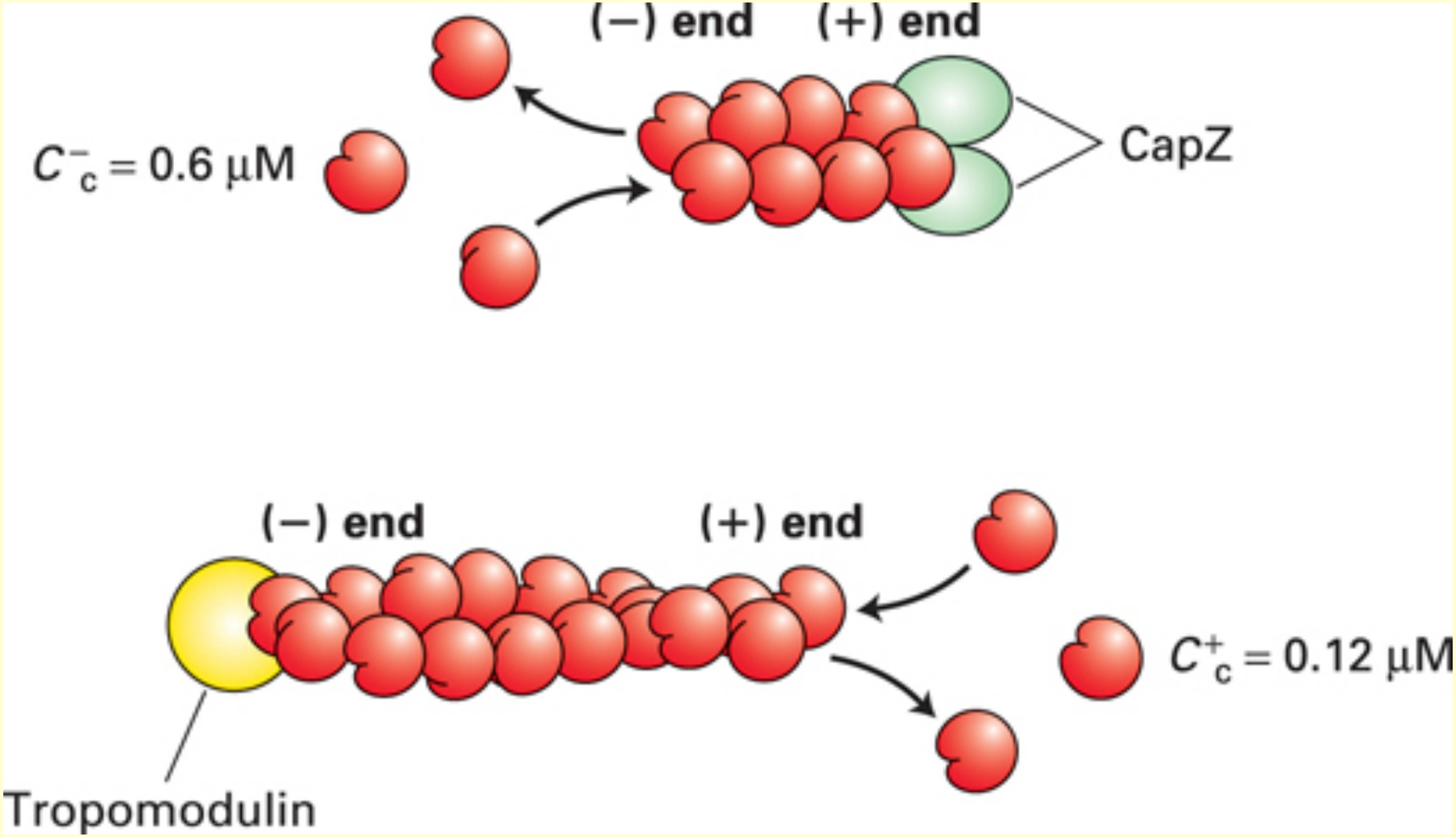
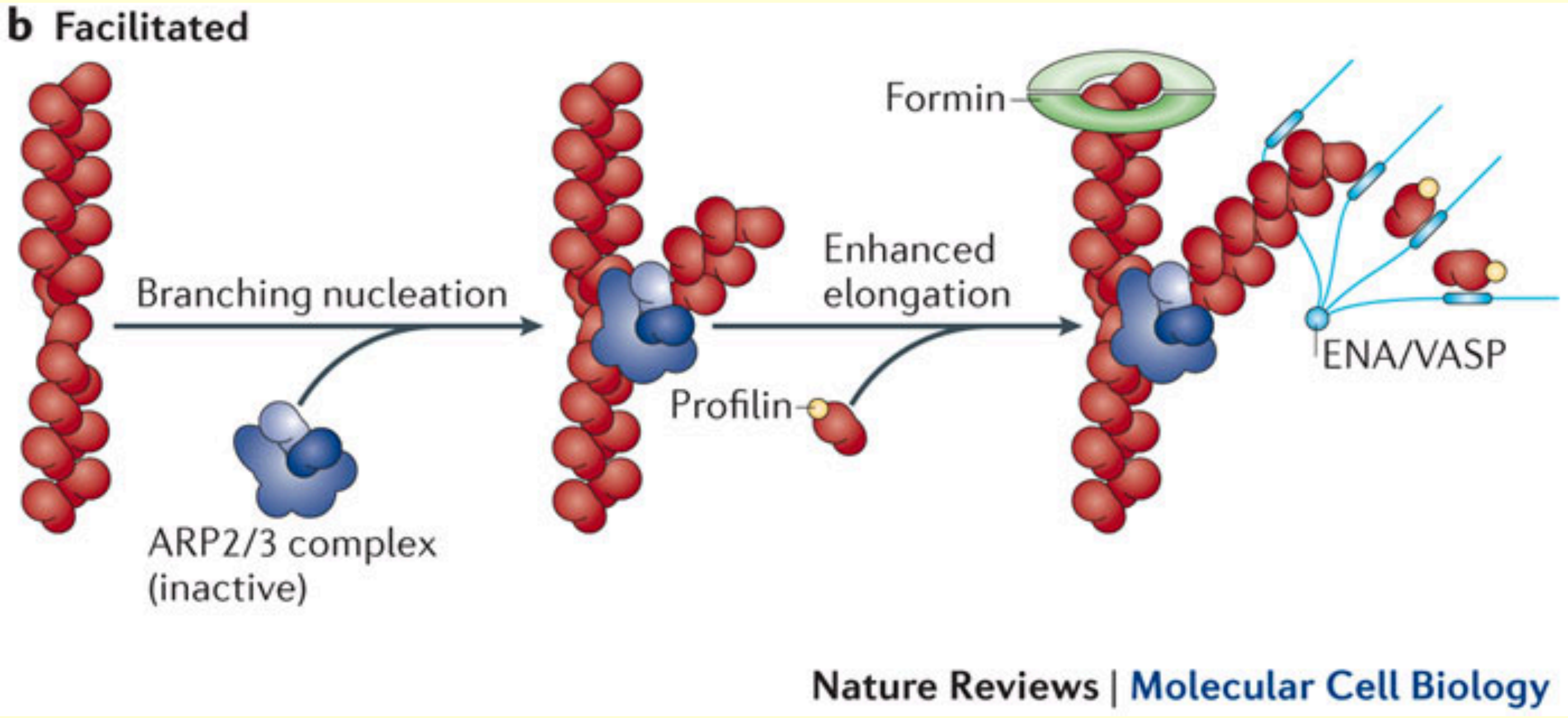
Actin capping proteins **CapZ** and **tropomodulin** bind selectively to either end of a filament to stabilise the filament



