Cardiovascular system

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Introduction

- The cardiovascular system, also called the circulatory system, consists of:
  - cardio meaning heart.
  - Vascular blood vessels.

The cardiovascular system has three main components:

1. The heart. A contractile pumping device
2. The blood vessel. Tubes/Vessels, which can transport the circulatory fluid (blood) to and from cells of the body.
3. The blood. A circulatory fluid.

The heart pumps blood around the body. The heart is divided into two sections according to types of blood:
- left side oxygen-rich side.
- right side oxygen-poor side.
The heart shape and location

**Shape**: cone-shaped about the size of a fist, is a muscular organ hollow.

**Location**
In a thoracic cavity between the lungs in the mediastinum, under the sternum slightly to the left of midline.

**The apex** in left fifth intercostal space.

Pericardium

- Tough a fibrous membrane that encloses the heart and great vessels, consist of two layers.

**Function of pericardium**
1. It keeps heart fixed in place within chest cavity.
2. It prevents heart from stretching too much.
3. It lubricates heart to prevent friction.
4. It protects heart from any infections.
The two layers of Pericardium.

1. Fibrous pericardium.
   The outermost layer protects the heart.

2. Serous pericardium.
   Deep to the fibrous pericardium consist of two-layer serous pericardium:
   a) **The parietal layer** adhered to the fibrous layer
   b) **The visceral layer** close to heart, is adhered to the myocardium (muscle of the heart). This layer is also known as the (epicardium)

* The two layers of the serous membrane enclose the pericardial cavity contains a small amount of pericardial fluid

**Pericardial fluid** is a fluid lubricates the heart and protects it from injury
chambers of the Heart

The four chambers

1. Upper chambers Receiving chambers. Two Atria
   - Left and right Separated by inter atrial septum.
   - The left atrium receives oxygenated blood from the lungs.
   - The right atrium receives blood without oxygen from the rest of the body.

2. Lower chambers Discharging chambers. Two Ventricles
   - Left and right Separated by inter ventricular septum
   - when they contract, blood is pumped out of the heart and into the circulation.
   - The right ventricle pumps deoxygenated blood to the lungs.
   - left ventricle pumps out oxygenated blood to the rest of the body.
2. **Heart Valves**

- There are four valves of the heart, which are divided into two categories:

**Atrioventricular valves:**

1. **The tricuspid valve** Right side
   - Separates **right atrium from right ventricle**, Has three cusp, allow blood to flow from the right atrium to the right ventricle.
   - Prevents the back flow of blood from the right ventricle to the right atrium.

2. **The mitral (bicuspid) valve** Left side
   - Has two leaflets.
   - Separates the **left atrium from the left ventricle**.
   - Opens to allow blood to flow from the left atrium to the left ventricle.
   - Prevents the back flow of blood from the left ventricle to the left atrium.
2. **Semilunar valves:**

1. **The pulmonary valve**
   - located between the right ventricle and the pulmonary trunk (pulmonary orifice).
   - The valve consists of three cusps.

2. **The aortic valve**
   - Has three cusp, separates the left ventricle from the aorta.
   - Opens to allow blood to leave the heart from the left ventricle through the aorta and the body.
   - **Valve** are fibrous flaps of tissue found between the heart chambers and in the blood vessels.

   - **Function** allows **blood to flow** in one direction through the chambers of the **heart**
**Chordae tendineae**

They are connective tissue cords that attach the **leaflets (cusp)** of the atroventricular valves to the **walls of the ventricles**.

**Papillary muscles**

- found on the **walls of the ventricles** anchor the chordae tendineae to the walls to aid them in preventing prolapse.
Blood vessels

It's a closed network of tubes which includes 5 types

1. **Arteries** which carry oxygen rich blood away from heart to body.

2. **Arterioles**. Small branches are carrying oxygen rich blood away from heart.

3. **Venules** very small branches that collect the poor O2 blood from the various organs and parts and they **unite to form veins**.

4. **Veins** and Venules carries deoxygenated blood to heart.

5. **Capillaries**: Smallest vessels, where gas exchange takes place, they are minute thin-walled vessels that connect the arterioles and venules.
**Arteries** Large vessels
- Carry blood from heart to tissues of body.
- Carry oxygen rich blood, except for pulmonary arteries.

**General structure of artery (Thick walls)** to withstand pressure
1. **Tunica intima** – endothelium cell.
2. **Tunica media** – smooth muscle with elastic fibers, this layer is responsible to vasoconstriction and vasodilation.
3. **Tunica adventitia** connective tissue.

**Veins**
- The vessels that collect blood from body to heart through venules.
- Walls contains **thin connective tissue** and **thin smooth muscle wide lumen**.
- Largest veins contain one-way valves that keep blood flowing toward heart.
**Difference between Arteries and Veins**

1. Arteries high blood pressure while veins contain blood at a low blood pressure.

2. **Arteries** have a thicker muscular wall (tunica media) than **veins**.

