Dr. Weyrich

G04: Anterior Thoracic Wall, Breast and Lymphatic System

Reading:
1. Gray's Anatomy for Students, Chapter 3
2. *Dissection Guide for Human Anatomy*, Lab 4

Objectives:
1. Osteocartilaginous thoracic cage
2. Anatomy of the female breast
3. Muscles of the thorax
4. Blood supply and innervation of the thoracic region

Clinical Correlates:
1. Breast cancer

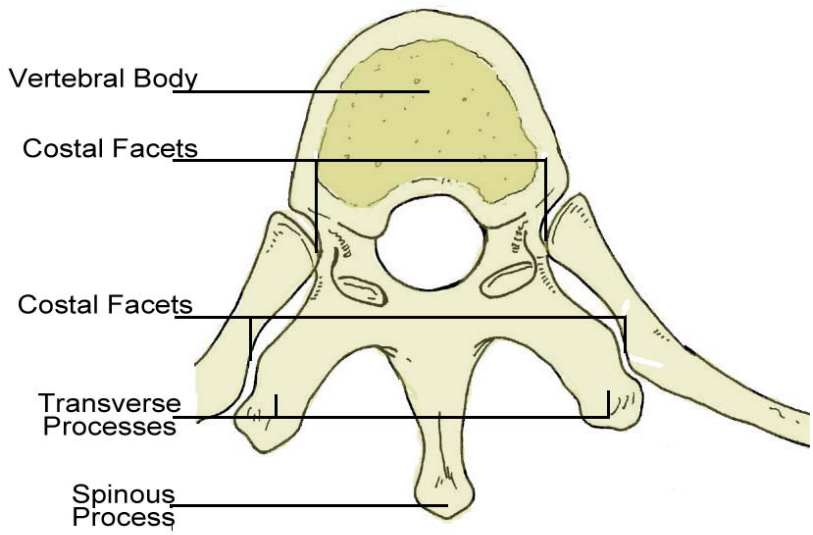
Bones of the Thoracic Wall
(pp. 118-126)

Skeleton of the Thoracic Wall

Thoracic vertebrae (pp. 119-120)

Costal facets

Spinous processes



Superior View, thoracic vertebrae and rib

Skeleton of the Thoracic Wall

Ribs (pp. 120-122)

True ribs (1-7) – attach directly to the sternum

False ribs (8-10) – attach to the costal cartilages of superior ribs

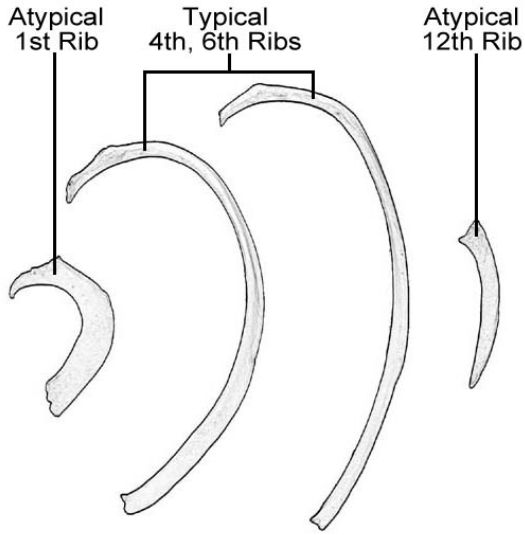
Floating ribs (11-12) – no attachment to the sternum

Typical rib features

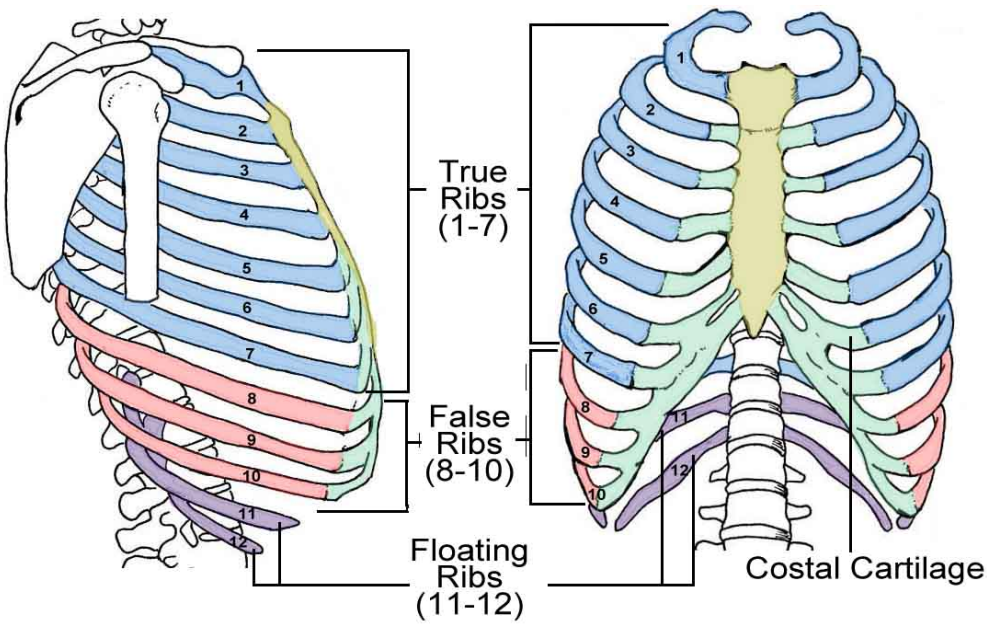
- head
- neck
- body
- superior facet
- inferior facet
- tubercle
- angle
- costal groove

Atypical ribs (1, 2, 11, 12)

Costal cartilages



Superior View of Ribs



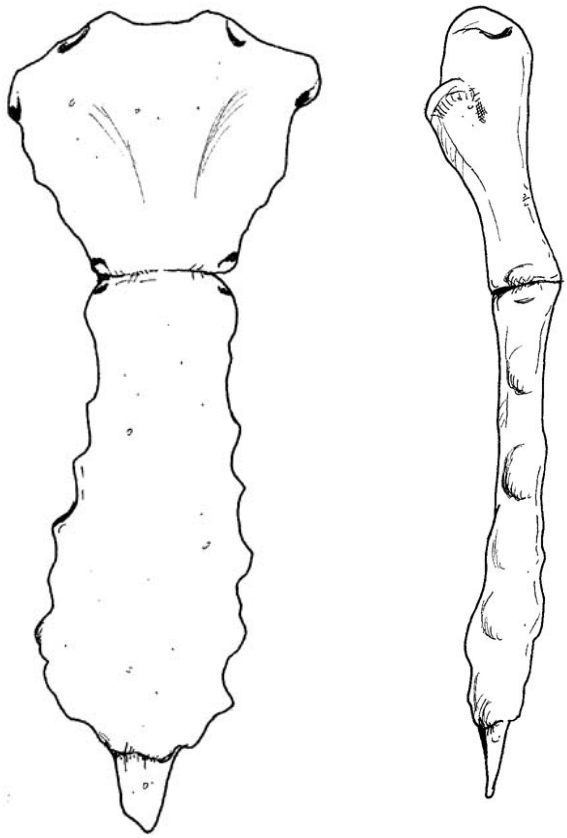
Lateral View of Ribs

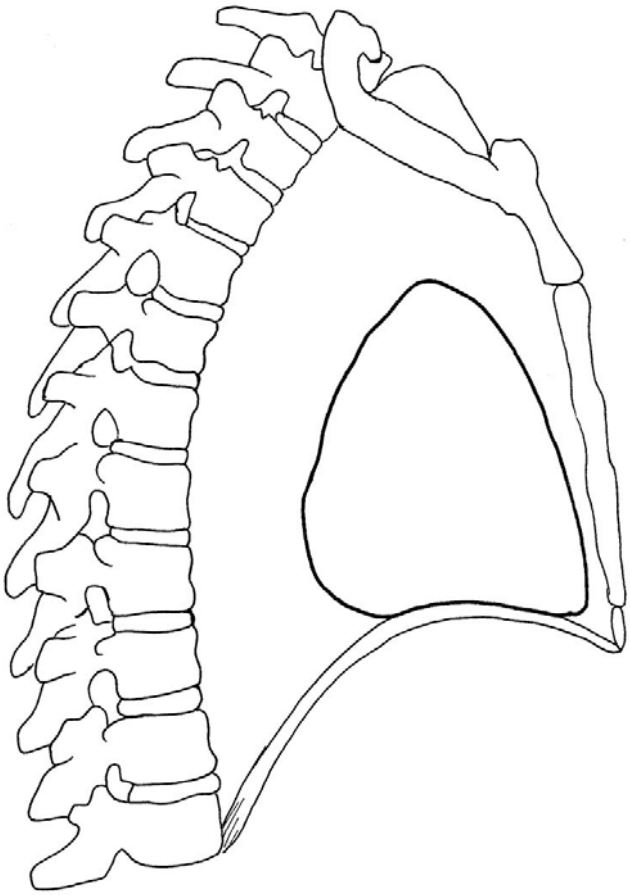
Anterior View of Ribs

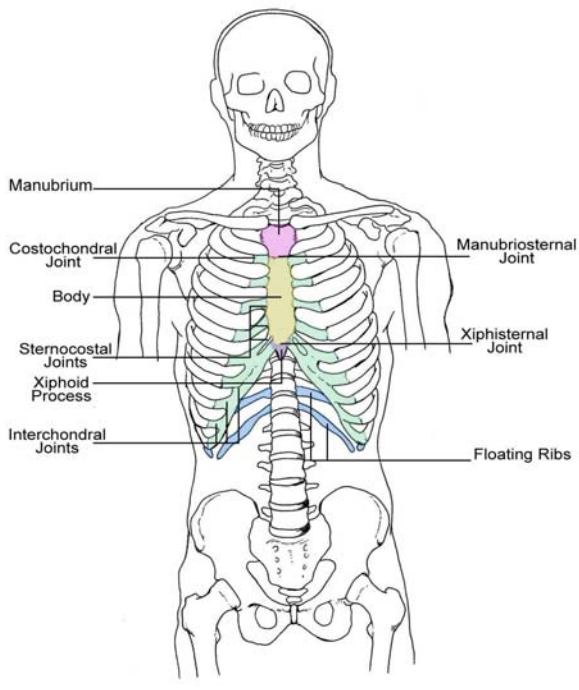
Skeleton of the Thoracic Wall

Sternum (p. 122)

- Manubrium
- Body
- Xiphoid process
- Jugular notch
- Sternal angle (2nd rib articulates here)
- Sternal joints
  - -Manubriosternal joint
  - -Xiphisternal joint







Anterior View of Thoracic Region

Skeleton of the Thoracic Wall – **Joints** (pp. 123-125)

