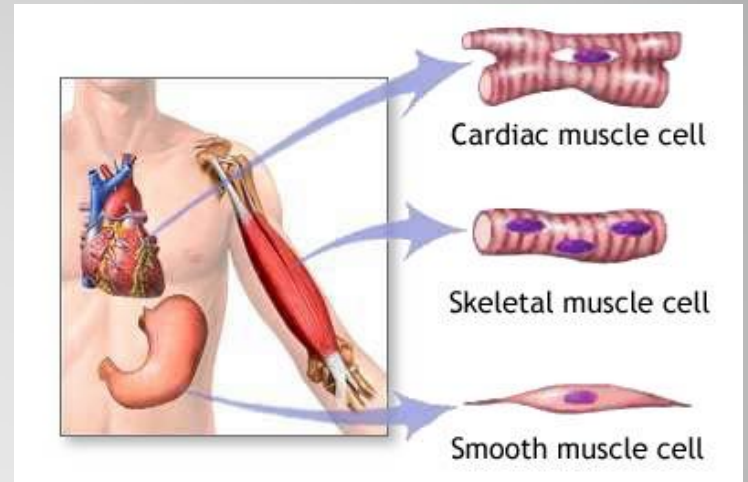


**Muscle**

- Consists of specialized cells that contract when stimulated
  - Originates from mesenchyme.
  - Provided with well developed vascular supply and nerve network.
- Tissue Types:
  - Skeletal, striated = voluntary.
  - Smooth, visceral = involuntary.
  - Cardiac, striated = mostly involuntary.



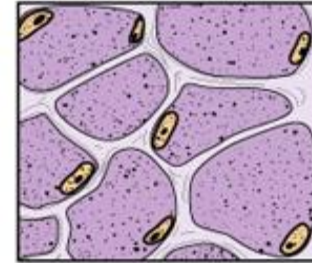
# Muscle Tissue

## Muscle types

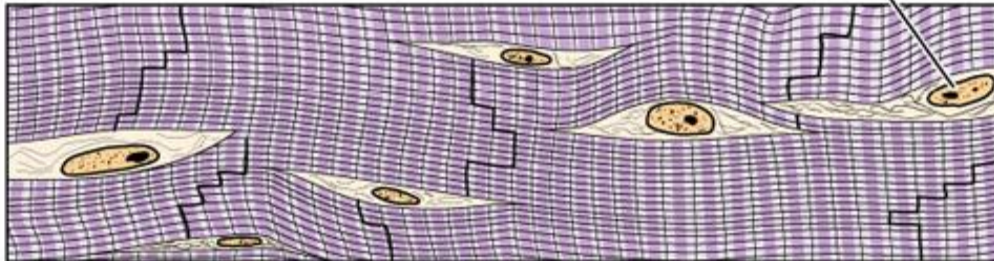
### Skeletal muscle



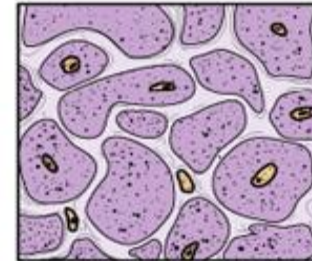
### Cross sections



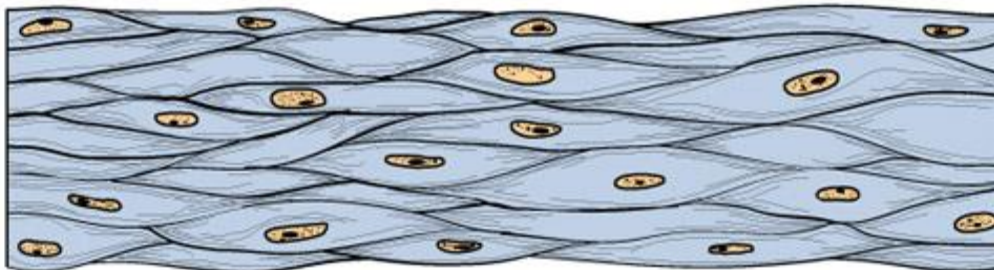
### Cardiac muscle



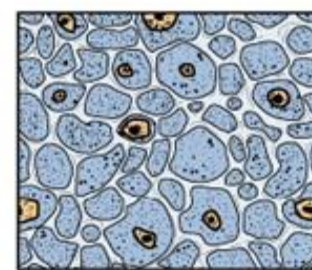
Nuclei



### Smooth muscle



Intercalated disks



## Activity

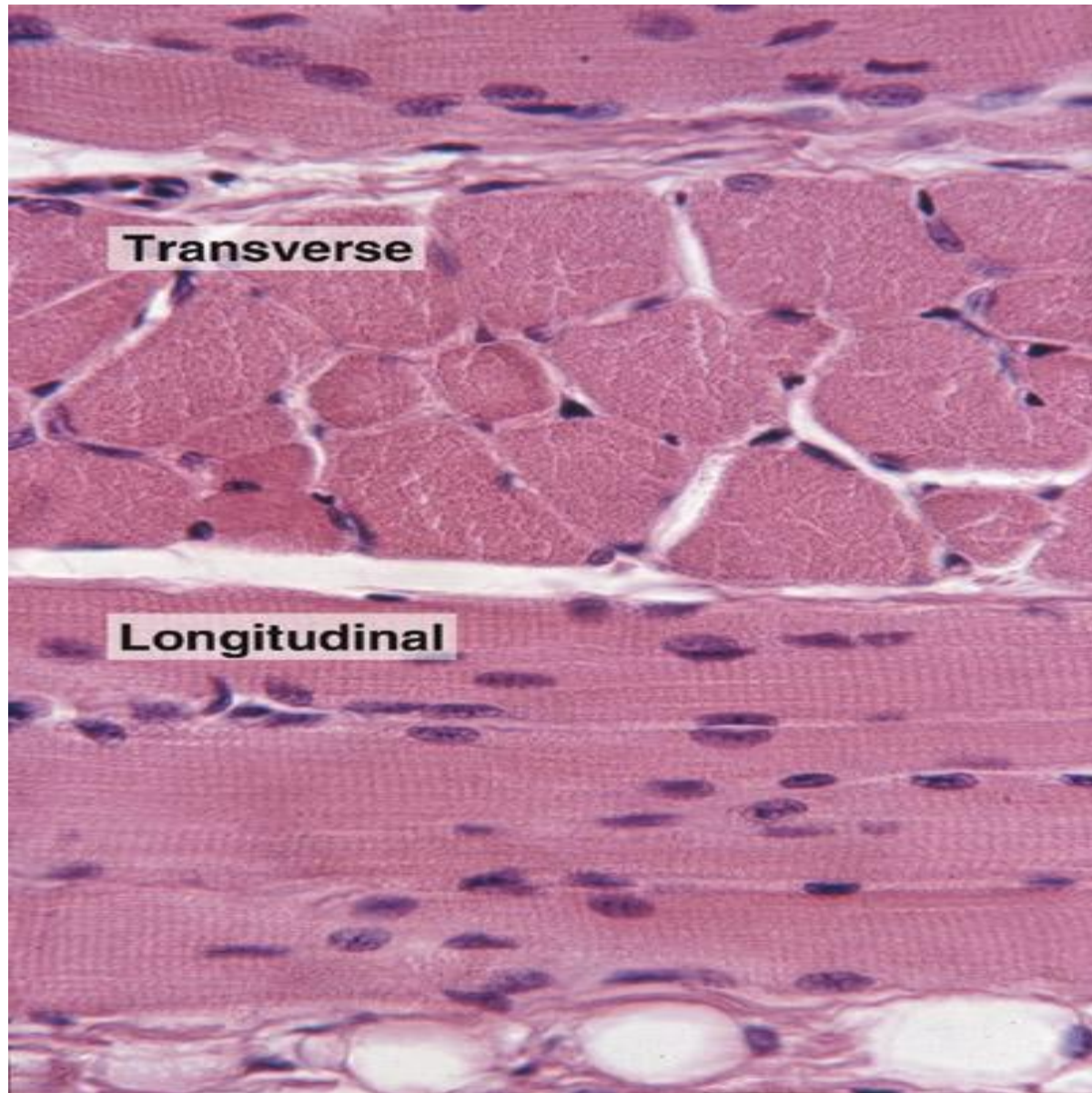
Strong, quick  
discontinuous  
voluntary  
contraction