Actin filament assembly in the cell – how are new filaments started ?

Actin nucleating proteins ***formin*** and ***Arp2/3***



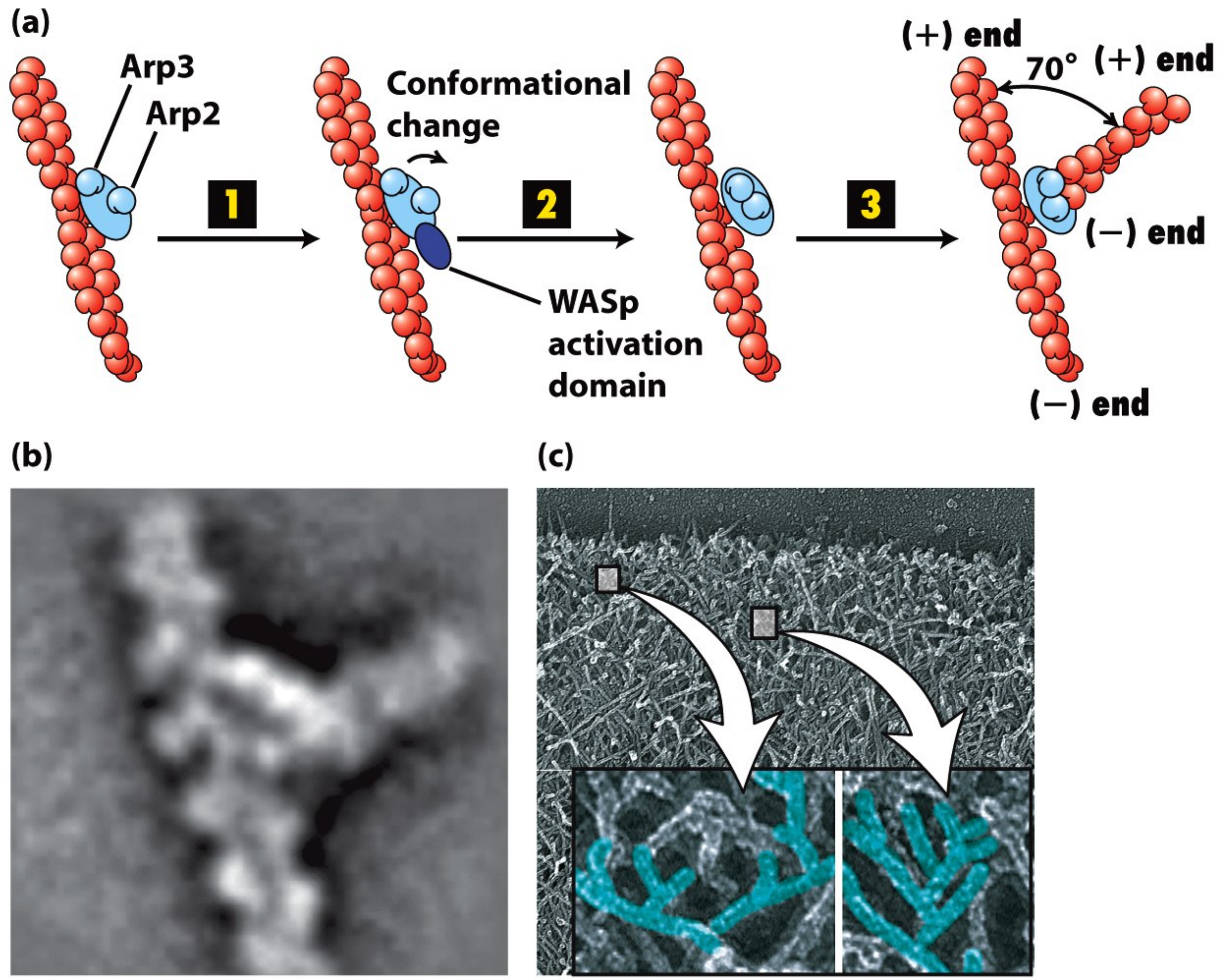
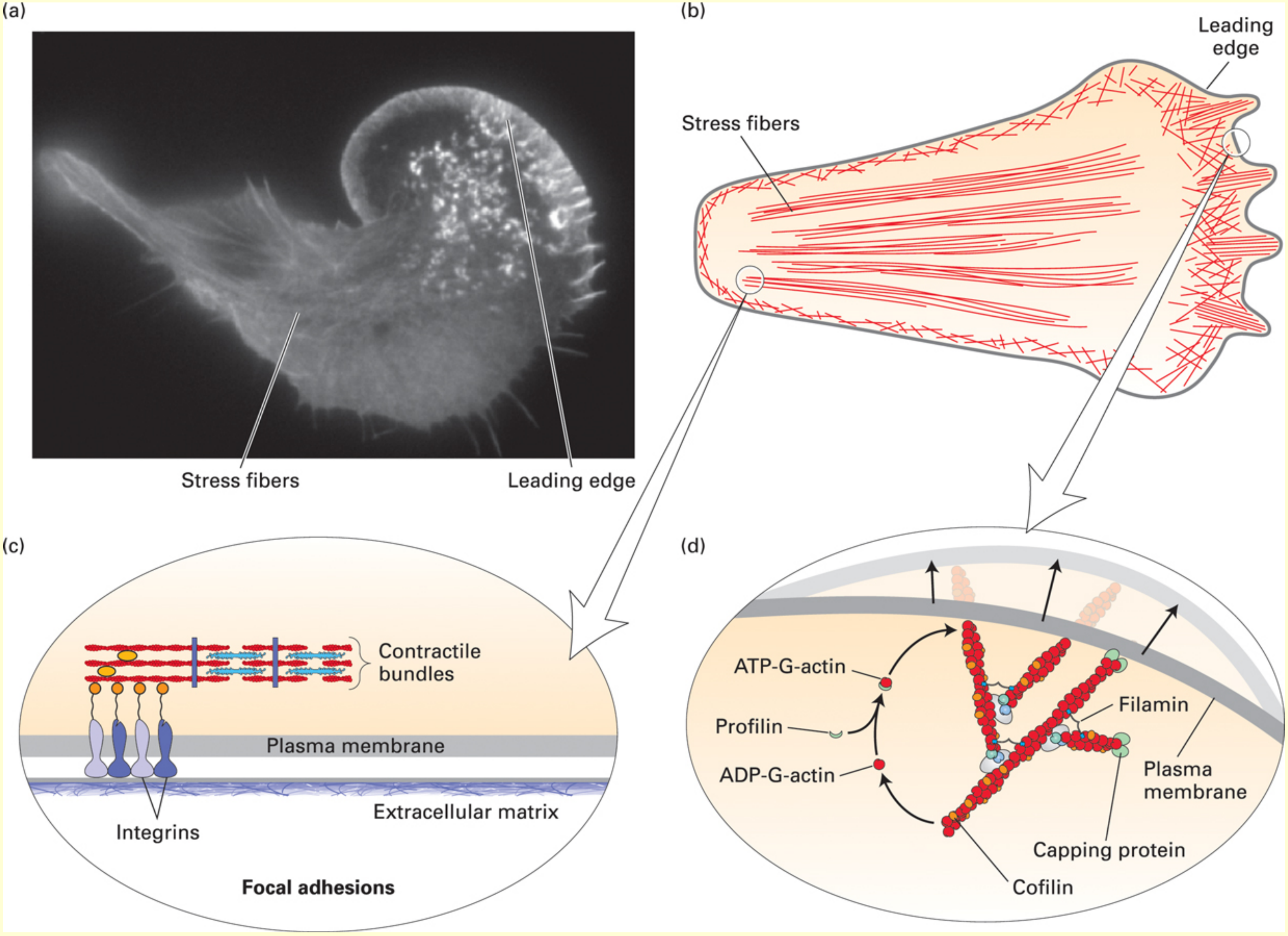