3. **Veins** have **valves** to prevent the backflow of blood.

4. **Arteries** have a **smaller lumen** because they need to maintain a high blood pressure, however **veins** have a larger lumen.

**Capillaries**

- Are the smallest blood vessels consisting of a **single layer** of flattened endothelial cells surrounded by a **basement membrane**.

- There are small gaps between the cells called **fenestrations**, which allow substances to be exchanged between the capillary and the interstitial area.
The great vessels attached to the heart

- located largely within the middle mediastinum.

1. **Superior and inferior vena cava.** carries deoxygenated from the body to the heart and the heart pumps it through the pulmonary trunk.

2. **Pulmonary arteries.** The pulmonary trunk splits into the right and left pulmonary arteries, which carry blood to the lungs.

3. **Pulmonary veins.** Oxygen-rich blood drains from the lungs and is returned to the left side of the heart through the four pulmonary veins.

4. **Aorta.** is the largest artery in the body. It carries oxygenated blood (pumped by the left side of the heart) to the rest of the body.
Two important circulation processes

- The right atrium receives deoxygenated blood from
  1. The superior vena cava.
  2. Inferior vena cava.
  3. The coronary veins.

1. Pulmonary circulation
   - The right atrium pumps this blood through the tricuspid valve into the right ventricle.
   - The heart then pumps it out of the right ventricle and into the pulmonary arteries to begin pulmonary circulation.
   - The blood moves to the lungs, exchanges carbon dioxide for oxygen, and returns to the left atrium.
2. Systemic circulation

- Blood from lung by four pulmonary veins to left atrium **Oxygen-rich blood**.
- The oxygenated blood shoots from the left atrium to the left ventricle.
- Blood then is pumped out of the heart into the **aorta**.
- From which the systemic arteries branch to supply essentially all body tissues.
  - The cycle starts again when blood without oxygen goes to the right side of your heart.
The aorta

- The aorta arises from left ventricle, with **aortic valve at orifis** can be divided into four sections:

1. The ascending aorta
2. Aortic arch
3. The thoracic (descending) aorta
4. Abdominal aorta.

- It terminates at the level of L4 by bifurcating into the left and right common iliac arteries.

The **ascending aorta**, give rise to the left and right coronary arteries supply heart.
The arch of the aorta give branches the major arteries to the head, neck and upper limbs. These are:

1. Brachiocephalic trunk divides into the
   1. right subclavian artery  right upper limb.
   2. the right common carotid artery  the head).

2. Left common carotid artery  the left side of the head and neck.

3. Left subclavian artery  left upper limb.

Descending thoracic aorta
until it reaches your diaphragm.

Descending abdominal aorta:
• Is the largest artery in the abdominal cavity and supplies blood to most of the abdominal organs below diaphragm.
Descending aorta supply

- Chest wall.
- Digestive system (esophagus, stomach, and small and large intestines).
- Kidneys
- Legs.
- Lymph nodes
- Reproductive organs (testes or ovaries).
- Respiratory tract.
- Spinal cord.
- Urinary tract.
Terminally descending aorta end into the

1. RT. common iliac arteries
2. Lt. common iliac arteries

which supply the pelvis and lower limbs divided to 

external and internal iliac artery.

• The external iliac artery passes into the thigh, becoming the femoral artery.
The superior vena cava (SVC)

- Is a large, valveless vein that collects venous blood to right atrium. Formed by
  1. Union of the right and left brachiocephalic veins – which provide venous drainage of the head, neck, and upper limbs.
  2. The azygous vein, which drains the upper lumbar region and thoracic wall. At the level of T4, the superior vena cava receives it.

The inferior vena cava

- Is a large vein. It is formed by the joining of the right and the left common iliac veins
- Carries the deoxygenated blood from lower limbs and abdominopelvic region to the right atrium of the heart.
**Blood**

Is a fluid that moves through the vessels of a circulatory system. It includes

1. **Plasma** is the main component of blood, a yellowish colored fluid 90% water, 10% dissolved gases, salts, nutrients, enzymes, hormones, wastes, and proteins.

2. **Red blood cells** are responsible for carrying oxygen and carbon dioxide.
   a) Get color from hemoglobin.
   b) Disk shaped.
   c) Made in red bone marrow.
   d) Circulate for 120 days.

3. **Platelets** are responsible for blood clotting.

4. **White blood cells** are part of the immune system.
**White blood cells**

- There are five major types of white blood cells: neutrophils, lymphocytes, eosinophils, monocytes, basophils.

- Cells and platelets make up about 45% of human blood, while plasma makes up the other 55%.

