

Histology  
肌肉組織  
Muscle Tissue  
**Muscular Tissue**

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# 肌肉組織

- 肌肉組織 主要是由 肌肉細胞(muscle cells)所組成的，其實在肌肉細胞 旁常伴隨著 豐富的 微血管、結締組織和神經。
- 肌肉組織 是一種 有能力收縮的 組織。
- 在人體軀幹四肢 的體壁上長有 幾百塊的 骨骼肌，各塊肌肉都取了醫學名詞，短的約幾公分長，長的也會大到幾十公分長。
- 內臟如心臟 富含 心肌組織，其他內臟如 腸道、泌尿道、呼吸道、生殖道 和血管壁 都含有豐富的 平滑肌組織。

# Function of Muscle cells

- The dominant function of muscle cells is to generate force through contraction.
- In these specialized contractile cells, movement is generated by interaction of the proteins actin and myosin (contractile proteins).

# Contractile Units

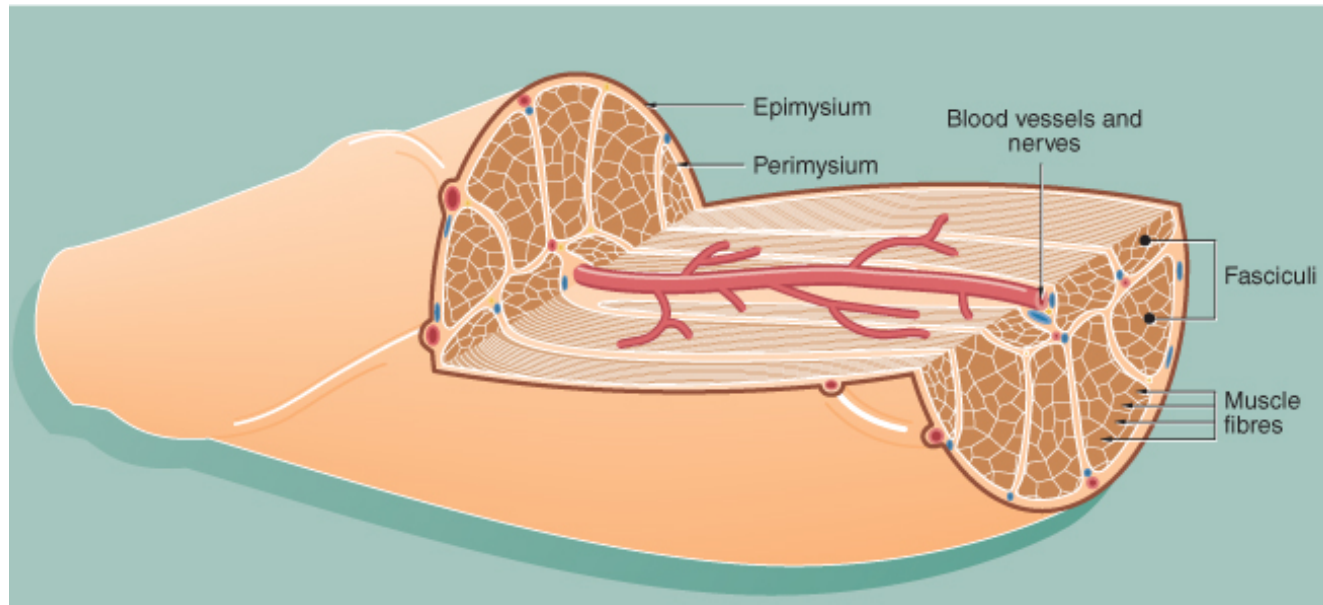
- **Single-cell contractile units 單細胞收縮單位**
  - Myoepithelial cells
  - Pericytes
  - Myofibroblasts
- **Multicellular contractile units 多細胞收縮單位**
  - Skeletal muscle
  - Smooth muscle
  - Cardiac muscle

# Skeletal Muscle and Connective Tissue

The whole muscle mass is invested in a dense collagenous sheath called the epimysium (肌外衣).

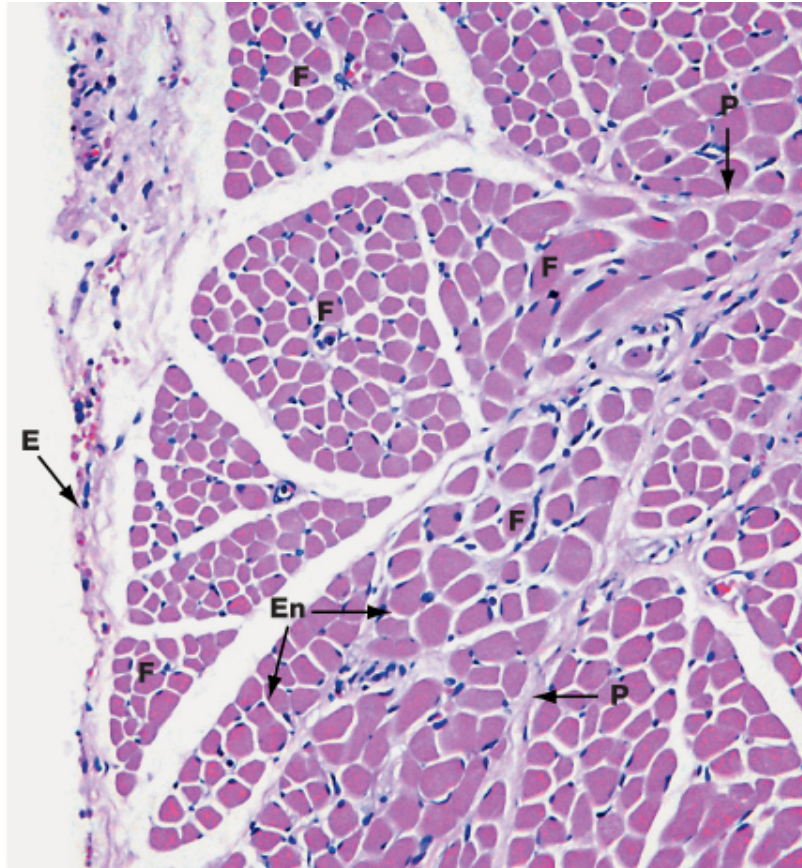
The individual muscle cells are grouped together into elongated bundles called fasciculi or fascicles with delicate supporting tissue called endomysium (肌內衣) occupying the spaces between individual muscle fibers.

Each muscle fascicle (bundle of muscle fibers 肌束) is surrounded by loose collagenous tissue called perimysium (肌束衣). Most muscles are made up of many fascicles.



