

Cytoskelet

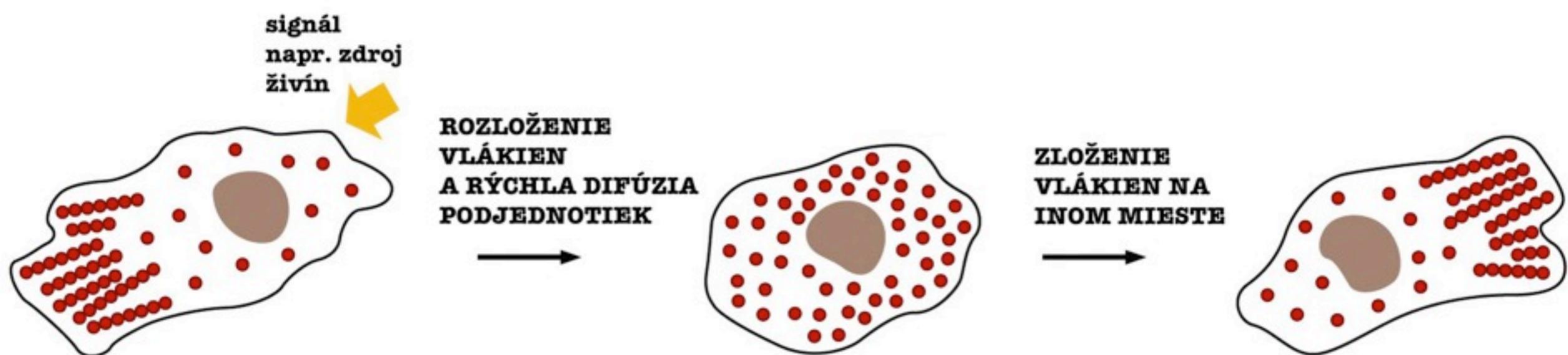
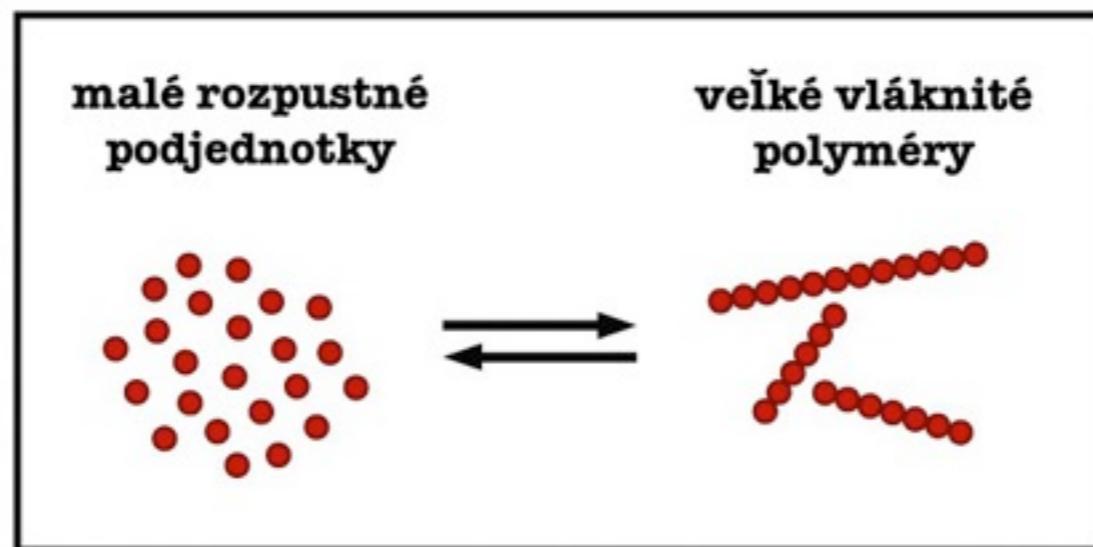
Bunkový cytoskelet

Mikrofilamenty

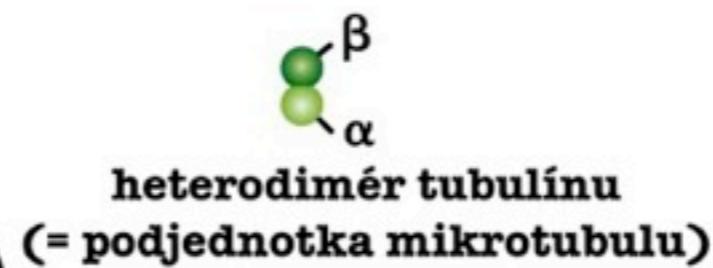
Mikrotubuly

Intermediálne filamenty

Cytoskelet je dynamický



Mikrotubuly



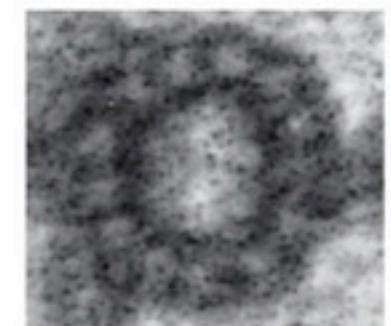
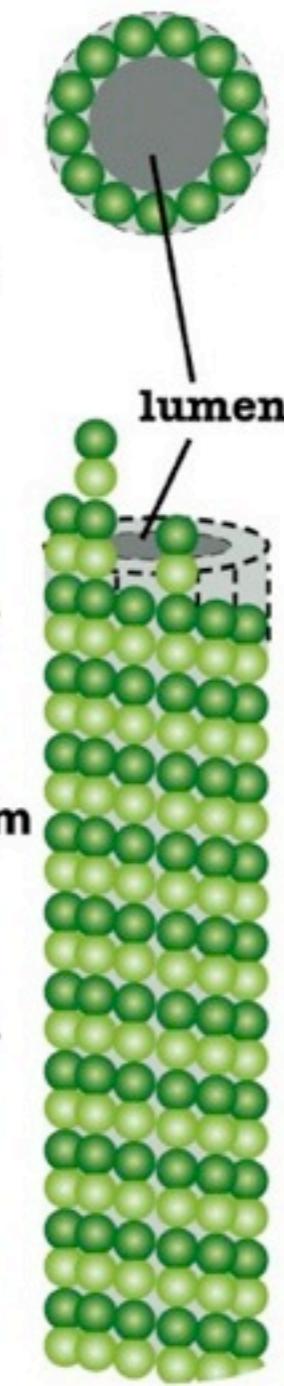
protofilament

plus koniec

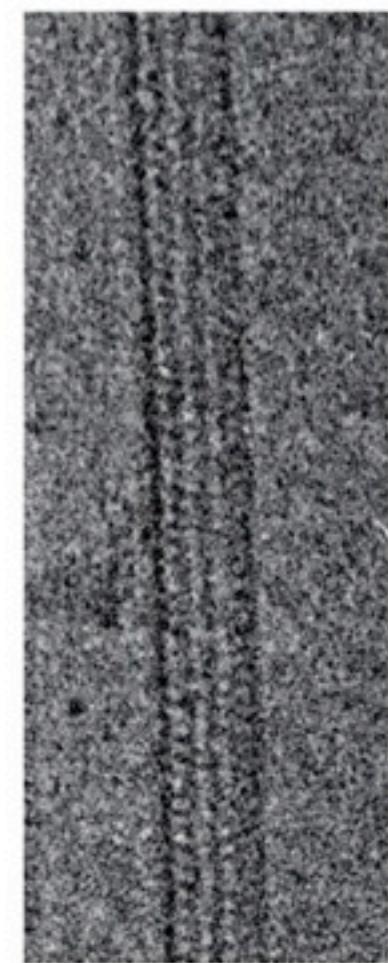
50 nm

minus koniec

(B)

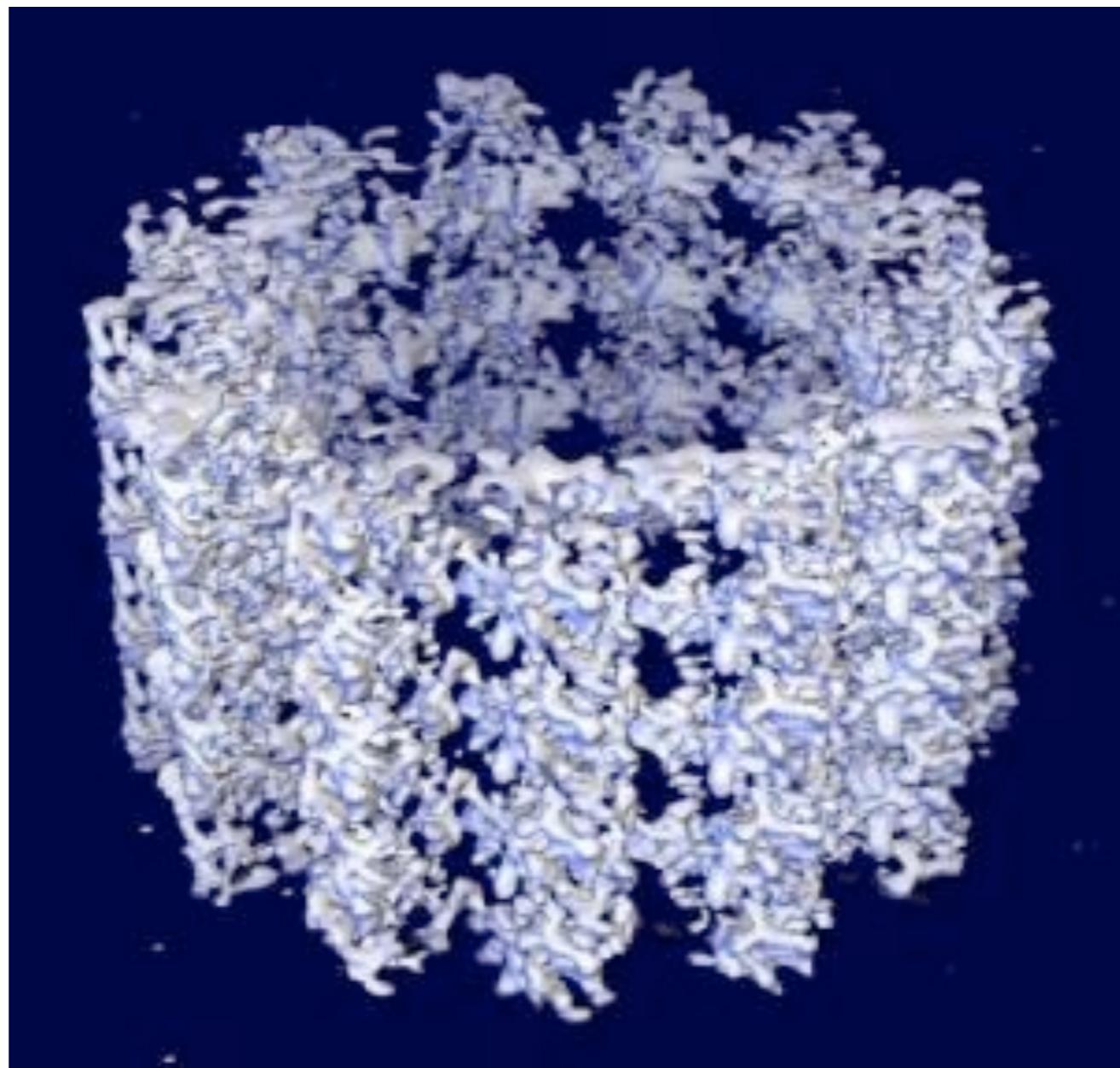


(E) 10 nm

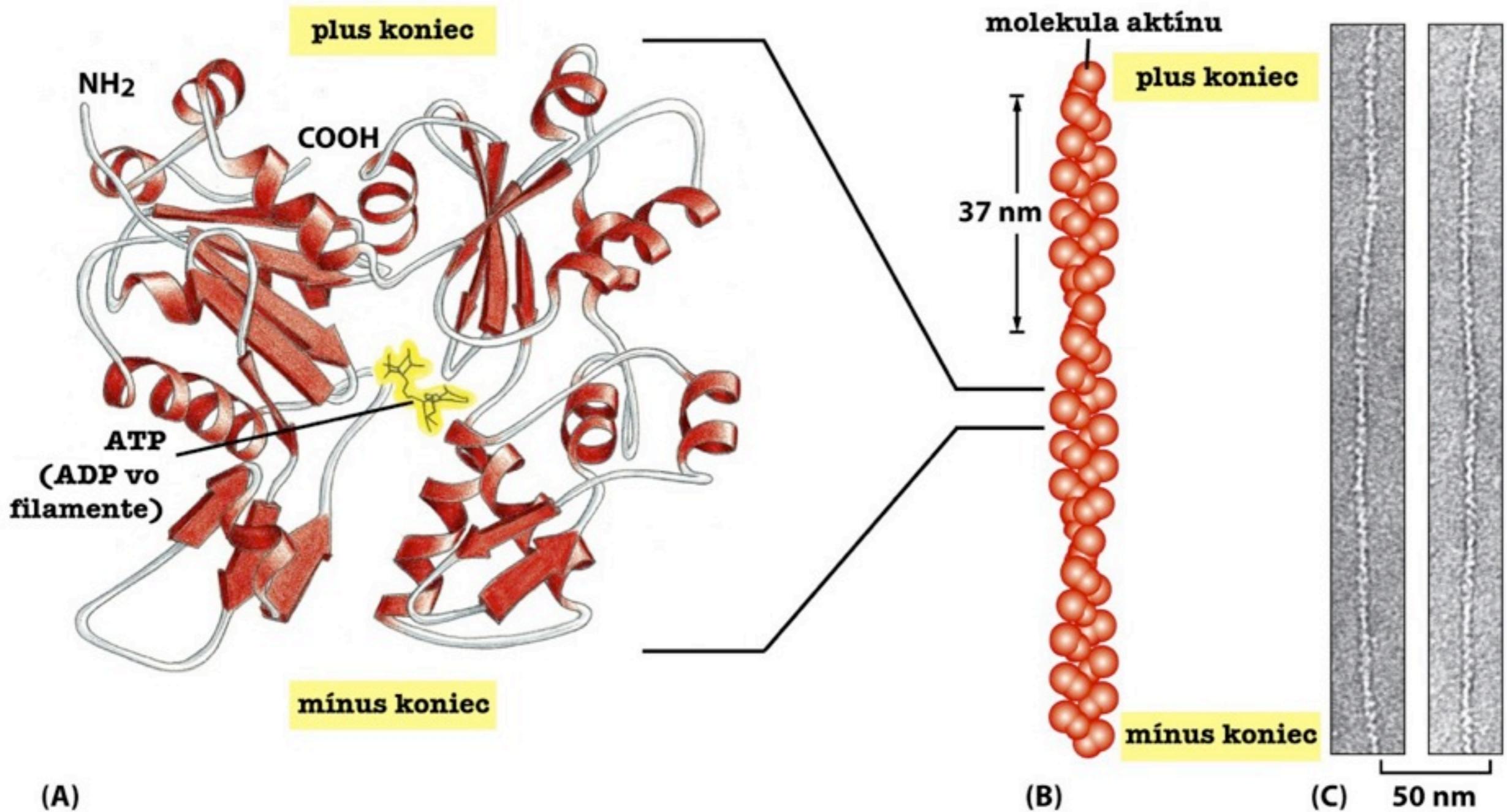


(D) 50 nm

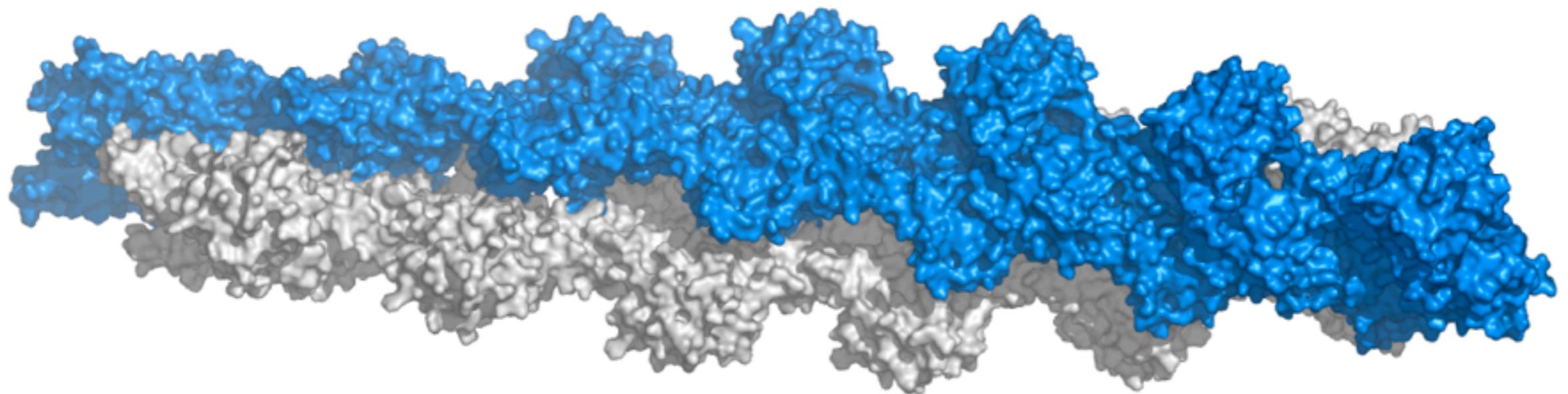
Mikrotubuly



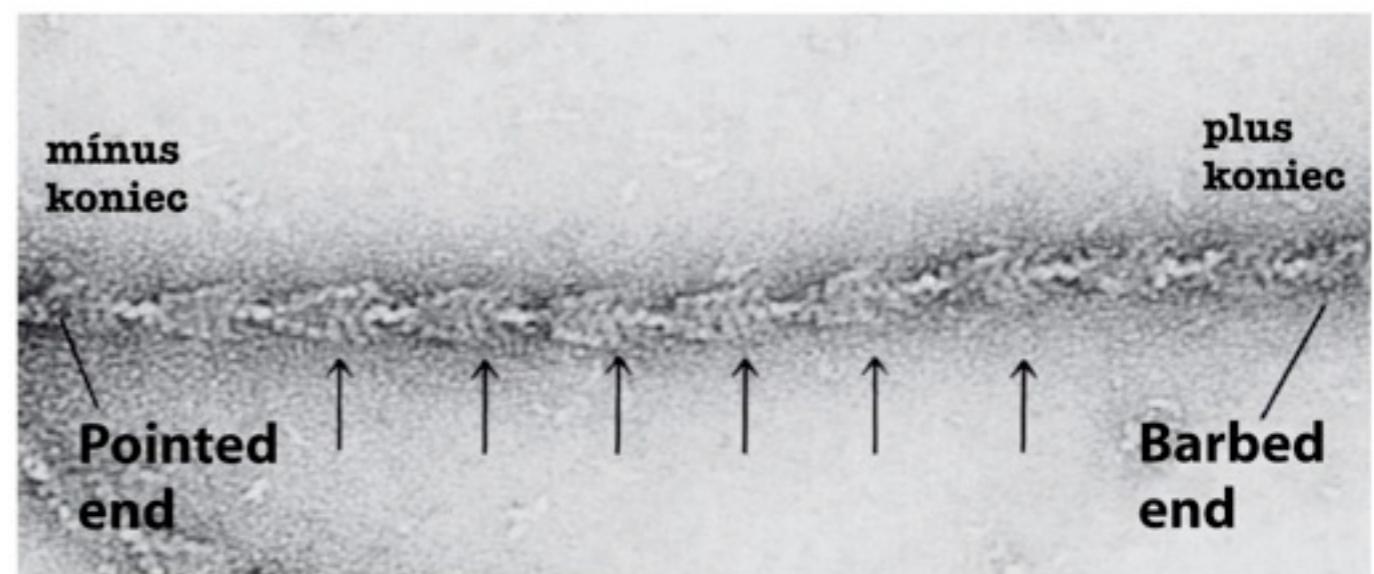
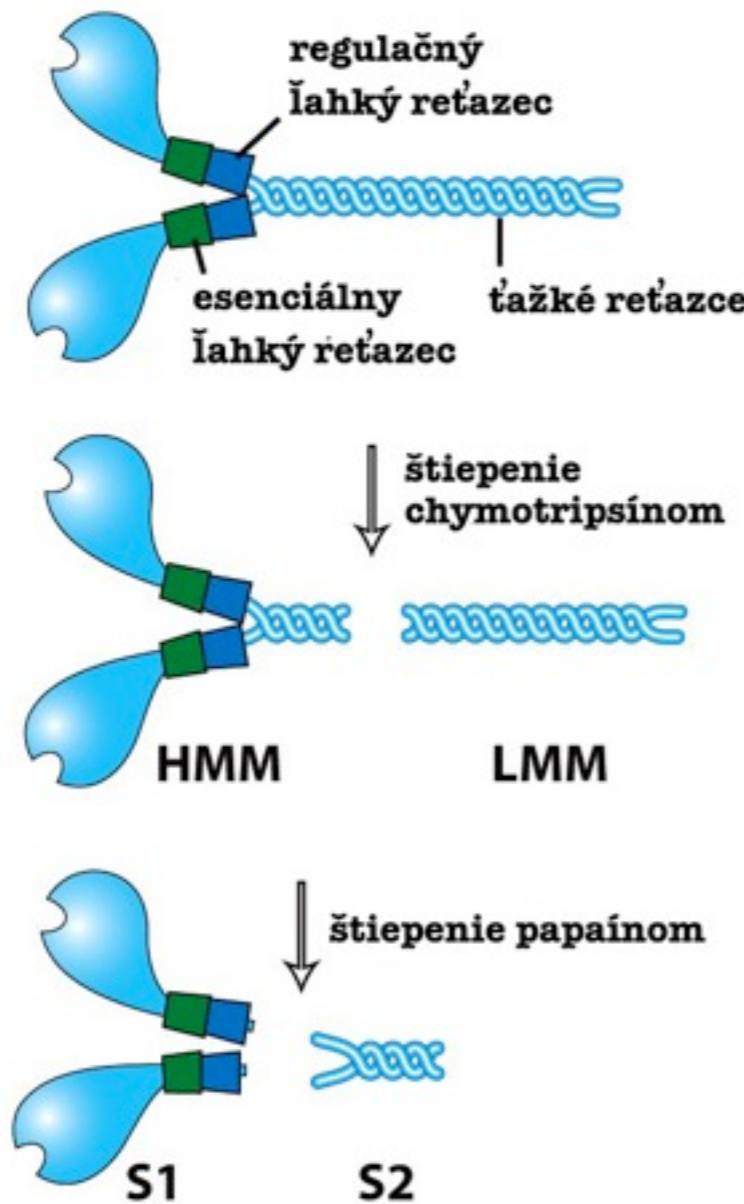
Mikrofilamenty



