Muscular Tissue

Muscular Tissue: It is made up of thin and elongated cells called muscle fibers (length 1 - 40 mm and breadth 10-100 micron) and the muscle fibers are considered to be unit of muscle. It is mesodermal in origin (Exception: muscles of iris are ectodermal in origin) and its helps in movement of an organs or the body. The muscle is covered by connective tissue.

Sarcoplasm: The cytoplasm in the muscle fibers is called sarcoplasm. It contains a thread like substructure myofilaments which is mainly formed of the contractile protein Actin, Myosin and Tropomyosin.

Sarcolemma: - The muscle fiber surrounded by a membrane is called sarcolemma. It is having thickness about $75A^0$.

Sarcoplasmic reticulim: - A modified endoplasmic reticulum it is tubular ingrowths from the sarcolemma are called sarcoplasmic reticulum. It stores Ca^{2+} and help in conveying waves of depolarization from the sarcolemma to every sarcomere.

Characteristics of muscle:

- **Contractibility: -** During contract muscle cells able to shorten in length and in relax muscle cells become in normal position.
- **Extensibility: -** The muscle fibers stretches when pulled
- **Excitability: -** The muscle fibers respond to a stimulus delivered from a motor neuron or hormone

Types of Muscular Tissue:-

The muscular tissue is of three types:

1. Skeletal Muscle

2. Smooth Muscle

3. Cardiac muscle

<u>Skeletal Muscle</u>:

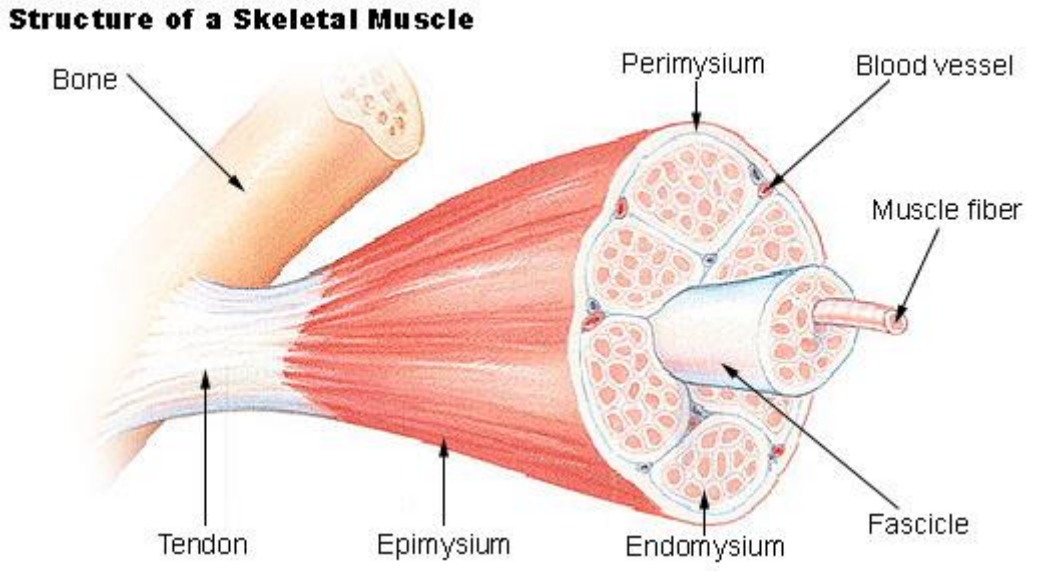
- Attached to bones & moves skeleton
- Cylindrical in shape
- Multinucleated
- Nucleus present at periphery

Ratnesh Kumar Choudhary

Associate Professor, Department of Veterinary Anatomy, Bihar Veterinary College, Patna

- Voluntary in nature
- Striations are present due to thick and thin filaments (contractile protein). Therefore also called striated muscle
- Locations- Limb, diaphragm, extrinsic eye muscles, muscles of mastication and facial expressions.

Structure of Skeletal Muscle:



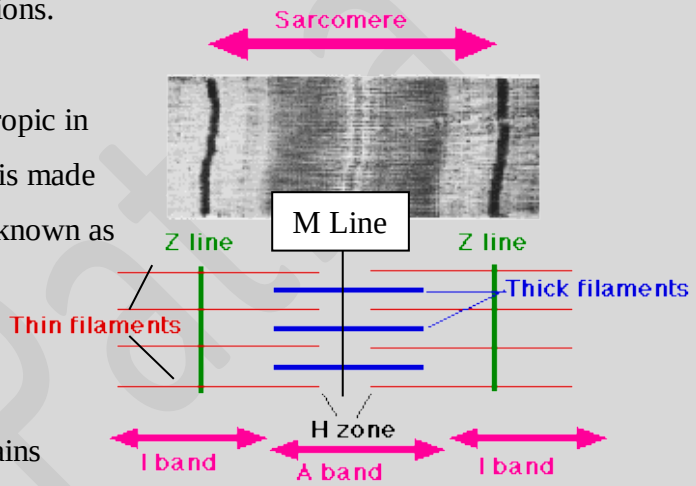
- Skeletal muscles are cylindrical in shape and consist of numerous muscle bundles called **fasciculus**. The muscle bundles (Fasciculus) surrounded by a connective tissue membrane called the **perimysium**. The entire muscle bundles covered by a connective tissue sheath called **epimysium**.
- Each muscle bundles (Fasciculus) is composed of numerous muscle fibers and the muscle fiber surrounded by connective tissue called the **endomysium**
- The muscle fibers consist of many **myofibrils** and these myofibrils are made up of long protein molecules called **myofilaments**.
- The myofilaments are two types thick and thin, the thick myofilaments made up of myosin protein and thin myofilaments made up of actin and tropomyosin proteins.