Costovertebral joints

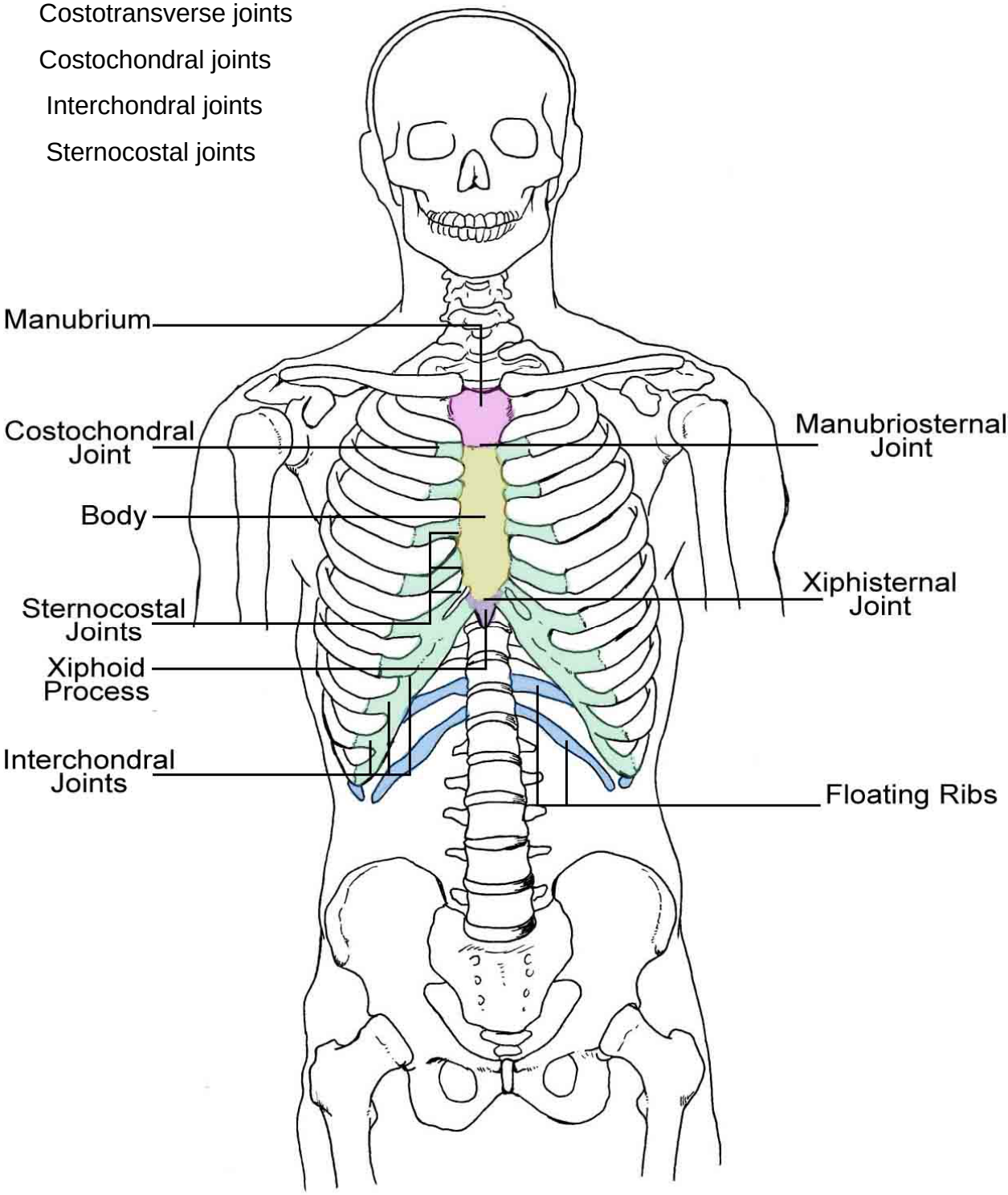
Joints of the heads of the ribs

Costotransverse joints

Costochondral joints

Interchondral joints

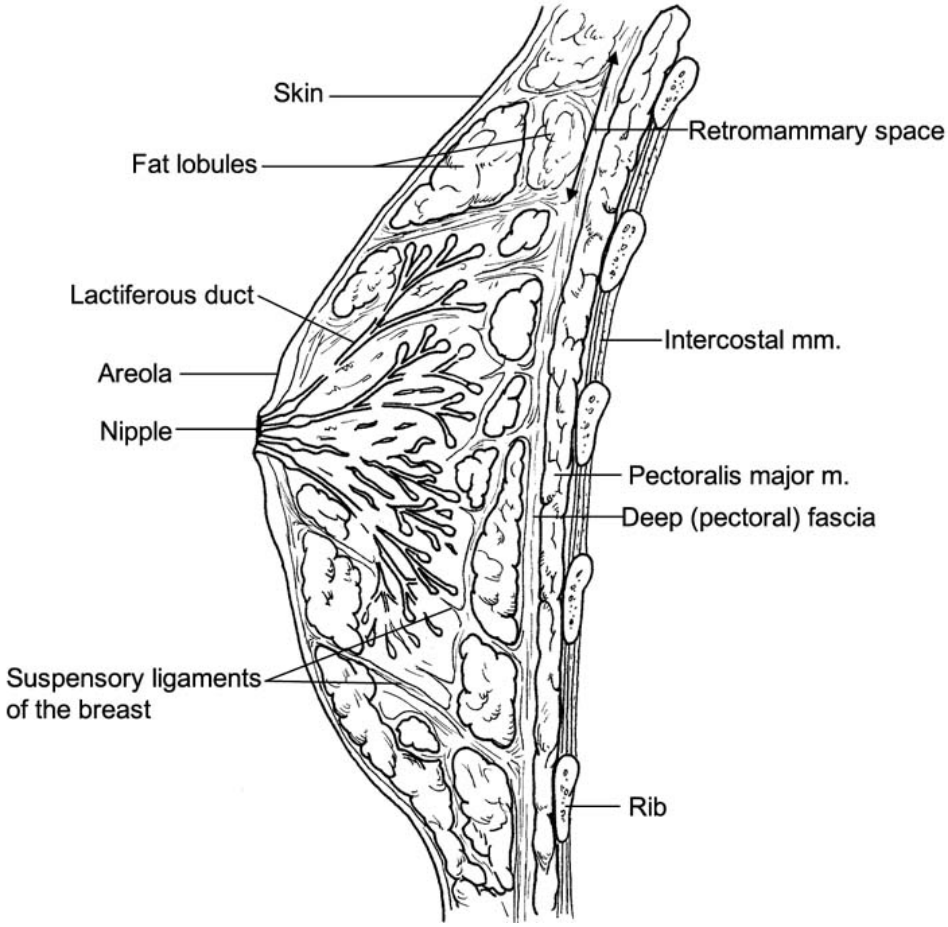
Sternocostal joints



Anterior View of Thoracic Region

Breast
(pp. 115-116)

Female Breast (pp. 115-116)



Areola

Nipple

Suspensory ligaments

Lactiferous ducts

Mammary glands

Breast - Arterial supply

Anterior intercostal aa.

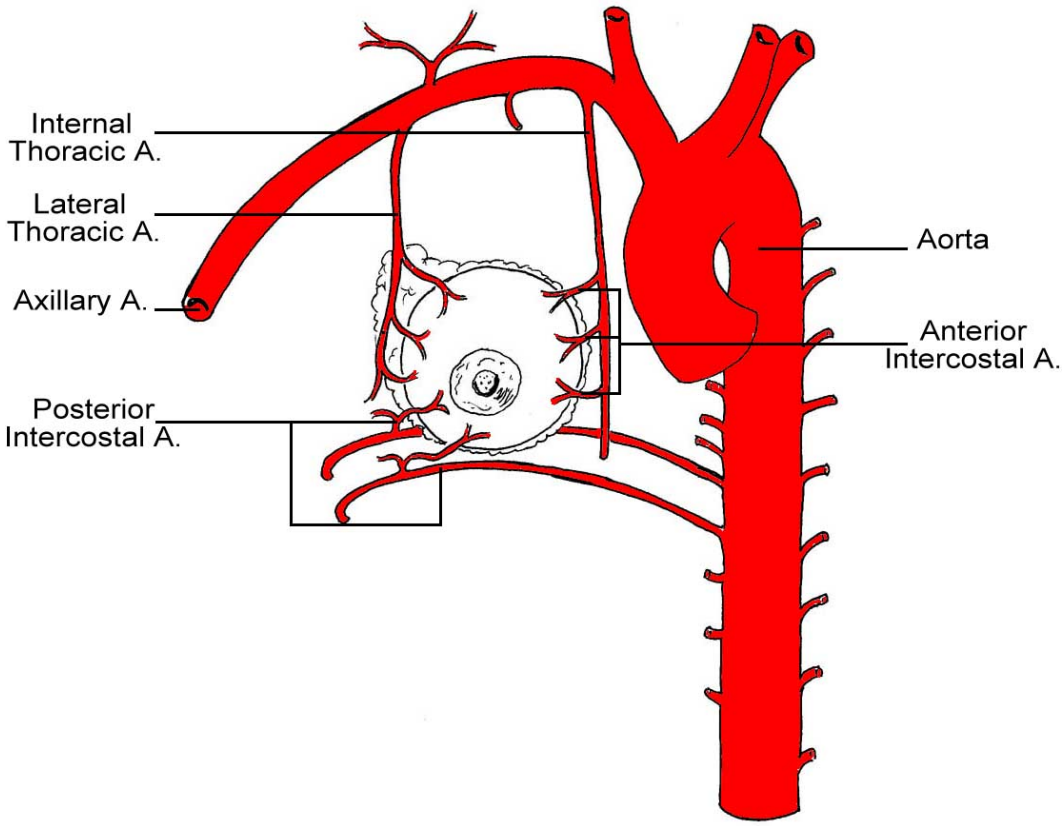
-Originate from internal thoracic a.

Lateral thoracic and thoracoacromial aa.

-Originate from axillary a.

Posterior intercostal aa.

-Originate from thoracic aorta



Blood Supply of the Breast

Breast - Venous drainage

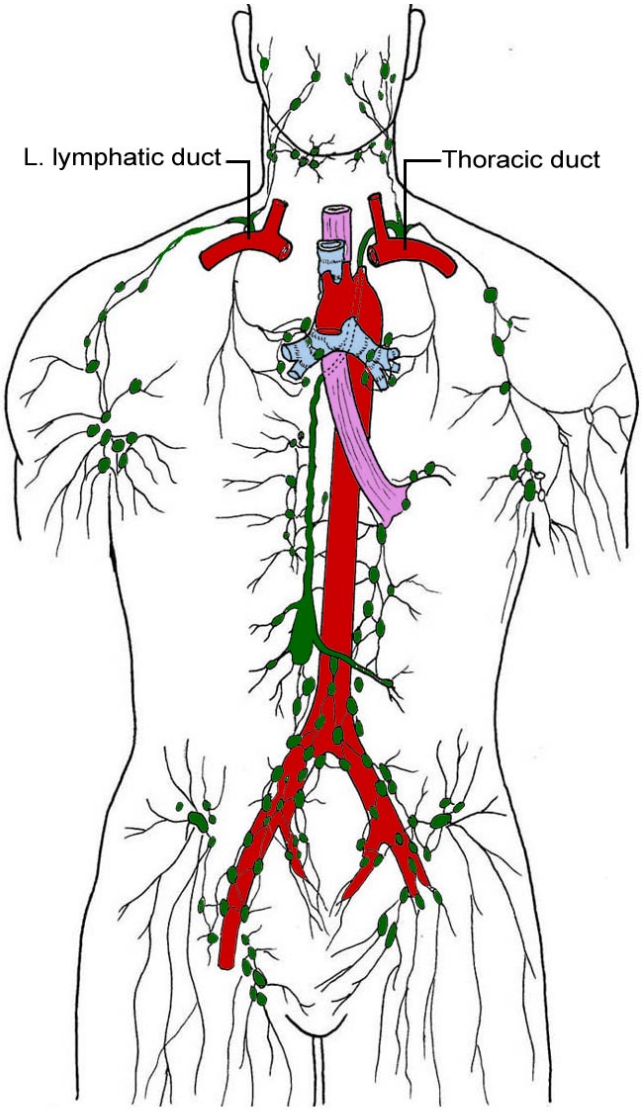
Mainly to the axillary v.

Some drainage to the internal thoracic v.

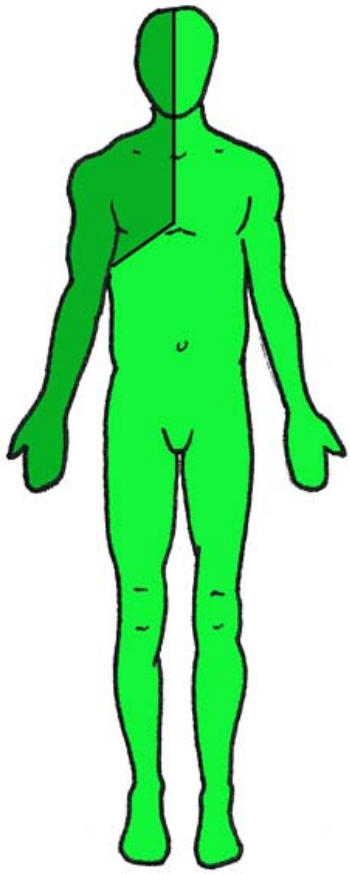
Breast - Innervation

Intercostal nerves

The Lymphatic System (pp. 333-336)



Lymphatic System Overview



Main Lymphatic Vessels

Cisterna chyli

- Located at approximately L1
- Drains into the thoracic duct

Thoracic Duct

- drains into the left subclavian vein

Right Lymphatic duct

- drains into the right subclavian vein

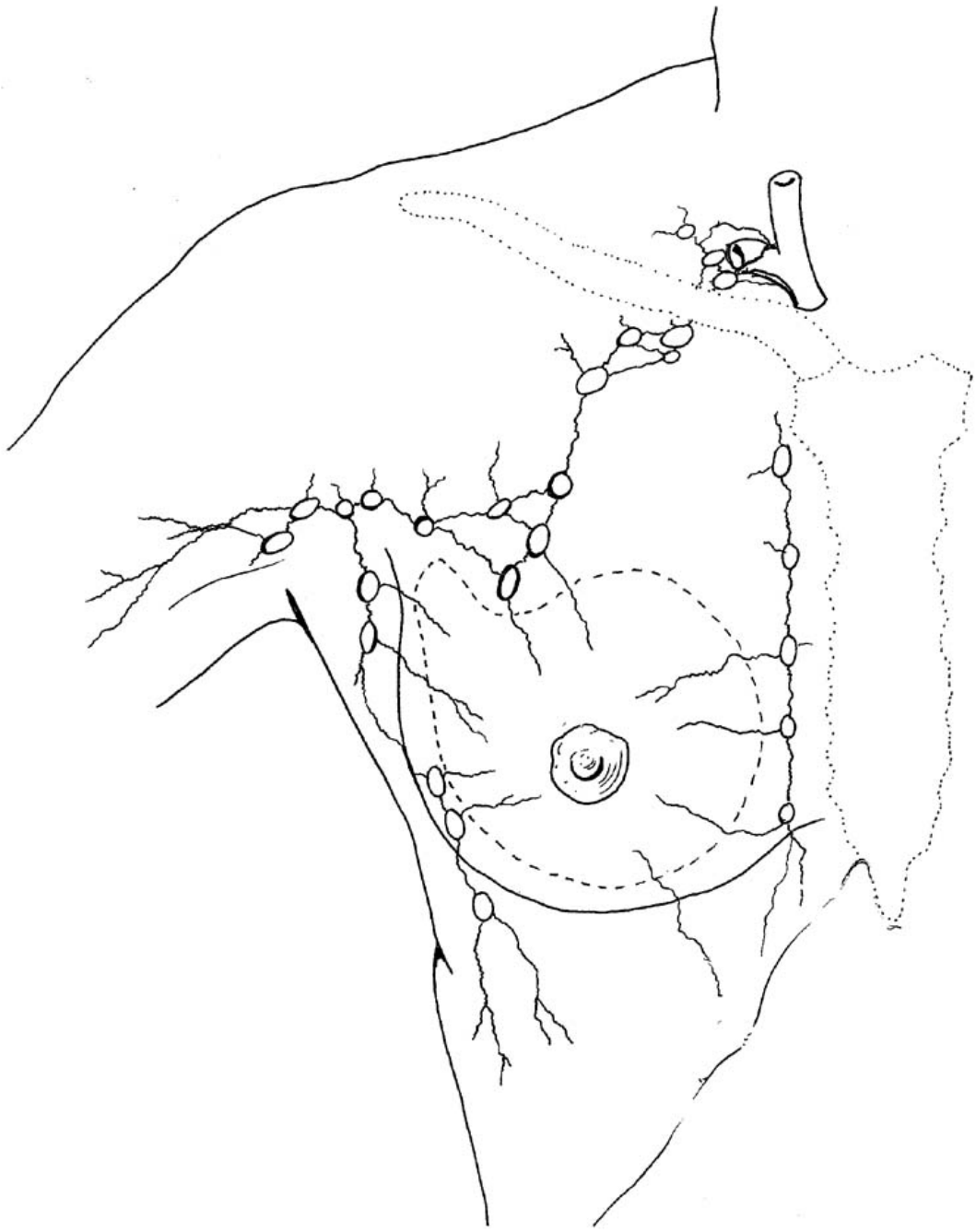
Lymphatic drainage of the breast (p. 116)

-Lateral quadrant of the breast drains mainly to the axillary lymph nodes

-Medial quadrant of the breast drains mainly to the parasternal lymph nodes

Clinical Correlate (p. 117)

Breast cancer and metastasis to lymph nodes



Muscles of the Thoracic Wall
(pp. 117-118)

Muscles of the Pectoral Region (pp. 117-118, table 3.1)

Pectoralis Major

Medial attachments

-Clavicular head – clavicle

-Sternocostal head – sternum, superior 6 costal cartilages, and aponeurosis of external oblique m.