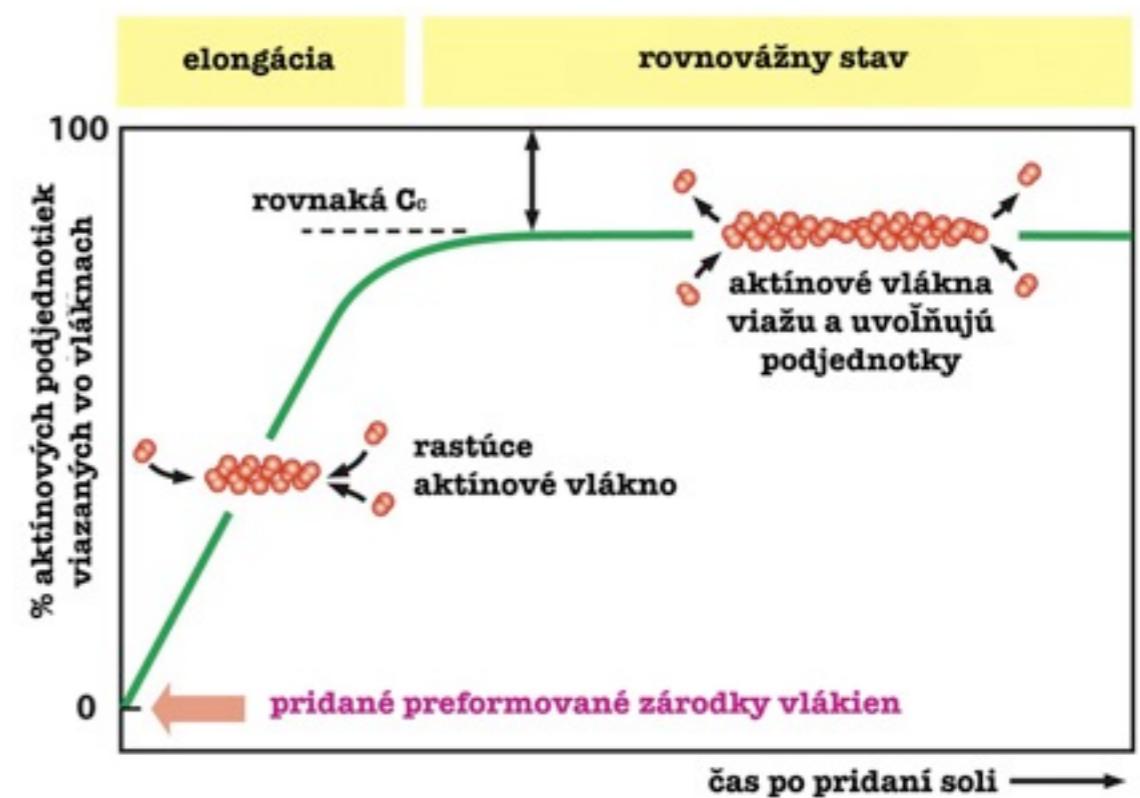
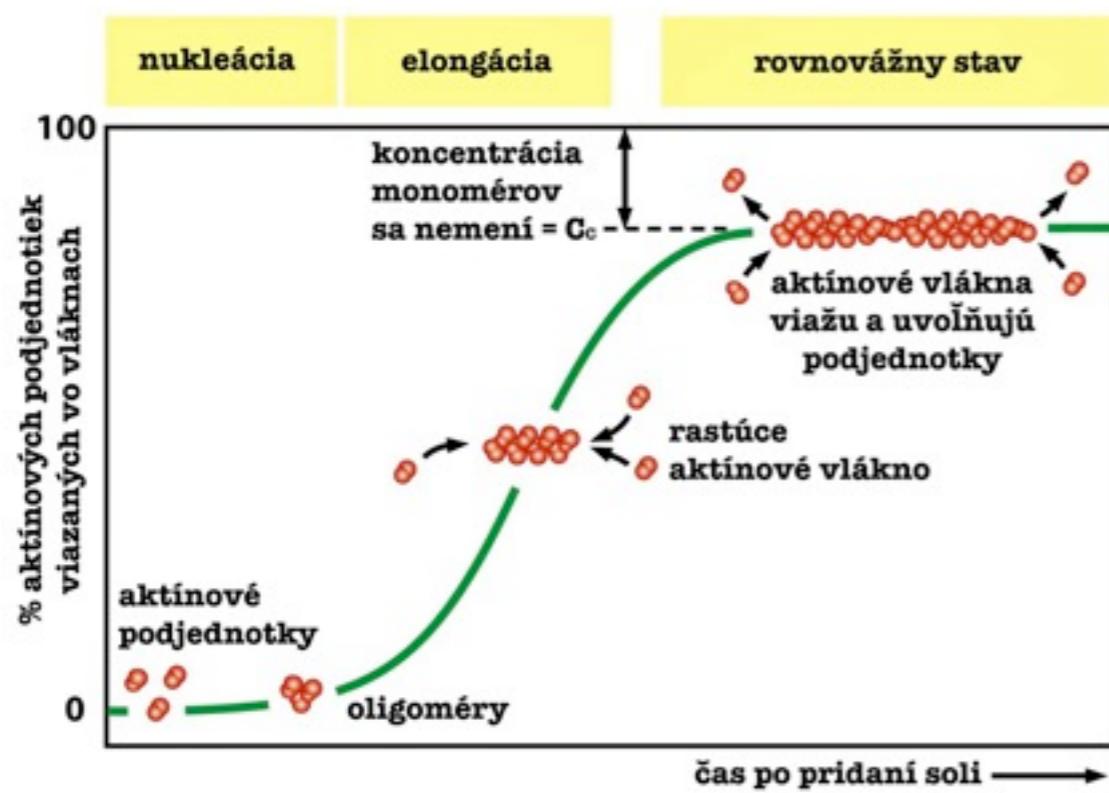
Mikrofilamenty



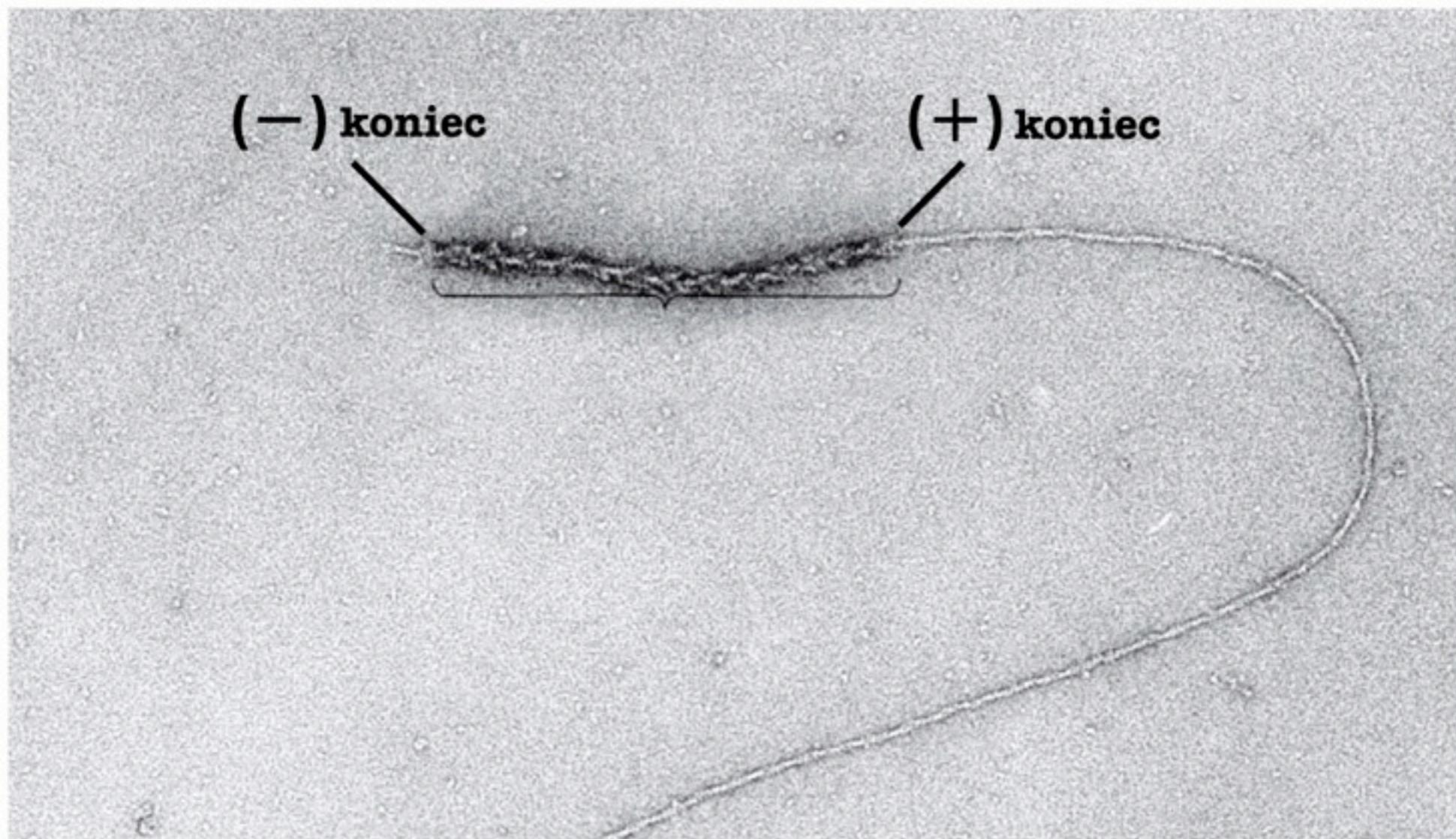
Vizualizácia mikrofilamentu pomocou hlavičiek myozínu



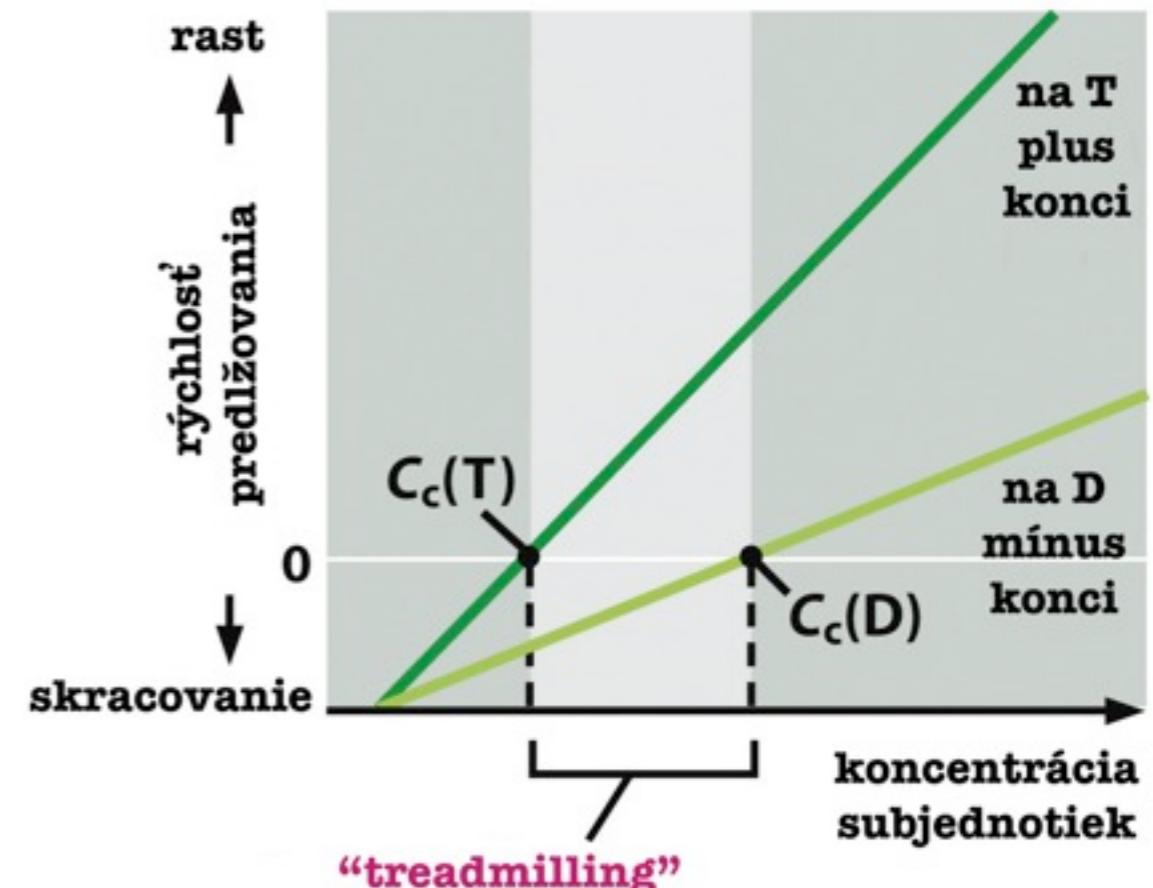
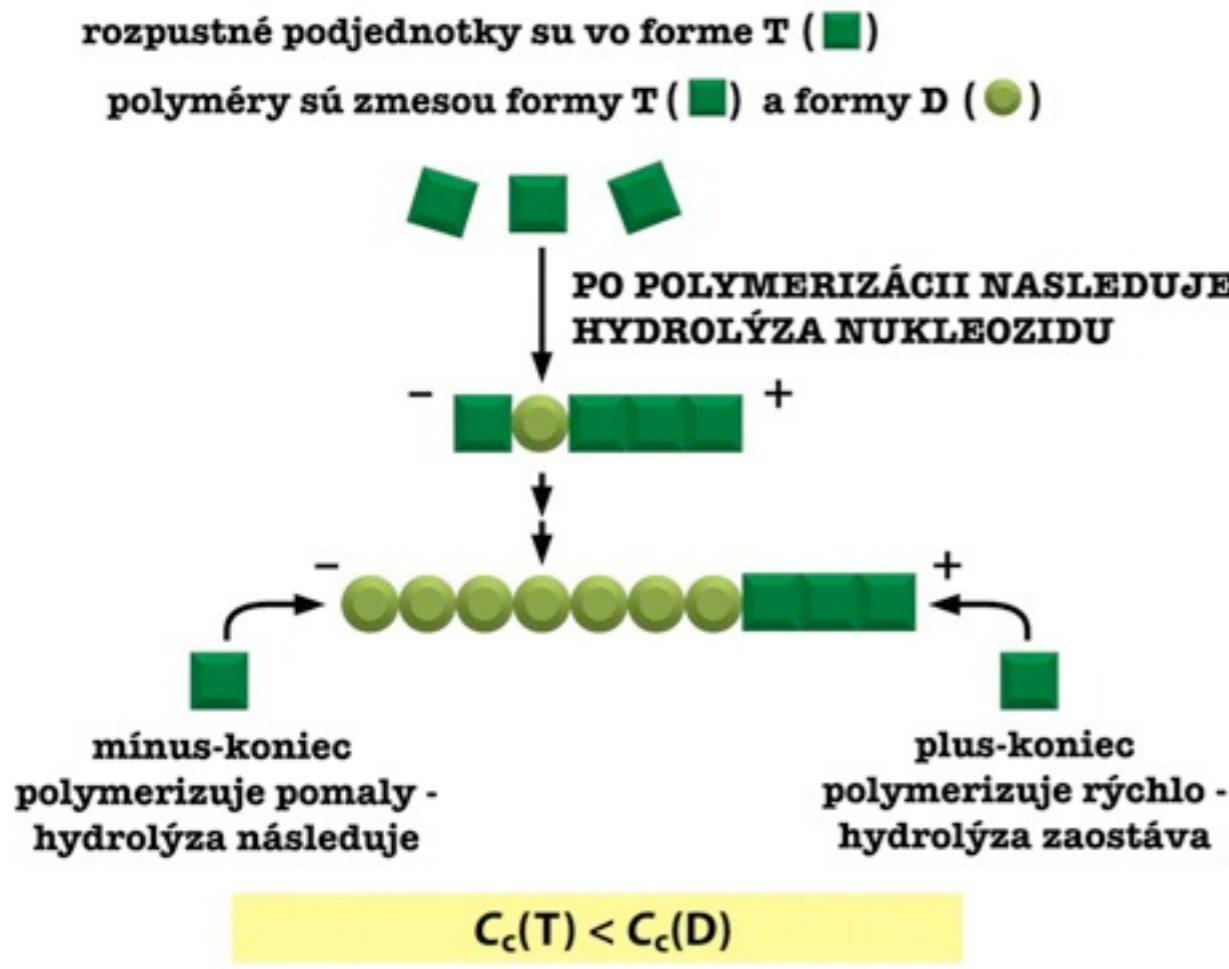
Nukleácia je rýchlosť určujúcim krokom tvorby fialemtov



Mikrofilamenty rastú rýchlejšie na plus konci

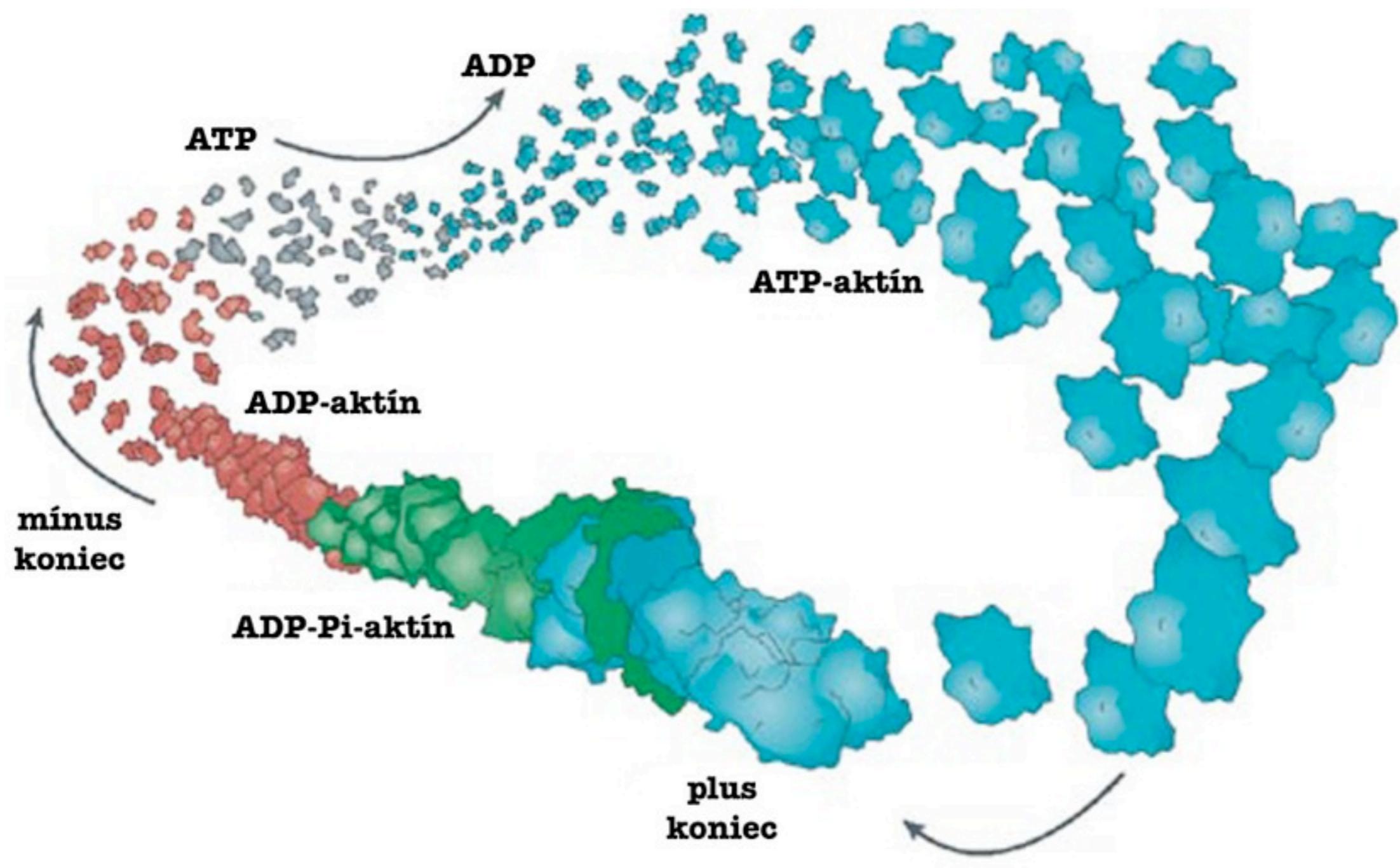


“Treadmilling”

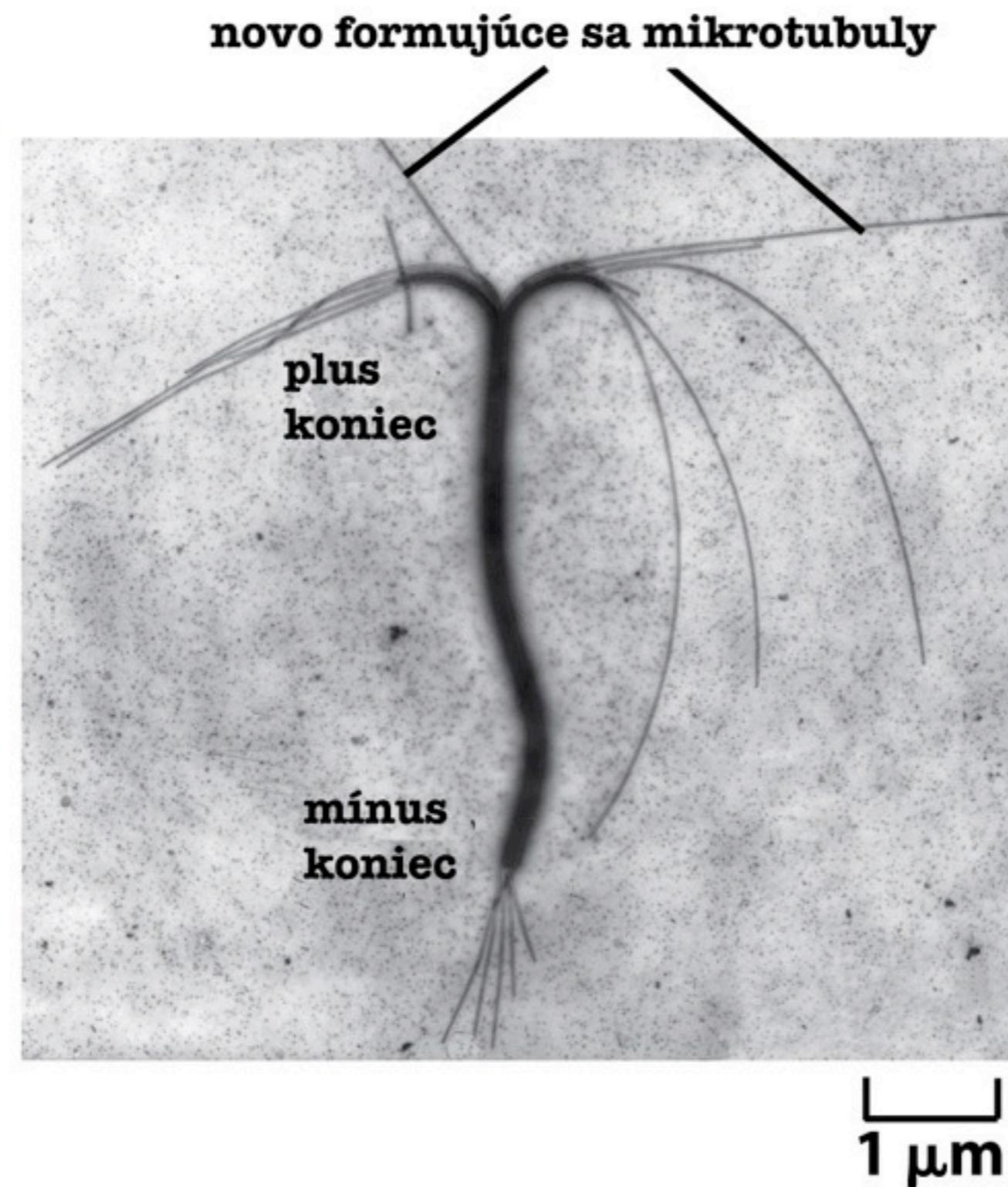


pri $C_c(T) < C < C_c(D)$
dochádza ku “treadmilling”