Figure 17-15
Molecular Cell Biology, Sixth Edition

Branching of actin filaments is regulated by Arp2/3 & WASp

Figure 17.41 Actin-based structures involved in cell locomotion.



NIH Intramural Research Program

Our Research Changes Lives

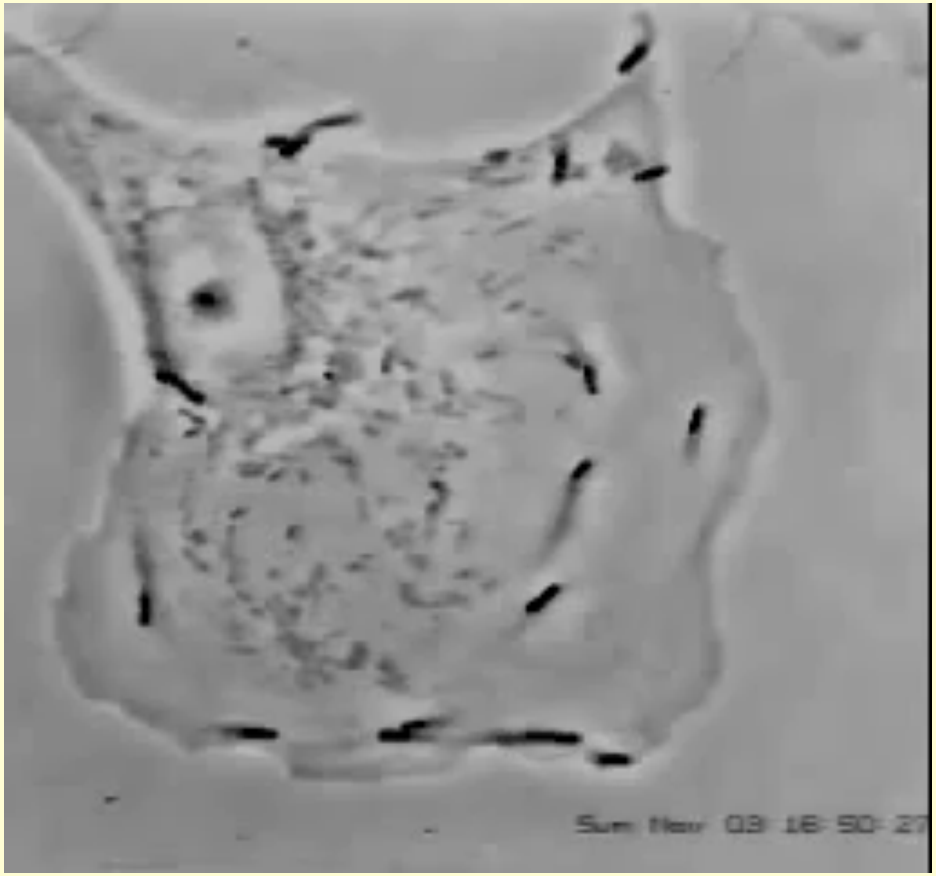
Review of actin-binding proteins and their function

