

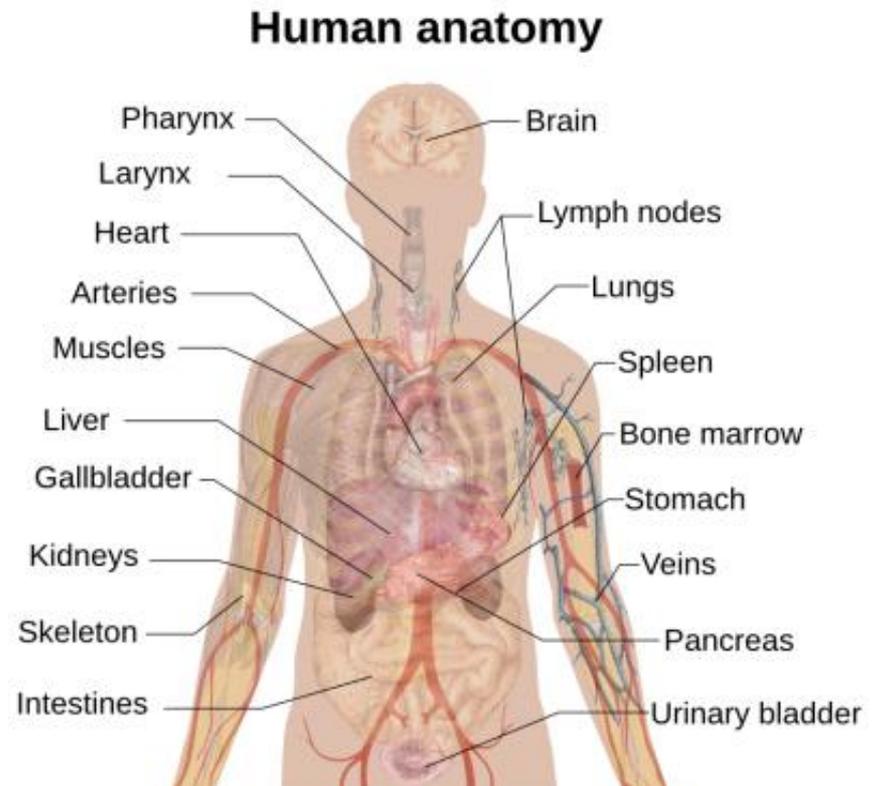


**Special Care Dental Nursing:
Anatomy and physiology update:
Part 1 : Body systems**

2025

Structure

- **1/ Cardiovascular system**
- **2/ Respiratory system**
- **3/ Gastro-intestinal system**
 - Anatomy
 - Physiology
 - Relevant medical conditions

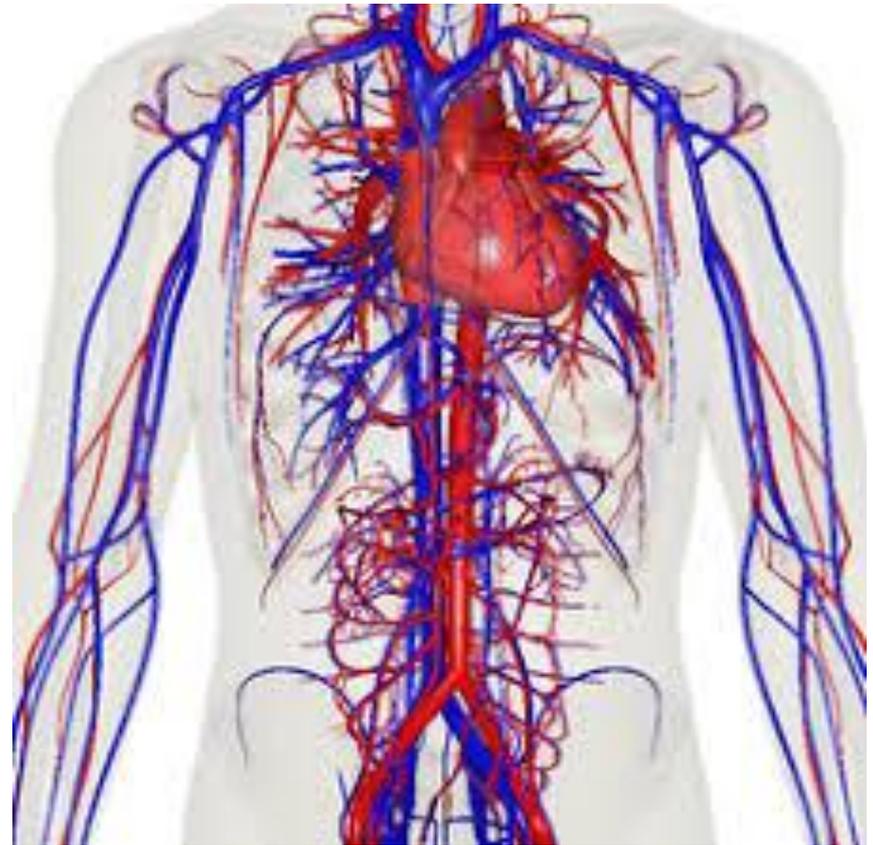




1: Cardiovascular System

Cardiovascular system: components

- **Heart**
- **Blood vessels:**
 - Arteries
 - Veins
 - Capillaries
- **Blood!**



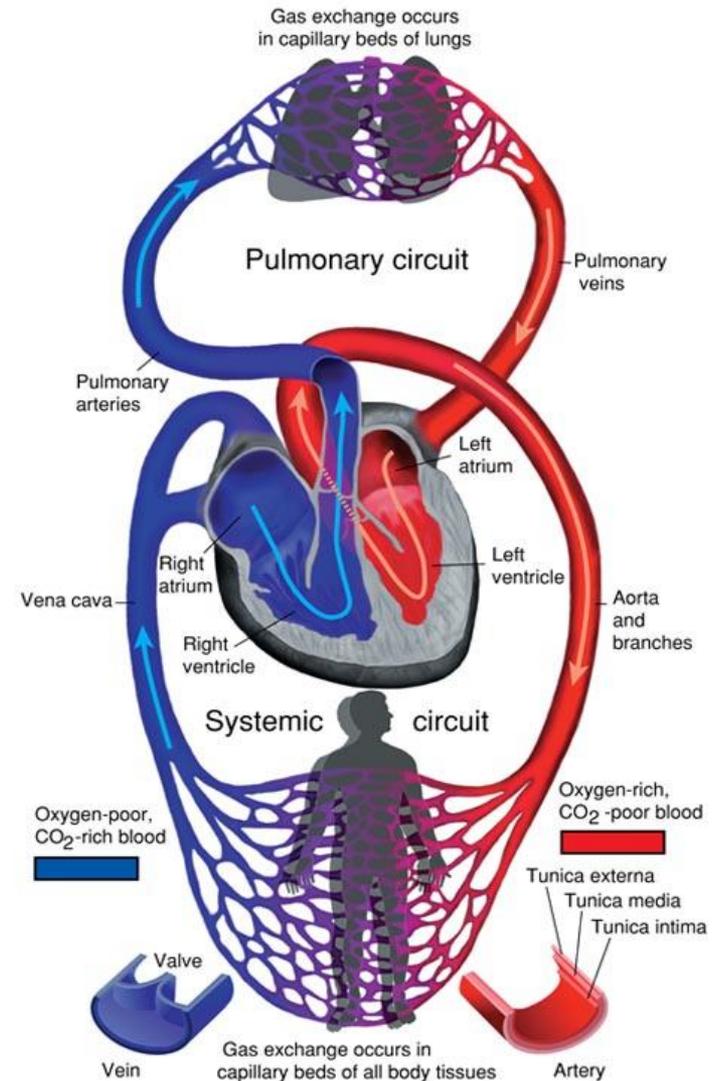
Cardiovascular system: function

- Main role of CVS is to pump blood around the body tissues
- Blood travels away from heart in **arteries**
- Returns to heart in **veins**
- **Capillaries** connect arteries and veins



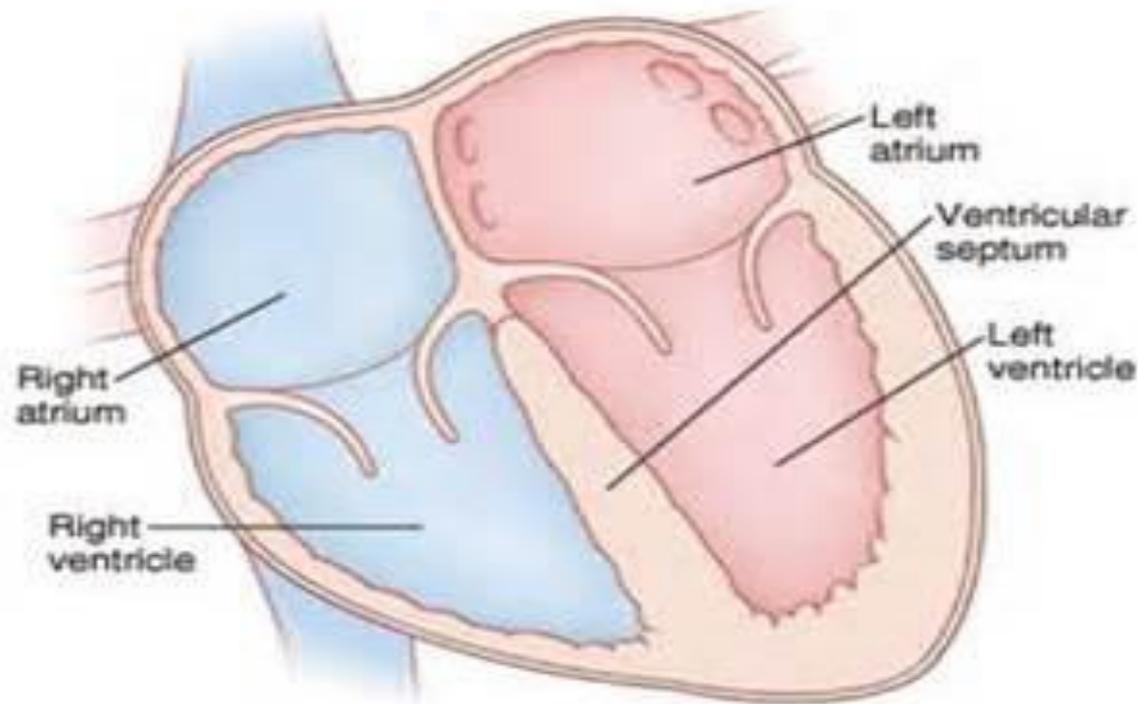
Overview of the circulatory system

- Heart is a basically 2 pumps side by side
- **Right side** pumps blood to the lungs
- **Left side** pumps blood around the body



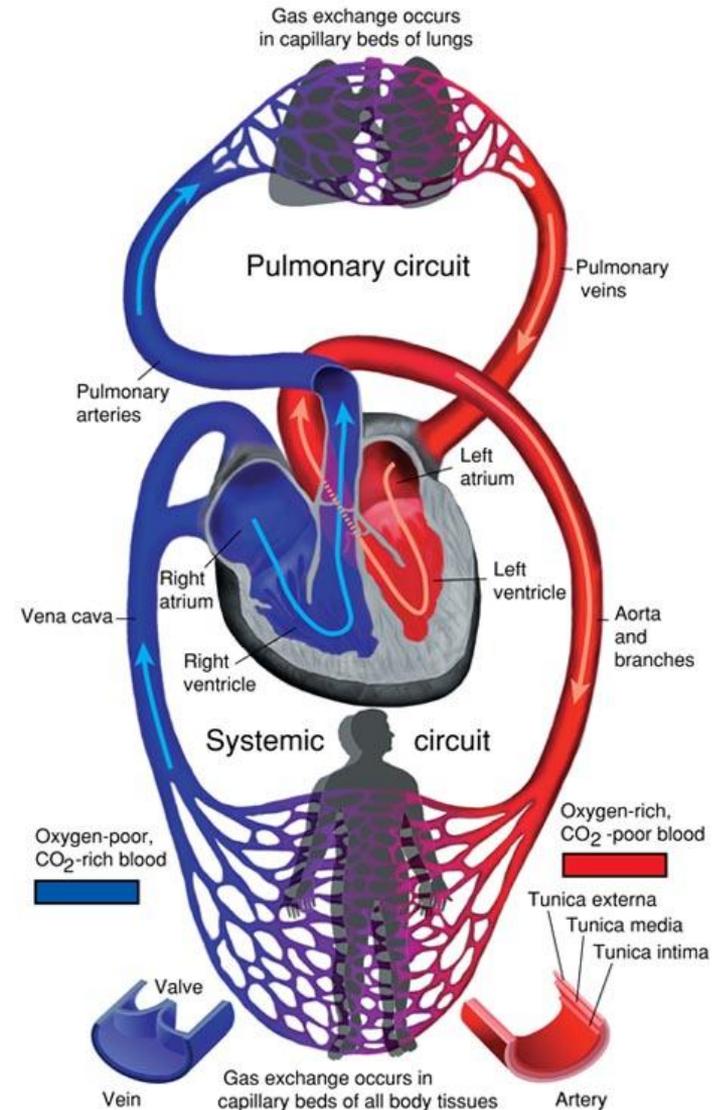
Structure of the heart

- 4 chambers
- 2 atria
(singular:
atrium)
- 2 ventricles
- Right and left
sides



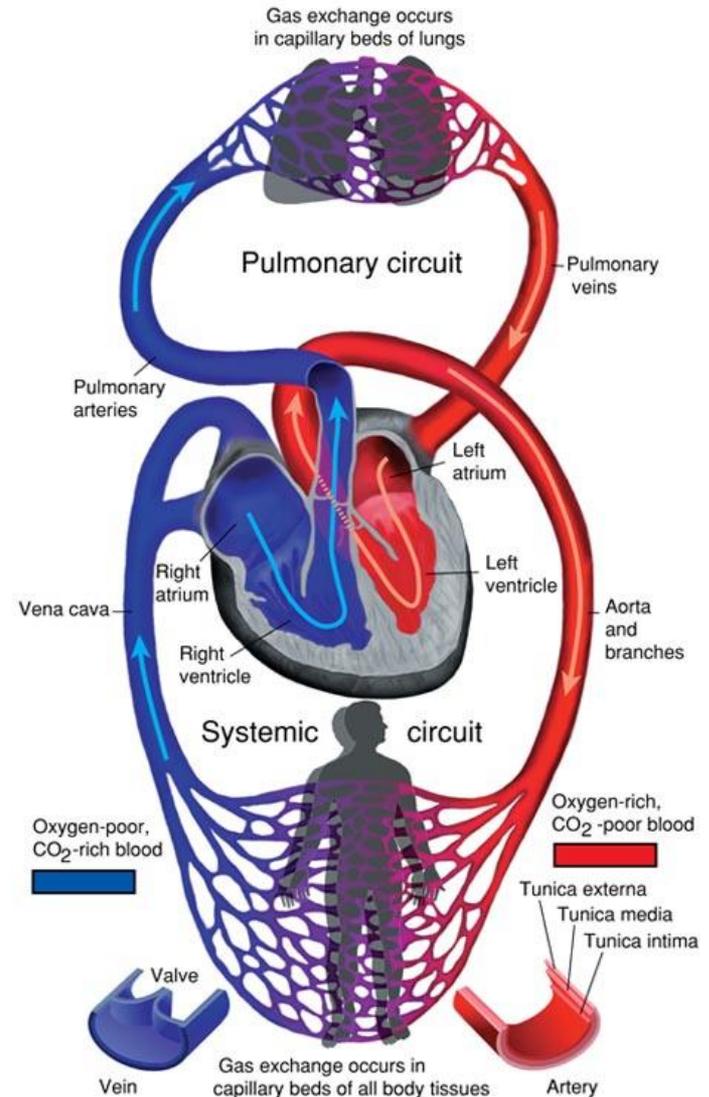
Pathway of blood through heart

- Blood pumped from right atrium to right ventricle
- From right ventricle pumped to lungs (“**pulmonary circulation**”) to be oxygenated
- Blood returns to the left atrium, and is pumped into left ventricle



Pathway of blood through heart

- Blood is pumped from the left ventricle to the **aorta** (largest artery in body), and from here to the rest of the body
- Blood returns deoxygenated to the right atrium, via the **superior vena cava** and **inferior vena cava** (largest veins in body)



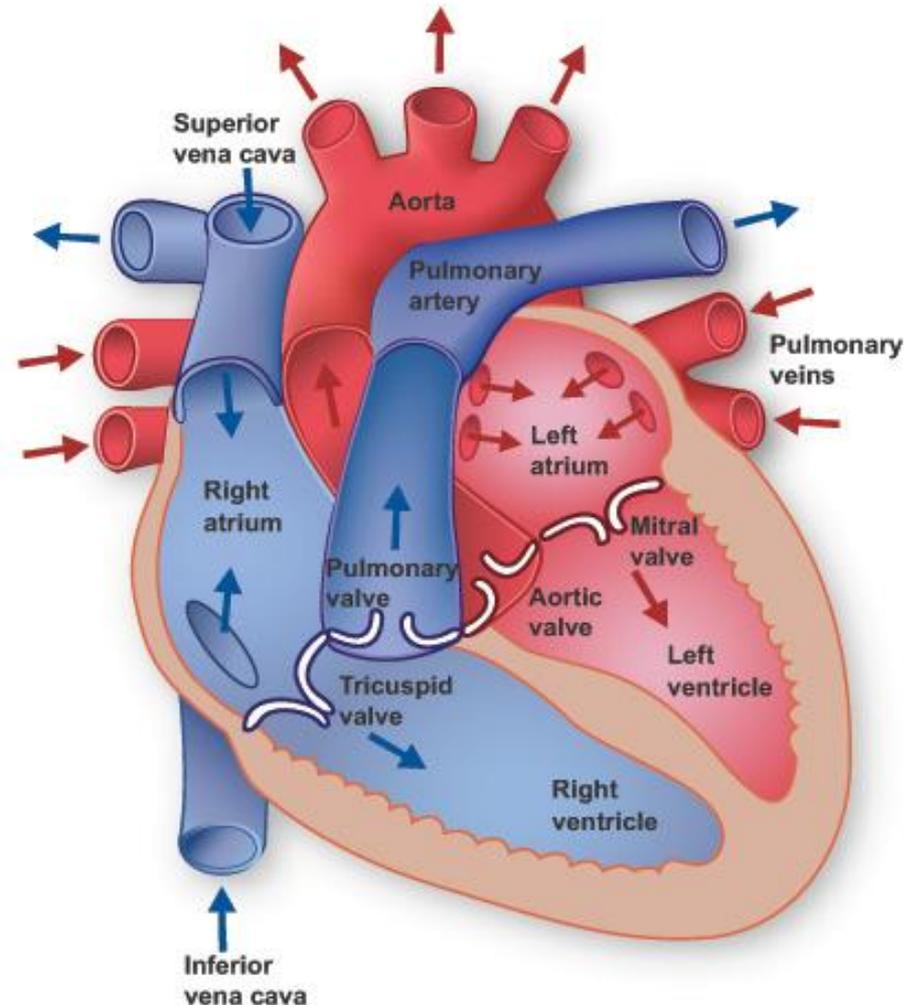
Cardiac cycle and Blood Pressure

- **Systole:**
 - atria contract, then...
 - ventricles contract
- **Diastole:**
 - relaxation
- **Blood pressure**
 - e.g. 120 / 80 mmHg