Lateral attachments

-Intertubercular groove of humerus

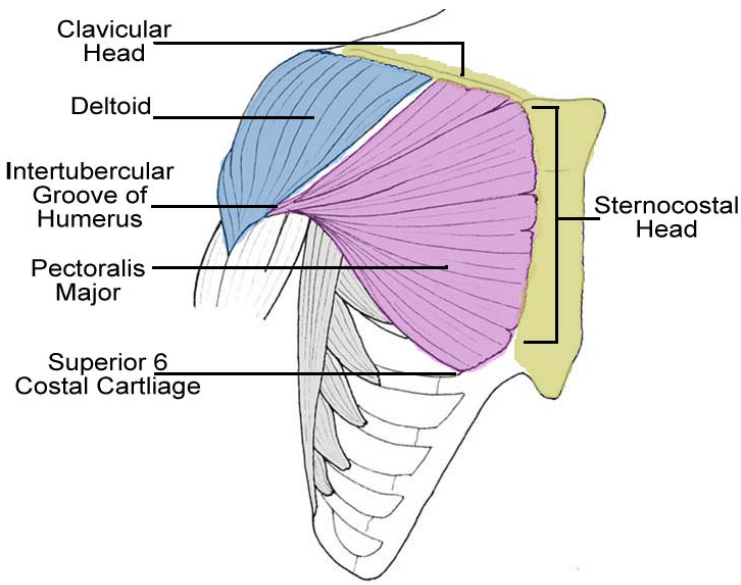
Innervation

-Lateral and medial pectoral nerves

Main actions

-Adducts and medially rotates humerus

-Draws scapula anteriorly and inferiorly



Anterior region of the thorax, right

Pectoralis Minor

Inferior attachments

-3rd-5th ribs

Superior attachments

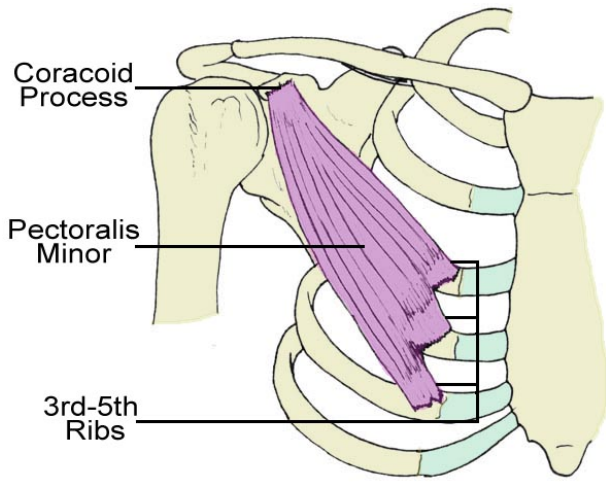
-Coracoid process of scapula

Innervation

-Medial pectoral nerve

Main actions

-Stabilizes scapula



Anterior Pectoralis Minor, right

Subclavius

Inferior attachments

-1st rib and its costal cartilage

Superior attachments

-Middle third of clavicle

Innervation

-Nerve to the subclavius

Main actions

-Anchors and depresses the clavicle

Serratus Anterior (pp. 645-646 and table 7.4)

Medial attachments

-Lateral parts of 1st-8th ribs

Lateral attachments

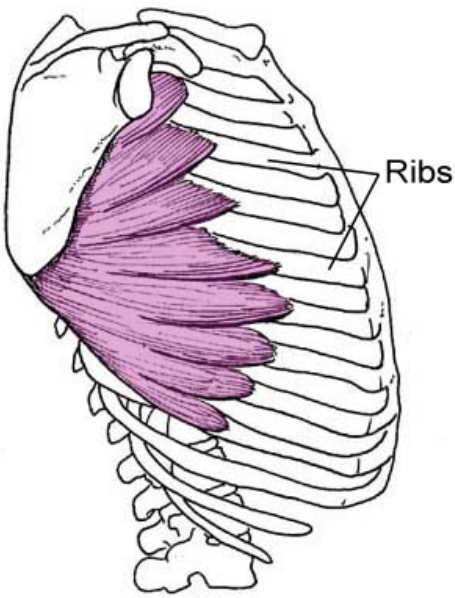
-Medial border of scapula

Innervation

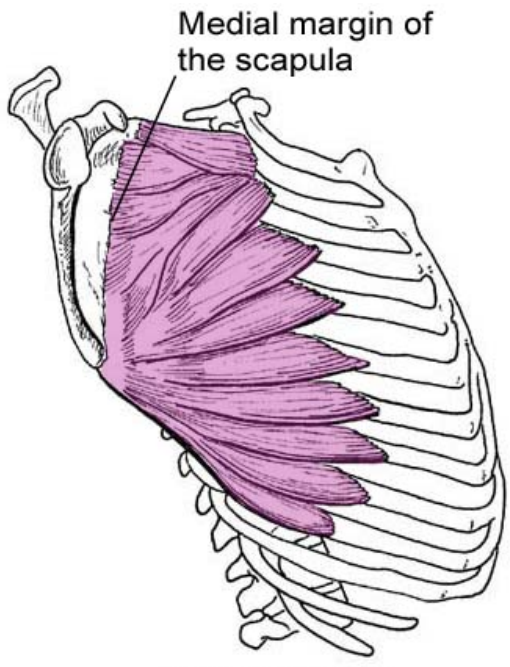
-Long thoracic nerve

Main actions

-Protracts and rotates scapula



Serratus anterior m. - attachments to the ribs



Serratus anterior m. - attachment to the scapula

Intercostal Muscle Group (pp. 127-129)

External Intercostals

Inferior attachments

-Superior border of inferior ribs

Superior attachments

-Inferior border of superior ribs

Innervation

-Intercostal nerves

Main actions

-Elevate ribs

Internal Intercostals

Inferior attachments

-Inferior border of rib

Superior attachments

-Superior border of ribs

Innervation

-Intercostal nerves

Main actions

-Depress ribs

Innermost Intercostals

Inferior attachments

-Inferior border of ribs

Superior attachments

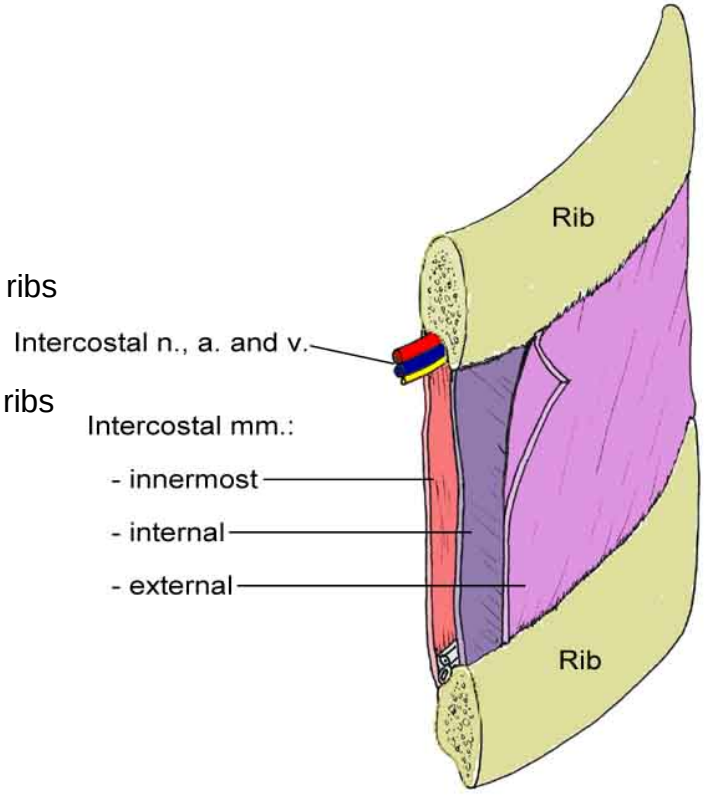
-Superior border of ribs

Innervation

-Intercostal nerves

Main actions

-Elevate ribs



Intercostal structures

Clinical Correlates:

Thoracocentesis

Intercostal nerve block

Subcostal

Inferior attachments

-Superior borders of lower ribs

Superior attachments

-Internal surface of lower ribs

Innervation

-Intercostal nerves

Main actions

-Elevate ribs

Transversus Thoracis

Inferior attachments

-Internal surface of costal cartilage

Superior attachments

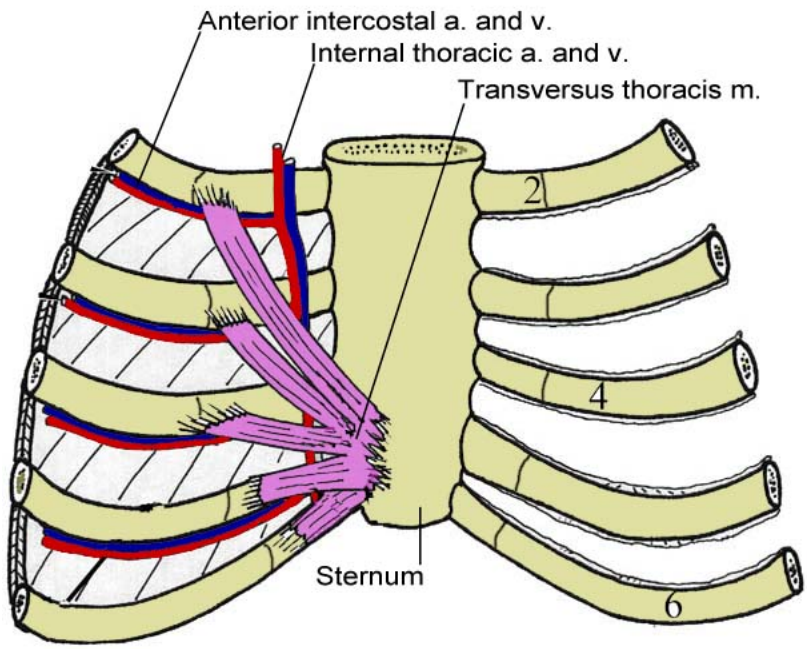
-Posterior surface of lower sternum

Innervation

-Intercostal nerves

Main actions

-Depress ribs



Rib cage and sternum - posterior view

Scalene Muscles

Medial attachments

-Transverse processes of C4-C6

Lateral attachments

-1st and 2nd ribs

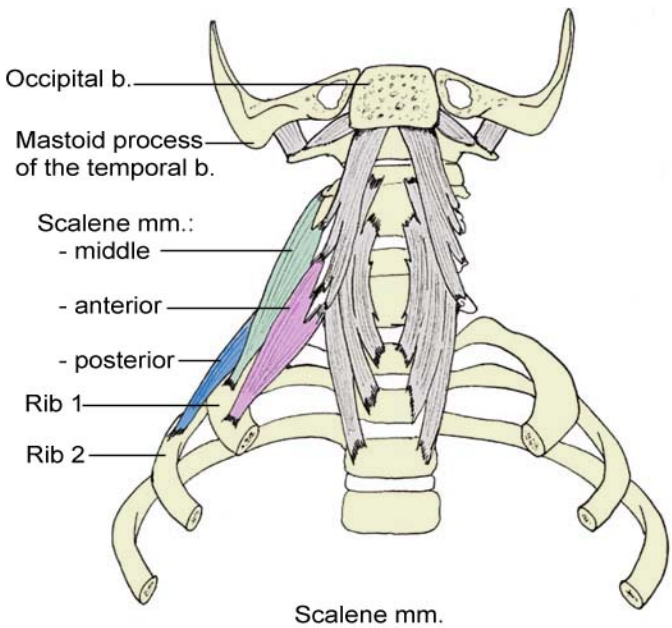
Innervation

-Ventral rami of cervical spinal nerves

Main actions

-Elevates first and second ribs

-Flexes neck laterally



Scalene mm.

Blood Supply and Innervation of the Thoracic Region

(pp. 129-133)

Arterial Supply

Internal thoracic arteries.

-Originate from subclavian arteries

Anterior intercostal arteries

-Originate from internal thoracic and musculophrenic arteries

Posterior intercostal arteries

-First two intercostal aa. originate from the superior intercostal a.

-Branch of the costocervical trunk of the subclavian artery

-Remaining posterior intercostals originated from thoracic aorta

Subcostal artery (feeds the 12^{th} rib)

-Originates from the thoracic aorta

Venous Supply

Internal thoracic veins

-Drain into brachiocephalic veins

Anterior intercostal veins

-Drain into internal thoracic veins

Posterior intercostal veins

-First three posterior intercostals unite to form the superior intercostal vein

-Superior intercostals drain into the brachiocephalic veins

-Remaining posterior intercostals usually drain into the azygos venous system

Diaphragm
(pp. 134-135)

Diaphragm

- Attachments
  - Xiphoid process
  - Costal Margin
  - Ribs XI and XII
  - Ligaments
  - Vertebrae of the lumbar region

Arterial Supply

- Superior phrenic arteries
- Inferior phrenic arteries

Venous Supply

- Parallels the arteries

Innervation

- Phrenic nerves

Thorax (Conceptual Overview)
(pp. 102-114)

Functions (p. 103)

- Breathing
- Protection of vital organs
- Conduit

Component Parts (pp. 102-106)

- Thoracic wall
- Superior thoracic aperture
- Inferior thoracic aperture
- Diaphragm
- Mediastinum
- Pleural Cavities

Relationship to Other Regions (pp. 107-108)

- Neck
- Upper Limb
- Abdomen
- Breast

Thorax (Conceptual Overview, con't)
(pp. 102-114)

Key Features (pp. 108-114)

Vertebral level

Venous shunts from left to right

Segmental neurovascular supply of thoracic wall

Sympathetic system

Flexible wall and inferior thoracic aperture

Innervation of the diaphragm

Dr. Weyrich

G05: Airways, Lungs and Diaphragm

Reading:
1. Gray's Anatomy for Students, chapter 3
2. *Dissection Guide for Human Anatomy*, Lab 5

Objectives:
1. Surface anatomy of thoracic wall
2. Relationship of the pleurae and lungs
3. Anatomy of the lung

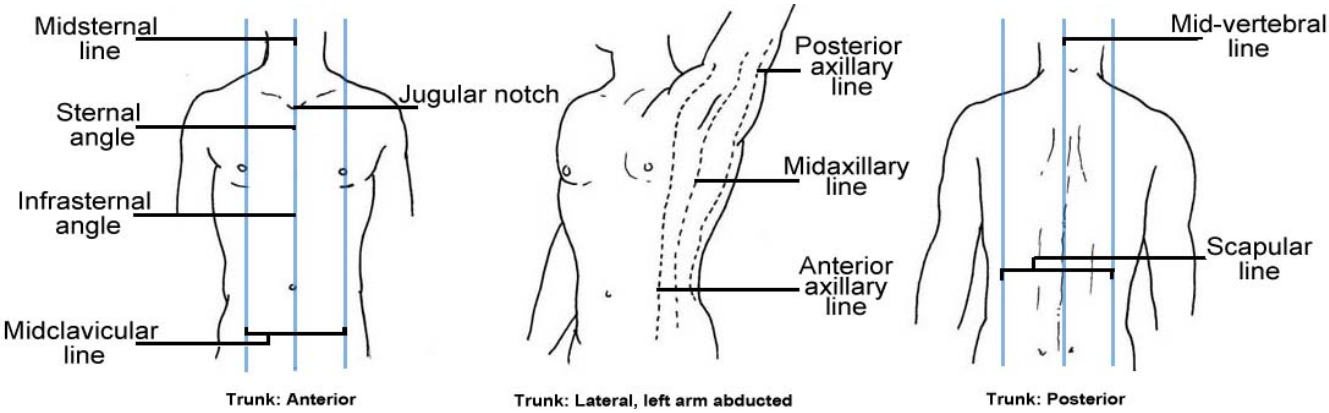
Clinical Correlates:
1. Pneumothorax
2. Bronchoscopy

Surface Anatomy of the Thoracic Wall

(pp. 200-208)

