

# Structure and Function: Organization of the Human Body

## How is the human body similar to a well-tuned machine?

Many people have compared the human body to a machine. Think about some common machines, such as drills and washing machines. Each machine consists of many parts, and each part does a specific job, yet all the parts work together to perform an overall function. The human body is like a machine in all these ways. In fact, it may be the most fantastic machine on Earth.

## Levels of Organization

The human machine is organized at different levels, starting with the cell and ending with the entire organism (see Figure on right). At each higher level of organization, there is a greater degree of complexity.

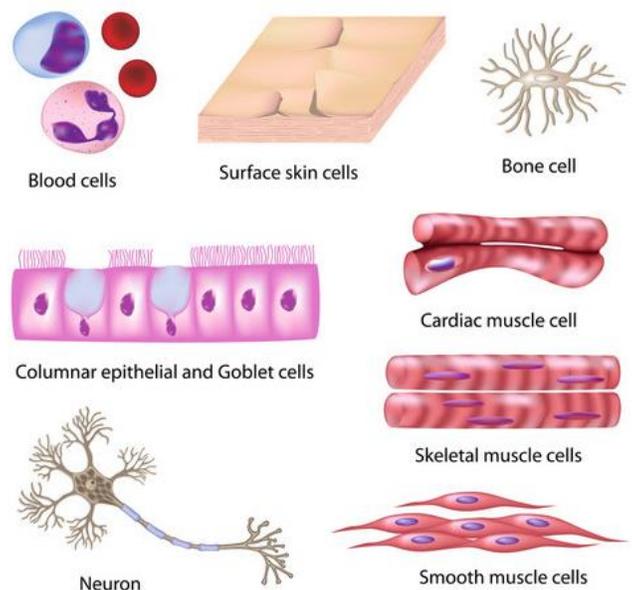
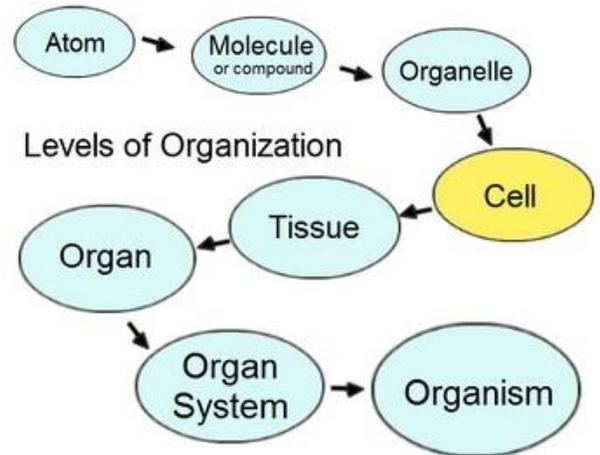
## Cells

The most basic parts of the human machine are cells – an amazing 100 trillion of them by the time the average person reaches adulthood! Cells are the basic units of structure and function in the human body, as they are in all living things. Each cell carries out basic life processes that allow the body to survive.

Many cells in our bodies do not look like the “typical” animal cell that we have all seen. Differences in cell structure include different shapes and different amounts and types of specific types of organelles. These differences in structure are related to differences in the function of different types of cells, as illustrated in diagram on the right. For some types of cells, a flexible structure that allows the cell to change shape is crucial for the cell’s function. The white blood cell shown in the image to the right defends our body against infection by squeezing themselves between other cells to get to the infected area to engulf, kill, and digest bacteria.

One of the images is of a nerve cell (neuron). Nerve cells are the primary cells in the nervous system. They are responsible for relaying electrical messages to cells and tissues in other organ systems.

Some columnar epithelial cells have small hair-like structures (cilia) attached. These structures can move back and forth, therefore these cells are located where movement of substances like mucus within the lining of the nose and lungs are necessary.