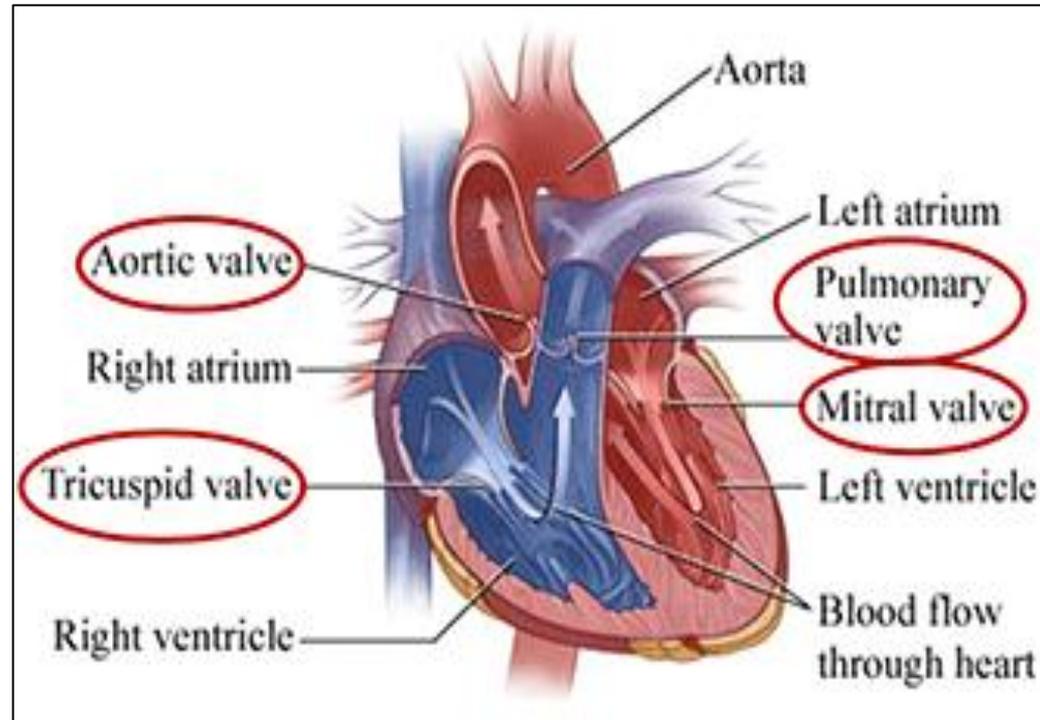
Internal structure of the heart

- The heart has:
 - Muscle (pumping)
 - Electrical circuitry (control of rate of pumping)
 - Valves between chambers (to prevent backflow)
 - Its own arteries and veins
- Diseases can affect any of these



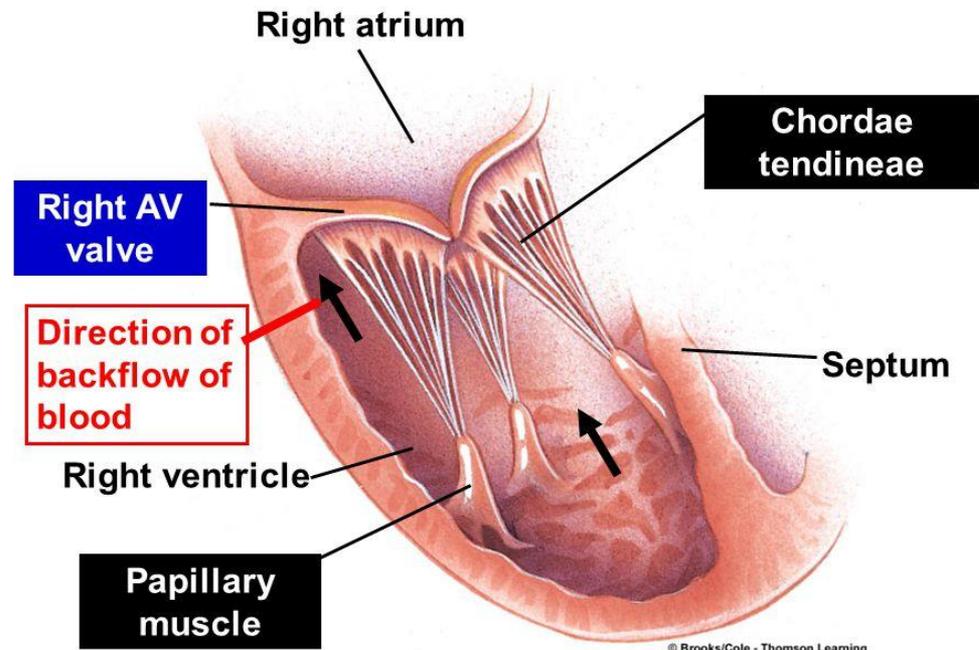
Heart Valves

- Semi-rigid structures:
 - between 2 chambers
 - between chamber & artery
- Prevent backflow when a chamber contracts



Heart Valves

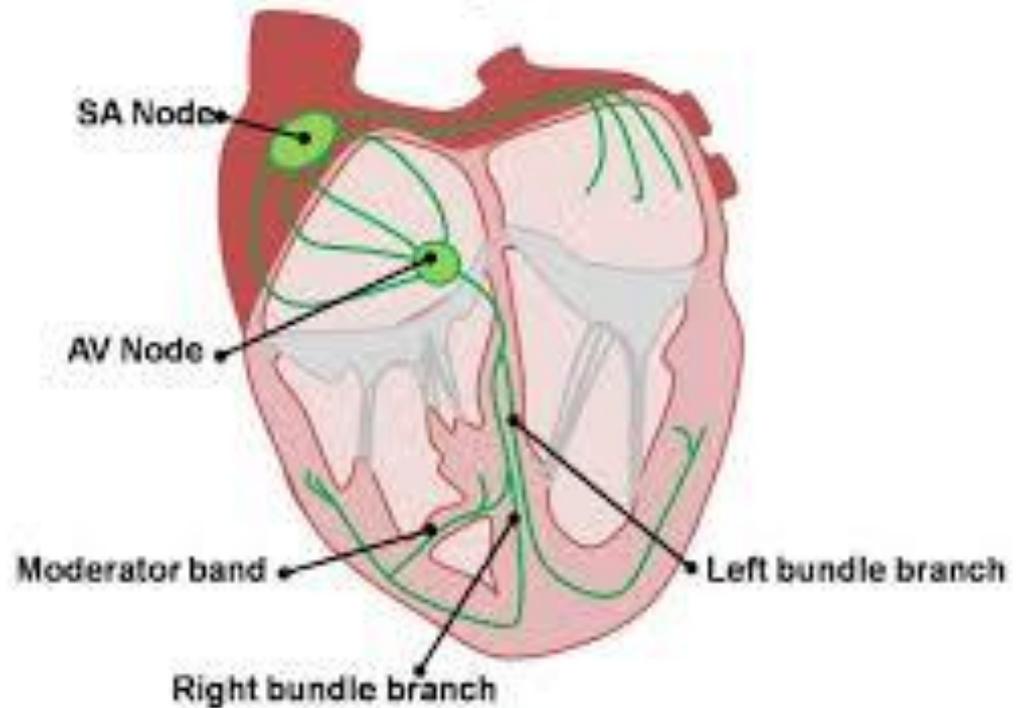
- Atrio-ventricular valves attached to fibrous cords to prevent them turning “inside out”
- Disease:
 - Stenosis
 - Incompetence
 - Infective endocarditis



Conducting system: coordinated contraction

- **SA node** (in right atrium)
- **AV node** (between 2 atria)
- Bundle branches
- Purkinje fibres
- Affected by :
 - Demands (eg exercise)
 - Other nerves (eg vagus)
 - Hormones (eg adrenaline)

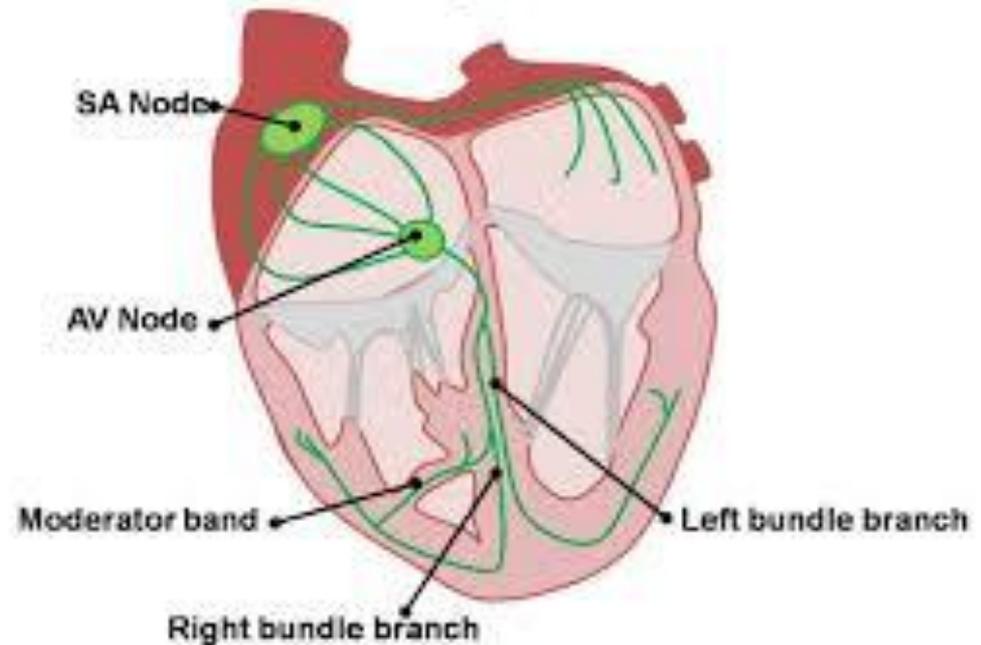
Cardiac Conduction System



Heart rate / Pulse

- Normally 60-100 beats per minute at rest
- Below 60: Bradycardia
- Above 100: Tachycardia
- Rises with exercise, stress, pain and some illnesses

Cardiac Conduction System



Heart Contractions

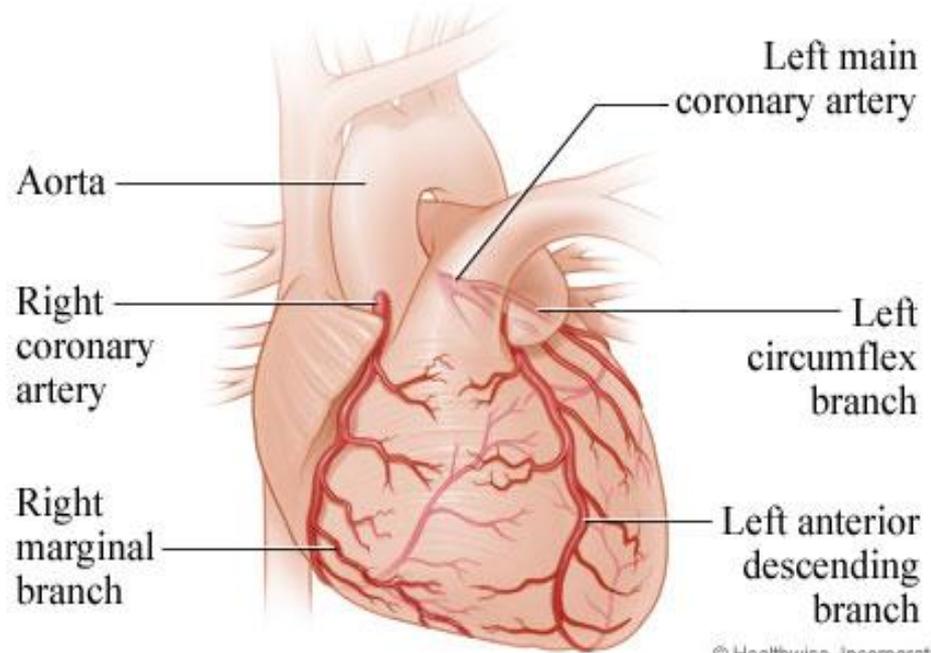
- Normal electrical activity and coordinated contractions is called **Sinus Rhythm**
- Measured with an ECG

ECG lead V6



Arterial supply to the heart

- Heart muscle pumps continuously and uses a lot of oxygen
- **Coronary arteries** supply heart muscle
- Equivalent veins empty into right atrium



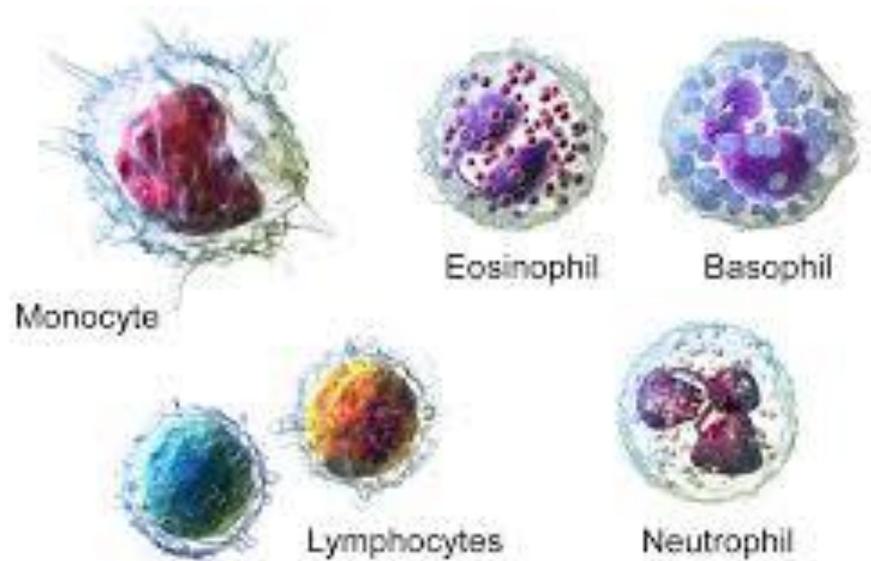
Blood

- **Red blood cells-** carries oxygen
- **White blood cells-** fight infection
- **Platelets and clotting factors** – clotting
- **Plasma-** fluid component, contains proteins, glucose, hormones, ions etc



White Blood Cells

- many types, with many functions associated with the immune system
- **Lymphocytes** include B- and T-lymphocytes (B-cells and T-cells), involved in the “adaptive” immune response
- “CD4+ T-helper” cells particularly affected in HIV/AIDS



White Blood Cells

Disorders: Angina

- Narrowing in coronary arteries
- Due to fatty deposits in vessels (**atherosclerosis**)
- Reduced oxygen to heart muscle
- Pain usually on exertion (stable), sometimes randomly (unstable)

Myocardial Infarction

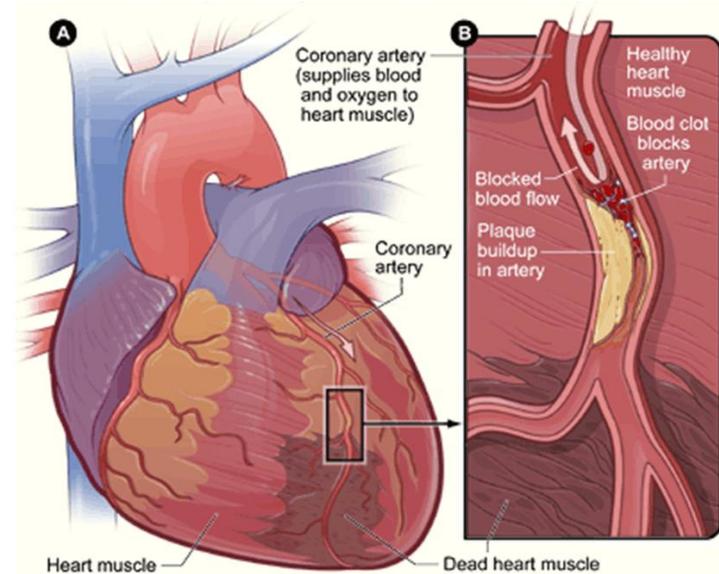
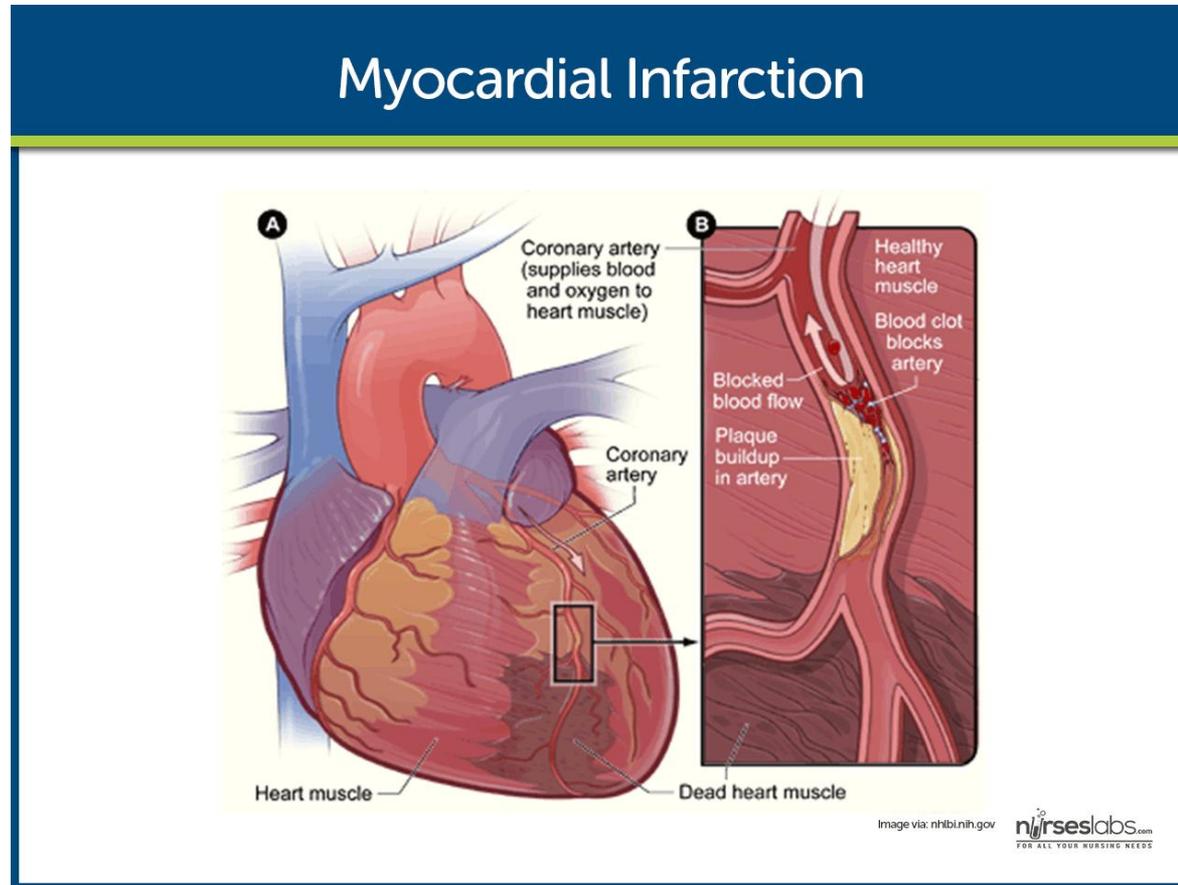


