



Section 3.0

- Healthy human function depends on a variety of interacting and reacting body systems. -

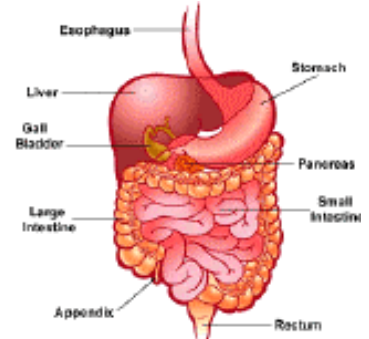
- Virtual Body <http://www.medtropolis.com/VBody.asp>
- Body Systems (Student Site) http://www.stcms.si.edu/hbs/hbs_student.htm
- Science Flash Movies <http://www.brainpop.com/science/seeall.weml>
- Human Body Links (Research on all Systems) <http://edtech.kennesaw.edu/web/humanbo.html>

3.1 – Digestive System

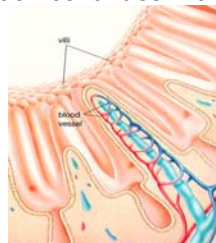
Food enters your body through the mouth and then passes to the stomach and intestines. It is broken down along the way into usable, soluble particles that can be used by different cells. (Figure 3.2)

There are two types of digestion:

- **mechanical digestion** involves the physical breakdown of food into useable pieces.
- **chemical digestion** breaks down the smaller pieces using **enzymes**



Digestion begins in the **mouth** with the mechanical breakdown of food. **Saliva** (produced by the salivary glands) mixes with the food to make it easier to swallow. **Salivary amylase**, an **enzyme**, begins the chemical digestion process by breaking the large starch molecules into smaller sugar molecules. The **epiglottis** is a flap of skin that covers the windpipe so that food will not enter the lungs. The food is pushed down the **esophagus** by contractions of muscle tissue. This is called **peristalsis**. The stomach churns the food mixing it with gastric juices (composed of mucus, hydrochloric acid, water and digestive enzymes). The **mucus** helps to protect the stomach from digesting itself. The food then enters the **small intestine** where chemical digestion continues with digestive enzymes added from the pancreas.

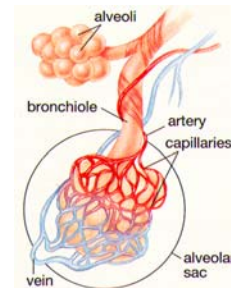


The inner surface is covered with **villi**, which increase the surface area for absorption of the nutrients that have been digested. **Microvilli** further this absorption of nutrients. In the **large intestine**, digestion is complete and those nutrients that have not been absorbed are formed into **feces**, which collect in the **rectum** and release from the body through the anus.

3.2 – Respiratory System

Breathing is the process, which moves air in and out of the lungs. The **diaphragm** muscles cause the air to be pushed out of and pulled into the lungs.

Diffusion occurs between the **alveoli** (tissues of the respiratory system) and the **capillaries** (tissues of the circulatory system)

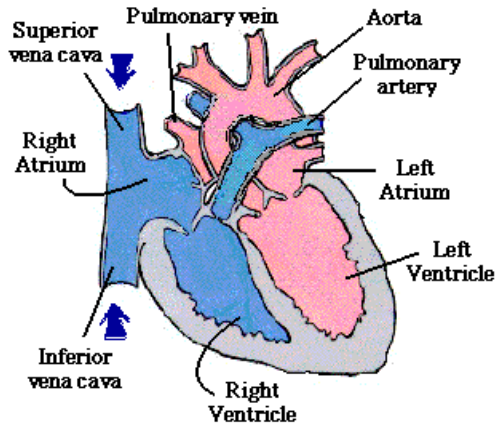




3.3 – Circulatory System

Transports food and gases throughout our body.

The Heart



Arteries, Veins, and Capillaries

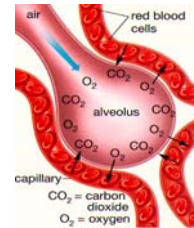
The blood vessels that carry blood away from your heart and transport it to all part of the body are called **arteries**.

The blood is returned to the heart from all parts of the body by the **veins**.

