OTOT

Kurnia Eka Wijayanti

Manusia memiliki tiga jenis otot:

1. Otot polos
2. Otot rangka
3. Otot jantung

	Skeletal	Cardiac	Smooth
Control	voluntary	involuntary	involuntary
Cross striations	striated	striated	plane
Nerve supply	somatic	autonomic	autonomic
Location	Attached to skeleton	In the wall of the heart	In the wall of viscera
Function	Movement of joints	Movement of blood	Movements of contents

Otot polos

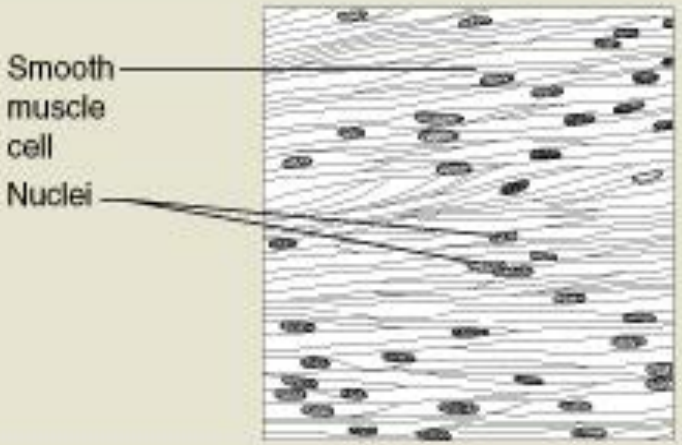
- Struktur seperti kumparan
- Inti satu ditengah
- Jarang memiliki corak
- Involuntary
- Gambar otot polos

(c) Smooth muscle

Description: Spindle-shaped cells with central nuclei; cells arranged closely to form sheets; no striations.

Function: Propels substances or objects (foodstuffs, urine, a baby) along internal passageways; involuntary control.

Location: Mostly in the walls of hollow organs.



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Otot jantung

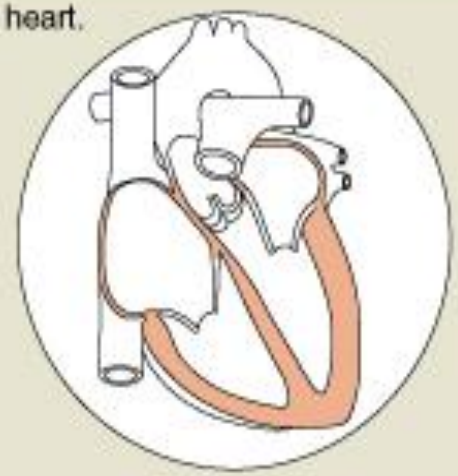
- Bercabang
- Inti satu ditengah
- Bercorak
- Involuntary
- Gambar otot jantung

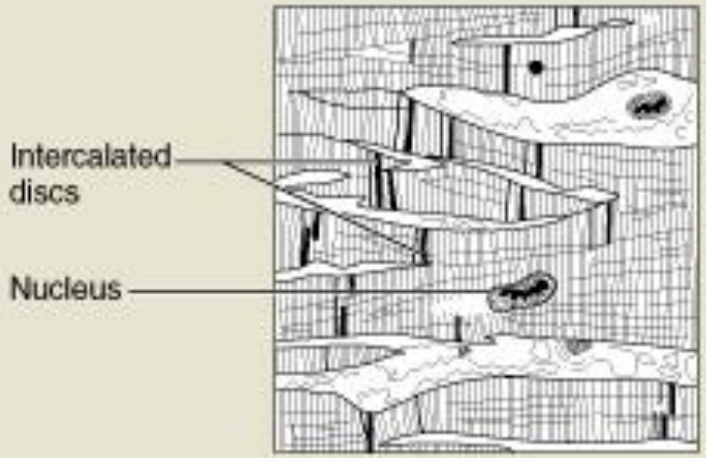
(b) Cardiac muscle

Description: Branching, striated, generally uninucleate cells that interdigitate at specialized junctions (intercalated discs).

Function: As it contracts, it propels blood into the circulation; involuntary control.

Location: The walls of the heart.





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Otot rangka

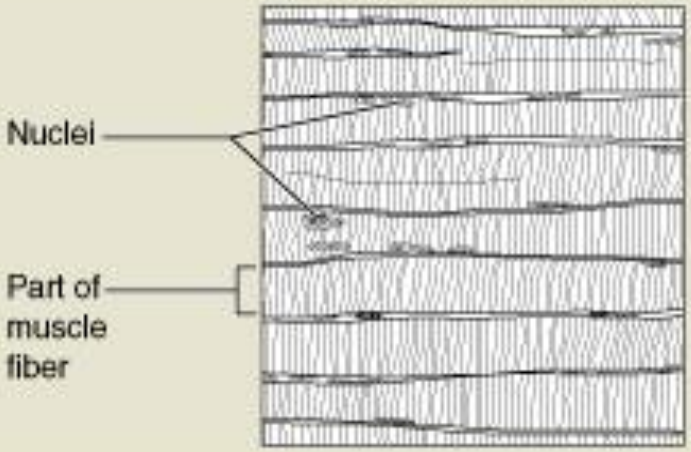
- Bentuk memanjang
- Inti banyak di sisi
- Terdapat corakan
- Voluntari

(a) Skeletal muscle

Description: Long, cylindrical, multinucleate cells; obvious striations.

Function: Voluntary movement; locomotion; manipulation of the environment; facial expression; voluntary control.

Location: In skeletal muscles attached to bones or occasionally to skin.