Image via: nihbl.nih.gov

Disorder: Myocardial infarction ("Heart Attack")

- Blockage of coronary arteries
- Muscle death due to lack of oxygen
- Leads to acute heart failure (cardiac arrest) and often fatal



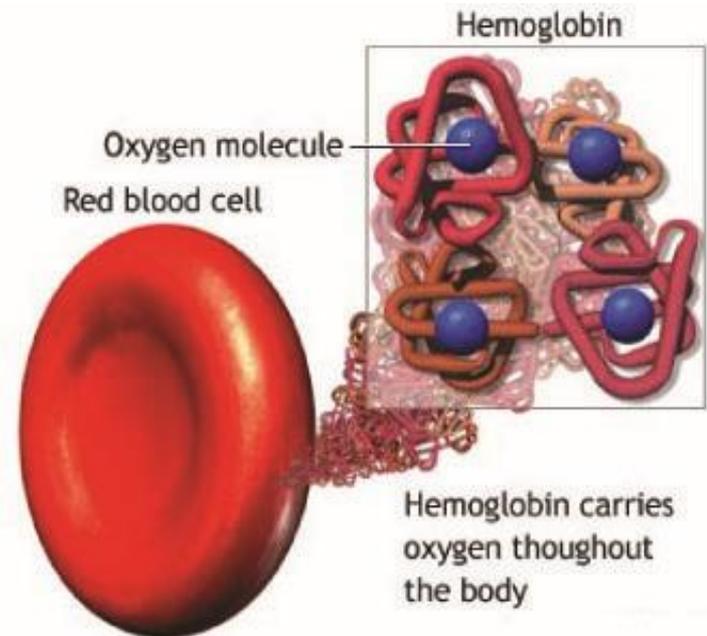
Drugs used in heart disease

- Many!
- **GTN** – opens up coronary arteries (angina attack)
- **Aspirin** (anti-platelet) – prevents clotting and thrombus propagation



Disorder: Anaemia

- Insufficient **haemoglobin** in blood (protein that carries oxygen)
- Breathless, fast heart rate
- Pallor, fatigue
- Causes include deficiency of iron, folate, B12, or blood loss
- Avoid sedation!

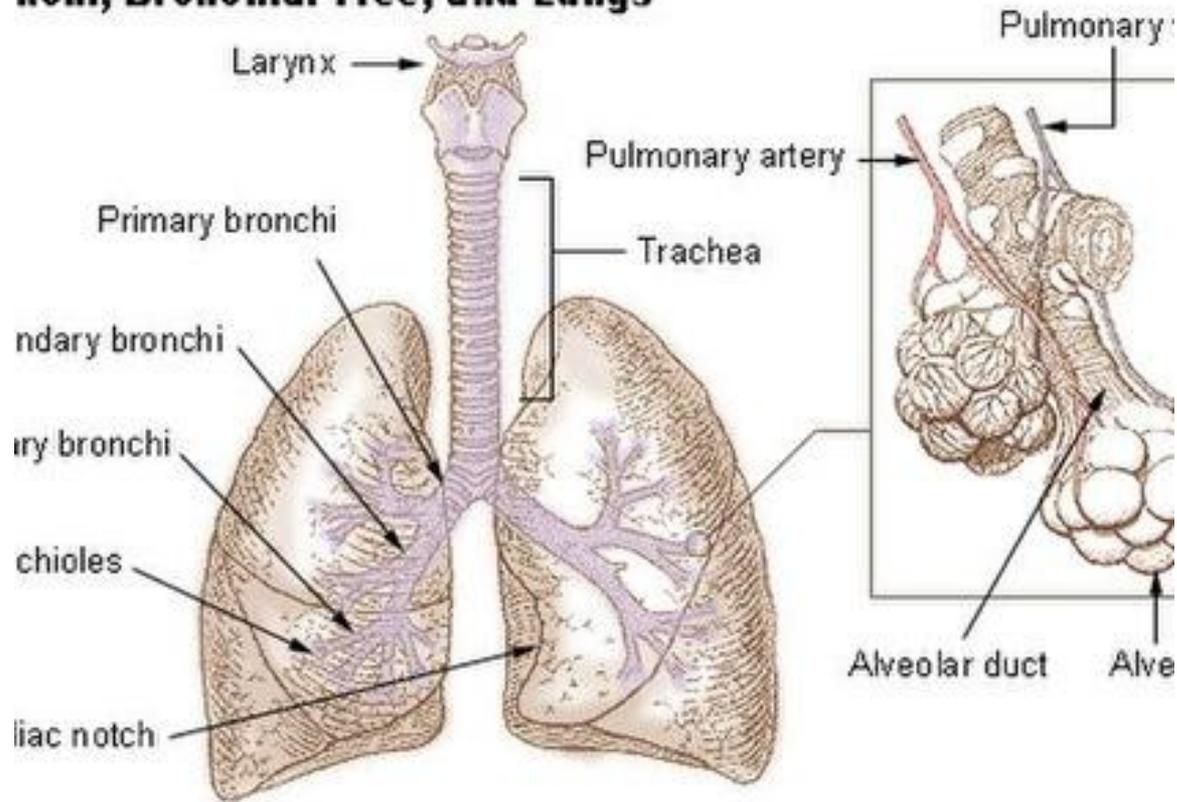


Blood conditions

- **Leukaemia:** malignancy of blood cells
- **Clotting** affected by abnormal function of platelets or clotting factors e.g.
 - genetic conditions e.g. Haemophilia, von Willebrand's Disease; and
 - drugs e.g. warfarin (clotting factors), aspirin (platelets)



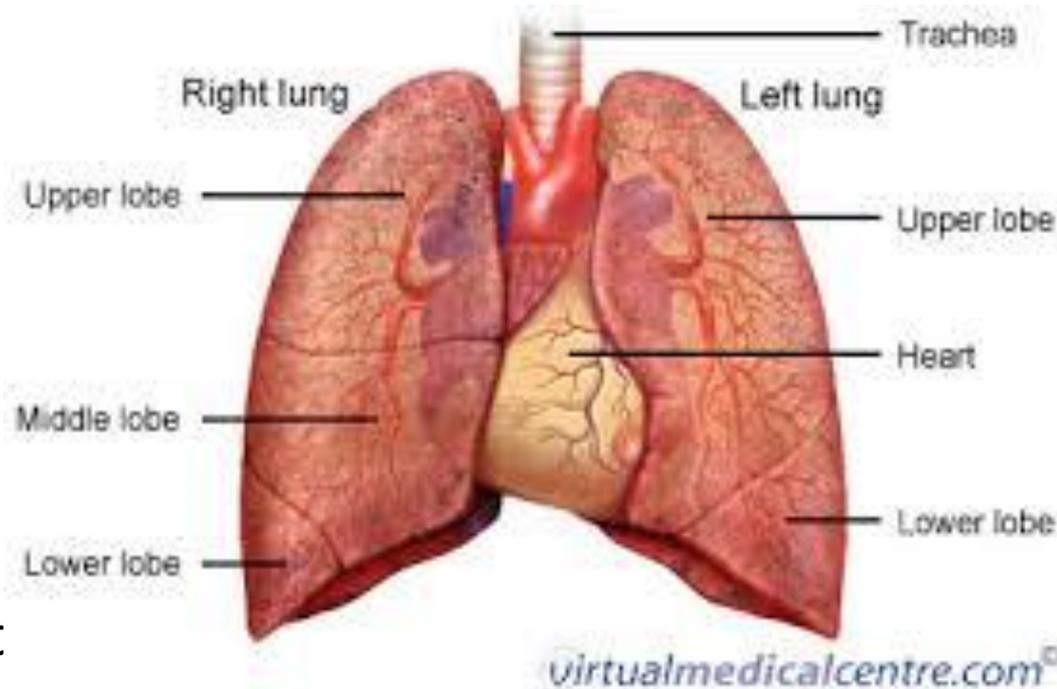
Trachea, Bronchial Tree, and Lungs



2: Respiratory System

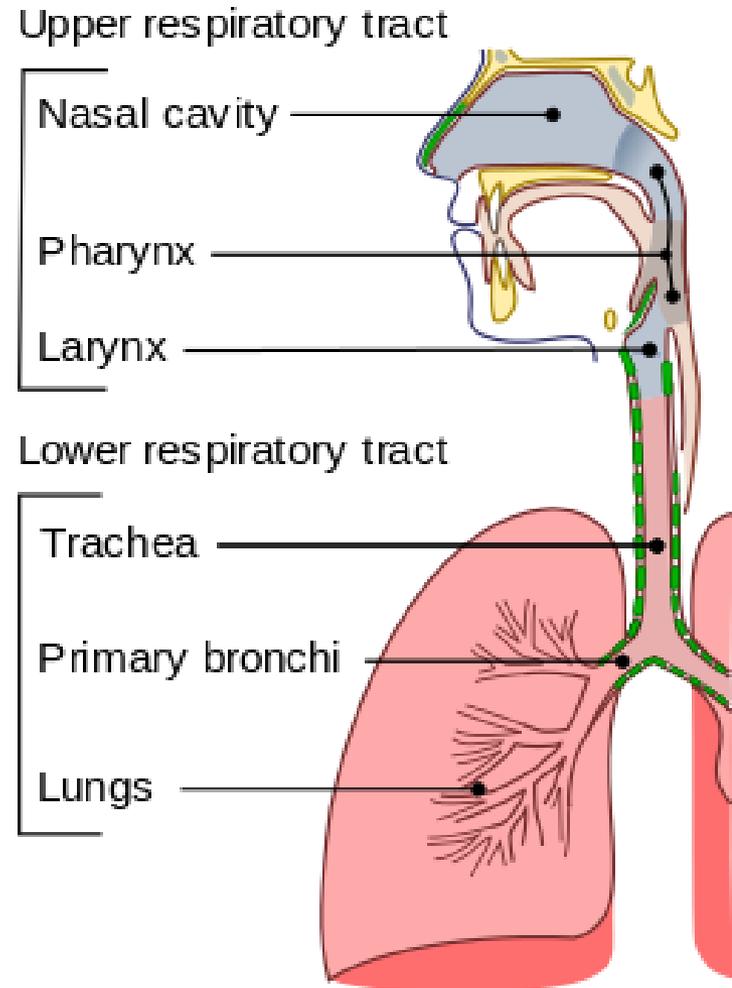
Respiratory System: overview

- **Breathing**- gas exchange between atmosphere and bloodstream
 - uptake of **oxygen** (needed for metabolic activities, e.g. getting energy from food)
 - excretion of **carbon dioxide** (waste product of metabolic reactions)



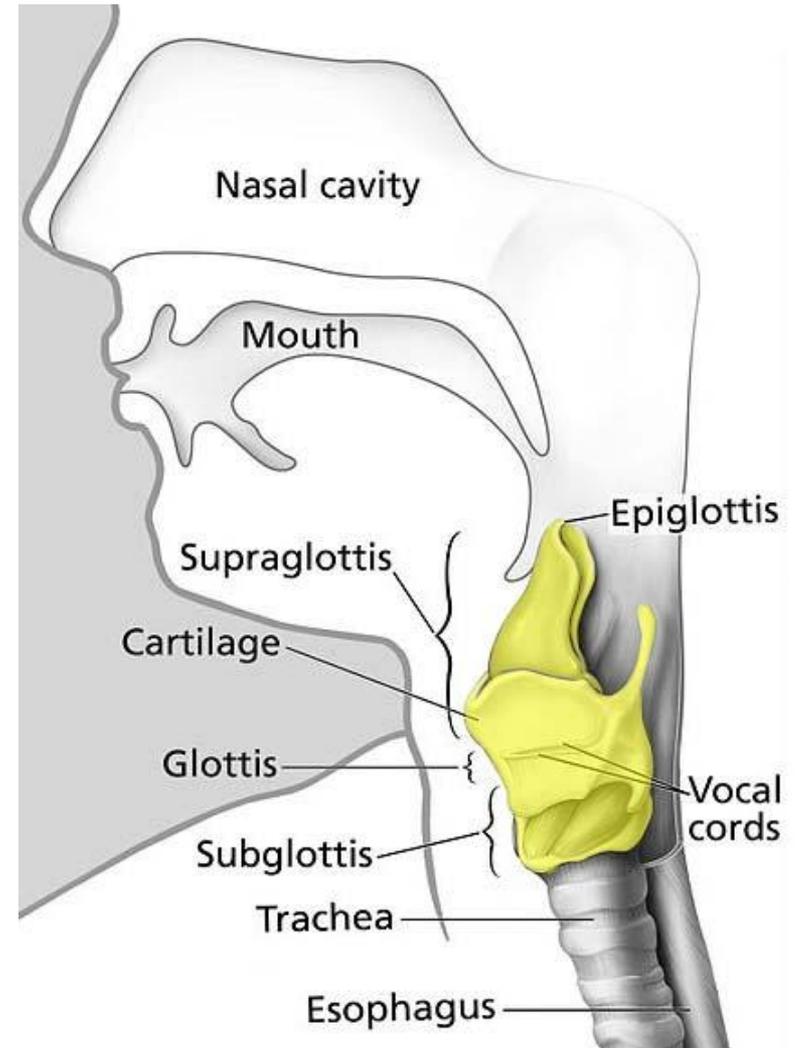
Respiratory system: conducting system

- **Pharynx**
- **Larynx**
- **Trachea** (tube of C-shaped rings of cartilage)
- Divides to a **main bronchus** to each lung
- Divides further within the lung

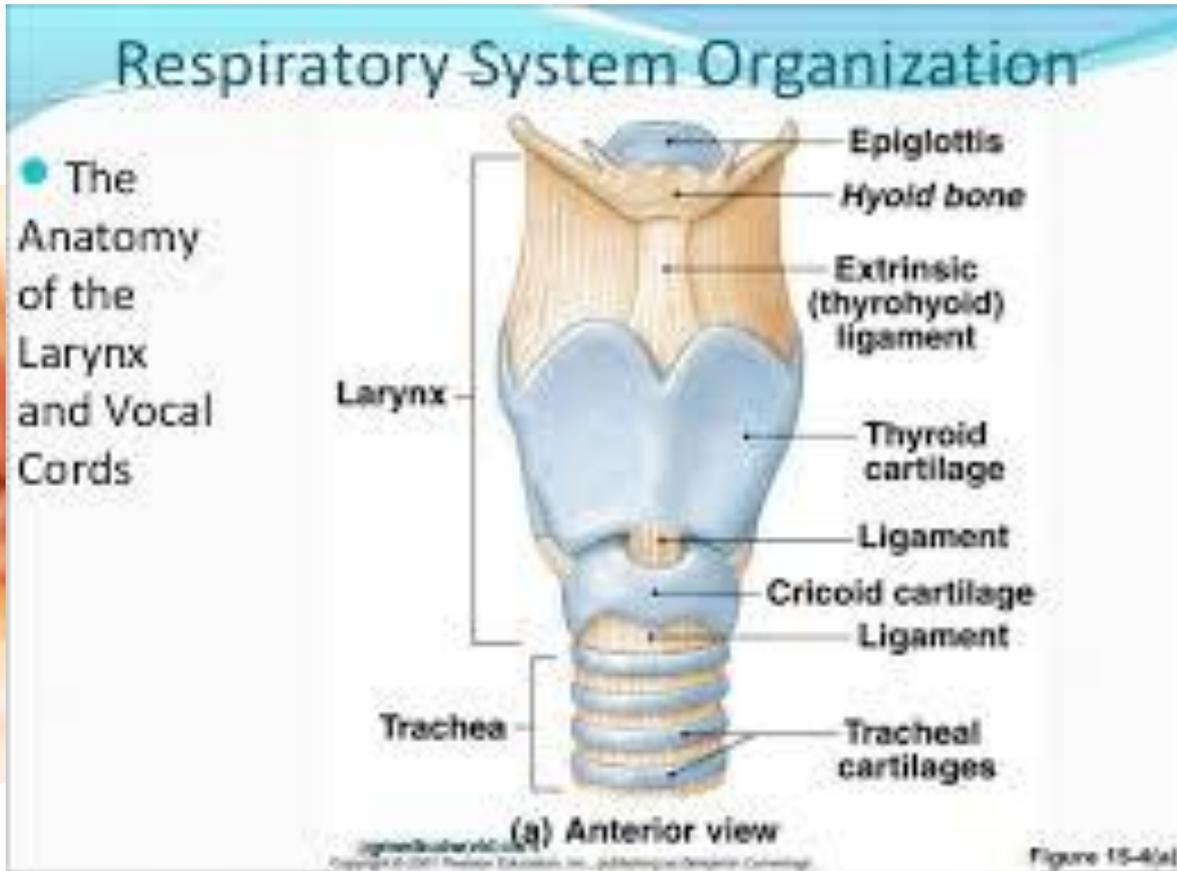


Larynx

- Structure above **trachea**, attached to back of tongue and hyoid bone
- Made of 9 cartilages
- Contains **vocal cords**
- Vocal cords are held open during breathing
- **Epiglottis** covers opening during swallowing
- **Soft palate** closes nasopharynx