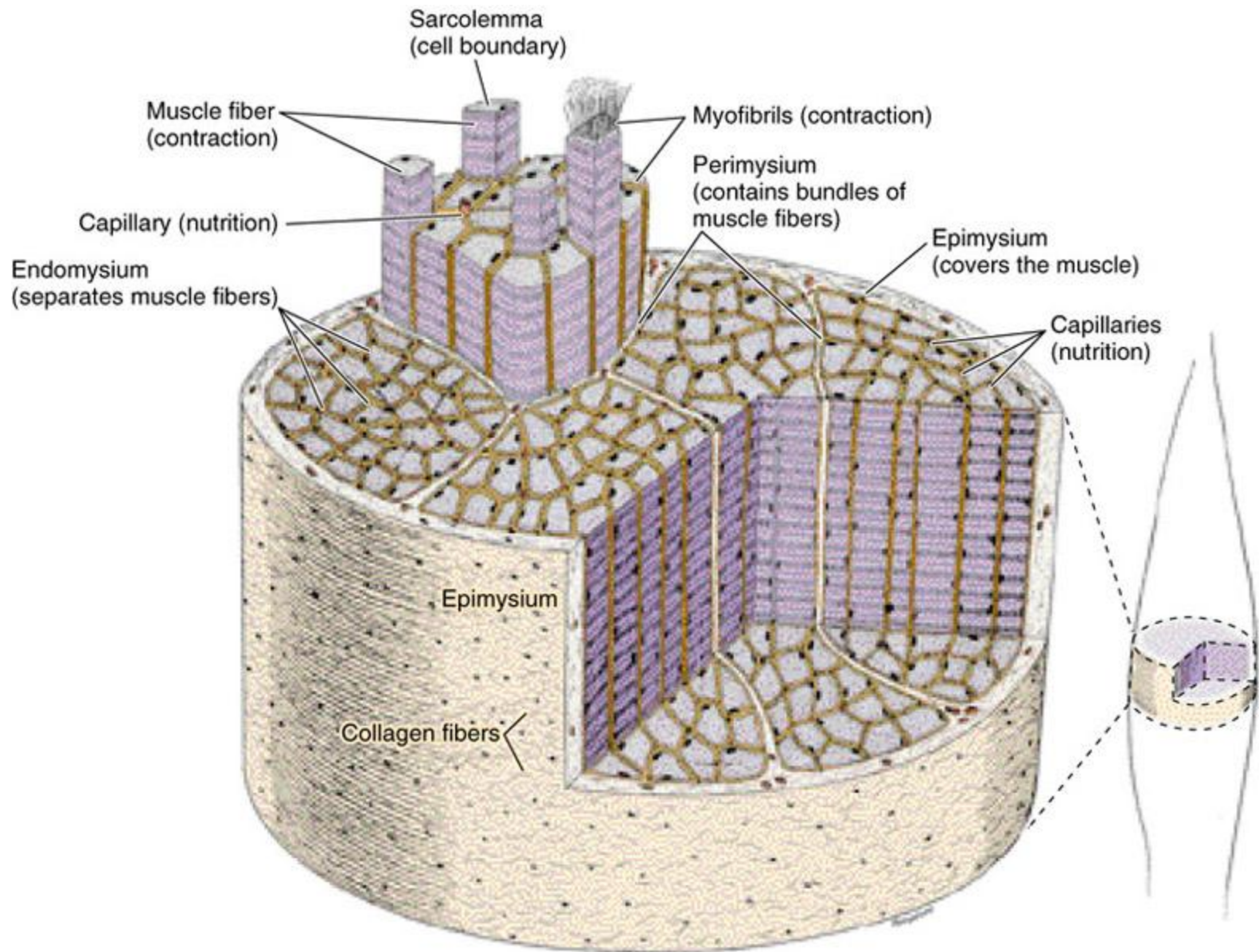
Strong, quick  
continuous  
involuntary  
contraction