Ratnesh Kumar Choudhary

Associate Professor, Department of Veterinary Anatomy, Bihar Veterinary College, Patna

Myofibrils:

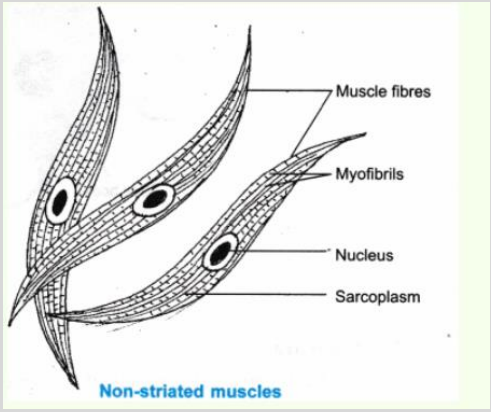
The **myofibrils** present along its length alternate dark and light band. The characteristic 'striations' of skeletal and cardiac muscle are readily observable by light microscopy as alternating light and dark bands on longitudinal sections.



The light band is made up of thin filaments and isotropic in nature known as the **I-band**, whereas the dark band is made up of thick and thin filaments, anisotropic in nature known as the **A-band**. The **Z-line** or **Z- disc** bisects the thin myofilaments and the area between two adjacent Z lines is called **sarcomere**. The sarcomeres are considered to be functional unit of a myofibril, contains one A band and one half of two I bands.

A band that contains the **M line** and only the thick myofilament is called the **H band**.

Smooth Muscle:



- Smooth muscle form the wall of hollow organs (viscera of the gastrointestinal tract, Urogenital tract, Blood vessels etc.) therefore called **visceral muscles**. In these muscle striations are absent and hence has a smooth appearance.
- In smooth muscle parallel thin filaments are abundant but thick filaments are rare and usually absent.
- The smooth muscle fibers may be arranged longitudinal, circular, spiral or irregular according to the function of viscera.
- These muscle fibres are elongated and fusiform in shape (Both the ends are tapering and central portion is wide). The muscle fibers are uninucleated and centrally placed.

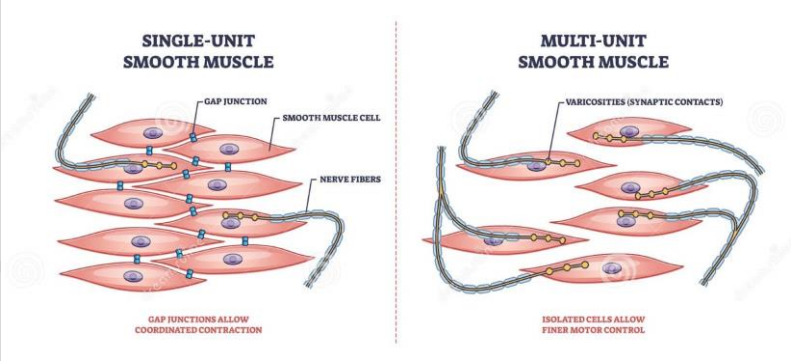
Ratnesh Kumar Choudhary

Associate Professor, Department of Veterinary Anatomy, Bihar Veterinary College, Patna

- Involuntary in nature.
- Sarcomere is absent

Smooth muscles are two types:

I. Single unit
II. Multiunit



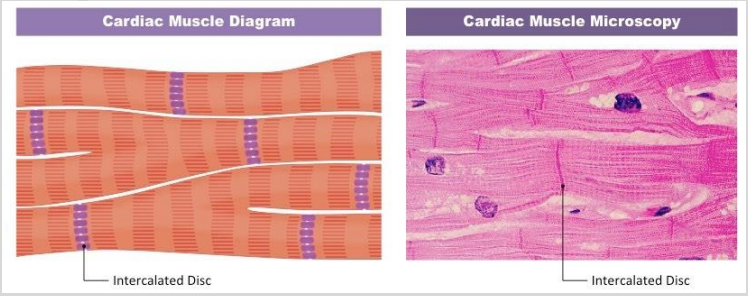
Single unit:

- Gap junctions are present
- The muscle fibers are contracting as a single unit
- Present in visceral organs

Multiunit:

- Gap junctions are absent
- All muscle fibers contract separately
- Present in Blood vessels and Arrector pilli (hair follicle)

Cardiac muscles are:



- Present in heart
- Cylindrical in shape
- Uninucleated
- Striations are present
- Sarcomeres are present
- Involuntary in nature
- Autorhythemic (self excitable)
- They can generate their own action potential.
- Mitochondria, Myoglobin, Glycogen and Blood supply more in cardiac muscle.
- Not get fatigue
- Intercalated discs join the ends of adjacent cardiac muscle cells which are composed of gap junction and desmosome.
- The cardiac muscle is branched

Ratnesh Kumar Choudhary

Associate Professor, Department of Veterinary Anatomy, Bihar Veterinary College, Patna