# HE stained Cross Section of Skeletal Muscle

E,  
Epimysium  
肌外衣

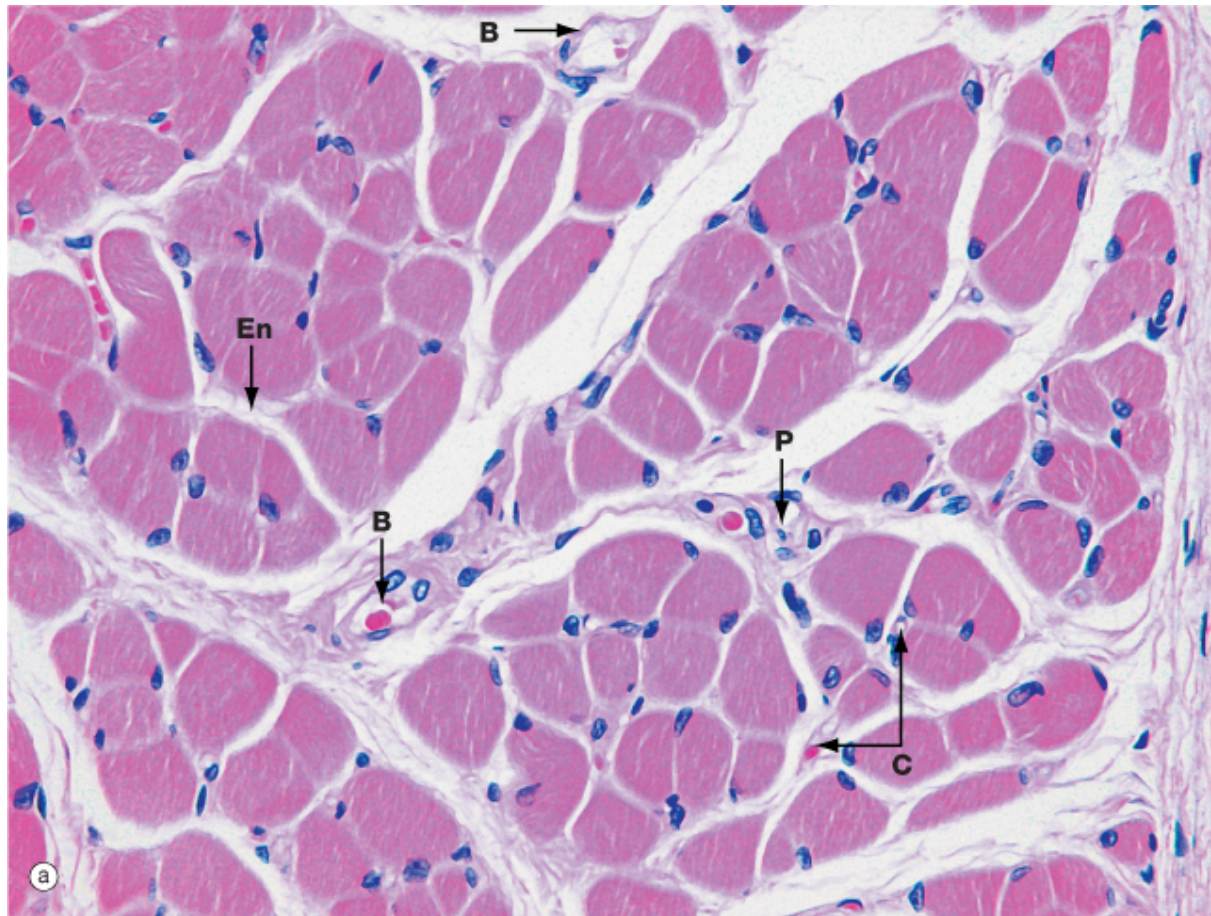


F, 骨骼肌細胞束  
P, Perimysium 肌束衣

En, Endomysium 肌內衣



# High magnification of Cross Section of Skeletal Muscle Tissue



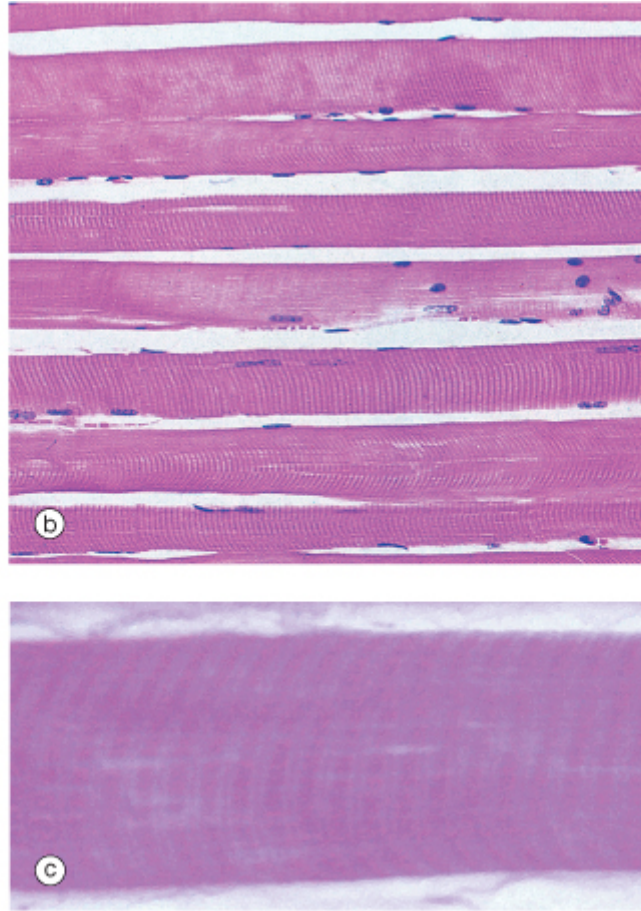
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Skeletal muscle cells = skeletal muscle fibers

Nu, Nucleus of skeletal muscle fibers stains blue with hematoxylin (蘇木精)

Cytoplasm of muscle fibers stains reddish with eosin.(曙紅)

# Longitudinal Section of Skeletal Muscle (骨骼肌縱切面)



## HE-stained tissue section

骨骼肌組織主要由長柱狀具有橫紋的骨骼肌細胞所組成, 彼此平行排列,

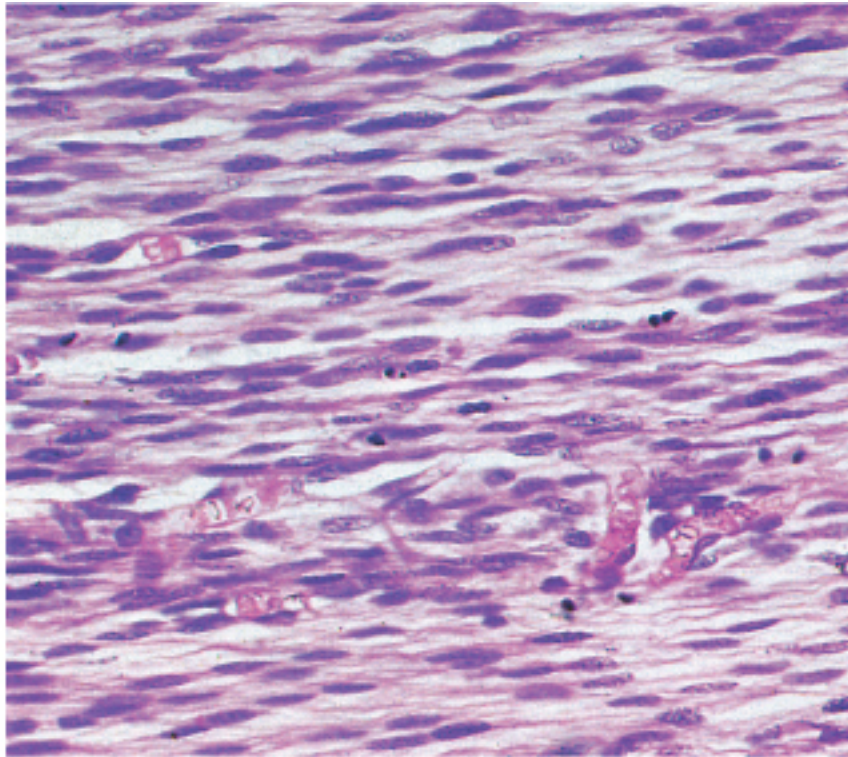
單一骨骼肌細胞擁有數百個細胞核, 細胞彼此之間沒直接接觸,

位於骨骼肌細胞之間的組織是疏鬆結締組織

Muscle cell showing A bands (暗帶) and I bands (明帶)

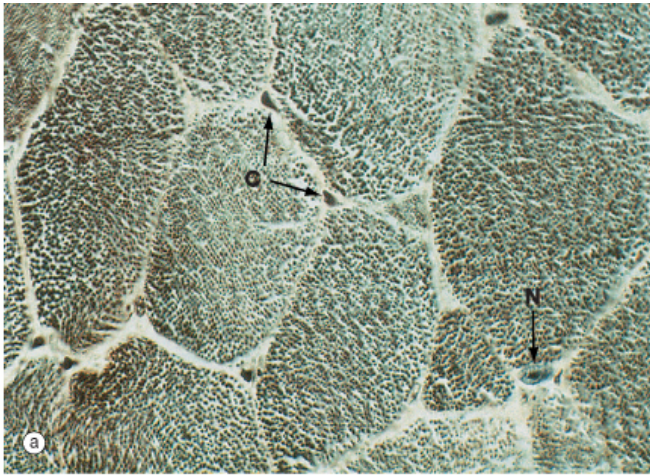


# Skeletal Muscle in Embryogenesis 在胚胎發育時的骨骼肌

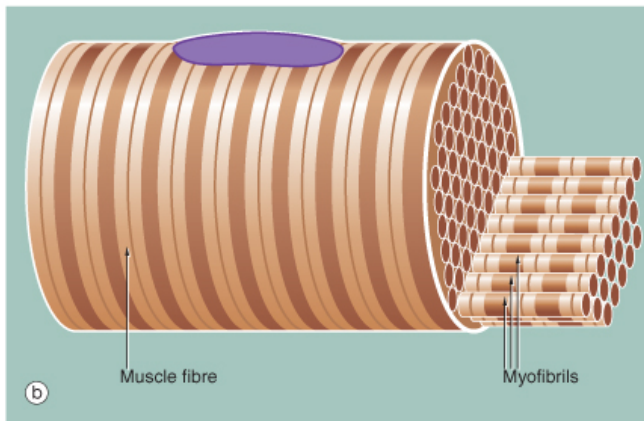


During embryological development, the long, mononuclear skeletal muscle precursors are myoblasts (肌芽胞).

# Skeletal Muscle Cells (Skeletal muscle fibers)

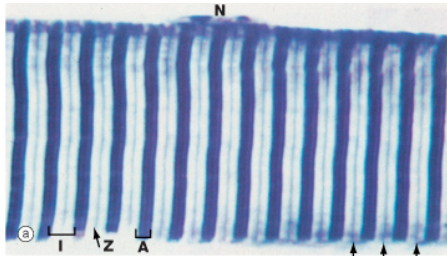


Iron hematoxylin-stained cross section of skeletal muscle

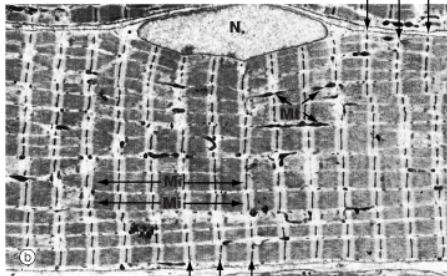


Schematic diagram of a segment of skeletal muscle fiber with many myofibrils that consist of sarcomeres (肌節), contractile units of skeletal muscle cells.

