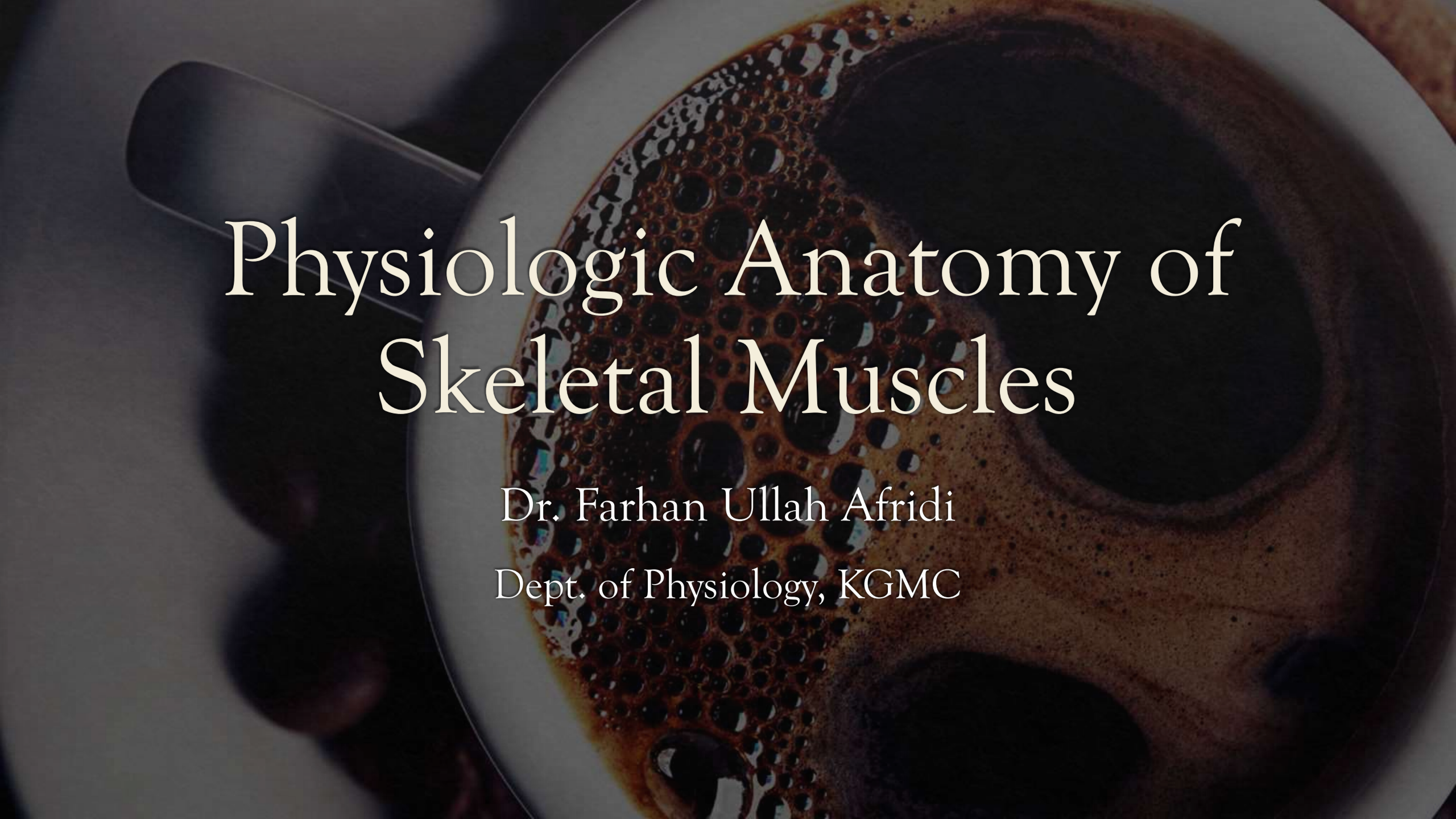

# Physiologic Anatomy of Skeletal Muscles

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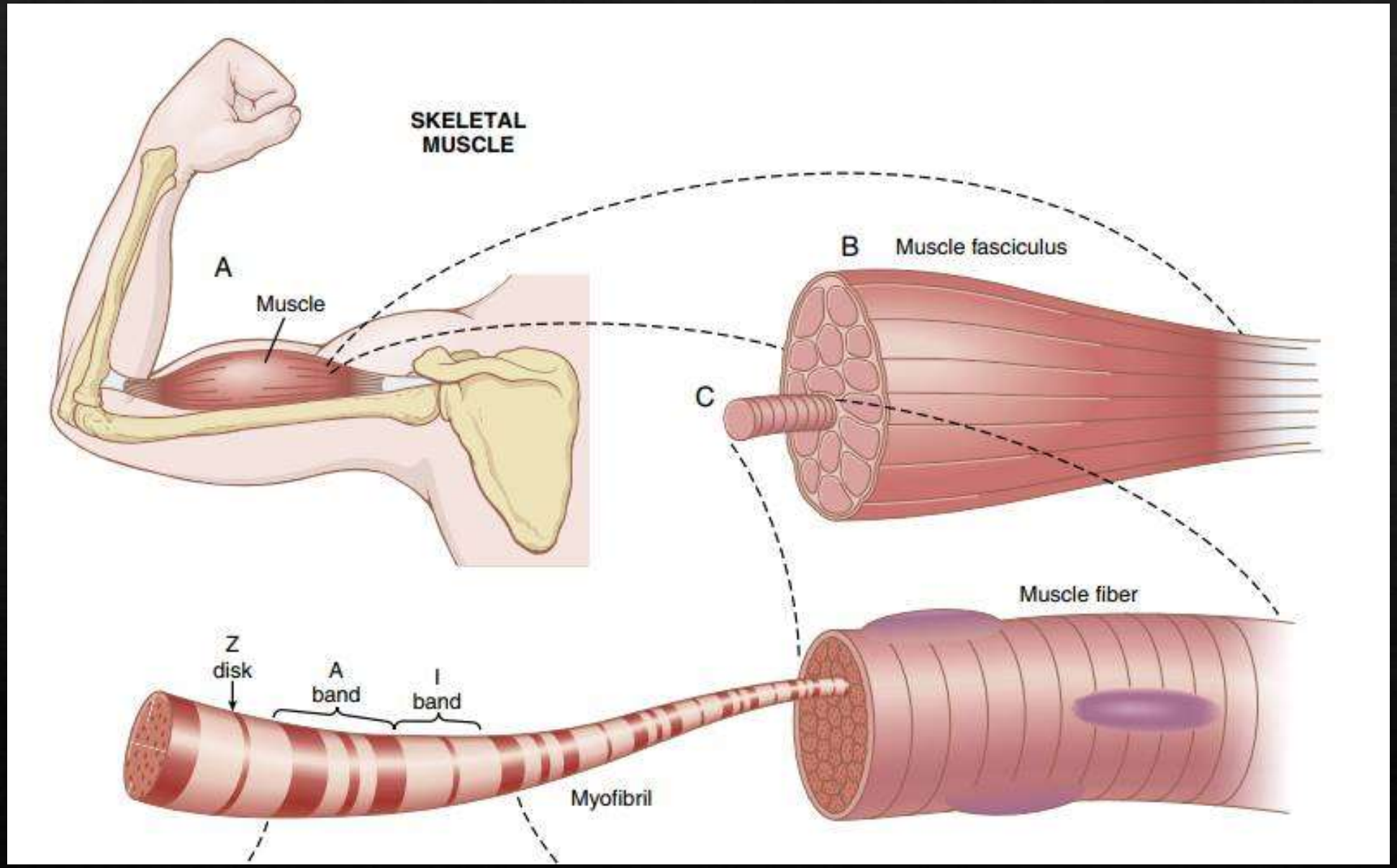
# Structural organization of skeletal muscles

- Composed of multiple **muscle fibers** extending across the length of muscle
- Each **fiber** is composed of smaller **subunits** called **myofibrils**
- Each myofibril is composed of **actin and myosin filaments**


SKELETAL MUSCLE
A
Muscle
B
Muscle fasciculus
C
Muscle fiber
Z disk
A band
I band
Myofibril

