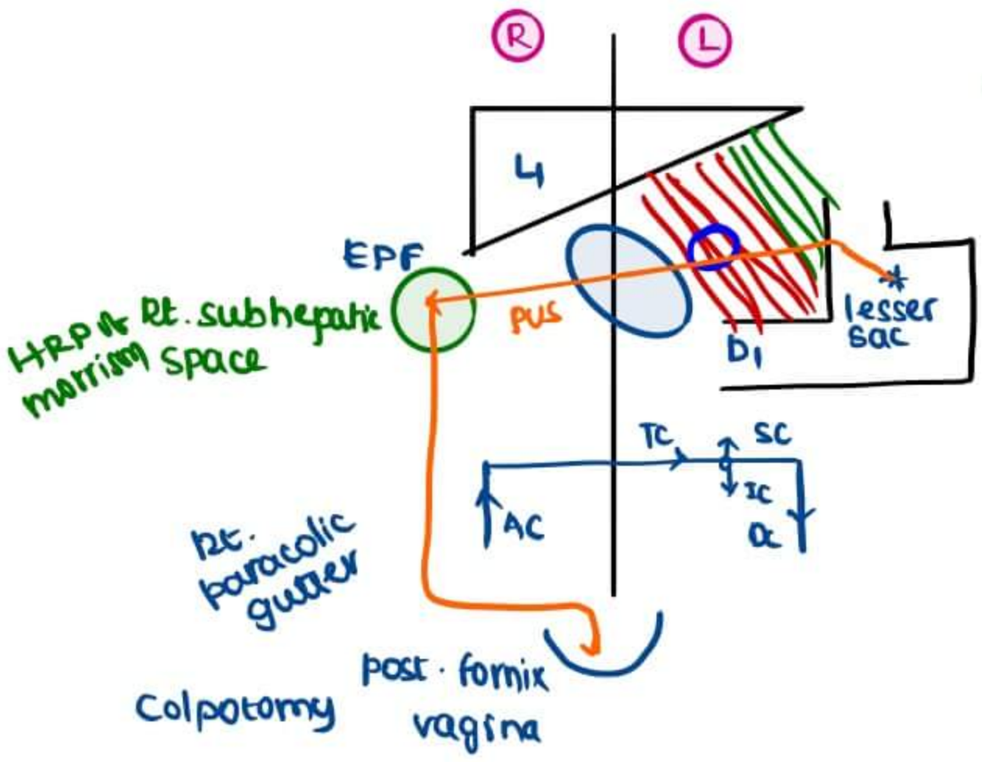


→ Foramen of WINSLOW present b/w Portal vein & IVC
→ Spleen projects into greater sac by Gastro splenic & Spleno renal ligaments
→ Splenic artery (br. of abd. aorta) carried by Spleno renal ligament
Splenic artery branches to greater curvature carried by Gastrosplenic ligament

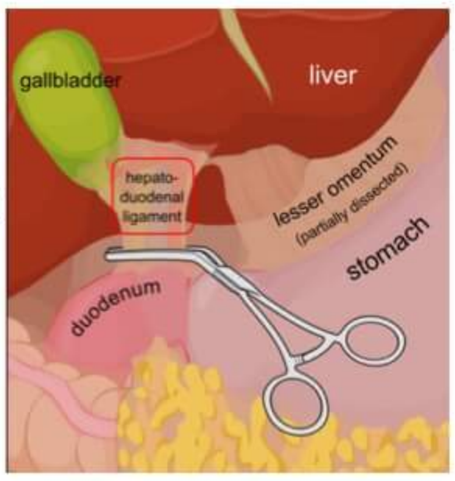
LESSER OMENTUM

→ has 2 parts
1. Hepato gastric Ligament
2. Hepato duodenal ligament | free margin of lesser Omentum (carries DAV to porta hepatis) (Duct is to the right side & artery to left/midline)

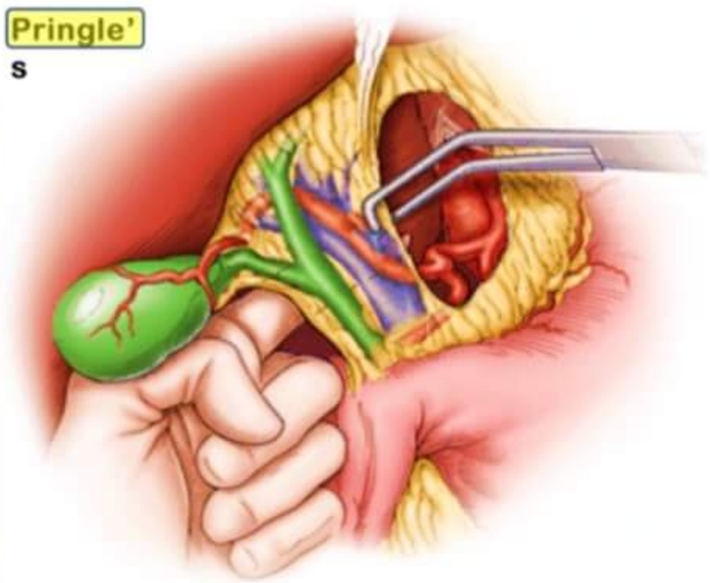
→ SUPRA COLIC & INFRA COLIC COMPARTMENT → above transverse colon → supra colic
below transverse colon → Infracolic



Hepatogastric ligament
Hepatoduodenal ligament
↓
free margin
DAV



Pringle's



PRINGLE'S MANOEUVRE

→ puting the finger into foramen winslow, to pull out the DAV structures to clamp them
→ After 15 min. we have to unclamp it to avoid ischemia
→ done intermittently

→ Hepatic artery sends O_2 to liver
Portal vein brings nutrients

Q Blood supply of Liver
a 80% hepatic artery, 20% portal vein
b 20% hepatic artery, 80% portal vein
c 50% hepatic artery, 50% portal vein
d 100% hepatic artery

Q In pringle's manoeuvre the structure ligated is
a Portal pedicle (DAV structure)
b Hepatic vein
c IVC
d Cystic Duct

Q True about relation of epiploic foramen is
a Portal vein posteriorly
b IVC inferiorly
c Hepatic artery superiorly
d Bile duct anteriorly

Q Most dependent part of abdomen in standing position is
a Vesicouterine pouch
b Pouch of Douglas
c Recto uterine pouch
d b & c

PERITONEAL SPACES

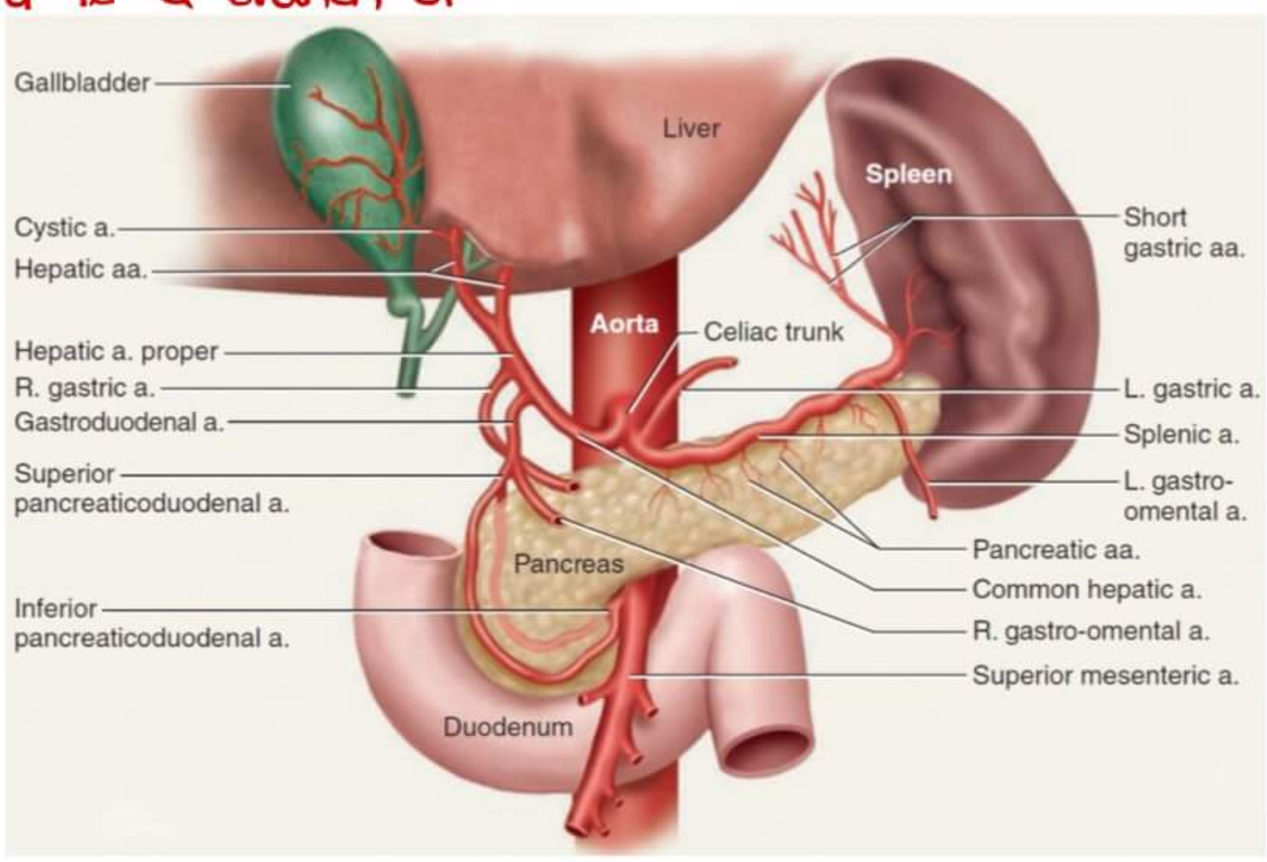
1. Left sub hepatic space → lesser sac / omental bursa
2. Right sub hepatic space → Hepato Renal pouch of morrison

Q Which of the following is true about the locatⁿ of omental bursa
a Left sub hepatic
b Left sub phrenic
c Right sub hepatic
d Right sub phrenic

Q Following are the boundaries of epiploic foramen EXCEPT
a Free margin of lesser omentum
b IVC
c Quadrate lobe of liver
d Right adrenal

ARTERIAL SUPPLY

Q Superior pancreatico duodenal artery is a branch of
a Superior mesenteric artery
b Gastro duodenal artery
c Celiac trunk
d Inferior mesenteric artery



CELIAC TRUNK

→ Supplies fore gut derivatives

BRANCHES

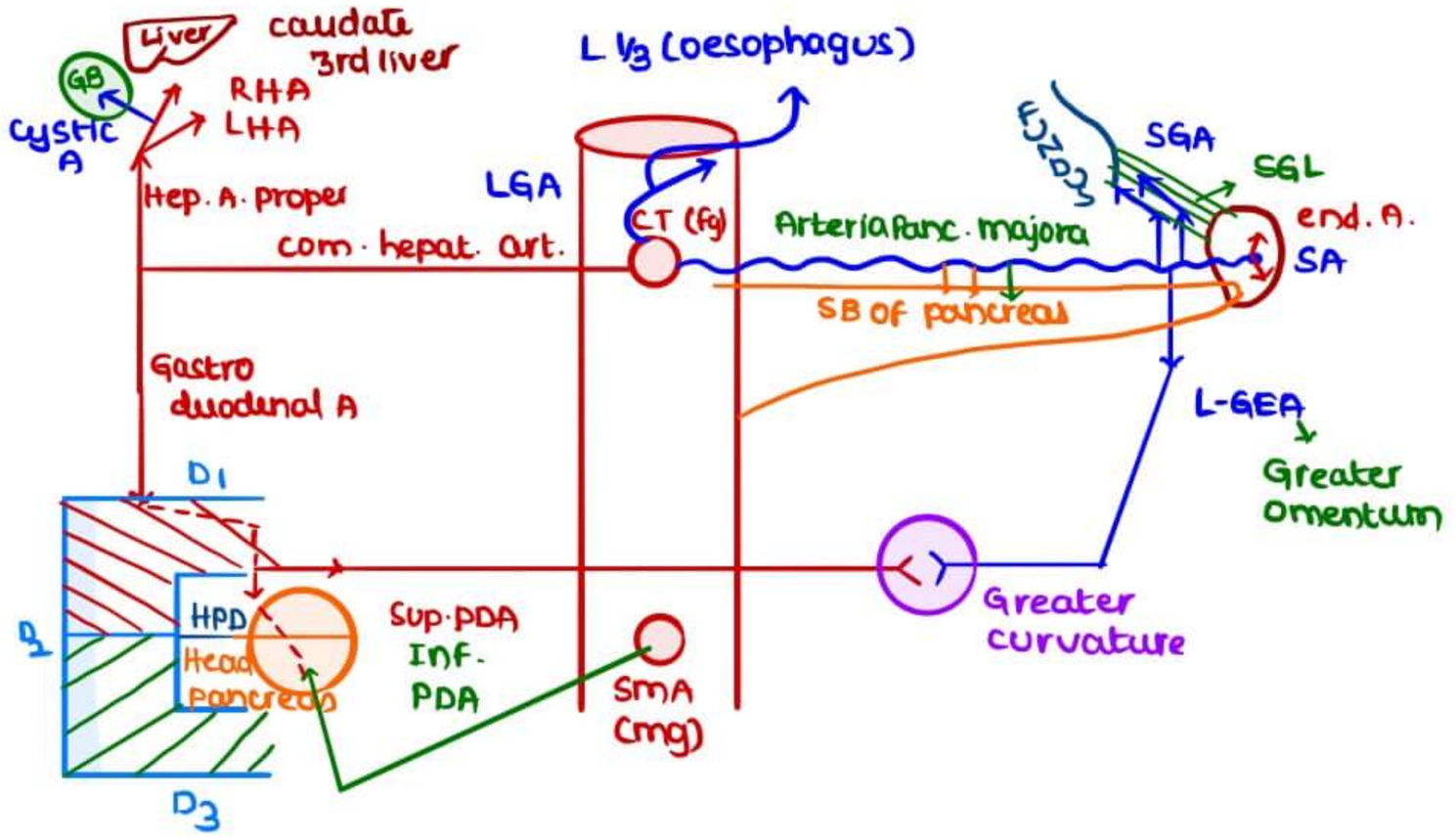
1 LEFT GASTRIC ARTERY
→ Supply lesser curvature

2. Splenic artery
→ has tortuous course
→ Supplies greater curvature of stomach by short gastric & long gastric arteries
→ Long gastric artery / Left Gastroepiploic artery / Lt. Gastro omental artery
– supplies spleen & multiple end arteries
– Supplies body & tail of pancreas

HEAD OF PANCREAS SUPPLY

Upper head → by Superior pancreatico duodenal artery (br of Gastroduodenal A., br. of common hepatic artery)
Lower head → by inferior pancreatico duodenal artery (br of SMA)

3. COMMON HEPATIC ARIERY
→ Branches
1 Proper Hepatic Artery
→ divides into rt, lt. hepatic artery
→ Rt. Hepatic artery gives cystic artery to gall bladder
2 Gastroduodenal artery
3. Rt. Gastric artery to lesser curvature



Lt. Gastric artery Supplies lesser curvature & Lower 1/3rd of oesophagus

Splenic artery

→ Largest branch of celiac trunk
→ runs torturously on superior border of pancreas, gives multiple branches into pancreas, which forms anastamoses ī substance of pancreas
→ ARTERIA PANCREATICA MAGNUM
  → Great artery to pancreas
  → br. of splenic artery
  → Supplies pancreas
→ END ARTERIES TO SPLEEN
  → no further anastamoses

GASTRODUODENAL ARTERY

→ passes behind the 1st part of duodenum
→ Hepato pancreatic duct opens into 2nd part at the junction of fore gut & midgut
  → proximal duodenum supplied by celiac trunk br.
  → distal duodenum supplied by br. of SMA
→ Superior Pancreatico duodenal artery supplies upper head of pancreas & prox. duodenum
→ Sup. Pancreatico Duodenal artery anastamose ī Inf. pancreatico duodenal artery (br. OF SMA) on head of pancreas
→ In posterior perforation of duodenal ulcer (less common than anterior), bleeding is from Gasoduodenal artery
  → In posterior perforatⁿ of gastric ulcer, Splenic artery bleeds (present at bed of Stomach) (less common)
→ Rt Gastroepiploic artery Supplies greater curvature of Stomach

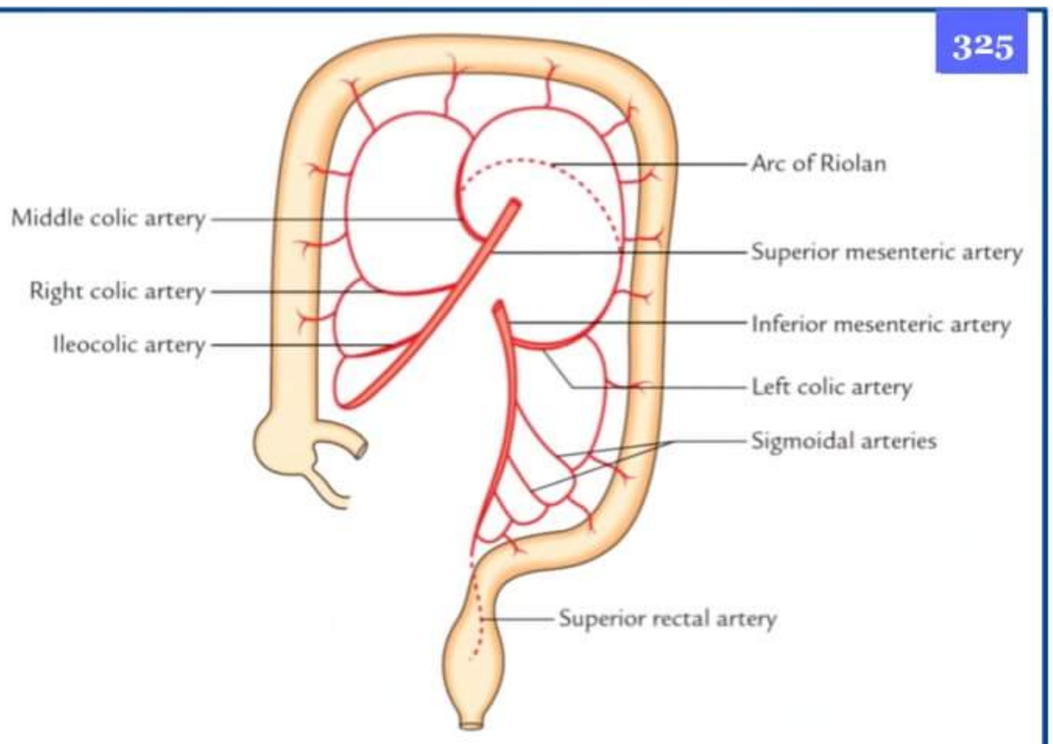
Q All of the following statements about splenic artery are true EXCEPT
a has a tortowous course
b is a br. of celiac trunk
c has branches that anastamose freely ī in Spleen
d supplies the greater curvature of stomach

SUPERIOR MESENTERIC ARTERY

→ Supplies midgut derivatives

→ Branches

1. Iliocolic artery → Ilium & asc. colon
2. Rt. colic artery → Asc. colon
3. Middle colic A. → Transverse colon (Rt. 2/3rd)



INFERIOR MESENTERIC ARTERY

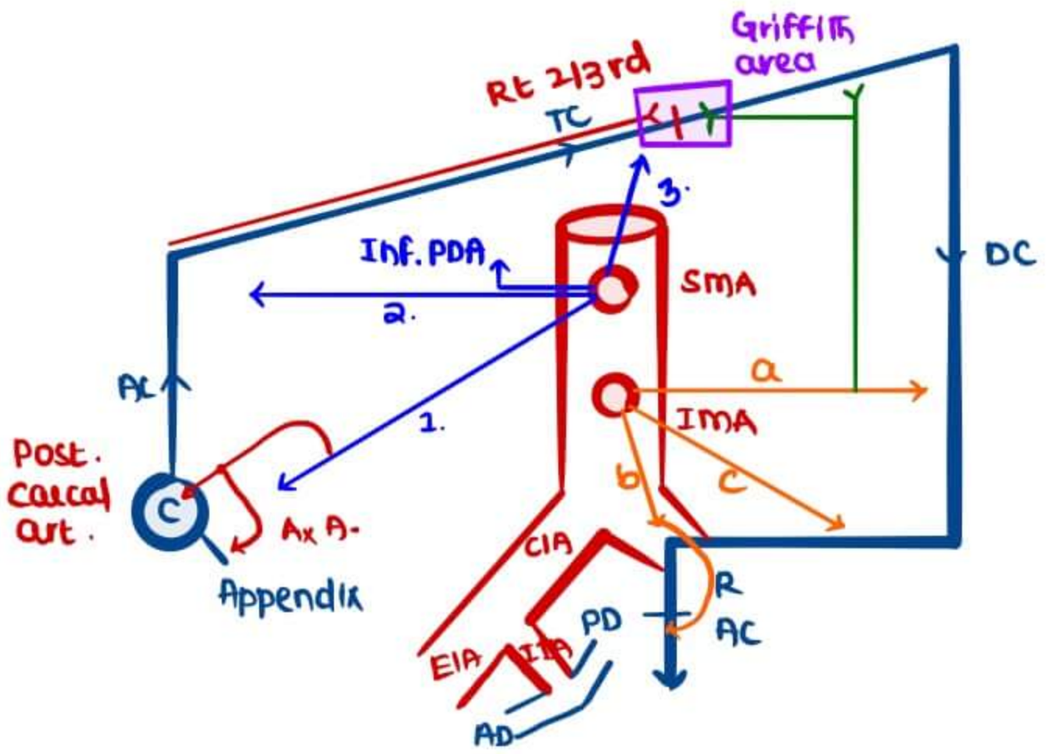
→ Supplies hind gut derivatives

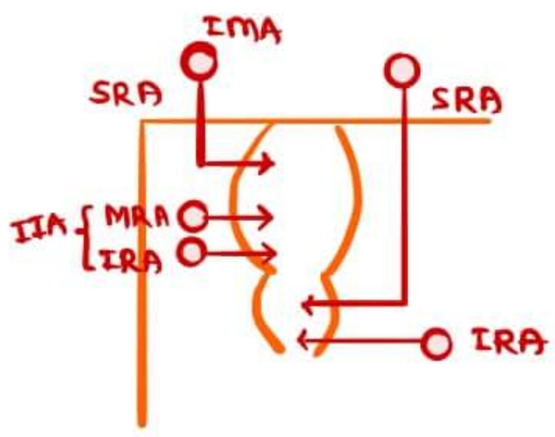
BRANCHES

a. Left colic Artery → descending colon
b Superior rectal A → Upper rectum, upper Anal canal
c Sigmoidal artery → sigmoid colon

INTERNAL ILIAC ARTERY Br. Supplies lower part of rectum
- Middle rectal artery
- Inferior rectal artery

SUDECK'S POINT
GRIFFITH'S POINT
} Watershed areas i more prone to Ischemia has dual supply but supplied by small arteries





→ Appendiceal artery is a branch of Iliocolic artery

→ Lt. colic Artery gives a Ascending br. & supplies Lt. 1/3rd of Transverse colon including splenic flexure

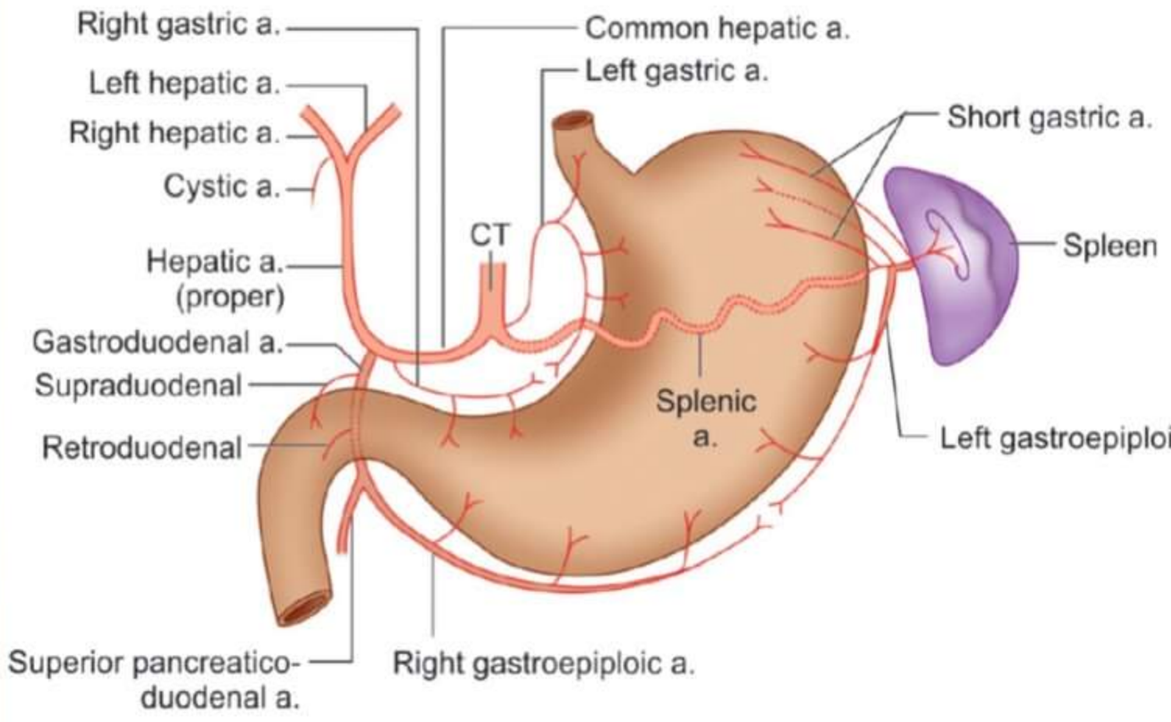
INTERNAL ILIAC ARTERY

→ Gives Ant. Division & Posterior division

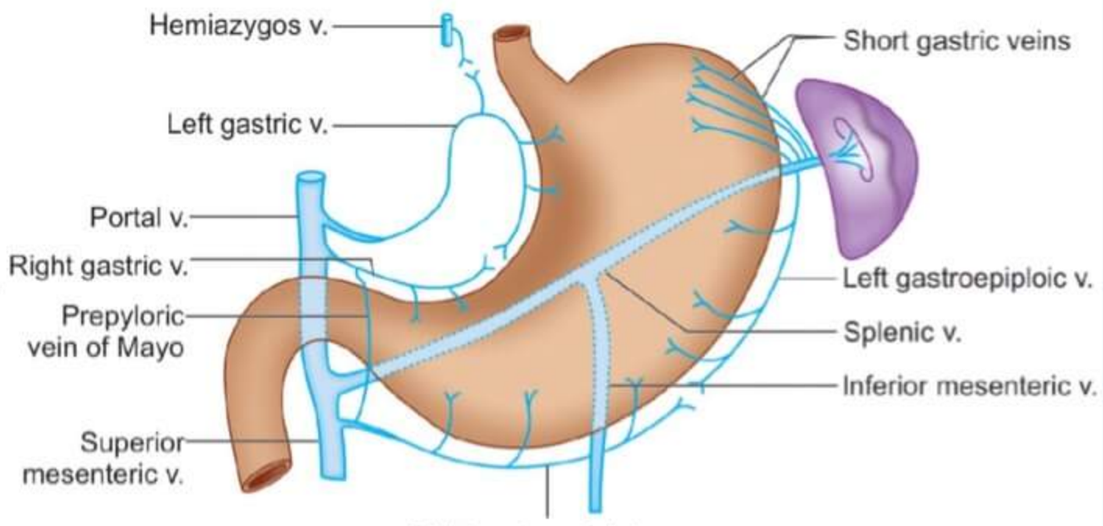
→ Ant. Divisions gives 2 rectal arteries
1. Middle rectal artery
2. Pudendal artery
   → gives Inf. Rectal Artery

ARTERIAL SUPPLY

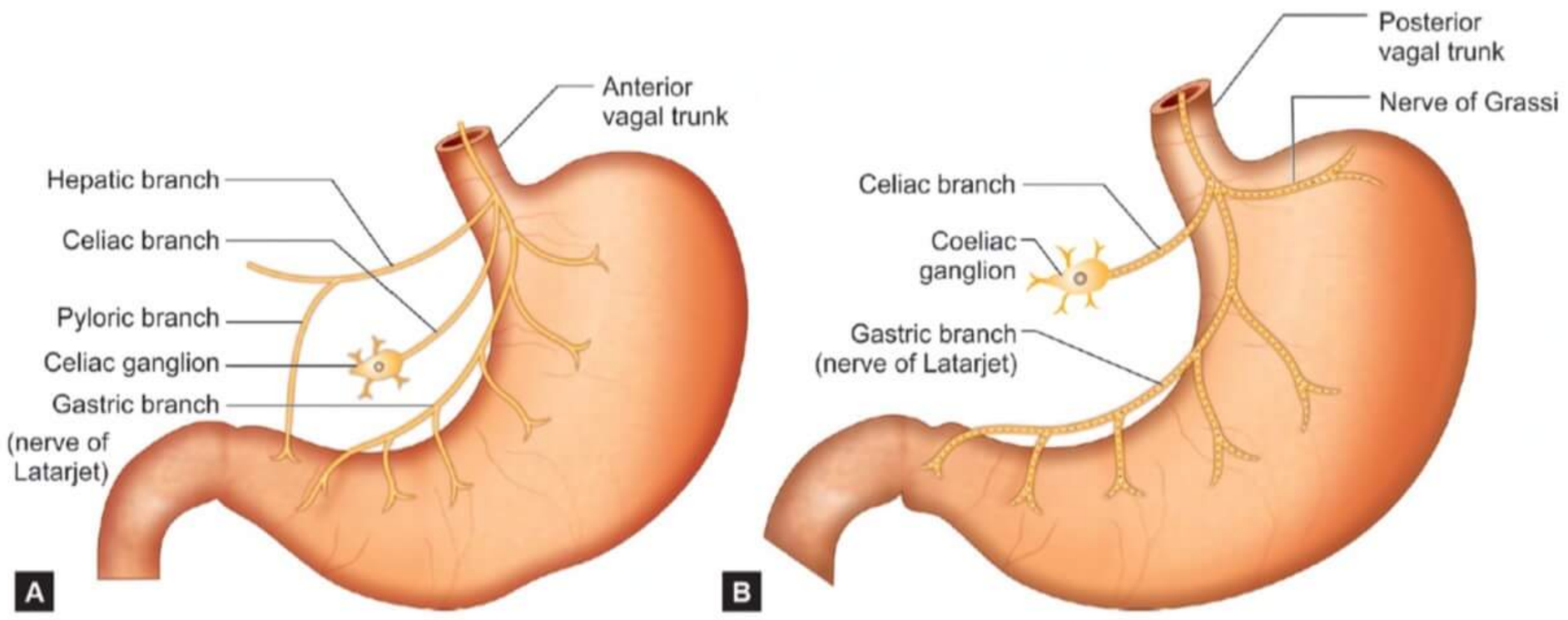
→ Left gastric & Rt gastric Arteries Supplies lesser curvature
→ Short gastric arteries Supply fundus & greater curvature
→ Rt gastro epiploic artery & lt gastro epiploic artery supply greater curvature



VENOUS DRAINAGE



NERVE SUPPLY



→ Rt vagus becomes posterior vagal trunk
→ Lt vagus becomes anterior vagal trunk

ANTERIOR VAGAL TRUNK

→ Supplies celiac ganglion & celiac plexus supplies foregut derivatives

NERVE OF LATARJET

→ present towards the pyloric sphinchter
→ Parasympathetic vagus nerve → ↑ peristalsis & relaxes sphincter → stomach drain into 1st part of duodenum
→ In highly selective vagotomy, care to be taken not to damage it
→ IF damage occurs → RETENTION SYNDROME

POSTERIOR VAGAL TRUNCK

→ In Selective vagotomy, CRIMINAL NERVE OF GRASSI to be resected

DUODENUM

→ Head of pancreas is present in C-LOOP of duodenum

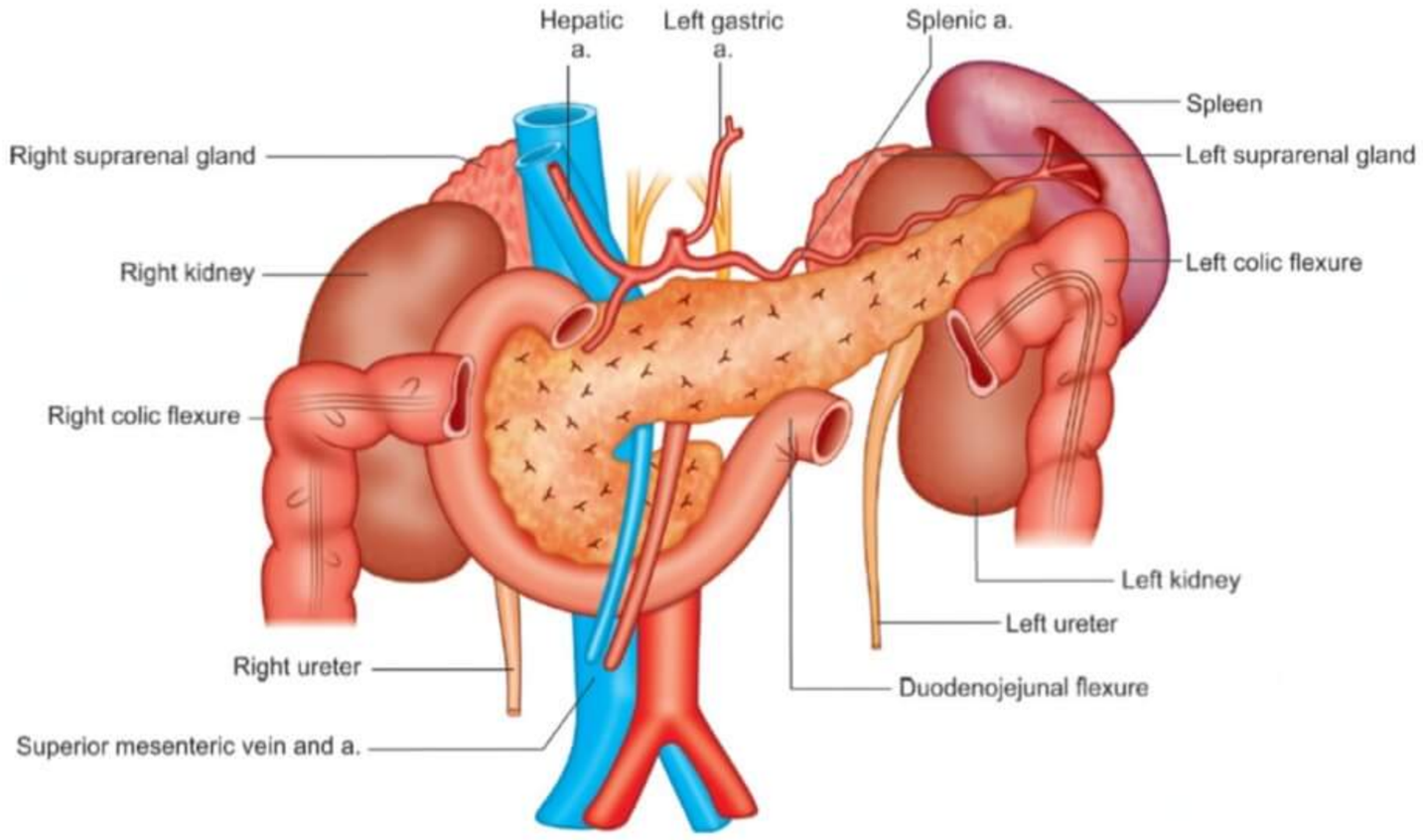
RELATIONS

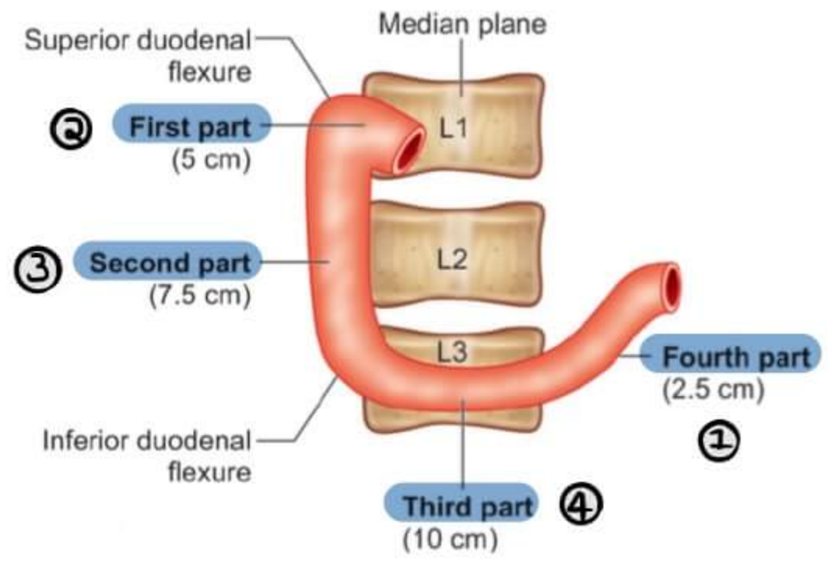
→ 1st part of duodenum comes anterior to head of pancreas

→ 2nd part of duodenum, anteriorly related to Rt. kidney

→ SMA & vein passing anterior to 3rd part of duodenum

→ In people ↓ less fat the SMA may compress 3rd part of duodenum





BILIARY APPARATUS

→ Liver segments 5,6,7,8 drains into Rt. Hepatic Duct

→ segments 2,3,4 drains into Lt. Hepatic Duct

→ segment 1 drains into both hepatic ducts

COMMON HEPATIC DUCT

→ formed by joining Rt & lt. Hepatic ducts

→ Cystic duct joins common hepatic duct to form common BILE DUCT

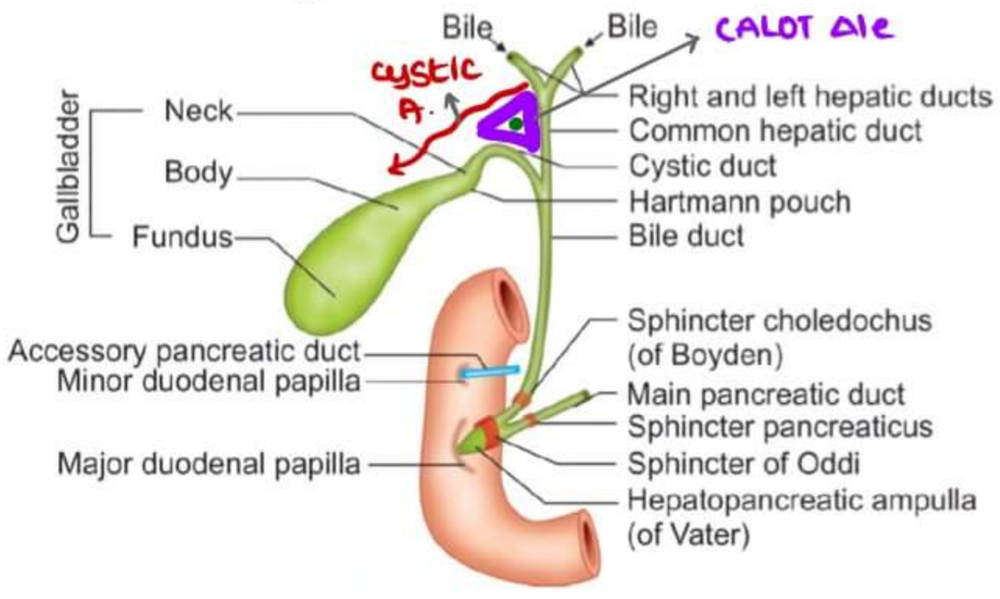
CYSTIC DUCT

→ HARTMANN POUCH

→ present at junction of cystic duct & neck of gall bladder

→ predisposed to gall stones

→ cystic duct has SPIRAL VALVE OF HEISTER



Liver produces Bile & Gall Bladder stores it

CYSTIC ARTERY

→ Supplies gall bladder

→ Br. of Rt. hepatic artery

CALOT TRIANGLE

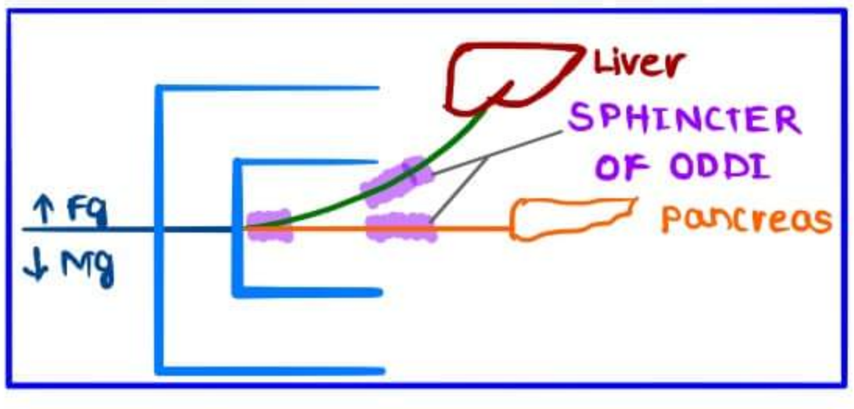
→ Contains LN of LUND

→ BOUNDARIES

Superiorly → Cystic Artery

Rt. side → Cystic duct

Lt. side → common Hepatic duct



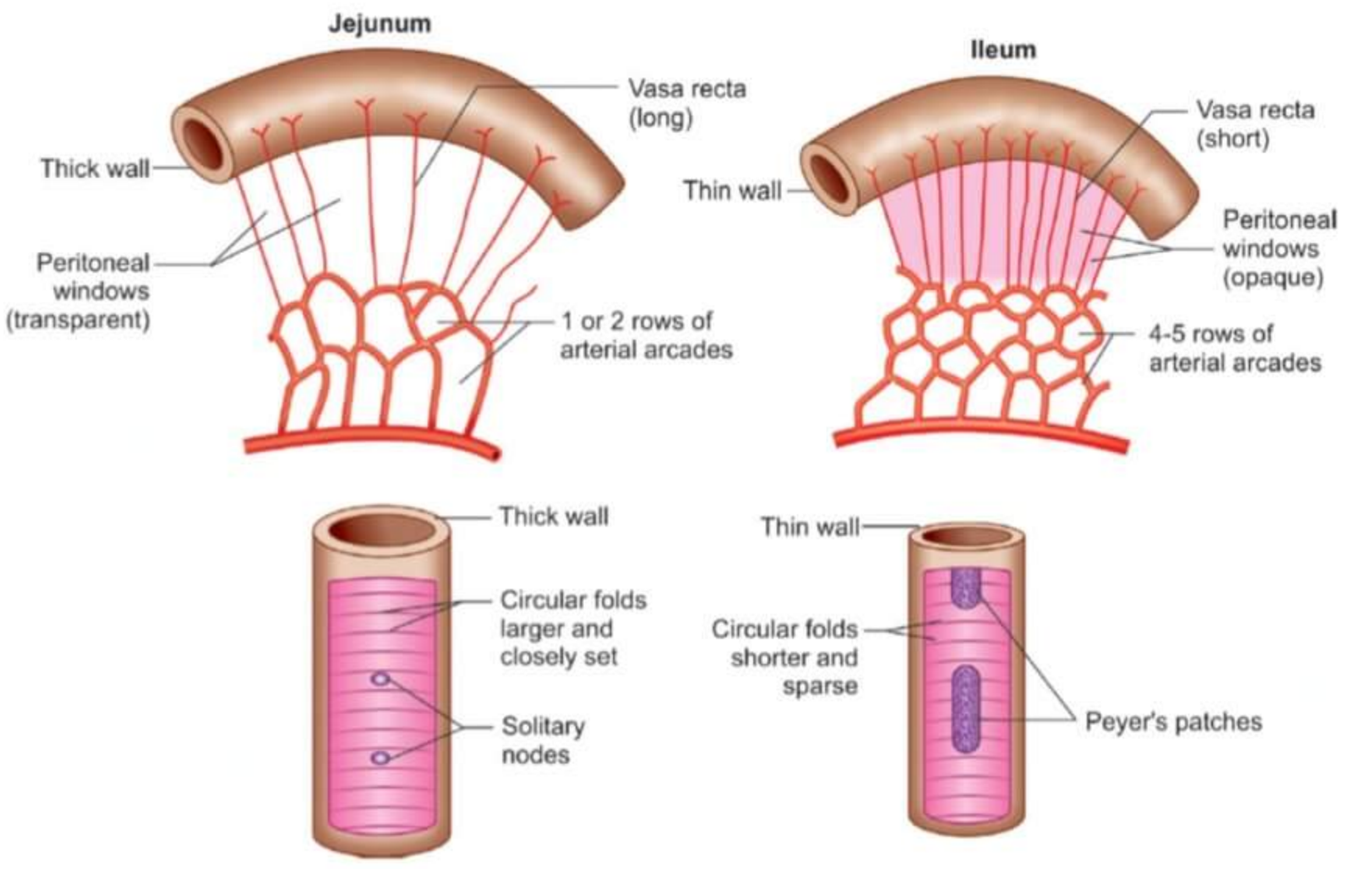
BILE DUCT

→ passing 1st part of duodenum
→ opens into 2nd part of duodenum i HPD

SPHINCTER OF ODDI

→ at junction of fore gut & midgut in 2nd part of duodenum medial wall Hepato pancreatic duct opens contain sphincter of Oddi
→ contains 3 Sphincters
  1. Biliary Sphincter
  2. Pancreatic Sphincter
  3. Hepato pancreatic (common) ampullary sphincter

JEJUNUM & ILEUM



→ Jejunum is more involved in absorptⁿ than ileum

JEJUNUM

→ contains thick wall & plenty PLICAE CIRCULARES / VALVES OF KERKRING
→ Plica circulares → mucosal folds, ↑ area of absorption
→ VILLI & MICROVILLI are more
→ MALT → Mucosa Associated Lymphoid tissue (less in number)
→ Few & Long VASA RECTA & contains less fat blw them (transparent)

ILEUM

→ contains thin wall & shorter, sparer Plicae Circular
→ Thin & blunt microvilli
→ PEYER'S PATCHES (MALT)
  → present towards the lower part of ileum (terminal ileum)
  → oval & longitudinal arrangement
  → oval, longitudinal ulcer found in biopsy of Typhoid perforatⁿ death patient
→ more, short vasarecta & more fat blw them (opaque)

DUODENUM

→ Plicae circular → not present in 1st part
present in 2nd part (less than jejunum)

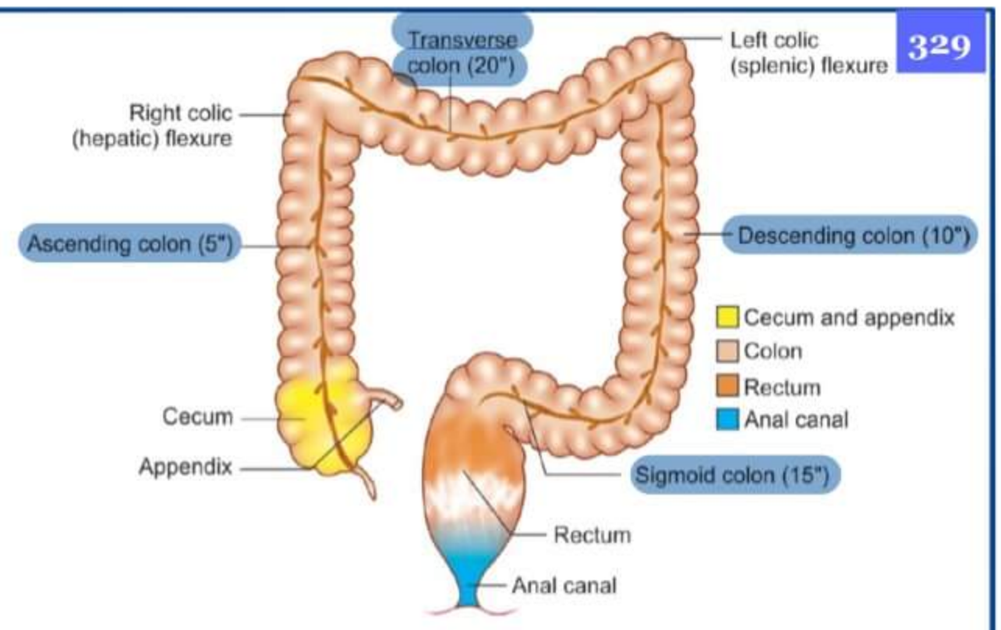
LARGE INTESTINE

→ Length of Small Intestine → 6 m

→ Length of large Intestine → 1.5 m

→ APPENDICES EPIPLOICAE

→ peritoneal pouches filled I fat along the Taenia (tape like longitudinal thickening of muscle)

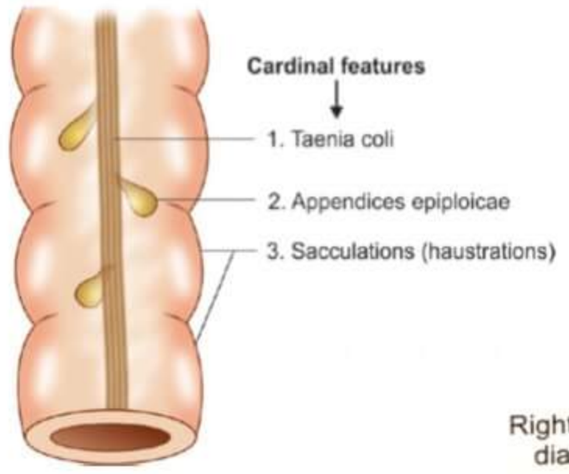


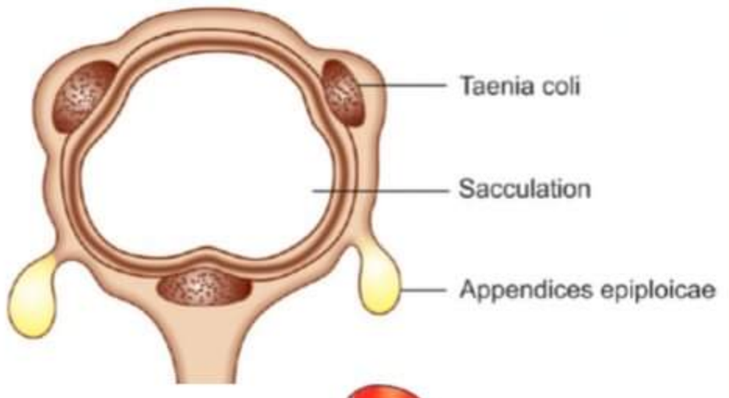
→ present in Ascending, transverse, descending & Sigmoid colon

→ caecum, appendix, rectum & anal canal do not have them

CARDINAL FEATURES

1. Taenia coli
   not present in Caecum, Apx, rectum, anal canal
2. Appendices Epiploicae
3. Sacculations (Haustrations)
   → dilatations & constrictions d/t Taenia

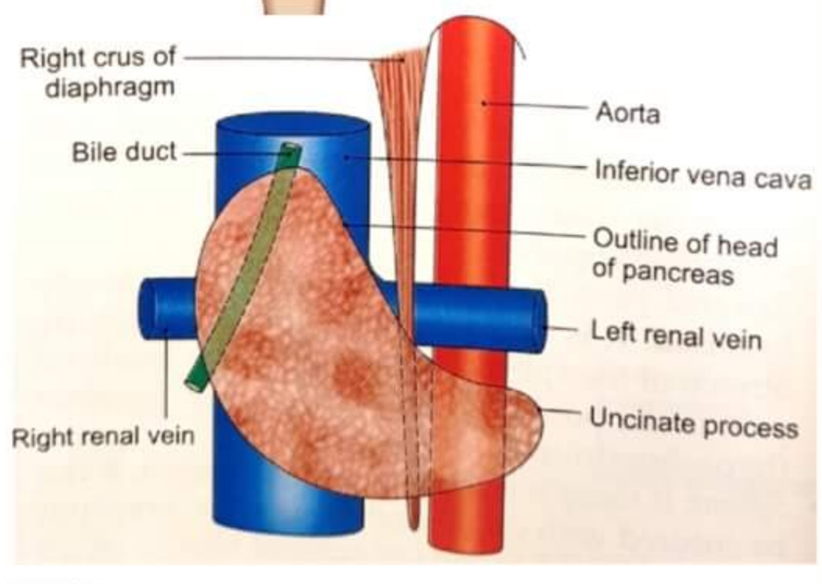


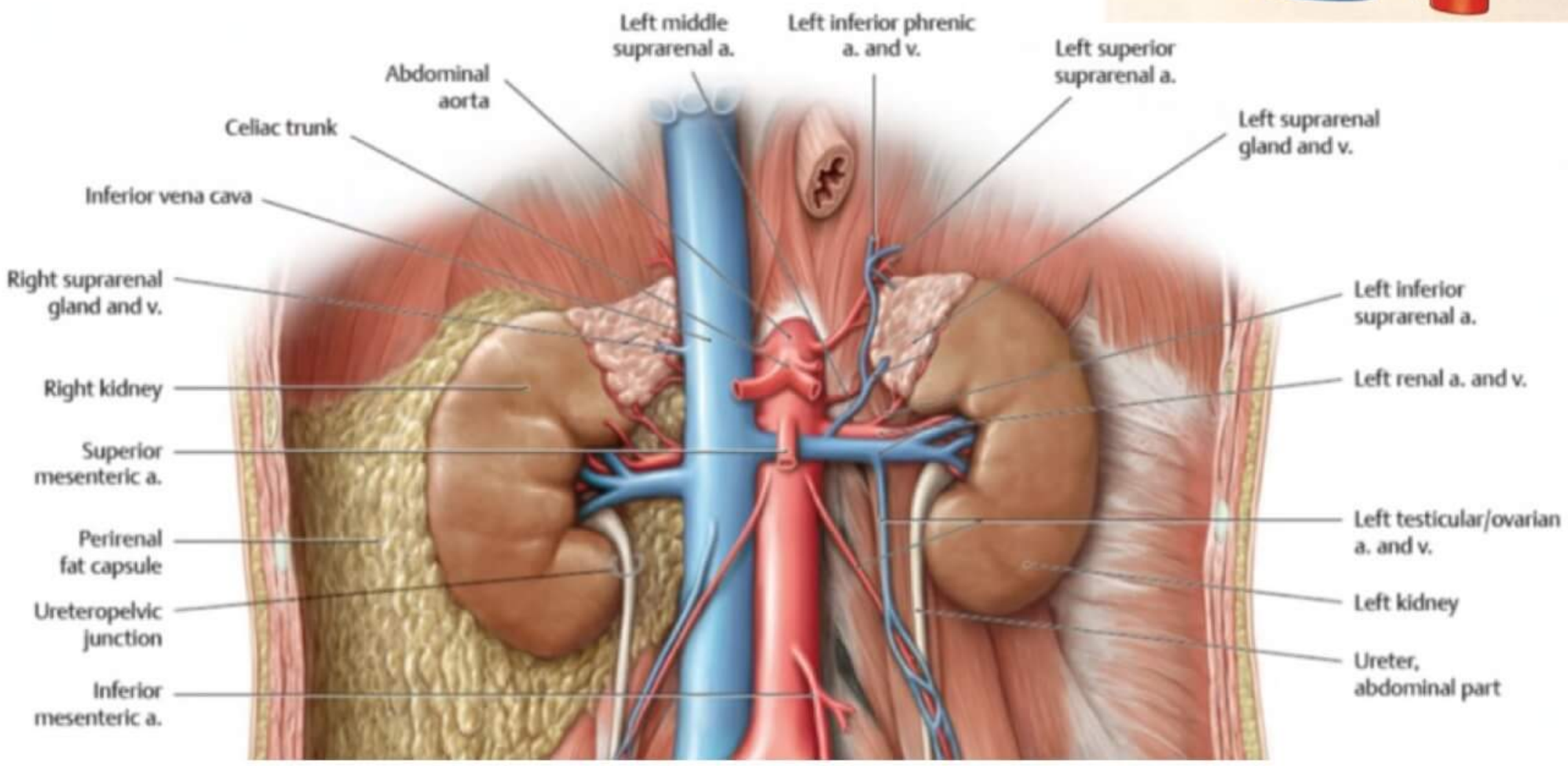


PANCREAS

RELATIONS

→ present in C-loop of duodenum





→ Head of pancreas is infront of 2 renal veins draining into IVC

→ uncinate process is passing infront of abdominal aorta towards the lt. side of midline

→ Left Renal vein is longer (has to cross the midline of body & drain into IVC on Right side)

→ Superior Mesenteric artery crossing anterior to Left renal vein

→ Left renal vein is passing anterior to abdominal aorta & below the SMA

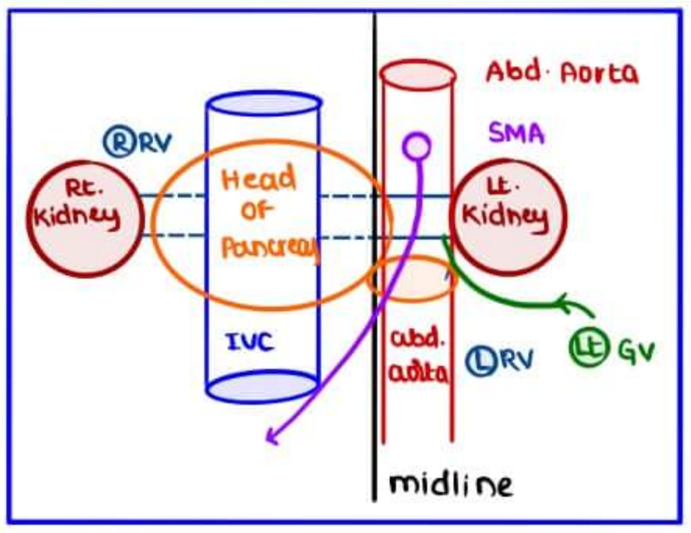
→ SMA can compress Left renal vein & causes NUTCRACKER SYNDROME & Renal HTN

→ left adrenal & left gonadal veins drains into lt. renal vein

→ Right adrenal vein & Rt. gonadal veins directly drain into IVC

NUT-CRACKER SYNDROME

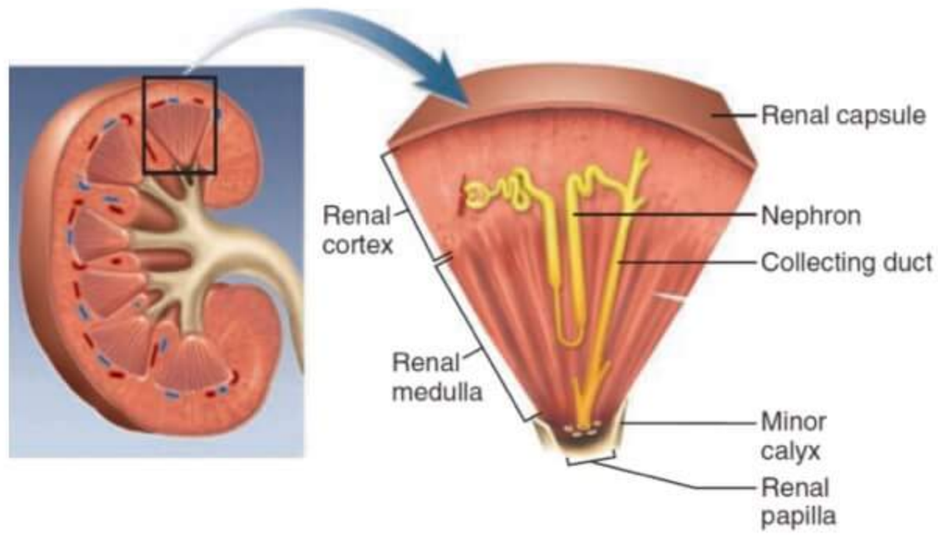
→ SMA compresses lt. Renal artery
→ Renal hypertension
→ varicocele
(as lt. gonadal vein is compromised)



KIDNEY

NEPHRON

Bowman's capsule
Proximal convuluted tubule
Loop of Henle
Distal convoluted Tubule
Collecting Duct

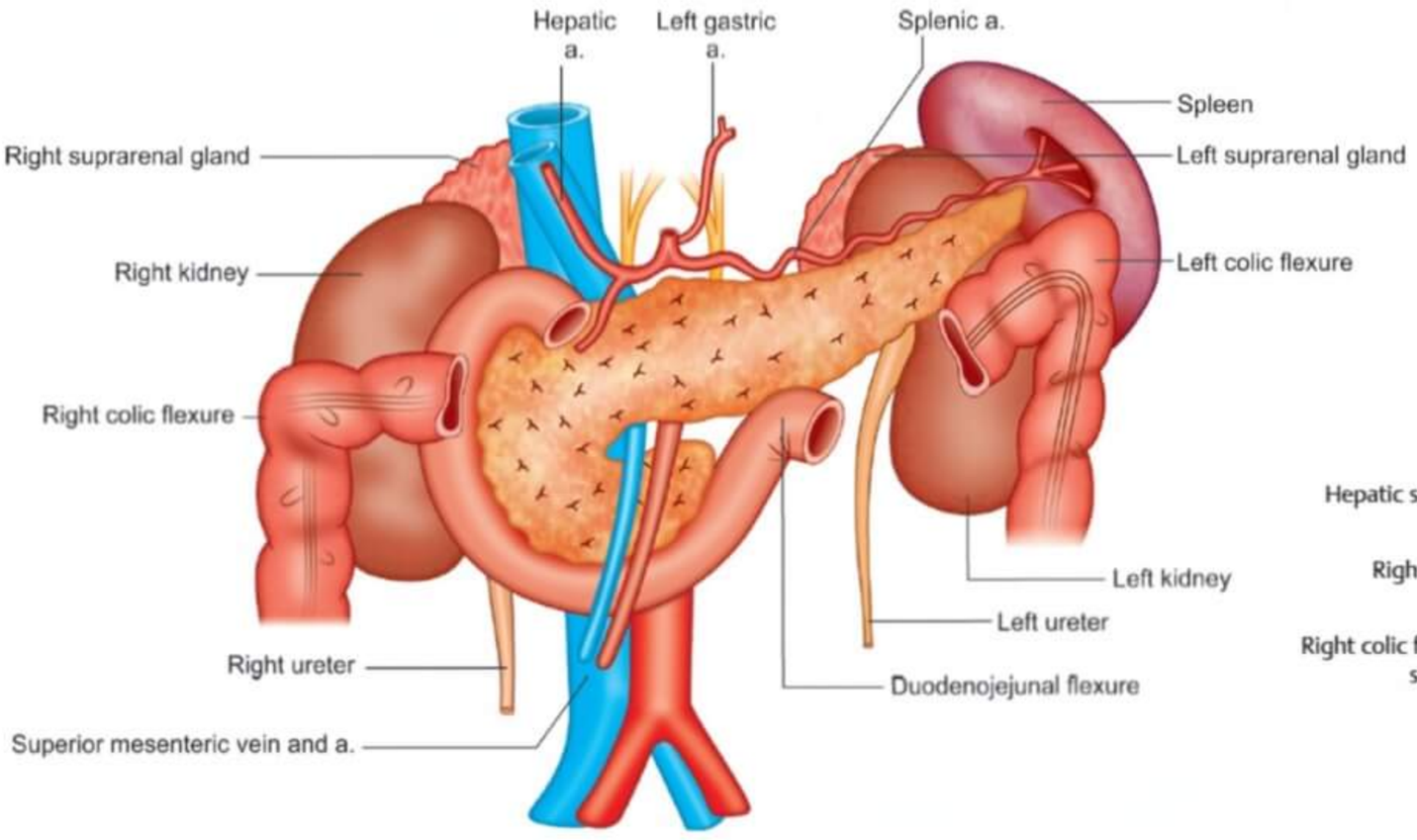


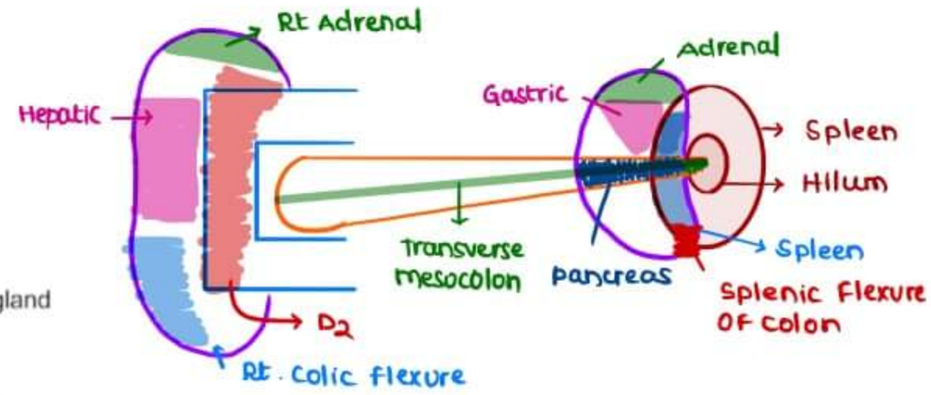
→ Renal cortex is at periphery
→ Renal medulla is deeper
→ Renal medulla have collecting ducts

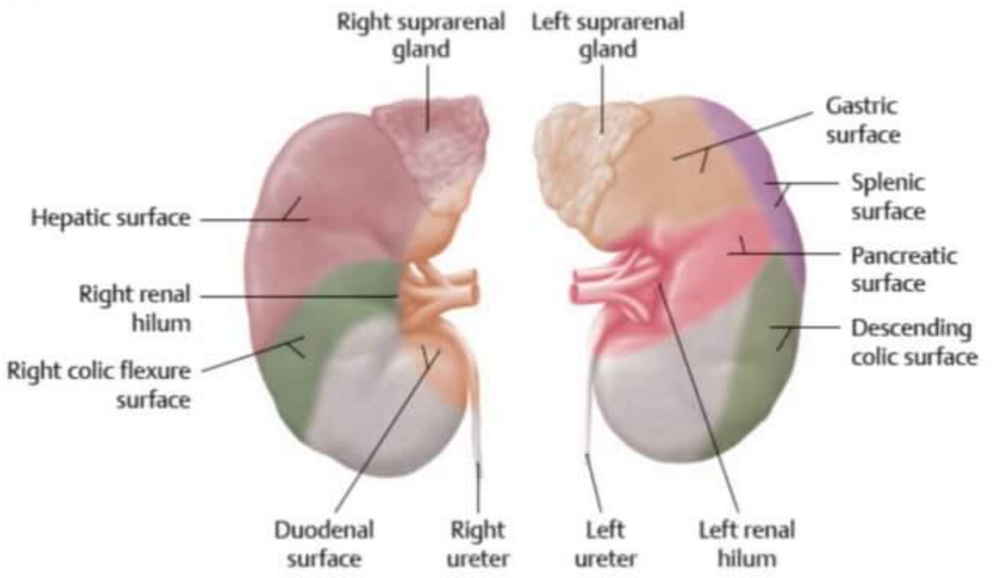
URINE FLOW

collecting Ducts → Renal papilla → minor calyx → major calyx → Renal pelvis → Ureter

RELATIONS OF KIDNEY







ANTERIOR RELATIONS OF RIGHT KIDNEY

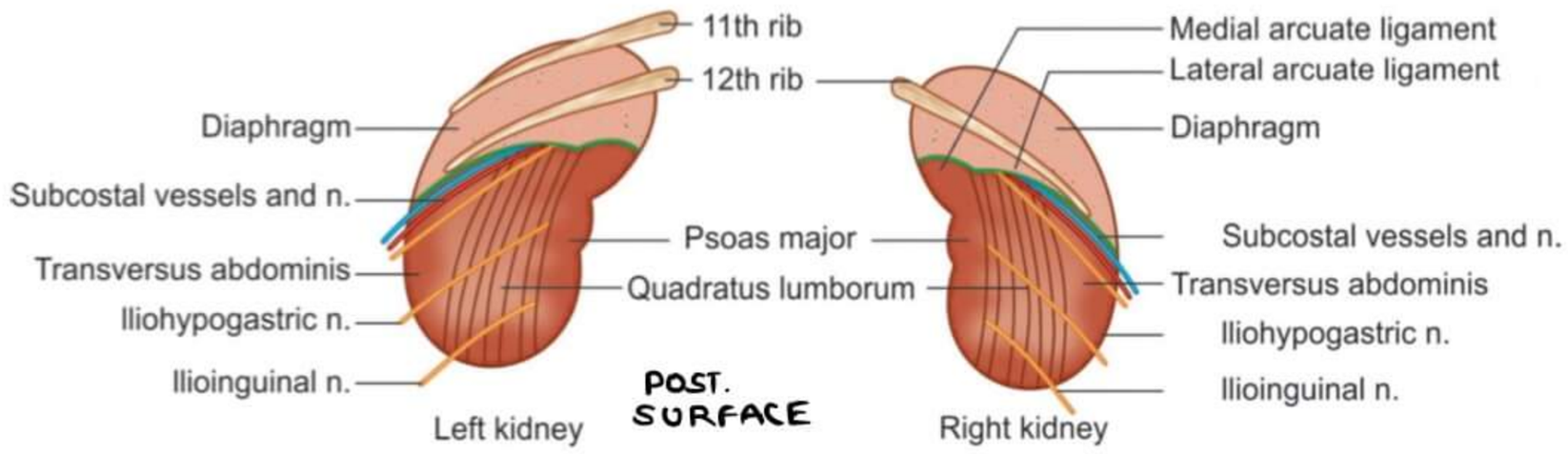
1. Hepatic / Right colic flexure
2. Rt. Adrenal gland
3. 2nd part of Duodenum
4. Liver
5. Anterior band of resonance by colon

