The Thorax

- Forms protective cage around vital organs of the thoracic cavity (heart, lungs, and great blood vessels).
- Supports the shoulder girdles and upper limbs.
- Provides attachment points for the muscles of the back, chest, and shoulders.
- Intercostal spaces between the ribs are occupied by intercostal muscles.

The Sternum

- Flat bone approximately 15cm long (6 in.)
- Fusion of three bones: *manubrium*, *body*, and *xiphoid process*.
- Landmarks: *jugular notch*, *sternal angle* and *xiphisternal joint*. 
The Ribs

- Ribs originate on/between thoracic vertebrae; attach to sternum
  - 12 pairs
    - 7 true (vertebrosternal)
    - 3 false (vertebrochondral)
    - 2 floating (vertebromuscular ribs)
- Rib morphology: head, neck, tubercle, angle, shaft, costal groove.

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The Mammary Glands

- Pectoral fat pad
- Nipple, areola
- Lactiferous duct
- Lactiferous sinus
- Suspensory ligament
- Angiology-branches of int.thoracic artery
Respiratory Muscles

- **Diaphragm**
- **External, internal intercostal**
- **Accessory muscles**: Sternocleidomastoid, serratus anterior, pectoralis minor, scalenes (inspiration)

Respiratory movements

- **Eupnea** diaphragmatic breathing/costal breathing
- **Hyperpnea**
Subclavian Arteries and Branches

- **Internal thoracic**- anterior thoracic wall

- **Axillary** - pectoral region, axilla

The Descending Aorta

*Thoracic Aorta & Branches*

- **Visceral branches**- Bronchial, pericardial, mediastinal, esophageal arteries.

- **Parietal branches**- Intercostal, superior phrenic.
Blood Supply

Bronchial arteries

Systemic Veins

SVC formation

- Subclavians
- Brachiocephalics (vertebrals, ext/int jugulars)
- Azygos (hemiazygos) - chief blood collectors of thorax

The Trachea

- Descends from larynx into mediastinum
- 10-12 cm (4 inches) long, 2.5cm diameter (1 inch)
- Tracheal walls - mucosa, submucosa, adventitia
- Trachealis muscle
- Carina
The Bronchi and Subdivisions:

The Bronchial Tree

*The Conducting Zone*

- Right/left primary bronchi (extrapulmonary)
- Secondary (lobar), tertiary (segmental), terminal bronchioles
- Structural changes occur as bronchi diameter diminish: (1) cartilage rings replaced by irregular cartilaginous plates; (2) pseudostratified > columnar > cuboidal; and (3) smooth muscle increases.

*The Bronchial Tree*

*The Respiratory Zone*

- Terminal bronchioles feed into respiratory bronchioles.
- Alveolar ducts
- Alveolar sacs

Respiratory membrane

- **Type I cells** (epitheliocytes)-alveolar walls; angiotensin converting enzyme (ACE)
- **Type II cells**-secrete surfactant (interferes w/H2O molecule cohesiveness)
- **Alveolar macrophages**
- **Respiratory membrane**-fused basal laminas of alveolar epithelium & capillary endothelium
Pathologies

Chronic Obstructive Pulmonary Disease
- Obstructive emphysema-alveolar enlargement, alveolar wall deterioration
- Chronic bronchitis-inhaled irritants
- Asthma
- Tuberculosis
- Lung Cancer

The Pleurae

- Parietal
- Visceral
- Pleural cavity

Respiratory Muscles

- Diaphragm
- External, internal intercostal
- Accessory muscles:
  Sternocleidomastoid, serratus anterior, pectoralis minor, scalenes (inspiration)
Gross Anatomy of the Lungs

- **Apex, base, root**
- **Lobes**: Superior, middle, inferior
- **Fissures**: Horizontal, oblique
- **Surfaces**: Costal, mediastinal, cardiac notch
- **Connective tissue, trabeculae, elastic fibers, smooth muscles, and lymphatics.**

Blood Supply and Innervation of the Lungs

- Pulmonary arteries, arterioles, pulmonary capillary network, venules, veins
- Bronchial arteries
- Pulmonary plexus-parasympathetic motor, visceral sensory fibers

The Heart

*Size, Location, and Orientation*

- **Weighs between 250-350 grams**
- **Located in mediastinum (extends obliquely from 2nd rib to 5th intercostal space)**
- **Base, apex**
Coverings of the Heart

