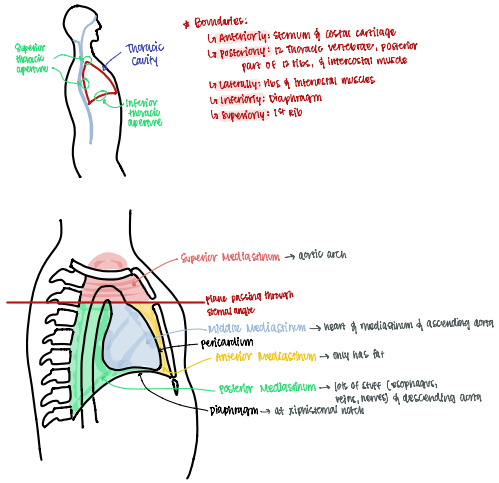
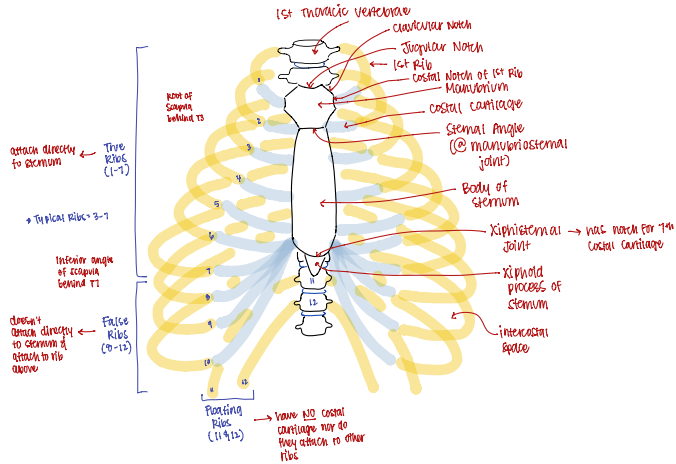


THORAX, LUNGS, & HEART



THORAX

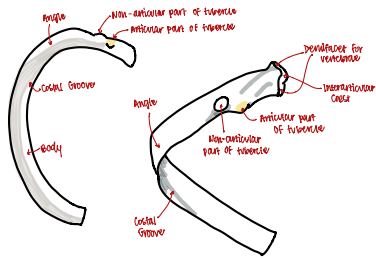
OSTEOLOGY



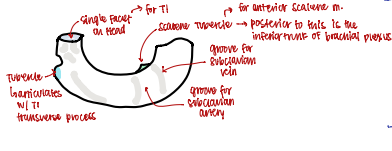
Boundaries:
 Anteriorly: sternum & costal cartilage
 Posteriorly: 12 thoracic vertebrae, posterior part of 13 ribs, & intercostal muscles
 Laterally: ribs & intercostal muscles
 Inferiorly: diaphragm
 Superiorly: 1st rib

Typical Rib

- Very smooth on top & has a sharp edge on the bottom
- Demi facet:** articulates with the thoracic body above & below
- Crest:** articulates w/ disc
- Head of rib is held by the radiate ligament
- Costal groove: where nerve, arteries & veins come through
- Thoracic spine:** nerve exits below vert
- 1st 10 ribs = T5-T4 facet joint (local), T0-T1, T4-T5
- 11 discs = T9-T4, T4-T5

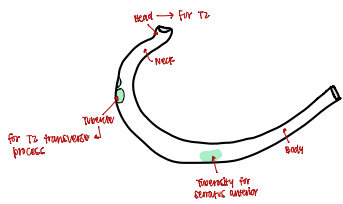


1st Rib: short, stubby, & round
 Indifferent from typical rib (atypical rib)
 It has attachments for subclavian vein & artery



Thoracic Outlet Syndrome:
 Compression of neural & vascular bundles crossing the superior aperture of the thorax can cause this
 Can be result of narrowing of 1st rib due to increased tension in the superior & middle scalenes
 Symptoms: tingling along ulnar distribution in the hand, numbness in the hypohumer & interosseous muscles, pain in the anterior base of shoulder, diminished pulse in involved limb

2nd Rib: slightly longer, less curved, & more rounded than 1st rib
 Atypical rib

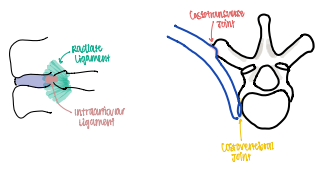


11th & 12th Rib: short & less curved than the other ribs
 Each head has a single, vertebral articular surface
 No prominent rib tubercle
 No costal notch → covered w/ hyaline cartilage

JOINTS

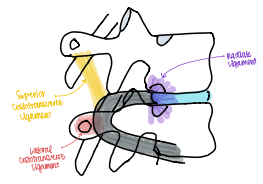
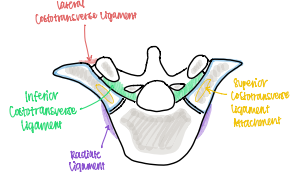
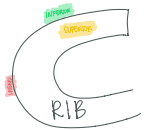
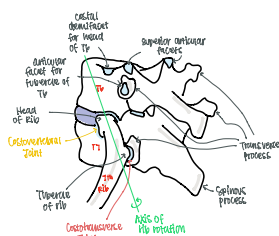
COSTOVERTEBRAL

- Typical rib: head of rib articulates with costal facets of vertebrae
- Ligaments:
 - radiate ligament: attaches head of rib to the vertebral bodies
 - interarticular ligament
 - intra-articular ligament
 - costovertebral joint
 - costovertebral joint



COSTOTRANSVERSE

- Rib attaches to the vertebrae's transverse process
- Ligaments:
 - Superior costotransverse: comes from transverse process above to help stabilize the rib
 - transverse process → neck of rib below
 - lateral costotransverse: transverse process → neck of rib same level
 - inferior costotransverse: lateral side of transverse process → neck of rib same level



MUSCLES

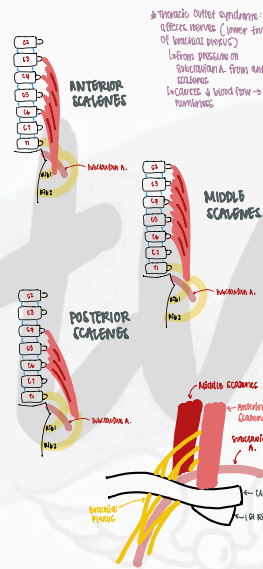
↳ EXTRINSIC MUSCLES

* attach to thoracic cage & humerus, scapula, vertebrae, or pelvis

- iliocostalis
- longissimus
- pectoralis Major
- pectoralis Minor
- Serratus Anterior
- External Intercostal Muscle
- Internal Intercostal Muscle
- Transverse Abdominis
- Rectus Abdominis
- Levator costarum muscles: elevates ribs for inspiration

Don't worry about these

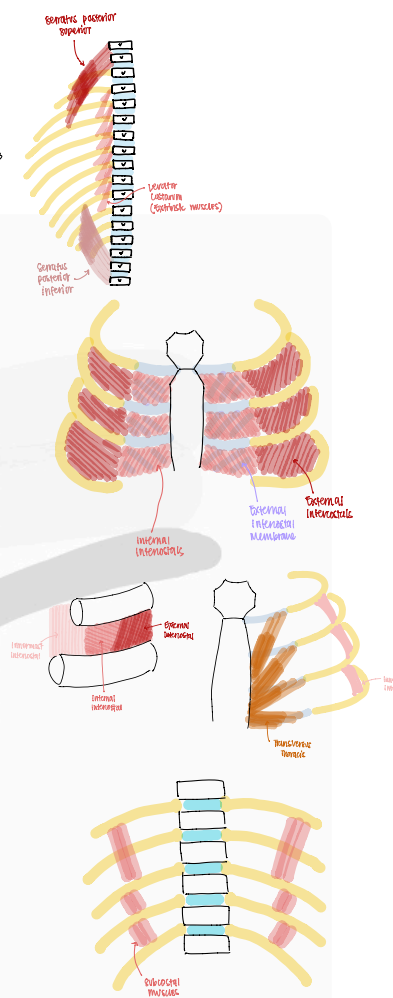
- Anterior Scalenes:
 - ↳ origin: anterior tubercle of the transverse process of C2-C6
 - ↳ insertion: scalene tubercle & ridge of 1st rib
 - ↳ nerve: C5-C6
 - ↳ action: elevation of 1st rib, cervical flexion (both sides), cervical rotation (opposite side)
- Middle Scalenes:
 - ↳ origin: posterior tubercle of the transverse processes of C2-C7
 - ↳ insertion: superior border of the 1st rib, posterior to the groove for the subclavian artery
 - ↳ nerve: C3-C6
 - ↳ action: elevation of 1st rib, cervical flexion (both sides), cervical rotation (opposite side)
- Posterior Scalenes:
 - ↳ origin: posterior tubercle of transverse processes of C4-C6
 - ↳ insertion: outer posterior border of the 2nd rib
 - ↳ nerve: C5-C6
 - ↳ action: elevation of the second rib, cervical flexion (both sides), lateral cervical flexion (same side)