ANTERIOR RELATIONS OF LEFT KIDNEY

1. Inferior surface of spleen
2. Lt adrenal gland superiorly
3. Body of pancreas
4. Left/Splenic flexure of colon
5. Gastric area
6. Anterior band of resonance by colon

Q All are anterior relations to kidney EXCEPT
a adrenal gland
b 4th part of duodenum
c Liver
d Hepatic flexure of colon

→ Rt kidney is relates ī 12 th rib (dlt restriction by Liver)
→ Lt Kidney is relates ī 11 th rib & 12 th rib (not much restrictⁿ by stomach)
→ Spleen related ī 9 th & 10 th rib on posterior veiw



3 nerves related ī Kidney	3 muscles related ī Kidney
1. Ilioinguinal nerve (most medial)	1. Psoas major (most medial)
2. Iliohypogastric nerve	2. Quadratus lumborum
3. Subcostal nerve (under 12 th rib)	3. Transversus abdominis

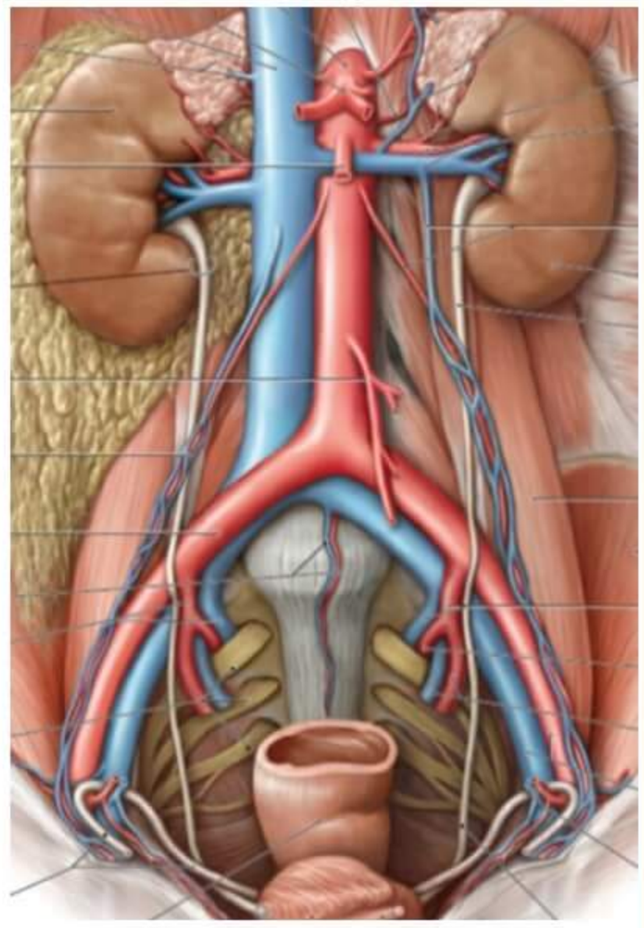
URETER

Rt URETER

→ comes from Renal pelvis, crosses pelvic brim, enters the pelvic cavity & opens into the posterior aspect of urinary bladder

Lt. URETER

→ comes into abdomen, pelvis & opens into posterior border of urinary bladder



→ URETER Length → 25 cm long
  First 12.5 cm → in abdominal region
  next 12.5 cm → in pelvis region

→ Boundary line → Pelvic brim (begining of pelvis)
→ retroperitoneal structure

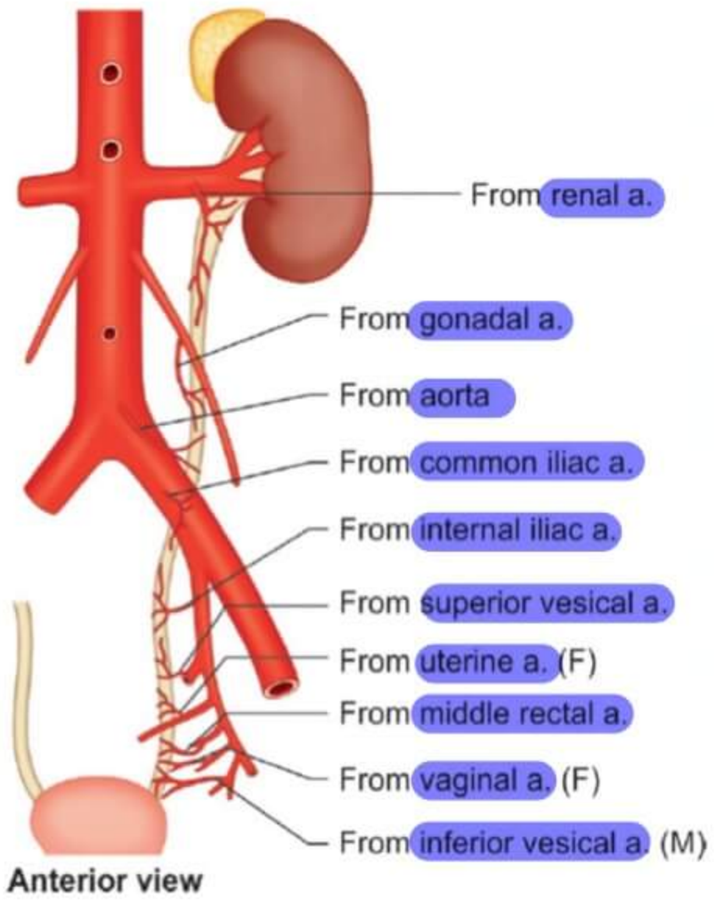
→ V → Renal vein (most anterior)
  A → Renal artery
  P → Renal pelvis (most posterior)

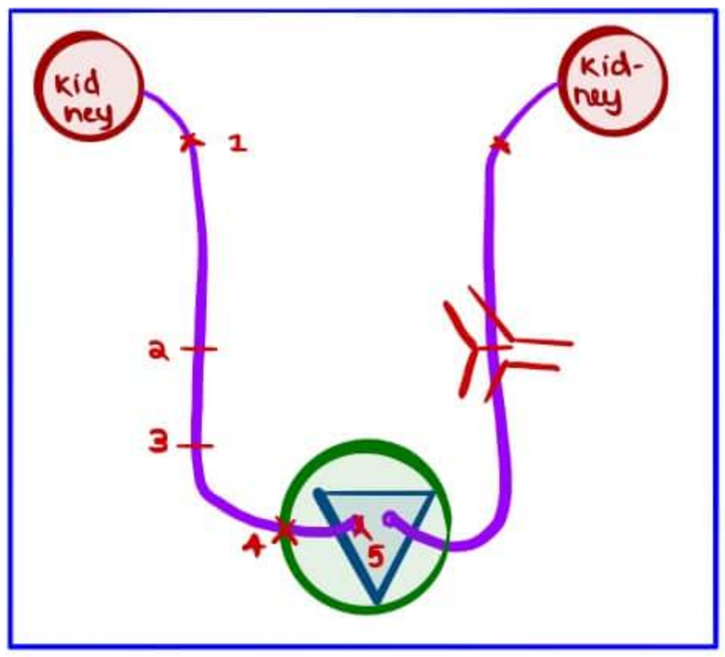
RELATIONS

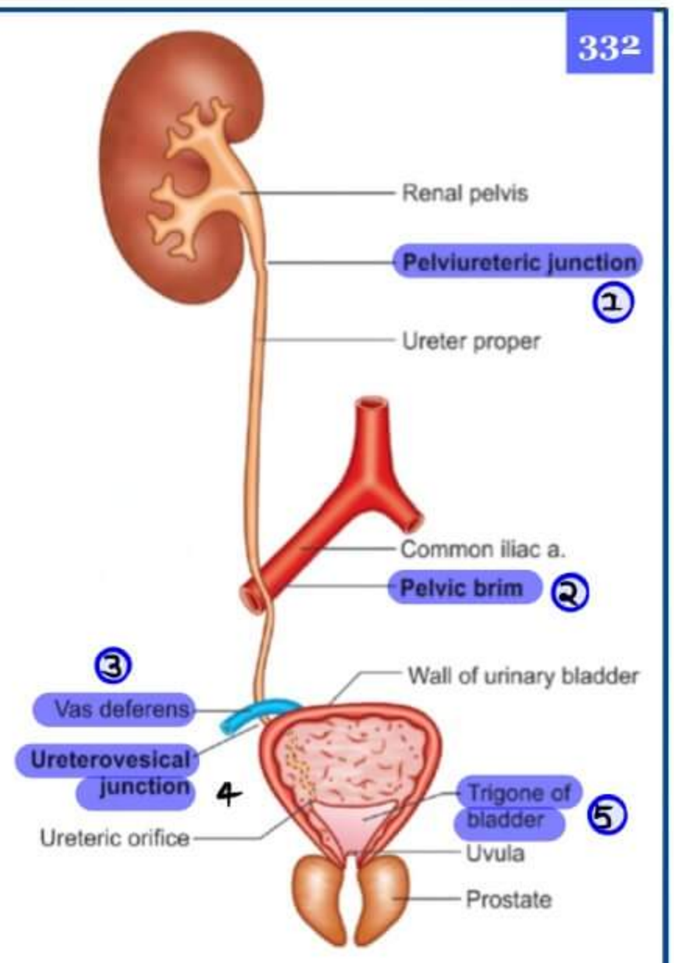
→ Gonadal arteries are Br. of Abdominal aorta passing the ureter from medial to Lateral side & anteriorly
→ behind the ureter,
  → Bifurcatⁿ of common iliac artery into internal & External Iliac arteries
  → Psoas major muscle

NARROWING OF URETER (calculi can be found here)

1. at pelviureteric junctⁿ
2. at pelvic brim
3. at vas deferens
4. at uretero vesical junctⁿ (Narrowest)
5. at Trigone of bladder (and Narrowest)







ARTERIAL SUPPLY → external Iliac artery DONOT SUPPLY

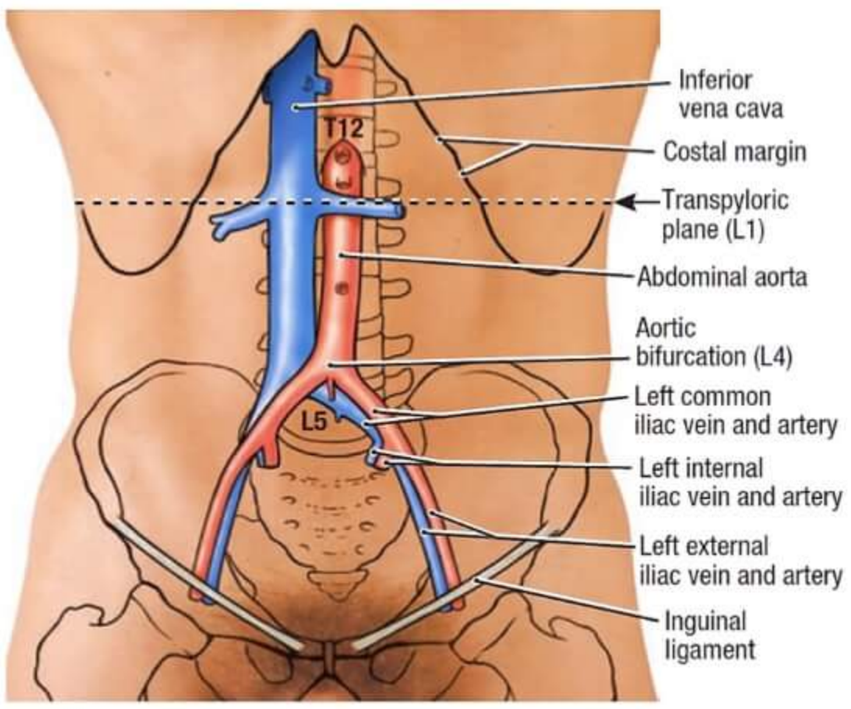
VENOUS DRAINAGE OF ABDOMEN & THORAX

VENOUS DRAINAGE OF ABDOMEN → Systemic circulation
→ Portal circulation

SYSTEMIC CIRCULATION

→ INFERIOR VENA CAVA drains blood FROM the parts BELOW DIAPHRAGM
→ SUPERIOR VENA CAVA drains blood FROM the parts ABOVE DIAPHRAGM

Q False statements regarding inferior vena cava
a receives few tributaries from thorax
b largest vessel in the body
c is retroperitoneal
d lies immediately to the right of aorta
e eustachian valve is non functional



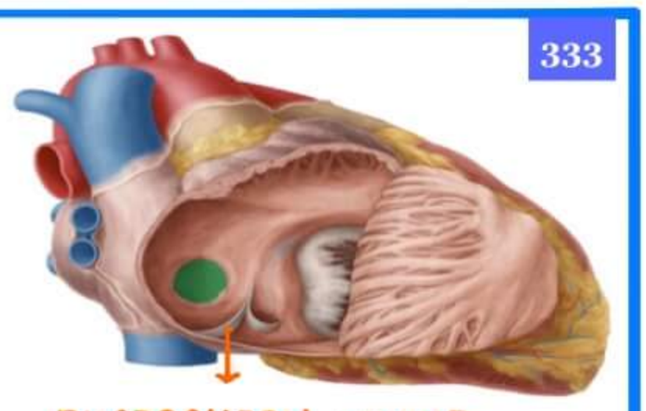
INFERIOR VENA CAVA

→ Largest VEIN in the body
→ retroperitoneal in posterior abdominal wall
→ lies to the right of aorta
→ all tributaries of IVC except testicular vein is valveless
→ IVC itself is valveless
→ Eustachian valve is non functional in adult life but functional in fetal life
→ formed at L_5 & extends to T_8
→ double the length of abdominal aorta
→ FEMORAL VEIN from lower limb passes inguinal ligament & continues as EXTERNAL ILIAC VEIN together ⊏ INTERNAL ILIAC VEIN to form COMMON ILIAC VEIN
→ Right & left COMMON ILIAC VEINS joins to form INFERIOR VENA CAVA

EUSTACHIAN VALVE

→ Fastigial in adults

→ Functional in fetal life to guide blood from inferior vena cava to pass foramen ovale & reach the left atrium



EUSTACHIAN VALVE

TRIBUTARIES IVC

→ LUMBAR VEIN [3rd & 4th] → drains POSTERO LATERAL ABDOMINAL WALL into IVC

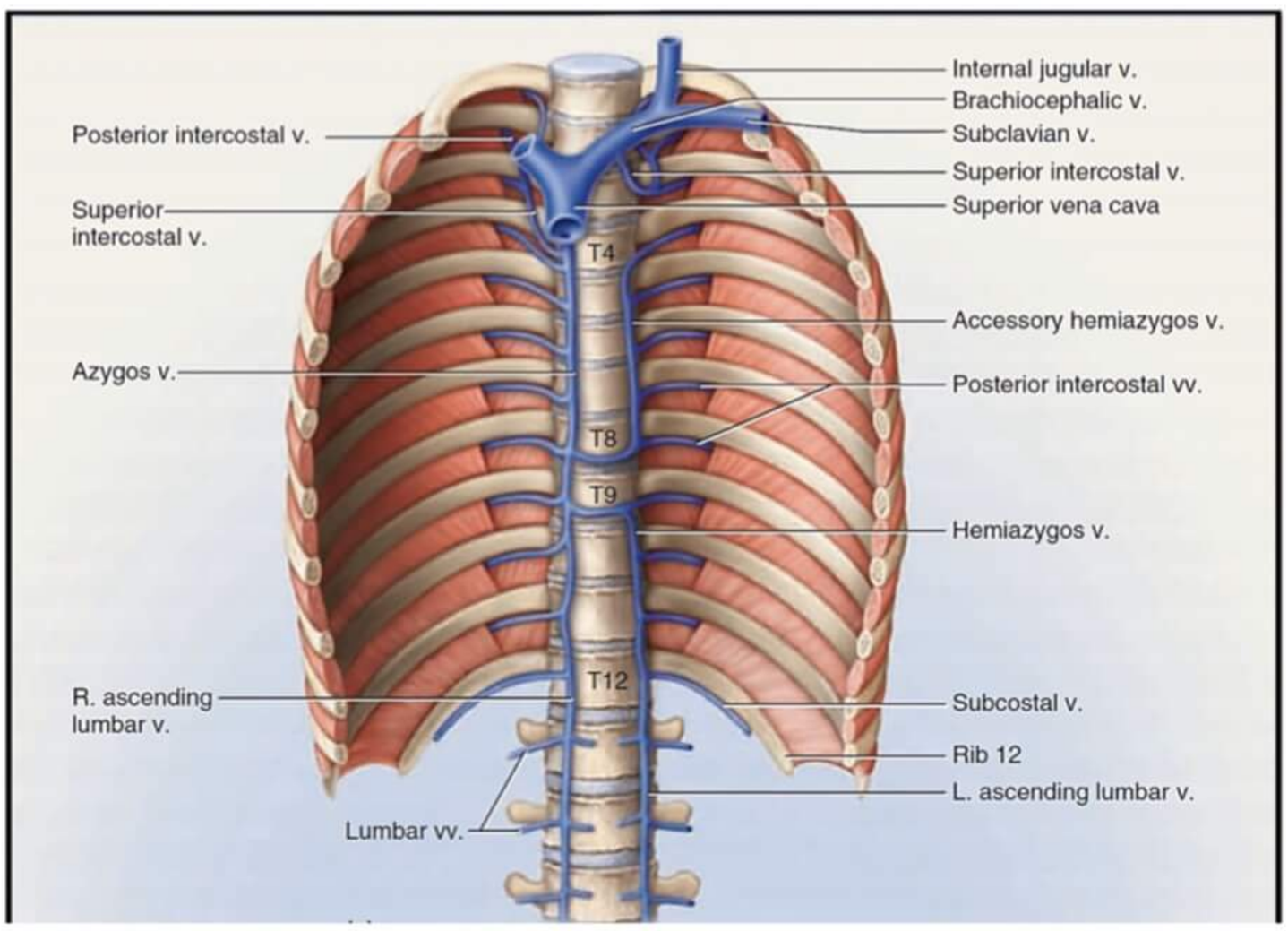
→ RIGHT GONADAL VEIN
RIGHT SUPRA RENAL VEIN
} drains DIRECTLY into IVC

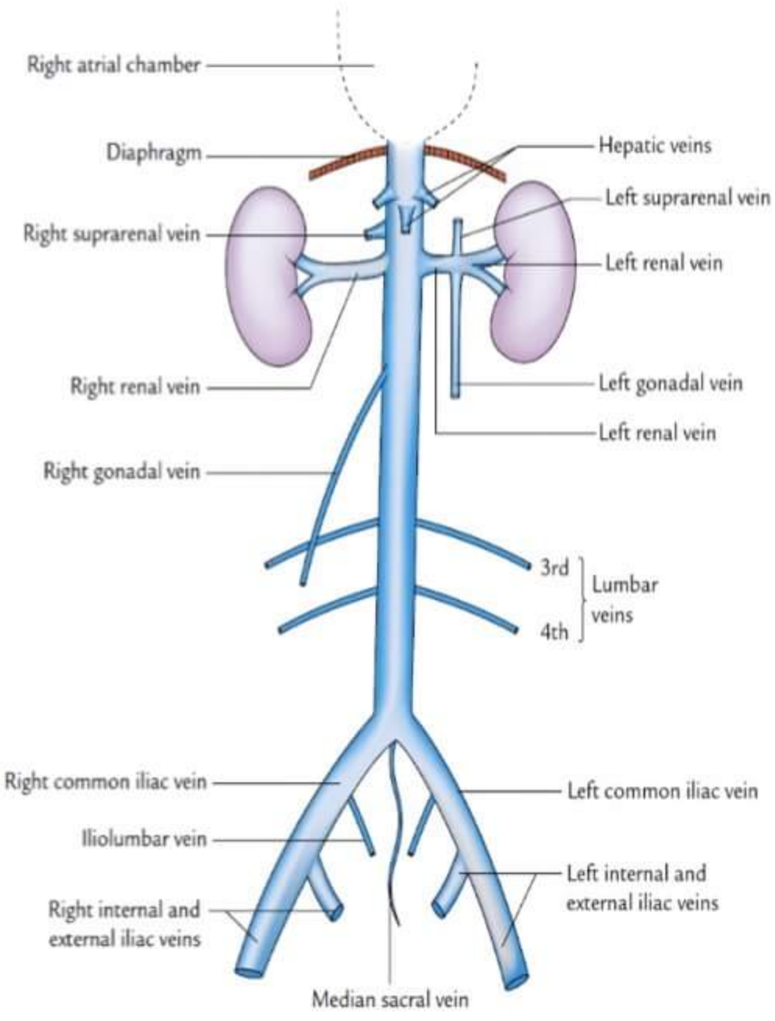
→ LEFT GONADAL VEIN
LEFT SUPRA RENAL VEIN
} → LEFT RENAL VEIN → IVC

→ LEFT INFERIOR PHRENIC VEIN [2.5cm] → drains into LEFT RENAL VEIN → IVC

→ RIGHT INFERIOR PHRENIC VEIN [7.5 cm] → drains into IVC

→ VENOUS DRAINAGE OF LIVER → drains into IVC via 3 HEPATIC VEINS [rt, lt, middle]





TRIBUTARIES OF IVC

Q Tributaries of Left renal vein are all except [NEET pattern 2014]

a. Left adrenal vein
b. Left lumbar vein
c. Left testicular vein
d. Diaphragmatic vein

→ Lumbar veins do not drain into renal veins

→ Lumbar veins 1, 2, 3, 4 drain into IVC [mainly 3 & 4]

ASCENDING LUMBAR VEINS

→ Right & Left ascending Lumbar veins draining posterior - Lateral abdominal wall towards IVC

→ Right sided ascending lumbar vein punctures right sided crus of diaphragm continues into thorax as Azygous vein which already have communicat^{n} ī IVC

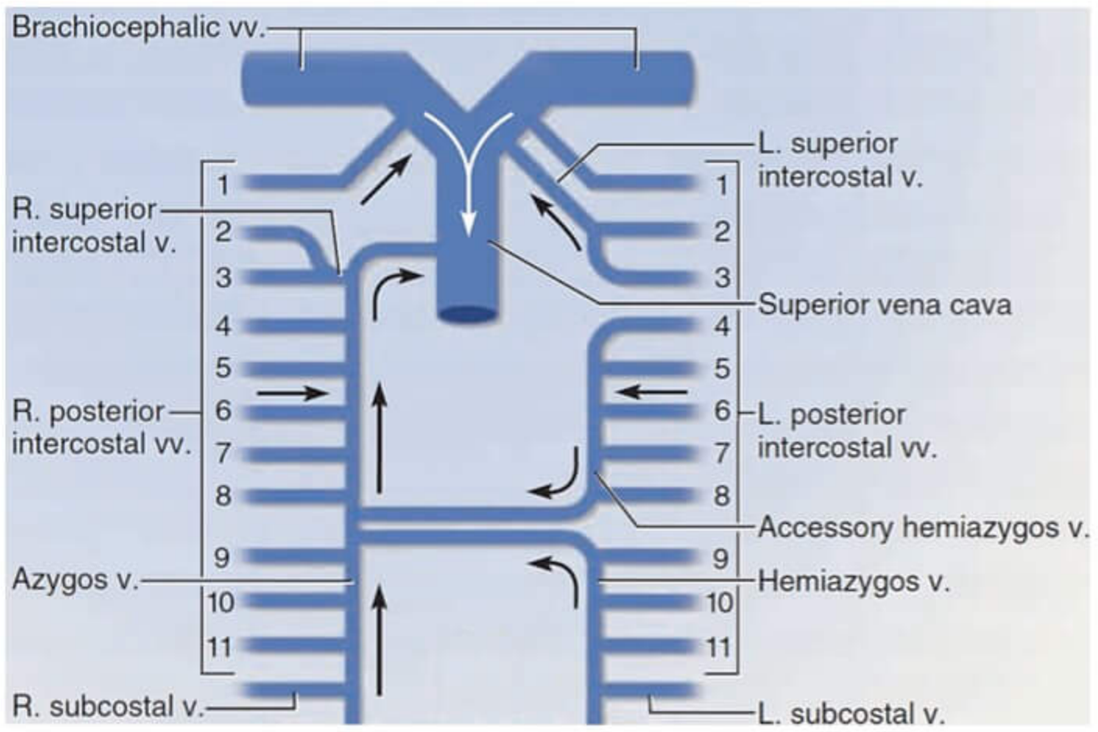
→ Left sided ascending Lumbar vein punctures Left crus of diaphragm to enter thorax & becomes Hemi - azygous vein by joining into Left Sub costal vein below 12 th rib. Hemi - azygous vein has some communicat^{n} ī renal vein & hence IVC

→ In case of IVC & SVC obstruction these communications help us

→ Right sided ascending Lumbar vein is joined by Subcostal vein below 12 th rib to become Azygous vein. Azygous vein continues in thorax & drain into SVC at T_4 level

→ Hemi Azygous vein drain Lower intercostal spaces [$t_{12,11,10}$ & 9] & at T_9 vertebra level it crosses midline & drain into Azygous vein

→ Upper intercostal spaces [4,5,6,7,8] of Left side are drained by Accessory hemi - azygous vein & at T_8 vertebra level it crosses midline behind heart & drain into Azygous vein which ultimately drain into SVC



→ Right SUBCLAVIAN VEIN joins ī Right INTERNAL Jugular v., form Rt BRACHIOCEPHALIC V.

→ Lt SUBCLAVIAN VEIN joins ī LEFT INTERNAL JUGULAR VEIN form Lt BROCHIOCEPHALIC V.

→ Right [short] & Left [long] BRACHIOCEPHALIC VEIN which drains HEAD & NECK & UL, join to form SVC to enter heart

→ Intercostal spaces drain into posterior - intercostal veins & they drain towards SVC

→ 1st Right & Left posterior intercostal veins drain into Brachiocephalic vein

→ Right 2nd & 3rd POSTERIOR INTERCOSTAL VEINS join to form RIGHT SUPERIOR INTERCOSTAL VEIN which drains into AZYGOUS VEIN which into SVC

→ Left sided 2&3rd posterior intercostal vein joins to form Left Superior intercostal vein which drains into Brachiocephalic vein

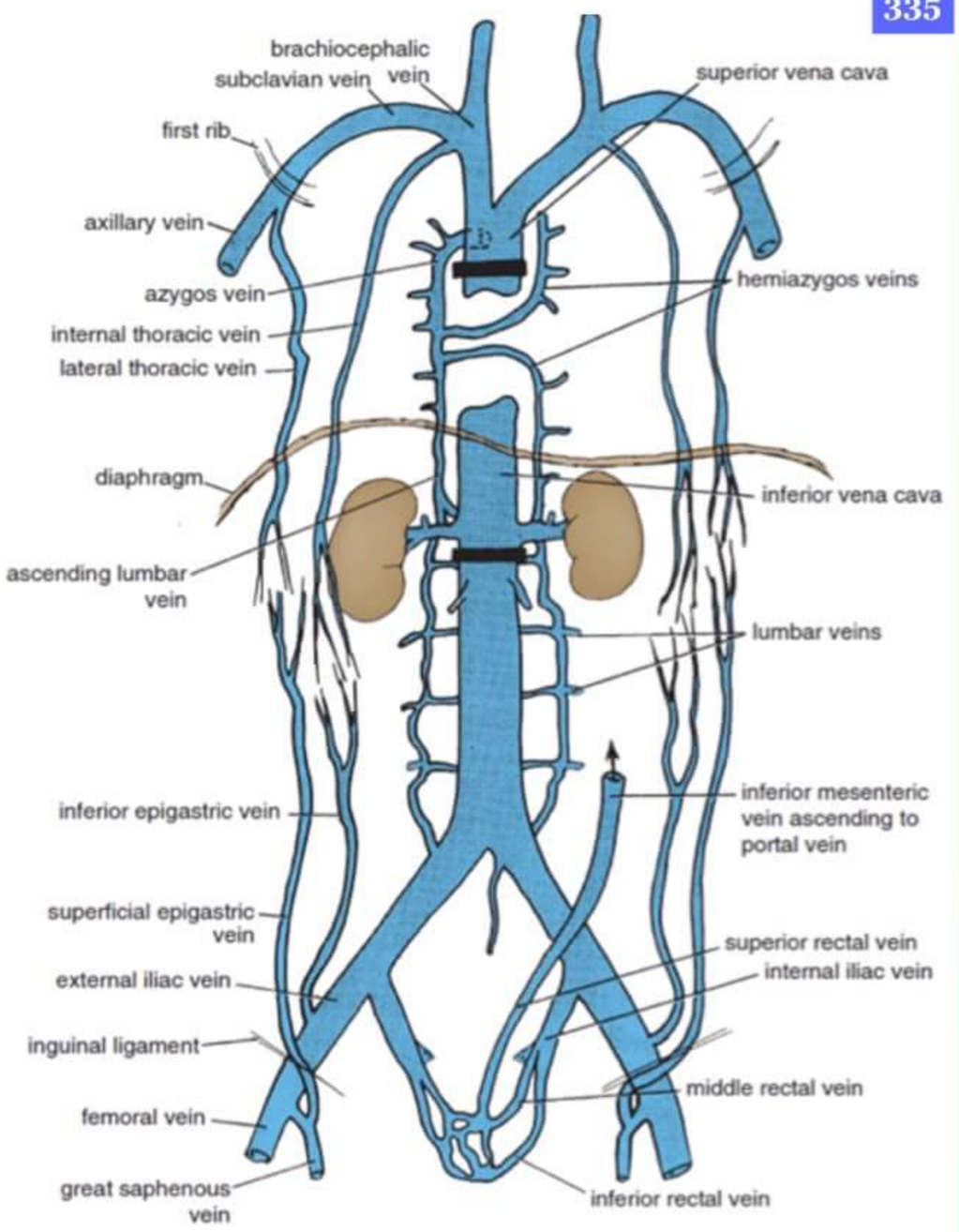
→ Remaining all Intercostal veins on right side [4-11 Rt intercostal veins; 12 th called as subcostal vein] & Lower intercostal veins of Left side [9,10,11; 12 th - subcostal vein] drain into Hemi-zygous vein.
Upper intercostal veins of left side [4-8] drain into Accessory Hemiazygous vein

→ Both Hemi-Azygous & Accessory hemi-azygous vein crosses midline of body & drains into Azygous vein which drain into SVC

IVC OBSTRUCTION

Q IVC Obstruct^{n} present i
a Esophageal varices
b hemorrhoids
c. Paraumbilical dilatat^{n}
d Thoraco epigastric dilatat^{n}

IN IVC OBSTRUCTION [may be d/t tumor], blood from below the diaphragm can't be drained into RA of Heart → COLLATERALS will be formed to facilitate drainage



COLLATERALS

1. In IVC Obstruct^{n} → Reversal of blood in IVC occurs → drains into LUMBAR VEINS

- ON RIGHT SIDE OF THE BODY

IVC OBSTRUCT^{n} → Lumbar veins → Ascending Lumbar veins ↓ Azygous vein ← SVC ← Heart [RA]

- ON LEFT SIDE OF BODY

IVC OBSTRUCT^{n} → Lumbar veins → Ascending Lumbar veins ↓ Hemi Azygous vein ← Azygous vein ← SVC ← Heart [RA]

→ volume of IVC is much greater compared to volume of Azygous & Hemi azygous veins, there will be requirement of more collaterals

2. The blood coming back due to Obstruct^{n} is recieved by external Iliac vein, common iliac, femoral vein

IVC OBSTRUCTION
↓
COMMON ILIAC VEIN
↓
EXTERNAL ILIAC VEIN
↓
INFERIOR EPIGASTRIC VEIN
↳ it is communicating i external iliac vein
↳ carry the blood upwards in an event of IVC block


IVC OBSTRUCTION

3. IVC OBSTRUCTION

↓

common Iliac vein

↓

External Iliac vein

↓

Femoral vein

↓

Great saphenous vein [GSV]

↓

Superior Epigastric vein [tributary of GSV]

↓

Superficial Epigastric vein [carry blood upwards]

→ Inferior & Superior Epigastric veins carry blood upwards

↓ [THORACO EPIGASTRIC ANASTAMOSIS]

received by Thoracic veins

↓

Lateral thoracic vein drains into axillary vein

↓

Axillary vein continues as subclavian vein

↓

Subclavian itself receives internal thoracic vein

SVC OBSTRUCTION

→ any mediastinal tumor can cause SVC block

→ there will be reversal of blood into Brachiocephalic vein

SVC BLOCKAGE

↓

Brachiocephalic vein

↓

Sub clavian vein

↓

Axillary vein

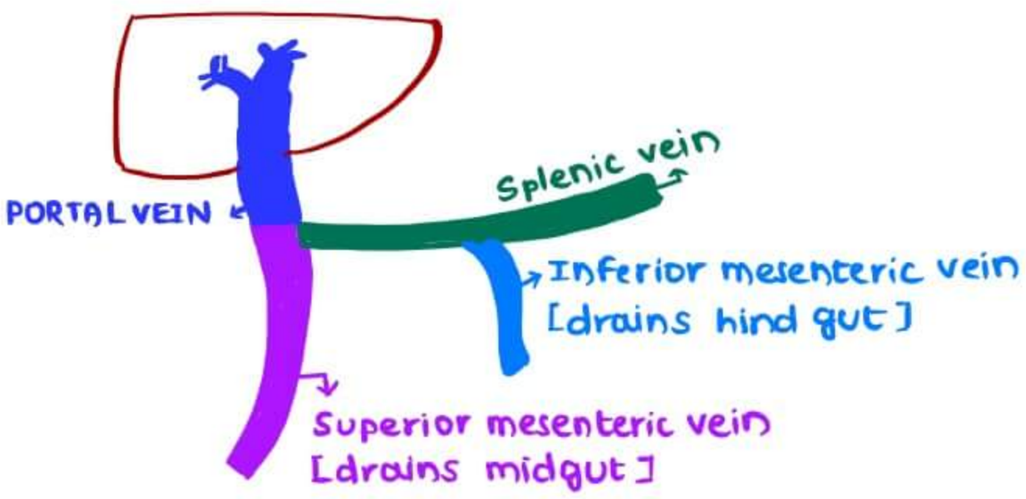
→ The same Thoraco Epigastric Anastomosis will take care of SVC block but in reverse direction

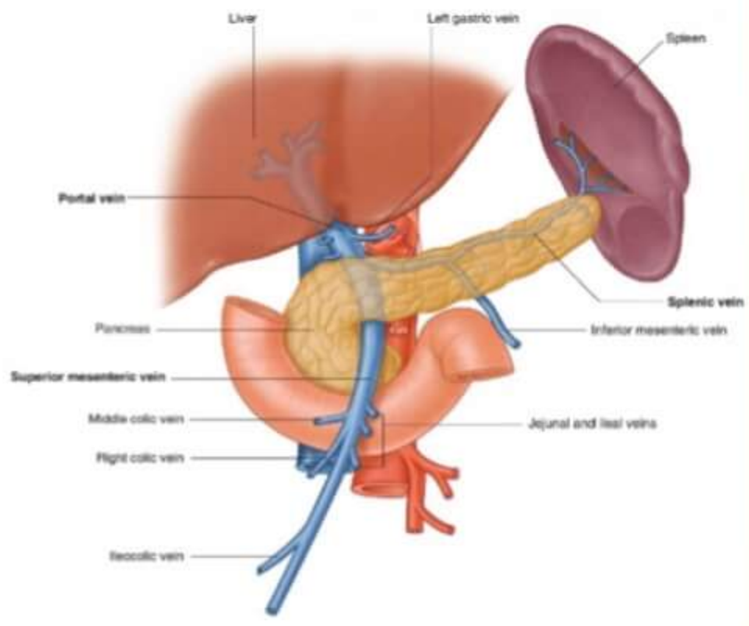
SUB CLAVIAN VEIN
↓
Internal thoracic vein
↓
Inferior Epigastric vein
↓
External Iliac vein
↓
common Iliac vein
↓
Inferior vena cava
↓
Right Atrium

AXILLARY VEIN
↓
Lateral thoracic vein
↓
Superior epigastric vein
↓
Great saphenous vein
↓
Femoral vein
↓
common Iliac vein
↓
Inferior vena cava
↓
Right Atrium

THORACO EPIGASTRIC ANASTOMOSIS

PORTAL VENOUS CIRCULATION



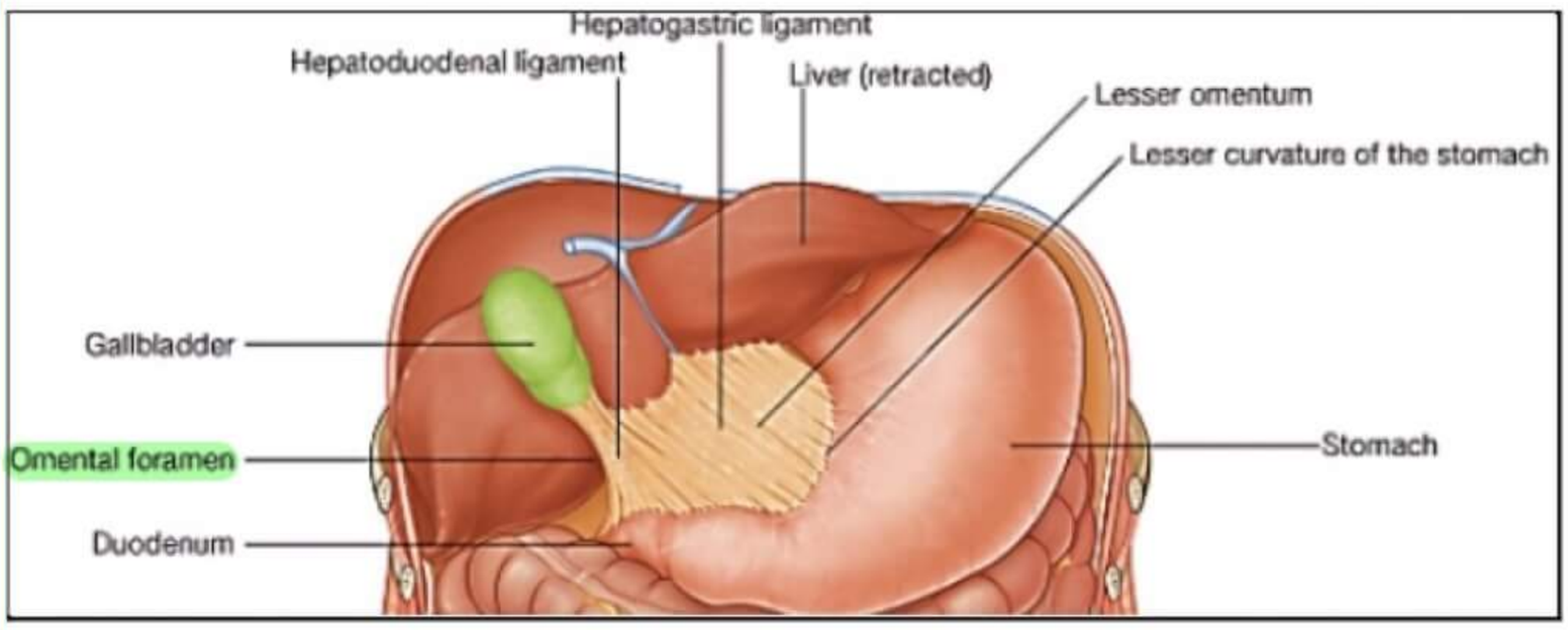


PORTAL VEIN

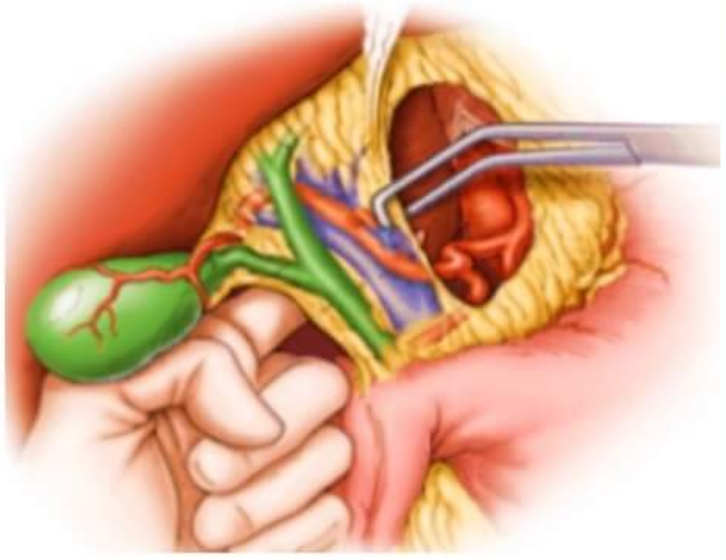
→ Formed behind the neck of Pancreas at transpyloric plane
→ at PORTA HEPATIS, it divides into rt & lt branches, opens into liver sinusoids
→ it is later drained by HEPATIC VEINS to IVC

LESSER OMENTUM

→ attaches between porta hepatis of liver & lesser curvature of stomach
→ contain 2 PARTS
1. HEPATOGASTRIC LIGAMENT → attaching to caudate lobe
2. HEPATODUODENAL LIGAMENT → attaching to 1st part of duodenum



PRINGLE'S MANEUVER



PRINGLE'S MANEUVER

→ Finger is inserted through epiploic foramen [foramen of Winslow]

→ pull the bile duct, hepatic artery & portal vein [anterior to posterior] anteriorly & clamp them

→ Performed in Liver surgery

→ Foramen of Winslow have 3 structures both anteriorly & posteriorly

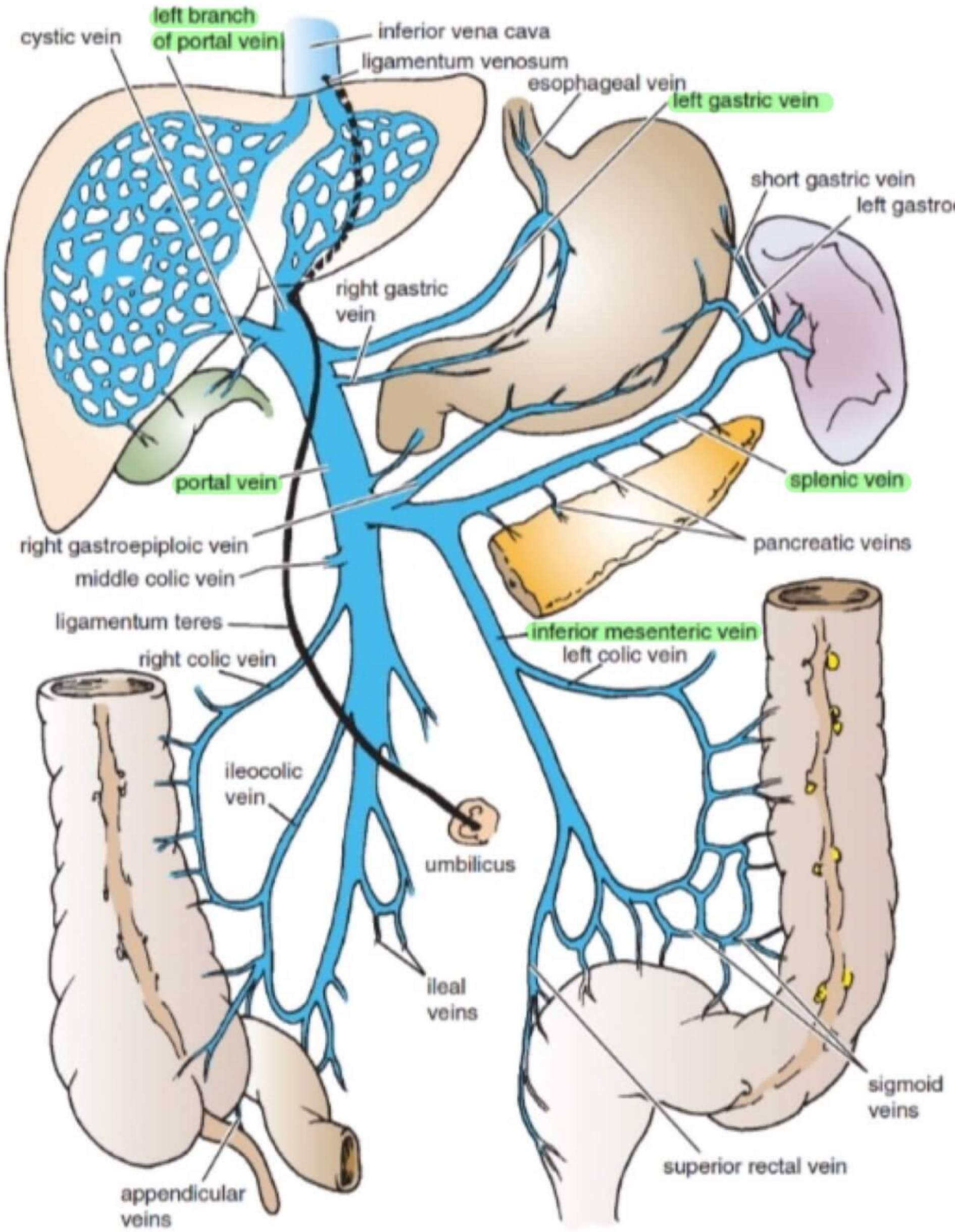
↳ posteriorly → Inferior vena cava, T_{12} vertebra, Right adrenal gland

→ PORTAL VEIN

↳ 5 - 8 cm

↳ passes behind 1st part of duodenum to reach porta hepatis

→ HEPATIC ARTERY lies towards aorta [Left] & DUCT is towards Gall bladder [right]



Q False statement about portal vein ?

a. Formed behind neck of Pancreas
b Bile duct lies anterior & right to it
c ascends behind 2nd part of duodenum
d is valveless

Q Wrong about portal vein

a Formed at transpyloric plane
b 10 cm long
c ascends anterior to the epiploic foramen
d traverses the hepatoduodenal ligament

Q Which veins drain directly into IVC

a Superior mesenteric vein
b Inferior mesenteric vein
c Hepatic vein
d Splenic vein

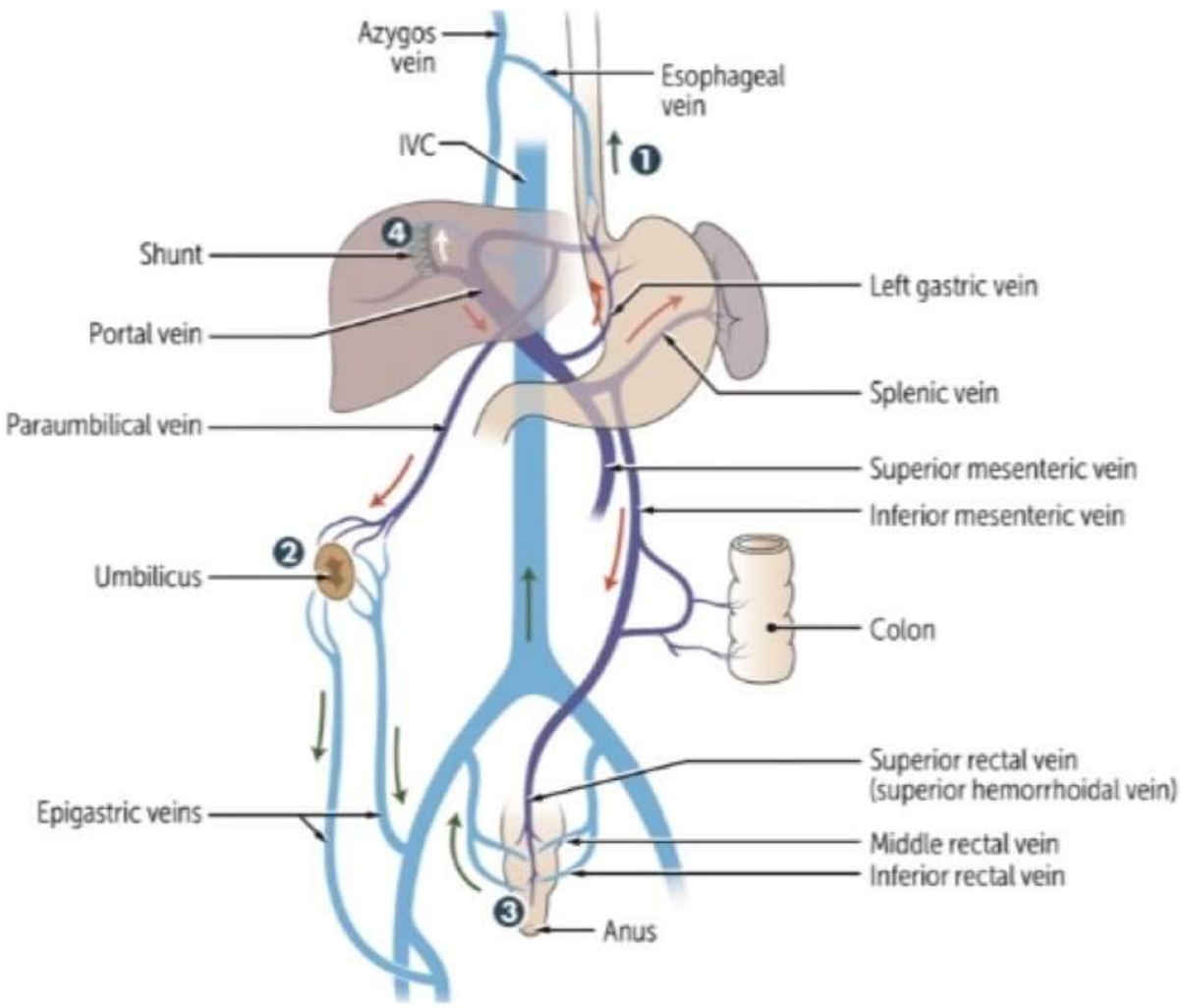
→ Gastric veins from foregut drains directly to portal vein

PORTAL HYPERTENSION

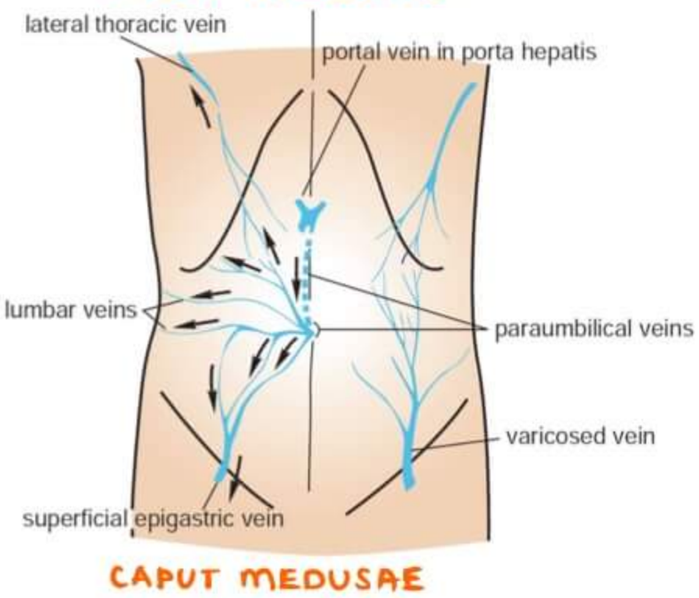
SYMPTOMS

- → Splenomegaly
- → Ascites
- → Esophageal varices
- → Rectal varices

PORTOSYSTEMIC ANASTAMOSIS



CAPUT MEDUSAE



CAPUT MEDUSAE

VENOUS DRAINAGE IN RECTUM

PORTAL CIRCULATION

UPPER ANAL CANAL & RECTUM ⟶ SUPERIOR RECTAL VEIN ⟶ INFERIOR MESENTERIC VEIN

SYSTEMIC CIRCULATION

MIDDLE & INFERIOR RECTAL VEINS ⟶ INTERNAL ILIAC VEIN ⟶ COMMON ILIAC VEIN ⟶ IVC

Portal hypertension causes dilation of veins that connects portal & systemic circulatⁿ in rectum → Fresh blood per rectum [rarely]

VENOUS DRAINAGE IN LOWER OESOPHAGUS

LOWER ESOPHAGUS → LEFT GASTRIC VEIN → PORTAL VEIN [PORTAL CIRCULATION]

SOME PARTS → AZYGOUS VEINS → SUPERIOR VENA CAVA [SYSTEMIC CIRCULATION]

Portal hypertension causes dilation of veins connecting portal & systemic circulatⁿ & causes VARICES → hematemesis & melena [more common]

LIVER CIRRHOSIS | BUDD-CHIARI SYNDROME

→ causes BACKFLOW OF BLOOD from liver , reaches superior vena cava

→ CAPUT MEDUSAE

↳ backflow of blood from left branch of portal vein to paraumbilical vein where it anastomose ī epigastric vein causing dilated, elongated & tortuous of veins in anterior abdominal wall

TREATMENT OF PORTAL HYPERTENSION

TIPS → Transjugular Intrahepatic Portosystemic Shunt [blw portal & hepatic veins]

Q Wrong matching regarding Portocaval anastamosis sites

a Superior rectal vein ; inferior rectal vein

b Left branch of portal vein ; retroperitoneal vein [azygous vein]

c coronary vein ; oesophageal vein

d Paraumbilical vein ; inferior epigastric vein

Q Which of the following vein(s) is | are part of portal circulation

a Splenic vein

b paraumbilical vein

c Superior rectal vein

d Left gastric vein

e inferior rectal vein

DEVELOPMENT OF GENITO URINARY SYSTEM

Q. WRONG about genital system development is

a) Develop from mesoderm
b) Genital ridge forms at week 5
c) Testes develops earlier to ovary
d) External genitalia are fully differentiated at week 10

→ Intermediate mesoderm contributes to Genito urinary system
→ female external genital differentiatⁿ completed by 11 weeks
→ Male external genital differentiatⁿ completed by 14 weeks

Y chromosome | SRY gene → TDF → W6 → Indeterminate embryo

Y chromosome

→ SRY gene present on Short arm
→ SRY (Sex Region Y chromosome) gene
→ codes for TDF (Testis Determining factor)

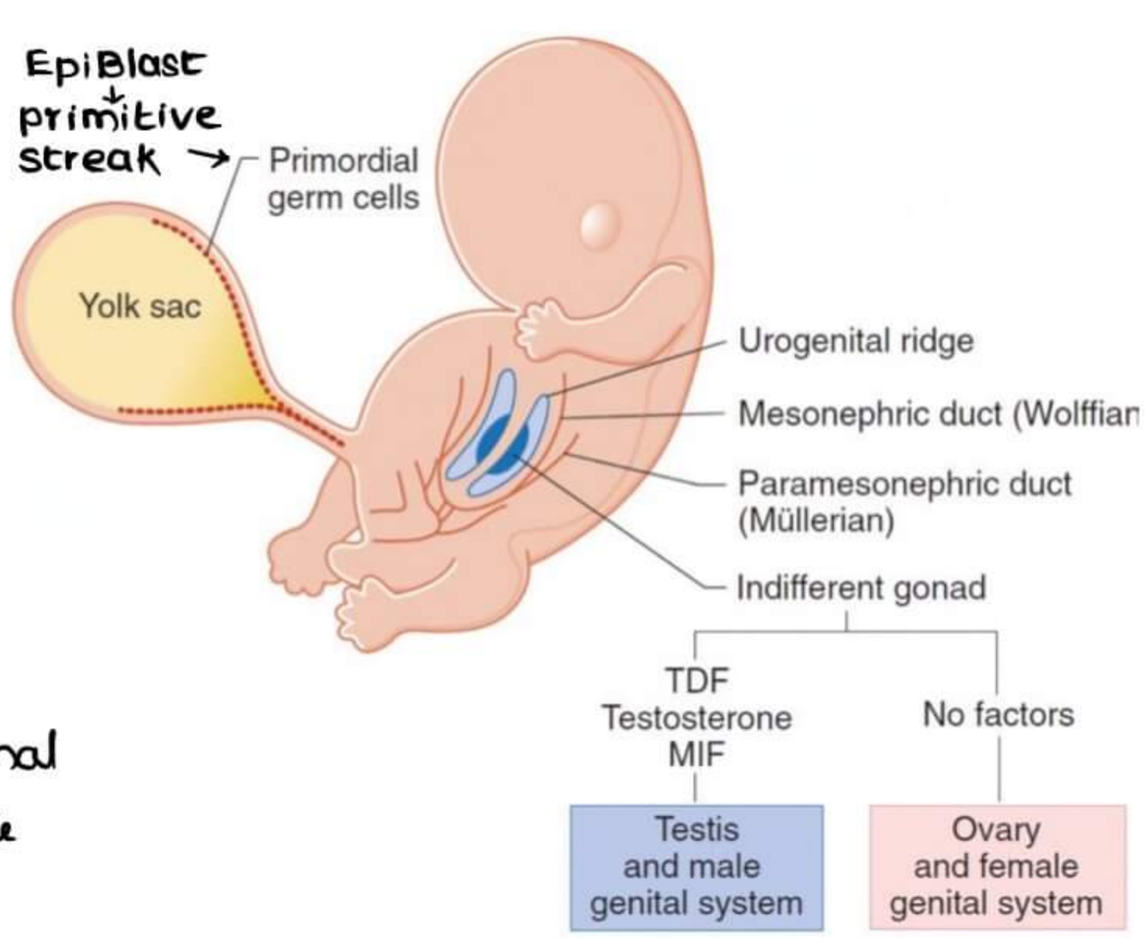
→ Genital ridge will develop at week 5
→ TESTIS → starts developing at week 7
→ OVARY → starts developing at week 8 onwards
→ Sex determinatⁿ not possible till W6 → indeterminate embryo
→ Ext. genital differentiation completed after week 11
→ USG Sex determination can be done this time

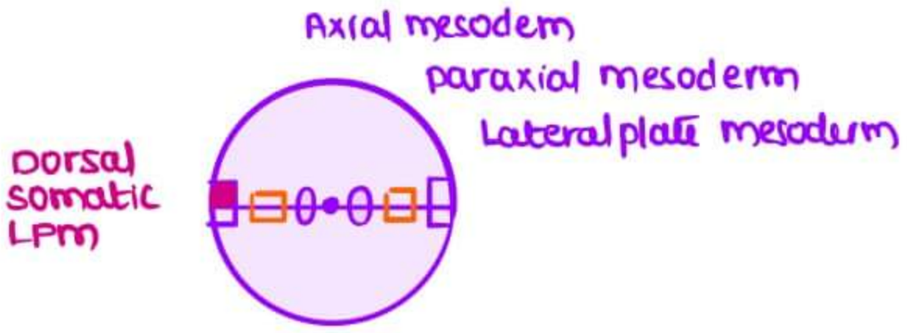
Q. Trigone of urinary bladder develops from

a) Mesoderm
b) Ectoderm
c) Endoderm of urachus
d) Endoderm of urogenital sinus

DEVELOPMENT OF UROGENITAL SYSTEM

→ Epiblast forms the primitive streak
→ Primordial cells can be isolated by the end of week 2 from primitive streak
→ Primordial germ cell reach Endodermal Wall of yolk sac, later they migrate to genital ridge





Intermediate mesoderm → major portⁿ of Genito urinary System

→ Ducts
- Mullerian Duct ♀ — MIS
- Wolffian duct ♂

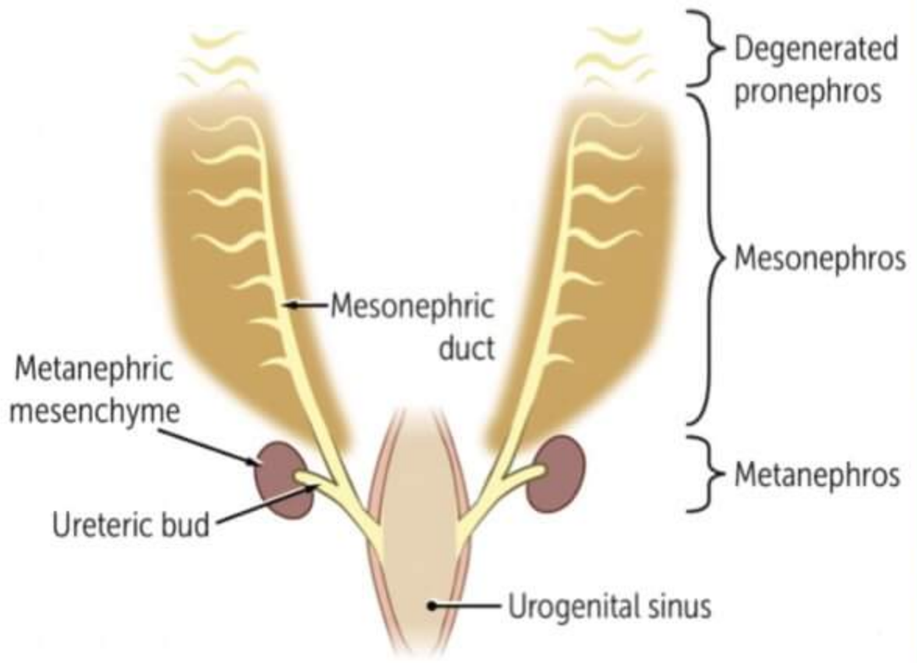
→ Ridges → Testis, ovary, Kidneys

DORSAL SOMATIC LATERAL PLATE MESODERM → forms external genitalia

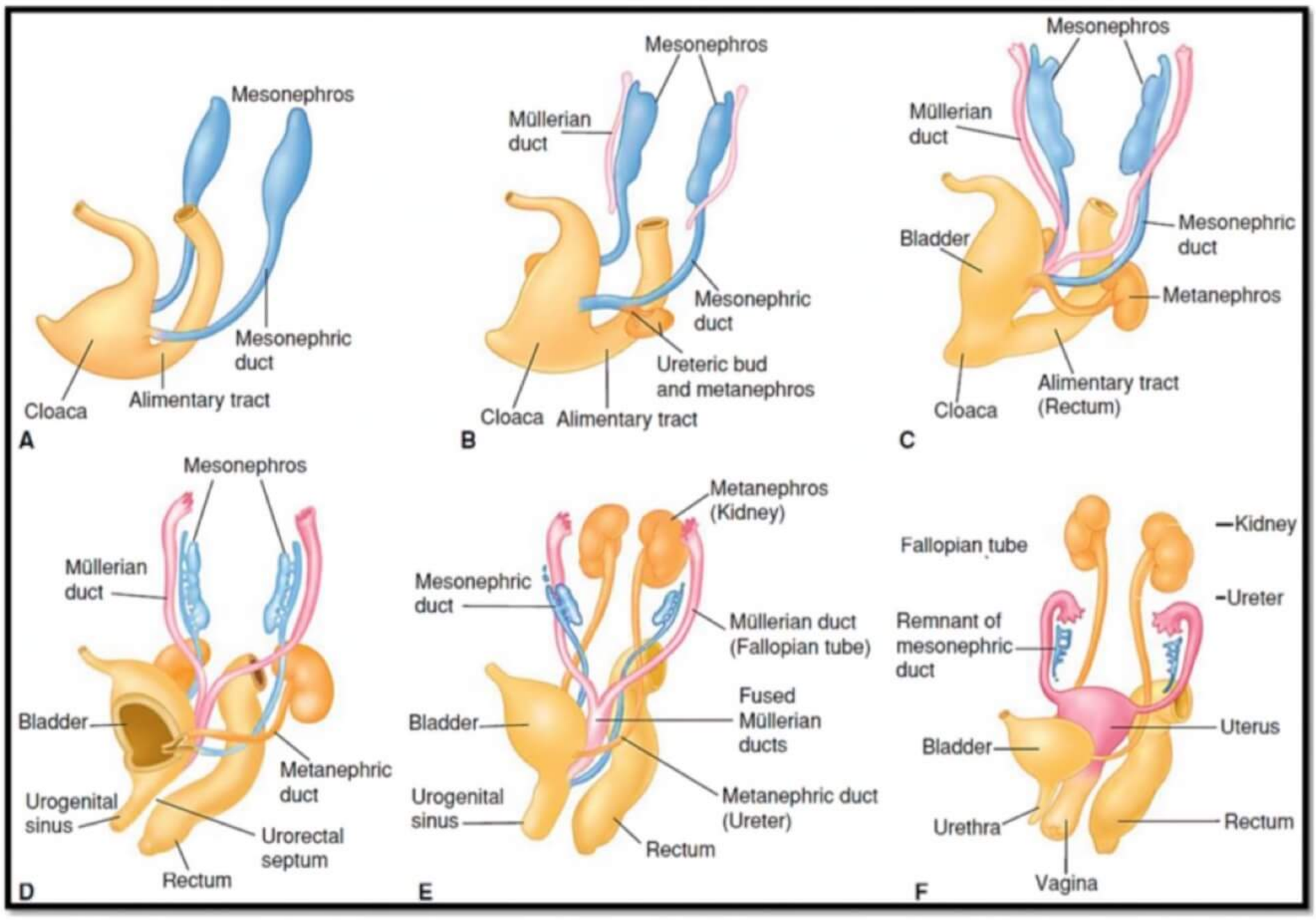
DEVELOPMENT OF RENAL SYSTEM

UROGENITAL RIDGE

→ Forms
- Pronephros
- Mesonephros
- Metanephros



→ Kidney develops from metanephros
→ Pronephros → degenerated
→ Mesonephros → leaves behind Mesonephric DUCT & degenerated
→ MESONEPHRIC DUCT gives Ureteric bud
→ Ureteric bud stimulates metanephros to form the kidney
→ UROGENITAL SINUS → forms urinary bladder, urethra, Lower vagina (2/3rd)
→ The definitive kidney becomes functional at → 12th week



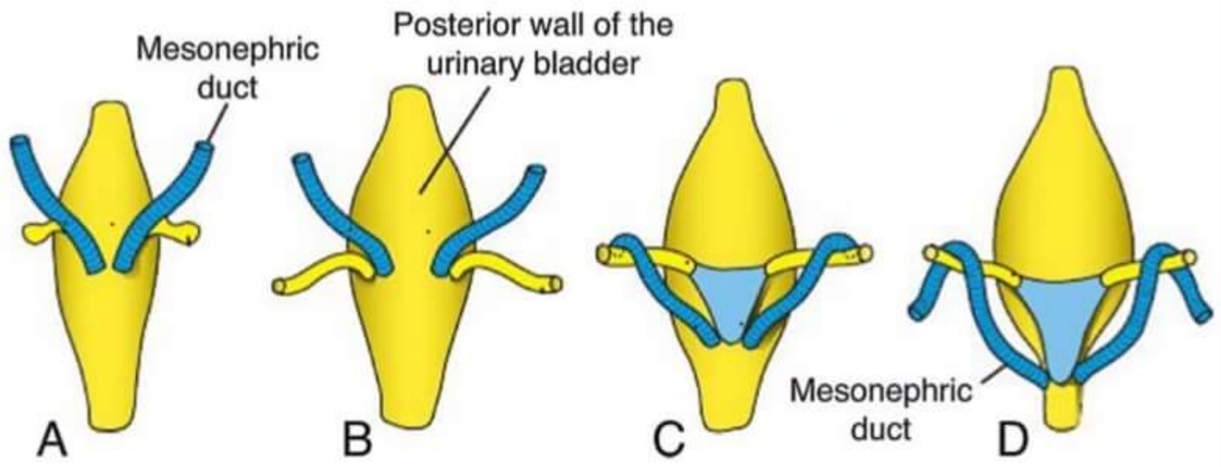
→ MULLERIAN / PARA MESONEPHRIC DUCT (Mesodermal)
  → Works in females
  → Fuse in the midline to form uterus & upper 1/3rd of vagina
  → unfused part becomes uterine tube

→ Endoderm of UROGENITAL SINUS Derivatives → UB, urethra, lower 2/3rd vagina
→ Mesonephric duct opens into post. wall of urogenital sinus in cloaca region
→ Ureter comes from ureteric bud

→ Tip of mesonephric duct is absorbed into posterior wall of urogenital sinus forms Trigone of Urinary Bladder
  → After this, mesonephric duct is called as wolffian duct
  → Wolffian duct forms genital tube in males & regresses in females giving vestigial remnants, Epoophoron, paraophoron & gartner's duct

