

# Kas

- Hücreler

Kas teli (fibra muscularis)

Hücre membranı

(sarkolemma)

Endoplazmik retikulum

(sarkoplazmik retikulum)

Mitokondriyon

(Sarkozom)

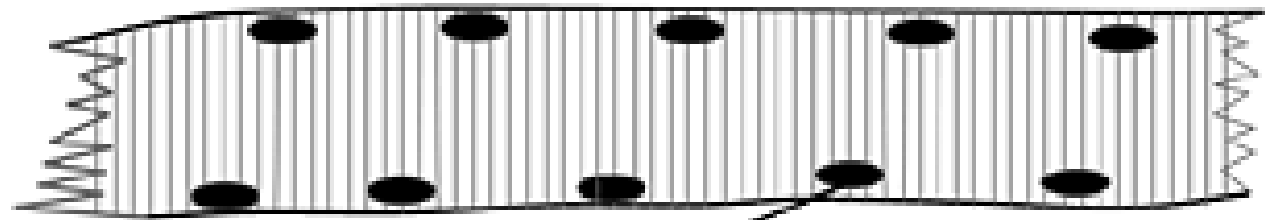
- Hücreler arası madde

Bağdokusu

# Kas Doku Türleri

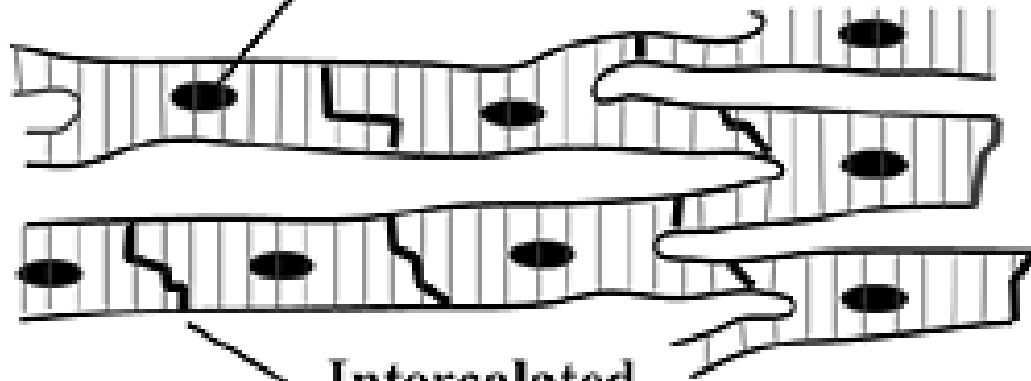
- 1. İskelet Kası
- 2. Kalp Kası
- 3. Düz kas

**Skeletal  
Muscle**



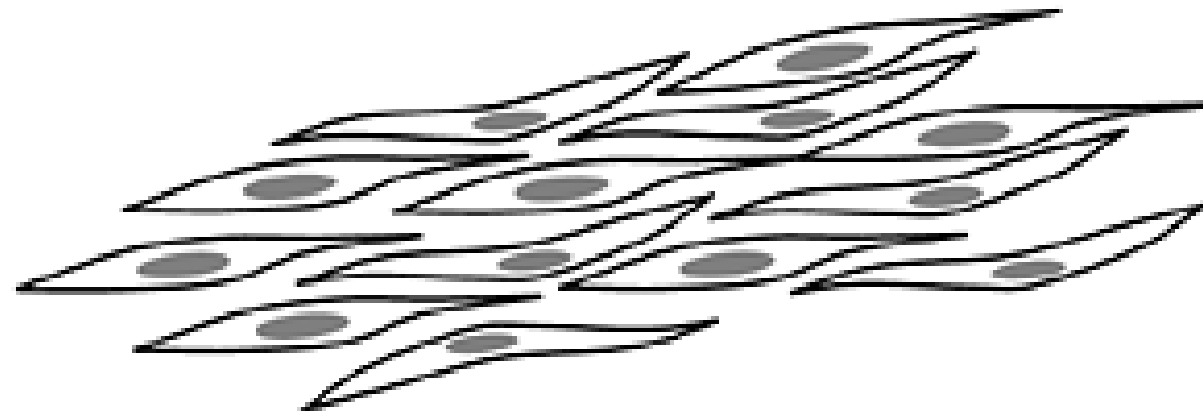
**Nuclei**

**Cardiac  
Muscle**



**Intercalated  
Disk**

**Smooth  
Muscle**



# 1. İskelet kası dokusu

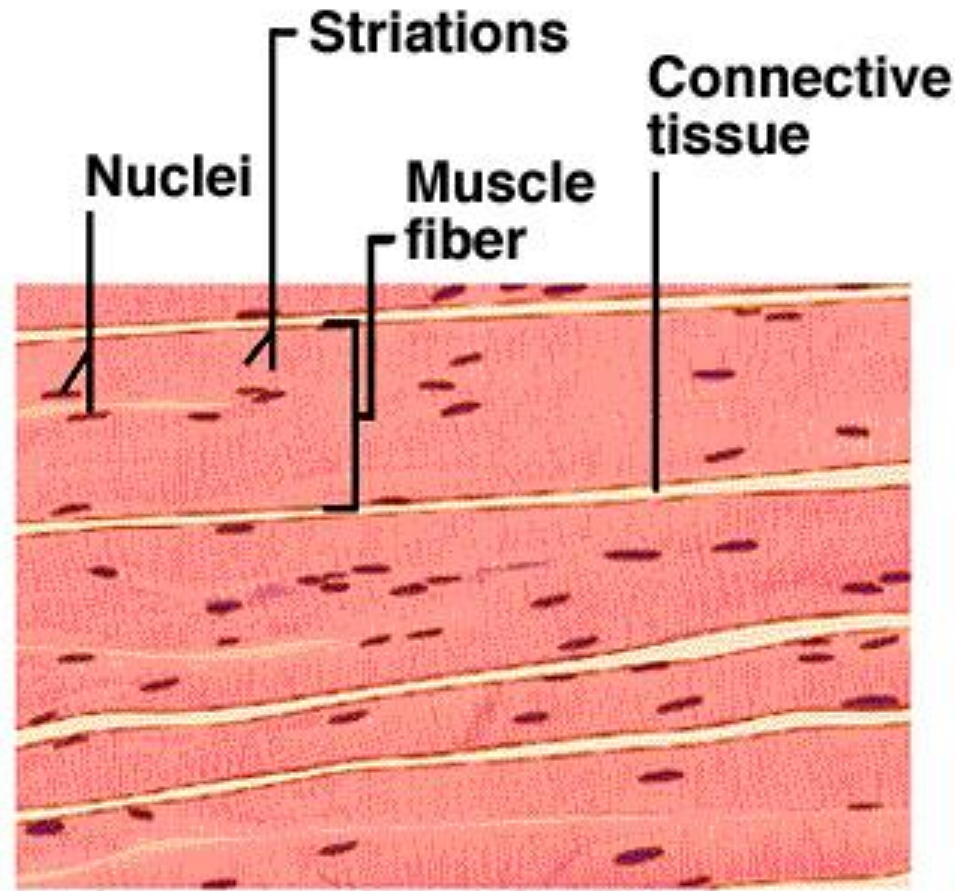
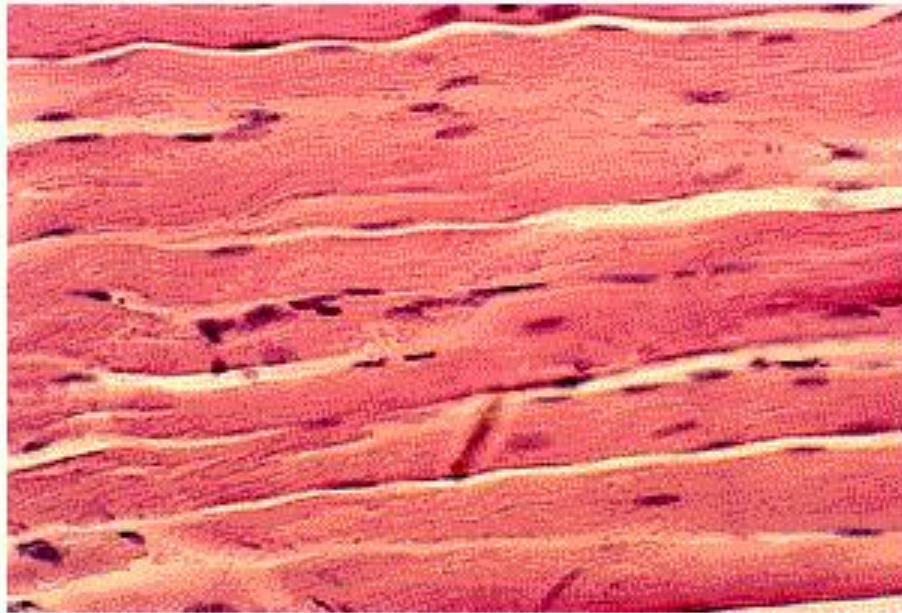
- Çizgili kas telleri bulunur.
- İskelete bağlıdır.
- Silindir şekillidir.
- Çekirdek uzun oval şekilli ve sarkolemin hemen altındadır.
- Enine çizgililik miyofibrillerdir.
- Miyofibrillerde açık koyu alanlar bandlardır.
- Açık bandlar **I** (izotrop), Koyu olanlar **A** (anizotrop) bandlardır.
- Miyofibrilleri oluşturan miyofilamanlar **aktin** ve **miyozin** filamanlarıdır.

- Dinlenmede I ve A eşit. Kontraksiyonda I bandı kaybolur.
- I nin ortasında Z (koyu) bandı bulunur.
- A nin ortasında H (açık) bandı bulunur. H nin ortasında M (koyu) bandı bulunur.
- Sarkomer= kontraksiyon ünitesidir, İki Z bandı arasındaki bölümdür.

- **Desmin filamanları:** Miyofibrilleri birbirine bağlayarak, A ve I bantlarının bir arada tutulmasını sağlayan kontraktil olmayan filamanlar.
- **Titin filamanları:** Kas çekildikten sonra tekrar eski halini almasını sağlayan filamandır. Kaslara esneklik katar.
- **Kasılma: Kontraksiyon:** Miyozin filamanlarının aktin filamanlarını kendi aralarına doğru çekip kaydırması.

- Motor sinirlerle innerve edilirler.
- Motor son plaklar uyarımıyla, sarkoplazma retikulumundan Ca (pasif transportla) dışarı çıkar ve myozin ve aktin filamanlarının arasına dağılır.
- Aktin, miyozin arasında kayar ve kontraksiyon gerçekleşir.
- Uyarım kesilince Ca iyonları tekrar sarkoplazma retikulumuna girer (aktif transport)
- Gerekli enerji filamanlar etrafında bol bulunan ATP ve kreatin fosfatın parçalanması ile elde edilir.
- Rigor mortisde miyozin aktinden ayrılmaz.
- Mitokondriyondan çok zengindir.
- Miyoglobinin: Oksijen bağlayıcı pigmenttir.

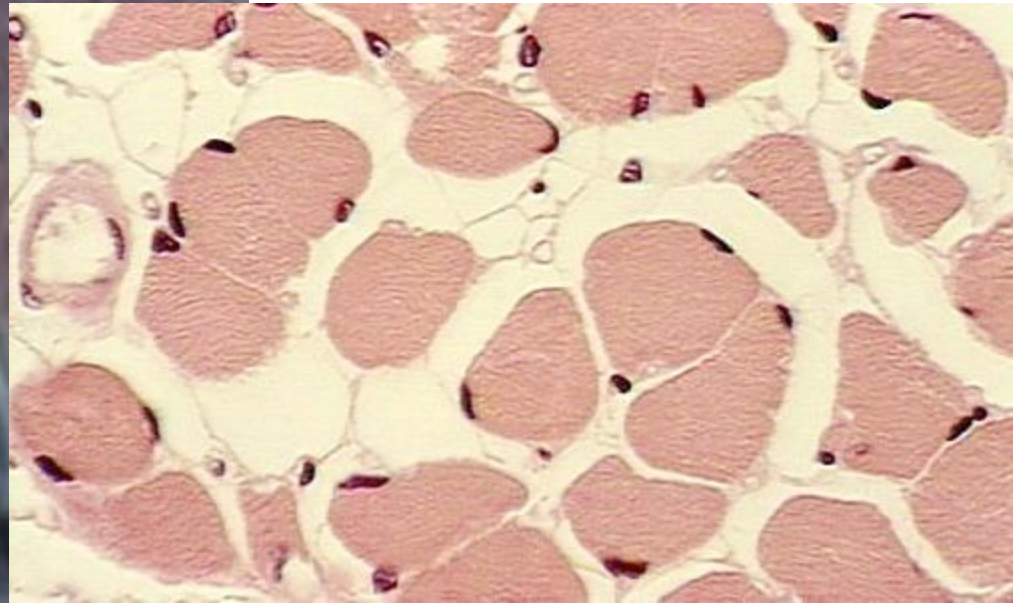
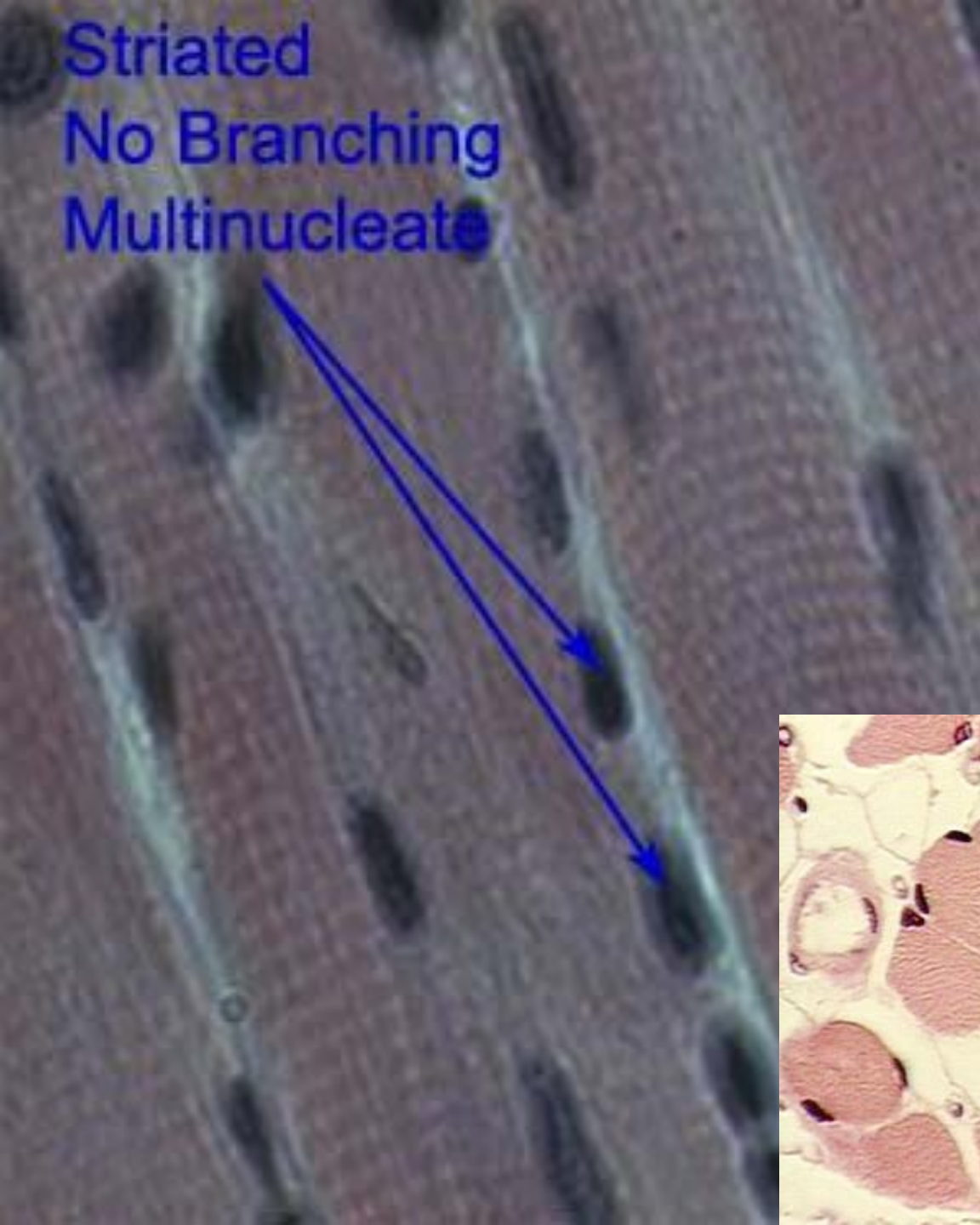
# Skeletal Muscle

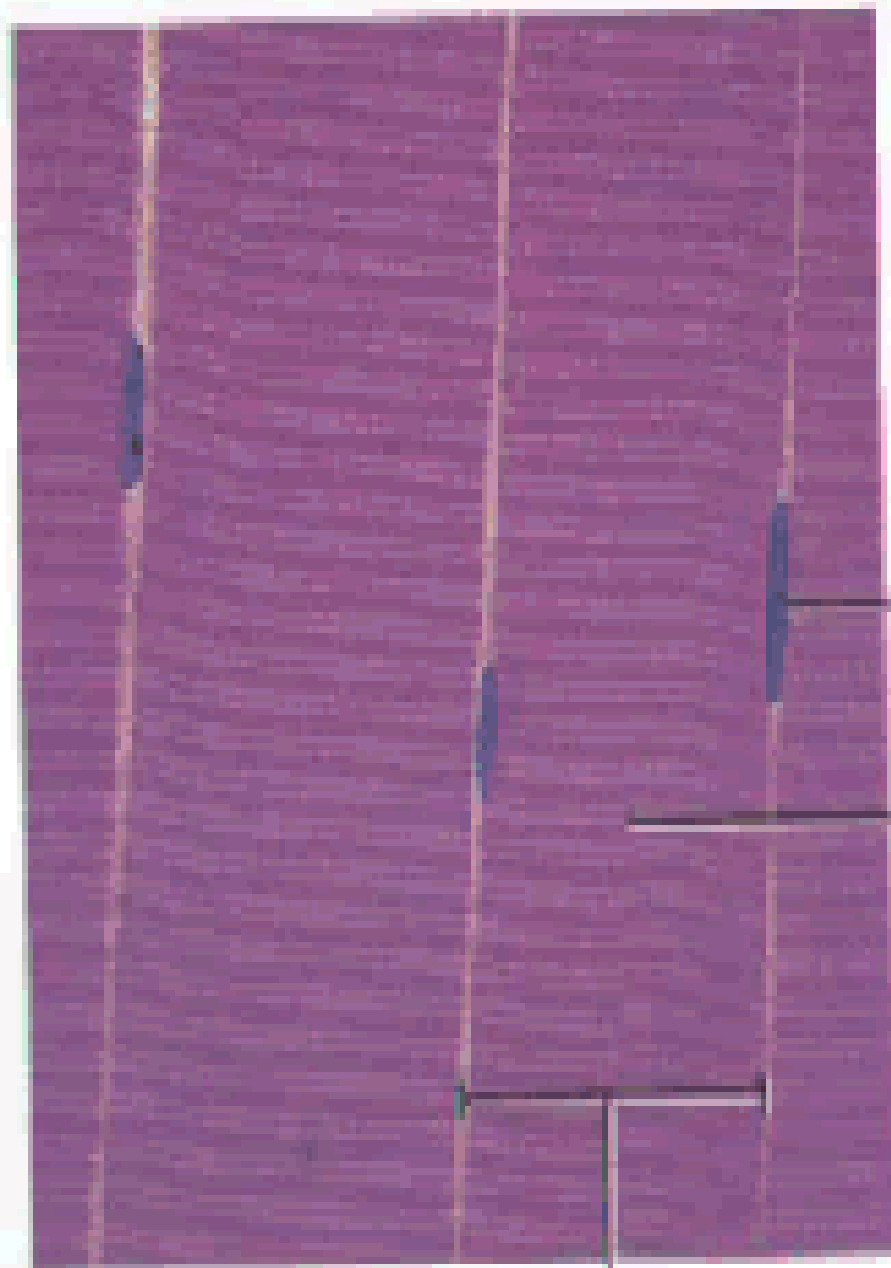




Striated  
No Branching  
Multinucleate

1-İskelet kasi



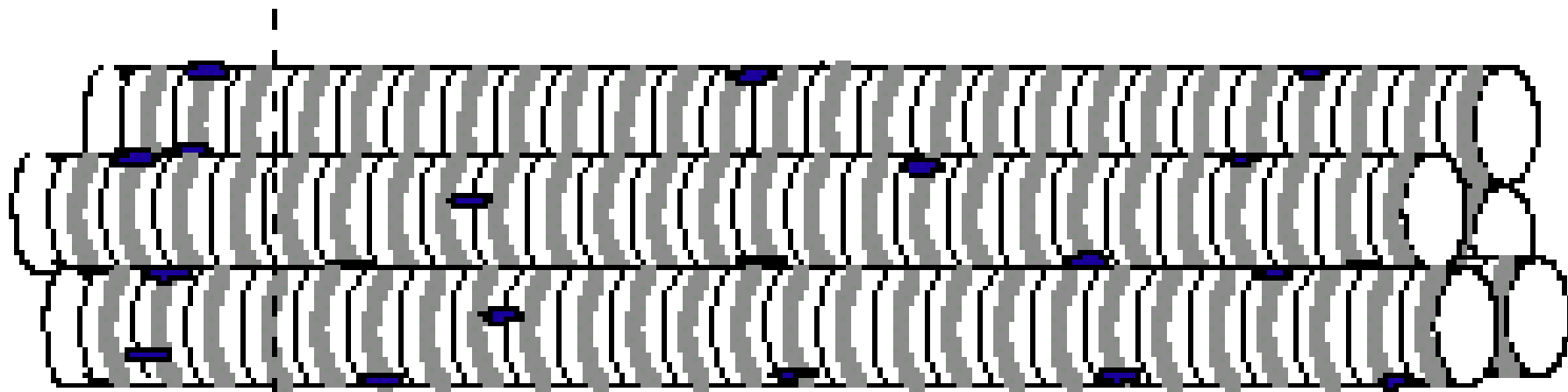


Nucleus

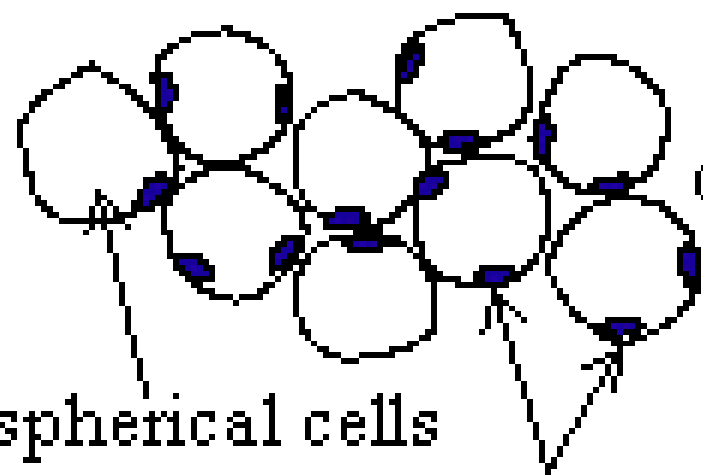
Striations



Skeletal muscle fibre



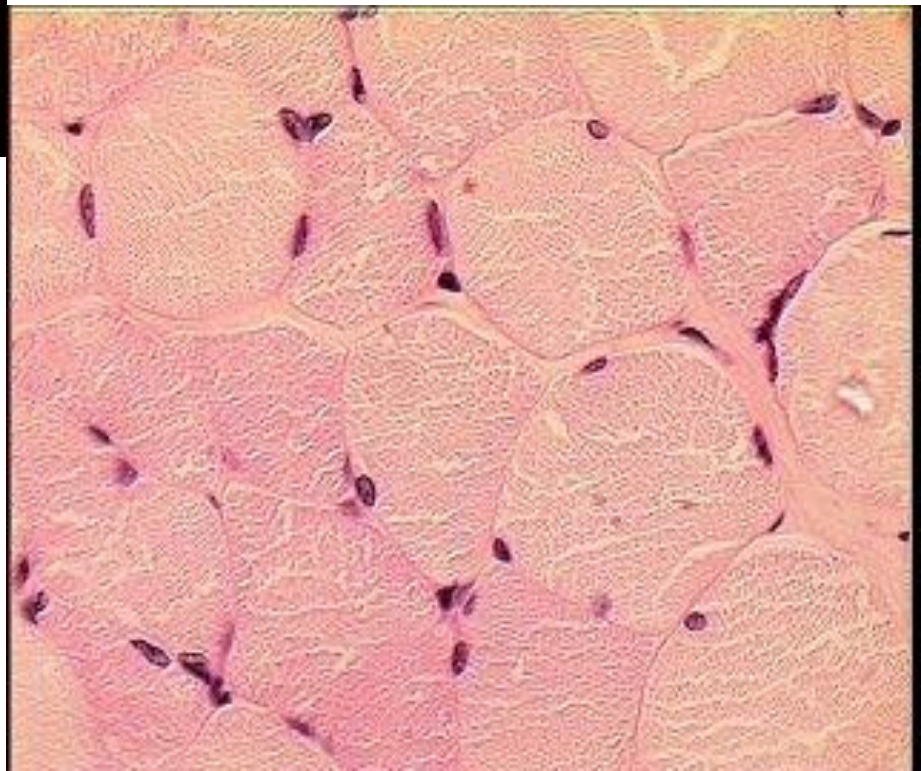
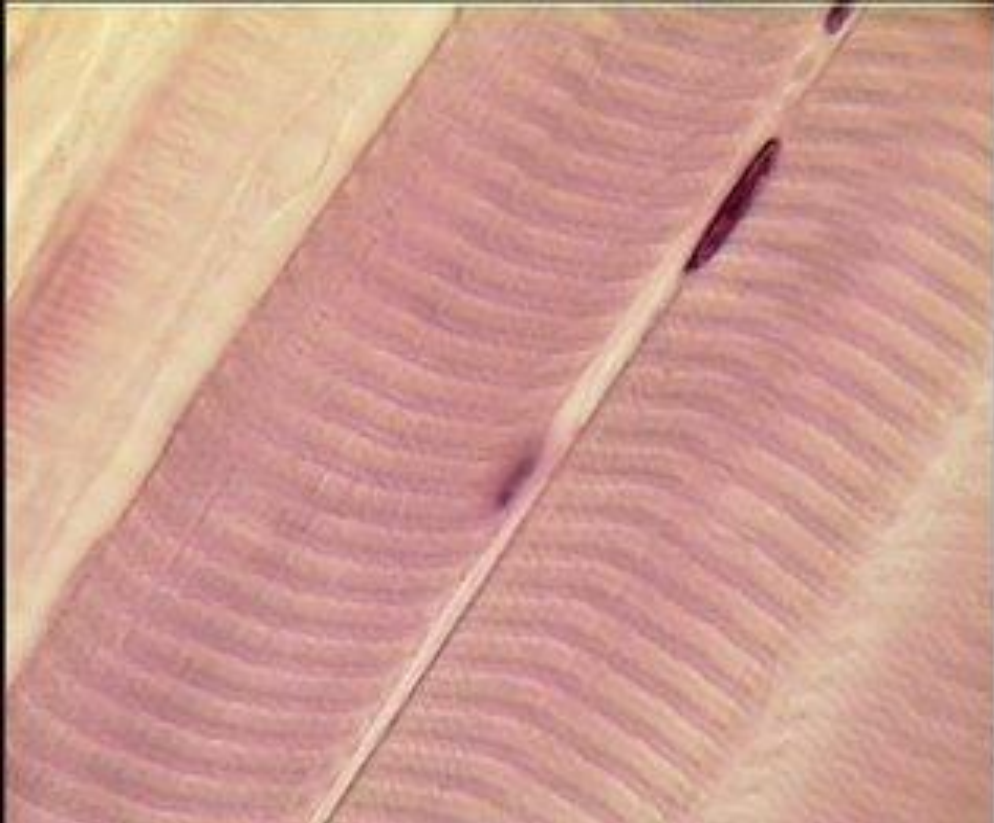
longitudinal section