**Think Question #1: Observe the very specialized structure of the nerve cell (neuron) in the previous diagram. Explain how the structure of nerve cells contributes to their function.**

---

---

---

**Think Question #2: What is the relationship between the structure of a white blood cell and its function in the body? Cite evidence from the text to support your response.**

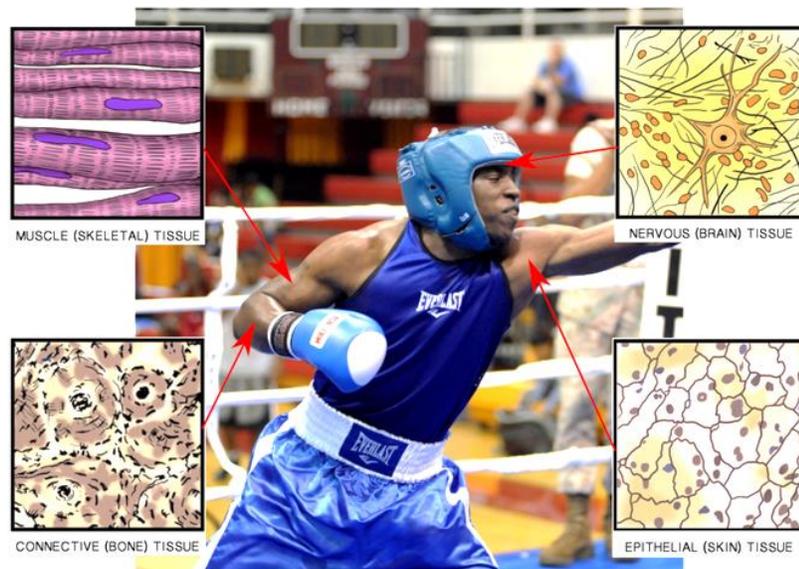
---

---

---

### Group of Cells Form Tissues

After the cell, the tissue is the next level of organization in the human body. A tissue is a group of connected cells that have a similar function. There are four basic types of human tissues: epithelial, muscle, nervous, and connective tissues. These four tissue types (see Figure below), make up all the organs of the human body.



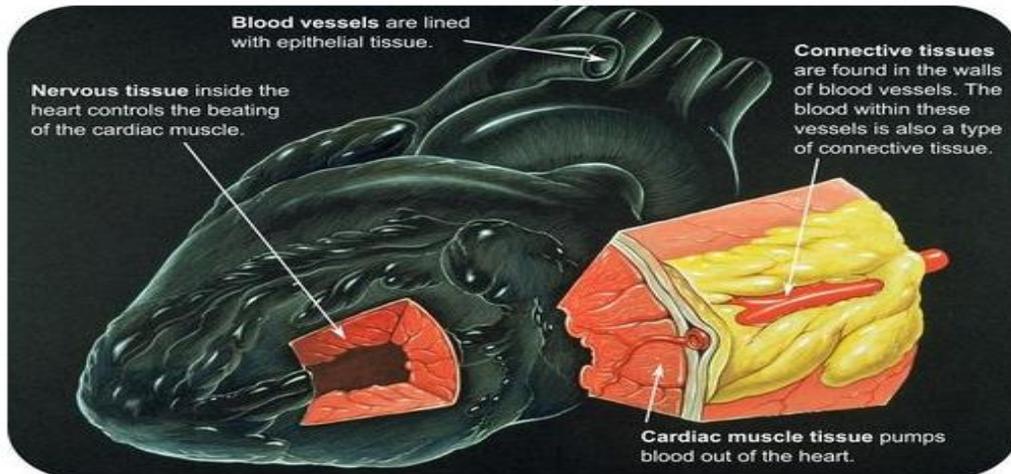
- **Connective tissue** is made of cells that form the body's structure. Examples include bone and cartilage.
- **Epithelial tissue** is made of cells that line inner and outer body surfaces, such as the skin and the lining of the digestive tract. Epithelial tissue protects the body and its internal organs, secretes substances such as hormones, and absorbs substances such as nutrients.
- **Muscle tissue** is made up of cells that have the unique ability to contract, or become shorter. When cardiac muscle tissues contract, it causes the rhythmical beating of the heart and

circulating of the blood. When skeletal muscle tissues contract, it enables the body to move. Smooth muscle tissue controls slow contractions in the walls of the stomach and intestines.