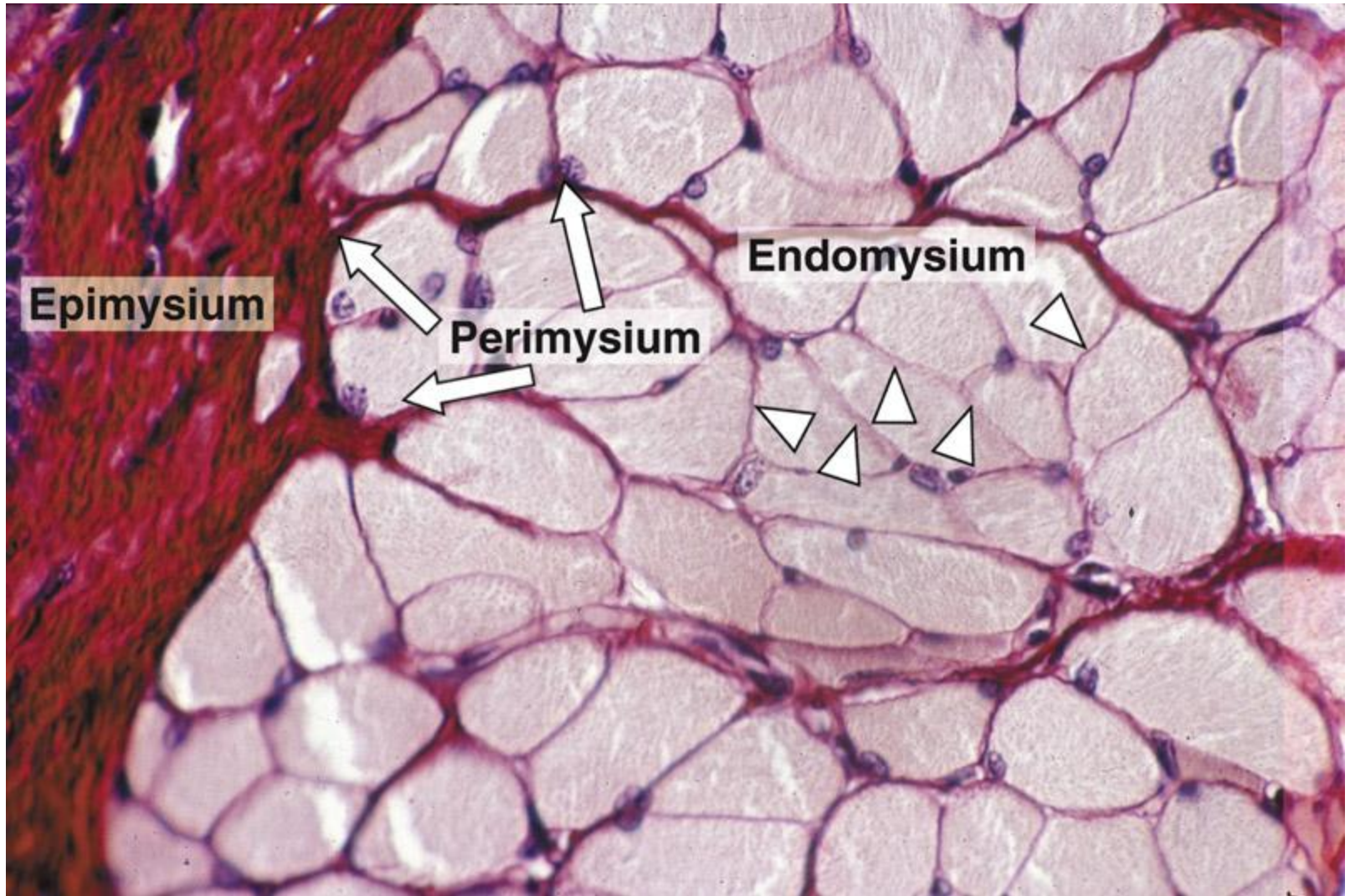
Weak, slow  
involuntary  
contraction

- Skeletal Muscle - forms 40% of total body weight.
- Cells form long fibers to 100 mm (4 in.)
- Cells are unique - formed from a syncytium, many cells fused together for more efficient function;
- Multinucleate, 3-5 nuclei/mm length; nuclei always at periphery of cell.
- very well organized; ensheathed by loose Connective Tissue (endomysium; perimysium; epimysium).