↳ INTRINSIC MUSCLES

* only attach to thoracic cage

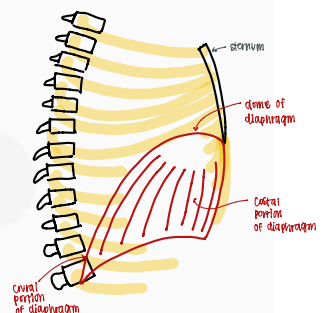
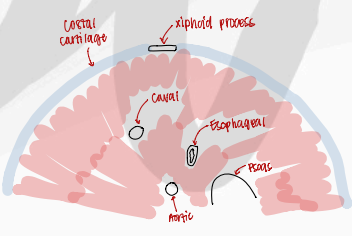
- Serratus Posterior Inferior:
 - ↳ origin: spinous process T1-T2/3
 - ↳ insertion: ribs 9-12
 - ↳ nerve: intercostal nerves T9-T11
 - ↳ action: depresses lower rib during ventilation, stabilizes upper costovertebral joints of ribs 9-12, helps with restricted rotation of trunk, helps with forced expiration
- Serratus Posterior Superior:
 - ↳ origin: caudal part of ligamentum nuchae, spinous processes of C1-T3
 - ↳ insertion: ribs 2-4/5
 - ↳ nerve: intercostal nerves T2-T5
 - ↳ action: depresses upper rib during ventilation, stabilizes upper costovertebral joints of ribs 2-4, helps move spine down, helps with forced inspiration
- External Intercostal:
 - ↳ origin: inferior body of the rib above, extending from the tubercle of the rib to the costal cartilage; from the costal cartilage junction of the rib to the sternum where the muscle is replaced by the external intercostal membrane
 - ↳ insertion: superior body of costal cartilage of the rib directly below
 - ↳ nerve: intercostal nerve of that intercostal space
 - ↳ action: lifts the lower rib to expand the anteroposterior diameter of the thoracic cavity during normal & forced inspiration; stabilizes body trunk
- Internal Intercostal:
 - ↳ origin: superior border of the rib below, extending from the angle of the rib to the sternum from the angle posteriorly, the junction intercostal membrane attaches to the superior surface of the rib; the inferior attachment lies internal to the attachment of external intercostal
 - ↳ insertion: inferior body of the rib above, extending along the edge of the costal groove from the angle of the rib to the sternum; from the angle of the rib posterior
 - ↳ nerve: intercostal nerve of that intercostal space
 - ↳ action: depression of the rib above to decrease the thoracic space during forced expiration; may also be active in forced inspiration, stabilizes the body trunk
- Transversus Thoracis Muscle:
 - ↳ origin: anterior surface of the costal cartilages from the second through the 5th ribs; inferior body of the sternum & xiphoid process
 - ↳ insertion: 4-5 ribs of muscle attaching along the inner surface of the costal cartilage of ribs 2-6
 - ↳ nerve: intercostal nerves of the intercostal space
 - ↳ action: depresses the rib during expiration
- Internalmost Intercostal:
 - ↳ origin: along the internal surface of the rib above, extending from the angle of the rib to the costal cartilage
 - ↳ insertion: on the inner surface of the body of the rib below, from the angle of the rib to the costal cartilage
 - ↳ nerve: intercostal nerve of that intercostal space
 - ↳ action: depression of the rib above to increase the thoracic cavity during inspiration; may also be active in forced inspiration, stabilizes the body trunk
- Subcostal Muscle:
 - ↳ origin: a larger in lower part of thorax
 - ↳ origin: inner surface of the angle of the rib above
 - ↳ insertion: internal surface of either the rib below or the second rib below or the second rib below the superior attachment
 - ↳ nerve: intercostal nerve of the intercostal space
 - ↳ action: elevation of the rib below to increase the size of the thoracic cavity for inspiration/expiration
 - ↳ can be both the upper down depending on the situation



↳ DIAPHRAGM

- thin sheet of muscle that spans the inferior thoracic aperture
- fibres originate from the sternum, ribs, & upper lumbar vertebrae & run inwardly to attach to a central tendon that has no bony attachments
- origin:
 - ↳ sternal part: xiphoid process of sternum
 - ↳ costal part: internal surface of the lower ribs & costal cartilages
 - ↳ vertebral part: upper 2 or 3 lumbar vertebrae by way of a muscular crus & a medial & lateral arched ligament on each side
 - arched ligaments are extensions of the thoracolumbar fascia
- insertion: central tendon of the diaphragm
- nerve: phrenic nerve
- action: contraction of the diaphragm lowers the central tendon increasing the volume of the thoracic cavity during inspiration
- this motion decreases pressure around the lungs allowing the inward movement of air
- openings:
 - ↳ vena cava foramen [T8]
 - inferior vena cava
 - ↳ esophageal hiatus [T10]
 - esophagus
 - R/L vagal trunks
 - ↳ aortic hiatus [T12]
 - aorta
 - thoracic duct
 - azygos vein
 - ↳ psoas gap [T12]
 - psoas major
 - ilioinguinal N.
 - genitofemoral N.
 - sympathetic chain

OPENINGS
Come Enter Abdominal Pleuro
cava (1)
Esophageal (2)
aorta (3)
psoas (4)



* Hiatal hernia: part of the stomach slips through the esophageal hiatus.

NERVES

↳ INTERCOSTAL NERVE

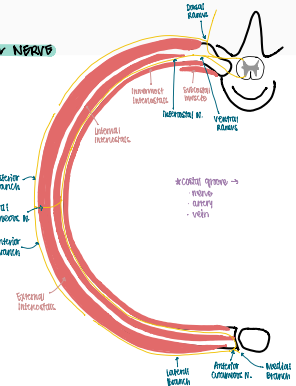
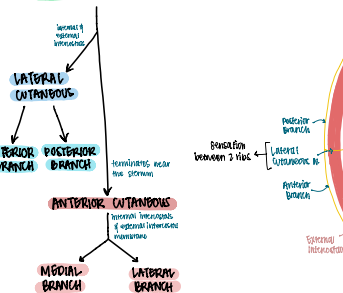
- ventral rami T1-T11
- run with A/V along each rib (in subcostal groove)
- motor to intercostal muscles
- sensory from skin of thoracic region
- lateral cutaneous N. branches to skin
 - ↳ divides into anterior & posterior branch
- Intercostal N. terminates near sternum as Ant. cutaneous N.
- Ant. cutaneous N. passes through the internal intercostal muscles & external intercostal membrane
- ↳ then divides into a medial & lateral branches

↳ SUBCOSTAL NERVE

- where the ventral ramus of T12 spinal nerve emerges below the 12th rib
- run w/ intercostal arteries & veins along the costal groove of each rib
- provide motor innervations to the intercostal muscles & sensory input to the skin of the thoracic region

* 1st Intercostal N. is between 1st & 2nd Rib

INTERCOSTAL NERVE → SUBCOSTAL NERVE



ARTERIES & VEINS

* Interstitial veins can either drain anteriorly or posteriorly

↳ ANTERIOR INTERCOSTAL A.

- supplies blood directly to anterior intercostal region
- **Internal Thoracic Artery:** to the first & second intercostal spaces
- **Internal Thoracic Vein:** to the 2nd - 6th intercostal spaces
 - ↳ lies along the lateral edge of the sternum deep to the transverse thoracic muscle
 - ↳ divides at 7th - 11th intercostal space into musculophrenic A. & superior epigastric A.
- **Musculophrenic A.:** gives off Ant. Intercostal A. to the 7th - 9th intercostal spaces
 - ↳ supplies the diaphragm
- **Superior epigastric A.:** supplies the diaphragm & upper rectus abdominis muscle
- 10th & 11th intercostal spaces have no anterior intercostal A. & are supplied by only posterior intercostal arteries.

↳ POSTERIOR INTERCOSTAL A.

- supplies blood directly to posterior intercostal region
- **Supreme Intercostal A.:** to the first & second intercostal spaces
 - ↳ off the costocervical trunk of the subclavian A.
- posterior intercostal A. from the 3rd - 11th intercostal spaces emerge from the thoracic aorta

↳ ANTERIOR INTERCOSTAL V.

- accompany the corresponding arteries & drain into the musculophrenic v. & internal thoracic vein

↳ POSTERIOR INTERCOSTAL V.

- drain either into the Azygos v. (on Ⓞ) or the Hemiazygos & Accessory Hemiazygos v. (on ⊙)

↳ AZYGOS V.

- drains into the superior vena cava
- only on the ⊙ side of the body

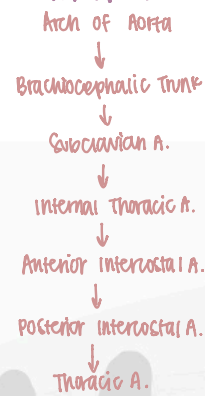
↳ HEMIAZYGOS V.