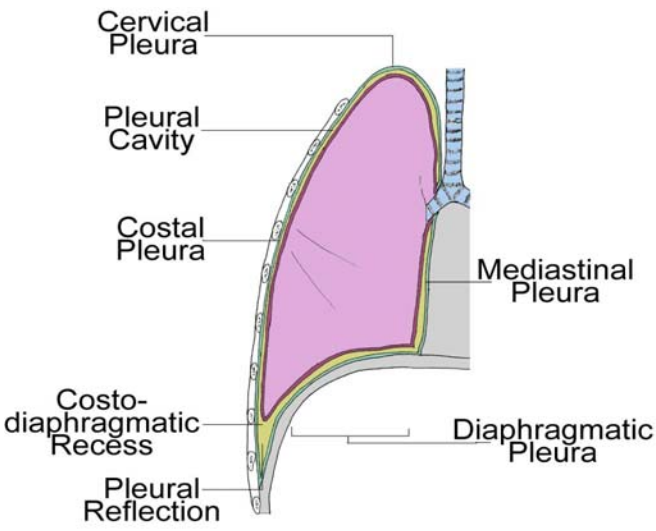
Lines of the Thoracic Wall

- Midsternal line
- Midclavicular line
- Anterior axillary line
- Midaxillary line (MAL)
- Posterior axillary line
- Mid-vertebral line
- Scapular line
- Jugular notch
- Sternal angle
- Infrasternal angle

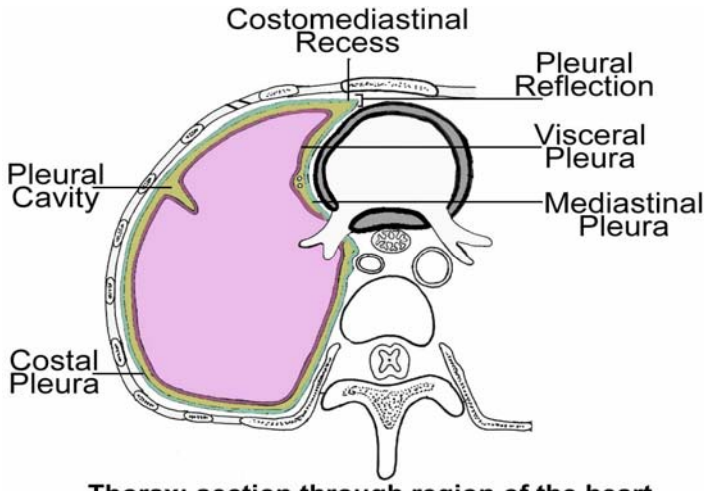


Pleurae and Pleural Cavities
(pp. 136-139)

Pleurae



Thorax; Coronal section through the right lung



Thorax; section through region of the heart

Visceral pleura – invests the lungs

Parietal pleura – lines the pulmonary cavities

-Costal pleura
-Mediastinal pleura
-Diaphragmatic pleura
-Cervical pleura

Pleural cavity – Potential space between the layers of pleura

Pleural reflections – abrupt lines along which pleura changes directions

Pleural recesses – pleura-lined gutters (made by reflections)

Costodiaphragmatic recesses
Costomediastinal recesses

Clinical Correlate

Pneumothorax

Lungs
(pp. 140-144)

Lungs

General features

Apex

Base

Root – lung attaches to heart and trachea by these structures

Hilum – canal or opening for the structures that comprise the root

Difference between right and left lung

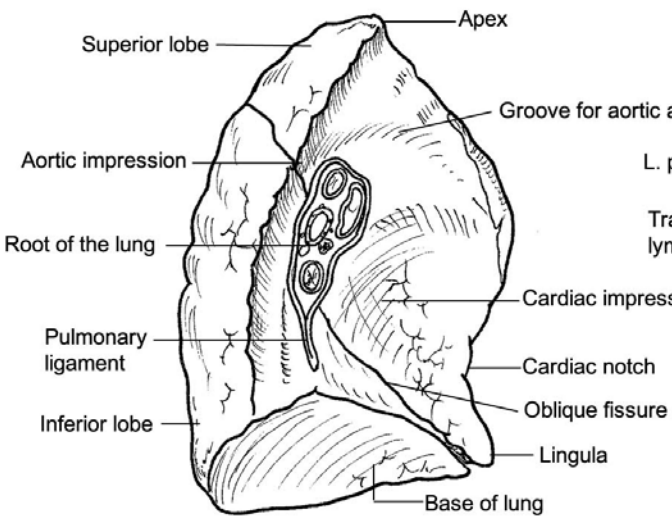
-Lobes – right lung has 3 lobes, left lung has 2 lobes

-Right lung is larger and heavier than left lung

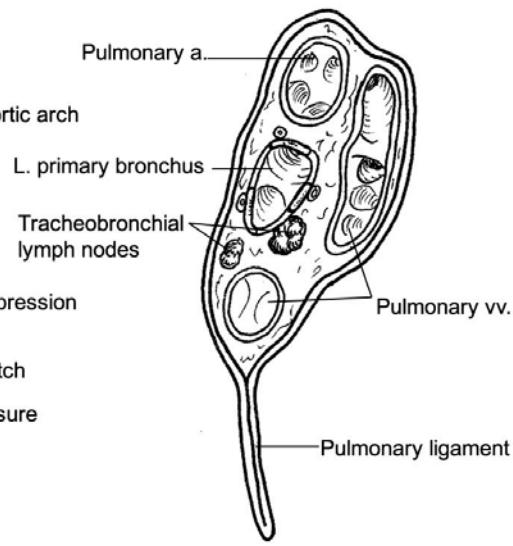
Despite being larger and heavier, the right lung is shorter and wider than the left lung because of the right dome of the diaphragm is higher

Mediastinal surface of left lung has a huge cardiac impression

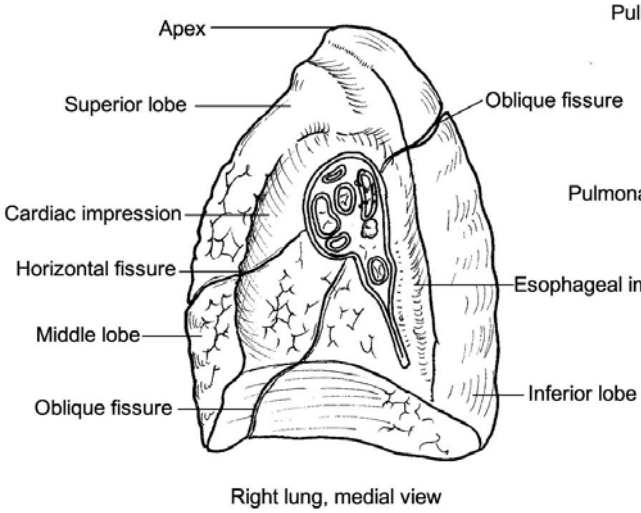
Left lung contains a lingula, a tongue-like projection that extends below the cardiac notch



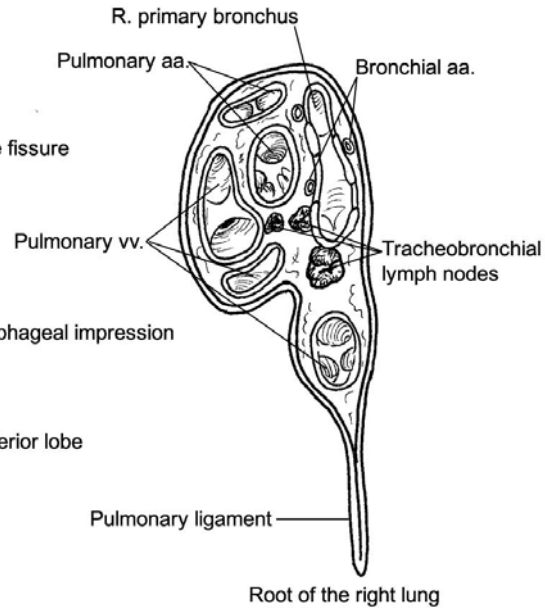
Left lung, medial view



Root of the left lung



Right lung, medial view



Root of the right lung

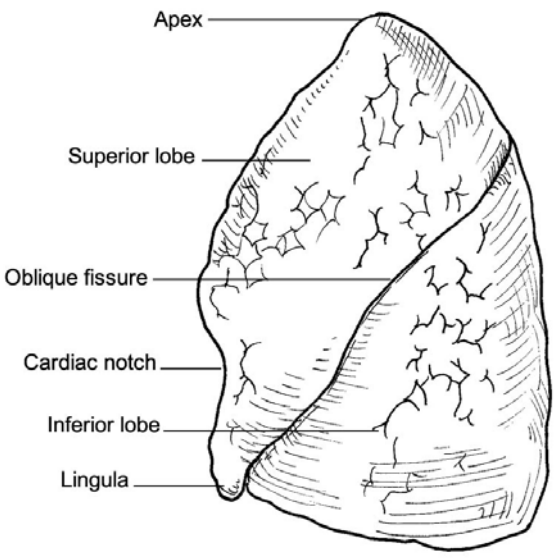
Lobes and Fissures

Left Lung

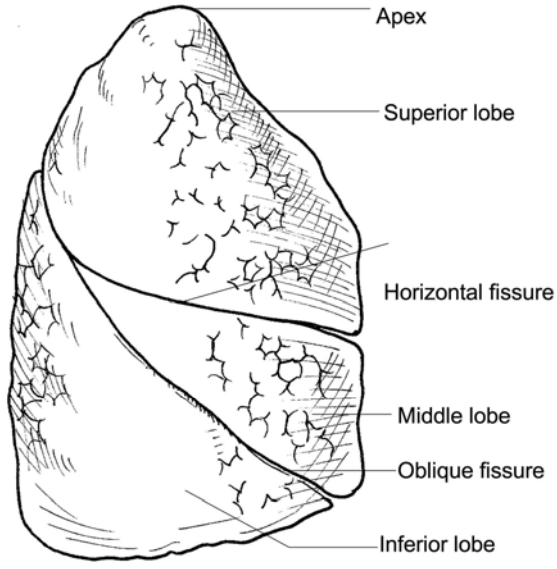
- Superior lobe
- Inferior lobe
- Oblique fissure

Right lung

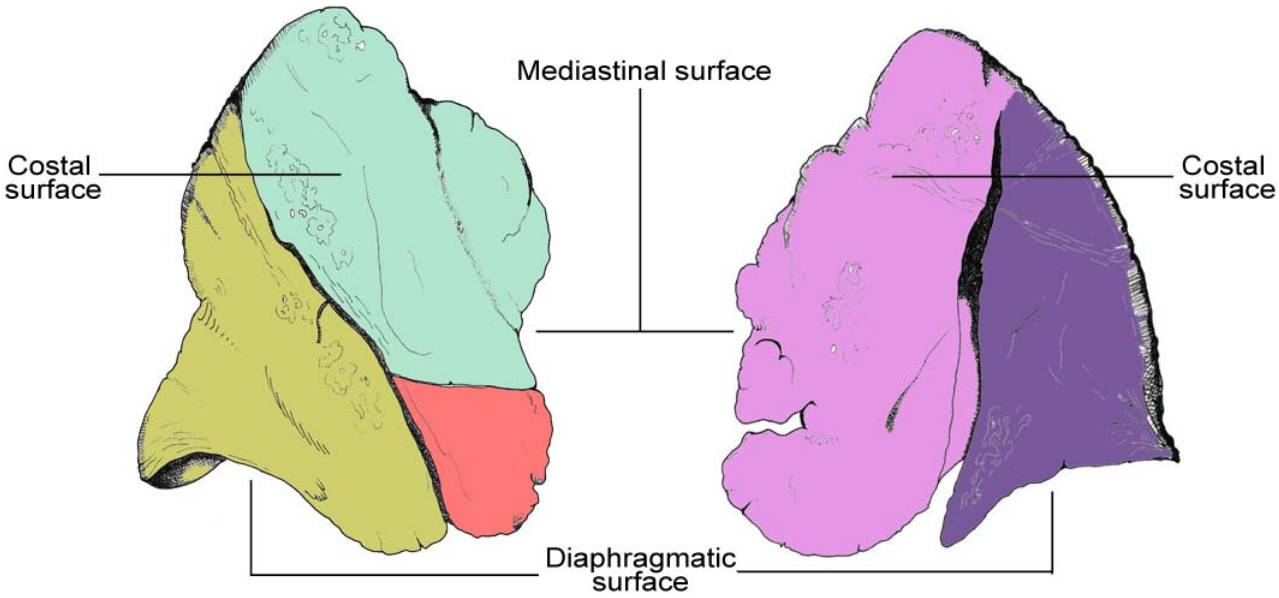
- Superior lobe
- Middle lobe
- Inferior lobe
- Oblique fissure
- Horizontal fissure



Left lung, anterior view



Right lung, anterior view



Surfaces of the Lung

Costal surface

Mediastinal surface

Diaphragmatic surface

Borders of the Lung

Anterior

Inferior

Posterior

Airways (pp. 145-146)

Main bronchi – right and left bronchus

-Right bronchus is wider, shorter and runs more vertically than left bronchus

-Left bronchus passes inferolaterally, inferior to arch of aorta

Lobar bronchi – also called secondary bronchi

Each lobar bronchi supplies a lobe of the lung (3 right, 2 left)

Segmental bronchi – also called tertiary bronchi

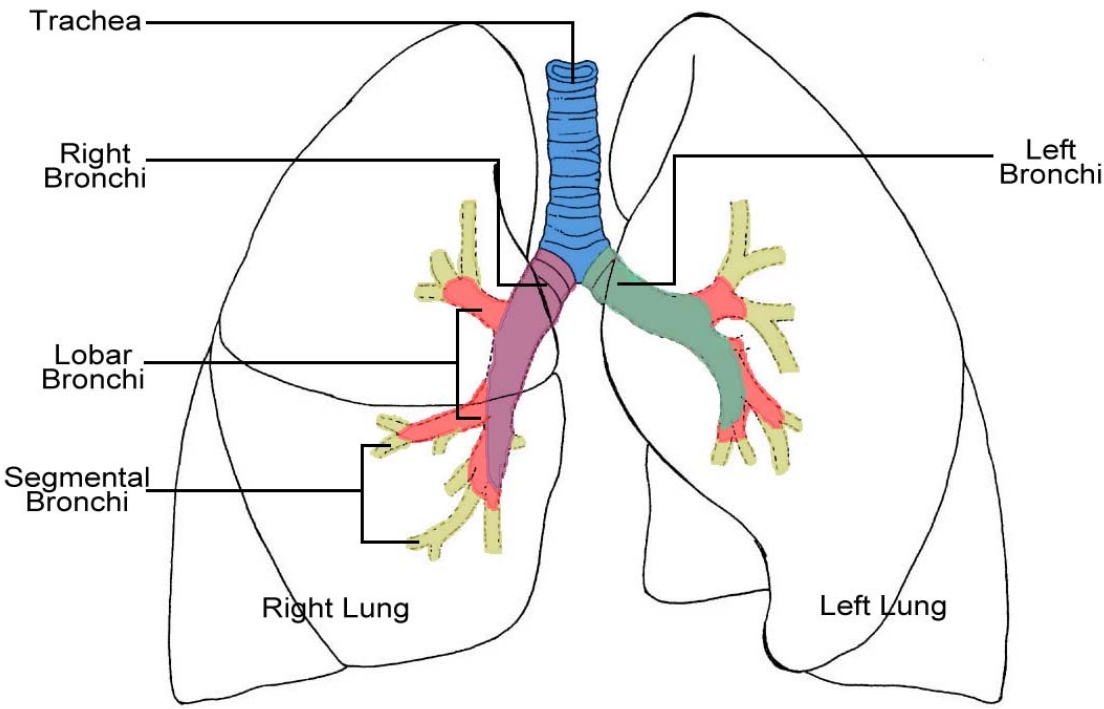
Supplies bronchopulmonary segments

Bronchopulmonary segments –structural unit of lung

-Terminal bronchioles
-Respiratory bronchioles
-Alveolus

CLINICAL CORRELATE

Bronchoscopy (p. 151)