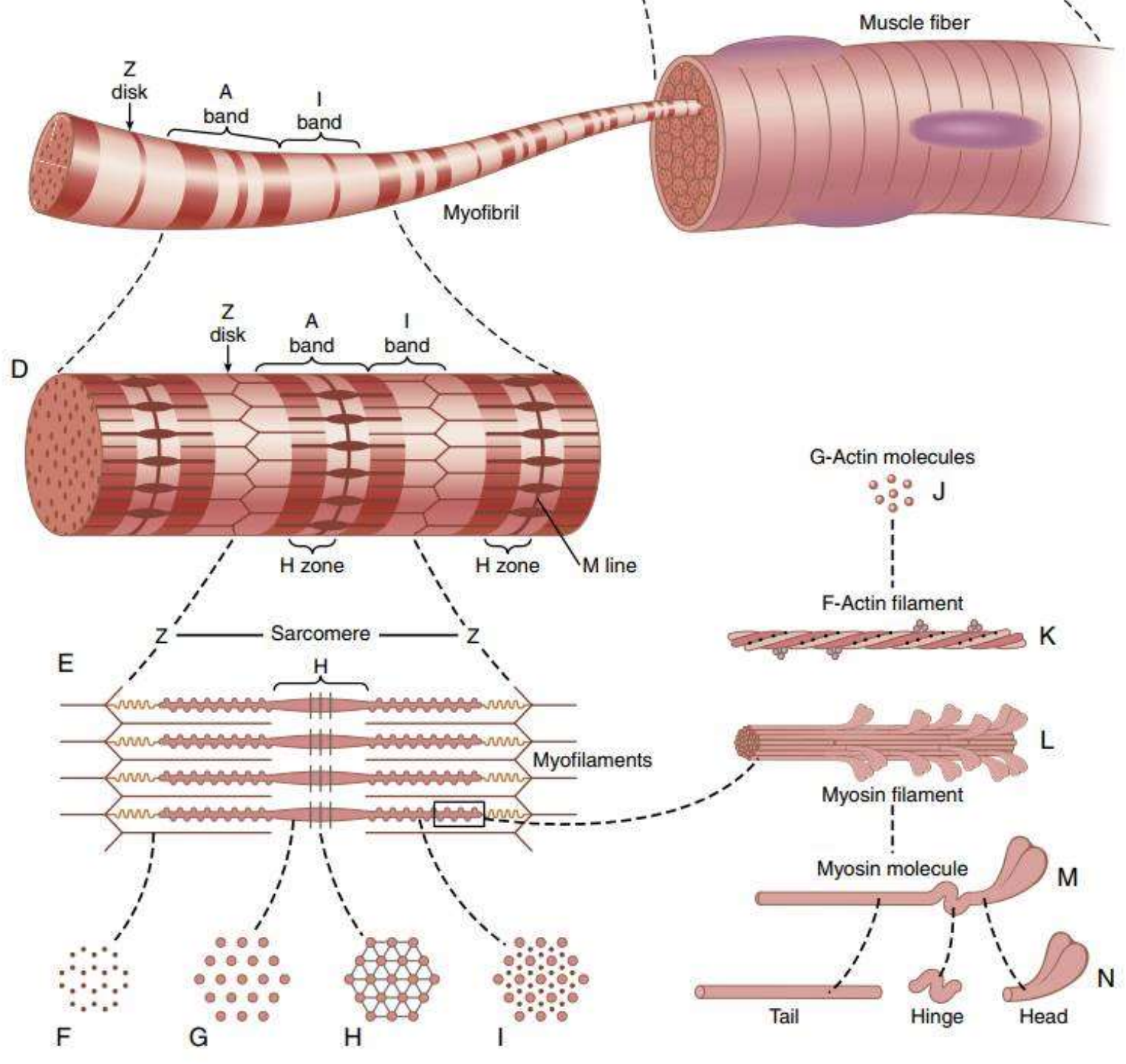
# Sarcolemma

- Analogous to plasma membrane of a cell
- Thin membrane enclosing each skeletal muscle fiber
- Has two main parts:

1. True cell membrane aka plasma membrane; inner part
2. an outer coat of polysaccharide and numerous thin collagen fibrils; continued with the tendon fibers at the end of each muscle fiber

# Myofibrils

- Composed of about 1500 adjacent Myosin filaments and 3000 Actin filaments
- These are polymerized proteins
- Responsible for the muscle contraction.
- **Myosin are thick filaments**
- **Actin are thin filaments**
- Myosin and actin filaments **partially interdigitate** and thus cause the **myofibrils** to have **alternate light and dark bands**


Muscle fiber
Z disk
A band
I band
Myofibril
D
Z disk
A band
I band
H zone
H zone
M line
Z
Sarcomere
Z
E
H
Myofilaments
F
G
H
I
G-Actin molecules
J
F-Actin filament
K
L
Myosin filament
Myosin molecule
M
Tail
Hinge
Head
N

# Myofibrils

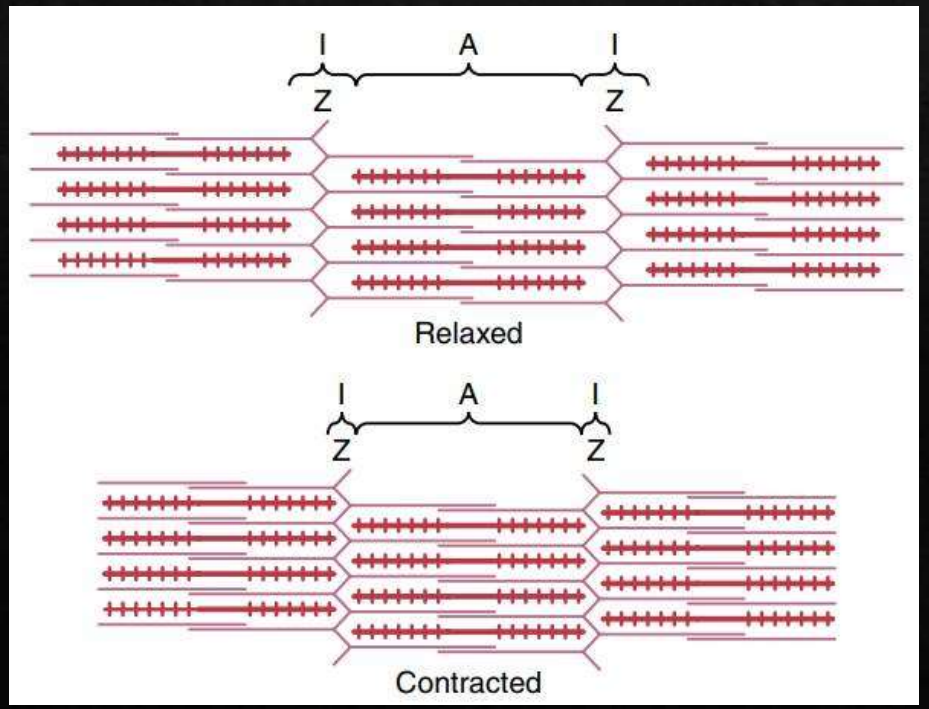
- **The light bands contain only Actin filaments and are called I bands. Isotropic to light**
- **The dark bands contain Myosin filaments, as well as the ends of the Actin filaments, where they overlap the myosin, and are called A bands;** Anisotropic to light
- **Ends of the actin filaments** are attached to a **Z disk**.
- From this disk, these filaments extend in both directions to interdigitate with the myosin filaments.
- Z disk: composed of filamentous proteins different from the actin and myosin filaments
- These bands give skeletal and cardiac muscle their striated appearance.