- drains into the azygos v. in the upper thorax
- only on the ⊙ side of the body
- receives blood from the lower intercostal veins

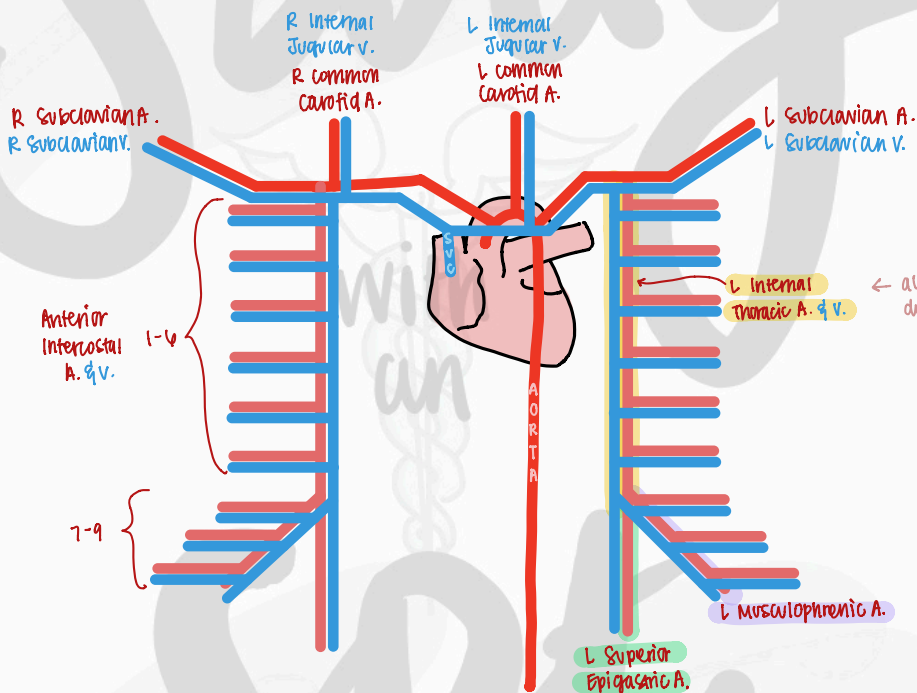
↳ ACCESSORY HEMIAZYGOS V.

- drains into the azygos v. in the upper thorax
- only on the ⊙ side of the body
- receives blood from the upper intercostal veins

IF AORTA IS BLOCKED DISTAL TO LIGAMENTUM ARTERIORUM:

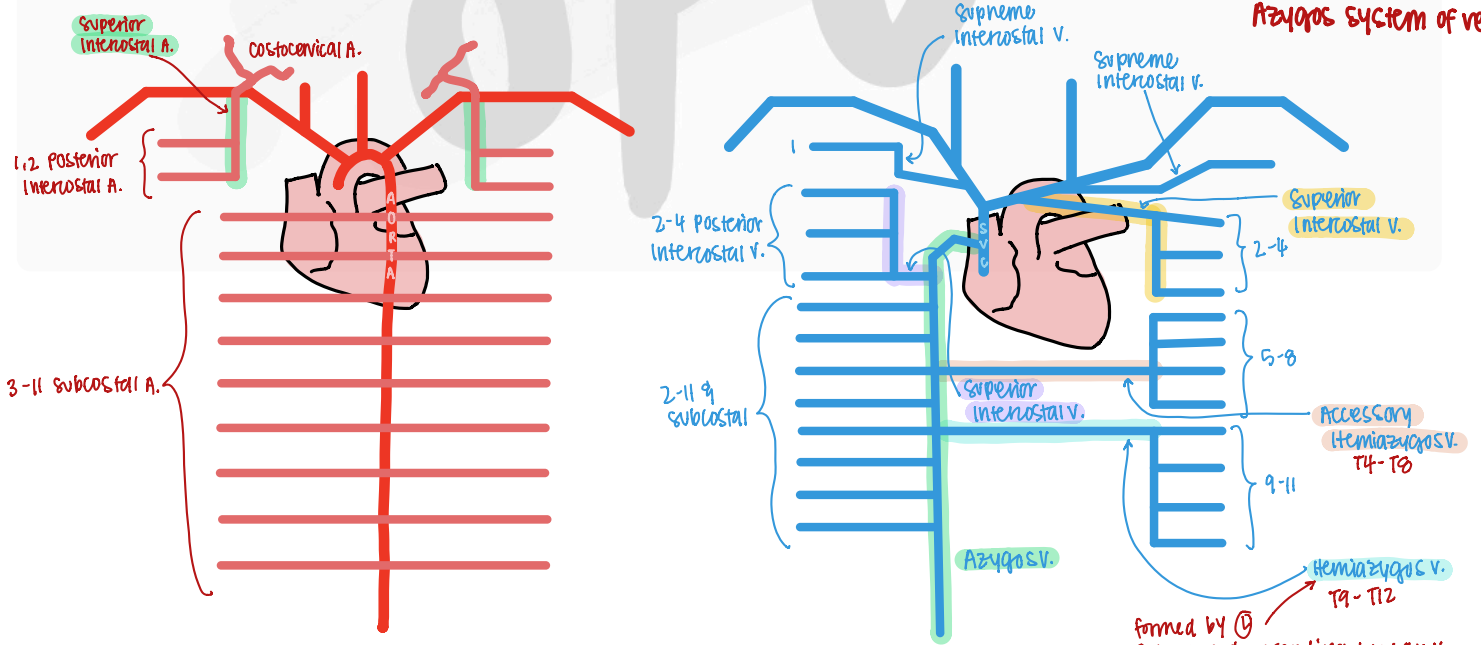


ANTERIOR INTERCOSTAL VESSELS



* Intercostal veins that drains towards anterior side → internal thoracic v.

POSTERIOR INTERCOSTAL VESSELS



* Intercostal veins that drains towards posterior side → Azygos system of veins

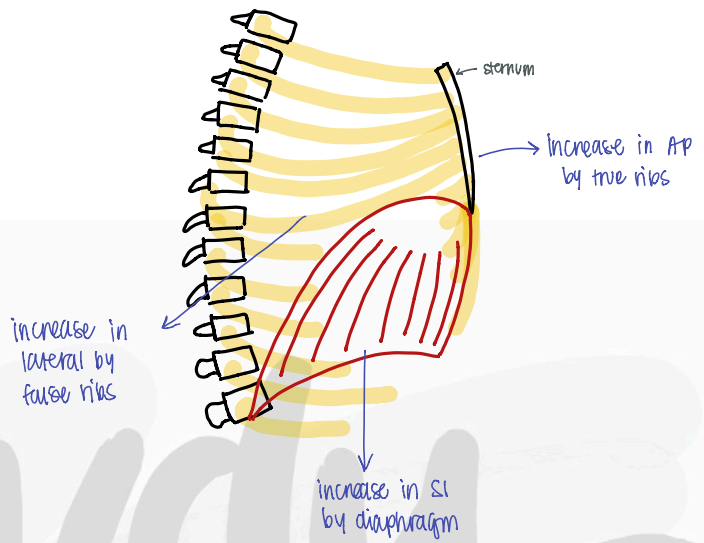
MECHANICS OF VENTILATION

↳ INSPIRATION

- intercostals contract, lift thoracic cage
 - ↳ ↑ A-P diameter & volume of cavity
- diaphragm contracts & moves down
 - ↳ ↑ volume of cavity = ↓ pressure in pleural cavity
 - ↳ pressure in lungs < atmospheric → air goes in

↳ EXPIRATION

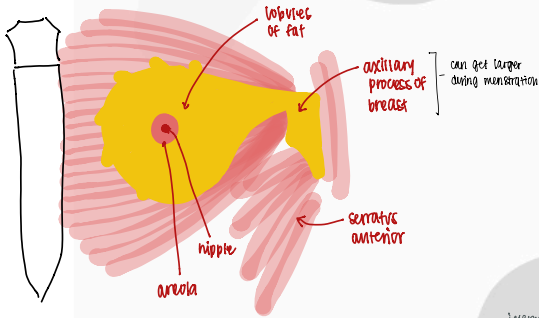
- intercostals relax, ribs move down
- diaphragm relaxes
- ↑ pressure
- pressure in lungs > atmospheric → air goes out
- abdominal contraction can further increase pressure



BREAST

↳ ANATOMY

- runs from sternum to mid-axillary line
- usually from ribs 2-6
- lies on fascia of pec major



↳ VASCULATURE

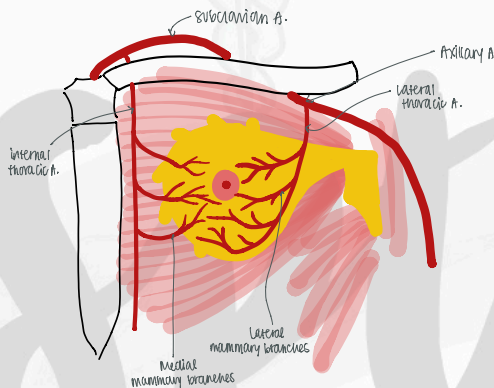
- major blood supply → lateral thoracic & internal thoracic

↳ Lateral thoracic:

- comes off axillary A. (2nd part)
- divides into lateral mammary branches

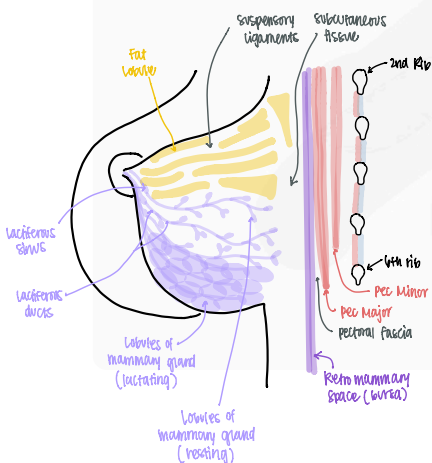
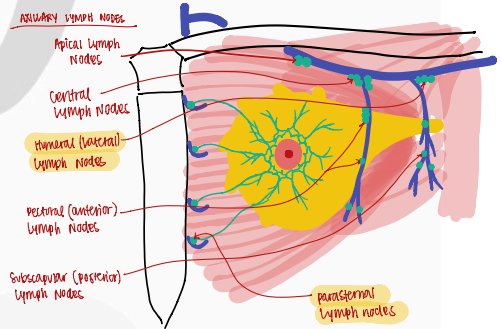
↳ Internal thoracic:

- comes off subclavian A.
- divides into medial mammary branches
- turns into superior epigastric A.