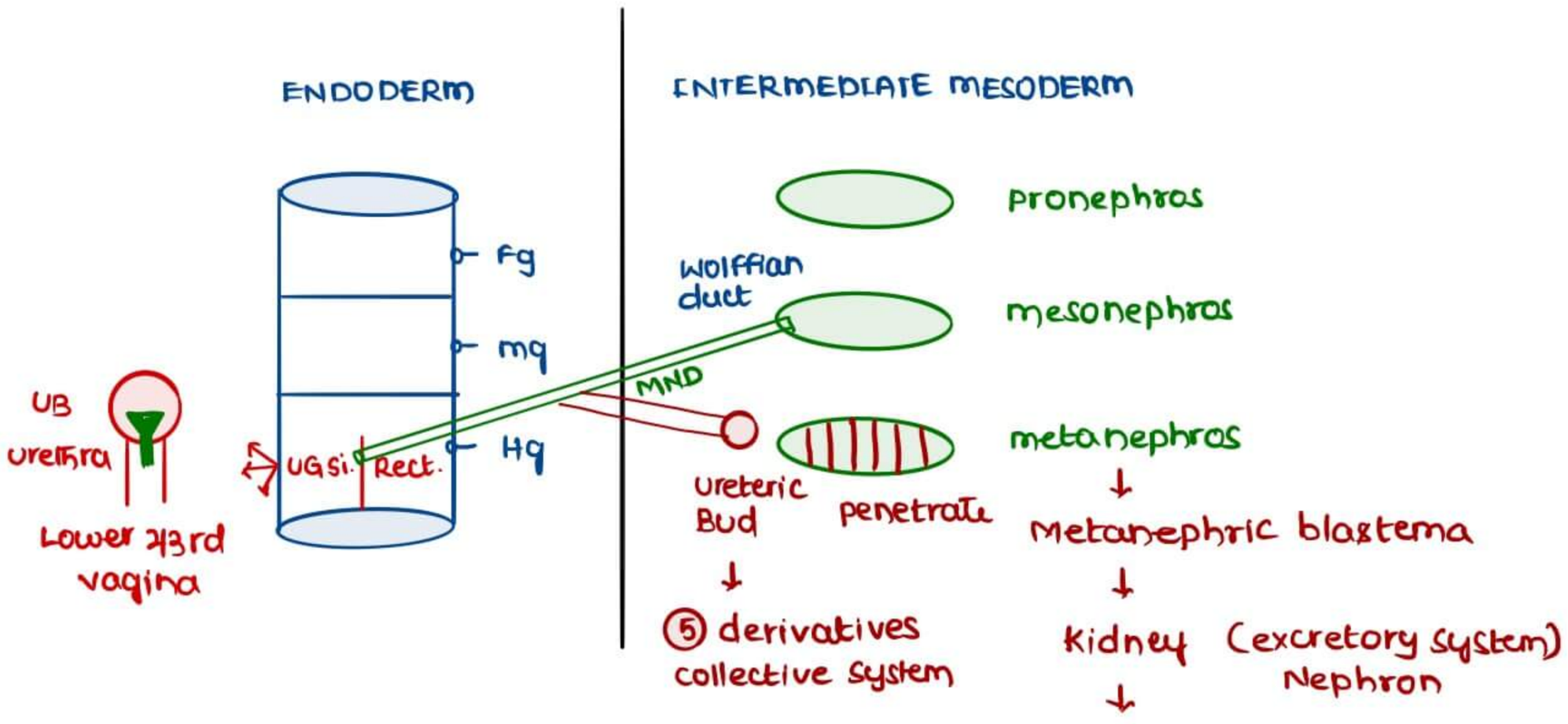
DEVELOPMENT OF TRIGONE

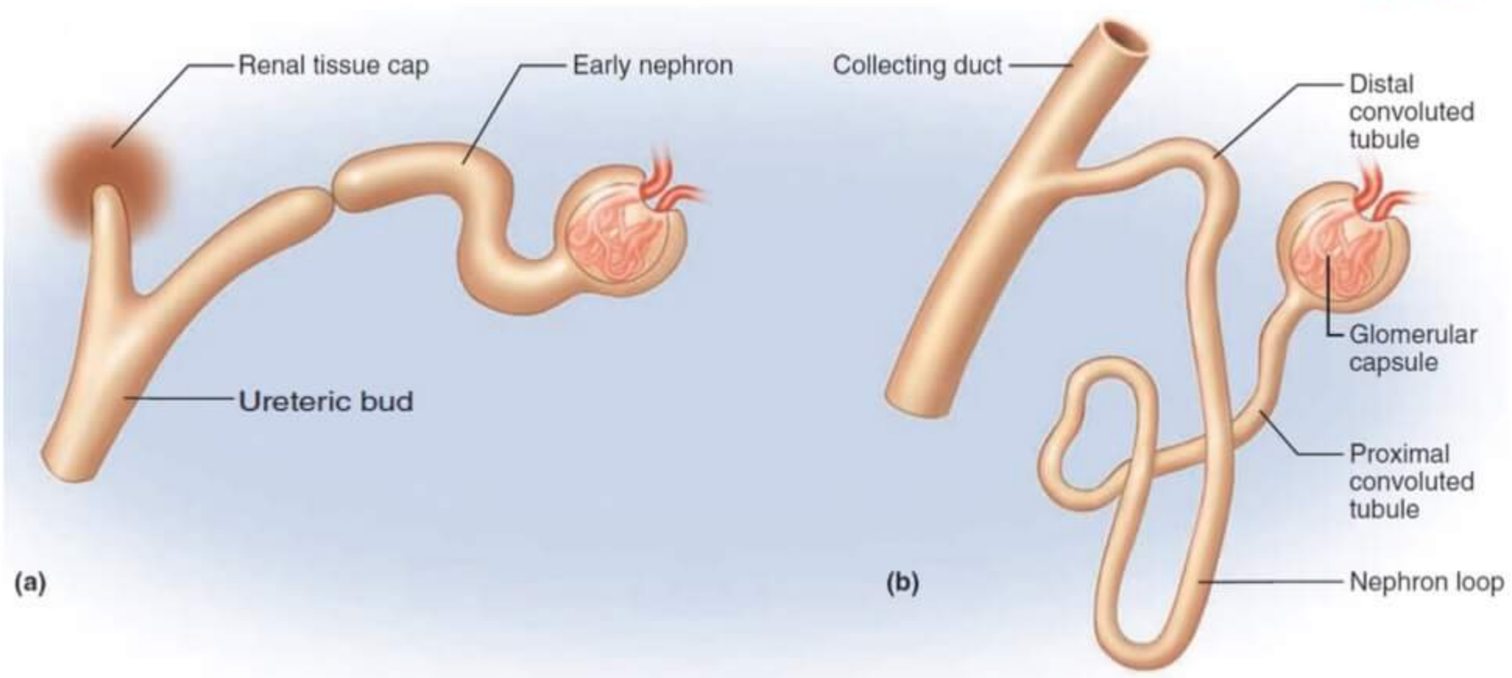
→ After forming trigone, proximal part of mesonephric duct, known as WOLFFIAN DUCT



→ Wolffian duct forms Ductus deferens in males
Ductus deferens in female is vestigial → Gartner's duct

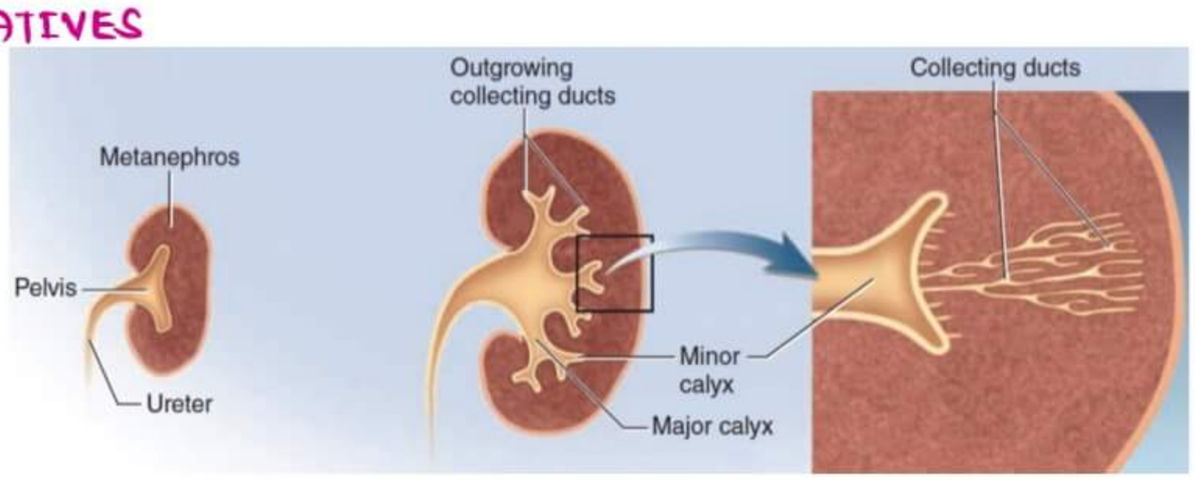
→ Trigone & proximal wall of urethra derived from mesoderm

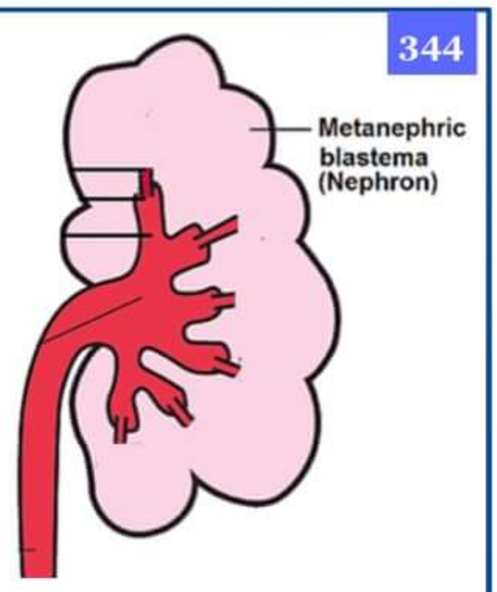




URETERIC BUD DERIVATIVES

1. Ureter
2. Renal pelvis
3. major calyx
4. minor calyx
5. collecting duct





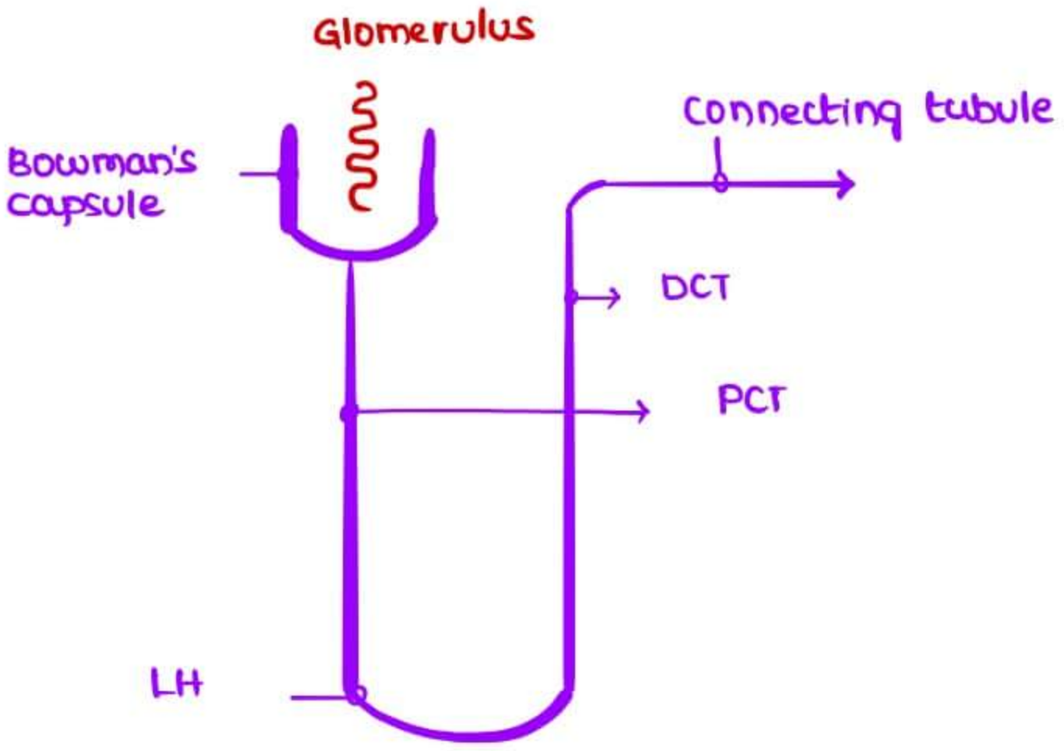
→ Renal pyramid / medulla

→ Renal columns of Bertini → part of cortex by the side of medulla

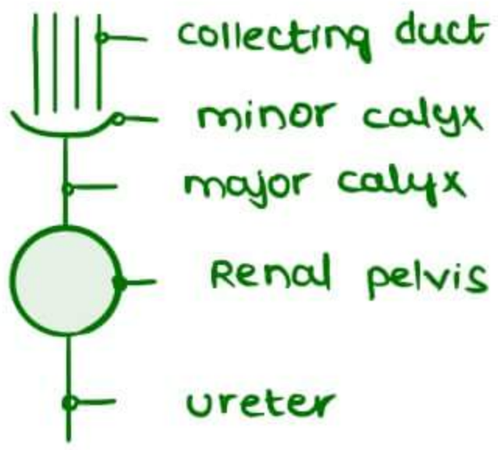
Q. All are derivatives of ureteric bud EXCEPT

a) Ureter
b) Renal pelvis
c) Minor calyx
d) Connecting tubule

Embryo	Adult Derivative
Metanephric mesoderm Metanephric vesicles S-shaped renal tubules	Connecting tubule Distal convoluted tubule Loop of Henle Proximal convoluted tubule Renal (Bowman's) capsule Renal glomerulus
Ureteric bud	Ureter Renal pelvis Major calyx Minor calyx Collecting duct



EXCRETORY SYSTEM

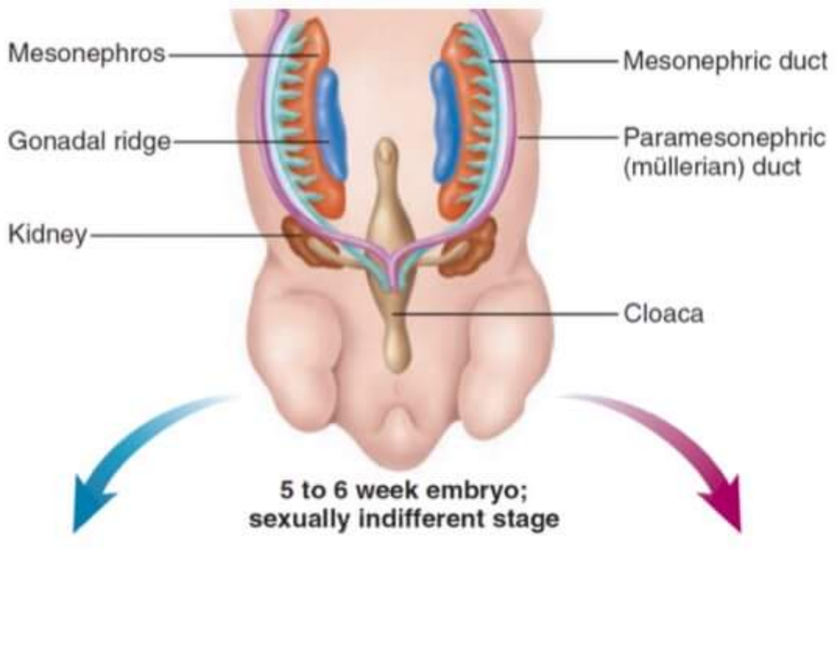


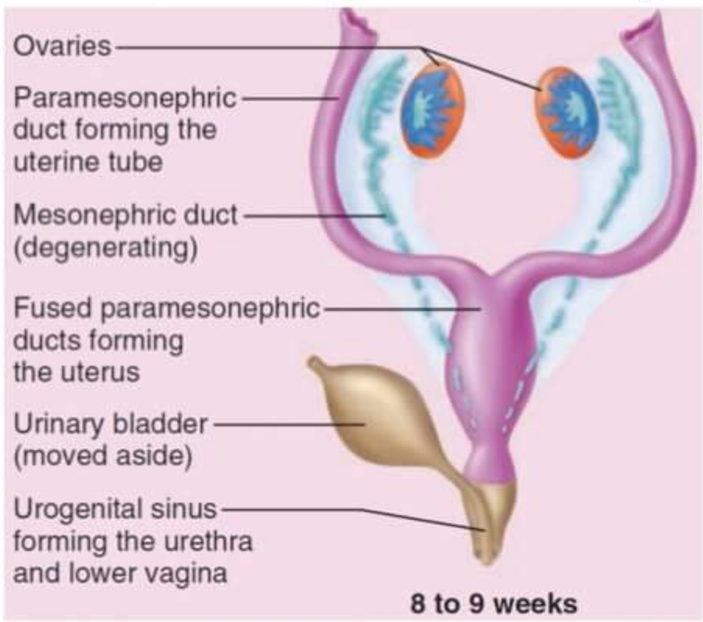
collecting duct

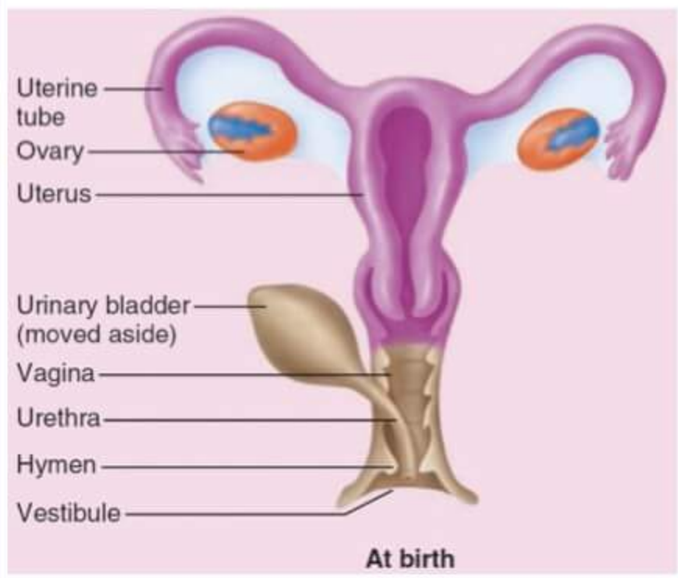
MULLERIAN & WOLFFIAN DERIVATIVES

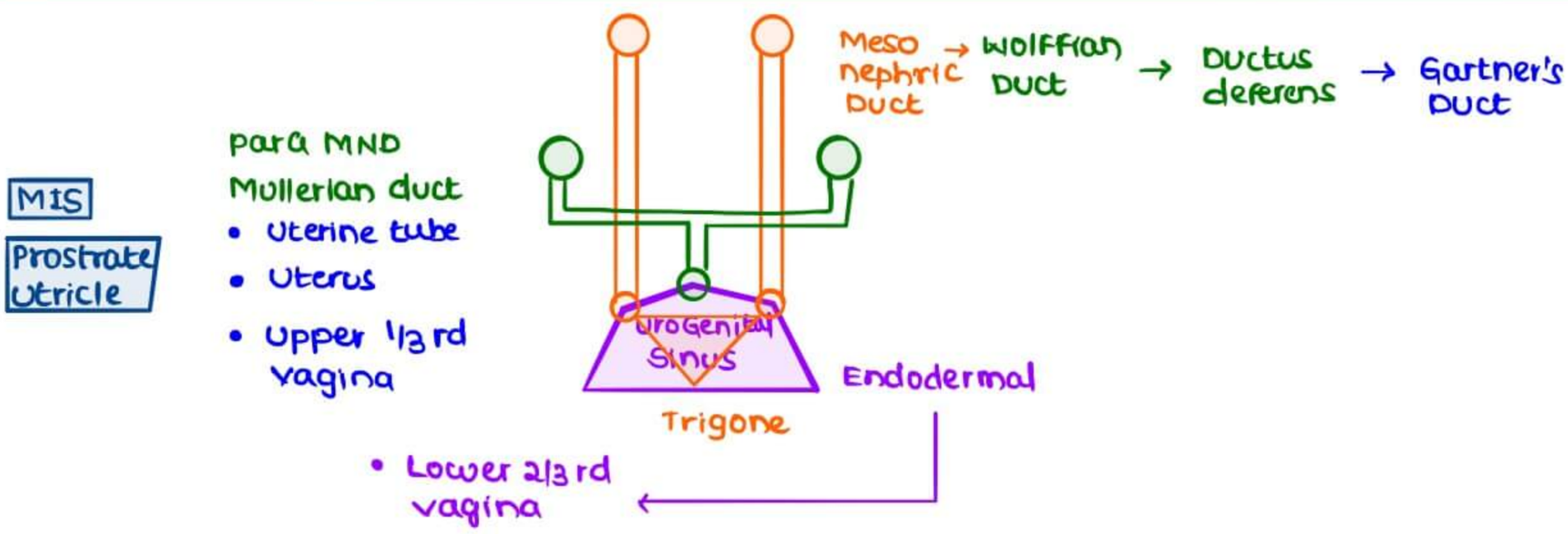
→ 2 paramesonephric ducts fuse and open into Urogenital sinus

→ 2 mesonephric ducts open separately into urogenital sinus







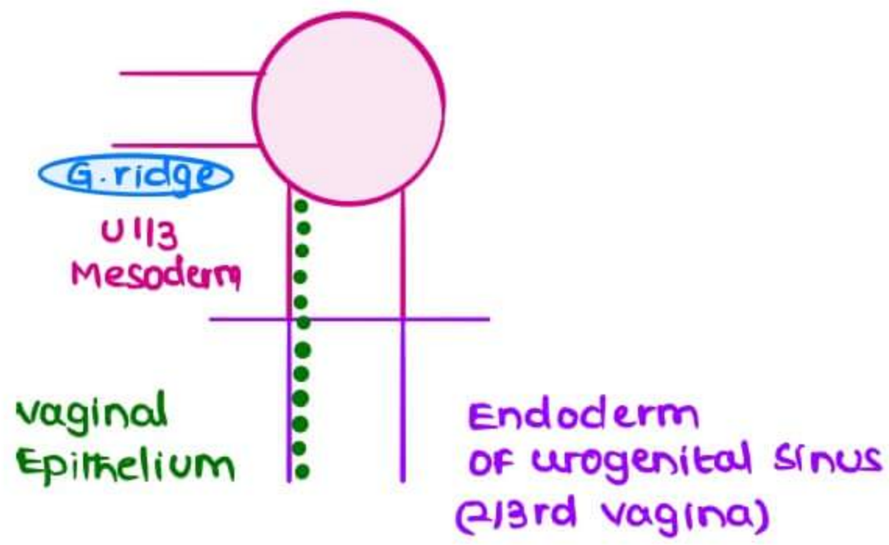


→ Prostrate utricle is the vestigial remnant of mullerian duct in male
→ Entire vaginal epithelium is endodermal

MULLERIAN AGENESIS

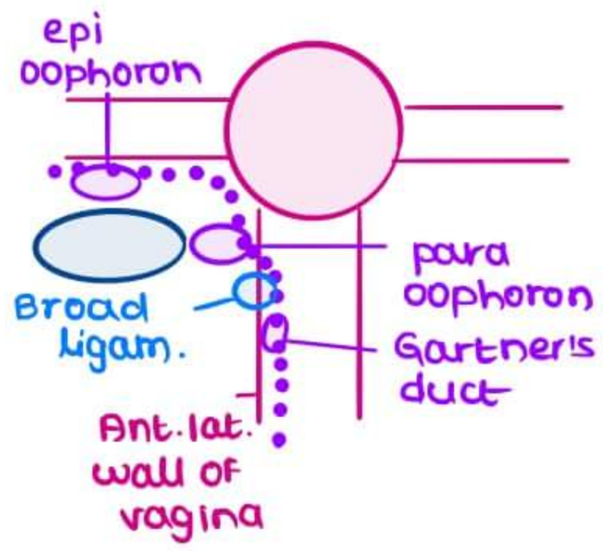
→ uterine tube not present
uterus not present
upper 1/3rd vagina not present

→ shallow vagina present
→ ovaries present (derived from Genital ridge)



MAYER ROKITANSKY KUSTER HAUSER SYNDROME

→ mullerian agenesis variant
→ Small uterus present



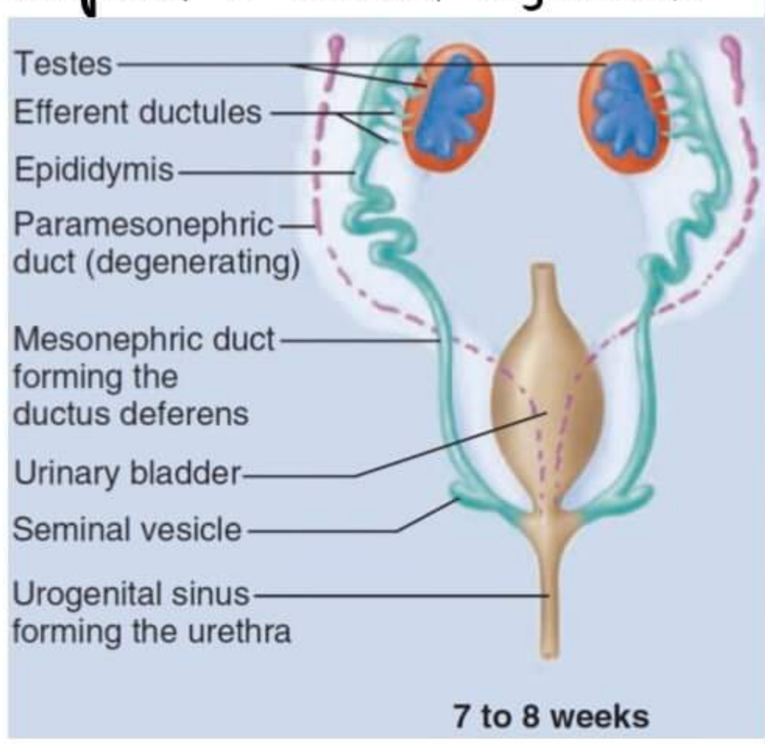
WOLFIAN DUCT : VESTIGIAL REMNANTS IN FEMALES

Epi oopheron → above ovary
Para oophoron → around ovary
Gartner's duct → duct in anterolateral wall of vagina > Broad ligament

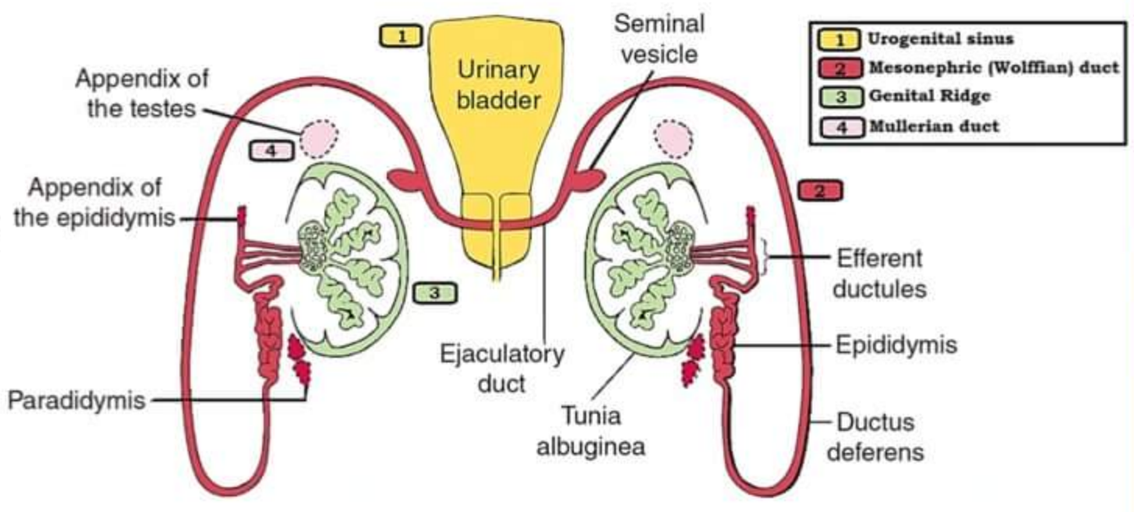
DERIVATIVES IN MALE

→ Ductus deferens
→ epididymis
→ ejaculatory duct
→ seminiferous tubule

→ efferent ductules from mesonephric tubule collects sperms
→ Mesonephric duct form
1. Epididymus
2. Ductus deferens
3. Seminal vesicle
4. Common ejaculatory duct
5. Peripheral prostate gland



→ urogenital sinus in male will form UB 'inner part of prostate gland, urethra
→ Storage, maturation & mobility of sperm occurs in Epididymis > Ductus deferens



Q. Ejaculatory duct develops from *(JIPMER 2018)*

a) Ureteric bud
b) Mesonephric duct
c) Para-mesonephric duct
d) Wolffian duct Better ANSWER

Q. Development of labia majora is from (NBEP-2013)

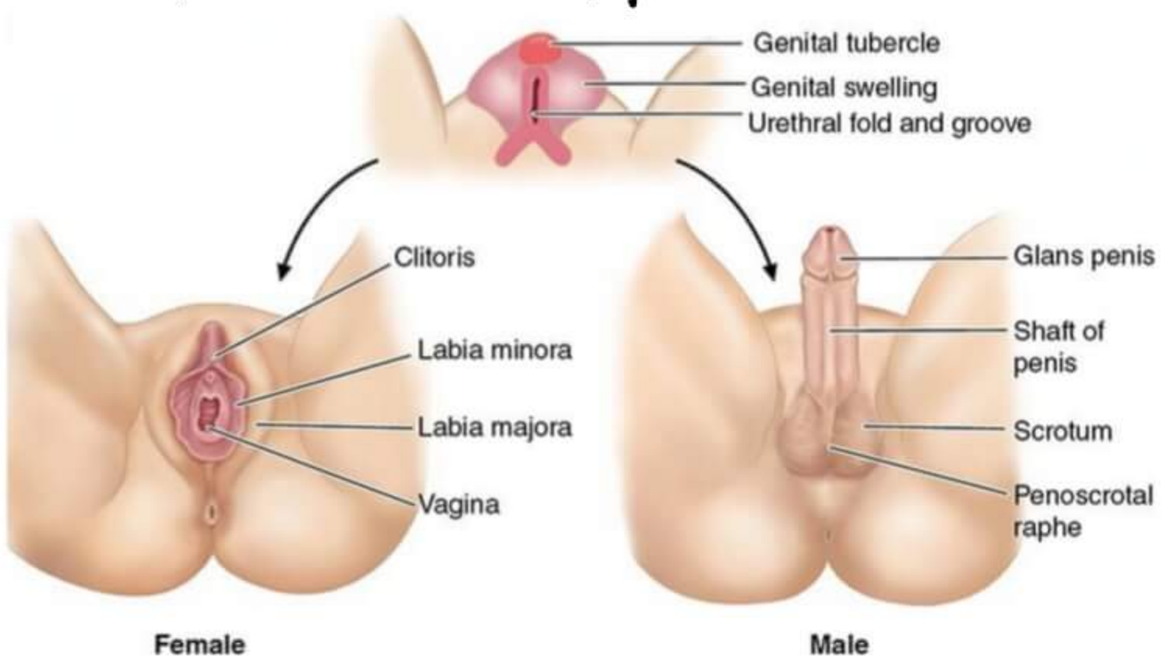
a) Urogenital sinus
b) Urethral fold
c) Genital ridge
d) Genital swelling

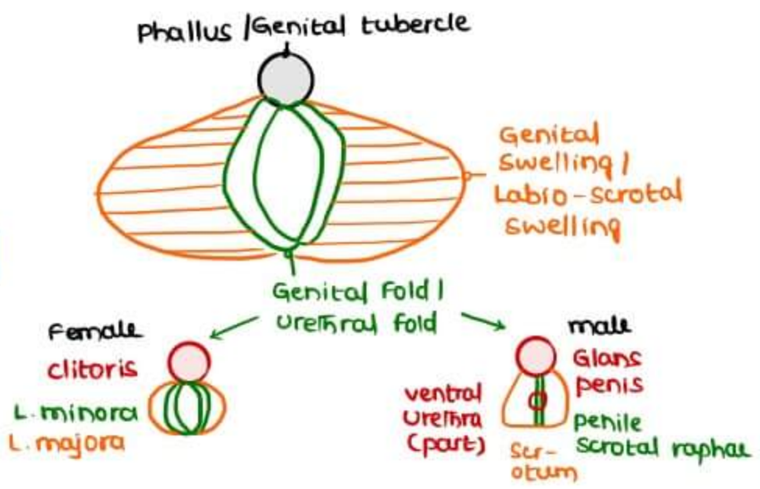
EXTERNAL GENITALIA → develops from dorsal somatic Lateral plate mesoderm

Genital tubercle
→ forms clitoris in female
glans penis in male

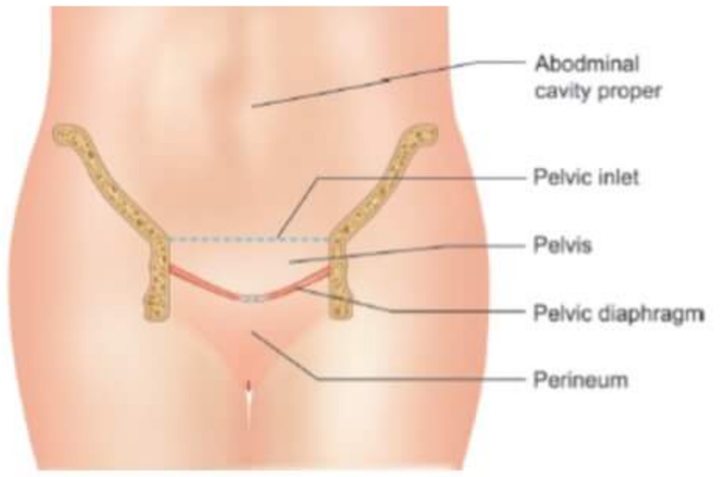
Genital Fold
→ forms Labia minora in female
penoscrotal raphae in male

Genital Swelling
→ forms Scrotum in male
Labia majora in female





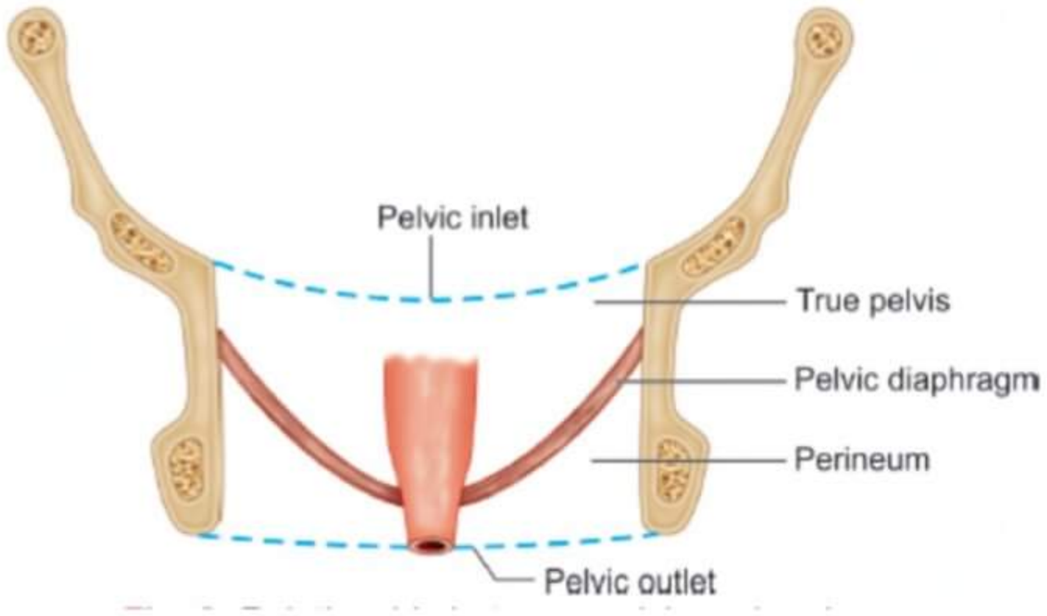
Indifferent Structure	Female	Male
Genital ridge	Ovary	Testis
Primordial germ cells	Ova	Spermatozoa
Sex cords	Granulosa cells	Seminiferous tubules, Sertoli cells
Gubernaculum	Uteroovarian and round ligaments	Gubernaculum testis
Mesonephric tubules	Epoöphoron, paroöphoron	Efferent ductules, paradidymis
Mesonephric ducts	Gartner duct	Epididymis, ductus deferens, ejaculatory duct
Paramesonephric ducts	Uterus, fallopian tubes, upper vagina	Prostatic utricle, appendix of testis
Urogenital sinus	Bladder, urethra	Bladder, urethra
	Vagina	Prostatic utricle
	Paraurethral glands	Prostate glands
	Greater (Bartholin) and lesser vestibular glands	Bulbourethral glands
Genital tubercle	Clitoris	Glans penis
Urogenital folds	Labia minora	Floor of penile urethra
Labioscrotal swellings	Labia majora	Scrotum



PELVIS & PERINEUM

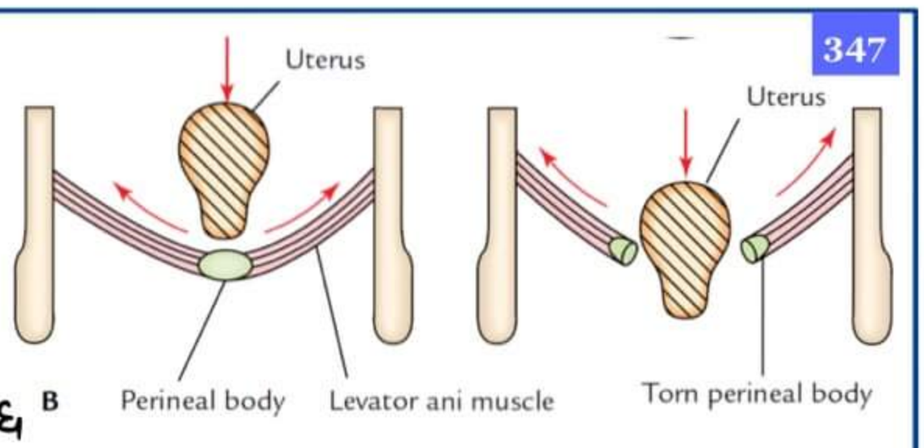
→ Pelvic diaphragm separates Upper pelvis & Lower perineum
→ Pelvis contains Urinary bladder, uterus & Rectum supported by pelvic diaphragm
→ Pelvic diaphragm is mostly Levator ani muscle
→ Perineum contains opening of pelvic viscera
  → Urethra (anterior)
  → Vagina (middle)
  → Anal canal (posterior)

→ Levator ani muscle inserted onto Perineal body
→ Perineal body is central/common perineal tendon
→ In perineal body tear, pelvic viscera prolapse down



OTHER SUPPORTS OF PELVIC VISCERA

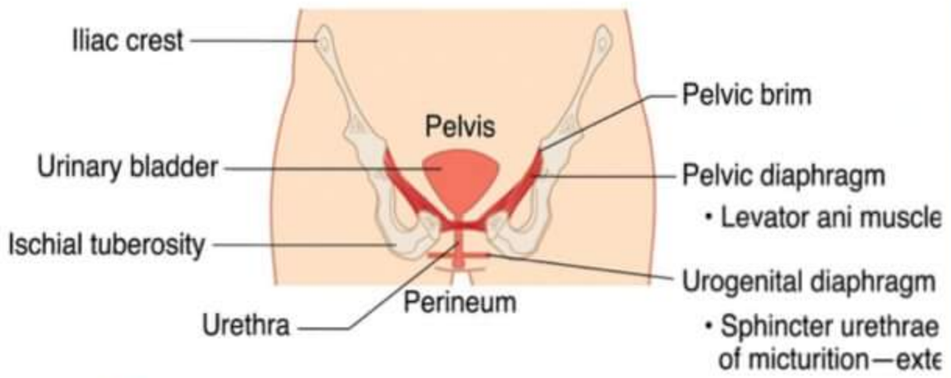
1. Perineal body
2. urogenital diaphragm
   - → more inferior
   - → contributed by
     sphincter urethra | Ext. urethral sphincter &
     Deep transverse perineal muscle



PERINEAL POUCHES

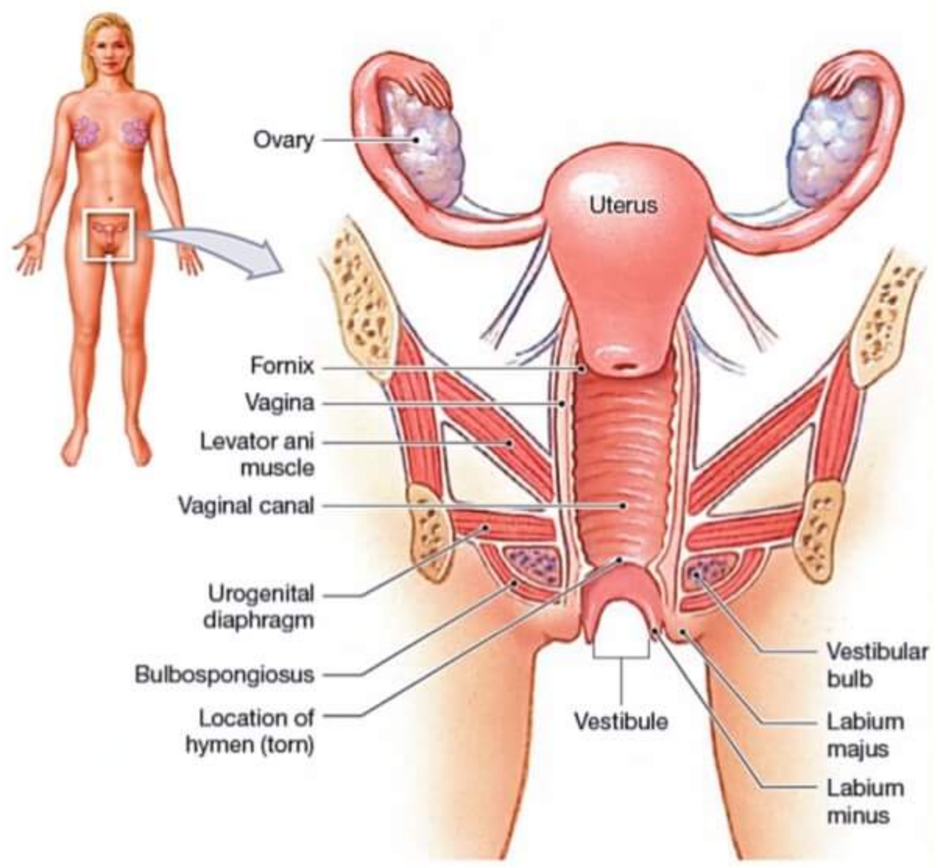
SUPERFICIAL PERINEAL POUCH

- → present below colles fascia
- → contents
  Bulbospongiosus



DEEP PERINEAL POUCH

- → contains
  - → urogenital diaphragm
  - → Deep Transverse perineal muscle
    contributes to urogenital diaphragm



VESTIBULE

- → present in vulva of female
- → urethra & vagina opens here
- → Bounded by 2 labia minora and
  below & inferior to hymen

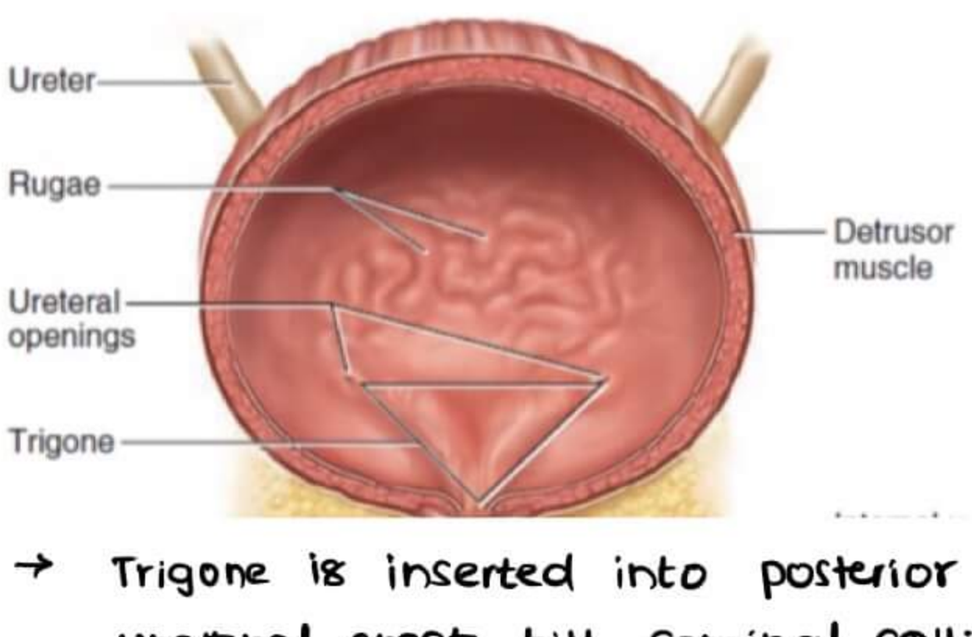
PROSTATE GLAND & PARTS OF MALE URETHRA

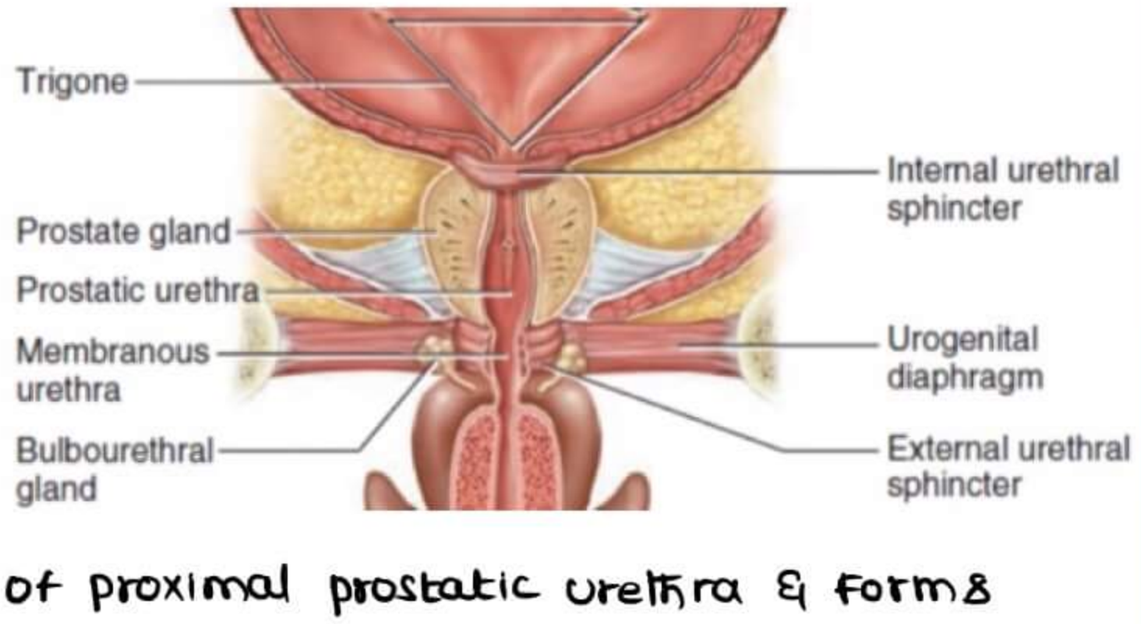
PROSTATE

CORONAL SECTION

TRIGONE

- → is at posterior wall of UB
- → Trigone epithelium is endodermal
- → no folded mucosa (no rugae)
- → rugae helps in streching & storage of urine
- → mucosa is adherent to deep detrusor muscle



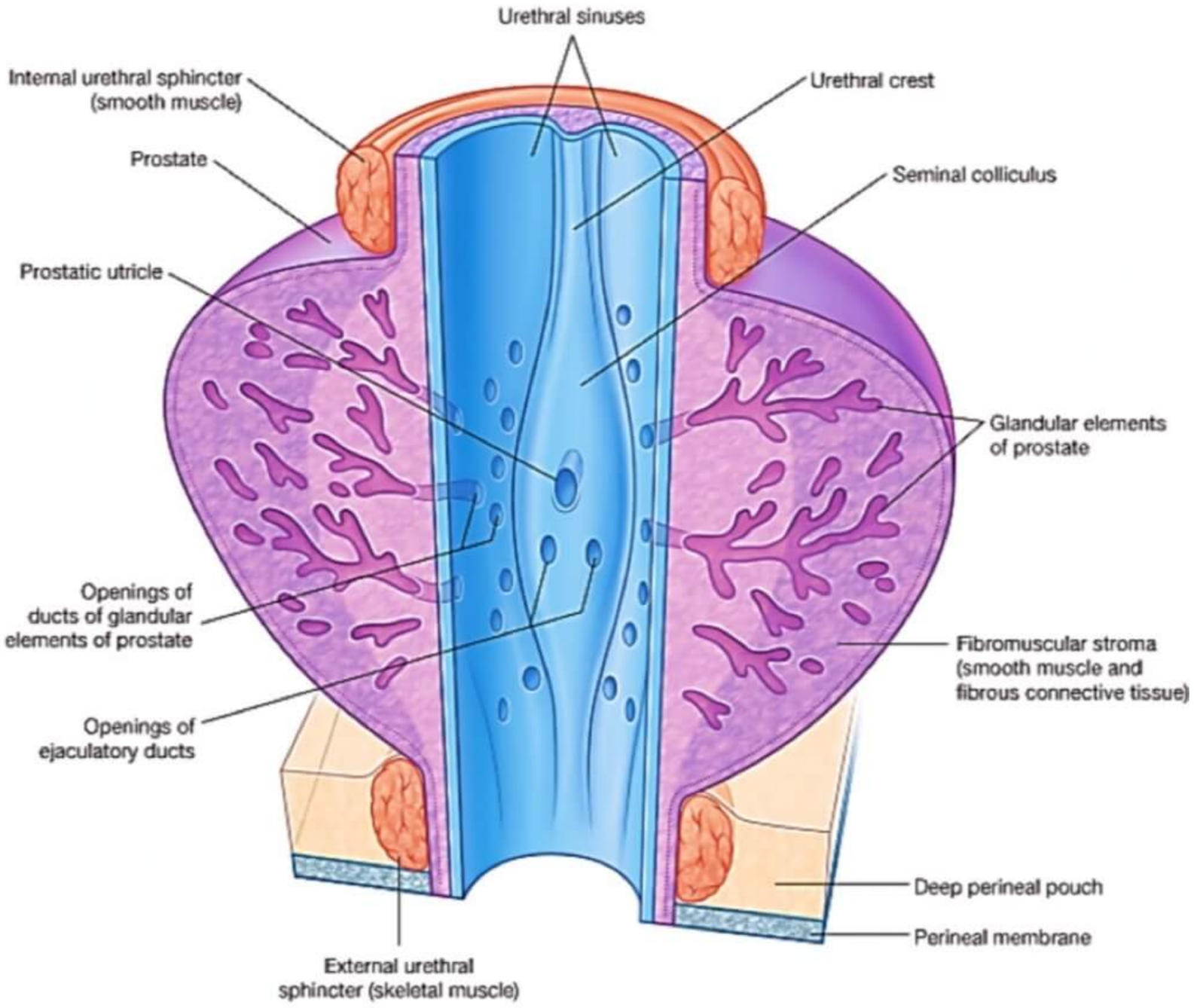


- → Trigone is inserted into posterior wall of proximal prostatic urethra & forms urethral crest till seminal colliculus

→ Prostatic urethra

→ Membranous urethra
  → present in urogenital diaphragm
  → External urethral sphincter present around it

→ SPONGY URETHRA
  → present in superficial perineal pouch



→ midline elevat^{n} on posterior wall of prostatic urethra → URETHRAL CREST dlt insertion of trigone till seminal colliculus / VERUMONTANUM (rounded elevation)

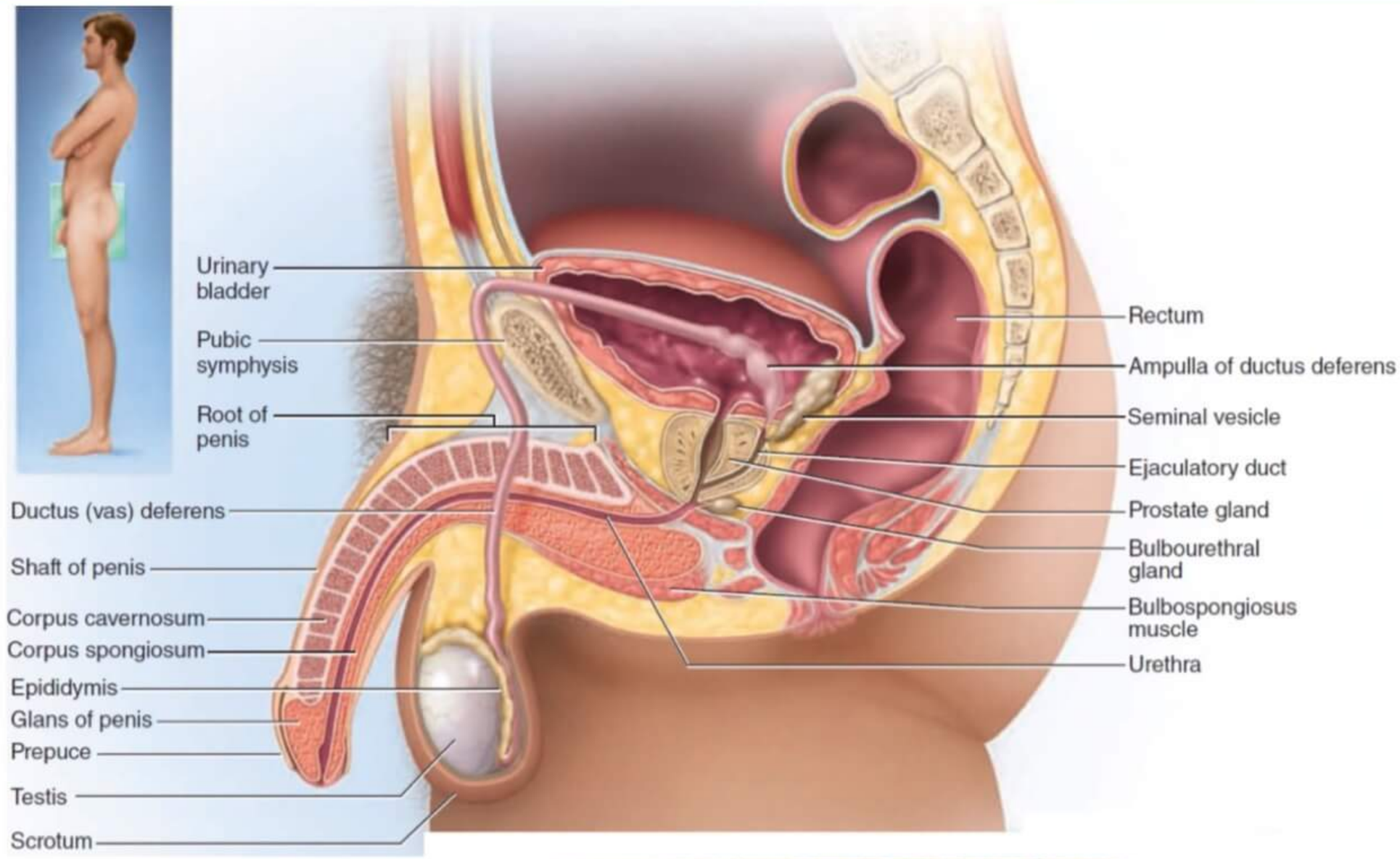
→ verumontanum has 3 openings
  → Prostate utricle opening
  → ejaculatory ducts openings

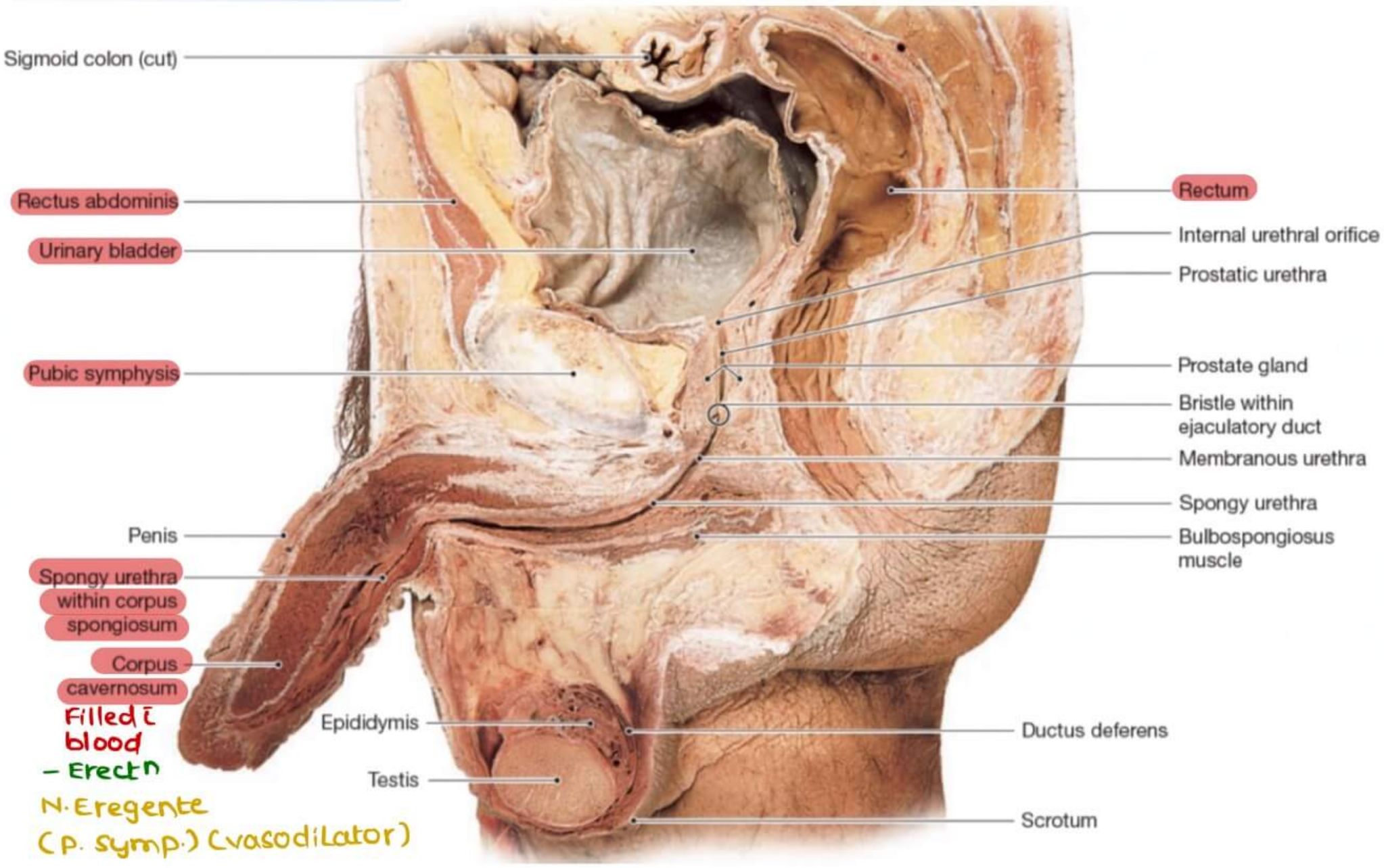
→ Internal urethral sphincter
  → well developed in male & poorly developed in female
  → smooth muscle sphincter prevents retrograde ejaculation of semen into bladder

→ External urethral sphincter
  → well developed in both sexes
  → skeletal muscle sphincter to hold urine at own will
  → supplied by Pudendal nerve

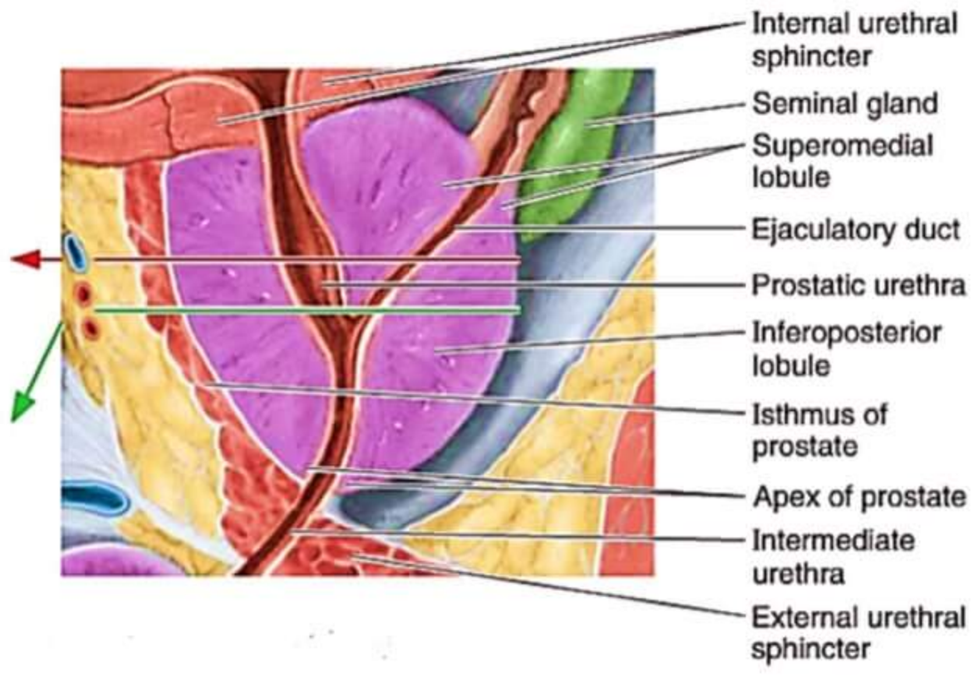
→ Pudendal nerve → nerve of perineum

→ Perineal membrane is floor of deep perineal pouch & also floor of urogenital diaphragm





Filled ī blood
– Erectn
N. Eregente
(P. symp.) (vasodilator)

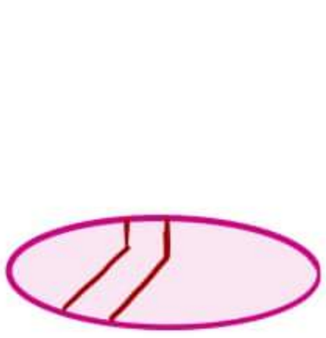


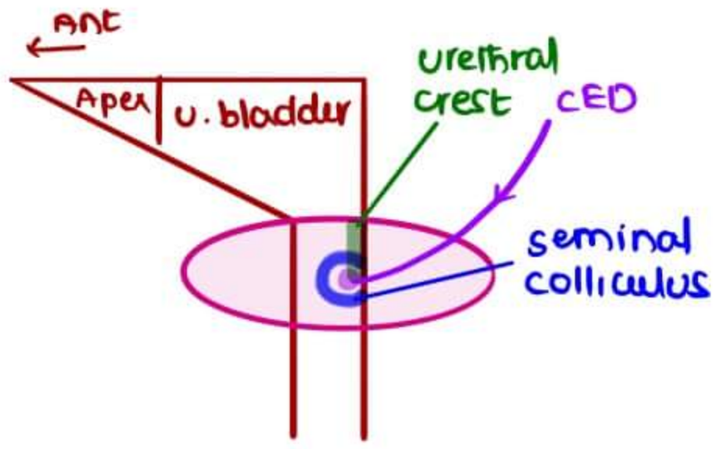
PROSTATIC URETHRA

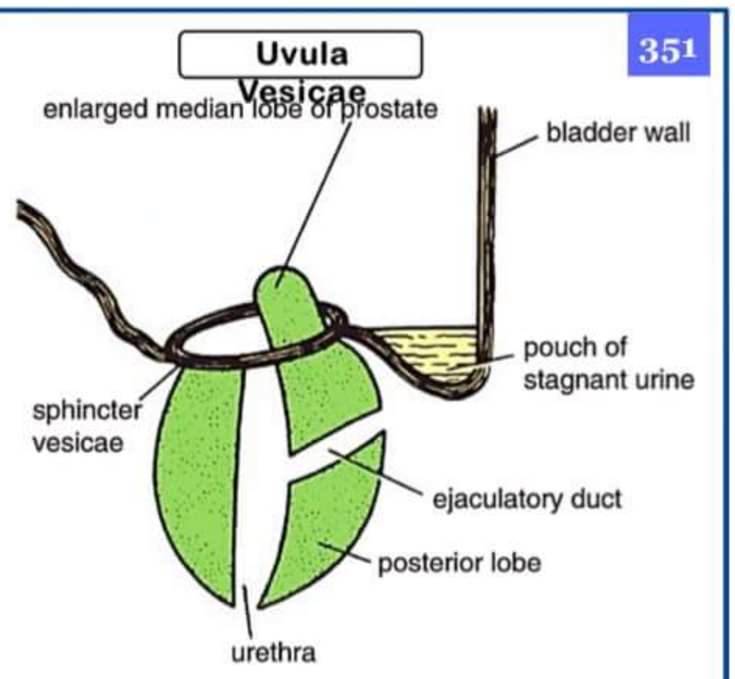
- → passing more anterior (less prostate infront & more prostate behind)
- → has anterior concavity

Prostate Lobe

- → median lobe → more prone to BPH
- → anterior lobe → minimal pathology
- → posterior lobe → cancer begins here





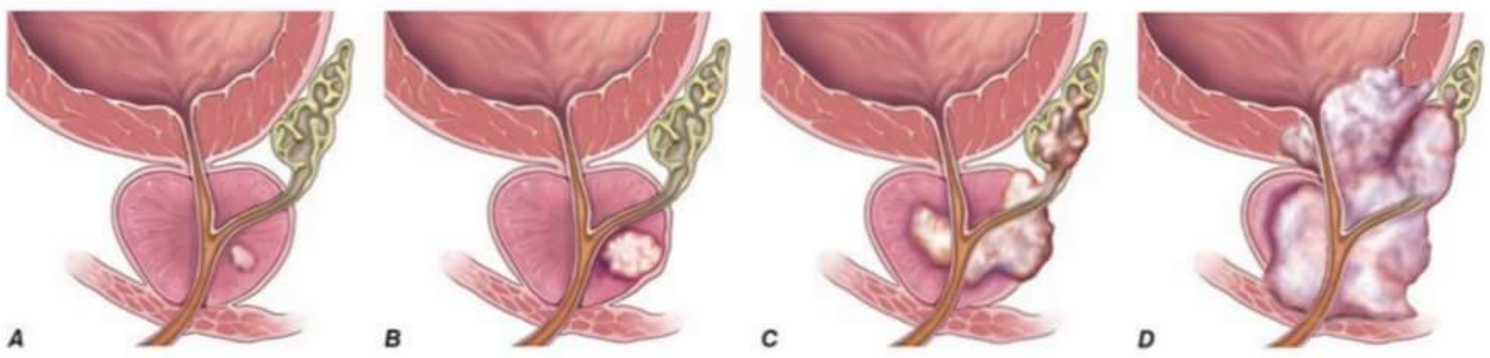


→ Median lobe hypertrophy causing Bladder outlet obstructn
→ Send tongue like projection → UVULA VESICAE
→ causes incomplete evacuatn of urine
→ Sphincter vesicae / Int. urethral sphincter

Q. Which lobe of prostate gland raises uvula vesicae

a) Anterior lobe
b) Posterior lobe
c) Median lobe
d) Lateral lobe

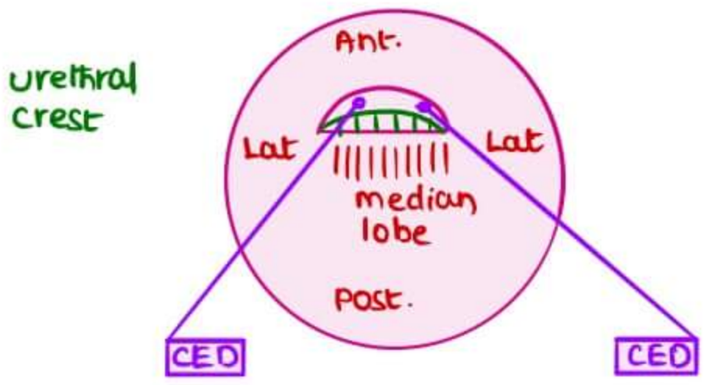
CANCER PROSTATE



→ begins in posterior lobe
→ spreads to other lobes & urinary bladder etc.