Arterial Supply of the Lungs (p. 146)

Pulmonary arteries – carry poorly oxygenated blood to lungs for oxygenation

-Give rise to lobar arteries

Bronchial arteries – supply blood for nutrition of structures that comprise the root of the lung

Left bronchial arteries – arise from thoracic aorta

Right bronchial artery – may have different origins

Venous Drainage of the Lungs (p.146)

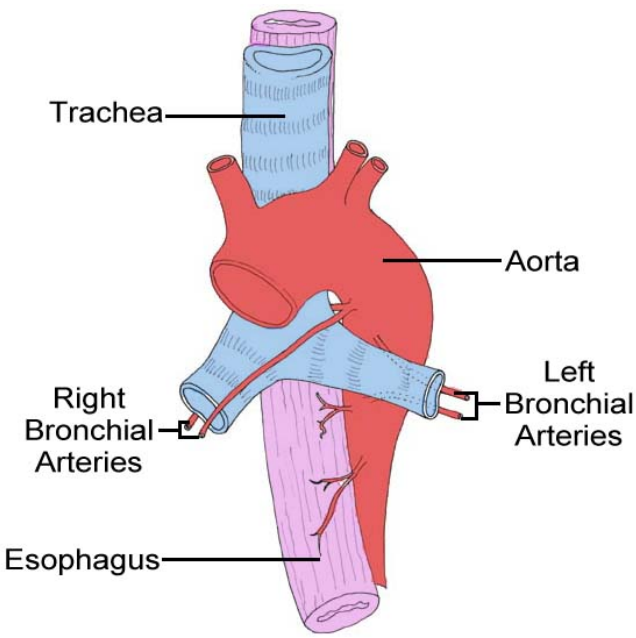
Pulmonary veins – carry oxygenated blood from lungs to left atrium

-Lobar veins drain into pulmonary veins

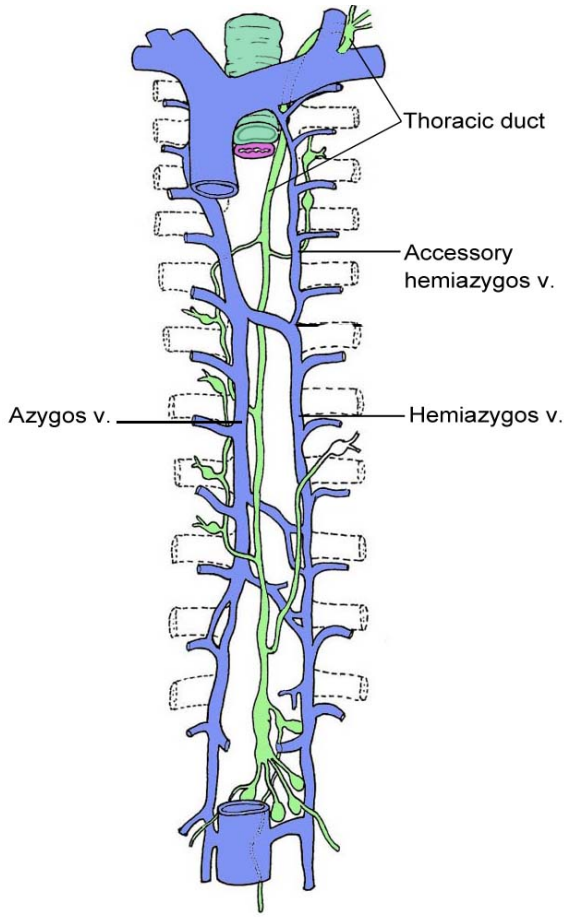
Bronchial veins – drain blood in lungs supplied by bronchial arteries although pulmonary vein tributaries drain some of bronchial arterial blood

-Left bronchial vein drains into accessory hemiazygos vein (usually)

-Right bronchial vein drains into azygos vein



Trachea, Esophagus, Aorta; Anterior View



Azygos system of veins and thoracic duct

Lymphatic Drainage of the Lungs (pp. 149-150)

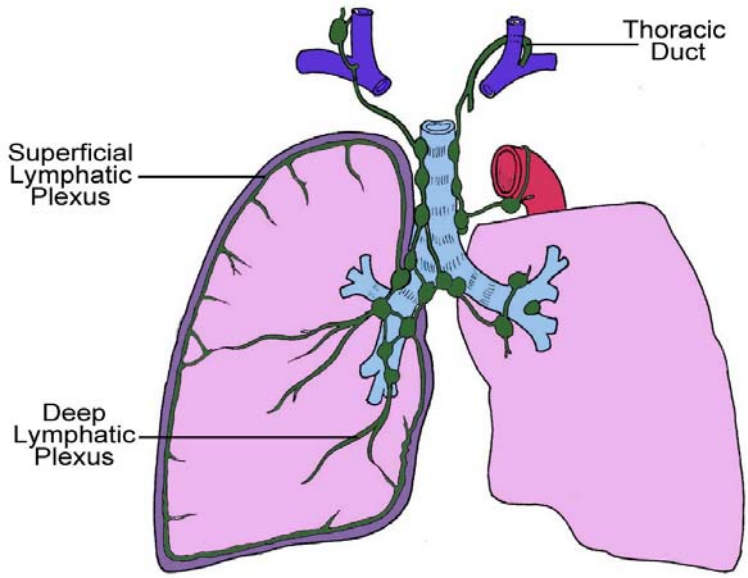
Superficial (subpleural) lymphatic plexus

-Lies just deep to the visceral pleura and drains this area
-Drains into bronchopulmonary lymph nodes

Deep lymphatic plexus

-Largely drain structures that form the root of the lung
-Drain into pulmonary and bronchopulmonary lymph nodes

*Note - Lymph from the superficial and deep plexuses drains into superior and inferior tracheobronchial lymph nodes



Lymphatic Drainage of Lungs

Innervation of the Lungs (p. 149)

Lungs and viscera

-Parasympathetic – from Vagus nerve
-Sympathetic – from sympathetic fibers of sympathetic trunk

Parietal pleura – from intercostal and phrenic nerves

Dr. Weyrich

G06: Heart and Middle Mediastinum

Reading:
1. Gray's Anatomy for Students, chapter 3
2. *Dissection Guide for Human Anatomy*, Lab 6

Objectives:
1. Subdivisions of mediastinum
2. Anatomy of the heart
3. Circulation of the heart

Clinical Correlates:
1. Cardiac tamponade
2. Surface anatomy of the heart
3. Coronary artery disease and associated problems

Mediastinum (pp. 153-154)

Superior mediastinum

-Comprises area within the superior thoracic aperture and

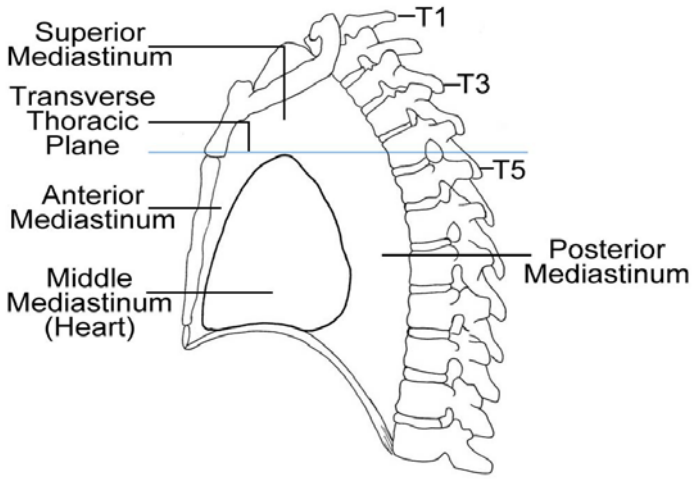
-Transverse thoracic plane

-Transverse thoracic plane – arbitrary line from the sternal angle anteriorly to the IV disk or T4 and T5 posteriorly

- Contains structures such as the thymus, great vessels related to the heart, trachea, etc. (reviewed thoroughly in lecture and lab #7)

Inferior mediastinum – area from transverse thoracic plane to diaphragm; It has 3 subdivisions:

- Anterior mediastinum
- Middle mediastinum – contains heart
- Posterior mediastinum



Mediastina, Lateral view of Thorax

Pericardium
(pp. 154-155)

Parts

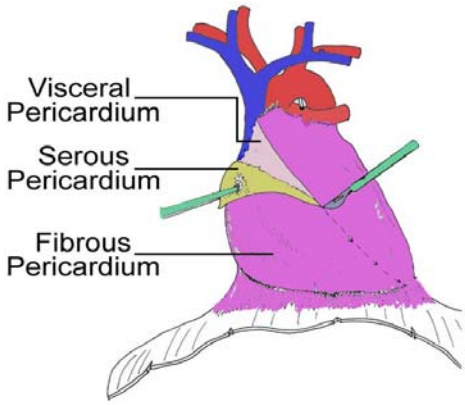
-Parietal pericardium:

-Fibrous pericardium – external sac

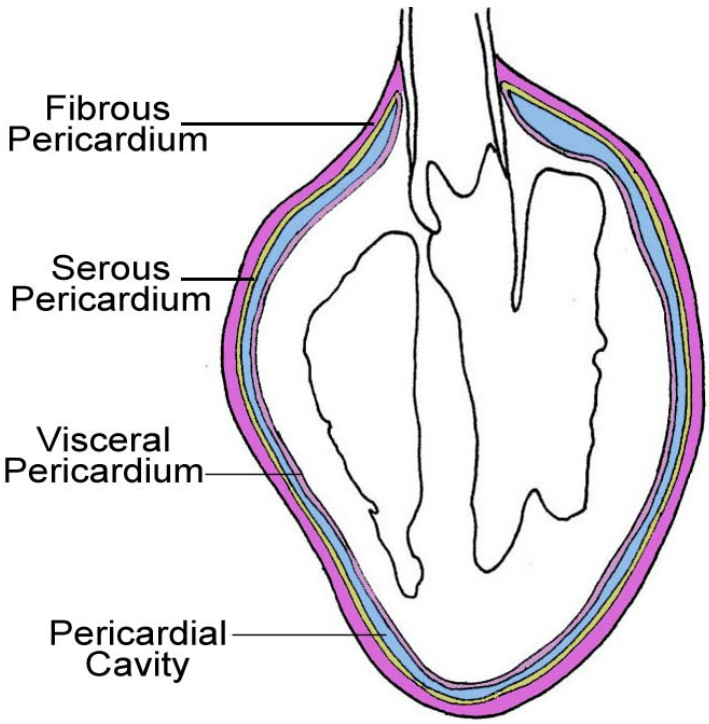
-Serous pericardium – internal sac

-Visceral pericardium – epicardium (outermost layer of wall of heart)

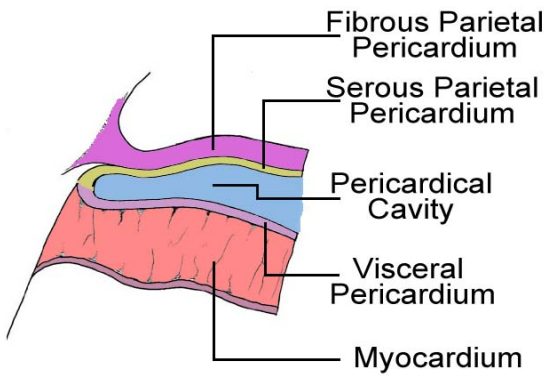
-Pericardial cavity – potential space between parietal and visceral layers



Heart in situ; Anterior View



Heart and Pericardium; longitudinal section



Pericardial Layers

Vessels and Nerves

Arterial supply

-Pericardiophrenic artery – Branch of internal thoracic artery

-Pericardium also has smaller contributions from:

-Musculophrenic – terminal branch of internal thoracic artery

-Bronchial, esophageal, and superior phrenic – thoracic aorta branches

-Coronary arteries (feed visceral pericardium only)

Venous drainage

-Pericardiophrenic veins – tributaries of brachiocephalic or internal thoracic veins

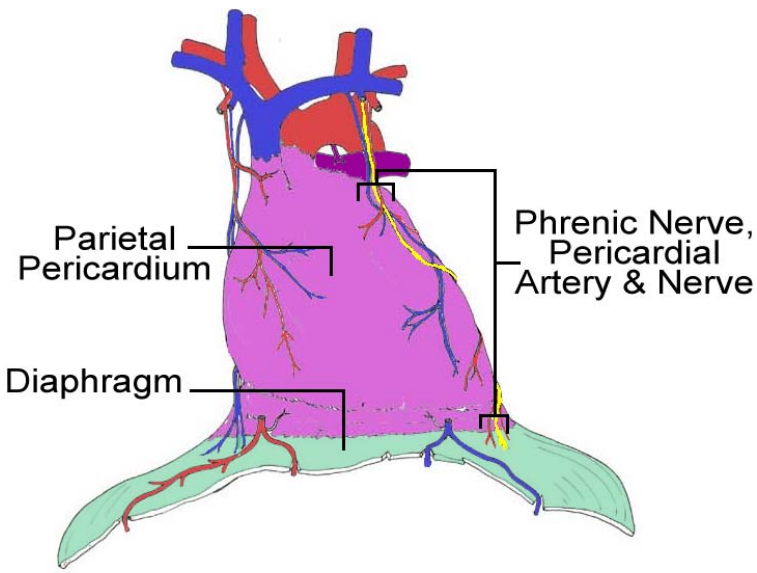
-Variable tributaries to azygos venous system

Innervation

-Mainly from the phrenic nerves

Clinical Correlate

Cardiac tamponade



Heart in situ; Anterior View

The Heart

(pp. 157-181)