Profilin
Colfilin
CapZ
tropomodulin
Firmin
Arp2/3

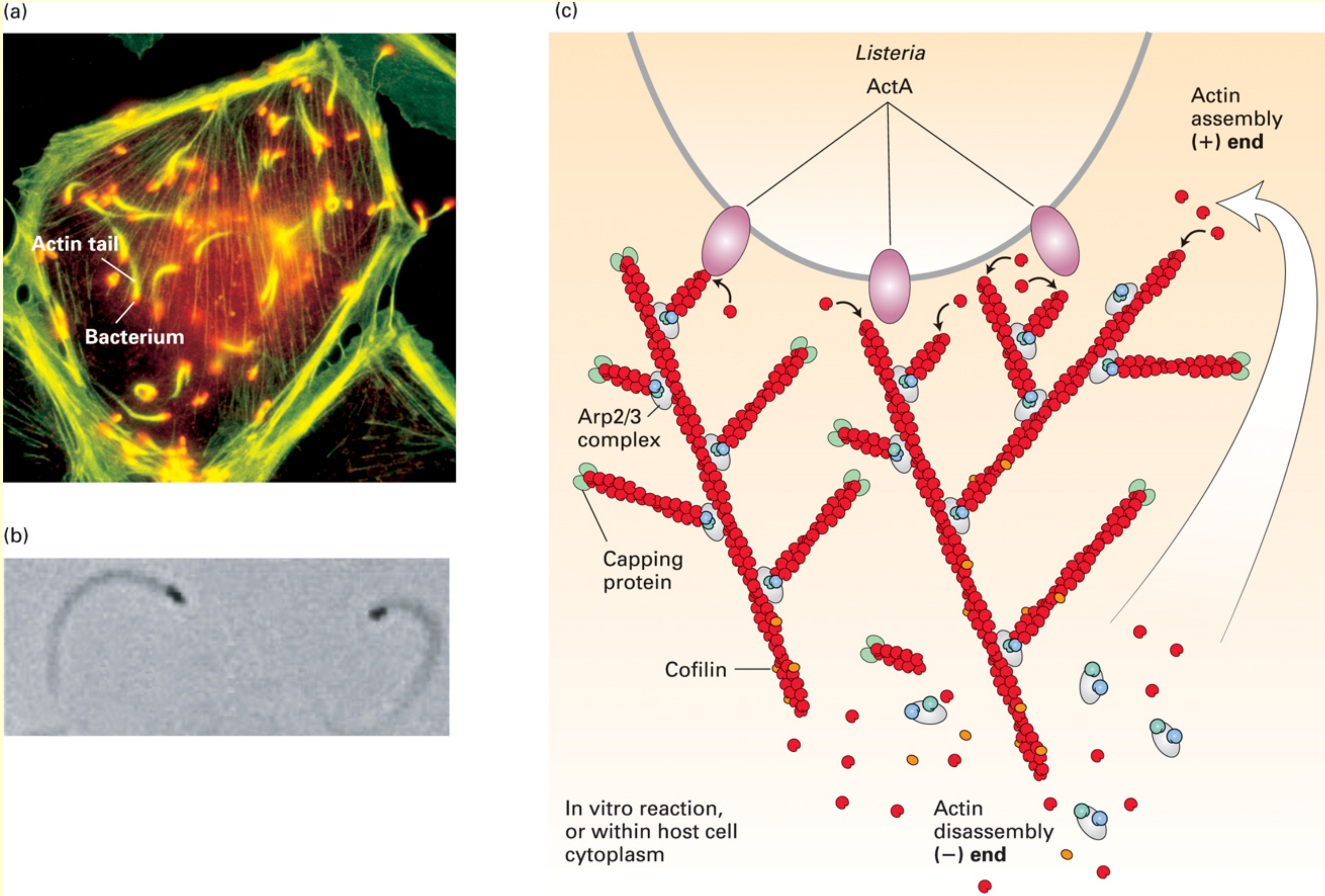
Learn how each protein interacts with actin and te effect of filament growth

4. Intracellular movement can be powered by actin polymerisation

Listeria monocytogenes, *a human pathogenic bacteria* uses actin polymerisation to push itself around inside a cell and into a neighbouring cell



Experimental Figure 17.17 ***Listeria*** **utilizes the power of actin polymerization for intracellular movement.**



See page 787 Lodish 7e

Actin-based movement powered by myosin – a mechanochemical enzyme.

Common Structure (head, neck and tail) - many variants

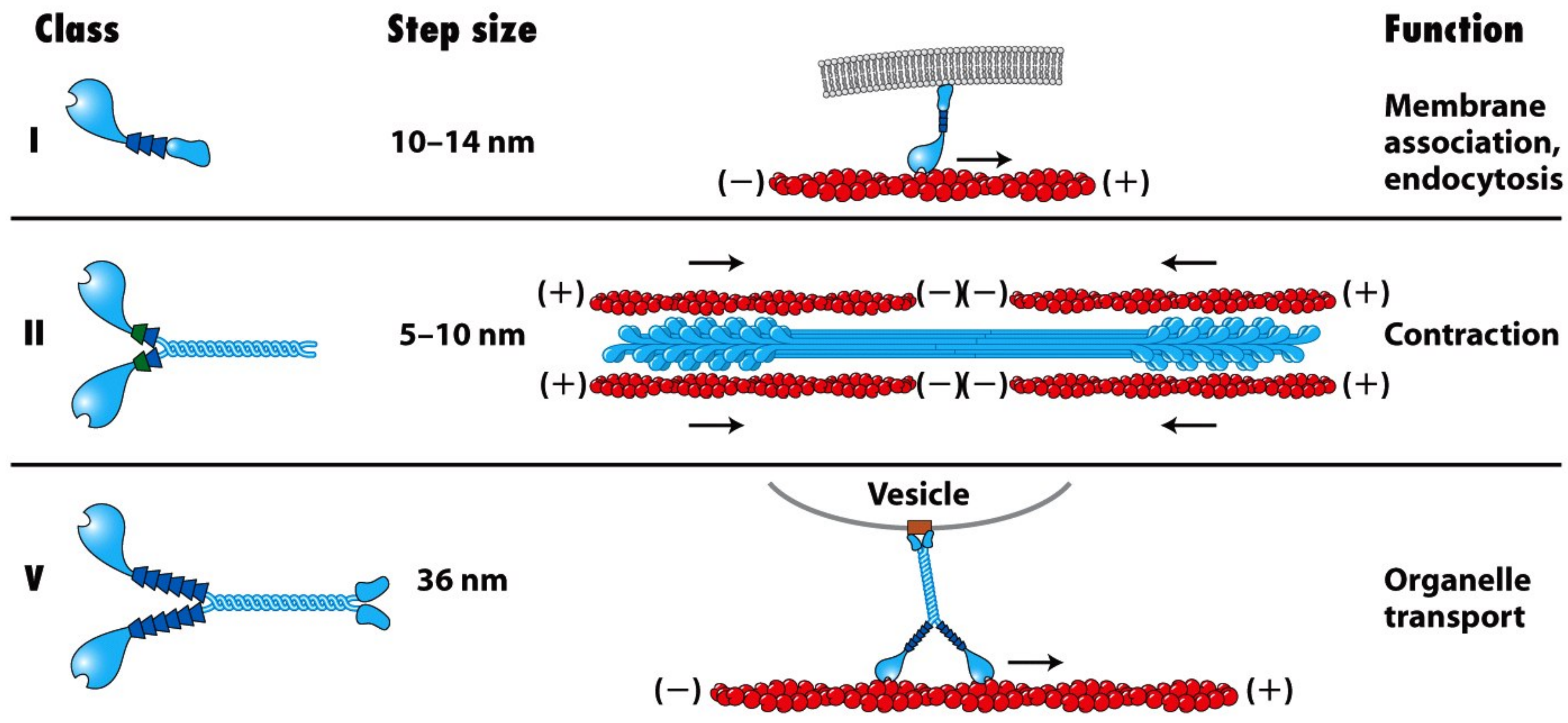


Figure 17-23
Molecular Cell Biology, Sixth Edition

Myosin can move along actin filaments

Model for the coupling of ATP hydrolysis to movement of myosin along an actin filament