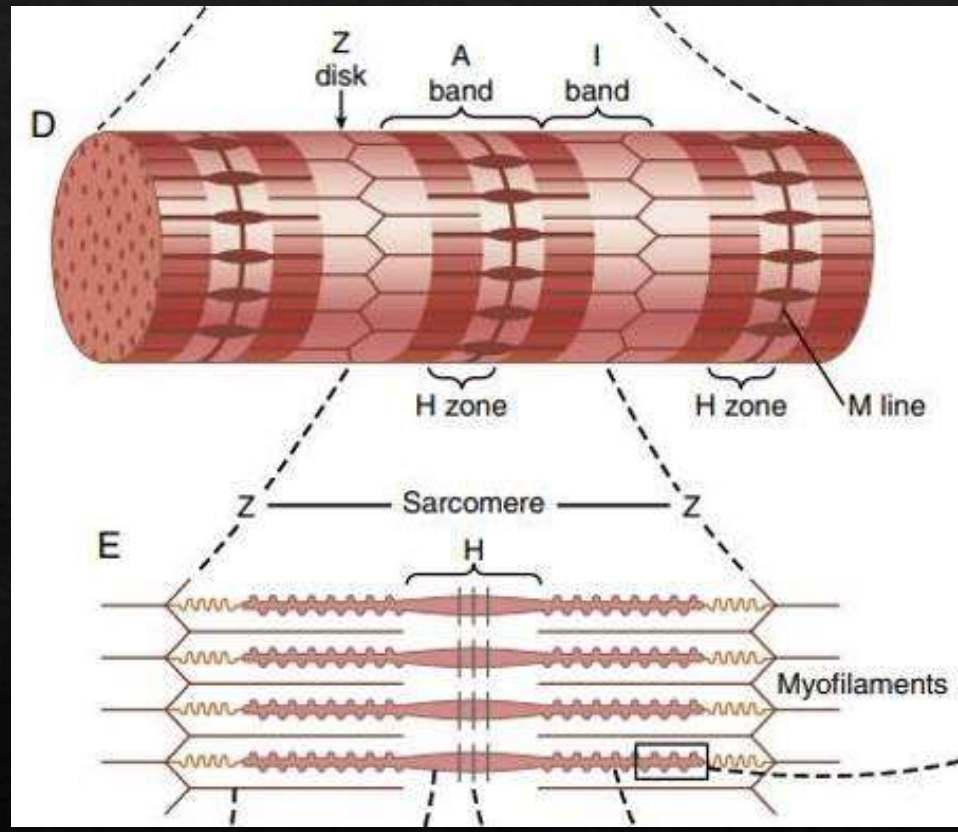
# Sarcomere

- The portion of the myofibril (or of the whole muscle fiber) that lies between two successive Z disks is called a sarcomere
- When the muscle fiber is contracted, the actin filaments

completely overlap the myosin filaments, and the tips

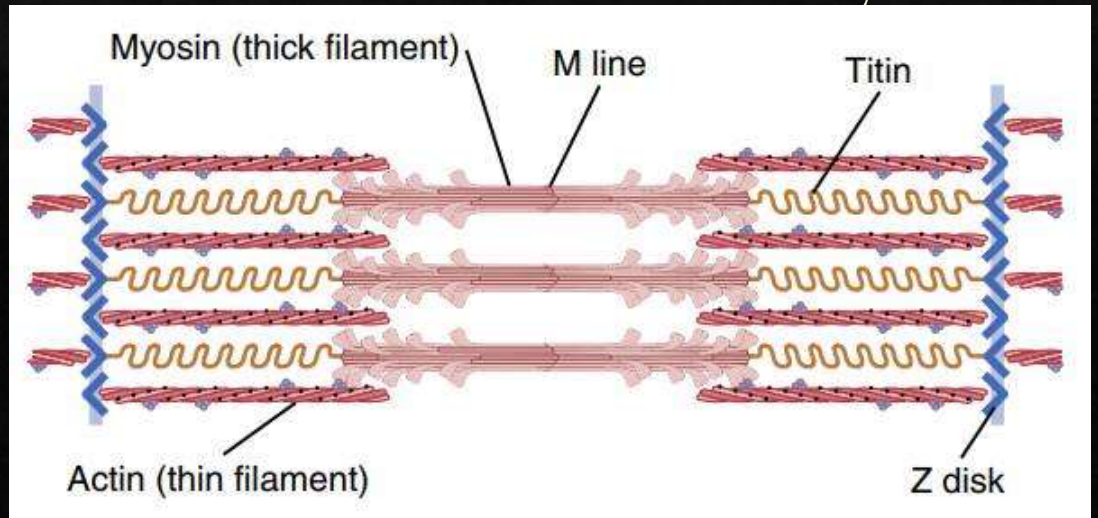
of the actin filaments are just beginning to overlap one another



