

## Muscular System

### Functions

- Movement
- Posture and joint stability
- Communication
- Control of body passages
- Heat generation

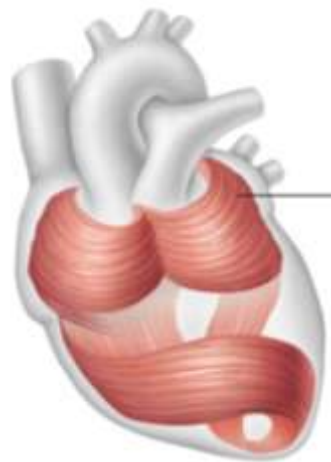


## Skeletal Muscle

- Attached to bone
- Fibers (Cells)
  - Single, very long, multinucleate
  - Obvious striations
- Voluntary control
  - Via nervous system
- Speed of contraction: Slow → fast
  - Contracts with great force but tires easily

## Cardiac Muscle

- Walls of the heart
- Fibers
  - Branching chains of cells, joined by intercalated disks
  - Uninucleate
  - Striated
  - Arranged in spirals or figure 8 bundles





## Cardiac Muscle

- Involuntary control
  - Heart pacemaker (sinoatrial node)
  - Nervous system
  - Hormones
- Speed of contraction: slow
- Rhythmic contraction



## Smooth Muscle

- Walls of hollow visceral organs
  - Stomach, bladder, arteries
- Fibers
  - Single, spindle-shaped, uninucleate
  - No visible striations
  - Arranged in sheets or layers

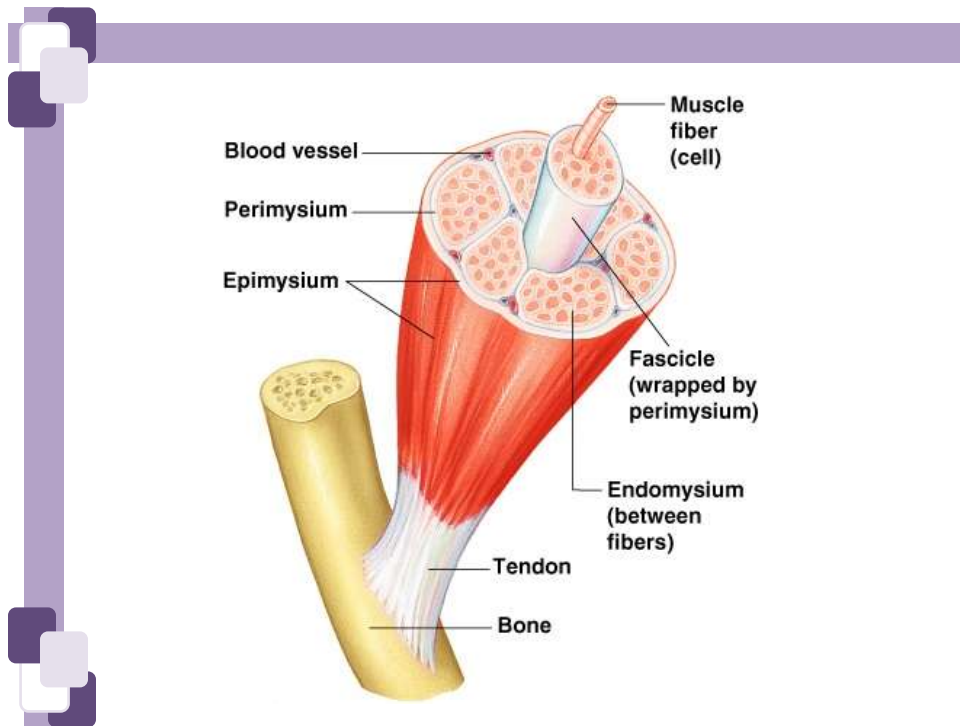


## Smooth Muscle

- Involuntary control
  - Nervous system
  - Hormones
  - Chemicals
  - Mechanical (stretch)
- Speed of contraction: Very slow
- Rhythmic contraction (in some cases)