**Blood has 3 main Functions**

- Transport
- Protection
- Temperature Regulation
The digestive system

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The digestive system consist of

1. The gastrointestinal tract.
2. The solid organs (salivary gland, liver, pancreas, gallbladder.)

The gastrointestinal tract
Is a series of hollow organs joined in a long, twisting tube from the mouth to the anus consist of

1. Mouth.
2. Esophagus.
4. Small intestine.
5. Large intestine.
6. Anus.
The mouth

The mouth extends from the lips to the pharynx.

The mouth is divided into

1. the vestibule the space between the soft tissue (lips and cheeks), and the teeth and gums.

The vestibule is kept moist by secretions from the salivary glands.

2. The mouth cavity bounded by the alveolar arches (bony structures that contain the teeth) surround the mouth cavity at the front and on the sides.

Mouth Function.

1. mechanical digestion.

2. moistens food by salivary glands make saliva.

3. Saliva also contains enzymes break down starches in food.
Mouth cavity contain

1. **The hard palate.** The hard palate is the bony **roof of the mouth**.
2. **Soft palate.** The back of the roof of the mouth.
3. **Uvula.** The soft tissue that hangs from the soft palate.
4. **Tonsils.** Lumps of tissue on the sides of the throat.
5. **Tongue.** A mass of striated muscle covered with mucous membrane. The tongue is divided into right and left halves by a median fibrous septum.
6. **Teeth** – A person has two sets of teeth over the course of a lifetime.
   - **primary teeth 20 primary** (or milk or baby)
   - **permanent (or secondary or adult) teeth 32** permanent teeth
     16 in the upper jaw and 16 in the bottom jaw.

   - four incisors.
   - two canines.
   - four premolars.
   - six molars in each jaw.
**Salivary gland**

There are **three pairs** of major salivary glands

1. **The submandibular** are under the jaw
2. **The sublingual** on the floor of the mouth under the tongue...
3. **The parotid gland**
   - Is the largest bilateral **salivary gland** located in the face in front of the ears and behind the angle of the jaw.
   - It produces **serous saliva**, a watery solution rich in enzymes.
   - Secreted into the oral cavity, near the **second upper molar**.

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**The Salivary Glands**

![Diagram of salivary glands](image)
The pharynx

The pharynx is commonly called **the throat**. Divided to
1. Nasopharynx.
2. Oropharynx.
3. The laryngopharynx.

**Oropharynx**: The passageway carries air to the respiratory system and food and liquid to the digestive system.

* (a passageway for food moving from the oral cavity to the esophagus)

**The esophagus** Is a tubular structure (muscular tube) 25 cm long.

**Location**
- vertebral column posteriorly.
- The trachea anteriorly that is continuous above with the laryngeal part of the pharynx.
- **Esophagus** Passes through the diaphragm at the level of the 11th thoracic vertebra to join the stomach at cardiac region of stomach.
- the gastroesophageal junction is surrounded by the lower esophageal sphincter, also known as the **cardiac sphincter**.
Function of the esophagus

1. The esophagus conducts food from the pharynx into the stomach by wavelike contractions of the muscular coat, called peristalsis.

2. Prevents the stomach contents from regurgitating into the esophagus.

Esophagus is anatomically divided into three parts: cervical esophagus, thoracic esophagus, and abdominal esophagus

1. **Cervical** which travels through the neck.

2. **Thoracic** which is located in the thorax, more specifically in the mediastinum.

3. **Abdominal** which travels past the diaphragm into the abdomen, reaching the stomach.
The stomach

- Is a dilated part of the alimentary canal J – shaped

**Location** Between the esophagus and the small intestine.
- The stomach lies within the superior aspect of the abdomen.
- It primarily lies in the epigastric and umbilical regions slightly to left hypochondrial region Inferior to diaphragm anterior to the spleen and pancreas.

**Stomach** Has three main functions:

1. **It stores food** (in the adult it has a capacity of about 1500 mL).
2. **It mixes the food** with gastric secretions to form a semifluid **chyme**.
3. **It controls the rate of delivery of the chyme** to the small intestine so that efficient digestion and absorption can take place.
The stomach is divided anatomically into 4 re the following parts

1- **Cardia** surrounds the superior opening of the stomach with esophagus.

2- **Fundus:**
   - Dome-shaped.
   - Projects upward and to the left of the cardia.
   - It is usually full of gas.

3- **Body:**
   - the large central portion inferior to the fundus.

4- **Pyloric region** This area connects the stomach to the duodenum It is divided into
   
   I. The pyloric antrum.
   II. pyloric canal .
   III. pyloric sphincter : The pyloric sphincter is a muscular valve that opens to allow food to pass from the stomach to the small intestine.
The medial and lateral borders of the stomach are curved, forming the

1. **Greater curvature** – forms the long, convex, Extends from the left of the cardiac orifice to the pylorus.

2. **Lesser curvature** – forms the shorter, concave, medial surface of the stomach Extends from the cardiac orifice to the pylorus.