## Skeletal Muscle

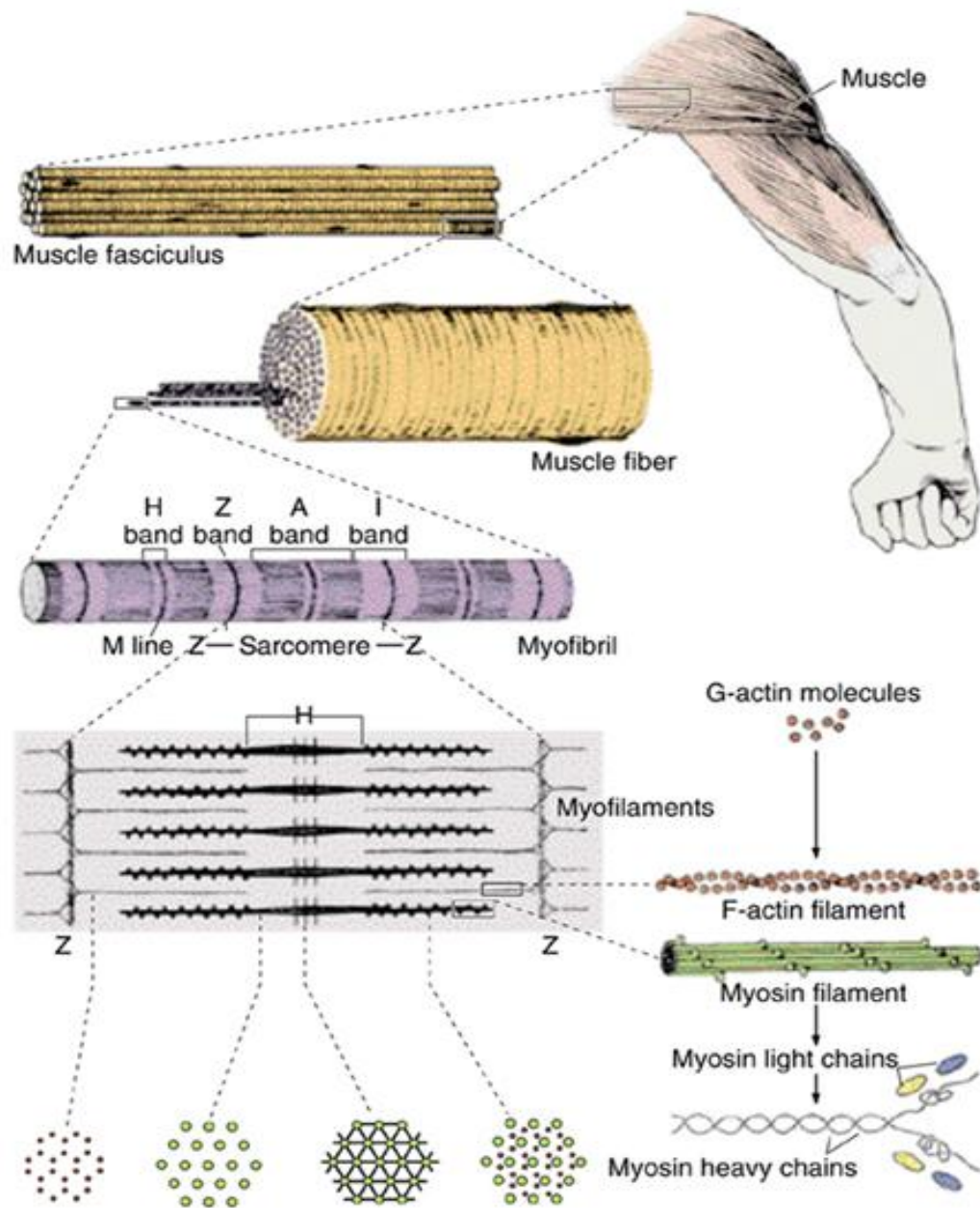






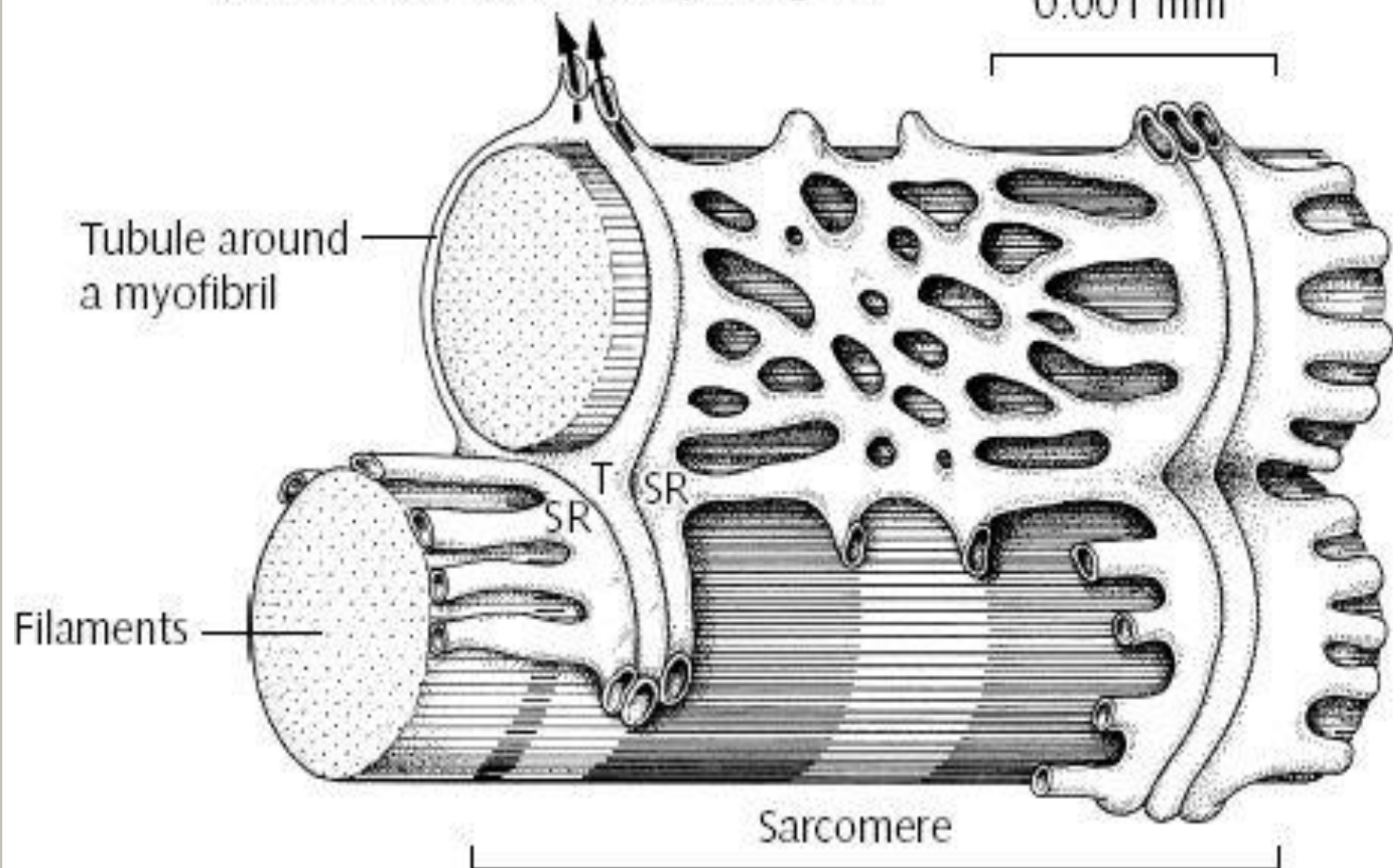
- Cells organized into contractile units = Sarcomeres.
- Sarcomeres are connected end to end = Myofibril  
Many myofibrils then make up a cell.
- Sarcomere - the basic functional contractile unit;
- Organization of myofilaments, thin (actin) and thick (myosin) ,
- SR = Sarcoplasmic Reticulum
- Triads (t-tubule + 2 cisternae) at A-I Junction