# A segment of a skeletal muscle fiber



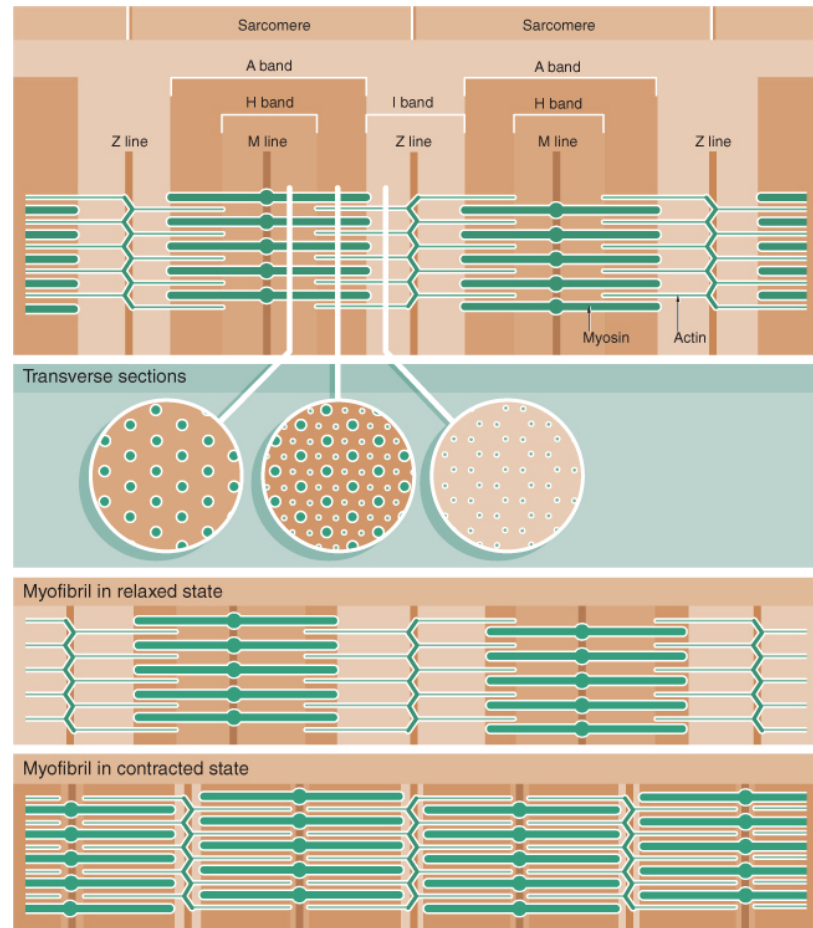
Photomicrograph of longitudinal section of a skeletal muscle fiber stained with Heidenhain's hematoxylin, composed of alternating light I bands and dark A bands.



Electron micrograph (電顯照片) of a segment of longitudinally sectioned skeletal muscle fiber.

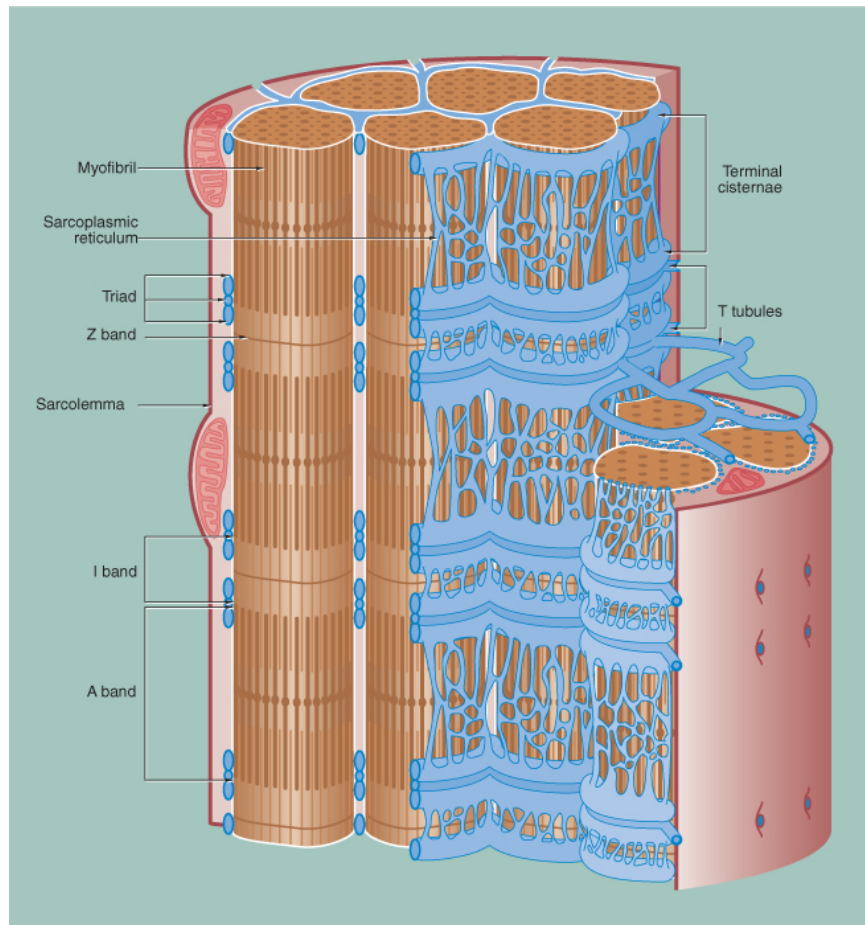


# Arrangement of myofilaments in the sarcomere (在肌節裡面的肌絲排列)



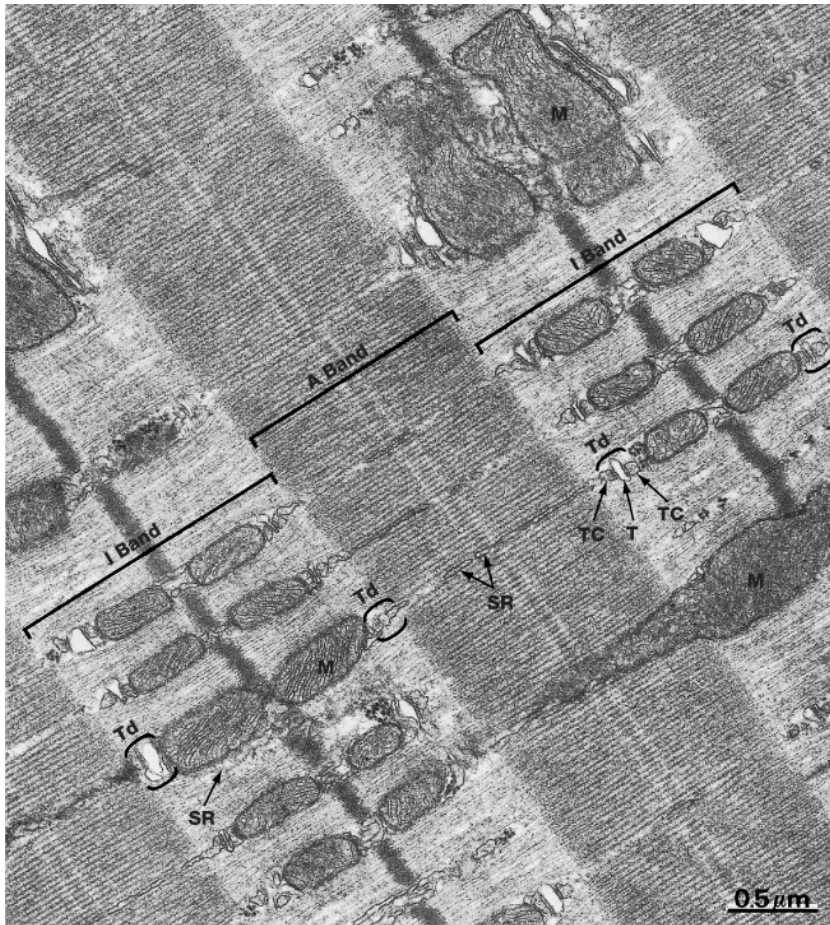


# Sarcoplasmic reticulum (smooth endoplasmic reticulum) and T tubules of skeletal muscle fiber



Triad of skeletal muscle fiber  
Two terminal cisternae of sarcoplasmic reticulum  
and  
a T tubule