↳ LYMPH

- 75% of breast drains into lateral lymph node
- 25% of breast drains into parasternal lymph node

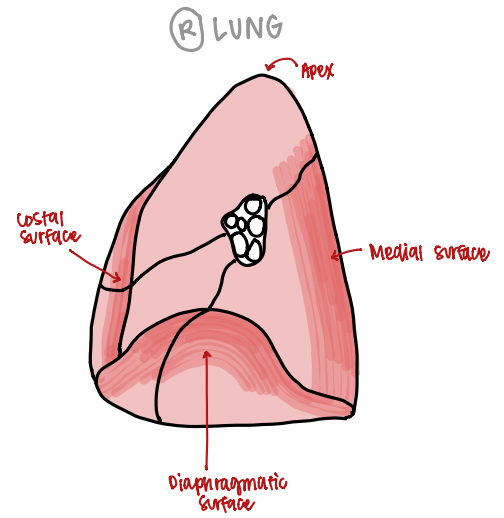


LUNGS

STRUCTURE

↳ Each lung has 4 surfaces

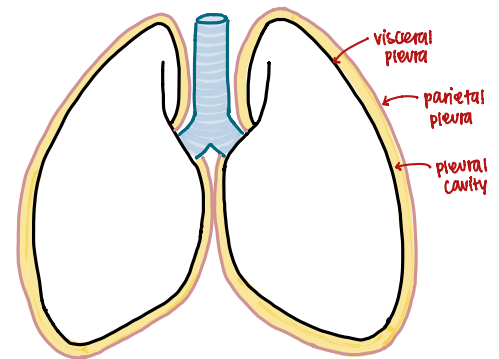
1. The **apex** of the lung lies at the T1 vertebral level & projects superiorly about 3cm above the medial clavicle
 - ↳ Subclavian A. & V. pass over the apex of the lung as they cross the superior thoracic aperture
2. The **costal surface** extends from the spine to the sternum
 - ↳ follows the curvature of the rib cage
3. The **diaphragmatic surface** is at the inferior base of the lung
 - ↳ follows the curvature of the diaphragm so that its anterior margin is more cranial than its posterior margin
 - ↳ at rest, inferior border of lung lies at the 6th rib (in the mid-clavicular line), at the 8th rib (in the mid-axillary line), & at the T10 vertebrae posteriorly
4. The **medial surface** of the lung faces the heart.
 - ↳ the pulmonary A., V., & bronchi enter this surface together at the hilus of the lung by the root of the lung



PLEURA

↳ each lung is surrounded by two very thin layers of cells called the pleura

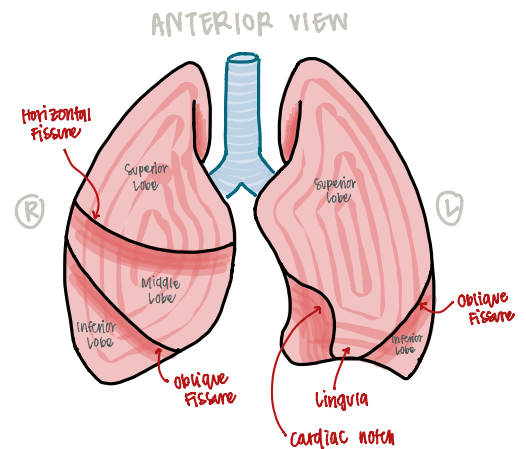
- **visceral pleura**: 1st layer, lies on the surface of the lung
- **parietal pleura**: 2nd layer, lies along the inner wall of the thoracic cavity
- **pleural cavity**: between the visceral & parietal pleura
 - ↳ very narrow space filled with a lubricant that reduces friction between the visceral & parietal layers during lung expansion & relaxation
 - ↳ allows lungs to expand



LOBES

↳ **R lung**:

- divided into 3 lobes → superior, middle, inferior
- **oblique fissure**: runs in a downward & forward direction from the vertebral border of the lung to the sternum
 - ↳ goes along the course of the 6th rib
 - ↳ divides middle & inferior lobes
- **horizontal fissure**: runs horizontally from the oblique fissure to the 4th costal cartilage
 - ↳ begins in the mid-axillary line
 - ↳ divides superior & middle lobe



↳ **L lung**:

- divided into 2 lobes → superior & inferior
- **oblique fissure**: goes along the course of the 7th rib
 - ↳ divides superior & inferior lobes
- **cardiac notch**: indentation along the medial surface of the superior lobe
 - ↳ filled by the heart
- **lingula**: tongue-like protrusion in the upper lobe
 - ↳ below the cardiac notch

R LUNG:

- ↳ Superior lobe:
 - Apical
 - Posterior
 - Anterior
- ↳ Middle lobe:
 - Lateral
 - Medial
- ↳ Inferior lobe:
 - Superior
 - Anterior Basal
 - Medial Basal
 - Lateral Basal
 - Posterior Basal

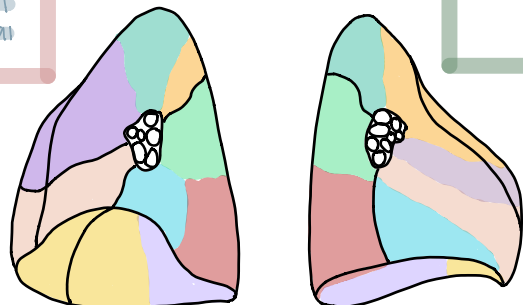
L LUNG:

- ↳ Superior lobe:
 - Apical
 - Posterior
 - Anterior
 - Superior Lingular
 - Inferior Lingular
- ↳ Inferior lobe:
 - Superior
 - Anterior Basal
 - Medial Basal
 - Lateral Basal
 - Posterior Basal

↳ **Bronchopulmonary segments**:

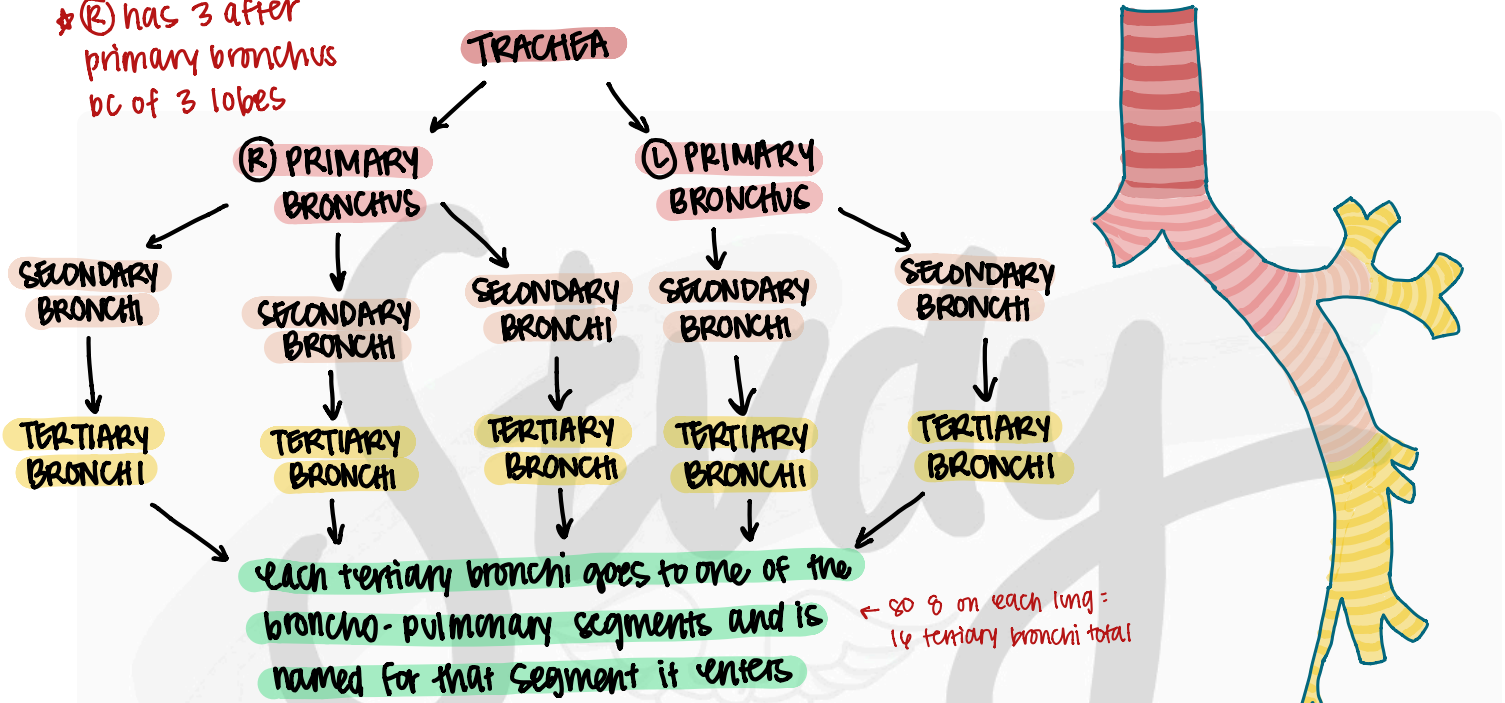
- each lobe can be further subdivided into segments called bronchopulmonary segments
- the segments anterior to the oblique fissure differ between the superior lobes of the lungs
 - ↳ **R lung** has the superior & middle lobes above the oblique fissure
 - ↳ **L lung** has only the superior lobe above the oblique fissure