A 'power stroke' is generated through the hydrolysis of ATP (and release of P_i) --> moving the myosin along the actin filament

Because myosin heads are tethered by the interaction of tails in a thick filament, the actin filament moves relative to myosin → muscle contraction

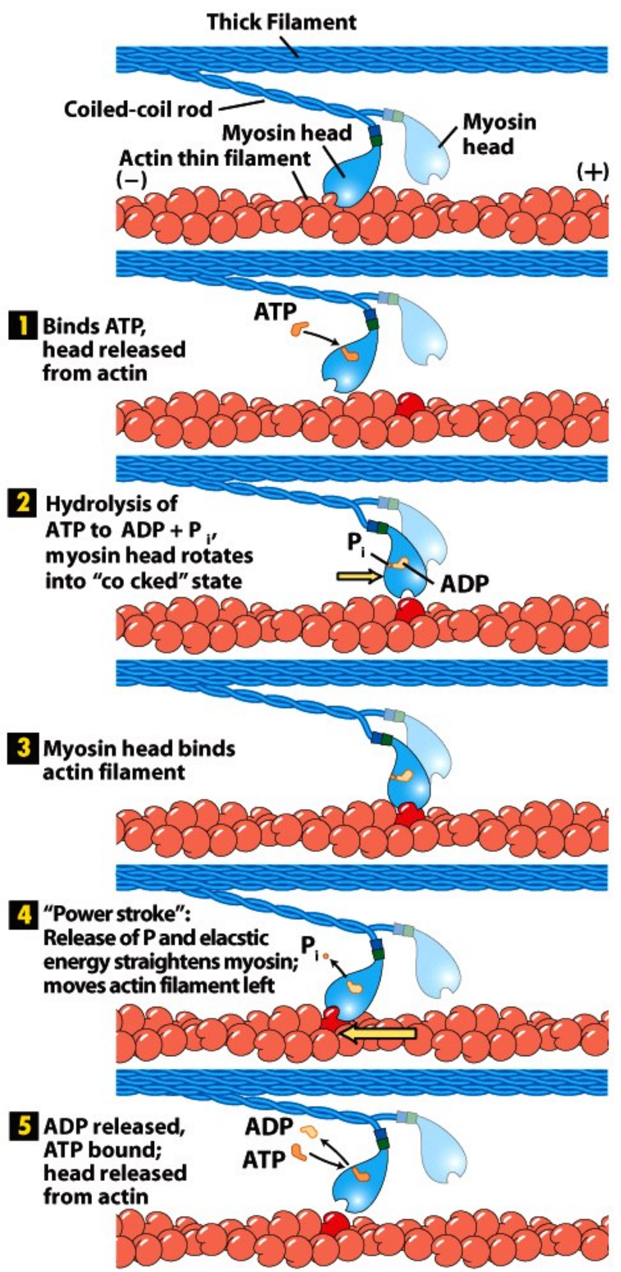
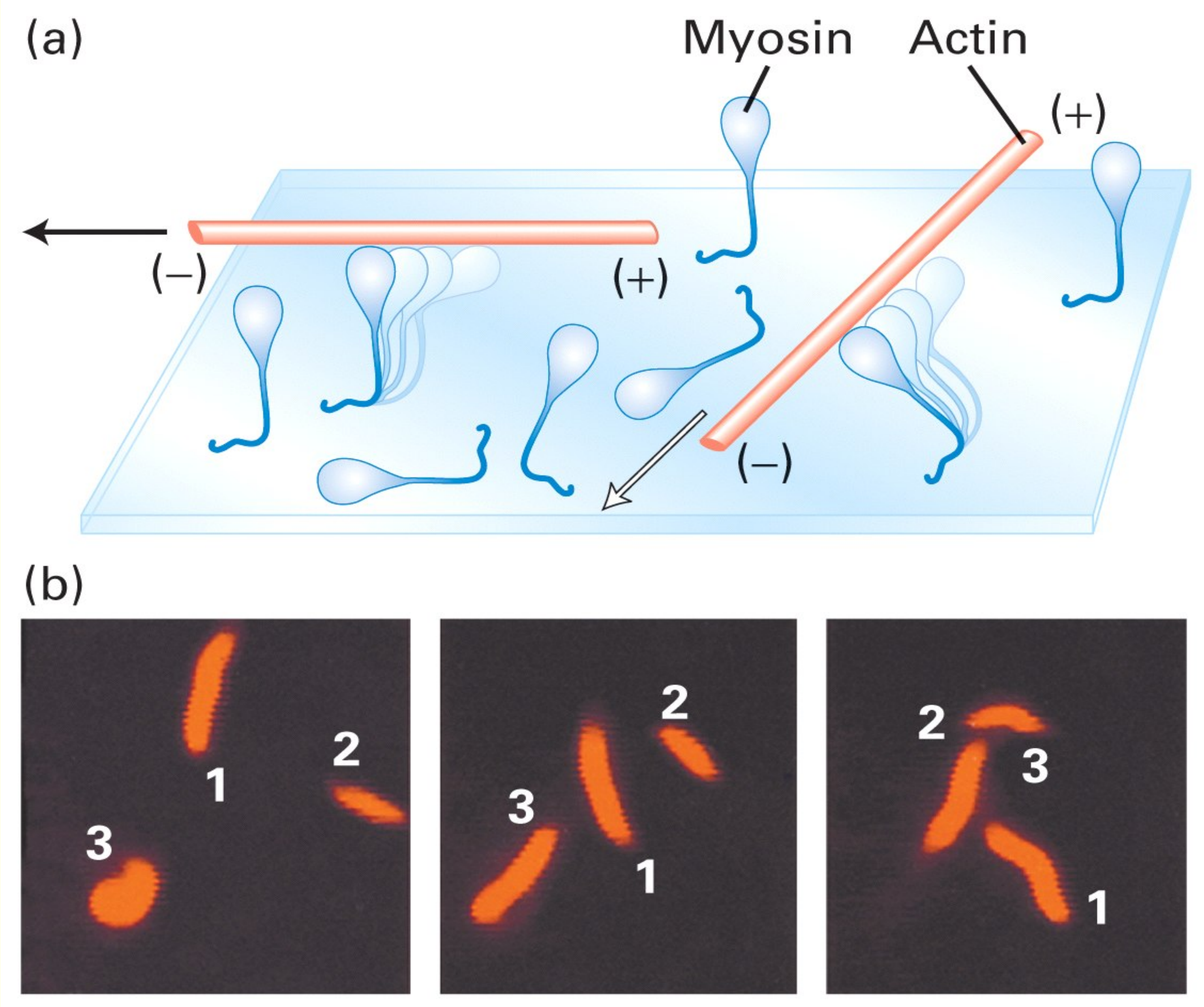