## Muscle Anatomy

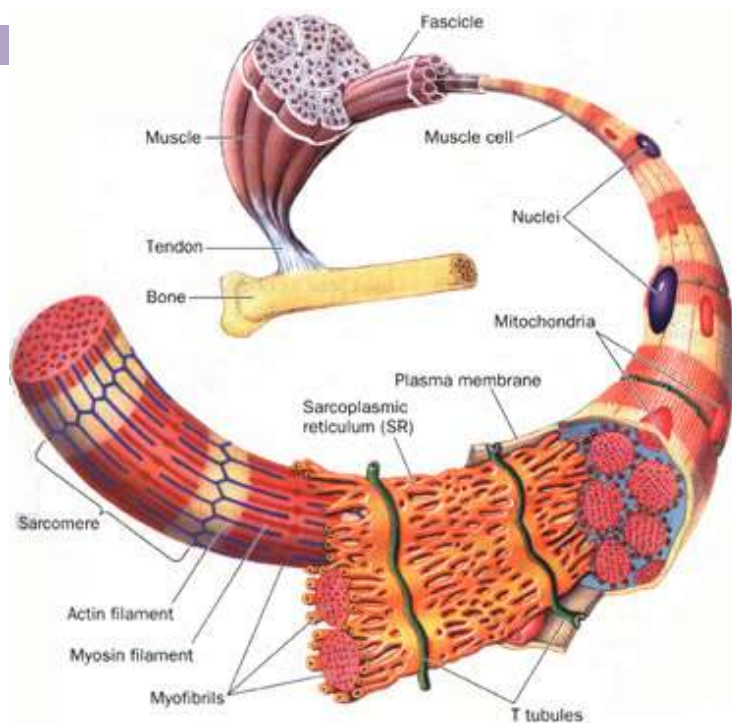


## Connective tissue sheaths

- Endomysium
  - fine sheath surrounds each muscle fiber
- Perimysium
  - bundles groups of muscle fibers into fascicles
- Epimysium
  - Bundles fascicles into muscle
  - blends into fascia
- all sheaths continuous w/ each other and w/ tendons

## Connective tissue sheaths

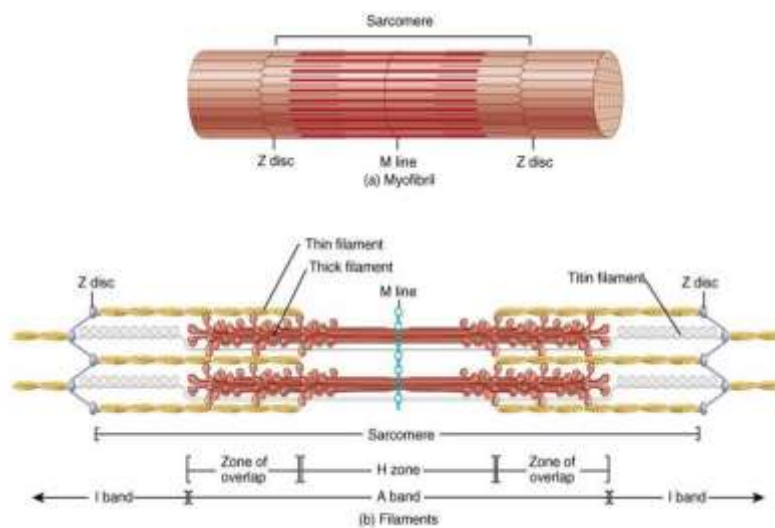
- attachments
  - direct or indirect
    - direct – epimysium fused w/ periosteum or perichondrium
    - indirect – epimysium joins tendon or aponeurosis, or collagen fibers of dermis
  - origins and insertions



## Muscle Fiber Anatomy

- Sarcolemma = plasma membrane
- Transverse (T) tubules = inward folds in sarcolemma
- Fibers packed with myofibrils
- Myofibrils composed of sarcomeres
- Sarcomere = contractile unit

## Sarcomere



## Sarcomere

- I band:
  - Light band
  - Thin filaments only
- A band:
  - Dark band
  - Thick and thin filaments
- H zone:
  - Central region of A band
  - Thick filaments only
- Z Disc:
  - Dark, midline of I band
  - Protein discs
  - Anchorage for thin filaments
- M line:
  - Protein fibers
  - connect neighboring thick filaments

## Sarcoplasmic reticulum

- Specialized smooth ER
- Surrounds each myofibril
- Stores  $\text{Ca}^{2+}$
- Releases  $\text{Ca}^{2+}$  on demand