**Small intestine**

- It is approximately 6.5m in the average person and assists in the digestion and absorption of ingested food.
- It extends from the pylorus of the stomach to the **ileocecal junction**, where it meets the large intestine at the ileocecal valve.
The small bowel can be divided into three parts:
1. the duodenum
2. jejunum
3. ileum.

The Duodenum
• The most proximal portion of the small intestine form a ‘C’ shape, that is around 25cm long, and which wraps around the head of the pancreas.
• It runs from the pylorus of the stomach to the duodenojejunal junction.

The duodenum can be divided into four parts:
1. Superior
2. descending
3. inferior or horizontal
4. ascending.
The jejunum

- makes up 2/3 of the total length of the small intestine and is about 0.9m in length.
- The jejunum begins at the duodenojejunal flexure and ends at the ileum.
- There is no clear external demarcation between the jejunum and ileum – although the two parts are macroscopically different.

The ileum

- The ileum is the longest part of the small intestine, making up about 3/5 three-fifths of its total length.
- It is thicker and more vascular than the jejunum ends at the ileocecal junction.
- The ileocecal valve is found in the lower right quadrant of the abdomen.
- The ileocecal valve function prevents reflux of the bacteria-rich content from the large intestine into the small intestine.
Large Intestine

- The large intestine is larger in diameter than the small intestine.
- Colon averages 150cm in length begins at the ileocecal junction, where the ileum enters the large intestine, and ends at the anus.

The large intestine consists of the

1. Cecum.
2. Appendix.
3. Ascending colon, transverse colon, descending colon, sigmoid colon.
4. Rectum.
5. Anal canal.
The cecum

- The proximal part of the large intestine.
- Located between the ileum (distal small bowel) and the ascending colon.
- Found in the right iliac fossa of the abdomen.

Appendix

- The vermiform appendix is a blind lymphoid pouch located in the right iliac fossa which arises from the cecum.
- These two parts (caecum, appendix) of the large intestine are connected by the meso-appendix.
- The appendix function has a role in the maintenance of gut flora and mucosal immunity.
The ascending colon

• Travels through the right iliac fossa, right flank (lumber), and right hypochondriac region.
• It ends at the right colic (hepatic) flexure.

Transverse colon

• The transverse colon is the second major part of the colon.
• colon: crosses under liver and stomach
• From the right hypochondriac, epigastric and left hypochondriac regions of the abdomen.
• The greater curvature of the stomach are superior to the transverse colon, while the greater omentum hangs over and extends inferiorly to it.
**Descending colon**
- The descending colon extends between the left colic flexure and sigmoid colon.
- It travels through the left hypochondriac region, left flank and left iliac fossa.

**Sigmoid colon**
- The S-shaped Sigmoid colon 40cm long is location from the left iliac fossa until the third sacral vertebra (rectosigmoid junction).
- It is connected to the pelvic wall by the sigmoid mesocolon.
- The long length of the mesentery permits this part of the colon to be particularly mobile.
Rectum

- The rectum is located within the **pelvic cavity** characteristic by its S-shape, between the rectosigmoid junction and the anal canal.
- The rectum ends about 5 cm below the tip of the coccyx, at the beginning of the anal canal.
- Function of the rectum include temporary storage of fecal matter and defecation.
**Anal canal**

- The anal canal forms the terminal part of the gastrointestinal tract.
- The last 2 to 3 cm of the digestive tract is the anal canal, which continues from the rectum and opens to the outside at the anus.
- The anus represents the external orifice of the digestive system.
- It has an important role in **defecation** and maintaining fecal continence by action of anal sphincters.
Gland related to digestive system

• 1. Salivary glands
• 2. Liver and gallbladder
• 3. Pancreas.

The liver

- Liver is a solid dark reddish-brown half-moon shaped organ.
- Location
  lies under the diaphragm in the right upper abdomen and mid abdomen and extends to the left upper abdomen.

Liver Surfaces there are two liver surfaces:
1. The diaphragmatic beneath the diaphragm.
2. The visceral the posteroinferior surface of the liver.

Divided into two main lobes by the falciform ligament.
1. large right lobe
2. smaller left lobe.
Accessory lobes arise from right lobe on the visceral surface of liver:

1. **Caudate lobe** – located on the upper aspect of the visceral surface.
2. **Quadrate lobe** – located on the lower aspect of the visceral surface.

**Functions of Liver**

1. **Bile production** and excretion. Helps in fat metabolism, production of cholesterol and triglycerides.
2. **Excretion** of bilirubin, cholesterol, hormones, and drugs.
3. **Metabolism** of fats, proteins, and carbohydrates.
4. **Enzyme activation**.
5. **Storage** of glycogen, vitamins, and minerals.
6. **Synthesis** of plasma proteins, such as albumin, and clotting factors.
Gall bladder

• The **gallbladder** is 10 cm sac, pear-shaped sac lies between the inferior aspects of the right and quadrate lobes of the liver.