Figure 17-24a
Molecular Cell Biology, Sixth Edition



Detection of myosin-powered movement of actin filaments by a sliding filament assay (Figure 17-23 Lodish et al., 7th ed)

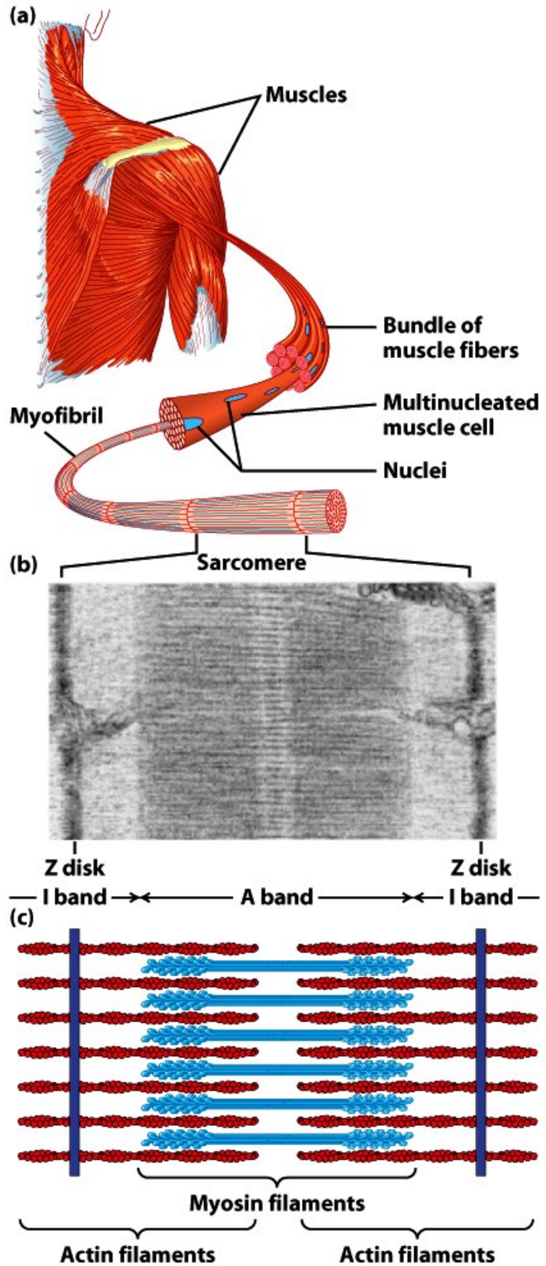
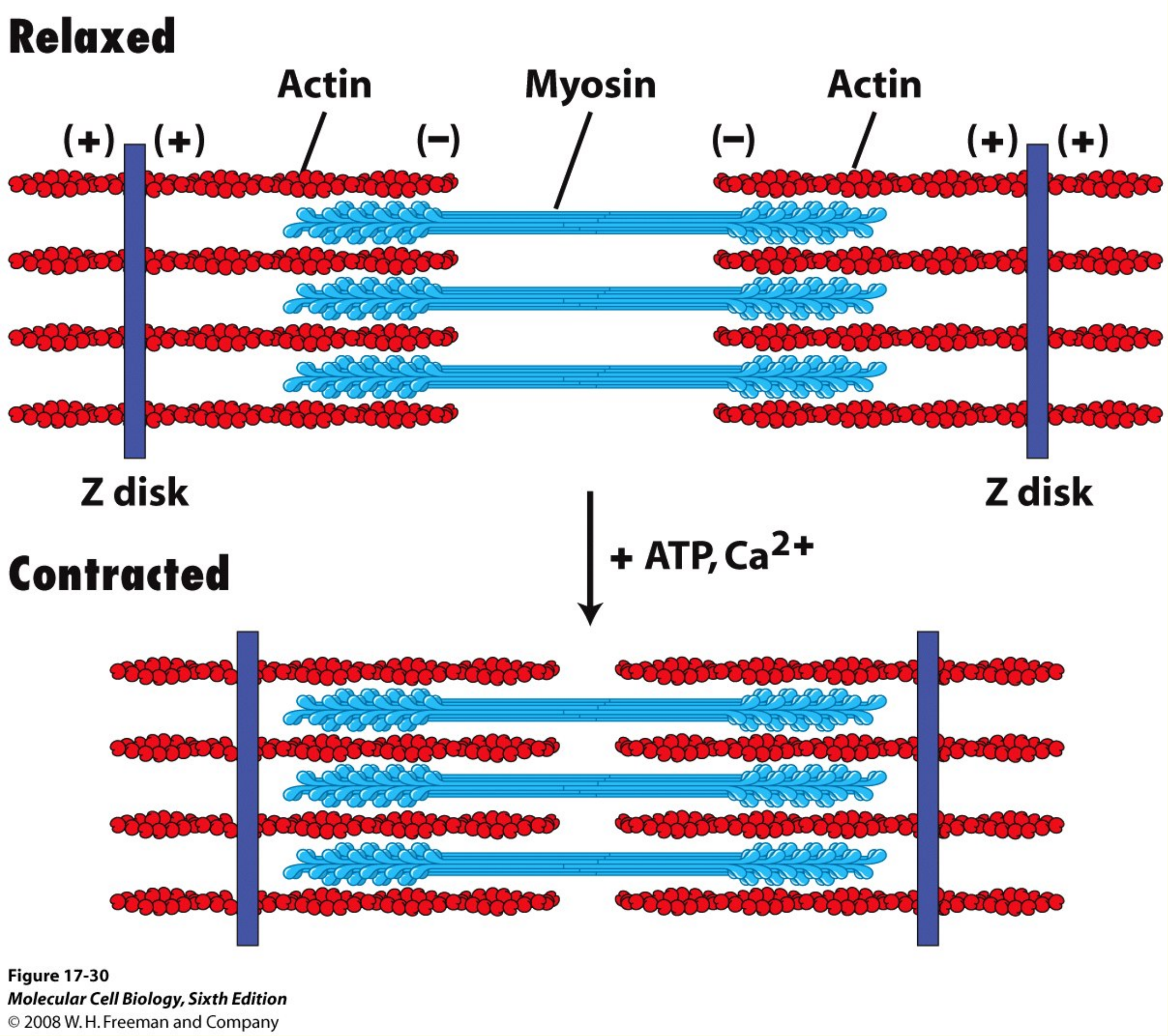


