



Different types of muscle and their structures

❖ Definition of Muscle:

A **muscle** is a group of muscle tissues which contract together to produce a force. A muscle consists of fibers of muscle cells surrounded by protective tissue, bundled together many more fibers, all surrounded in a thick protective tissue. A muscle uses ATP to contract and shorten, producing a force on the objects it is connected to.

Muscle tissue is a soft tissue that makes up most of the tissues in the muscles of the human muscular system. Other tissues in muscles are connective tissues, such as tendons that attach skeletal muscles to bones and sheaths of connective tissues that cover or line muscle tissues. Only muscle tissue per se, however, has cells with the ability to contract.

Muscle cells, commonly known as **myocytes**, are the cells that make up muscle tissue. There are 3 types of muscle cells in the human body; cardiac, skeletal, and smooth. Cardiac and skeletal myocytes are sometimes referred to as muscle fibers due to their long and fibrous shape. Cardiac muscle cells, or cardiomyocytes, are the muscle fibers comprise the myocardium, the middle muscular layer, of the heart. Skeletal muscle cells make up the muscle tissues connected to the skeleton and are important in locomotion. Smooth muscle cells are responsible for involuntary movement, like that of the intestines during peristalsis (contraction to propel food through the digestive system).



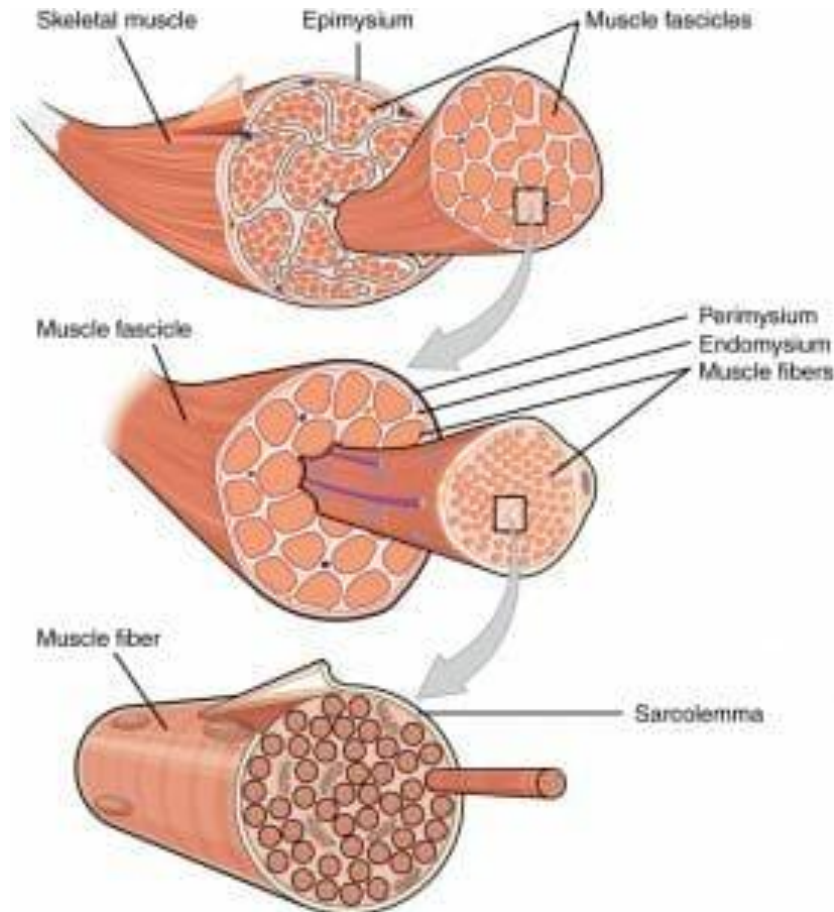
Compiled and circulated by Dr. Parimal Dua, Assistant Professor,
Dept. of Physiology, Narajole Raj college

Key facts about the muscle cells	
Cardiac muscle cell	Rectangular in shape Single nucleus Contain many mitochondria Communicate via intercalated discs - Present in myocardium (cardiac muscle)
Skeletal muscle cell	Cylindrical Striated Multinucleated Contain many mitochondria - Present in skeletal muscles
Smooth muscle cell	Spindle shaped Single central nucleus Arranged in sheets - Present in muscular layers of the vessels, and within internal organs

❖ **Structure of Muscle:**

A muscle consists of many muscle tissues bundled together and surrounded by **epimysium**, a tough connective tissue similar to cartilage. The epimysium surrounds bundles of nerve cells that run in long fibers, called **fascicles**. These fascicles are surrounded by their own protective layer, the **perimysium**. This layer allows nerves and blood to flow to the individual fibers. Each fiber is then wrapped in an **endomysium**, another protective

layer. As seen in the image below, a muscle is arranged in a basic pattern of bundled fibers separated by protective layers.