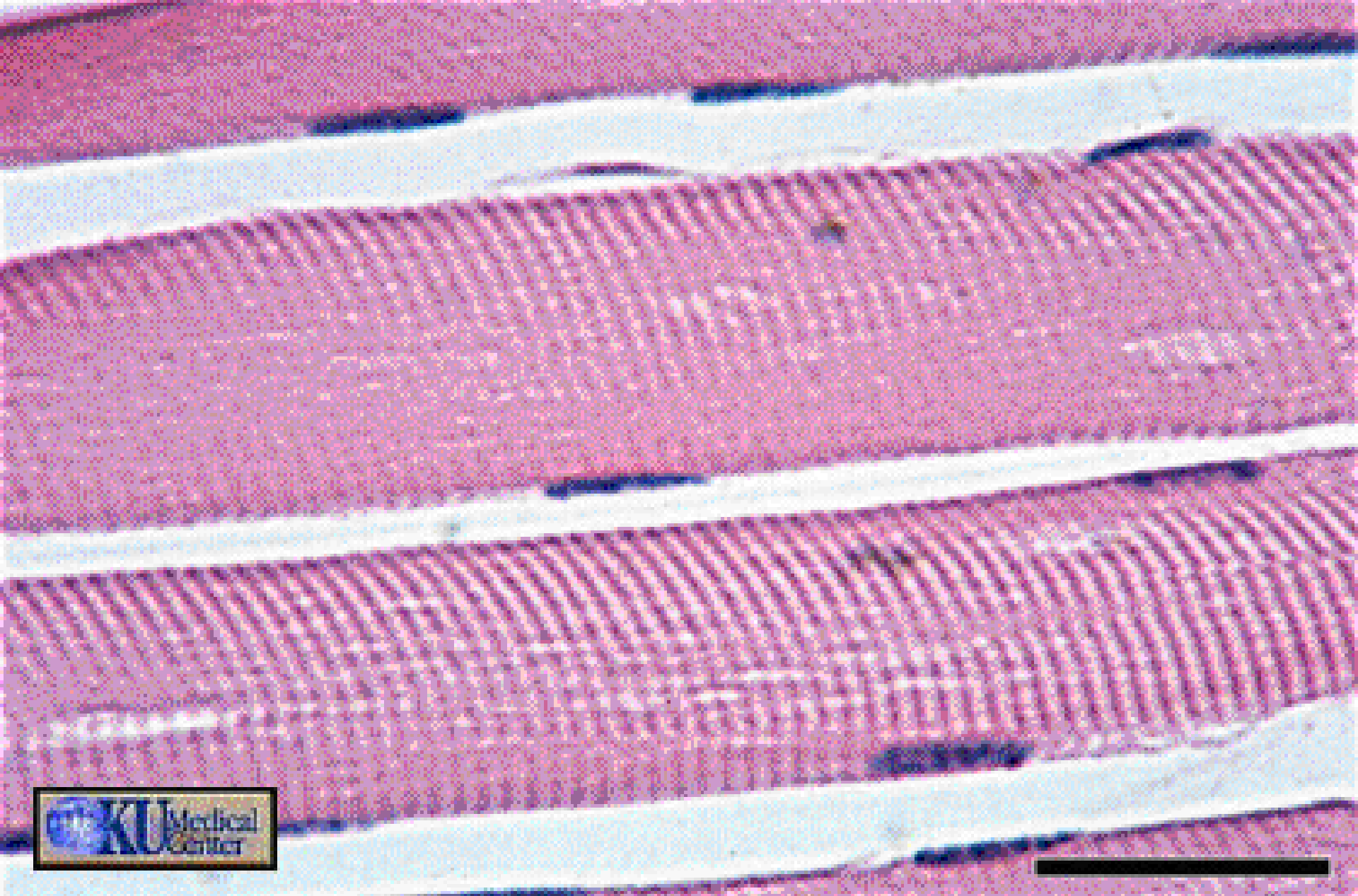


cross-section

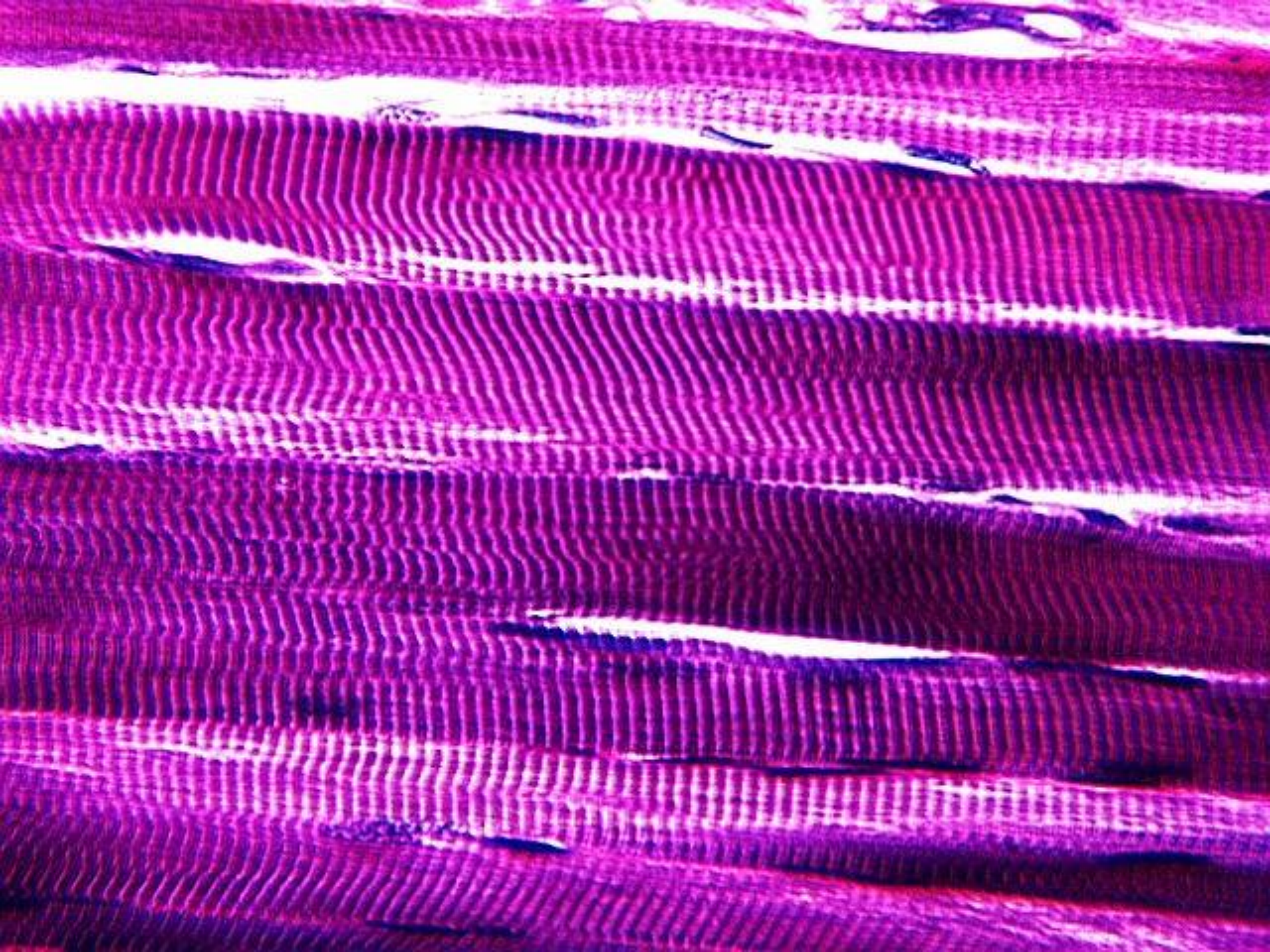
spherical cells  
multiple, peripheral nuclei