PROSTATE TRANSVERSE SECTION

→ prostatic urethra is in concentric shape

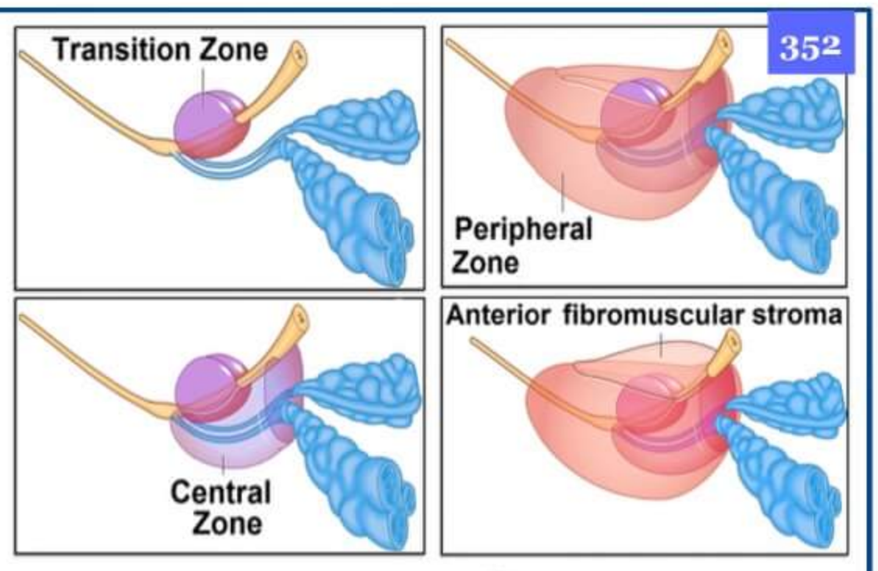


→ prostatic urethra is compromised by urethral crest & becomes crescent shape

LOBE SYSTEM

→ 5 lobes
→ well defined in fetal prostate

ZONE SYSTEM (ADULT PROSTATE)



TRANSITION ZONE

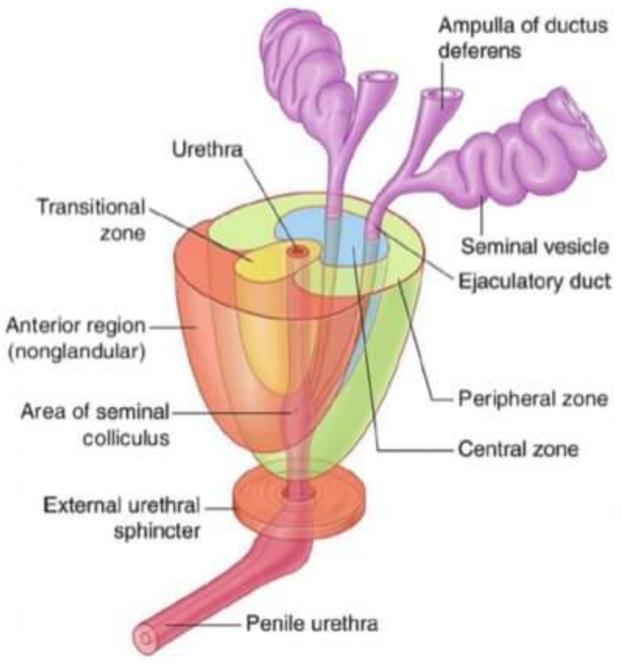
→ periurethral transition zone prone to BPH causing Bladder outlet obstruction

CENTRAL ZONE

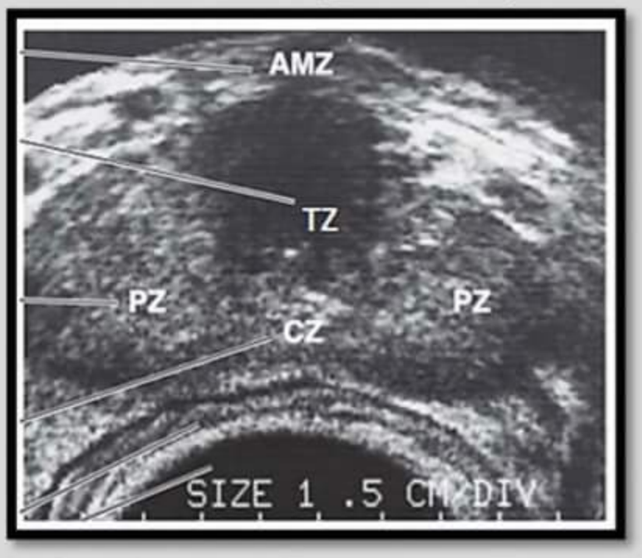
→ present behind the transition zone
→ minimal pathology detected

PERIPHERAL ZONE → cancer begins here

ANTERIOR FIBROMUSCULAR ZONE → minimal pathology

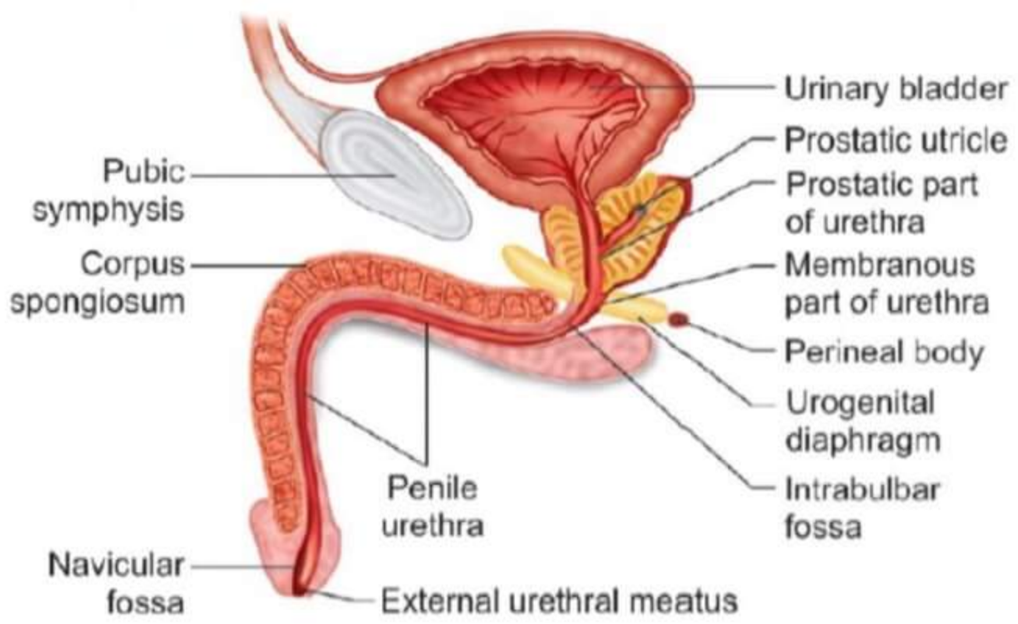


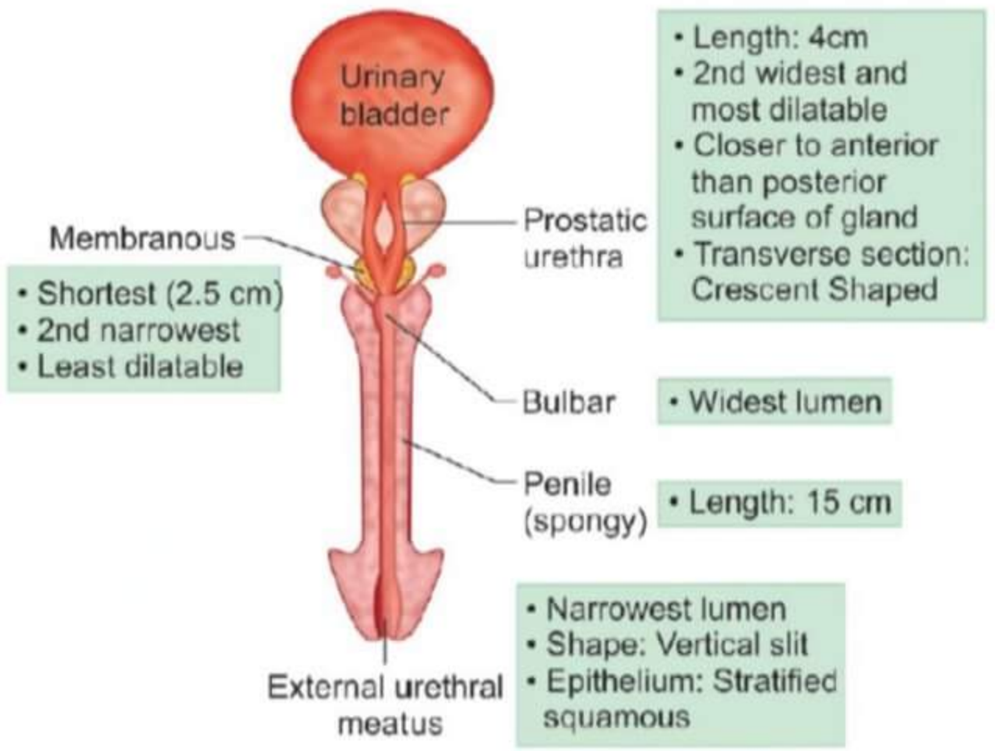
6. Which of the following zones is prone to benign prostatic hypertrophy



a) Anterior muscular zone
b) Transitional zone
c) Peripheral zone
d) Central zone

Male urethra: Parts and characteristic features



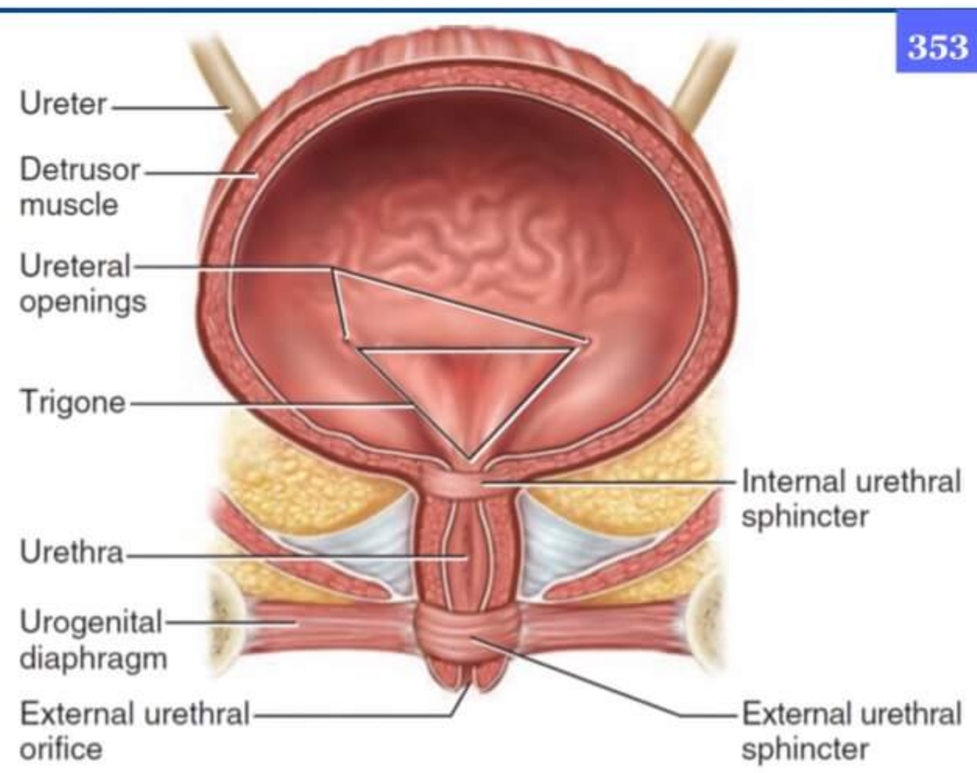


PERINEAL POUCHES & ISCHIORECTAL FOSSA

PERINEAL POUCHES

DEEP PERINEAL POUCH

→ contributed by
- Deep Transverse perineal muscle
- External urethral Sphincter



PELVIC DIAPHRAGM

→ mostly contributed by Levator ani muscles

FEMALE IN LITHOTOMY POSITION

→ Anterior bone → Pubis bone
→ Posterior bone → Sacrum & coccyx
→ Lateral bone → ischial tuberosity
→ Antero lateral → Ischiopubic ramus

→ Glands clitoris comes from Genital tubercle
→ Labia minora comes from Genital fold
→ Hymen
  → membrane covers the vaginal opening partially
→ Vestibule → urethra & vagina opens
  bounded by ② labia minora
  below hymen

GREAT VESTIBULAR GLAND OF BARTHOLIN

→ more posteriorly
→ present at the junct^{n} of middle 1/3rd & post. 1/3rd of labia majora
→ BARTHOLIN CYST occurs here

UROGENITAL TRIANGLE

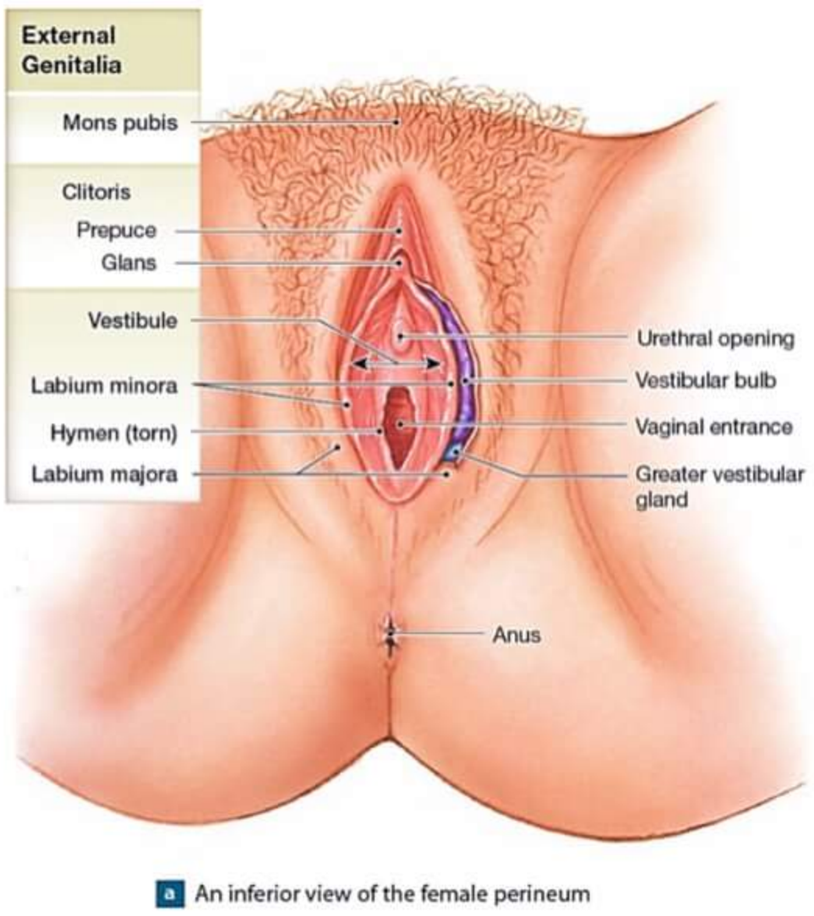
→ urethra & vagina opens here
→ Anterior → pubis
  Lateral → Ischial tuberosity
  Antero lateral → Ischio pubic Ramus

ANAL TRIANGLE → Anal canal opens here

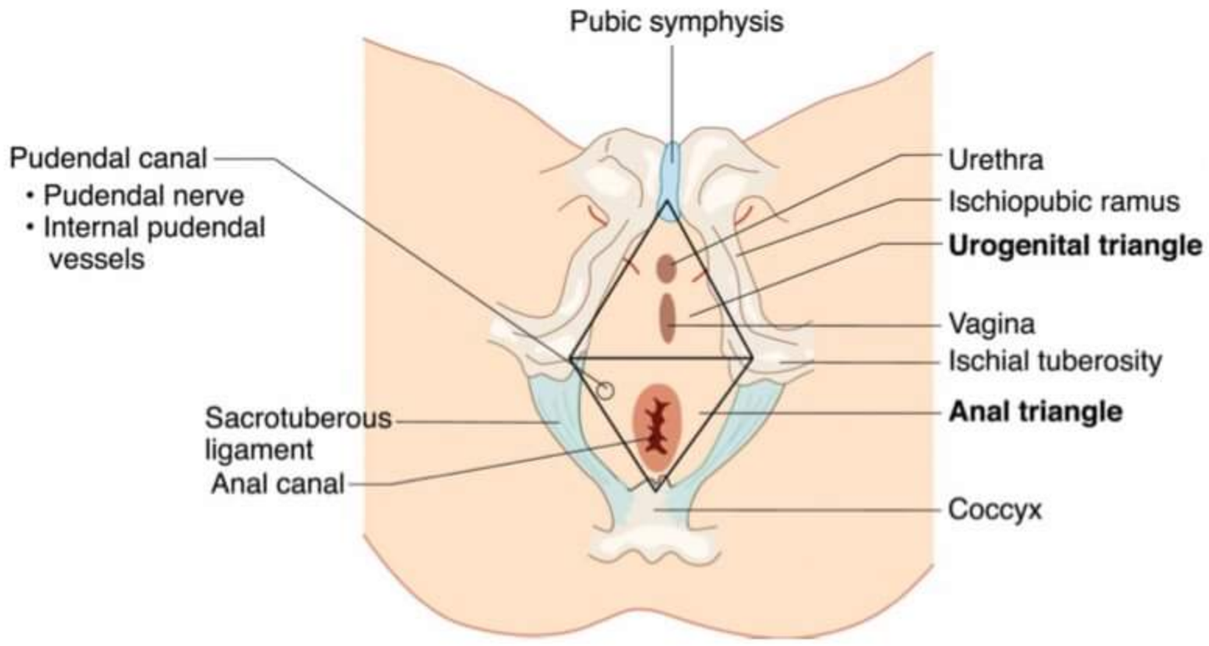
PERINEAL BODY

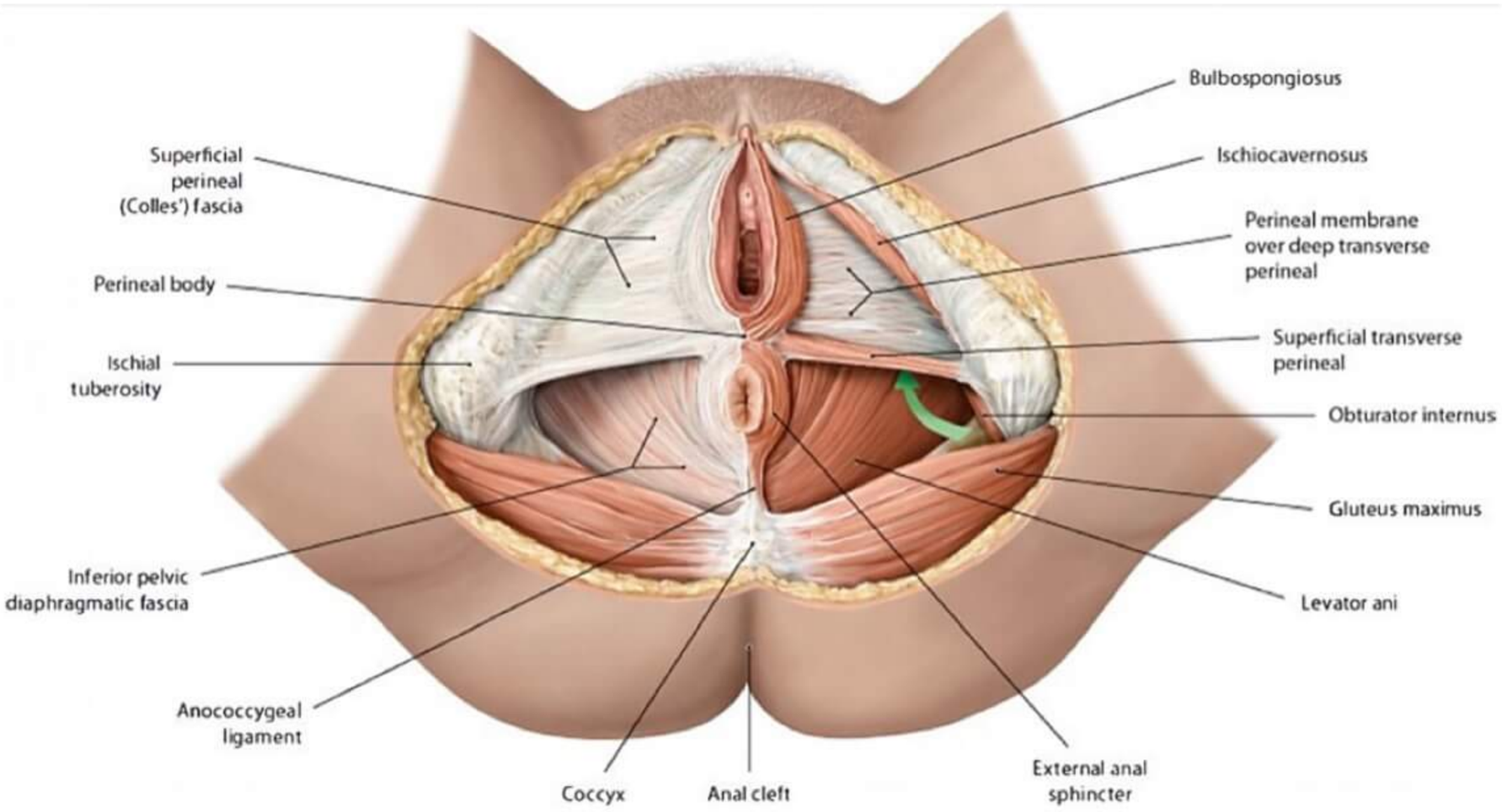
→ present in midline
→ present b/w vagina anterior Anal canal posterior
→ posterior → Sacrum & coccyx
→ posterolateral → Sacrotuberous ligament
  → origin of gluteus maximus
  → present b/w sacrum & Ischial tuberosity

Superficial Transverse perineal muscle → present in superficial perineal pouch
Deep transverse perineal muscle → present in deep perineal pouch



a An inferior view of the female perineum





SUPERFICIAL PERINEAL POUCH

MUSCLES

1. Bulbospongiosus
2. Ischiocavernosus
3. Superficial transverse perineal

Ischiocavernosus

→ lateral muscle
→ do not inserted into perineal body

PERINEAL MEMBRANE

→ triangular membrane
→ Boundary line blw superficial perineal pouch & deep perineal pouch
→ Floor → colle's fascia

DEEP PERINEAL POUCH

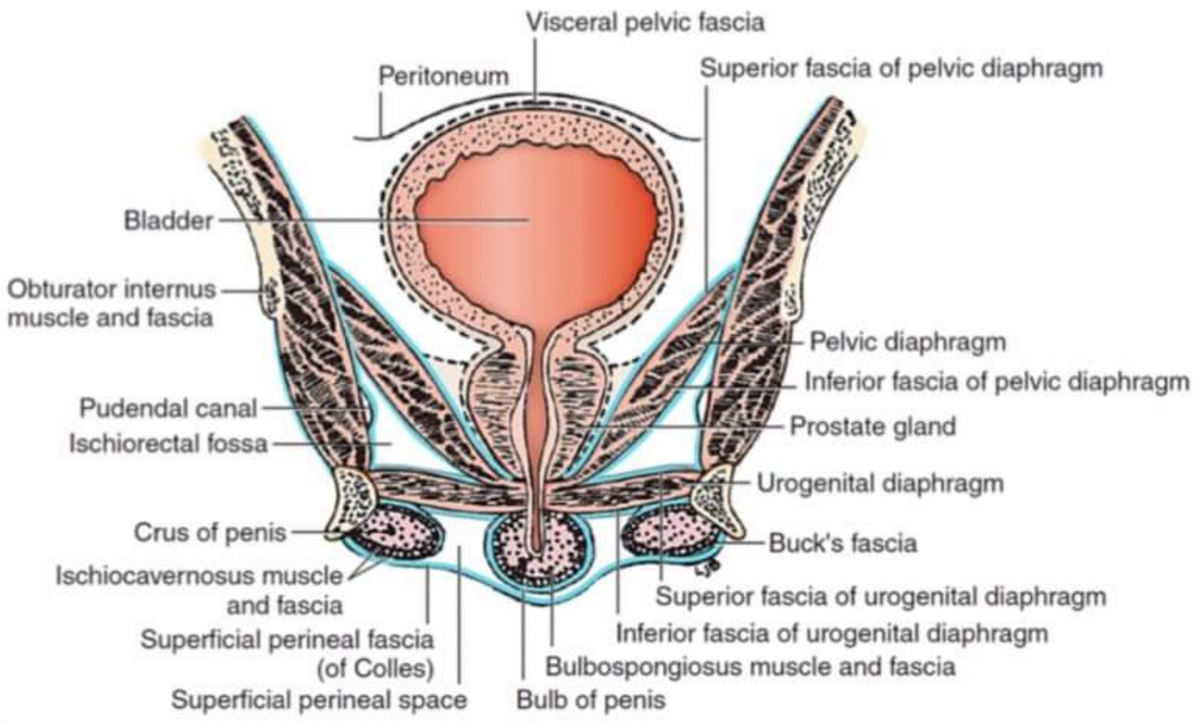
→ contains deep transverse perineal muscle & External urethral sphincter
→ insertn → Perineal body

PERINEAL BODY TEAR

→ Episiotomy (manual) is helpful in vaginal opening enlargement during vaginal delivery & prevents perineal body tear

Q. All insert into perineal body EXCEPT

a) Superficial transverse perenei
b) Deep transverse perenei
c) Bulbo spongiosus
d) Ischio cavernosus



ISCHIO RECTAL FOSSA

→ Space blw ischial bone laterally & anus/rectum in midline

→ HIP BONE

PARTS

PUBIS BONE → anterior
Ilium → lateral
Ischium → posterior

→ prone to ischiorectal abscess

→ BOUNDARIS

Medial → Levator ani muscle
Lateral → Ischium bone ī Obturator internus muscle & obturator fascia & pudendal canal (pudendal neurovascular bundle in it)
Anterior → Perineal membrane ī Sup. transverse perineal muscle
Posterior → Sacrotuberous ligament ī Gluteus maximus

→ CONTENTS

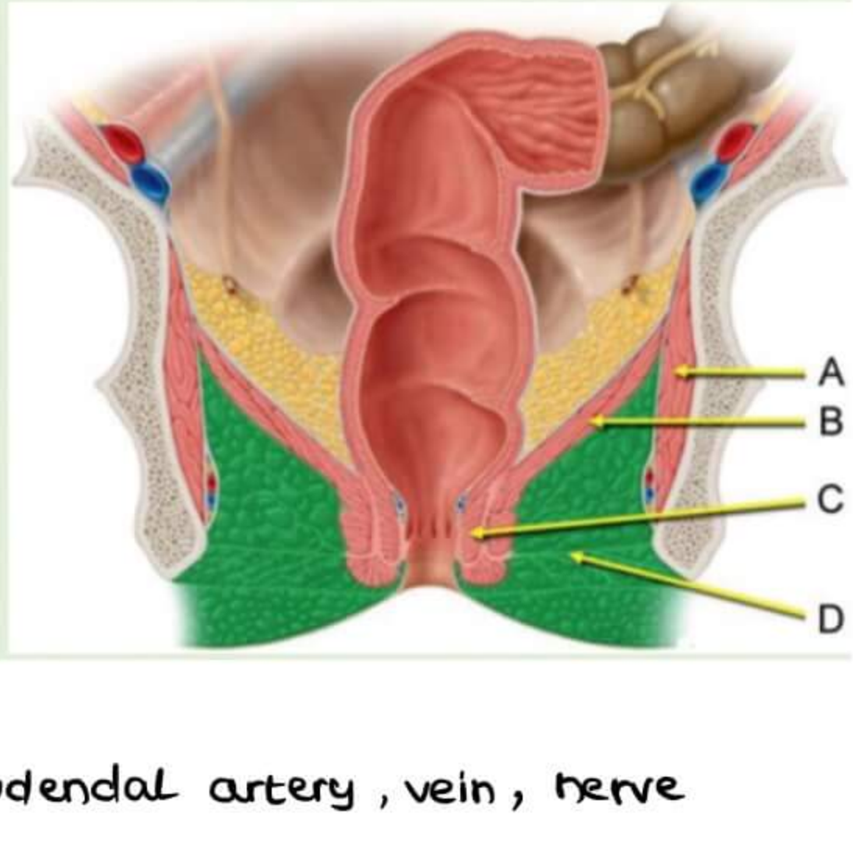
→ Inferior Rectal nerve (pudendal nerve br)
Inferior Rectal artery (pudendal artery br.)
Inferior Rectal vein (pudendal vein br.)

→ External haemorrhoid pain carried by Inf. rectal nerve

→ one fossa communicates ī other fossa, U/L abscess becomes BIL abscess by passing behind anal canal in horse shoe fashion

1. Which of the following marked structure in the figure given below forms the pelvic diaphragm *(AIIMS 2017)*

a. A → obturator internus
b. B
c. C →
d. D



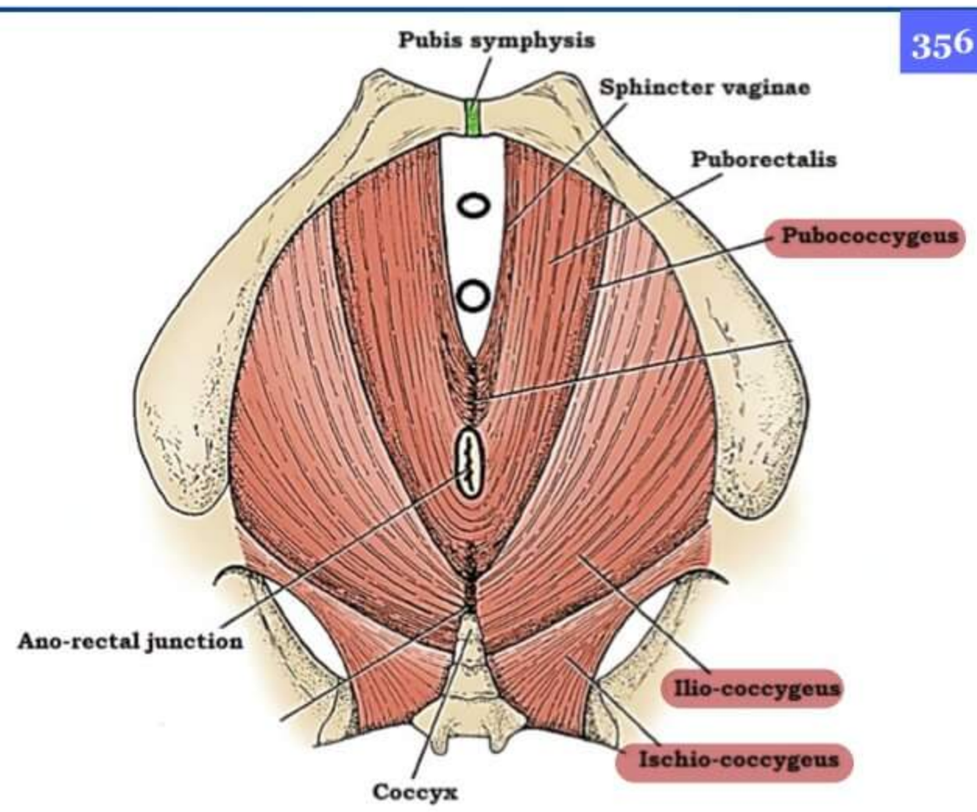
PUDENDAL/ ALCOCK'S CANAL → contains Pudendal artery, vein, nerve

PELVIC DIAPHRAGM

CONTRIBUTED BY

1. Pubococcygeus } LEVATOR ANI (chief muscle)
2. Iliococcygeus }
3. Ischiococcygeus / coccygeus

→ Levator ani muscle elevates anus

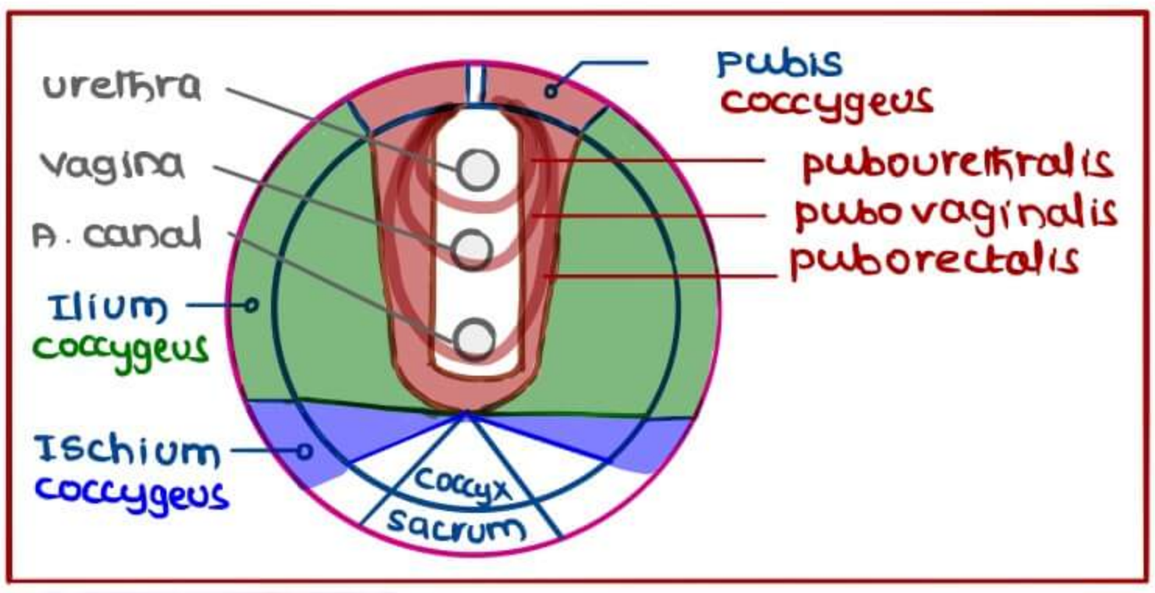


PUBOCOCCYGEUS

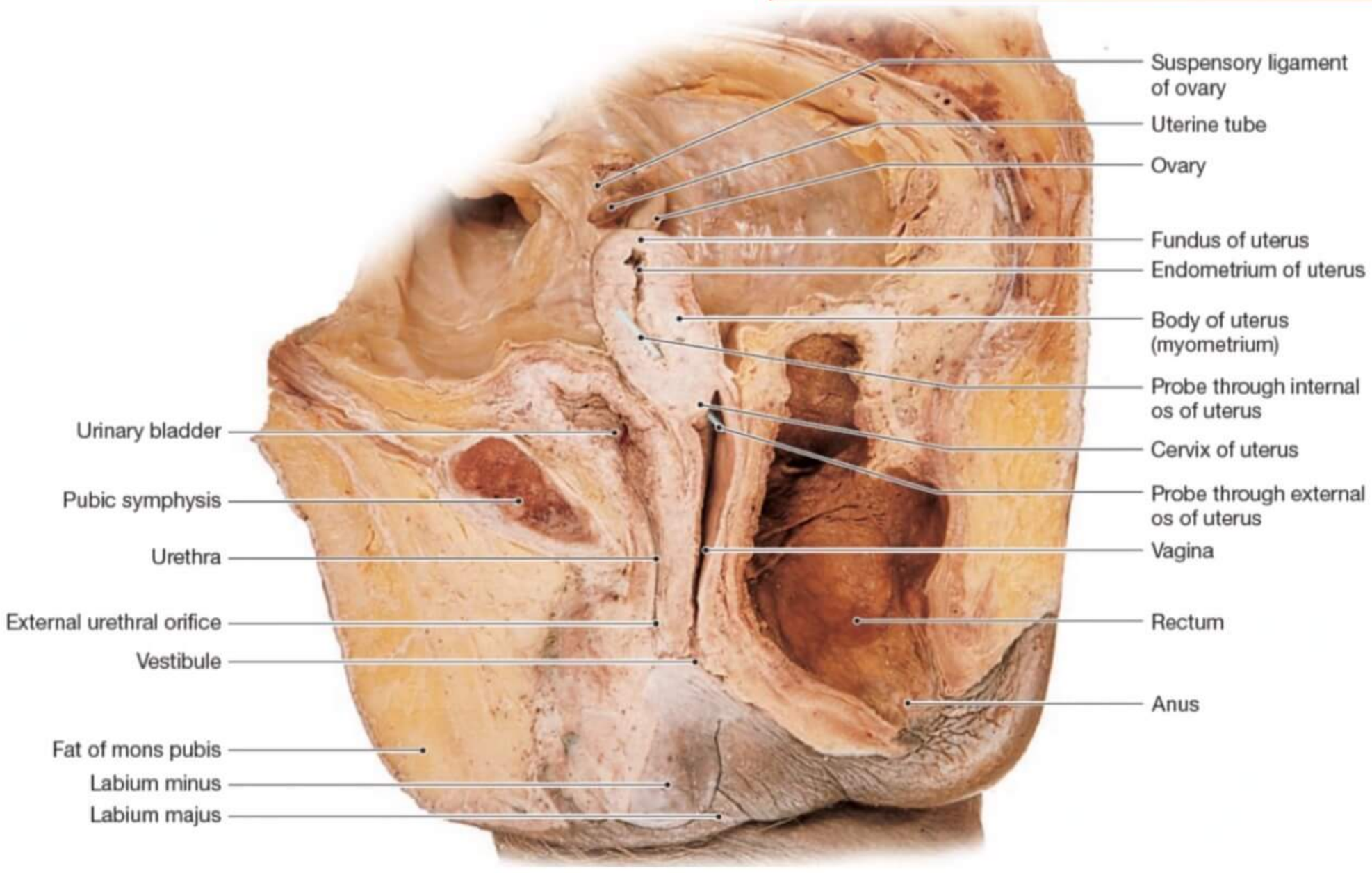
→ origin → Pubis
→ Insertn → coccyx
→ PARTS (Sphicters)
1. Pubourethralis → present around urethral opening
2. Pubovaginalis → present around vaginal opening
3. Puborectalis → present around anorectal opening

Q. Levator ani muscle include all EXCEPT

a) Puborectalis
b) Pubococcygeus
c) Iliococcygeus
d) Ischiococcygeus



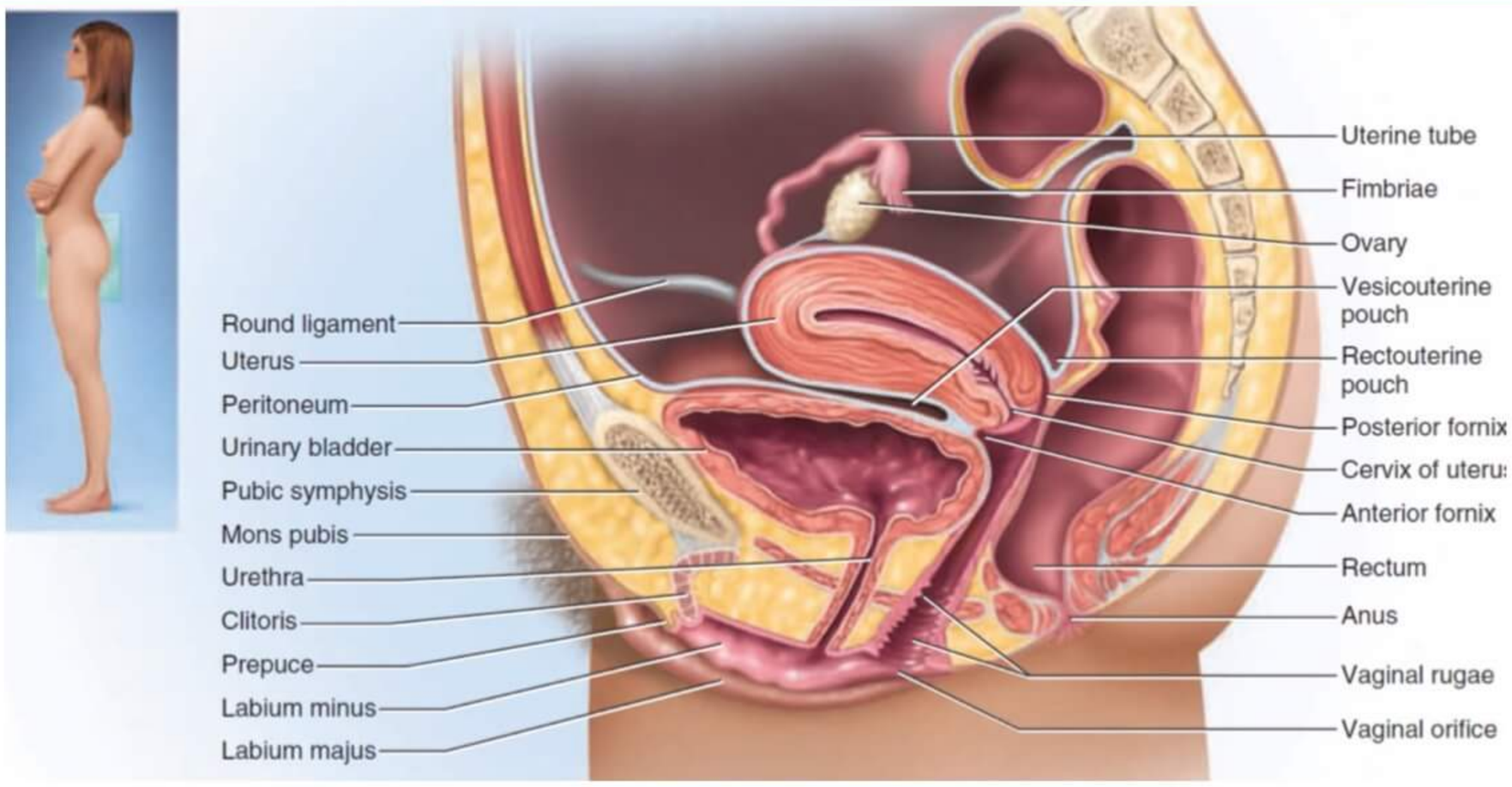
PERINEAL POUCHES II



→ length of urethra in female → 4cm
male → 20cm

→ Peritoneum comes from ant. abdominal wall & covers urinary bladder, uterus, Rectum & continues on posterior abdominal wall & gives broad ligament around uterus (poor supporter of uterus)

→ Rectouterine pouch of Douglas → present blw uterus & rectum



ROUND LIGAMENT OF UTERUS

→ sends lymphatics to labia majora

→ pulls the uterus & responsible for (along ↑ uterosacral ligament)

→ angle of anteflexion (angle between uterus & cervix)

→ angle of anteversion (angle between cervix & vagina) → 90°

→ uterosacral ligament pulls the uterus posteriorly

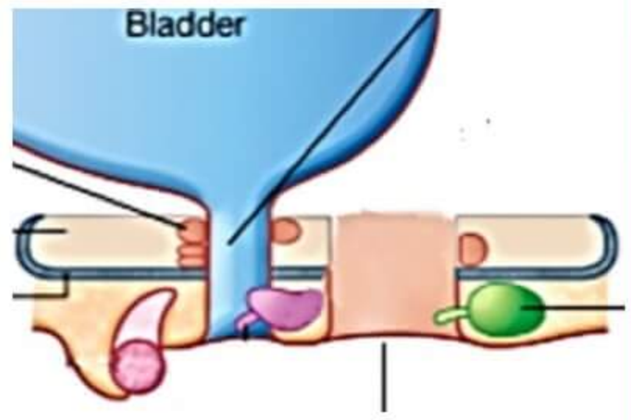
DEEP PERINEAL POUCH

→ PERINEAL MEMBRANE

→ Floor of deep perineal pouch

→ roof of superficial perineal pouch

→ pierced by urethra & vagina to enter into superficial perineal pouch



→ contains Ext. urethra vaginal sphincter

GREAT VESTIBULAR GLAND OF BARTHOLIN

→ present below the perineal membrane in superficial perineal pouch ↓ duct Opening into it

MALE PELVIS

→ Testis produce sperms

→ Sperms carried by ductus deferens

→ Ductus deferens passes superficial inguinal ring, inguinal canal, deep inguinal ring & become common ejaculatory duct (puts the sperms into prostatic urethra)

→ Sperms then comes out side through penile urethra

→ Bulb of Penis

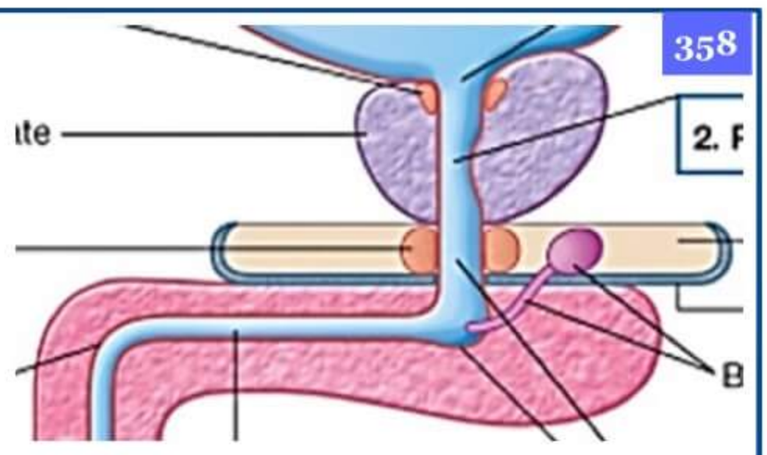
→ covered by Bulbus spongiosus

→ present in superficial perineal pouch

→ present below the perineal membrane

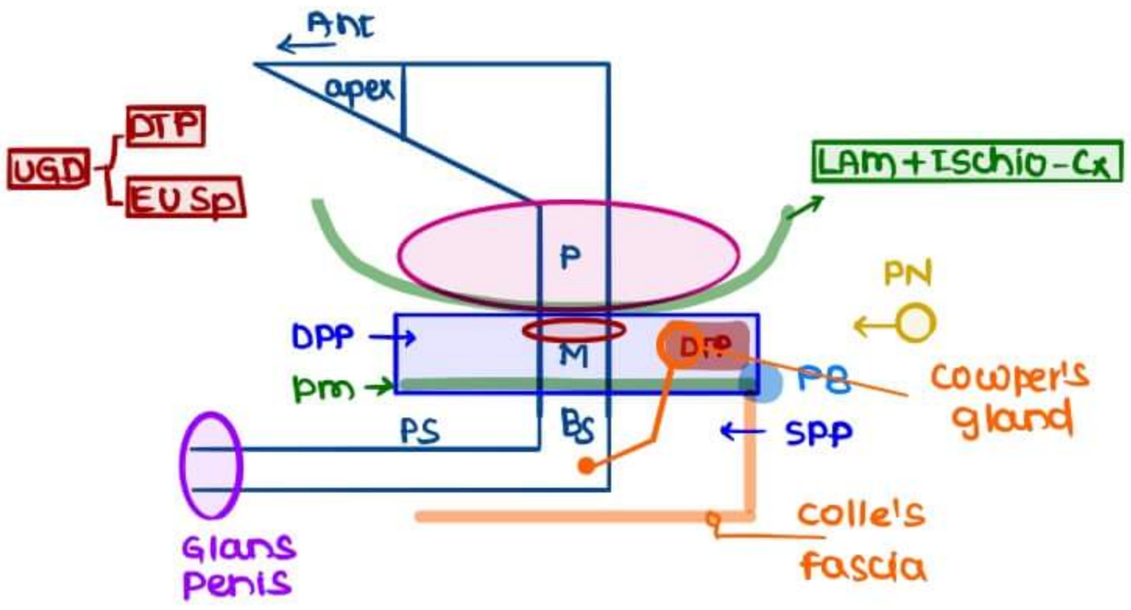
MALE URETHRA

Prostatic urethra (4cm)
membranous urethra (1-2 /2.5cm)
Spongy urethra



→ membranous urethra punctures perineal membrane to become Bulbous spongy urethra

→ COWPER'S / BULBO URETHRAL GLAND
  → present in deep perineal pouch
  → duct punctures perineal membrane & enters sup. perineal pouch & opens into bulbous spongy urethra



→ Lymphatic drainage of distal spongy urethra & glans penis → Deep inguinal LN of CLOQUET & ROSEN-MULLER

→ For circumcision, dorsal nerve of penis to be blocked
DORSAL NERVE OF PENIS
  → supplies tip of penis & glans penis
  → Br. of pudendal nerve
  → content of DPP

Q. Contents of deep perineal pouch are all EXCEPT

a) Dorsal nerve of penis
b) Urethral sphincter
c) Root of penis
d) Bulbourethral gland

EXTRAVASATION OF URINE

CASE 1

→ sometimes urine can come into peritoneal cavity causing Ascites
→ dlt rupture of fundus of UB & peritoneum

CASE 2

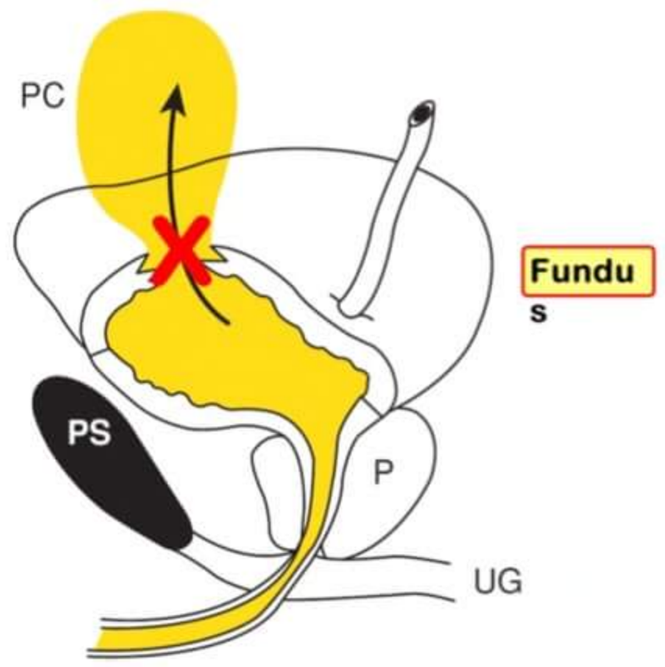
→ dlt rupture of membranous urethra above perineal membrane, urine can come into retropubic space of RETZIUS in the paravesical space
→ urine can't enter peritoneal cavity (intact peritoneum)
→ occurs in case of # pelvis
→ urine can extravasated into deep perineal pouch & superficial perineal pouch

CASE 3

→ Scarpa's fascia on anterior abdominal wall continuous ∑ penile, scrotal fascia & colle's fascia and perineal membrane

→ dlt Straddle injury (rupture of urethra below perineal membrane), (rupture of Bulbus spongy urethra), Urine can be at

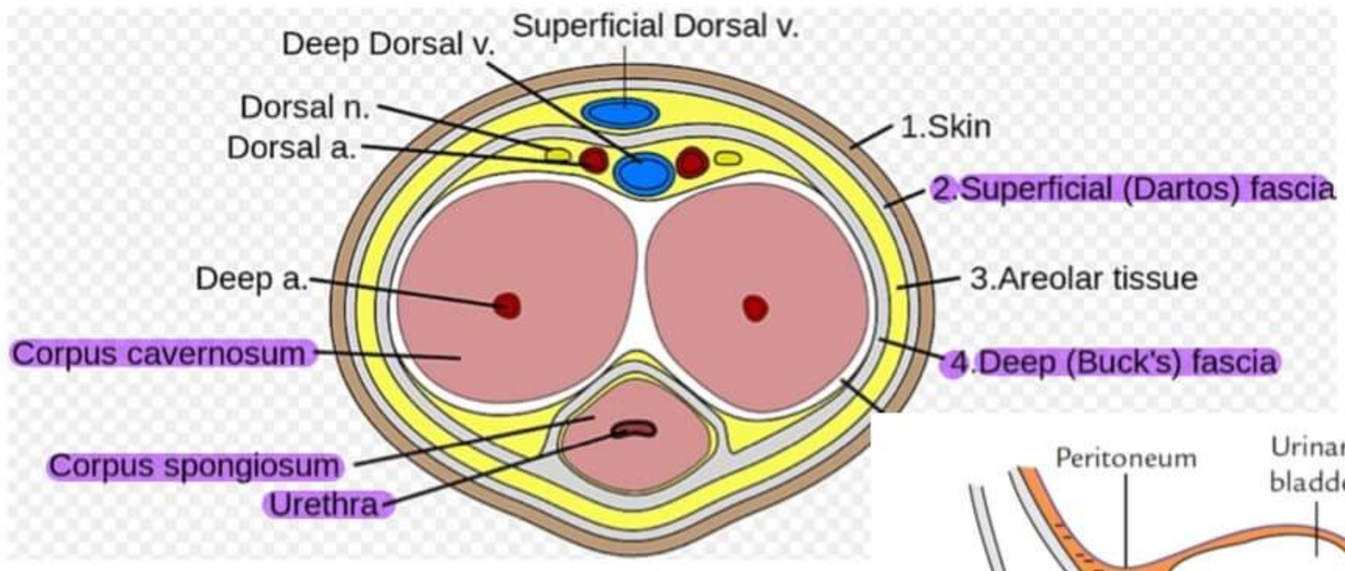
1. Superficial perineal pouch
2. Scrotum
3. Penis
4. Ant. abdominal wall

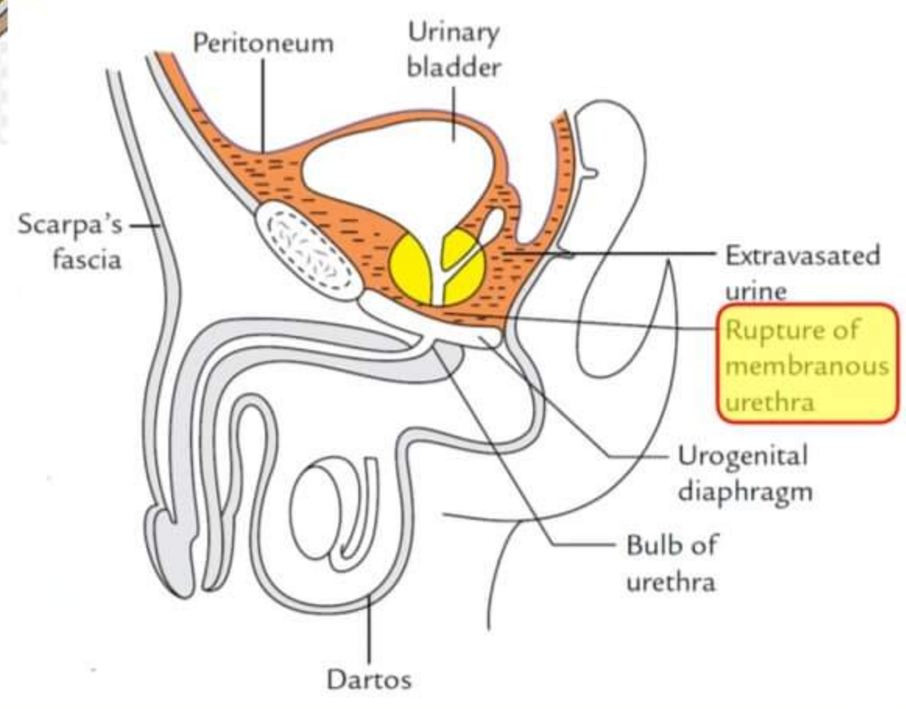


Q. A patient exposed to bomb explosion injury presents with rupture of the fundus of urinary bladder. The extravasated urine reaches

a) Space of Retzius
b) Deep perineal pouch
c) Superficial perineal pouch
d) ~~Peritoneal cavity~~

→ most urethral ruptures are at junction of posterior & anterior urethra
→ DEEP FASCIA OF PENIS → BUCK'S FASCIA
→ If buck's fascia is intact, blood in urine is confined to shaft of penis





Q. Injury to the male urethra above the perineal membrane due to a pelvic fracture, causes urine to accumulate in all of the following EXCEPT

a) Space of Retzius
b) Deep perineal pouch
c) Superficial perineal pouch
d) ~~Peritoneal cavity~~ (BETTER ANSWER)

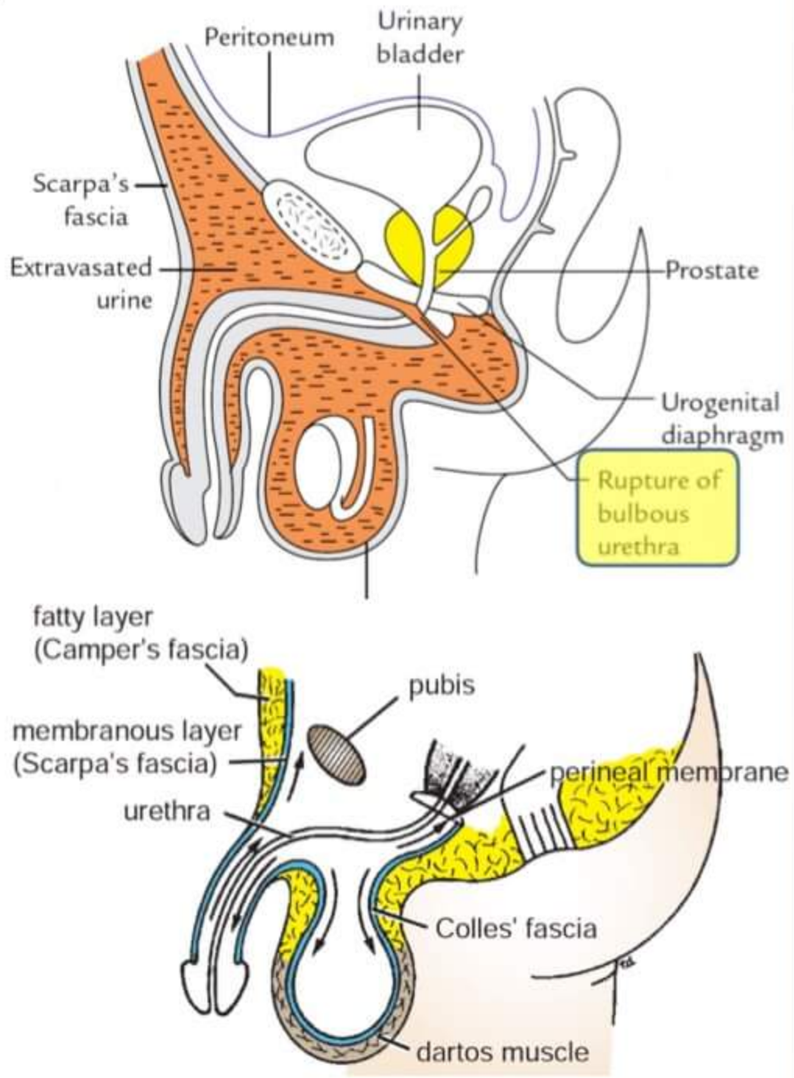
Q. A 16-year-old boy presents to the emergency department with straddle injury and rupture of the bulbous urethra. Extravasated urine from this injury can spread into which of the following structures

a) **Scrotum**
b) **Ischiorectal fossa**
c) **Deep perineal space**
d) **~~Thigh~~**

STRADDLE INJURY

→ occurs d/t fall on urethra from a height
(bicycle riding on a bumpy road)

→ rupture of Bulbar Spongy urethra below perineal membrane



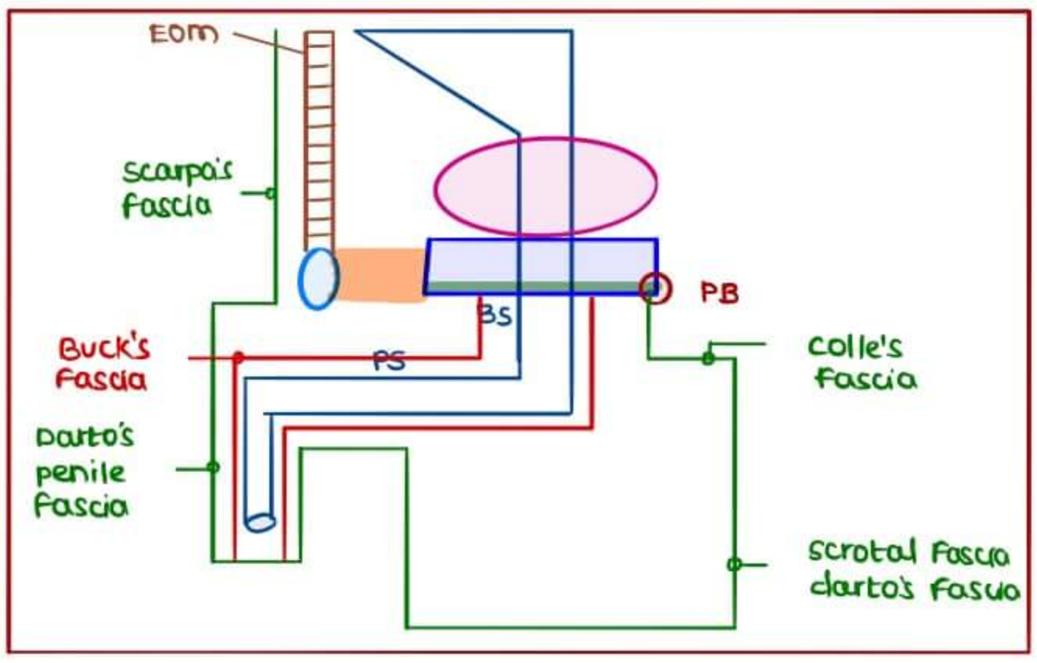
BULBO SPONGY URETHRAL RUPTURE

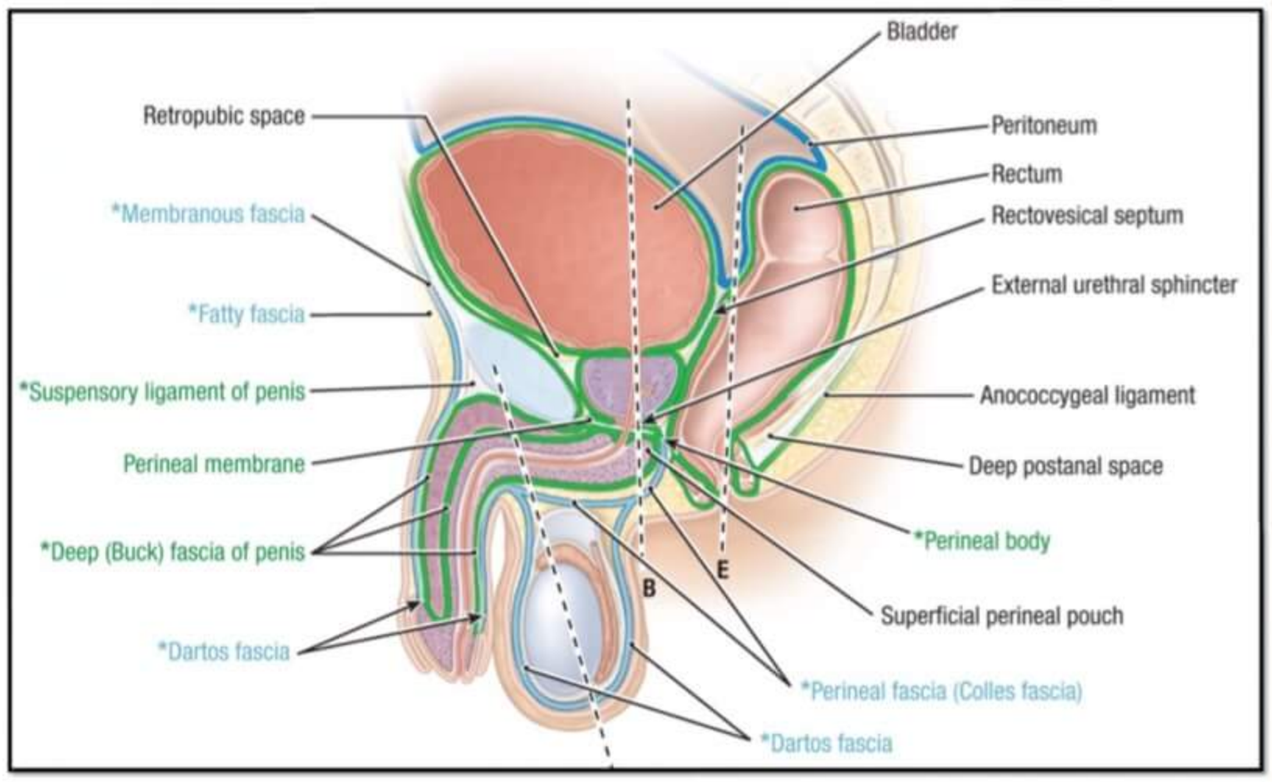
→ urine can't enter into
1. Deep perineal pouch (PM intact)
2. Ischiorectal fossa (colles' fascia intact)
3. Thigh (fascia Lata is intact)

ANTERIOR ABDOMINAL SUPERFICIAL FASCIA

→ Superficial Layer
→ CAMPER'S FASCIA
→ fatty layer

→ POSTERIOR
→ MEMBRANOUS | SCARPA'S FASCIA

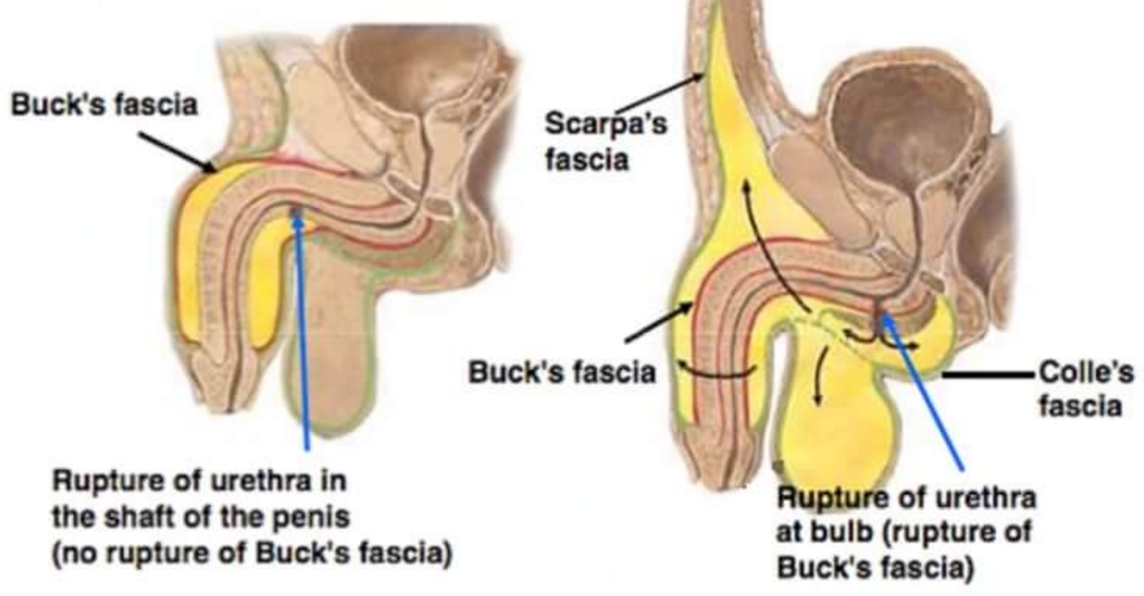




Q. After fracture of the penis (injury to the tunica albuginea) with intact Buck's fascia, there occurs hematoma at

a) **The penis and scrotum**
b) **At the perineum in a butterfly shape**
c) **Penis, scrotum, perineum and lower part of anterior abdominal wall**
d) **Shaft of the penis only**

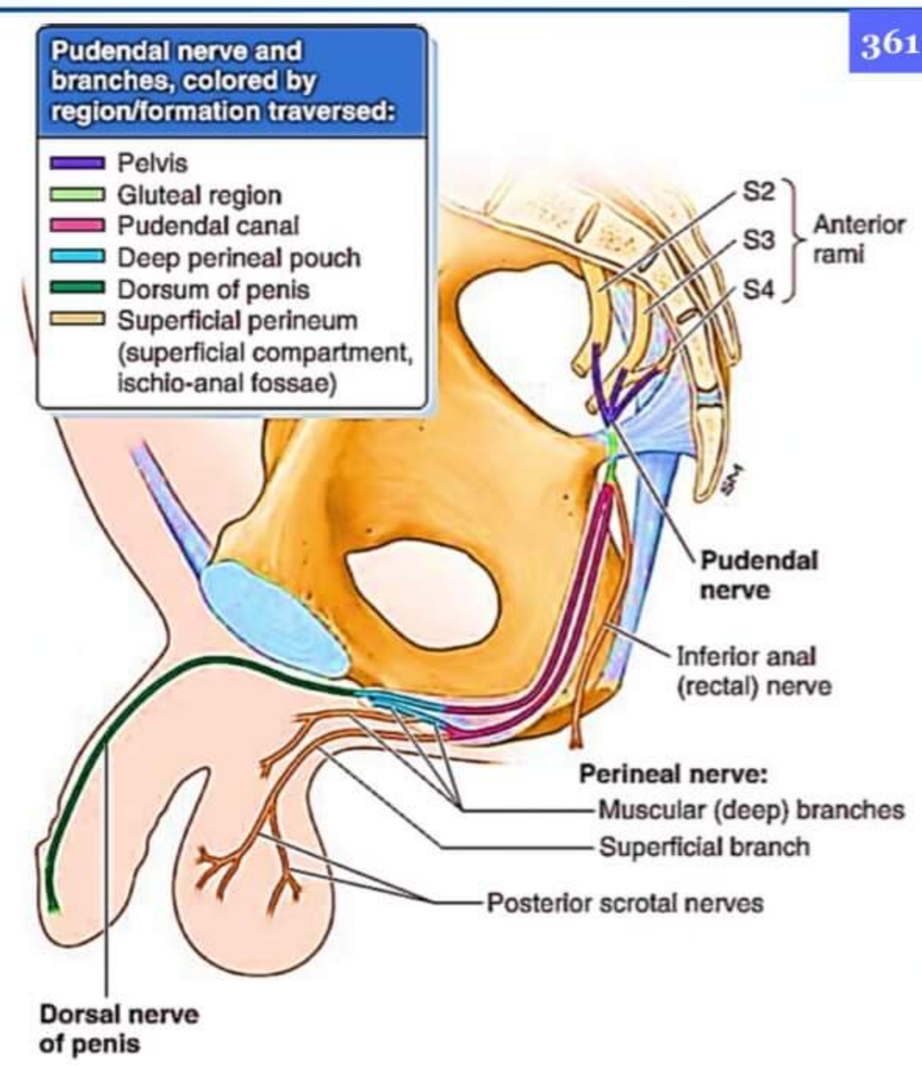
EXTRAVASATION OF URINE



PUDENDAL NERVE

Q. FALSE statement regarding pudendal nerve is

a) Both sensory and motor
b) Derived from S2,3,4 spinal nerve roots
c) Leaves pelvis through the lesser sciatic foramen
d) Only somatic nerve to innervate the pelvic organs



