MICROFILAMENTS

- **7nm (smallest)**, best known as [contractile filaments](#)
- **functions:**
  - structural: cell cortex (inside plasma membrane) & microvilli core
  - functional: [cytoplasmic streaming], [cleavage furrow], also [cause locomotion], amoeboid movement, muscle contraction

**STRUCTURE:**
- G actin, single-most abundant protein in cells (5% total) polymerizes into double stranded polymer of F actin, first seen in muscle, 7 nm diameter

**ASSEMBLY:**
- ATP bound to G actin monomers, cleaved to ADP on assembly.

**Polar:** move toward nucleus, one end add (+), removed at other (-): [treadmill](#) demonstrated by radioactive labeling.

**GENETICS:** mostly [same for all species](#) (90% same AA for yeast & chicken) (i.e., highly conserved sequence)

**ACTIN-BINDING PROTEINS:** many & varied, three classes of functions:
- lengthening: cap the + end, slow polymerization
- depolymerizing: prevents polymerization until needed (acrosomal reaction)
- cross linking: stabilize structure as in membrane, cell shape

**EFFECT ON CELL SHAPE:**
- **cell cortex**
  - 3D mesh of actin and associated proteins supports cell membrane (stress fibers), movement
- **microvilli:**
  - increase cell surface area 20x, core of microfilaments, "+" ends at tip, extend to mesh at "+" end (terminal web), forms stable foundation for microvilli (438)

**MUSCLE CONTRACTION:**
- for actin, myosin, troponin, Ca++, sarcomere, sarcoplasmic reticulum, nerve

**INTERMEDIATE FILAMENTS:** (8-12 nm diameter) First discovered in muscle cells. (p. 442)

Most stable, least soluble of cytoskeletal elements, only found in multicellular organisms filamentous, remain after detergent removal of microtubules & microfilaments globular subunits.

Fibrous, **principal structural determinant**. Tension bearing, maintain nucleus position

**TISSUE SPECIFICITY:** composition varies to tissue, can be used to identify tissue origin

**At least six classes of intermediate filaments based on AA sequence:** (p. 443)

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
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<tbody>
<tr>
<td>I</td>
<td>acidic cytokeratin (epithelial tissue) terminal &quot;web&quot;</td>
</tr>
<tr>
<td>II</td>
<td>basic cytokeratin (epithelial tissue, slightly heavier than acidic)</td>
</tr>
<tr>
<td>III</td>
<td>vimentin (fibroblasts (connective tissues), lens, maintains cell shape)</td>
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<tr>
<td>IV</td>
<td>glial fibrillary acidic protein (in muscles, supports contractile machinery)</td>
</tr>
<tr>
<td>V</td>
<td>neurofilament proteins (maintains shape in astrocytes, glial cells)</td>
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<tr>
<td>VI</td>
<td>nuclear lamina (in nerves, axon strength, size)</td>
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</tbody>
</table>

Can be used to diagnose classes of secondary CA tumors by immunofluorescence

**STRUCTURE & FUNCTION:** products of related genes, classified by AA sequence (p. 448)

- have highly conserved central domain flanked by variable terminal regions
- 2 polypeptides = coil lengthwise to form a dimer with globular terminal domains
- 2 dimers wide, many long = protofilament (total of four, slightly displaced).
- 8 protofilaments = bound together to form intermediate filament

**DISEASES:** amyotrophic lateral sclerosis (ALS) and certain cardiomyopathies may be due to IF defect.