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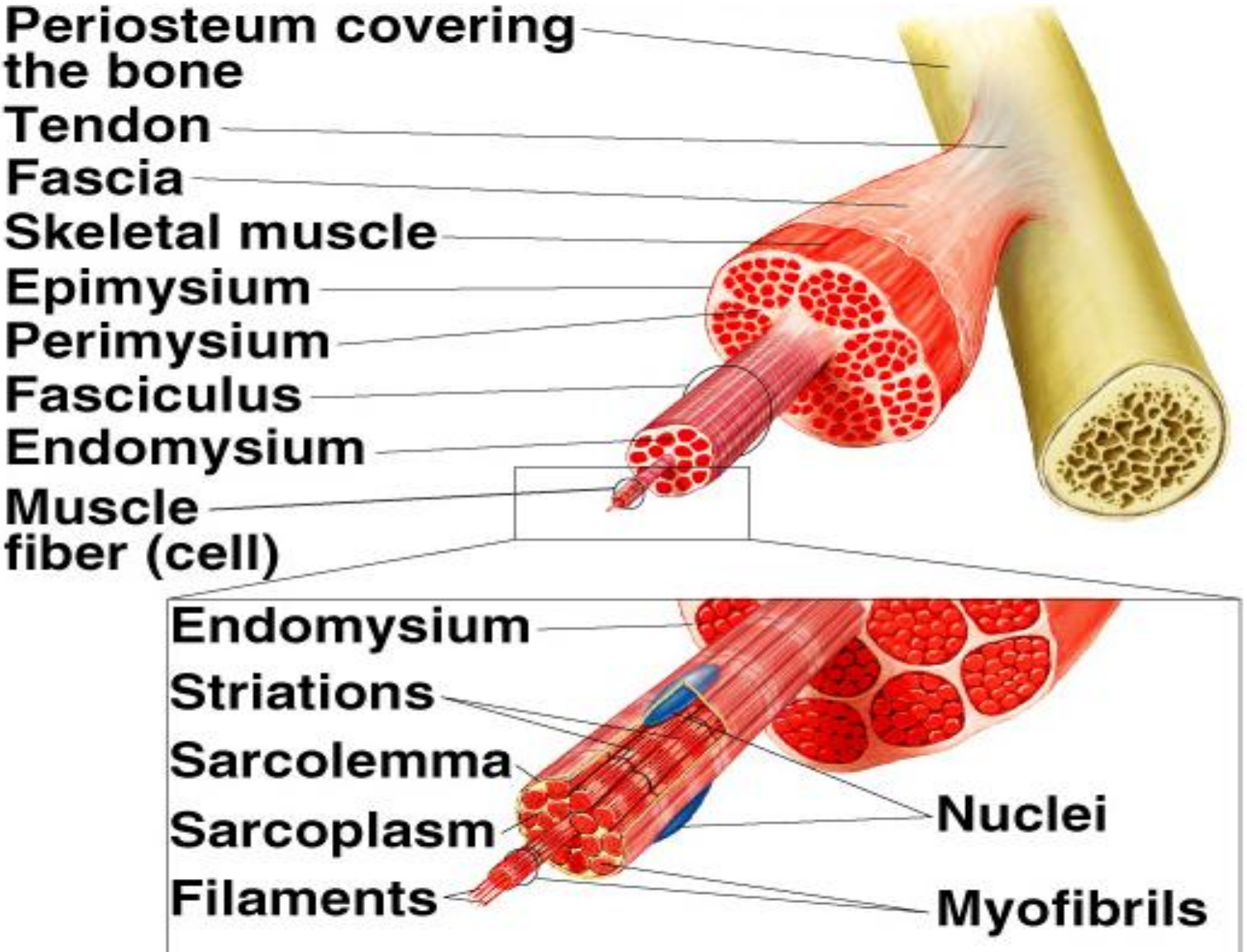
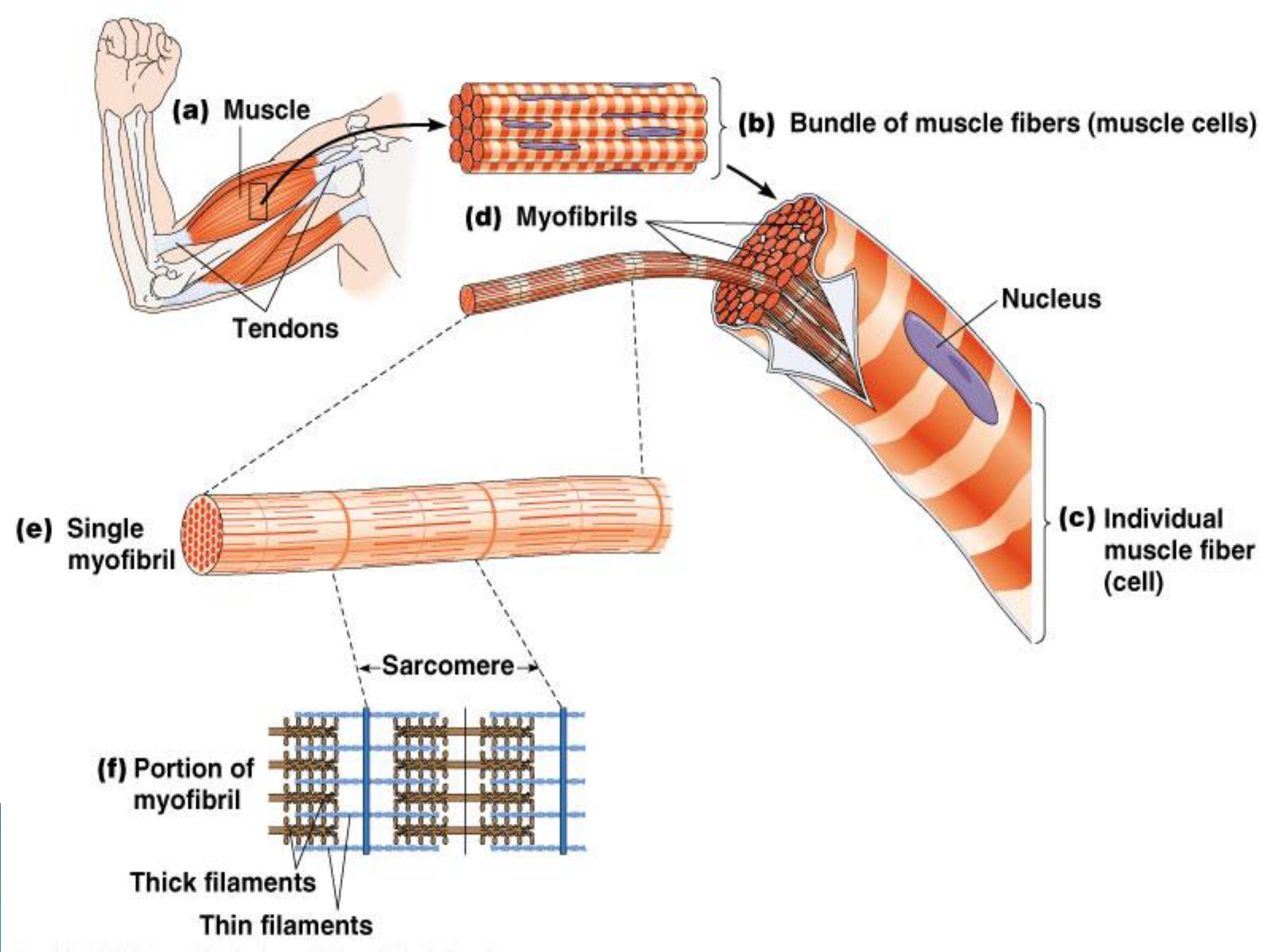
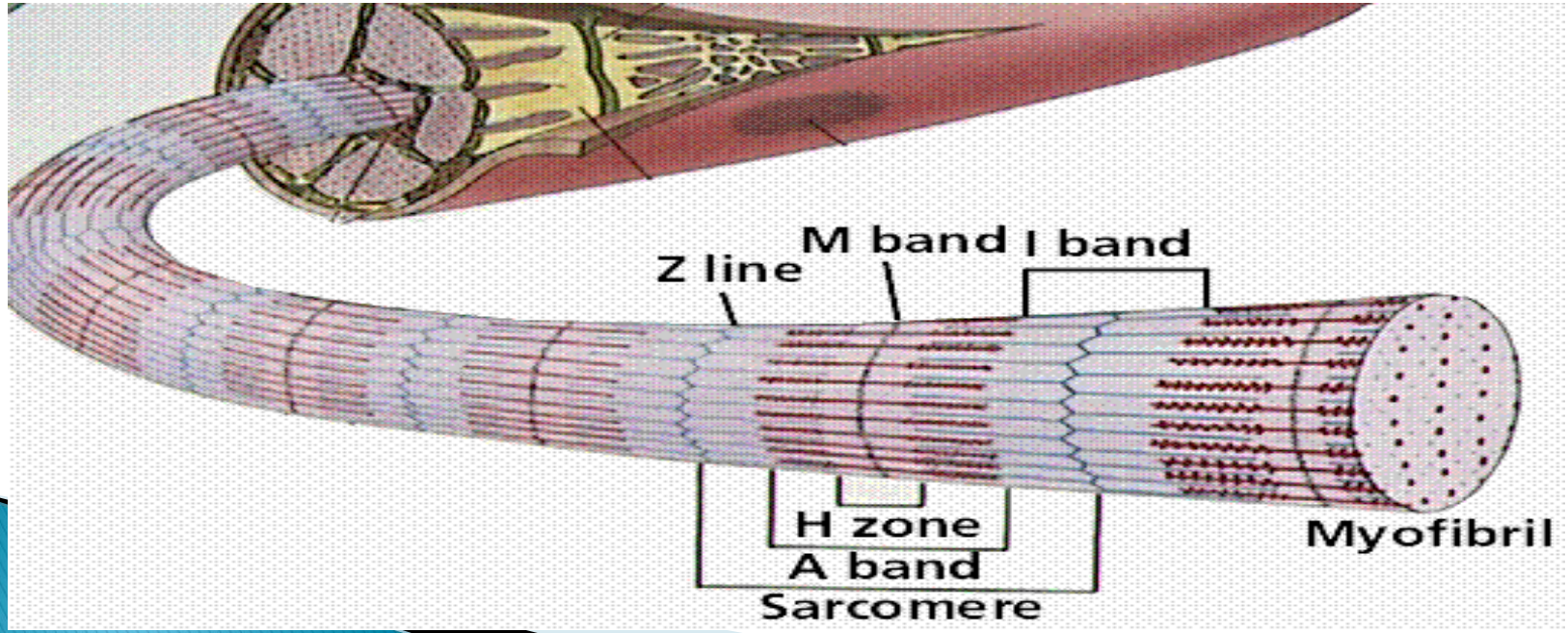
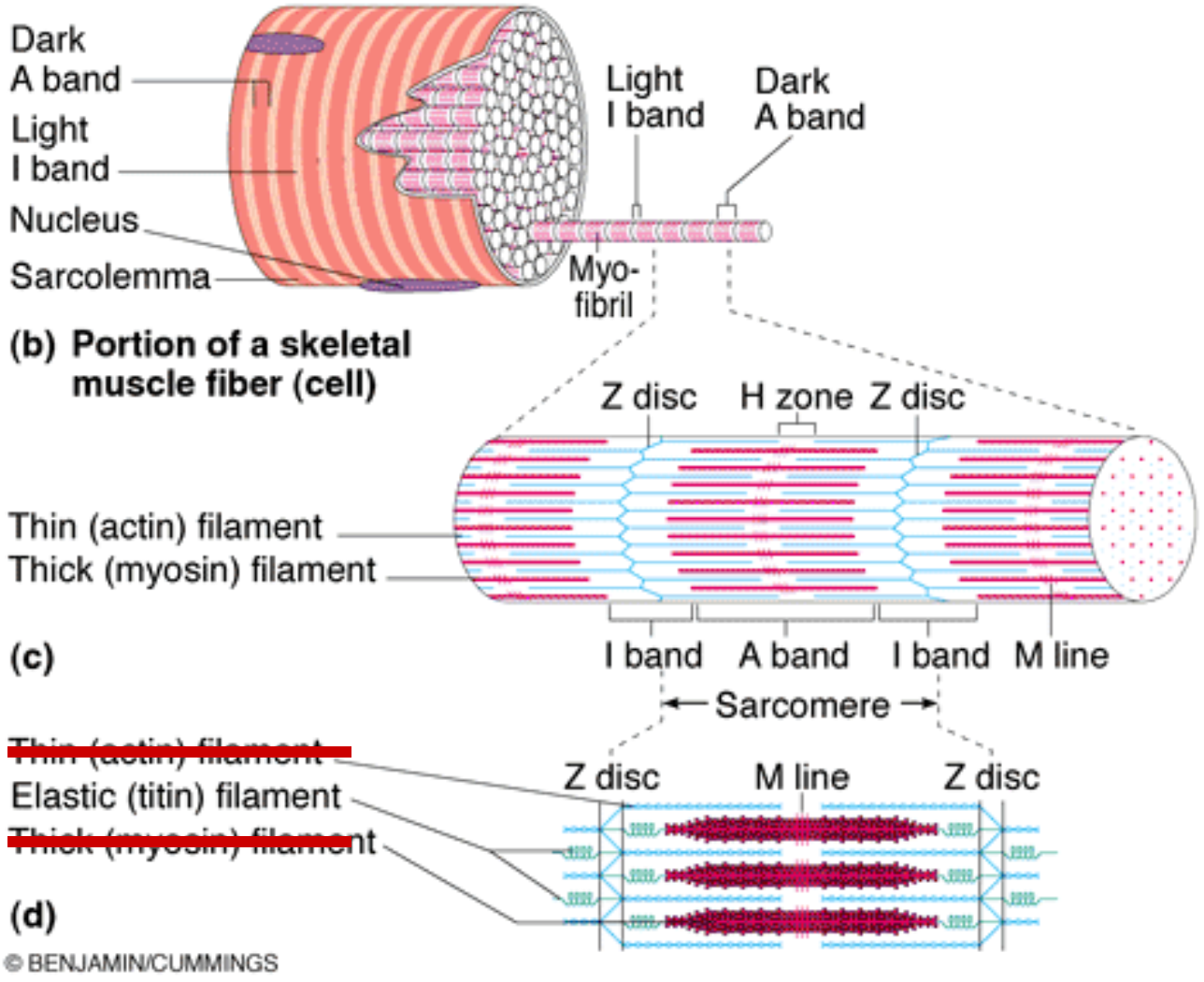