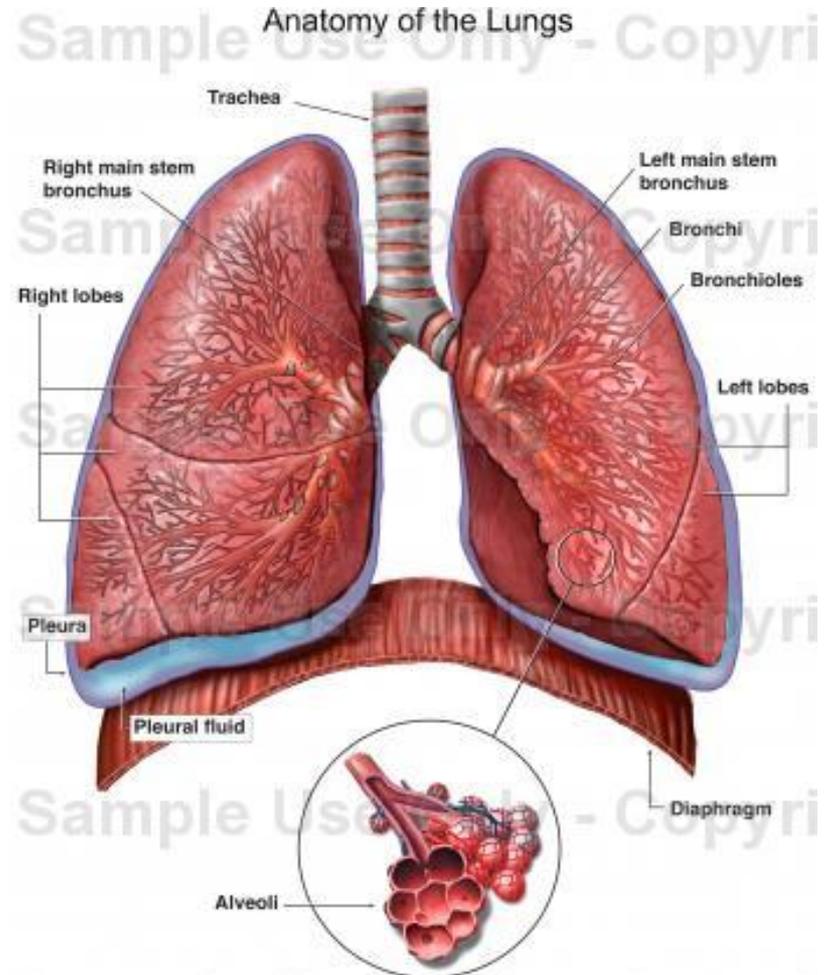


Larynx



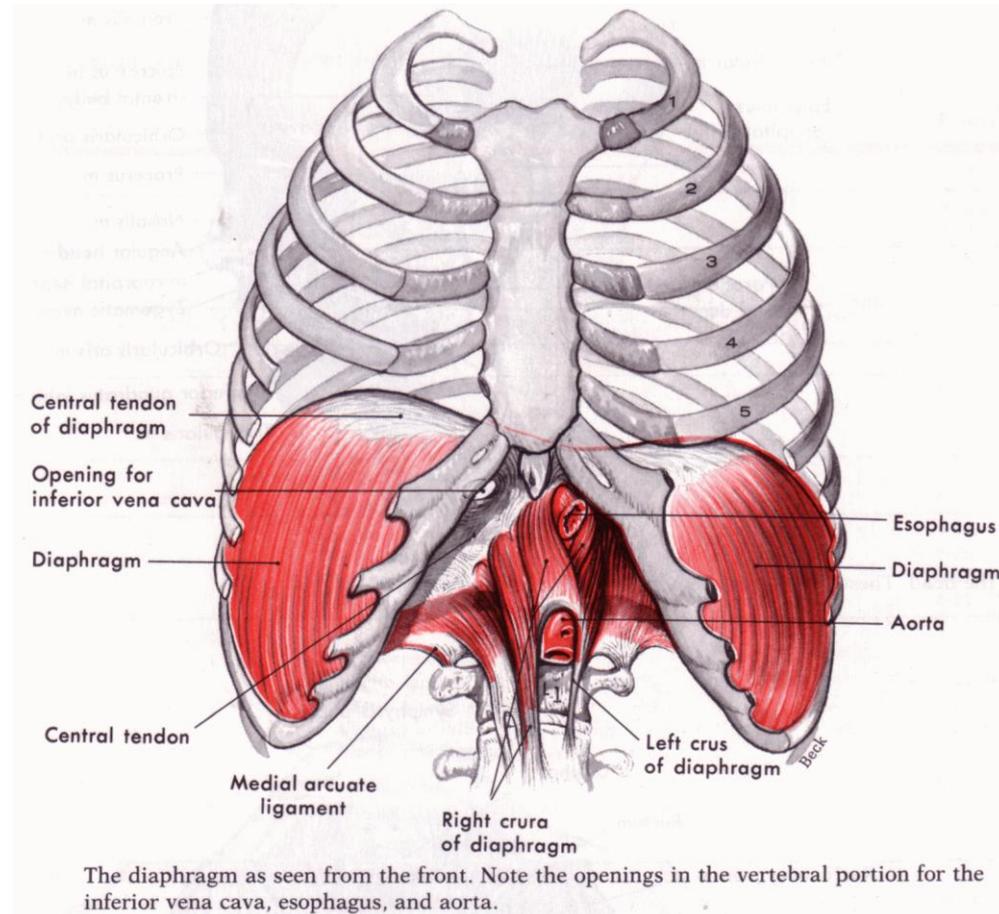
Lungs

- 2 lungs – asymmetrical
- Attached to the inside of the chest wall, under tension, via **pleural membranes** with fluid between
- Movement of chest wall (breathing) mainly due to :
 - **Diaphragm**
 - **Intercostal muscles**



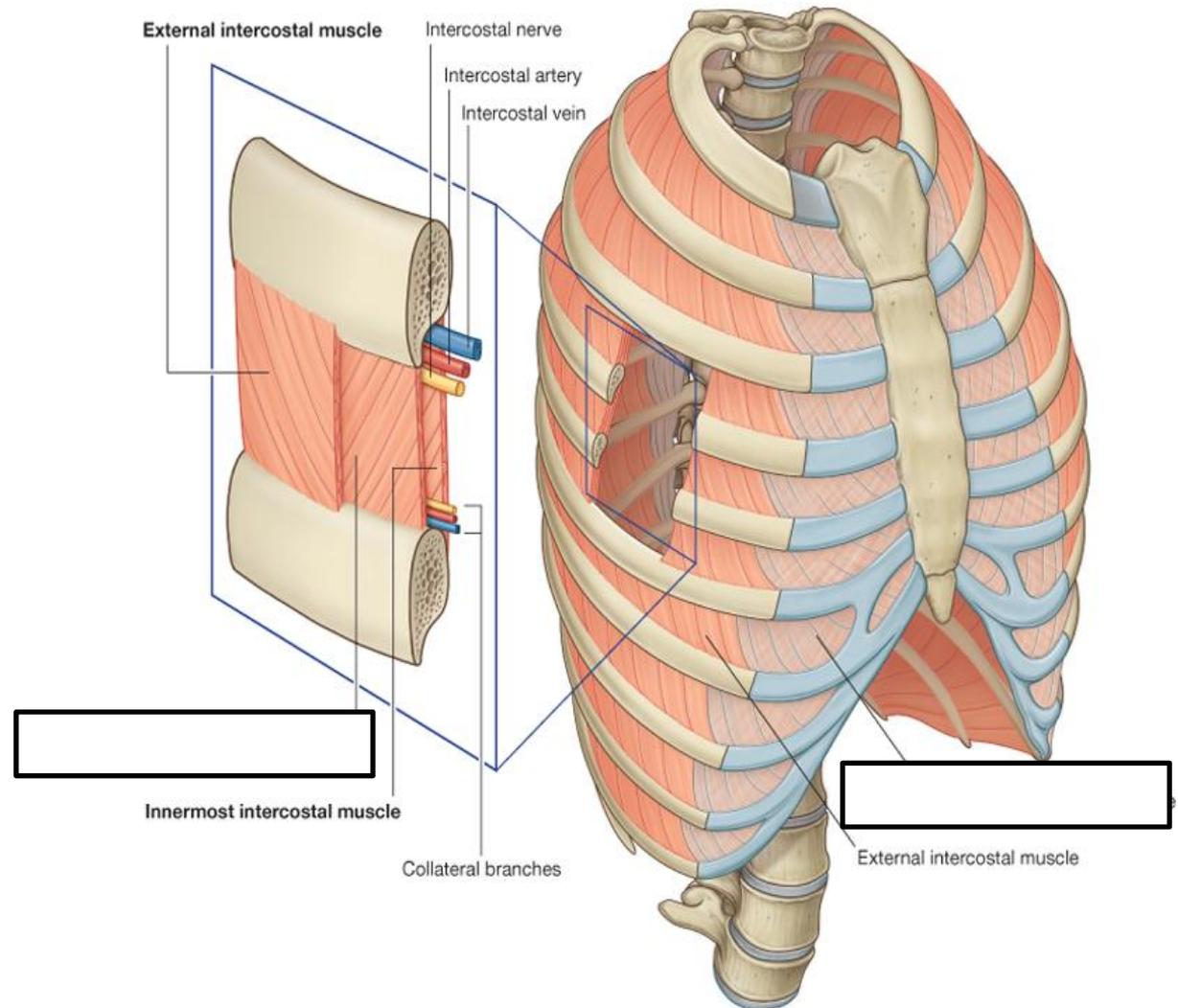
Diaphragm

- Muscle separating thorax (chest) from abdomen
- Moves down when contracts
- Increases volume of thorax- air drawn in
- Relaxes passively – air expelled



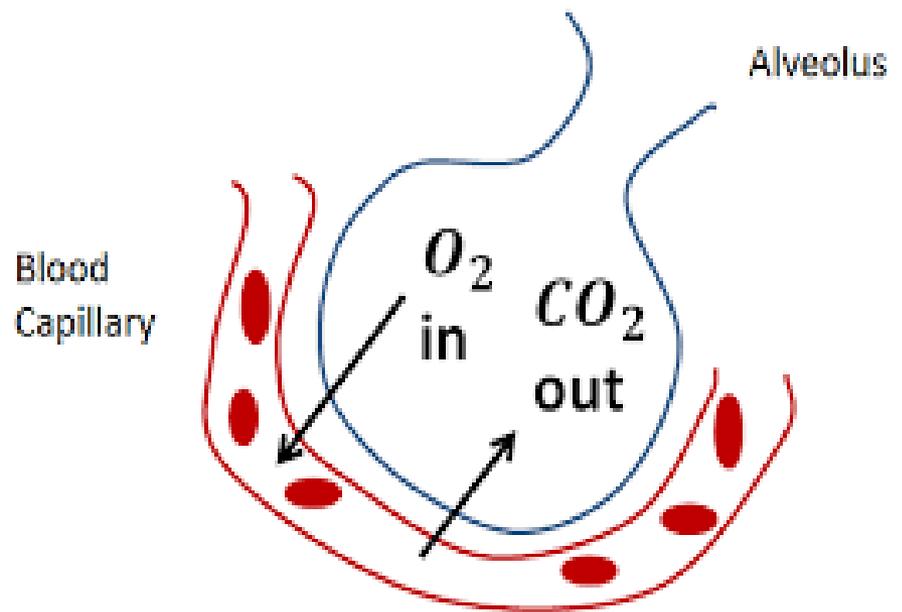
Intercostal Muscles

- 3 muscle layers between ribs
- Involved in breathing in and out
- Forceful breathing



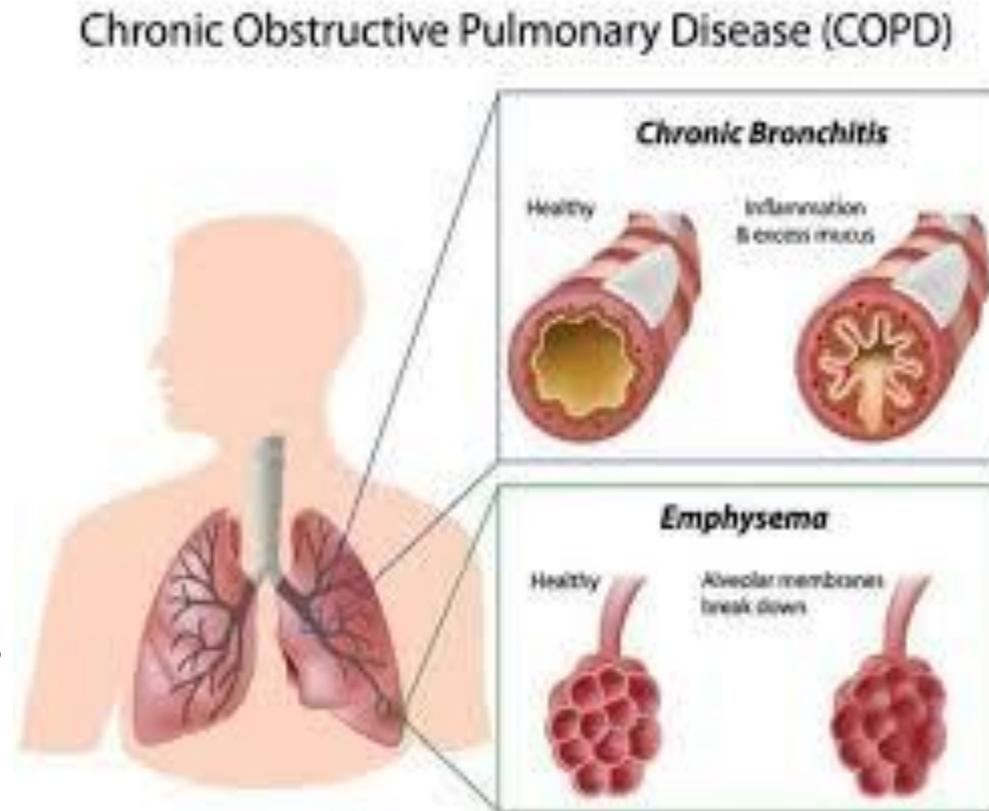
Reason for breathing: Gas exchange

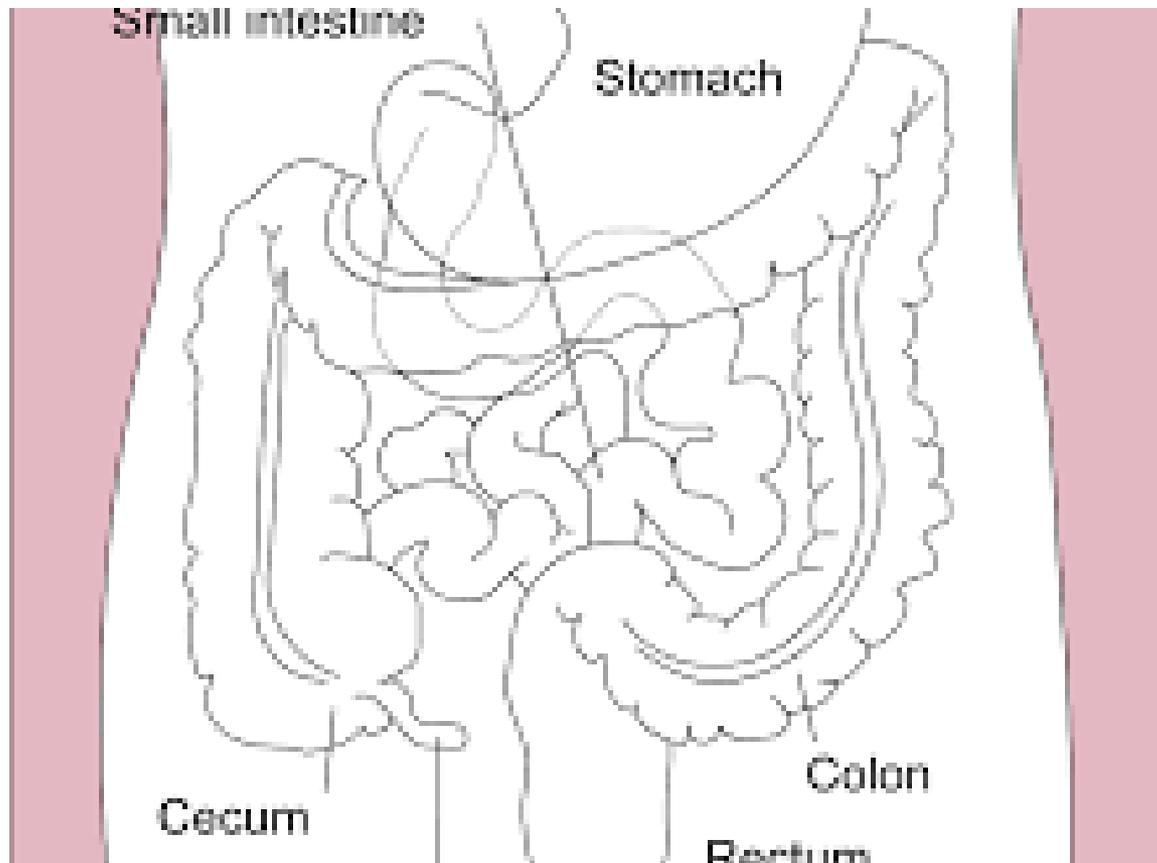
- Conducting tubules repeatedly divide, and eventually end in thin-walled sacs (“**alveoli**”)
- These are surrounded by fine blood vessels
- Gas exchange across this thin wall



Disorder: Chronic Obstructive Pulmonary Disease (COPD)

- General term for a variety of progressive lung diseases:
 - chronic bronchitis
 - emphysema
- Dental Treatment:
 - position in chair
 - drugs – inhalers, steroids
 - IV sedation contra-indicated

