Anatomy

FOR 3RD YEAR MEDICAL PHYSICS STUDENTS

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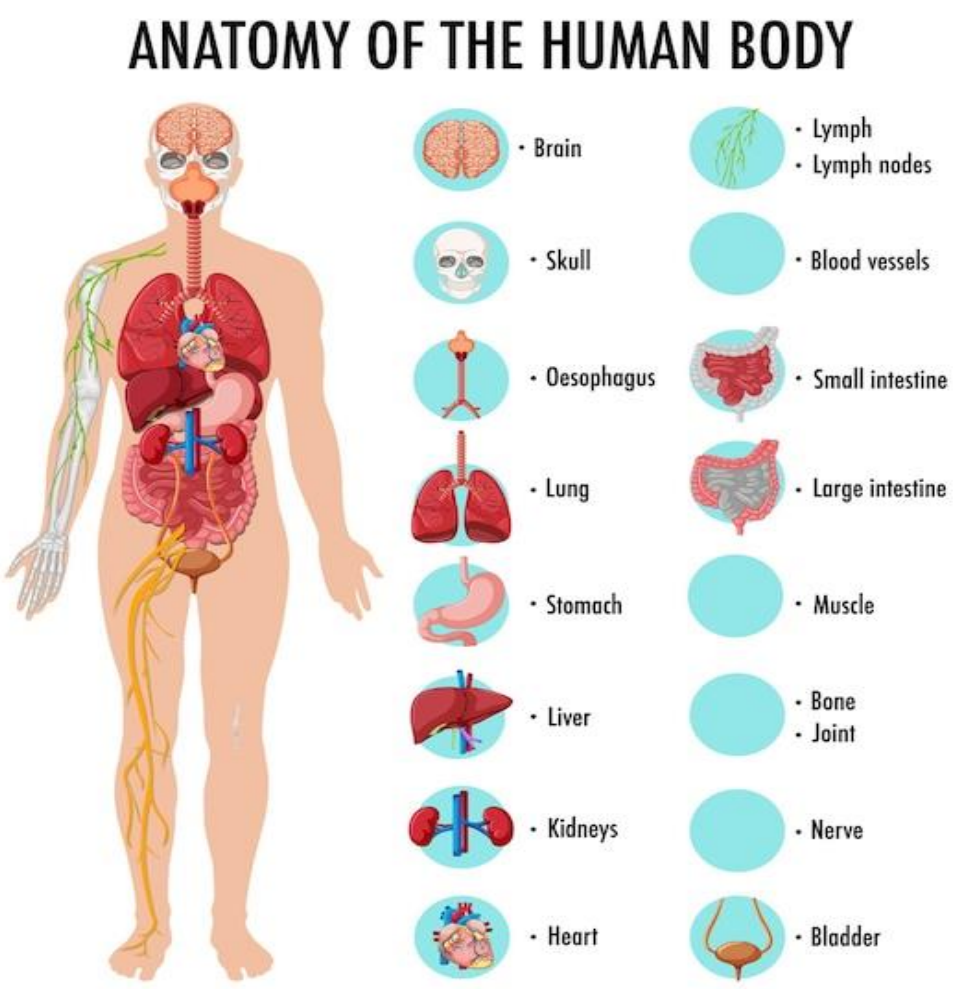


Nerves and the Nervous System

Nerves are the wires of the body's action circuit and are responsible for our thoughts, emotions, actions and intelligence. Nerves and nerve cells, along with supporting cells make up the nervous system which is the master communicating and controlling system of the body. The human body has a single, highly integrated and complete nervous system. All its component parts are related to each other both by structure and function. However, for the sake of convenience, it is customary to classify the nervous system into the central nervous system and the peripheral nervous system (Figs 6.1 and 6.2). The autonomic nervous system, which has its distribution through both of them, is sometimes classified as a separate component.