# Skeletal Muscle



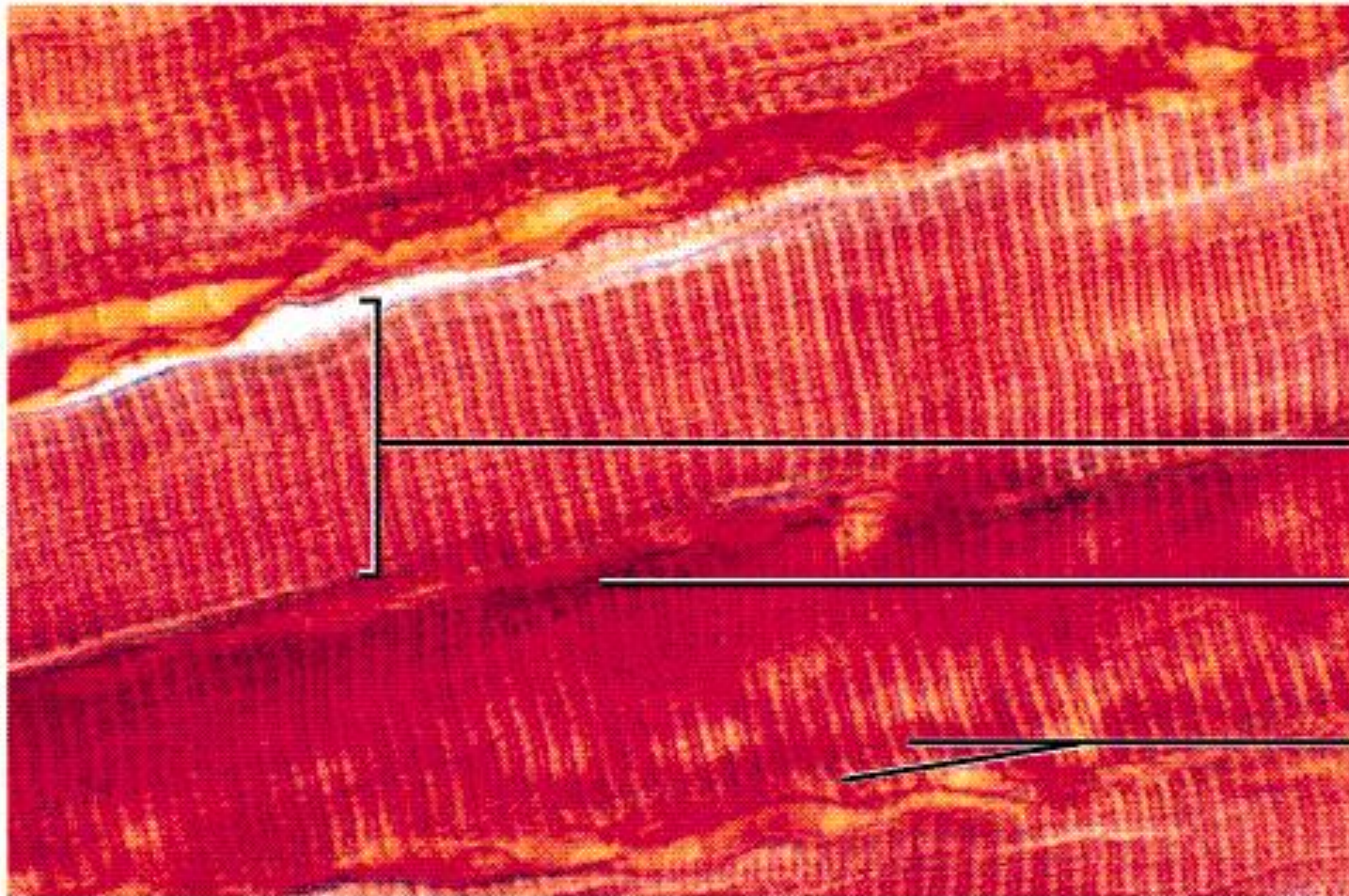








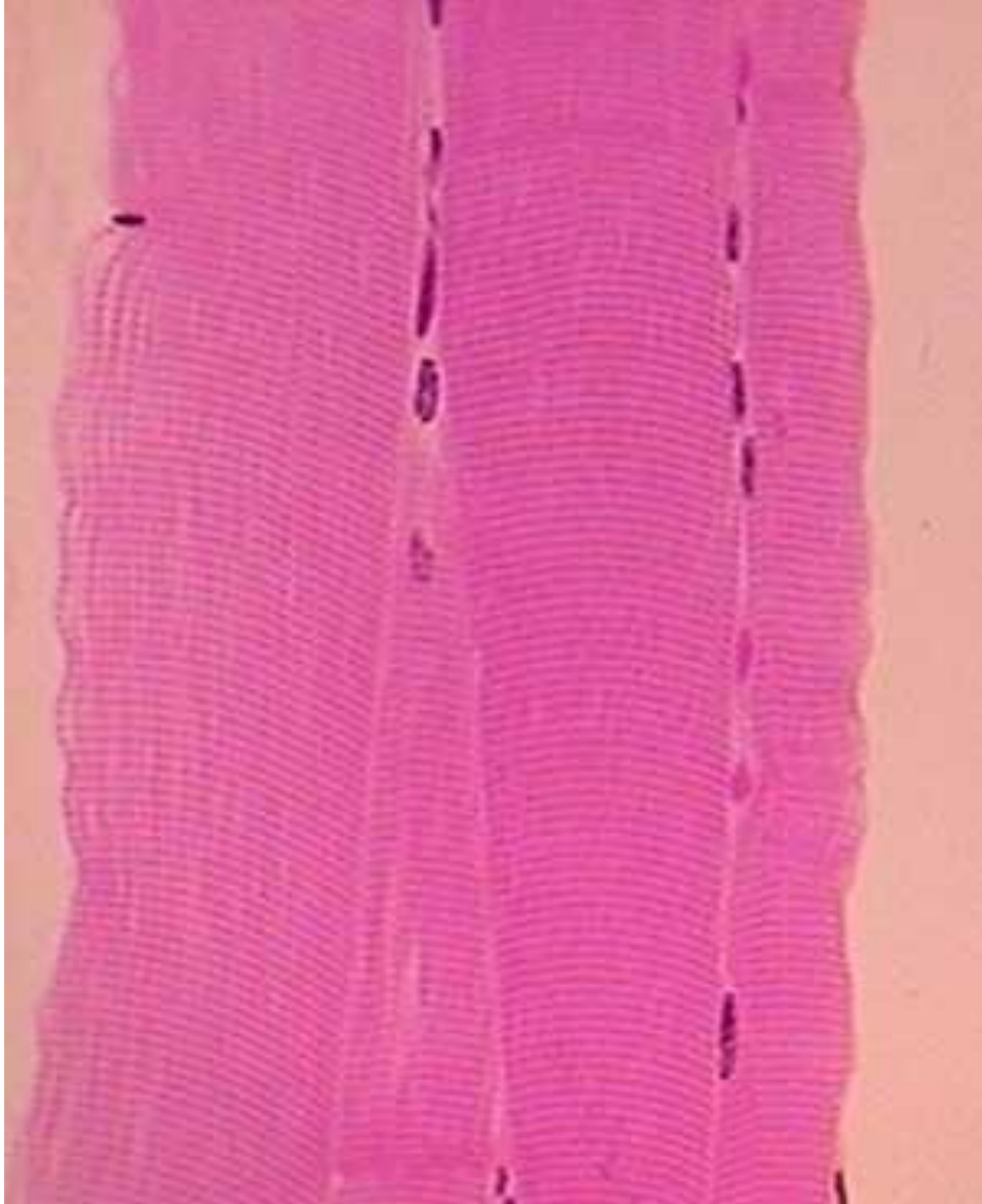
# Skeletal Muscle



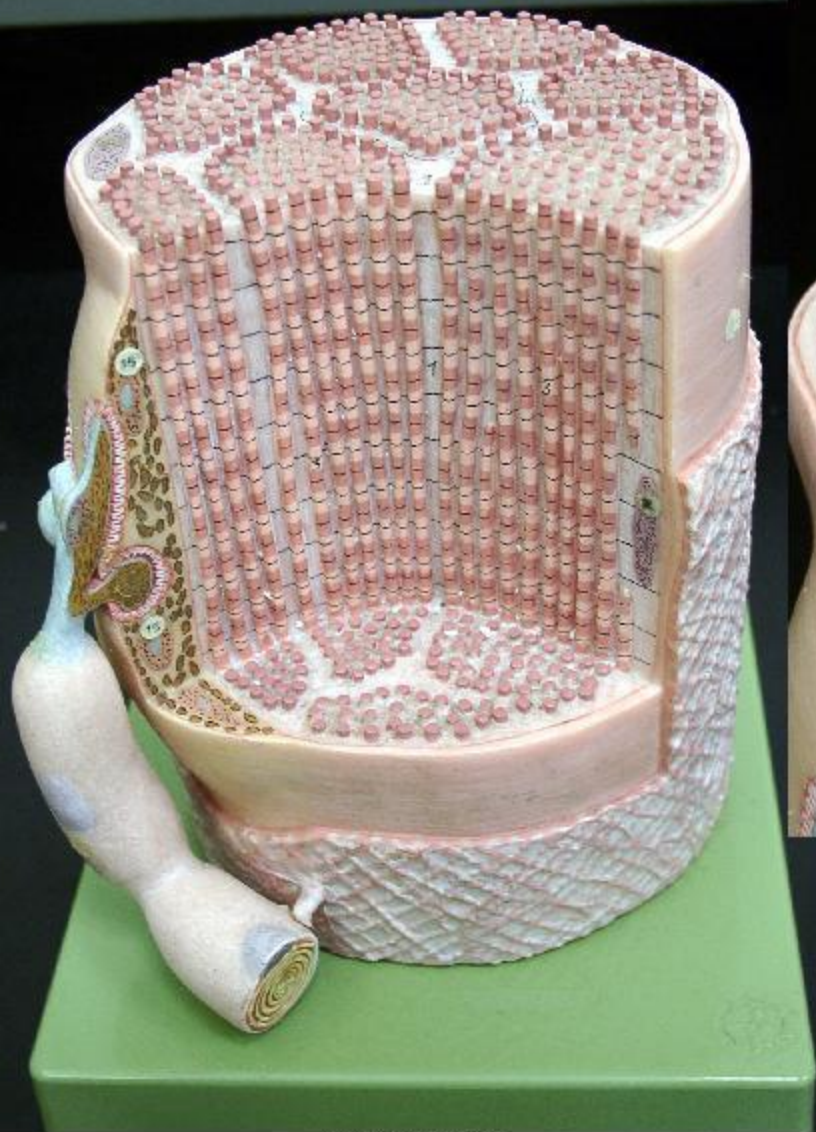
**Muscle  
fiber**

**Nucleus**

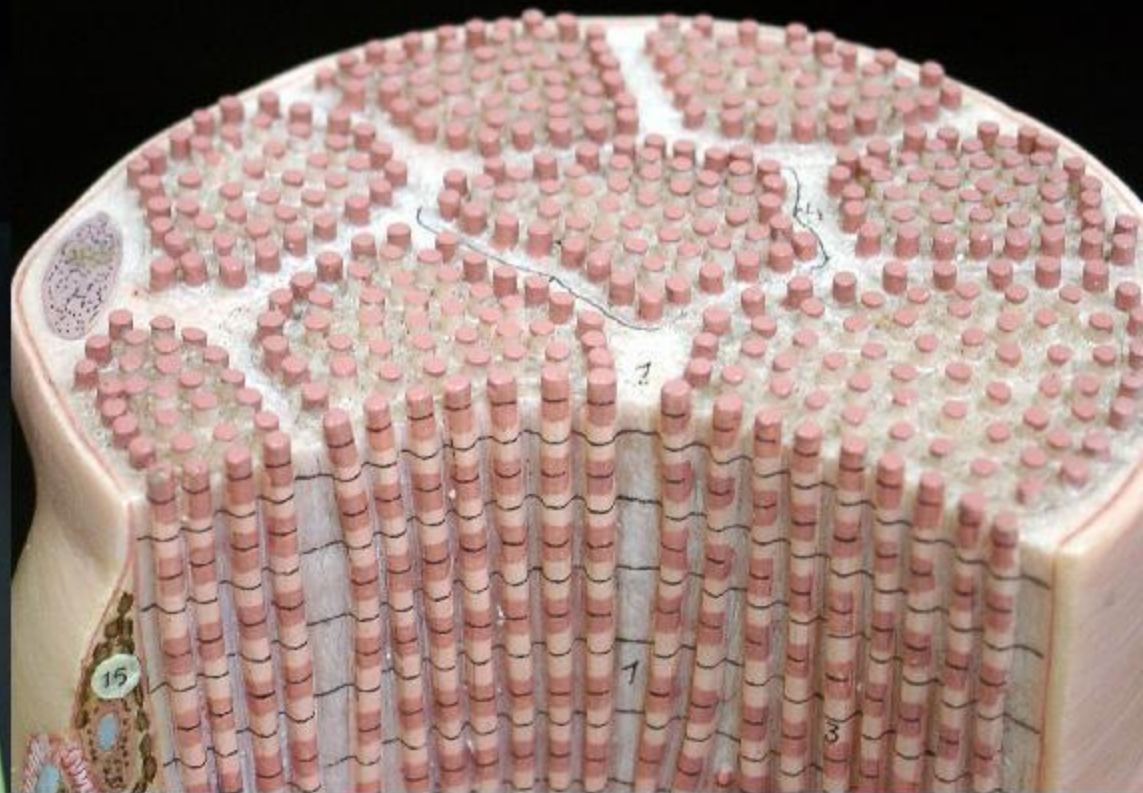
**Striations**



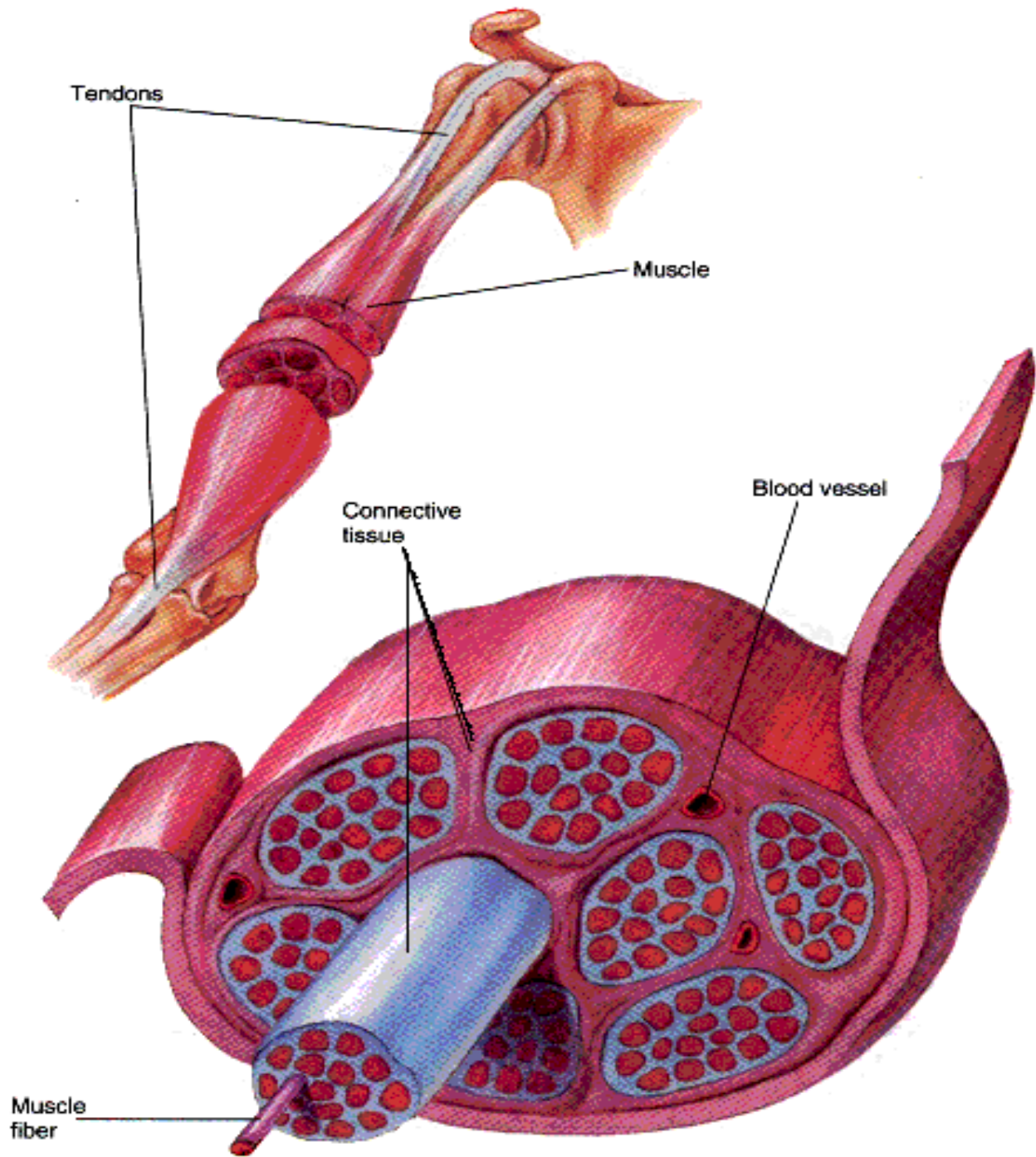




11140008.jpg

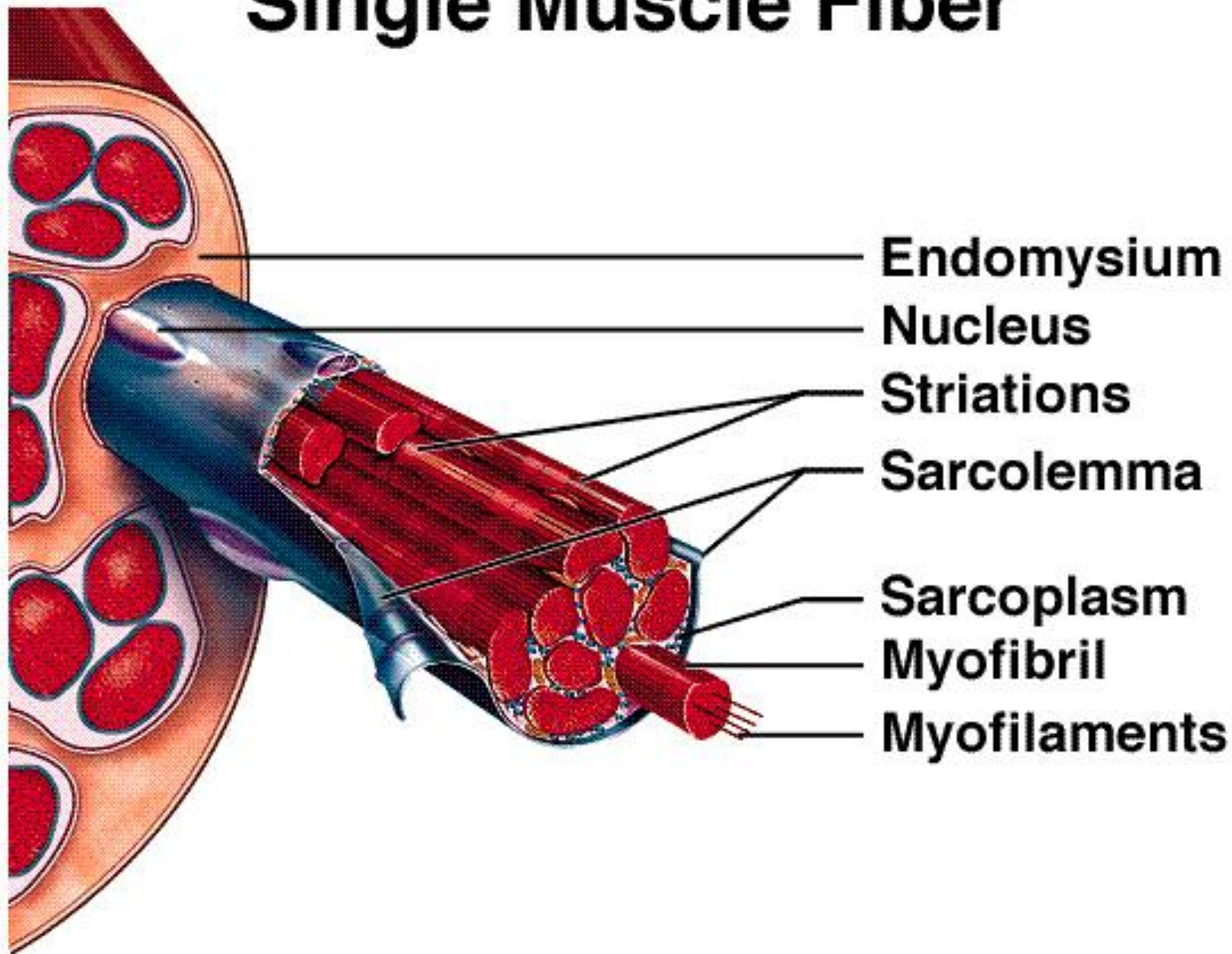


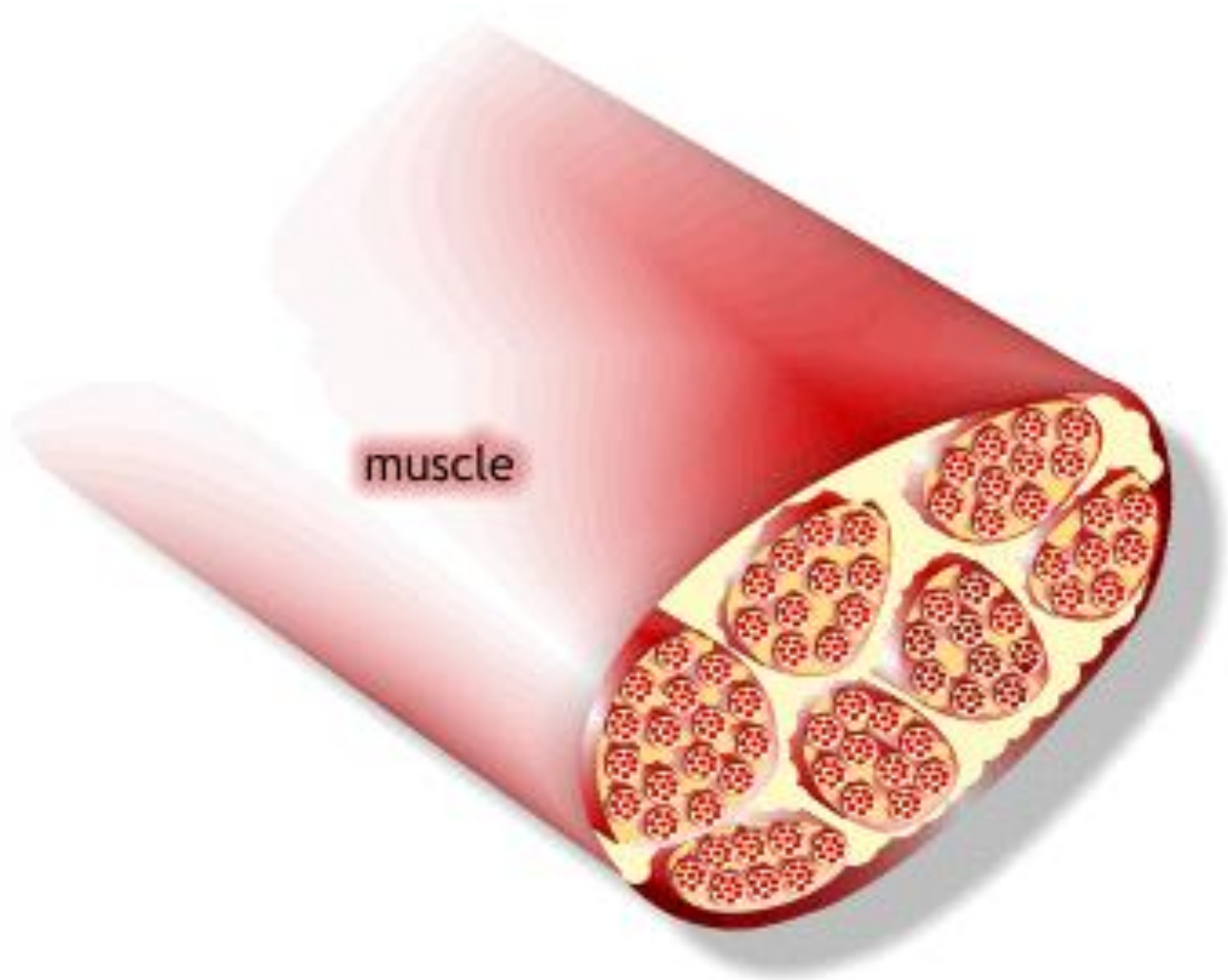
11140009.jpg





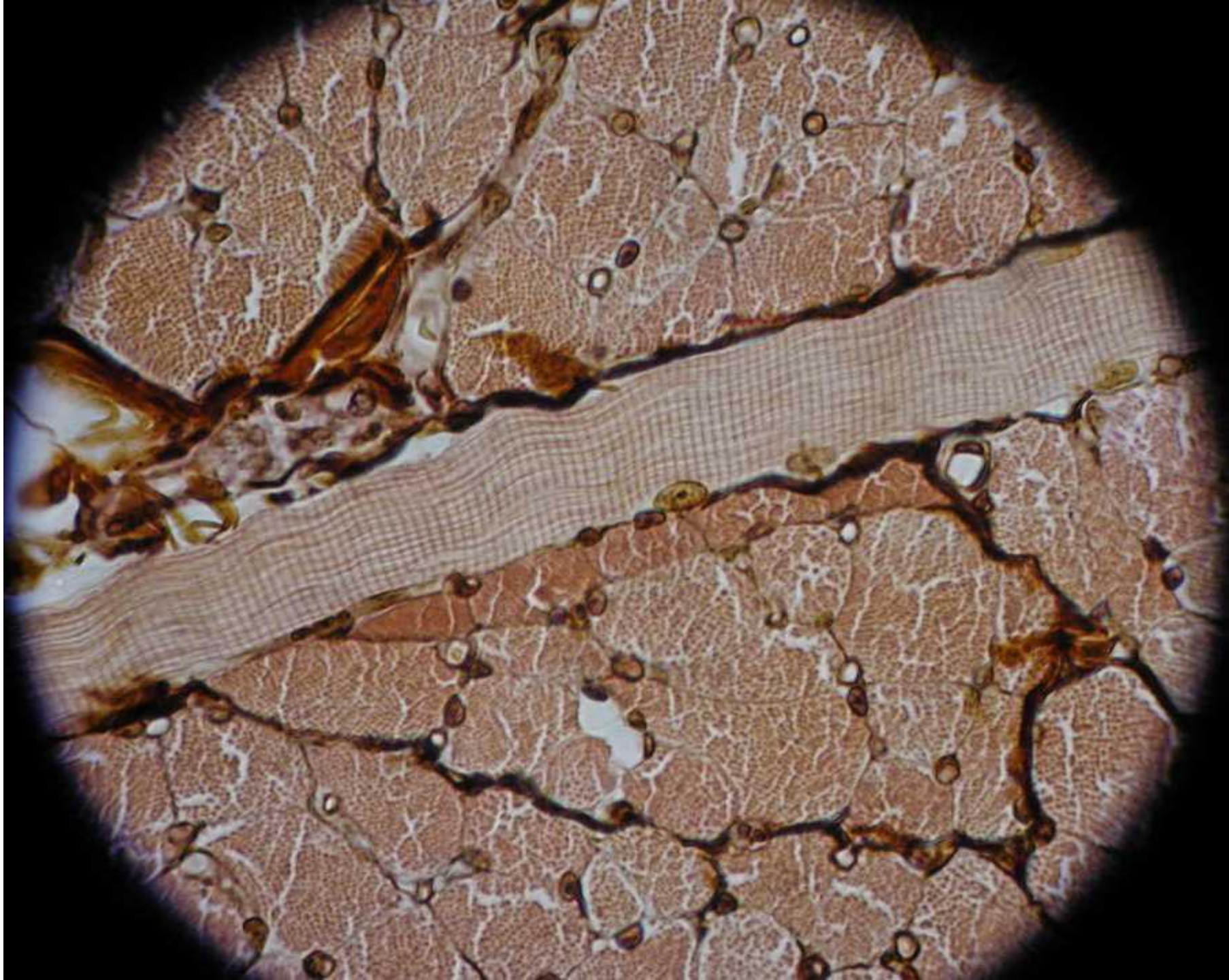
# Single Muscle Fiber





muscle

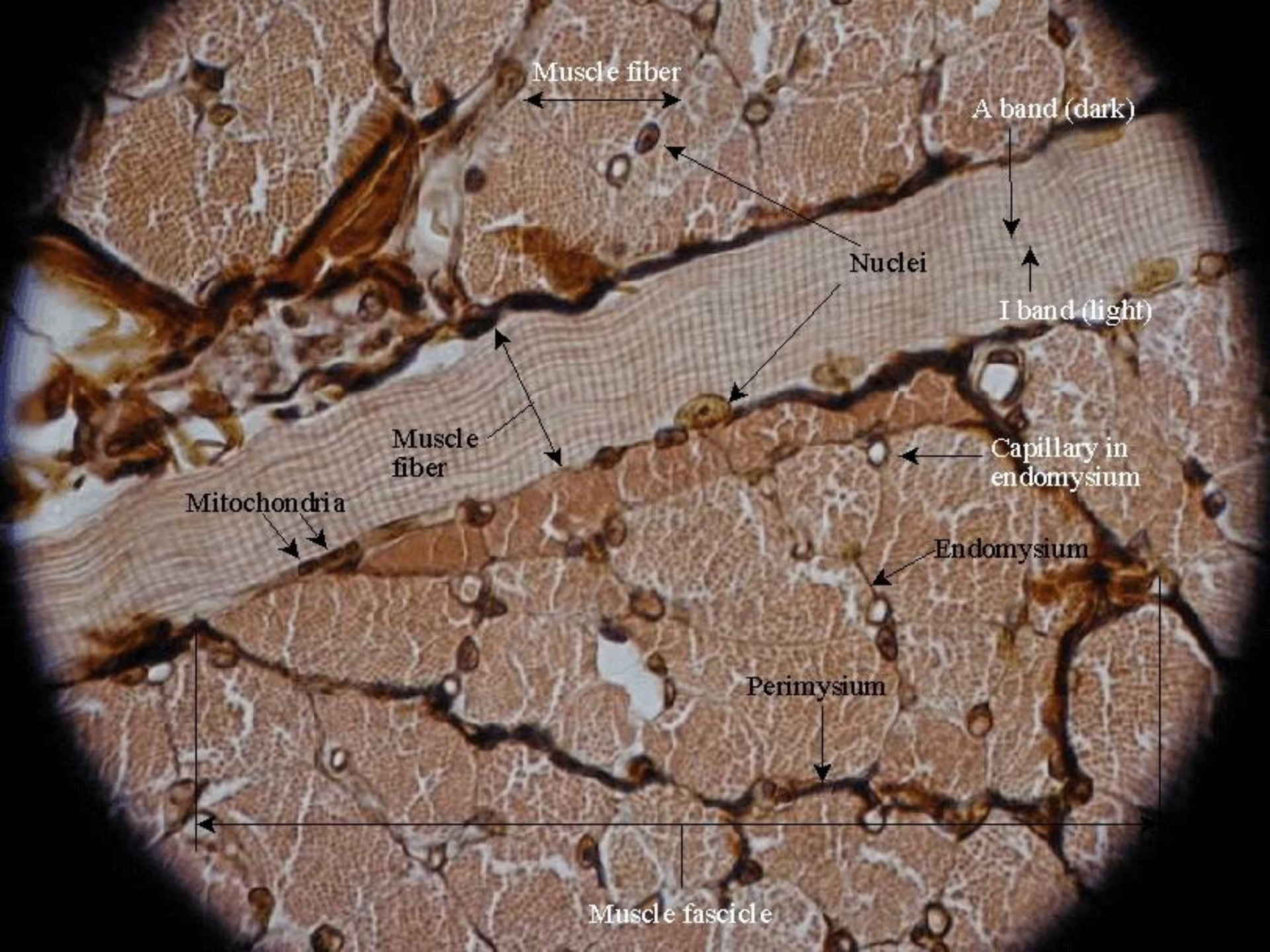












Muscle fiber

A band (dark)

Nuclei

I band (light)

Muscle fiber

Capillary in endomysium

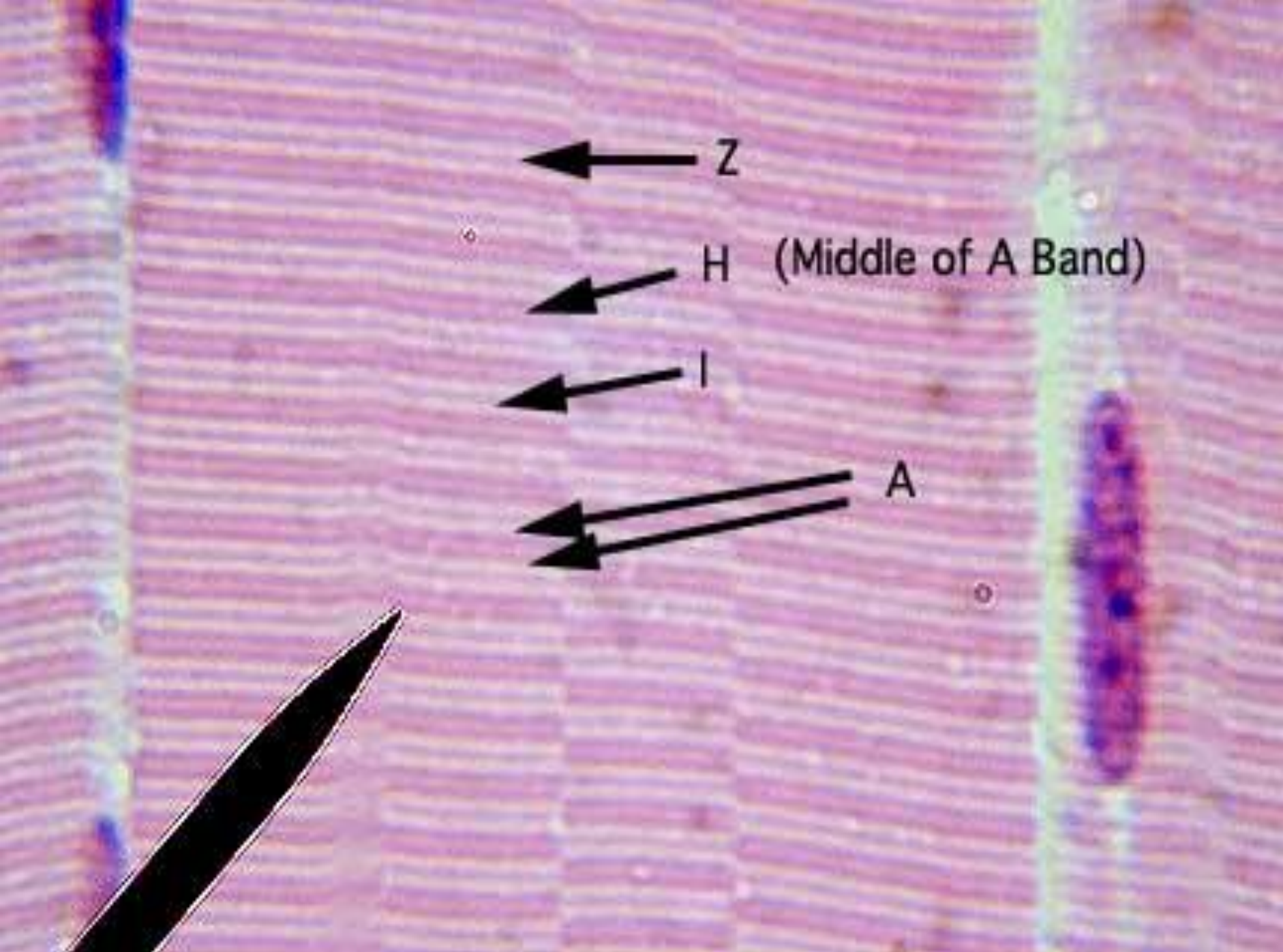
Mitochondria

Endomysium

Perimysium

Muscle fascicle





← Z

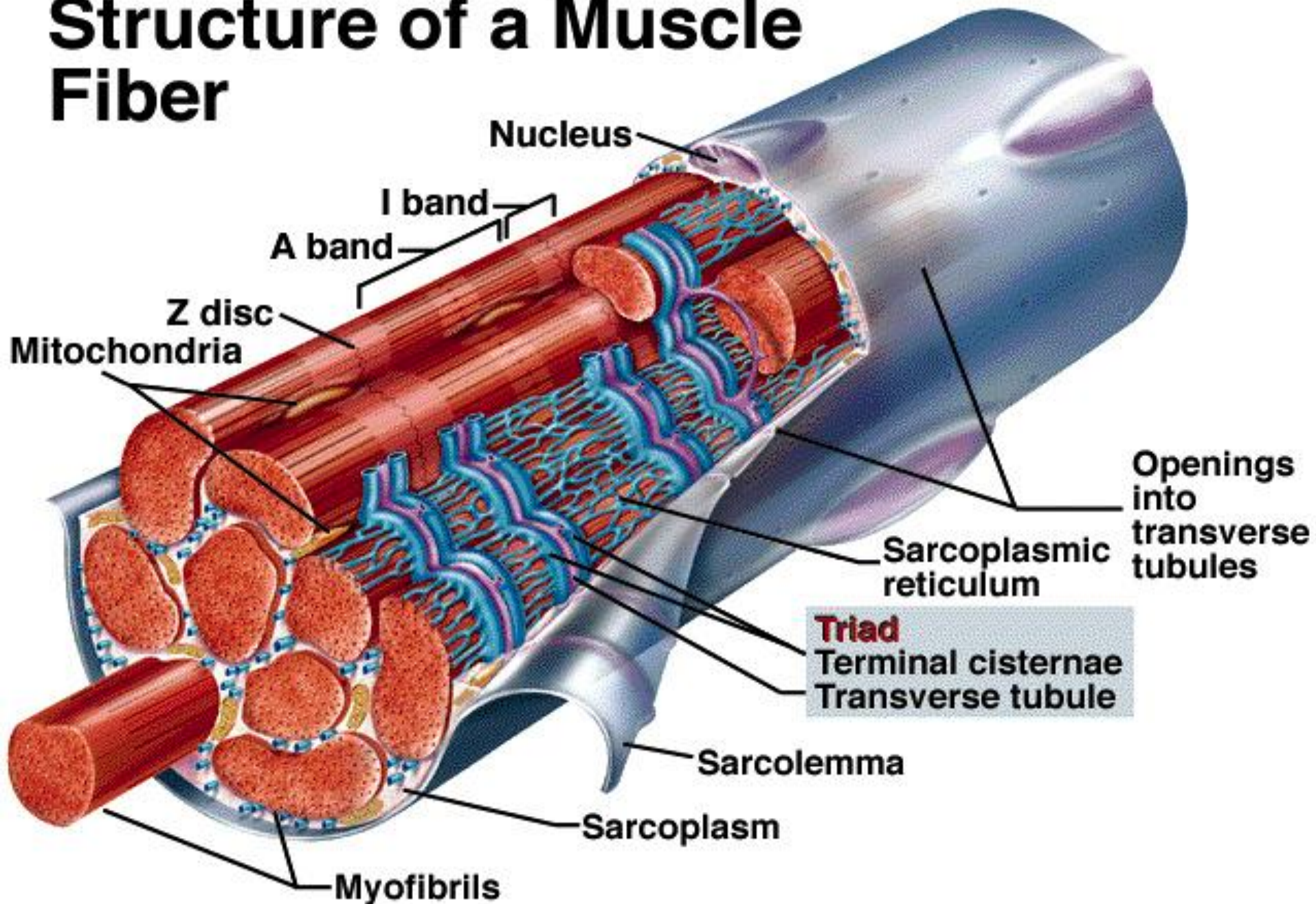
← H (Middle of A Band)

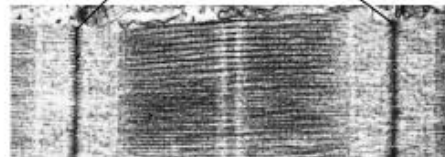
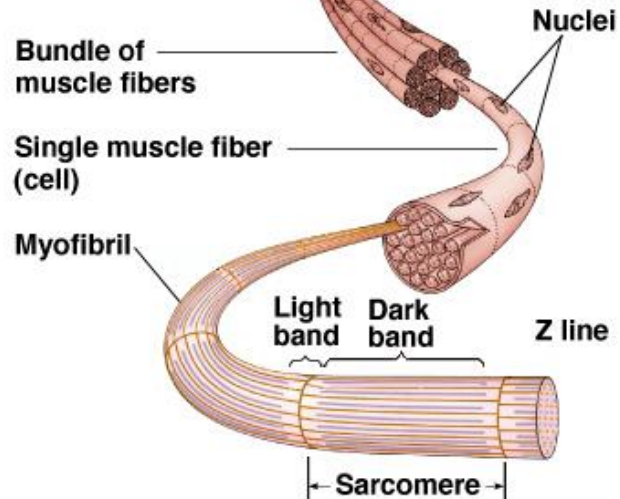
← I

← A

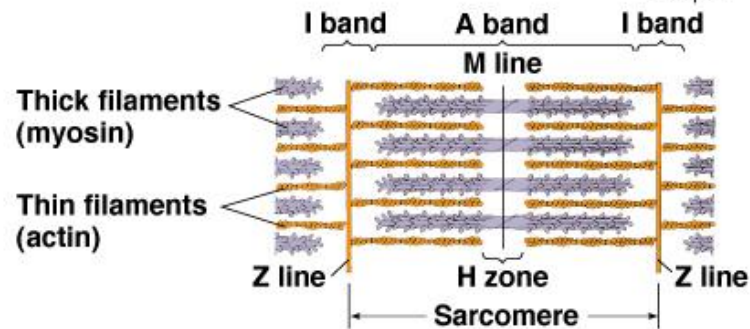


# Structure of a Muscle Fiber





0.5  $\mu\text{m}$

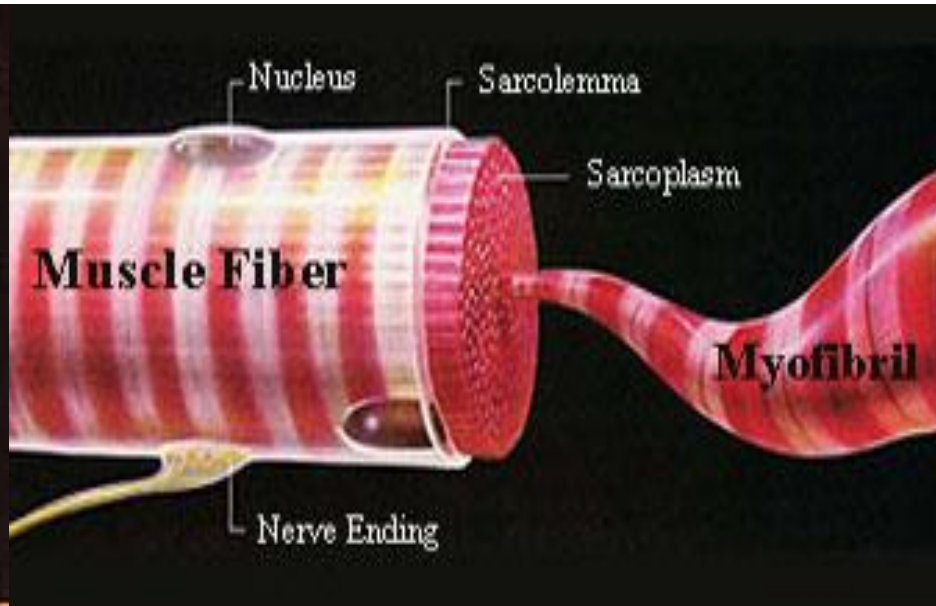




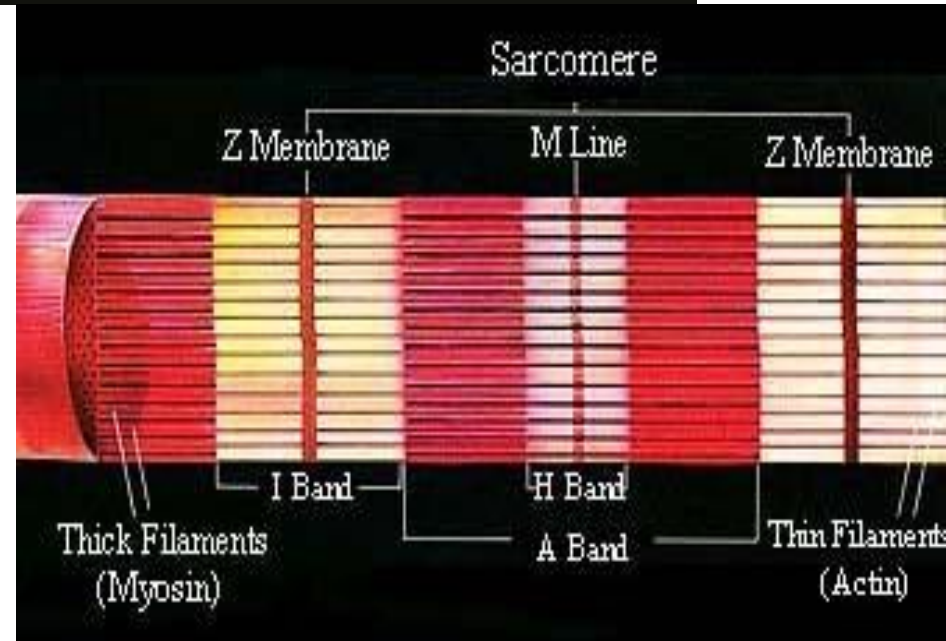
# Muscle

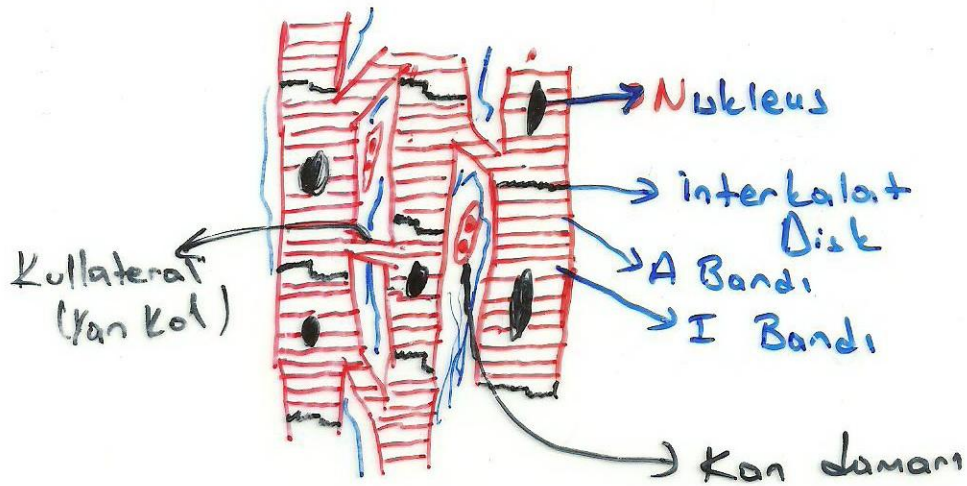
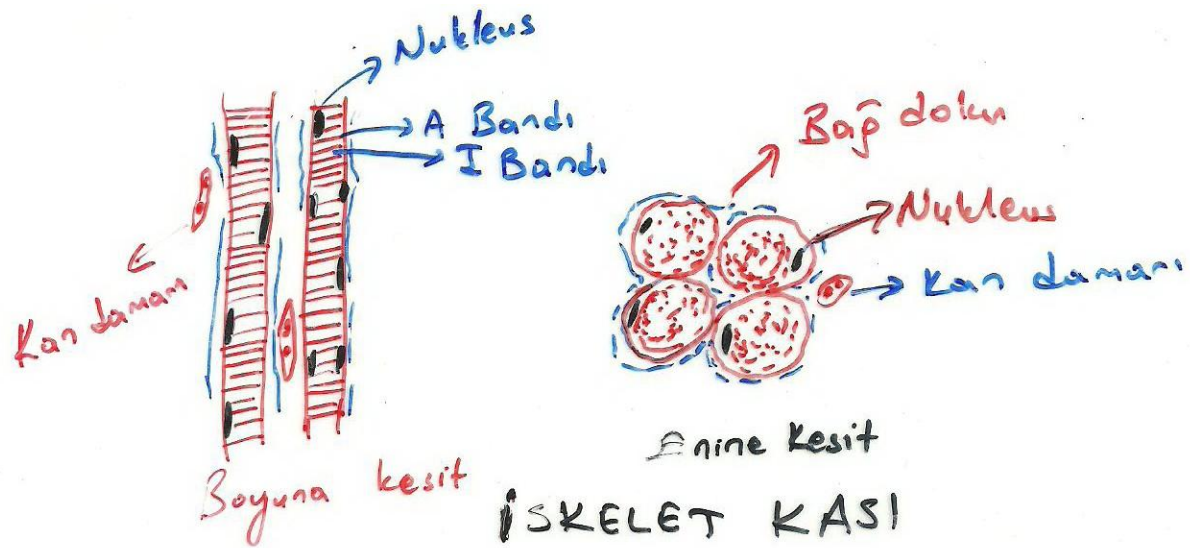