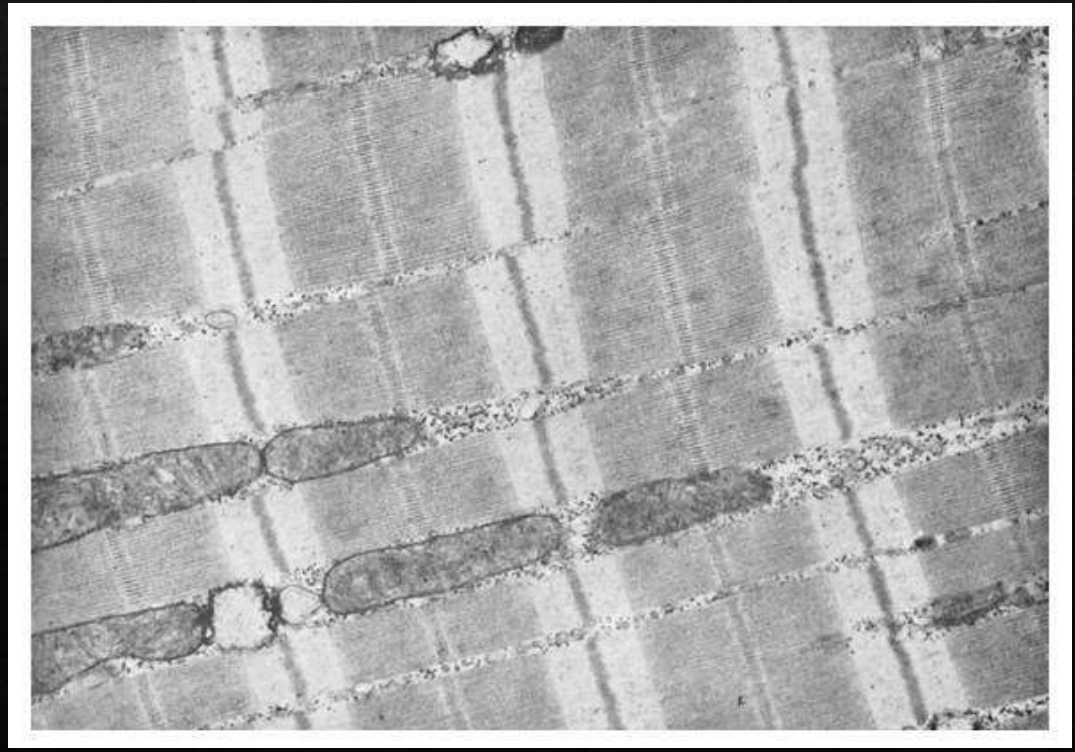
# Titin Filamentous Molecules

- Titin Filamentous Molecules Keep the Myosin and Actin Filaments in Place
- The side-by-side relationship between the myosin and actin filaments is maintained by a large number of filamentous molecules of a protein called titin
- Titin is filamentous hence it is very springy → act as a framework that holds the myosin and actin filaments in place.
- One end of the titin molecule is elastic; attached to the Z disk; acts as a spring and changing length as the sarcomere contracts and relaxes.
- The other part of the titin molecule tethers it to the myosin thick filament.



# Sarcoplasm

- Intracellular Fluid Between Myofibrils
- Many myofibrils are suspended side by side in each muscle fiber. The spaces between the myofibrils are filled with intracellular fluid called sarcoplasm
- Contains large quantities of potassium, magnesium, and phosphate, and enzymes.
- Large numbers of mitochondria in sarcoplasm; lie parallel to the myofibrils; ATP



# Sarcoplasmic Reticulum

- Sarcoplasmic Reticulum Is a Specialized Endoplasmic Reticulum of Skeletal Muscle
- Located in the sarcoplasm surrounding the myofibrils
- Very extensive; surrounds the myofibrils
- Important in regulating calcium storage and release and reuptake during muscle contraction

