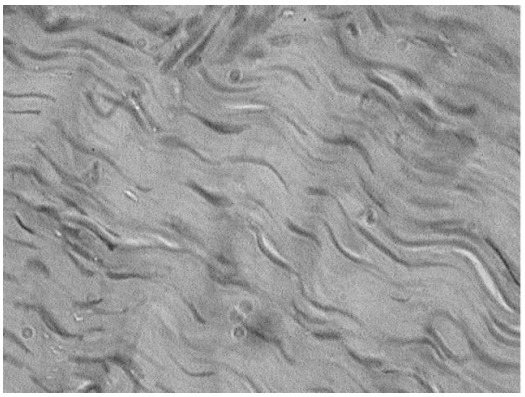
6
TISSUES OF THE MUSCULOSKELETAL SYSTEM

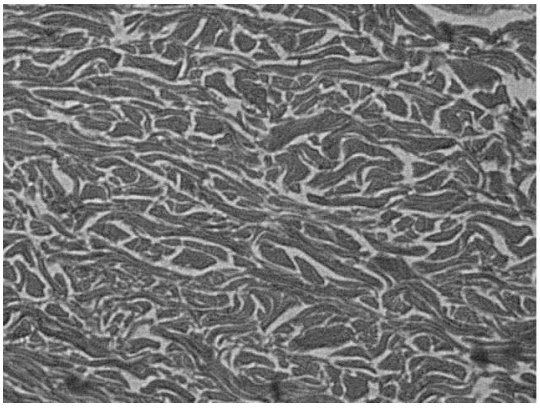
The Musculoskeletal system is composed of many tissues, some of which were covered in Skeletal tissue. Ligaments are the dense regular or irregular connective tissue which hold bones to bones or form capsules around joints. In muscles, the tendons are dense regular connective tissue which connects the muscle to the bones. Then, one must look at the striated skeletal muscle tissue which is in the contractile tissue family. The microstructure of both ligaments and tendons are produced by cells derived from the mesoderm called fibroblast and composed of mostly collagen. These tissues are poorly vascular which means that when injured, they have a hard time healing completely, if they ever do.

1. Redraw what is seen in Dense regular connective tissue slide labeling the fibers and cells that make the tissue.



2. What two places in the Musculoskeletal system composed of Dense regular connective tissue found?

3. Examine a slide of dense irregular connective tissue which is easiest to find in the dermis of skin. Draw and label the cells and fibers in the tissue.



Striated skeletal muscle, the main type of contractile tissue in the musculoskeletal system. Its appearance is dependent on its embryological development while its function is based on modification of the cell. It is vital to understand both gross and histological structure of skeletal muscles to understand how it functions.

In week four of development, as the sclerotome (sclera means hard, tome is layer so the hard layer) and dermatome (Derma is skin) finishes migrating to the area below the epidermis, the last part of the somite, called the myotome, grows ventrally to form the limb buds. These will become the skeletal muscle. The cells that develop will fuse to form long contractile fibers. As these develop, specific cytoskeleton proteins, mainly myosin and actin filaments form interlocking layers, and the cells fuse together making a multinucleated cell.

The muscle fibers are composed of many myofibrils units' structure which is called a sarcomere (sarco means flesh) from Z to Z. Z-disk is the portion of the sarcomere that holds the Actin and elastic filaments together without