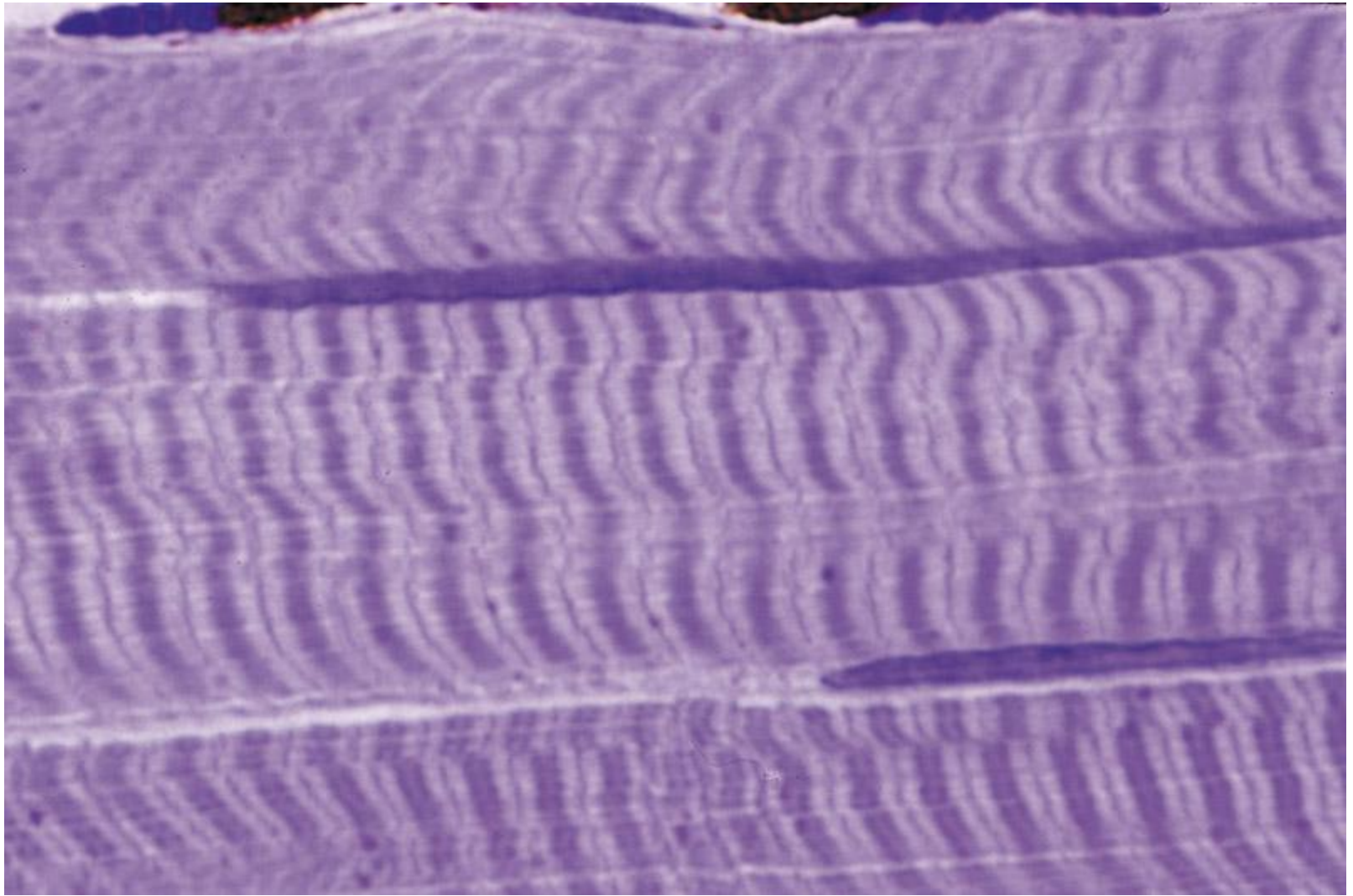
## Skeletal Muscle

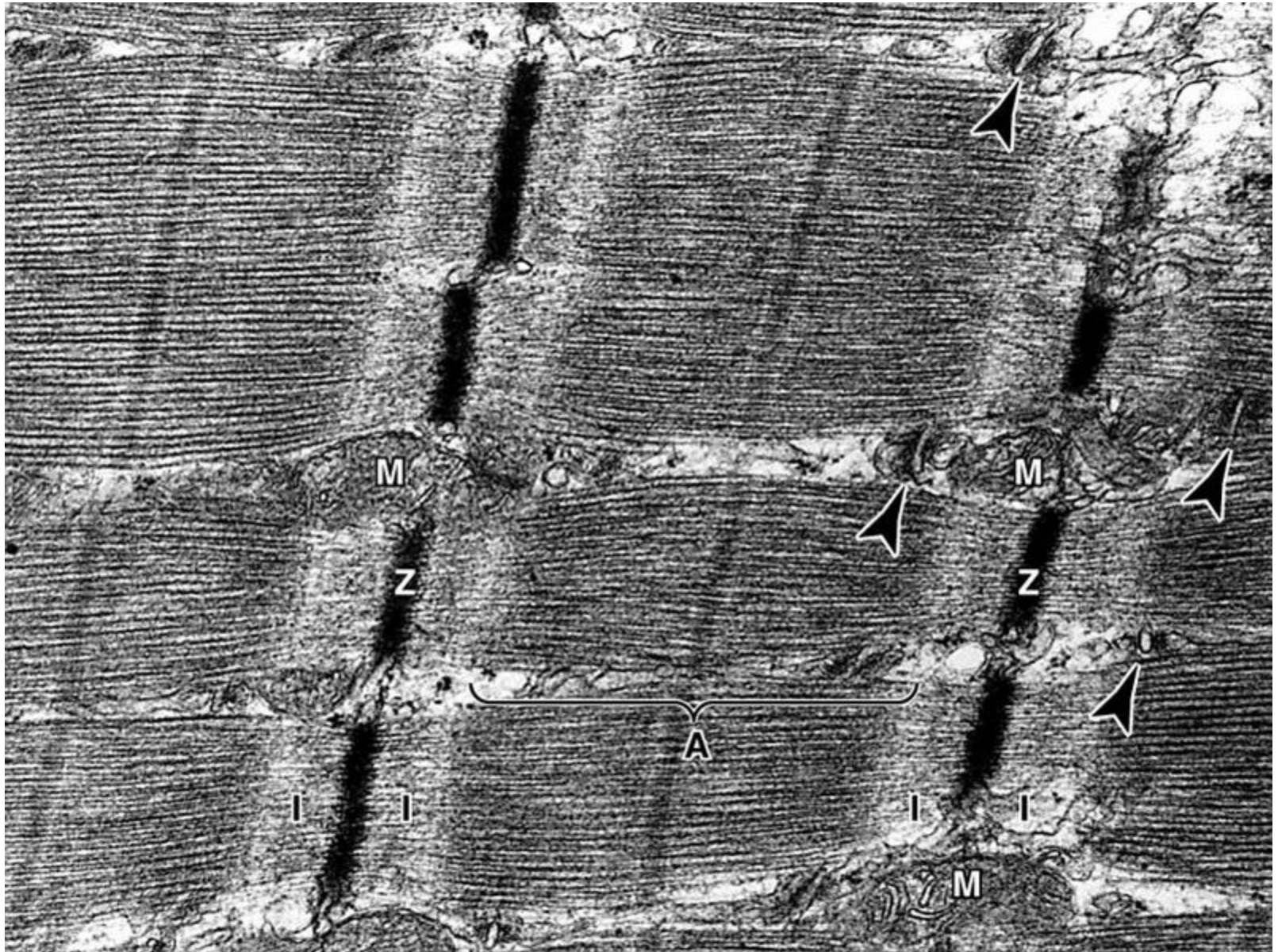


To surface of fibre    To adjoining SR

0.001 mm

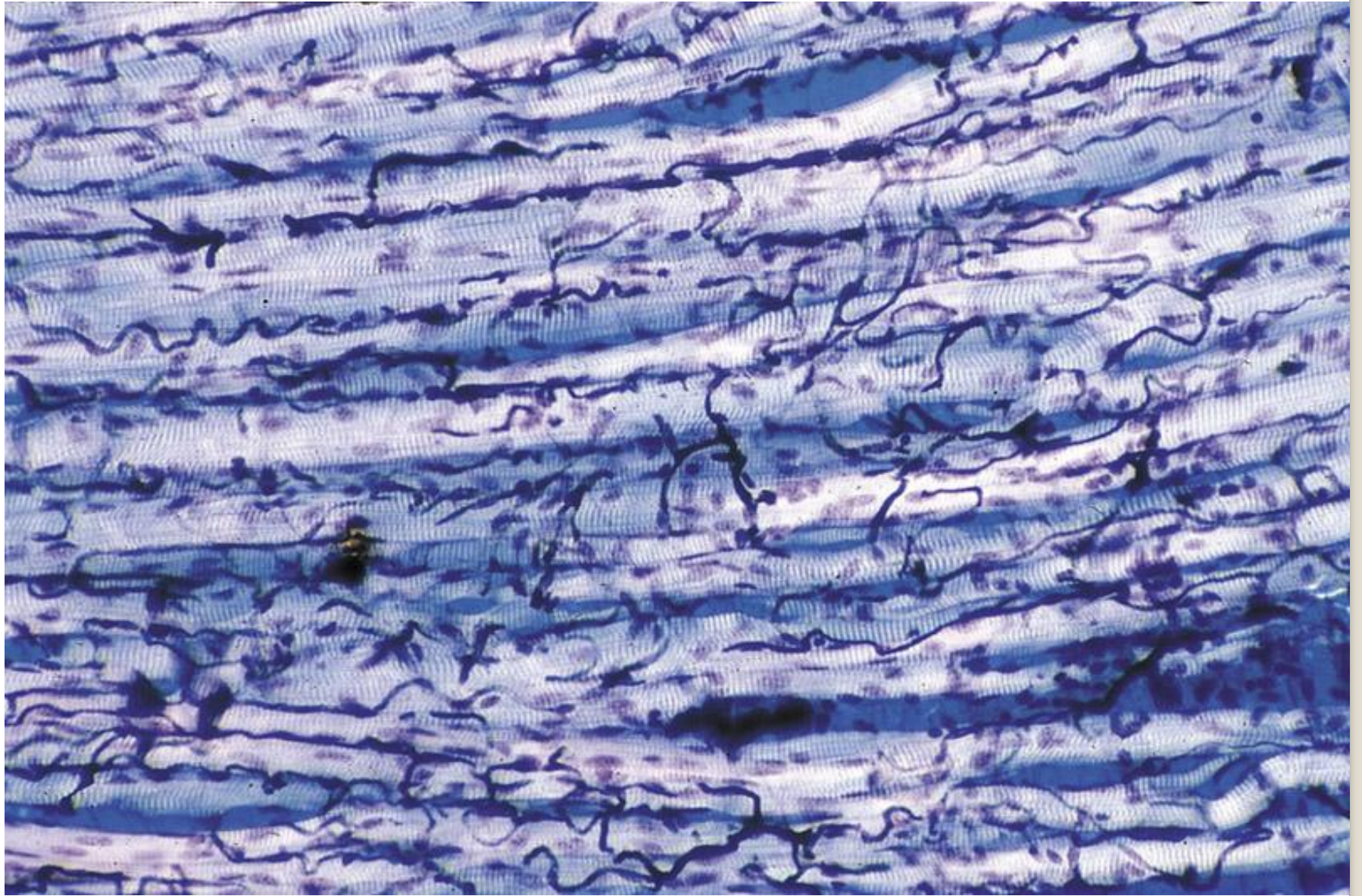


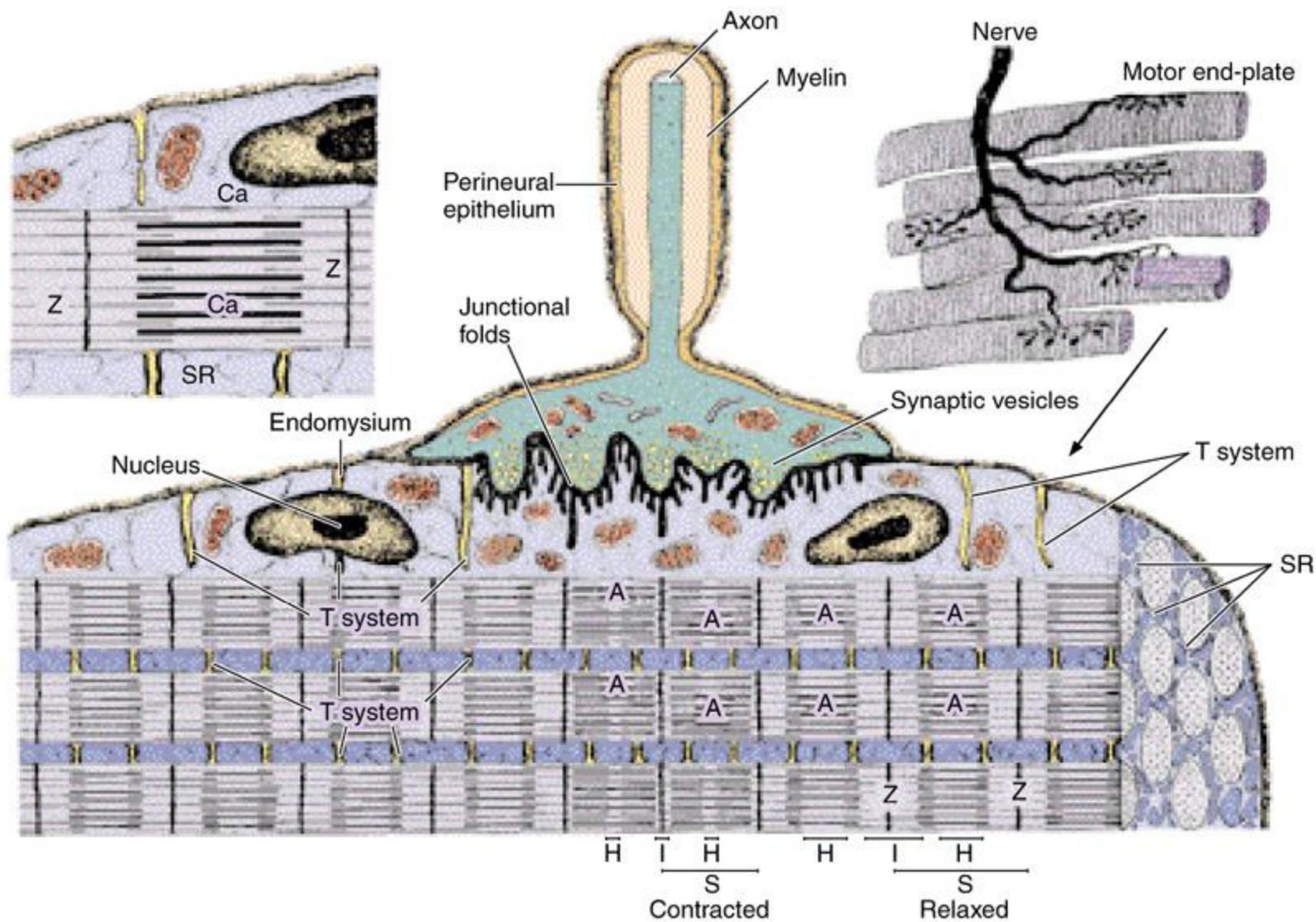




- Skeletal muscle cells exhibit no cell division ( = hyperplasia) following birth; Satellite cells = injury repair when membrane is intact.