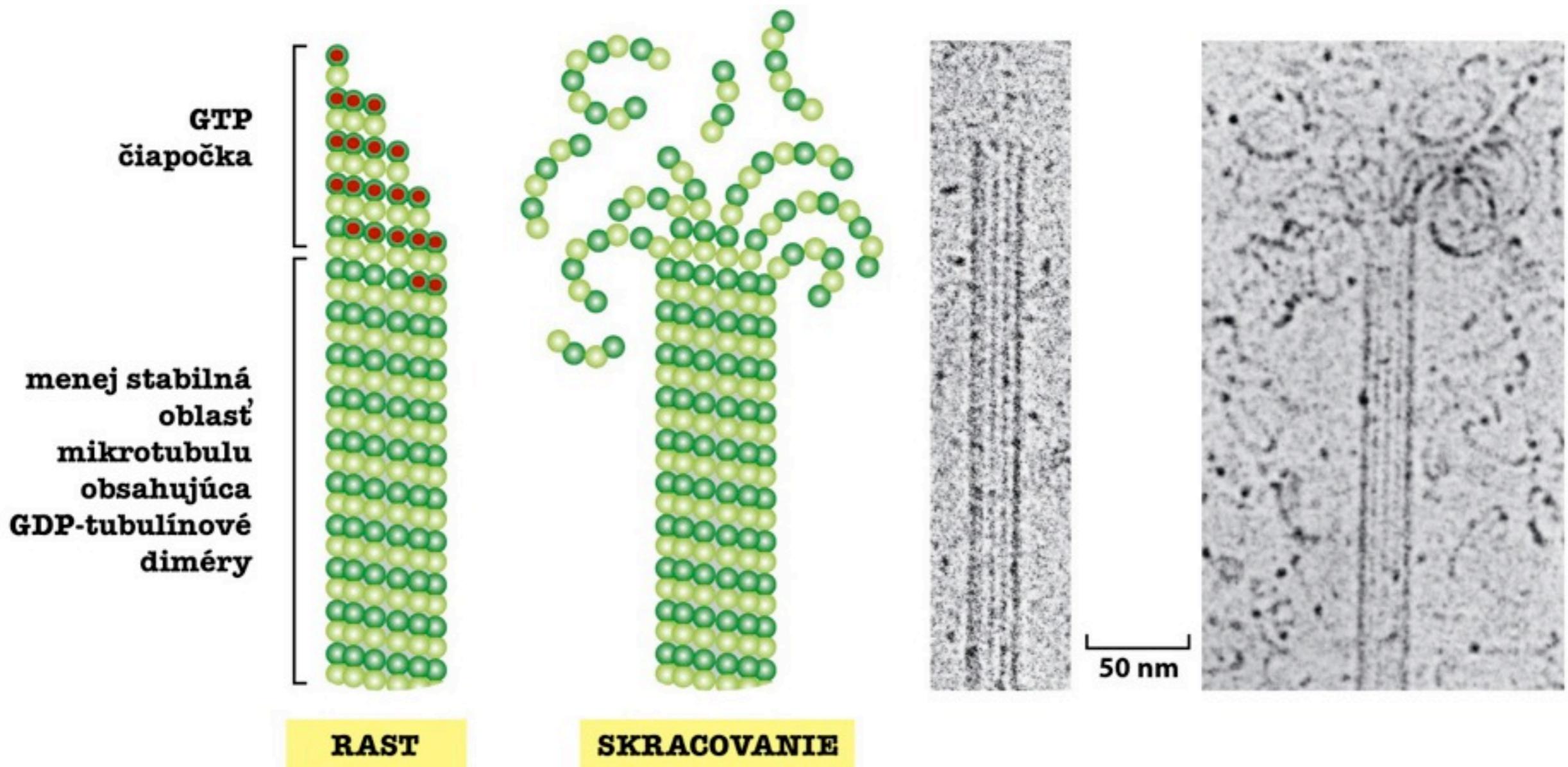
“Treadmilling”



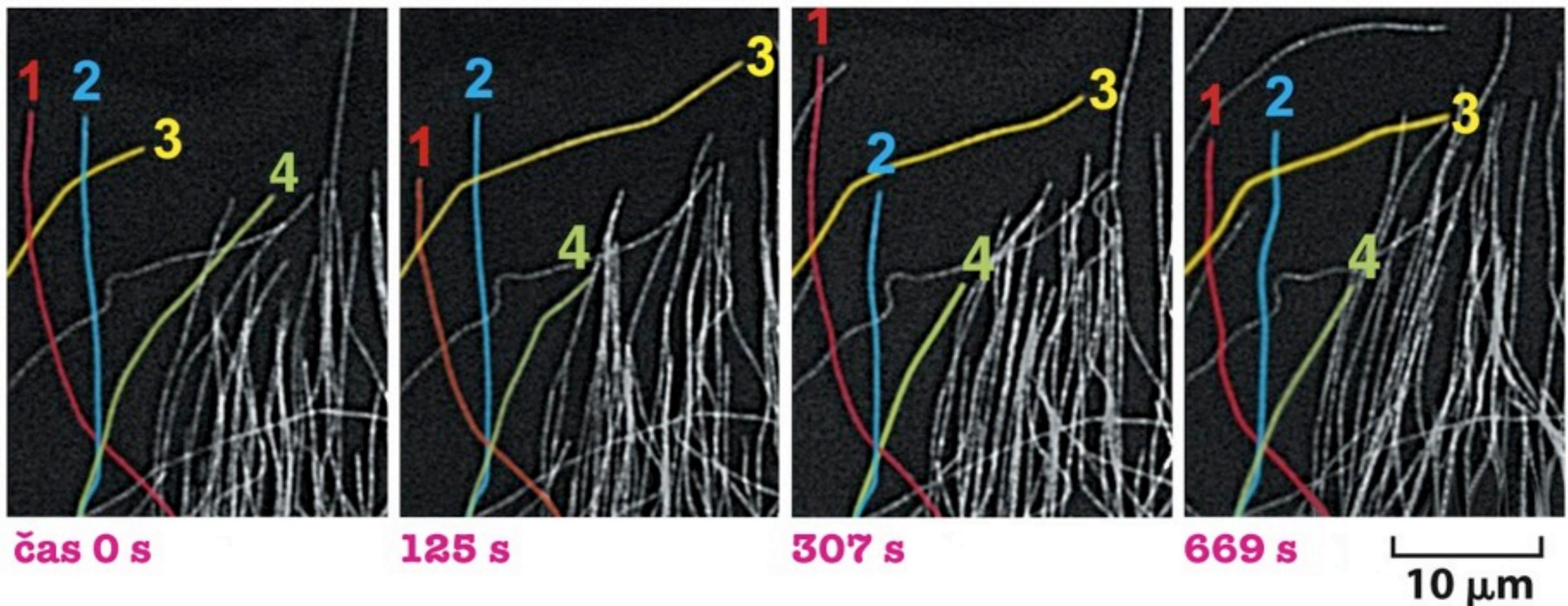
Mikrotubuly rastú rýchlejšie na plus konci



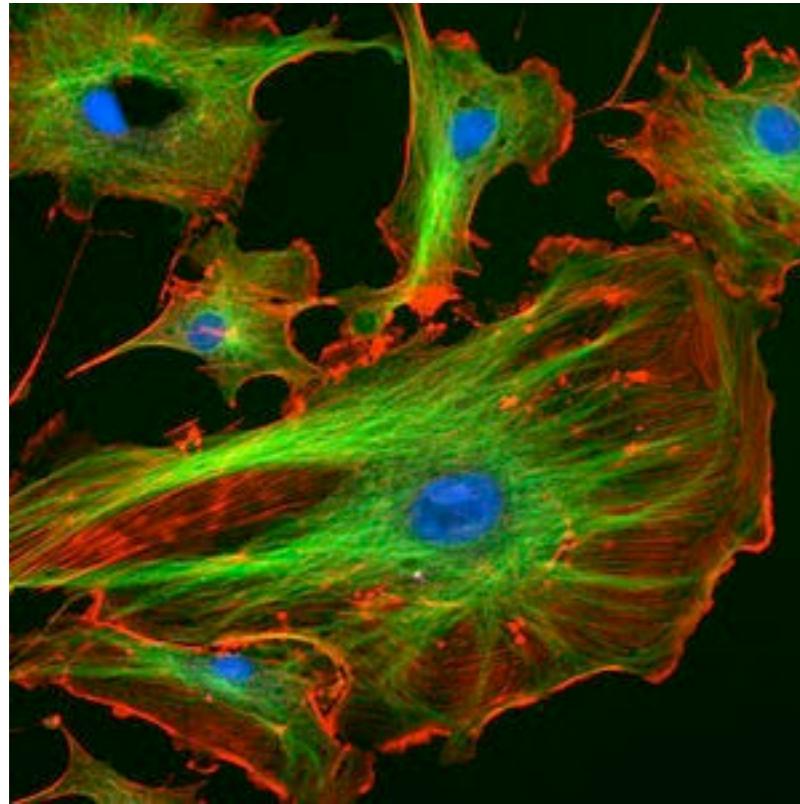
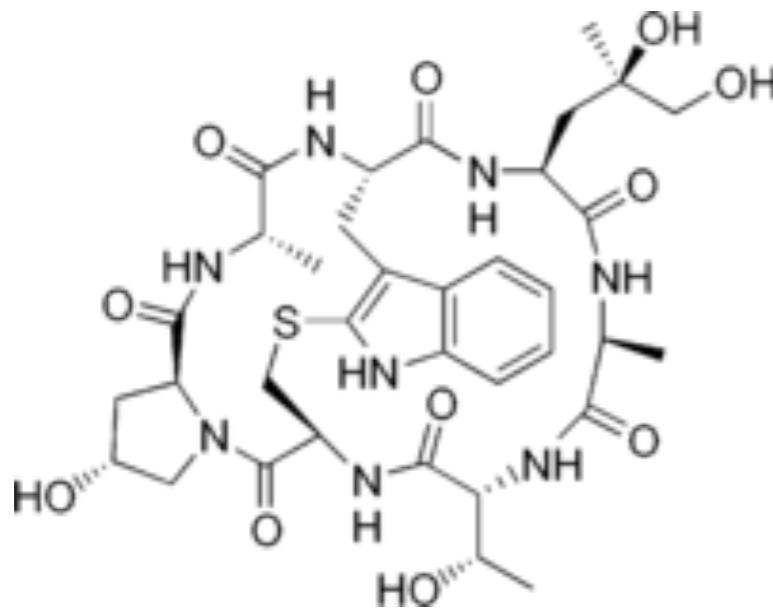
Dynamická nestabilita mikrotubulov



Dynamická nestabilita mikrotubulov



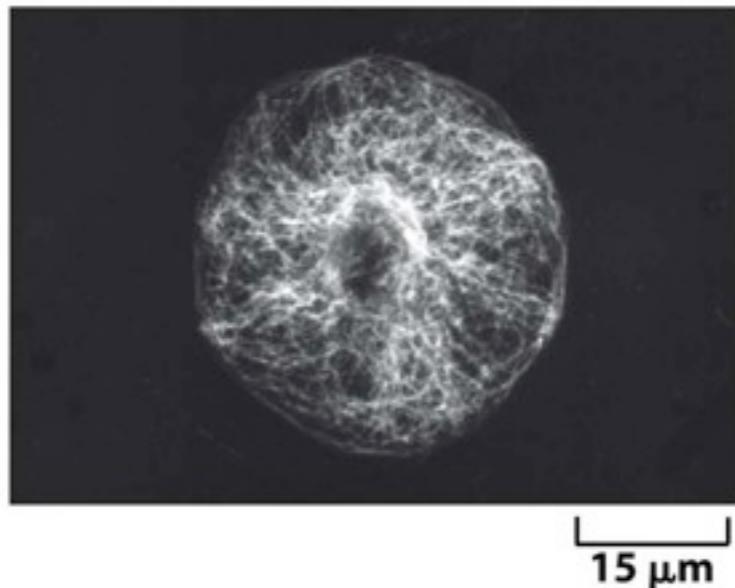
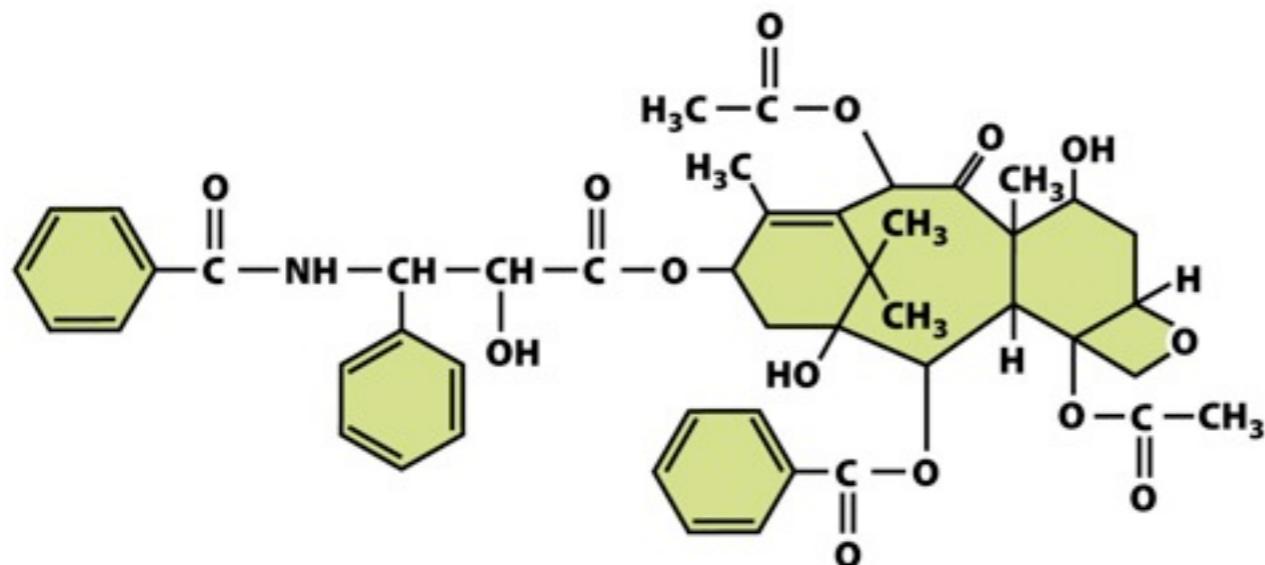
Faloidín stabilizuje aktínové mikrofilamenty



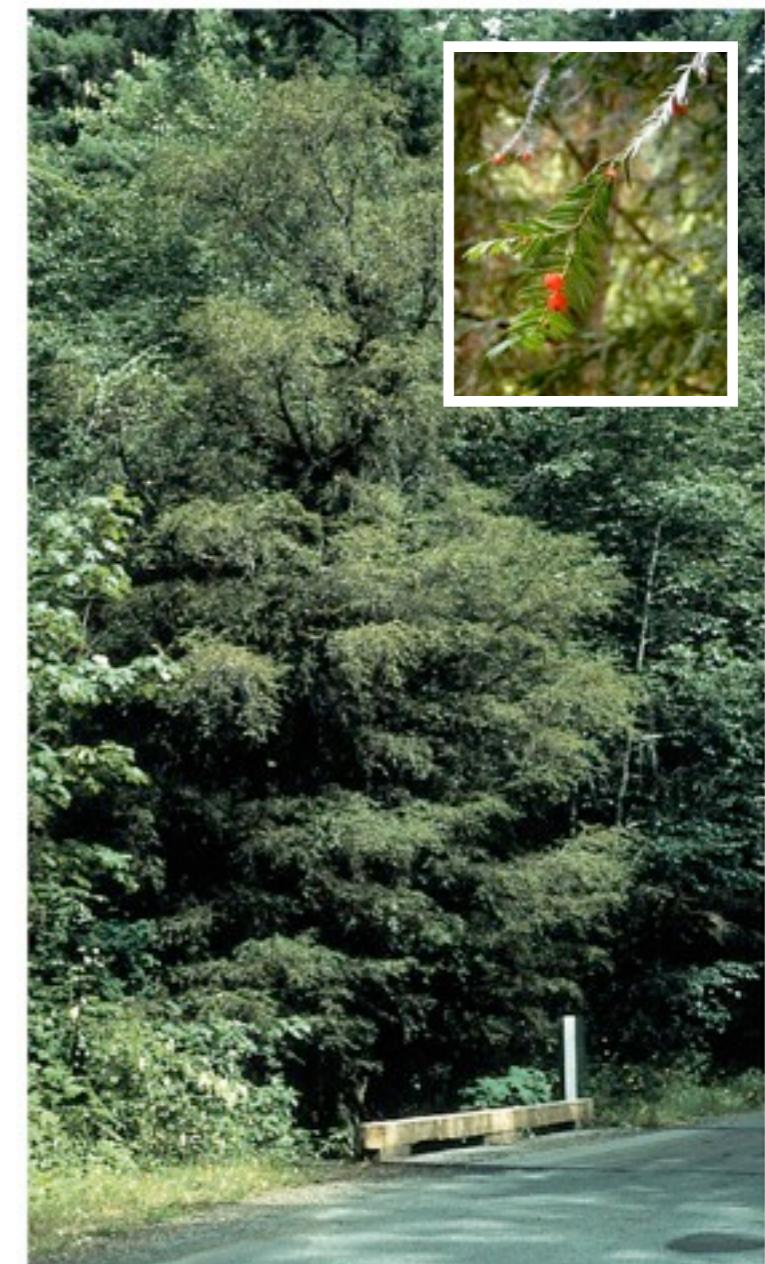
Amanita phalloides

Faloidín-TRITC (červená) - mikrofilamenty,
protilátku-FITC (zelená) - mikrotubuly,
DAPI (modrá) - jadrá.

Taxol stabilizuje mikrotubuly

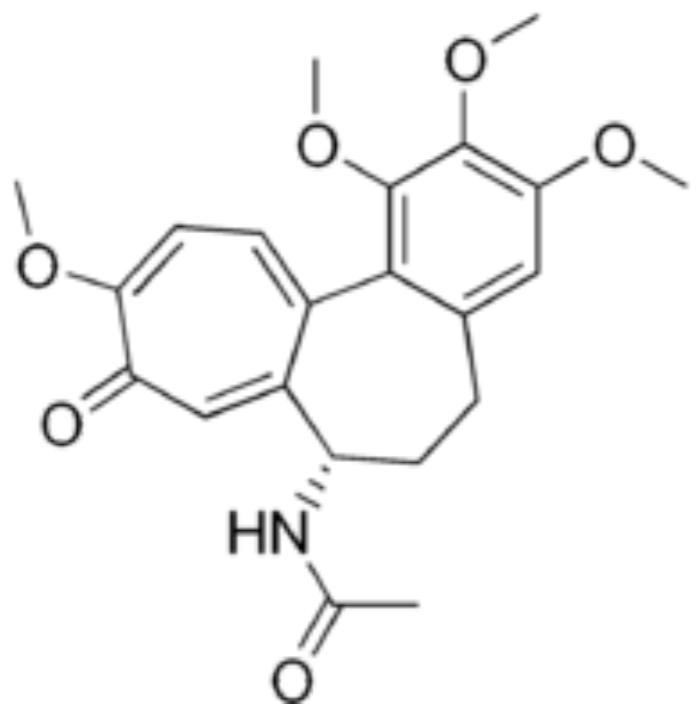


pečeňová epitaliálna bunka pred a po pridaní taxolu



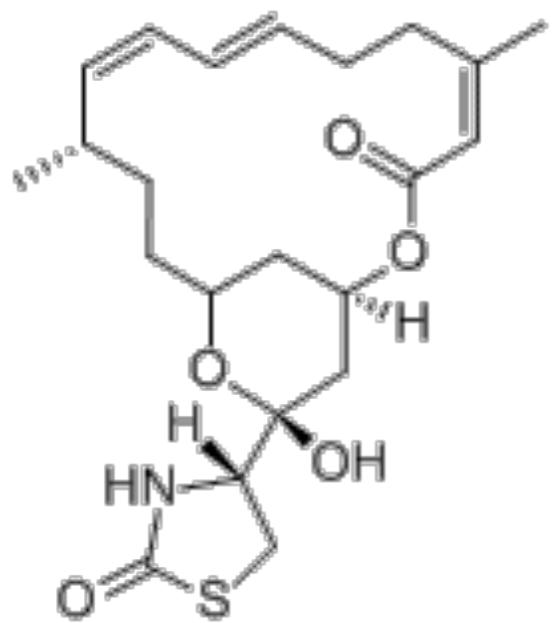
Taxus brevifolia

Kolchicín inhibuje polymerizáciu tubulínu



Colchicum autumnale

Latrunkulín inhibuje polymerizáciu aktínu



Latrunculia magnifica

Látky ovplyvňujúce aktínové vlákna a mikrotubuly

Aktín-špecifické látky

Faloidín viaže sa na filamenty a stabilizuje ich

Cytochalazín blokuje (čiapočkuje) plus koniec

Swinholide rozkladá filamenty

Latrunculin viaže sa na G-aktín a bráni ich polymerizáciu

Tubulín-špecifické látky

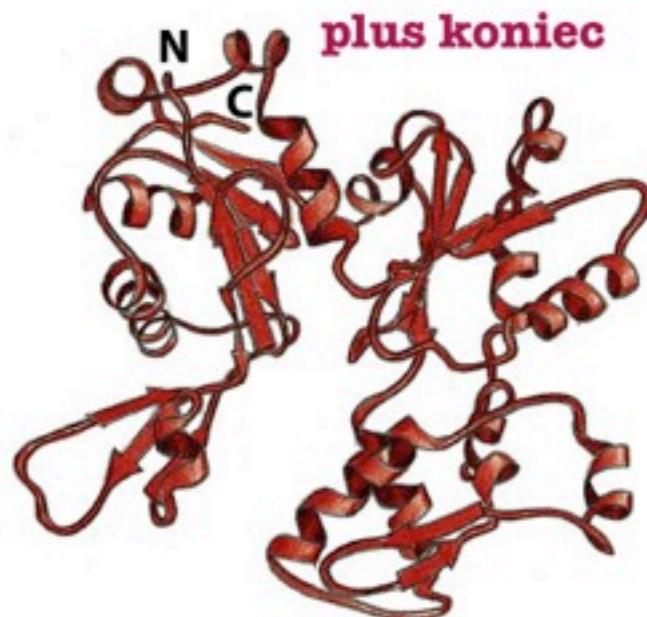
Taxol viaže sa na mikrotubuly a stabilizuje ich