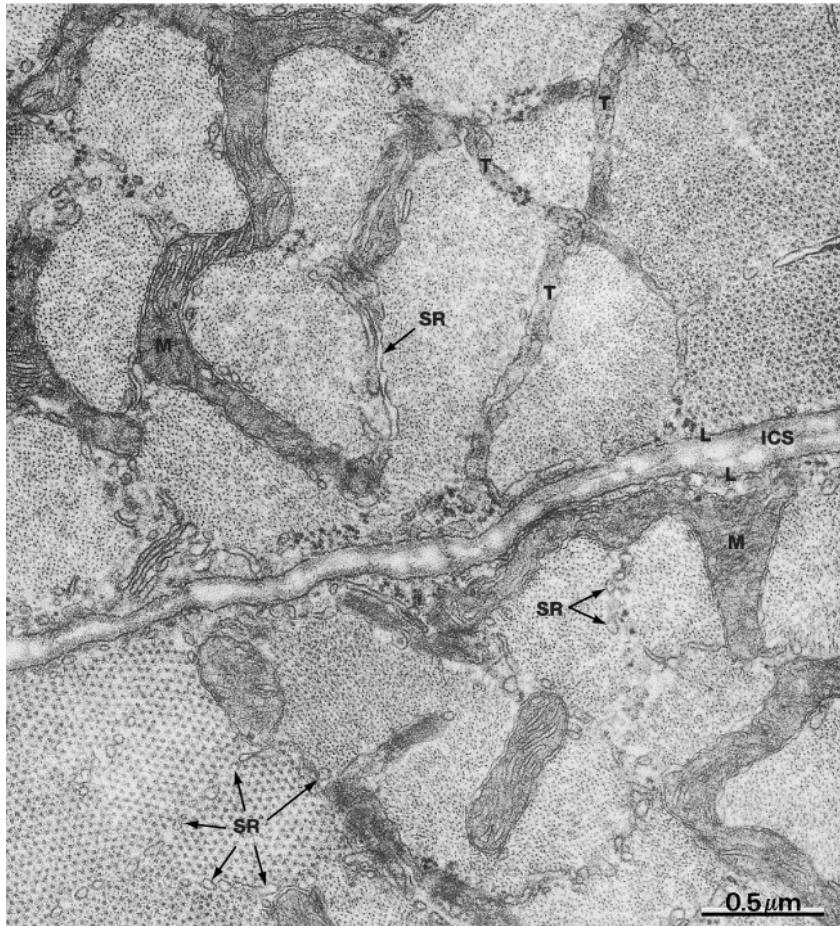
# Longitudinal section showing A band and I band of sarcomere in skeletal muscle fiber



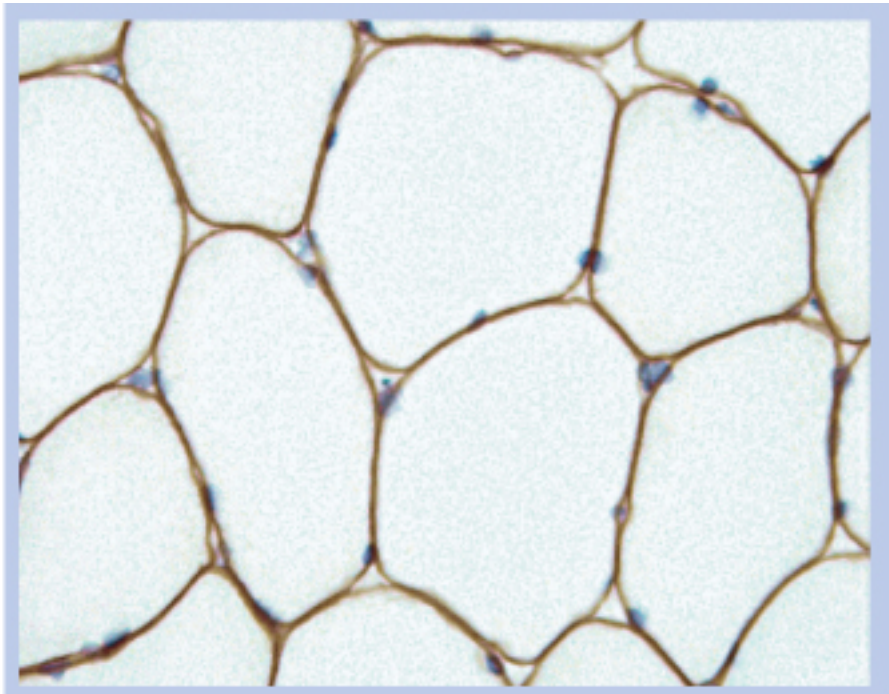
骨骼肌細胞 (縱切面) 的一部份細胞質的電子顯微照片



# skeletal muscle fiber (横切面) and intercellular space

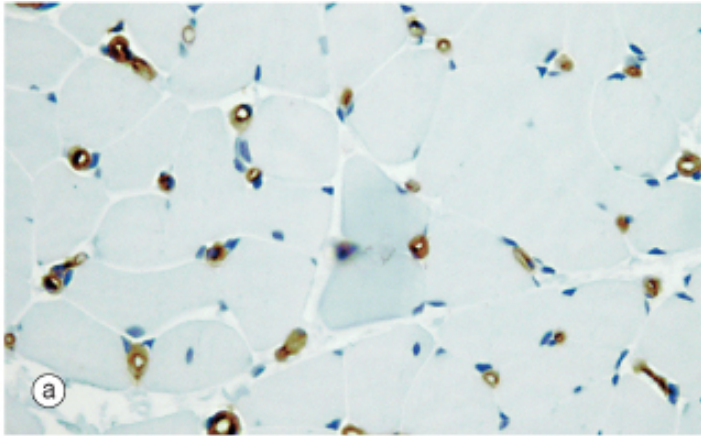


# Immunohistochemical stain for dystrophin, the linkage proteins that are closely associated with the skeletal muscle cell membrane

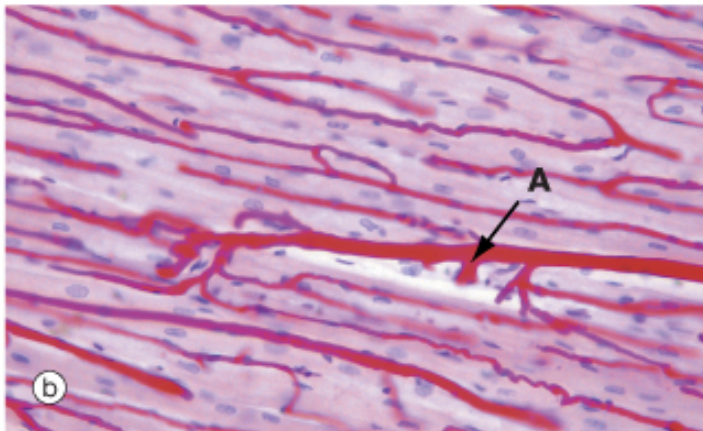


骨骼肌組織的橫切面。  
骨骼肌細胞的表面染成褐色是含有 dystrophin。

# Skeletal muscle blood supply



Endothelial cells stain brown with immunohistochemical technique.



Blood vessels (血管) have been injected with red gel.

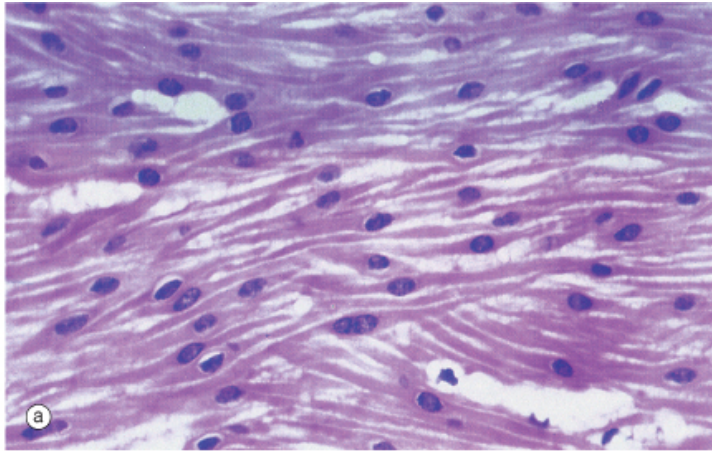
A small artery (A) running in the permysium can be seen, giving off capillaries which branch out and run along the length of the muscle fibers.