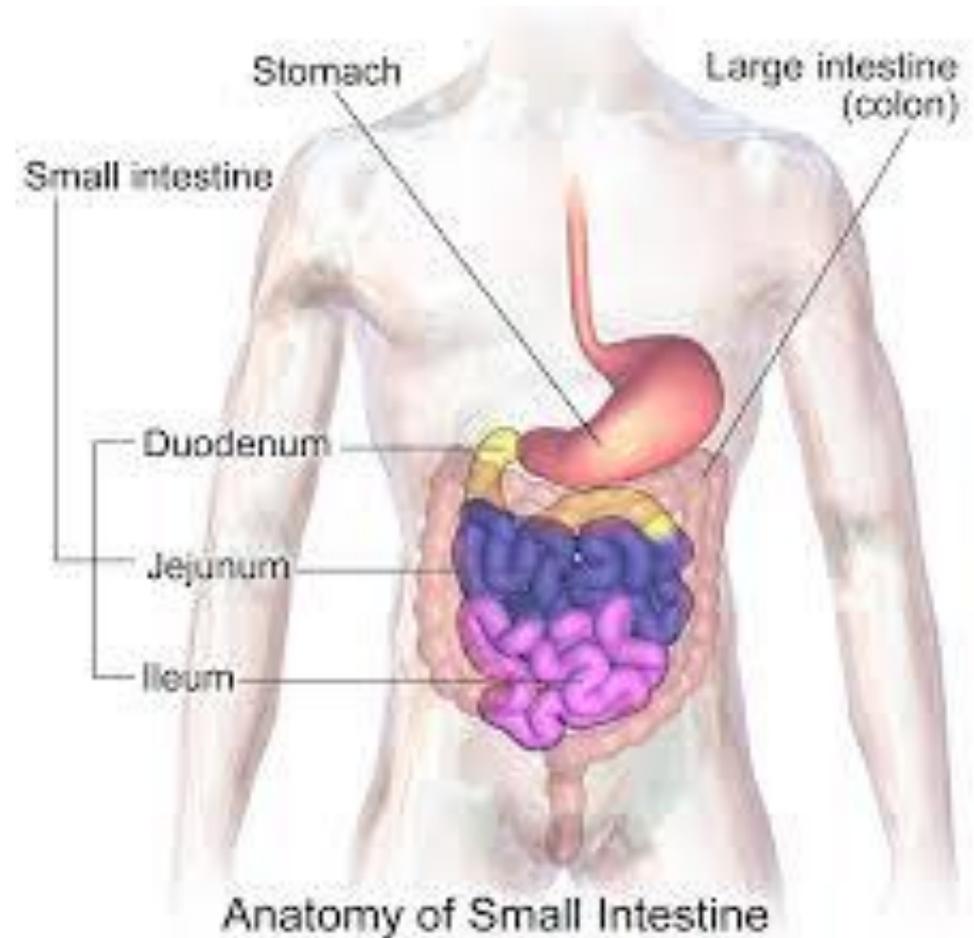




3: Gastro-Intestinal System

Gastro-intestinal tract: overview

- Digestion and absorption of food and water
- Essentially a long muscular tube, with some associated glands and other organs



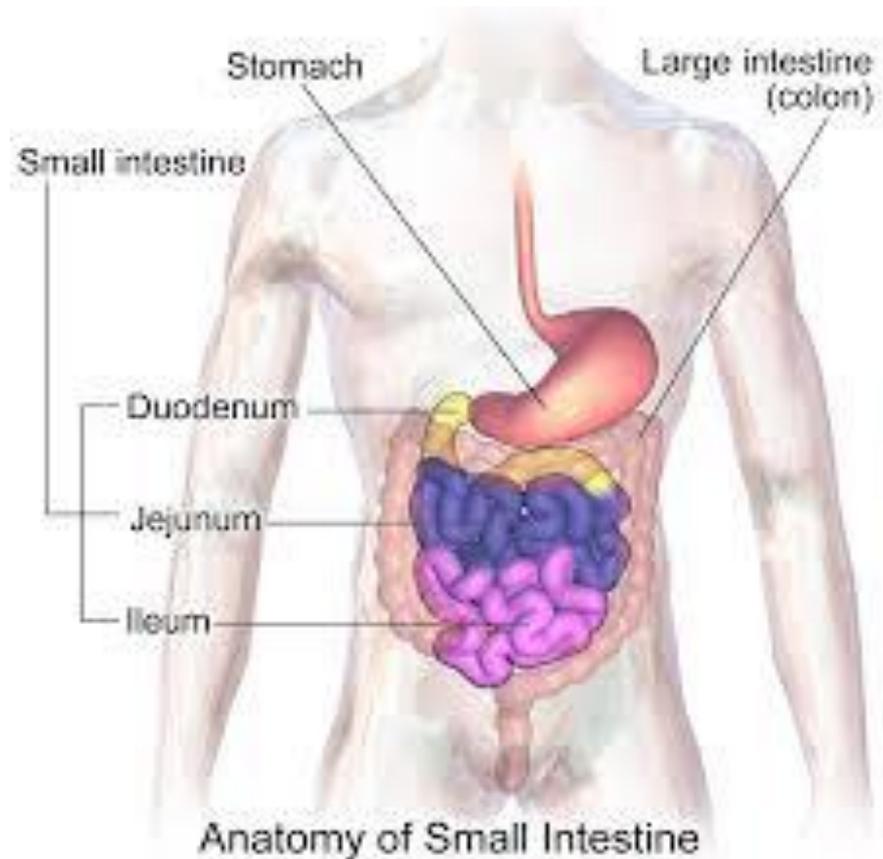
GIT: components

- **GIT:**

- pharynx
- oesophagus
- stomach
- small intestine
- large intestine

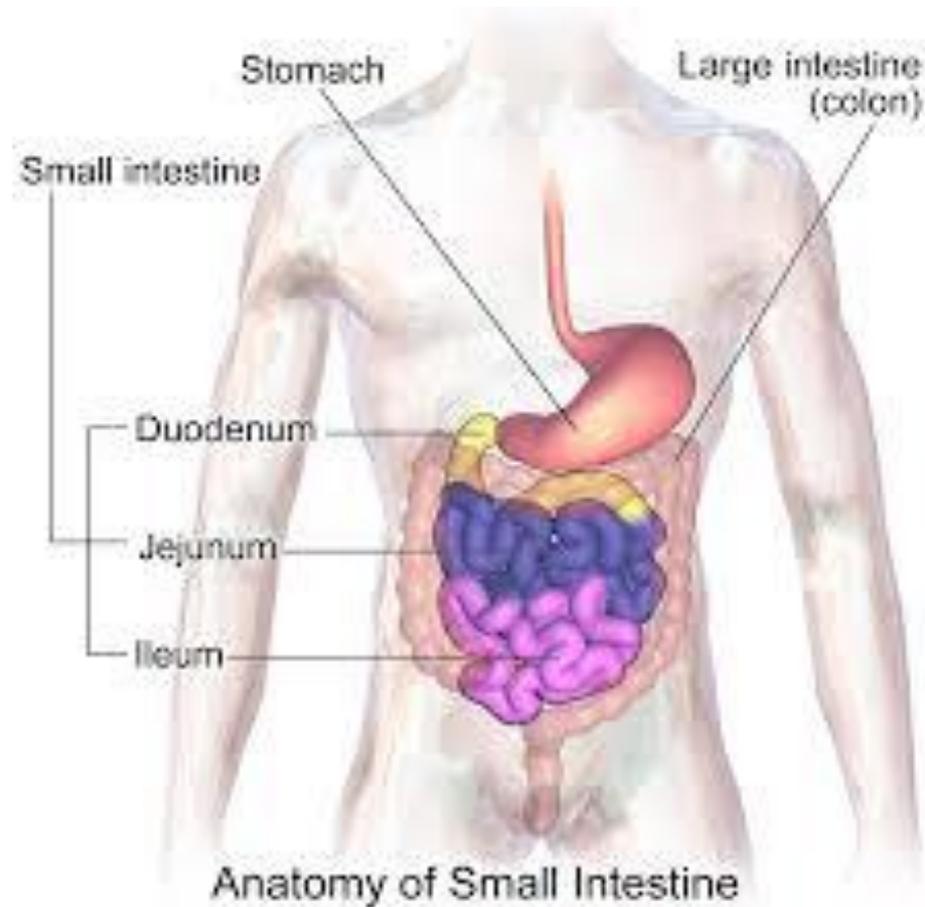
- **Other associated organs:**

- liver
- gall bladder
- pancreas



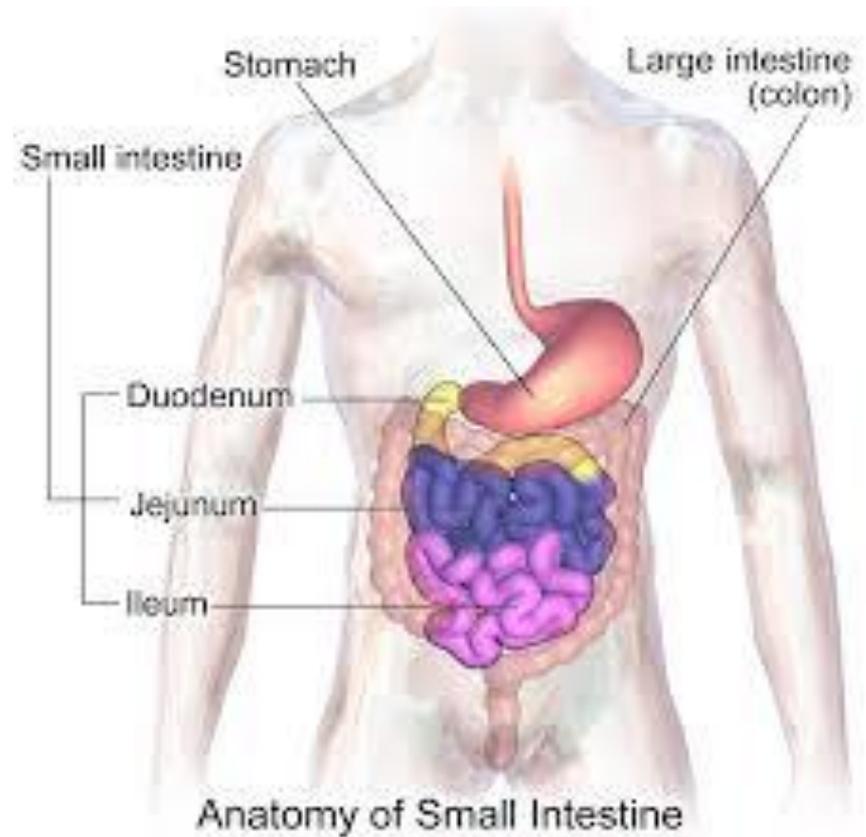
GIT: physiology

- **Digestion** of food:
- Physical breakdown-
 - muscular action
 - bile
- Chemical breakdown-
 - acid
 - enzymes in secretions



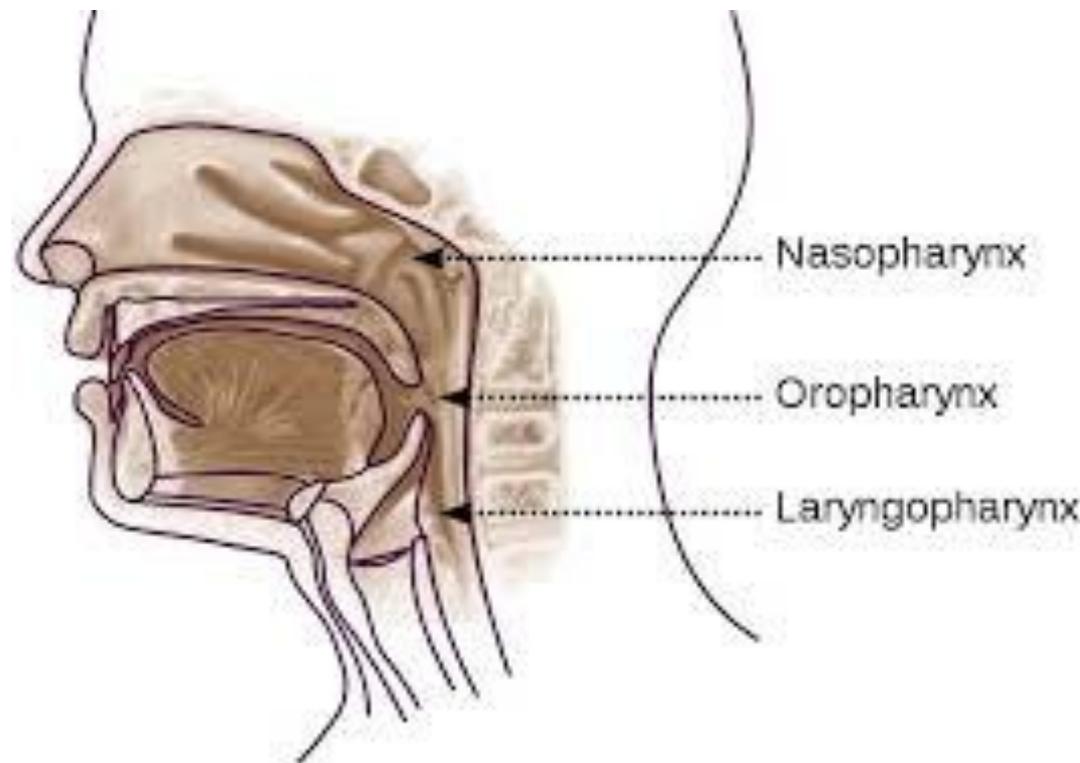
GIT: physiology

- **Absorption** of food and water
- **Processing** in liver of food and ingested toxins, before entering systemic bloodstream



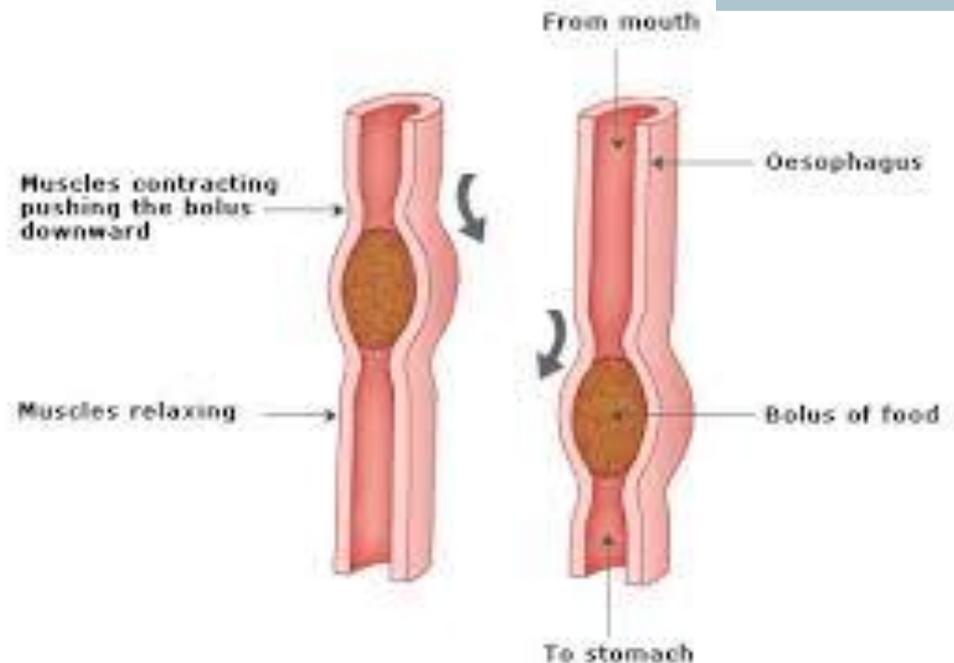
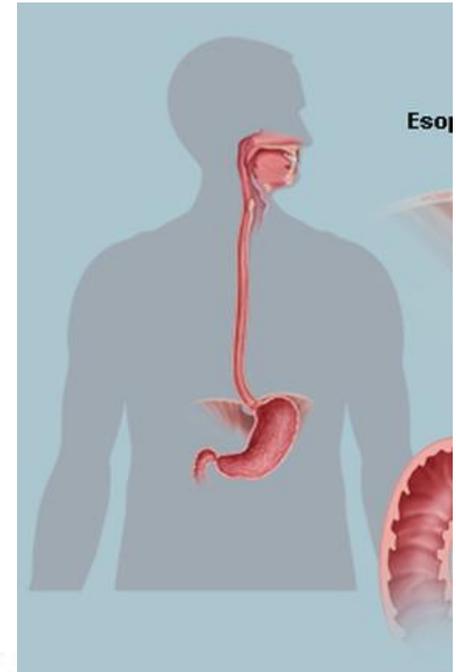
Pharynx

- Chamber behind mouth and nose
- Shared entry to both larynx (breathing) and oesophagus (swallowing)-
potential for choking!