The gallbladder function

• **stores** and **concentrates** bile which is produced by the liver and then **releases** it into the duodenum in the small intestine to help absorb and digest fats.

Pancreas

The pancreas is an elongated, tapered organ located **behind** the stomach.

• Spans the epigastric, left hypochondriac, and a portion of the umbilical abdominal regions
The pancreas consist of
1. **The head** is the widest part of the organ and lies in the curve of the duodenum.
2. **The neck.**
3. **The body third part.**
4. **The tail** the last part ends near the spleen.

The pancreas is a **mixed gland**, i.e. it has both an endocrine and a digestive function:
- **Exocrine** function 99% of the pancreas.
- **Endocrine** 1%.

**Exocrine gland secrete**
1. The **pancreatic enzymes** secreted by the exocrine gland help break down carbohydrates, fats, proteins, and acids in the duodenum.
2. **Secretes a bicarbonate** to neutralize stomach acid in the duodenum.
The endocrine gland secreted hormones

1. insulin.
2. glucagon, both regulate the level of glucose in the blood
3. somatostatin prevents the release of insulin and glucagon.

How gastrointestinal system work?
Whenever the body’s energy stores fall below a set point
1. The hunger centers of the hypothalamus are activated.
2. The digestive process begins in mechanical digestion in all digestive system start from mouth
The digestive system

**Function**

1. **Secretion:** Producing digestive enzymes and preparing food for absorption, help the body to break down food into nutrients such as carbohydrates, fats and proteins.

2. **Motor/Peristaltic Movement:** Transporting food through the digestive system.

3. **Absorption:** Absorbed nutrients into the bloodstream so the body can use them for energy, growth and repair.

4. **Elimination:** Disposal of toxic waste products. Unused materials are discarded as waste products.
RESPIRATORY SYSTEM
Lec 2

Dr. Intisar H. Mohammed
Respiration

- exchange of oxygen and carbon dioxide between the atmosphere and the body cells.
- Every 3-5 seconds, nerve impulses stimulate the breathing process or ventilation which moves air through a series of passages into and out of the lungs, After this, there is an exchange of gases.
Gas Exchange

• External respiration—Diffusion of gases between alveolar air and pulmonary capillary blood across the respiratory membrane (exchange of gases between the lungs and the blood)

• Internal respiration
   The blood transports the gases to and from the tissue cells.
   The exchange of gases between the blood and tissue cells.
Respiratory system

Divided anatomically

A- upper respiratory tract
1. Nose, nasal cavity, and paranasal sinuses
2. Pharynx
3. Larynx

B- lower respiratory tract
1. Trachea
2. Bronchial tree.
3. Lungs.
Respiratory system divided according to **function**

- **Conducting portion** transports air.
  1. nose, nasal cavity
  2. pharynx
  3. larynx
  4. trachea
  5. smaller airways, from the primary bronchi to the terminal bronchioles
Respiratory portion carries out gas exchange.

1. respiratory bronchioles.
2. alveolar ducts.
3. air sacs.
4. alveoli.
The upper respiratory system

• The nose can be divided into
  1. the external portion
  2. the internal portions being the nasal cavities.

The external portion divided to

A. **Bony component** – located superiorly, and consist of:
   1. The nasal bones.
   2. maxillae bone.
   3. frontal bone.

B. **Cartilaginous component** – located inferiorly, and is comprised of the
   1. two lateral cartilages.
   2. two alar cartilages.
   3. one septal cartilage
Nasal cavity (internal portion)

- The nasal cavity is the most superior part of the respiratory tract.
- It extends from the vestibule of the nose to the nasopharynx divided by septum to two parts.

The septum in nasal cavity is made of

1. the vomer bone
2. the ethmoid bone.

- Nasal cavity boundary
- Roof: frontal, ethmoidal, sphenoidal nasal bone
- Floor: maxillary and palatine bone.
- Medial: nasal septum.
- Laterally: nasal conchae, maxillary, palatine bone.
The lateral nasal walls each contain three finger-like structures called turbinate's or conchae

**conchae** is a bony core covered with soft tissue and mucosa.

**The are three conchae** – inferior, middle and superior.

- **Inferior meatus** – between the inferior concha and floor of the nasal cavity.
- **Middle meatus** – between the inferior and middle concha.
- **Superior meatus** – between the middle and superior concha.
The functions of nasal passage

• Prevent entry of dust particle into lungs.
• Warm the incoming air entering the nasal cavity.
• Moisten the dry air.
• Olfactory receptor present in the roof of nasal cavity detect the smell.
• Hold and sweep the micro organisms entering the nasal chamber.