# Fiber Muscle



# Myofibril

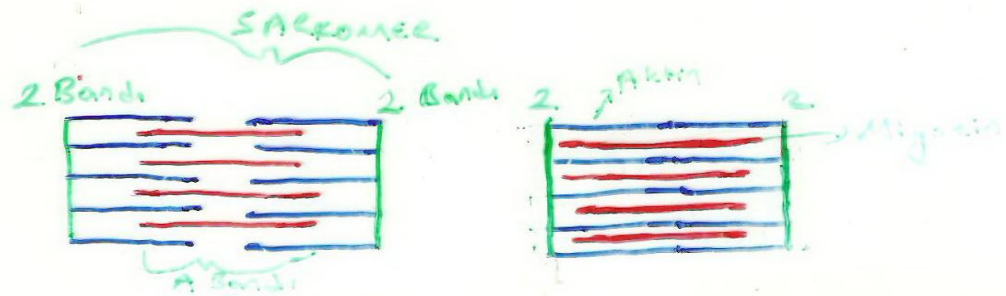
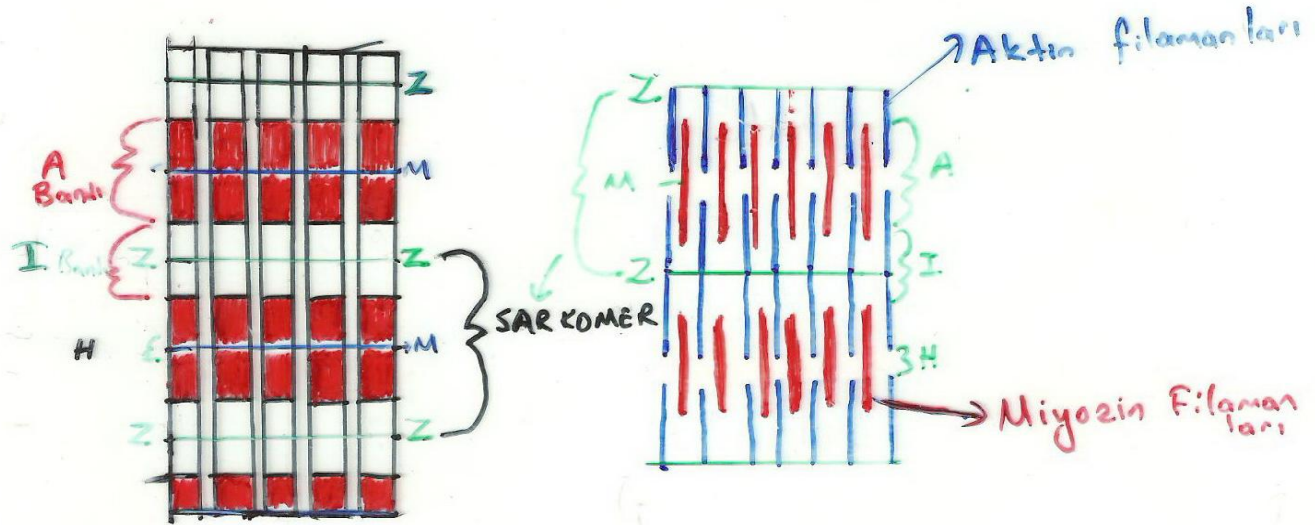
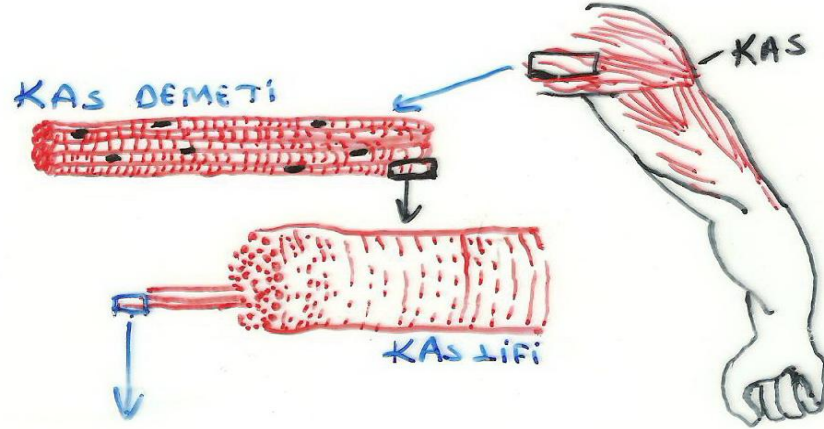




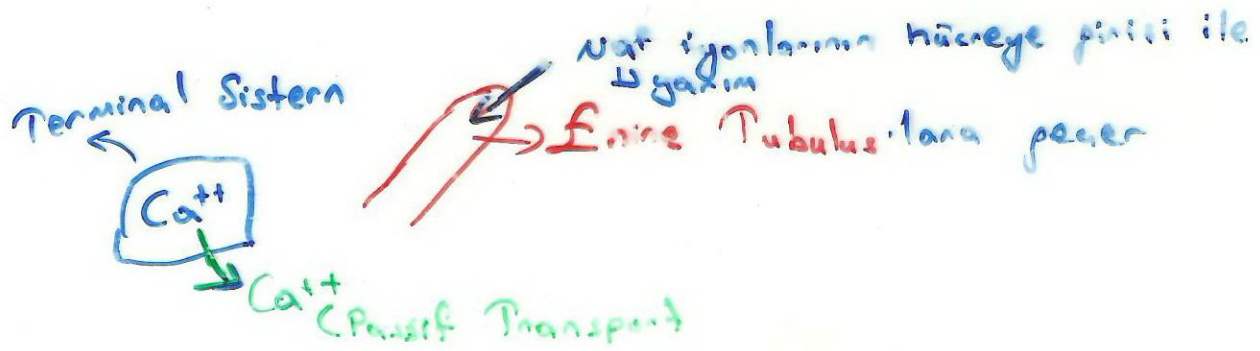
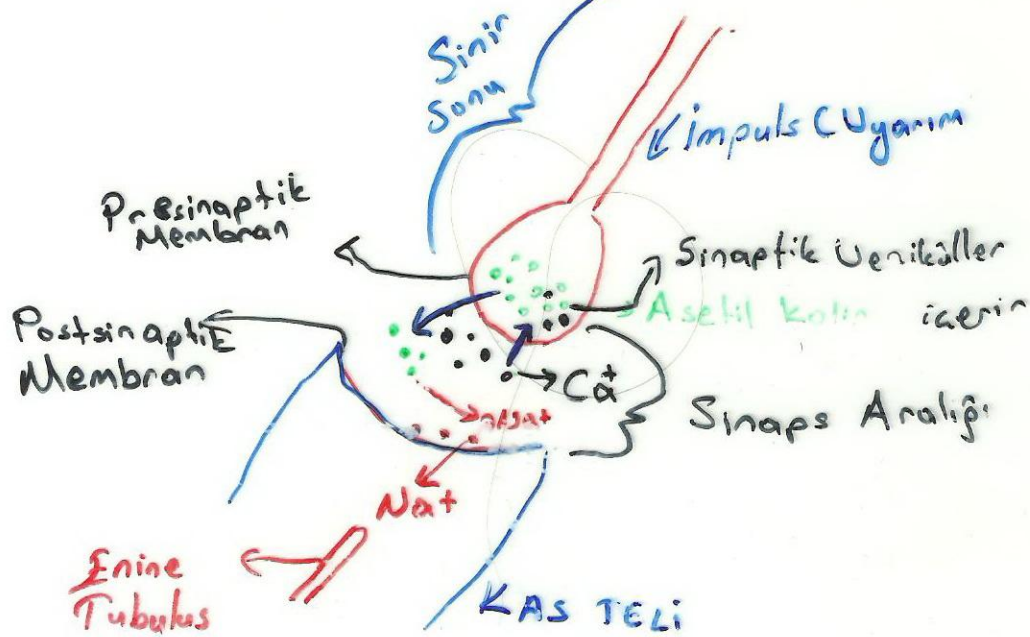
**KALP KASI (Boyuna kesit)**



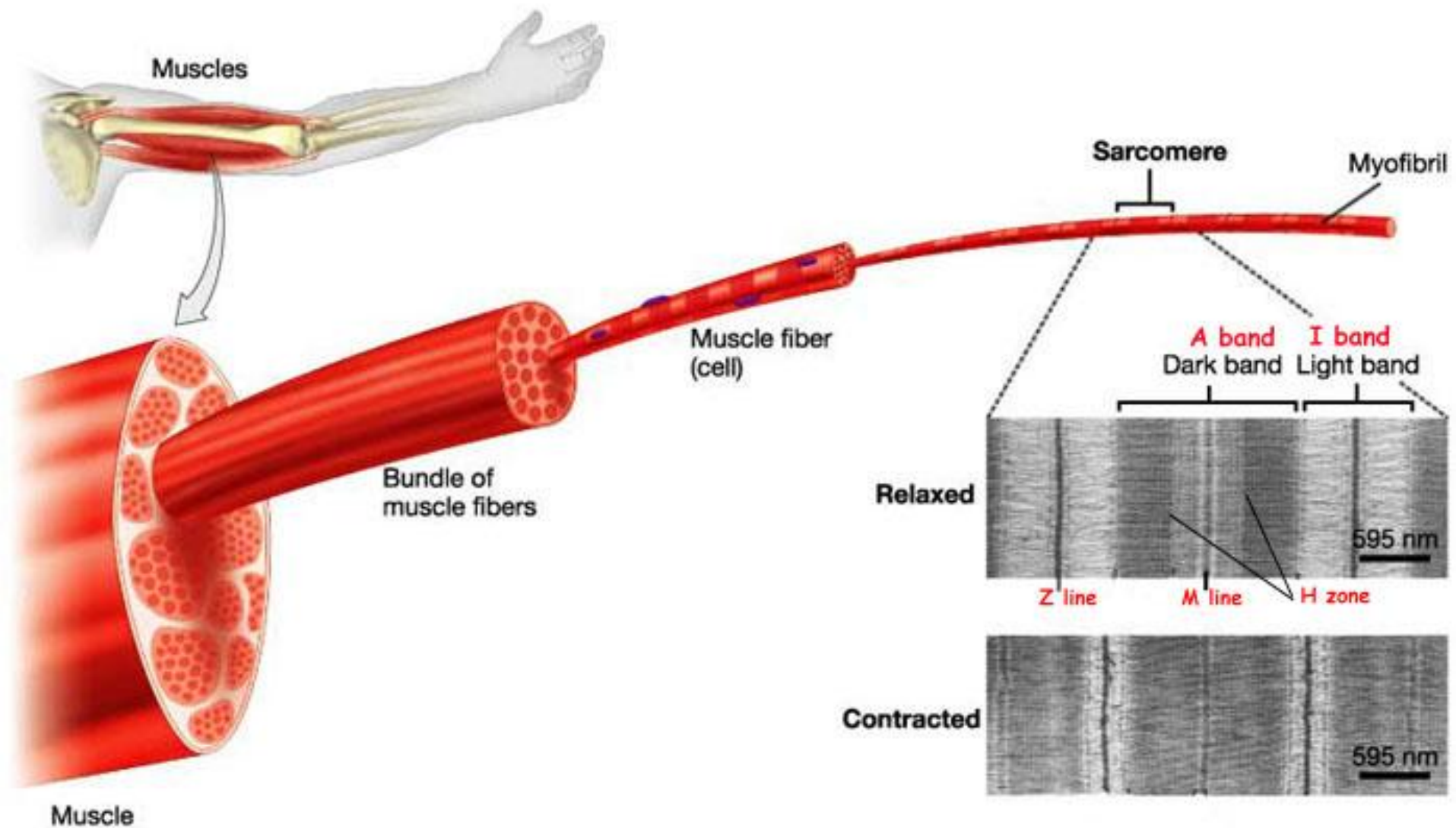
# KASIN HISTOLOJİK YAPISI ve KONTRAKSİYON OLUŞUMU







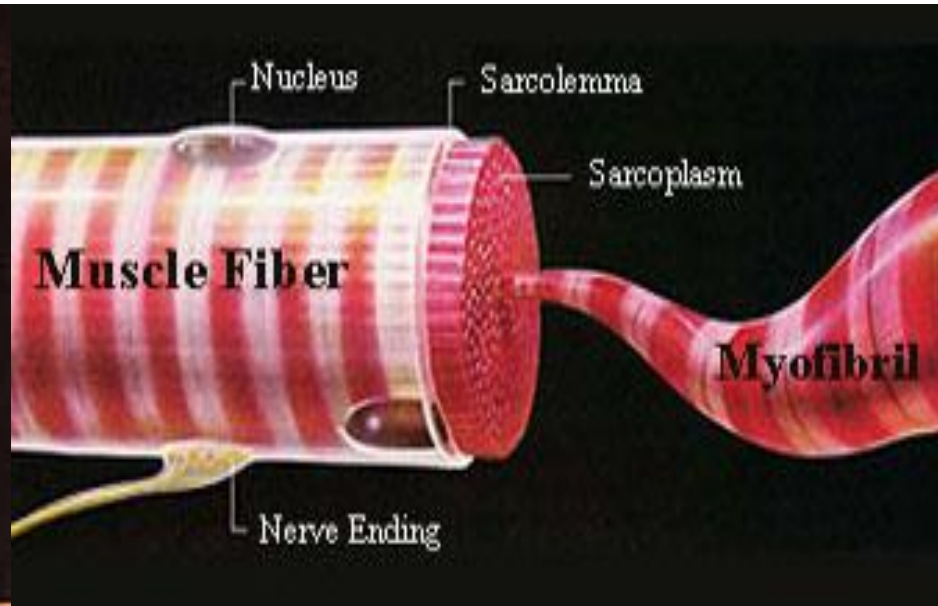
Ca varlığında Aktin filamanları, miyozin filamanları üzerinde bir seri reaksiyon sonucu kayarak kontraksiyon oluşur



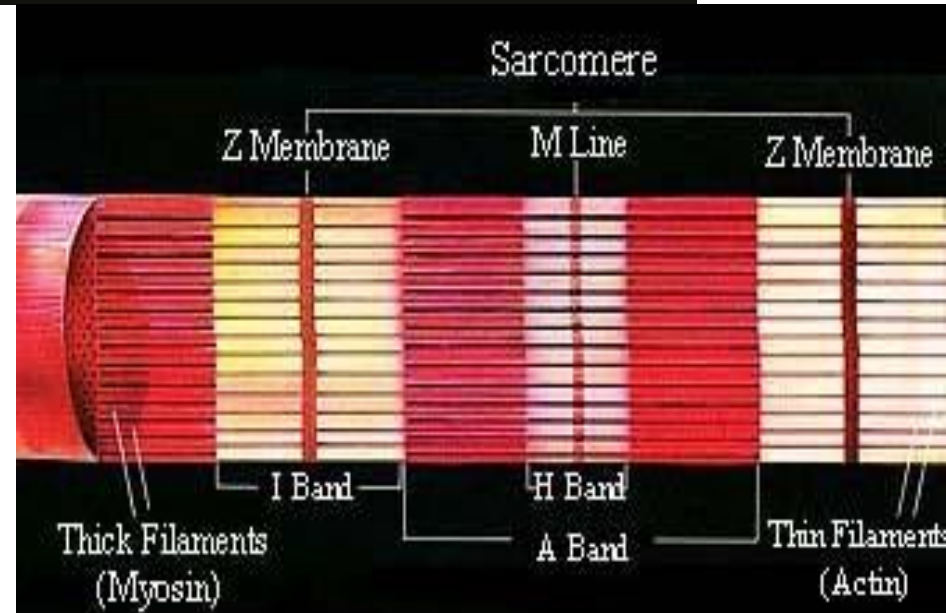
# Muscle



# Fiber Muscle

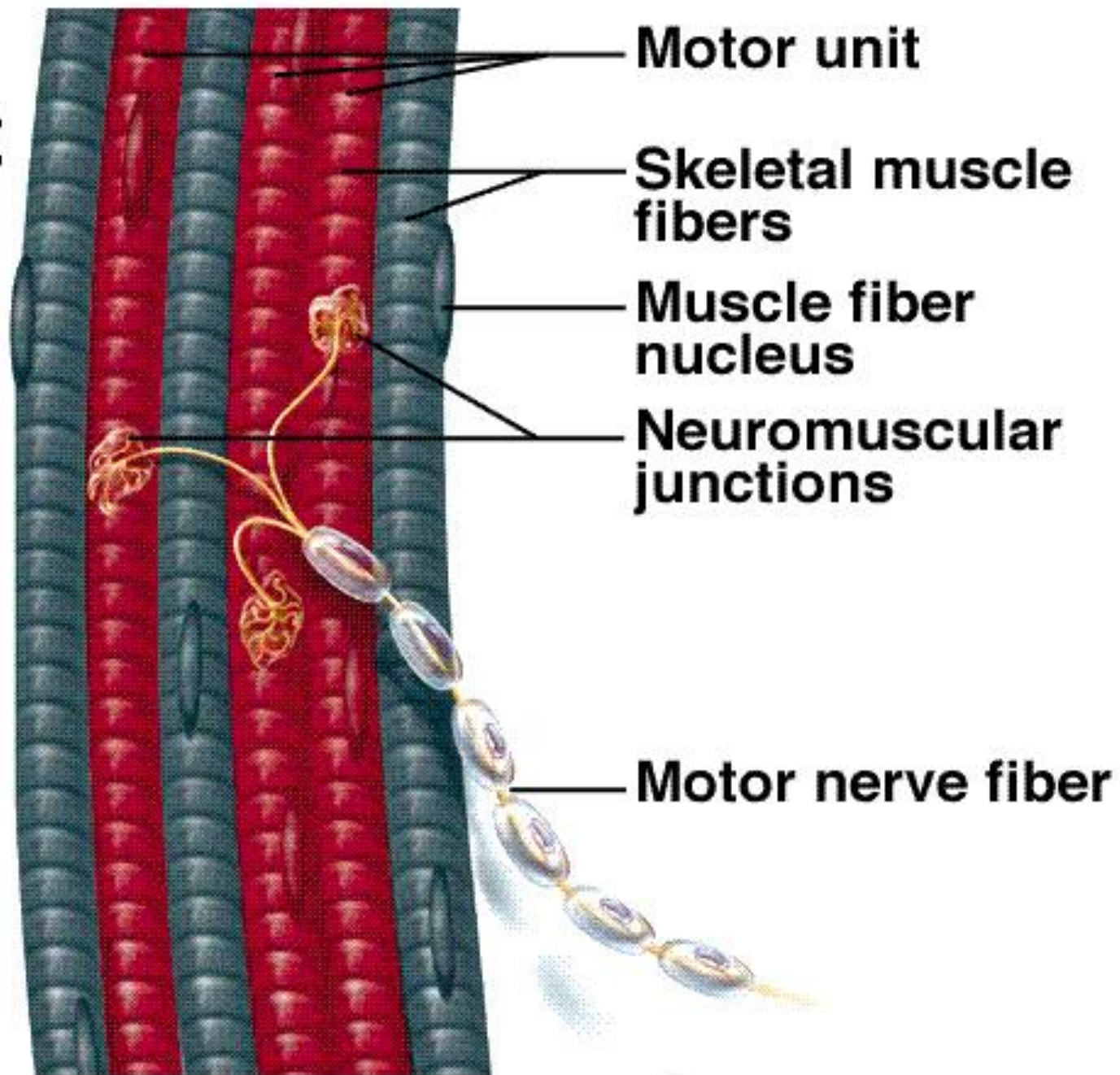


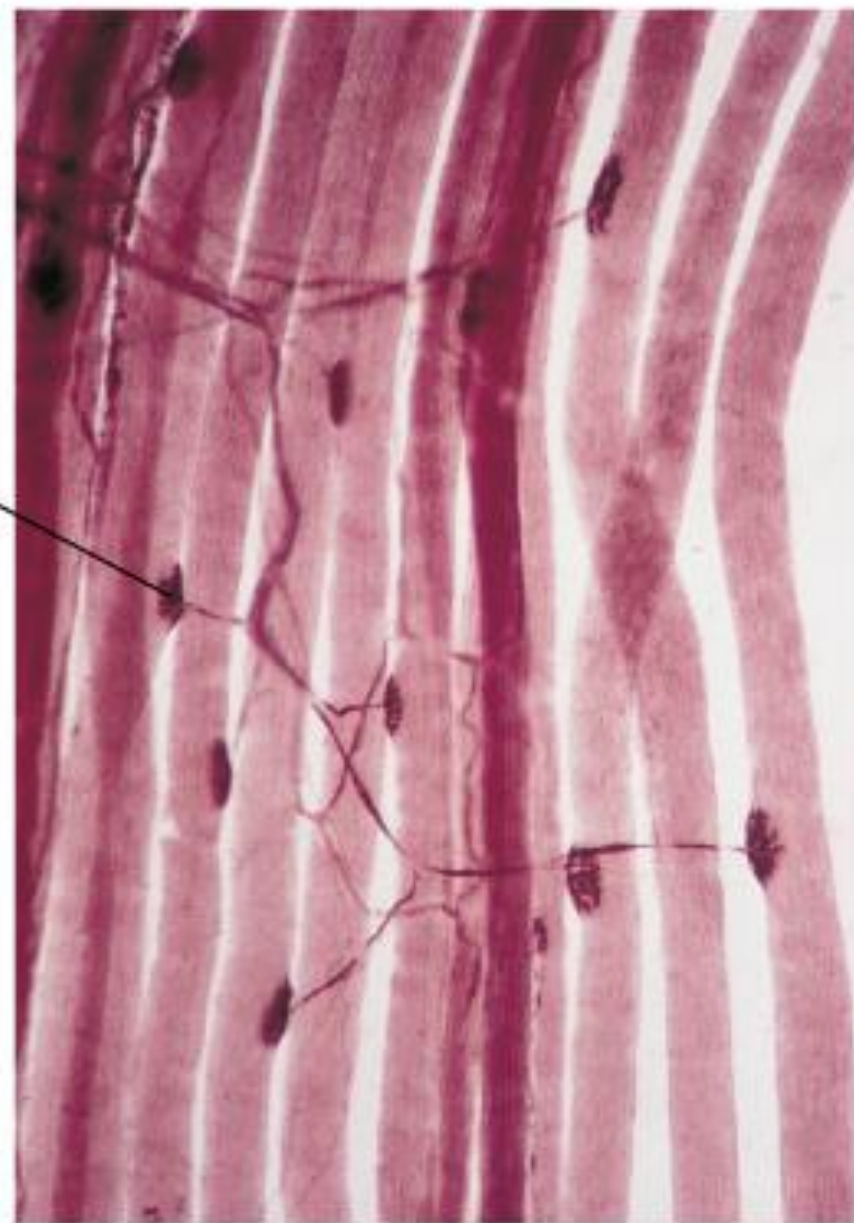
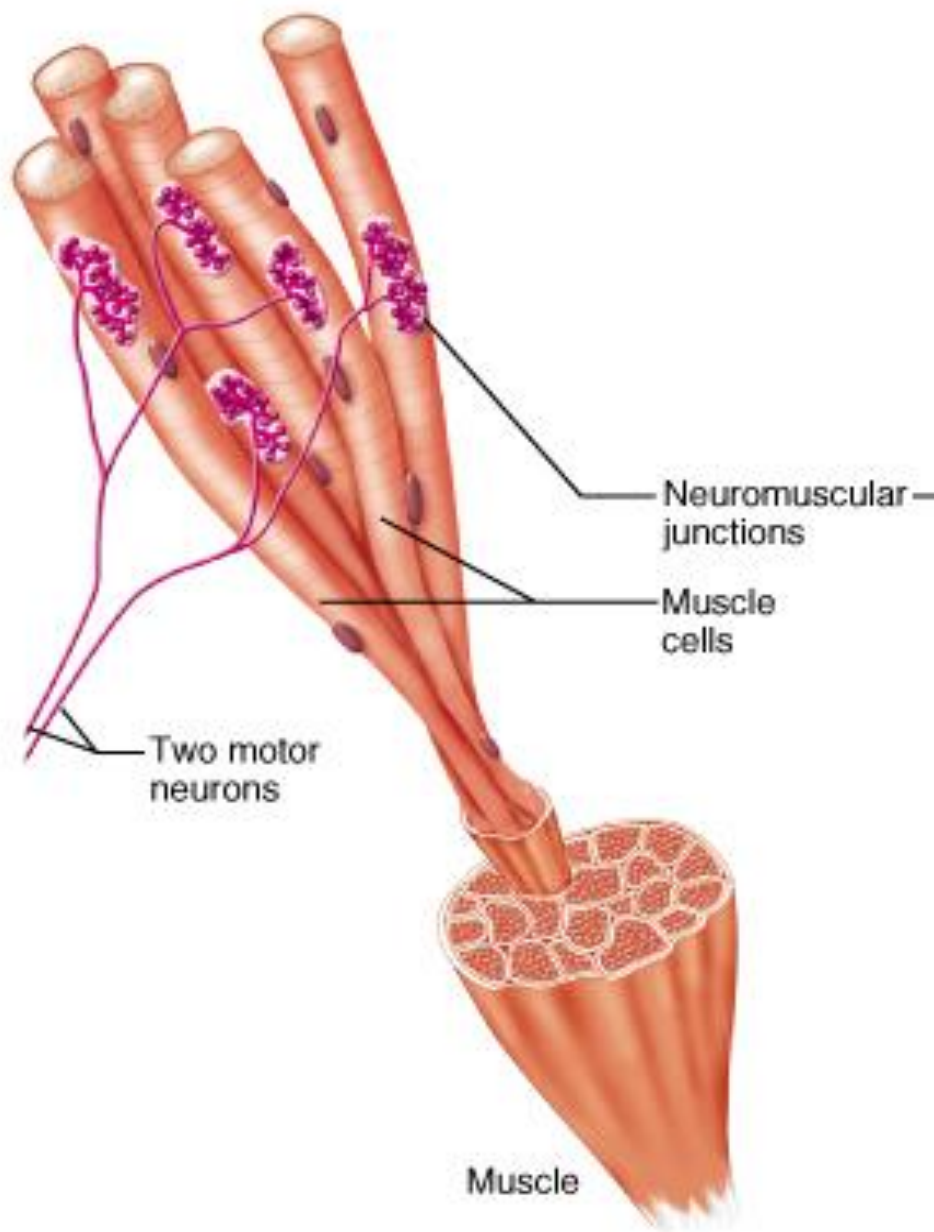
# Myofibril





# Motor Nerve Unit

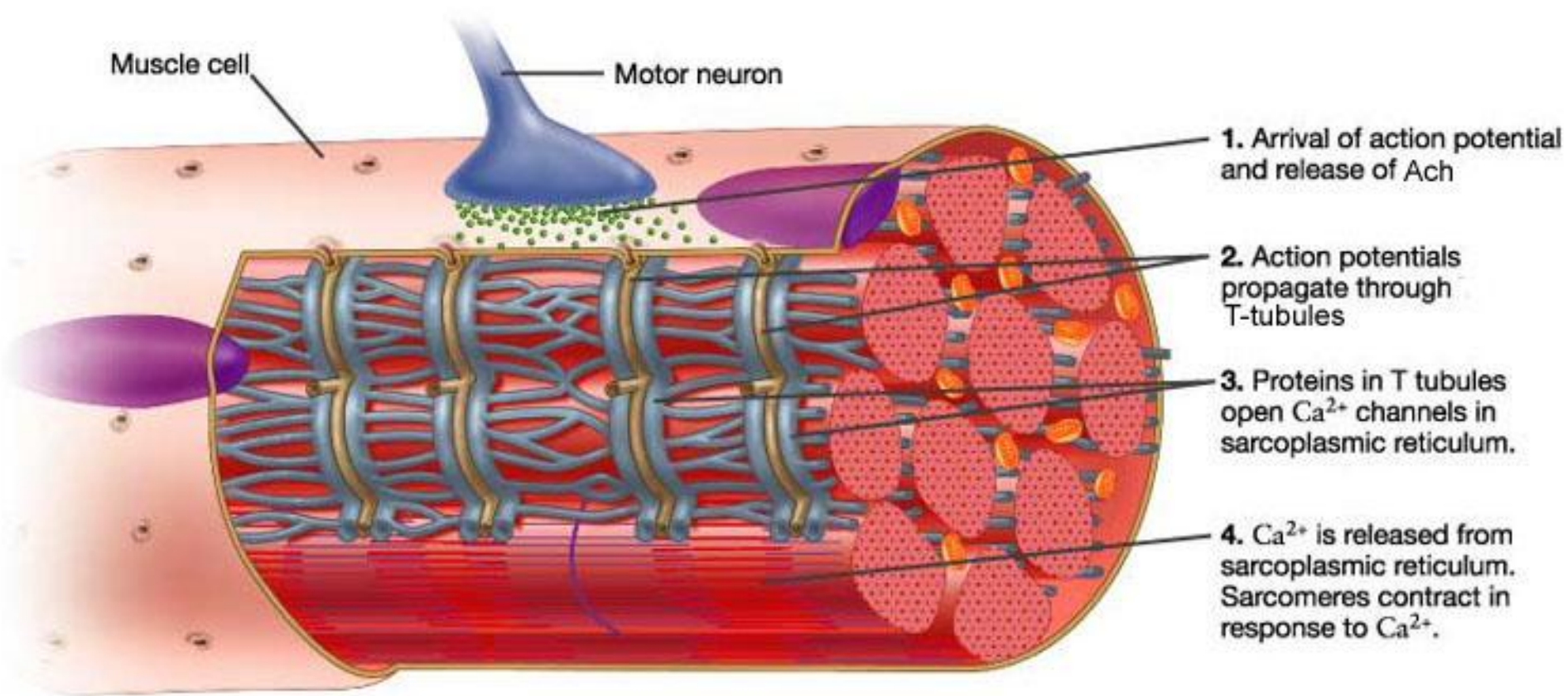




(a)

(b)





# Morfolojik farklılıklarına göre iskelet kası telleri

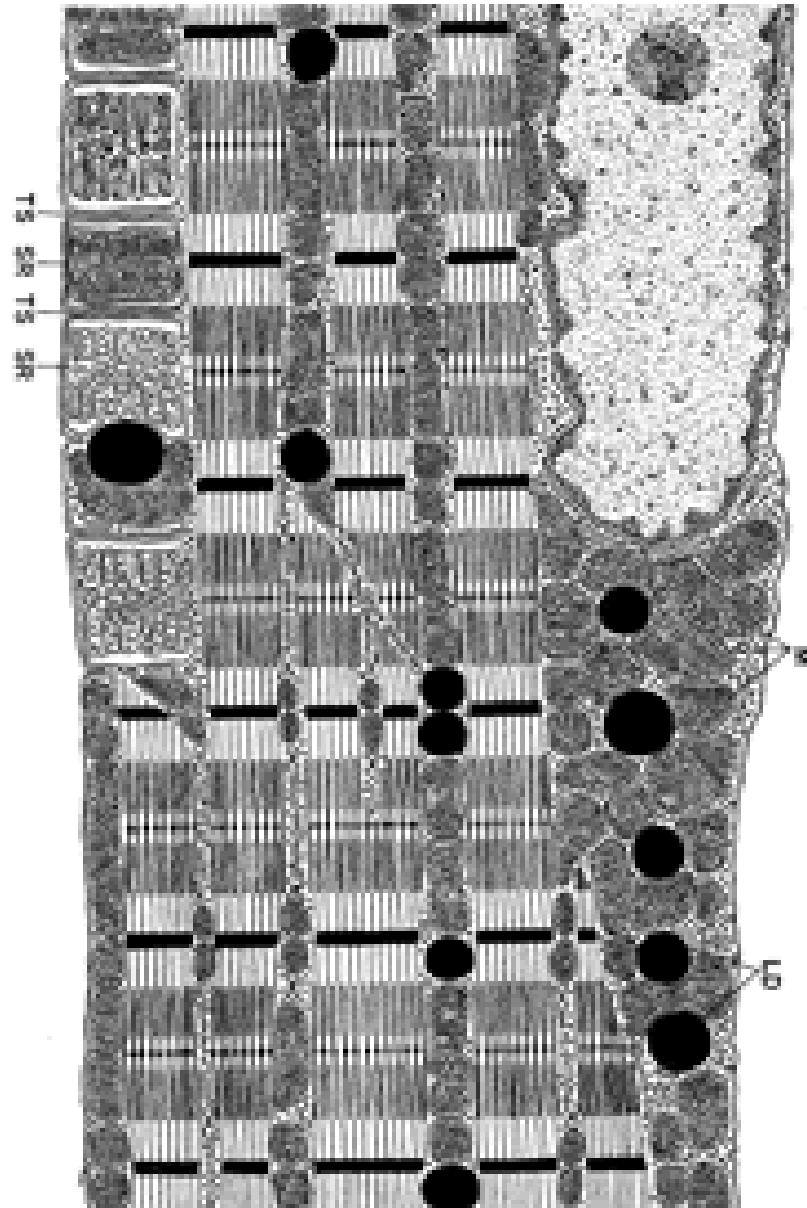
Beyaz kas teli

Kırmızı k.t.