Kolchicín, kolcemid viaže sa na podjednotky a bráni ich polymerizáciu

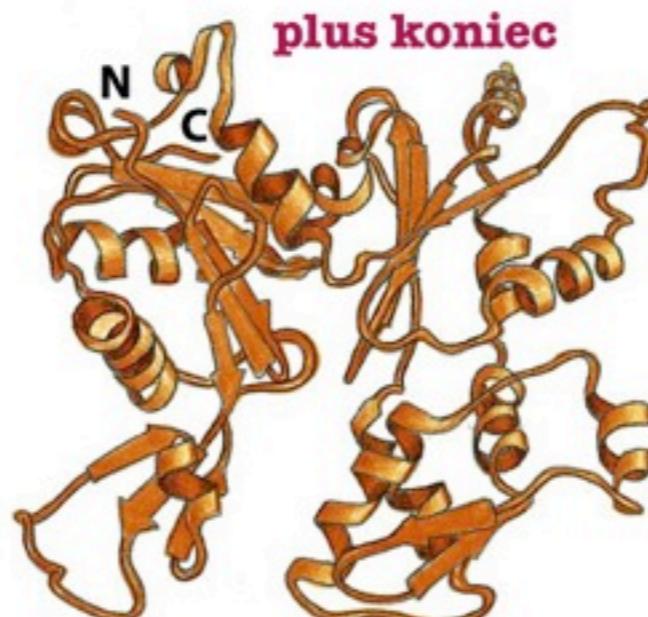
Vinblastín, vinkristín viaže sa na podjednotky a bráni ich polymerizáciu

Nokodazol viaže sa na podjednotky a bráni ich polymerizáciu

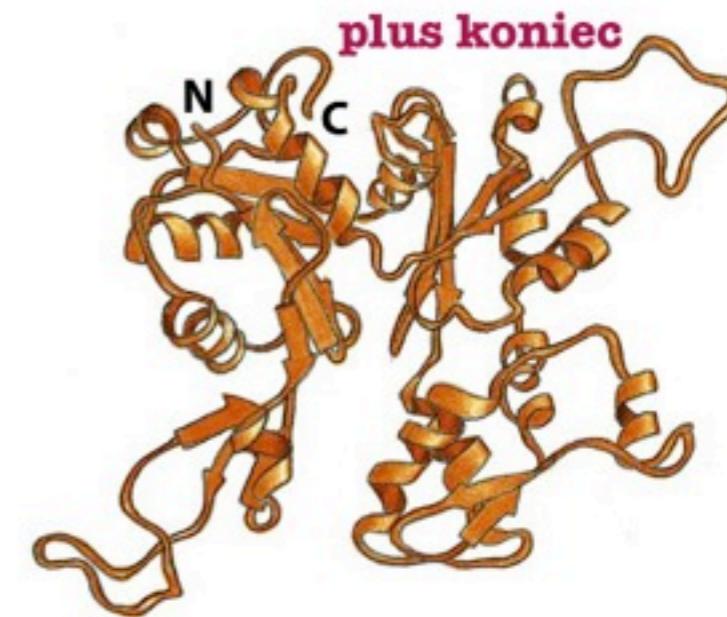
Aktínové vlákna bývajú nukleované Arp komplexom



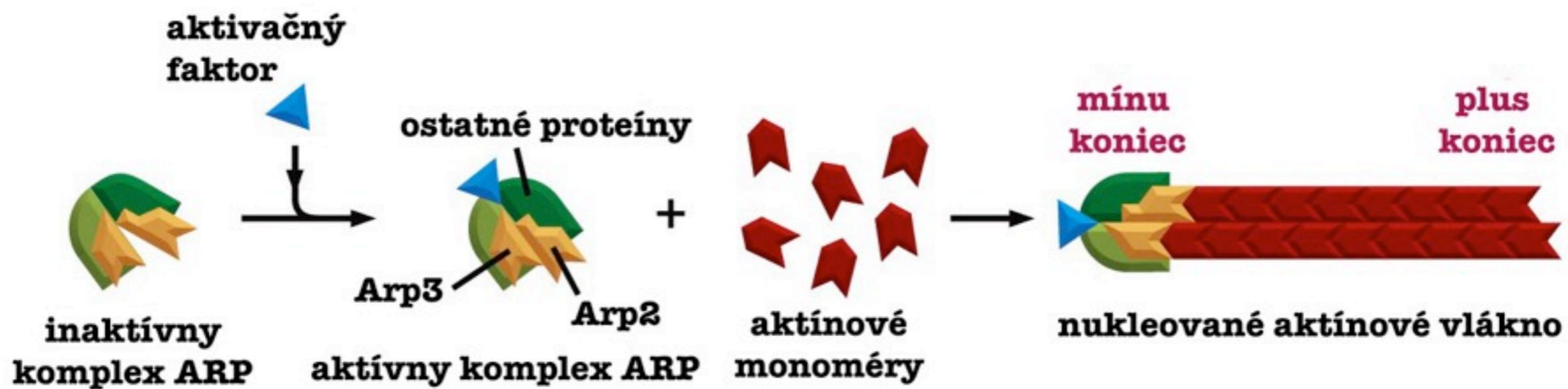
aktín [▼]



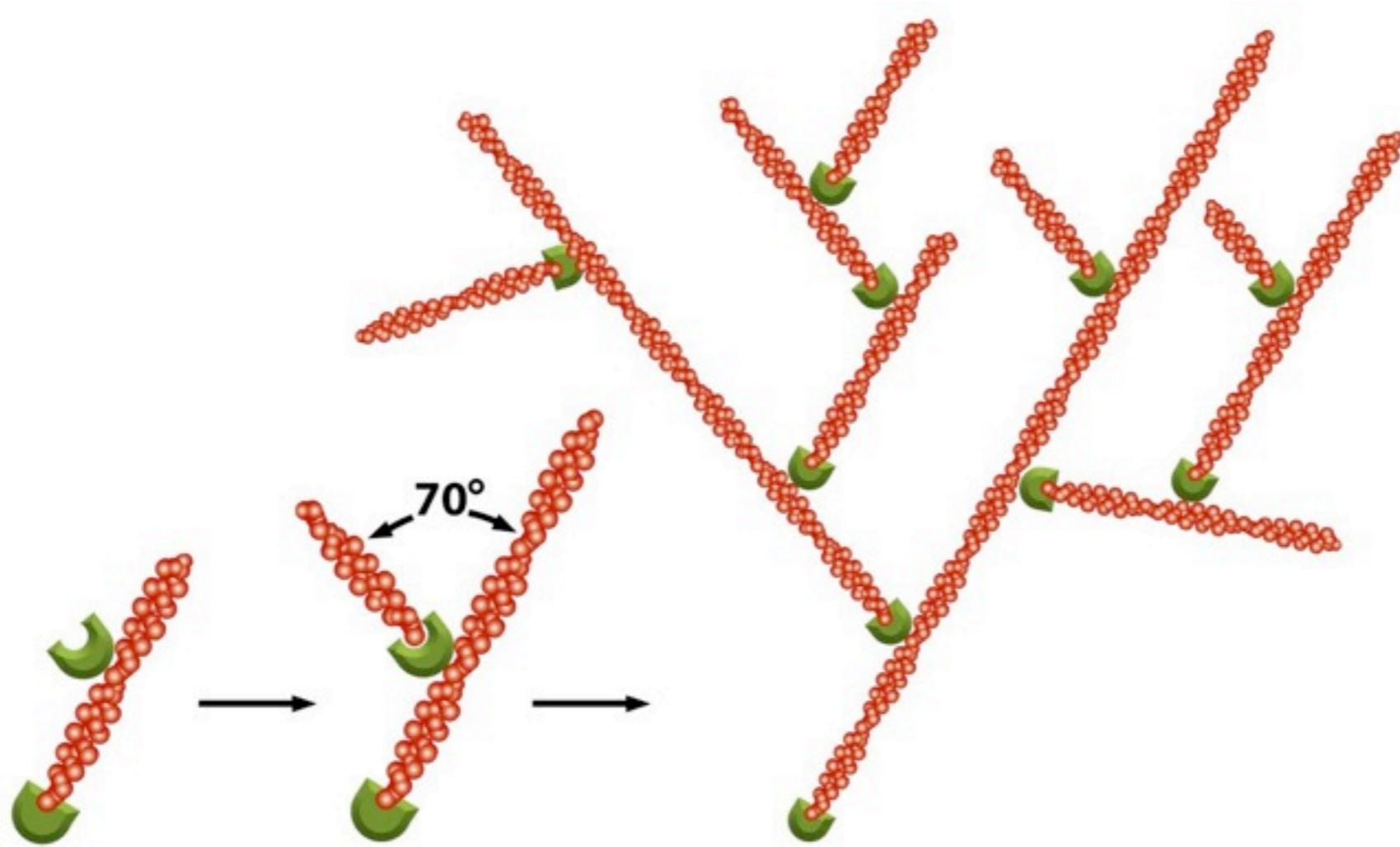
Arp2 [▼]



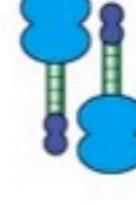
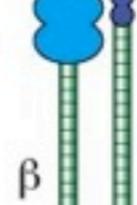
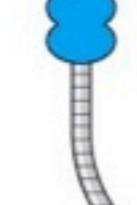
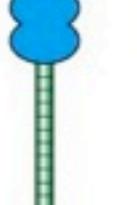
Arp3 [▼]



Aktínové vlákna bývajú nukleované Arp komplexom



Príklady proteínov viažúcich aktínové vlákna

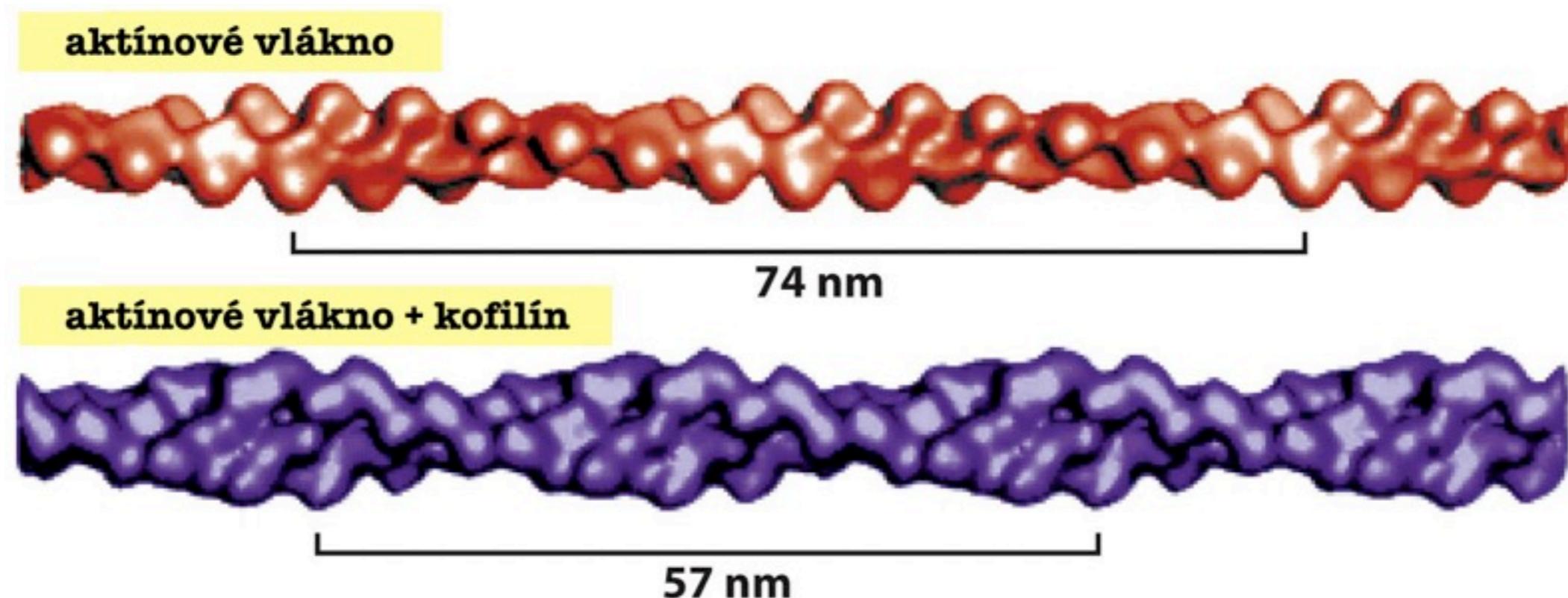
Fimbrín	α -aktinín	Spektrín	Filamín	Dystrofín
				
Mikroklky, filopódiá, fokálne adhézie	Stresové vlákna, filopódiá, Z-línia svalov	Bunkový kortex	Vedúci okraj bunky, stresové vlákna, filopódiá	plazmatická membrána Spája membránové proteíny s aktínovým kortexom v svaloch

Proteíny regulujúce polymerizáciu aktínu

Tymozín - viaže monomérny aktín, bráni mu polymerizovať

Profilín - umožňuje pridávanie aktínových monomérov na plus koniec filamentov (kompetuje o aktínové monoméry s tymozínom)

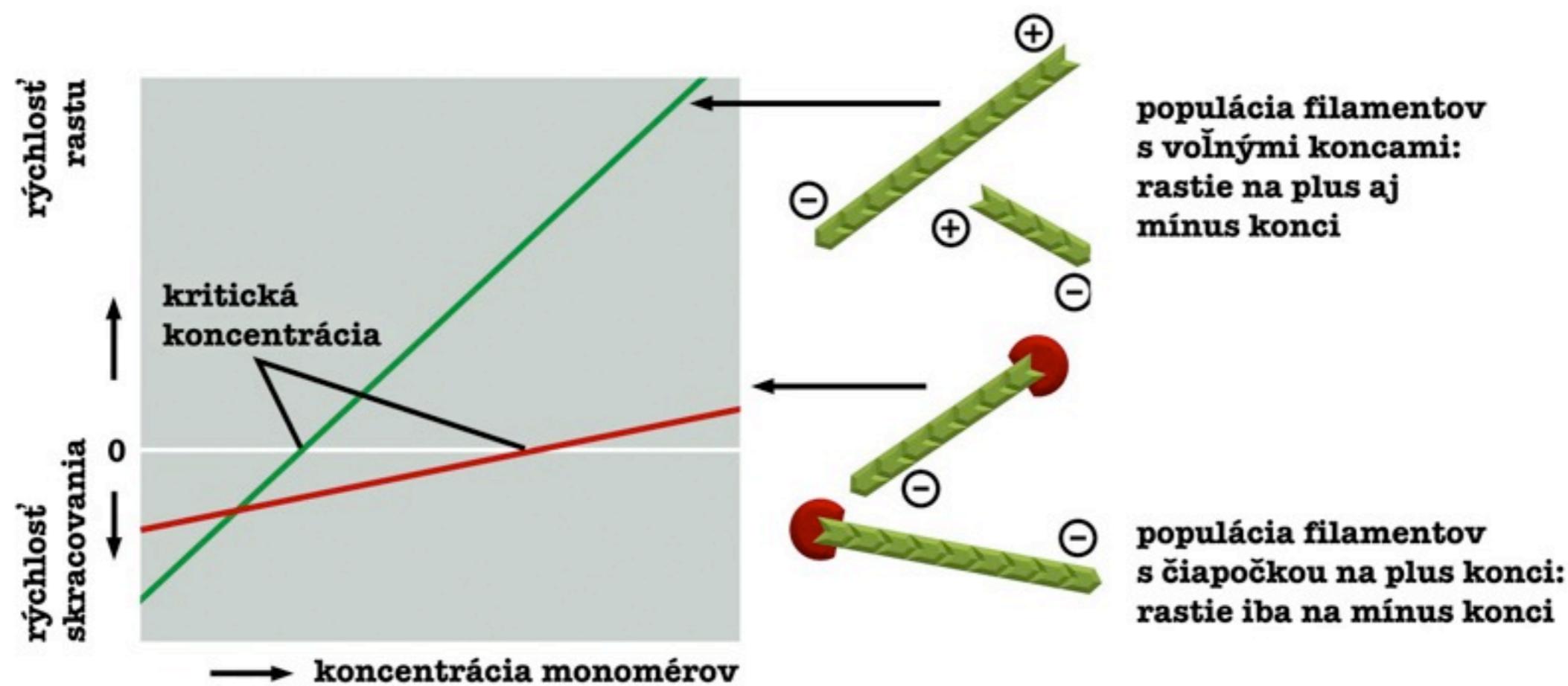
Kofilín - destabilizuje aktínové vlákna



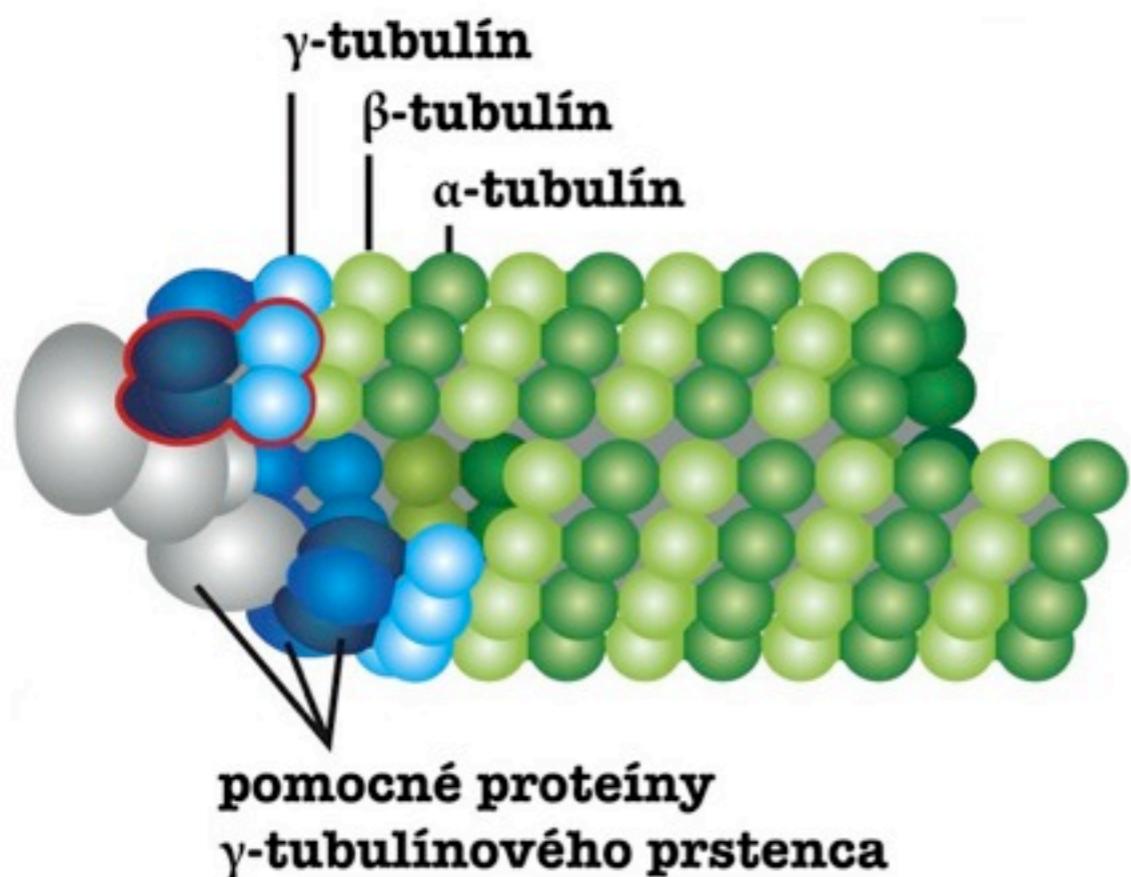
Proteíny regulujúce polymerizáciu aktínu

CapZ - viaže sa na plus koniec aktínových vlákien

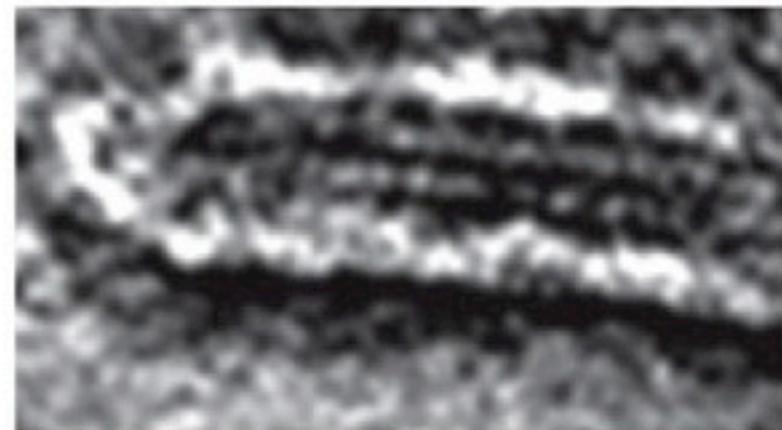
Tropomodulín - viaže sa na mínus koniec aktínových vlákien



Mikrotubuly sú nukleované komplexom obsahujúcim γ -tubulín



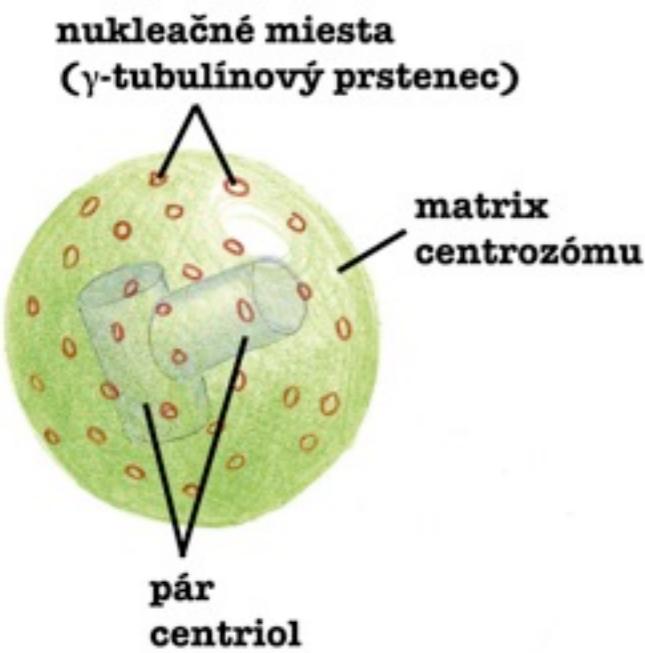
γ -tubulínový prstenec
(γ -tubulin ring complex)