Paranasal sinuses

• They are air-filled extensions of the nasal cavity.
• There are four paired sinuses named according to the bone in which they are located.
The sinuses are

1. Maxillary sinuses.
   They are the largest of the sinuses and are located under the eyes.

2. Frontal sinuses.
   Two frontal sinuses above eyes in forehead.

   They are situated within the body of the sphenoid bone and are behind the eyes.

4. Ethmoid sinuses.
   They are between the eyes and the nasal cavities.

The function of the paranasal sinuses

1. Lightening the weight of the head.
2. Supporting immune defense of the nasal cavity.
3. Humidifying inspired air.
4. Increasing resonance of the voice.
Pharynx

Is a muscular tube that connects the oral and nasal cavity to the larynx and esophagus.

• Three Regions of the Pharynx

1. Nasopharynx
   located posterior to the nose.
2. The oropharynx
   o Is posterior to the oral cavity.
   o Shared with digestive system.
   o Opens into both esophagus and larynx.
3. The laryngopharynx
   o located inferior to the oropharynx.
   o respiratory system only.
Larynx ‘voice box’

- (voice box) The larynx is a complex hollow structure located in the anterior midline in the anterior neck.
- It is anterior to the esophagus and at the level of the C3 and C6 cervical vertebra.
- It consists of a cartilaginous skeleton connected by membranes, ligaments and associated muscles that suspend it from surrounding structures.
- It sits just above the trachea below oropharynx.

Larynx important functions.

1. **Phonation**: Supports true vocal cords, the exhaled air vibrates them to make sound.
2. **The cough reflex**.
3. **Protection** of the lower respiratory tract covered by epiglottis during swallowing.
• The larynx made of **nine cartilages**
• (3 paired and 3 unpaired) that are connected to each other by membranes and ligaments.

**The main laryngeal cartilages are:**

**Single cartilages**
1. **Thyroid cartilage** large (incomplete ring)
2. **Cricoid cartilage** (ring shape)
3. **Epiglottic cartilage** cartilage function to cover the laryngeal inlet during swallowing.

**Paired cartilages**
1. **Arytenoid cartilage** have vocal cord and muscular processes.
2. **Corniculate cartilage**
3. **Cuneiform cartilage**
Larynx

Air passageway made of 9 pieces of cartilage – (1) Thyroid cartilage, (1) Epiglottis, (1) Cricoid cartilage, (2) Arytenoid, (2) Corniculate, (2) Cuneiform

A.K.A your "voicebox" because it contains the vocal cords
The hyoid bone

- The **hyoid** bone is a ‘U’ shaped structure located in the anterior neck.
- does not articulate with any other bones, and is suspended in place by the **muscles and ligaments** that attach to it.
- It lies at the base of the mandible (approximately C3).

The hyoid is composed of

1. a body.
2. two greater horns
3. two lesser horns
- **Trachea**
  - Windpipe structure.
  - Divides at the **carina** at level of the 5th thoracic vertebra.
  - Divides to right and left primary bronchi, one bronchus going to each lung.
  - **Length** It is about 10–11 cm long.
  - **Location** mainly in the median plane in front of the esophagus.
  - Consist of 16 and 20 incomplete (C-shaped) rings of hyaline cartilage.
  - The rings are incomplete posteriorly where the trachea lies against the esophagus.
The bronchial tree.
Divided to

- **Extrapulmonary bronchi**
  
  **Primary bronchi branch** Incomplete rings of hyaline cartilage support the walls of the primary bronchi to ensure that they remain open.

- **Intrapulmonary bronchi**
  1. secondary bronchi (lobar bronchus))
  2. tertiary bronchi .
Bronchioles divided to.
1. Lobar bronchiole.
2. Terminal bronchioles.
3. Respiratory bronchiole communicating directly with the alveolar ducts.

**Bronchioles features**
- Cartilage absent.
- Diameter < 1.0 mm.
The Alveolar Ducts and Alveoli

- **Respiratory bronchioles** lead into alveolar ducts.
- **Alveolar ducts** lead into alveolar sacs.
- **Alveolar Sacs (Alveoli)** are tiny, balloon-shaped air sacs located at the end of the bronchioles.

The alveoli are

- **the functional units** of the lungs and they form the site of gaseous exchange.
- The walls of the alveoli are surrounded by blood vessels and capillaries.
- Gives lung an open, spongy look.
Lung
located on either side of the heart in the within the thoracic cavity protected by the rib cage.

• The pleura consists of a two-layered membrane that covers each lung.
• The **visceral pleura** that covers the surface of the lungs
• The **parietal pleura** is the outer membrane that lines the inner chest wall and diaphragm
• Each lung is surrounded by a pleural cavity, which is formed by the **visceral and parietal pleura**.
• The pleural cavity contain small amount of viscous lubricant known as **pleural fluid**.

Each lung is divided into distinct lobes.

**The right lung has three lobes:**
• superior, middle and inferior. The lobes are divided from each other by two fissures:
  o Oblique fissure
  o Horizontal fissure.
• The left lung has two lobes
• contains superior and inferior lobes, which are separated by a similar oblique fissure.