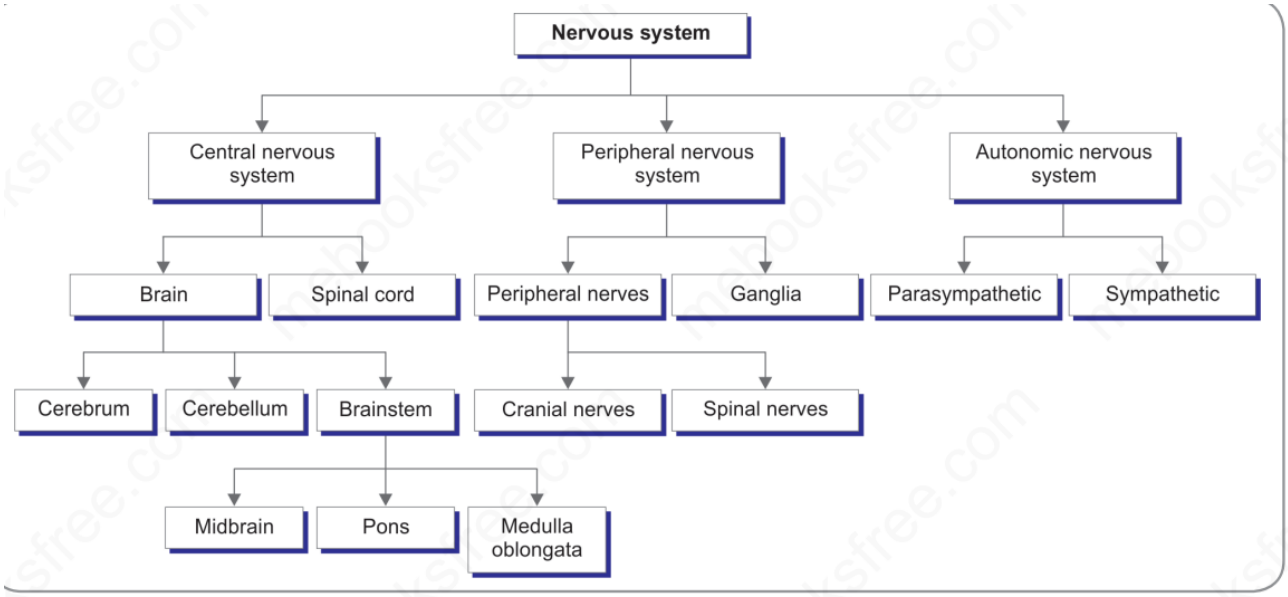


Fig. 6.1: Divisions of nervous system

Cells of nervous system and their functions The two types of cells found in the nervous system are called neurons or nerve cells and neuroglia, which are specialized connective tissue cells. Neurons conduct impulses, whereas neuroglia supports neurons.

The nervous system controls the entire body. It has fibers that run across every inch of the body, controlling muscles, organs, and glands; while returning information to the spinal cord and brain to allow them to make decisions. Neurons have several parts, dendrites that receive signals, axons that transmit them, and the cell body, which maintains the nerve cell.

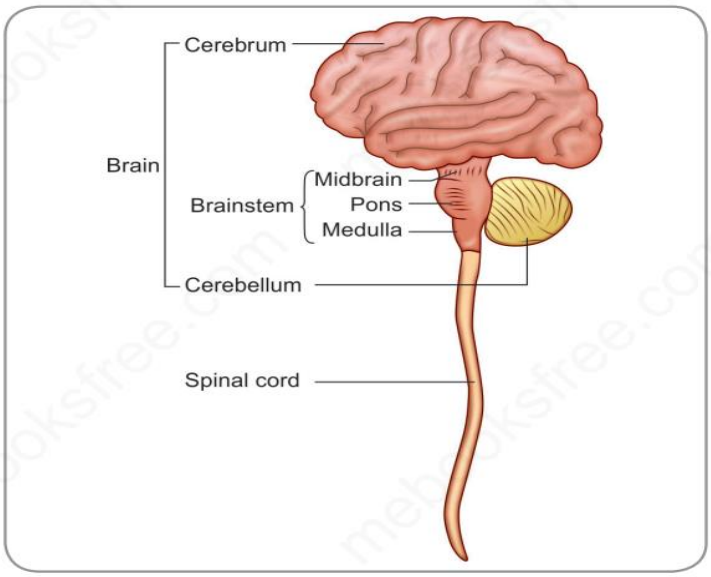


Fig. 6.2: Diagram showing parts of the central nervous system

The anatomy of the nervous system is divided into the **central** and **peripheral** systems, with the central nervous system acting as the control system for the body and the peripheral as communication lines that relay information to and from the central system.