# Smooth Muscle Tissue (平滑肌組織)

- Smooth muscle tissue consists of elongated, spindle-shaped cells (平滑肌細胞呈紡錘形) with tapered end which may occasionally be bifurcated.
- Smooth muscle fibers are generally much shorter than skeletal muscle fibers and contain only one nucleus (平滑肌細胞含有單一細胞核).
- 平滑肌細胞的細胞質 沒有橫紋，但是也含有大量的 肌絲。

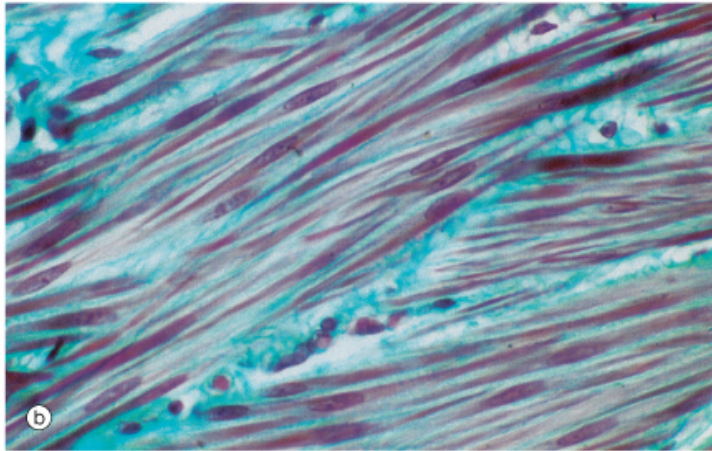


# Smooth Muscle



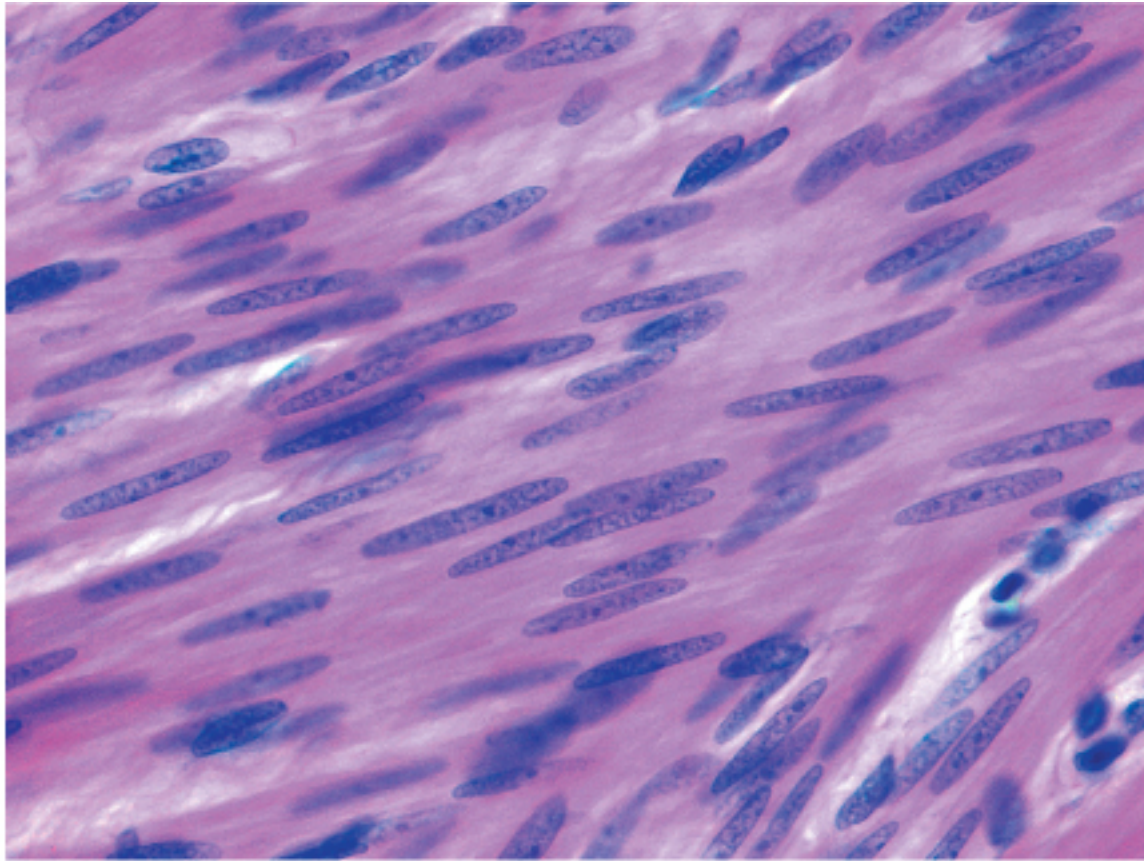
HE-stained longitudinal section of smooth muscle

Smooth muscle fibers are elongated, spindle-shaped cells with tapered ends.



Masson trichrome-stained

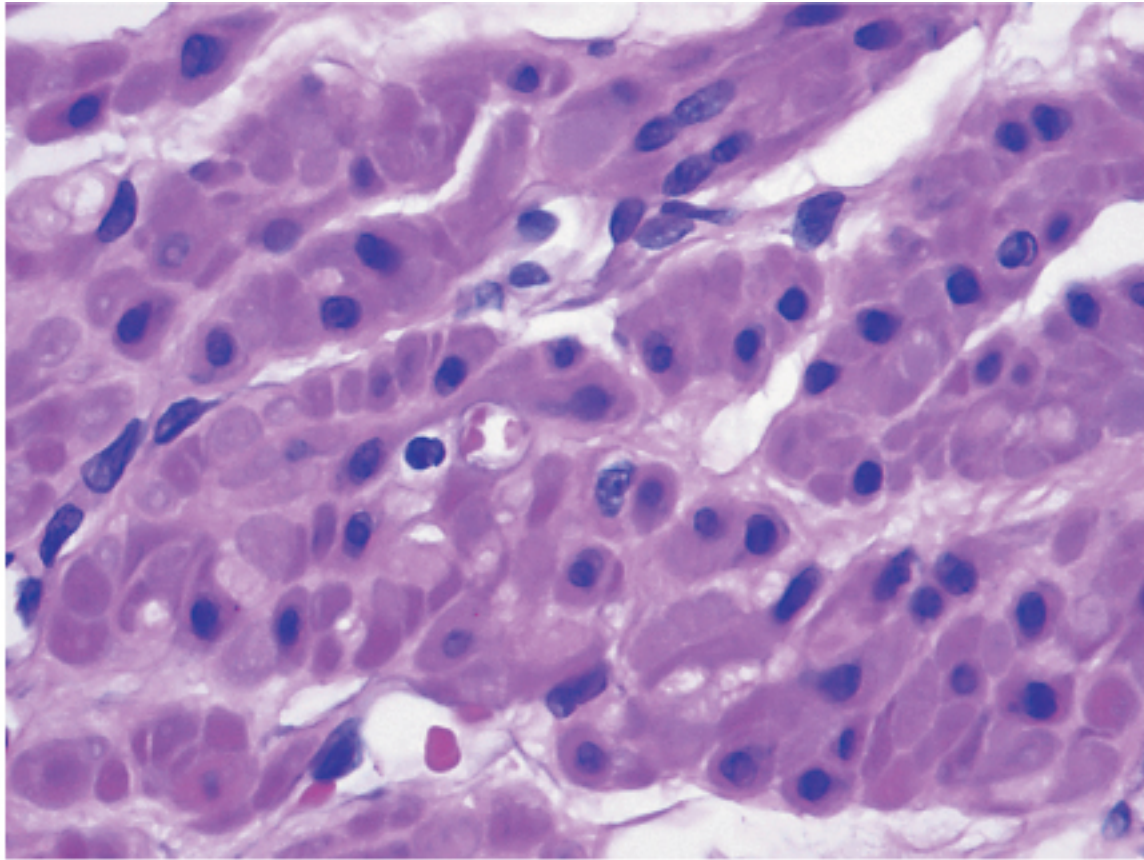
# HE-stained Longitudinal section of smooth muscle



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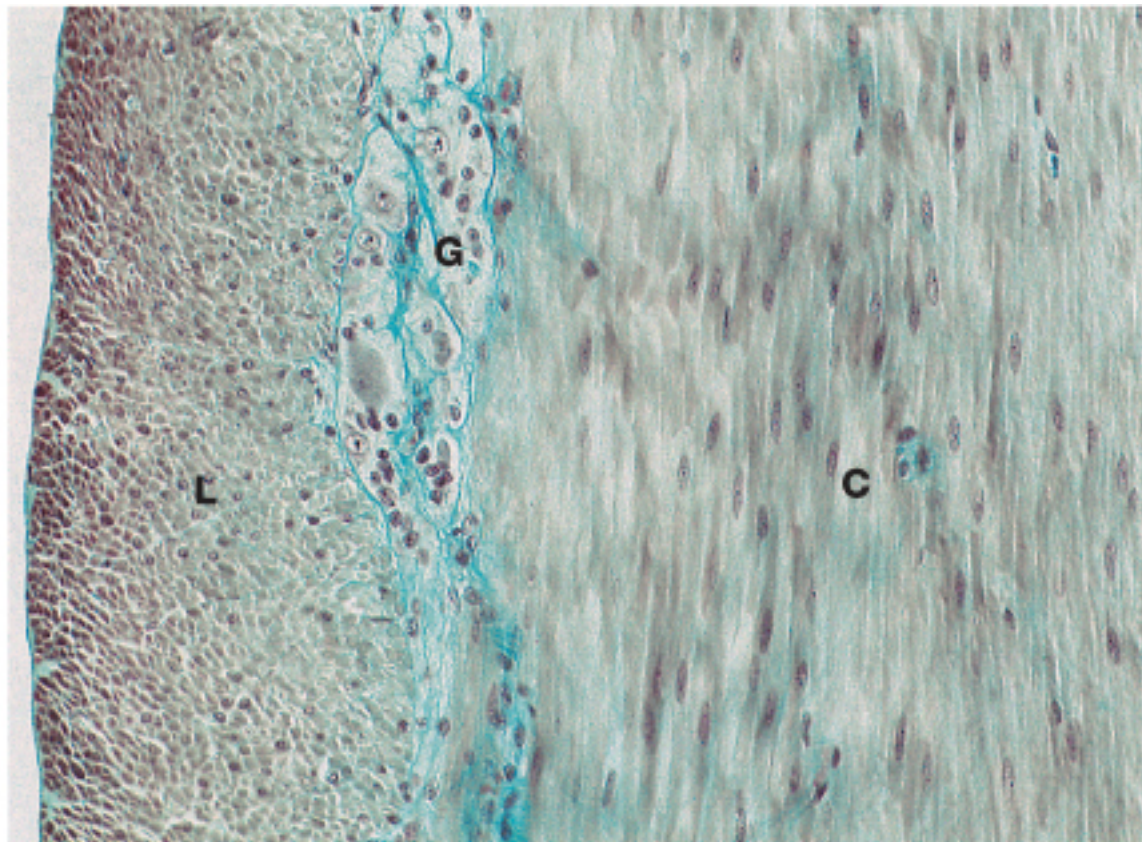