→ Nerve of perineum
→ Supplies skin & skeletal muscles of perineum
→ Somatic & mixed nerve

→ controls External urethral sphincter
vaginal sphicter
Anal sphincter

→ responsible for continence

→ Root value → S – 2,3,4 & for continence
→ Same root value as Nervi Erigentes & for evacuatn

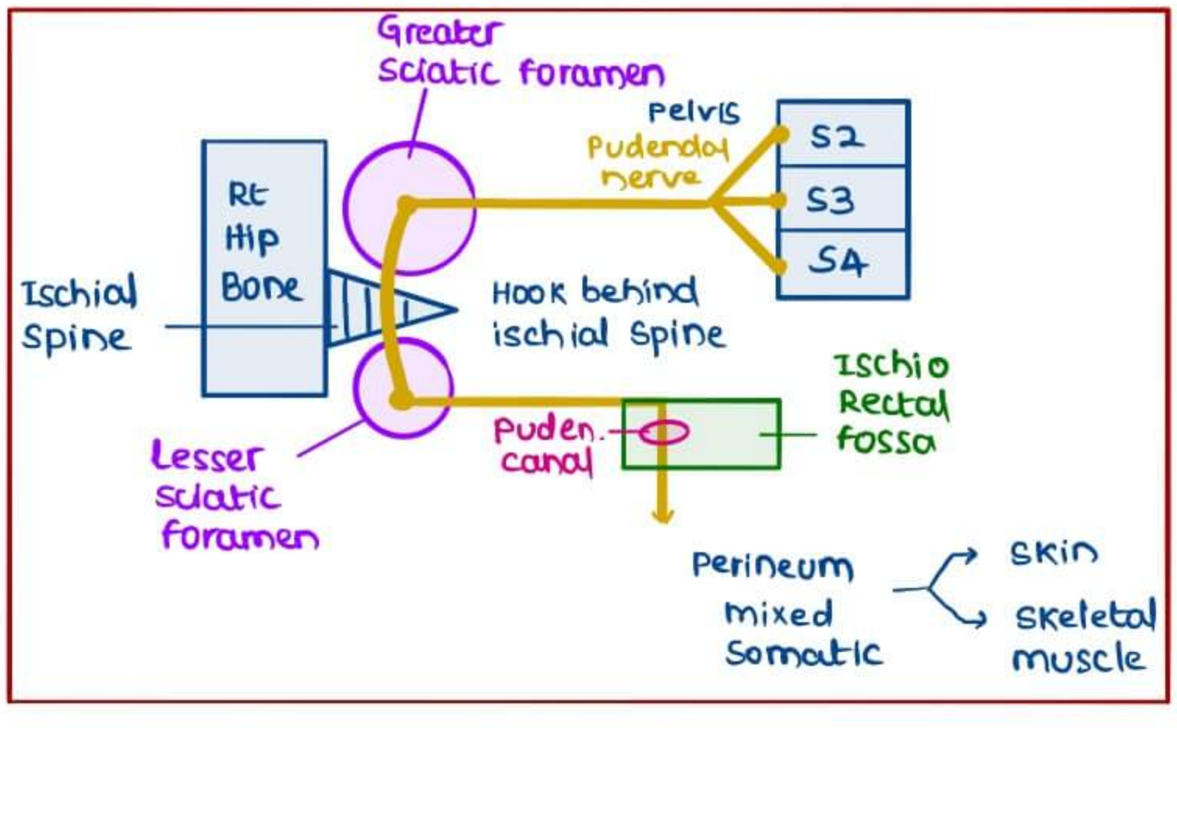
→ Leave the pelvis through Greater Sciatic notch
→ Only somatic nerve to innervate the pelvic organs

Ischial Spine
→ is directed towards midline
→ separates Greater sciatic notch (above) & lesser sciatic notch (below)
→ pudendal block is given here

PUDENDAL NERVE
→ formed in pelvis, infront of sacral bone in pelvis cavity
→ Leaves the pelvis to enter gluteal region through greater sciatic notch
→ hook behind ischial spine in gluteal region for short distance
→ then enters pudendal canal on laterwall of ischiorectal fossa by passing through lesser sciatic notch

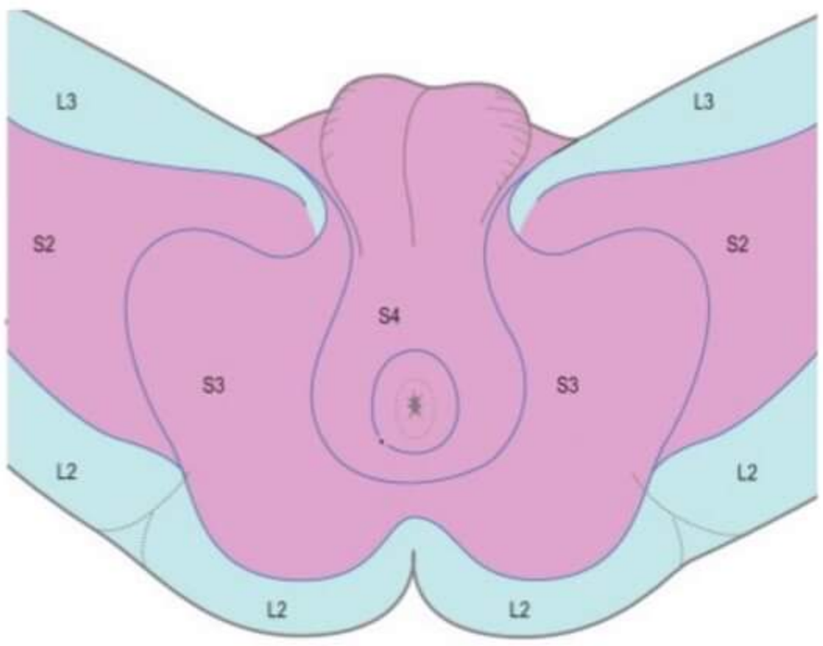
→ Obturator Internus
→ have obturator fascia
→ Pudendal canal present in obturator fascia

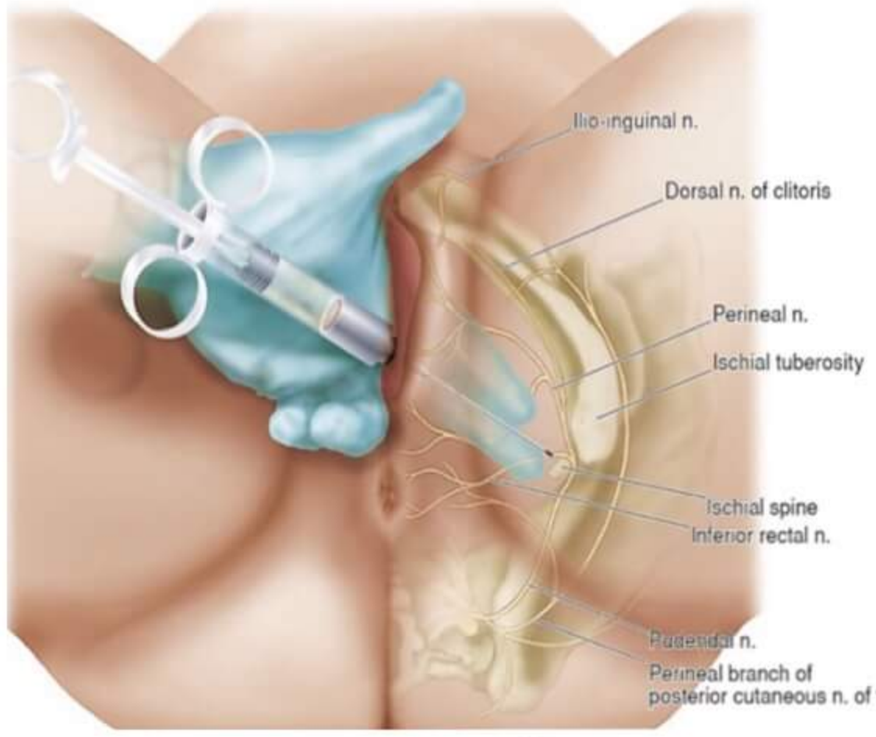
→ Dorsal Nerve of Penis
→ br. of pudendal nerve
→ passes deep perineal pouch &
→ supplies tip of penis



PUDENDAL NERVE BLOCK

→ put 2 fingers inside vagina & palpate for ischial spine
→ can be given from outside through labia mayora
→ on BIL Block, saddle shape anesthesia occurs





Q. While a patient was being given an obstetric nerve block she gradually lost her voluntary control over urination. The muscle which got anaesthetized is located in the

a) Trigone of the bladder
b) **Urogenital diaphragm**
c) Superficial perineal pouch
d) Pelvic diaphragm

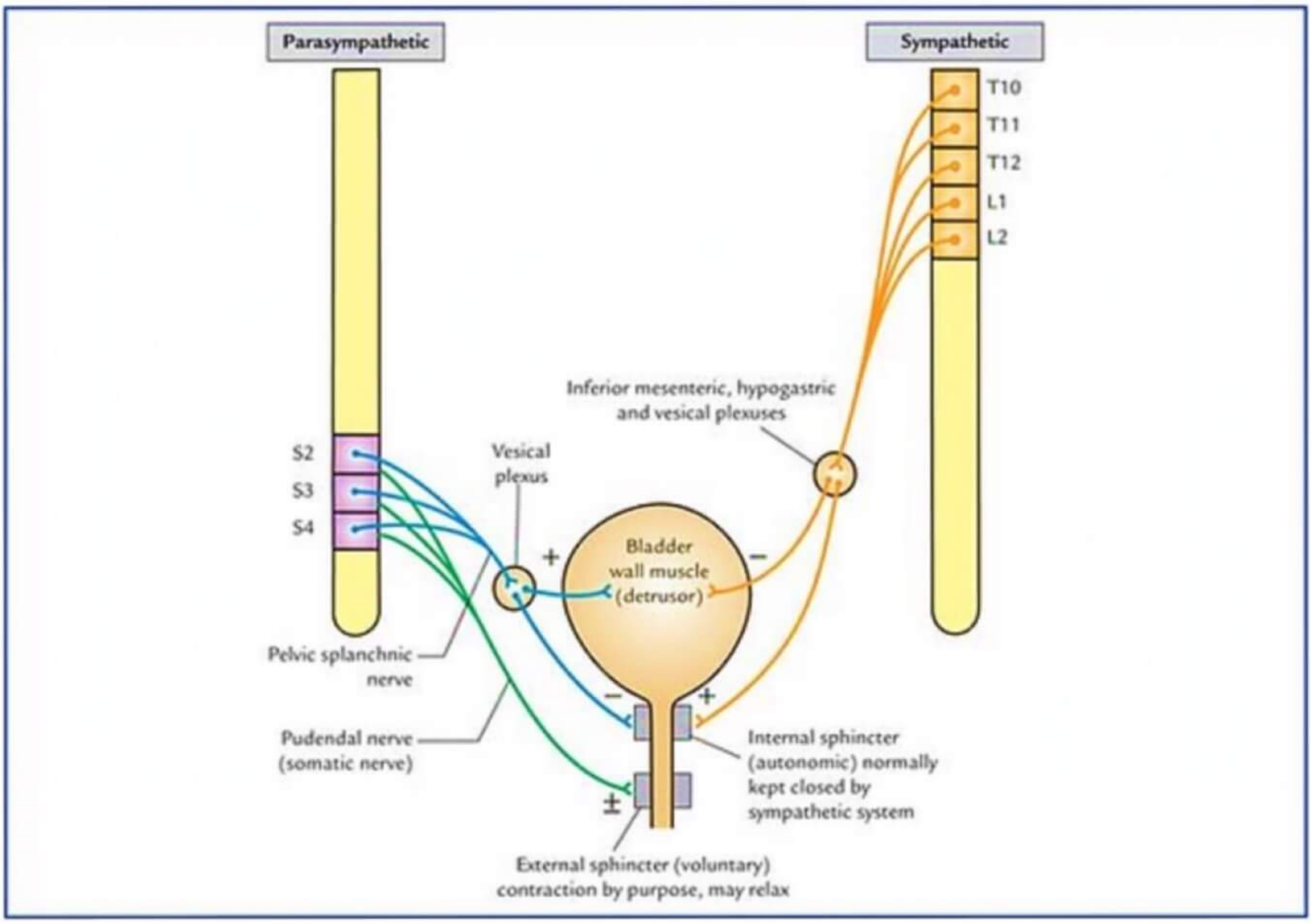
Q. Uterine tube is supplied by

a) T: 6-8
b) T: 8-10
c) **T: 10-12**
d) L: 1-2

Q. Urinary bladder is supplied by sympathetic root value

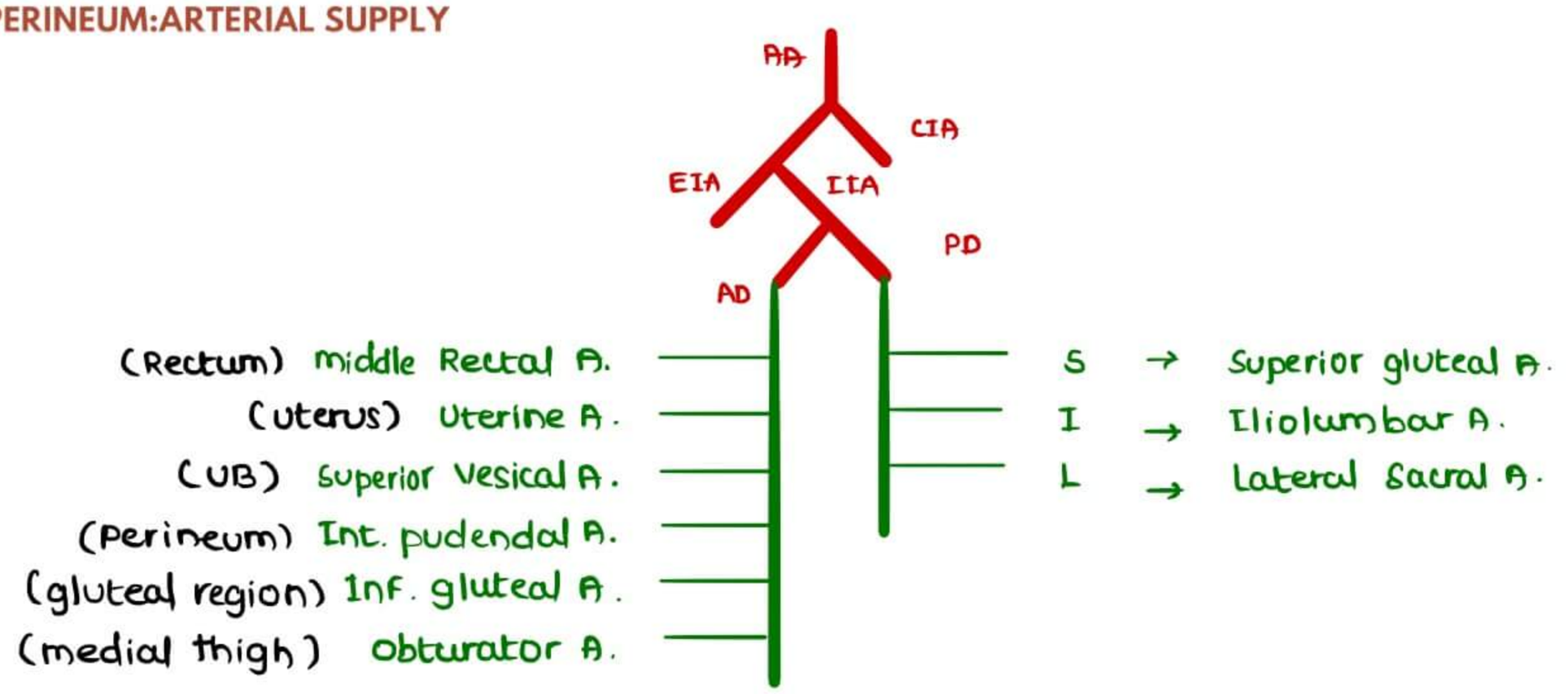
a) **L1 & L2**
b) L2 & L3
c) L3 & L4
d) L2,L3 & L4

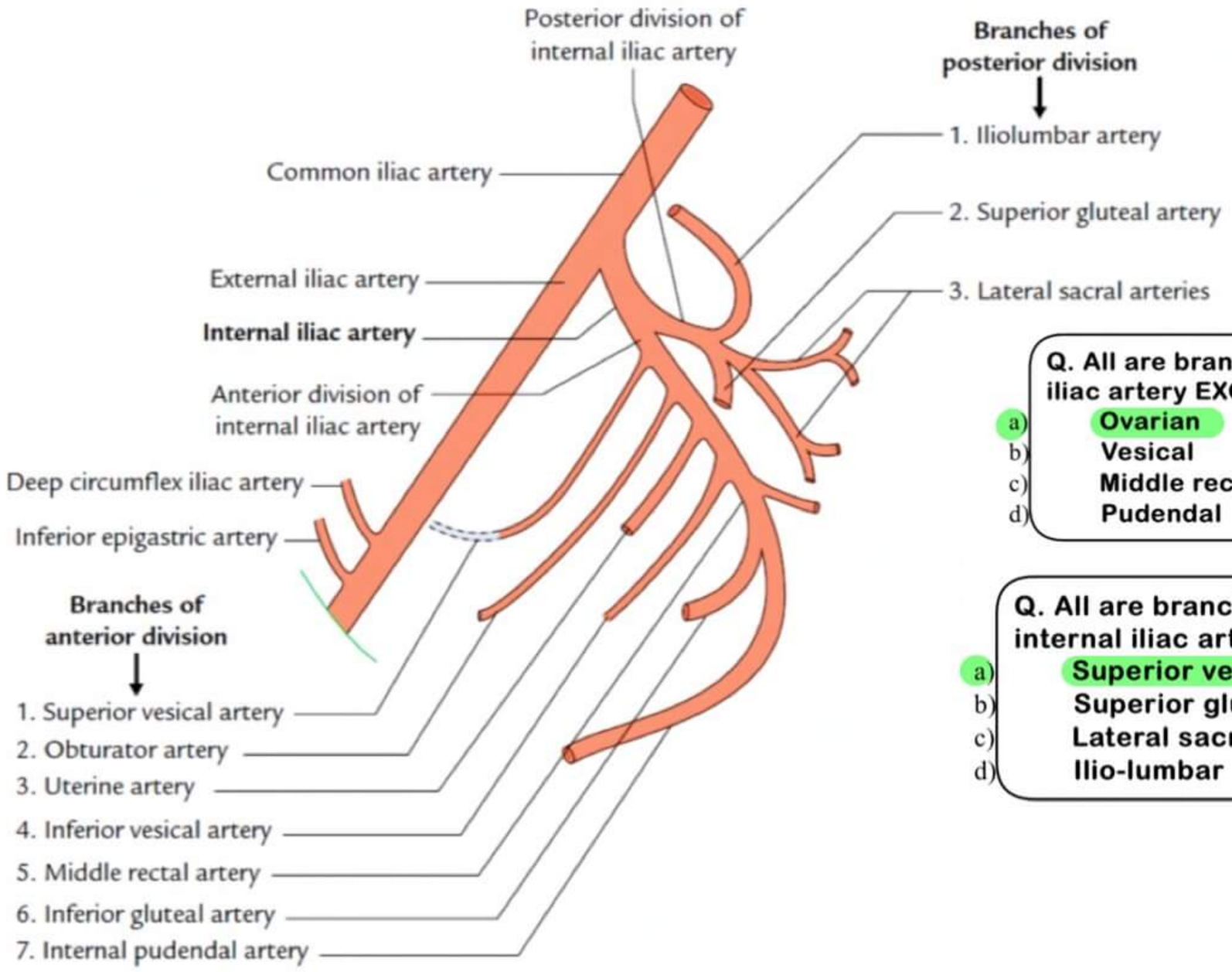
PELVIS & PERINEUM:NERVE SUPPLY



Q. Parasympathetic nerve innervation of urinary bladder has

a) Inhibitory control on detrusor contraction
b) **Excitatory effect on detrusor**
c) No effect on detrusor
d) Excitatory control over internal urethral sphincter





SUPERIOR VESICAL ARTERY → persistent proximal part of umbilical Artery

Q. All are branches of anterior division of internal iliac artery EXCEPT

a) **Ovarian**
b) **Vesical**
c) **Middle rectal**
d) **Pudendal**

Q. All are branches of posterior division of internal iliac artery EXCEPT

a) **Superior vesical**
b) **Superior gluteal**
c) **Lateral sacral**
d) **Ilio-lumbar**

FEMALE REPRODUCTIVE SYSTEM

cervix

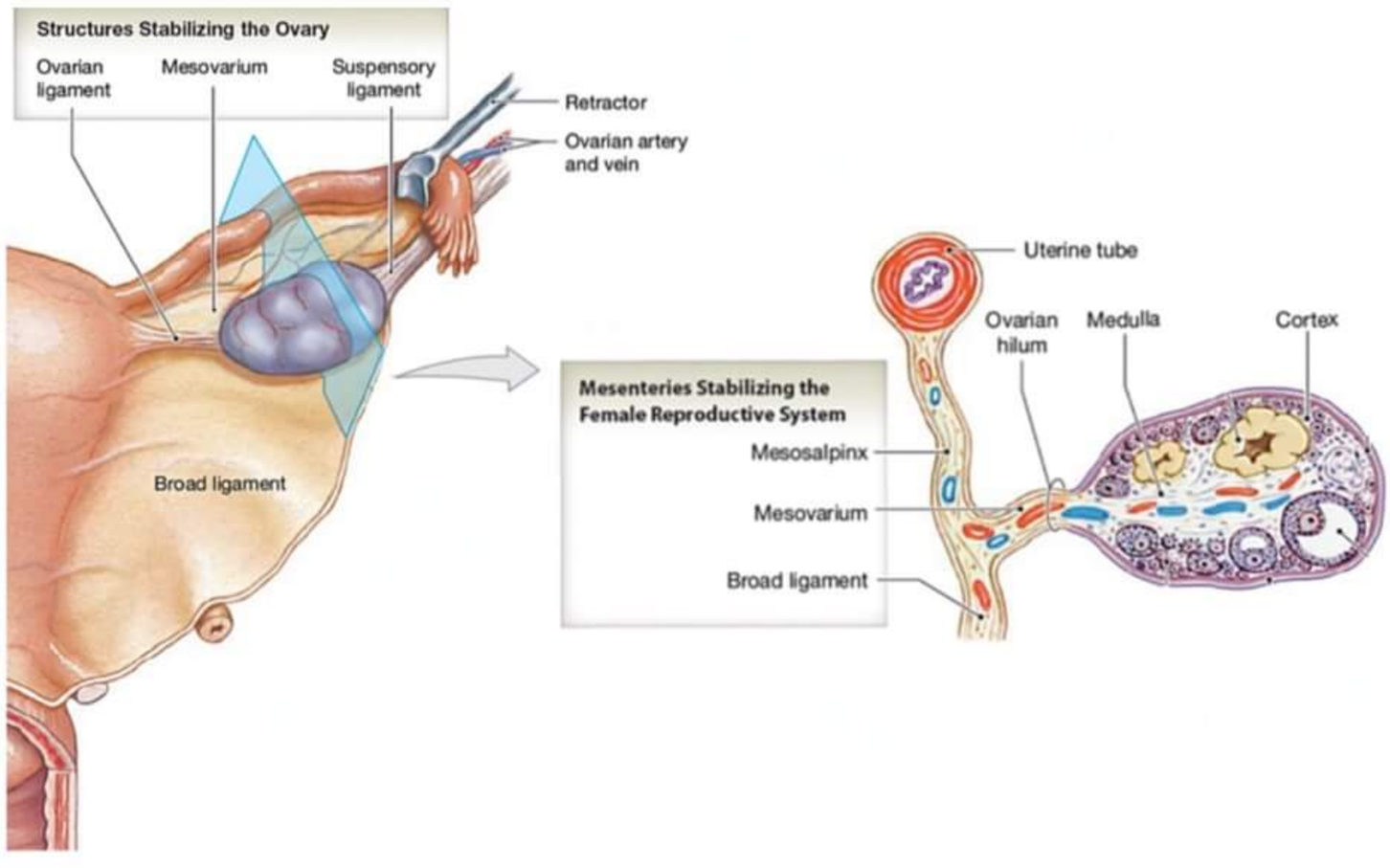
- circular in nullipara
- trasnsverse slit in multipara

Broad ligament

- Double fold of peritoneum
- poor support of uterus

Round ligament

- poor support of uterus



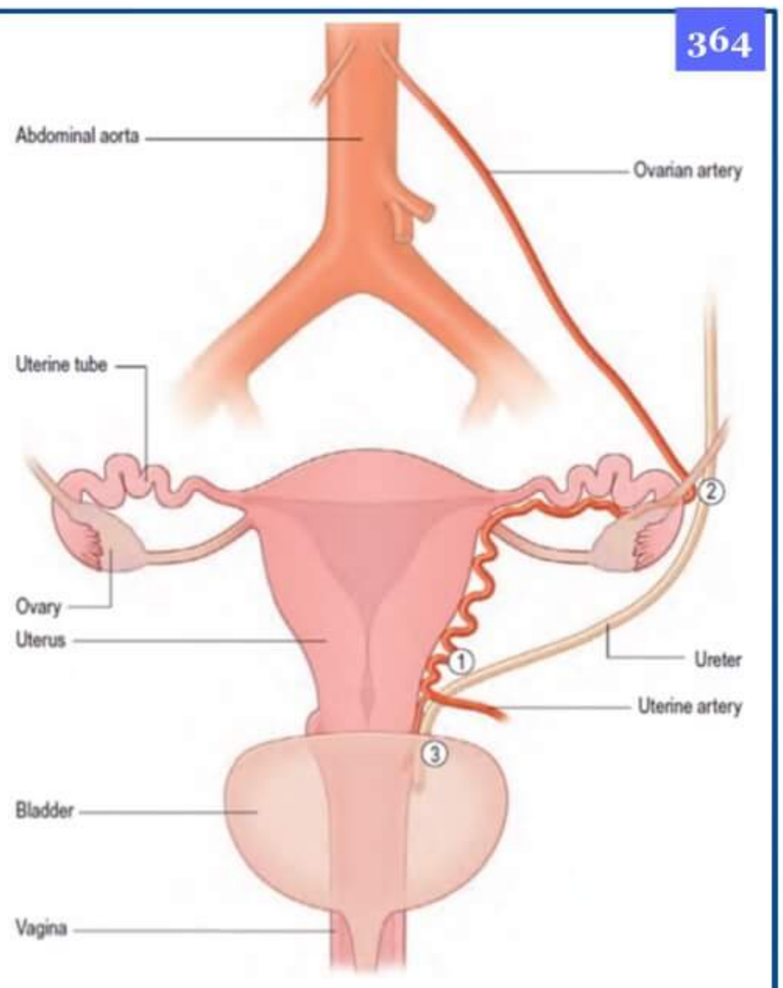
MESOSALPINX → uterine tube suspended by mesentery

MESOOVARIUM → ovary suspended posteriorly from broad ligament

OVARIAN ARTERY

→ br. of abdominal aorta

→ supplies ovary



UTERINE ARTERY

→ br. of Ant. division of Internal Iliac artery

→ supplies uterus

Ovarian artery & Uterine artery anastomose & supplies uterine tube, uterus, ovary, part of vagina

WATER UNDER THE BRIDGE

→ WATER → urine carried by ureter from posteriorly
BRIDGE → by uterine artery

→ ureter can be identified by peristaltic movement

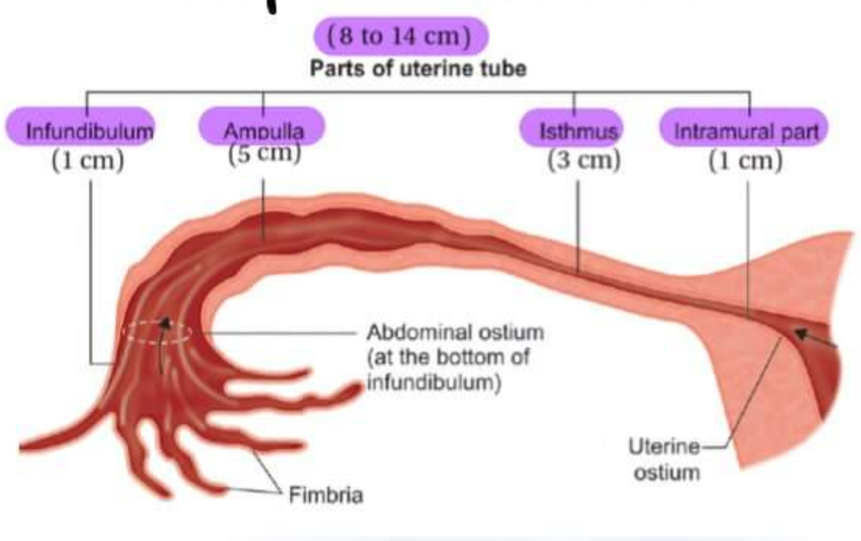
→ care to be taken not to ligate / damage ureter during removal of uterus

UTERINE TUBE

→ Length → 14cm long

→ Fertilizatn occur at ampulla

→ anatomical sphincter → ISTHMUS > Intramural part



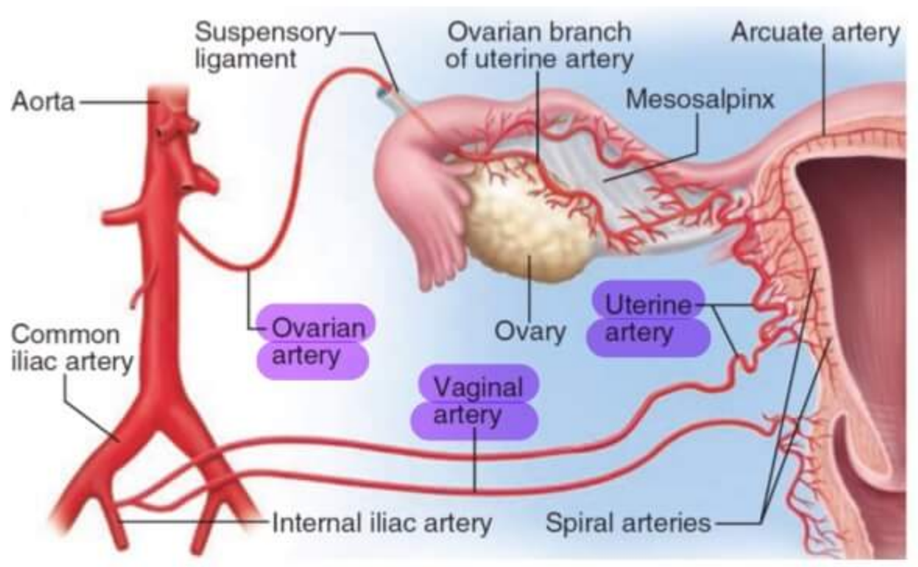
UTERINE ARTERY – BRANCHES

ARCUATE A. → Arc shaped

RADIAL A.

BASAL A. → donot slough during menstruatn
→ remains in basal layer (stratum vasculorum)

SPIRAL A. → sloughed off during endometrium



LYMPHATIC DRAINGE OF UTERUS

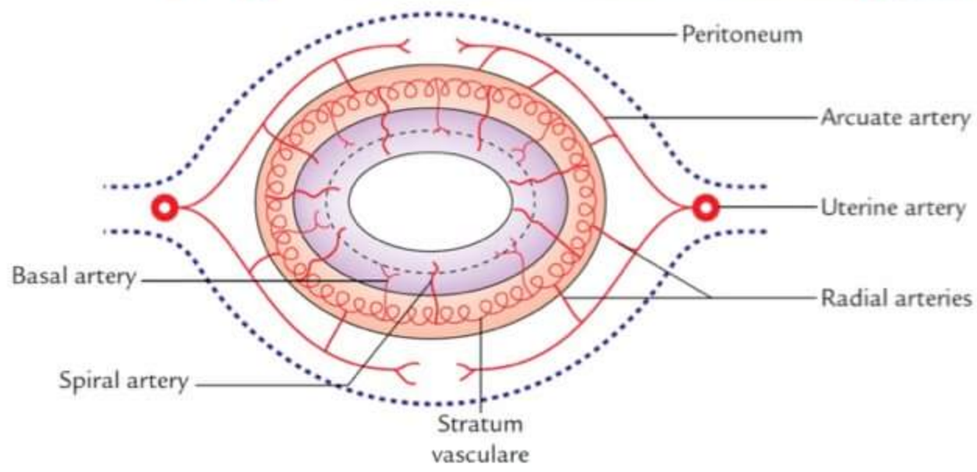
UPPER UTERUS

Fundus

Isthmus → Round lig → Sup. Inguinal LN

MID UTERUS

LOWER UTERUS (Cervix) → drains every where but not Inguinal LN (Sup & deep)



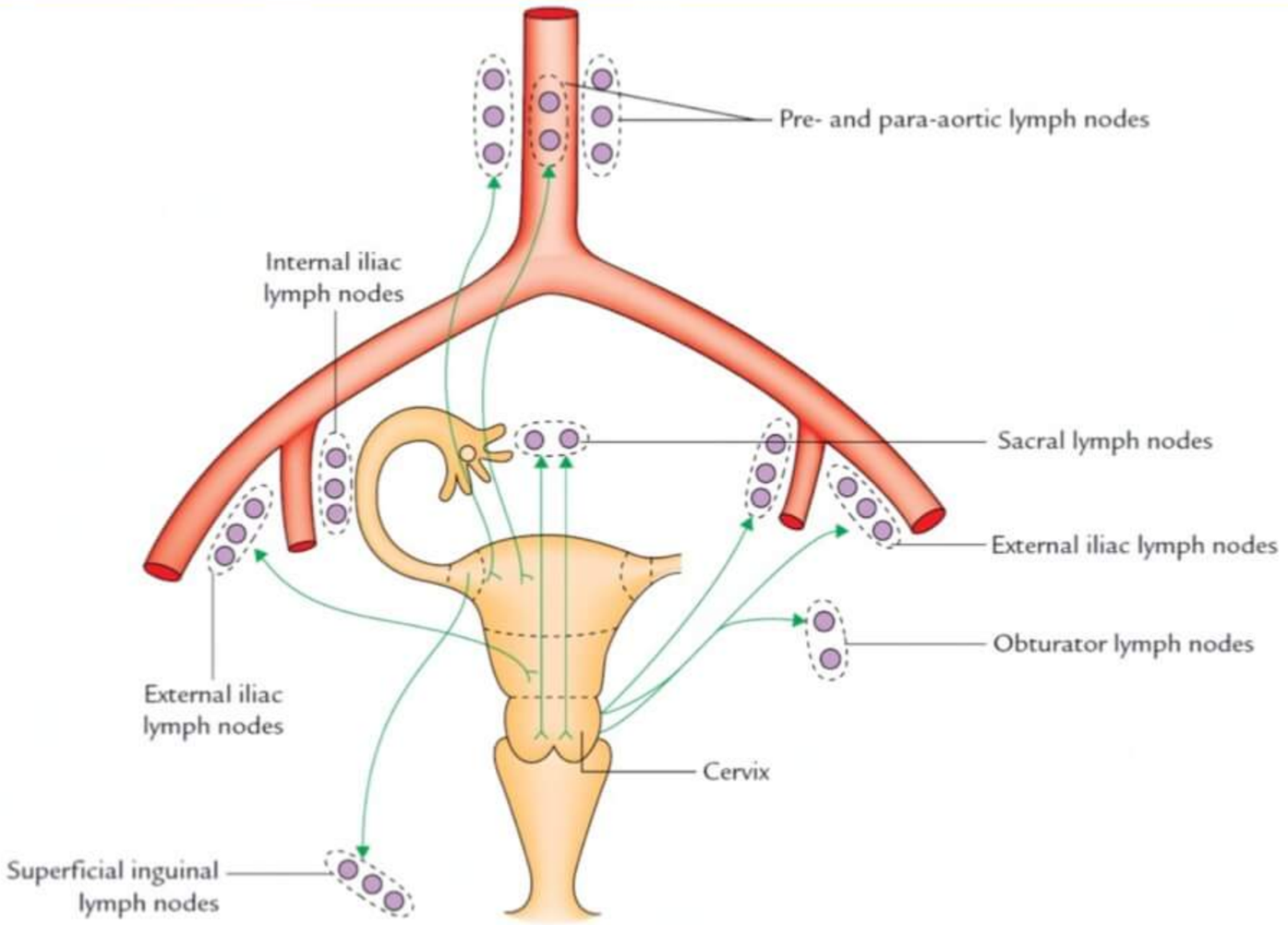
Q. All the following pairs are correct concerning the lymphatics of uterus EXCEPT

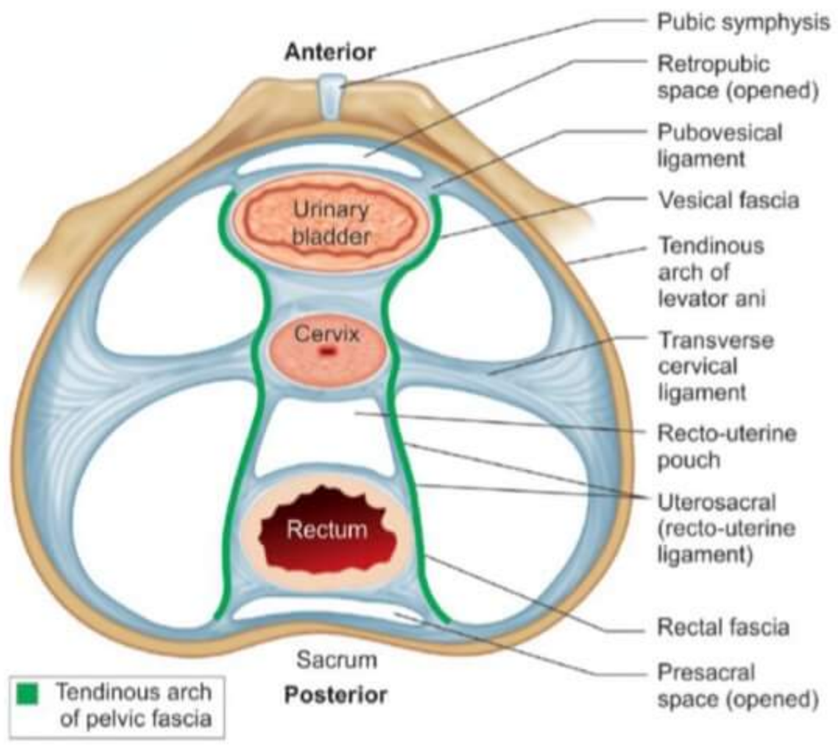
a) Fundus: Para-aortic
b) Mid-uterus: External iliac
c) **Cervix: Superficial inguinal lymph nodes**
d) Cervix: Sacral

UPPER UTERUS

FUNDUS → Pre & para aortic LN

Isthmus → Round ligament (lymphatics) → superficial inguinal LN

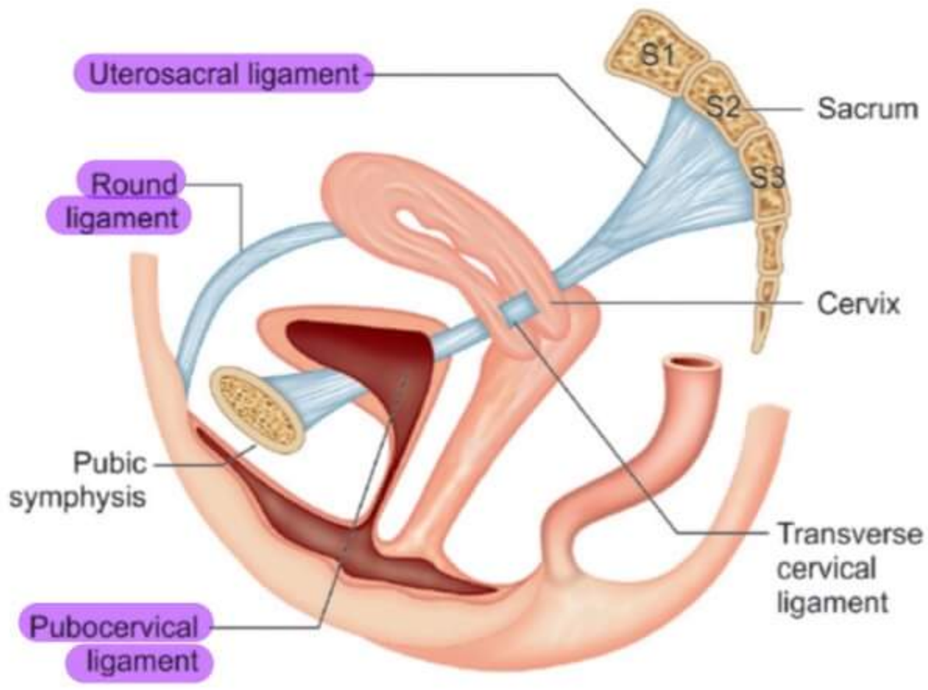




MIDUTERUS → External Iliac LN
LOWER UTERUS → Every where
(CERVIX) EXCEPT Inguinal LN (Superficial & deep)

SUPPORTS OF PELVIC VISCERA

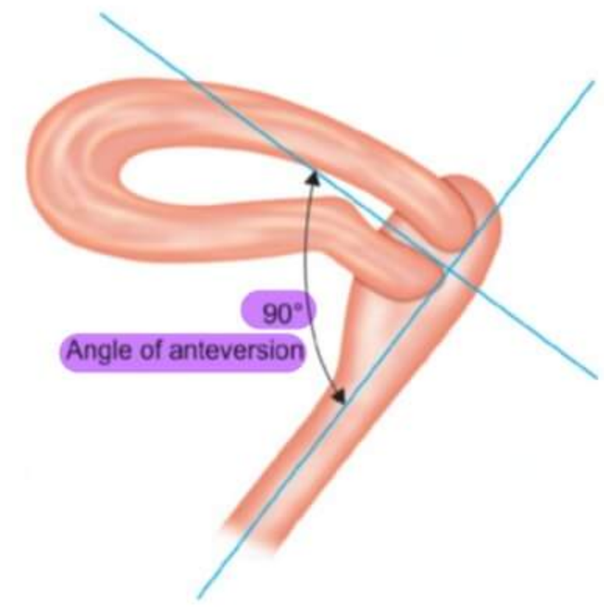
1. EXCELLENT SUPPORT
   - Pelvic Diaphragm
   - Urogenital Diaphragm
   - Perineal Body

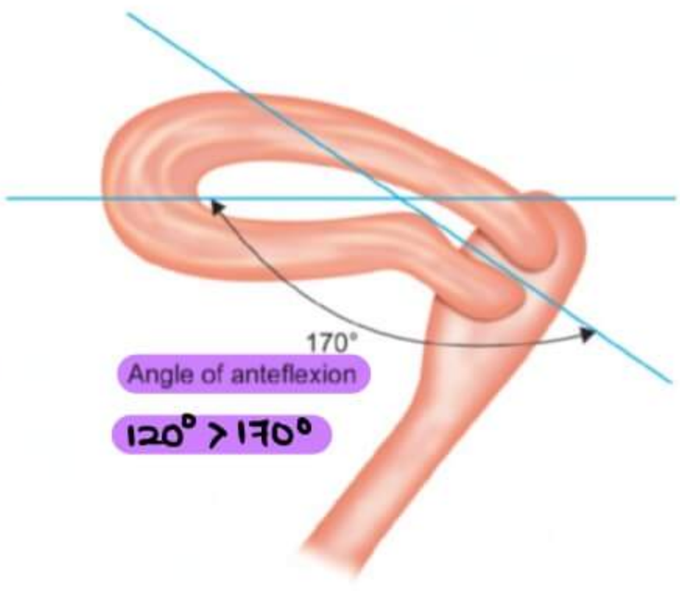


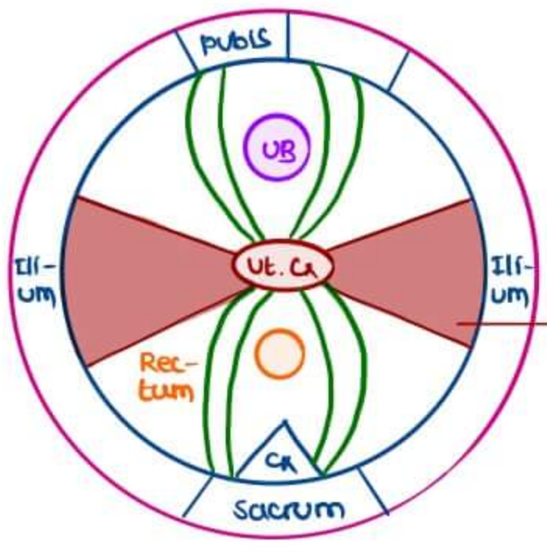
2. GOOD SUPPORT
   Pelvic fascia condensation
   - → Pubocervical Ligament (anterior)
   - → Sacrocervical Ligament (posterior)
   - → Cardinal / Lateral cervical / Mackenrodt ligament (lateral)
   - → Hypogastric Sheath → carries NVB

3. POOR SUPPORT
   Peritoneal folds
   - → Broad Ligament of Uterus
   - → Round ligament of Uterus

ANTEVERSION & ANTEFLEXION







Lat. pelvic wall
Transverse Cx ligament
OF Mackenrodt

RECTUM & ANAL CANAL

RECTUM

VALVES OF HOUSTON

→ permanent

→ contain muscle & mucosa

ANAL CANAL

→ 4cm long

Middle rectal artery → do not supply anal canal

ANORECTAL ANGLE & RING → for fecal continence

PERITONEAL FOLDS & FASCIA

→ Peritoneal fold of Ant. Abdominal wall, reflects on fundus of UB & covers Seminal vesicle & ascend upto posterior abdominal wall & covers Upper rectum

→ Nerve carrying pain from fundus of UB, Seminal vesicle & upper rectum by Lumbar Splanchnic nerve T-12, L-1,2

→ Sub peritoneal structures pain carried by Nervi Eregentes (S-2,3,4) pain felt at the opening of urethra, vagina & anal canal

DENOVILLIER'S FASCIA

→ Recto vesical fascia

→ present b/w prostate & rectum

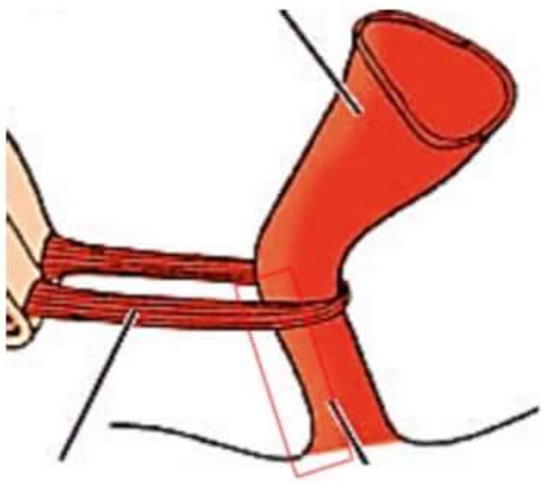
WALDEYER'S FASCIA

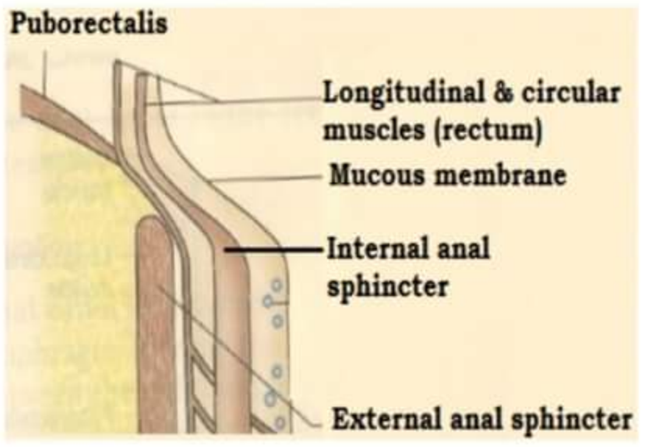
→ Pre sacral fascia (behind the rectum)

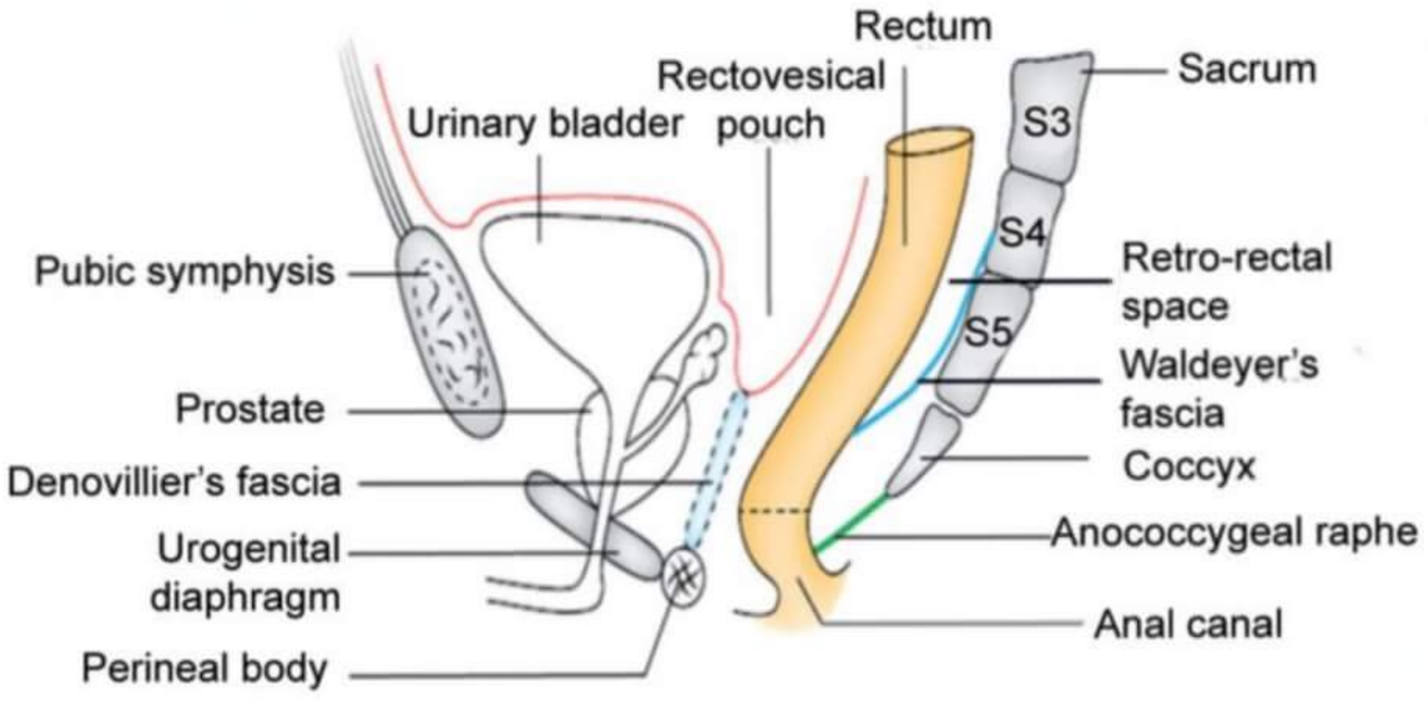
ANORECTAL RING

Q. All form anorectal ring EXCEPT

a) External sphincter
b) Internal sphincter
c) Puborectalis
d) Anococcygeal raphe







ANO RECTAL RING

→ part of puborectalis makes a sling around anorectal junctn to pull it anterior to hold fecal matter

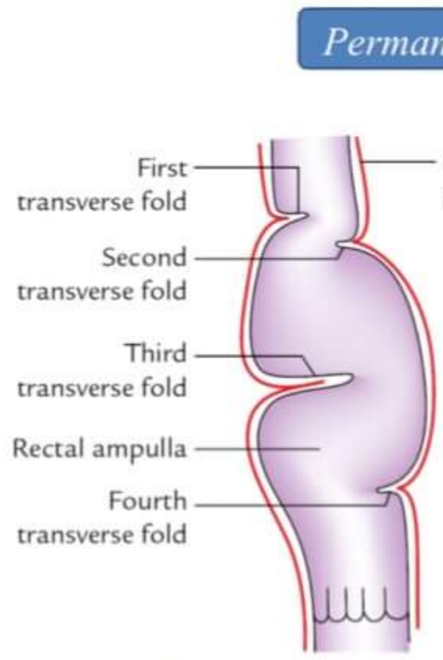
→ works along c int & ext anal sphicters forming Anorectal ring

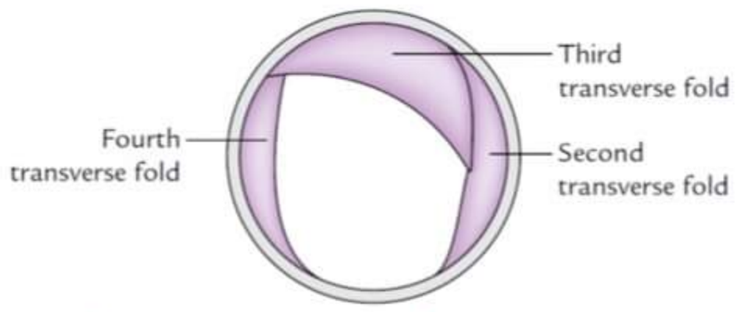
→ Longitudinal muscle of rectum continues as internal anal sphincter

ANORECTAL ANGLE → 90° > 120°

Q. Normal ano-rectal angle is

a) 70°
b) 90° (Better answer)
c) 120°
d) 150°





RECTUM

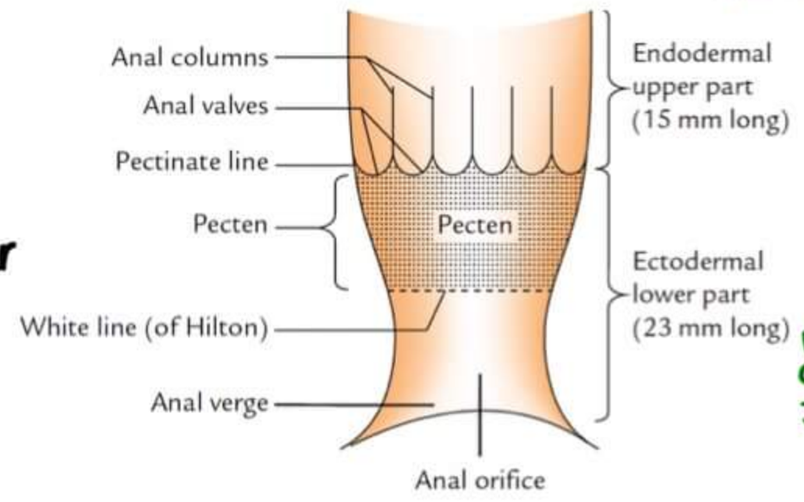
HOUSTON FOLDS

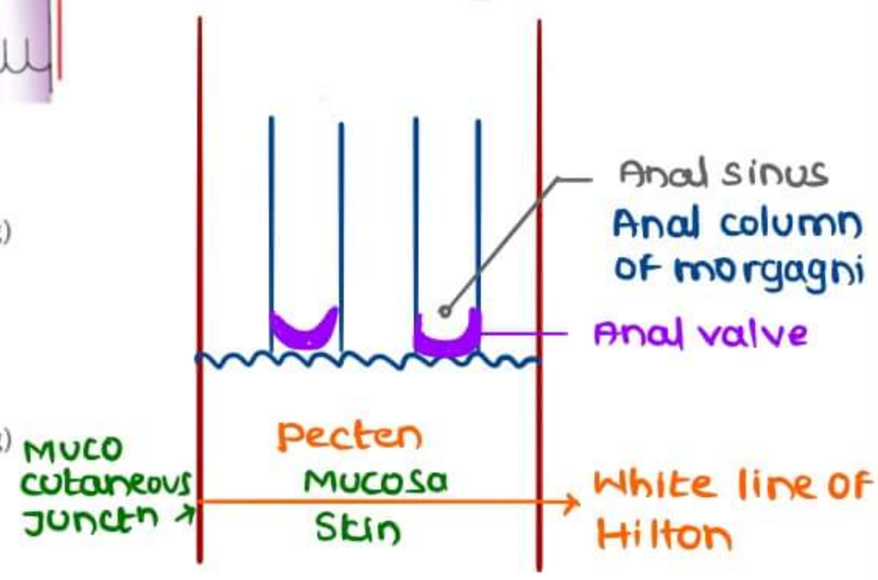
→ permanent folds

→ contains mucosa & muscle layer

→ 4 in number

→ holds fecal matter





ANAL CANAL

→ 4 cm long

→ DENTATE / PECTINATE LINE

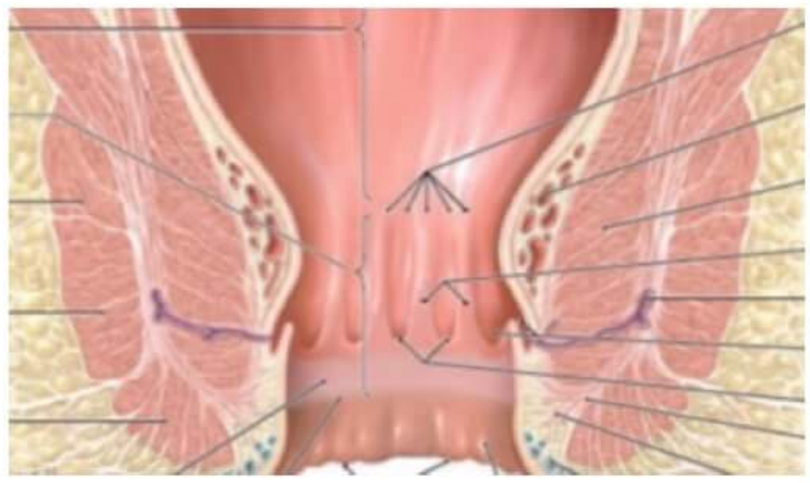
→ embryological / histological / neurological boundary line

→ teeth like dlt longitudinal folds in which anal sinuses & anal valve are present → ANAL COLUMNS OF MORGAGNI

→ WHITE LINE OF HILTON

→ mucocutaneous junctn

→ pecten is present blw Dentate line & White line of Hilton



RECTUM & ANAL CANAL : VASCULAR SUPPLY

ARTERIAL SUPPLY

SUPERIOR RECTAL ARTERY

→ supplies upper rectum
upper anal canal

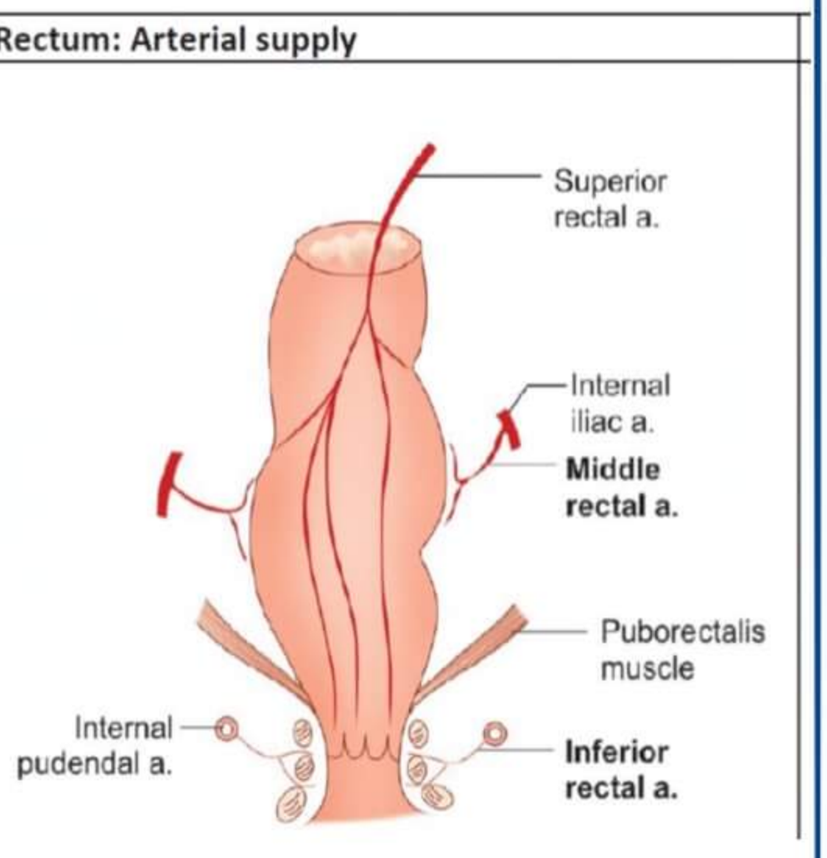
MIDDLE RECTAL ARTERY

→ supplies middle rectum

→ do not supply middle anal canal

INFERIOR RECTAL ARTERY

→ supplies inferior rectum
inferior anal canal



VENOUS SUPPLY

SUPERIOR RECTAL VEIN or HEMORRHOIDAL VEIN

→ Drains into PORTAL CIRCULATⁿ

SRV → IMV → Splenic v → PV

MIDDLE & INFERIOR RECTAL VEINS

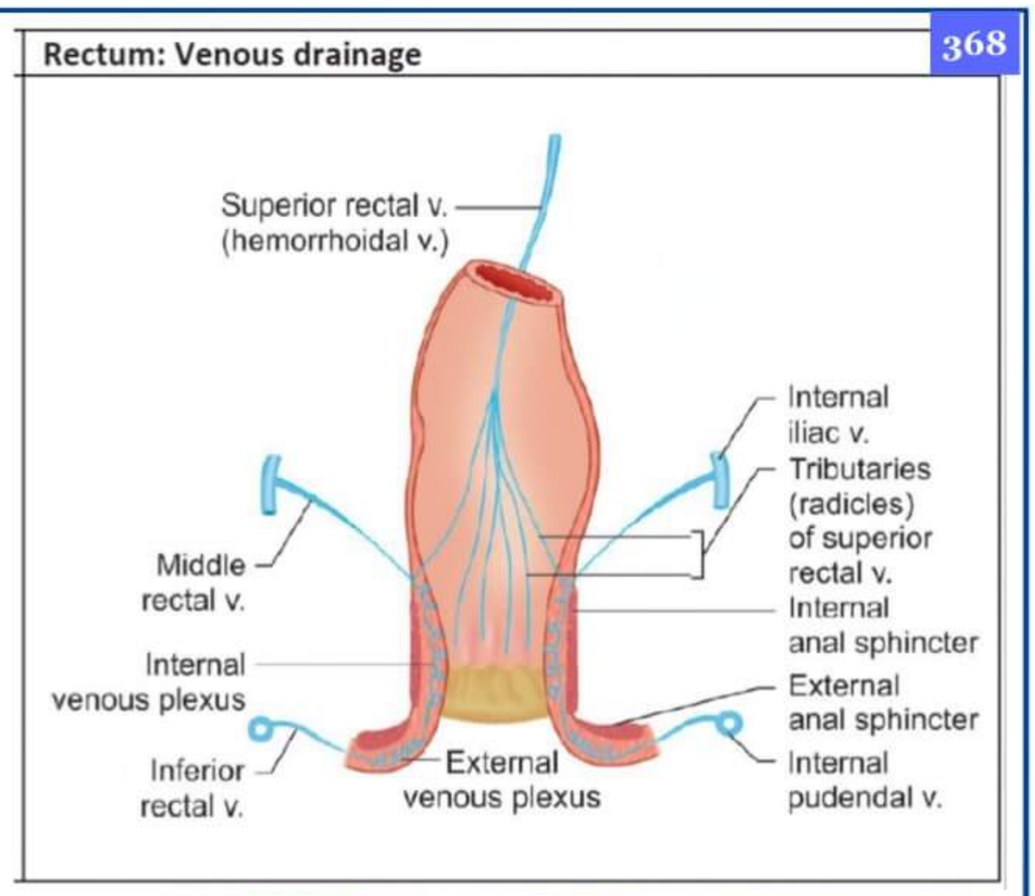
→ drains Rectum & anal canal

→ drains into Systemic circulatⁿ

drains into Iliac veins

Iliac veins drains into IVC

→ Portal & Systemic anastomoses occurs



INTERNAL HAEMORRHOIDS

→ present above the dentate line

→ painless bleeding occurs

EXTERNAL HAEMORRHOIDS

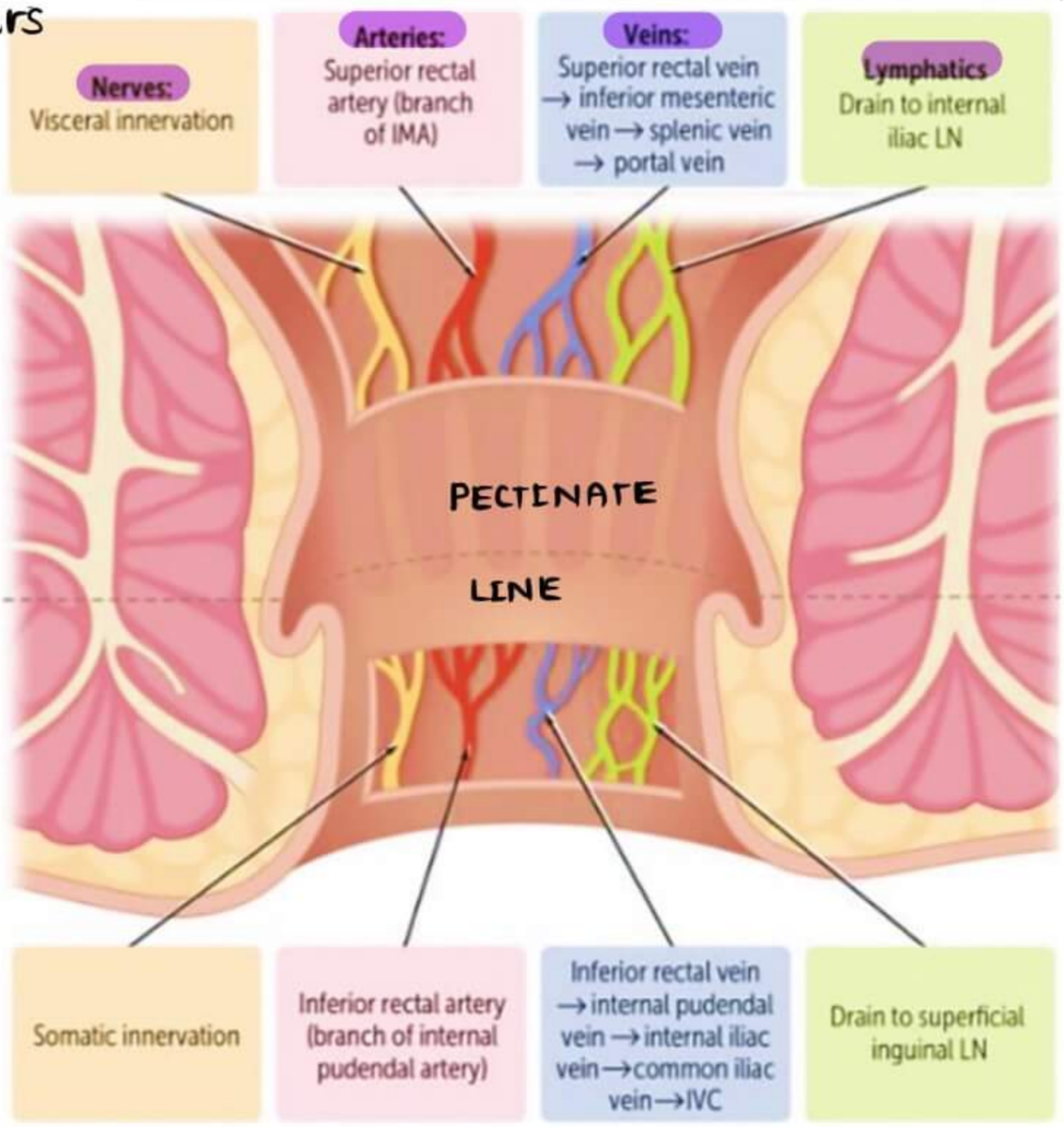
→ present below the dentate line

→ painful bleeding present

→ carried by Inf. rectal nerve

HAEMORRHOIDS

→ dilated, elongated tortuous veins



RECTUM & ANAL CANAL :