Figure 17-29
Molecular Cell Biology, Sixth Edition

The interaction of myosin and actin drive the contraction of skeletal muscle

Muscle cells contain repeating arrays of filament bundles - sarcomeres

Actin filaments (thin filaments)
Myosin filaments (thick filaments -myosin II)



The *sliding filament* model of muscle contraction; myosin ‘pulls’ actin filaments towards the centre of the sarcomere.

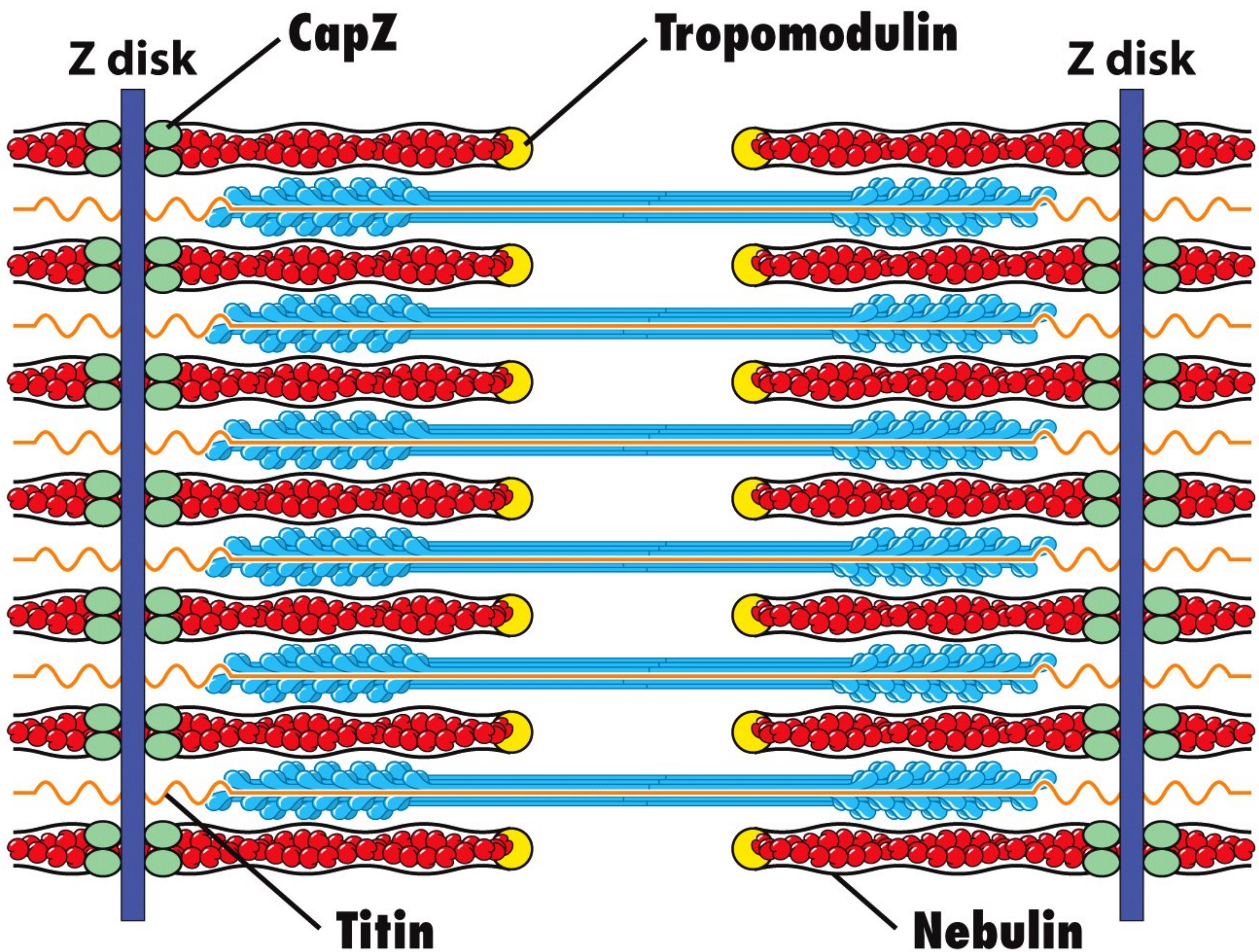


Figure 17-31
Molecular Cell Biology, Sixth Edition

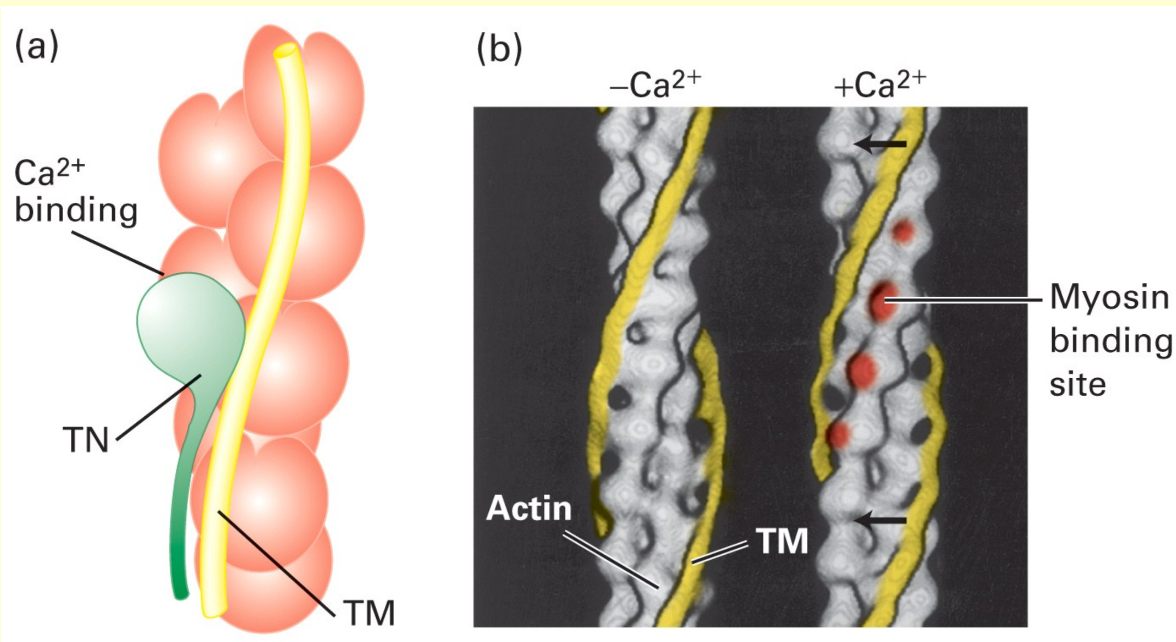
Accessory proteins maintain the contractile apparatus within each sarcomere