- Cell protoplasm growth = hypertrophy.
- Red Fibers - fatigue resistant;  
White Fibers – fatigue quickly
- Highly vascular and innervated tissue.

## Skeletal Muscle





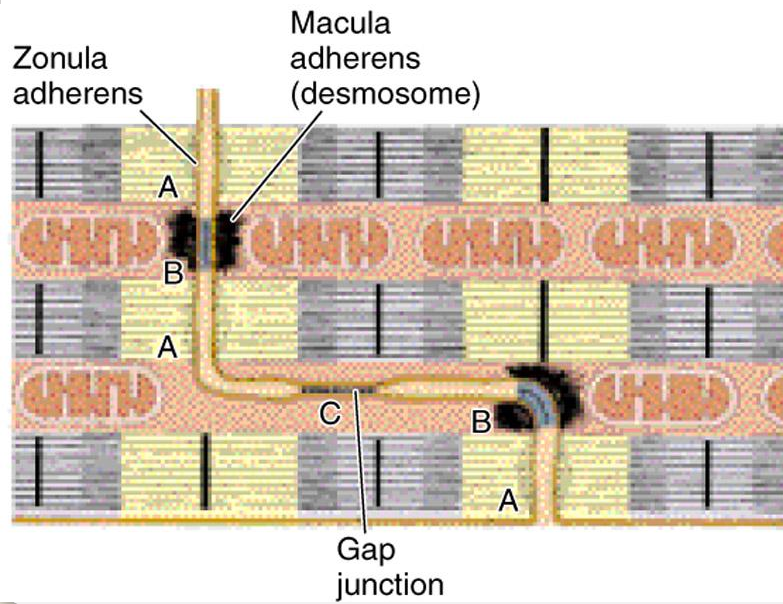
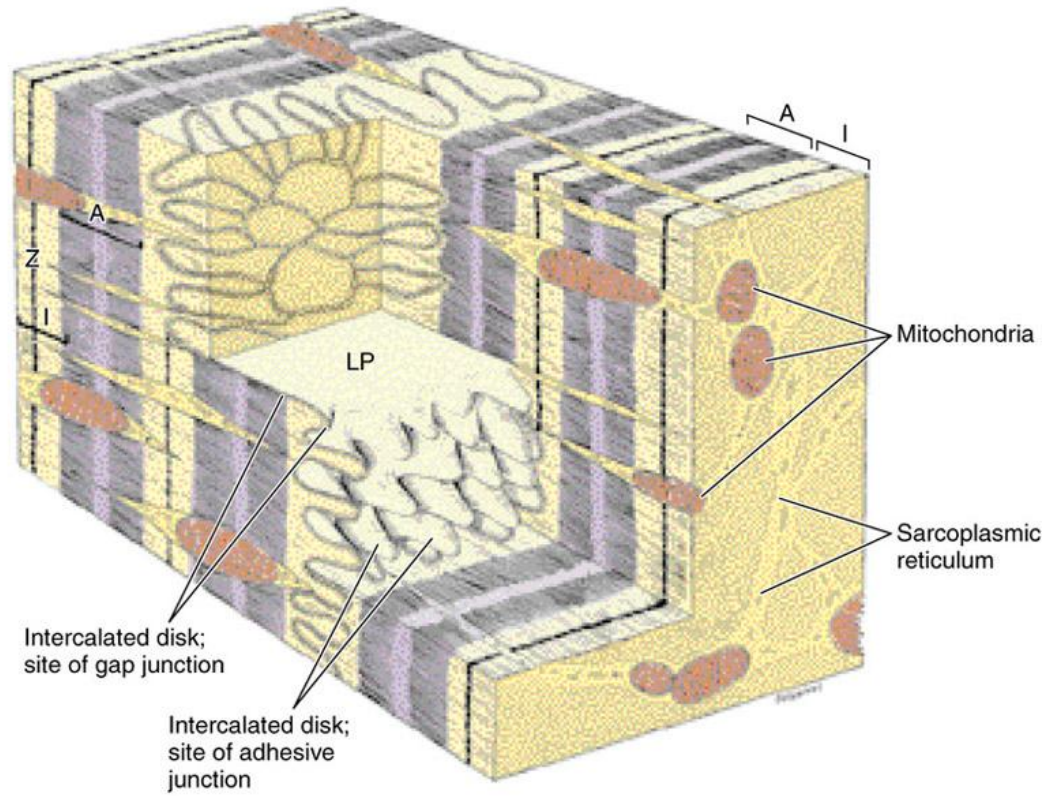
Cells branch, anastomose; 85-100  $\mu\text{m}$  long;  
sarcomeres with striations;