The **central nervous system (CNS)** is made up of the brain and spinal cord; both of these structures are made up of a large number of neurons and support cells, with both large blood vessels and capillaries supplying the large amount of energy the neurons require.

The **peripheral nervous system (PNS)** is extensive and covers all areas of the body. These nerves have a myriad of functions controlling movement in the body, controlling the function of the organs, and returning sensory information from all across the body to the spinal cord and brain. The nerves of the PNS branch off of the spinal cord. The **somatic nervous system (SNS)**, a branch of the PNS, is responsible for controlling voluntary muscle movements.

The **autonomic nervous system (ANS)** is a division of the peripheral nervous system (PNS) that controls and regulates the involuntary functions of the body. It plays a crucial role in maintaining internal homeostasis by regulating various physiological processes, such as heart rate, blood pressure, digestion, respiratory rate, and body temperature, among others.

The ANS is further divided into **two main branches**:

1. **Sympathetic Nervous System:** The sympathetic nervous system is often referred to as the "fight or flight" system because it prepares the body to respond to stressful or

threatening situations. When activated, it increases physiological arousal and mobilizes energy reserves to help the body deal with perceived threats.

2. **Parasympathetic Nervous System:** The parasympathetic nervous system is often referred to as the "rest and digest" system because it promotes relaxation and conserves energy.

NEURONS

Neurons (Fig. 6.3) are the basic structural units of the nervous system. These are specialized cells capable of conducting electrical impulses from one part of the body to the other. Crores of neurons exist in the human body. The neurons have special characteristics. These are as follows:

‰Impulse transmission ‰Longevity ‰Undividing ‰High metabolic rate Parts of a Neuron

A neuron has a **cell body called the soma** and one or more **cellular processes**. The characteristic feature of a neuron is the presence of extensions from the cell body. These extensions are called processes. There are two types of processes, namely the (1) axons and (2) dendrons.

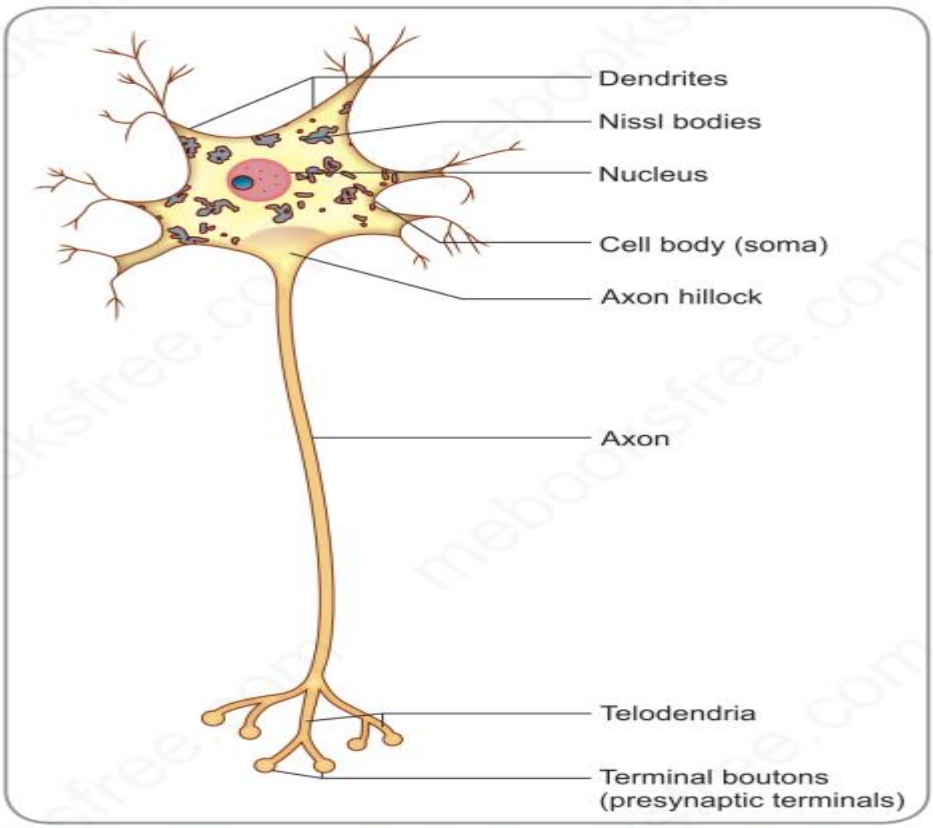


Fig. 6.3: Diagram showing the main parts of a typical neuron

Types of a Neuron (Figs 6.4 and 6.5)