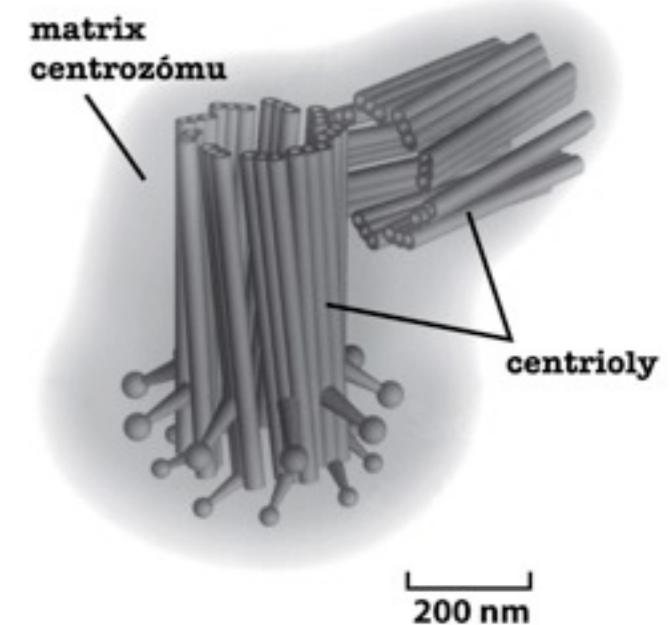
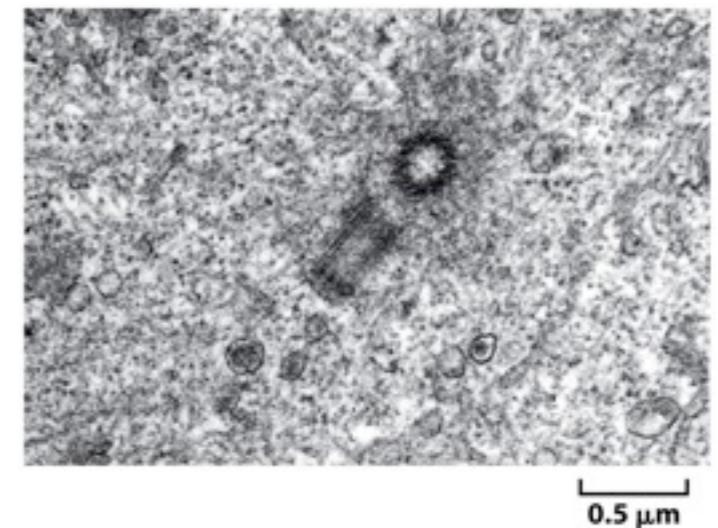
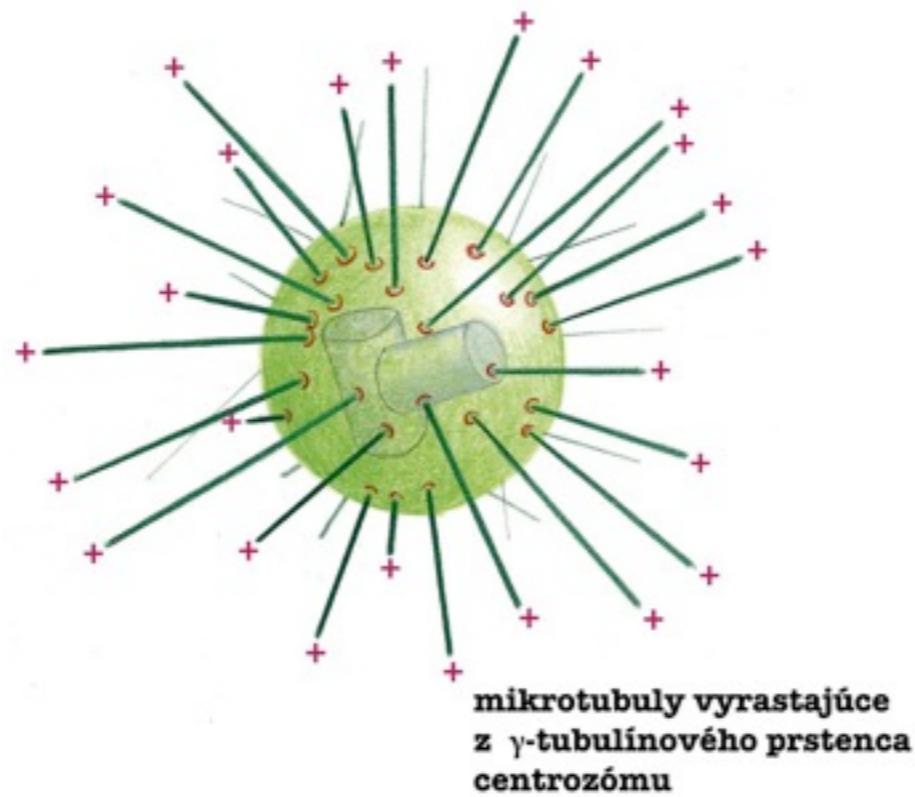
100 nm

MTOC - microtubule organizing center

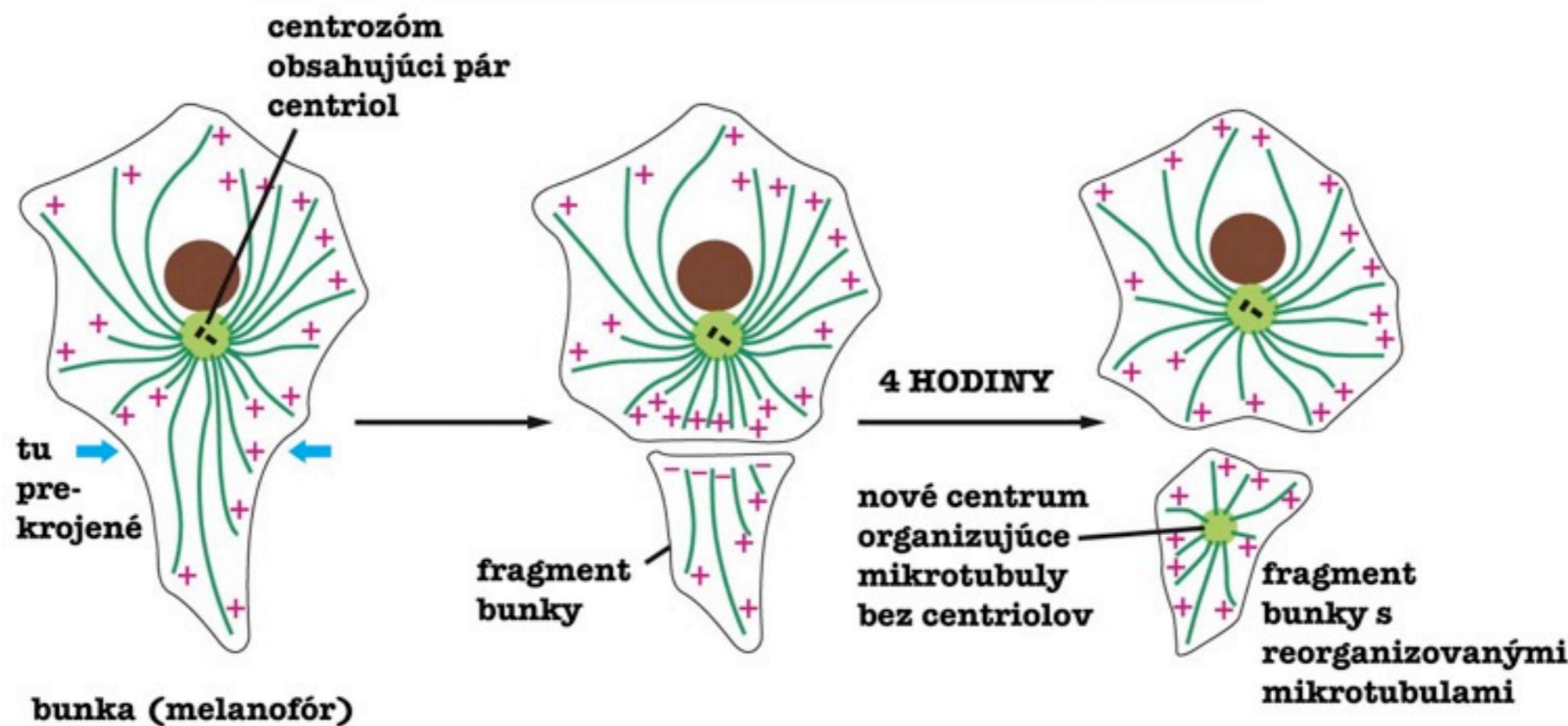
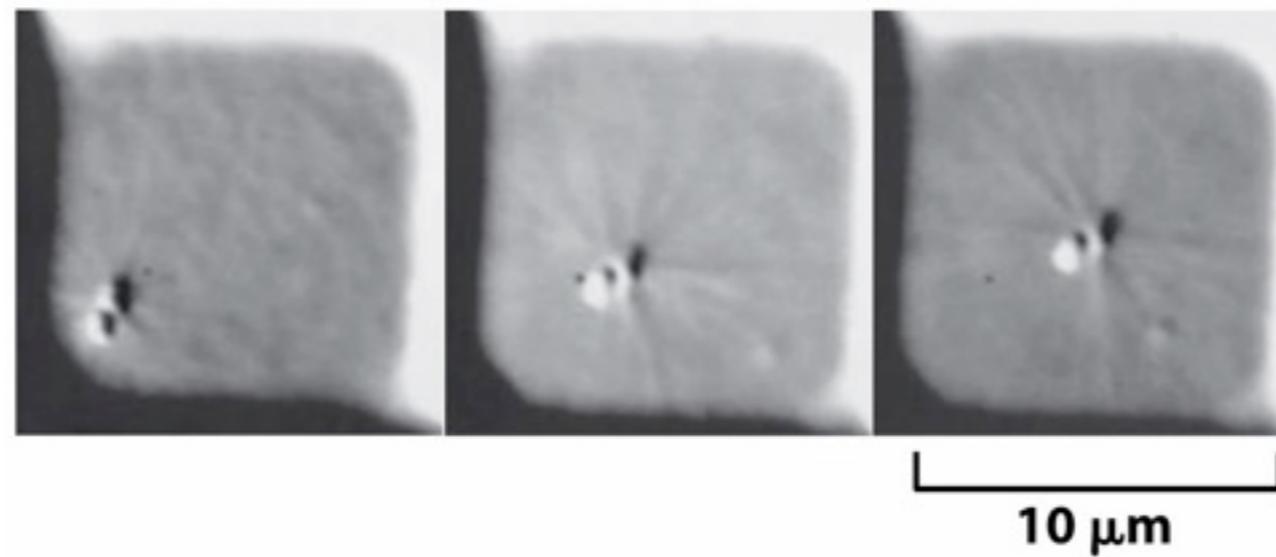
Mikrotubuly obvykle vyrastajú z MTOC



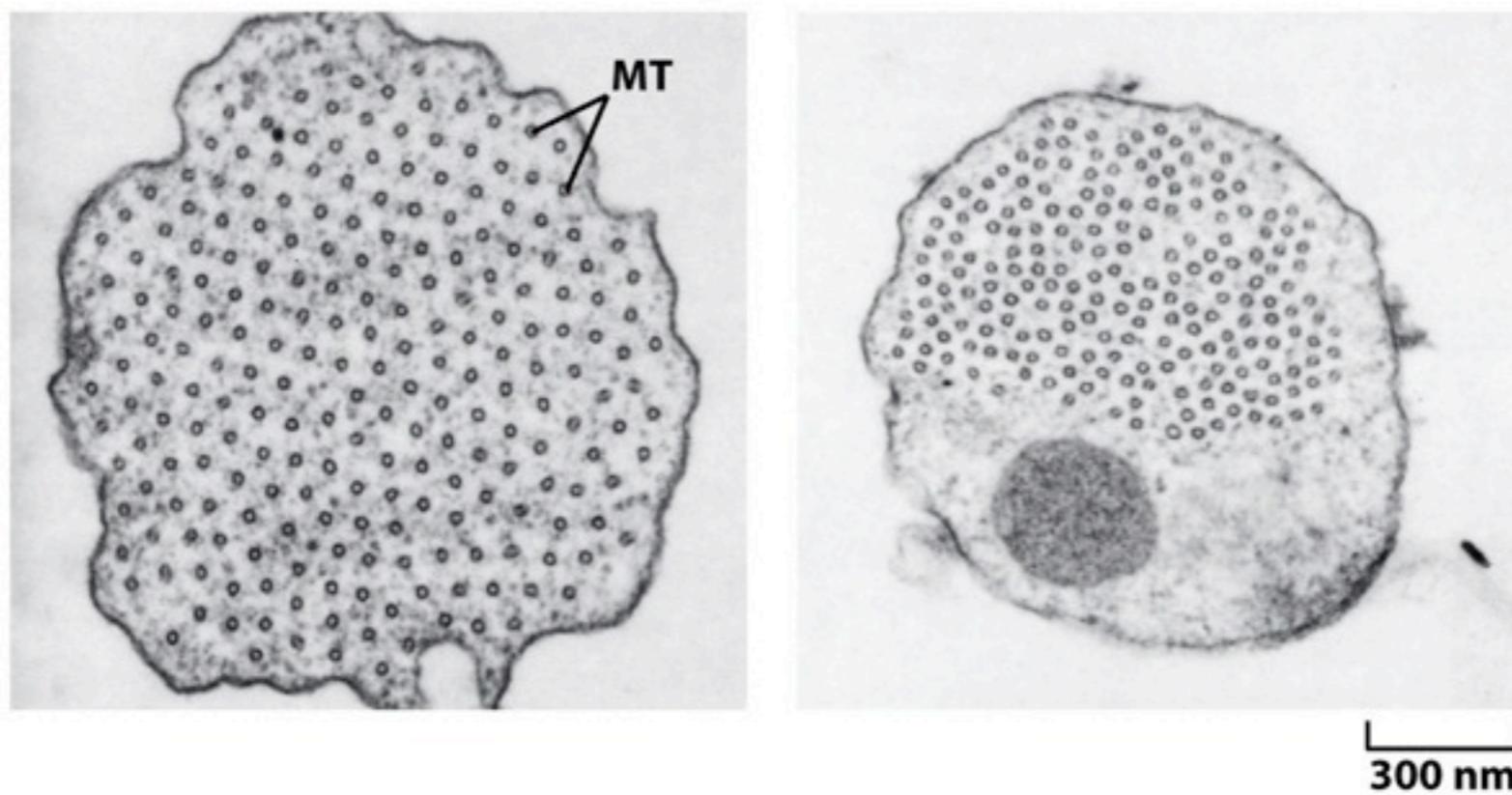
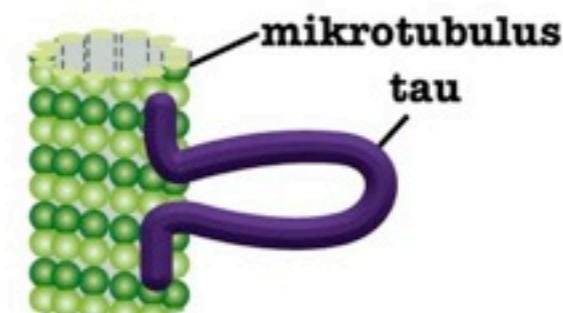
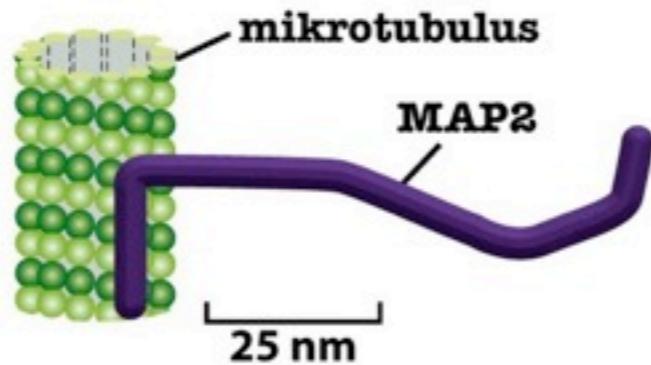
Centrozóm



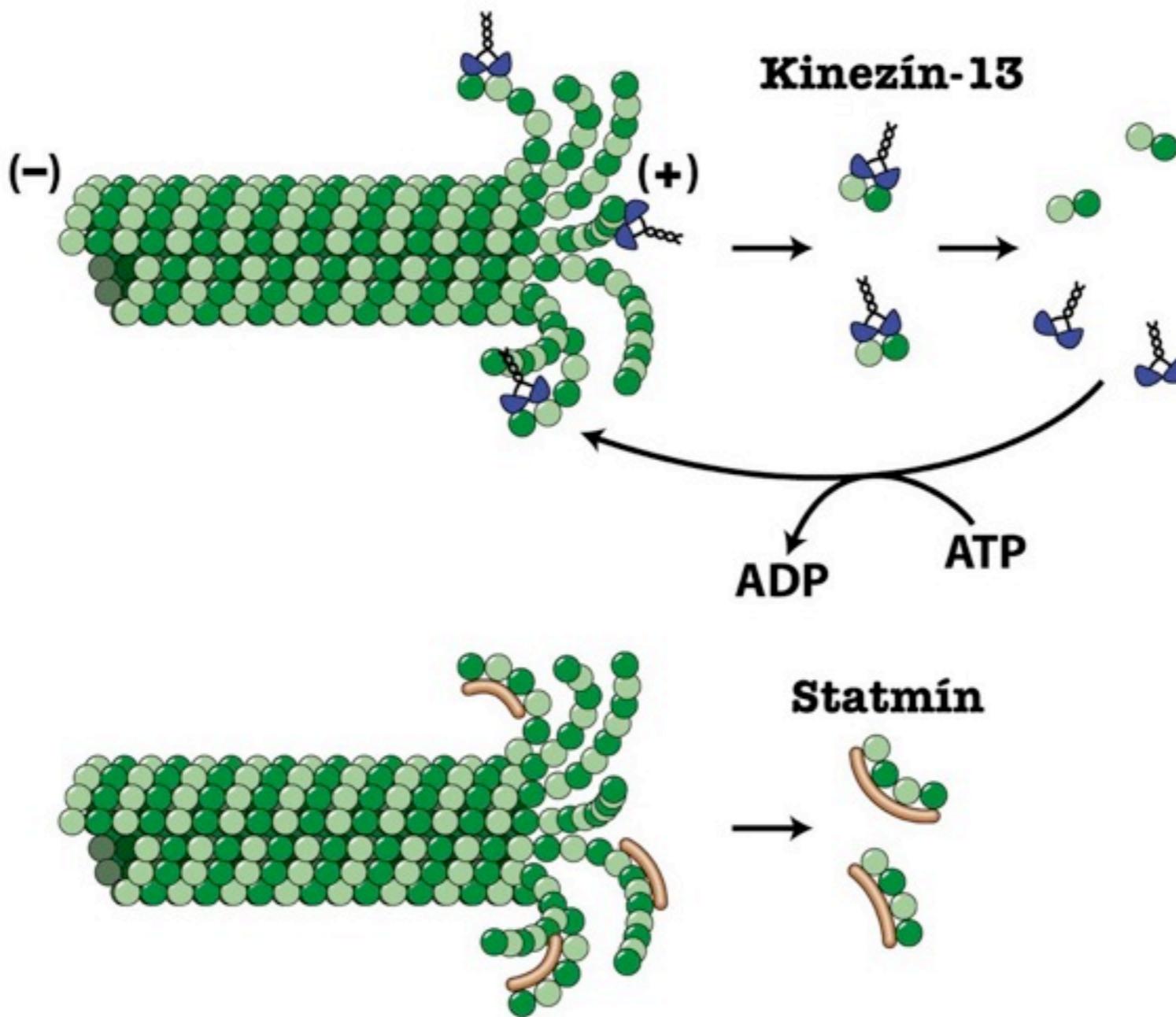
MTOC - microtubule organizing center



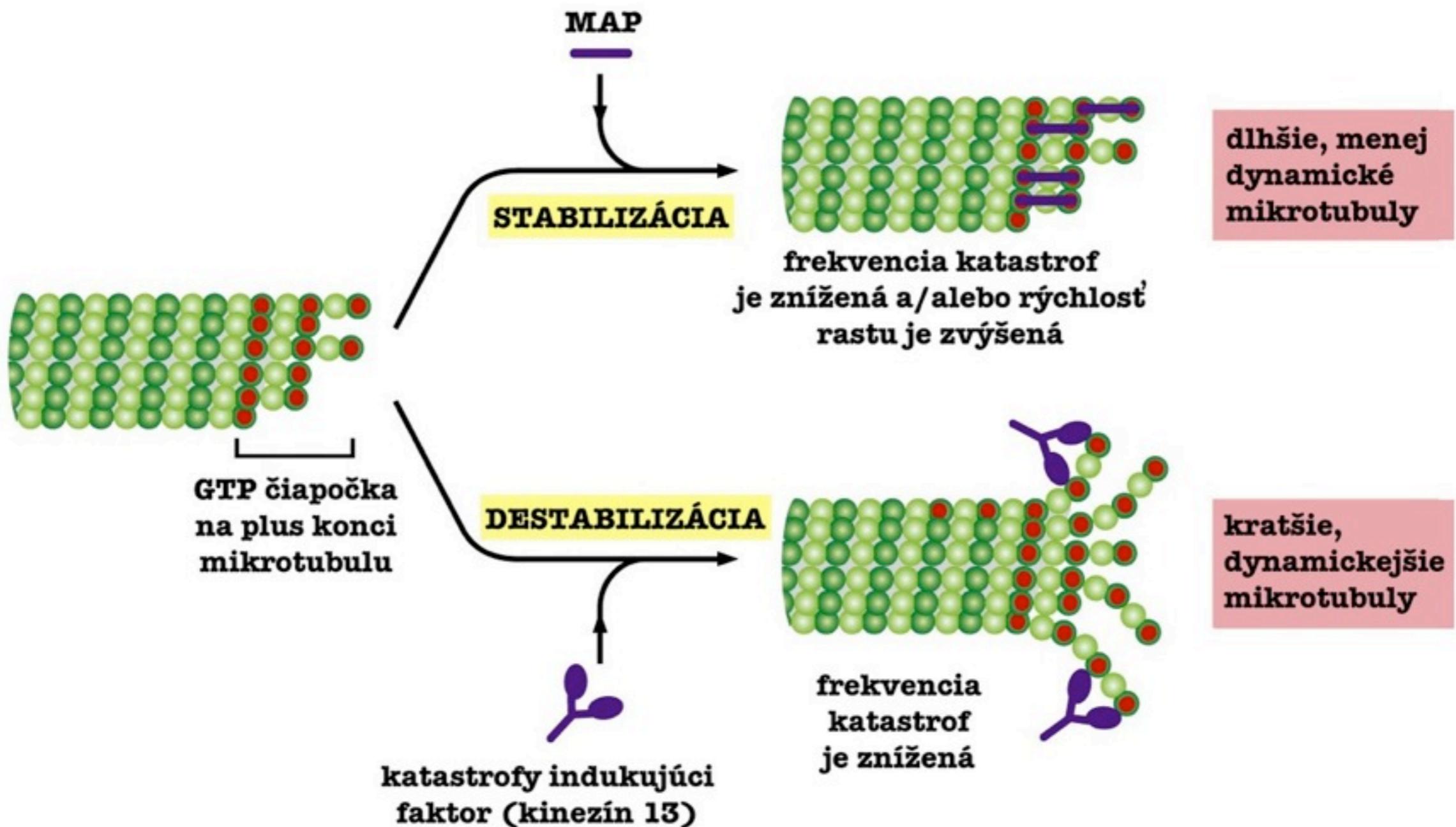
S mikrotubulami asociované proteíny (MAP) stabilizujú mikrotubuly