Periosteum covering the bone
Tendon
Fascia
Skeletal muscle
Epimysium
Perimysium
Fasciculus
Endomysium
Muscle fiber (cell)
Endomysium
Striations
Sarcolemma
Sarcoplasm
Filaments
Nuclei
Myofibrils


(a) Muscle
Tendons
(b) Bundle of muscle fibers (muscle cells)
(d) Myofibrils
Nucleus
(c) Individual muscle fiber (cell)
(e) Single myofibril
Sarcomere
(f) Portion of myofibril
Thick filaments
Thin filaments

Myofibril

- Setiap myofibril terdiri dari bagian I yang terang dan pita A yang gelap
- Pada pita A terdapat zona H
- Pada pita I terdapat garis Z




Dark
A band
Light
I band
Nucleus
Sarcolemma
Light
I band
Dark
A band
Myo-
fibril
(b) Portion of a skeletal muscle fiber (cell)
Z disc
H zone
Z disc
Thin (actin) filament
Thick (myosin) filament
(c)
I band
A band
I band
M line
Sarcomere
Thin (actin) filament
Elastic (titin) filament
Thick (myosin) filament
Z disc
M line
Z disc
(d)
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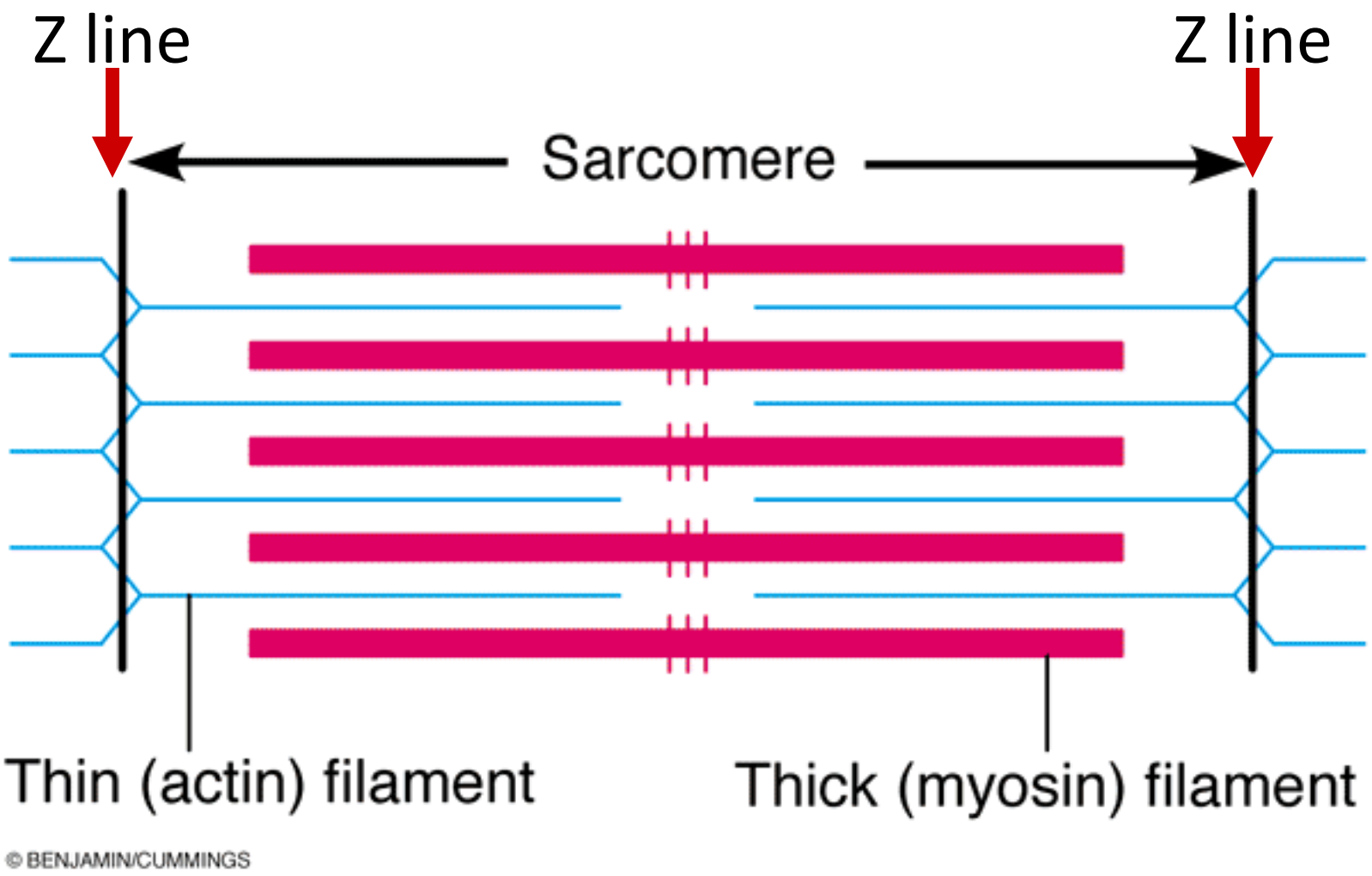
- Sarcomere : merupakan unit struktural dan fungsional dari otot
- Terdiri atas myofilamen:
  - filamen tipis: actin , menempel pada Z line
  - filamen tebal : myosin , terdapat di tengah sarcomer dan ujungnya tidak terikat