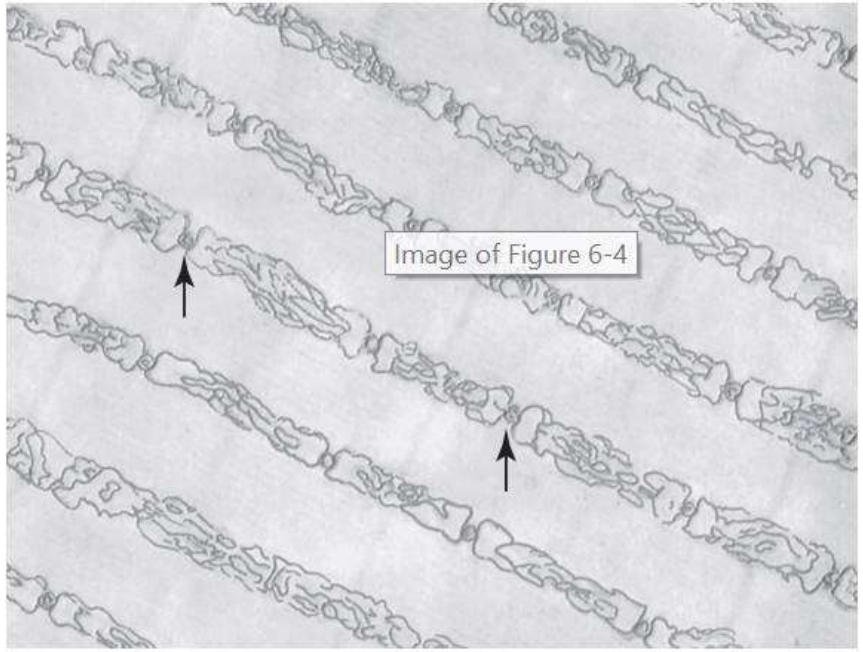
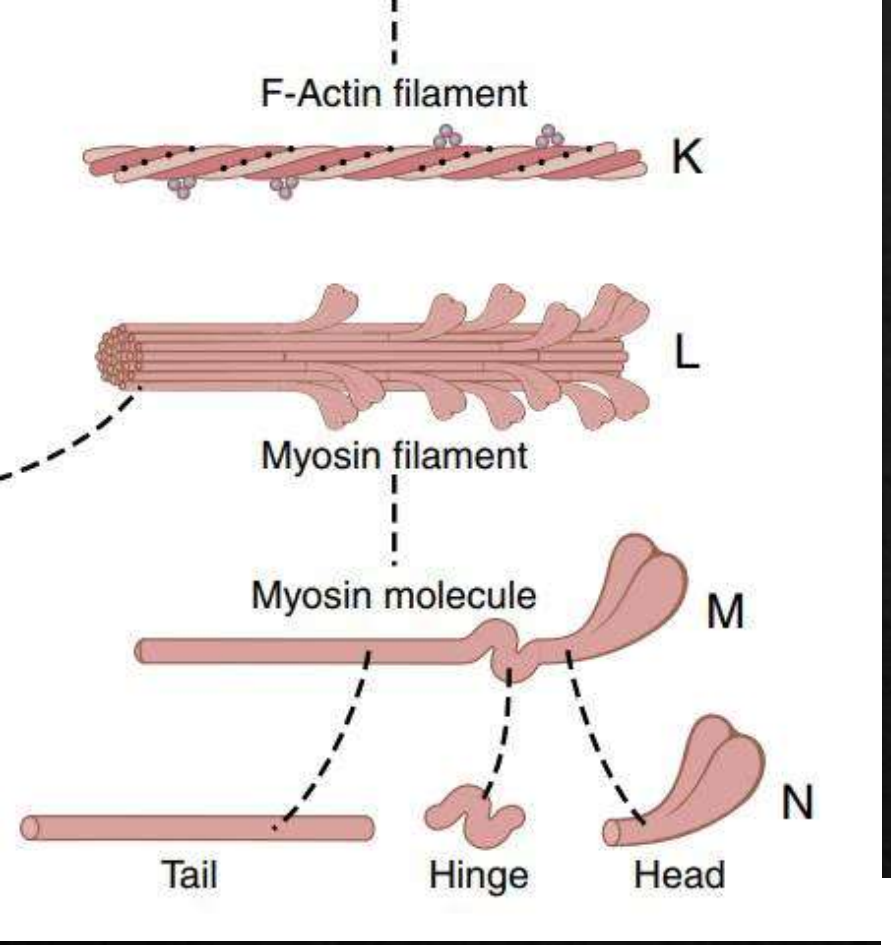
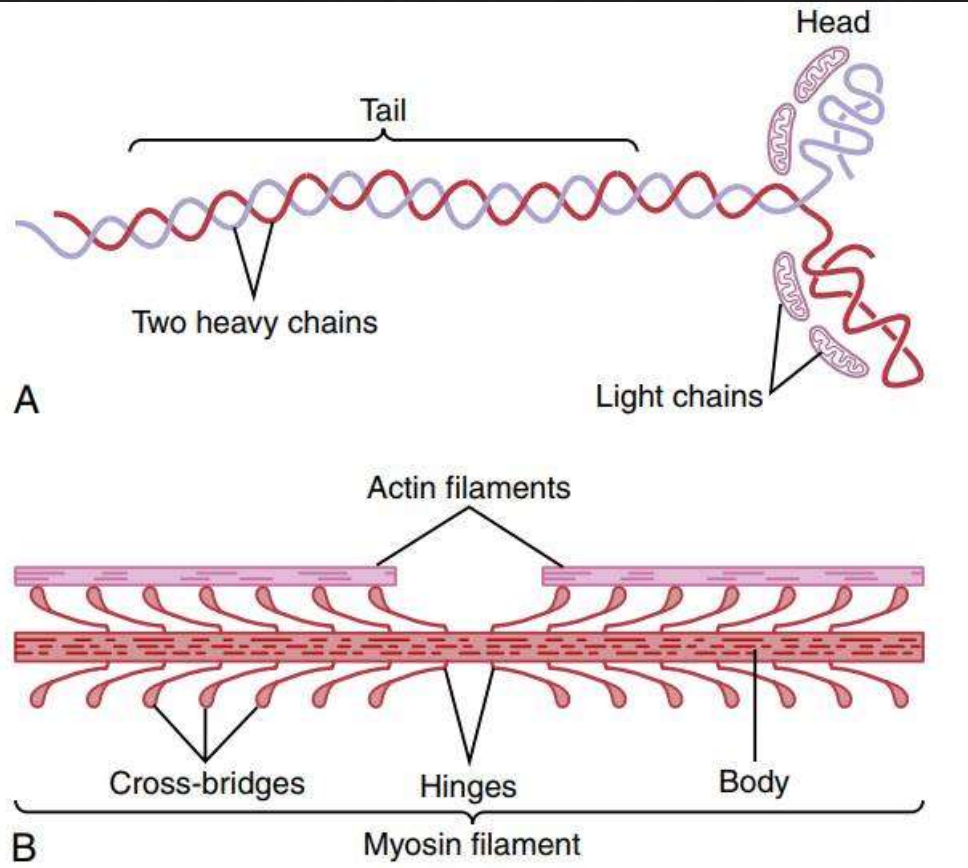