Arteries and veins are connected by **capillaries**, which allow the exchange of nutrients and gases. Capillaries have two adaptations for this:

- they are made of specialized epithelial tissue that is *only one layer thick*
- they are *very narrow* so that blood cells must pass through in single file

Oxygen goes from the alveoli to the capillaries and *Carbon Dioxide* goes from the capillaries to the alveoli



Blood - The Body's Transportation System

The blood vessels of the circulatory system form a complex network linking the outside environment with the internal environment of the body. The blood supplies all the living cells in the body with the nutrients they need to carry out their functions. The circulatory system must work closely with the respiratory system (which supplies the oxygen) and the digestive system (which supplies the nutrients)

(Composition)

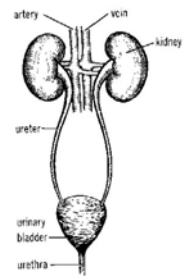
About 8% of an adult's body weight is blood, made up of:

Component	% of blood (by volume)	Main Function
plasma	55%	carries nutrients, waste products, hormones, and blood cells
red blood cells	44%	carries oxygen (because they have hemoglobin – an iron- rich chemical, which attracts oxygen)
white blood cell	less than 1%	defends the body against infection and disease
platelets	less than 1%	causes the blood to clot (thicken) at site of wounds to prevent blood loss

3.4 – Excretory System

Waste removal in the body is done through the organs of the **excretory system**. (The respiratory and circulatory systems also assist in the process) **Ammonia** is a chemical waste that the body produces when cells break down protein. The **liver** converts the ammonia to a less harmful substance called **urea**. The urea is carried to the kidneys, where it is mixed with water, and other salts to produce **urine**. The urine is transported to the bladder through the **ureter** tubes. The **bladder** expands and then releases the urine out through the **urethra**.

The **skin** also gets rid of waste (excess salt that the body does not need). This process, called '**sweating**' also keeps you cool.

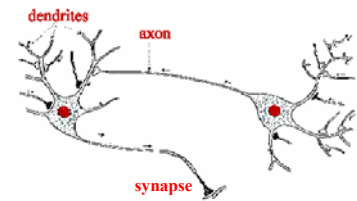


Urine can reveal diseases – That is why you often take a urine test for a doctor to determine if certain processes in the excretory system are functioning properly. (See Section 4 Notes)



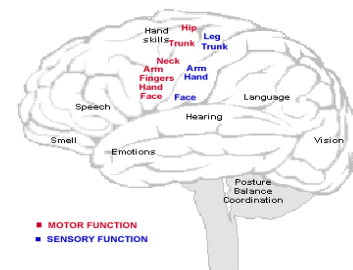
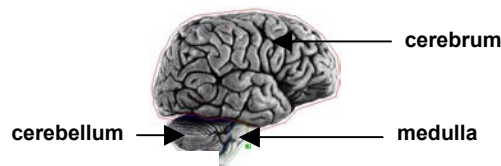
3.5 – Nervous (Sensory Awareness) System

Nervous tissue is made entirely of specialized cells called **neurons**. A neuron's job is to *send and receive messages*. Small branches in the neuron, called **dendrites**, *receive messages*, which then pass them on through the cell body to the axon. The **axon** then *passes the messages on* to neighboring dendrites at a **synapse**.



The nervous system consists of two main divisions:

- the **central nervous system**, which is composed of the brain and the spinal cord
- The brain receives stimuli from the outside world through sensory organs in the body. Internal stimuli are also received from inside the body. It reacts to all this stimuli and responds appropriately. The brain is divided into three main sections:



The **spinal cord** connects the brain to the peripheral nervous system. It contains **interneurons**, which connect one neuron to another.

- the **peripheral nervous system** is made up of the cranial (head) and spinal nerves, which travel to all parts of the body

Sensory neurons carry information from the body to the central nervous system. **Motor neurons** carry information from the central nervous system to the muscles and organs. The responses to these stimuli can be **automatic** (*autonomic nervous system*) or **voluntary** (*somatic nervous system*).

The nervous system allows each of the systems of the body to respond to changing conditions and make adjustments in order to maintain a stable internal environment, allowing the cells to function properly.

The Reflex Response

Sensory and motor nerves work together, sometimes not involving the brain. This is known as a **reflex**.

- Quivering muscles generate heat.
- 90% of heat loss is through the skin (most of the rest is through the lungs).
- Hairs on the skin stand on end when the tiny muscle cells near the surface contract, creating '*gooseflesh*' (goosebumps)
- Fluffing body hair (in animals with thick fur) reduces heat loss by improving insulation
- Feeling flushed (red and hot) happens because tiny blood vessels in the skin expand, which increases blood flow. Sweating helps cool down your body as moisture evaporates from the skin surface.

The nervous system helps to keep your body temperature stable by monitoring conditions outside, using temperature receptors in the skin. The information is then transmitted to the **hypothalamus** (section of the brain which regulates body functions), which then decides what action needs to be taken – increasing activity to raise the temperature or, reduce it to prevent heat loss.

Response to stimuli is coordinated by the nervous system (brain, spinal cord and nerves) and the **endocrine system** (glands that produce **hormones**).