Z line
Z line
Sarcomere
Thin (actin) filament
Thick (myosin) filament
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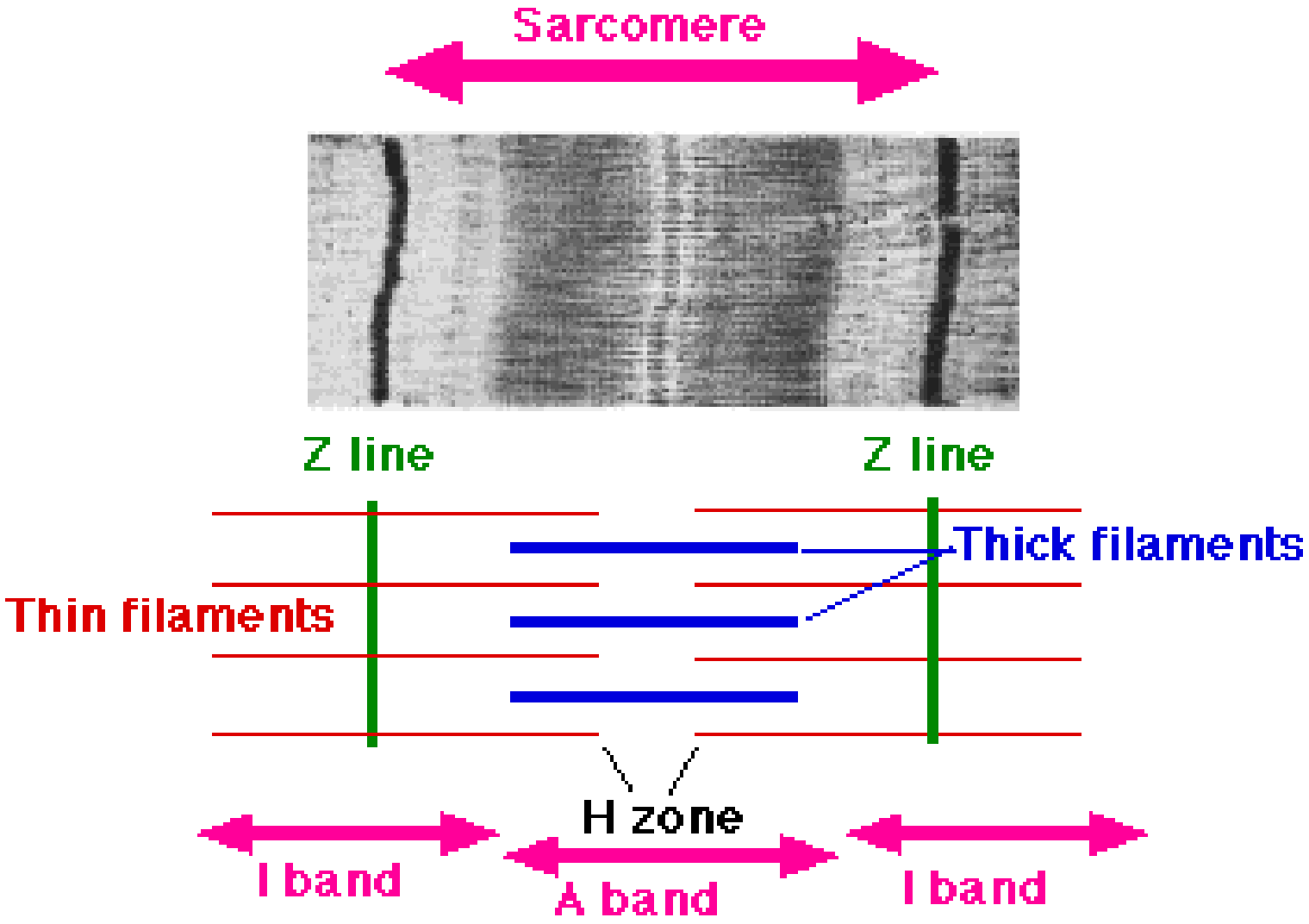
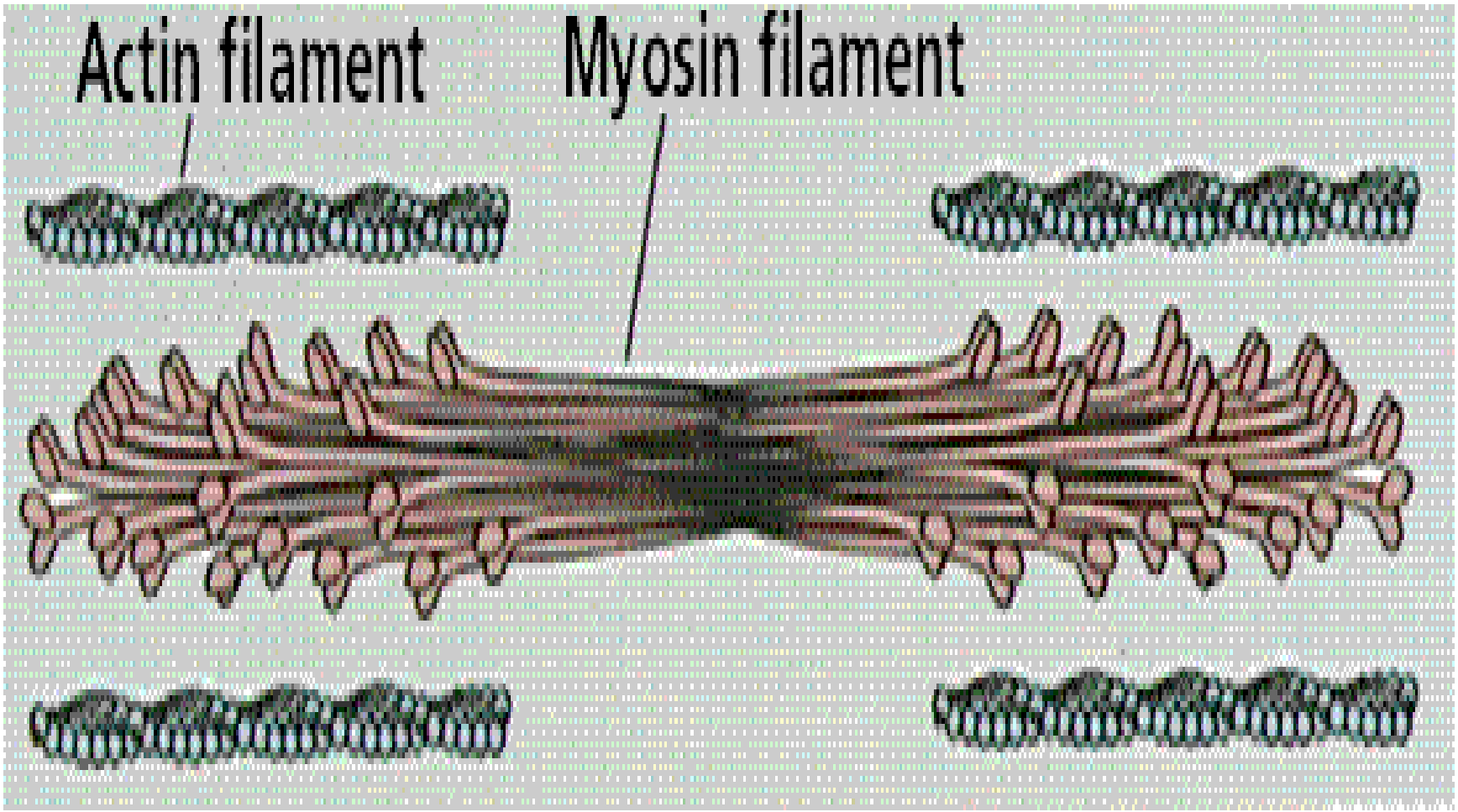
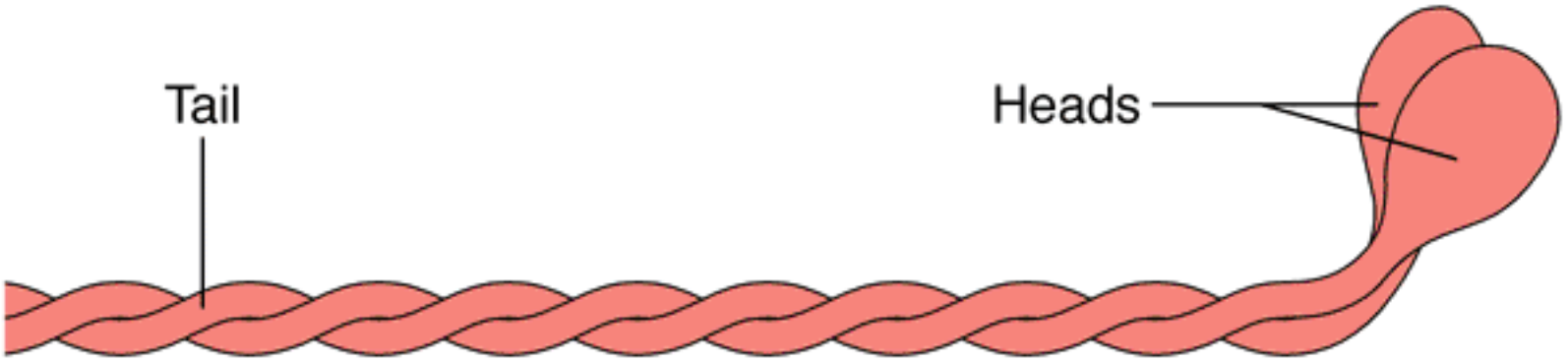