- **Nervous tissue** is made up of neurons, or nerve cells, that carry electrical messages. Nervous tissue makes up the brain and the nerves that connect the brain to all parts of the body.

## Group of Tissues Form Organs

A single type of tissue alone cannot do all the jobs that are needed to keep you alive and healthy. Two or more tissues working together can do a lot more. An organ is a structure that consists of two or more types of tissues that work together. The heart (see Figure below) is made up of four types of tissues.



## Groups of Organs Form Organ Systems

Your heart pumps blood around your body. But how does your heart get blood to and from every cell in your body? Your heart is connected to blood vessels such as veins and arteries, which are also organs in your body. Organs that work together form an organ system. Together, your heart, veins, and arteries form your circulatory system. An organ system is a group of organs that work together to carry out a complex overall function for an organism. Each organ of the system does part of the larger job. Other examples of systems are: excretory, digestive, respiratory, muscular, and nervous.

**Think Question #3: What is the relationship between the structure of a muscle cell and its function? Include an example from the text to support your response.**

---

---

---

**Think Question #4: Explain the interaction of tissues and organs within the circulatory system. Use examples from the text.**

---

---

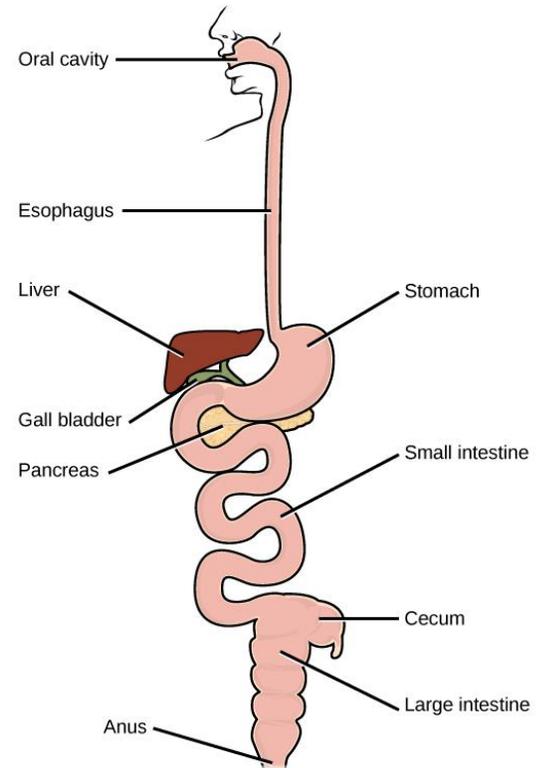
---

## Deep Dive into the Structure and Function of the Digestive System

Your digestive system is uniquely constructed to perform its specialized function of turning food into the energy you need to survive and packaging the residue for waste disposal. This is a major job; therefore, many kinds of cells, tissue, and organs must interact to carry out the process. To help you understand how the many parts of the digestive system work together, let's review the structure and function of this complex system.

The organs in the human digestive system include the:

- *Oral cavity* where teeth, jaw muscles and saliva work together to begin breaking down food into smaller particles.
- *Esophagus* which carries this mixture of food and digestive juices to the stomach where acid helps to kill any germs in the food; the stomach stores the partially digested food and gradually releases small amounts of it for further digestion in the small intestine.
- *Pancreas and liver* which supply the small intestine with enzymes and other molecules that further aid in the digestion of food molecules.
- *Small intestine* where enzymes break down food molecules into smaller molecules that are absorbed into the blood. This is also where the circulatory system becomes involved in the process by moving the necessary nutrients around the body and transporting unwanted materials away. Most digestion and absorption occur in the small intestine which is a much longer organ than shown in diagram to the right.
- *Large intestine* where water is absorbed into the body and the feces or waste is stored for excretion.



**Think Question #4: Imagine a digestive system where food entered the small intestine directly without first going through the oral cavity and stomach. What would be the disadvantages of this type of digestive system?**

---

---

---

**Think Question #5: The digestive and circulatory systems must work together in order for your body to break down food and get the energy from it necessary for survival. Explain how these two systems interact to carry out the processes.**

---

---

---