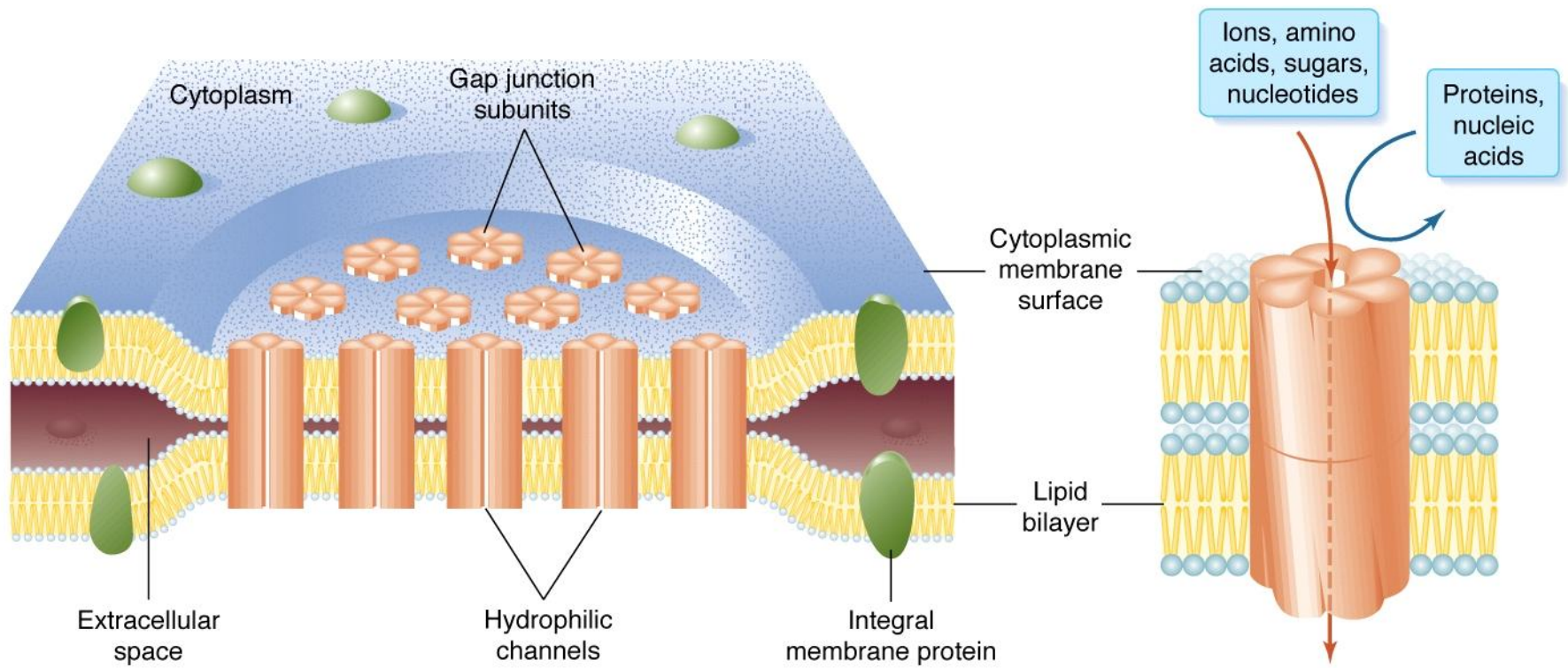
1 or 2 nuclei per cell; diads (t-tubule and one cisterna) at Z lines; nuclei in center of cell;

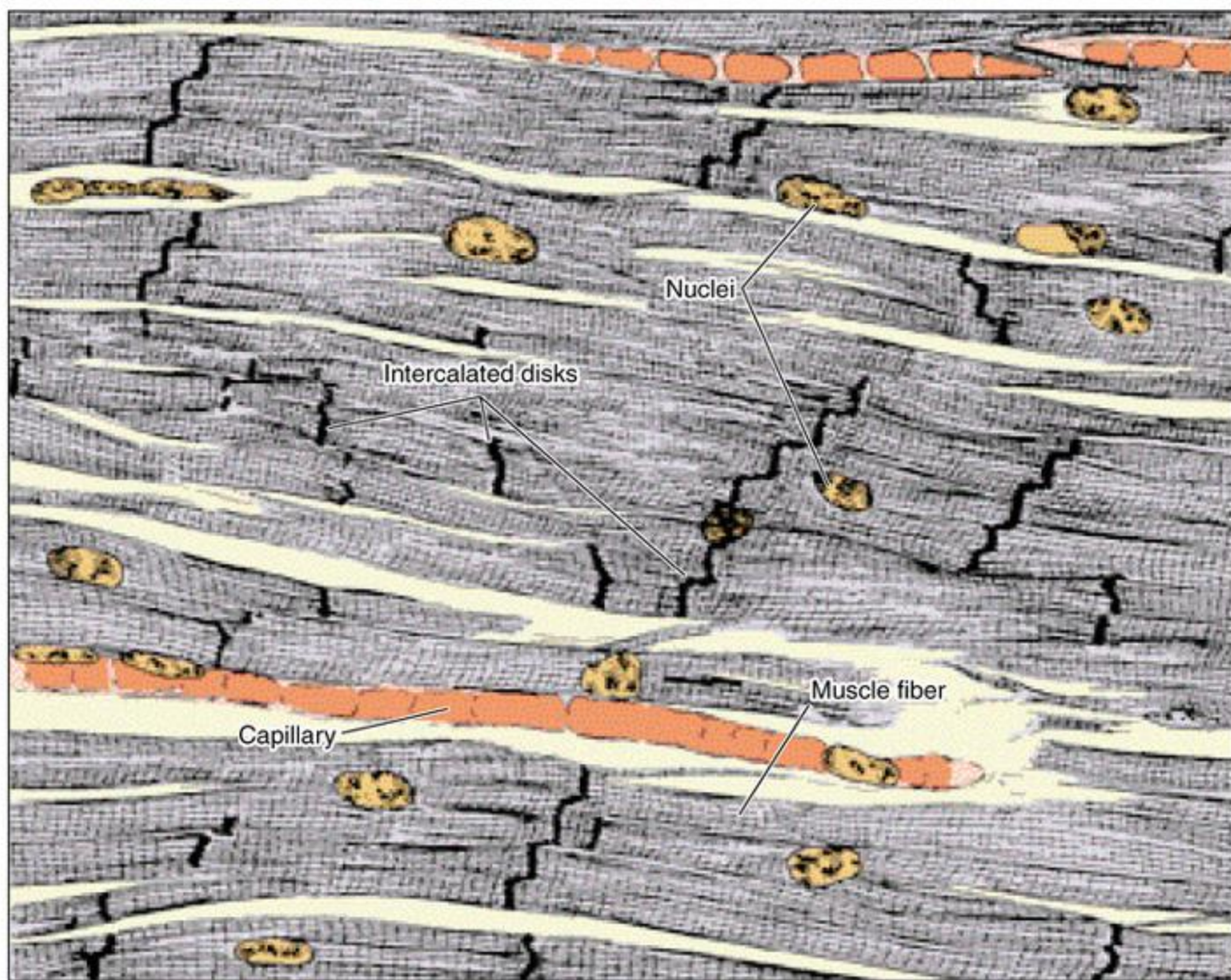
Cell membranes interdigitate with each other  
= intercalated discs