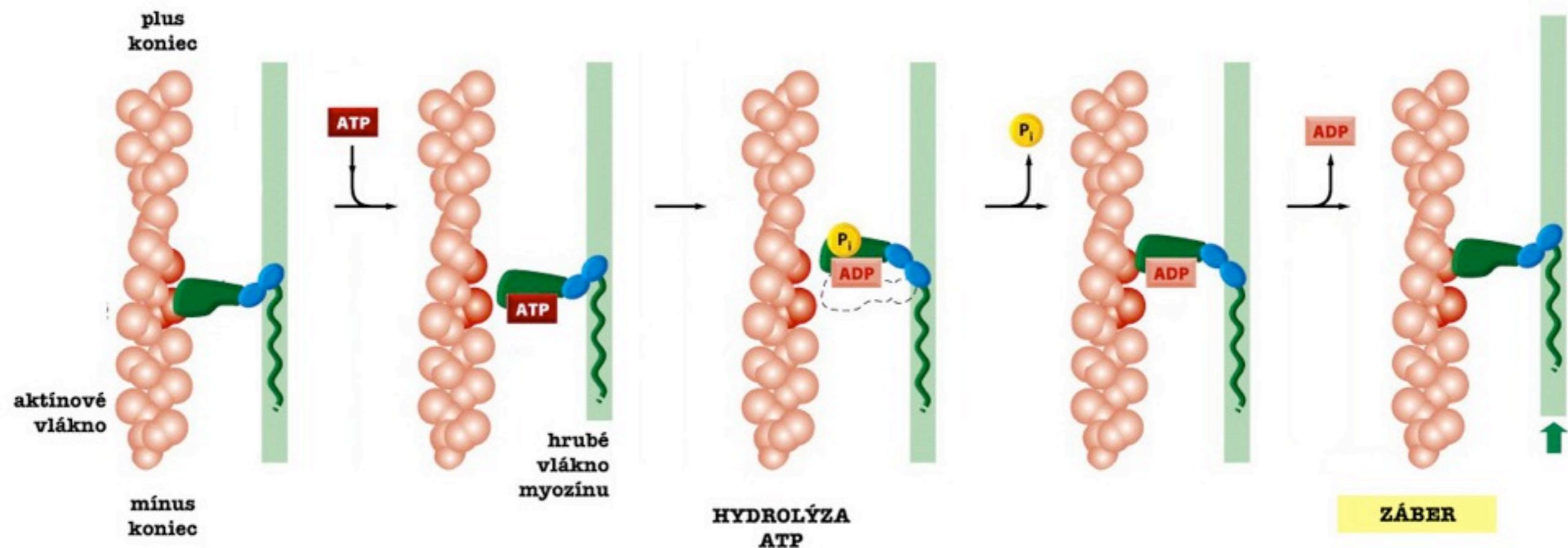
Proteíny regulujúce polymerizáciu tubulínu



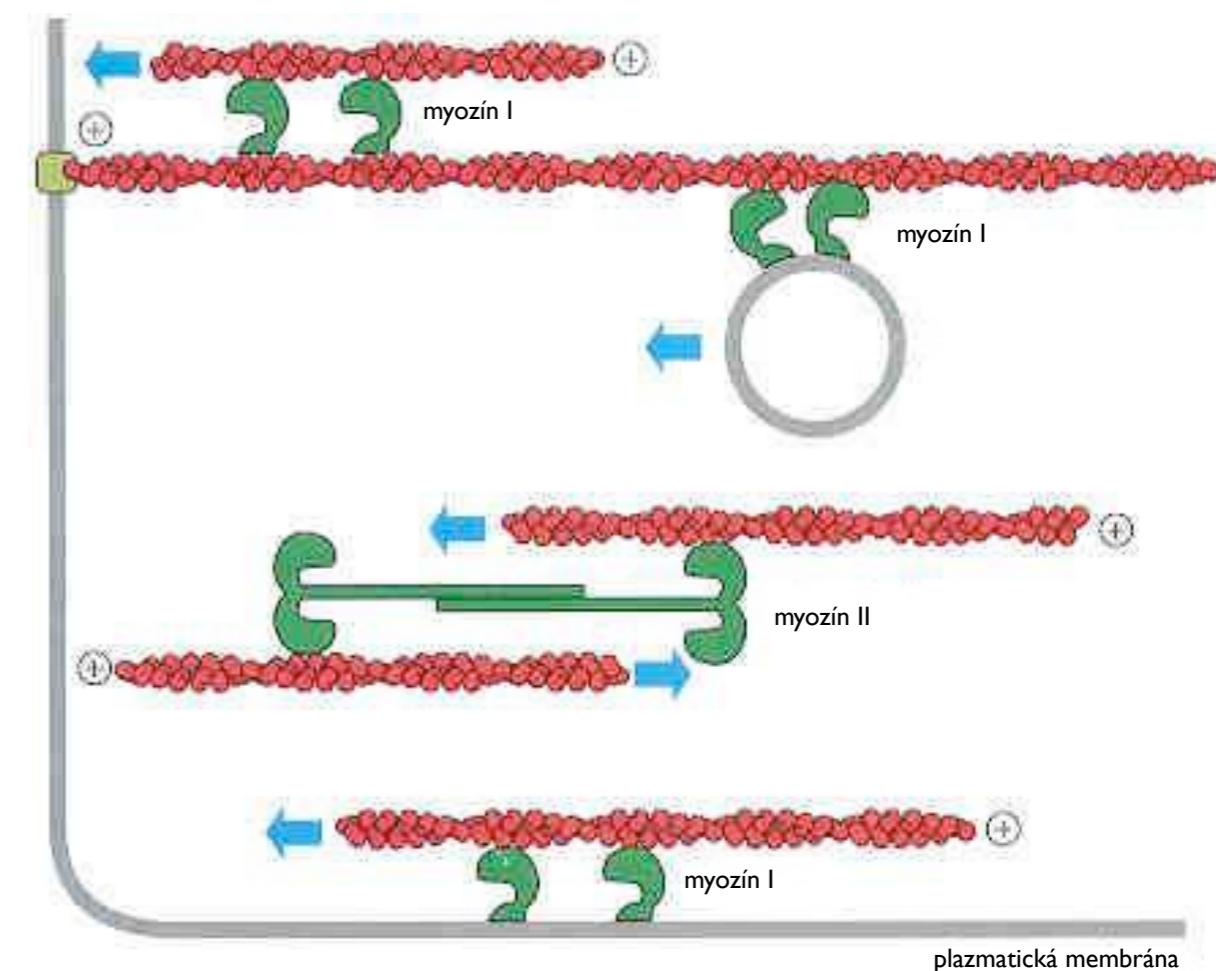
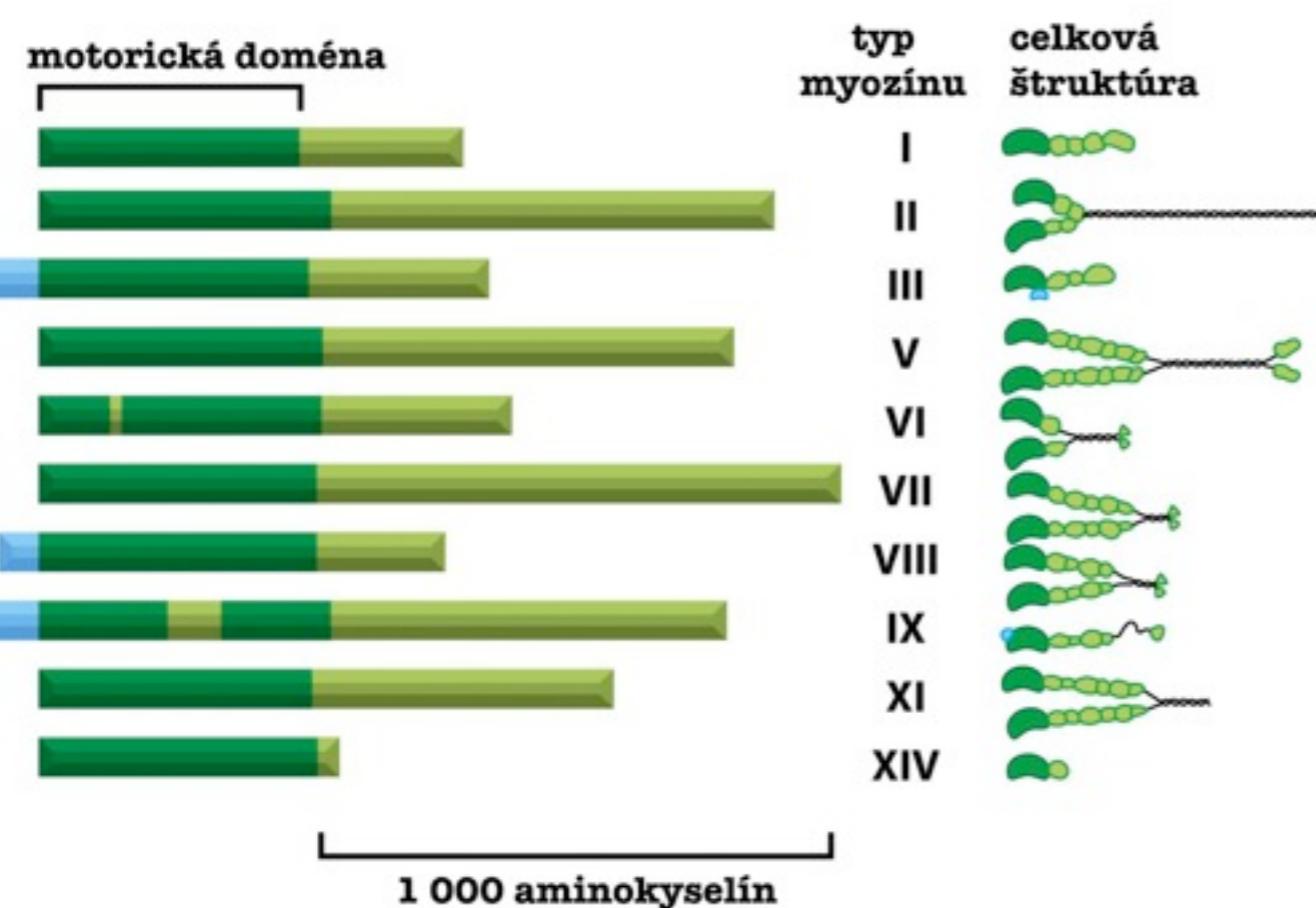
Proteíny regulujúce polymerizáciu tubulínu



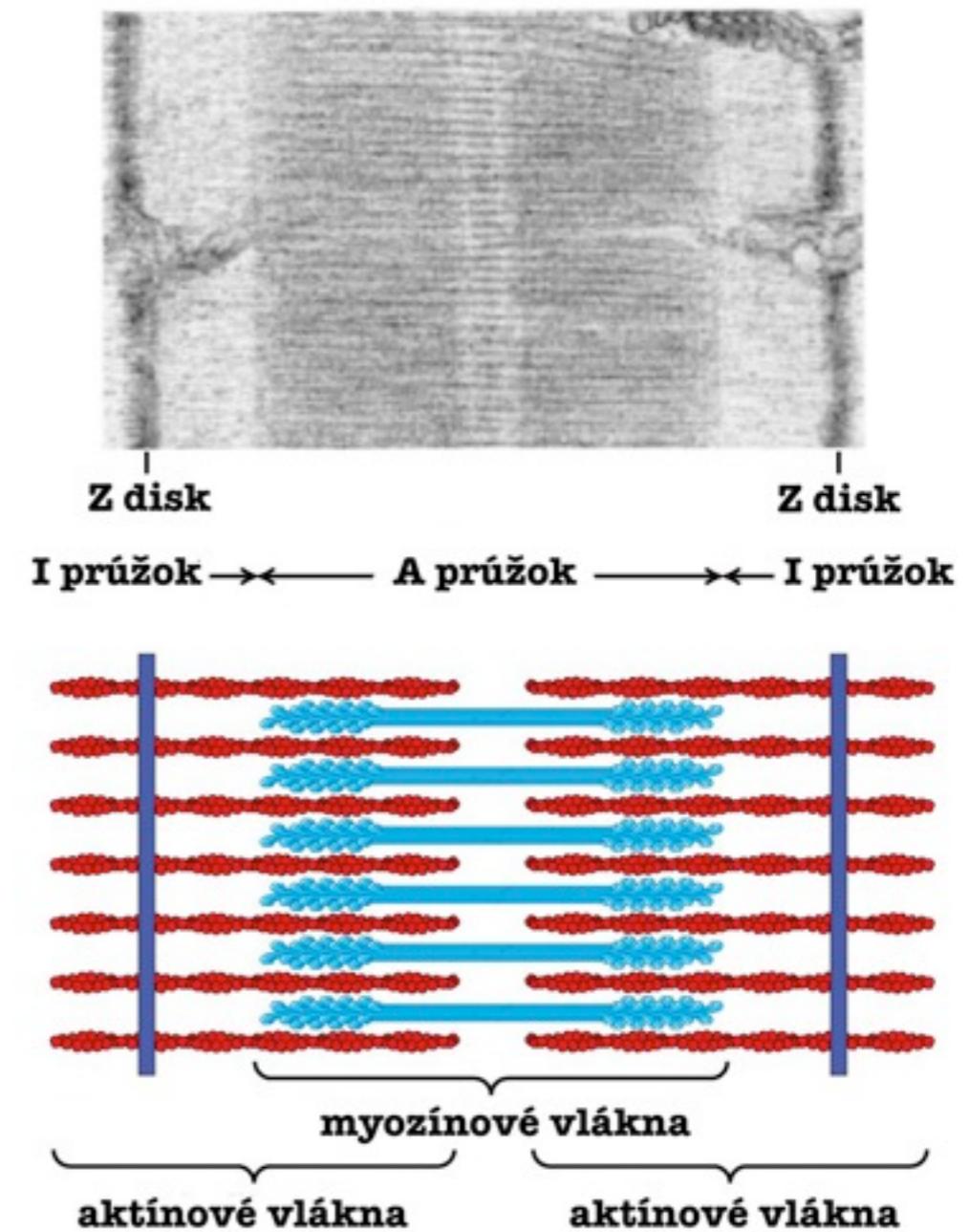
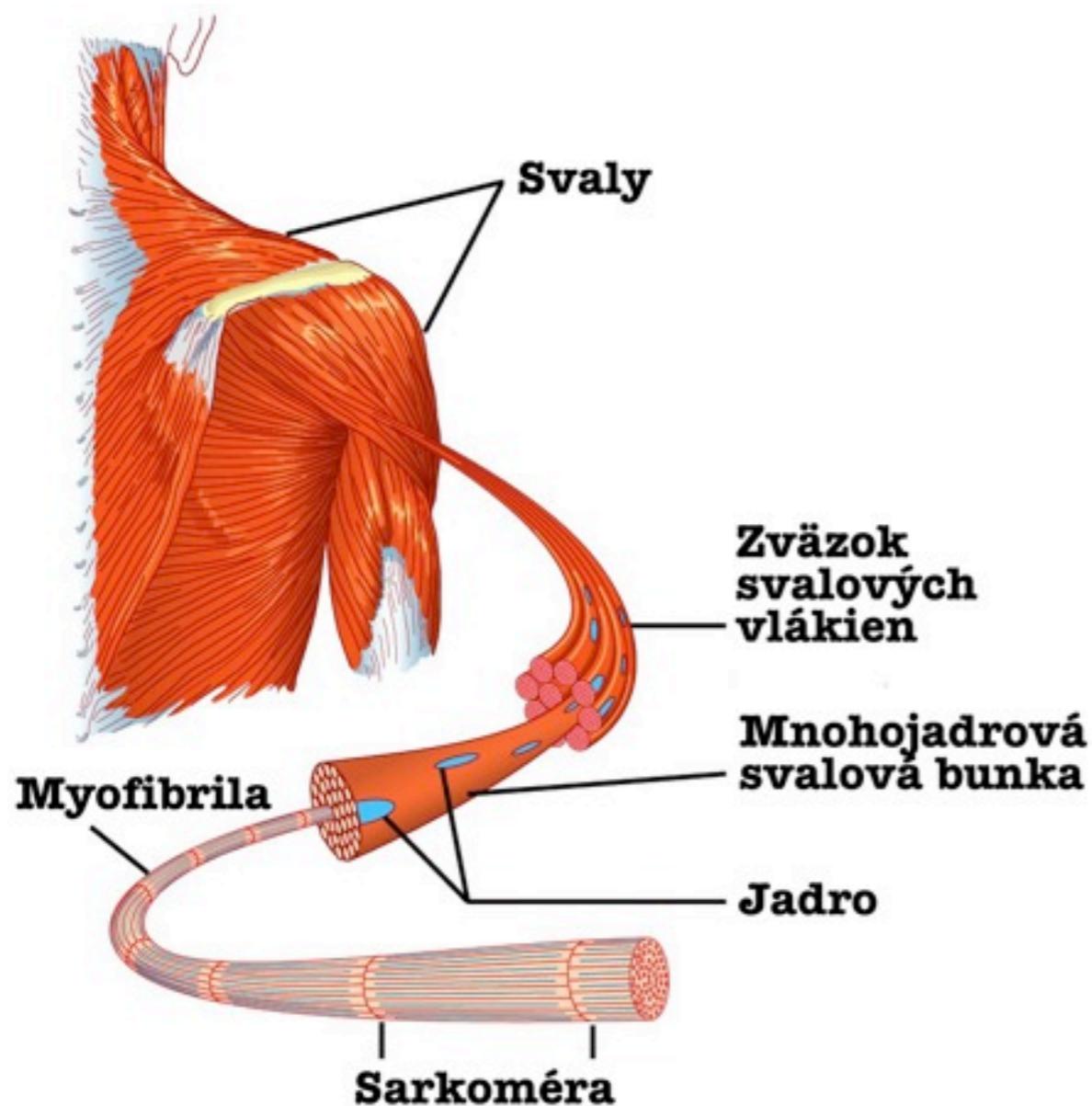
Aktín a myozín



