MCB 150
The Molecular and Cellular Basis of Life

Microtubules

Today’s Learning Catalytics Session ID is:
72002868

Announcements:

• Exam III Answer Key will be posted some time today
• Questions about exam problems should be addressed to the instructor in person, questions about your scantron etc. should be addressed to the coordinator
• Conflict exam packets are available in 252 Davenport
• Exam data will be shared when available
• Reminder: Final Exam (Exam IV) is Monday, May 8, 7-10 PM and will be worth 200 points (67 questions)
Microtubules (MTs) can be used for:

- Guiding intracellular transport
- Segregating chromosomes during mitosis
- Propulsion or sweeping of fluids over membranes

Microtubules are rigid, hollow tubes made of tubulin
- Tubulin is itself a dimer of α-tubulin and β-tubulin
Tubulin dimers polymerize to form microtubules:
- 13 linear “protofilaments” surrounding hollow core
- Assembled head-to-tail, so microtubule has polarity

Polymerization and depolymerization is possible at both ends, but *in vivo*, most assembly and disassembly occurs at plus end.

Tubulin dimers polymerize *in vitro* to form microtubules:
Video of tubulin polymerization into microtubules:

Video available in MasteringBiology

Both α-tubulin and β-tubulin have GTP binding sites
• Shortly after dimer addition to a MT, the GTP in the β-tubulin is hydrolyzed

- GTP hydrolysis weakens the affinity for other tubulin
Dynamic instability and the “GTP cap”:
• GTP-bound tubulin prevents subunits from peeling away

Videos showing dynamic instability:
Videos available in MasteringBiology
Microtubule behavior can be influenced by drugs:

**Binding tubulin**
- Induces depolymerization
- Non-specifically affects all MTs
  - Colchicine
  - Colcemid

**Binding microtubules**
- Stabilizes microtubules
- Targets rapidly-dividing cells
  - Vincristine
  - Vinblastine
  - Taxol

Where do new microtubules come from?
Microtubules originate from **microtubule-organizing centers** (MTOC):

In animal cells, the major MTOC is the **centrosome**

Demonstrating that MTs emanate from the centrosome:

1. Treat cells with colcemid for 1 hour
2. After 1 hour, wash colcemid away
3. Let cells recover and start forming new microtubules