MCB 150
The Molecular and Cellular Basis of Life

Begin the Cytoskeleton with Actin

Today’s Learning Catalytics Session ID is: 86351440

Announcements:

• Exam III is Thursday, April 13, from 7:00–9:00 PM
  - Room assignments have been posted to the course web site
  - Monday at 5 PM is the deadline for requesting a conflict exam

• Review Session Monday, April 10, from 5:00–7:00
  - 100 Noyes Lab
  - slido event code is 410

• Monday’s class period is flipped; problem solving for activity
  - Screencast material is already available in MasteringBiology

• Wednesday is optional review; exam material will go through Monday’s class period
The Cytoskeleton:
Dynamic system of protein fibers of various sizes
- Can be reorganized as needed
Provides physical support and allows for movement
- Examples: phagocytosis, organelle positioning, mitosis

Actin monomers are highly folded, *globular* proteins:

**G actin**
- 43 kDa protein, 375 amino acids
- Has a nucleotide binding site that can accommodate ATP or ADP
- Has polarity (directionality)
- Highly conserved
- Very abundant
Actin monomers polymerize “head to tail”:

Polymerization begins with nucleation:
Polymerization occurs at both ends, and is reversible:

G-actin

F-actin

Barbed (+) end

Pointed (–) end

Actin polymerization:

Hydrolysis of ATP

Exchange of ATP for ADP

Pointed end

Barbed end
Video of actin polymerization and critical concentration:

Available in MasteringBiology

Various types of actin binding proteins (ABPs):

1. Monomer binding proteins (e.g., thymosin β4)
2. Filament severing proteins (e.g., gelsolin)
3. Filament bundling proteins (e.g., α-actinin, fimbrin)
4. Filament capping proteins (e.g., CapZ)
5. Filament crosslinking proteins (e.g., filamin)
ABPs allow for microfilaments to be assembled in different ways for a variety of functions:

- Bundles
- Networks
- Contractile Elements

Actin bundles:

**Microvilli**
- Increase surface area 10-20X
Actin bundles under fluorescence microscopy:

Actin networks:
- Provide structural stability, but are more flexible than bundles
Actin networks:

Terminal web beneath microvilli

Branched actin at leading edge

The actin network is dynamic: