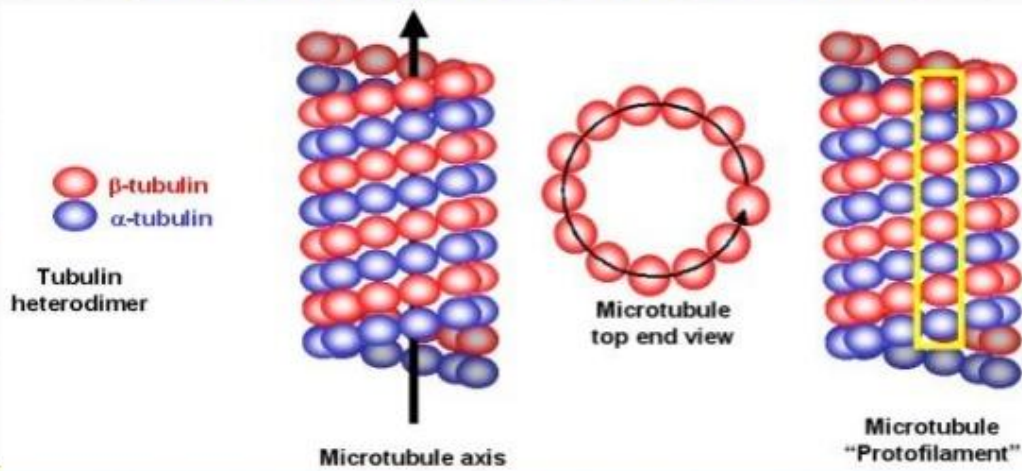


MICROTUBULES

- 25 nm diameter, 14 nm internal channel tubulin cytoplasmic
- All cells contain
- Same core structure
- Same motors Dynein (-) and Kinesin (+)
- Different associated proteins
- Dynamic
- Continuous remodelling

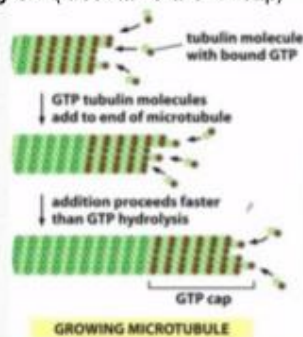
- Movement
- Intracellular > cellular
- Cell division mitotic spindle
- Specialized structures
- centrosome, Spindle pole
- Cell processes - cilia (9+2)

STRUCTURE OF MICROTUBULE

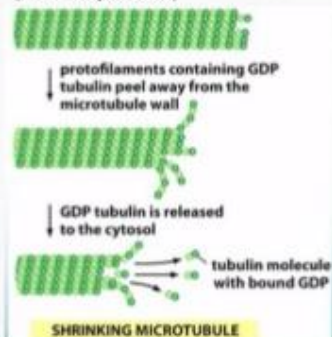


Microtubules (MTs) – Dynamic Instability

If the rate of polymerization is faster than the rate of GTP hydrolysis, **the microtubule will grow** (It contains a GTP cap)



If the rate of GTP hydrolysis is faster than the rate of polymerization, the microtubule will disassemble (GTP cap is lost)



Some functions of Microtubules :

- Microtubules participate in a wide variety of cell activities.
- Most involve motion that is provided by protein “motors” that use ATP.
- They determine the positions of membrane-enclosed organelles and direct intracellular transport.
- The migration of chromosomes during mitosis and meiosis takes place on microtubules that make up the spindle fibers.

MICROFILAMENTS

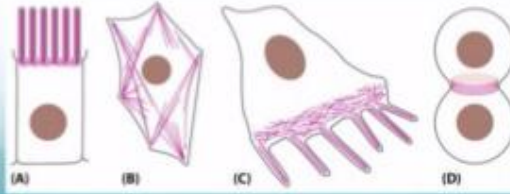
-
- ✓ Twisted chain 7 nm diameter
 - ✓ most abundant protein in cells (5% of all cell protein)
 - ✓ Motility
 - ✓ Adhesion
 - ✓ Actin binding proteins
 - ✓ myosin motors
 - ✓ Muscle actins

Actin Filaments

Actin filaments are found in all eucaryotic cells

They form structures such as:

- A) The microvilli
- B) small contractile bundles
- C) Dynamic protrusions
- D) The contractile ring (cytokinesis)



Actin Filaments

Actin filaments are 7nm in thickness (microfilaments)

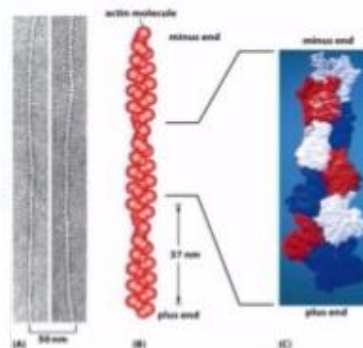
2 filaments of actin monomers all of which point in the same direction
twist around each other

Monomer = Globular actin = **G-actin**

Actin filament = **F-actin**

Actin has polarity

- + end (addition)
- end (loss)



Actin Filaments

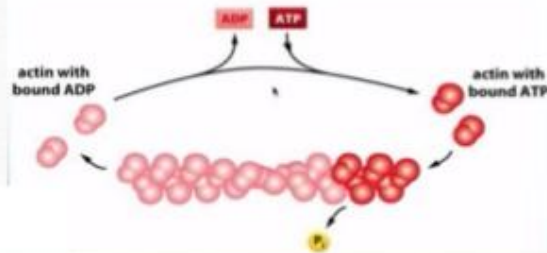
Actin can **bind and hydrolyze** ATP

Like tubulin, ATP bound actin has a higher affinity to form a filament

ADP-actin is more likely to disassemble

Actin-ATP adds – (+) end

Actin-ADP then disassembles – (-) side



CELL CRAWLING DEPENDS ON ACTIN

Three main actin **structures** that cells use to move:

- **Filopodium**
- **Lamellipodium**
- **Contractile bundles**