# HE-stained cross section of smooth muscle



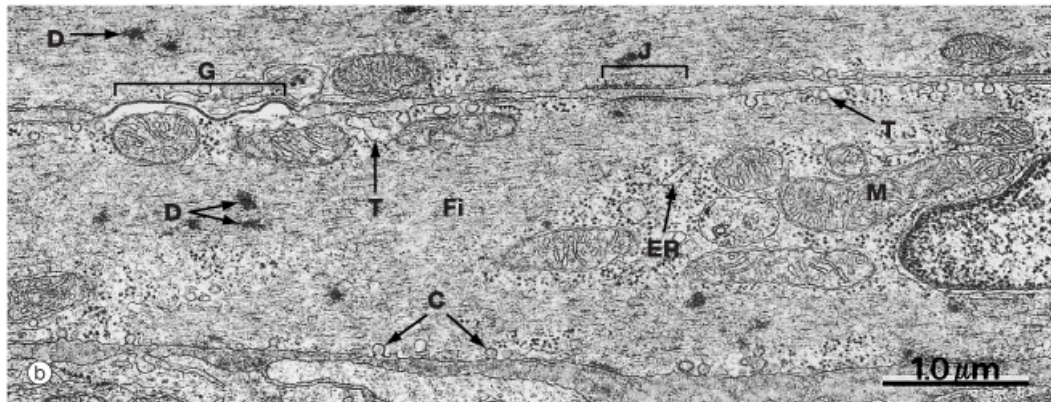
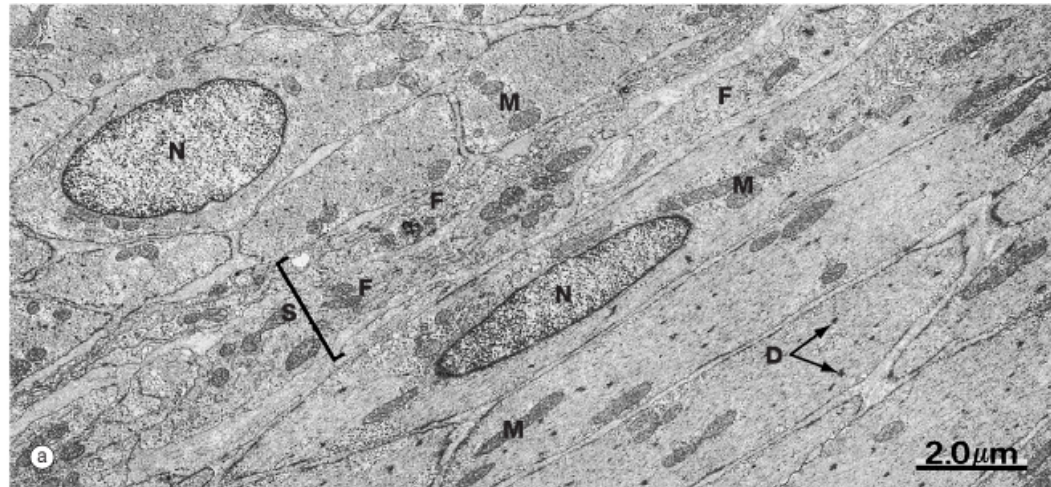
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# Cross section of the wall of ileum showing inner circular and outer longitudinal layers of smooth muscle

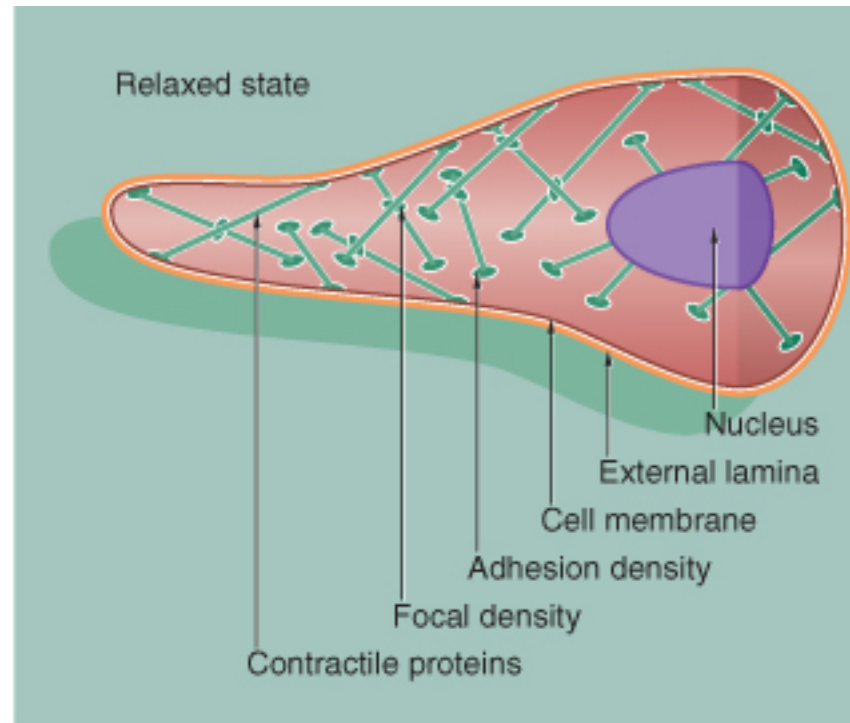




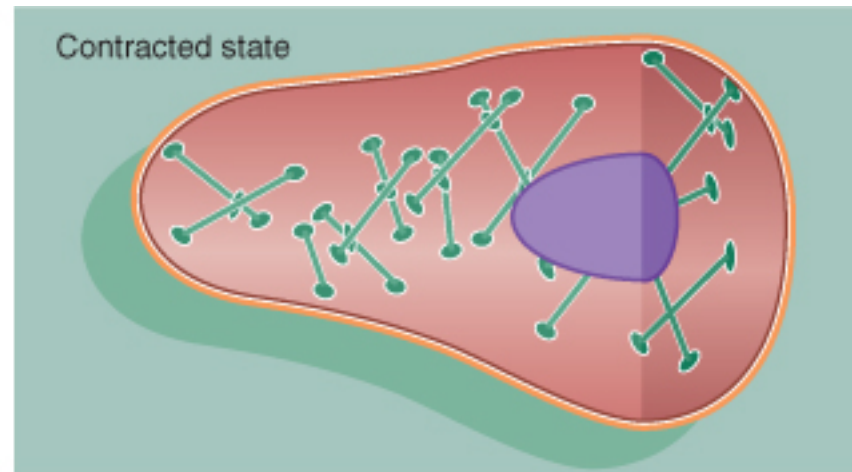
# Transmission electron micrograph of smooth muscle