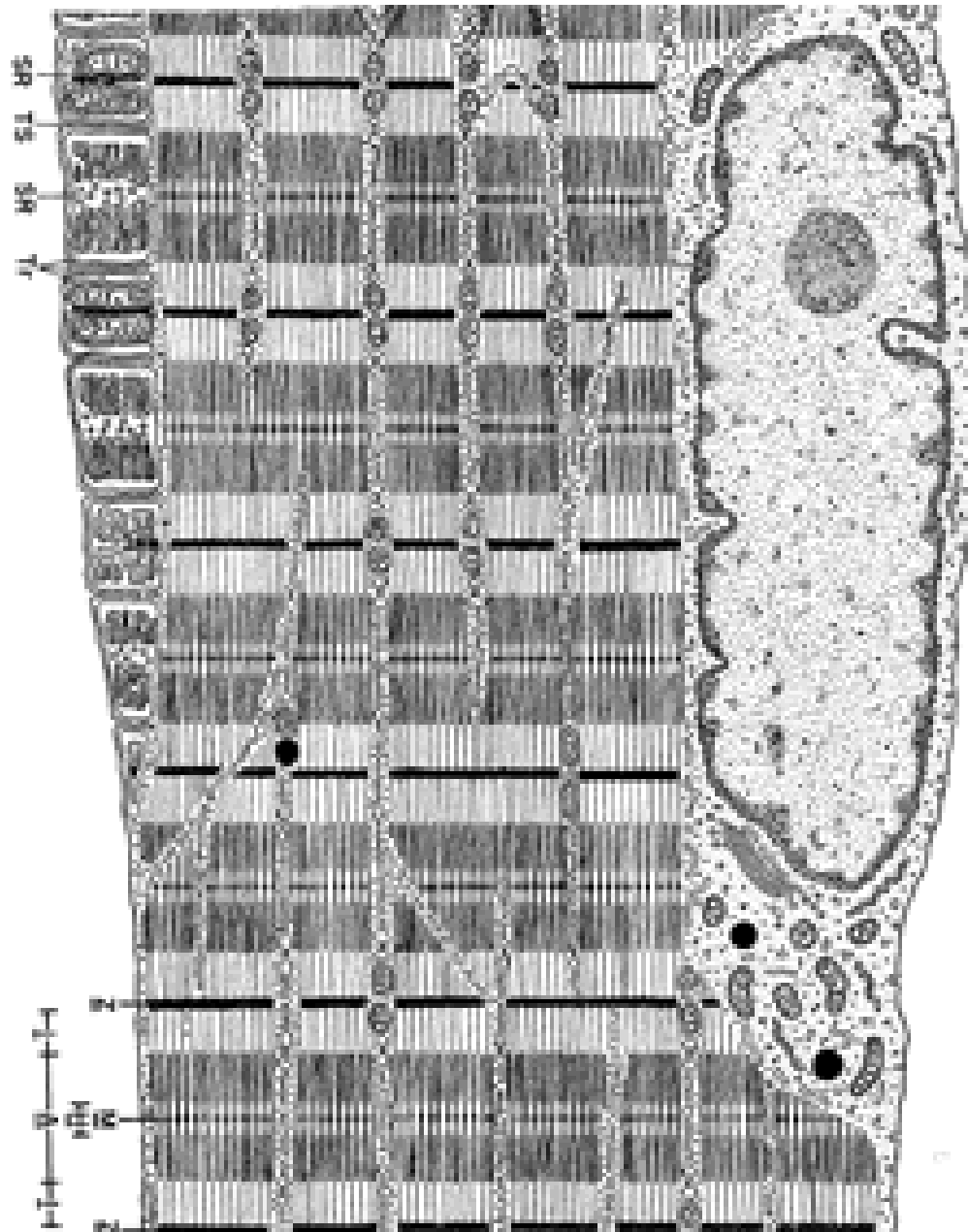
İntermediyer

	Beyaz kas teli	Kırmızı k.t.	İntermediyer
İçedikleri miyoglobin	Az	Çok fazla	
Damar miktarı	Az(1-2 adet)	Fazla(3-5 adet)	
Çapları	Kalın	İnce	
Miyofibrillerin yerleşimi	Homojen	Topluluk halinde (Konhaym alan.)	
Enerji maddesi	Glikojen	Lipidler	
Enerji üretim şekli	Glikolitik(Glikojen-sitoplazma-pirüvat-laktat) (fosforilaz)	Oksidatif (Lipid-Mitokondri-Oksidatif enzimler)	Oksidatif-Glikolitik
Kontraksiyon	Çok güçlü ve kısa	Zayıf fakat uzun süreli	

## Skeletal muscle red fiber



# Skeletal muscle white fiber



# Fizyolojik özelliklerine göre iskelet kaslarının sınıflandırması

## 1. Twitch Teller

Aksiyon Potansiyeli tek uyarımla şekillenebilir ve kas telinin kontraksiyon hızına göre 2 tiptir:

**A-Slow Twitch:** yavaş kasılıp yorulmadan uzun zaman çalışırlar (kırmızı kas telleri)

**B-Fast Twitch:** 2 gruba ayrılırlar:

1-Hızlı ve güçlü kontraksiyon yapar ancak çabuk yorulurlar (beyaz kas telleri, yakıt glikojendir)

2-İntermediyer tellerden oluşur, yakıt glikojen ve lipiddir.

## 2. Tonik teller

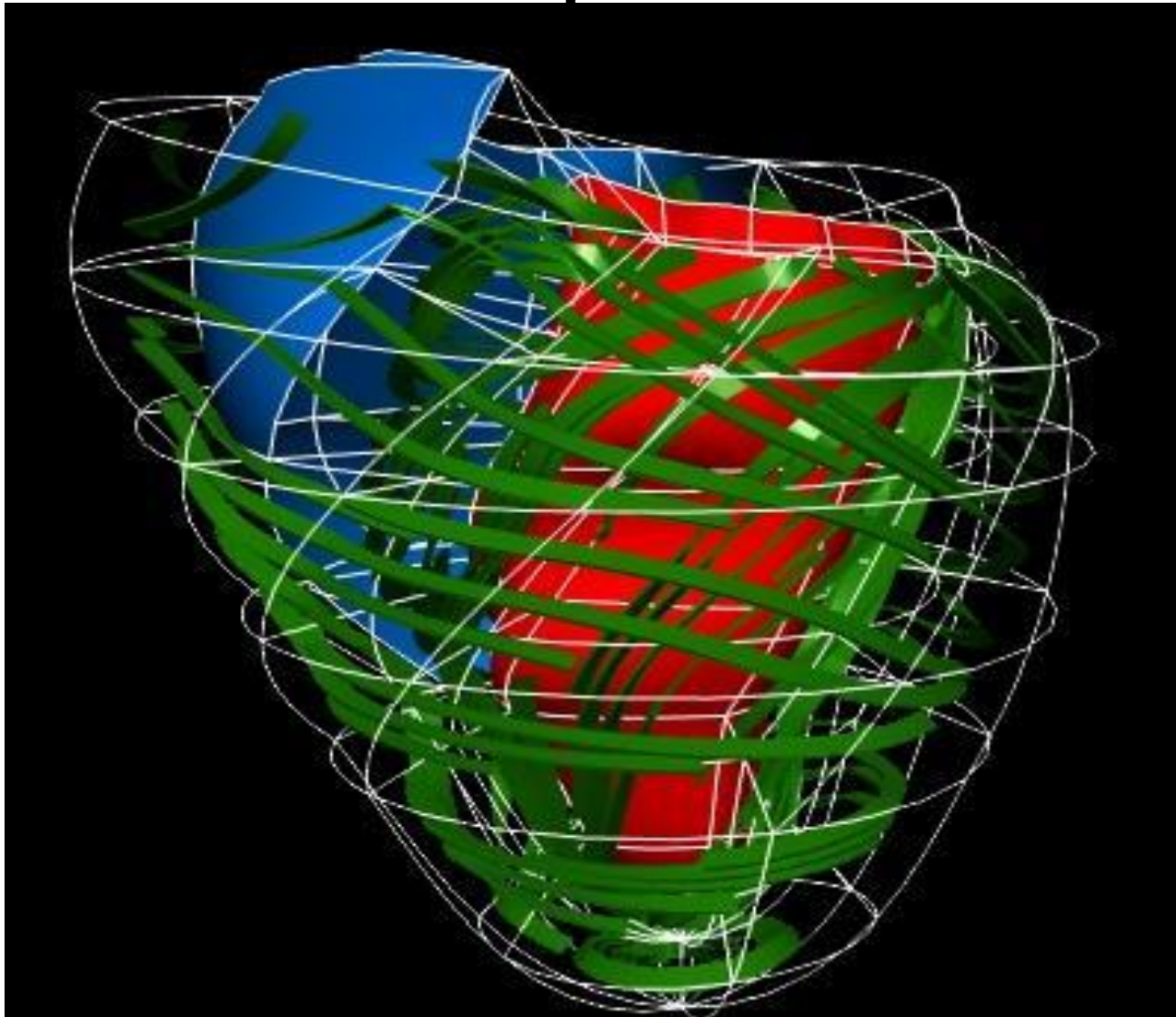
Kontraksiyon yapabilmeleri için peşpeşe seri halde uyarım almaları gerekir, buna rağmen kontraksiyonları uzun zaman alır. Reptillerde ve amfibilerde var, memelilerde nadiren görülür.

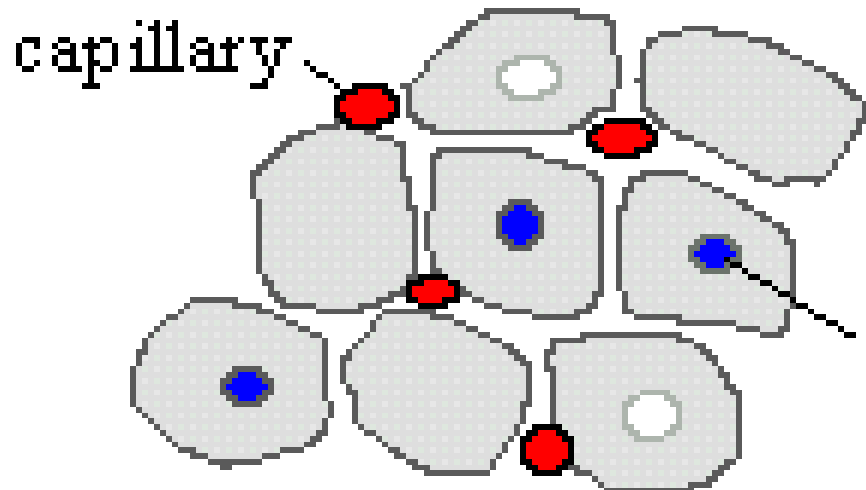
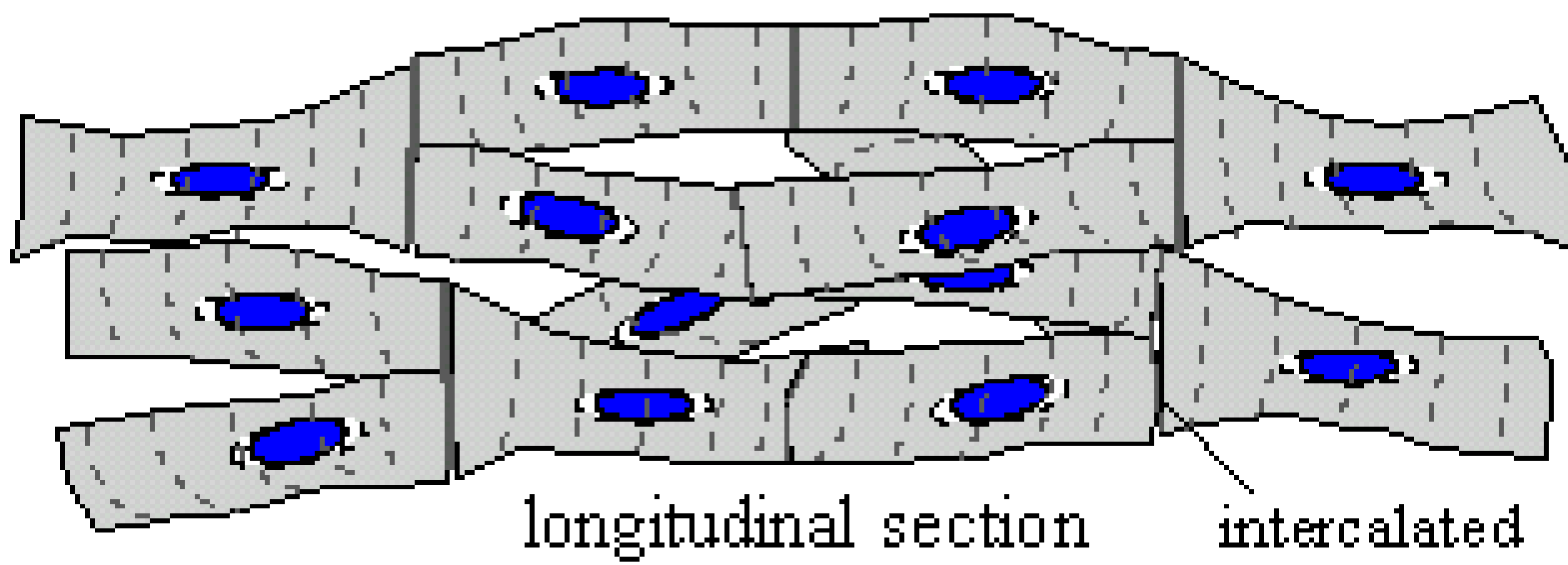
## 2. Kalp Kası Dokusu

- izgili
- Tek ekirdekli, ortadadır.
- Kollateral kolllar bulunur.
- İnterkalat diskler.(uyarımların hücreden hücreye iletilmesi)
- Özel uyarım üretim ve iletim alanları
- Otonom sinir sistemi etkisi altında
- His demetleri
- Purkinje telleri