* don't need to know inferior lobe



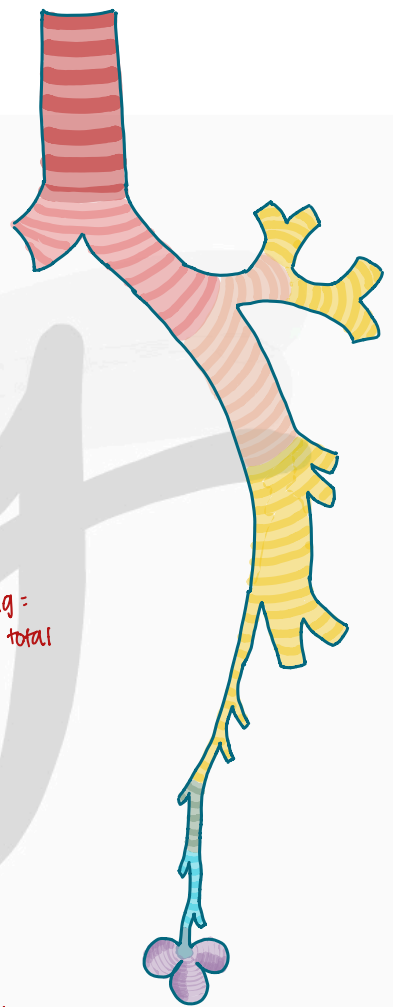
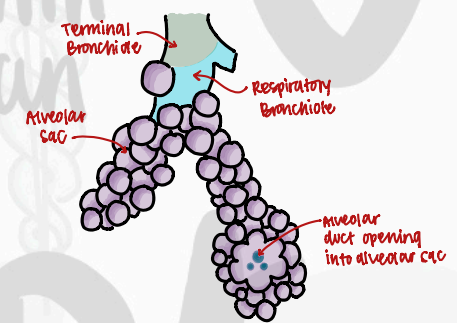
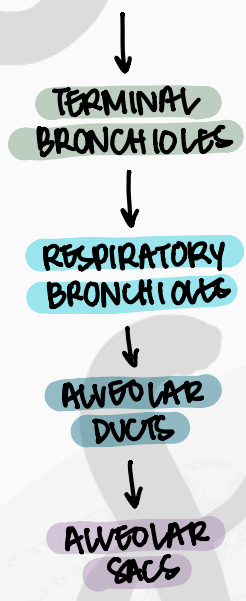
BRONCHIAL TREE

* R has 3 after primary bronchus bc of 3 lobes



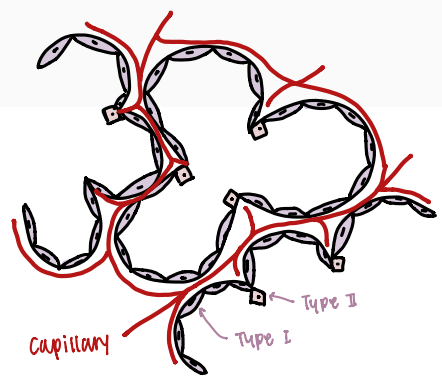
each tertiary bronchi goes to one of the broncho-pulmonary segments and is named for that segment it enters

← 80 ♂ on each lung = 16 tertiary bronchi total



↳ Alveoli:

- thin walled sacs
 - ↳ simple squamous: easy for gas exchange
 - ↳ surrounded by blood supply
- pneumocytes (Type I cells)
- Type II
 - ↳ cuboidal cells
 - ↳ for protection & secretion
 - se cretes surfactant (microscopic film)
 - ↳ keeps alveoli open & maintains surface tension
 - ↳ keeps alveoli from collapsing



POSTURAL DRAINAGE

↳ help clear mucoid congestion

↳ position so gravity assists

- move mucous from BP segment to primary bronchus
- mucous freed by tapping the chest over the segment
- coughing moves mucous from the bronchi to oral cavity for removal

↳ Lingula: lying on @ side, 15° - 30°

↳ Middle lobe: lying on @ side, 15° - 30°

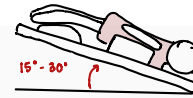
↳ Anterior segments: supine, 30° - 45°

↳ posterior segments: prone, 30° - 45°

↳ posterior apical: sitting, arms & head on desk

* Have to know which position to test pt in depending on which BP segment

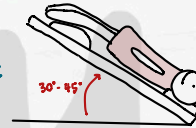
LINGULA



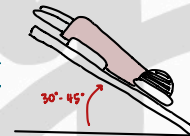
MIDDLE LOBE



ANTERIOR SEGMENTS



POSTERIOR SEGMENTS



POSTERIOR APICAL SEGMENTS



spt

HEART

MEDIASTINUM

↳ **Anterior Mediastinum**: narrow space lying between the sternum & pericardium of the heart

- infants: has thymus gland here
- adults: is mainly fat & connective tissue

↳ **Middle Mediastinum**: region containing the heart & pericardial sac

↳ **Posterior Mediastinum**: lies between the vertebral bodies & the posterior aspect of the heart

- has thoracic aorta, azygos vein, hemiazygos vein, accessory hemiazygos vein, esophagus, vagal trunks, & sympathetic trunk

↳ **Superior Mediastinum**: lies above the heart & overlaps the anterior, middle, & posterior mediastinum superiorly

- **inferior border**: line connecting the sternal angle anteriorly w/ the T4 & T5 between T4 & T5
- **superior border**: superior thoracic aperture (1st Rib)
 - ↳ contains vessels that enter & leave the heart, vagus nerves, recurrent laryngeal nerves, phrenic nerves, trachea, esophagus, cranial end of the thoracic duct & part of the thymus gland
- from manubrium to vertebrae
- can move because of gravity → laying down ≠ standing
- 4 different planes (anterior → posterior)

↳ **Glandular plane**

- thymus gland

↳ **Venous plane**

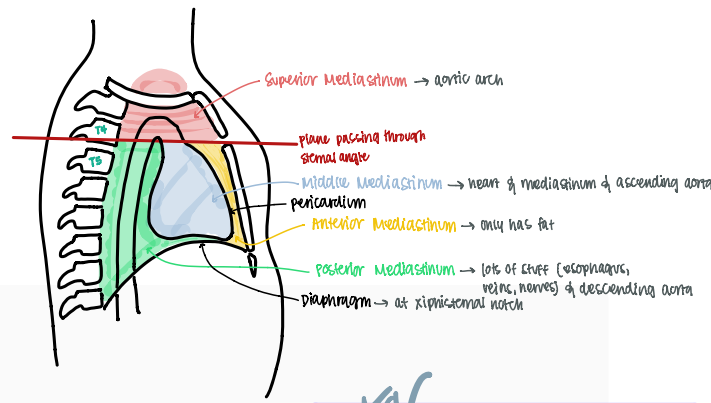
- (L) Brachiocephalic v.
- (R) Brachiocephalic v.
- Superior vena cava
- arch of azygos vein

↳ **Arterial - Nervous plane**

- aortic arch & its branches:
 - ↳ brachiocephalic trunk
 - (R) subclavian A.
 - (R) common carotid A.
 - ↳ (L) common carotid A.
 - ↳ (L) subclavian A.
- (L) & (R) vagus N. ← in superior, middle, & posterior mediastinums
- (L) & (R) phrenic N.

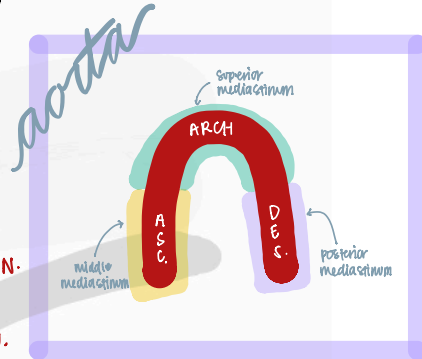
↳ **Visceral plane**

- Trachea
- Esophagus
- (L) recurrent laryngeal N.
 - ↳ wraps around arch of aorta & goes back up to larynx
- Thoracic duct
 - ↳ dumps into (L) internal jugular v., (L) subclavian v., & (L) brachiocephalic v.
 - ↳ widens at cisterna chyli (T12)

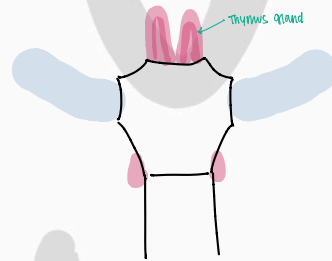


SYMPATHETIC TRUNKS:

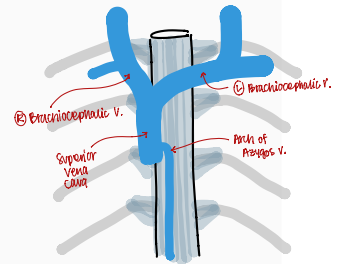
- Neck → sacrum
- Superior mediastinum
 - ↳ greater splanchnic N.
 - ganglia T5-T9
 - ↳ lesser splanchnic N.
 - ganglia T9-T10
 - ↳ least splanchnic N.
 - ganglia T11-T12