# Relaxed state of smooth muscle fiber (鬆弛狀態的平滑肌細胞)



# Contracted state of smooth muscle fiber (收縮狀態的平滑肌細胞)



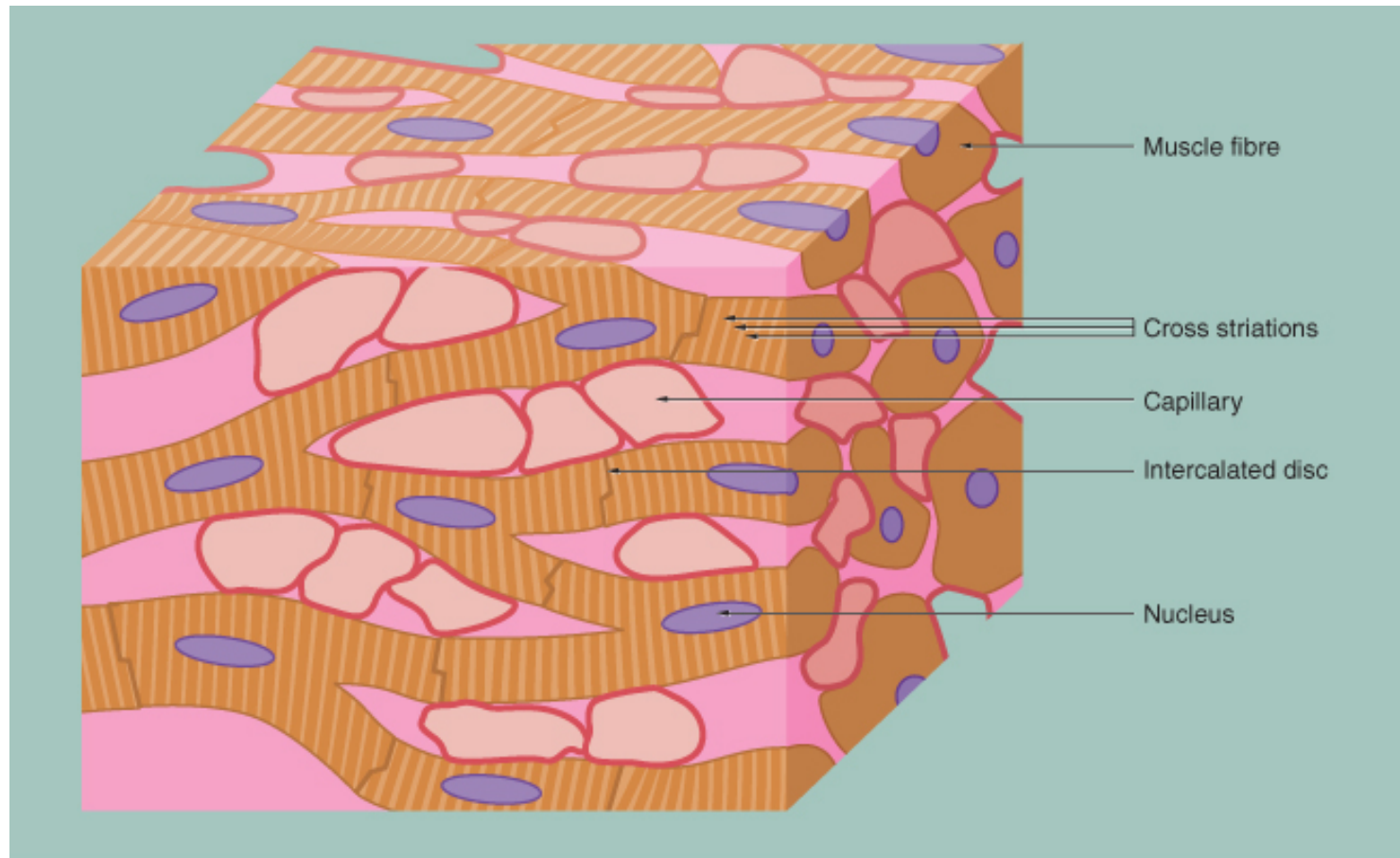
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# Cardiac Muscle Tissue (心肌組織)

- Cardiac muscle fibers are essentially long, cylindrical cells with one or two nuclei which are centrally located within the cell. The ends of the fibers are split longitudinally into a small number of branches, the ends of which abut onto similar branches of adjacent cells, giving the impression of a continuous three-dimensional cytoplasmic network.
- 心肌細胞會有分支，細胞分支彼此會連接著形成的閏板(Intercalated Disc)，是由細胞聯結構成的，此處細胞膜含有離子通道，能互通訊息。