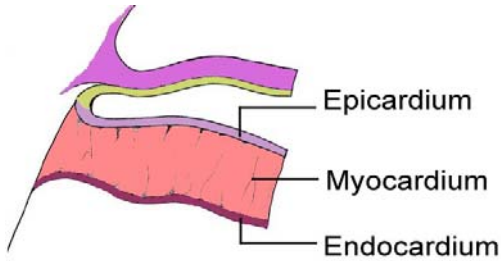
Walls

-Endocardium – internal layer of endothelium

-Myocardium – thick middle layer composed of cardiac muscle

-Epicardium – same as visceral layer of serous pericardium

-Fibrous skeleton – complex layer of dense collagen where muscle fibers attach



Heart Layers

General Features

Base

Apex

Surfaces

-Sternocostal

-Diaphragmatic

-Pulmonary

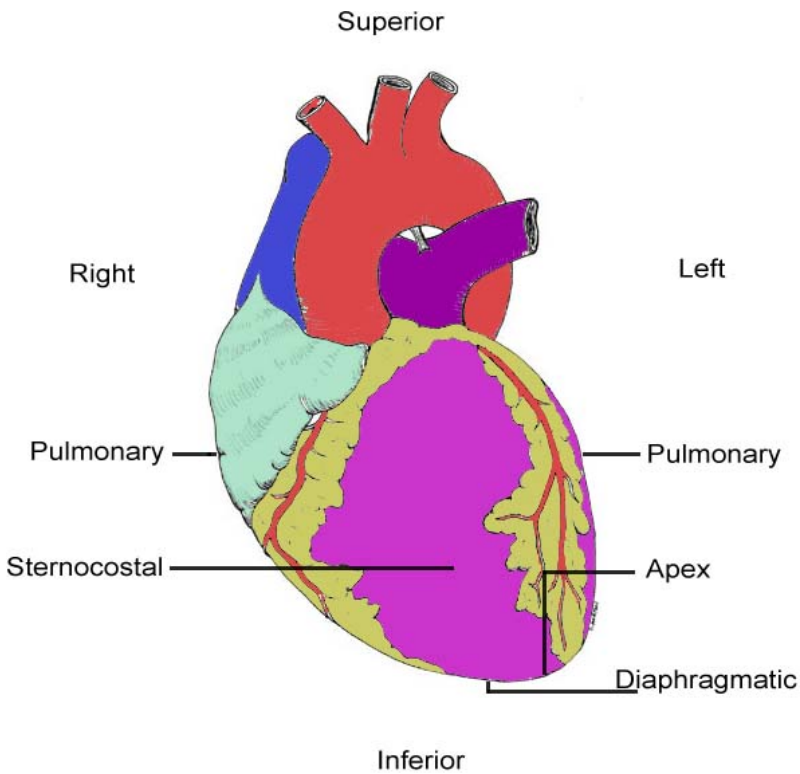
Borders

-Right

-Inferior

-Left

-Superior



Heart, Anterior View

Chambers

Right atrium

-Sinus venarum

-Coronary sinus – small trunk receiving most of cardiac veins

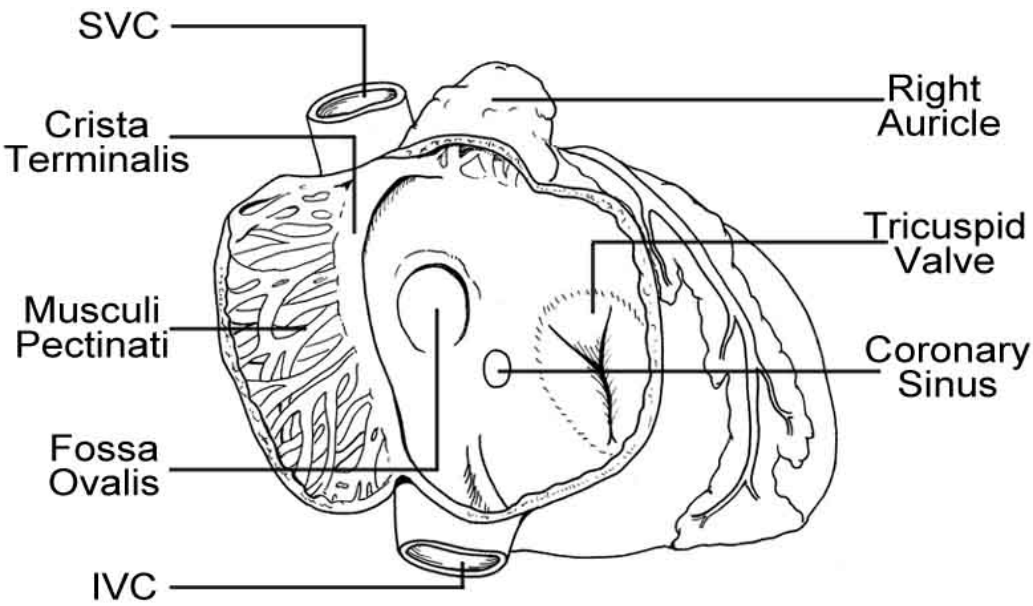
-Musculi pectinati

-Right auricle

-Sulcus terminalis – external groove that separates smooth and rough parts of atria

-Crista terminalis – internal ridge

-Fossa ovalis – remnant of the oval foramen



Right atrium; open

Right ventricle

-Trabeculae carneae – irregular muscular elevations of the interior right ventricle

-Conus arteriosus – arterial cone that leads into the pulmonary trunk

-Right atrioventricular valve – also called the tricuspid valve

-Chordae tendinae – tendinous cords that attach to the anterior, posterior and septal cusps of tricuspid valve

-Papillary muscles – anterior, posterior, and septal

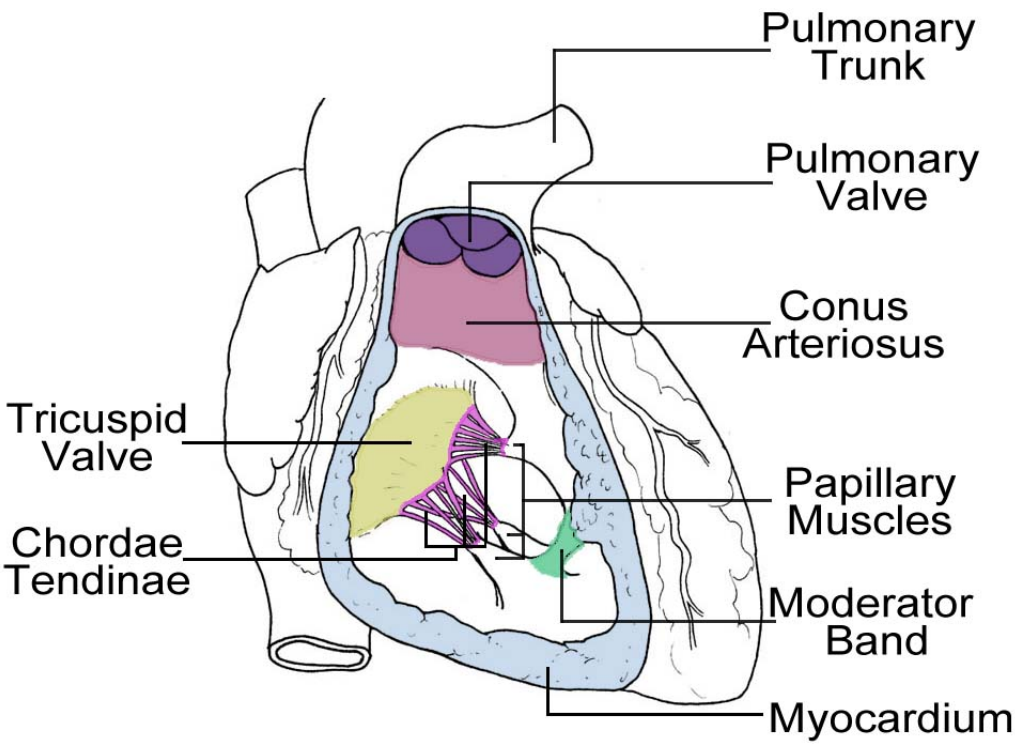
-Conical projections that attach to the ventricle wall and tendinous cords arise from their apices

-Septomarginal trabecula – moderator band

-Muscular bundle that runs from interventricular septum to the base of the anterior papillary muscle

-Important because it carries part of the right bundle branch of AV node

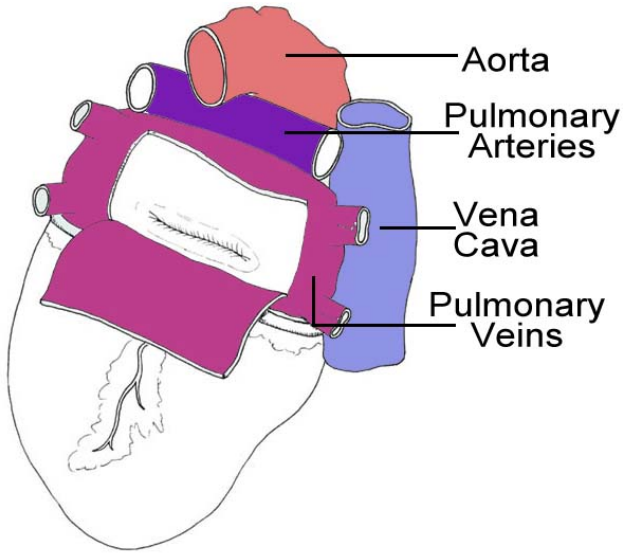
-Pulmonary valve – 3 semilunar cusps (anterior, right, and left)



Right Ventricle; Open

Left atrium

-Pulmonary veins (4) – enter its posterior wall



Left Atrium Open; Posterior View of Heart

Left ventricle – thick wall

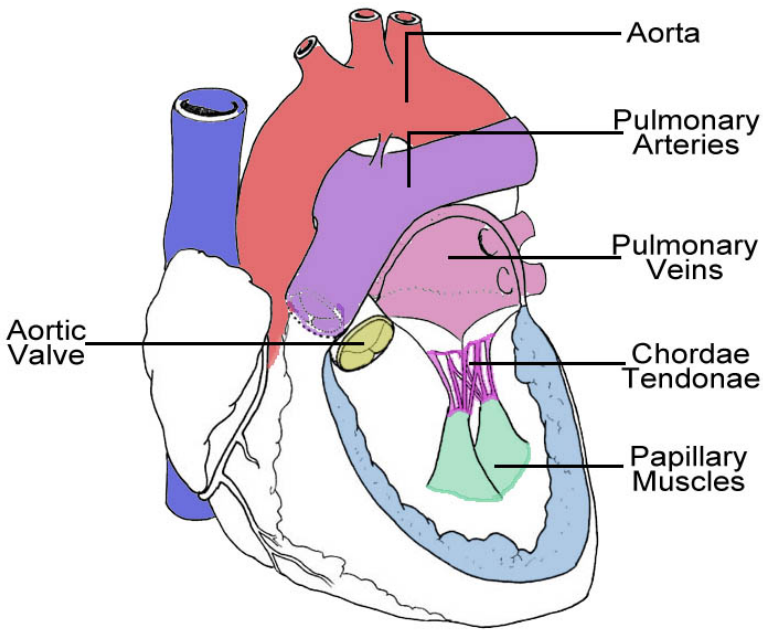
-Mitral valve – 2 cusps

-Aortic Valve – 3 cusps

-mouth of right coronary artery is in the right aortic sinus

-mouth of left coronary artery is in the left aortic sinus

-no artery arises from the posterior aortic sinus



Left Ventricle Open; Anterior View of Heart

Clinical Correlate (pp. 200-205)

Surface anatomy of the heart

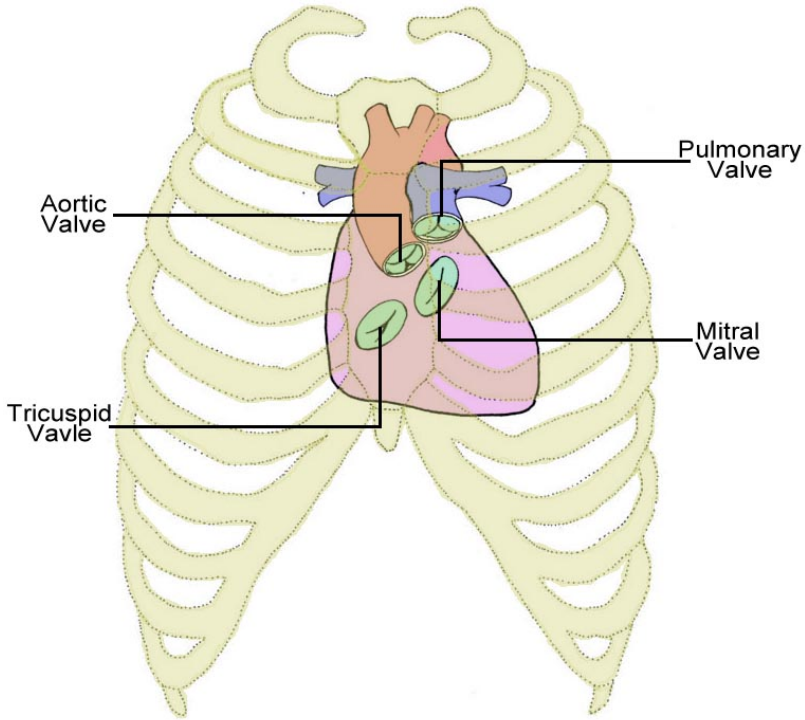
-Aortic area: Right upper sternal border (2nd intercostal space)

-Pulmonary area: Left upper sternal border

- Secondary pulmonic area: 2nd and 3rd Left intercostal space

-Tricuspid area 4th Left intercostal space (left sternal border)

-Mitral area: 5th Left intercostal space (near apex of heart)



Anterior View of Rib Cage; Surface Anatomy of Heart

Arterial Supply to the Heart

Right coronary artery – arises from right aortic sinus

SA nodal artery – supplies SA node

-NOTE: the SA nodal artery can also arise from the LCA(~40%)

Right marginal branch – supplies the right border of the heart

AV nodal artery – supplies AV node

Posterior interventricular branch – supplies both ventricles and IV septum

Left coronary artery – arises from left aortic sinus

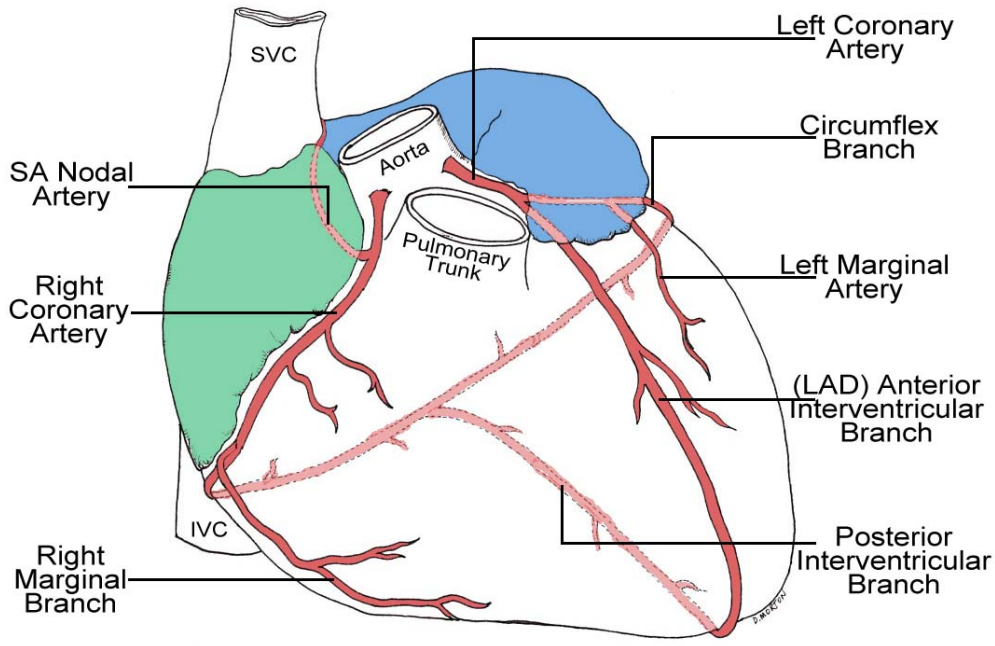
Anterior interventricular branch – also called LAD