Sarcomere
Z line
Z line
Thick filaments
Thin filaments
H zone
I band
A band
I band


Actin filament
Myosin filament



(a) Myosin molecule

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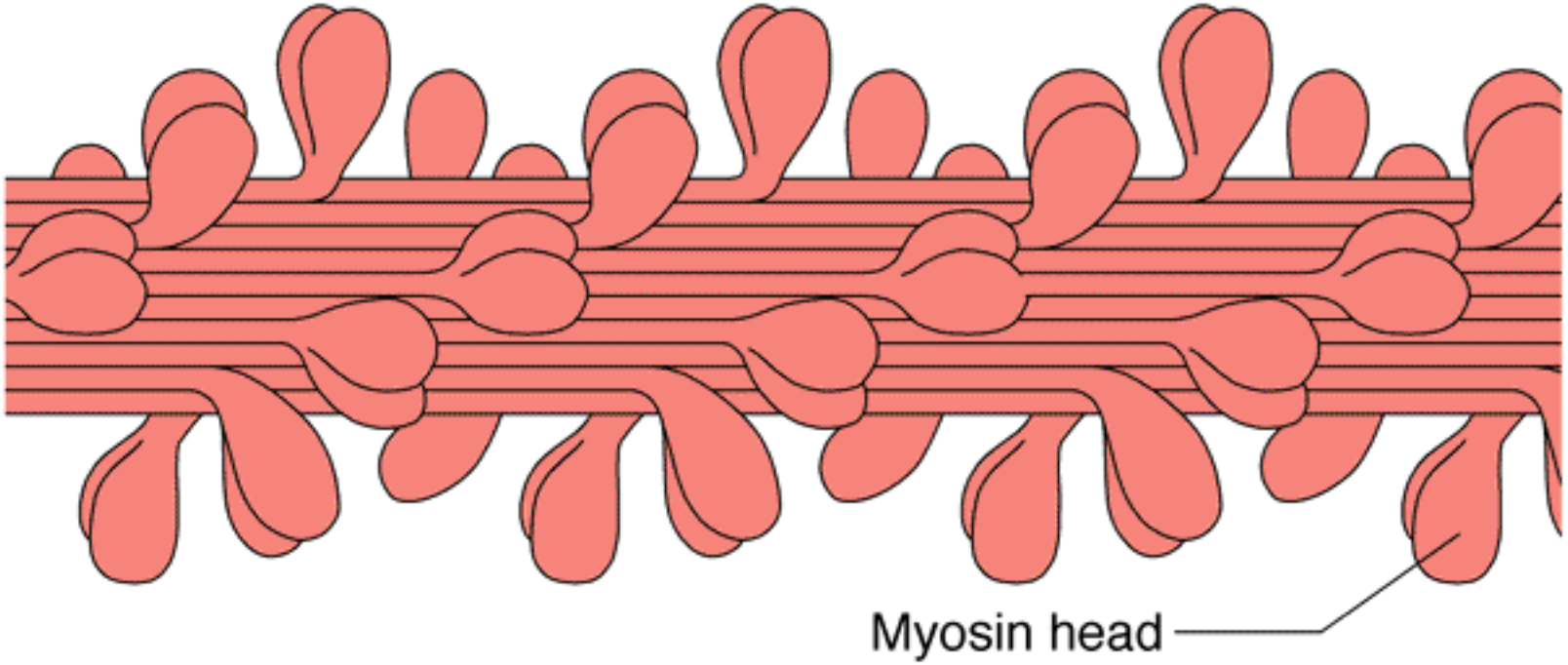

(b) Portion of a thick filament

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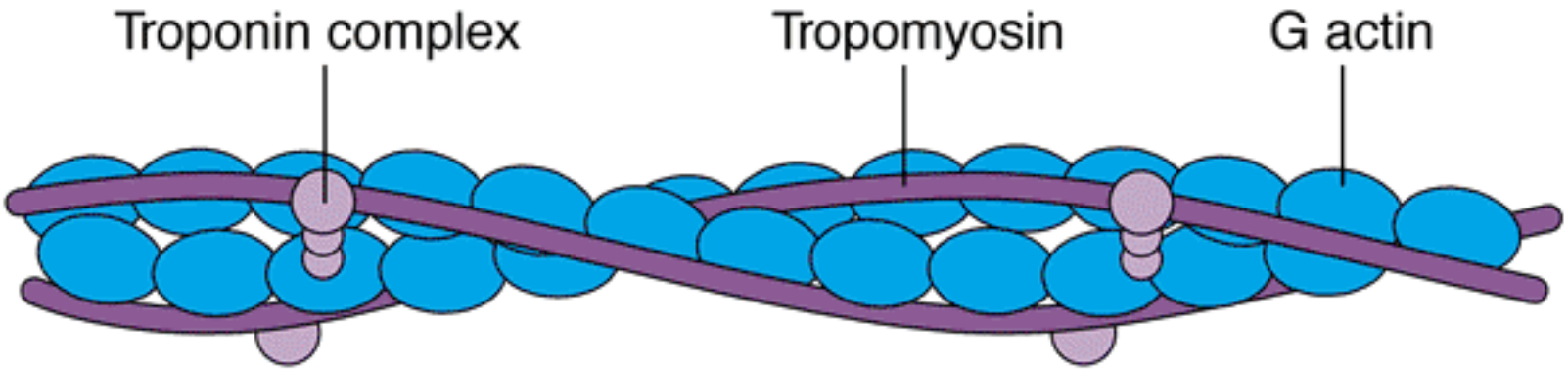

(c) Portion of a thin filament

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Thin myofilaments

It composed of 3 types of protein:

ACTIN

TROPONIN

TROPOMYOSIN.

