Muscular tissue

One of the four primary tissues, muscle gives rise to only three cell types: skeletal, cardiac, and smooth muscle.

The contractile unit of a muscle cell is called a sarcomere. These units are kept perfectly aligned during the formation of the muscle fiber and, finally, the muscle itself. In this way, the muscle, composed of thousands of individual sarcomeres all aligned in register, contracts as though it were a single unit. Sarcomeres are constructed from four kinds of protein: Actin, Myosin, CapZ, and Alpha-actinin.

Smooth Muscle

Smooth (visceral) muscles are spidlelike shape with a central nucleus, they are arranged in circular layers in the walls of blood vessels and ureters.

Although smooth muscle cells do not contain sarcomeres (which produce striations in skeletal and cardiac muscle), they do contain a great deal of actin and some myosin, they are a non-striated with involuntary contracted muscles. Furthermore, the Ca++ enters the cell from the extracellular space rather than the sarcoplasmic reticulum (which is poorly developed in smooth muscle) .There are small, cup-shaped indentations in the sarcolemma called **caveolae** that may play a role in sequestering calcium.

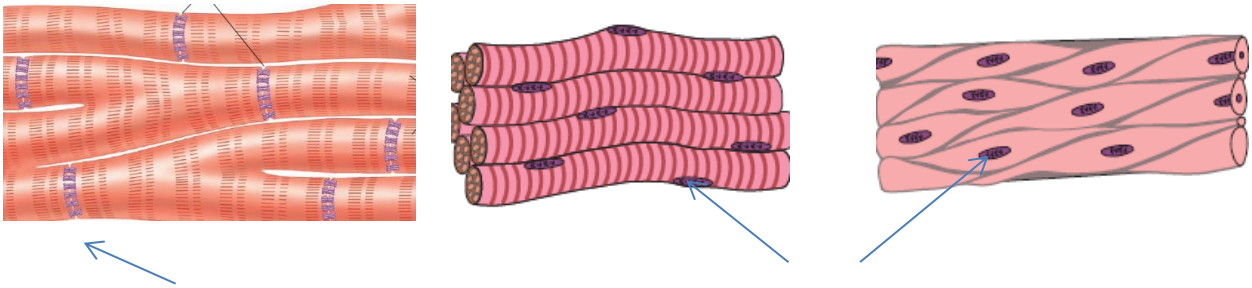
Cardiac Muscle

The **muscle of the heart** is similar to skeletal muscle in that it is striated and the fibers contain sarcomeres made up of arrays of actin and myosin filaments. However, cardiac muscle cells are much shorter than those of skeletal muscle and typically split into two or more branches, which join end to end with other cells at **intercalated disks** . A transverse tubule system is present in cardiac muscle, but the sarcoplasmic reticulum is not as highly developed as in skeletal muscle. Each cardiac muscle fiber does not receive direct innervation as skeletal muscle fibers do. Excitation spreads

from fiber to fiber via **gap junctions**. Contraction is also controlled by a system of **pacemaker nodes** and **Purkinje cells**.

SKELETAL MUSCLE

Skeletal muscle is invested by dense collagenous connective tissue known as the **epimysium**, which penetrates the substance of the gross muscle, separating it into fascicles. Each fascicle is surrounded by **perimysium**, a looser connective tissue. Finally, each individual muscle fiber within a fascicle is enveloped by fine reticular fibers, the **endomysium**. The vascular and nerve supplies of the muscle travel in these interrelated connective tissue compartments. There are three types of skeletal muscle fibers: **red, white**, and **intermediate** depending on their contraction velocities, mitochondrial content, and types of enzymes the cell contains .Each gross muscle, for example, biceps, usually possesses all three types of muscle cells. Each skeletal muscle fiber is roughly cylindrical in shape, possessing numerous elongated nuclei located at the periphery of the cell (not central nucleus), just deep to the sarcolemma. Longitudinally sectioned muscle fibers display intracellular contractile elements, which are the parallel arrays of longitudinally disposed **myofibrils**. This arrangement of myofibrils produces an overall effect of **cross-banding** of alternating light and dark bands traversing each skeletal muscle cell. The dark bands are **A bands**, and the light bands are **I bands**. Each I band is bisected by a thin dark **Z disc**, and the region of the myofibril extending from Z disc to Z disc, the **sarcomere**, is the contractile unit of skeletal muscle cell. The A band is bisected by a paler **H zone**, the center of which is marked by the dark **M disc**. During muscle contraction, the various transverse bands behave characteristically, in that the width of the A band remains constant, the two Z discs move closer to each other approaching the A band, and the I band and H zone become extinguished.



Intercalated disk nucleus