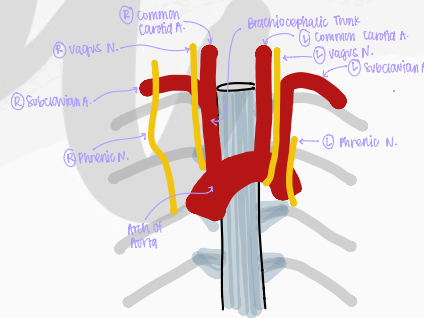
GLANDULAR PLANE



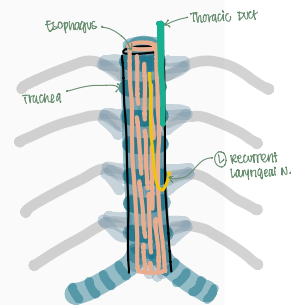
VENOUS PLANE



ARTERIAL - NERVOUS PLANE



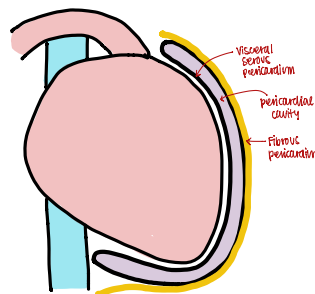
VISCERAL PLANE



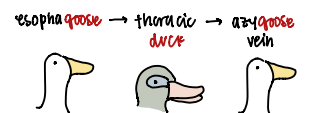
PERICARDIUM

↳ **Fibrous pericardium**: outermost layer of the pericardium

- is securely attached inferiorly to the central tendon of the diaphragm
- is loosely attached anteriorly to the sternum
 - ↳ **sternopericardial ligament**: sternal attachment
- is strained by movements of the diaphragm & sternum during ventilation



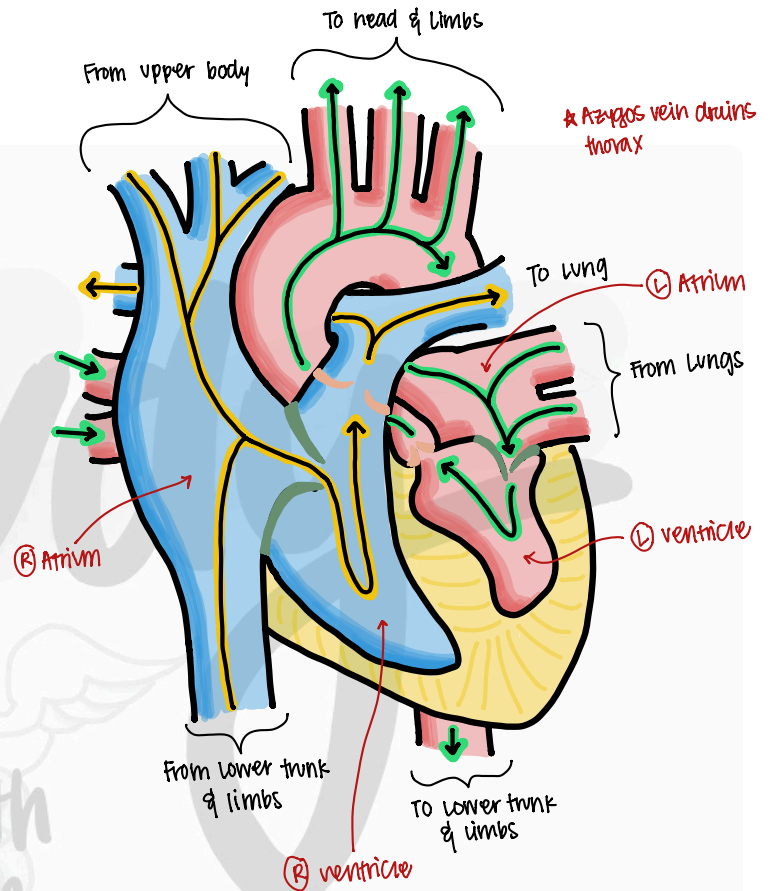
THORACIC DUCT DUCK BETWEEN TWO GEESE



- ↳ **serous pericardium**: two thin layers of cells
 - ↳ **visceral serous pericardium**: innermost layer
 - ↳ lies directly on the heart
 - ↳ **parietal serous pericardium**: outer layer
 - ↳ lies on internal surface of the fibrous pericardium
 - ↳ **pericardial cavity**: in between the two serous layers

CARDIAC CYCLE

- ↳ **right atrium**: receives venous blood from the body
- ↳ **right ventricle**: pumps venous blood to the lungs
- ↳ **left atrium**: receives oxygenated blood from the lungs
- ↳ **left ventricle**: pumps oxygenated blood to the body
- ↳ **superior & inferior vena cava**: receives blood from the body & goes into the (R) atrium
- ↳ **right atrioventricular valve**: venous blood passes through from the (R) atrium to the (R) ventricle
 - AKA Tricuspid valve
- ↳ **pulmonary valve**: venous blood passes through from the (R) ventricle to the pulmonary trunk
- ↳ **pulmonary trunk**: venous blood passes through from (R) ventricle to lungs
 - splits into **pulmonary arteries (2)**
- ↳ **pulmonary veins (4)**: oxygenated blood goes through here to return to the (L) atrium
- ↳ **aortic valve**: oxygenated blood passes through from the (L) ventricle to the aorta



ANTERIOR SURFACE OF HEART

- ↳ heart extends from the 5th → 8th thoracic vertebrae
- ↳ **auricle (2)**: small ear-like structures
 - on (R) & (L) atrium
 - embryonic remnant of the primitive atrium
- ↳ **ascending aorta**: arises from the (L) ventricle
 - curves posteriorly to form the **aortic arch**
- ↳ **apex**: rounded point at the inferior surface of the heart
 - left of the vertebral column

- ↳ **right coronary artery**: in the coronary sulcus
 - on the (R) sternal surface of the heart under the (R) auricle
 - bends posteriorly to run along the posterior aspect of the heart
 - before it bends, the **right marginal artery** branches off of it

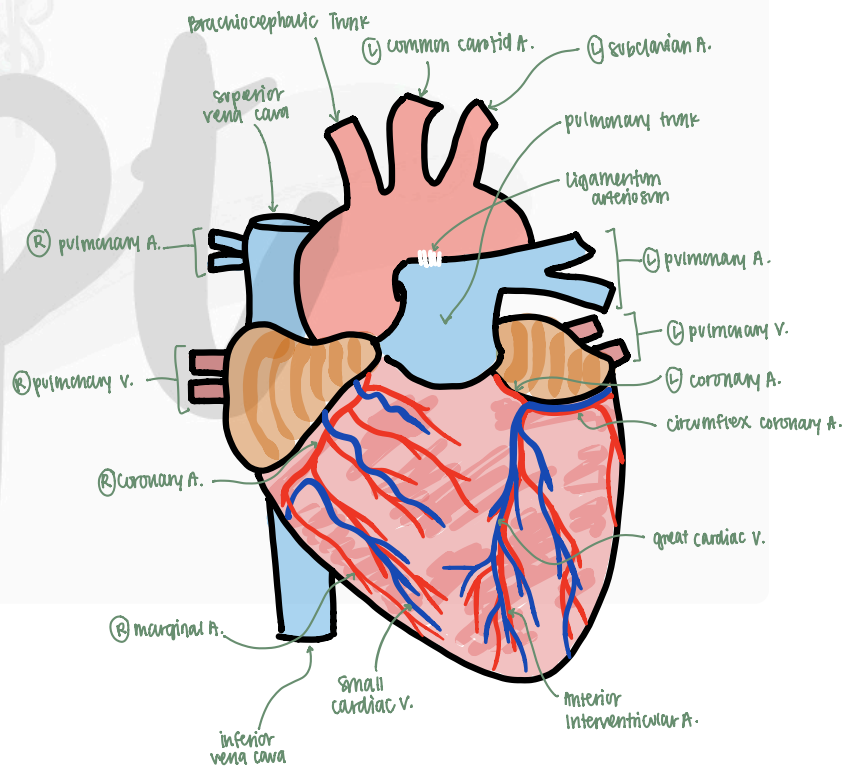
- ↳ **left coronary artery**: much shorter than the (R)
 - on the (L) sternal surface of the heart under the (L) auricle
 - divides near the inferior aspect of the (L) auricle into the **anterior interventricular artery** & the **left circumflex artery**

supplies blood to
IV septum, AV of
SA nodes,
(R) atrium &
ventricle; less of
the (L) ventricle,
LEAST of the (L)
atrium

supplies blood to
(L) atrium, (L) ventricle,
IV septum, ant. part
of (R) ventricle, bundle
of His