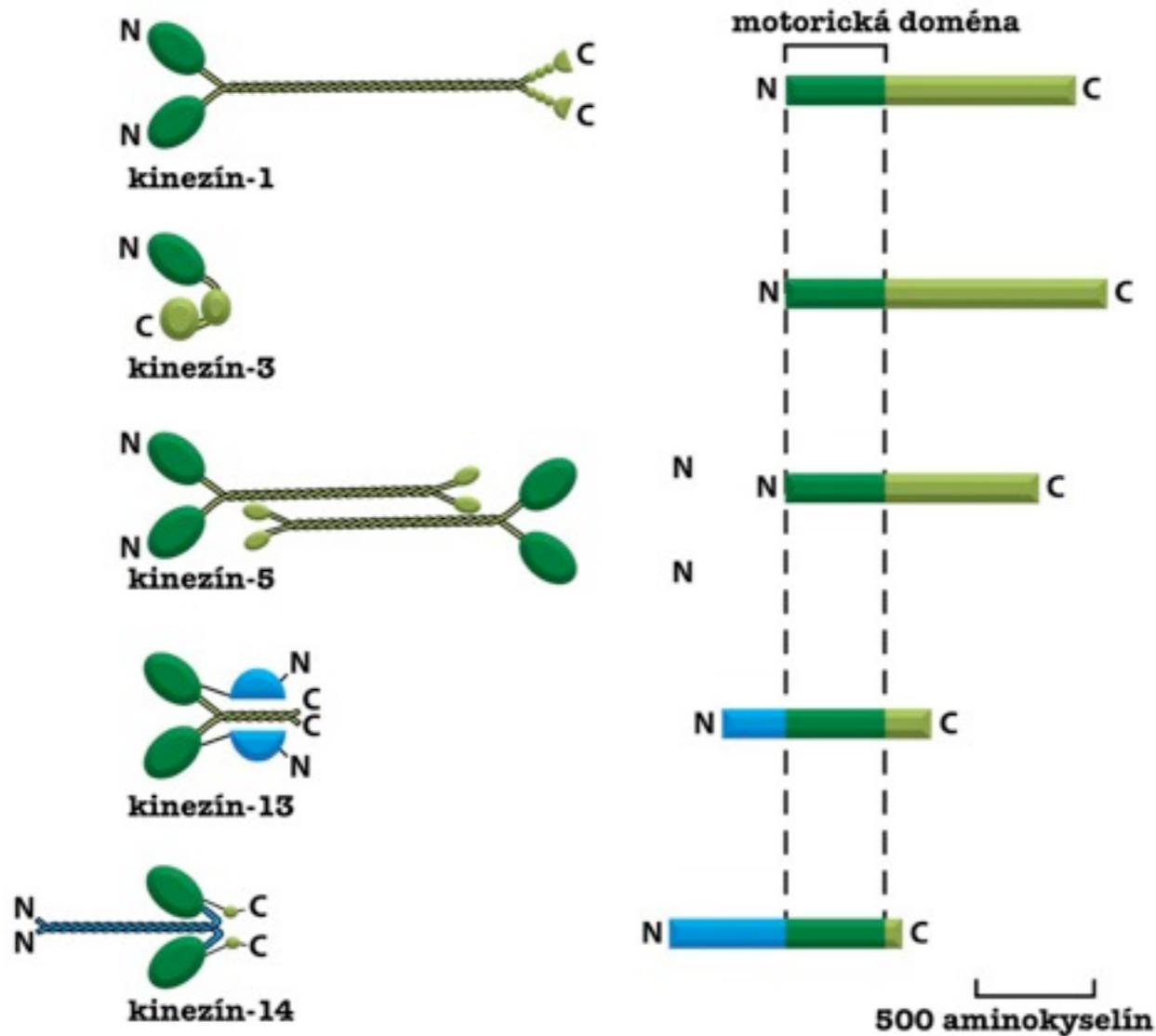
Typy myozínu



Aktín a myozín vo svaloch



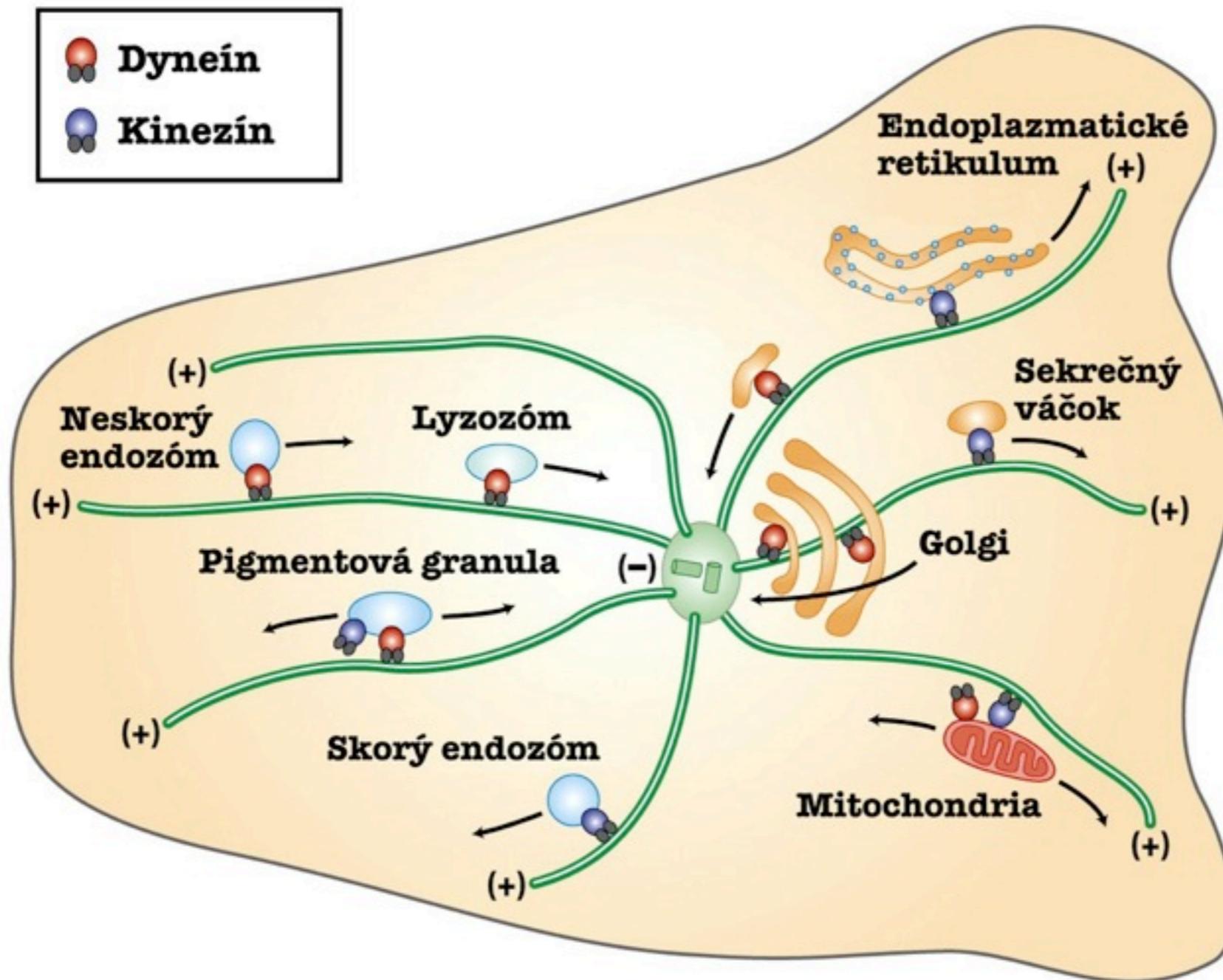
Kinezín a dyneín sú motorové proteíny asociované s mikrotubulami



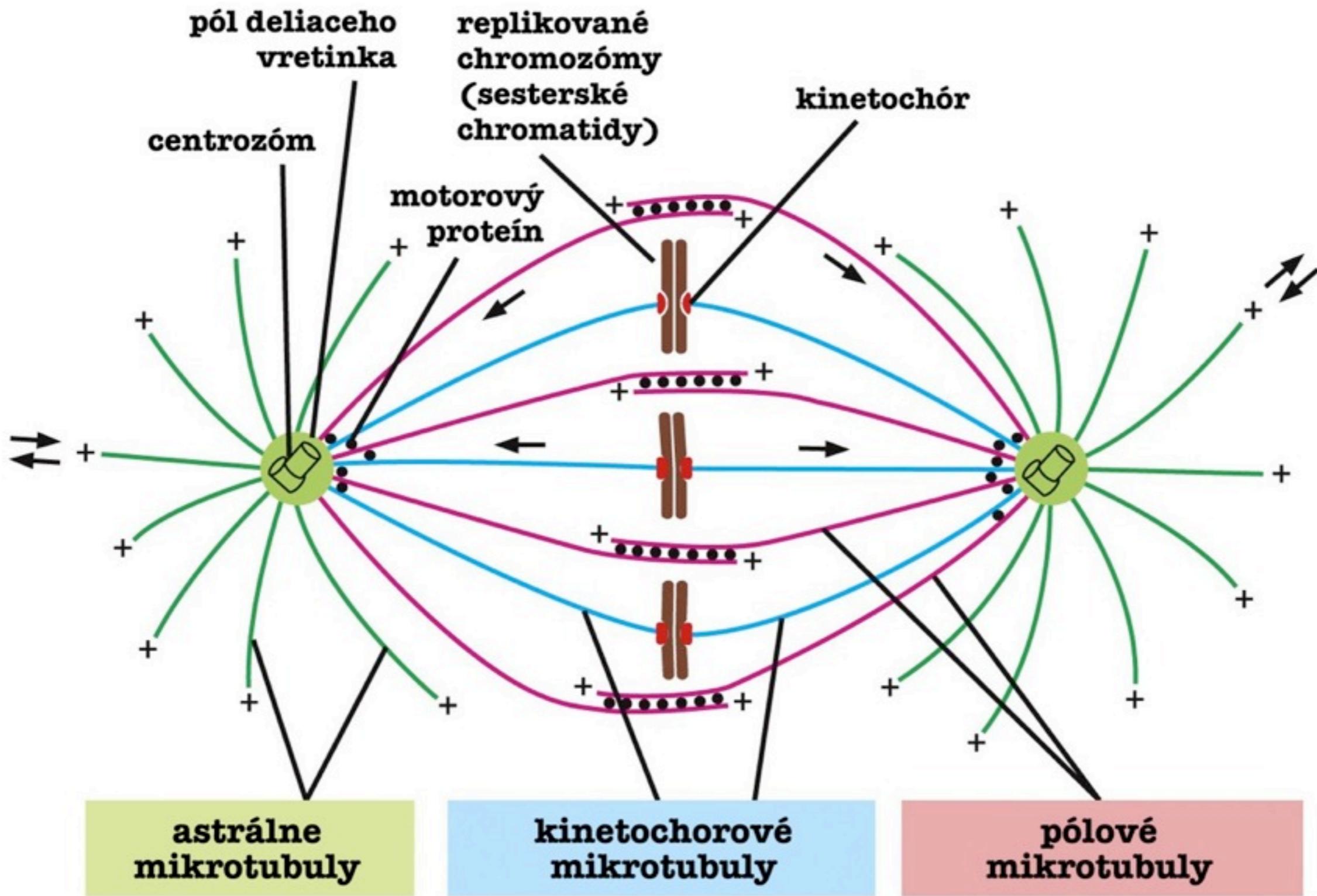
Kinezín - pohyb v smere ku plus koncu

Dyneín - pohyb v smere k minus koncu

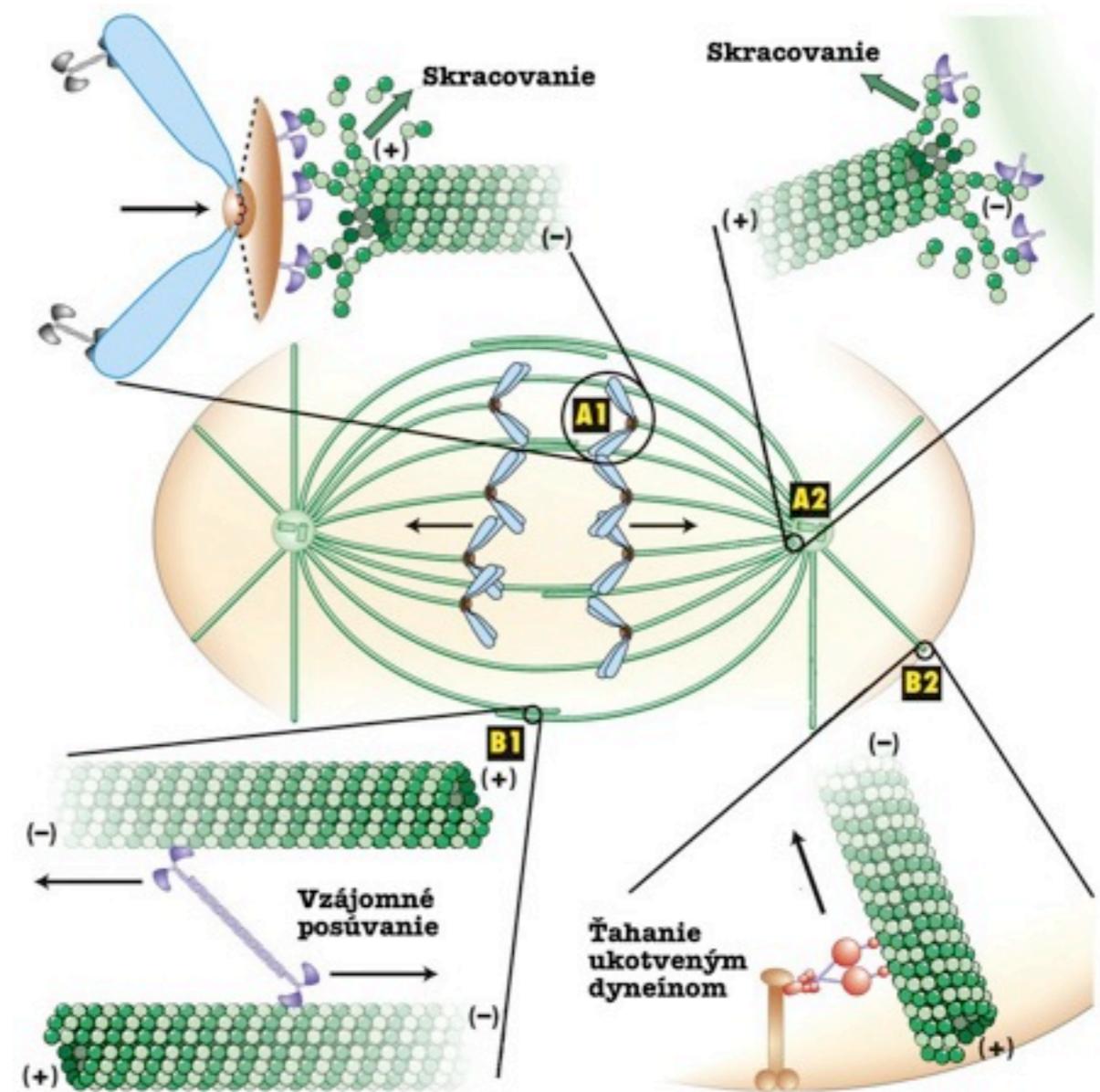
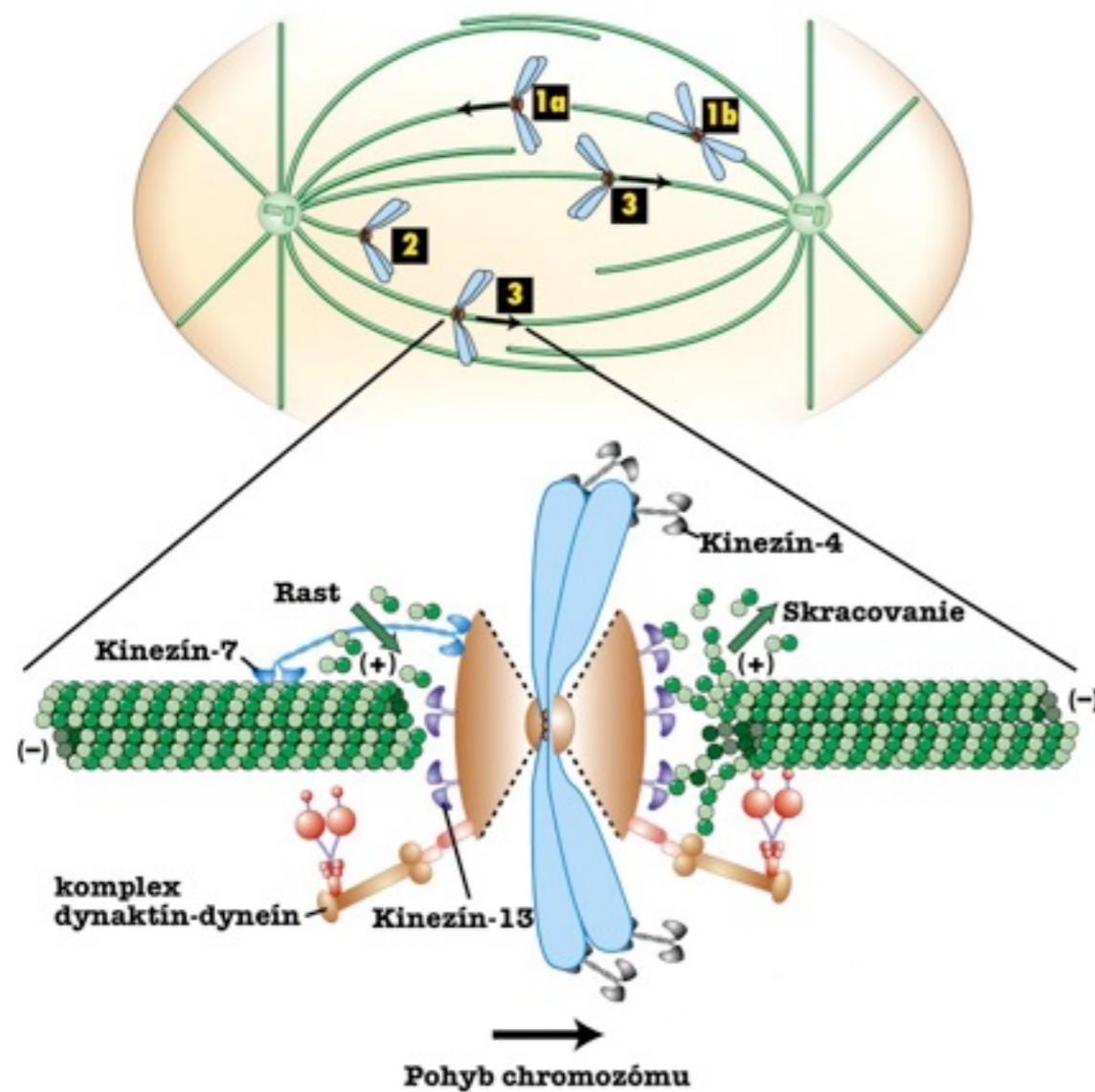
Transport pozdíž mikrotubulov



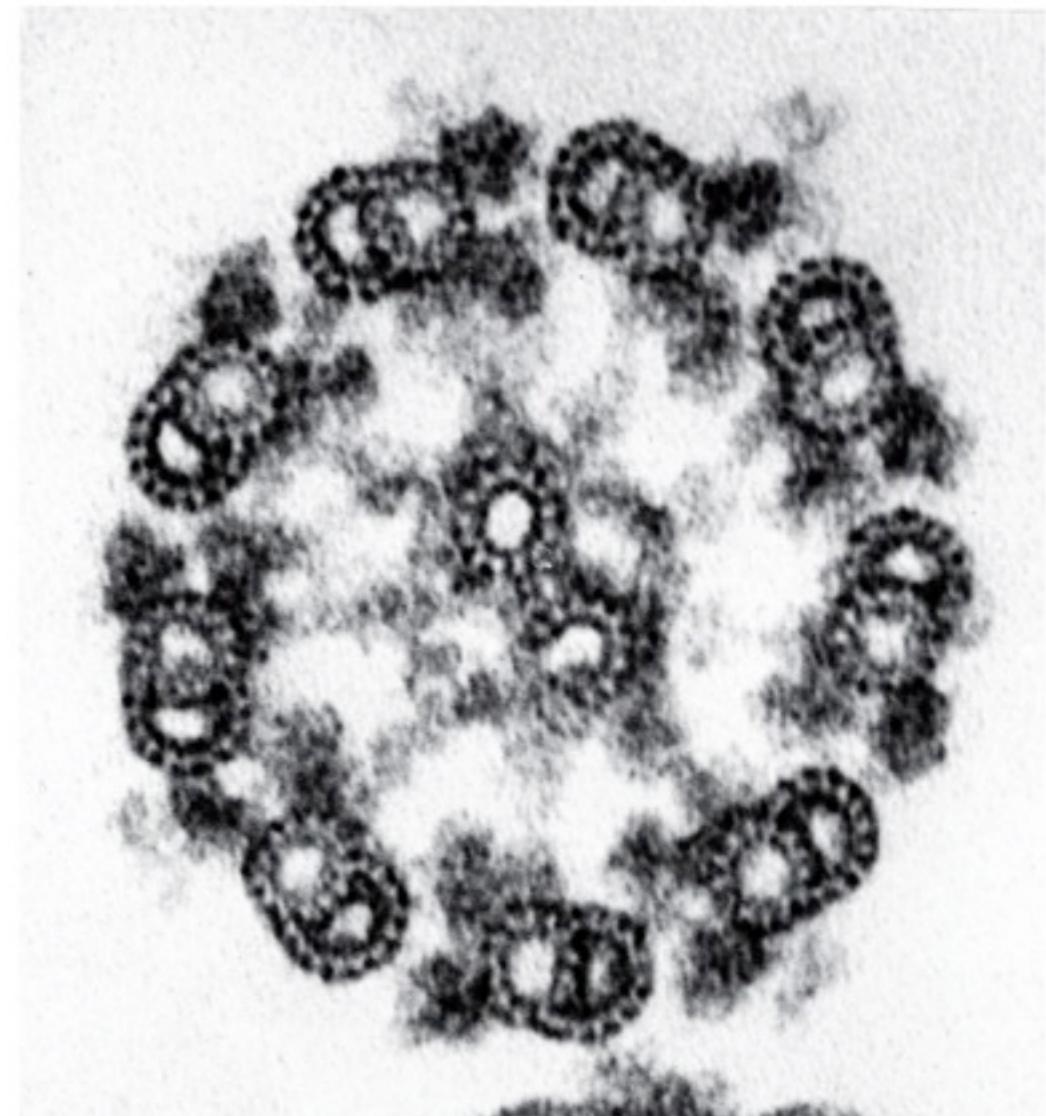
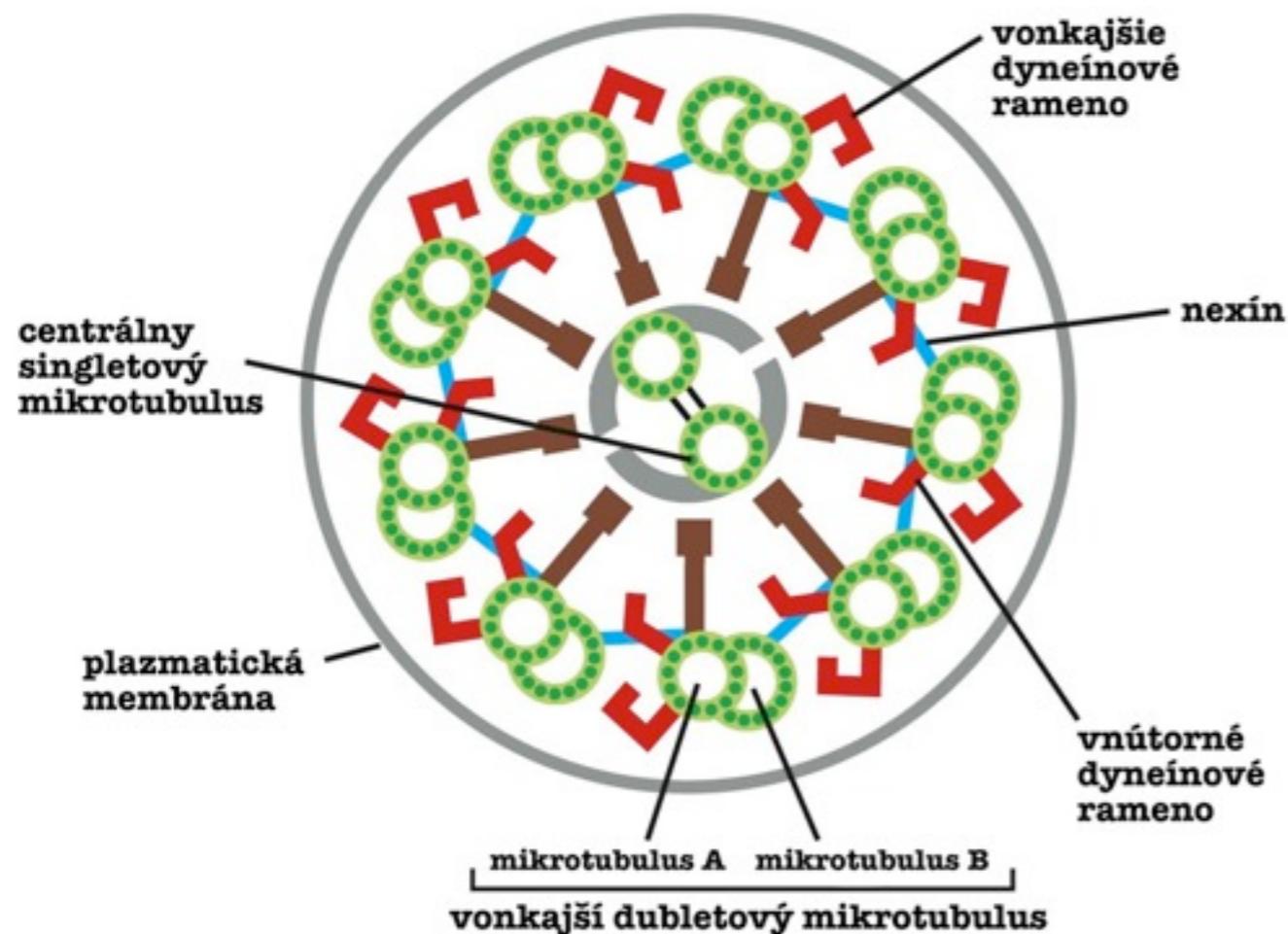
Mikrotubuly počas mitózy