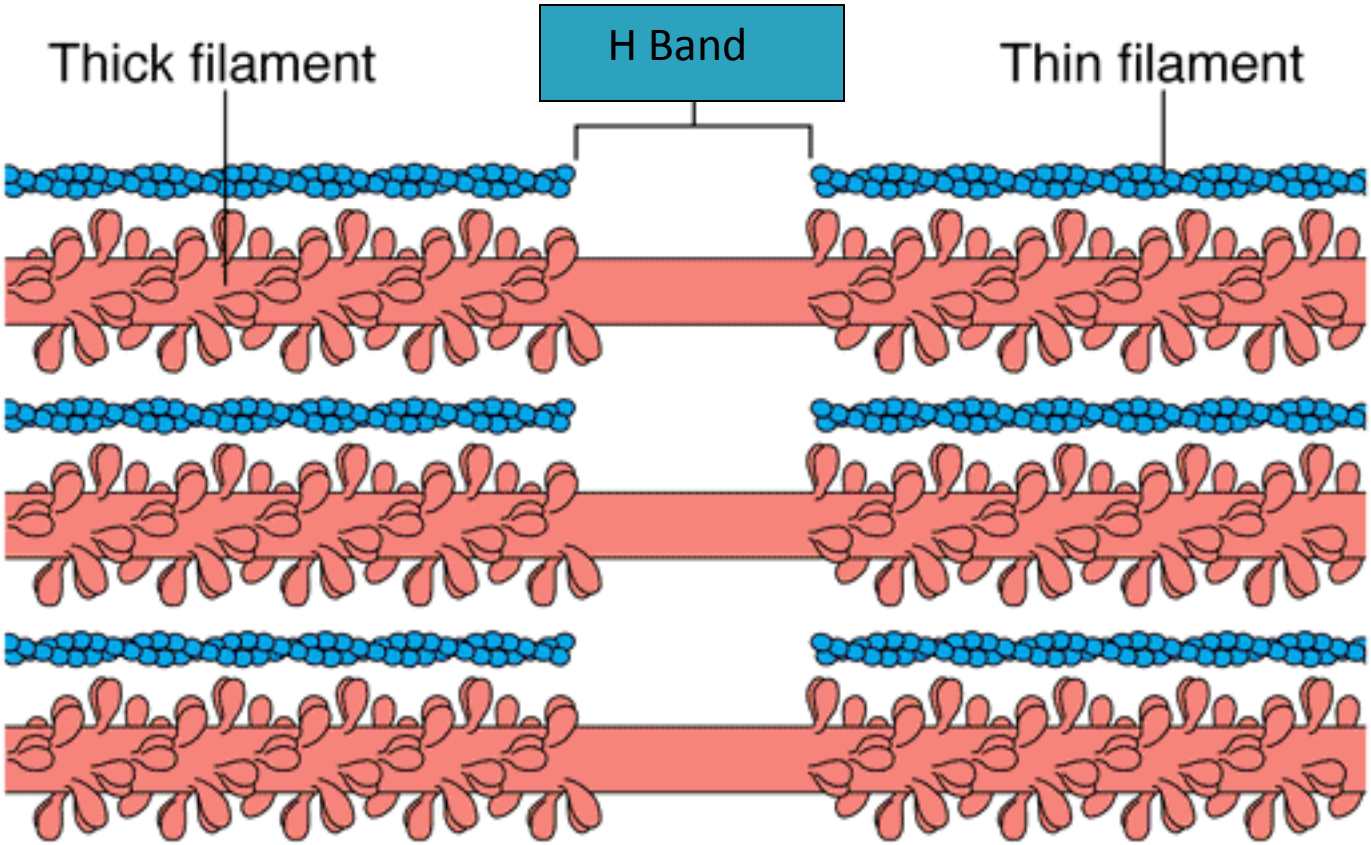
The actin molecules are spherical and form long chains. Each thin myofilament contains two such chains that coil around each other.

TROPOMYOSIN molecules are thin molecules that wrap around the chain of actin.

At the end of each tropomyosin is a troponin molecule.

The tropomyosin and troponin molecules are connected to each other.

Troponin molecules have binding sites for calcium ions.



(d) Longitudinal section of filaments within one sarcomere of a myofibril

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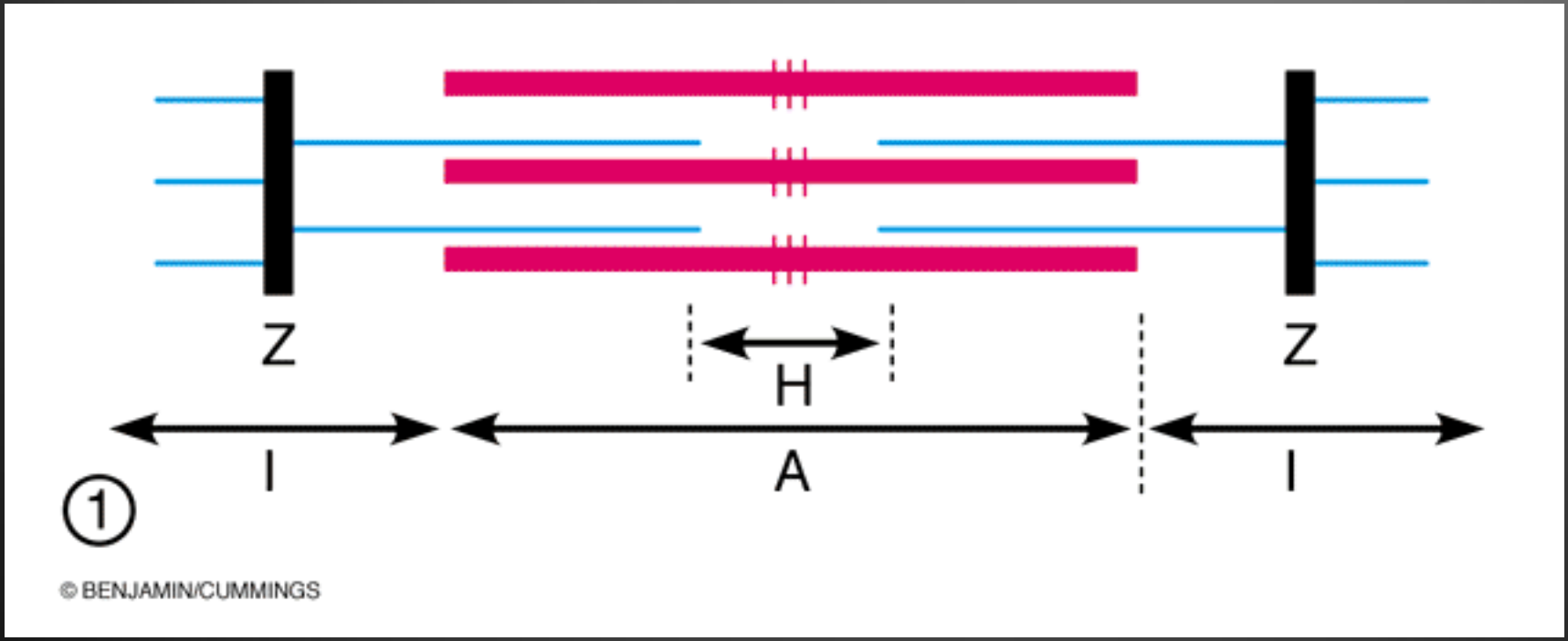
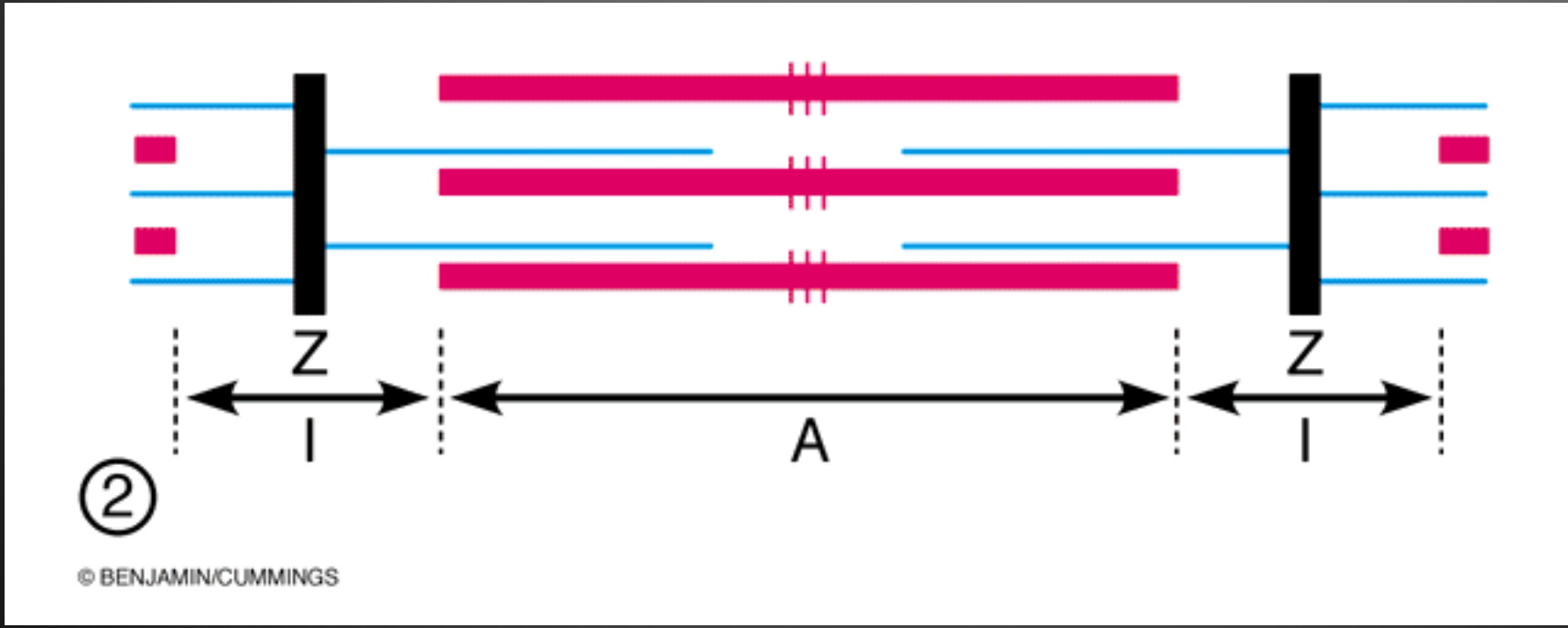
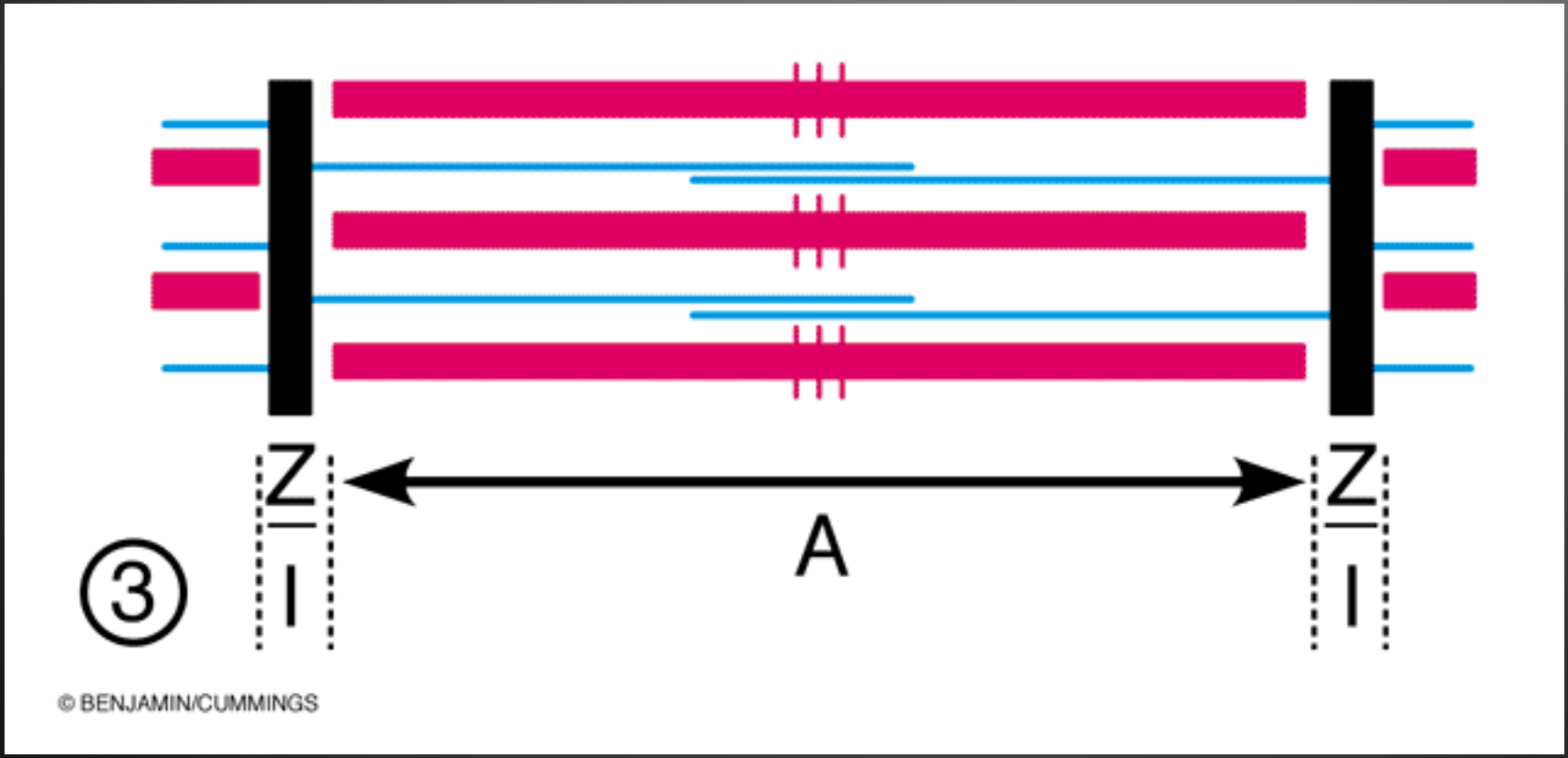
Sarcomere Relaxed