The lungs shape
• They are roughly cone shaped, with an apex, base, three surfaces and three borders.

• Surfaces (three) – These correspond to the area of the thorax that they face.
  1. mediastinal The lung hilum is located on this surface.
  2. diaphragmatic on the dome of the diaphragm.
  3. Costal surface face intercostal ribs.
Root and Hilum

an area on its mediastinal surface contains
- bronchus and bronchial vessels.
- pulmonary artery, veins.
- pulmonary plexus of nerves and lymphatic vessels.

Blood supply of lung

- pulmonary circulation –

1. The **pulmonary artery** and its branches deliver **blood rich in carbon dioxide (and lacking in oxygen)** to the capillaries that surround the air sacs.
2. Inside the air sacs, exchanges occur.
3. The **oxygen-rich blood** then travels to the heart through the **pulmonary vein** and its branches.
4. The heart pumps the oxygen-rich blood out to the body.
bronchial circulation –
bronchial arteries supply oxygenated blood to lungs, bronchial veins carry away deoxygenated blood from lung tissue to superior vena cava.

**Muscle in respiration**
- The primary inspiratory muscles are the
  1. **Diaphragm** contract to expand thoracic cavity.
  2. **External intercostals** contract to elevate the ribs.

- Normal exhalation requires no active muscular effort.
  1. **Internal intercostals** contract to depresses the ribs.
  2. **Diaphragm** relax to reduce the thoracic cage.
Muscle assist in respiration

• The **pectoralis minor, serratus anterior, and sternocleidomastoid** help with **forced inspiration**.

• while the **abdominal muscles** assist in **active exhalation**.

• (external and internal obliques, transversus abdominis, and rectus abdominis)
Respiratory System Functions

1. Move Air: The respiratory system is responsible for moving air to and from exchange surfaces of lungs.
2. Protect respiratory system and filters inspired air.
4. Produce Sounds.
5. Acid-Base Balance helps regulate blood pH ...
6. Olfactory function contains receptors for smell.
7. Regulating Blood Volume and Blood Pressure (rids the body of some excess water and heat).
Urinary system

Dr. Intisar H. Mohammed
Urinary system
The urinary system's function is to filter blood and create urine as a waste product and help the body to eliminate urine.

Urine consist from:
1. Electrolytes such as sodium, potassium, calcium, magnesium and chloride.
2. Nitrogenous chemicals such as urea and creatinine.
3. Vitamins.
4. Hormones.
5. Organic acids such as uric acid.
6. Other organic compounds.
The major functions of the kidneys are to:

1. A - controlling Acid-base balance (body pH).
2. W - controlling Water balance.
3. E - maintaining Electrolyte balance.
4. T - removing Toxins and waste products from the body.
5. B - controlling Blood pressure.
6. E - producing the hormone Erythropoietin.
7. D - activating vitamin D.

(AWET BED)
The urinary system consists of:
1. two kidneys.
2. two ureters.
3. urinary bladder.
4. urethra.

The kidneys alone perform the functions and manufacture urine in the process.

while the other organs of the urinary system function:

a) temporary storage reservoirs for urine
b) transport channels to carry it from one body region to another.
• The kidneys

**Location.**
- In the upper abdominal wall.
- On side of the vertebral column extend from the T12 to the L3 vertebra.
- Its retroperitoneal organ.

**Shape**
- Dark red organs with a kidney-bean shape.
- The lateral surface of each kidney is convex.
- The medial surface of each kidney is concave (hilum) allow for the entry of ureters, nerve and renal blood vessels.

**Positioning**
- Because it is crowded by the liver, the right kidney is positioned slightly lower than the left.
- **Size.** An adult kidney is about **12 cm long, 6 cm wide,** and **3 cm thick.**

**Adrenal gland (not part of urinary system)** Top of each kidney is adrenal gland, which is part of the endocrine system.
• The kidneys are encased in 3 layers of fascia and fat.
• They are arranged as follows (deep to superficial):
  1. **Renal Fibrous capsule.** A transparent fibrous capsule (inner layer) encloses each kidney and gives a fresh kidney a **glistening appearance.**
  2. **Perirenal fat** A fatty mass, the perirenal fat capsule, surrounds each kidney and acts to **cushion** it against blows.
  3. **Renal fascia** The **outermost** capsule.
     - surrounds the kidney and **hold it in place**
     - encloses the kidneys and the suprarenal glands.
• **Internal gross Anatomy**
  
  • The kidney composed of three distinct areas:

1. **an outer region** called the **renal cortex**
2. **Inner region** called the **renal medulla**
3. **renal pelvis**

• **In the medulla**

  • 5-8 **renal pyramids** are separated by connective tissue **renal columns** cortex-like tissue.
  