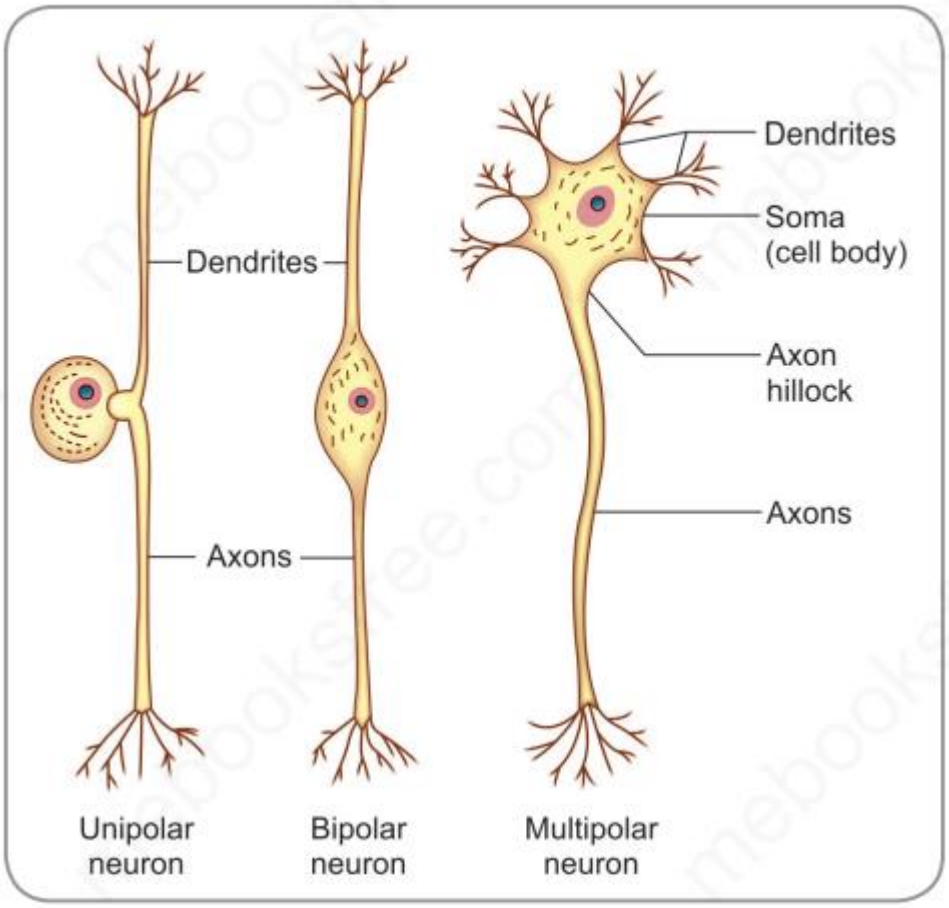


Fig. 6.4: Unipolar, bipolar and multipolar neurons

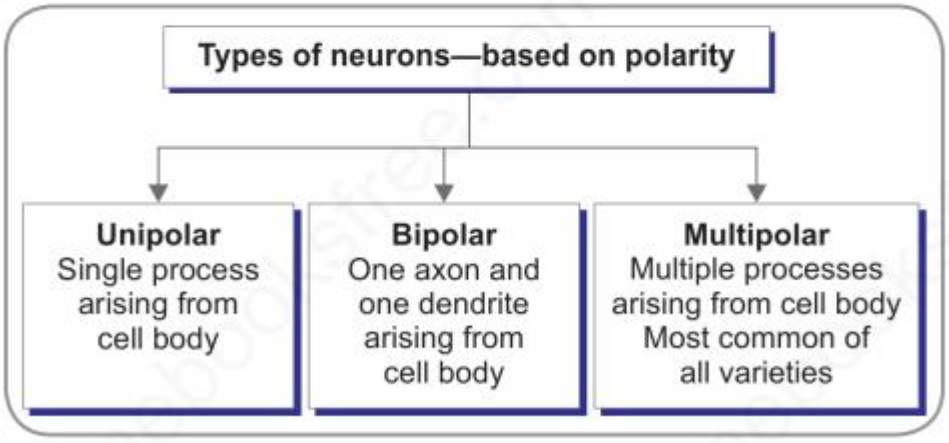