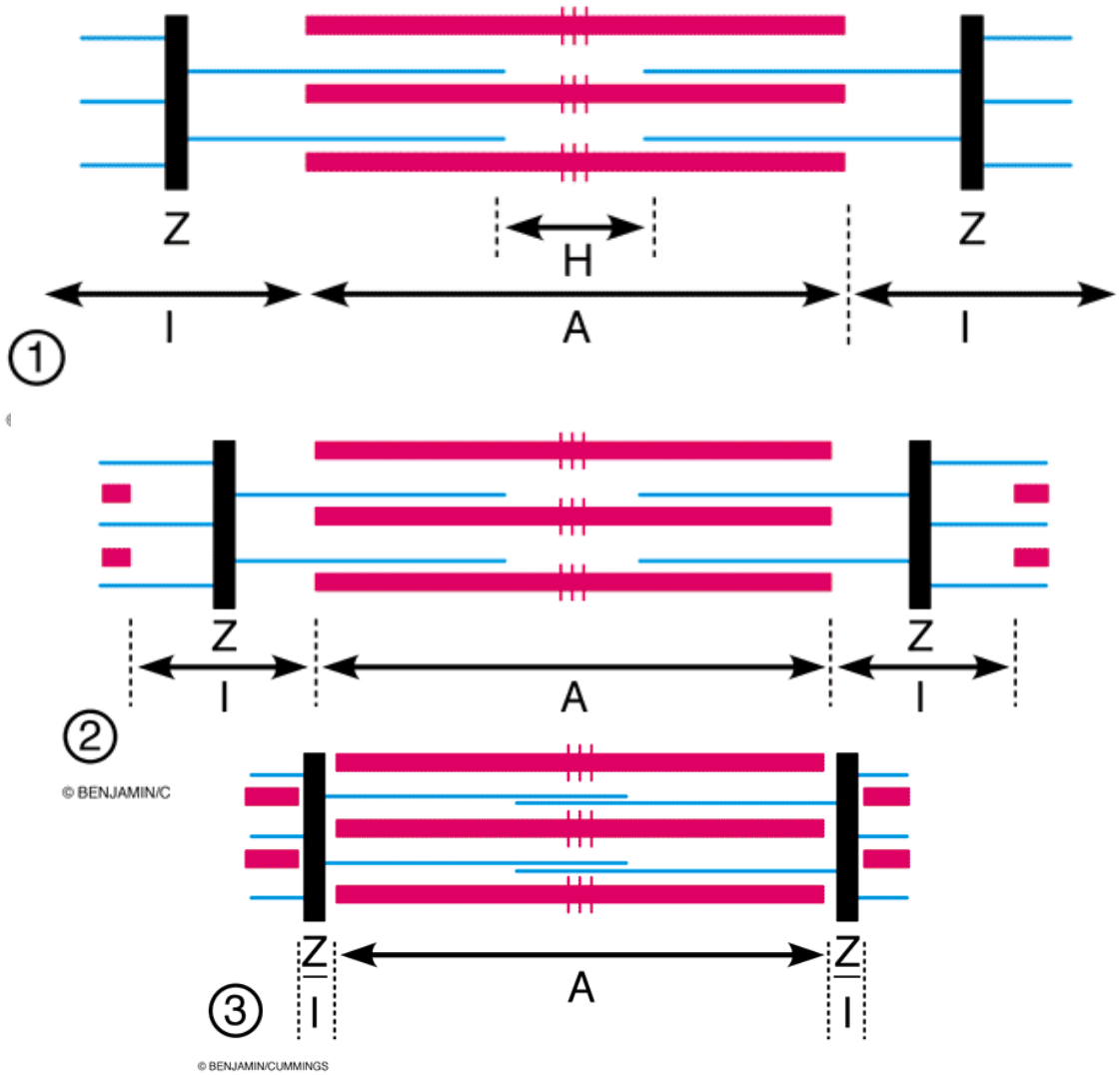


Sarcomere Partially Contracted



Sarcomere Completely Contracted




Z
H
Z
I
A
I
①
Z
Z
I
A
I
②
© BENJAMIN/C
Z
Z
A
I
I
③
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Muscle Fatique

- Dikerenakan kekurangan oksigen sehingga menyebabkan defisit ATP
- Terkumpulnya asam laktat yang dihasilkan oleh respirasi anaerob

Atrophy Otot

- Otot melemah dan mengecil
- Dikarenakan
  - Imobilisasi
  - Kehilangan persyarafan