# Kalp kasi

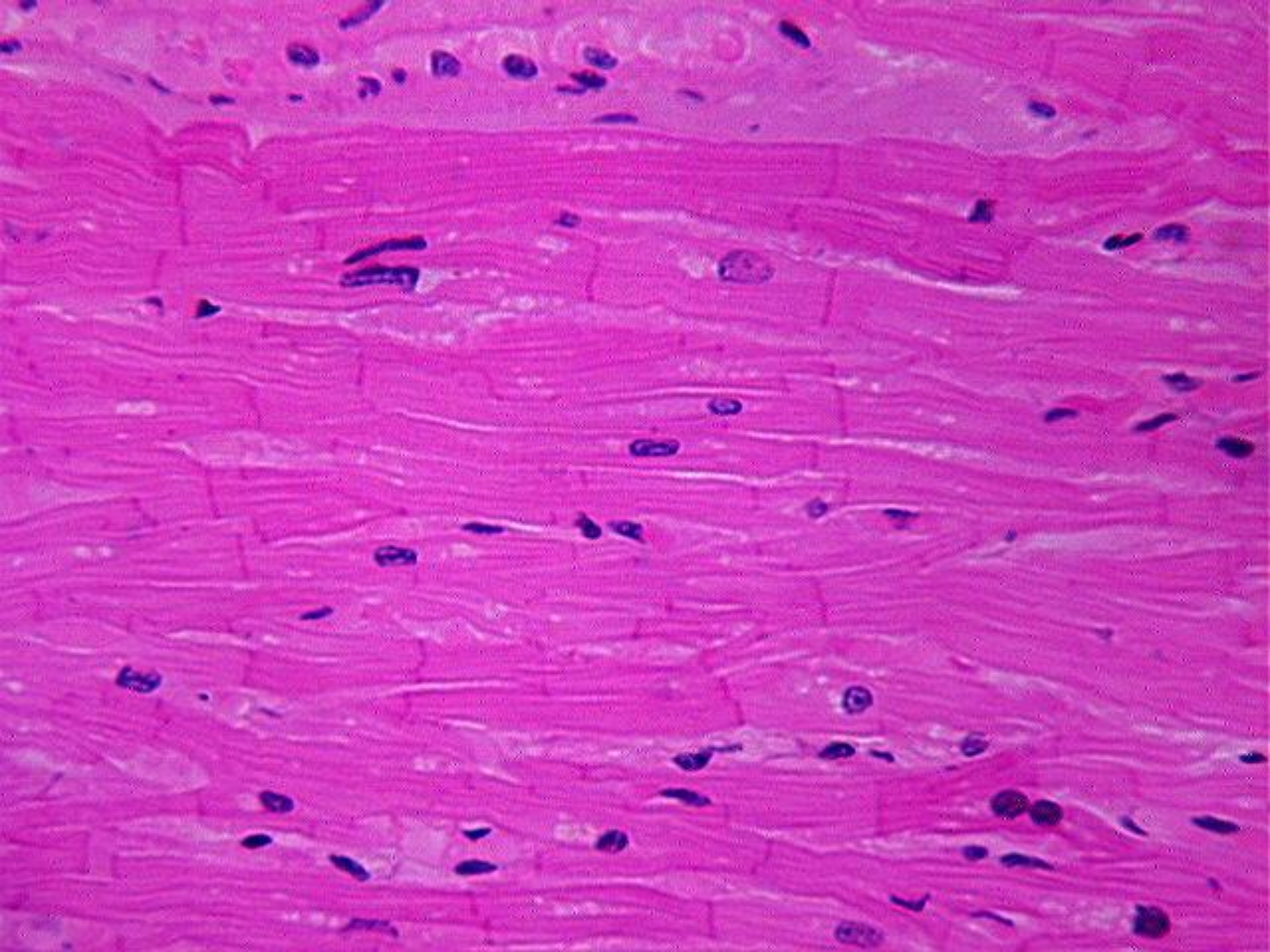




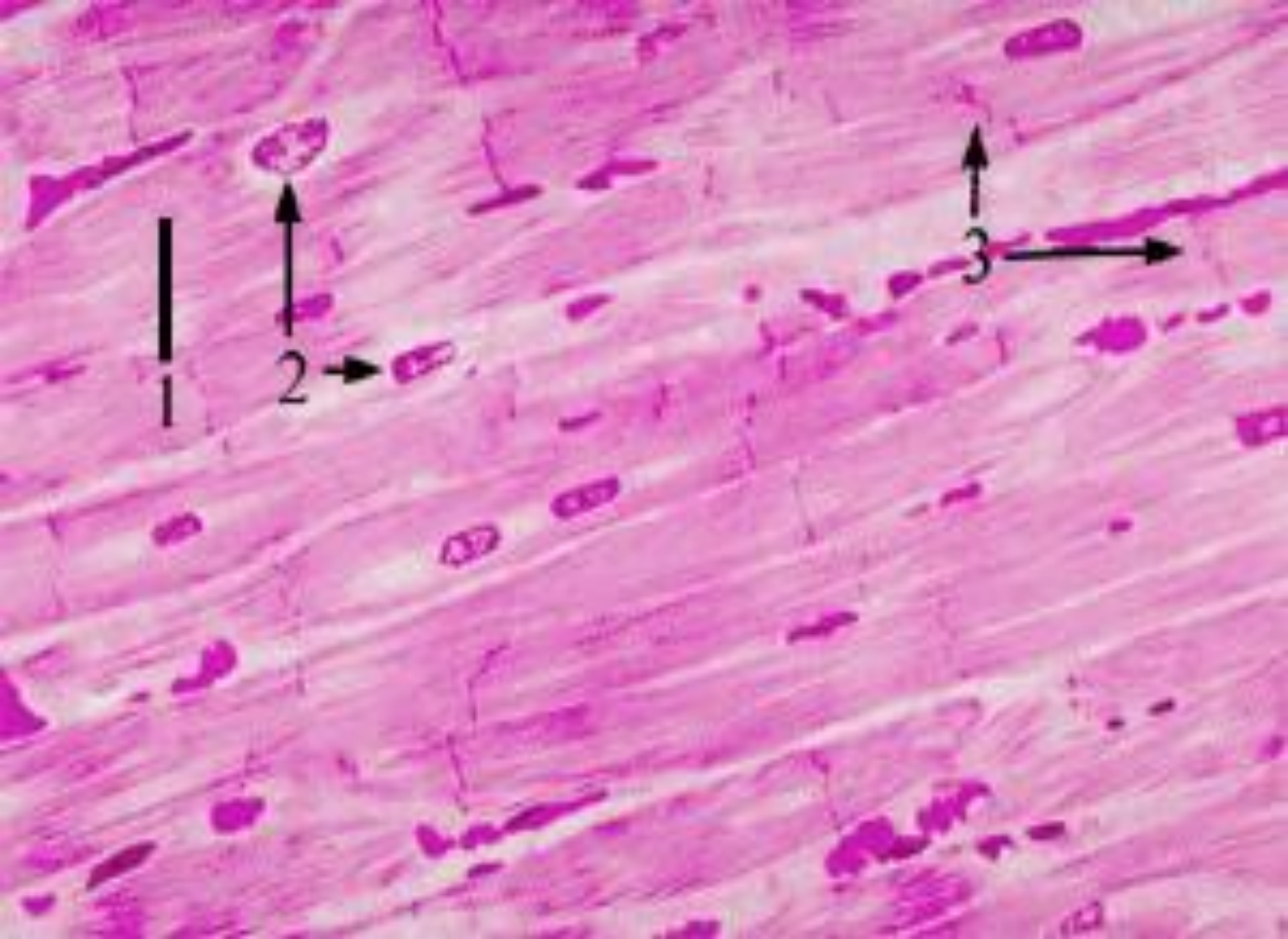
# Cardiac Muscle

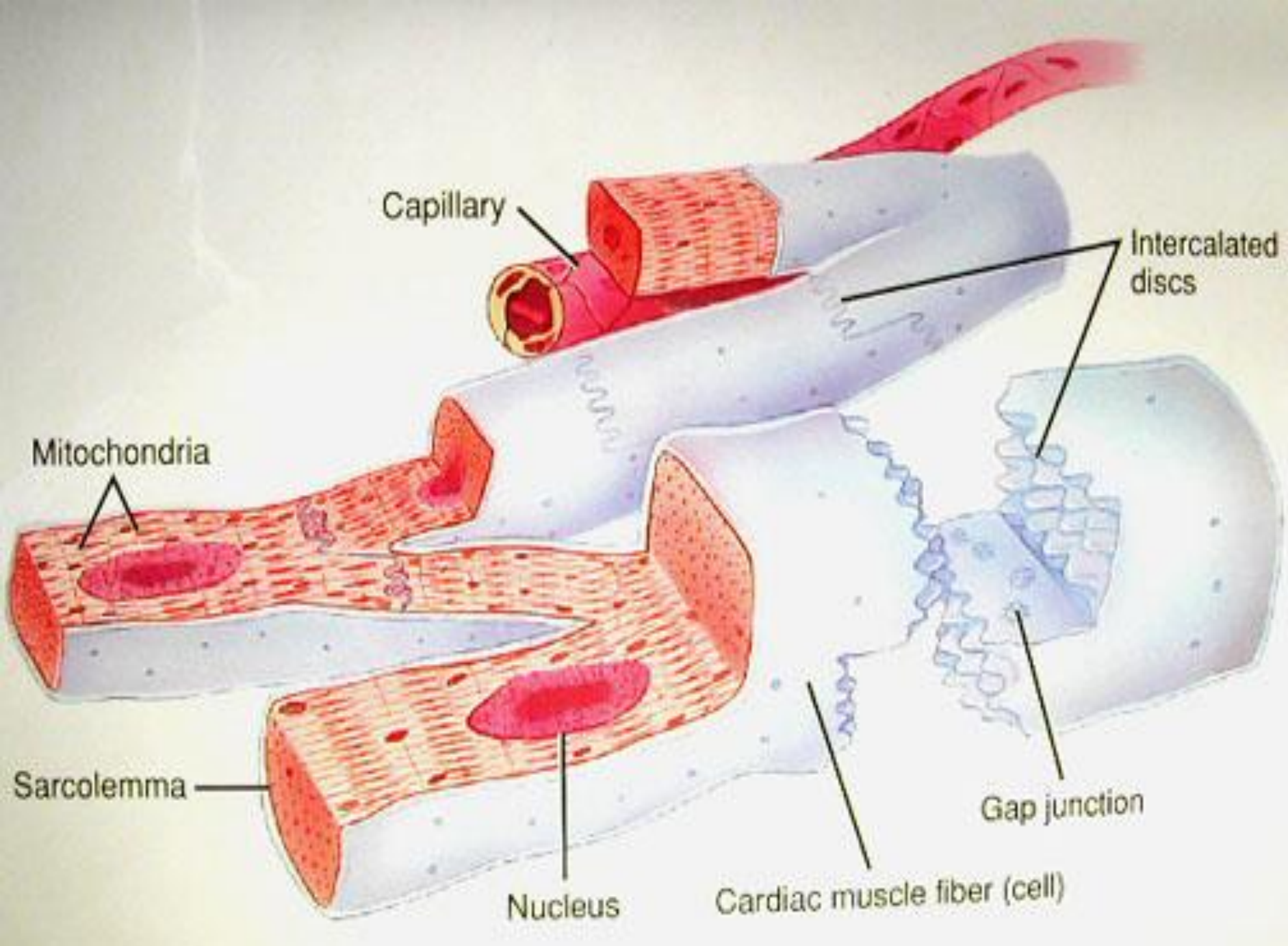
cross section





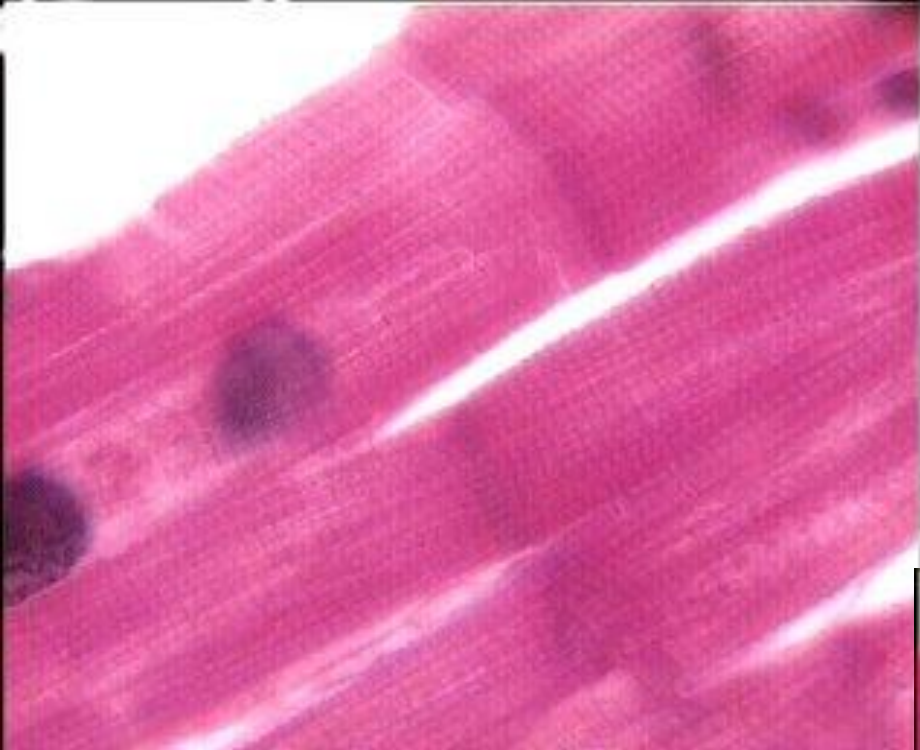




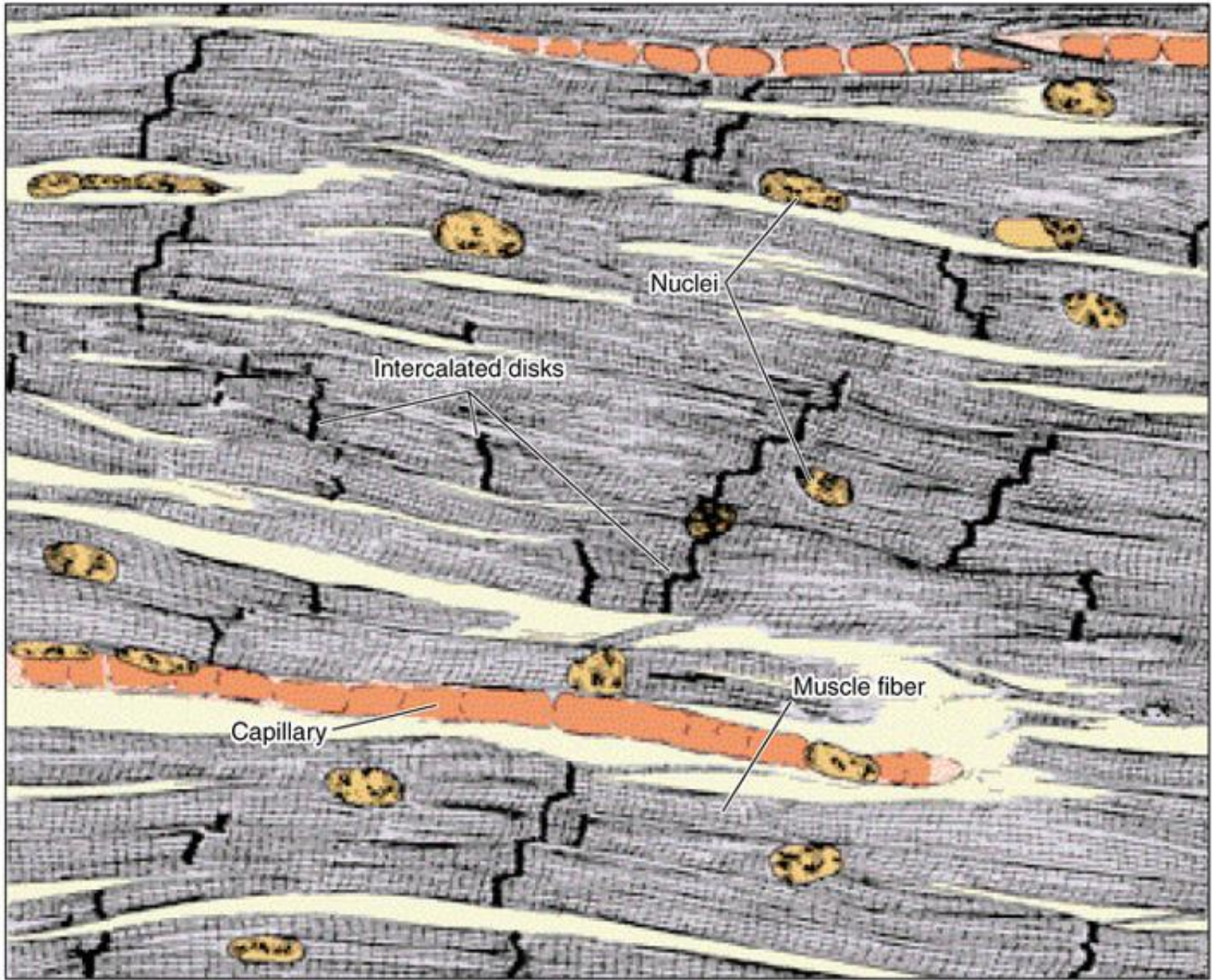




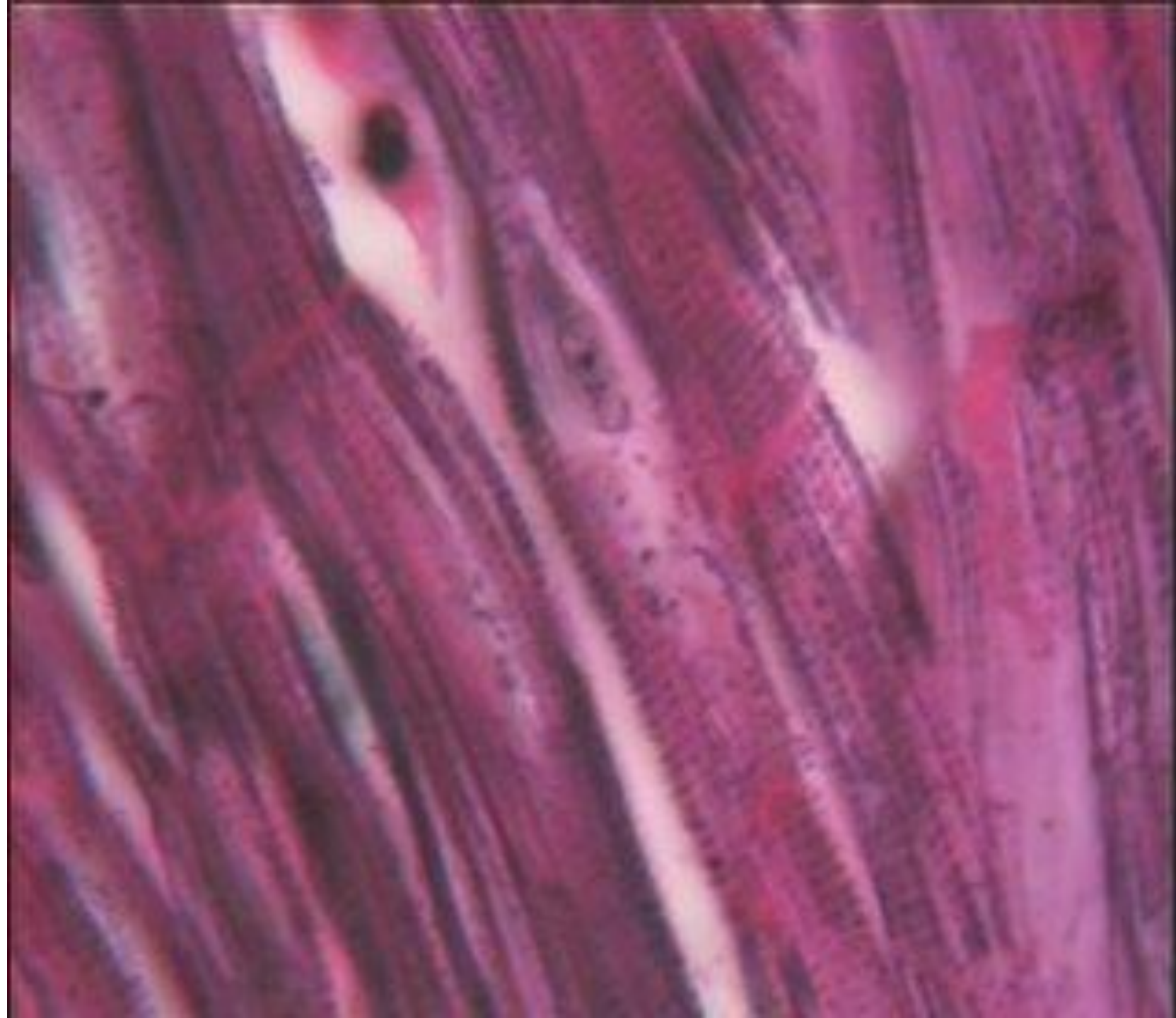


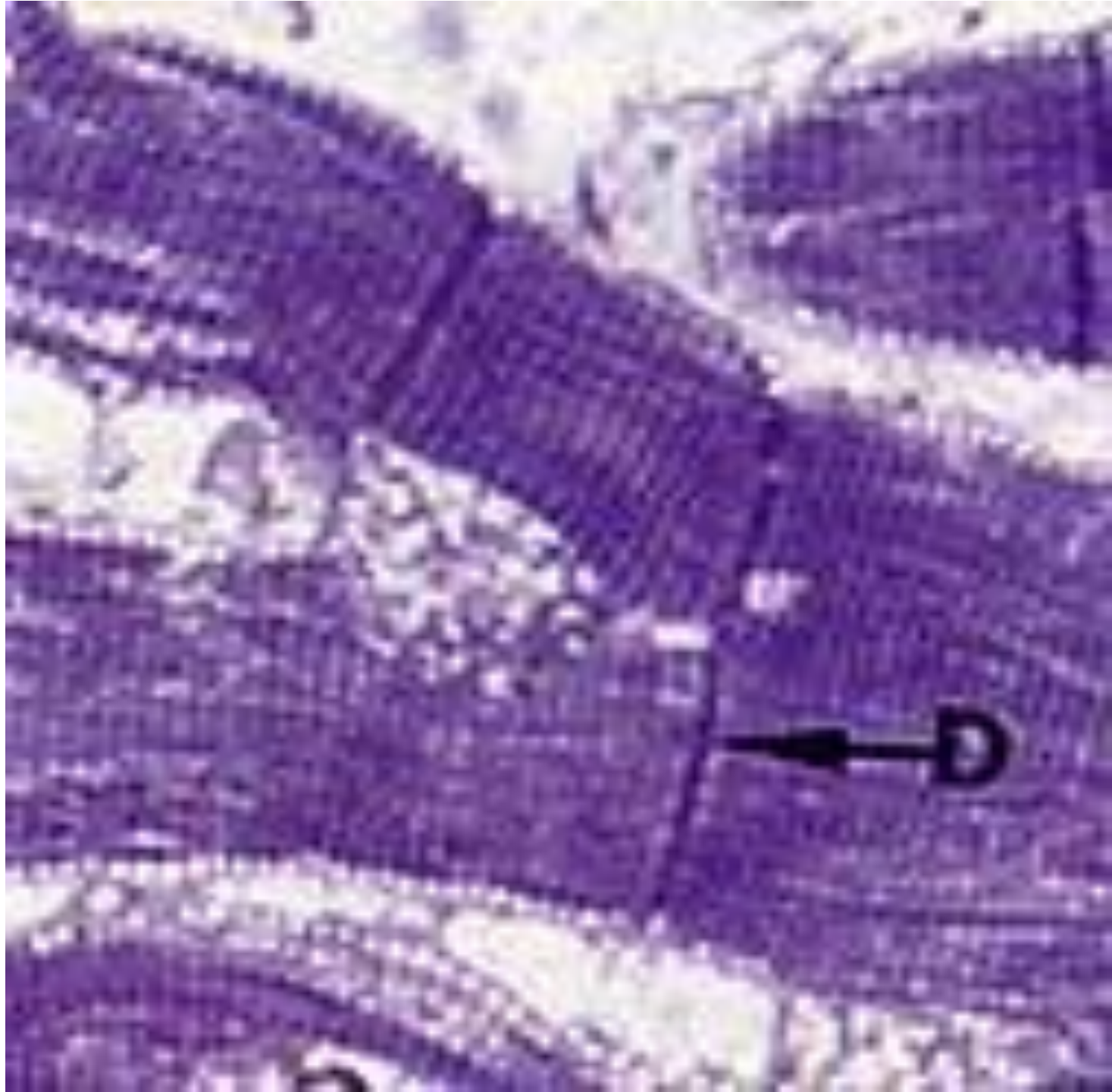




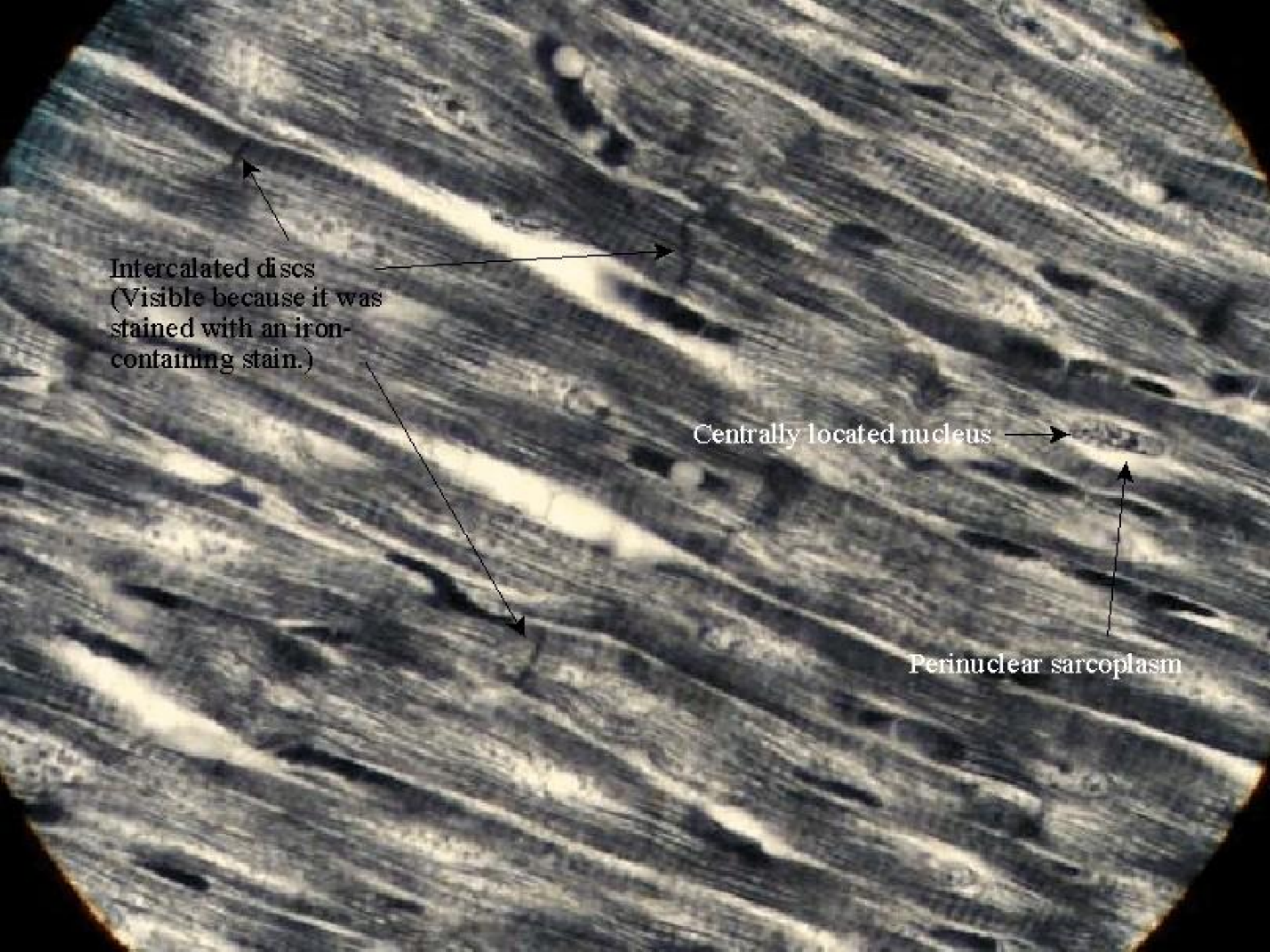








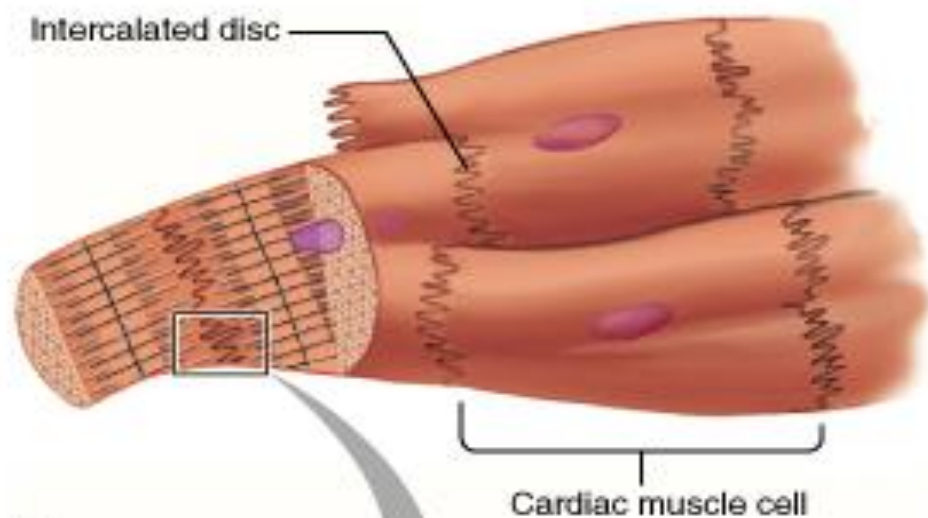




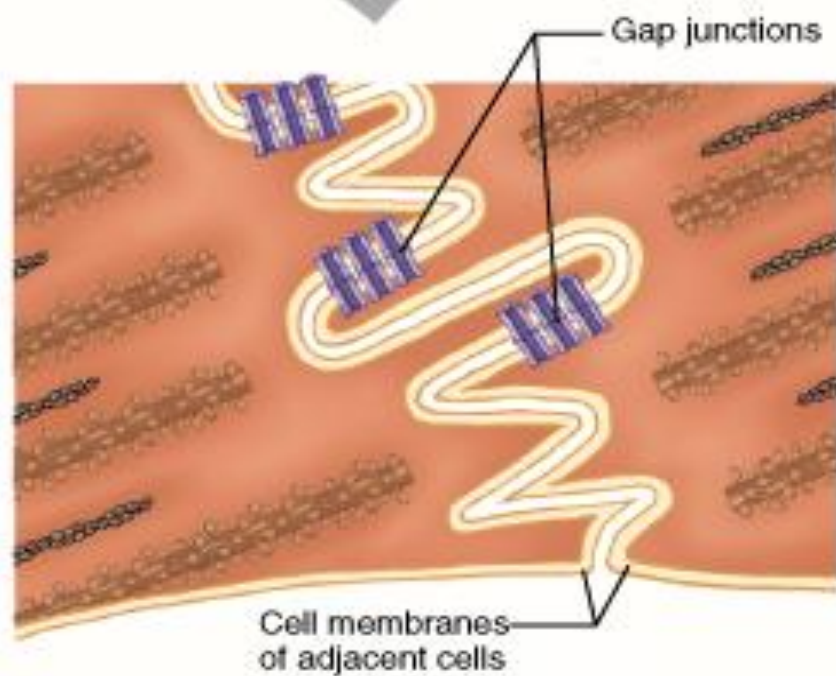
Intercalated discs  
(Visible because it was  
stained with an iron-  
containing stain.)

Centrally located nucleus

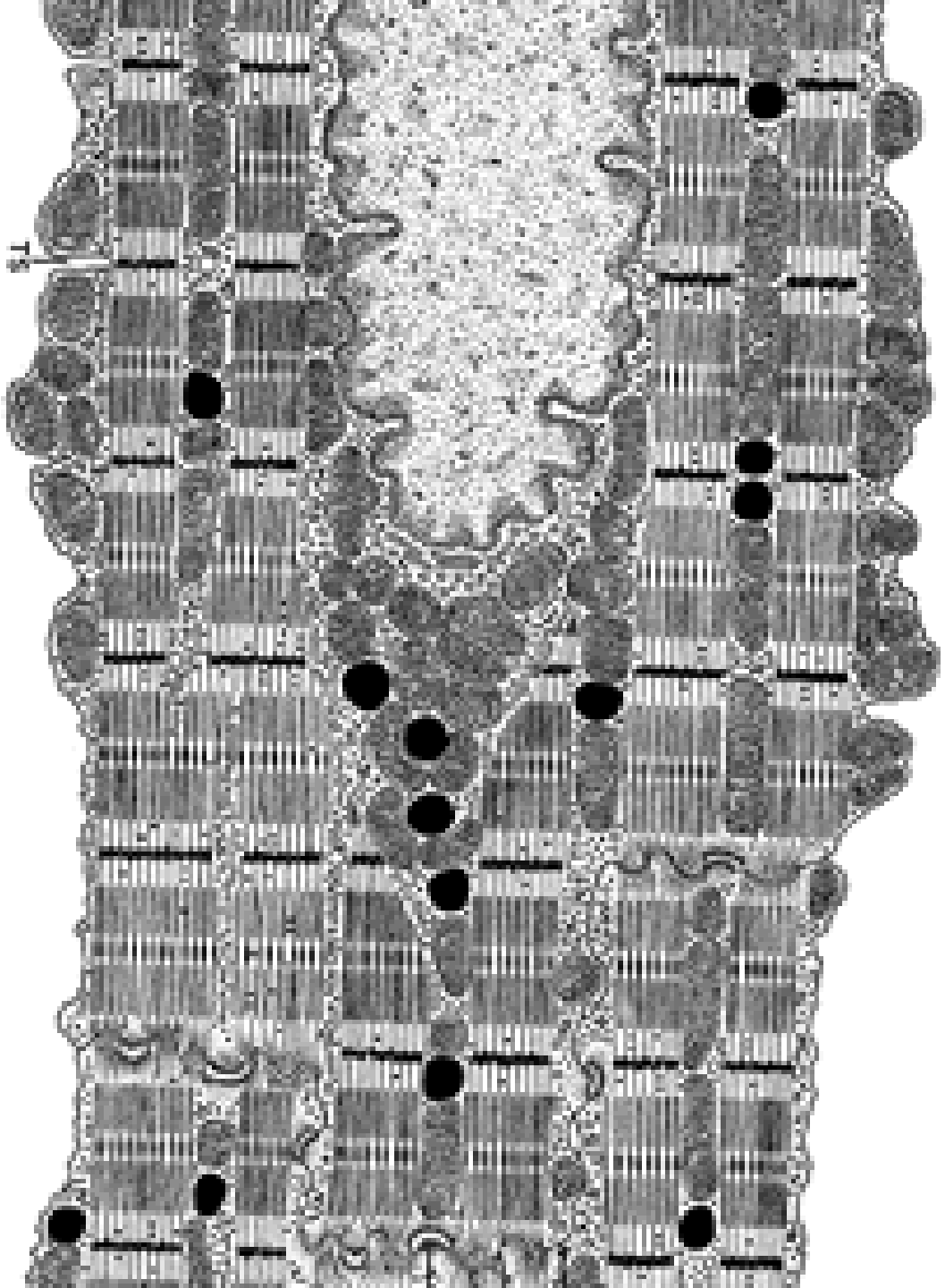
Perinuclear sarcoplasm



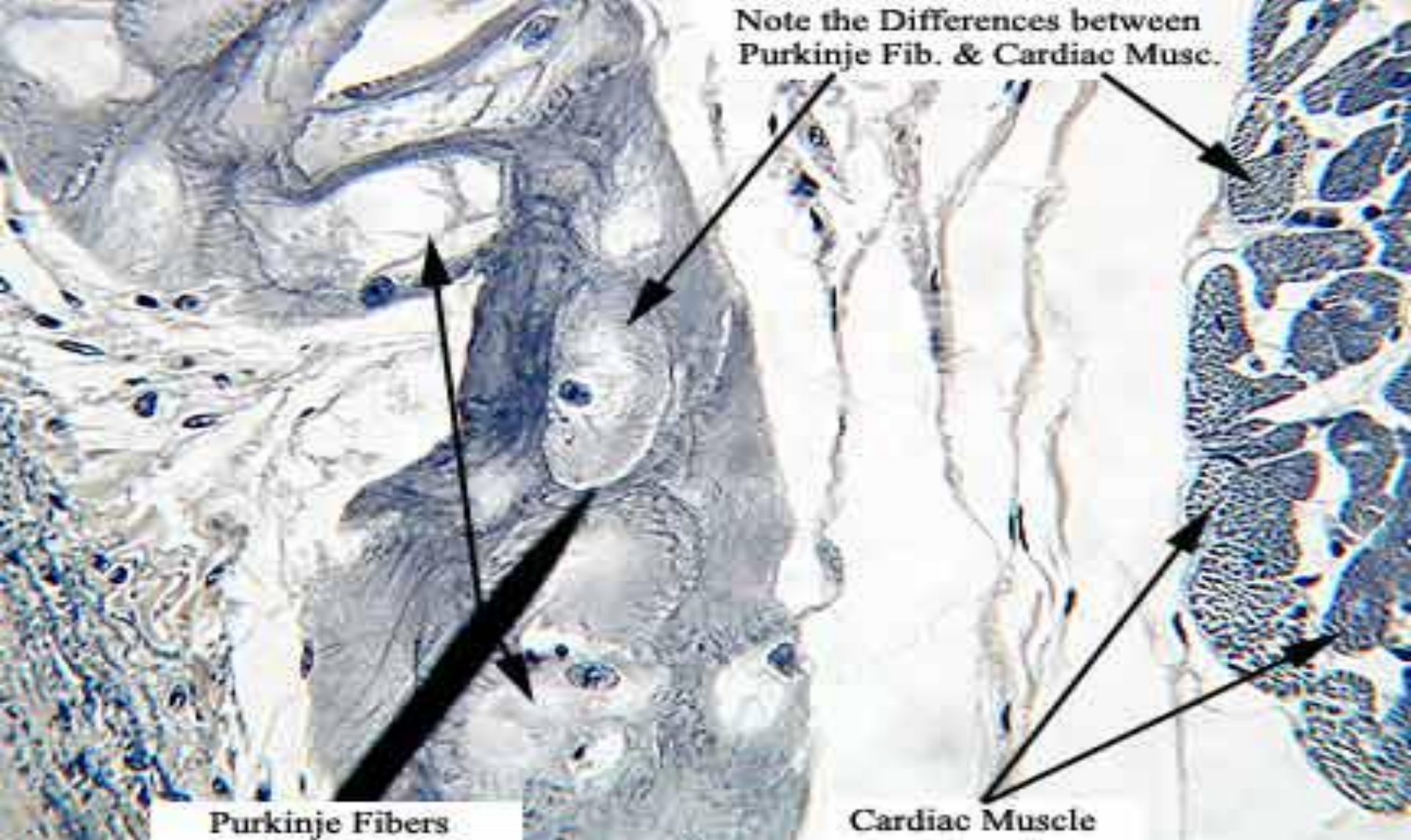
(a)



(b)



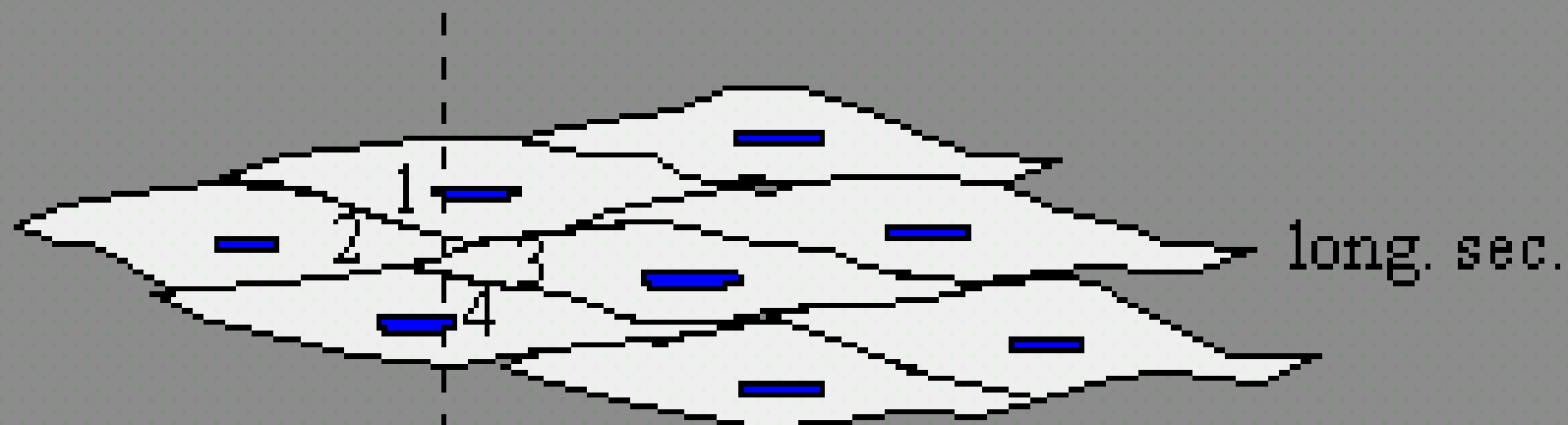




**Purkinje Fibers Stained with Iron Hematoxylin Compare PF with regular Cardiac Muscle Fibers. Note larger numbers of Myofibrils and smaller cell size in regular Cardiac Muscle Fibers**