Circumflex branch

-Left marginal artery

Clinical Correlate *(*pp. 174-175)

Coronary atherosclerosis



Coronary Arteries; Anterior View of Heart

Venous Drainage of the Heart

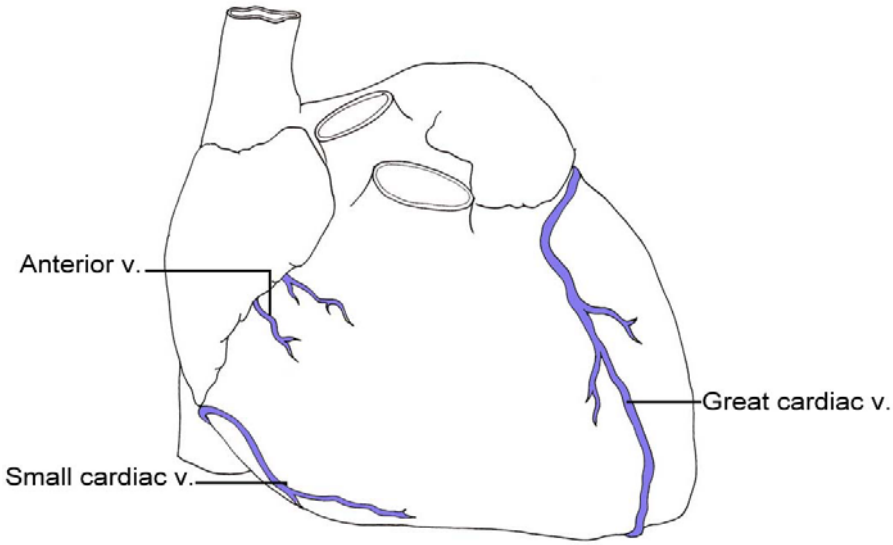
Coronary sinus – most veins empty into coronary sinus

Great cardiac vein - main tributary of the coronary sinus

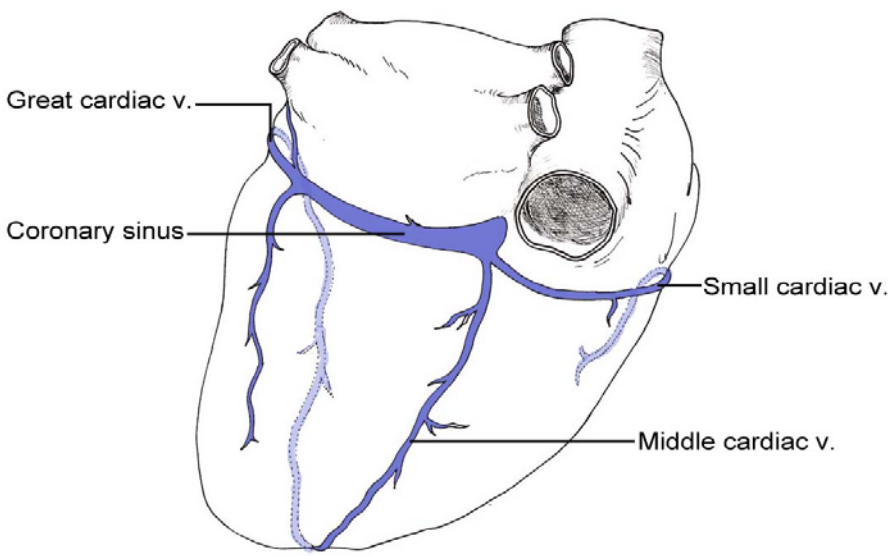
Middle cardiac vein – also called posterior interventricular vein

Small cardiac vein – runs close to right marginal artery

Anterior veins – begin at anterior surface of right ventricle; cross over the coronary groove and directly drain into right atrium



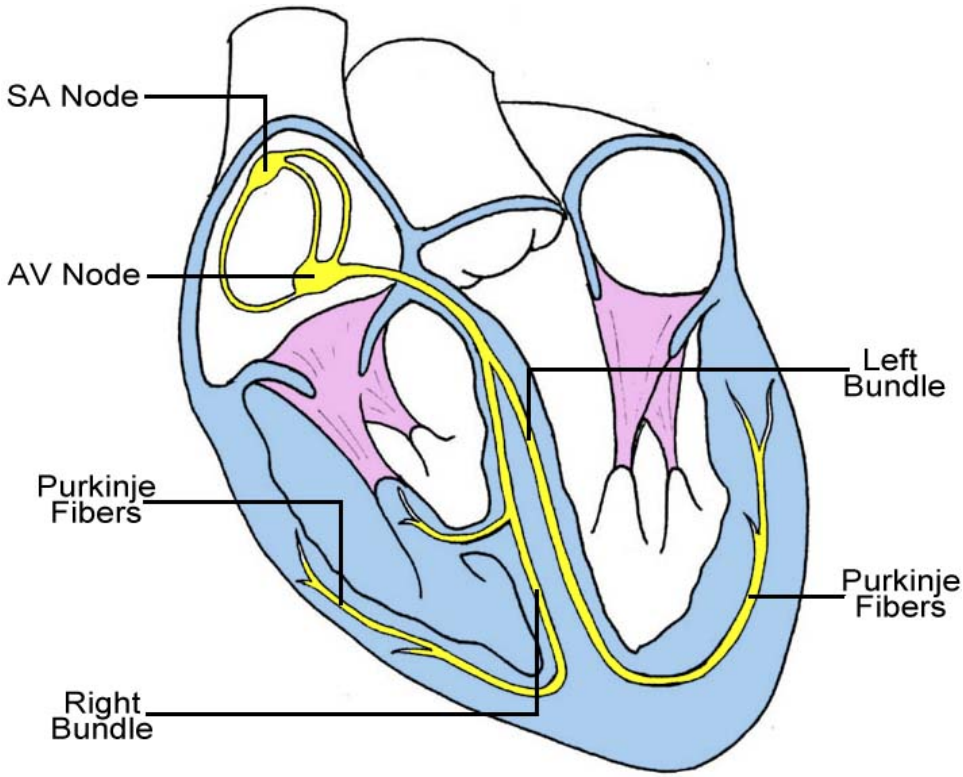
Cardiac veins; anterior view



Cardiac veins; posterior view

Conduction System of the Heart

- SA node: pacemaker of the heart
- AV node: distributes signal from SA node to ventricles through AV bundle
    - Right and left bundles
        - Purkinje fibers: extends signal into walls of ventricle



Conduction System of the Heart

Arterial Supply of the Heart

Artery/Branch	Origin	Course	Distribution	Anastomoses
Right Coronary	Right aortic sinus	Follows atrioventricular groove	Right atrium; SA and AV nodes; posterior part of IV septum	Circumflex and anterior IV of left coronary artery
SA Nodal	Right coronary artery near its origin (60%)	Ascends to SA node	Pulmonary trunk and SA node	
Right Marginal	Right coronary artery	Passes to inferior margin of heart and apex	Right ventricle and apex of heart	IV branches
Posterior IV	Right coronary artery	Runs from posterior IV groove to apex of heart	Right and left ventricles and IV septum	Circumflex and anterior IV branches of left coronary artery
AV Nodal	Right coronary artery near origin of posterior IV	Passes to AV node	AV node	
Left Coronary	Left aortic sinus	Runs in groove and gives off anterior interventricular and circumflex branches	Most of left atrium and ventricle; IV septum; AV bundles; AV node	Right coronary artery
Anterior Interventricular	Left coronary artery	Passes along anterior IV groove to apex of heart	Right and left ventricles and IV septum	Posterior IV branch of right coronary artery
Circumflex	Left coronary artery	Passes to left in AV groove and runs posterior surface of heart	Left atrium and left ventricle	Right coronary artery
SA Nodal	Circumflex branch (40%)	Ascends on posterior surface of left atrium to SA node	Left atrium and SA node	
Left Marginal	Circumflex branch	Follows left border of the heart	Left ventricle	IV branches

*IV=interventricular; AV=atrioventricular

Dr. Weyrich

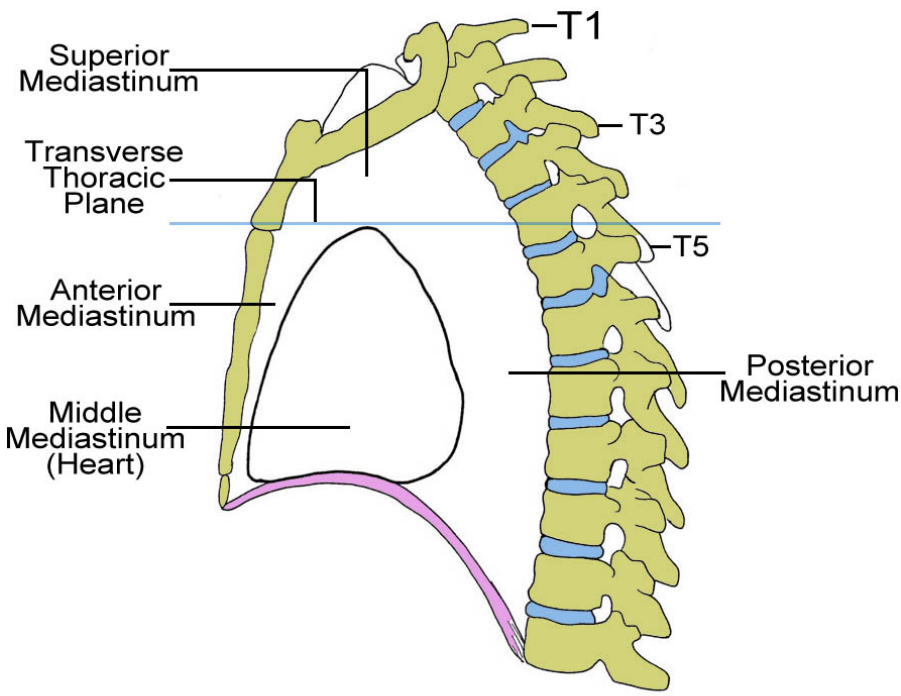
G07: Superior and Posterior Mediastina

Reading:
1. Gray's Anatomy for Students, chapter 3
2. *Dissection Guide for Human Anatomy*, Lab 7

Objectives:
1. Subdivisions of mediastinum
2. Structures in Superior mediastinum
3. Structures in Posterior mediastinum

Clinical Correlate:
1. Aortic aneurysms

Superior Mediastinum
(pp.181-199)



Mediastina, Lateral view of Thorax

Review of the Subdivisions of the Mediastinum

Superior mediastinum

Comprises area within superior thoracic aperture and transverse thoracic plane

-Transverse thoracic plane – arbitrary line from the sternal angle anteriorly to the IV disk or T4 and T5 posteriorly

Inferior mediastinum

Extends from transverse thoracic plane to diaphragm; 3 subdivisions

Anterior mediastinum – smallest subdivision of mediastinum

-Lies between the body of sternum and transversus thoracis muscles anteriorly and the pericardium posteriorly

-Continuous with superior mediastinum at the sternal angle and limited inferiorly by the diaphragm

-Consists of sternopericardial ligaments, fat, lymphatic vessels, and branches of internal thoracic vessels. Contains inferior part of thymus in children

Middle mediastinum – contains heart

Posterior mediastinum

Superior Mediastinum

Thymus – lies posterior to manubrium and extends into the anterior mediastinum

-Important in development of immune system through puberty

-Replaced by adipose tissue in adult

Arterial blood supply

-Anterior intercostals and mediastinal branches of internal thoracic artery

Venous blood supply

-Veins drain into left brachiocephalic, internal thoracic, and thymic veins

Brachiocephalic Veins - Formed by the juncture of respective internal jugular and subclavian veins

Right brachiocephalic vein

-Receives lymph from right lymphatic duct

Left brachiocephalic vein

-Over twice as long as the right brachiocephalic vein
-Receives lymph from the thoracic duct

Left Superior Intercostal Vein

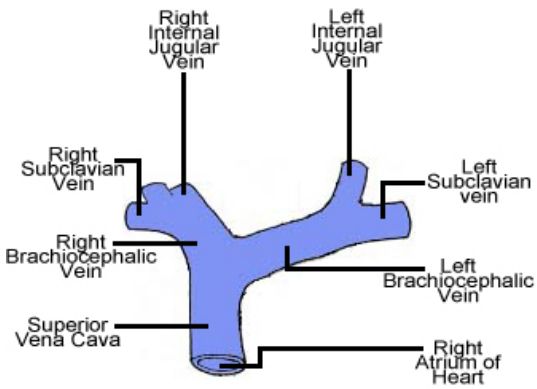
Superior Vena Cava (SVC)

Returns blood from all structures superior to diaphragm except the heart and lungs

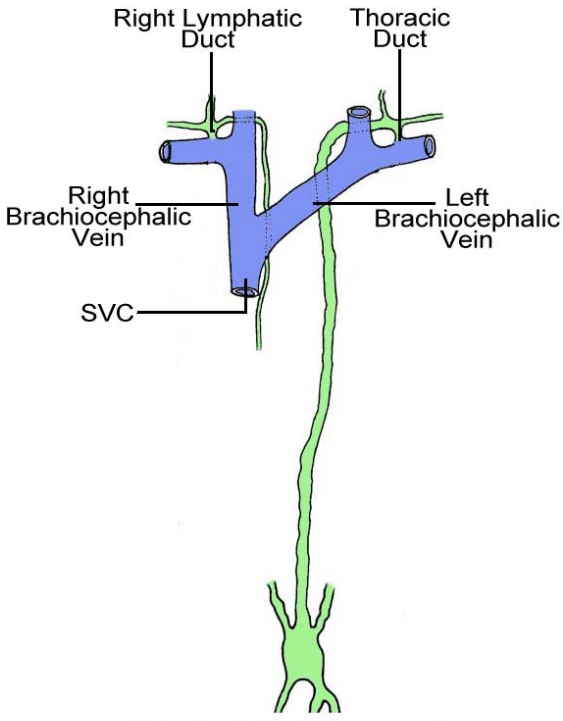
-Drains into right atrium

-Runs in the right side of the superior mediastinum

-Right phrenic nerve lies between the SVC and mediastinal pleura



Tributaries of the SVC



Major lymphatic drainage vessels

Arch of the Aorta (table 1.6, p. 145)

Ligamentum arteriosum – remnant of fetal ductus arteriosus

-Extends from root of left pulmonary artery to inferior surface of arch of aorta

-Left recurrent laryngeal hooks beneath arch of aorta, adjacent to ligamentum arteriosum

