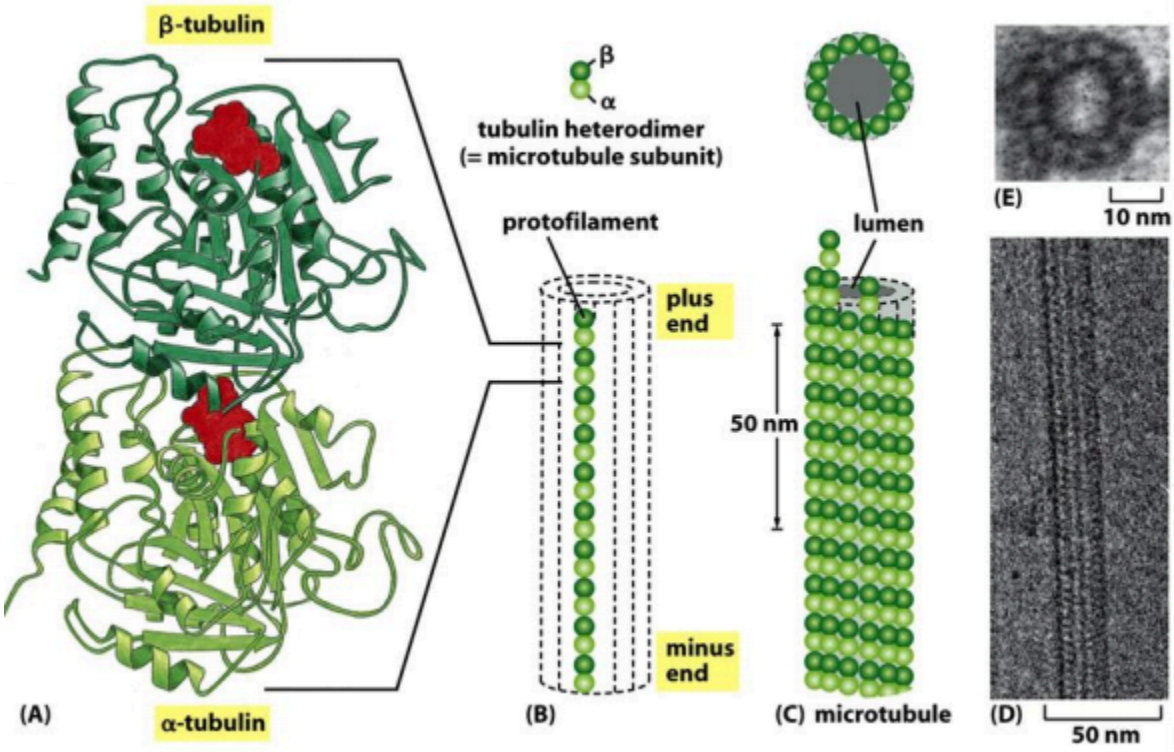
LECTURE 13. CYTOSKELETON and CELL MOVEMENT II