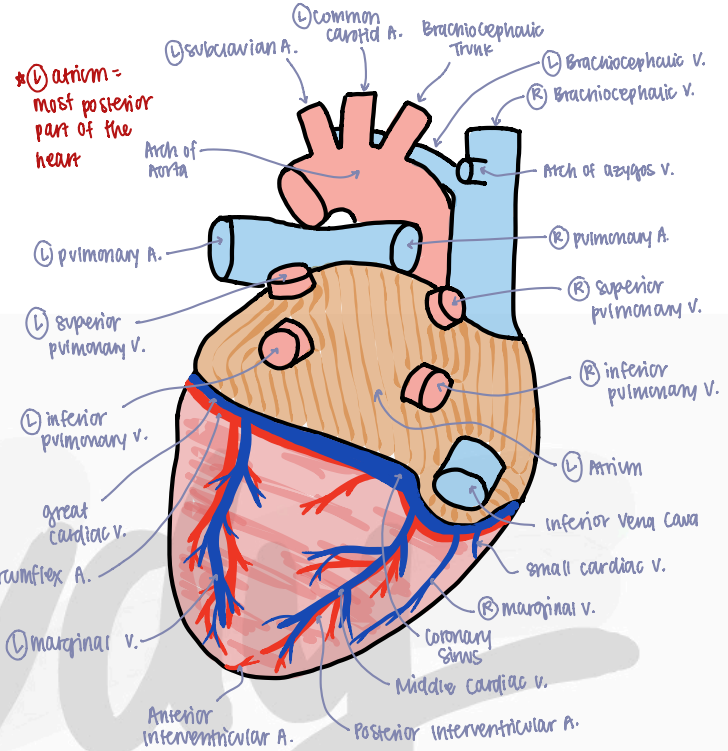
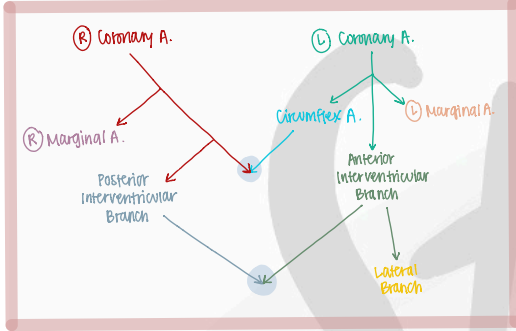
- ↳ **anterior interventricular artery** runs downward along the sternal surface of the heart between the (R) & (L) ventricles
 - runs along the **great cardiac vein**

- ↳ **circumflex artery** runs posteriorly along the inferior surface of the (L) atrium in the coronary sinus

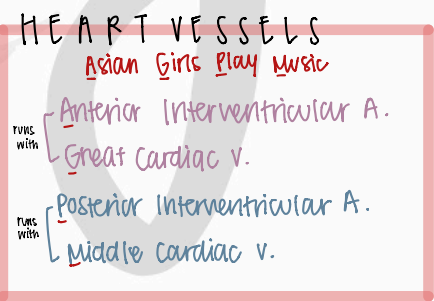


POSTERIOR SURFACE OF HEART

- ↳ **coronary venous sinus**: in the coronary sulcus between the (L) atrium & (L) ventricle
- ↳ **posterior interventricular artery**: branches off the (R) coronary artery
 - runs downward between the (R) & (L) ventricles
 - anastomose w/ the anterior ventricular artery from the left coronary
 - runs with the **middle cardiac vein**



- ↳ **coronary sulcus**: between the atrium & ventricles
 - has:
 - ↳ circumflex branch of (L) coronary A.
 - ↳ small cardiac vein
 - ↳ coronary sinus
 - ↳ (R) coronary A.

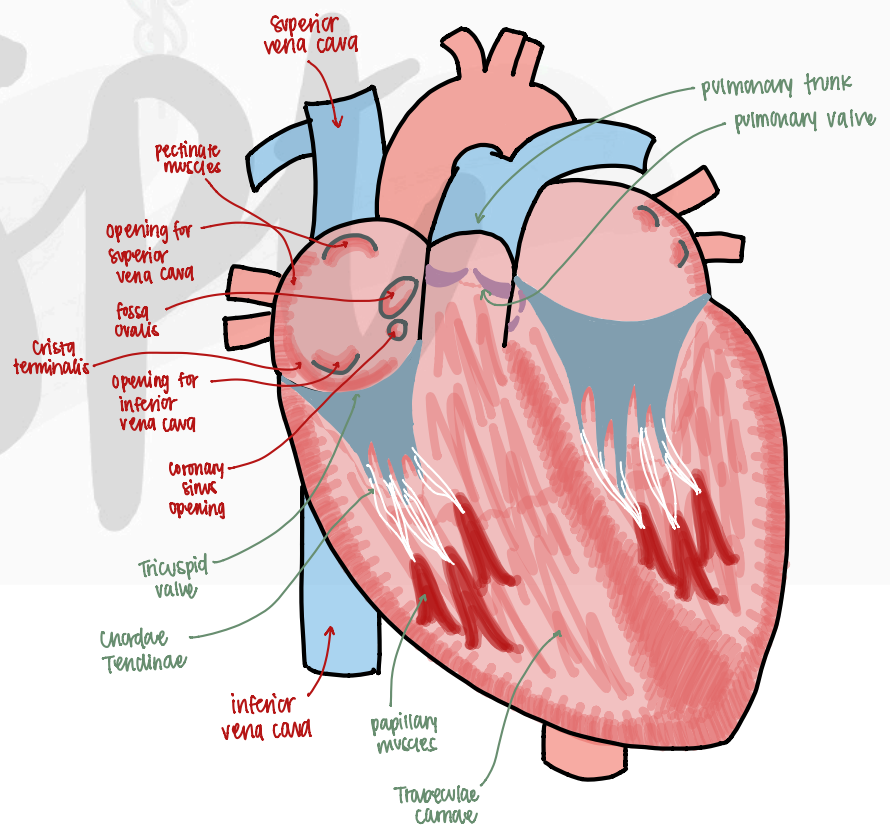


RIGHT ATRIUM

- ↳ **vessels**:
 - superior vena cava
 - inferior vena cava
 - coronary sinus opening
- ↳ **structures**:
 - pectinate muscles (ridged muscle wall)
 - ↳ ridged muscle wall
 - ↳ only in (R) & (L) atrium
 - fossa ovalis
 - ↳ was foramen ovalis before birth
 - ↳ wall between (L) & (R) atrium
 - crista terminalis
 - ↳ ridge that separates ridged muscle from smooth wall

RIGHT VENTRICLE

- ↳ **structures**:
 - (R) AV valve
 - ↳ AKA Tricuspid valve (3 cusps)
 - Chordae Tendinae
 - ↳ attached to AV valve, rope-like tendons
 - papillary muscles
 - ↳ contract to pull on chordae tendinae to close AV valve
 - pulmonary trunk
 - pulmonary valve
 - ↳ AKA Semilunar valve
 - trabeculae carneae
 - ↳ thick muscular wall with distinct ridges



LEFT ATRIUM

↳ most posterior portion of the heart

↳ vessels:

- ① superior pulmonary v.
- ② inferior pulmonary v.

↳ structures:

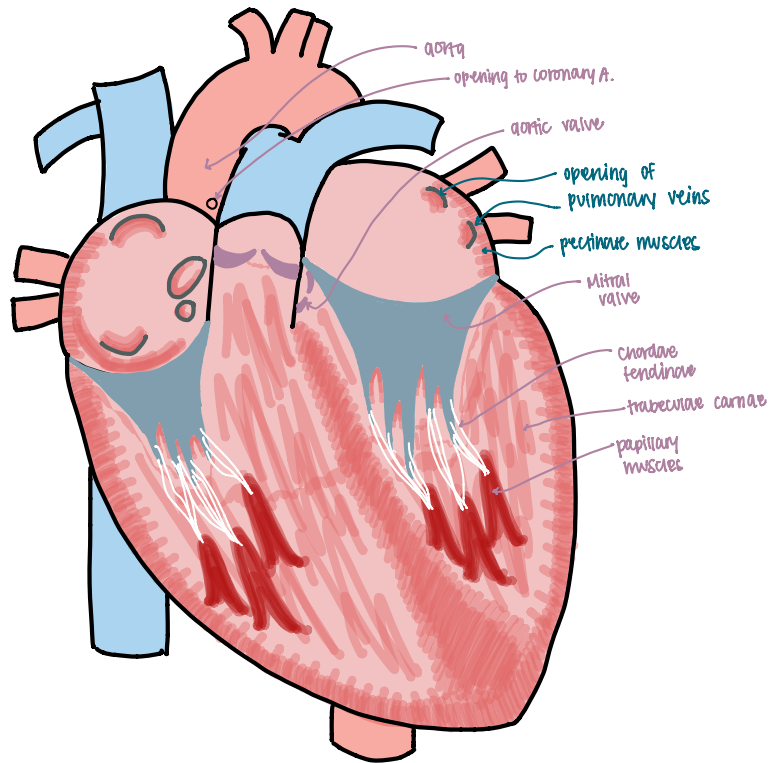
- pectinate muscles

LEFT VENTRICLE

↳ most muscular

↳ structures:

- ① AV valve
 - ↳ AKA mitral valve or bicuspid valve (2 cusps)
- aortic valve
 - ↳ AKA semilunar valve
 - ↳ blood pools here & moves to coronary A.
 - ↳ concaves superiorly to form the aortic sinus
 - then blood goes to coronary A.
- aorta
- Chordae Tendinae
 - ↳ attached to AV valve
- papillary muscles
 - ↳ contract to pull on chordae tendinae to close AV valve
- trabeculae carneae
 - ↳ thick muscular wall with distinct ridges