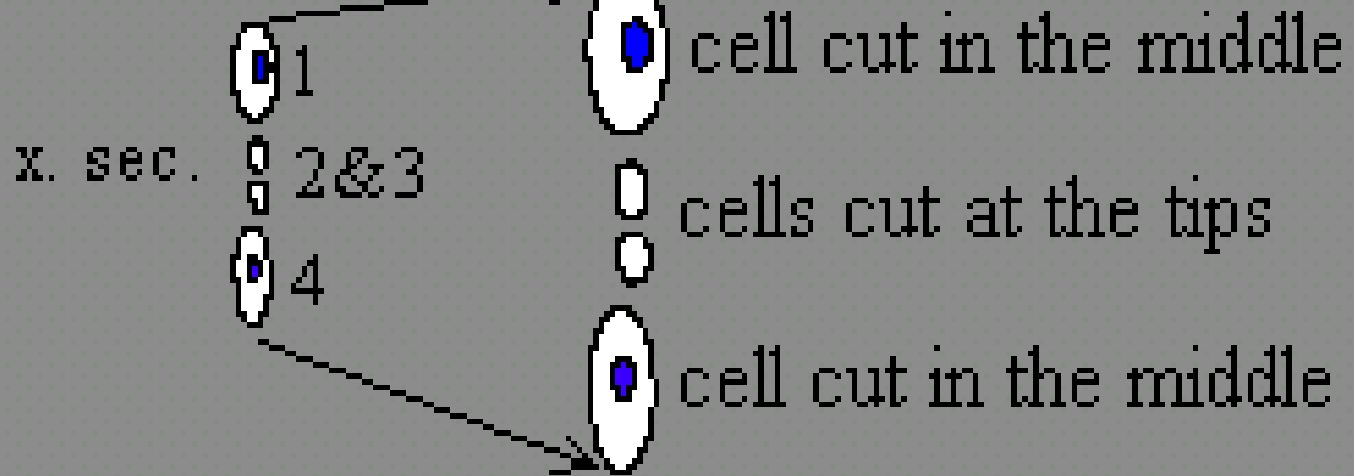
# 3. Düz Kas Dokusu

- Mekik şeklindedir
- Çekirdek oval ve ortadadır.
- Sindirim sistemi ve genital organlar da bulunur
- En kısıları damar duvarında, en uzun olanları ise uterus duvarında bulunur.
- miyozin filamanları, aktin filamanlarına göre daha azdır. Miyofibril oluşturmazlar ve çizgili değildir.
- İnnervasyonu otonom sinir sistemine ait sempatik ve parasempatik sinir telleri tarafından sağlanır.



smooth muscle

enlarged



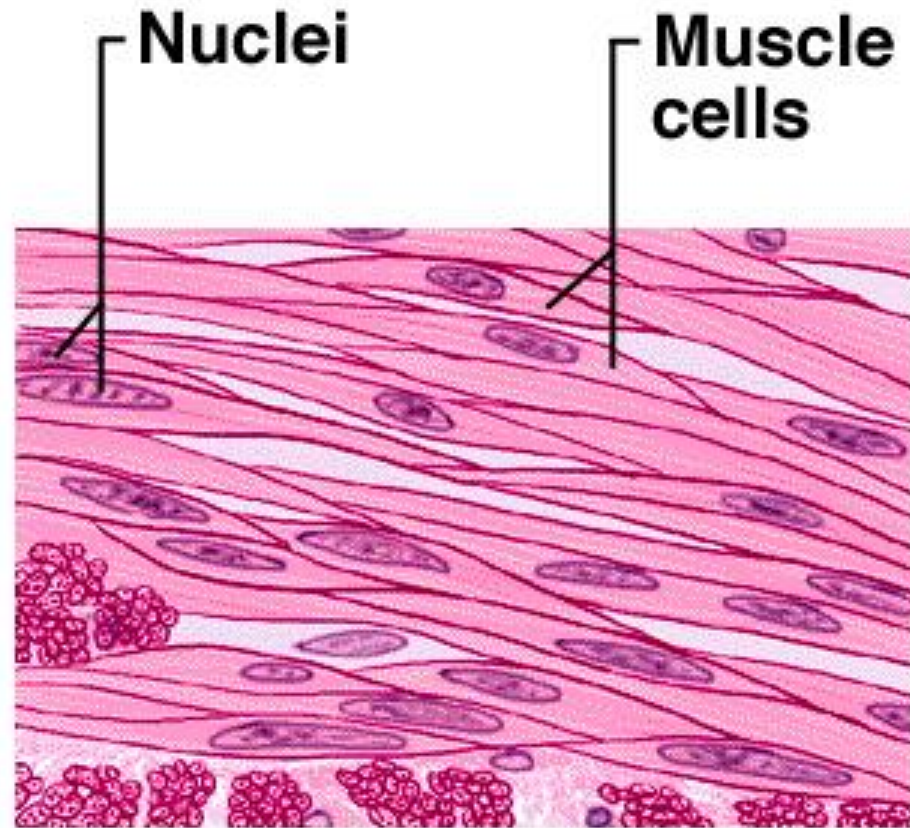
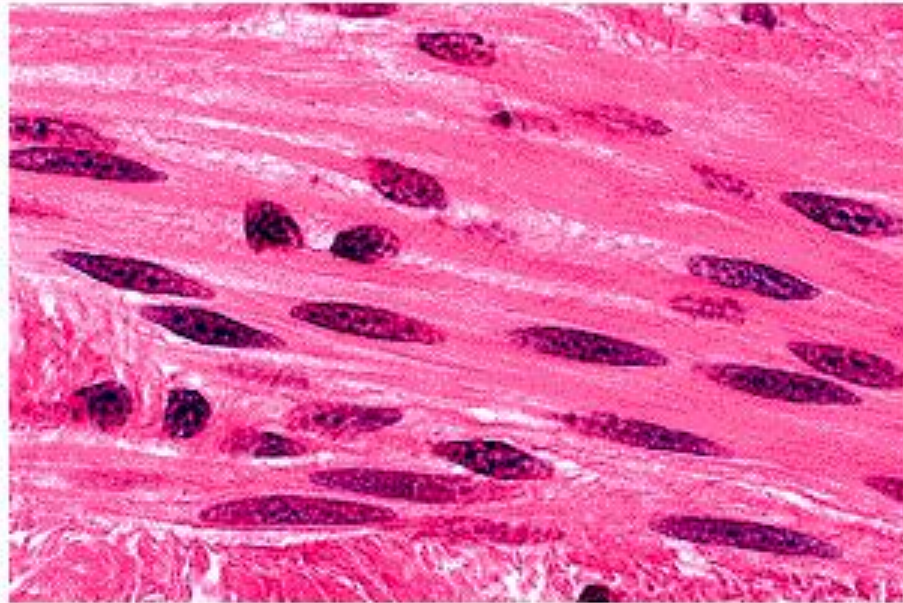
myofiber relaxed



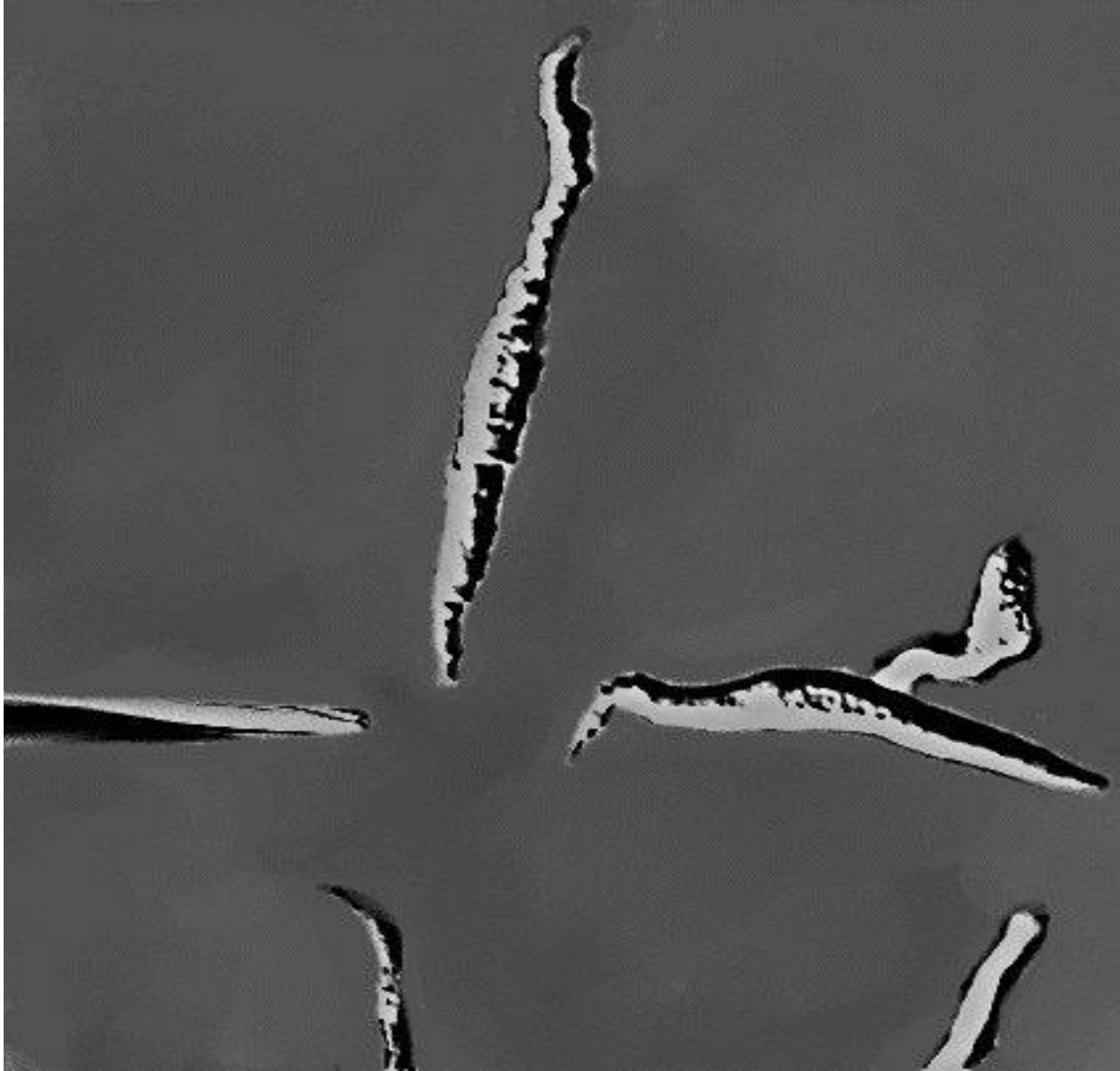
myofiber stretched



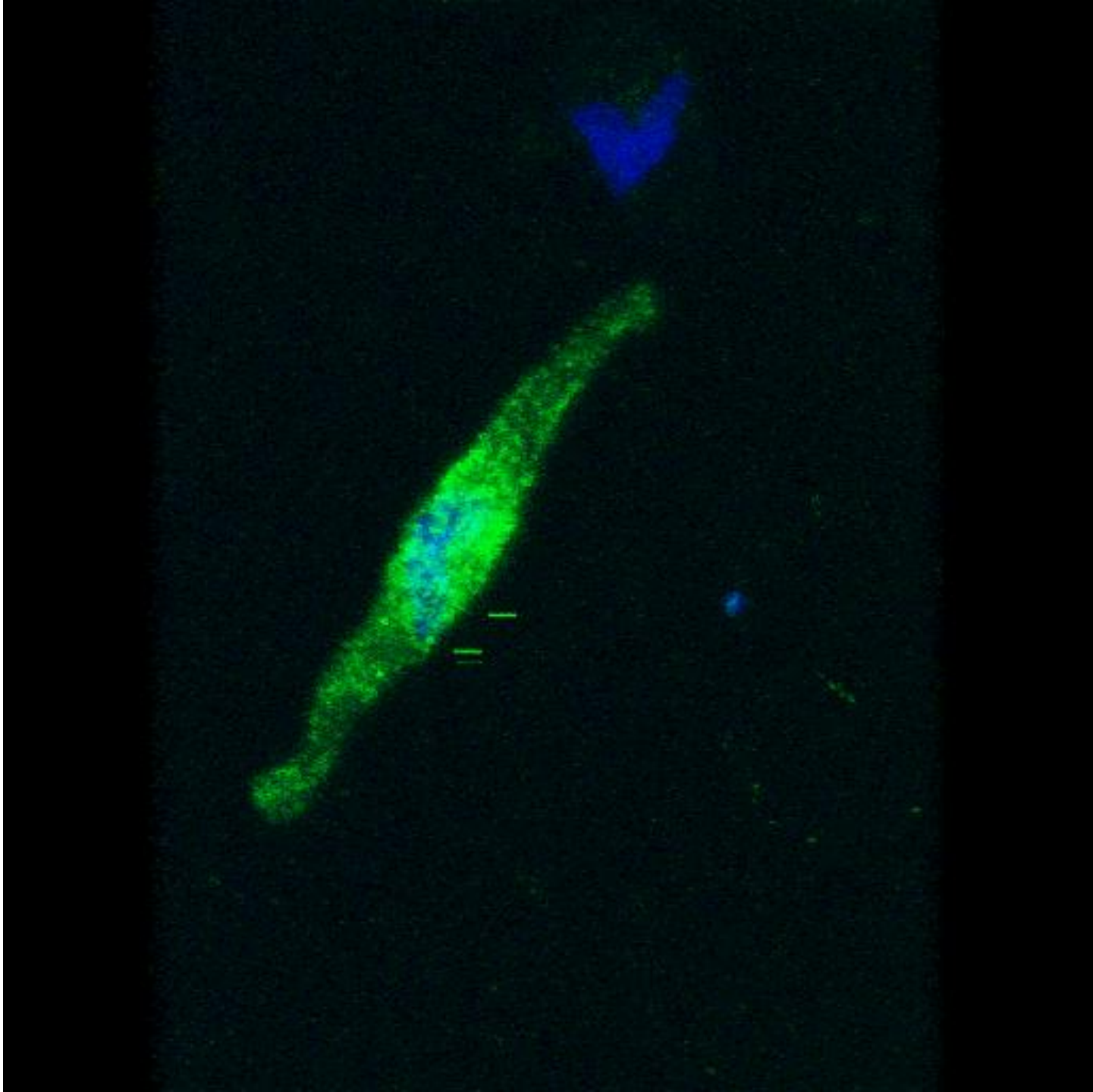
# Smooth Muscle

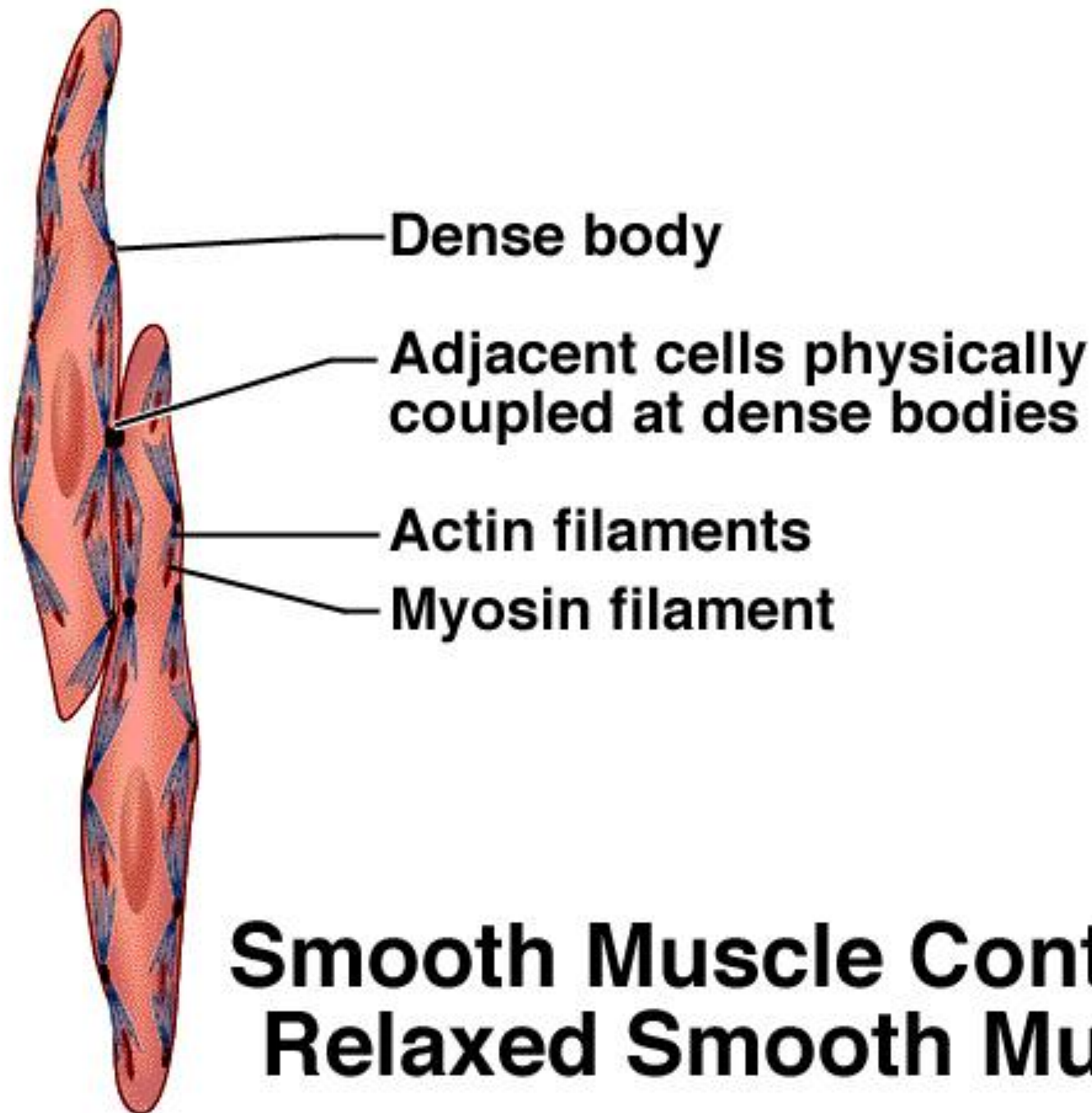




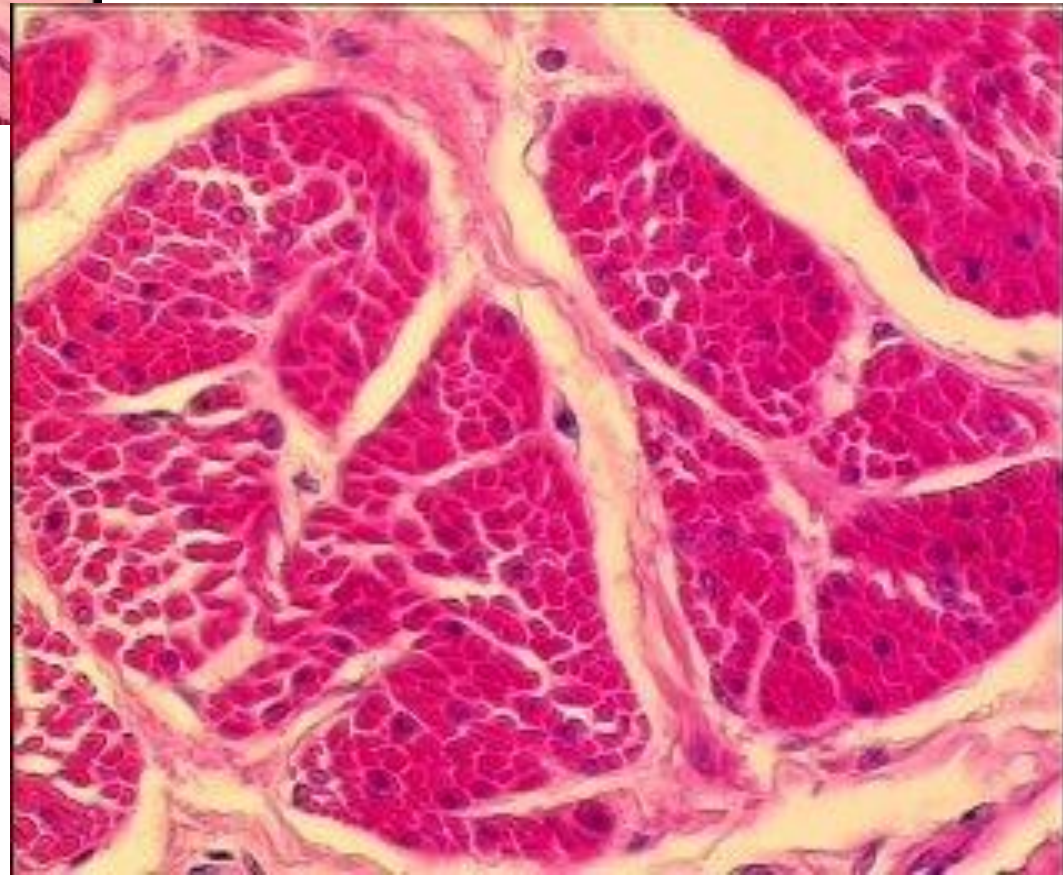
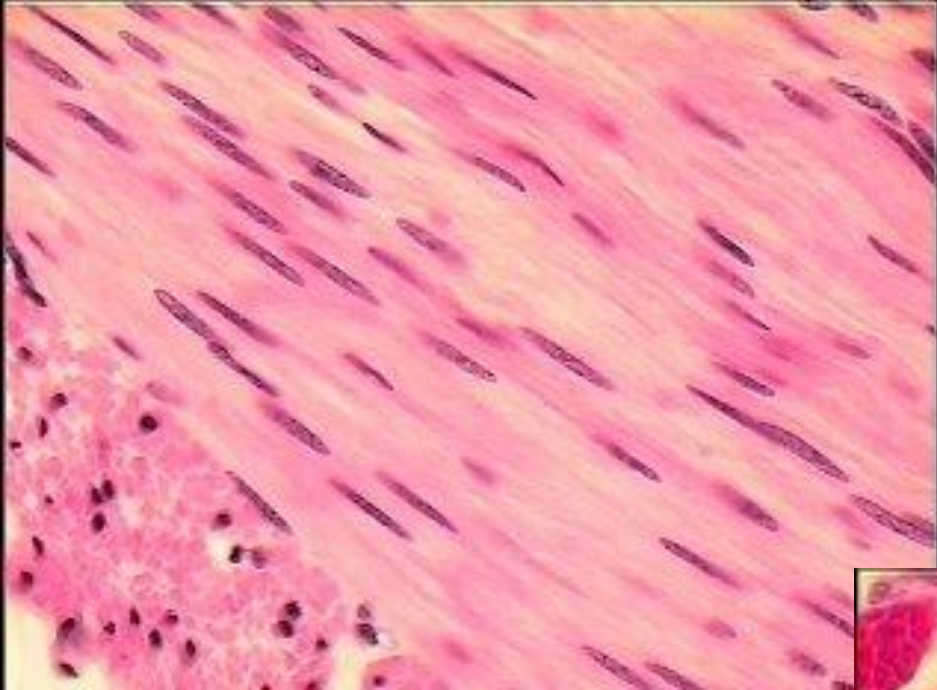