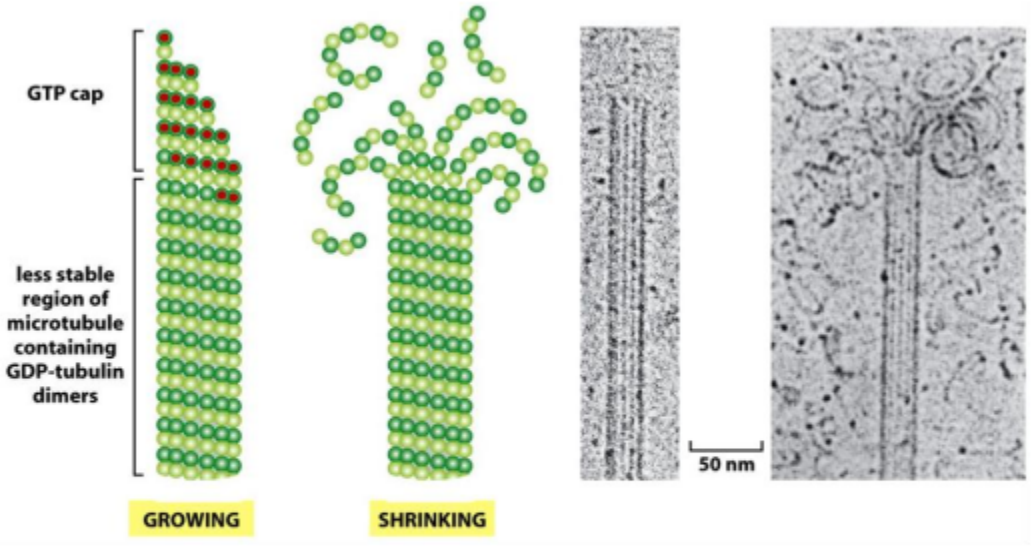
Microtuble

Microtuble exist in mitotic spindle, structural support in axon, structutal elements in cilia and flagella, centriole, basal bodies. Most microtubles are singles, some are in doublet(cilia, flagella), some are truplet(basal bodies and centrioles). Most have 13 protofilametns, two major types of tubulins, alpha-tubulin, and beta-tubulin, forming heterodimer. All subunits are oriented in same way, the one with exposed **alpha-tublin in minus end**, **beta-tubulin** is **plus end**. The GTP on alpha-tublin is never hydrolyzed, but GTP on beta-tubulin is hydrolyzed. Gama-tublin is important for microtuble assembly, MAP(Microtuble-associated-protein) aer important in assembling and dynamics for microtulbes.



gama-tubulin ring complex(gama-TuRC)(Growth from minus to puls), perientriolar, is critical to assemble microtubles. Microtube is dynamics instablility.

Individual microtubles can therefore alternate between a peroid of slow growth and a period of rapid disassemble. Like actin, assembly at puls end is much faster than assembly at minus end.

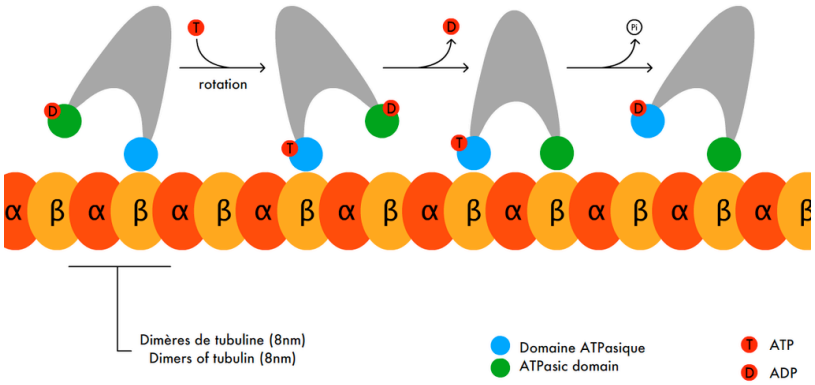


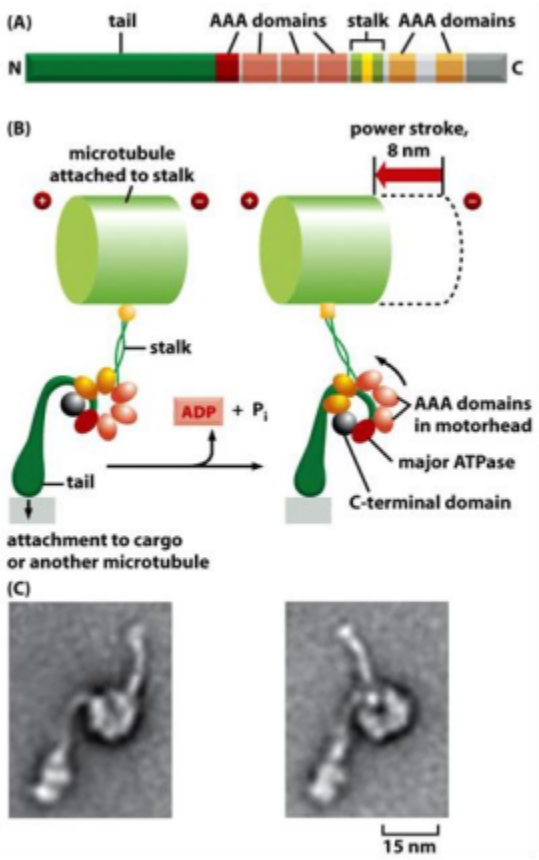
Microtube rapid growth with GTP-capped end. When accidental loss of GTP cap, it rapid shrinkage. But it willrescue after regain of GTP cap. Taxol ??? an other drugs can influence tubulin assembly. Microtube can be stabilized by side-binding protiens: tau, MAP2, MAP4, which are control by phoshorylation(??). Microtube plus end binding proteins(kinesin-13, XMAP215 ???) modulate microtuble assembly.