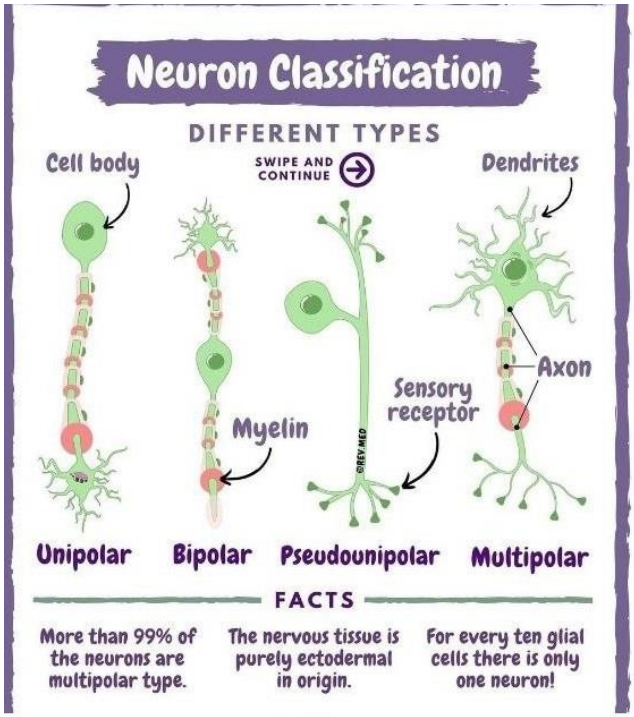
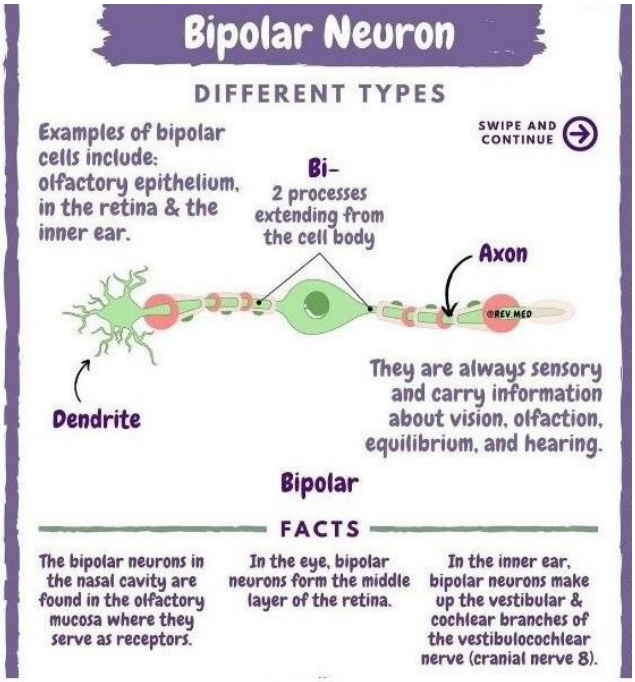
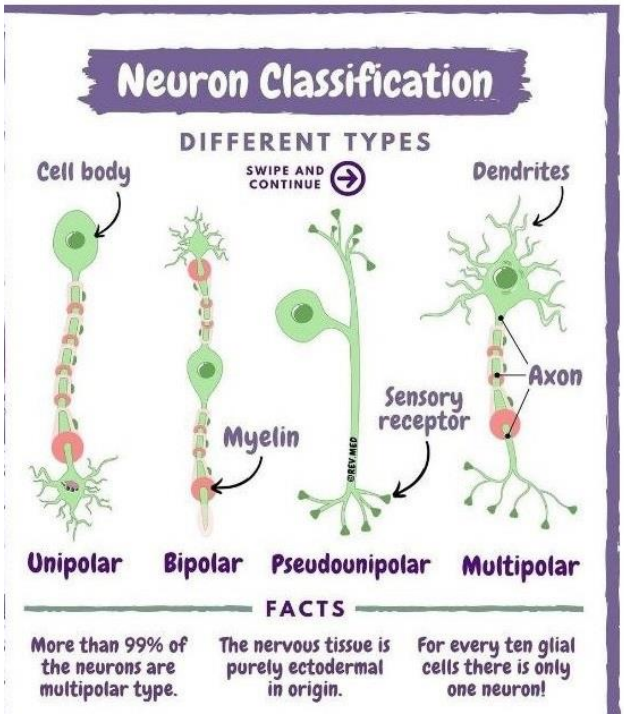
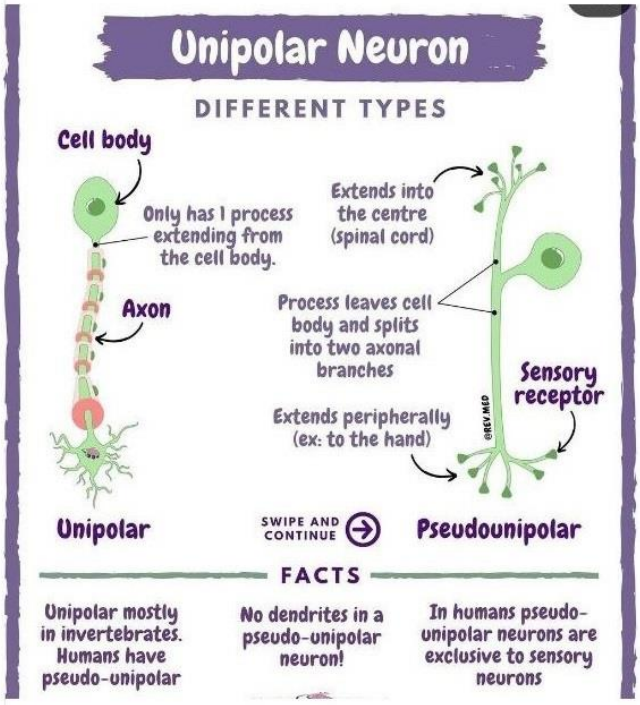