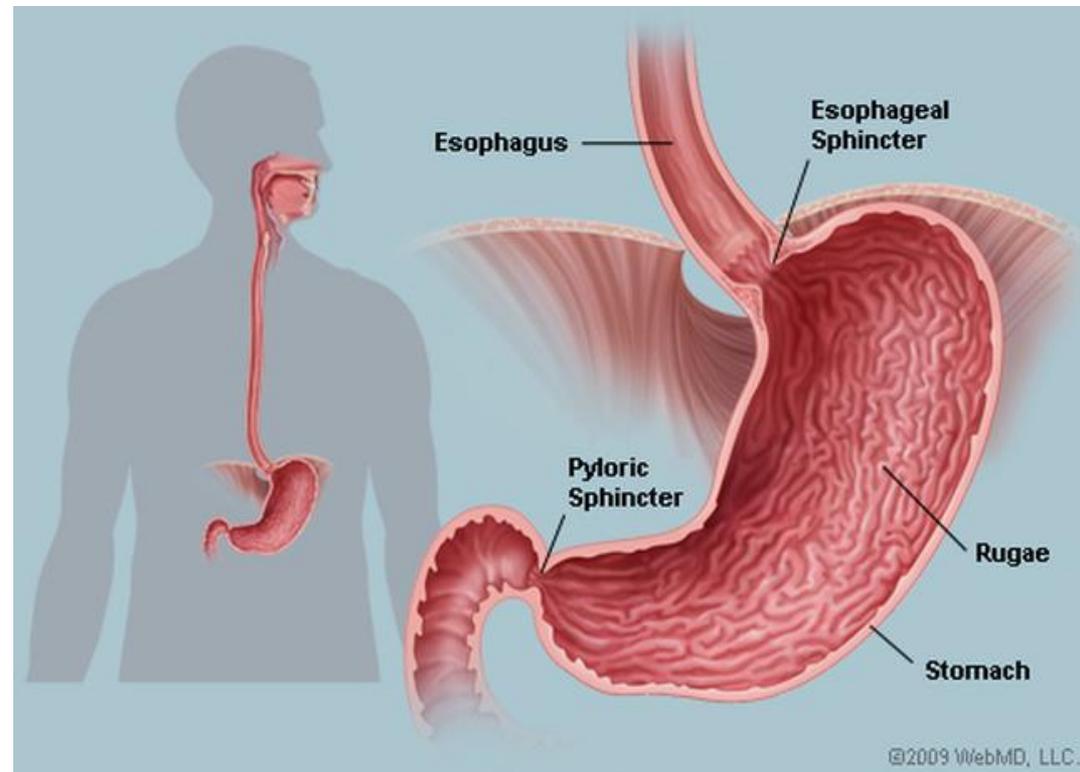
Oesophagus

- Muscular tube linking pharynx with stomach
- Goes through diaphragm
- Waves of contraction (peristalsis)



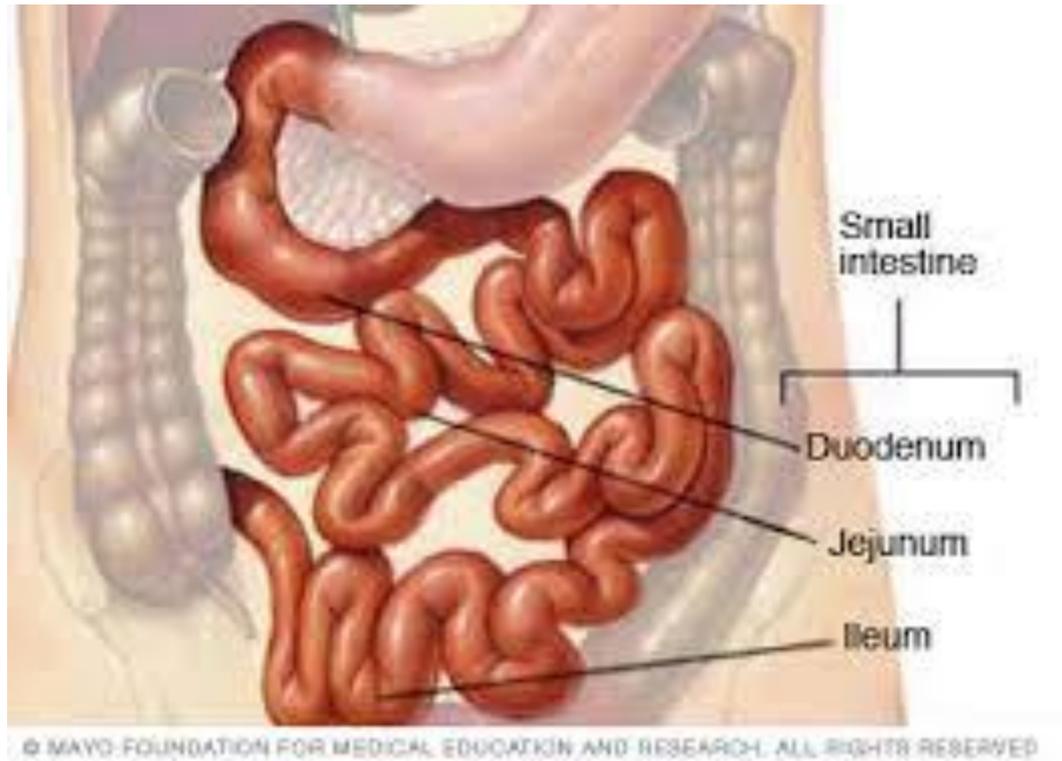
Stomach

- Initial storage of food
- Mechanical breakdown of food
- Initiation of enzyme digestion eg pepsin (protein)
- Acid – antibacterial
- Intrinsic Factor (helps absorption of Vitamin B12)



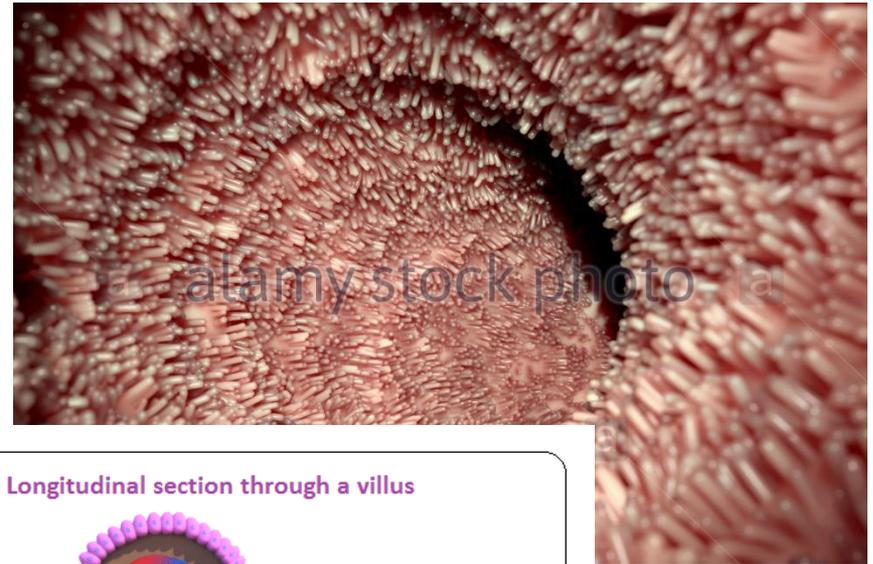
Small intestine

- 3 parts:
 - duodenum
 - jejunum
 - ileum
- 3-5m long
- 90% digestion and absorption occur in small intestine

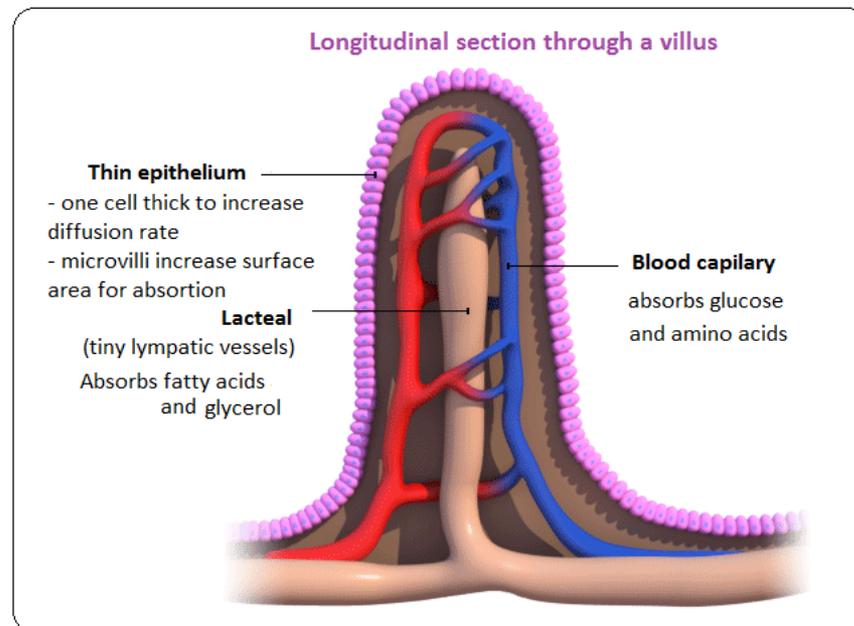


Physiology of small intestine

- Digestion:
 - pancreatic secretions
 - bile

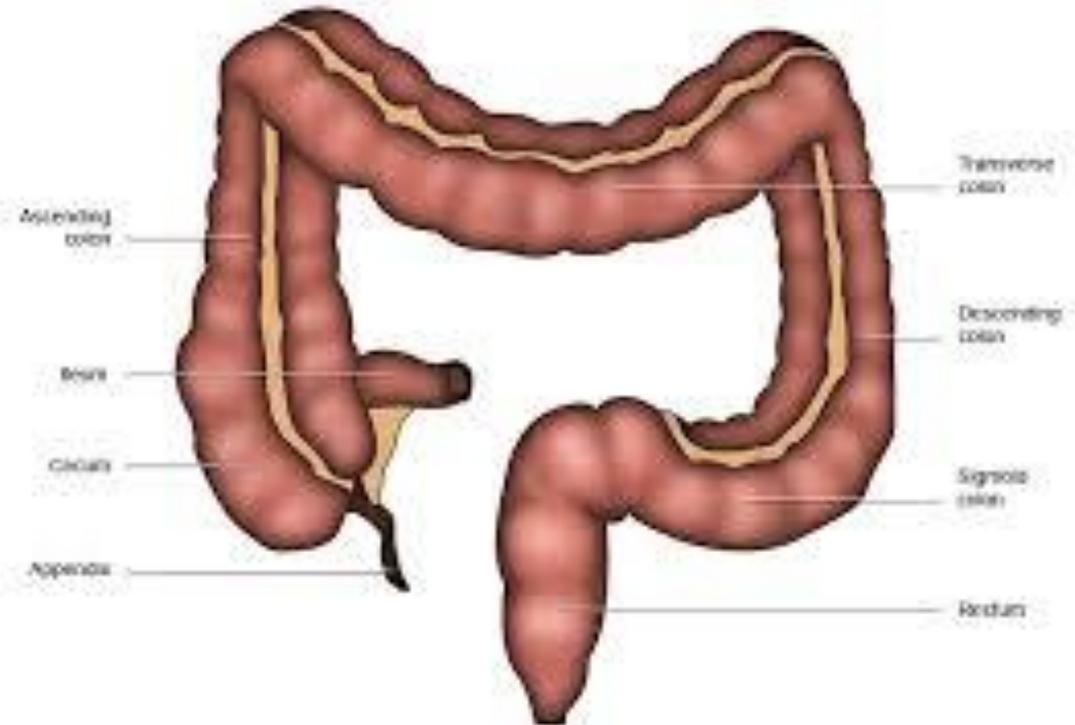


- Absorption:
 - Villi (finger-like projections)



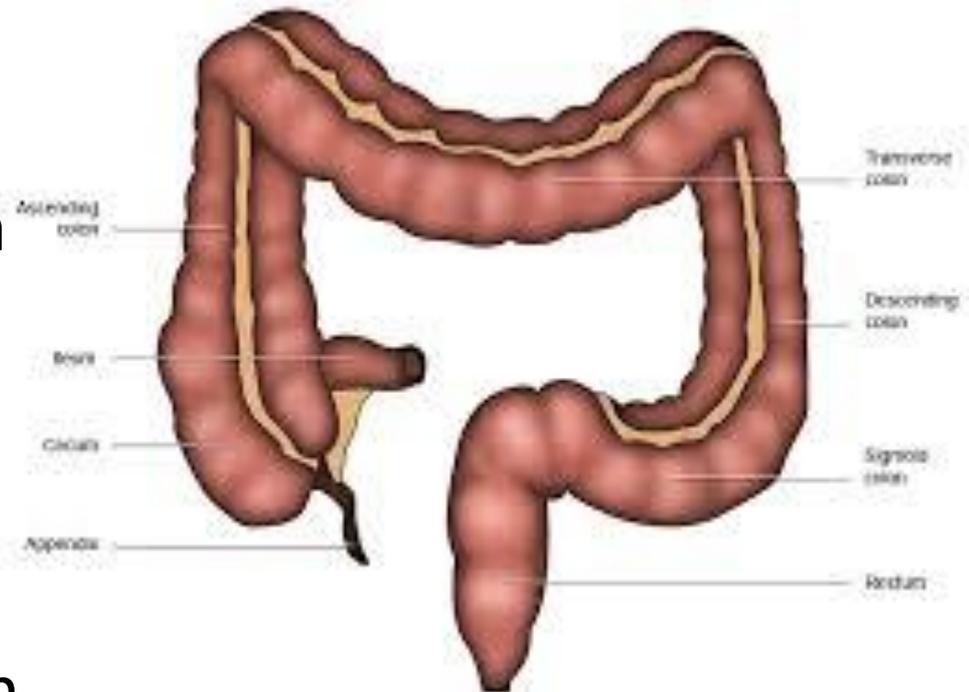
GIT: large intestine

- Large intestine
 - caecum
 - appendix
 - ascending colon
 - transverse colon
 - descending colon
 - sigmoid colon
 - rectum
 - anal canal



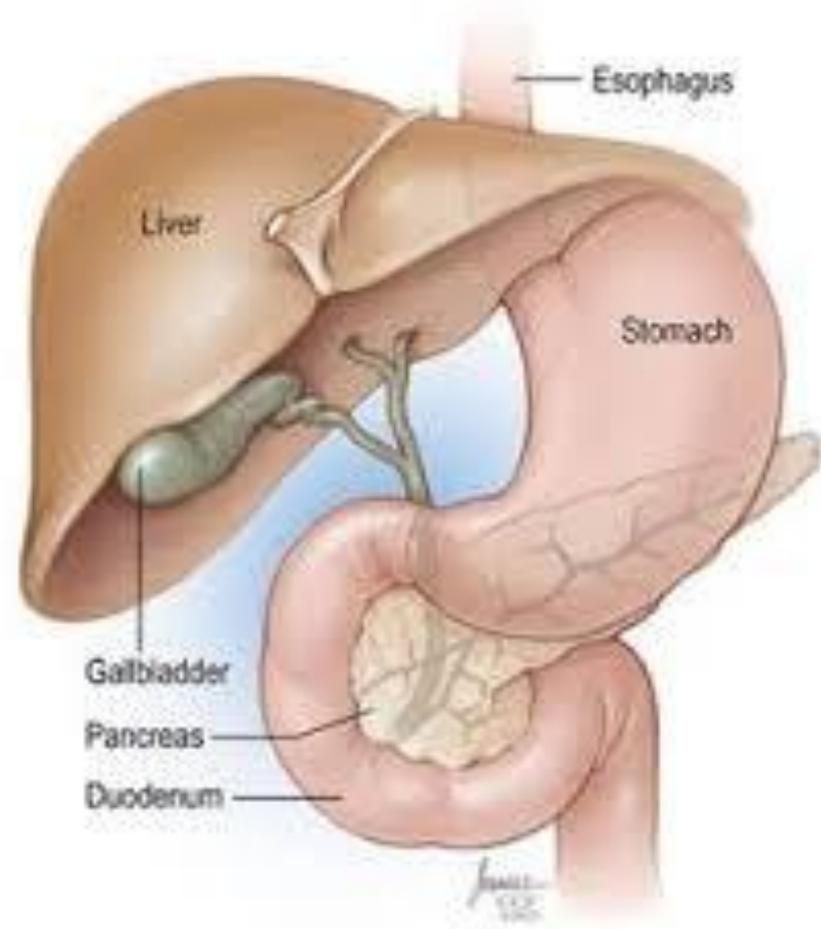
Physiology of large intestine

- Absorption of water
- Absorption of electrolytes
- Storage and elimination of indigestible material
- Accommodation of bacteria (“flora”) which help in drug breakdown, and vitamin synthesis e.g. Vit K



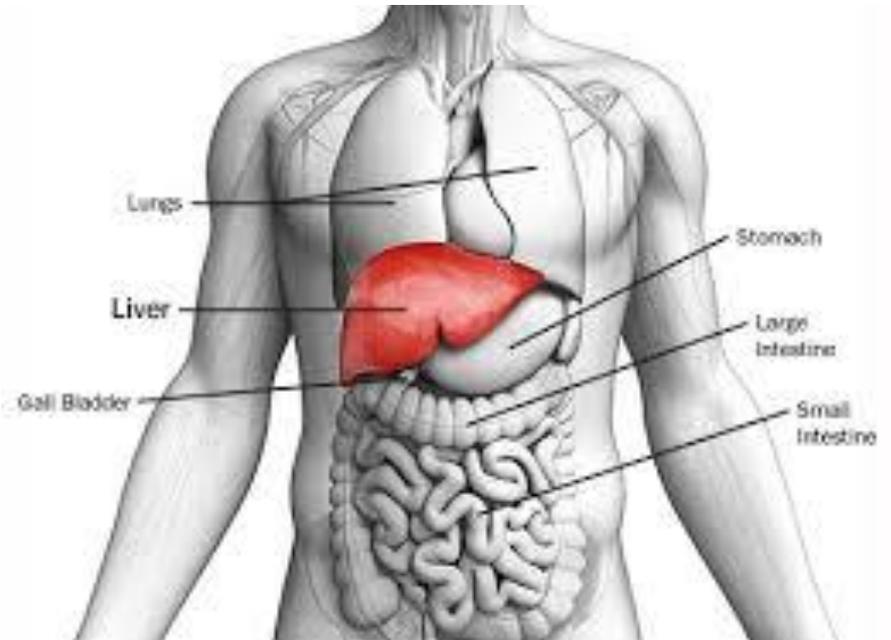
GIT: other organs

- Liver
- Gall bladder
- Pancreas



Liver

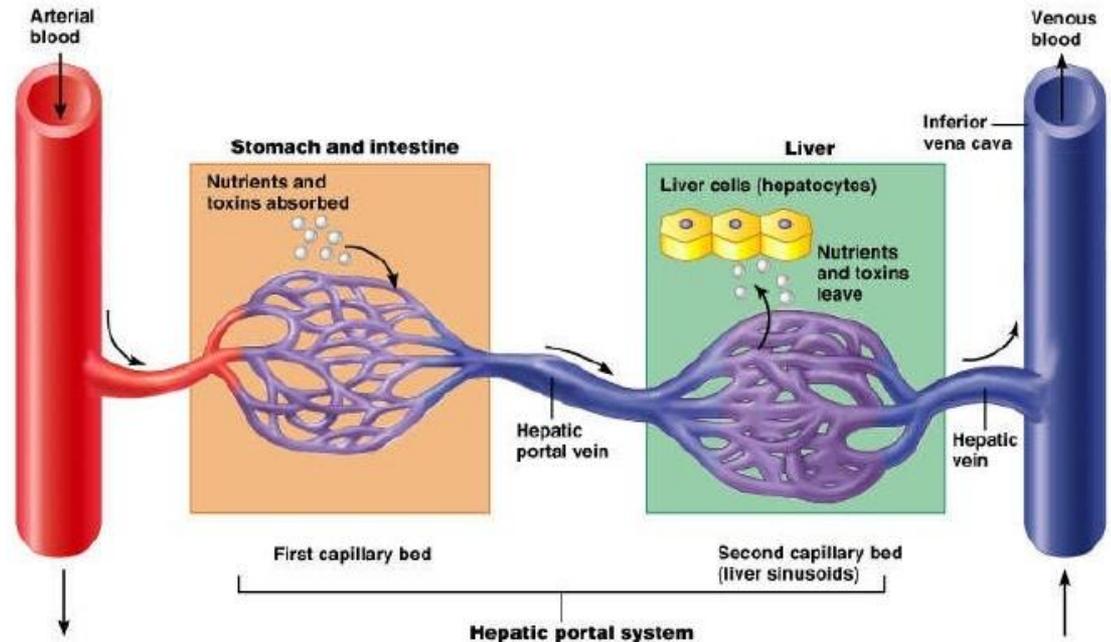
- Large organ in upper right abdominal cavity
- Under diaphragm
- Receives almost all the blood from the GIT for processing (“**hepatic portal system**”)



