

# The Heart: Structure and Function

## Endocardium

Inner lining with **simple squamous** endothelium joined by tight and gap junctions, plus subendothelial connective tissue.

## Myocardium

Network of cardiac muscle fibers, **thinner** in atria than ventricles, with **rich capillary network** between fibers.

## Epicardium

Visceral layer of pericardium (serous membrane) covering outer surface, resting on loose connective tissue with **fat cells and coronary vessels**.

## Cardiac Muscle Structure

### Intercalated Discs

Specialized stepwise junctions at Z lines connecting adjacent cardiomyocytes:

- **Transverse portion:** Fascia and macula adherens for strong adhesion
- **Longitudinal portion:** Gap junctions for rapid excitation spread

### Cellular Features

- Cylindrical cells that branch and anastomose
- One or two centrally located, oval, pale nuclei
- Faint transverse striations
- Numerous large mitochondria with more cristae
- Glycogen granules and lipofuscin pigments

## Types of Cardiomyocytes Comparison

| Type            | Structure  | Function   | Location                        |
|-----------------|--|--|---------------------------------|
| Contractile     | Standard myofibrils, intercalated discs  | Muscle contraction   | Atria and ventricles            |
| Endocrine       | Fewer myofibrils, secretory granules   | Secrete atrial natriuretic factor for blood pressure control | Atria (especially right)        |
| Nodal Cells     | Smaller, fewer myofibrils, lack typical intercalated discs                     | Initiate depolarization                                      | SA node, AV node, bundle of His |
| Purkinje Fibers | Larger, binucleated, peripheral myofibrils, pale cytoplasm, many gap junctions | Propagate impulses rapidly                                   | Subendocardial ventricles       |

### T-Tubules

Large inward extensions at Z line providing surface area for metabolite exchange and excitation-contraction coupling.

### Sarcomere Contraction

Actin glides over myosin, shortening sarcomere and I-band while A-band remains constant. H-zone disappears.

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### Sarcoplasmic Reticulum

Less organized than skeletal muscle, with scattered expansions forming **diads** with T-tubules for calcium release.

**Key Clinical Point:** Cardiac muscle fibers **cannot regenerate** because they are static cells that cannot divide by mitosis and lack satellite cells. Injured fibers are replaced by fibrous tissue. The heart responds to increased demands through compensatory hypertrophy.