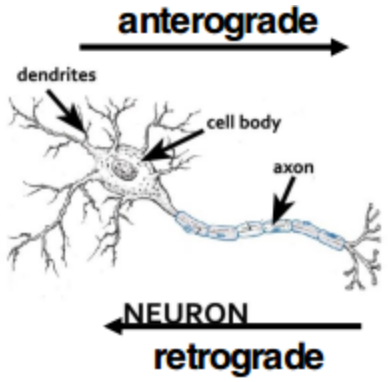
Kinesins and dyneins: microtuble-based motor proteins ?????????

We can isolate axon from giant squid to study microtube transport. Kinesin family toward puls end(anterograde). Dynein is retrograde---toward minus end. Dyneins are the largest of the known molecular moteors, and thy are also among the fasters: axonemal of dyneins attached to a glass slide can move microtubles at the rate of 14 mcirometer/sec. Dynein need dynactin to link cargo.

Déplacement d'une kinésine
Motility of kinesin





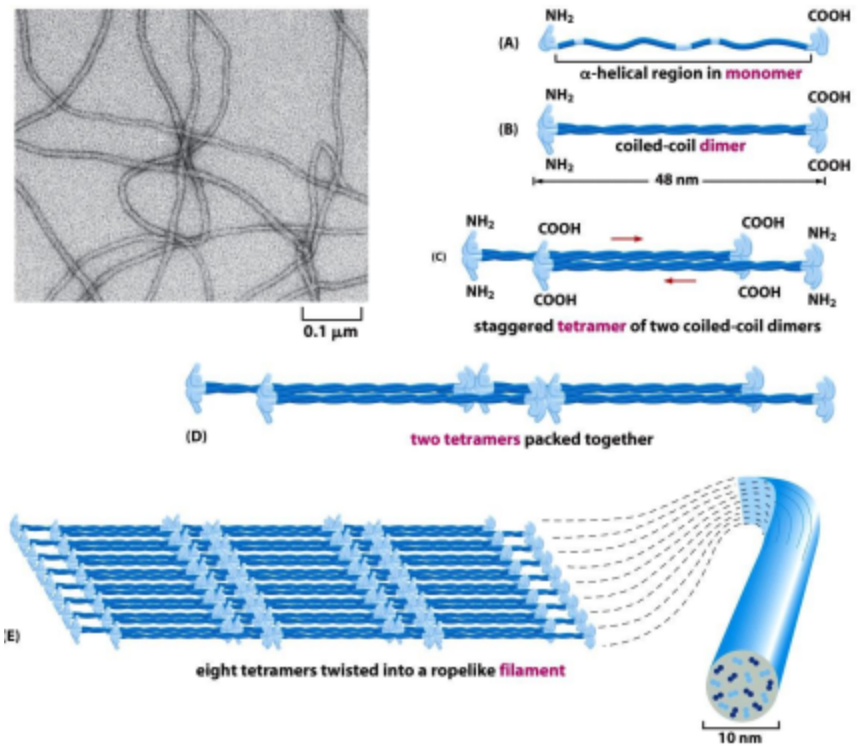


Cila and flagella

They both are built from microtubule and dynein. Basal bodies---microtubule assembly sites for cilia and flagella. In axoneme of cilia and flagella, here are "9+2" arrangement for microtube. Because the existence of linking proteins, the axoneme will bend between microtuble doublets. Genetic defectes in dynein result in Kartagener's syndrome. Point mutation in a kinesin family member that transport synaptic vesicle precursors down the axon, which resut in neurological disease (Charcot-Marie-Tooth disease)?????????????.

Intermediate filament

Intermediate filament is no polarity, no motor activity, tensile and stable, hard to be solubilized, very heterogeneous(??). Defects in keratin results in skin bistering(??).


0.1 μm
(A)
NH2
COOH
α-helical region in monomer
(B)
coiled-coil dimer
48 nm
(C)
staggered tetramer of two coiled-coil dimers
(D)
two tetramers packed together
(E)
eight tetramers twisted into a ropelike filament
10 nm