Fig. 6.5: Types of neurons—anatomical classification









The Abdomen

The abdomen is the part of the body that contains all of the structures between the thorax (chest) and the pelvis, and is separated from the thorax via the diaphragm. The region occupied by the abdomen is called the abdominal cavity, and is enclosed by the abdominal muscles at front and to the sides, and by part of the vertebral column at the back.

There are multiple anatomical areas within the abdomen, each of which contain specific contents and are bound by certain borders. The bones of the abdomen are made up of the lumbar spine, the third region of the vertebral column, located in the lower back between the thoracic (above) and sacral (below) vertebral segments. The muscles of the abdomen work together to protect the internal organs (viscera) by covering them completely, and are made up of the muscles of the anterolateral abdominal wall and the muscles of the posterior abdominal wall. The abdomen contains organs involved in the gastrointestinal tract, including the esophagus, stomach, small intestine, cecum, appendix, colon, rectum and the anal canal. The gastrointestinal tract is an organ system that enables us to ingest food, digest it, absorb it, and then expel the remaining waste as stool. The abdomen contains many accessory organs, including the liver, gallbladder, pancreas, spleen, adrenal glands, kidneys and the mesentery. The role of these organs is to help the functioning of the other organs in the system.

The abdominal vasculature consists of various arterial branches that all come from the aorta, and two venous structures that help to drain the abdominal structures, carrying deoxygenated blood and waste products away.

What Does the Abdomen Do?

As a body cavity, the abdomen's job is to hold and protect vital internal organs of the digestive, urinary, endocrine, exocrine, circulatory, and female reproductive systems. The membrane, tissue, and muscle layers work together to support these organs so they don't fall out of the cavity and also protect them from the outside world.