Hypertrophy Otot

- Pembesaran otot
- Pembuluh darah menjadi lebih banyak
- Lebih banyak mitokondria
- Disebabkan oleh
  - Latihan intensif
  - Steroid hormones

Steroid Hormones

- Stimulate muscle growth and hypertrophy

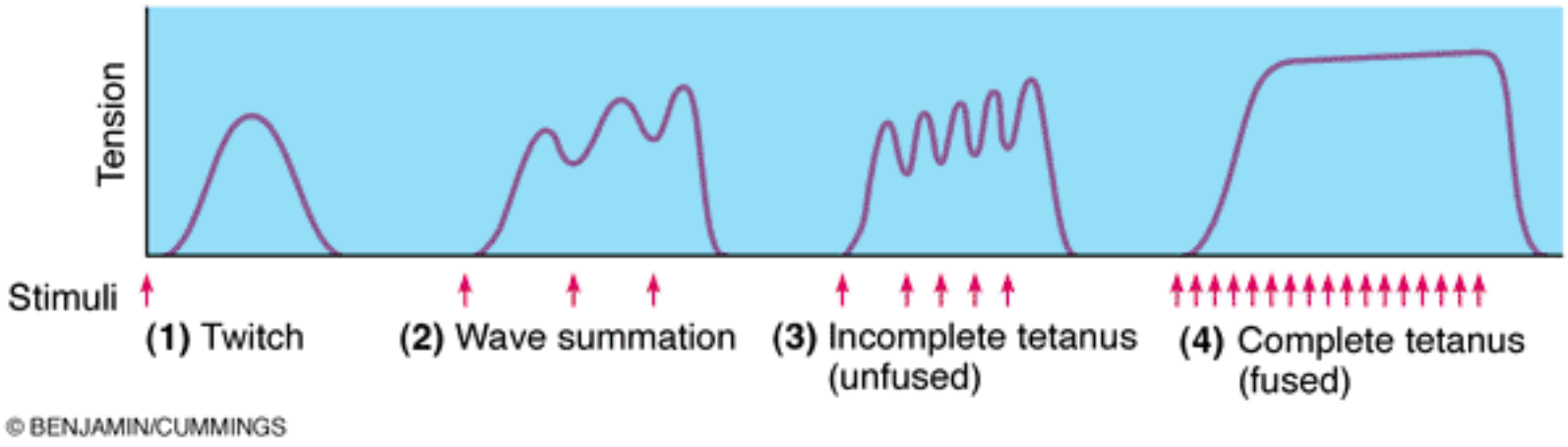
Tonus Otot

- Kekenyalan otot
- Selalu ada otot yang berkontraksi

Tetany

- Kontraksi otot yang terus menerus
- Karena impuls saraf yang terus menerus

Tetanus


Tension
Stimuli
(1) Twitch
(2) Wave summation
(3) Incomplete tetanus (unfused)
(4) Complete tetanus (fused)
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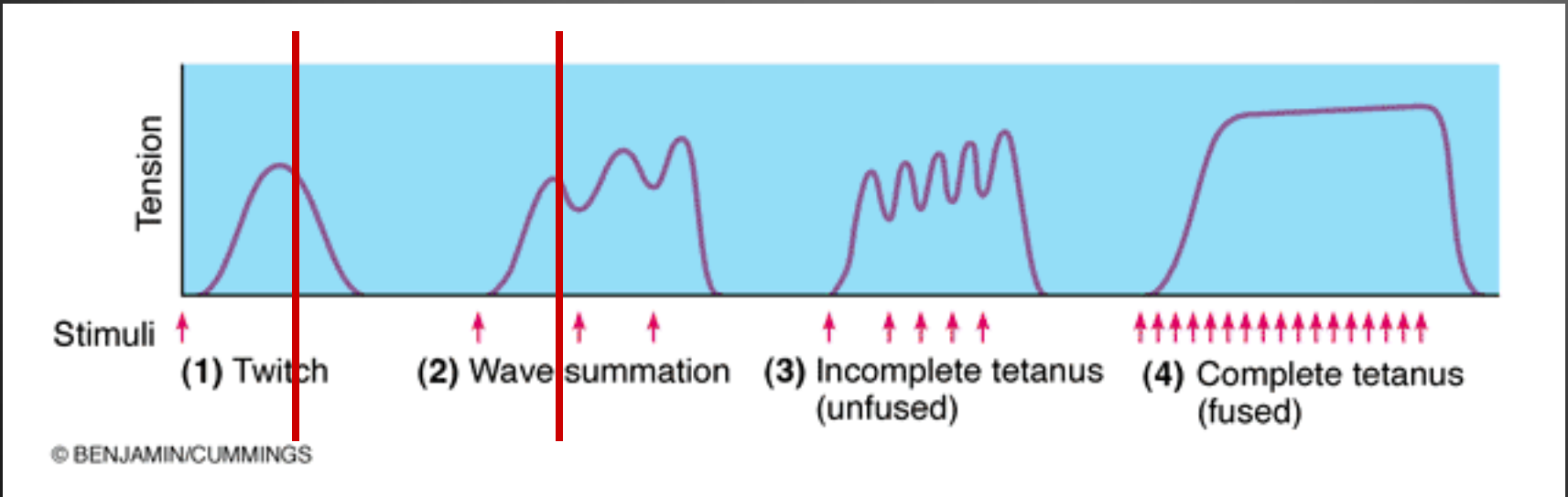
Periode Refractory

- Periode yang pendek ketika sel otot tidak berespon terhadap rangsangan saraf

Refractory


Tension
Stimuli
(1) Twitch
(2) Wave summation
(3) Incomplete tetanus (unfused)
(4) Complete tetanus (fused)
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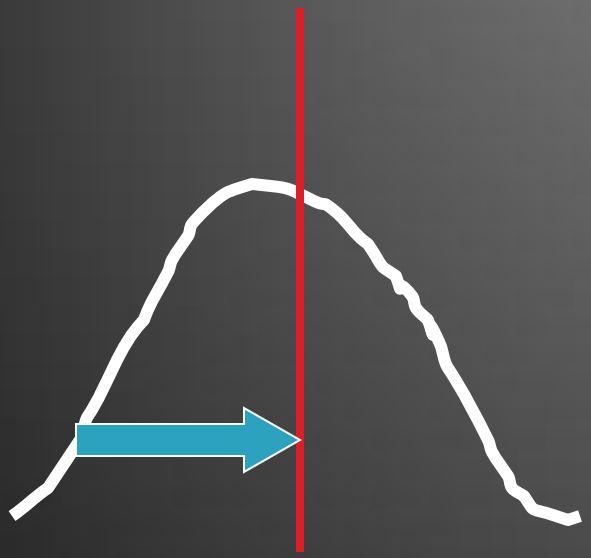
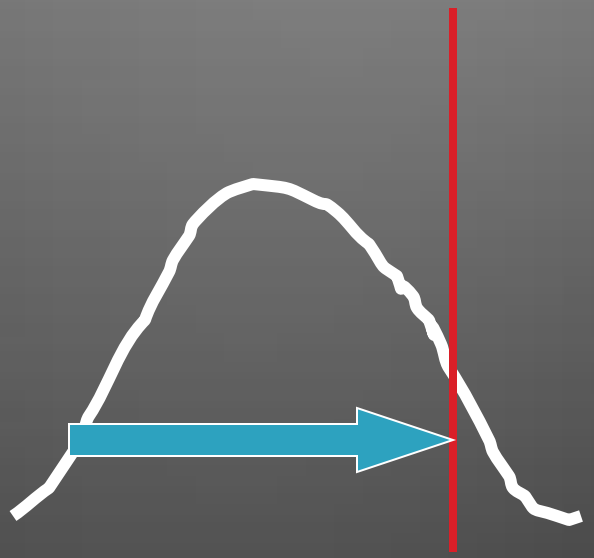
Refractory Periods



Skeletal Muscle



Cardiac Muscle

Kontraksi Isometric

- Tidak memproduksi gerakan
- Dipergunakan ketika
  - berdiri
  - duduk
  - Mempertahankan postur

Kontraksi Isotonic

- Berperan dalam pergerakan
- Digunakan untuk
  - berjalan
  - Pergerakan anggota tubuh

	Isotonic	Isometric
Muscle length	Decreased	Remain Constant
Muscle tension	Remain constant	Increase
Energy of contraction	Converted to external work and waste heat	Converted to waste heat
Sliding of myosin and actin	Occur to a muscle extent	-
Duration of contraction	Long	short
O2 and nutrient requirement	Great	less
Heat production	Less	Great