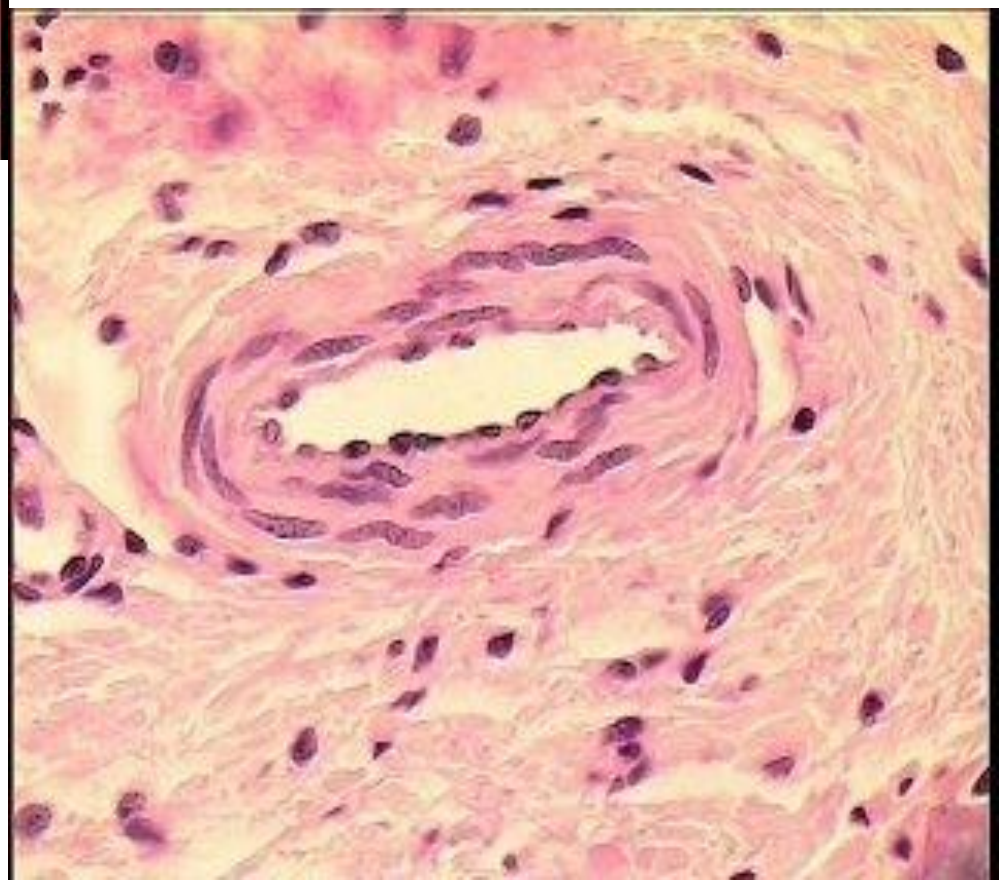
Contracted Smooth Muscle Cell





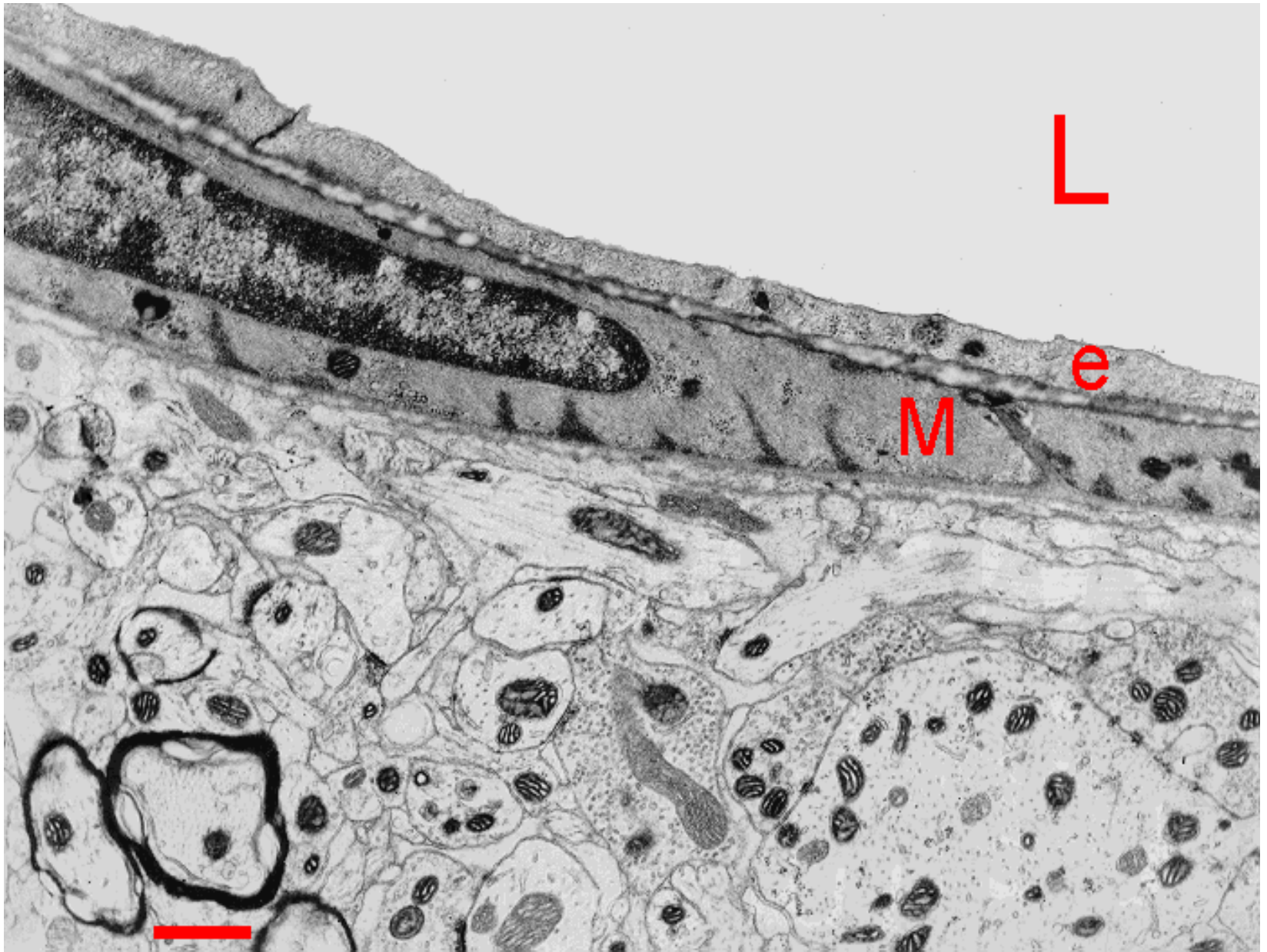






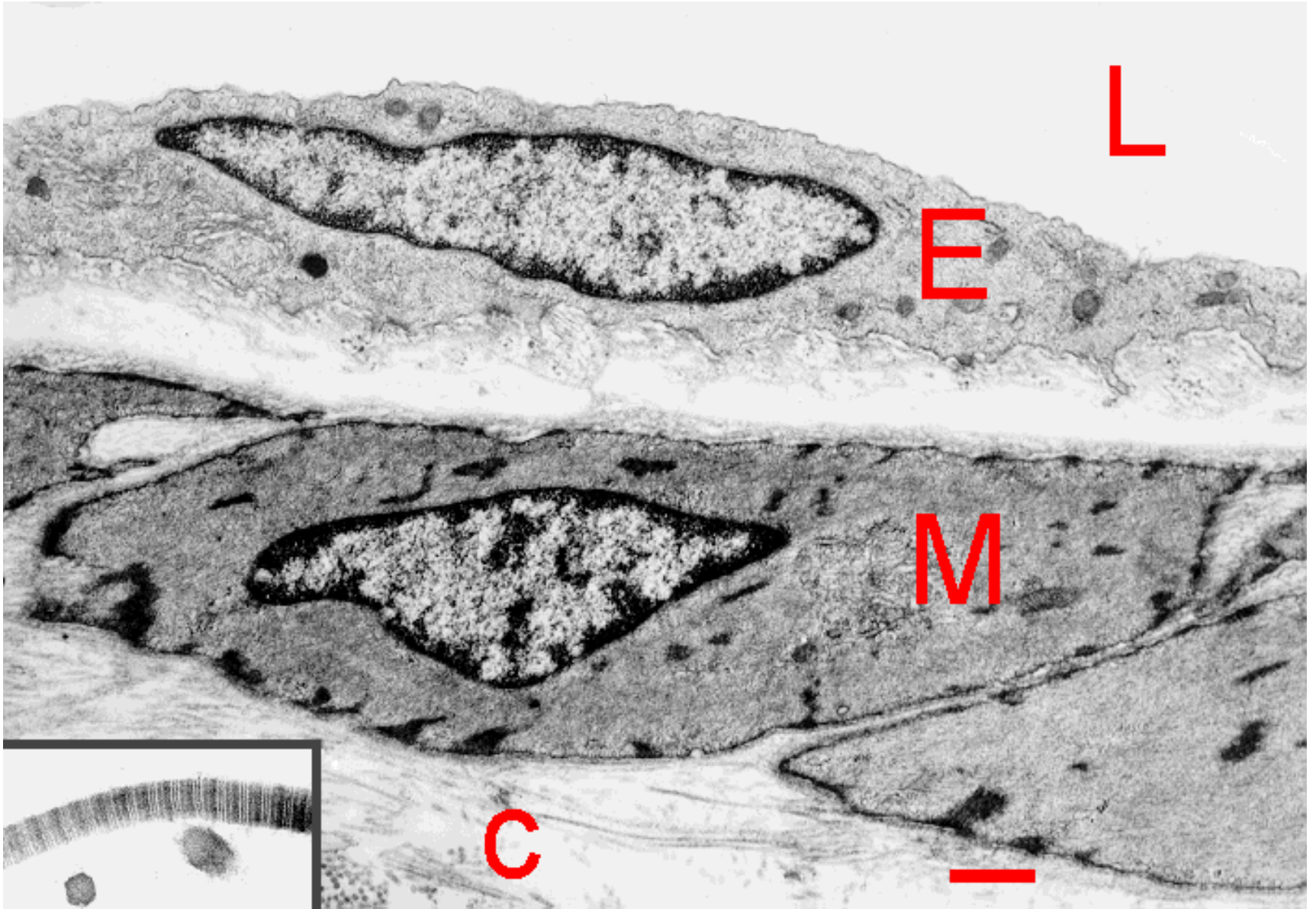


The wall of the arteriole. L - lumen, e - endothelium, M - smooth muscle cell.

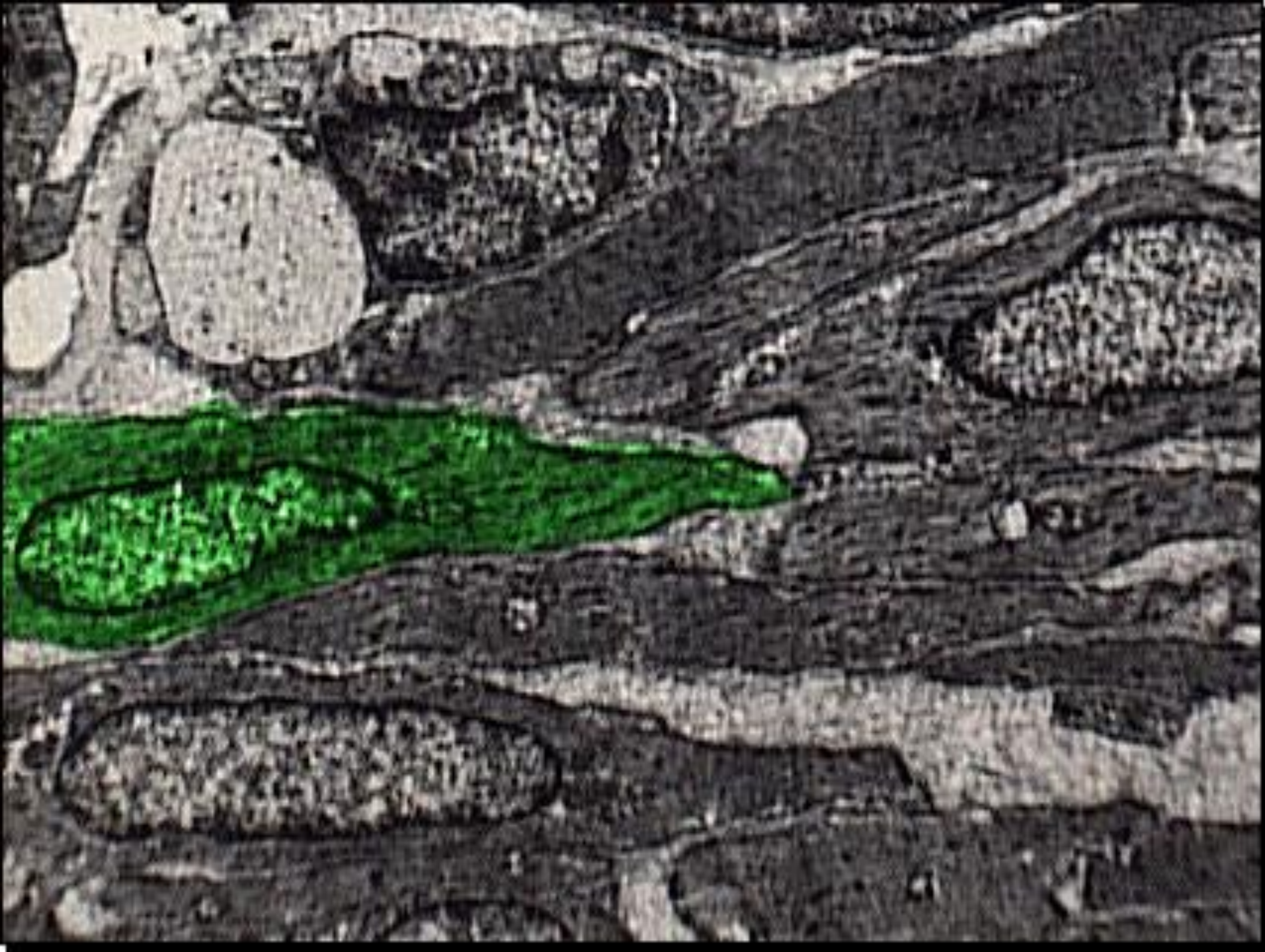




The *wall of the venule*. L - lumen, E - endothelium, M - smooth muscle cell, C - collagen fibres in the perivascular space of Virchow-Robin. Inset: collagen fibres cut transversally and longitudinally.



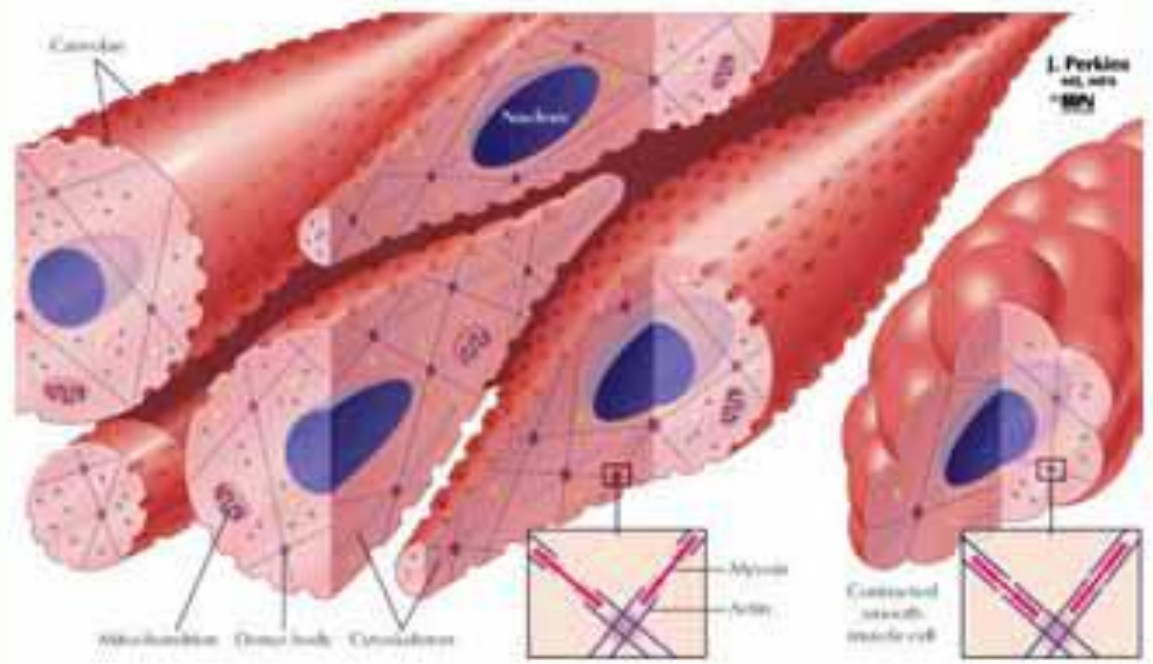


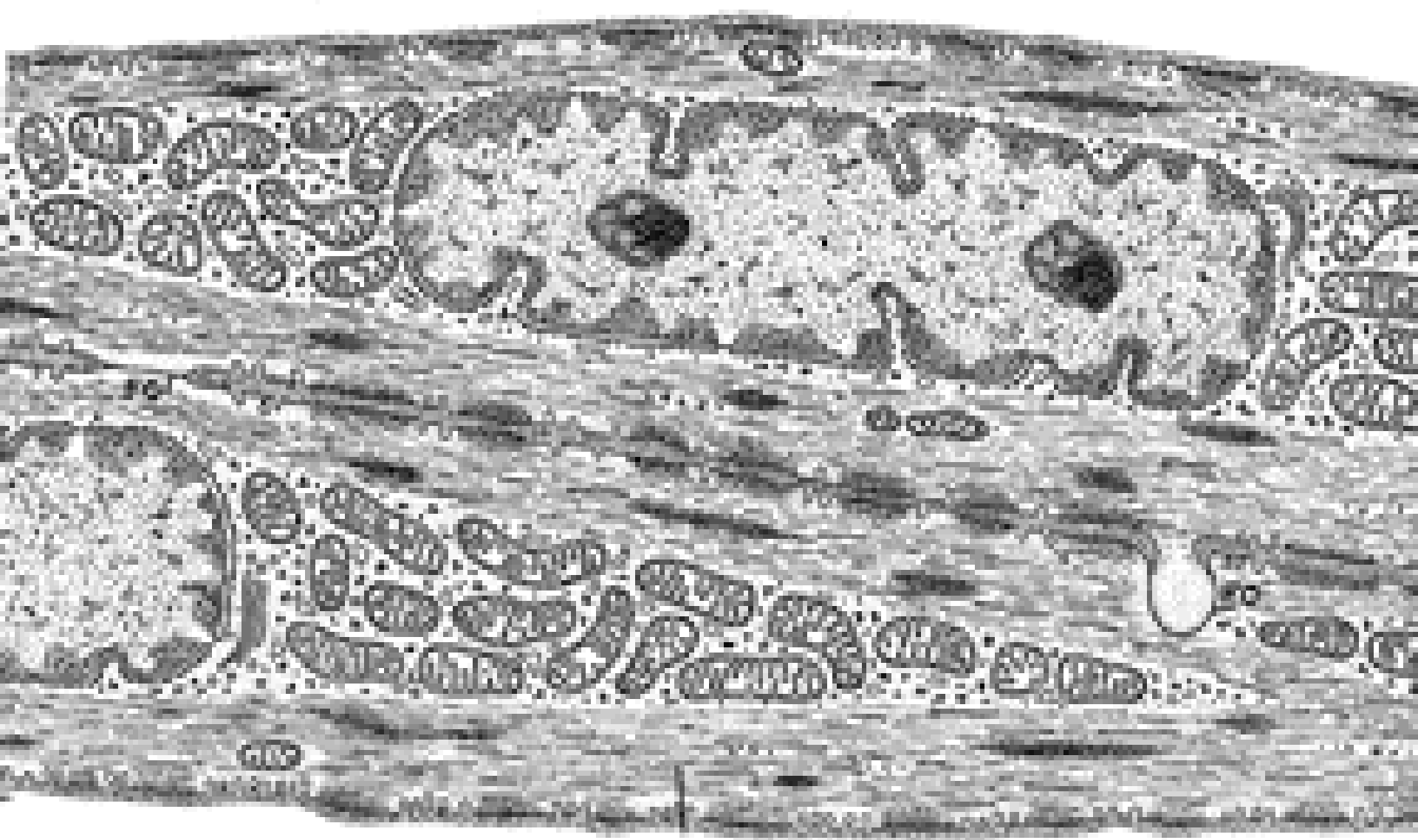






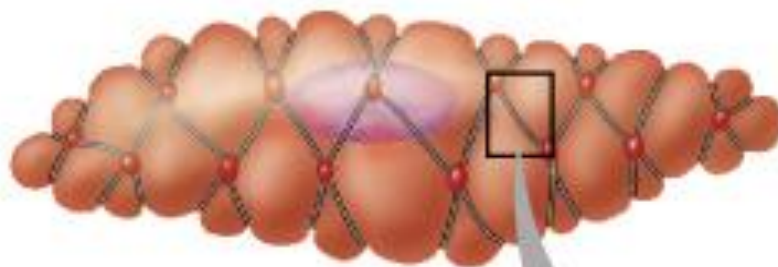




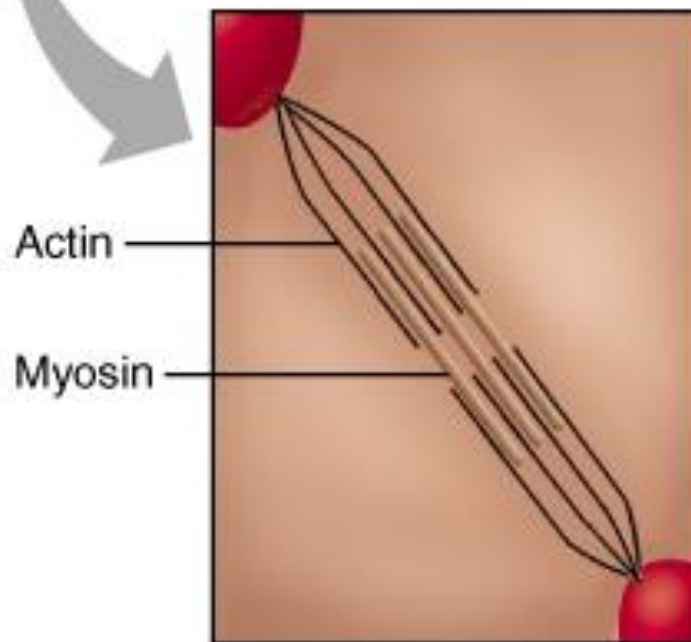




(a)



(b)

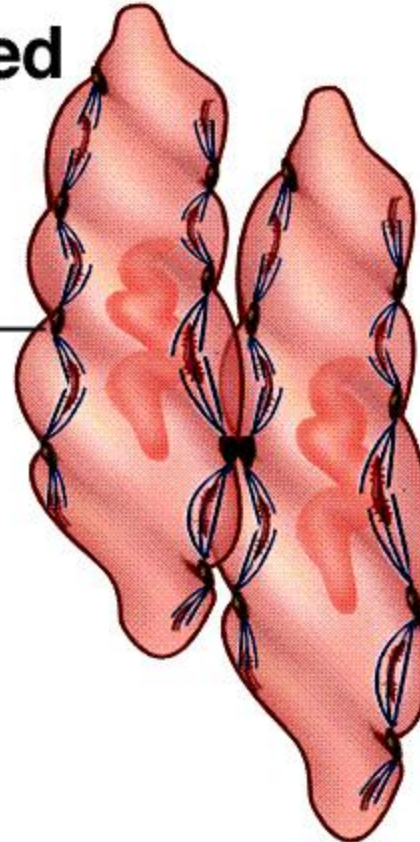


(c)



# Smooth Muscle Contraction — Contracted Smooth Muscle Cell

Dense  
body

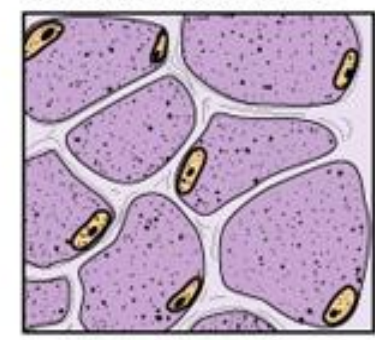
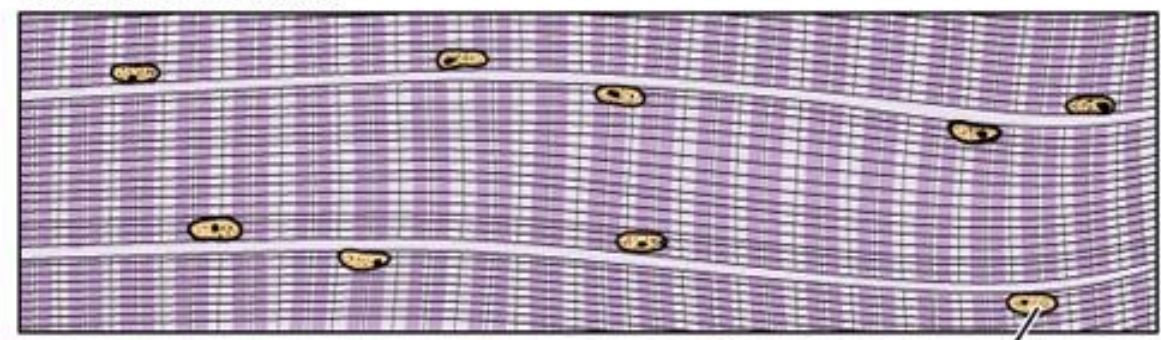


# Muscle types

# Activity

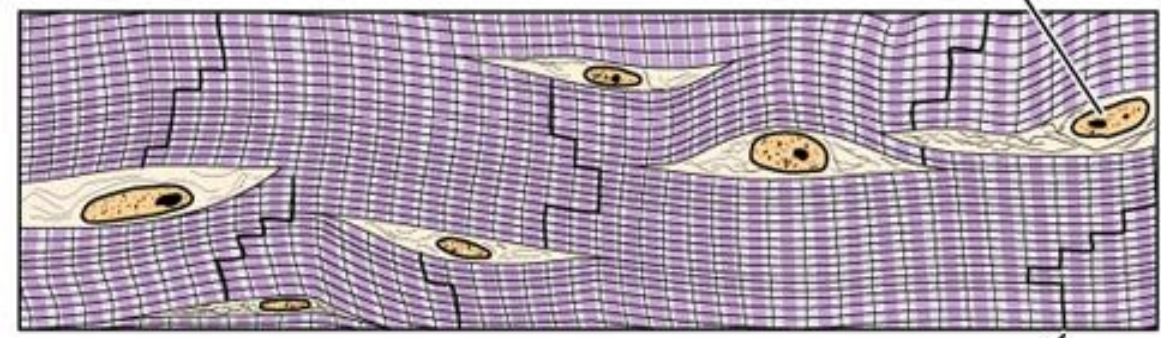
## Skeletal muscle

## Cross sections



Strong, quick discontinuous voluntary contraction

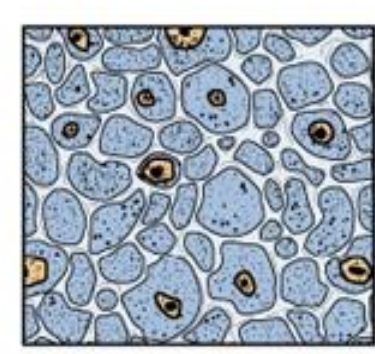
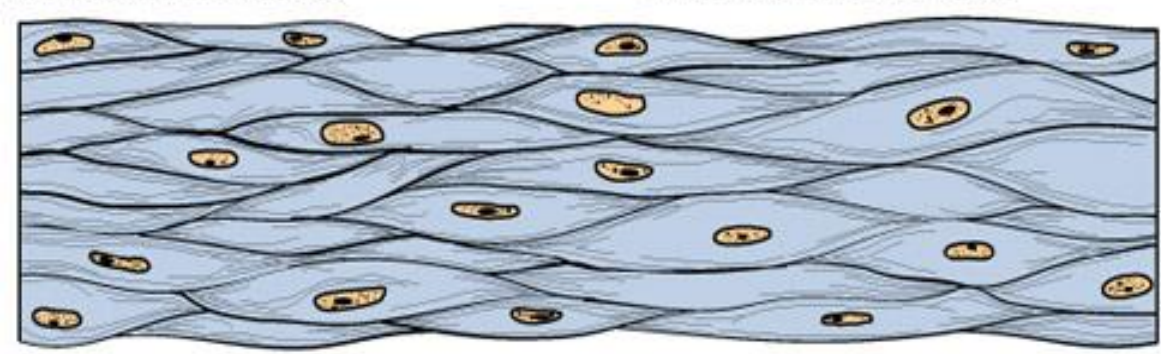
## Cardiac muscle



Strong, quick continuous involuntary contraction

## Smooth muscle

## Intercalated disks



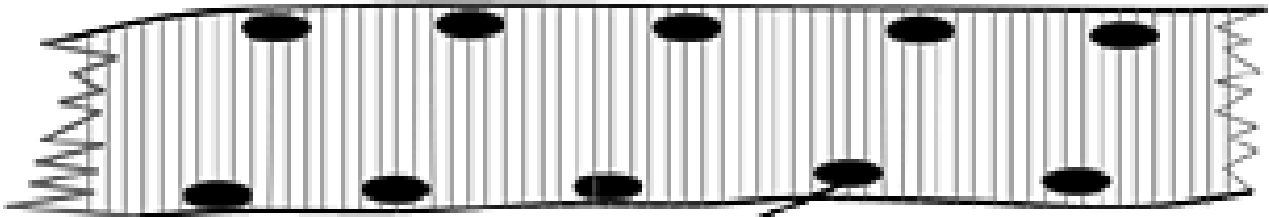
Weak, slow involuntary contraction

### 3 tip kasın karşılaştırması

Özellik	İskelet kası	Kalp kası	Düz kas
Sarkomer	var	var	yok
Çekirdek	Çok, periferde	1-2, merkezde	1, merkezde
Sarkoplazmik Retikulum	İyi gelişmiş, Terminal sisternli	Zayıf, küçük terminal sisternli	Ca depo etmeyen türde
T tubul	Triad formunda	Diad formunda	yok
Hücre bağlantısı	Yok	İnterkalat disk	Nexus Gap junction
Kontraksiyon	İstemli (hep-hiç)	İstemsiz (ritmik ve spontan)	İstemsiz (yavaş ve etkili)
Ca kontrolü	Terminal sisterndeki depo	Ekstraselluler olarak sağlanır	Caveolalardan sağlanır
Ca bağlama	Troponin-C	Troponin-C	Calmodulin
Rejenerasyon	Satellit hücreleriyle	Yok	Var
Mitoz	Yok	Yok	Var
İnnervasyon	Somatik motor	Otonom	Otonom

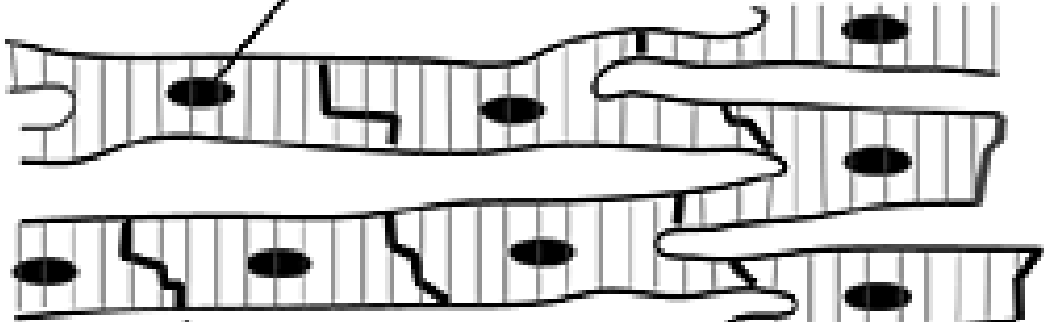


**Skeletal  
Muscle**



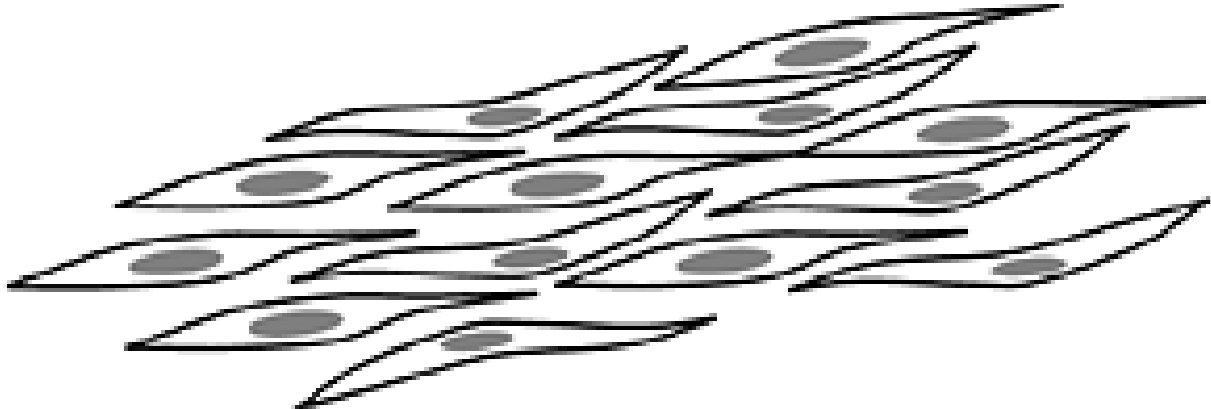
**Nuclei**

**Cardiac  
Muscle**



**Intercalated  
Disk**

**Smooth  
Muscle**



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