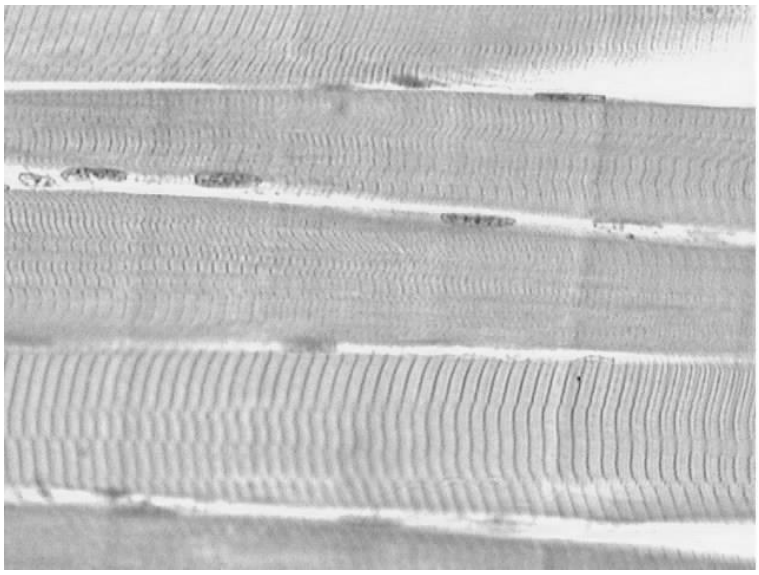
other proteins. I bands are the portions the sarcomere which contain the thin filaments (actin) and will shrink with contraction. A band contains both myosin and actin interlocking. M line holds only the myosin. The muscles fibers arrangement leads to the thin and thick filaments forming stripes within the tissue leading to its name, Striated.

Muscle fibrils are encircled by the Sarcoplasmic reticulum, an Endoplasmic reticulum modified to hold and release calcium (Ca). Inside these fibers, we find mitochondria intermixed, but the amount depends on if it is fast or slow twitch muscle. The Sarcoplasmic reticulum forms deep penetrating T tubules which allow for easier intercellular communication. This stored Calcium is needed for contractions, so it is released then actively pumped back into the SR via an ATPase. The entire unit is covered by a connective fiber sheath called the perimysium. Inside these structures, we find arteries, veins, and nerves that support and send messages to the Striated Skeletal muscle tissue.

The clinical significance of this is that sometimes muscles are subjected to trauma which leads to inflammation. As the muscle is covered by connective tissue, when it swells it can compress the arteries and the nerves starving the muscle and causing severe pain. This is known as Compartment syndrome which is treated based on severity. In minor cases, rest, icing, compression, and elevation (RICE) can be enough. Other times, when severe the outer layer of connective tissue is cut to relieve pressure. That surgery is called a fasciotomy.

Muscle attaches to bone via tendons. Surrounding some tendons are bursas which are sacs containing synovial fluid to lubricate and protect the tendon as it is moves. Sometimes, people get inflammation of the bursa called bursitis usually caused by overuse. Another condition occurs when the bursa balloons near a joint causing the formation of a ganglion cyst, once known as a "Bible Bump."

4. Draw what is seen in striated skeletal muscle slide and label the nucleus and sarcomeres.



5. Draw the divisions of muscle tissue. Start with the Epimysium, then show the Perimysium and Endomysium. Show and label the muscle fibers and myofibrils.

6. Define the following:
    a. Striated
    b. Myo
    c. Sarco
    d. Sclero
    e. Derma
    f. Tome
    g. Epi
    h. Peri
    i. Endo

7. What tissue makes the coverings of muscle?

8. Draw a sarcomere labeling the Z-disc, H-zone on top and the I band, A band, and M line on the bottom. Label the thin and thick filaments.

9. Where are the actin, myosin, and titin found?

There are two main types of striated skeletal muscle tissues. These are fast-twitch muscle and slow twitch. The fast twitch muscle is divided further into Slower fast-twitch and fast-fast twitch and intermediate fast twitch. The difference is in if they have high level of mitochondria and blood or lower levels. When there are high levels of mitochondria and blood supply the muscle tends to contract slowly but does not fatigue. The lower level of mitochondria causes the muscles to contract fast but is more likely to fatigue. Due to the nature of mitochondria type one fibers have more mitochondria than type two.

10. What is the difference in type I and Type II muscle fibers?

11. Draw a stick figure using I for the postural muscles and II for the legs and arms then explain what this tells you.