The abdomen aids in protecting and supporting a developing fetus, too. During pregnancy, the abdomen's muscles stretch and organs squish to the top of the cavity to help accommodate the growing uterus

Anatomy of the Abdomen

The abdomen is a body cavity a hollow, fluid-filled space that holds organs and other bodily structures. Organs inside the abdomen include:

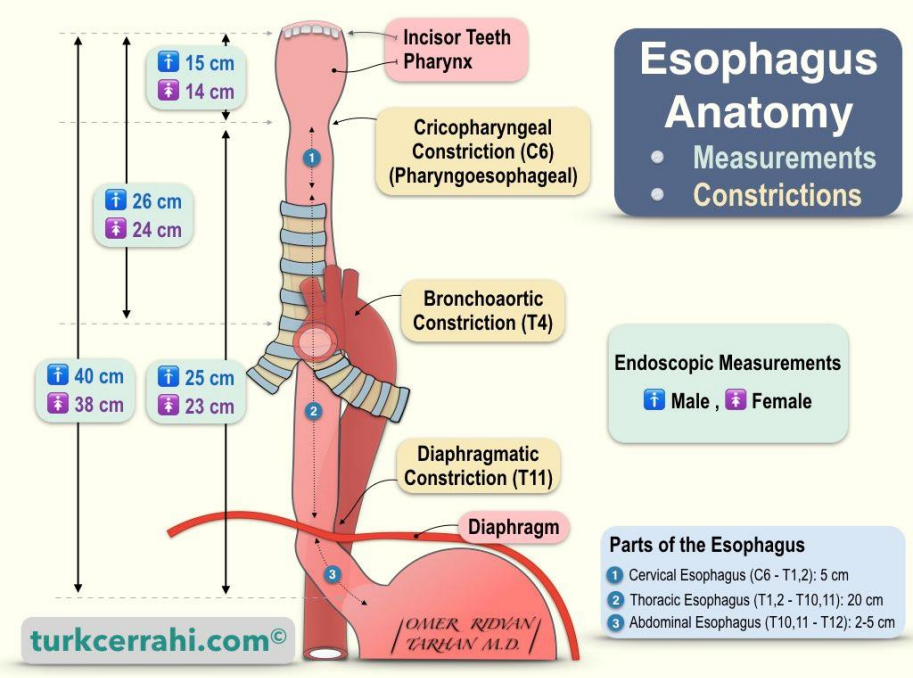
- Digestive system organs like the stomach, small intestine, large intestine (colon), pancreas, appendix, liver, and gallbladder
- Lymphatic system organs like the spleen and lymph vessels

- Urinary system organs like the kidneys, ureters and bladder
- Reproductive organs like the uterus, ovaries, and fallopian tubes
- Blood vessels (arteries and veins)
- Parasympathetic and sympathetic nerves

The Gastrointestinal Tract

The gastrointestinal tract is an organ system that enables us to ingest food via the mouth, digest it by breaking it down, absorb it, and then expel the remaining waste as stool via the anus. The gastrointestinal tract is made up of a series of hollow organs joined together in a long tube with many folds from the mouth to the anus. The hollow organs that make up the gastrointestinal tract include the mouth, esophagus, stomach, small intestine, cecum, colon (large intestine), rectum and anal canal.