Brachiocephalic trunk – first branch of aorta

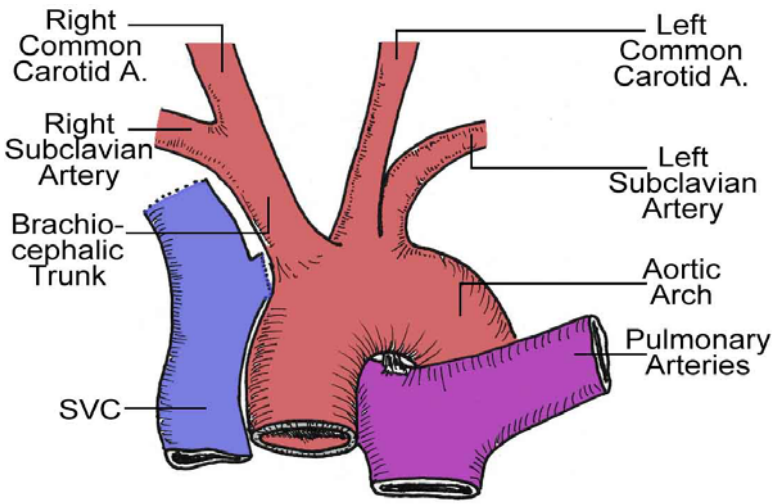
-Divides into right common carotid and right subclavian arteries

Left common carotid artery – 2nd branch of the arch

Left subclavian artery –3rd branch of the arch

Clinical Correlate (p. 147)

Aortic arch aneurysms



Branches of the Aortic Arch

Nerves (pp. 188-191)

Vagus nerves – arise from medulla of the brain, exit the cranium, and descend through the neck posterolateral to the common carotid arteries

-Right vagus nerve – enters thorax anterior to right subclavian artery

-Right recurrent laryngeal nerve – arises from right vagus and hooks around the right subclavian artery and ascends to larynx

-Contributes to pulmonary, esophageal, and cardiac plexuses

-Left vagus nerve – enters mediastinum between left common carotid and left subclavian arteries

-Left recurrent laryngeal nerve – arises from left vagus and ascends to larynx

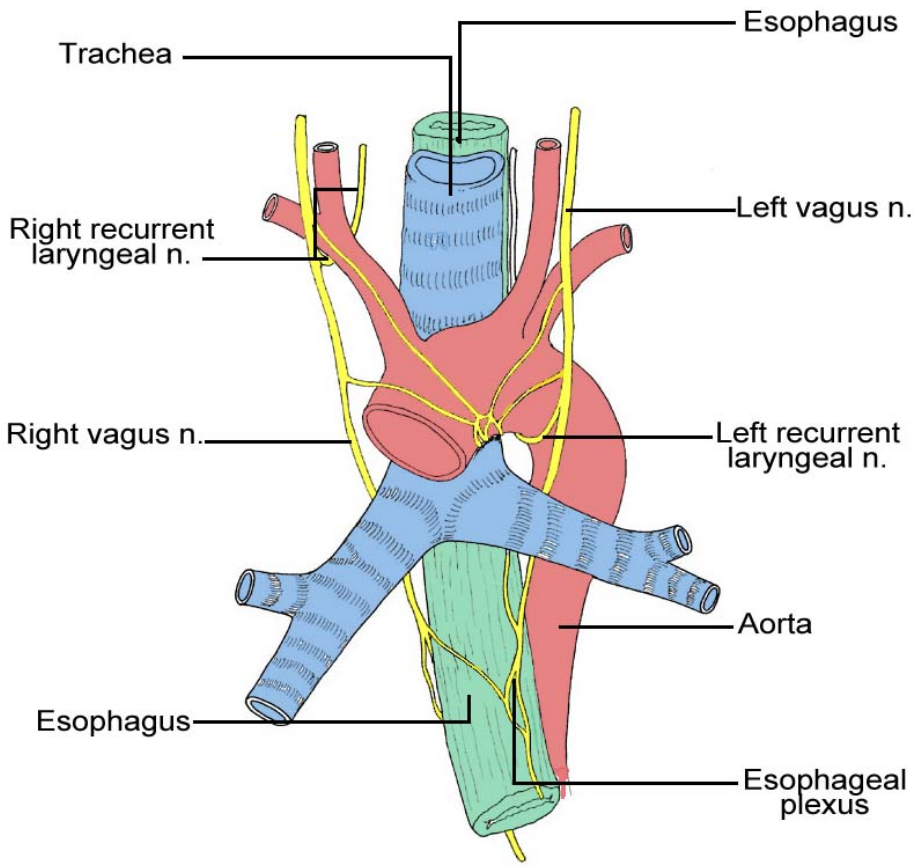
Phrenic nerves – supply the diaphragm

-Right phrenic nerve

-Left phrenic nerve

Trachea

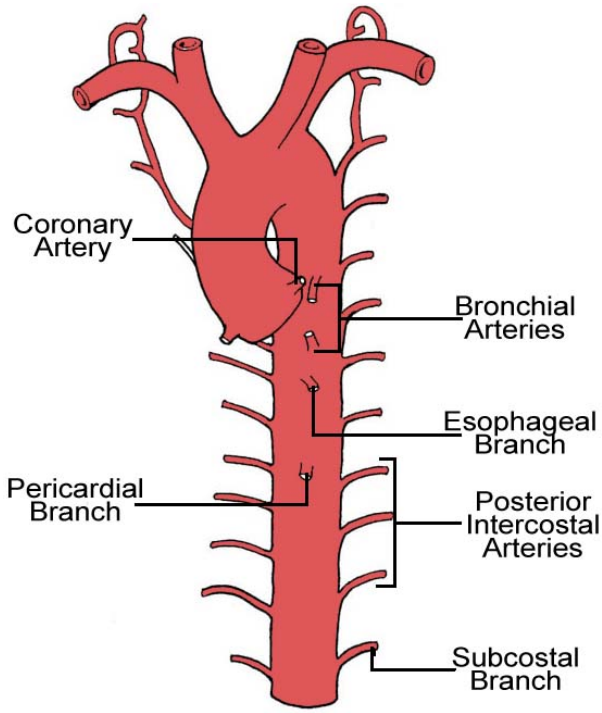
Esophagus



Thoracic contents; anterior view

Posterior Mediastinum
(pp. 150-156)

Contents



Thoracic Aorta Branches

Thoracic aorta

- Bronchial branches – supply trachea, bronchi and lymph nodes
- Pericardial branches – supply pericardium
- Posterior intercostal branches
- Superior phrenic branches
- Esophageal branches
- Subcostal branches

Esophagus

Thoracic duct - largest lymphatic channel in the body; empties into the venous system near the union of the left internal jugular and subclavian veins

Cisterna chyli – origination of thoracic duct

Azygos system of veins – drains back and thoracoabdominal walls

Azygos (*i.e*., paired) vein – forms collateral pathway between the SVC and IVC

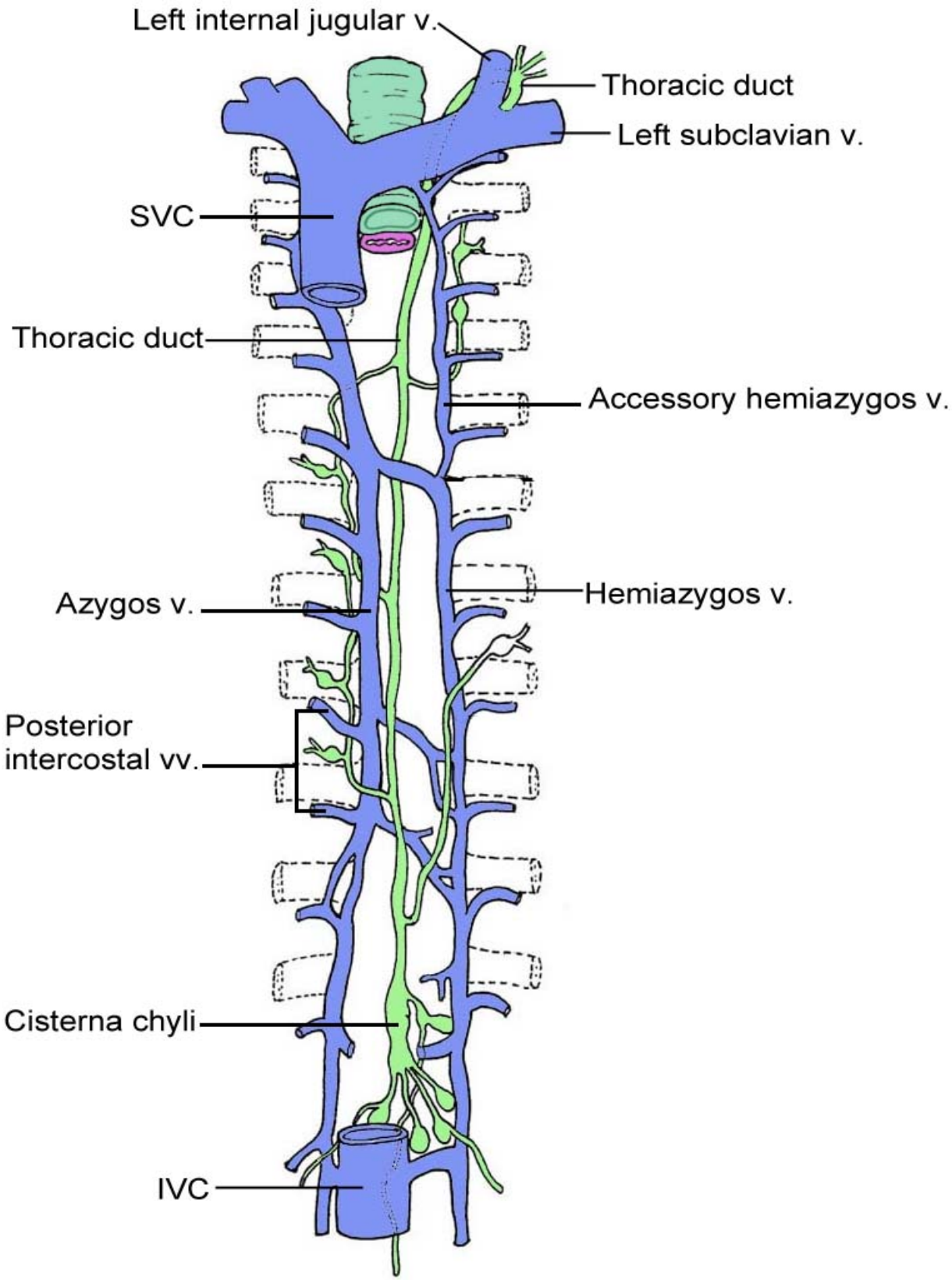
-Receives the posterior intercostal, mediastinal, esophageal, and bronchial veins. Also receives vertebral venous plexuses

Hemiazygos vein – ascends on the left side of the vertebral column; crosses to the right side (~ T9 vertebra) and joins azygos vein

-Receives the inferior three posterior intercostal, inferior esophageal, and some mediastinal veins

Accessory hemiazygos vein – passes on the left side of the vertebral column through the medial end of 4^{th}-5^{th} intercostal space to T7-T8 where it crosses to the right side and joins the azygos vein

•NOTE – The azygos system exhibits tremendous variation from person to person



Azygos system of veins and thoracic duct

Nerves

Thoracic sympathetic trunks

Lower thoracic splanchnic nerves

-Greater (arises from sympathetic trunk at T5-T9)

-Conveys preganglionic sympathetic fibers to the celiac ganglia

-Lesser (arises from sympathetic trunk at T10-T11)

-Conveys preganglionic sympathetic fibers to the superior mesenteric ganglia

-Least (arises from sympathetic trunk at T12)

-Conveys preganglionic sympathetic fibers to the aorticorenal ganglia

Nerves of the Thorax

Nerve	Origin	Course	Distribution
Vagus (CN X)	8 to 10 rootlets from medulla of brainstem	Enters superior mediastinum posterior to sternoclavicular joint and brachiocephalic vein; gives rise to recurrent laryngeal nerve; continues to abdomen	Pulmonary plexus; esophogeal plexus; cardiac plexus
Phrenic	Ventral rami of C3-C5 nerves	Passes through superior thoracic aperture and runs between mediastinal pleura and pericardium	Central portion of the diaphragm
Intercostals	Ventral rami of T1 to T11 nerves	Run in intercostal spaces between internal and innermost layers of intercostal muscles	Muscles and skin over intercostal space; lower nerves supply muscles and skin of anterolateral abdominal wall
Subcostal	Ventral ramus of T12 nerve	Follows inferior border of 12^{th} rib and passes into abdominal wall	Abdominal wall and skin of gluteal region
Recurrent laryngeal	Vagus nerve	Loops around subclavian on right; on left runs around arch or aorta and ascends in tracheoesophageal groove	Intrinsic muscles of larynx (except cricothyroid)
Cardiac Plexus	Cervical and cardiac branches of vagus nerve and sympathetic trunk	From arch of aorta and posterior surface of heart; fibers extend along coronary arteries and to SA node	Impulses pass to SA node
Pulmonary Plexus	Vagus nerve and sympathetic trunk	Forms on root of lung and extends along bronchial subdivisions	Bronchial subdivisions
Esophageal Plexus	Vagus nerve; sympathetic trunk; greater splanchnic nerve	Distal to tracheal bifurcation, the vagus and sympathetic nerves form a plexus around the esophagus	Vagal and sympathetic fibers to smooth muscle and glands of inferior two-thirds of esophagus

Aorta and Branches in the Thorax

Artery	Origin	Course	Branches
Ascending aorta	Aortic orifice of left ventricle	Ascends approximately 5 cm to sternal angle where it becomes arch of aorta	Right and left coronary arteries
Arch of aorta	Continuation of ascending aorta	Arches posteriorly on left side of trachea and esophagus and superior to left main bronchus	Brachiocephalic; left common carotid; left subclavian
Thoracic aorta	Continuation of arch of aorta	Descends in posterior mediastinum to left of vertebral column; gradually shifts to right to lie in median plane at aortic hiatus	Posterior intercostal; bronchial; esophageal; pericardial; superior phrenic; subcostal arteries
Posterior intercostal	Posterior aspect of thoracic aorta	Pass laterally, and then anteriorly parallel to ribs	Lateral and anterior cutaneous branches
Bronchial	Anterior aspect of aorta or posterior intercostal artery	Run with tracheobronchial tree	Bronchial and peribronchial tissue; visceral pleura
Esophageal	Anterior aspect of thoracic aorta	Run anterior to esophagus	To esophagus
Pericardial	Anterior aspect of thoracic aorta	Send twigs to pericardium	To pericardium
Superior Phrenic	Anterior aspects of thoracic aorta	Arise at aortic hiatus and pass to superior aspect of diaphragm	To diaphragm
Subcostal	Posterior aspects of thoracic aorta	In series with posterior intercostal arteries just inferior to the 12^{th} rib	Lateral and anterior cutaneous branches