**Figure 6-4** Sarcoplasmic reticulum in the spaces between the myofibrils, showing a longitudinal system paralleling the myofibrils. Also shown in cross section are T tubules (*arrows*) that lead to the exterior of the fiber membrane and are important for conducting the electrical signal into the center of the muscle fiber. *(From Fawcett DW: The*



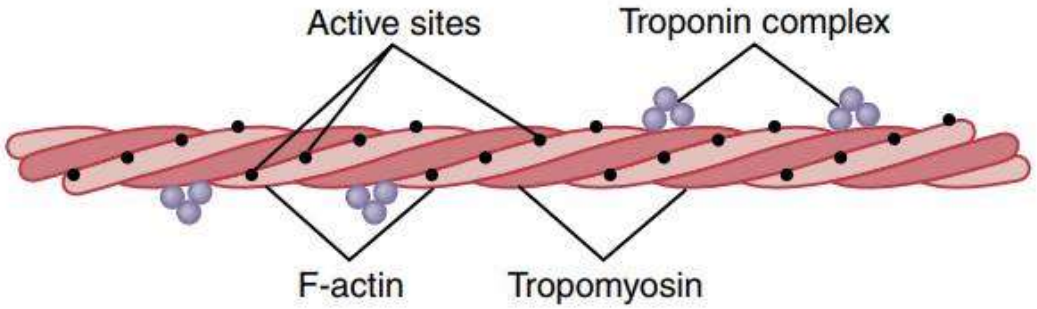
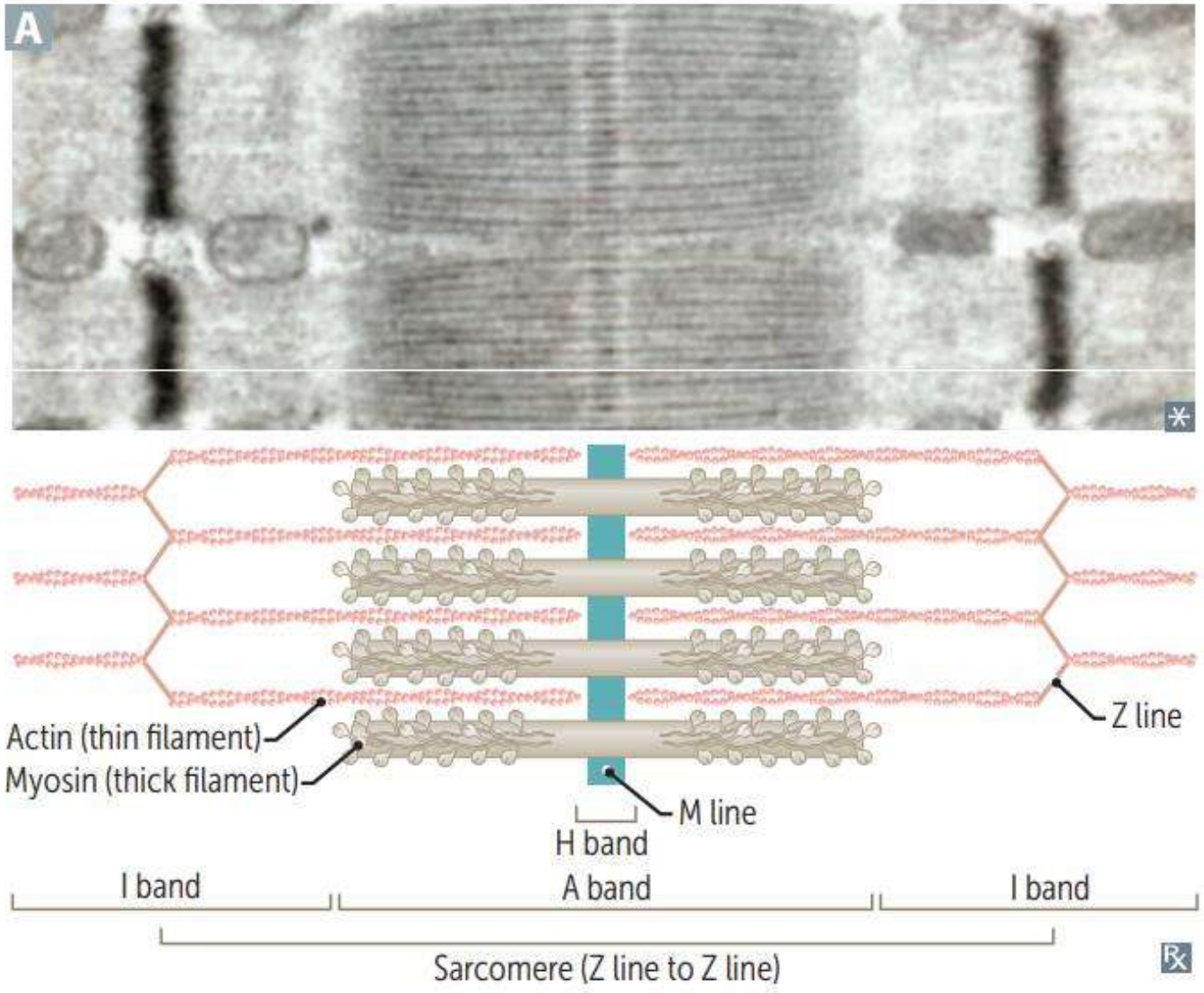
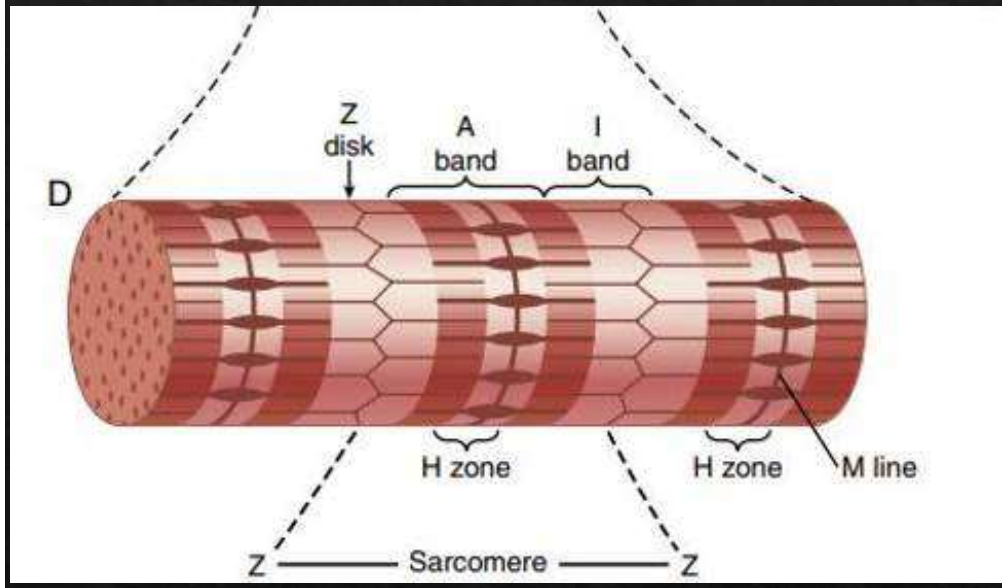




**Figure 6-7** Actin filament composed of two helical strands of *F-actin* molecules and two strands of *tropomyosin* molecules that fit in the grooves between the actin strands. Attached to one end of each tropomyosin molecule is a *troponin* complex that initiates contraction.


A
Actin (thin filament)
Myosin (thick filament)
Z line
M line
H band
I band
A band
I band
Sarcomere (Z line to Z line)


D
Z disk
A band
I band
H zone
H zone
M line
Z
Sarcomere
Z

# ICEBERG MOTIVATION

## Iceberg Illusion of Success


- Persistence
- Daily goals
- Rejections
- Hard Work
- Expenses
- Focus
- Growth Mindset
- Time Management
- Disappointment
- Dedication
- Tears
- Staying Healthy
- Sacrifice
- Discipline
- Meeting Targets