Hepatic portal system

- Blood vessels from GIT form **Hepatic Portal Vein**
- Reforms capillaries in liver
- Reforms **Hepatic Vein**
- Why?
 - Efficient processing of food
 - Detoxification of ingested toxins before enter systemic circulation

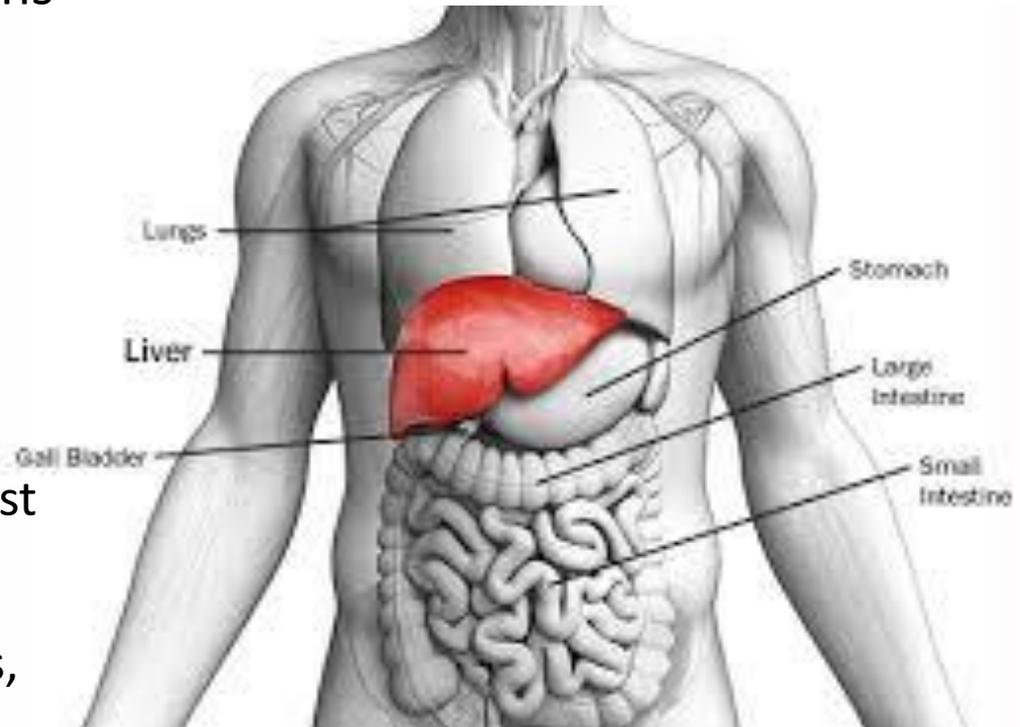
The Basic Scheme of the Hepatic



21-42
Figure 19.22

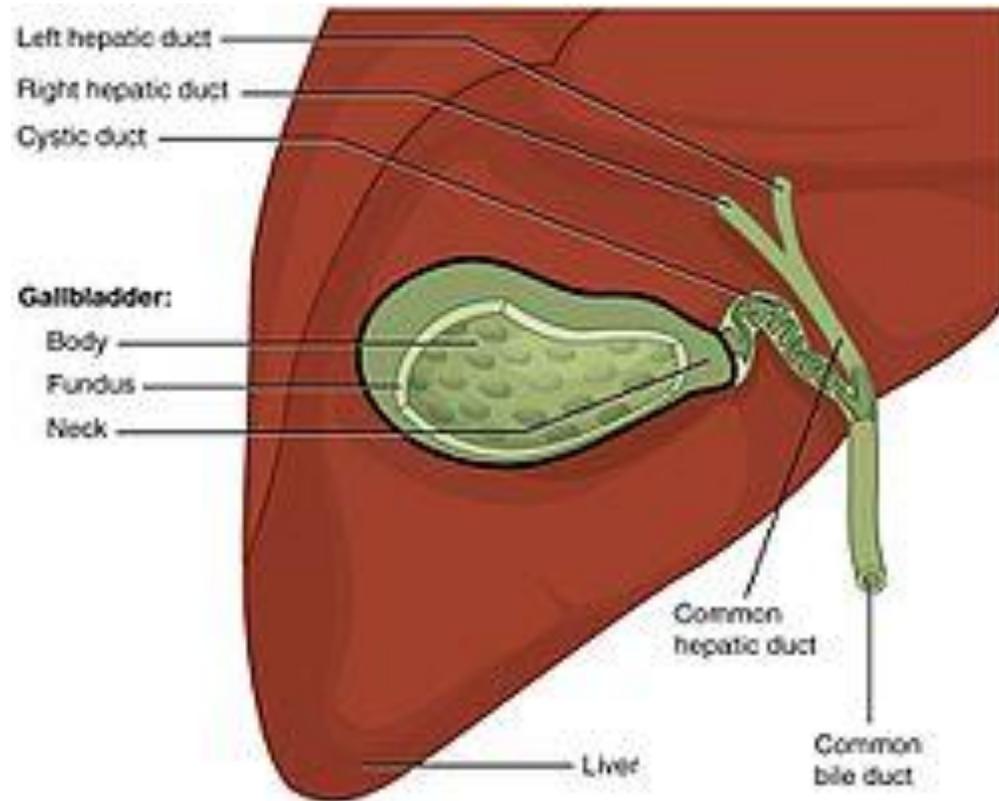
Physiology of liver

- **Metabolism** (fats, proteins and carbohydrates)
- **Storage** (glucose, some vitamins and minerals)
- **Detoxification and excretion** (bilirubin, cholesterol, hormones and most drugs)
- **Synthesis** (plasma proteins, clotting factors, and bile)



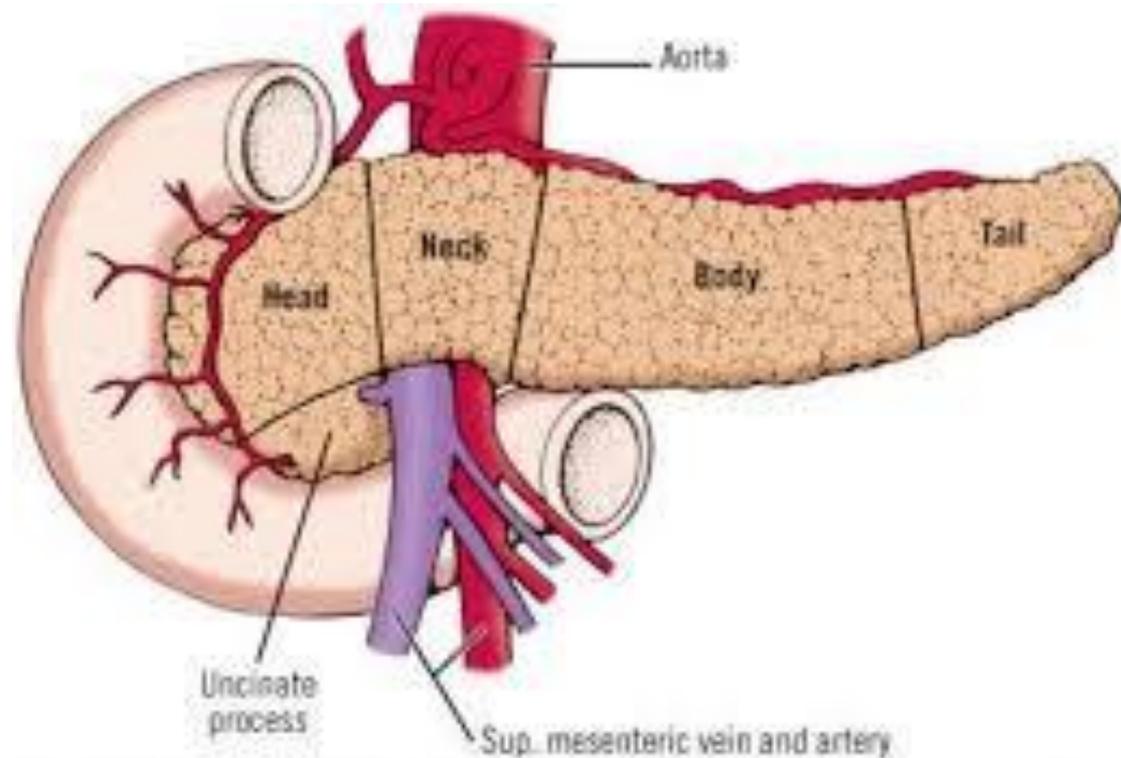
Gall Bladder

- Muscular sac which stores **bile**
- Attached to underside of liver
- Bile secreted into small intestine (duodenum) to increase fat digestion



Pancreas

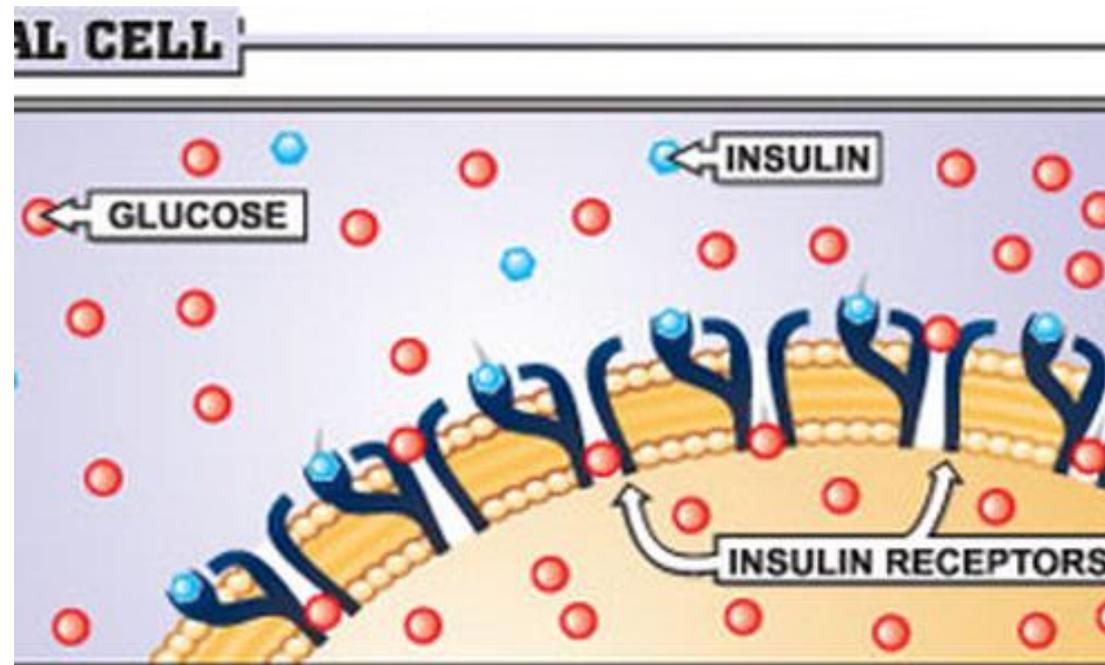
- Located between duodenum and spleen, behind stomach
- **Exocrine** gland:
 - digestive enzymes
- **Endocrine** gland:
 - insulin
 - other hormones



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Insulin

- Secreted in response to rise in blood sugars (usually due to eating food)
- Causes glucose to be taken up into cells for metabolism or storage

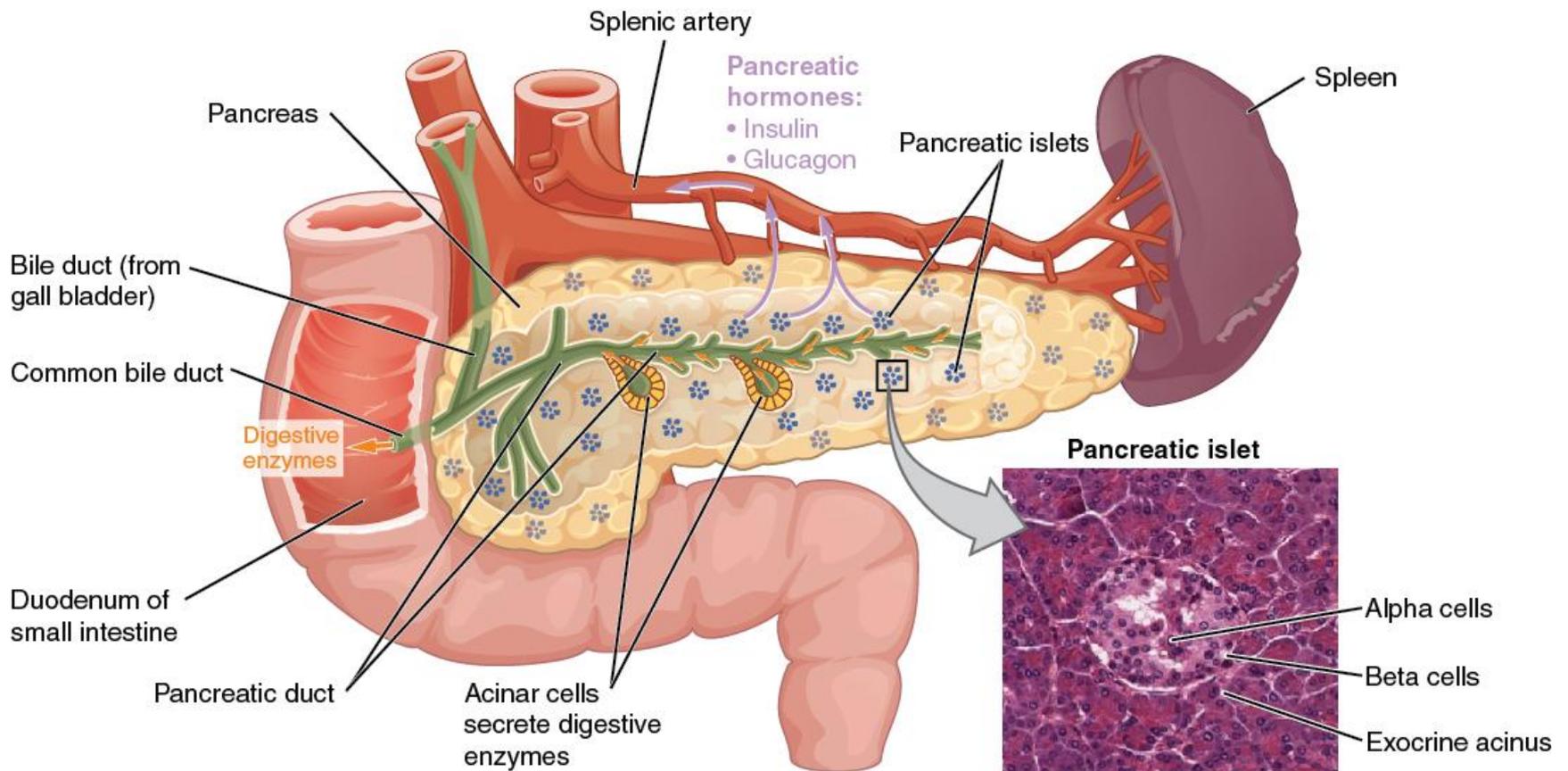


Disorders: Diabetes mellitus

- **Type I:** insufficient insulin produced by pancreas, usually begins in childhood (autoimmune)
- **Type II:** peripheral resistance to insulin, usually begins in middle age
- People with Type 1, and some people with (usually poorly controlled) Type 2, need to take insulin

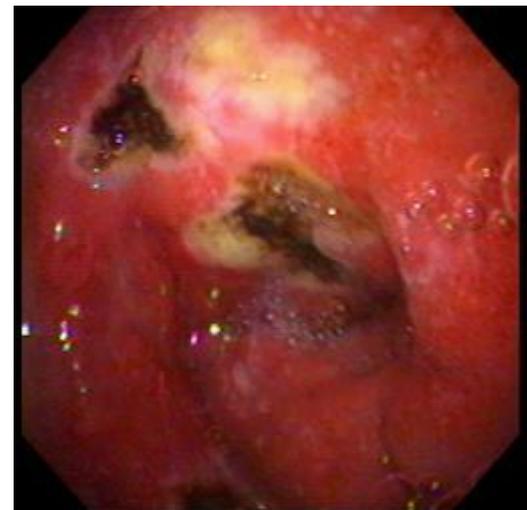
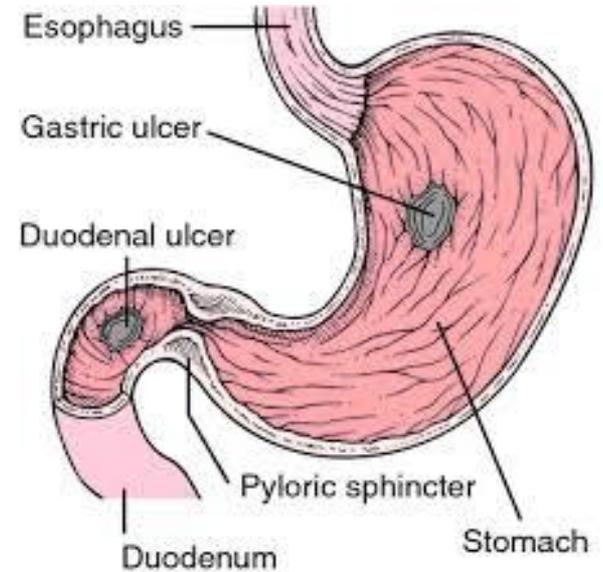


Pancreas: exocrine and endocrine functions



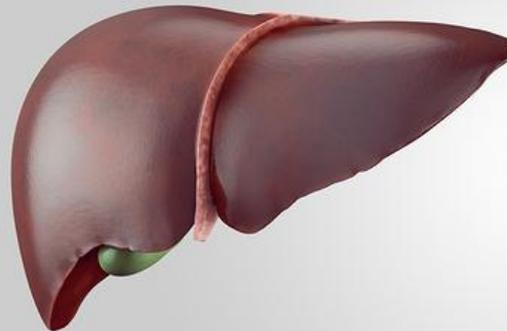
Disorders: peptic ulcer

- Risk Factors:
 - smoking
 - alcohol
 - diet
 - drugs e.g. NSAIDs (like ibuprofen)
 - stress
 - some infections

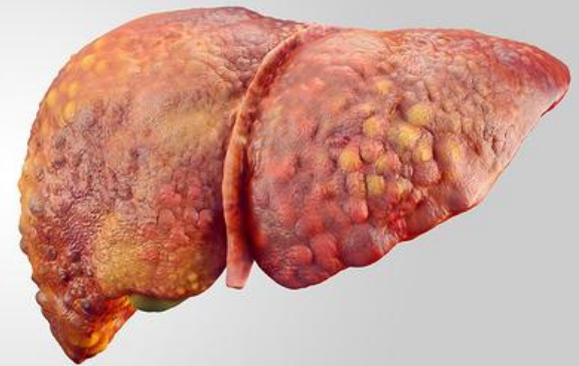


Disorders: Liver cirrhosis

- Caused mainly by chronic alcohol misuse
- Other causes include viral hepatitis and autoimmune disease
- Can affect:
 - Blood clotting
 - Drug breakdown



healthy liver



cirrhosis

Disorders: Gallstones

- Stones that form in the gall bladder
- Usually made of cholesterol
- May be asymptomatic
- May cause severe pain and require gall bladder removal