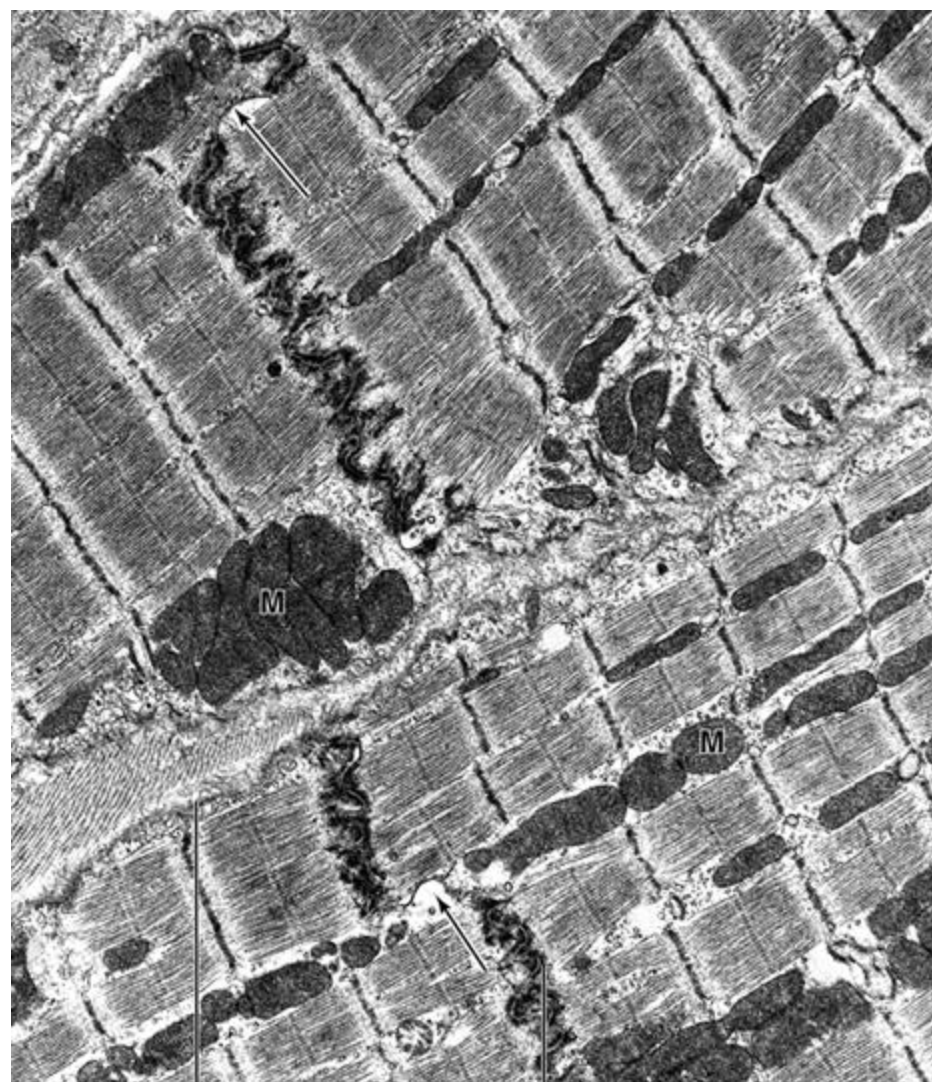
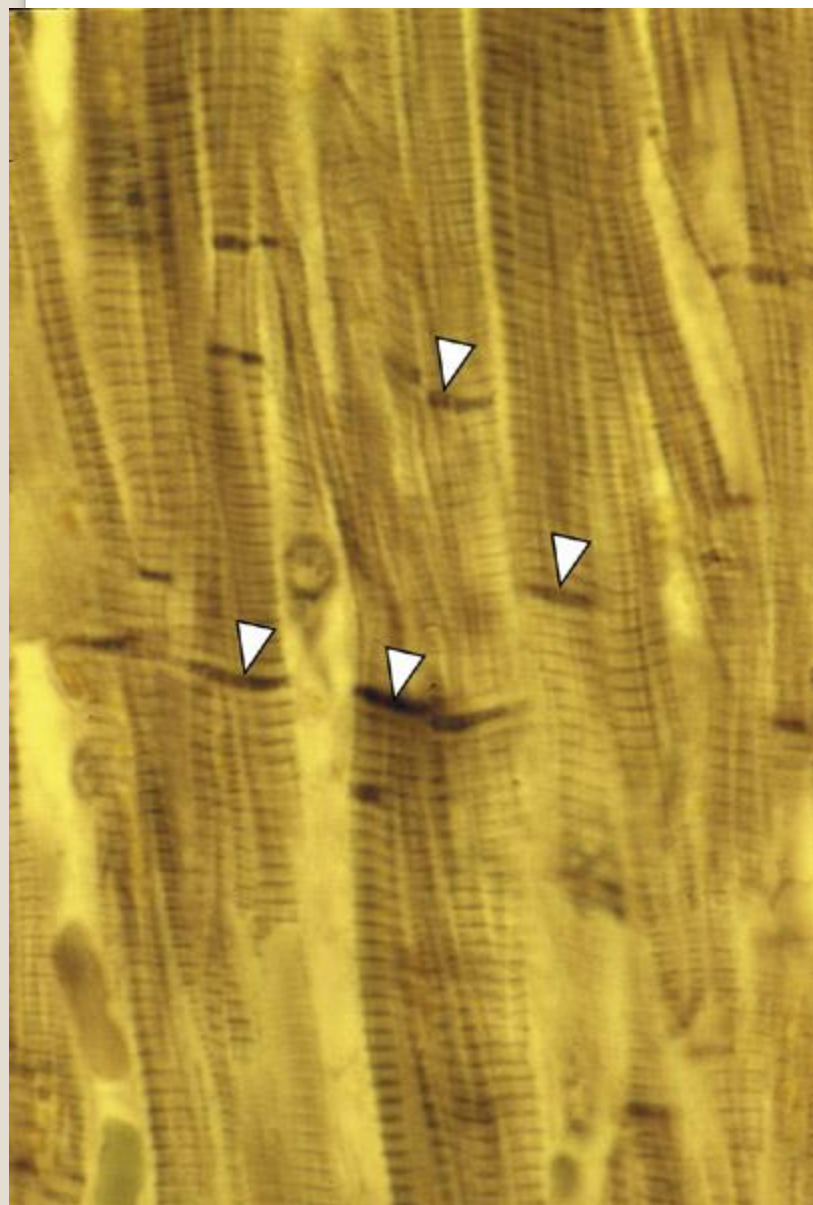
Rich with mitochondria (up to 40% of volume)

## Cardiac Muscle









Fibrils of  
reticular  
fibers

Intercalated  
disk

- Forms broad, thin sheets of muscle in layers around organs; e.g. GI tract.
- Individual spindle (fusiform) shaped cells are small (20 - 500  $\mu\text{m}$ ) loosely packed, have one cigar shaped nucleus in the center of the cell;
- Actin and myosin myofilaments are unorganized; there are no striations or sarcomeres.
- Capable of hyperplasia (e.g. uterus in pregnancy)
- The tissue is poorly innervated

## Smooth Muscle