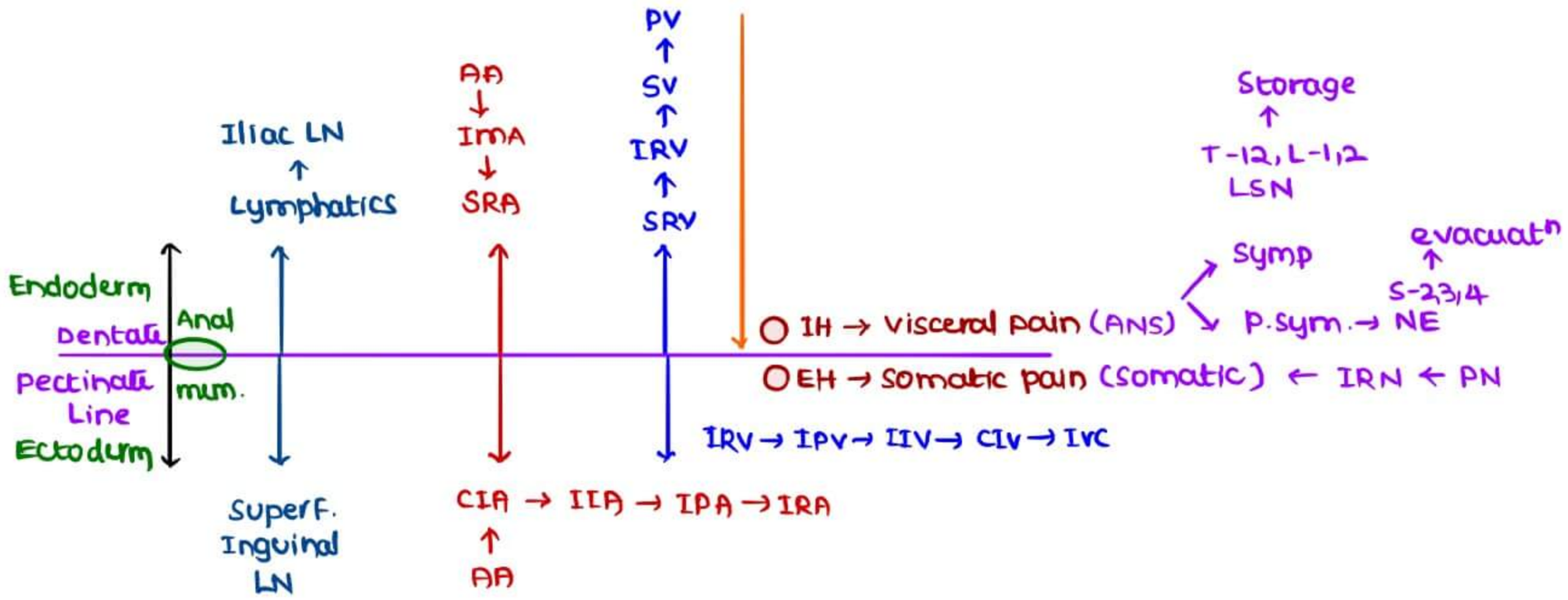
BOUNDARY LINES FOR NVB

→ Inside the pectinate line

→ Endodermal (fore gut)

→ Outside the pectinate line → Ectodermal (Proctodeum)

→ Anal membrane is fusion of Ectoderm & Endoderm



PUDENDAL CANAL contains

Int. Pudendal Artery	→	Inf. Rectal Artery
Int. Pudendal vein	→	Inf. Rectal vein
Int. Pudendal Nerve	→	Inf. Rectal Nerve
Lateral wall of IRF		Contents of Ischiorectal fossa

NERVE SUPPLY

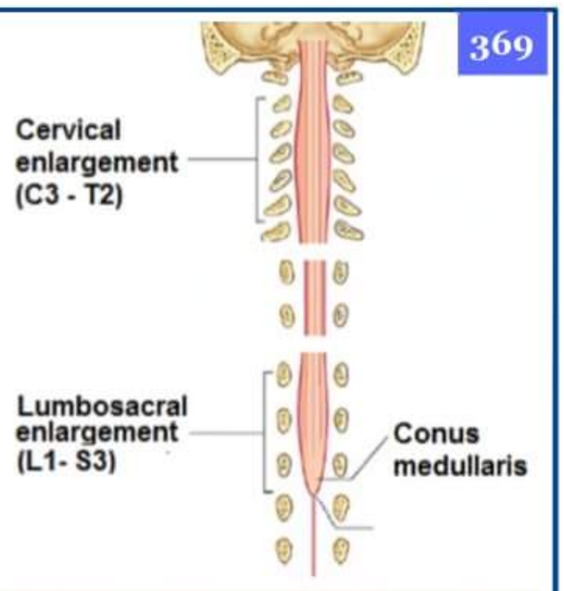
Q Root value of sciatic nerve is

a L-1,2,3,4,5

b L-2,3,4,5 ; S-1

c L-3,4,5 ; S-1,2

d L-4,5 ; S-1,2,3



LUMBO - SACRAL ENLARGEMENT

→ Root value → L-1 to S-3

LUMBAR PLEXUS

→ Ilio hypogastric nerve → L-1

→ Ilioinguinal nerve → L-1

→ Genitofemoral nerve → L-1,2

→ Obturator nerve

→ L-2,3,4

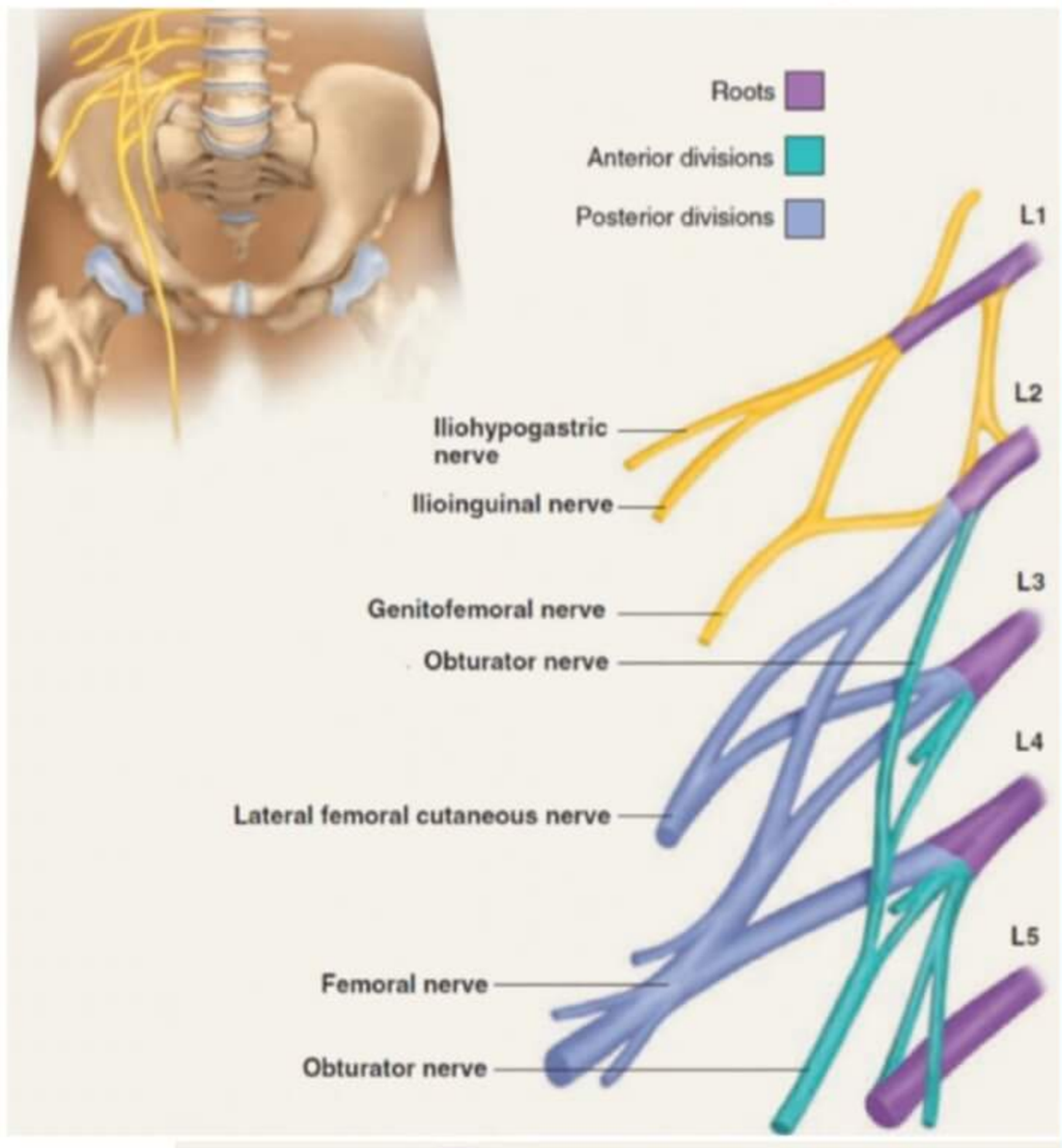
→ Ventral Division

→ FEmoral nerve

→ L-2,3,4

→ Dorsal division

→ L-2,3,4 are from anterior primary ramus



LUMBO - SACRAL PLEXUS

SCIATIC NERVE

→ Root value → L - 4,5 ; S - 1,2,3

→ passes from pelvis through the greater sciatic notch & enters the gluteal region & continues in the posterior thigh

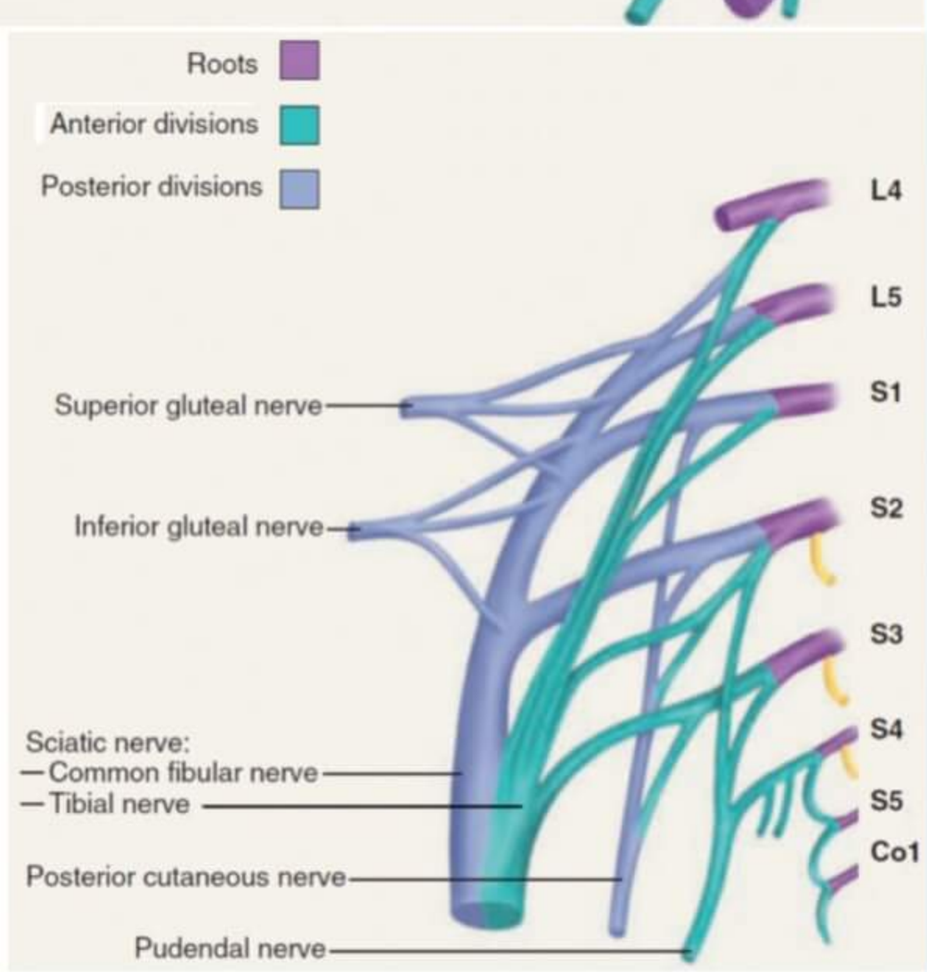
→ combined nerve

Tibial nerve (runs ↕ Tibia)

common fibular nerve (runs ↕ fibula)

→ superficial & Deep branches

→ aka common peroneal nerve



SUPERIOR GLUTEAL NERVE (L - 4,5 ; S-1)

INFERIOR GLUTEAL NERVE

→ L-5 ; S-1,2

→ Supplies gluteus maximus

PUDENDAL NERVE → S - 2,3,4

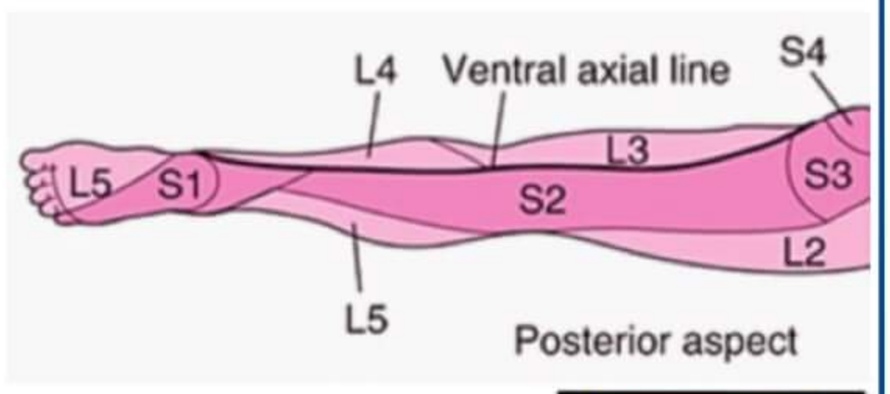
POSTERIOR CUTANEOUS NERVE OF THIGH → S - 1,2,3

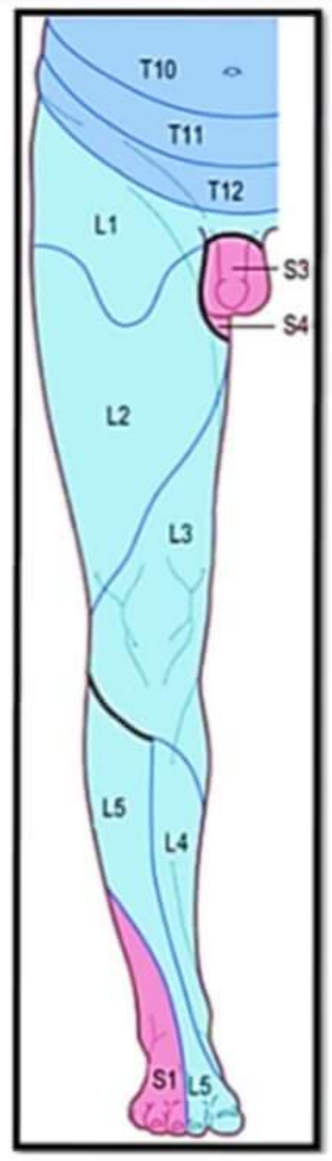
DERMATOMES

Little toe → S 1
Great toe → L 5
Lower limb → L 1 – S 1

L 1 → inguinal region
S 1 → little toe, lateral margin of foot
L 5 → dorsum of 1st web space (great toe)
→ deep saphenous nerve supplies here

L 4 → Medial malleolus
medial margin of foot
Saphenous nerve supplies here





POSTERIOR ASPECT OF THE LL

L 5 → Great toe
→ Supplied by medial plantar n.
(br. of Tibial n.)

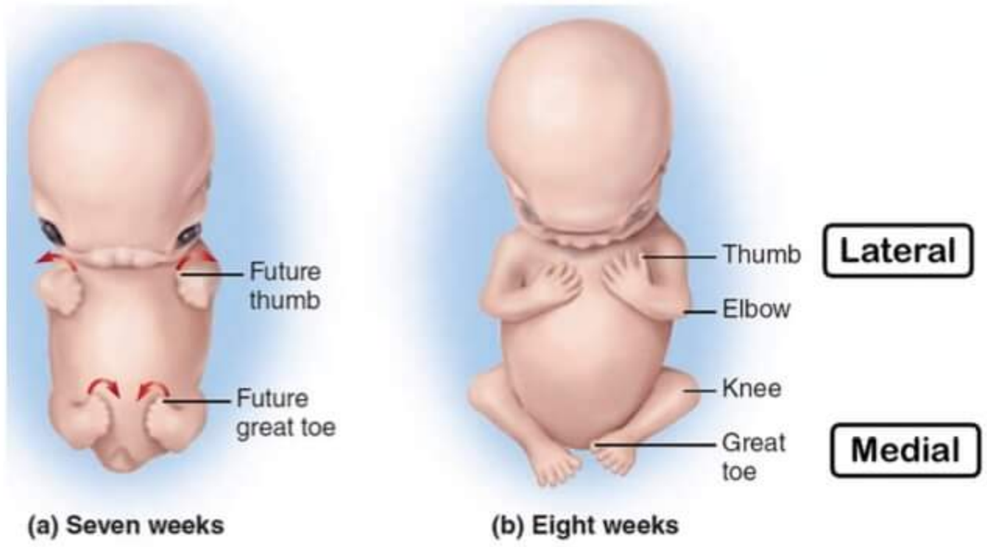
S1 → little toe & Lateral margin
→ Supplied by Lateral plantar n.
(br. of Tibial nerve)

S 2 → calf, thigh
S 2,3,4 → Pelvis perineum

LIMB ROTATION

→ UL rotate 90° laterally
Thumb will become lateral
Flexor compartment is anterior

→ LL rotate 90° medially
Great toe become medial
Flexor compartment posterior
anterior compartment is extensor
– hip extension not included



MYOTOMES

ACTION	MUSCLE	NERVE ROOT	NERVE	REFLEX
Hip flexion	Iliopsoas	L2,3	Femoral/lumbar plexus	None
Knee extension	Quadriceps	L4	Femoral	Patellar
Ankle dorsiflexion	Tibialis anterior	L5	Deep peroneal	None
Ankle plantarflexion	Gastrocnemius, soleus	S1	Tibial	Achilles
Toe plantarflexion	Flexor hallucis longus	S2	Tibial	None

THIGH MUSCLES

MUSCLES FROM LUMBAR VERTEBRA

ILIOPSOAS [ILIACUS + PSOAS MAJOR]

- Insertⁿ → Lesser trochanter of femur [along ī Iliacus]
- Action → Chief hip flexor

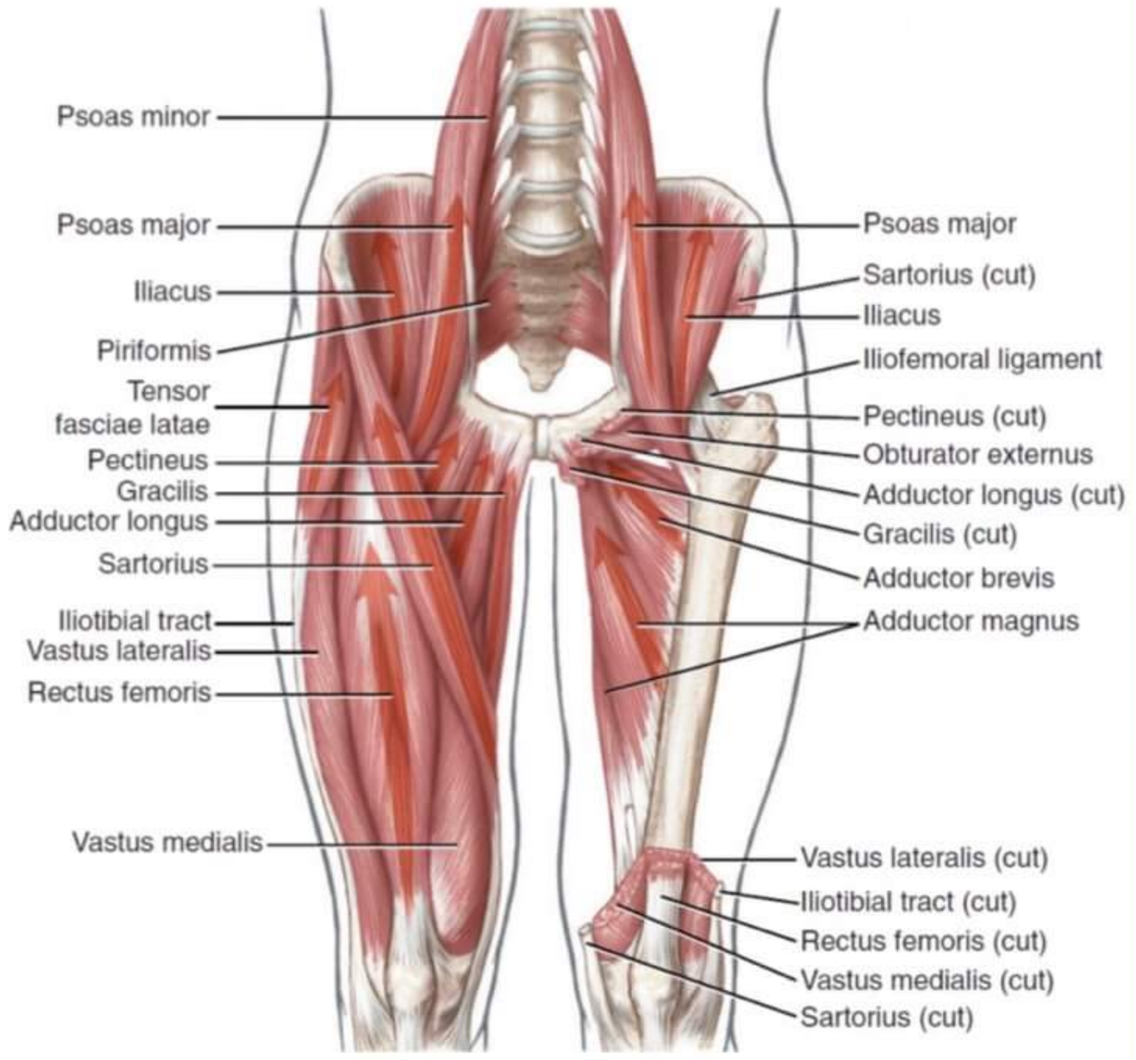
ACCESSORY MUSCLES OF HIP FLEXION

SARTORIUS

- Origin → ASIS
- Insertⁿ → Upper medial tibia
- Accessory muscle of hip flexⁿ

RECTUS FEMORIS

PECTINEUS



QUADRICERS FEMORIS

→ 4 HEADS

1. Rectus femoris
2. vastus lateralis
3. vastus medialis
4. vastus intermedius

→ Knee Extensor (pull the tibia anterior)

MEDIAL THIGH MUSCLES

→ adductors of thigh

1. Adductor longus
2. Adductor brevis
3. Adductor magnus

Muscles of the Anterior Compartment of the Thigh (Flexors of the Hip Joint)

Muscle	Innervation	Action
Pectineus	Femoral nerve (L2, L3)	Adducts and flexes the thigh Assists in medial rotation of the thigh
Psoas major	Anterior rami of L1, L2, L3	Flexes the thigh
Psoas minor	Anterior rami of L1, L2	Flexes the thigh
Iliacus	Femoral nerve (L2, L3)	Flexes the thigh
Sartorius	Femoral nerve (L2, L3)	Flexes, abducts, and laterally rotates the thigh Flexes the leg

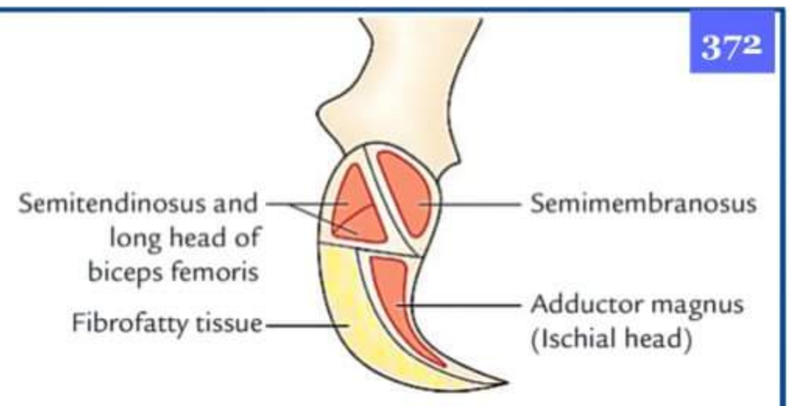
POSTERIOR THIGH MUSCLES

HAMSTRING MUSCLES

1. Adductor magnus (post. part)
2. Biceps femoris (long head)
3. Semitendinosus
4. Semimembranosus

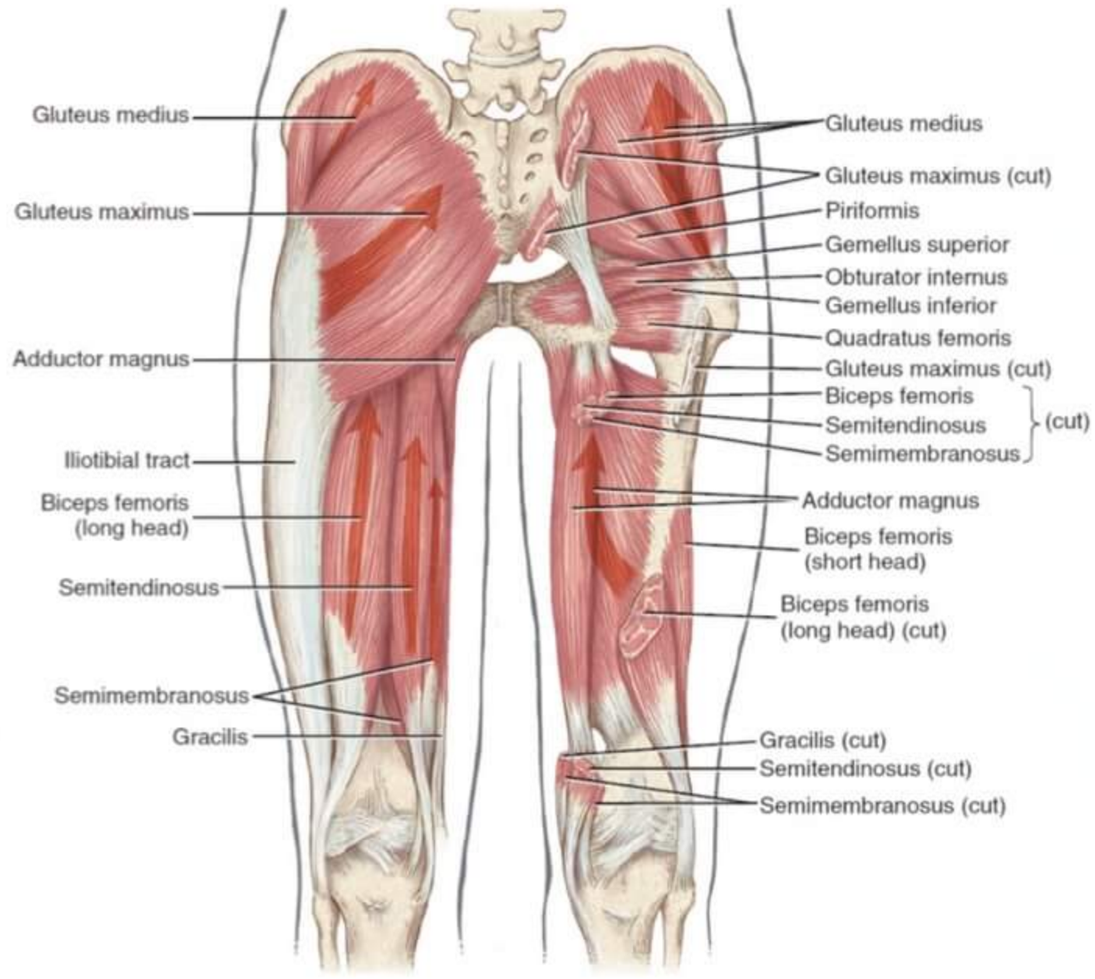
Origin → ischial tuberosity on hip bone

- Infero medial → fibrofatty tissue
- Infero lateral → Adductor magns (post. part)
- Supero lateral → semimembranosus
- Supero medial → Biceps femoris (long head)
  semitendinosus



Insertn

Tibia bone except biceps femoris
Lateral head of fibula (biceps femoris)



POPLITEAL FOSSA

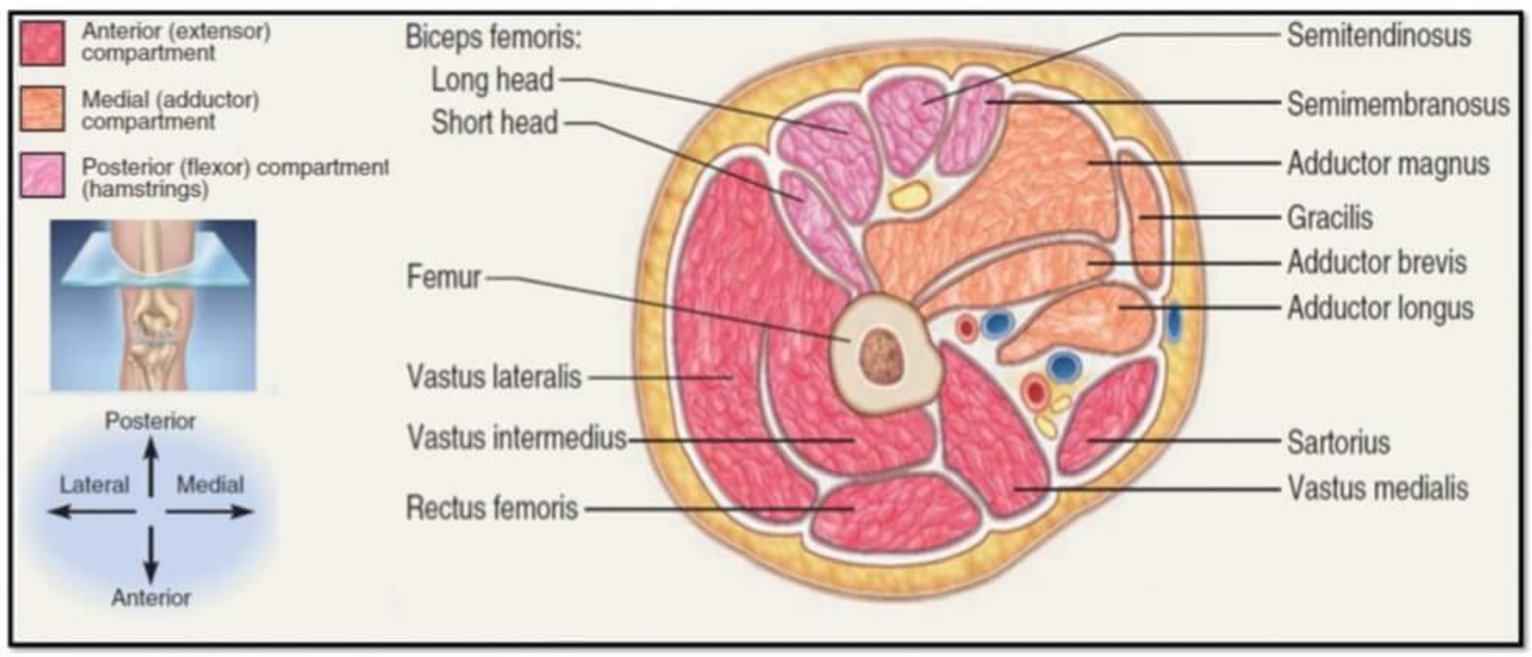
→ present behind the knee joint
→ Boudaries
  - Superolateral → Biceps femoris
  - superomedial → adductor magnus
    semitendinosus
    semimembranosus

ACTION

1. Knee flexion
   → Quadriceps femoris (knee extensors). Hamstring muscles (knee flexors) are antagonistic muscles

2. Hip Extension
   → chief muscle → Gluteus maximus
   → Accessory muscles → Hamstring muscles

THIGH MUSCLES TRANSVERSE SECTION



Muscles of the Medial Compartment of the Thigh (Adductors of the Thigh)

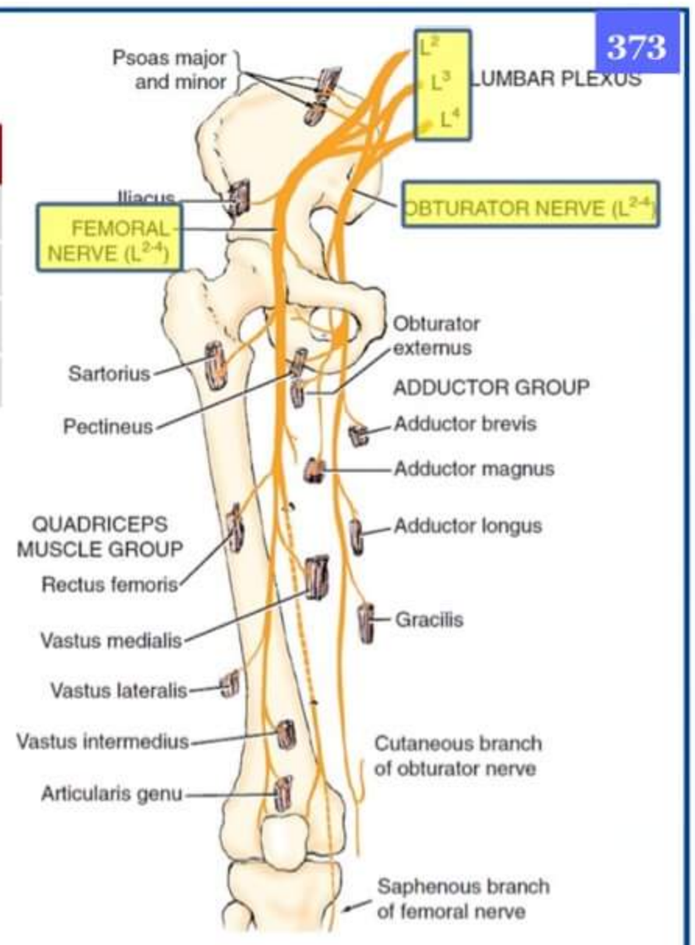
Muscle	Innervation	Action
Adductor longus	Obturator nerve (L2, L3, L4)	Adducts the thigh
Adductor brevis	Obturator nerve (L2, L3, L4)	Adducts the thigh
Adductor magnus	Obturator nerve (L2, L3, L4) Tibial part of sciatic nerve (L4)	Adducts the thigh Adductor part: Flexes the thigh Hamstring part: Extends the thigh
Gracilis	Obturator nerve (L2, L3)	Adducts the thigh Flexes the leg
Obturator externus	Obturator nerve (L3, L4)	Laterally rotates the thigh

Muscles of the Anterior Compartment of the Thigh (Extensors of the Knee Joint)

Muscle	Innervation	Action
Rectus femoris	Femoral nerve (L2, L3, L4)	Extends the leg
Vastus lateralis	Femoral nerve (L2, L3, L4)	Extends the leg
Vastus medialis	Femoral nerve (L2, L3, L4)	Extends the leg
Vastus intermedius	Femoral nerve (L2, L3, L4)	Extends the leg

Muscles of the Posterior Compartment of the Thigh (Extensors of the Hip Joint and Flexors of the Knee Joint)

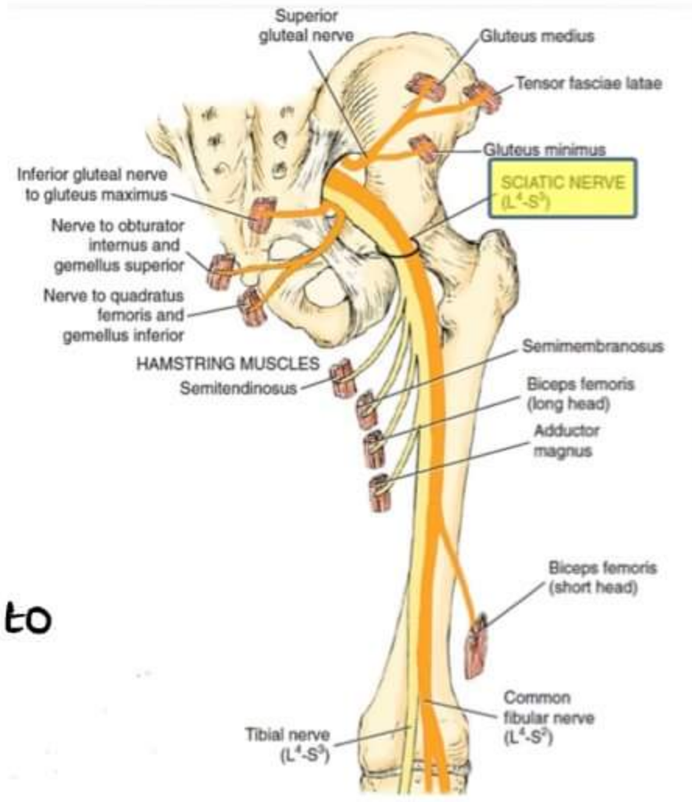
Muscles	Innervation	Action
Semitendinosus	Tibial part of sciatic nerve (L5, S1, S2)	Extends the thigh Flexes the leg Medially rotates the flexed leg
Semimembranosus	Tibial part of sciatic nerve (L5, S1, S2)	Extends the thigh Flexes the leg Medially rotates the flexed leg
Biceps femoris	Long head: Tibial part of sciatic nerve (L5, S1, S2) Short head: Common fibular part of sciatic nerve (L5, S1, S2)	Flexes the leg Laterally rotates the flexed leg



NERVE SUPPLY: THIGH MUSCLES

Obturator nerve

- → L - 2, 3, 4
- → Ventral Division
- → passes obturator foramen & comes to medial thigh & supply Adductors
- → nerve of adduction (except for obturator externus)

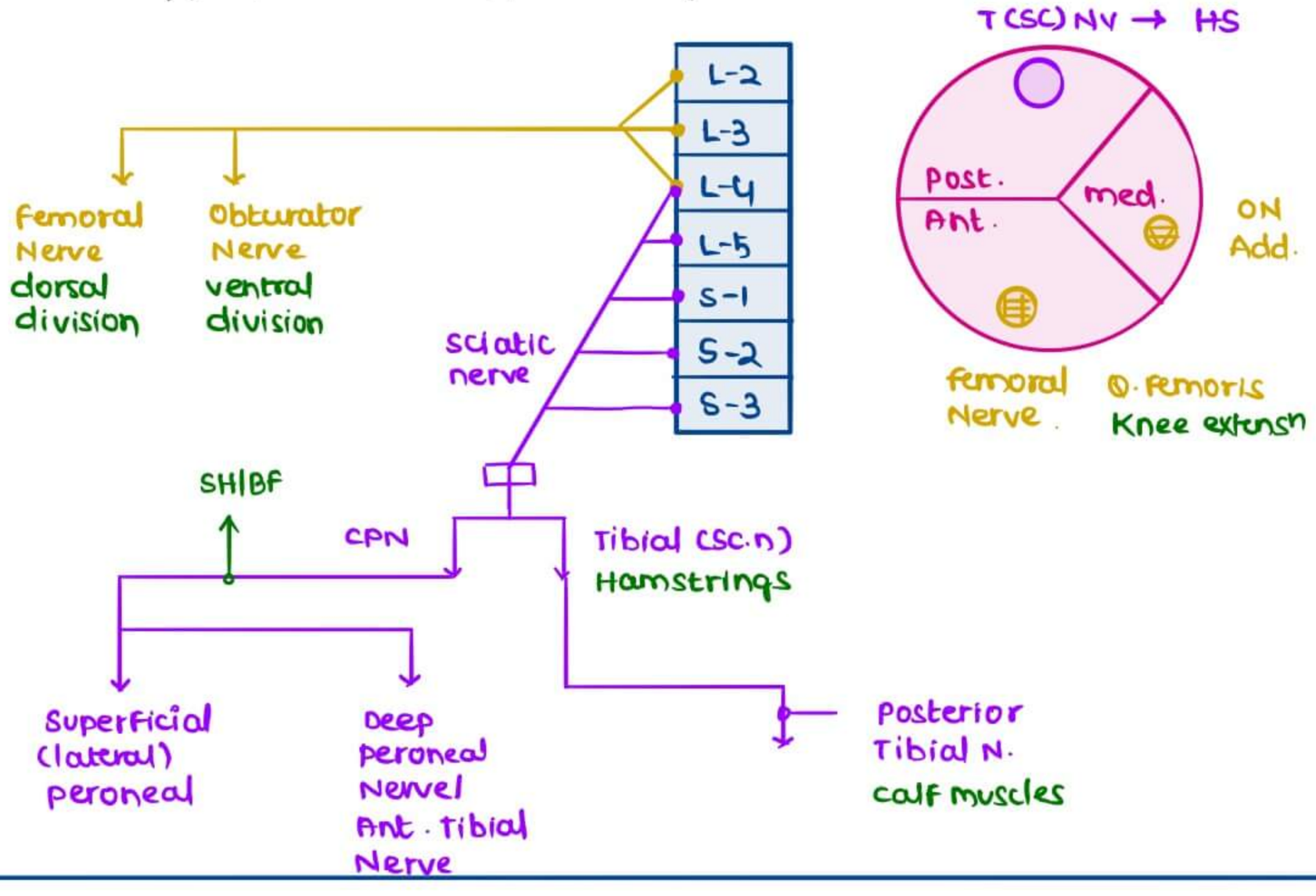


FEmoral nerve

- → L- 2, 3, 4
- → Dorsal division
- → Supply the muscle of ant. thigh (Quadriceps femoris)
- → Nerve of knee extension

SCIATIC NERVE

- → comes from pelvis, passes great sciatic notch, comes to gluteal region runs in posterior thigh & divides into
  1. Tibial nerve → supplies hamstrings
  2. common fibular nerve
     - → divides into superficial peroneal nerve & deep peroneal nerve
     - → supplies short head of biceps



Q Rectus femoris is a part of quadriceps femoris causes
a Hip flexion & knee extension
b Hip & knee flexion
c Hip & knee Extension
d Hip extension & knee flexion

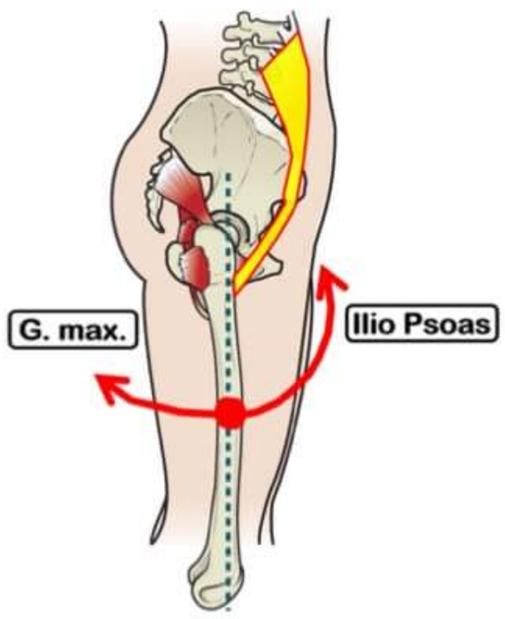
RECTUS FEMORIS

1st Action → knee extension
2nd Action → Hip flexion (↑ iliopsoas)

GENERAL RULE

Any muscle which cross hip joint anterior, pull the femur anterior cause FLEXION
Any muscle which cross hip joint posterior, pull the femur posterior cause EXTENSN

Gluteus muscle → chief muscle of hip extension
Iliopsoas → chief muscle of hip flexion



Hip flexion is a high range movement (180°)
Hip Extension is a limited movement
→ Ilio Femur ligament of Bigelow
→ strongest ligament of human body
→ prevents hyper extension

HIP	
POSTERIOR (EXTENSION) Gluteus maximus Hamstring muscles (accessory) - chief actn → knee flexion	ANTERIOR [FLEXION] Ilio psoas Rectus femoris Sartorius Pectineus } Accessory

Q which of the following muscle is involved in movement from sitting to standing position (squats)
a Gluteus maximus
b Obturator internus
c Gluteus medius
d Gluteus minimus

Q Biceps femoris, a hamstring muscle causes
a Hip flexion & knee extension
b Hip & knee flexion
c Hip & knee extension
d Hip extension & knee flexion

HIP JOINT MOVEMENTS

ABDUCTORS

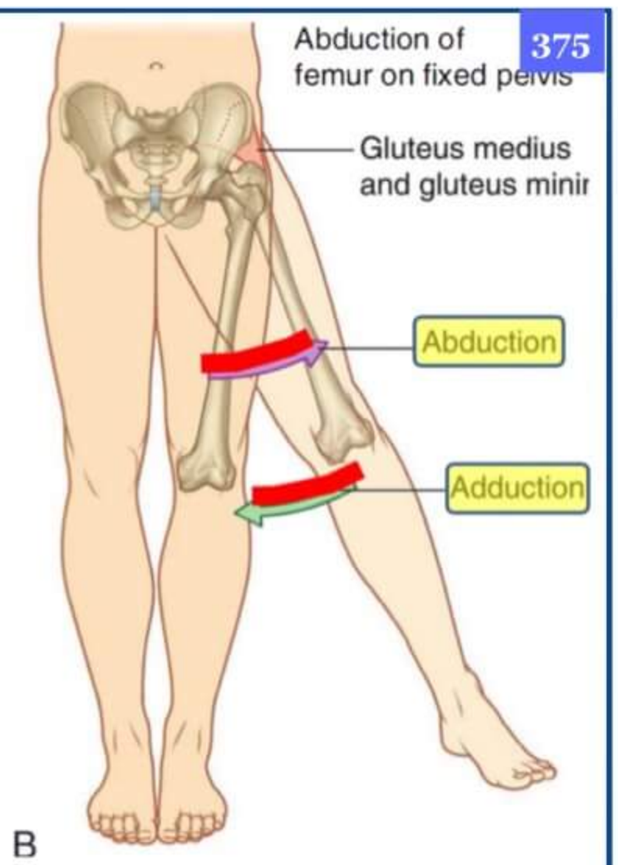
TRIO MUSCLES

1. Gluteus medius
2. Gluteus minimus
3. Tensor fascia lata

→ Supplied by Superior Gluteal nerve (L5, S1

→ ACTIONS

1. Hip abduction
2. Medial rotation of hip joint
3. Walking



HIP	
ADDUCTION	ABDUCTION
Adductor brevis Adductor longus Adductor magnus → medial thigh muscles → Supplied by obturator N (L-2,3,4) → In case of L5 root compression, → Hip adduction not affected → Hip abduction Compromised	Gluteus medius Gluteus Minimus Tensor fascia lata

MUSCLES OF GLUTEAL REGION

Q. Muscle attached to lateral surface of greater trochanter (NBEP-2014)

a) Gluteus maximus
b) Gluteus medius
c) Gluteus minimus
d) Piriformis

GLUTEUS MAXIMUS

→ posterior muscle

→ INSERTION → Gluteal tuberosity OF femur

→ Tibia (ILIO TIBIAL TRACT) (some fibres)

GLUTEUS MEDIUS

→ INSERTn → lateral surface OF Greater trochanter

→ middle

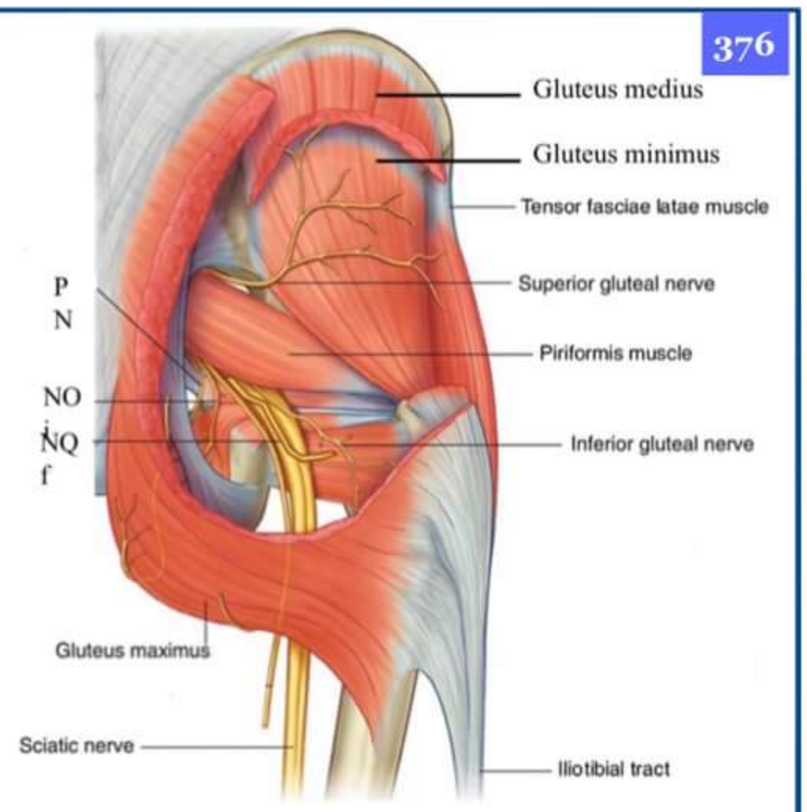
GLUTEUS MINIMUS

→ Insertn → Anteriorly On Greater trochanter

→ anterior

TRIO MUSCLES

1. Gluteus medius
2. Gluteus minimus
3. Tensor fascia latae (most anterior)
   → Insertn → Girdy's tubercle of tibia (Iliotibial tract)



→ Superior Gluteal nerve supplies Trio muscles
   → came from pelvis, passes through Greater Sciatic notch above the piriformis muscle
   → Piriform muscle
      → coming from anterior aspect of Sacrum bone passing through greater Sciatic notch & inserted on tip of greater trochanter
      → pulls the femur laterally → Lateral rotator of femur

→ Gluteus medius & minimus, medially rotates the femur

Inferior gluteal nerve
→ comes from great Sciatic notch, below the piriformis
→ Supplies Gluteus maximus

Sciatic nerve
→ comes from pelvic region to Gluteal region & then to posterior thigh region

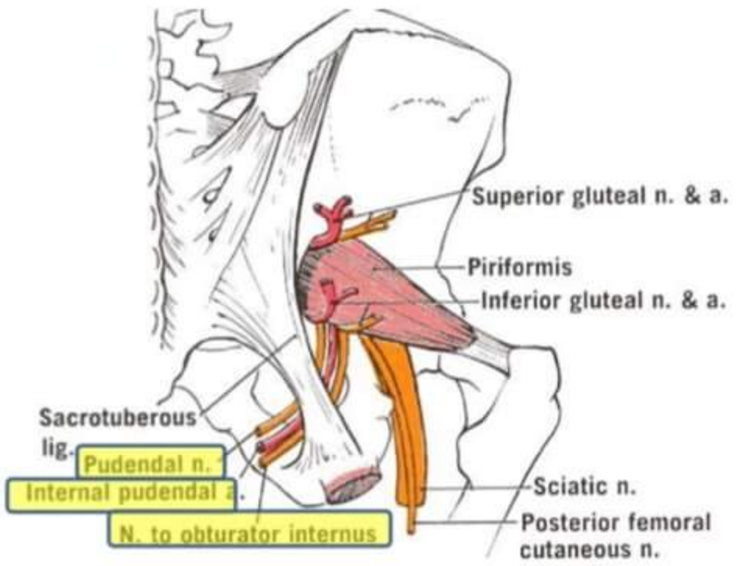
GREAT SCIATIC NOTCH

STRUCTURES PASSING FROM GREATER TO LESSER SCIATIC NOTCH

P → Pudendal nerve
I → Internal pudendal vessels
N → Nerve to obturator internus

TENDON OF OBTURATOR INTERNUS

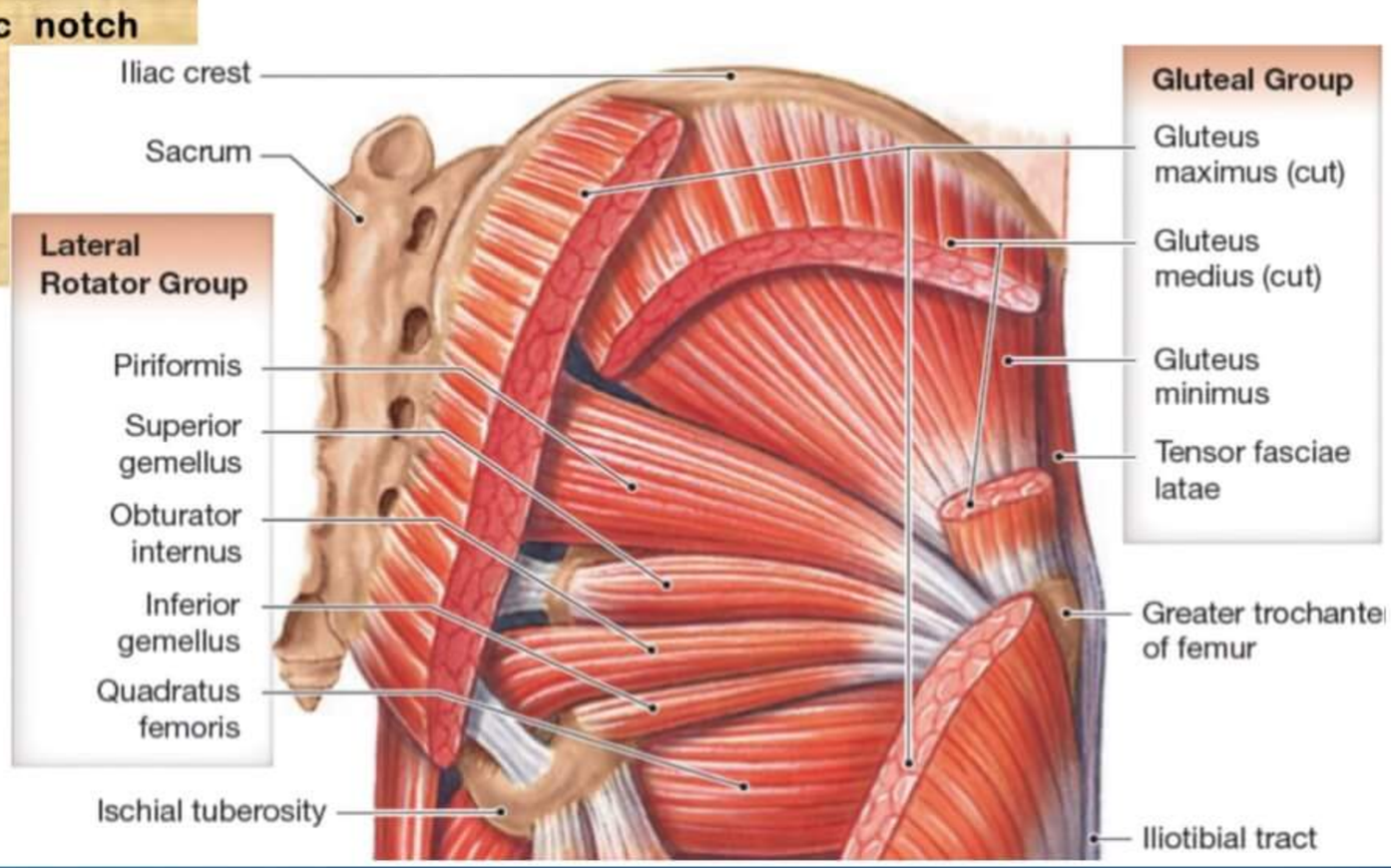
→ present in lesser Sciatic notch
→ Follow PIN structures in lesser sciatic notch **PIN**



SUPERIOR GLUTEAL NERVE → Supplies TRIO muscles

Q. Injury to nerve which passes superior to piriformis and winds around greater sciatic notch paralyzes (NBEP- 2013)

a) Gluteus medius
b) Gluteus maximus
c) Obturator internus
d) Piriformis



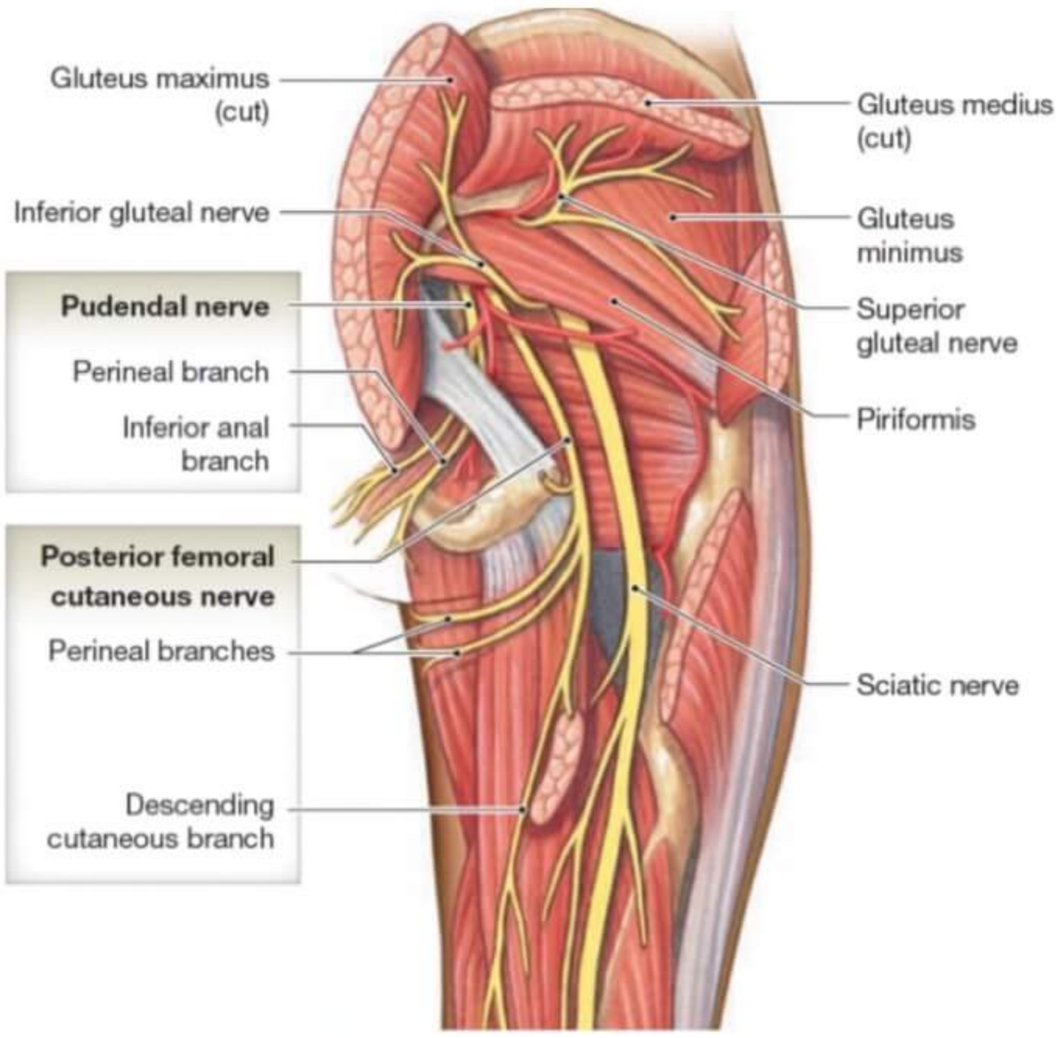
Piriformis
Obturator internus
Sup & Inf. Gemelli
} Lateral Rotators of Hip

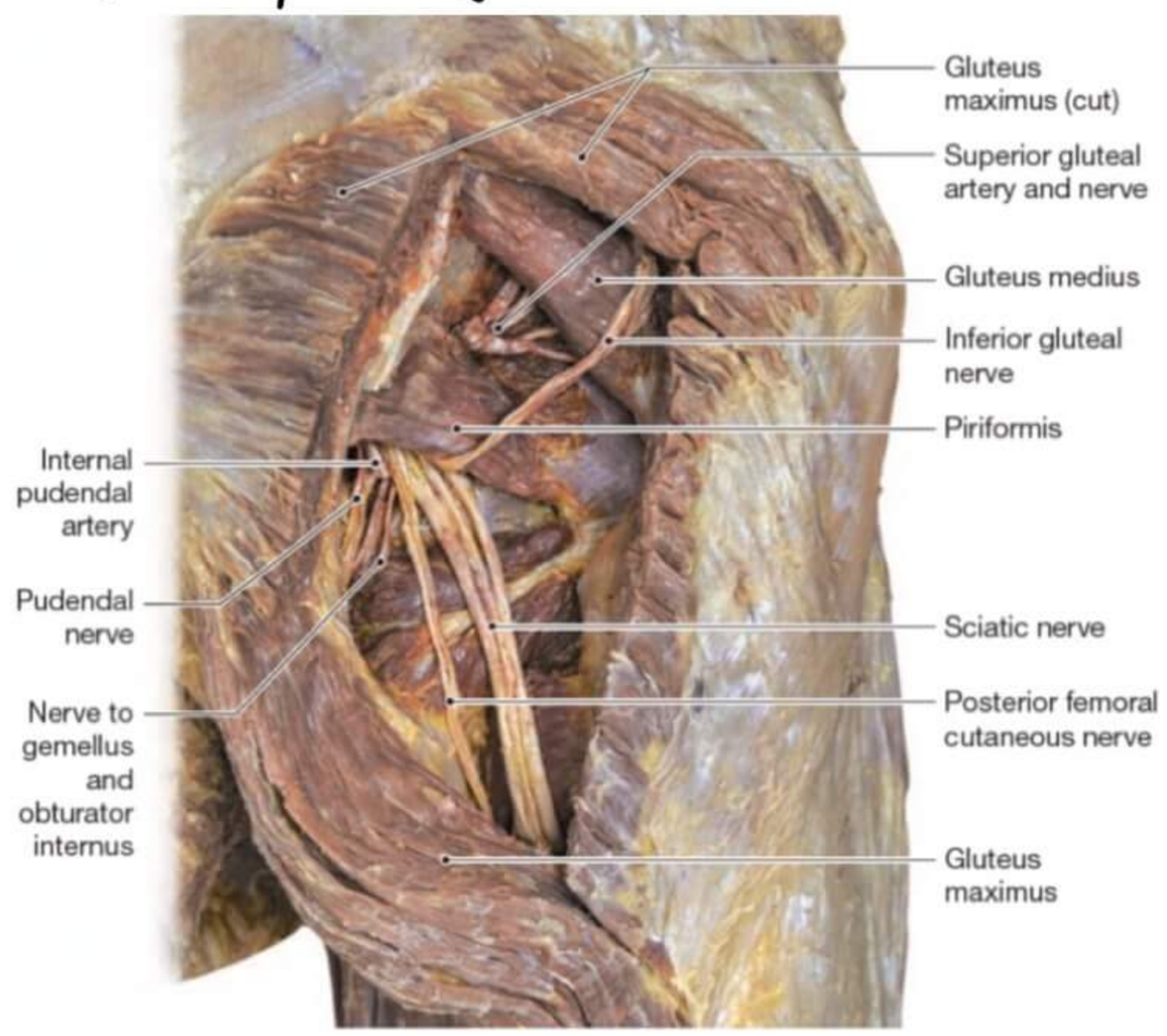
Gluteus medius
Gluteus minimus
} Medial Rotators of Hip

TWIN MUSCLES

→ Superior & Inferior Gemellus

→ sandwiches obturator internus after passing through lesser sciatic notch





Muscles of the Gluteal Region (Abductors and Rotators of the Thigh)

Muscle	Innervation	Action
Gluteus maximus	Inferior gluteal nerve (L5, S1, S2)	Extends the thigh(especially from a flexed position) Assists in lateral rotation of the thigh Assists in rising from a sitting position
Gluteus medius	Superior gluteal nerve (L5, S1)	Abducts and medially rotates the thigh
Gluteus minimus	Superior gluteal nerve (L5, S1)	Abducts and medially rotates the thigh
Tensor of fascia lata	Superior gluteal nerve (L5, S1)	Abducts and medially rotates the thigh
Piriformis	Branches of anterior rami S1, S2	Laterally rotates extended thigh Abducts flexed thigh
Obturator internus	Nerve to obturator internus (L5, S1)	Laterally rotates extended thigh Abducts flexed thigh
Superior gemellus	Nerve to obturator internus (L5, S1)	Laterally rotates extended thigh Abducts flexed thigh
Inferior gemellus	Nerve to quadratus femoris (L5, S1)	Laterally rotates extended thigh Abducts flexed thigh
Quadratus femoris	Nerve to quadratus femoris (L5, S1)	Laterally rotates the thigh

QUADRATUS FEMORIS

→ quadrangular muscle

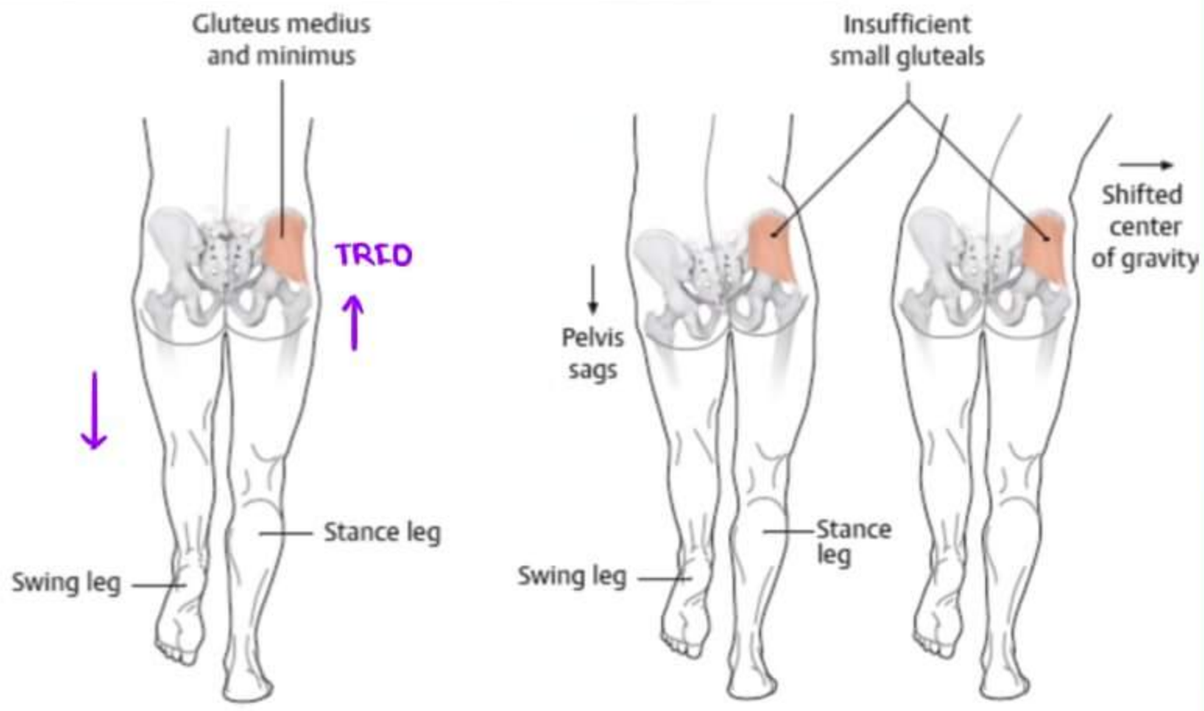
→ insertion → Femur

TRIO MUSCLES → ACTIONS

1. Abduction
2. Medial Rotation
3. Stabilize the pelvis (pulls the hip bone up against gravity on other side)

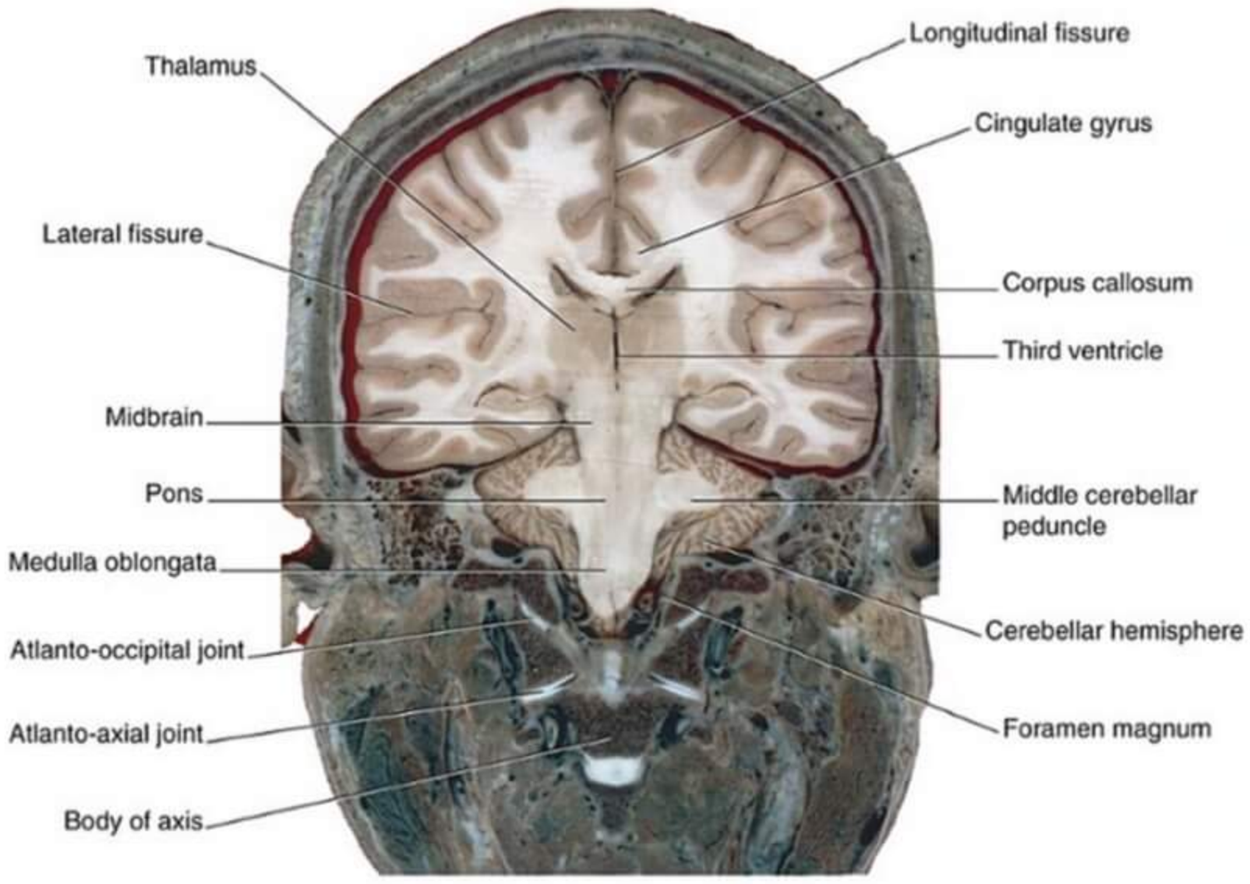
If Trio muscles not working properly, then