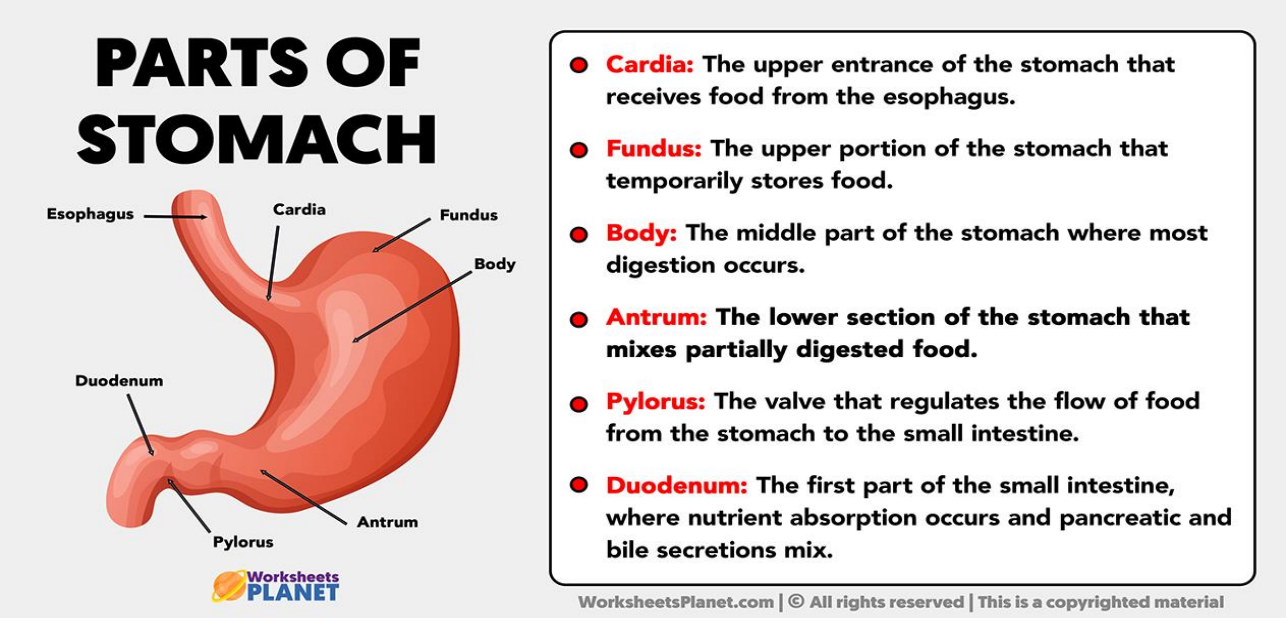
The esophagus is a muscular tube, transporting food and liquid from the pharynx (part of the throat behind the mouth and nasal cavity) to the stomach. It descends down into the thorax and enters the abdomen, where it then joins the stomach.

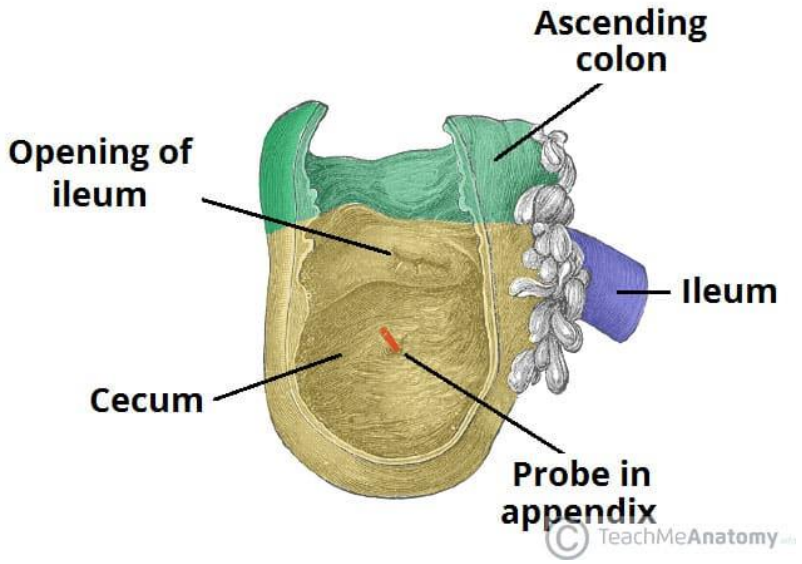


The stomach is located between the esophagus and the duodenum. After food enters the stomach, the muscular walls of the stomach act to mix the food and liquid with digestive juices. The contents of the stomach, called chyme, are then emptied into the small intestine.

The small intestine is approximately 6.5m long and extends from the stomach to the large intestine. Anatomically, the small intestine can be divided into three parts: the duodenum, jejunum and ileum.

The appendix is a small, blind-ended tube that is attached to the cecum. It contains a large amount of lymphoid tissue, and is not thought to have any vital functions.
The cecum is the first part of the large intestine and is located between the ileum and the ascending colon. It acts as a store for chime (the pulpy acidic fluid which passes from the stomach to the small intestine, consisting of gastric juices and partly digested food) which it receives from the ileum.





The colon extends from the cecum to the anal canal, and can be divided into four parts anatomically. It receives digested food from the small intestine, and absorbs water and electrolytes to form stool.
The rectum is located between the large intestine and the anal canal, and enables the temporary store of stool. The anal canal is the final segment of the gastrointestinal tract