- **Fibrous pericardium** - (1) protection; (2) anchors to surroundings (diaphragm, great vessels); (3) prevents blood overfill.
- **Serous pericardium** - (1) parietal layer lines inner fibrous pericardium; (2) visceral layer (epicardium); (3) Pericardial cavity-in between

Layers of the Heart Wall

- **Epicardium** - often infiltrated with adipose
- **Myocardium** - layered cardiac muscle tissue (contractile), CT, blood vessels, & nerves
- **Endocardium** - glistening white endothelial layer resting on CT; continuous with endothelium

Fibrous Heart Skeleton

- **Collagen & elastic fibers**
- **Encircle bases of pulmonary trunk/aorta and heart valves**
- **Functions**: (1) stabilizes cardiocyte/valve positionings; (2) reinforcement of blood vessels & nerves; (3) elasticity
Anatomical Orientation and Superficial Heart Anatomy

- **Borders**: Superior, Right, Inferior, Left
- **Sternocostal surface**: rt. atrium & ventricle
- **Diaphragmatic surface**: post./inf. wall of left ventricle
- **Auricles**
- **Coronary sulci**
- **Interventricular sulci** (ant., post.)

Internal Anatomy/Organization of the Heart

- **Right atrium**: superior/inferior vena cavae, coronary sinus; pectinate muscles, interatrial septum, fossa ovalis
- **Tricuspid valve**
- **Right ventricle**: chordae tendineae, papillary muscles, trabeculae carneae, pulmonary semilunar valve, pulmonary trunk

Internal Anatomy/Organization of the Heart (cont’d)

- **Left Atrium**: Lt./Rt. Pulmonary veins
- **Bicuspid valve**
- **Left ventricle**: Aortic semilunar valve, aortic sinuses, ascending aorta
- **Vestigial structures**: Ligamentum arteriosum (pulm. trunk, aortic arch), fossa ovalis
AV valve functional anatomy

Semilunar valve functional anatomy

**Coronary Circulation**

*Arterial Supply*

- **Left coronary artery**: anterior interventricular art. (supplies intervent. septum & ant.walls of rt./lt. ventr.) and circumflex art. (Lt. atrium & post.walls of lt. vent.)
- **Right coronary artery**: marginal art. (supplies myocardium of lateral part (rt.side) and post.intervent.art. (post.ventr.walls)
- **Anastomoses**: fusing collateral routes
Coronary Circulation

Venous Supply

- **Coronary sinus** - receives blood from great, middle, and small cardiac veins

Cardiac Cycle

- **Systole** - chamber contraction (atrial 0.1s, ventricular 0.3s)
- **Diastole** - chamber relaxation (0.4s)

Cardiac Cycle

Heart Sounds

- **1st ("lubb") sound** - beginning ventricular systole
- **2nd ("dupp") sound** - beginning ventricular diastole
- **3rd/4th sounds** - associated with ventricular blood flow & atrial contractions
Cardiac Cycle
Coordination of Cardiac Contractions

- **Nodal cells** - establish contraction rates (SA, AV nodes)
- **Conducting fibers** - distribute contractile stimuli to myocardium (AV bundle, Purkinge fibers)
- **Bradycardia, Tachycardia**

Mediastinum

- Viscera between pulmonary cavities
- Covered by mediastinal pleura

Mediastinum

Boundaries:
- Superior thoracic aperture
- Diaphragm
- Sternum
- Thoracic vertebral bodies
Mediastinum

Surrounded by
- Blood & lymphatic vessels
- Lymph nodes
- Nerves
- Adipose
- Loose CT & lung elasticity accommodates movement

Mediastinal Divisions

• Superior
• Inferior
  Anterior
  Middle
  Posterior

Superior Mediastinum

• Superior vena cava
• Brachiocephalic veins
• Aortic arch
• Thoracic duct
• Trachea
• Esophagus
• Thymus
Superior Mediastinum

- Nerves
  - Vagus
  - L. recurrent laryngeal
  - Phrenic

Anterior Mediastinum

- Sternopericardial ligaments
- Adipose
- Lymphatic vessels
- Lymph nodes
- Internal thoracic vessels
Middle Mediastinum

- Pericardium
- Heart
- Ascending aorta
- Pulmonary trunk
- SVC
- Azygos arch
- Main bronchi

Posterior Mediastinum

- Thoracic aorta

Posterior Mediastinum

- Thoracic duct
- Lymph nodes
- Azygos vein
- Hemiazygos vein
Posterior Mediastinum

- Esophagus
- Esophageal plexus
- Thoracic sympathetic trunks and nerves