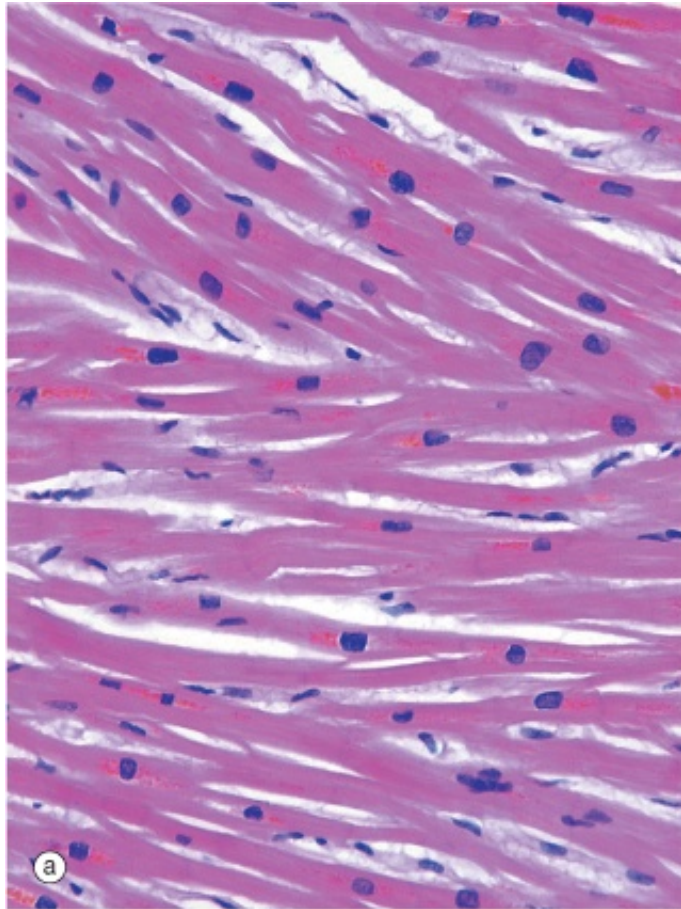


# Cardiac muscle (myocardium)

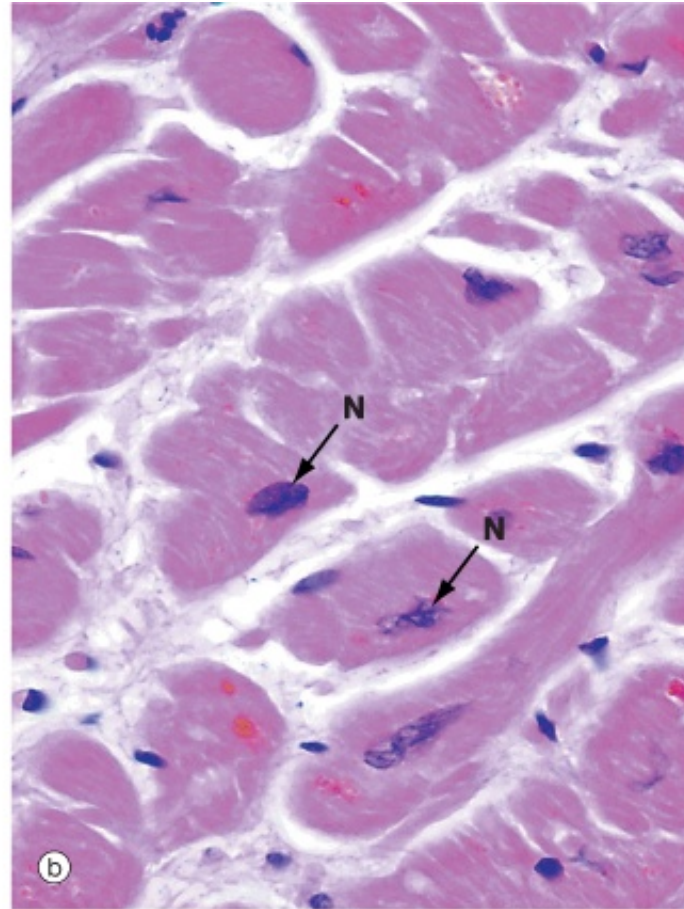


# Cytoplasm and nucleus of cardiac muscle cells

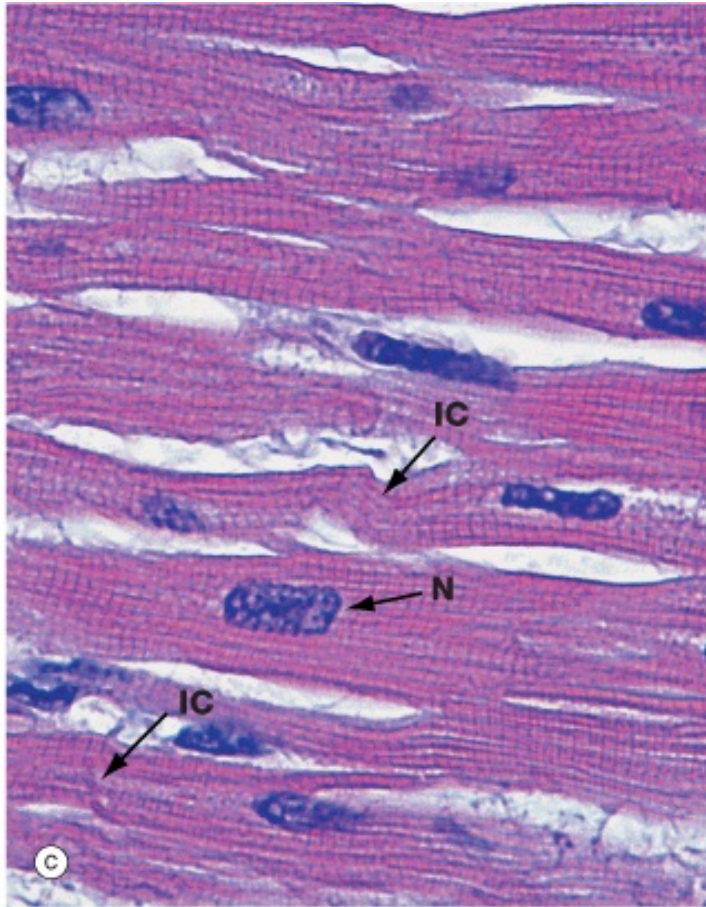
Longitudinal section



Cross section



# Longitudinal section of cardiac muscle

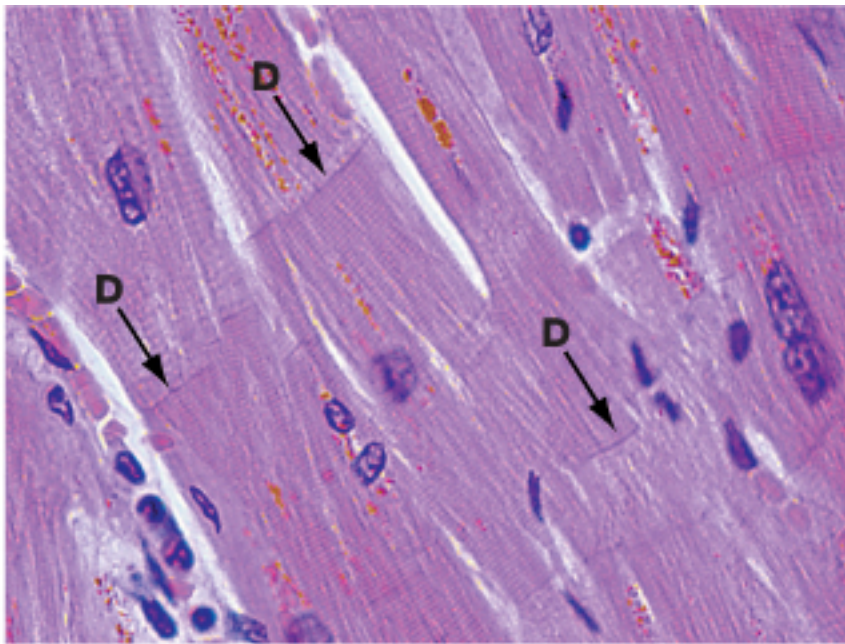


IC, Intercalated  
Disk

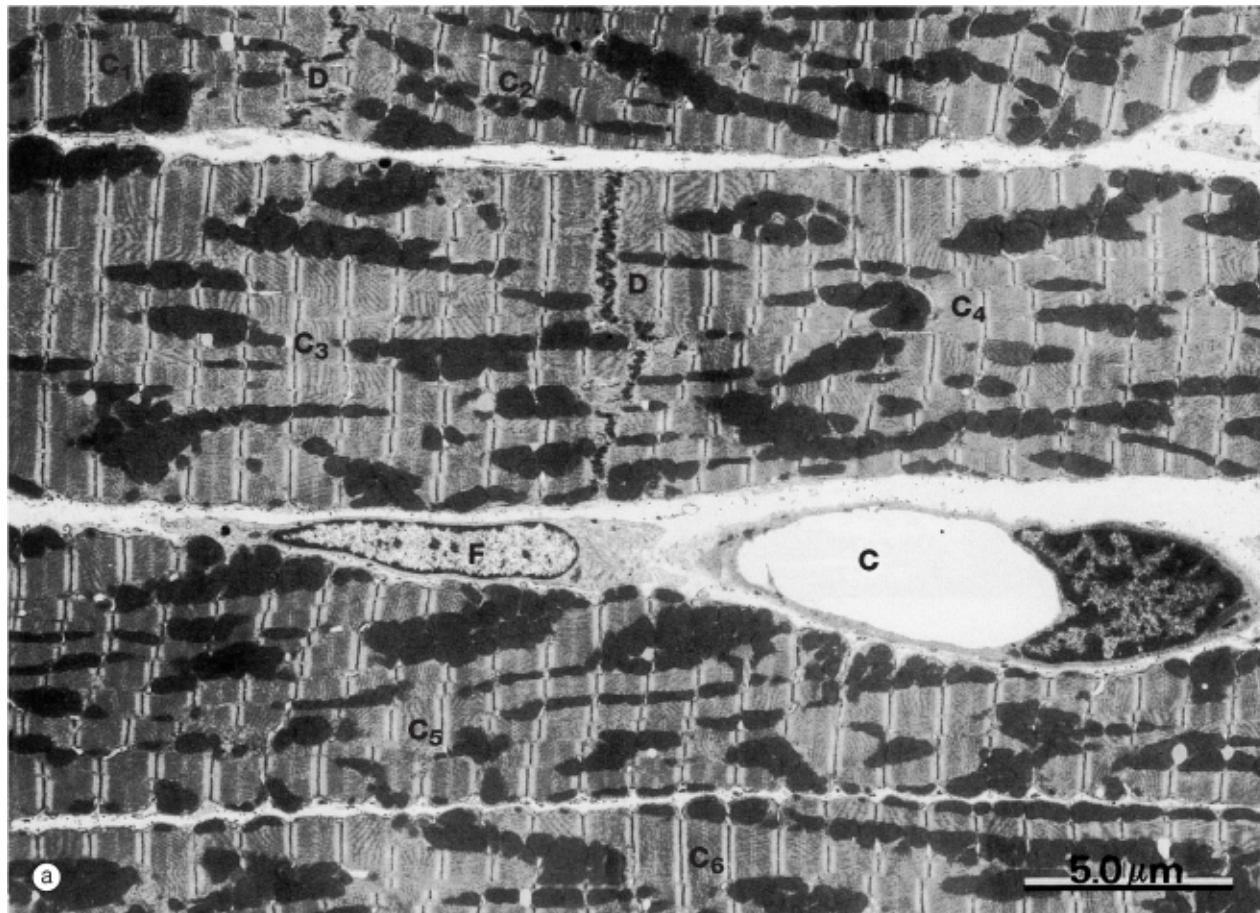
N, Nucleus



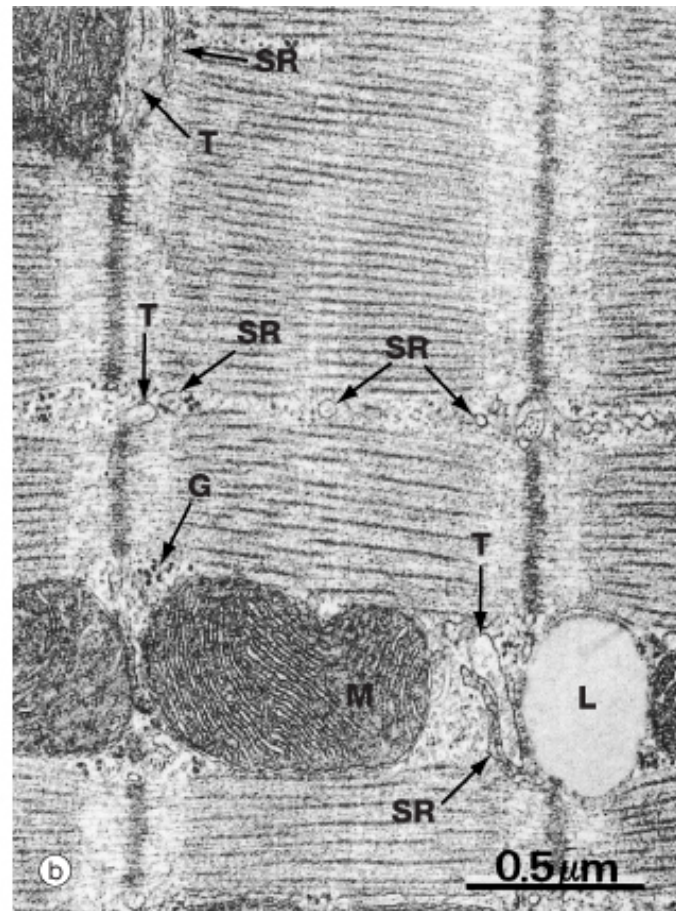
# Intercalated disc (D)



# Transmission electron micrograph of cardiac muscle



# Sarcomere of cardiac muscle cell





# EM of intercalated disc