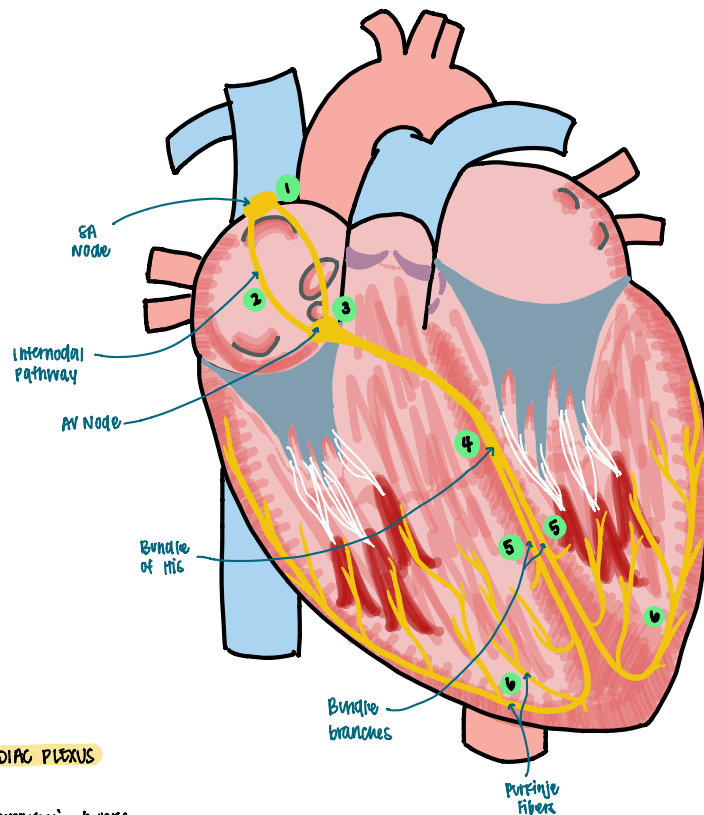
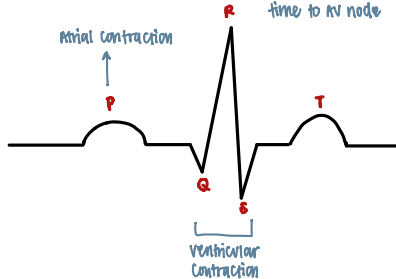


CONDUCTION SYSTEM

↳ steps:

1. sinoatrial (SA) node (pacemaker)
2. Internodal pathway
3. Atrioventricular (AV) node
4. Bundle of His
5. Bundle branches
6. Purkinje fibers

A contraction → beginning of V contraction
↳ basically conduction time to AV node



↳ Autonomic nervous system:

- the vagus nerve & cervical & thoracic sympathetic trunk = **CARDIAC PLEXUS**
 - ↳ network of sympathetic & parasympathetic nerves
 - ↳ sympathetic: cervical & upper thoracic ganglia of both sympathetic trunks
 - ↳ parasympathetic: both vagal nerves
 - ↳ splits to form 2 coronary plexuses
 - follows ②/① coronary A.

MECHANICS OF BLOOD FLOW IN HEART

↳ **Ohm's Law**: flow is directly proportional to difference in pressure & inversely proportional to resistance

↳ **METs**: Metabolic Equivalence

· ml/kg/BW/min

↳ **THR**: target heart rate

· max = $220 - \text{age}$

· can improve w/ training

PATHOLOGY

↳ **Coronary Artery Disease**:

· ↓ diameter of coronary A. → ischemia (lack of oxygen)

· ↓ O_2 to heart mm → chest pain (angina pectoris)

· severe decrease → myocardial infarction

↳ **Congestive Heart Failure**:

· inability of heart (⊖ ventricle) to eject all the blood it receives

↳ "plumbing problem"

⊖ atrium is backed up → ⊕ A & V are backed up

· pooling of blood in ventricle reduces amount of blood in can receive from pulmonary circulation

· leads to restriction of blood flow out of lung

↳ results in pulmonary edema (stage 3 - 100 bpm)

↳ decreases elasticity of lungs

↳ pushes fluid into alveoli → decreased respiration

↳ **Congenital Heart Defects**

· **Interventricular Septal Defect**:

↳ hole in IV septum

↳ more common in superior (membranous)

↳ results in loss of pressure in ⊖ ventricle during contraction → ↓ blood flow

↳ will also push blood back into ⊕ ventricle

· ↑ pulmonary flow

· may cause CHF

· **Tetralogy of Fallot**:

1. IV septal defect

2. Infundibular pulmonary stenosis (narrow opening of pulmonary trunk)

3. Overriding aorta (opening of aorta to ⊕ & ⊖ ventricle)

4. ⊕ ventricular hypertrophy

CARDIAC VEINS

↳ venous blood from ⊕, ⊖ ventricles & ⊖ atrium into coronary sinus

↳ **Coronary Sinus**:

· in coronary sulcus

· empties into lower right atrium near inferior vena cava

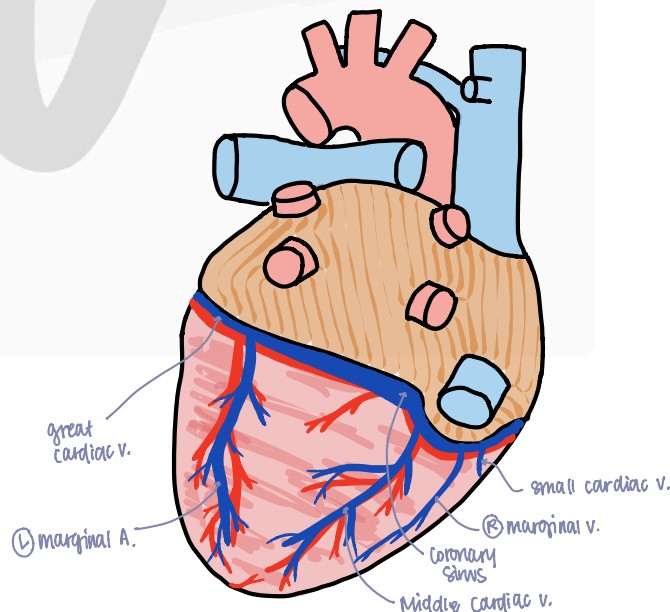
· receives blood from:

↳ great cardiac v. → runs w/ anterior interventricular A.

↳ middle cardiac v. → runs w/ posterior interventricular A.

↳ ⊖ & ⊕ marginal v. → runs w/ ⊖ & ⊕ marginal A.

↳ small cardiac v. → runs w/ ⊕ coronary A.



STRUCTURE OF ARTERIES & VEINS

↳ 3 layers:

1. Intima

- ↳ simple squamous cells • endothelial cells
- line the lumen of all blood vessels
- ↳ can have collagen & elastic fibers & smooth muscle

2. Media

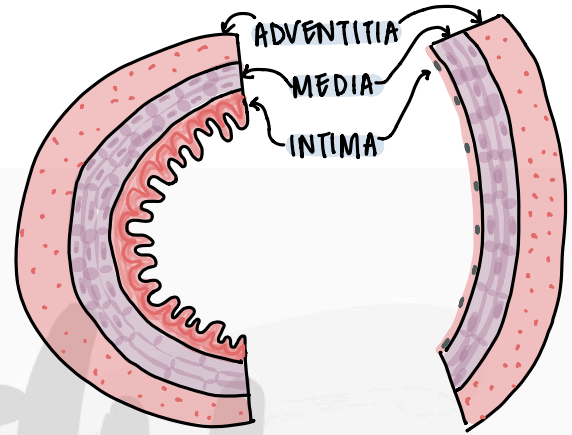
- ↳ varying amounts of smooth muscle, collagen, & elastic fibers

3. Adventitia

- ↳ mainly collagen fibers
- ↳ can have longitudinal bundles of smooth muscle

ARTERY

VEIN



↳ Arteries:

• 3 divisions:

1. Large Elastic Arteries

- ↳ ex) aorta, primary trunk
- ↳ intima: thick w/ distinct layer of elastic fibers
- ↳ media: has abundance of smooth muscle & elastic fibers
- ↳ adventitia: primary collagen fibers

* need elasticity & lots of collagen to expand

2. Medium size Arteries / Muscular Arteries

- ↳ intima: distinct layer of elastic fibers
- ↳ media: thick, distinct layer of circular smooth muscle
- ↳ adventitia: thick & mostly collagen fibers w/ some elastic fibers

3. Small Arteries / Arterioles

- ↳ intima: only a few elastic fibers
- ↳ media: only a few layers of circular smooth muscle
- ↳ adventitia: thin & mostly collagen fibers

* blood drifts through

↳ veins:

• 3 divisions:

1. Large veins

- ↳ ex) superior & inferior vena cava
- ↳ intima: thin w/ endothelial cells on luminal surface, few elastic fibers, thin zone of collagen fibers
- ↳ media: thin w/ collagen fibers w/ few elastic fibers & some smooth muscle cells
- ↳ adventitia: thick, lots of collagen fibers & smooth muscle along vein

* don't have to take as much pressure → no muscle

2. Medium size veins

- ↳ intima: very thin w/ mainly endothelial cells w/ few collagen fibers
- ↳ media: thin w/ collagen fibers w/ some smooth muscle
- ↳ adventitia: distinct & has collagen fibers, elastic fibers, & some smooth muscle

3. Small veins

- ↳ intima: very thin w/ mainly endothelial cells
- ↳ media: very thin w/ only a few collagen fibers
- ↳ adventitia: few layers of collagen fibers mixed w/ some elastic fibers

↳ capillaries:

- communication between small arteries & small veins
- are small vessels formed mainly by a single layer of endothelial cells

• types:

↳ **Continuous capillaries:** no pores

↳ **Penetrated capillaries:** thin porous regions that lack cytoplasm but contain the cell membrane

• fenestra: thin membranous areas

↳ permit passage of material easily between the capillary & surrounding tissue

LYMPH

↳ lymphatic system filters fluid

↳ lymph capillaries:

- larger than arterial capillaries
- one way system
- drain to a central area