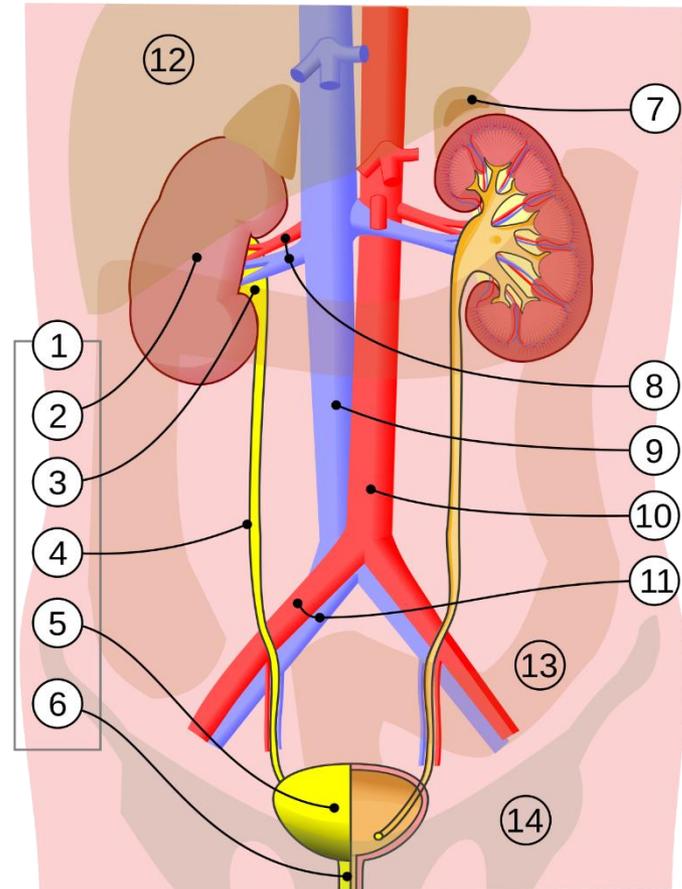


Disorders: Inflammatory Bowel Disease

- e.g.
 - Crohn's
 - Ulcerative colitis
 - Crohn's (or related OFG) may be associated with lip swelling, gingivitis, oral ulcers and "cobblestoning" of the mucosa

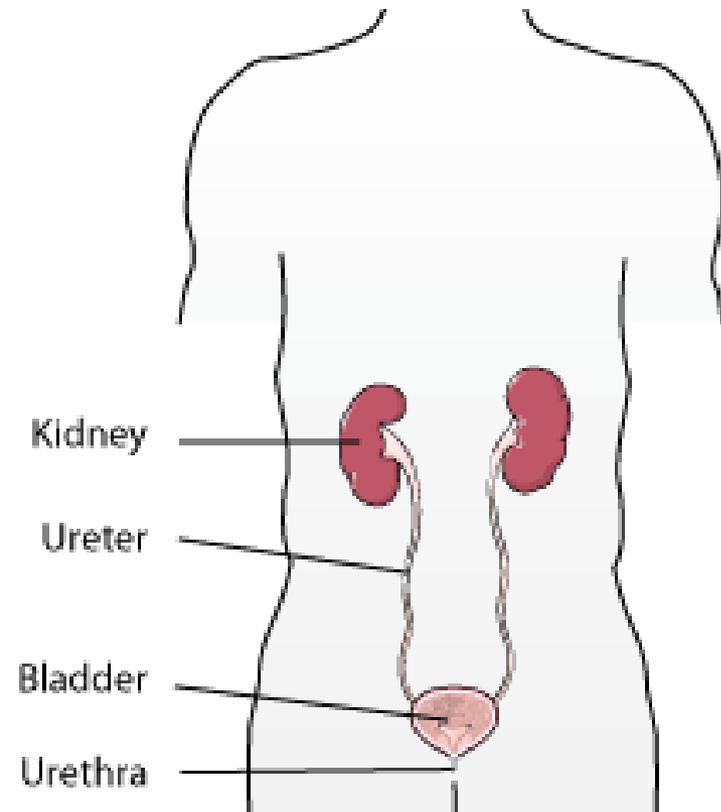


4: Renal System



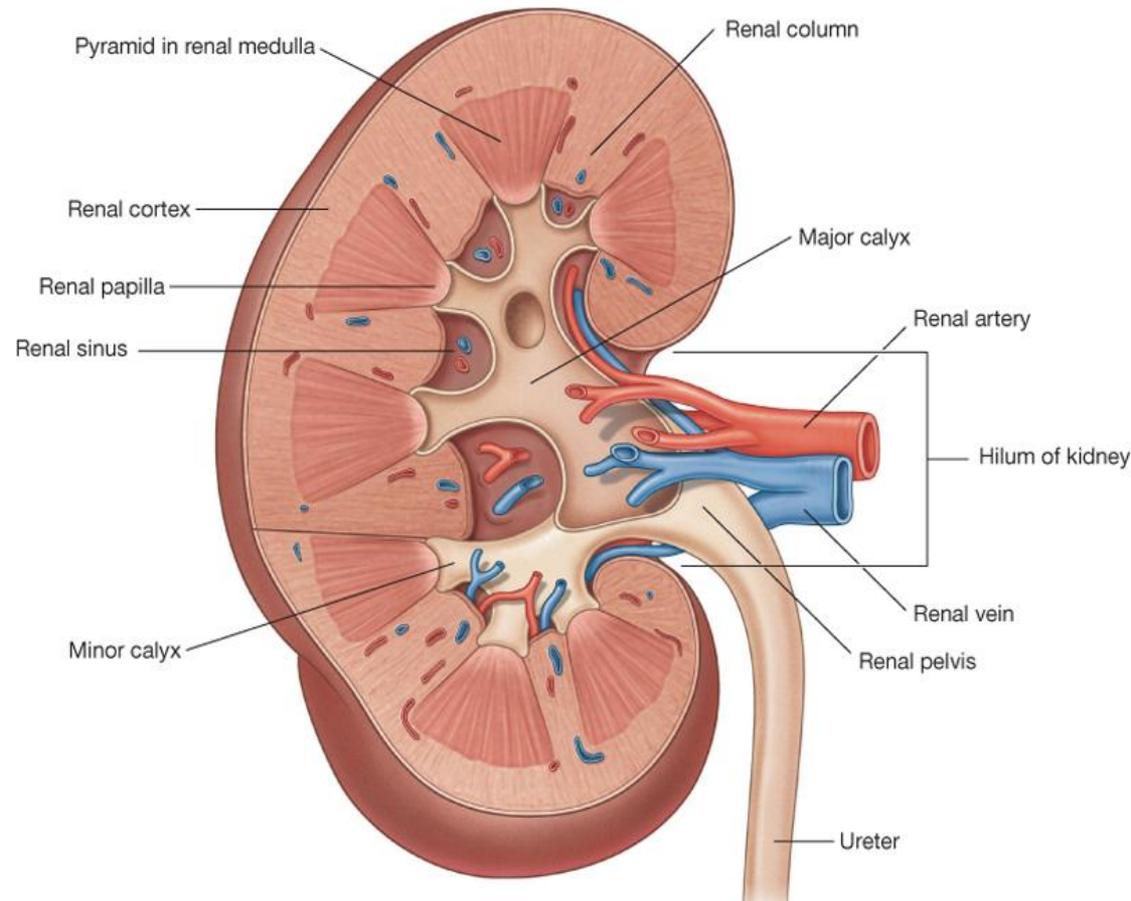
Renal System: components

- Kidneys
- Urinary bladder
- Ureters (x 2)
- Urethra



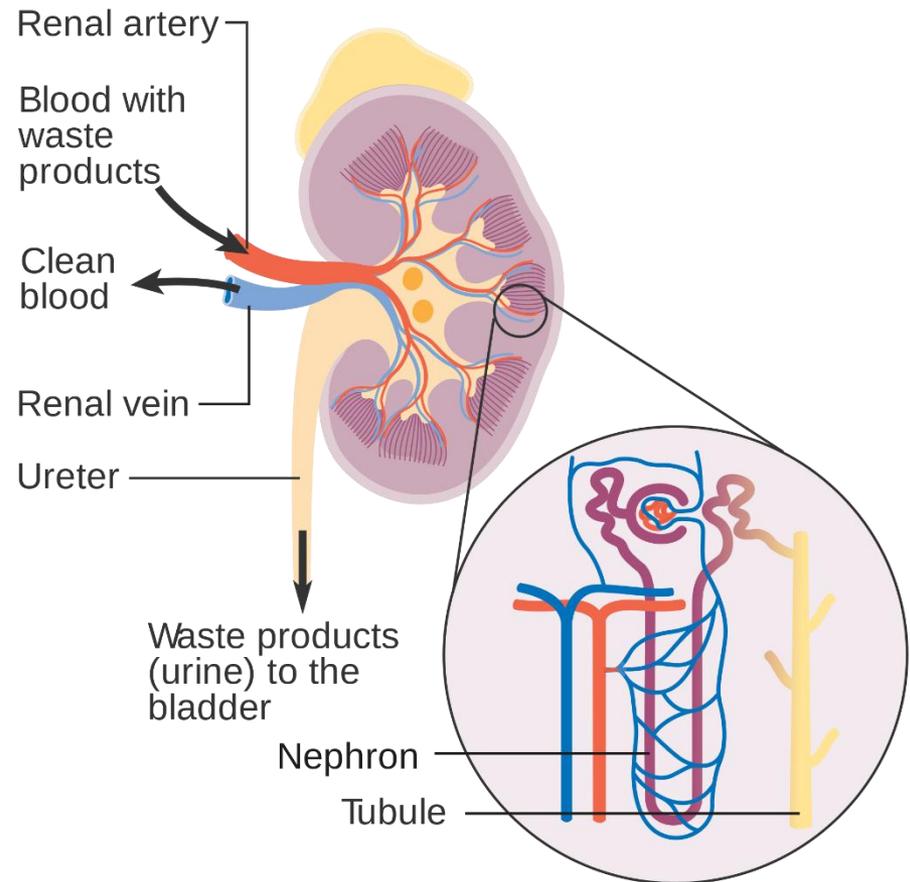
Internal structure of kidney

- Bloodflow through complex network of tubules
- Ultimately becomes urine
- Excreted via ureters to bladder



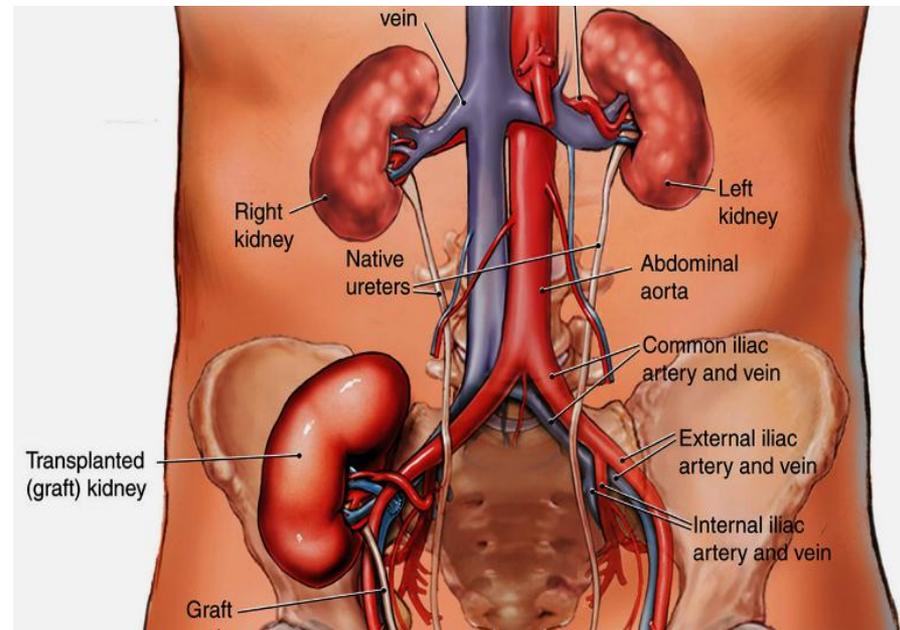
Function of renal system

- **Filter** blood and remove wastes e.g. urea from protein breakdown
- Maintain **pH** of blood
- Helps maintain **blood pressure**
- Secrete **hormones**
- Maintain **electrolyte** balance, esp. calcium



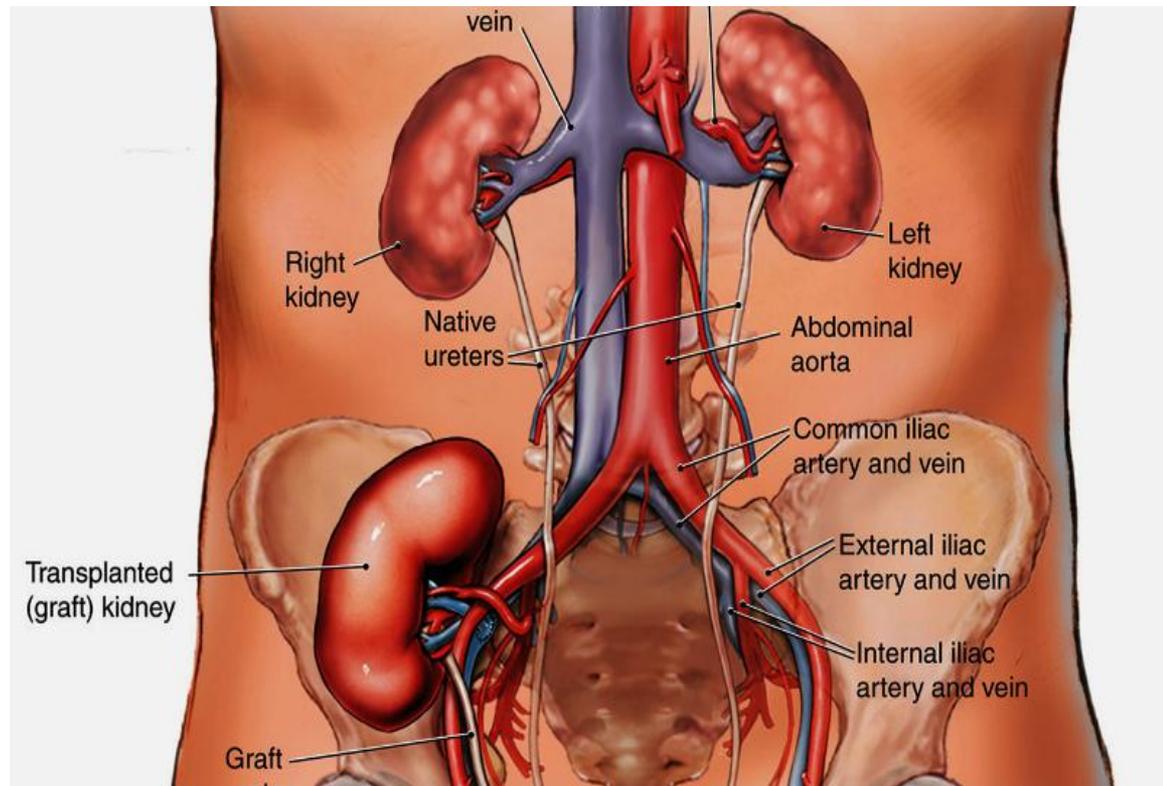
Disorder: Chronic Renal Disease

- Many causes:
 - diabetes
 - high blood pressure
 - obstruction e.g. stones
 - inflammatory diseases e.g. glomerulonephritis
 - polycystic kidney disease
 - recurrent infections
 - particularly common in elderly people



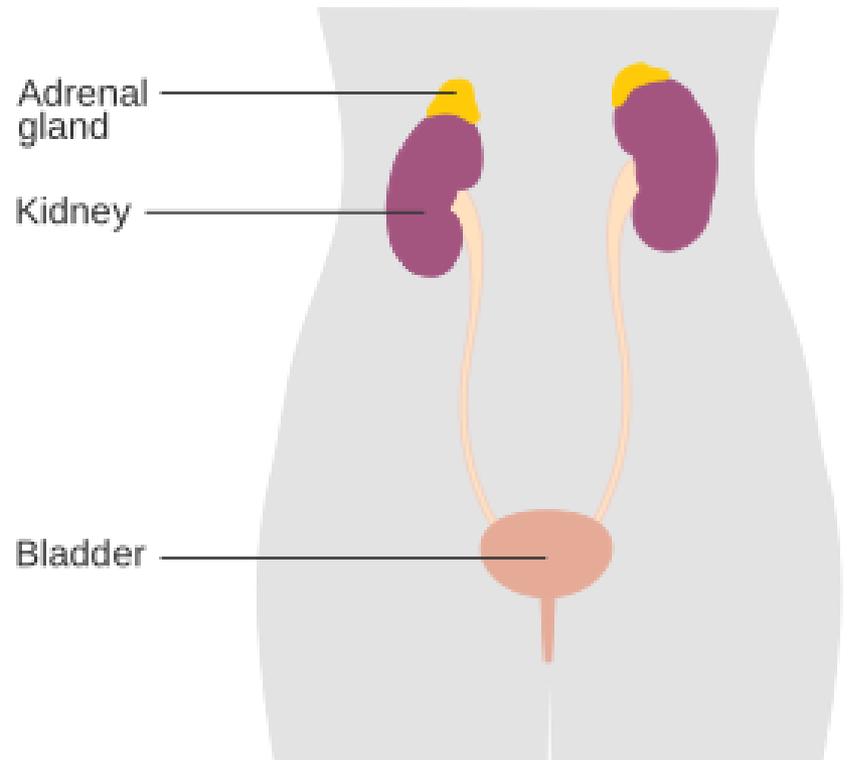
Drugs and Kidney Function

- Many drugs are excreted through the kidneys
- May increase action of drug or even cause toxicity
- e.g. warfarin, NSAIDs, midazolam
- Caution in prescribing certain drugs to people with kidney disease, or consider dose reduction



Adrenal (Supra-Renal) Glands

- sit on top of the kidneys...
- but...functionally separate from the kidneys
- Produce a range of hormones, including **adrenaline** and **cortisol**



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