How is the contraction of muscle regulated ?

Nerve impulse at neuromuscular junction releases Ca^{2+}

Accessory proteins bound to actin reveal a myosin binding site on the thin filament

Tropomyosin / troponin (TN)



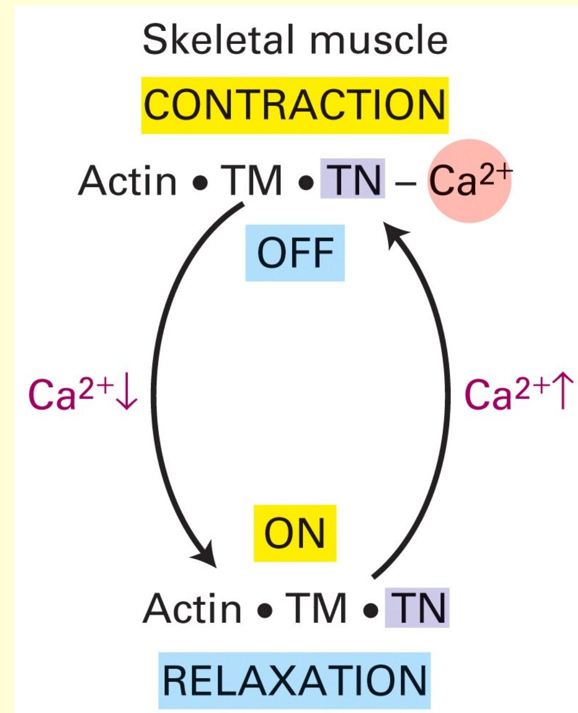


Figure 17-35 Lodish et al., 7th ed

In *smooth* muscle cells, contraction is regulated by the activity of myosin directly *via* phosphorylation of the *myosin regulatory light chain* (LC) by protein kinase and phosphatase enzymes

myosin light chain kinase (MLCK) & myosin light chain phosphatase

Calcium ions (Ca^{2+}) are still the key regulator

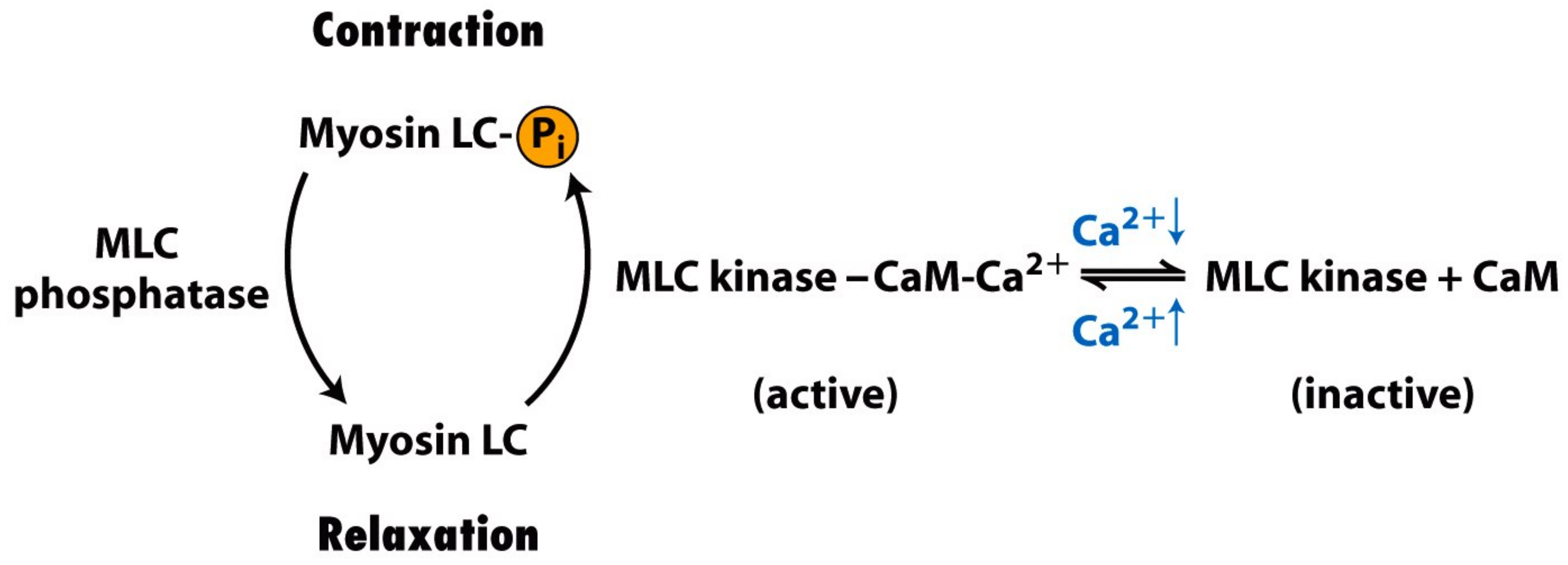


Figure 17-35
Molecular Cell Biology, Sixth Edition

Learning Objectives.

1. Become familiar with the structure of actin and the reversible assembly of F-actin.

2. Understand the role played by actin-binding proteins.

3. Understand how actin is critical to the shape of different types of cells and that cell movement involves actin polymerization.

4. Give examples of how intracellular pathogens use actin polymerization for movement

5. Know the basic features of myosin structure and the function of different classes of myosin in different cell types.

6. Understand how actin and myosin II function together during the contraction of skeletal muscle and know how this process is regulated by other actin-binding proteins.