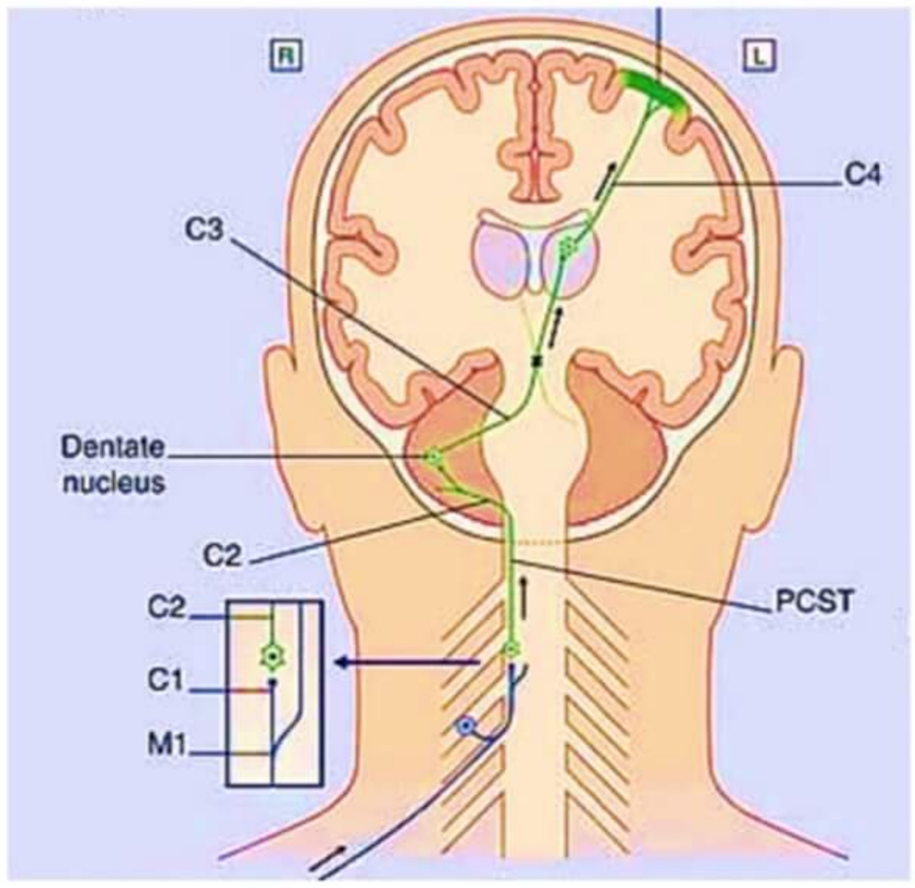
1. Trendelenburg test ⊕
2. Limb length (on gravity side) is more
3. Lurching gait (on affected side)



Q. In walking, gravity tends to tilt pelvis and trunk to the unsupported side, major factor in preventing this unwanted movement is

a) Adductor muscles
b) Quadriceps
c) Gluteus maximus
d) **Gluteus medius and minimus**



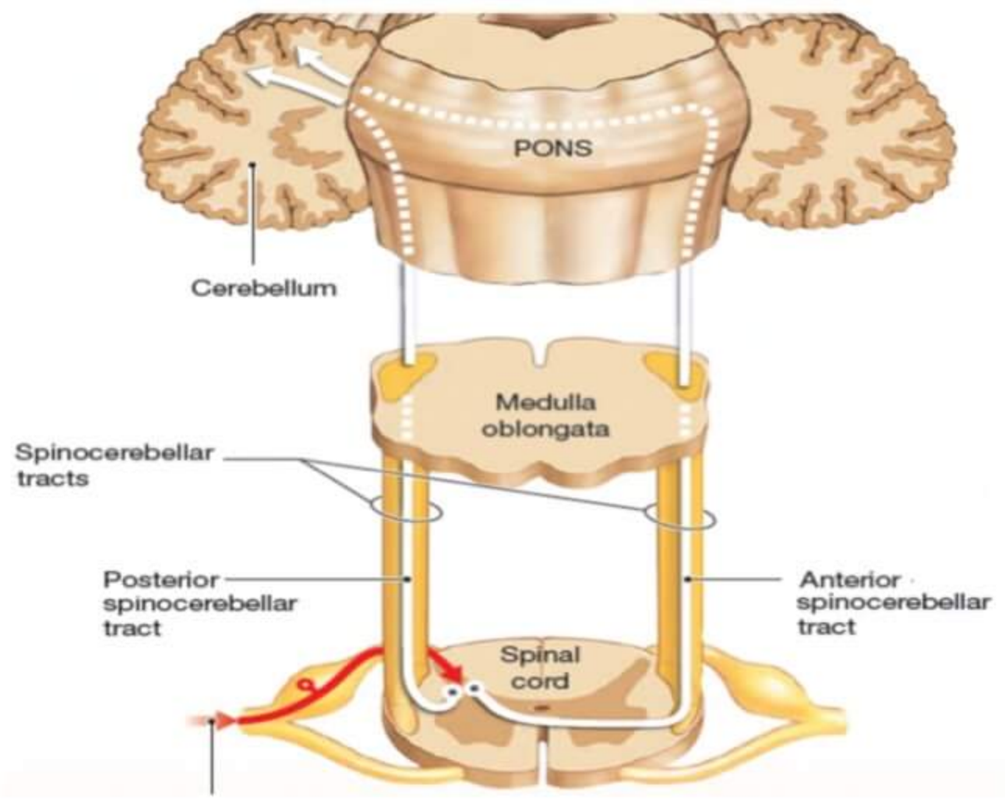


Coronal section – Front view

Middle cerebellar peduncle carries → Ponto cerebellar tract
Superior cerebellar peduncle carries → Dentato Thalamic tract
Inferior cerebellar peduncle carries → Spino cerebellar tract

CEREBELLAR PATHWAYS

→ Rt. LL moving
↓
Rt. dorsal Spinocerebellar tract activated
↓
Position sense carried towards rt. cerebellum
↓
Cerebellum communicates i C/L Thalamus via Dentato Thalamic tract
↓
Thalamus communicates i left cerebrum
↓
Rt. LL moved by Lt. cerebrum 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 in cerebellum and reaches ipsilateral cerebellum

→ Dorsal spinocerebellar tract uses inferior peduncle & reaches I/L cerebellum

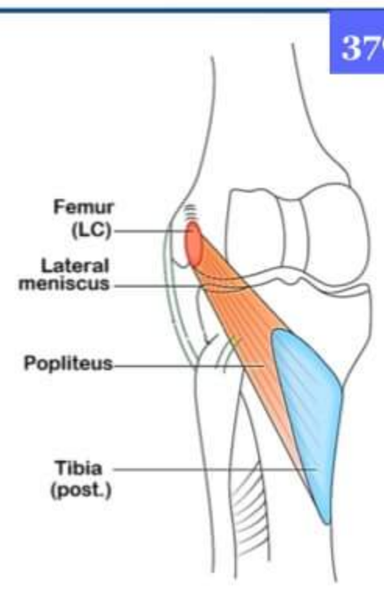
→ ventral Spinocerebellar tract uses superior peduncle & reaches C/L cerebellum but RECROSSING occurs & reaches I/L cerebellum again

CEREBELLAR LESIONS CAUSES IPSILATERAL MANIFESTATIONS

POPLITEUS

Q. All are true about popliteus EXCEPT (NBEP-2013)

a) Flexes the knee
b) Unlocks the knee
c) Inserted on medial meniscus
d) Is intracapsular



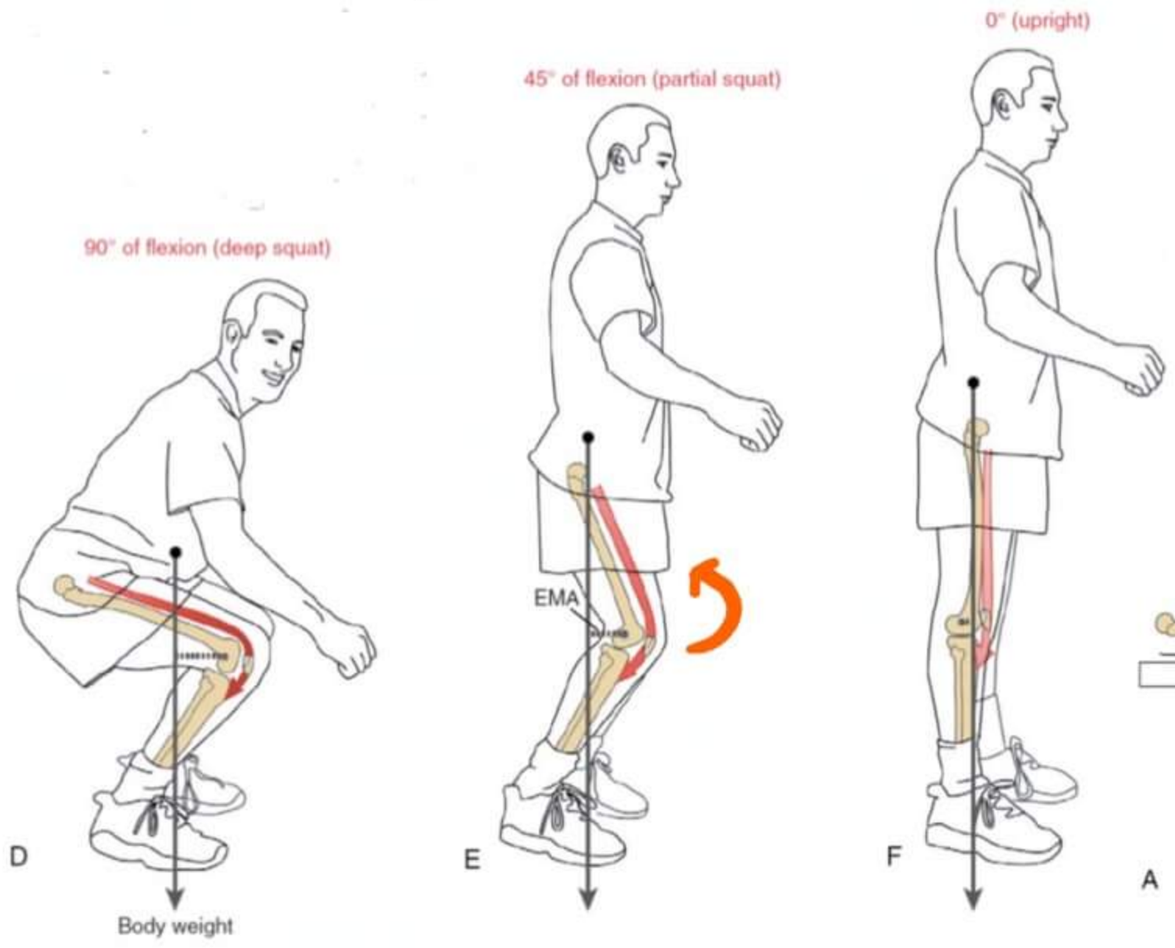
→ Intra capsular origin (also long head of biceps brachii)
→ comes from lateral femoral condyle & runs in floor of popliteal fossa & inserts on posterior aspect of upper tibia

→ medial meniscal injuries are more common than lateral meniscal injuries
  → medial meniscus do not have popliteus like muscle which can pull it out from injury & also less mobile

KNEE JOINT

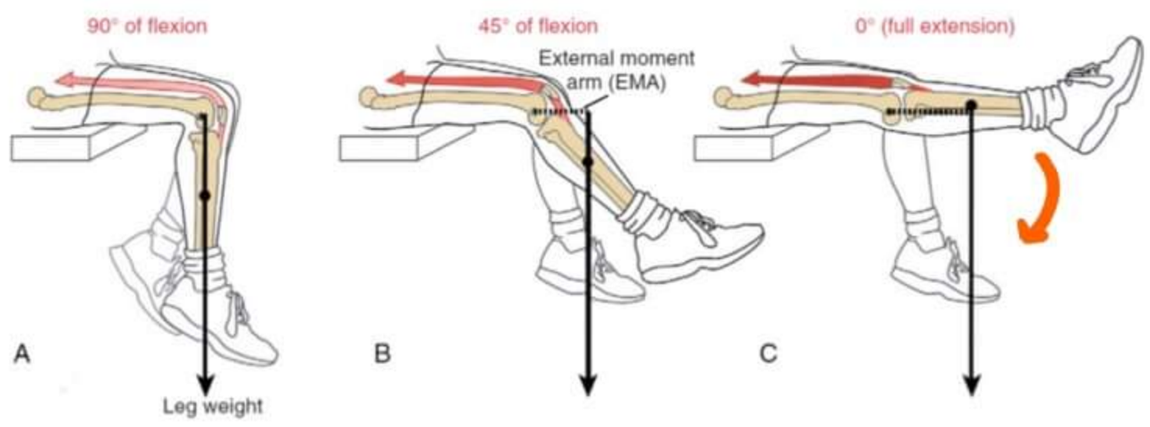
LOCKING

→ Full knee extension while standing straight or sitting & extending the knee fully
→ In last stages, femur rotates medial & knee gets locked (while standing)
→ In sitting & knee locking tibia rotates lateral in last stages



→ when foot fixed, femur medially rotated

→ when foot is free, tibia laterally rotated (tibial tuberosity moves to lateral border of patella)



→ Quadriceps femoris continued action helps in knee locking

Q. Physiological locking involves (UPPG; NBEP 2013)

a) Internal rotation of femur over stabilized tibia (Better answer)
b) Internal rotation of tibia over stabilized femur
c) External rotation of tibia over stabilized femur
d) External rotation of femur over stabilized tibia

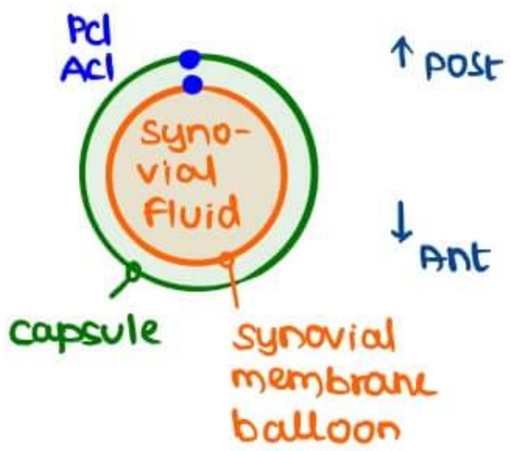
Q. A healthy young athlete sitting at table with knee at 90 degree flexion. What will happen when he fully extends the knee (AIIMS)

a) Movement of tibial tuberosity towards lateral border of patella
b) Movement of tibial tuberosity towards medial border of patella
c) Movement of tibial tuberosity towards centre of patella
d) No change in relationship

KNEE JOINT

ANTERIOR CRUCIATE LIGAMENT → has ant. attachment on tibia
POSTERIOR CRUCIATE LIGAMENT → has post. attachment on tibia

→ Both are crossing fibres
→ Both are intra capsular, extrasynovial



Acl → completely lined by synovial membrane
Pcl → partly lined by synovial membrane
(clt deflectn of sm laterally)

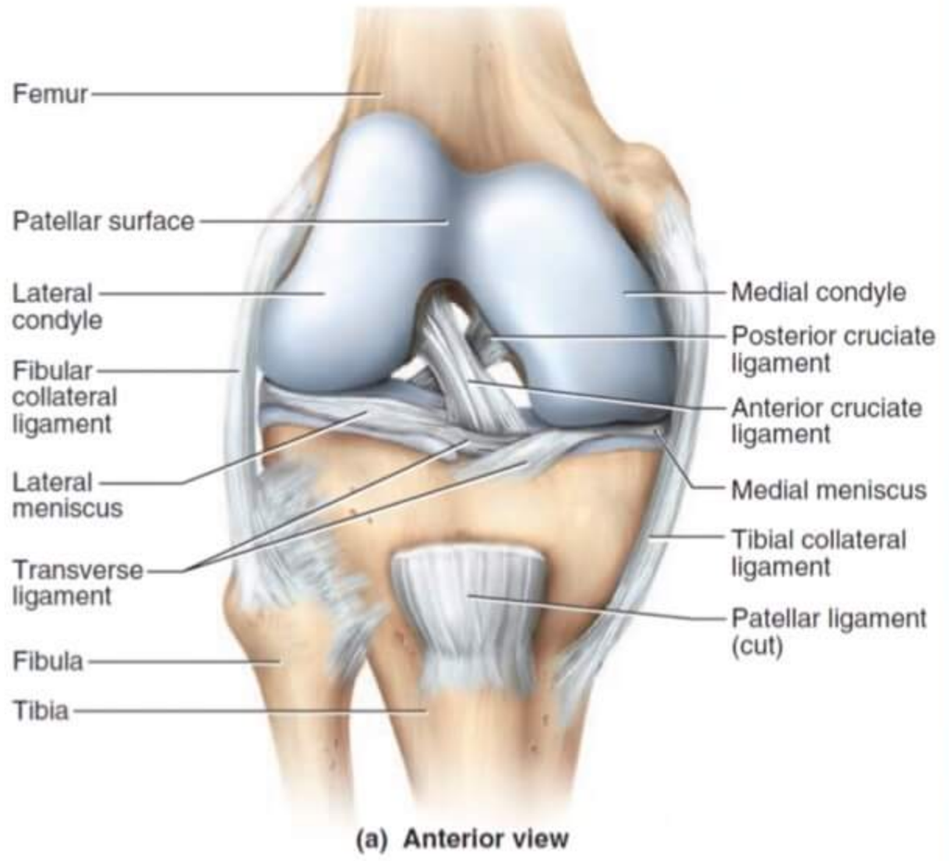
ACL

→ anteriorly attached to tibia in intercondylar region
→ running backward, upward & lateral & attach lateral condyle of femur medially & posteriorly
→ Intra capsular origin

PCL

→ comes from posterior aspect of tibia from intercondylar region
→ runs anteriorly & medially & forward
→ attaches to lateral surface of medial condyle

LATERAL MENISCUS } fuse c capsule
MEDIAL MENISCUS }

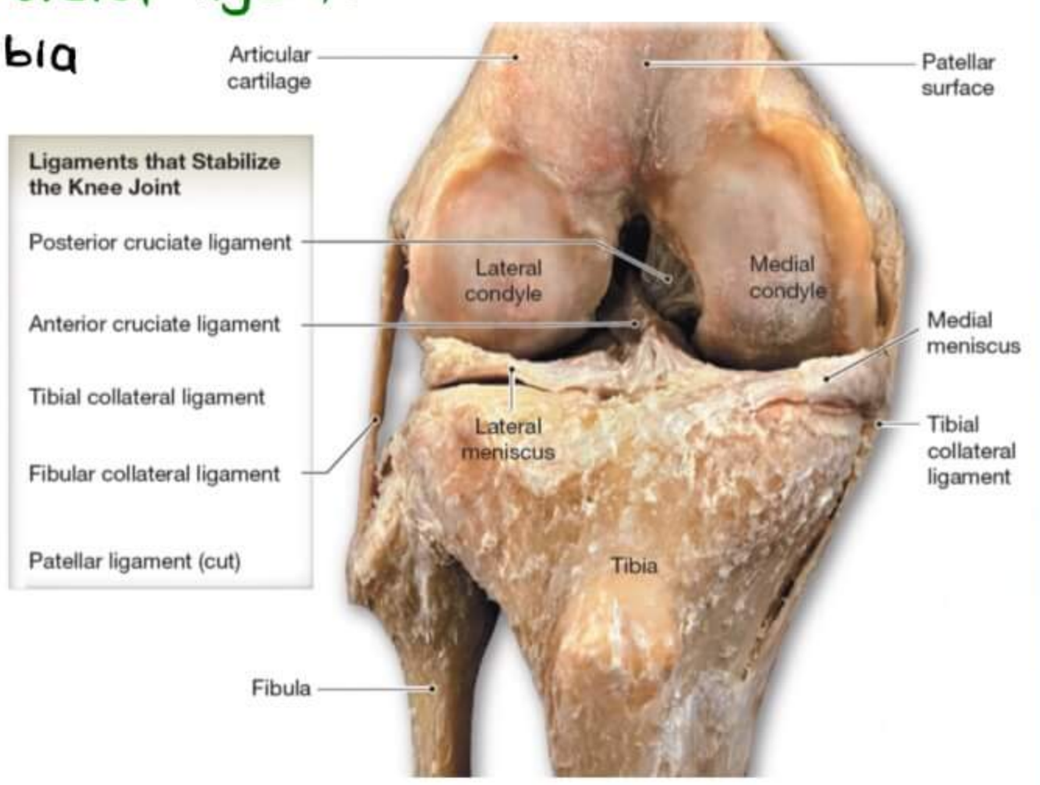


(a) Anterior view

CORONARY LIGAMENT OF KNEE JOINT / meniscotibial ligament

Lowerpart of capsule connecting femur & tibia

MENISCUS → Fibrocartilage
→ acts as shock absorber



FIBULAR / LATERAL COLLATERAL LIGAMENT

→ present on lateral side attaching to fibula
→ Extra capsular

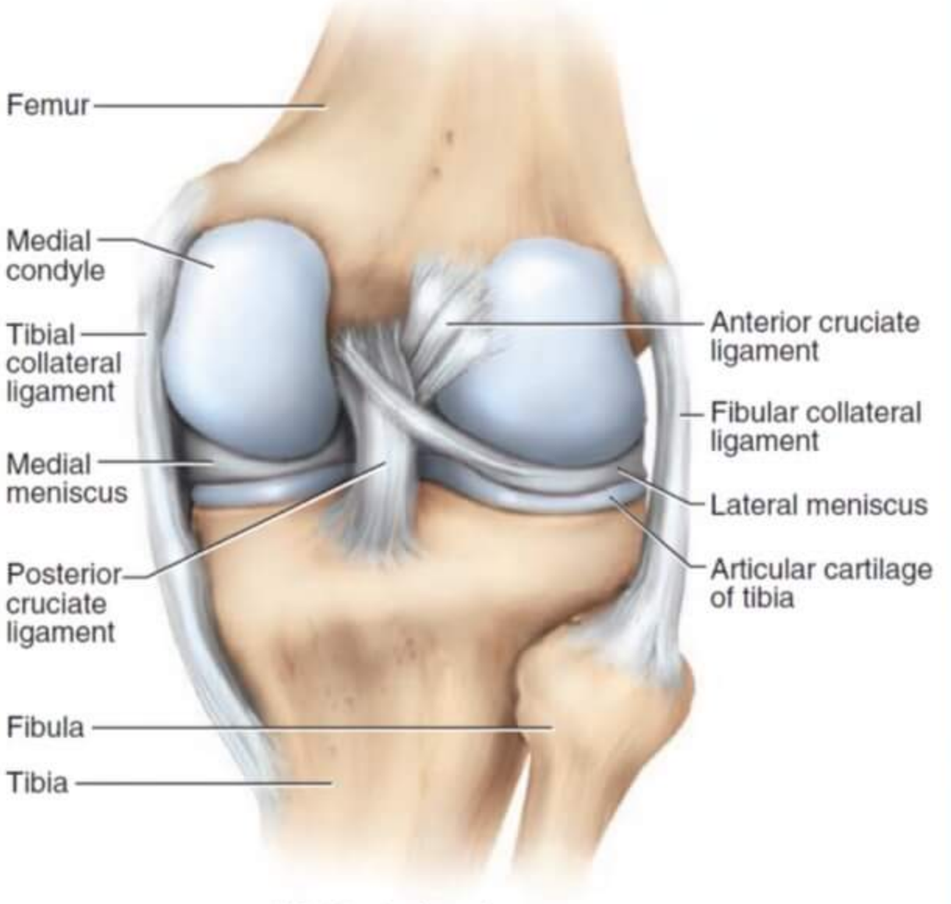
TIBIAL / MEDIAL COLLATERAL LIGAMENT

→ present on medial side attached to tibia
→ Extra capsular

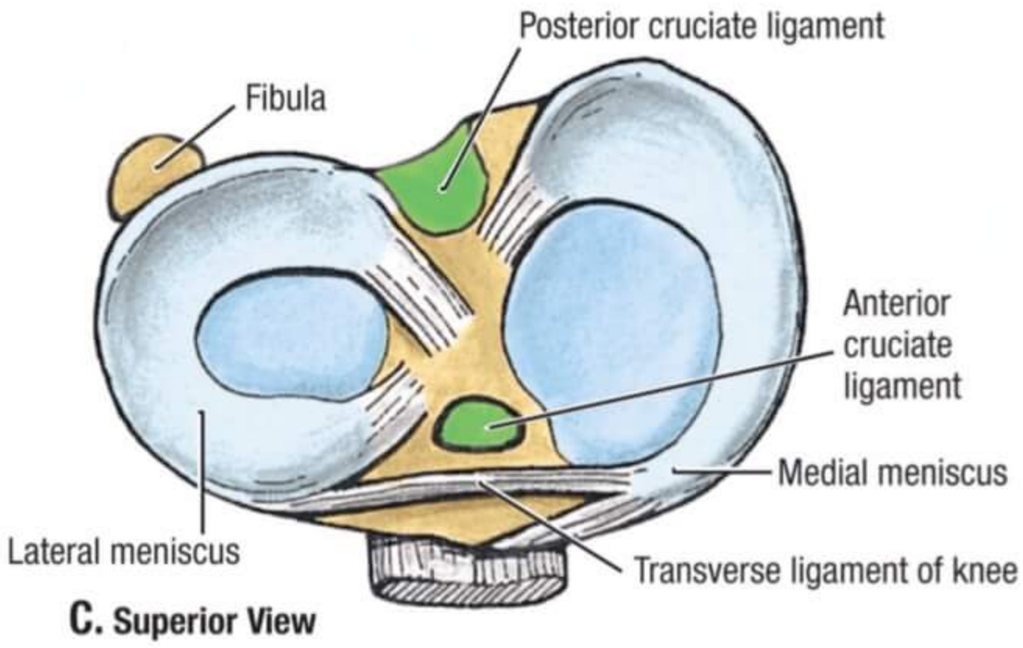
TERRIBLE TRIAD

Ligaments involved are
1. Tibial collateral ligament
2. medial meniscus
3. ACl

ACL prevents posterior displacement of Femur on tibia & anterior displacement of tibia

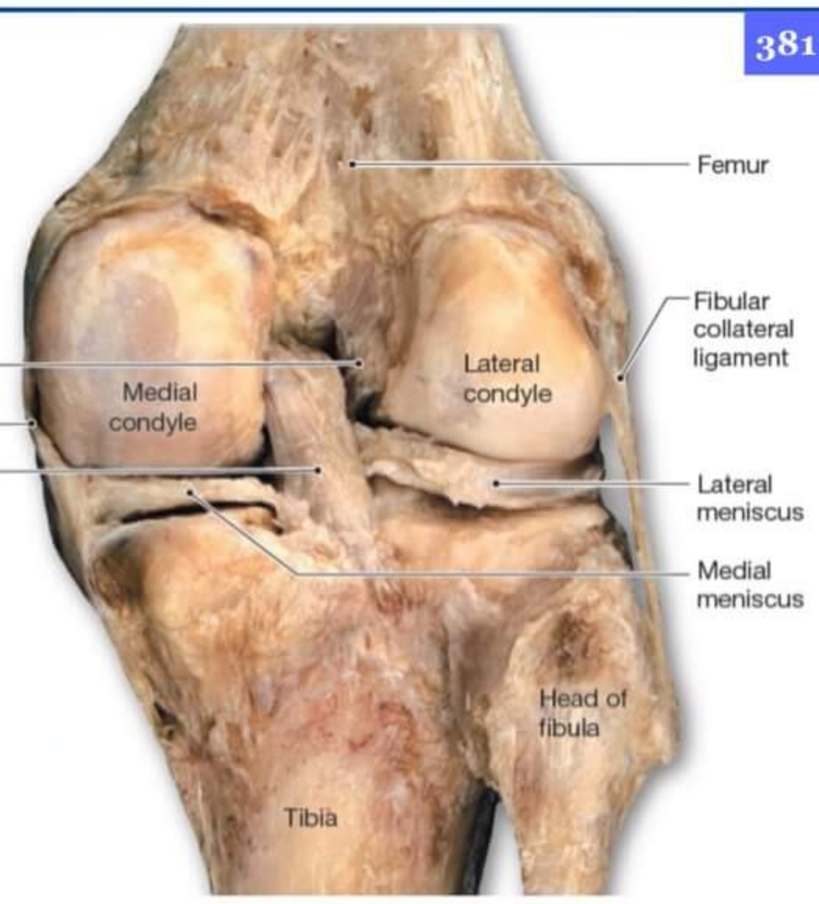


(b) Posterior view



Ligaments that Stabilize the Knee Joint

- Anterior cruciate ligament
- Tibial collateral ligament
- Posterior cruciate ligament
- Fibular collateral ligament
- Popliteal ligaments



LATERAL MENISCUS

→ Almost circular

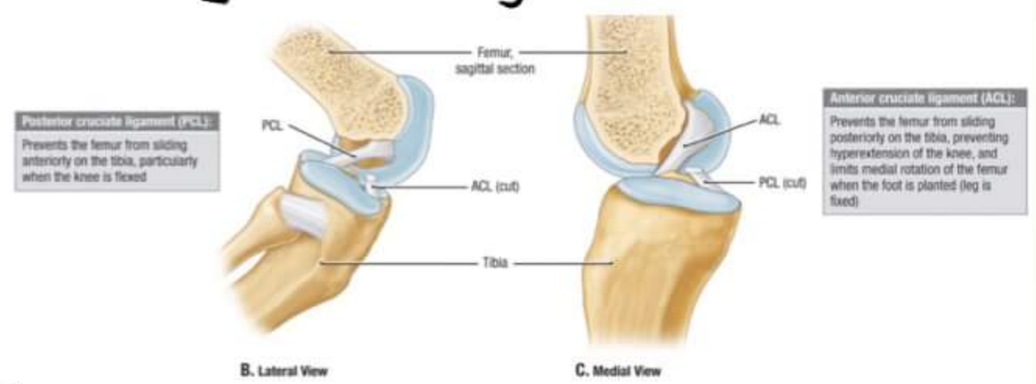
→ contains 1 anterior horn & 1 posterior horn close to each other attaching inter-condylar eminence

LIGAMENTUM PATELLA → attaches to tibial tuberosity anteriorly

MEDIAL MENISCUS

→ C shaped

→ attaches to Intercondylar eminence



College → Cruciate ligament posterior
Medical → medial Leminiscus
LUCKNOW → Lateral meniscus posterior
LUCKNOW → Lateral meniscus anterior
college → Cruciate ligament Anterior
Medical → Medial ligament

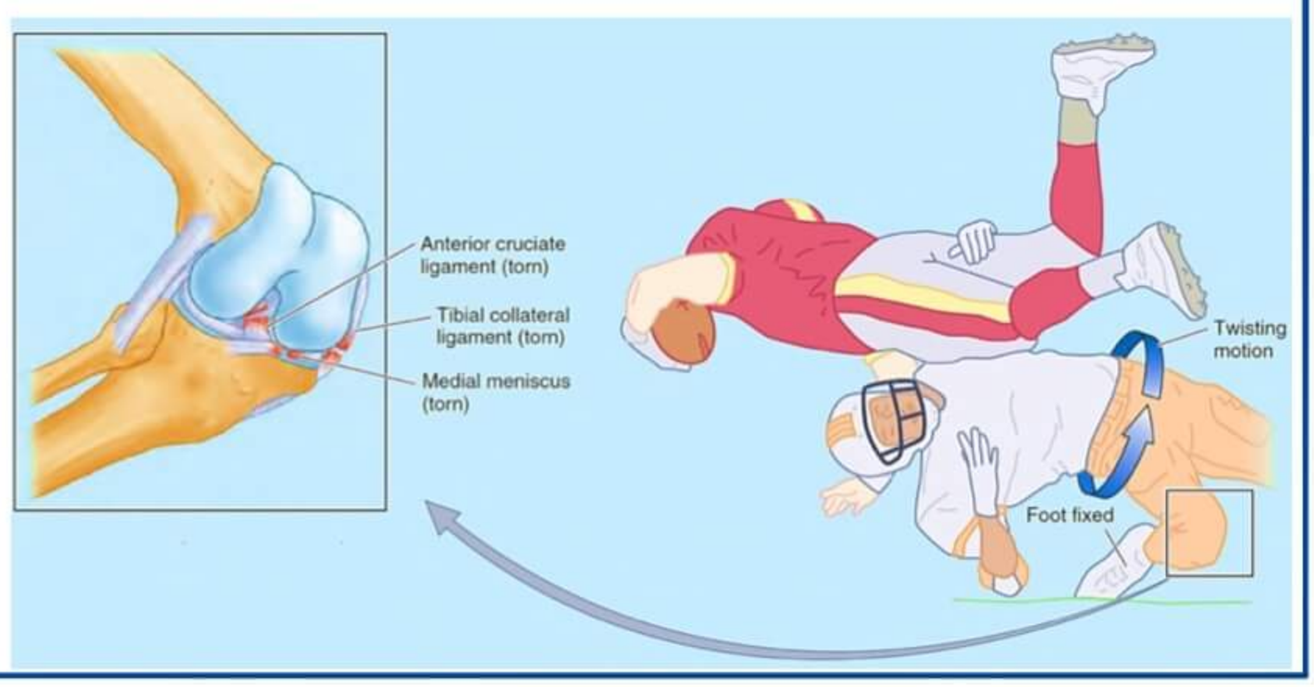
ACL → prevents the posterior displacement of Femur & Anterior displacement of tibia
→ tightened at extension
→ ACl damaged in hyper extension injuries
→ weak ligament than PCL

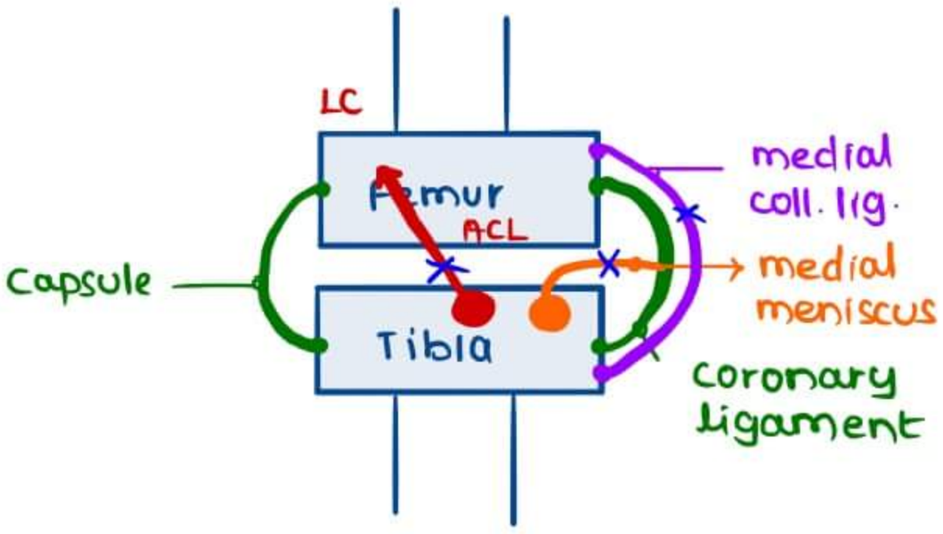
PCL → prevents the anterior displacement of femur & posterior displacement of tibia
→ tightened at flexion

TERRIBLE TRIAD

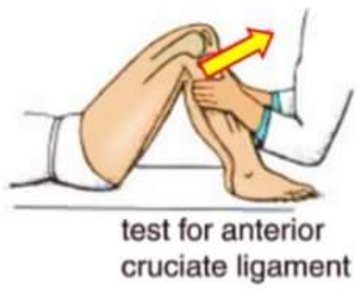
→ Seen in football player

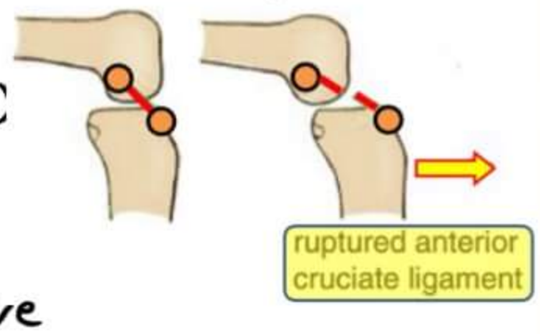
→ foot is fixed to ground
knee is in flexion
twisting fall to same side





→ medial meniscus injury is alw medial collateral ligament injury (as both are attached to same capsule)


test for anterior cruciate ligament


ruptured anterior cruciate ligament

ANTERIOR DRAWER TEST is (+)

→ normally, tibia can't be pulled anteriorly (prevented by ACL)
→ on ACL injury, it can be done
→ Ask the patient to lie down & do 90° knee flexion
Try to pull tibia, if tibia can be pulled, then test is +ive
→ painful test

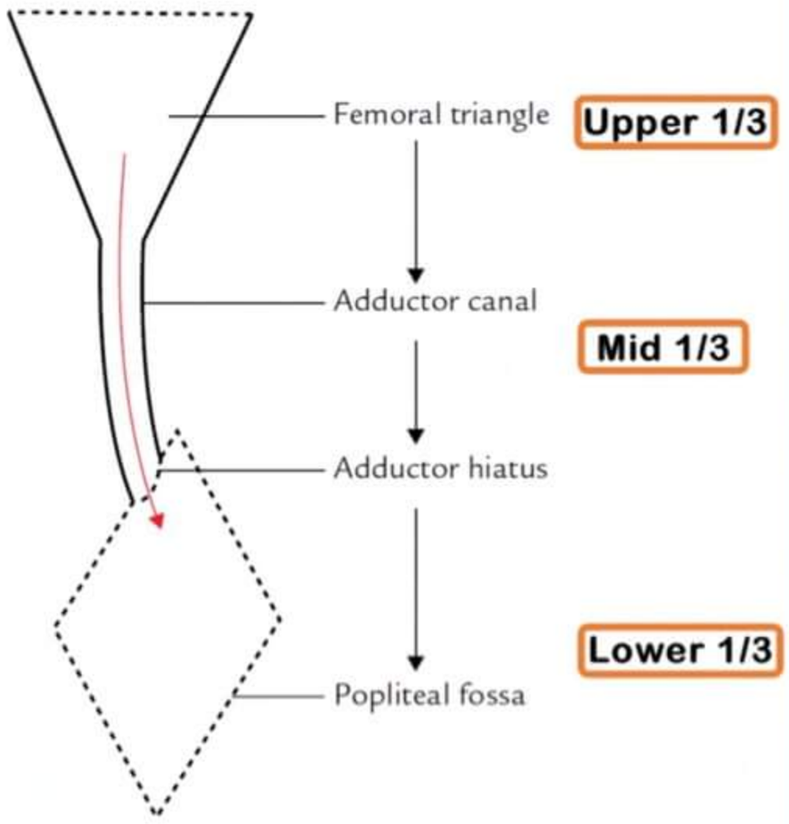
LACHMAN TEST

→ Less painful
→ Knee flexed upto 20°
→ Fix the femur & try to pull tibia anterior
→ modificatn of ant. drawer test
→ highly specific (93%) & highly sensitive (84–87%) than anterior drawer test
→ used for diagnosis & screening as well

ADDUCTOR CANAL

THIGH

→ Femoral Δle seen in upper 1/3rd of thigh
→ Adductor canal seen in middle 1/3rd of thigh
→ Popliteal fossa seen in Lower 1/3rd of thigh

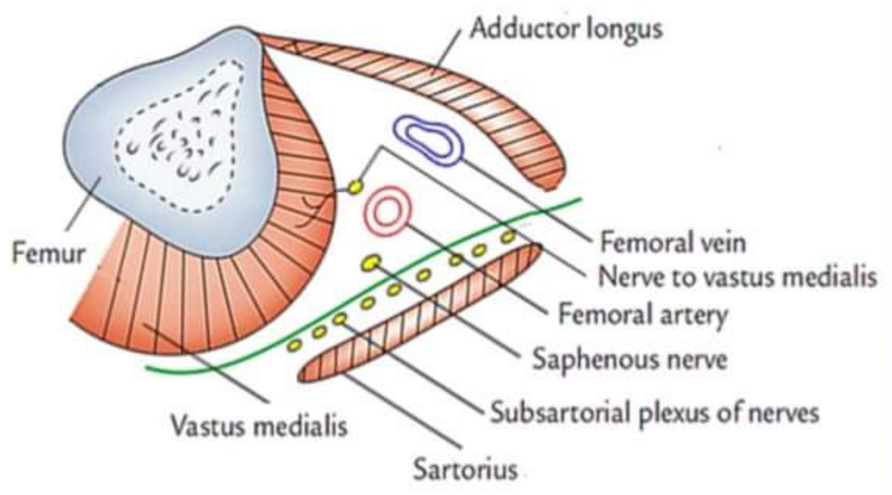


FEMORAL TRIANGLE

→ contains femoral NVB
1. deep inguinal LN (most medial)
2. Femoral vein
3. Femoral Artery
4. Femoral nerve

} medial to lateral

→ femoral nerve gives saphenous nerve & enters adductor canal



ADDUCTOR CANAL / HUNTER'S CANAL CONTENTS

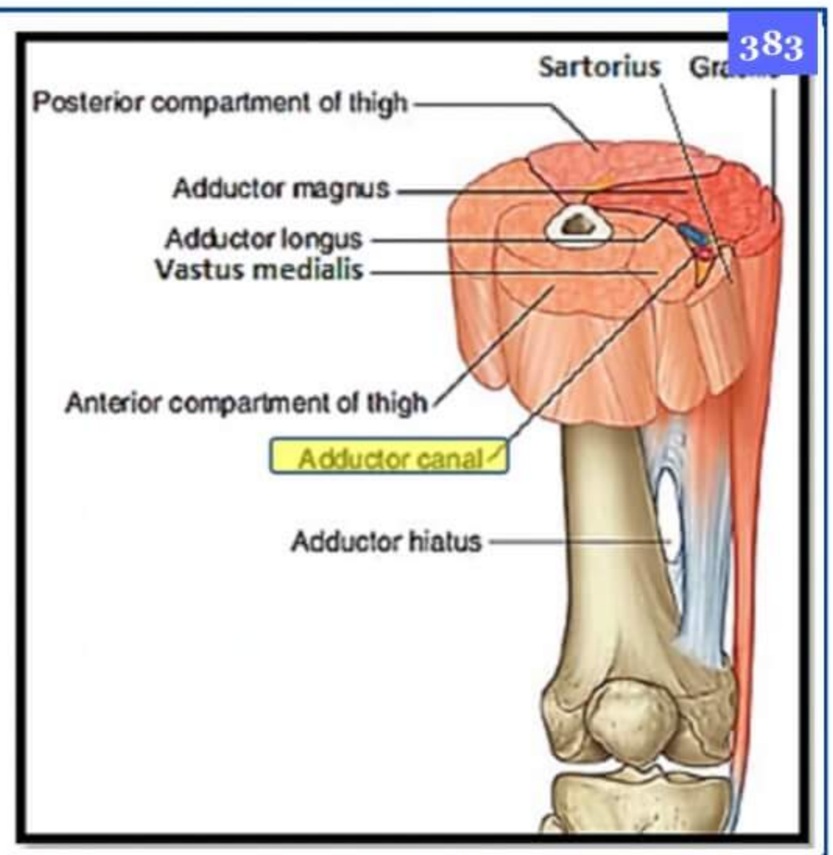
1. Saphenous nerve (br. of femoral nerve)
2. Femoral artery
3. Femoral vein

POPLITEAL FOSSA CONTENTS

1. Popliteal artery (femoral artery continues as popliteal artery after passing popliteal hiatus)
2. Popliteal vein
3. Tibial nerve → supplies popliteus at floor

SARTORIUS MUSCLE

→ longest muscle
→ attaching to upper tibia medially
→ comes from ASIS



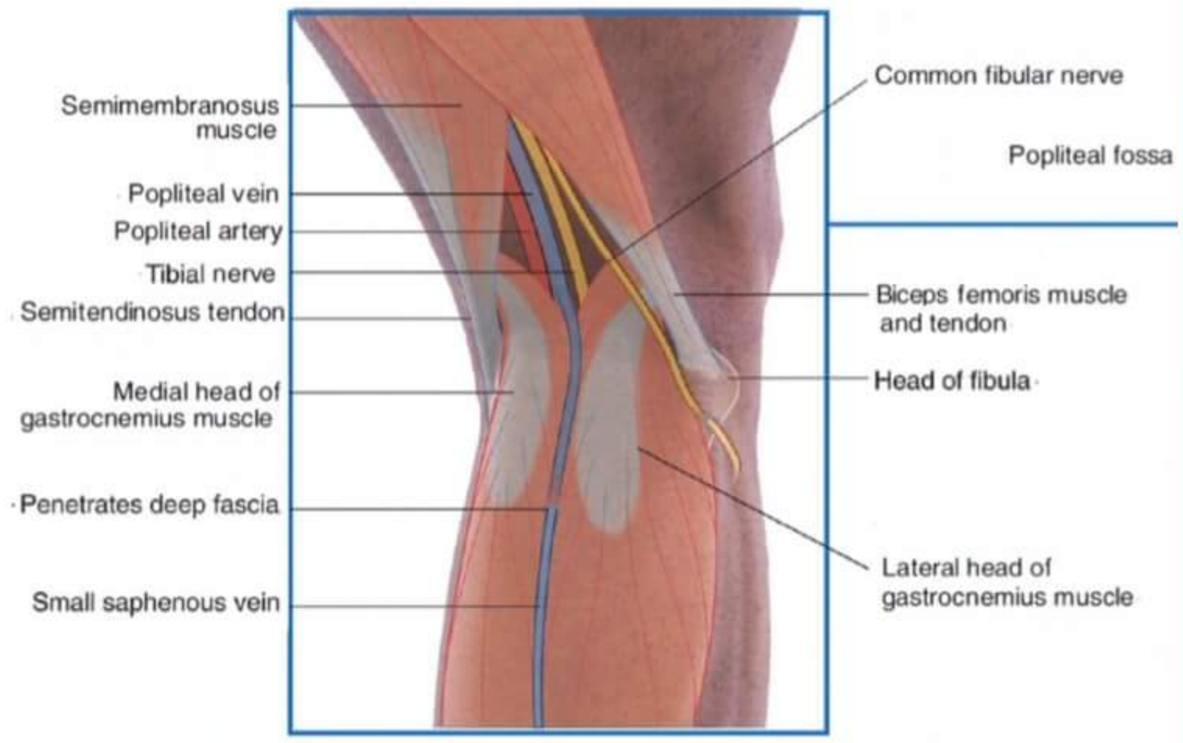
BOUNDARIES ADDUCTOR CANAL / SUB SARTORIAL CANAL

Roof → sartorius
Floor → Adductor longus
→ Adductor magnus

Antero lateral → vastus medialis

Q. All of the following pairs regarding adductor canal are true EXCEPT

a) **Roof: Sartorius muscle**
b) **Contents: Femoral nerve**
c) **Floor: Adductor longus and magnus**
d) **Antero-lateral boundary: Vastus medialis**



POPLITEAL FOSSA

BOUNDARIES

Supero lateral → Biceps femoris
→ com. peroneal nerve

Supero medial → Semitendinosus
Semimembranosus

Infero lateral → Gastrocnemius lateral head
→ Plantaris tendon

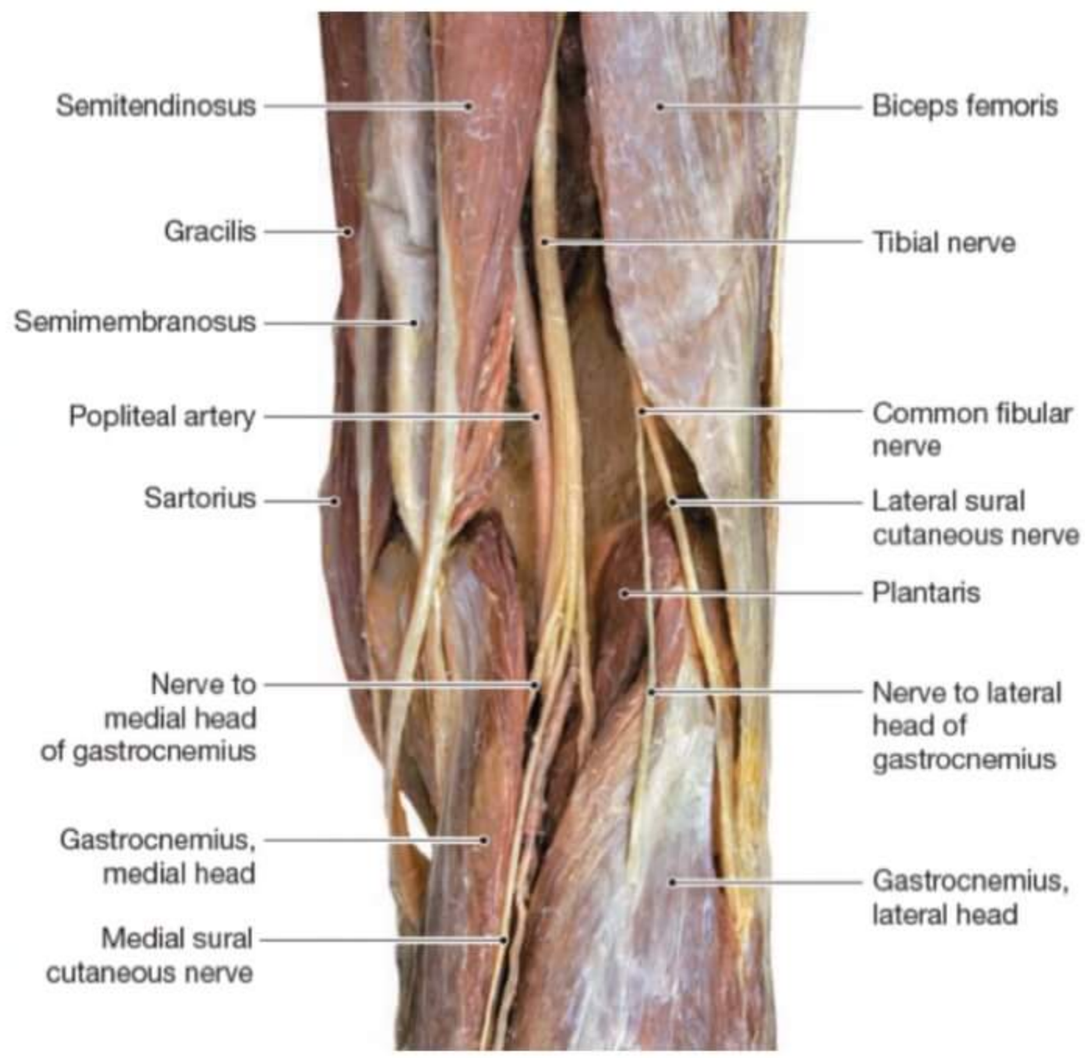
Infero medial → Gastrocnemius medial head

common peroneal nerve

→ forms supero lateral boundary
→ under the cover of Biceps femoris
→ winds around neck of fibula laterally
- damage causes FOOT DROP
→ divides into superficial & lateral branches

Q. All of the following pairs for boundaries of popliteal fossa are correct EXCEPT

a) **Supero-medial boundary: semimembranosus**
b) **Supero-lateral boundary: Biceps femoris**
c) **Infero-lateral: Gastrocnemius and plantaris**
d) **Infero-medial: Gastrocnemius and soleus**

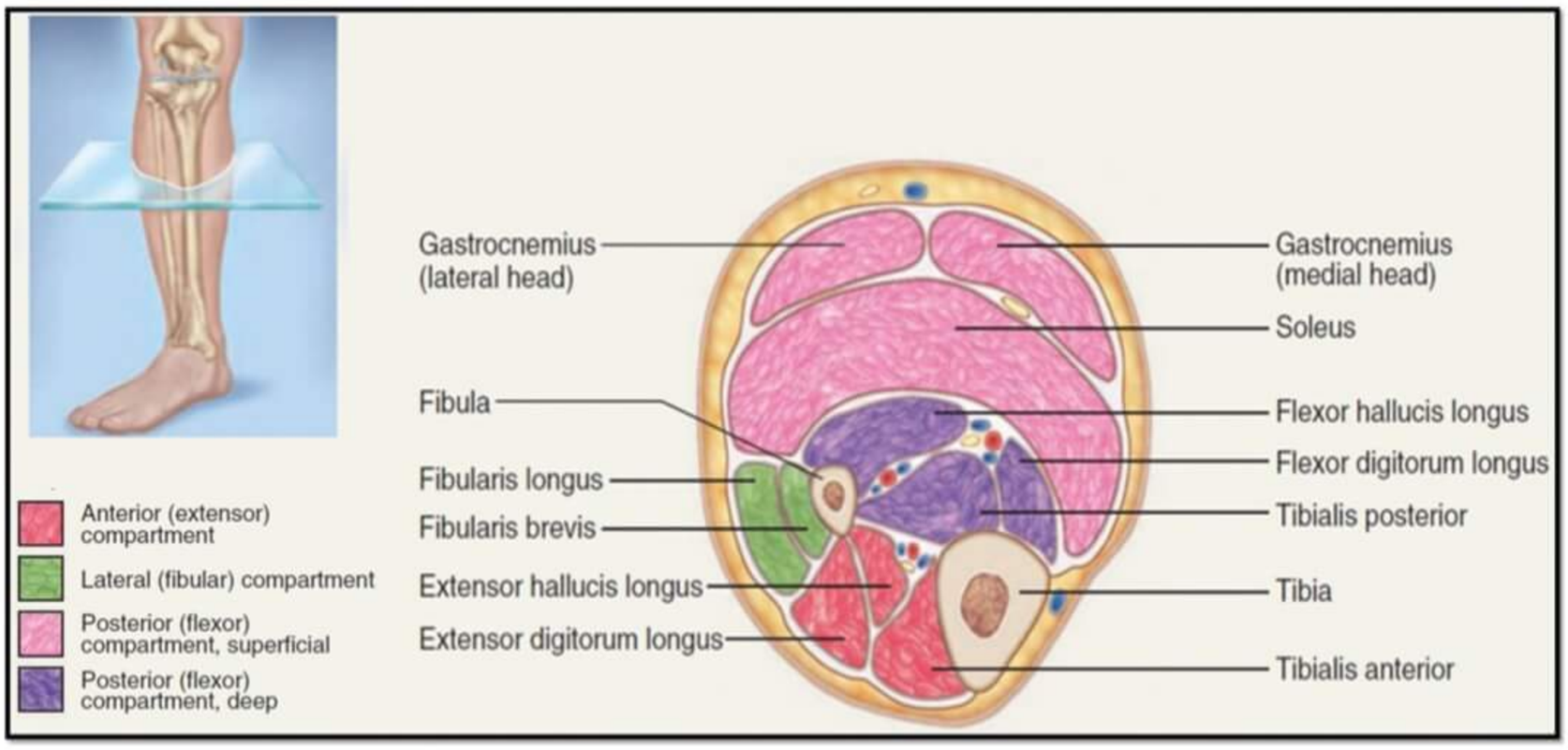


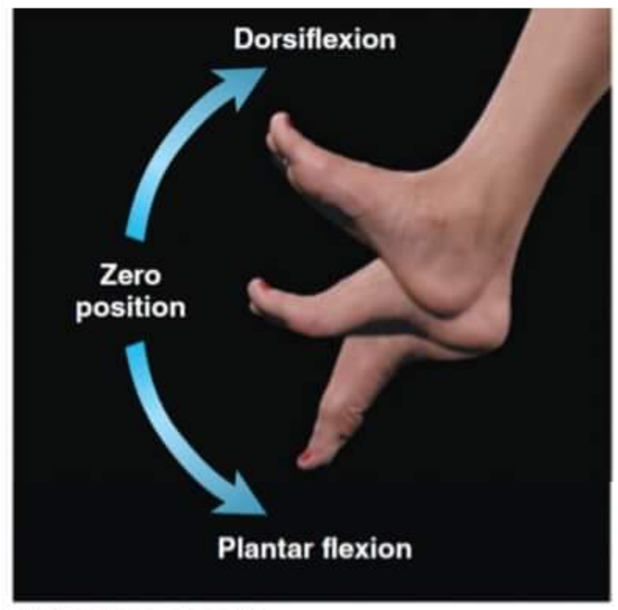
CONTENTS

1. Popliteal artery
2. Popliteal vein
3. Tibial nerve

LEG MUSCLES

ANTERIOR (EXTENSOR) COMPARTMENT → causes dorsiflexⁿ of ankle/foot joint
LATERAL (FIBULAR) COMPARTMENT → Eversⁿ (turns the sole lateral
POSTERIOR (FLEXOR) COMPARTMENT
- SUPERFICIAL } Plantar flexⁿ
- DEEP } Toe flexⁿ





(a) Flexion of ankle

POSTERIOR COMPARTMENT

- G → Gastrocnemius
- P → Plantaris
- S → soleus

} Superficial group in calf region

- T → Tibialis posterior
- D → Digitorum longus (flexor)
- H → Hallucis longus (flexor)

} Deep group in calf region

ANTERIOR COMPARTMENT

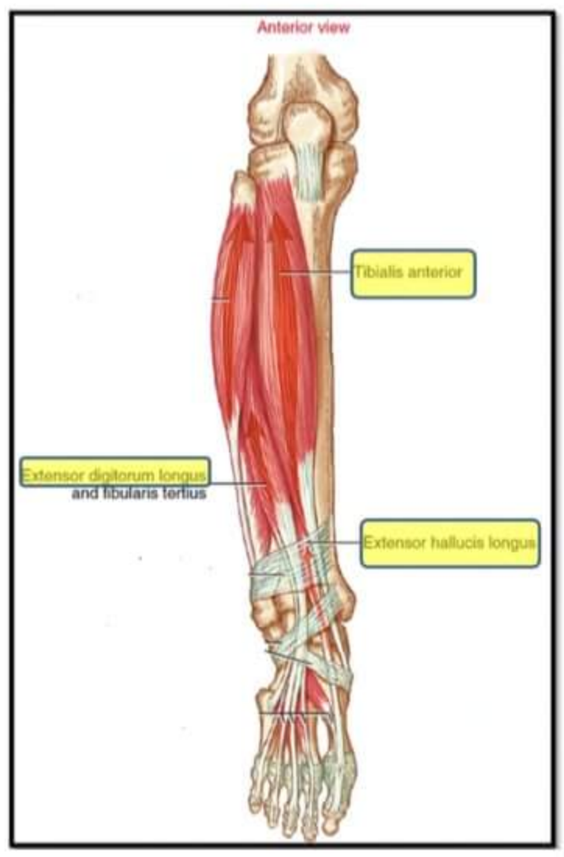
- T → Tibialis anterior
- D → Digitorum longus (extensor)
- H → Hallucis longus (extensor)

LATERAL COMPARTMENT

Peroneus longus
peroneus brevis
} Everters

Muscles of the Anterior Compartment of the Leg

Muscles	Innervation	Action
Anterior Compartment		
Tibialis anterior	Deep fibular nerve (L4, L5)	Dorsiflexes the foot Inverts the foot
Extensor digitorum longus	Deep fibular nerve (L5, S1)	Dorsiflexes the foot Extends lateral four toes
Extensor hallucis longus	Deep fibular nerve (L5, S1)	Dorsiflexes the foot Extends the big toe
Fibularis tertius	Deep fibular nerve (L5, S1)	Dorsiflexes the foot Assists in eversion of the foot



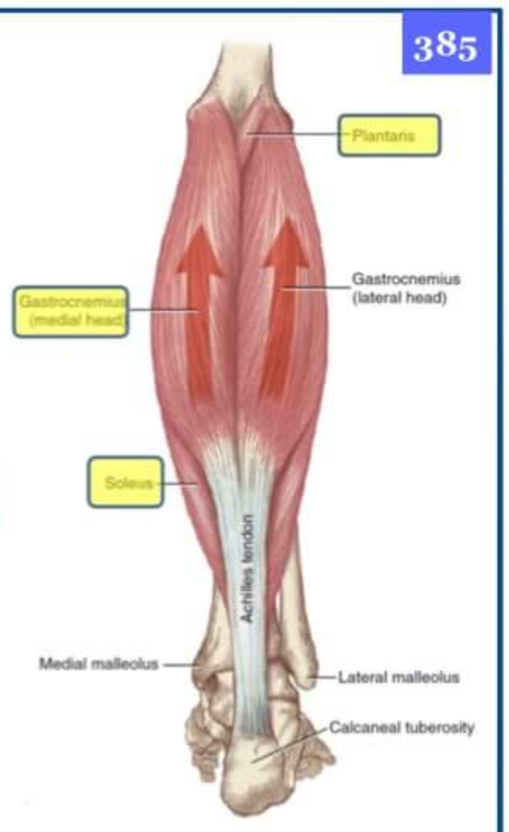
TIBIALIS ANTERIOR

→ circumpinnate muscle
→ muscle fibres are arranged in circular fashion & inserted into ant. tibia

Muscles of ant. compartment passes under extensor retinaculum
Extensor retinaculum keeps these tendons close to the bone for good movement

EXTENSOR RETINACULUM

1. Superior ER
2. Inferior ER
   - → y shaped
   - → holds the muscles of anterior compartment



Muscles of the Posterior Compartment of the Leg

Muscle	Innervation	Action
Gastrocnemius	Tibial nerve (S1, S2)	Planter flexes the ankle when leg is extende Flexes the leg
Soleus	Tibial nerve (S1, S2)	Plantar flexes the ankle independent of leg position
Plantaris	Tibial nerve (S1, S2)	Assists the gastrocnemius

TRICEPS SURAE → 3 muscles in the calf region (G,P,S)
- → GPS tendons (TENDO ACHILIS) inserts on calcaneum
- → hit on tendon achilis ∴ Knee hammer gives ankle reflex (S1)

MUSCLES IN DEEP GROUP OF POST. COMPARTMENT OF LEG

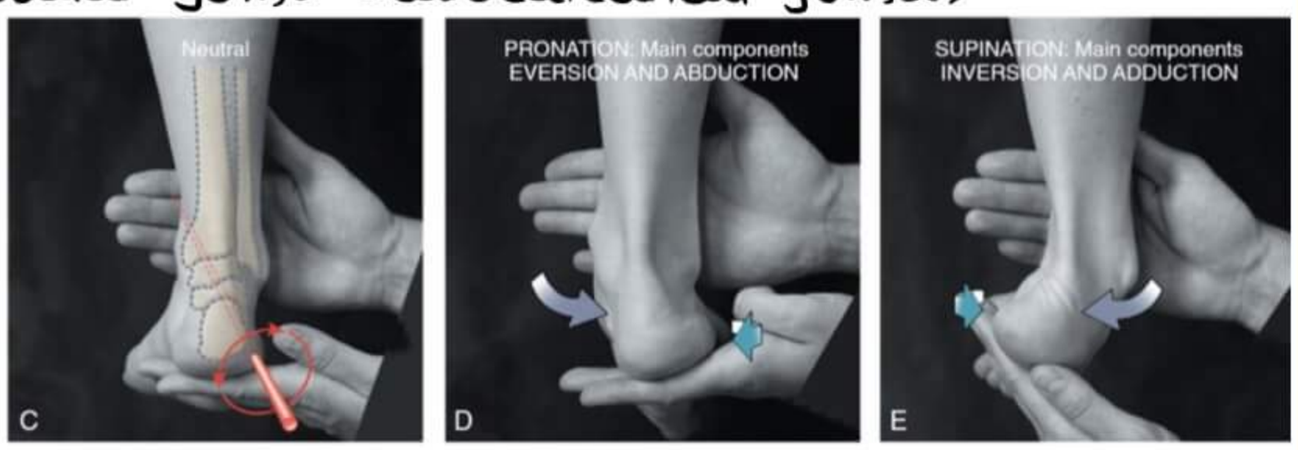
MUSCLE	INNERVATION	ACTION
Flexor Hallucis longus	Tibial nerve (S-2,3)	Flexes the big toe at all joints Plantar flexes the ankle weekly
Flexor digitorum longus		Flexes the lateral four toes Plantar flexes the ankle
Tibialis posterior	Tibial nerve (L4,5)	Plantar flexes the ankle Inverts the foot

→ These muscle tendons are passing deep to the flexor retinaculum on medial side of ankle

LATERAL COMPARTMENT

EVERSION

- → foot eversion occurs at subtalar joint (talocalcaneal joints)
- → done by
  1. Peroneus Longus
  2. Peroneus brevis
  3. Peroneus tertius



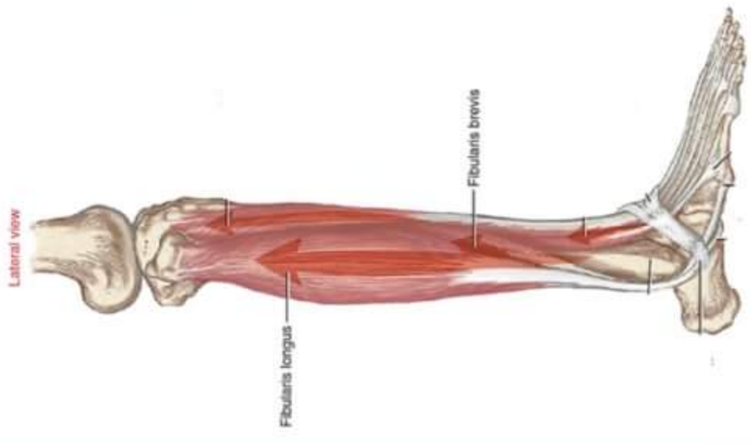
INVERSION

- → done by
  1. Tibialis anterior
  2. Tibialis posterior

SUPINATION → Inversion + forefoot adduction + Plantar flexion
PRONATION → Eversion + forefoot abduction + dorsiflexion

Pronation, supination occurs at subtalar joint & Transverse tarsal joint (fore foot adductn & abductn)

Lateral compartment muscles maintain Lateral Longitudinal arch (especially Peroneus Longus)