These layers and bundles allow different parts of a muscle to contract differently. The protective layer surrounding each bundle allows the different bundles to slide past one another as they contract. The epimysium connects to *tendons*, which attach to the *periosteum* connective tissue that surrounds bones. Being anchored to two bones allows movement of the skeleton when the muscle contracts. A different type of muscle surrounds many organs, and the epimysium connects to other connective tissues to produces forces on the organs, controlling everything from circulation to food processing.

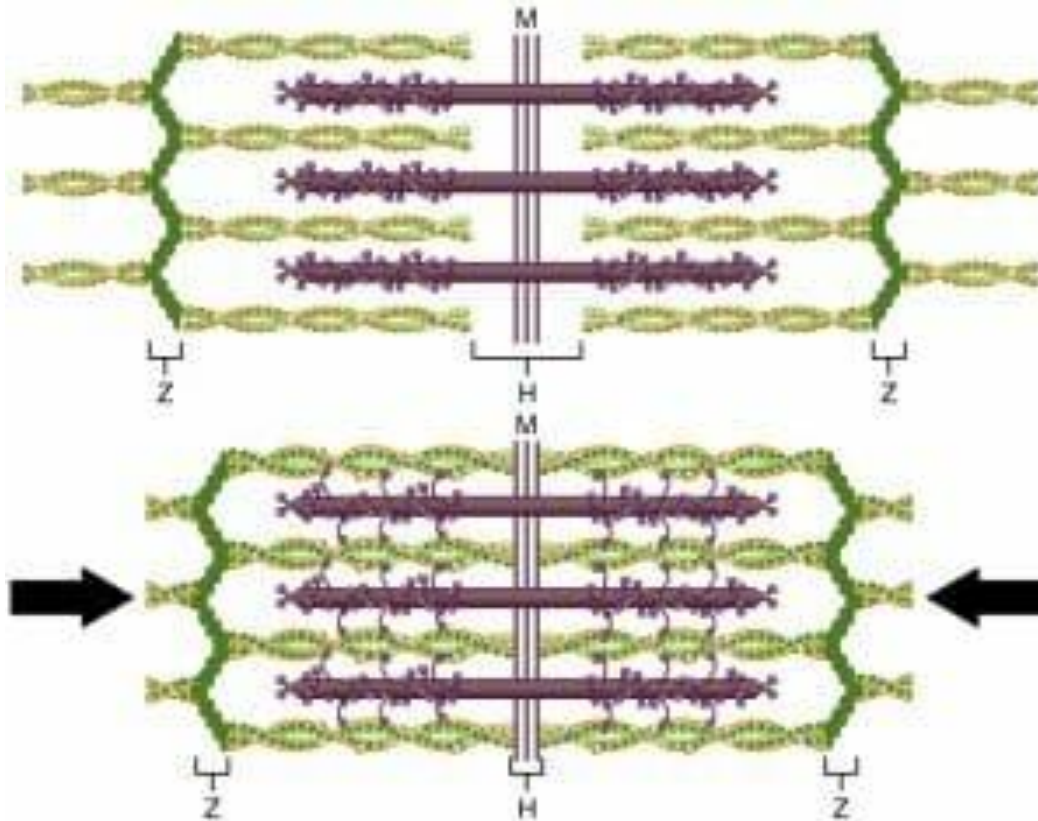


❖ Function of Muscle:

Whether it is the largest muscle in your body or the tiny muscle controlling the movement of your eye, every muscle functions in a similar manner. A signal is sent from the brain along a bundle of nerves. The electronic and chemical message is passed quickly from nerve cell to nerve cell and finally arrives at the *motor end plate*. This interface between the muscle and nerve cells releases a chemical signal, *acetylcholine*, which tells the muscle fiber to contract. This message is distributed to all the cells in the fiber connected to the nerve.

This signal causes the *myosin* proteins to grab onto the actin filaments around them. These are the purple proteins in the image below. Myosin uses ATP as an energy source to crawl along the green filament, *actin*. As you can see, the many small heads of the myosin fibers crawling along the actin filaments effectively shortens the length of each muscle cell. The cells, which are connected end-to-end in a long fibers, contract at the same time and shorten the whole fiber. When a signal is sent to an entire muscle or group of muscles, the resulting contraction results in movement or force being applied.

NRC, Dept. of Physiology



A muscle can be used in many different ways throughout the body. A certain muscle might contract rarely with a lot of force, whereas a different muscle will contract continually with minimal force. Animals have developed a plethora of uses for the forces a muscle can create. Muscles have evolved for flying, swimming, and running. They have also evolved to be pumps used in the circulatory and digestive systems. The heart is a specialized muscle, which is used exclusively for pumping blood throughout the body. These different types of muscle will be discussed below.

❖ Types of muscle:

There are three types of muscle found in the human body:

1. **Skeletal Muscle**
2. **Smooth Muscle**
3. **Cardiac Muscle** (heart muscle)