  • Each pyramid terminates into a **renal papilla**.
  
  • Each renal papilla drains into a collecting pool called a **minor calyx**; cup-like structures receiving urine.
  
  • several minor calyces connect to form a **major calyx**
  
  • all major calyces connect to the single **renal pelvis** which connects to the ureter.
Renal cortex
Nephron
• The functional units of the kidneys.
• 85% are cortical nephrons
• There are about one million nephrons in a kidney, and they are responsible for forming urine.

Nephron composed of
A. renal corpuscle.
B. renal tubule.

A. The renal corpuscle is a spherical structure.
It consists of the
1. glomerulus.
2. (Bowman’s) capsule.

The glomerulus is the filtering unit of the kidney and is composed of a network of capillaries surround by capsule.
B. Renal Tubule

- The renal tubule is a long and convoluted structure that emerges from the glomerulus and can be divided into three parts based on function.

1. **The proximal convoluted tubule (PCT)** it stays in the **renal cortex**.
   - The blood brought by the renal artery is filtered by the glomerulus and then passed to the PCT.
   - **Maximum reabsorption** takes place in PCT of the nephron.
2- The loop of Henle
   o Descending
   o Ascending limbs.
   • Both the descending and ascending limbs that go through the renal medulla show different permeability.
   • But reabsorption is limited in this segment.
3- The distal convoluted tubule (DCT) in renal cortex.
   o between the ascending part of loop of Henle and the collecting duct system.
   o connects and empties its contents into collecting ducts.
   o **Conditional reabsorption** of sodium ions and water takes place in DCT.
   o Thus, it maintains the pH and sodium-potassium level in the blood cells.
Collecting Duct

- Collecting duct is a long, straight tube maintain the electrolyte balance of the blood.
- This is also the region where the maximum reabsorption of water takes place to produce concentrated urine.
- End in renal pelvis.

Types of Nephron

- There are two types of nephron:
  - **Cortical nephron**
    - These are the nephrons present within the cortex. These are short and comprise about 85% of the total nephrons.
  - **Juxtamedullary nephron**
    - These have long loops of Henle and extend into the medulla. These are about 15%.
    - Serve to concentrate urine.
Urine formation

• The kidneys filter unwanted substances from the blood and produce urine to excrete them.

There are 3 main steps of urine formation:
• Glomerular filtration.
• Reabsorption.
• Secretion.
• These processes ensure that only waste and excess water are removed.
• **The ureter**

Is a fibromuscular tubes play an active role in urine transport.

• **Size.** The ureters are two slender tubes each **25 to 30 cm** long and **6 mm** in diameter.

• **Location.** Retro peritoneum structures from the renal hilum to the posterior aspect of the bladder, which it enters at an angle.

• **Function.**

  • **carry urine** from the kidneys to the bladder through contraction of the smooth muscle layers in their walls by peristalsis.

  • prevented urine from flowing back by **small valve-like folds** of bladder mucosa that flap over the ureter openings.
The urinary bladder

Is a smooth, collapsible, muscular sac that stores urine temporarily.

- **Location.** It is located retroperitoneally in the pelvis just posterior to the symphysis pubis.

- **Function.** Urine storage.

- **Trigone.** The smooth triangular region of the bladder base outlined by these three openings two ureteric orifices and the internal urethral orifice.

- **Detrusor muscles.** The bladder wall contains three layers of smooth muscle, collectively called the detrusor muscle. It can also contract for a long time whilst voiding, and it stays relaxed whilst the bladder is filling.

Its mucosa is a special type of epithelium, *transitional epithelium.*
Bladder have four parts

• **Apex of bladder** is directed forward toward the upper part of the pubic symphysis.

• **Body**

• **Neck** at the base of the trigone that surrounds the internal urethral orifice that leads to the urethra.

• In males the neck of the urinary bladder is next to the prostate gland.

• **Fundus (base)** which contains the trigone.

❖ the range of urine that can be held in the bladder is roughly 400 mL to 1000 mL with the average capacity being 400 to 600 mL.
The urethra
- Is a thin-walled tube.
- Serves as a passageway from bladder to the exterior.

**Internal urethral sphincter.**
- At the bladder-urethral junction, a thickening of the **smooth muscle** forms the internal urethral sphincter.
- It's an **involuntary** sphincter that keeps the urethra closed.

**External urethral sphincter.**
- A second sphincter, the external urethral sphincter,
- It's a **skeletal muscle** as the urethra passes through the pelvic floor and is **voluntarily** controlled.
Female urethra.
• The female urethra is about 3 to 4 cm long, and its external orifice, or opening, lies anteriorly to the vaginal opening.

Male urethra.
• The urethra is approximately 20 cm long and has three named regions:
  1. The prostatic.
  2. The membranous.
  3. Spongy (penile) urethrae; it opens at the tip of the penis after traveling down its length.