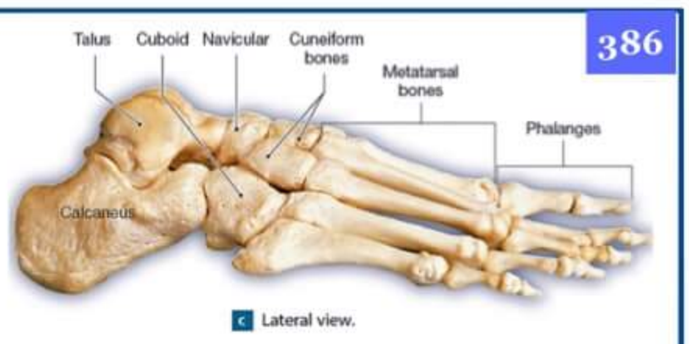


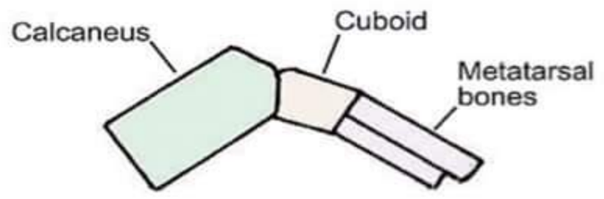
LATERAL LONGITUDINAL ARCH

→ useful in weight transmission & flexibility

→ CONTRIBUTED BY

1. cuboid (lateral bone)
2. Navicular (medial bone)
3. calcaneus (heel bone)
4. calcaneocuboid joint (saddle synovial joint)
5. metatarsals 4, 5





Anterior pillor → metatarsals
Posterior pillor → calcaneum
Summit → cuboid

Q. Which of the following muscles is included in 'Triceps surae' (NBEP-2014)

a) **Gastrocnemius**
b) **Popliteus**
c) **Extensor hallucis longus**
d) **Extensor digitorum longus**

Tendons → Peroneus longus (main)
Peroneus brevis

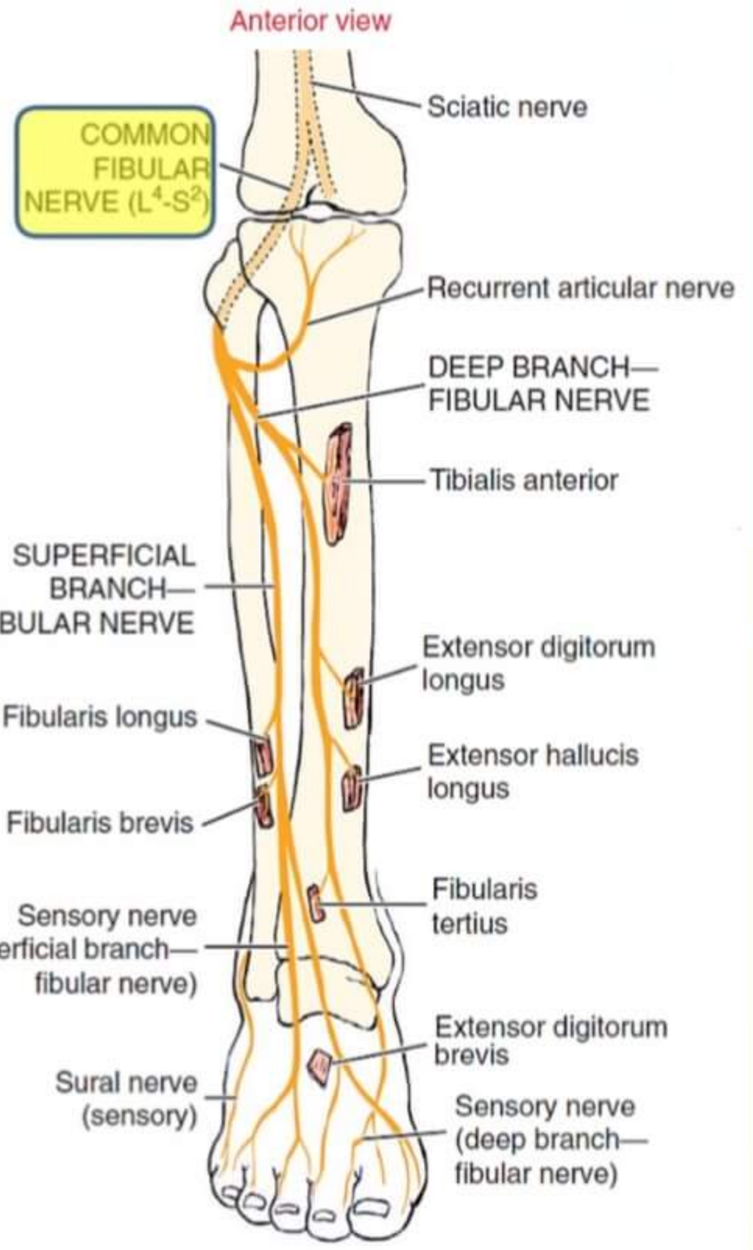
Ligaments → Long & Short Plantar Ligament

LEG & FOOT REGION : NERVE SUPPLY

COMMON PERONEAL NERVE

→ Sciatic neve gives common peroneal nerve behind the knee joint near popliteal fossa

→ present under cover of biceps femoris in the superolateral boundary of popliteal fossa, & winds around lateral neck of fibula & gives deep & superficial branches
  → If damaged, FOOT DROP occurs
  → FOOT DROP
    → Loss of dorsiflexion
    → dit injury to deep peroneal nerve



SUPERFICIAL PERONEAL NERVE

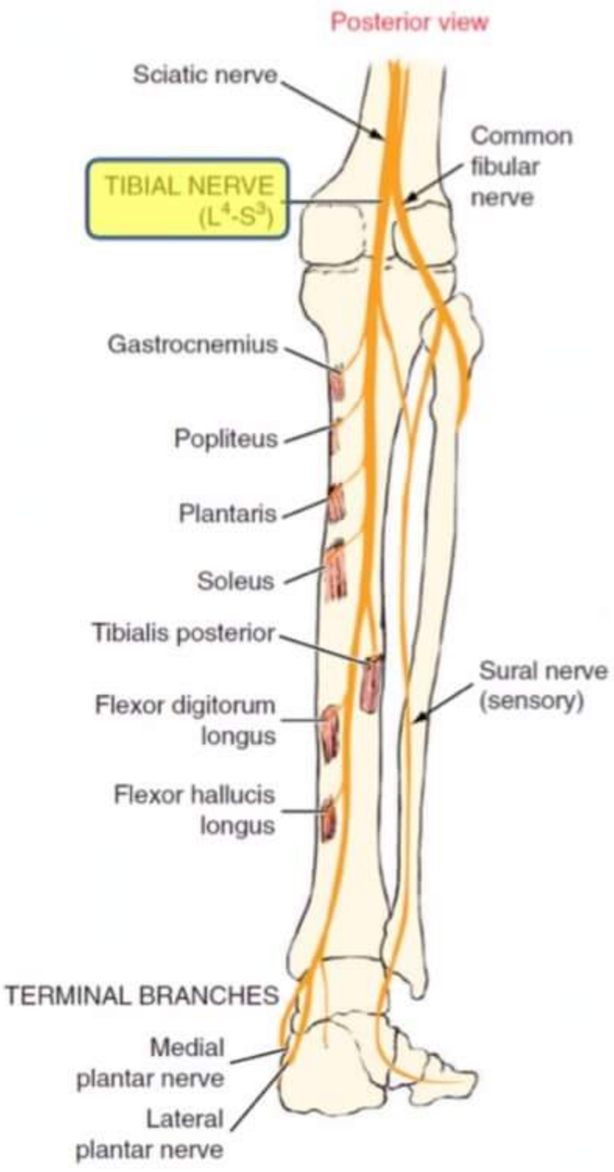
→ Going lateral & supplies
  1. Peroneus longus
  2. Peroneus brevis
→ nerve of eversion
→ also supplies most of skin on dorsum of foot
  (skin on dorsum of 1st web space supplied by Deep peroneal n (L5))

DEEP PERONEAL / ANTERIOR TIBIAL NERVE

→ comes anterior to tibia
→ Supplies Skin of dorsum of 1st web space
  Tibialis anterior
  Extensor digitorum longus
  Extensor hallucis longus
  } Dorsiflexion (damage → Foot drop)

INJURY TO COMMON PERONEAL NERVE (Lateral to neck of fibula)

1. Loss of foot eversion
2. Sensory loss of dorsum of foot
3. Foot drop

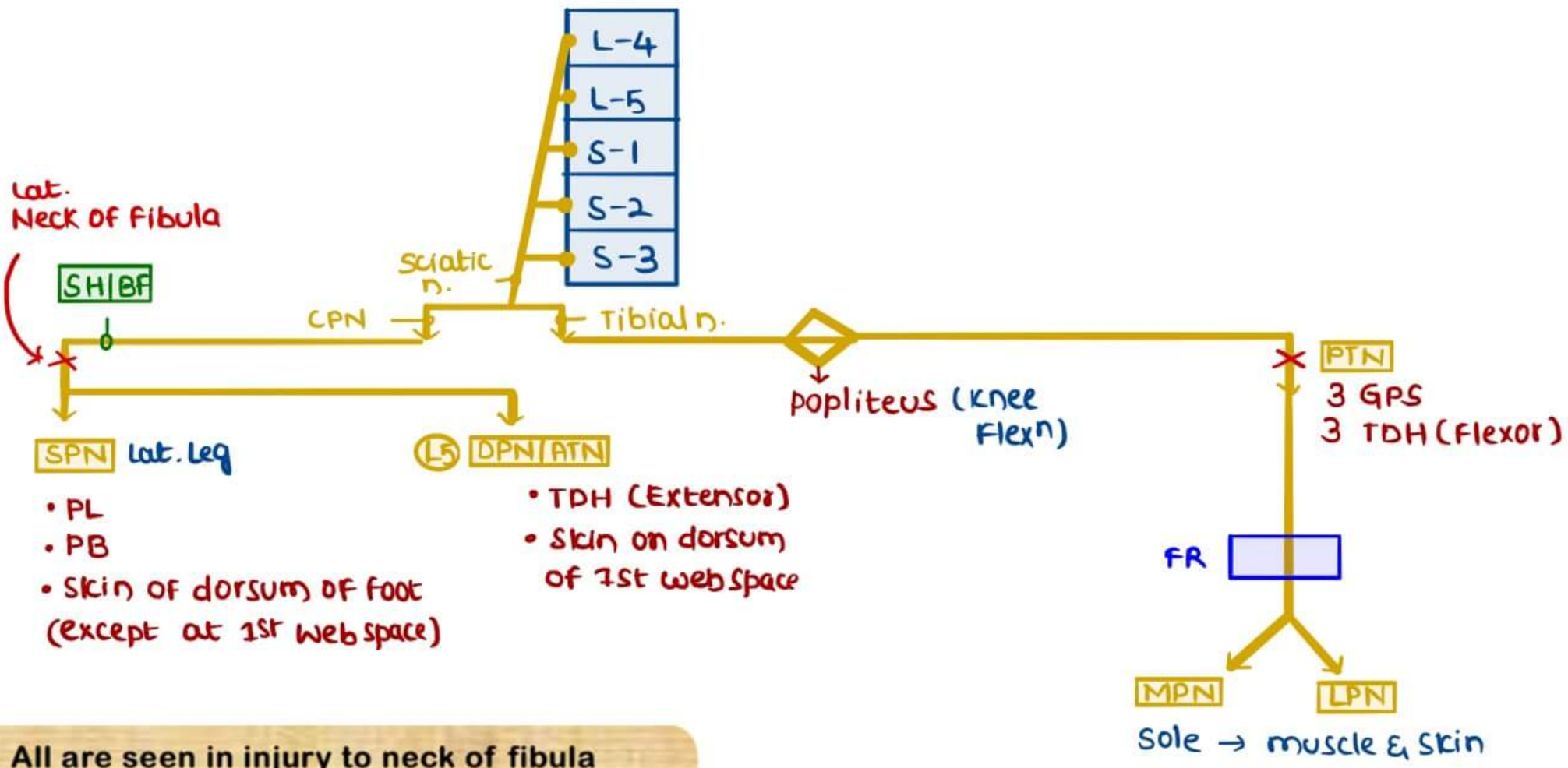


TIBIAL NERVE (nerve of Flexion)

→ Branch of Sciatic nerve
→ Supplies popliteus
→ goes post. to tibia in calf region → POST. TIBIAL N
→ POST. TIBIAL NERVE (S1) Supplies
- G → Gastrocnemius
- P → Plantaris
- S → Soleus
- T → Tibialis posterior
- D → Flexor Digitorum longus
- H → Flexor hallucis longus

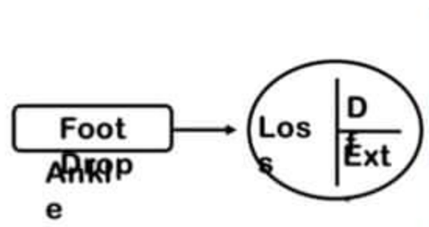
→ Then goes under flexor retinaculum to the medial side of ankle & gives 2 branches to the sole
1. Medial plantar n. } supplies
2. Lateral plantar n. } skin & muscles of sole

→ also gives cutaneous SURAL nerve & supplies little toe & Lateral margin of dorsum of foot

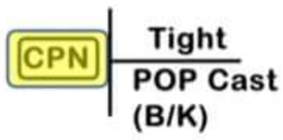


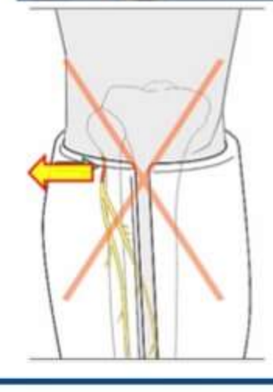
Q. All are seen in injury to neck of fibula EXCEPT

a) Common peroneal nerve injury
b) Loss of sensation over sole
c) Foot drop
d) Loss of foot eversion



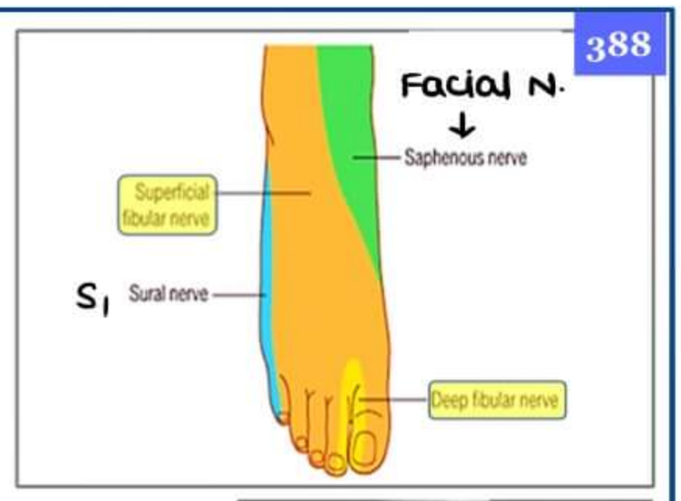
→ dlt tight POP cast below the knee (out padding the nerve)
→ common peroneal nerve injured
→ FOOT DROP → loss of dorsiflexion & extension at right ankle joint
→ loss of evers^n
→ sensory loss of dorsum of foot





Q. Medial aspect of great toe is supplied by

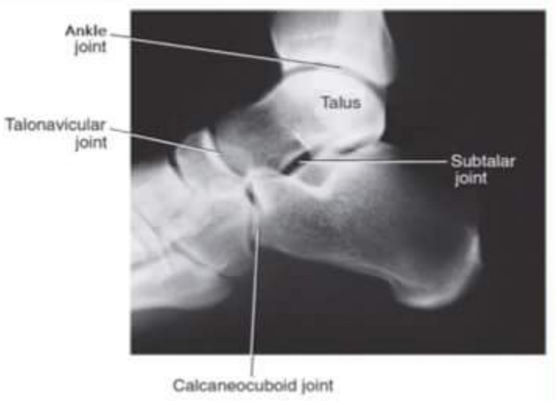
a) Saphenous nerve
b) Deep peroneal nerve
c) **Superficial peroneal nerve**
d) Sural nerve



PLANTAR ARCHES

STRUCTURES AROUND ANKLE

→ Medial malleolus
→ Talus
→ Calcaneum



SUB TALAR JOINT / TALO CALCANIAL JOINT

→ helps in eversion, inversion
→ 2 invertors → Tibialis anterior
Tibialis posterior

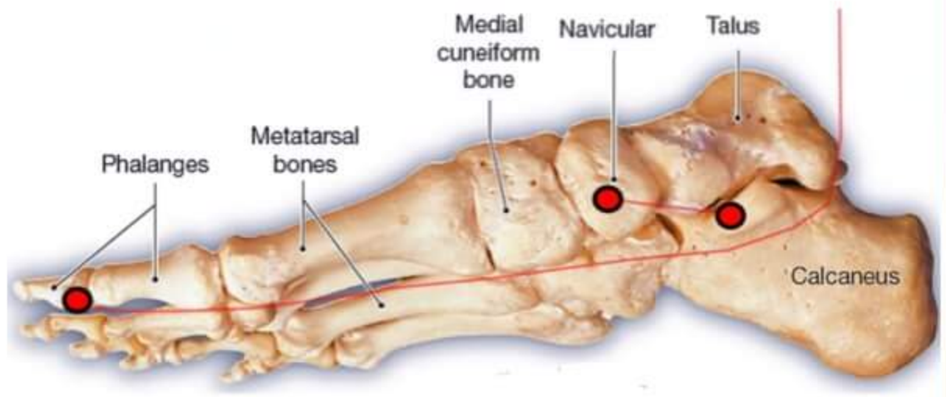
→ 2 evertors → Peroneus longus
Peroneus brevis

Medial Bone forming Medial longitudinal arch → Navicular

TALO CALCANEO NAVICULAR JOINT

→ Ball & socket joint
ball → head of Talus
socket → calcaneo navicular

→ helps in Supination & pronatⁿ



FHL SL ST

SUSTENTACULUM TALI → medial projectⁿ on calcaneous bone to support talus

SPRING / CALCANEO NAVICULAR LIGAMENT

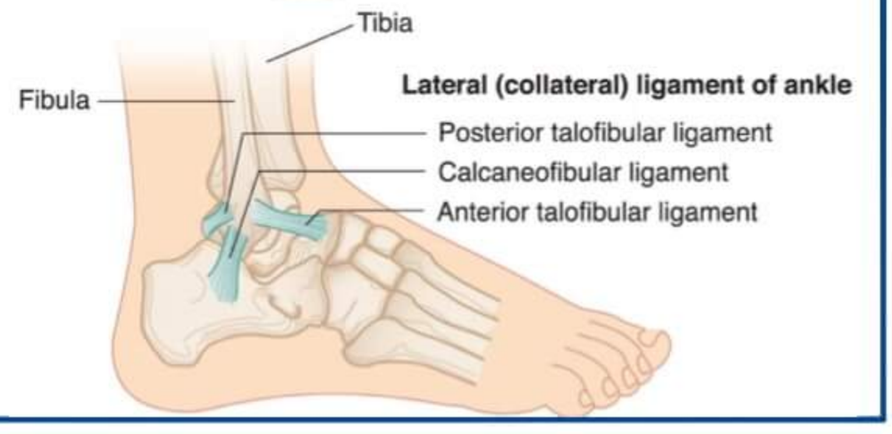
→ attaches to sustentaculum tali & Naviculum
→ passive support for medial longitudinal arch
→ fused t deltoid ligament but not a part of deltoid ligament
→ Flexor Hallucis Longus
→ comes from calf region & pulls great toe (flexⁿ)
→ hooks under sustentaculum tali using as a pully to flex great toe
→ dynamic support for medial longitudinal arch
→ pulls the middle bone up to maintain the arch
→ cutting of tendon leads to flat foot

Q. Deltoid ligament has all the following components EXCEPT

a) Anterior tibiotalar
b) Tibionavicular
c) Tibiocalcaneal
d) **Calcaneonavicular**

DELTOID LIGAMENT – 4 parts

1. Anterior tibiotalar
2. Posterior tibiotalar
3. Tibiocalcaneal part
4. Tibionavicular part

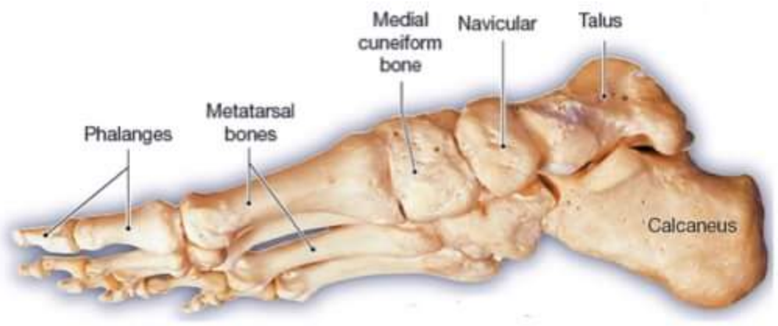


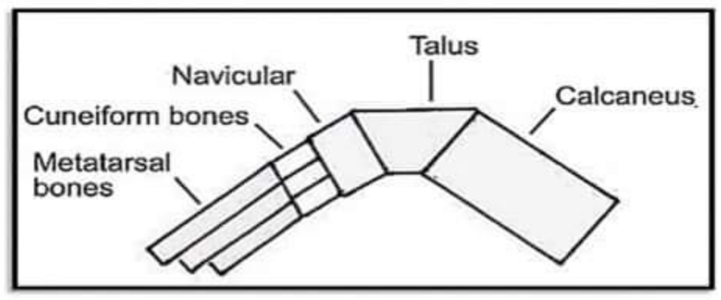
MEDIAL LONGITUDINAL ARCH

→ helps in running & jumping

→ contributed by

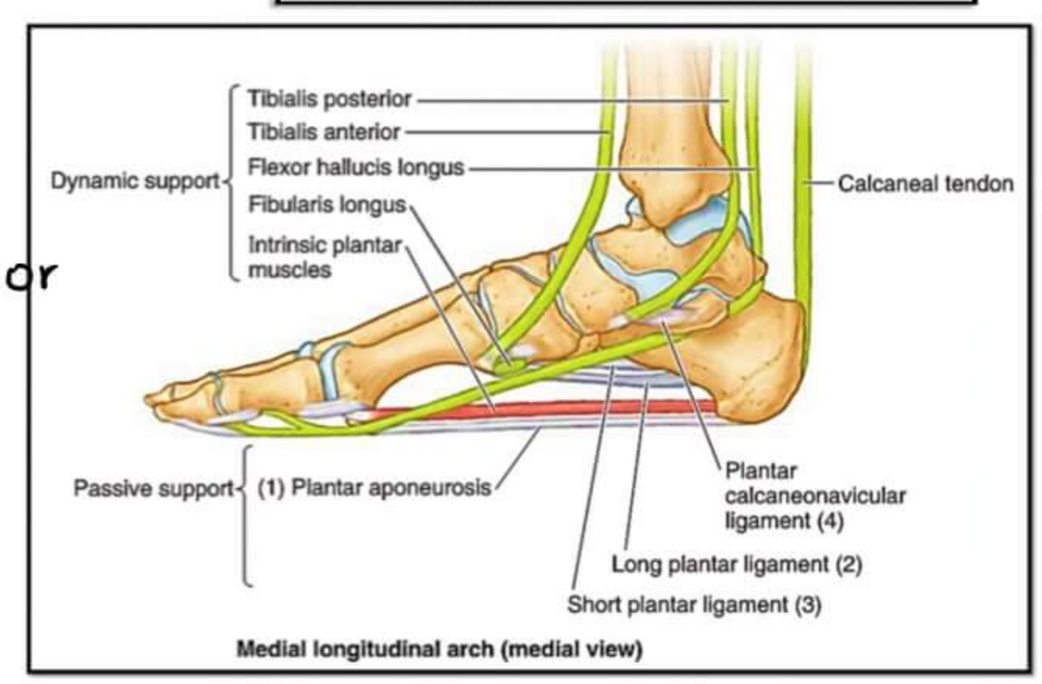
1. Medial metatarsals (1,2,3) (ant. pillor)
2. Navicular
3. Cuneiform
   - medial
   - Lateral
   - Intermediate
4. Talus (summit)
5. calcaneus (post. pillar)





→ Passive Supporters

1. Plantar aponeurosis
   pulls ant. pillor close to post. pillor to maintain the arch
2. SPRING LIGAMENT
   Supports head of talus



→ Dynamic Supporters

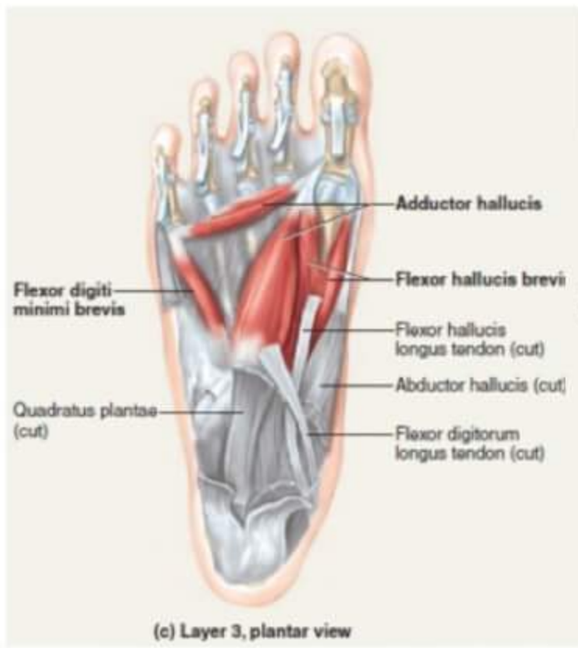
1. Flexor Hallucis longus
2. Tibialis anterior

SOLE MUSCLES

Q. All of the following pairs concerning layers of sole muscles are correct EXCEPT

a) **First layer: Adductor hallucis**
b) **Second layer: Lumbricals**
c) **Third layer: Flexor hallucis**
d) **Fourth layer: Interossei**

1st layer	2nd layer	3rd layer	4th layer
Abductor hallucis	Lumbricals	Adductor hallucis	Plantar interossei (three muscles)
Flexor digitorum brevis	Quadratus plantae	Flexor hallucis brevis	Dorsal interossei (four muscles)
Abductor digiti minimi		Flexor digit minimi brevis	



1st LAYER → ABDUCTOR HALLUCIS
2nd LAYER → LUMBRICALS (comes from flexor digitorum longus)
3rd LAYER → ADDUCTOR HALLUCIS
4th LAYER → INTEROSSEI

IF Lumbricals & Interossei are paralysed
→ CLAW FOOT DEFORMITY

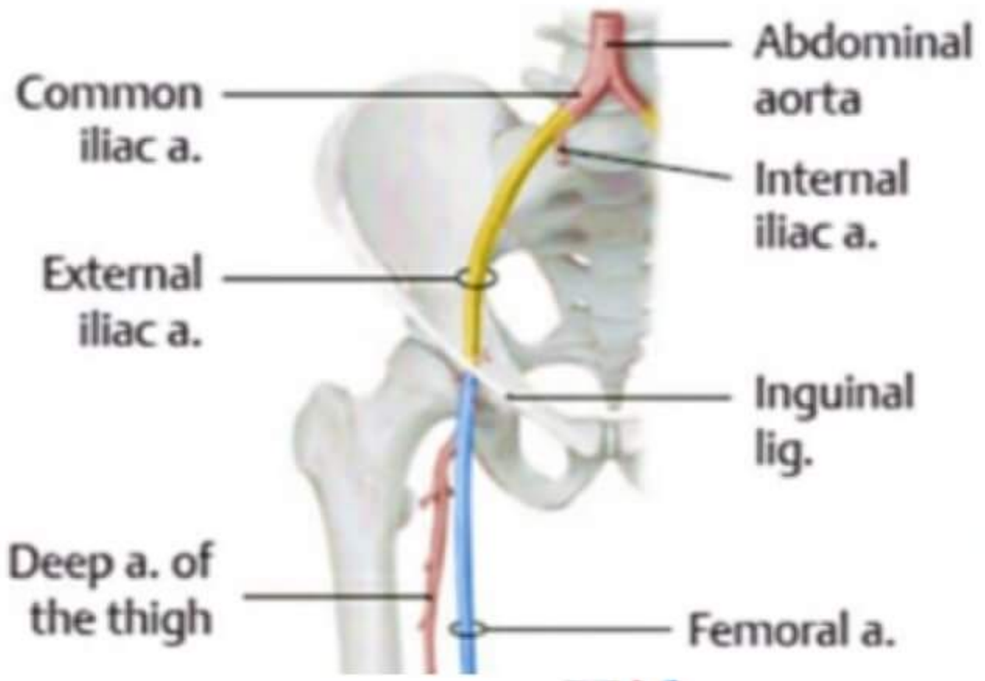
Muscles of the Foot

Muscle	Innervation	Action
Abductor hallucis	Medial plantar nerve (S2, S3)	Abducts and flexes the big toe
Flexor digitorum brevis	Medial plantar nerve (S2, S3)	Flexes lateral four toes
Abductor digiti minimi	Lateral plantar nerve (S2, S3)	Abducts and flexes the little toe
Quadratus plantae	Lateral plantar nerve (S2, S3)	Flexes lateral four toes
Lumbricals	Medial 1: Medial plantar nerve (S2, S3) Lateral 3: Lateral plantar nerve (S2, S3)	Flex proximal phalanges of lateral four toes Extend middle and distal phalanges of lateral four toes
Flexor hallucis brevis	Medial plantar nerve (S2, S3)	Flexes proximal phalanx of the big toe
Adductor hallucis	Lateral plantar nerve (S2, S3)	Adducts the big toe
Flexor digiti minimi brevis	Lateral plantar nerve (S2, S3)	Flexes proximal phalanx of the little toe
Plantar interossei (3)	Lateral plantar nerve (S2, S3)	Adduct the toes 2–4 Flex metatarsophalangeal joints
Dorsal interossei (4)	Lateral plantar nerve (S2, S3)	Abduct the toes 2–4 Flex metatarsophalangeal joints
Extensor digitorum brevis	Deep fibular nerve (L5, S1)	Extends the four medial toes at the metatarsophalangeal and interphalangeal joints
Extensor hallucis brevis	Deep fibular nerve (L5, S1)	Extends the big toe at the metatarsophalangeal joint

ARTERIAL SUPPLY

→ Extenal Iliac artery pass under inguinal ligament to continue as FEMORAL ARTERY

→ FEMORAL ARTERY gives PROFUNDA FEMORAL ARTERY (Deep artery of thigh)



FEMORAL ARTERY

→ Present in adductor canal in middle 1/3 rd of thigh

→ passes adductor hiatus & enters popliteal fossa as POPLITEAL ARTERY behind the knee joint

→ Popliteal artery gives

ANTERIOR TIBIAL ARTERY (runs anteriorly to tibia)

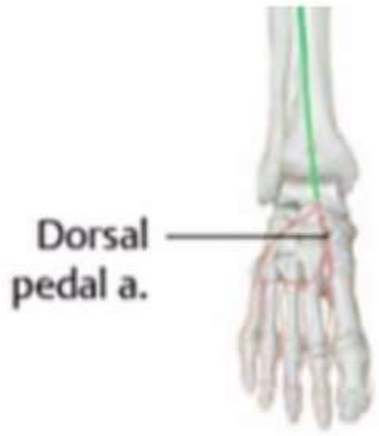
- continues to dorsum of foot as DORSALIS PEDIS ARTERY

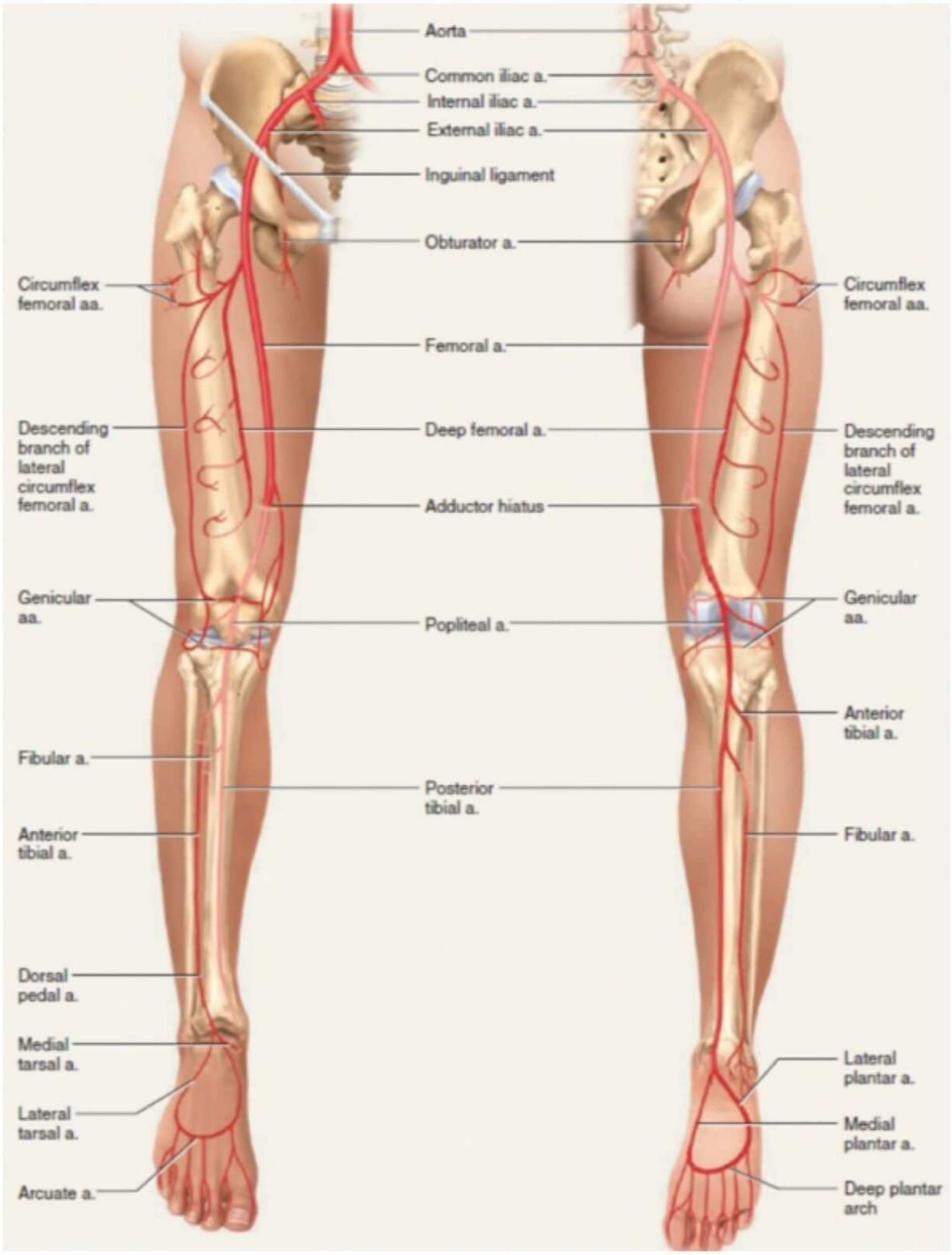
TIBIO PERONEAL TRUNK

→ divides into

1. Posterior tibial artery (posterior to tibia)
   - pass under flexor retinaculum on medial side of ankle & divides into to medial & Lateral plantar arteries & Supplies Sole

2. Fibular artery (do not go to lateral compartment) but supplies muscles of lateral compartment



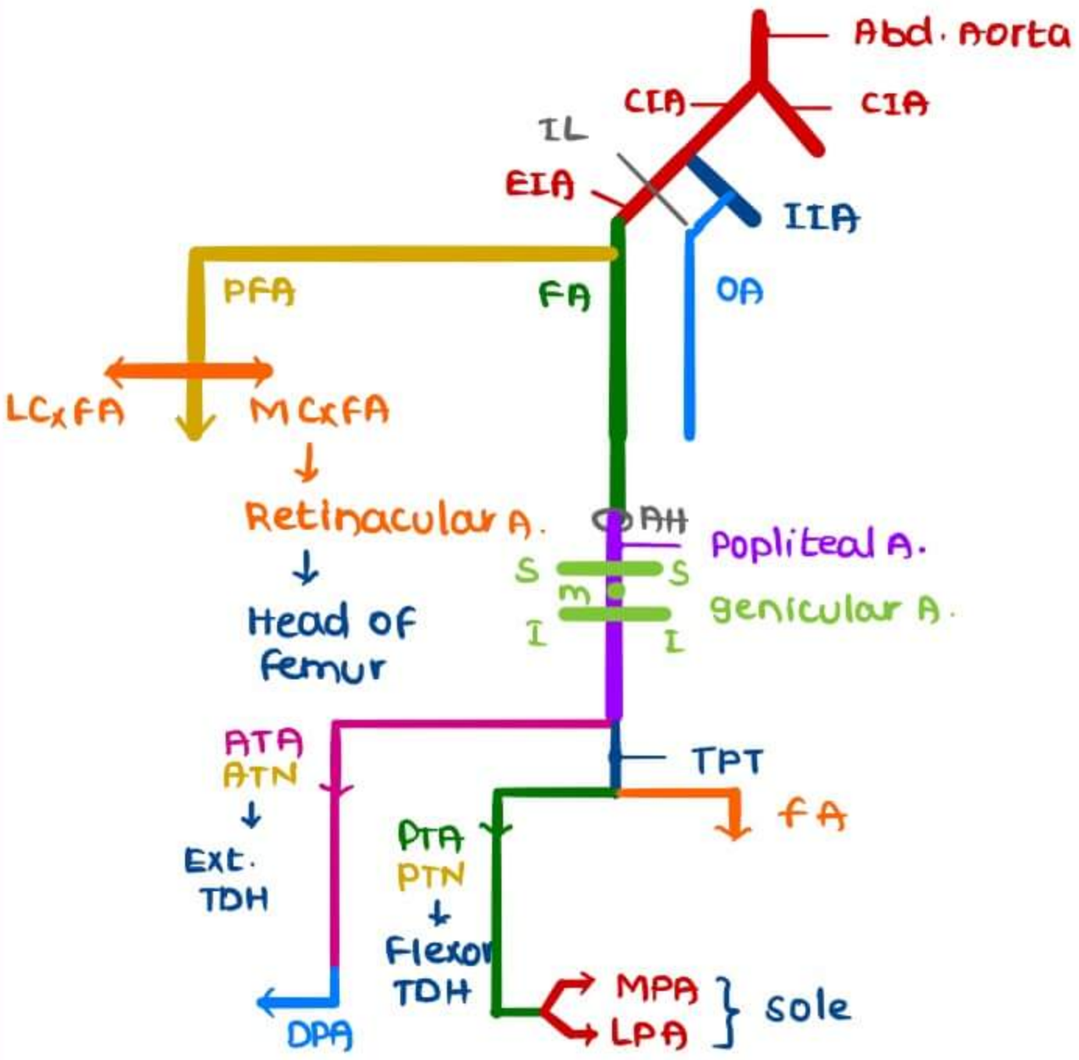


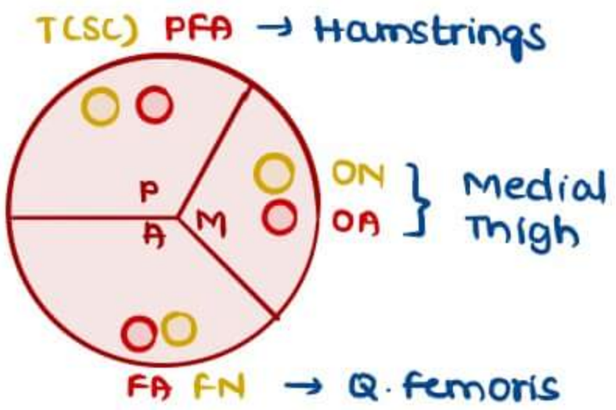
→ Anterior division of Internal Iliac artery gives Obturator artery to medial thigh which passes obturator foramen in hip bone

→ Major artery in thigh → PROFUNDA FEMORAL ARTERY
- Supplie posterior, anterior & medial thigh
- Gives Ant. & post. circumflex femoral arteries & supplies head of femur
  - major artery for the head of femur → Retinacular A (br. of middle circumflex femoral artery) (Intracapsular # neck of femur causes Avascular necrosis)

→ Popliteal artery gives 5 Genicular arteries in popliteal fossa
- → 2 superior
- → 2 inferior
- → 1 middle

} Supplies knee joint



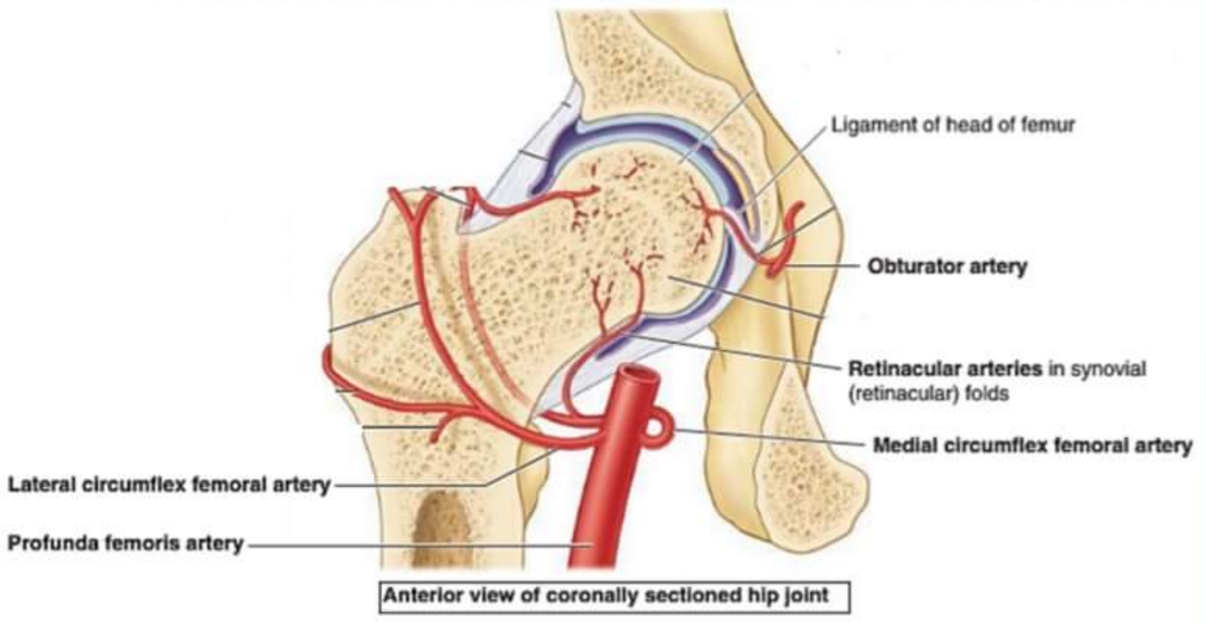


Compartments of the leg

Compartment		Muscular contents	Neurovascular contents
① Anterior compartment		Tibialis anterior	Deep fibular n. Anterior tibial a. and v.
		Extensor digitorum longus	
		Extensor hallucis longus	
		Fibularis tertius	
② Lateral compartment		Fibularis longus	Superficial fibular n.
		Fibularis brevis	
Posterior compartment	③ Superficial part	Triceps surae (gastrocnemius and soleus)	—
		Plantaris	
	④ Deep part	Tibialis posterior	Tibial n. Posterior tibial a. and v. Fibular a. and v.
		Flexor digitorum longus	
		Flexor hallucis longus	

Q. Head of femur is chiefly supplied by

a) Obturator artery
b) Medial circumflex femoral artery
c) Lateral circumflex femoral artery
d) Superior gluteal artery



Anterior view of coronally sectioned hip joint

VENOUS DRAINAGE

VEINS

SUPERFICIAL GROUP (sub cutaneous)

→ Great saphenous vein
Short Saphenous vein etc

DEEP GROUP

→ Popliteal vein
Femoral vein
Tibial vein etc

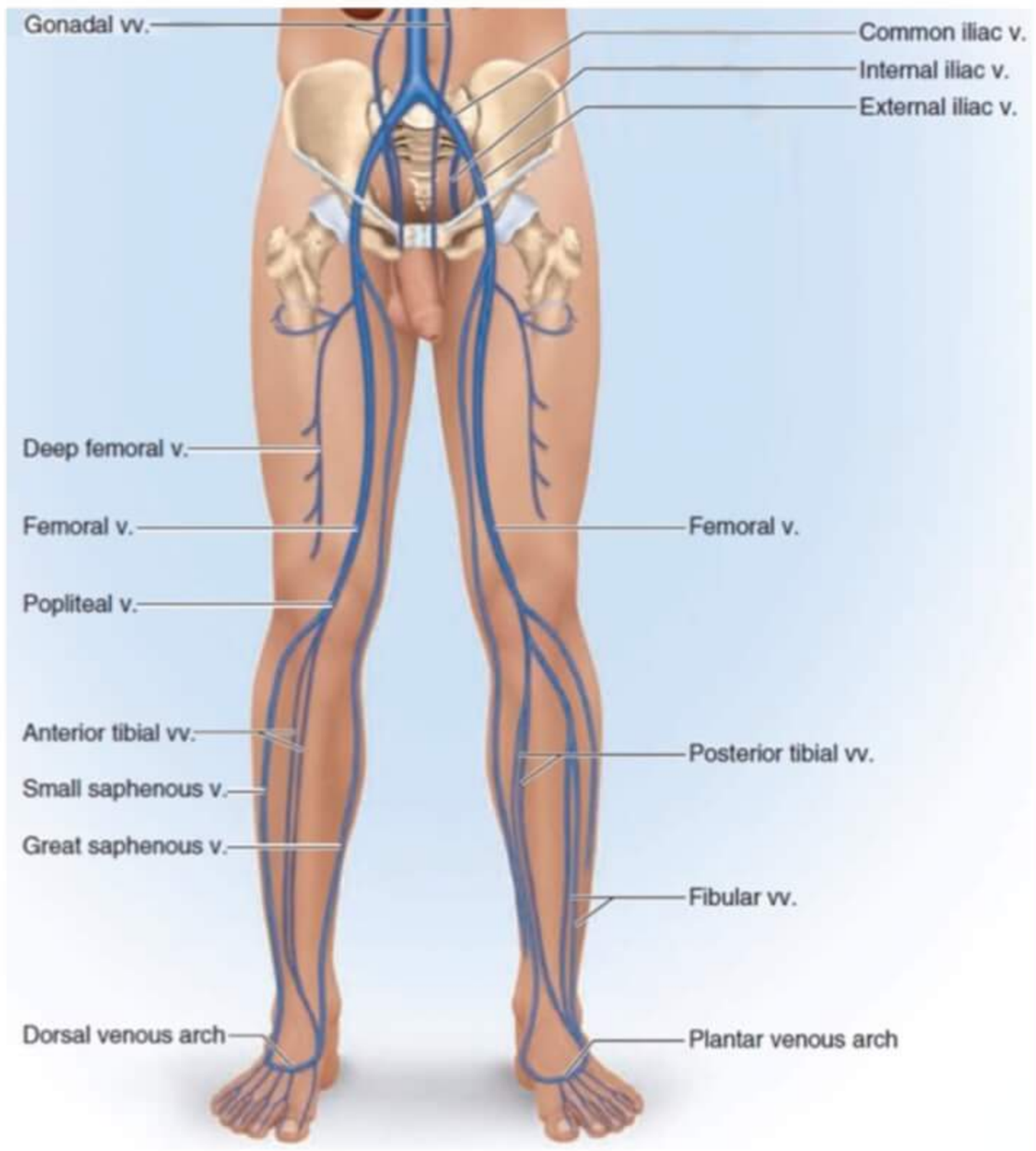
→ Deeper veins collect blood from superficial veins
→ Perforators prevents blood coming back into superficial veins from deep veins
→ Incompetent perforators leads to varicosity

LL - VENOUS DRAINAGE

→ Dorsal venous arch gives GREATER SAPHENOUS VEIN
→ GSV passing anterior to medial malleolus (site for venesectn in bum pt.) ascend up in leg & thigh region & drains into femoral vein

→ Femoral vein is the continuatn of Popliteal vein in popliteal fossa
→ Popliteal vein formed by the union of tibial veins (deeper veins)
→ Great saphenous & short saphenous are superficial vein
→ Profunda femoral vein drains into femoral vein
→ Femoral vein after passing under inguinal ligament, becomes Ext. Iliac vein & receives Int. Iliac vein join to form common Iliac vein

→ common Iliac veins on both sides contribute to IVC



GREAT SAPHENOUS VEIN

→ comes from dorsal venous arch, passes anterior to medial malleolus & goes up slightly behind & again comes anterior & enters into Cribriform fascia to enter femoral vein.

→ in vacose sx, it is ligated & removed as close as possible to femoral vein

SHORT SAPHENOUS VEIN

→ Lateral marginal vein merging dorsal venous arch form short saphenous vein

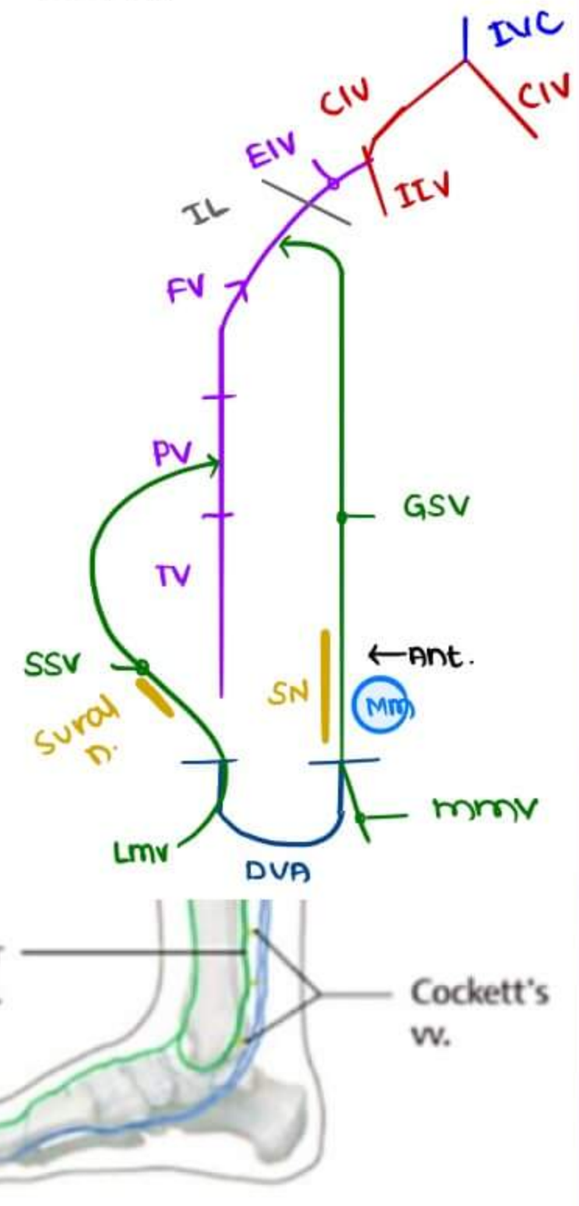
→ runs Lateral to achilis tendon, runs posterior in leg region, drains into popliteal vein piercing the roof of popliteal fossa

PERFORATORS

SUPRA ANKLE COCKETT'S PERFORATORS

→ drains the superficial blood into deeper veins

→ superficial vein → posterior Arch vein
deeper vein → posterior tibial vein



HUNTERIAN PERFORATOR

→ present in midthigh

→ blw femoral vein & great saphenous vein

DODD'S PERFORATOR

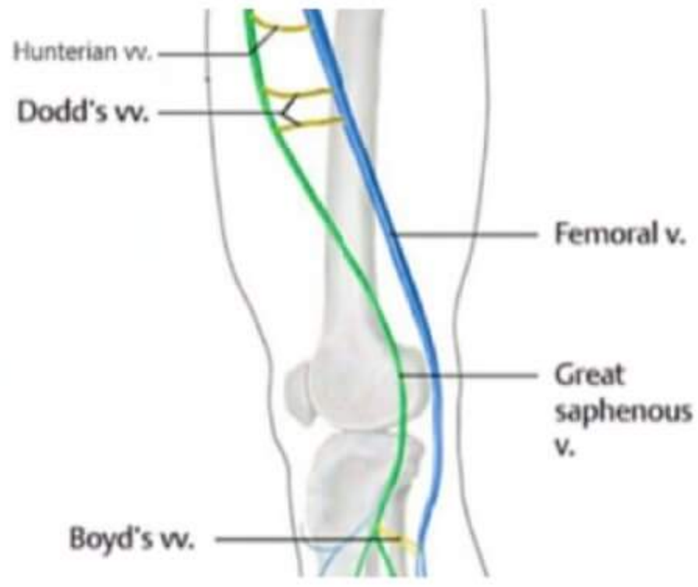
→ present above the Knee

→ blw femoral vein & great saphenous vein

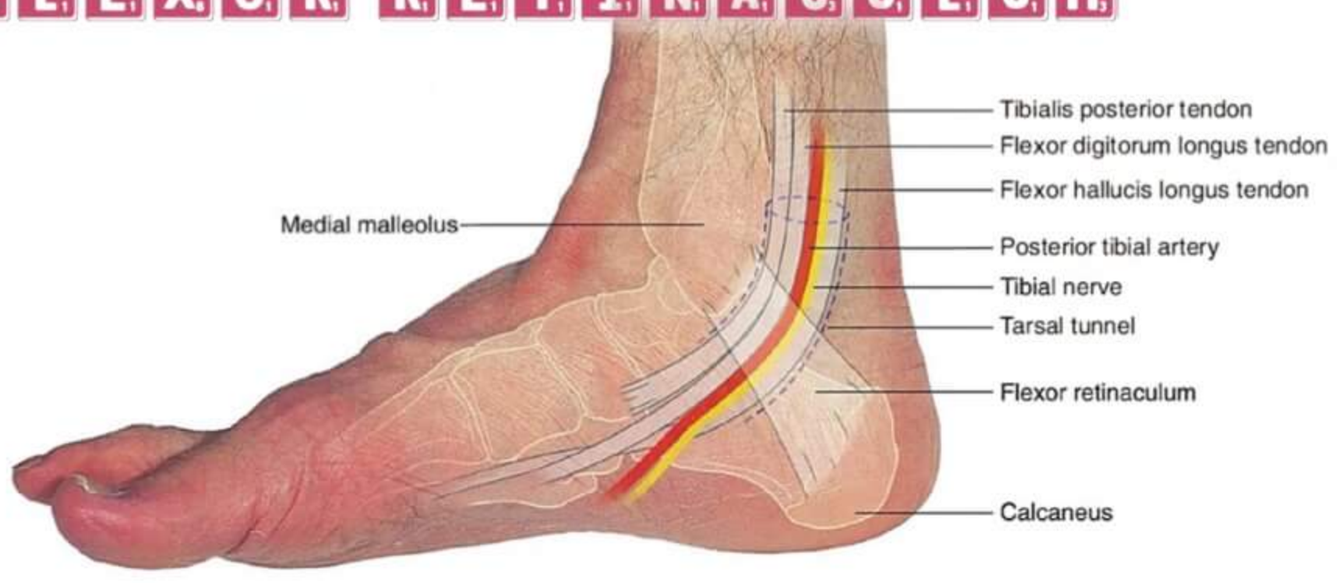
BOYD'S PERFORATOR

→ present below the knee

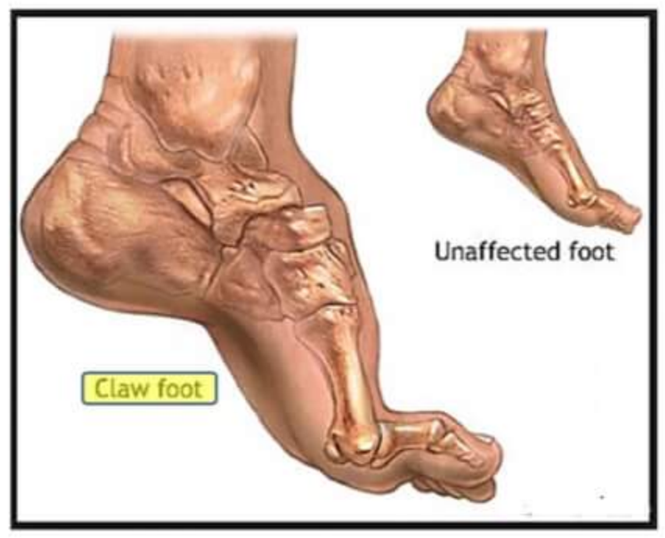
→ blw great saphenous vein & post. tibial | popliteal vein



FLEXOR RETINACULUM



→ present on medial side of ankle
→ attaching to medial side of lower end of tibia & calcaneum
→ posterior tibial nerve passing under flexor retinaculum & gives medial, lateral plantar nerve



→ ANTERIOR to POSTERIOR
Tom → Tibialsis posterior
Dick → flexor digitorum
ANd → post. tibial Artery & Nerve
Harry → flexor hallucis longus

→ TARSAL TUNNEL SYNDROME
→ compression of post. tibial n. under flexor retinaculum
→ medial & later plantar nerves compromised
→ sensory loss of sole & sole muscles paralysed (L&I)
→ CLAW FOOT DEFORMITY
→ Meta tarso phalangeal joint hyperextension
→ Interphalangeal joint flexion

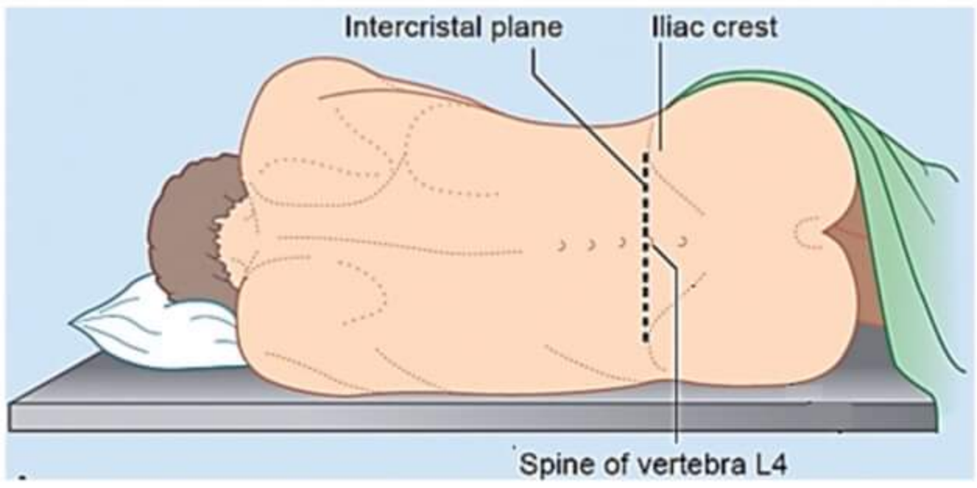
→ MTP Extension is by Tibialis anterior, extensor digitorum, Ext. Hallucis
→ Toe flexion is by Tibialis posterior, Flexor digitorum, flexor hallusis

Q Structure passing deep to flexor retinaculum is
a Posterior tibial artery
b Long saphenous vein
c Tibialis anterior
d Peroneus tertius

LUMBAR PUNCTURE

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

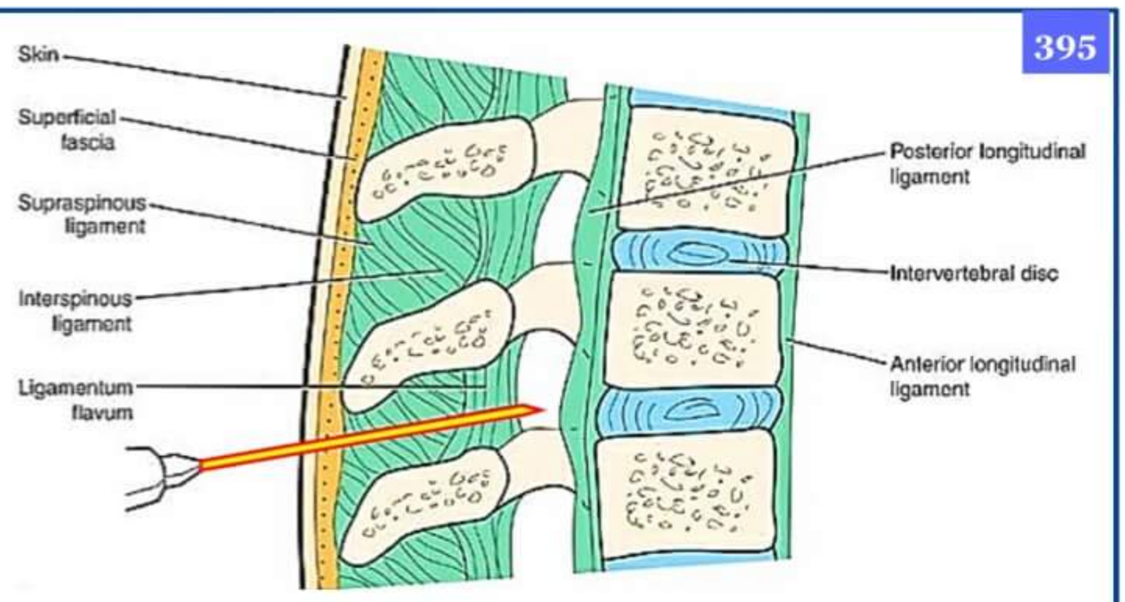
a) **Anterior longitudinal**
b) **Ligamentum flava**
c) **Posterior longitudinal**
d) **Supraspinous**



→ Put the patient in Flexion posture
→ mark the highest point of Iliac crest (L-4)
↳ needle to be inserted here (L-4 & L-5 space)

LIGAMENTS THAT ARE ASSOCIATED C VERTEBRA
→ Anterior longitudinal ligament
→ posterior longitudinal
→ Ligament Flavum
↳ present more posteriorly blw the lamina of vertebra
↳ lamina present behind the body

→ Supra spinous ligament
→ Interspinous ligament

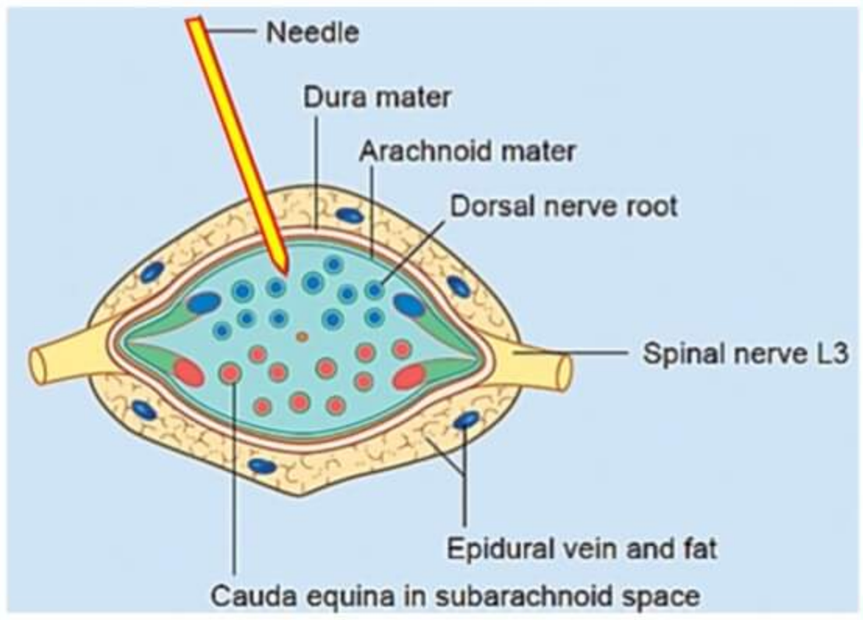


LIGAMENTS THAT ARE PUNCTURED

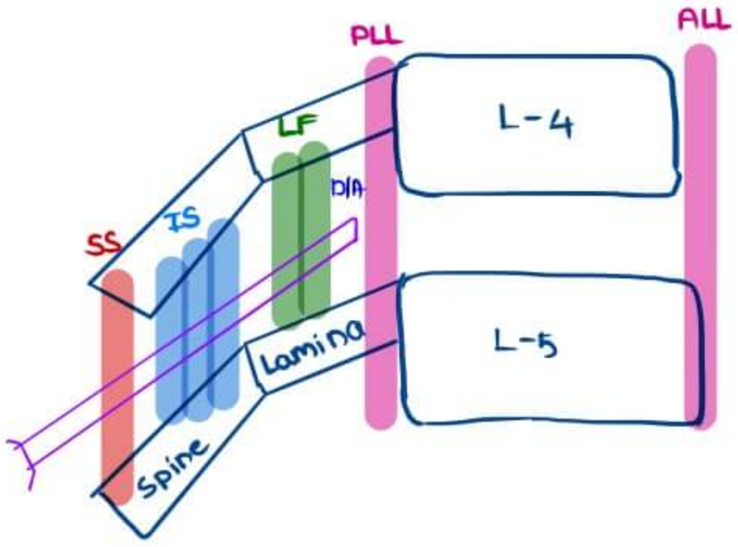
→ ligamentum flavus
→ Supra spinous ligament
→ Interspinous ligament

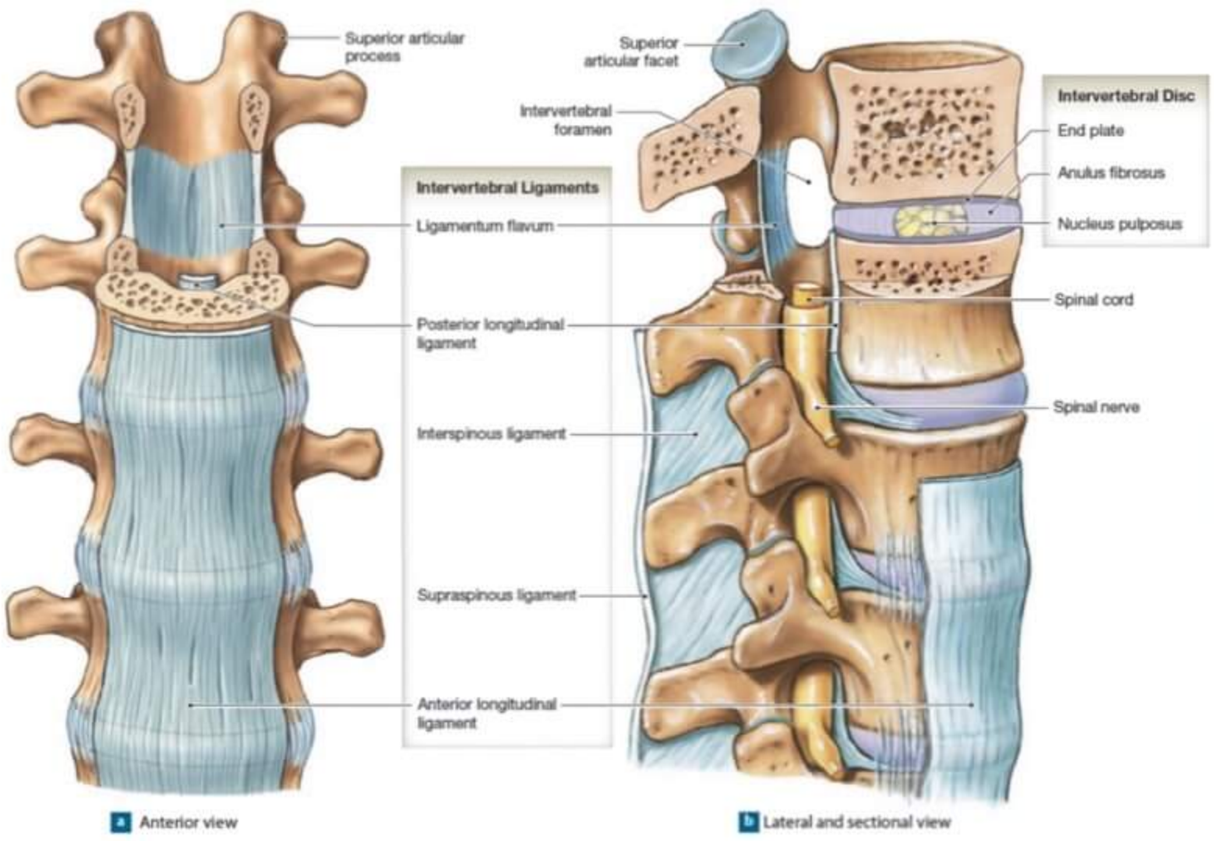
→ Resistance will be present while puncturing the ligaments
↳ Fell of sudden loss of resistance after puncturing the ligaments (ligamentum flavum) → 1st POPPING SENSATION

→ **PROCEDURE**
→ Needle is inserted b/w L4 & L5
→ **STRUCTURES THAT ARE PUNCTURED**
→ Ligaments
↳ ligamentum flavus
↳ Supra spinous ligament
↳ Interspinous ligament



→ Meninges
↳ dura mater (and Popping sensatn occur after it's puncture)
↳ Arachnoid mater





Q. Popping sensation felt on doing Lumbar puncture is while piercing
Ligamentum flavum (Better Answer)
Supraspinous ligament
Interspinous ligament
Duramater