Mikrotubuly počas mitózy

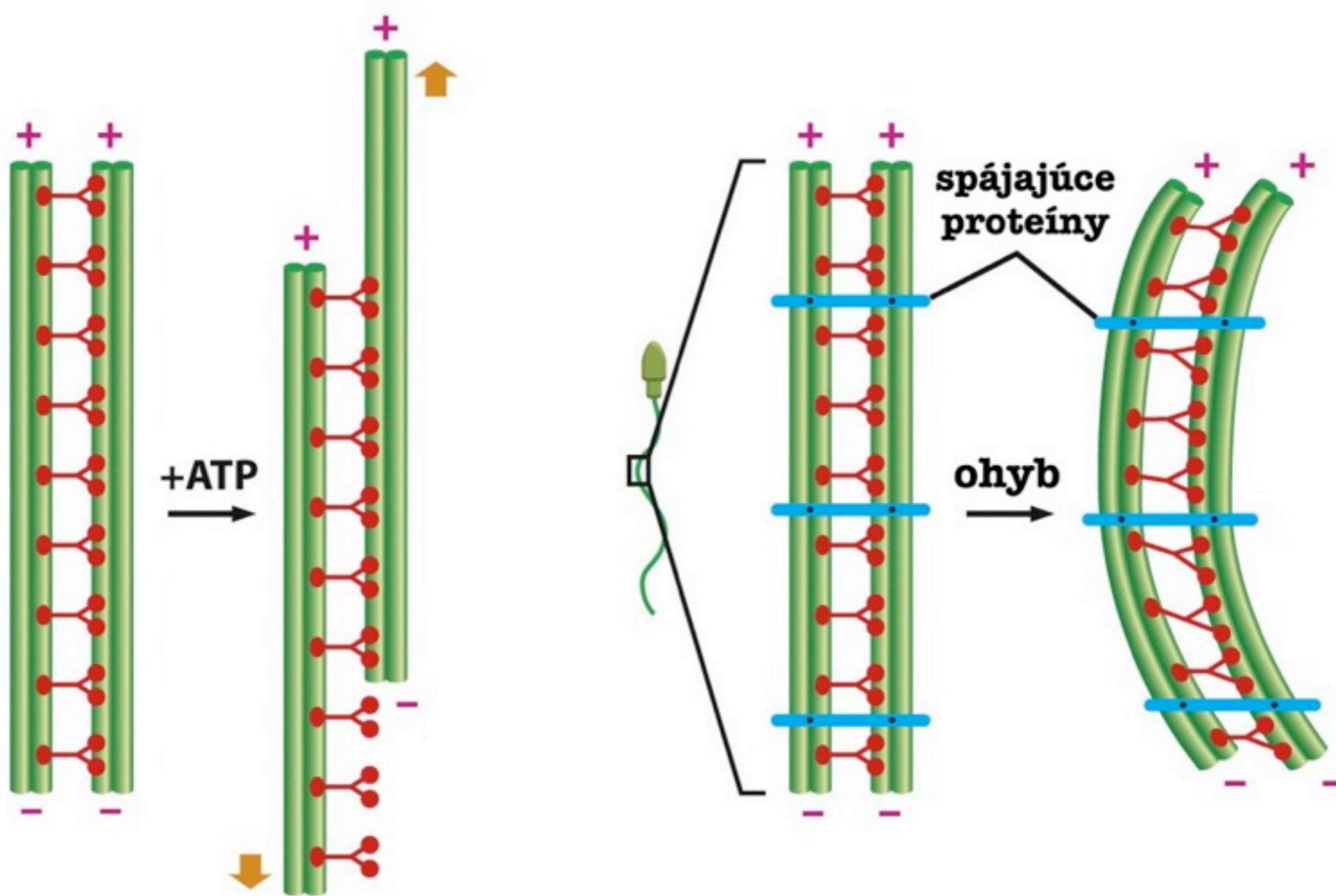


Dyneín v bičíku

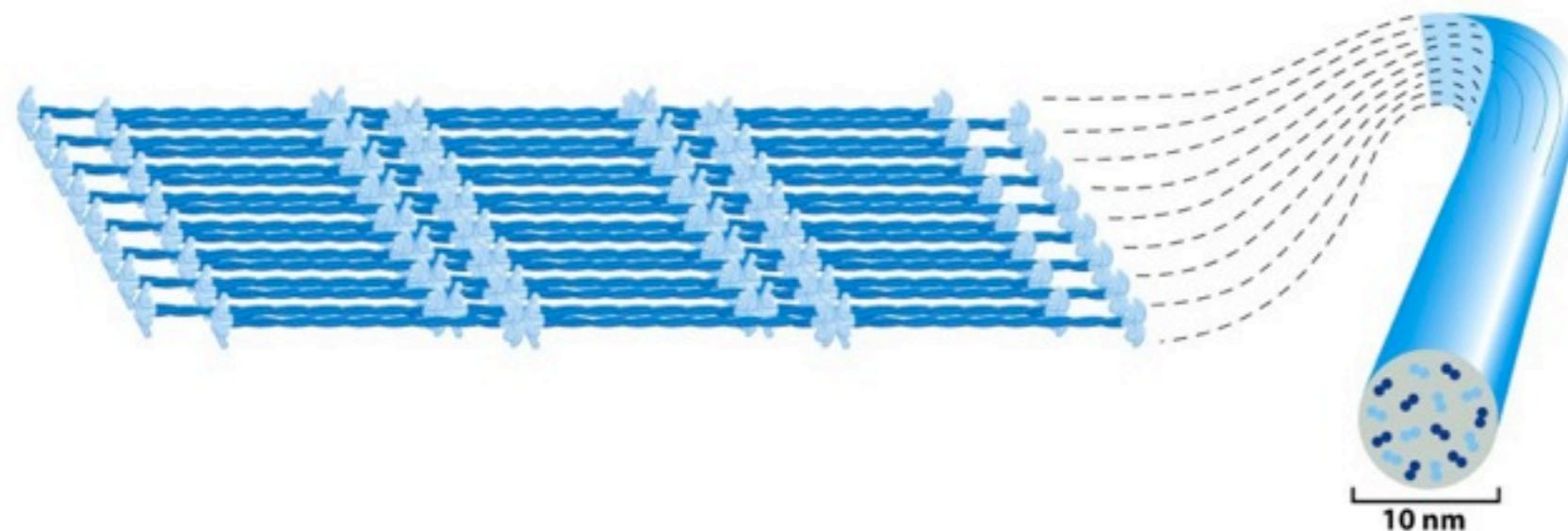
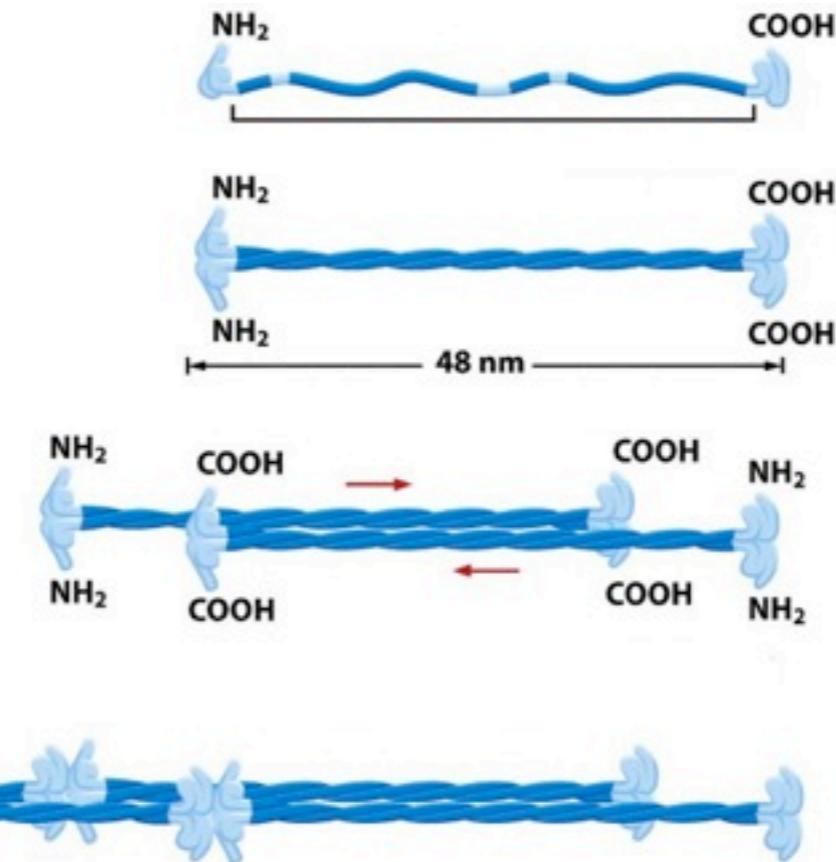
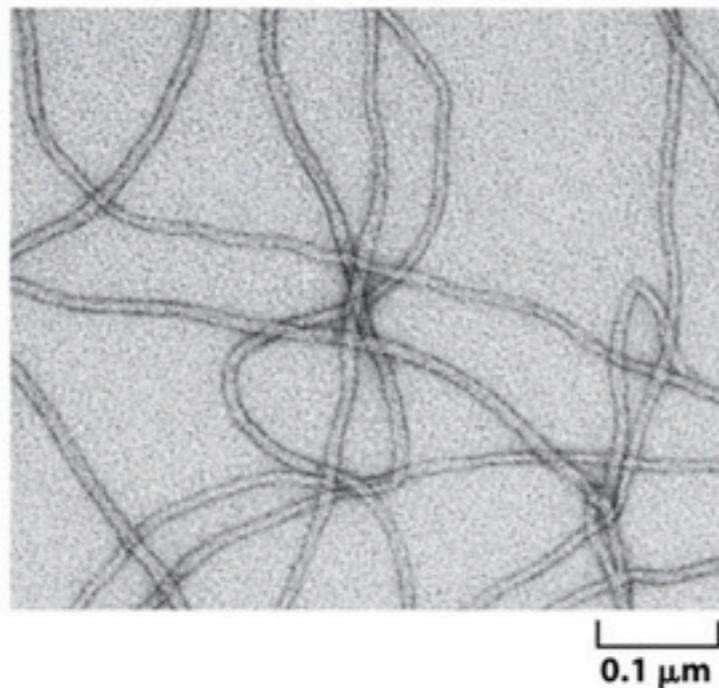


100 nm

Dyneín v bičíku



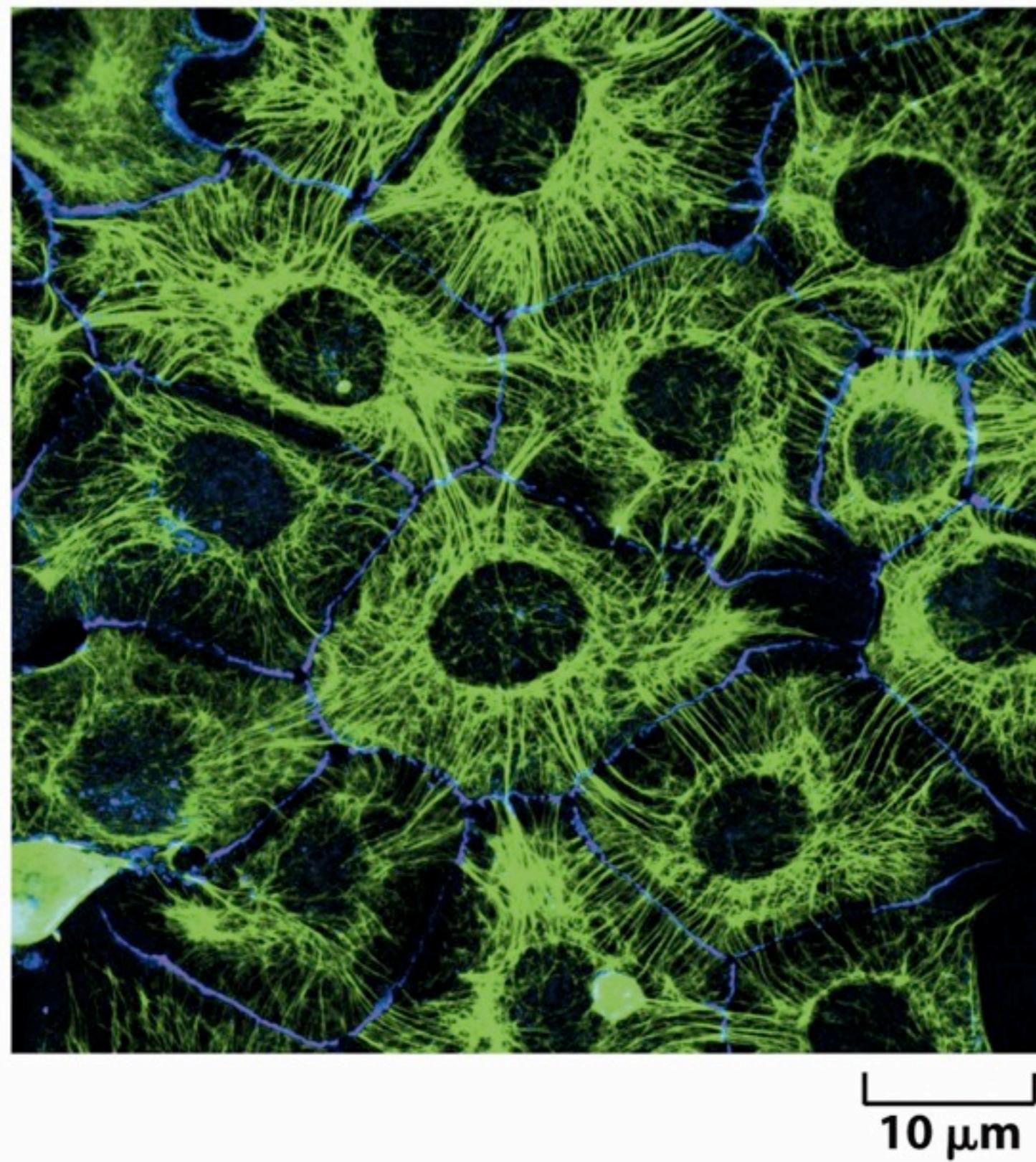
Intermediálne filamenty



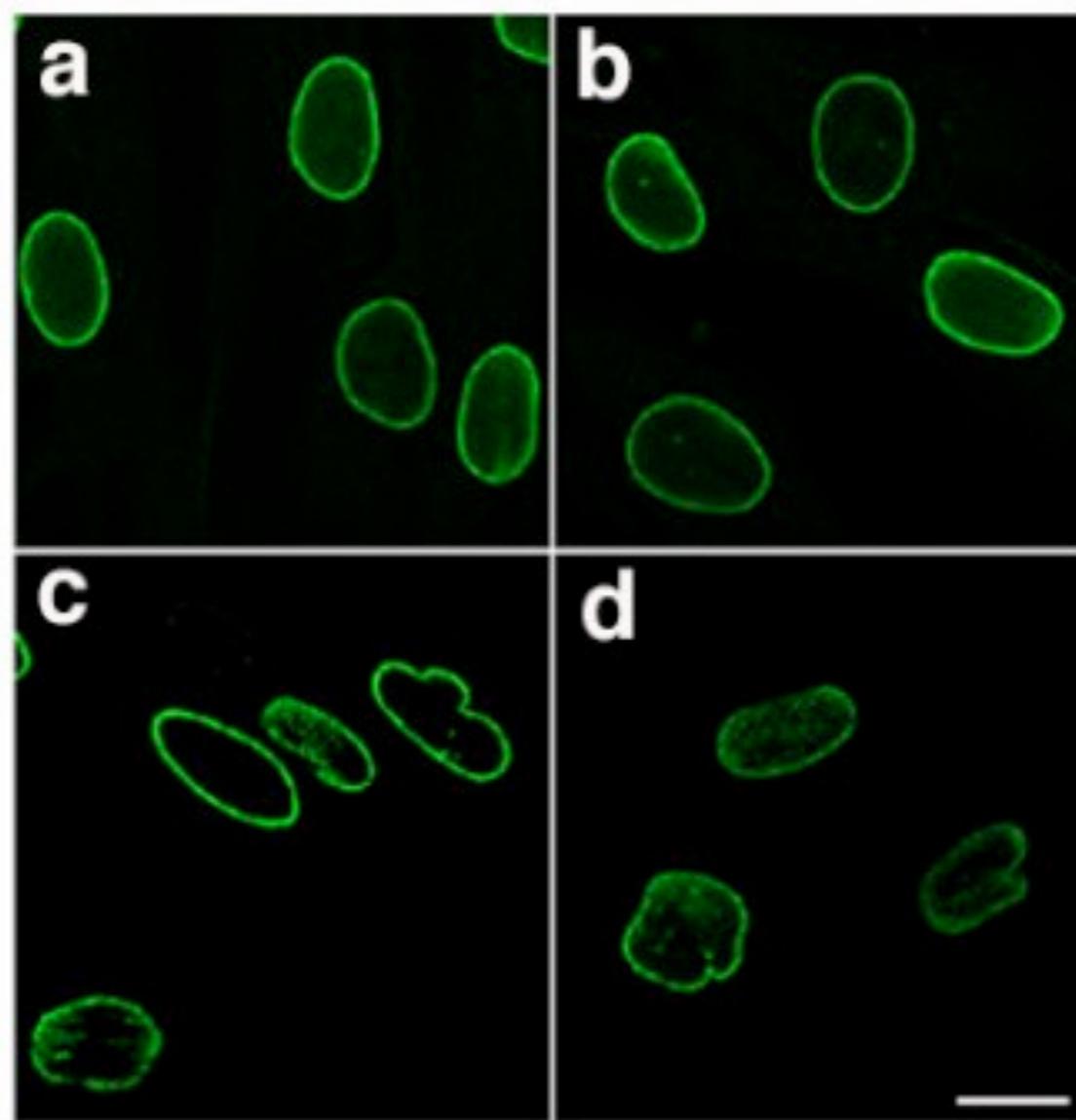
Hlavné typy IF v cicavčích bunkách

TYP IF	KOMPONENT	BUNKOVÁ LOKALIZÁCIA
Jadrové	lamíny A, B a C	jadrová lamina (vnútorná podpora jadrovej membrány)
Vimentínu-podobné	vimentín	rôzne bunky mezenchymálneho pôvodu
	desmín	sval
	glial fibrillary acidic protein	gliálne bunky (astrocyty a niektoré Schwannové bunky)
	periferín	niektoré neuróny
Epiteliálne	keratíny typu I (kyslé)	epitheliálne bunky a ich deriváty (napr., vlasy a nechty)
	keratíny typu II (zásadité)	
Axonálne	proteíny neurofilamentov (NF-L, NF-M, a NF-H)	neuróny

Keratín v epitelových bunkách

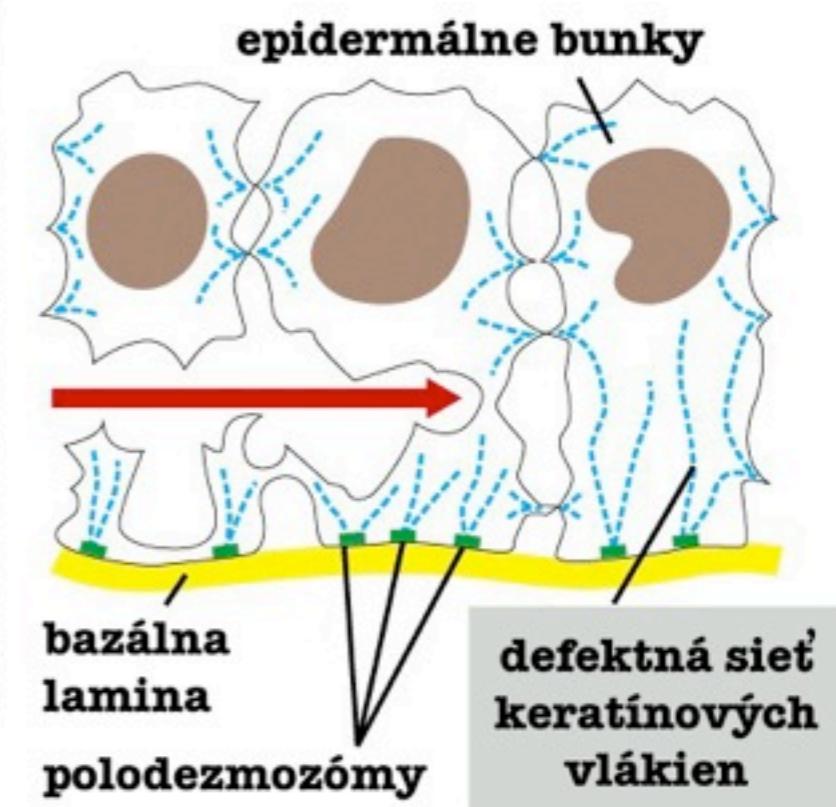
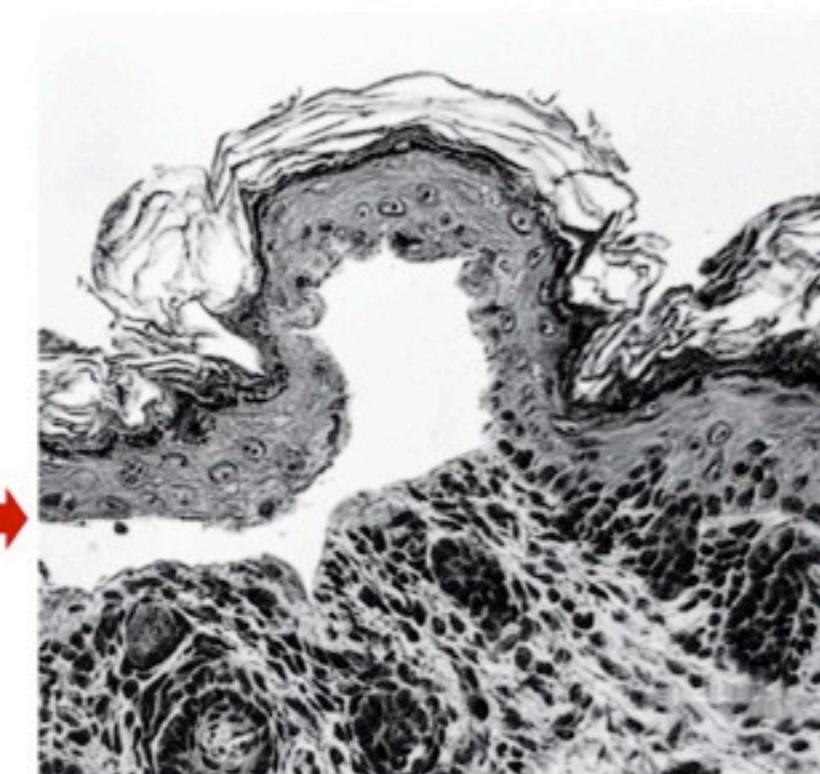
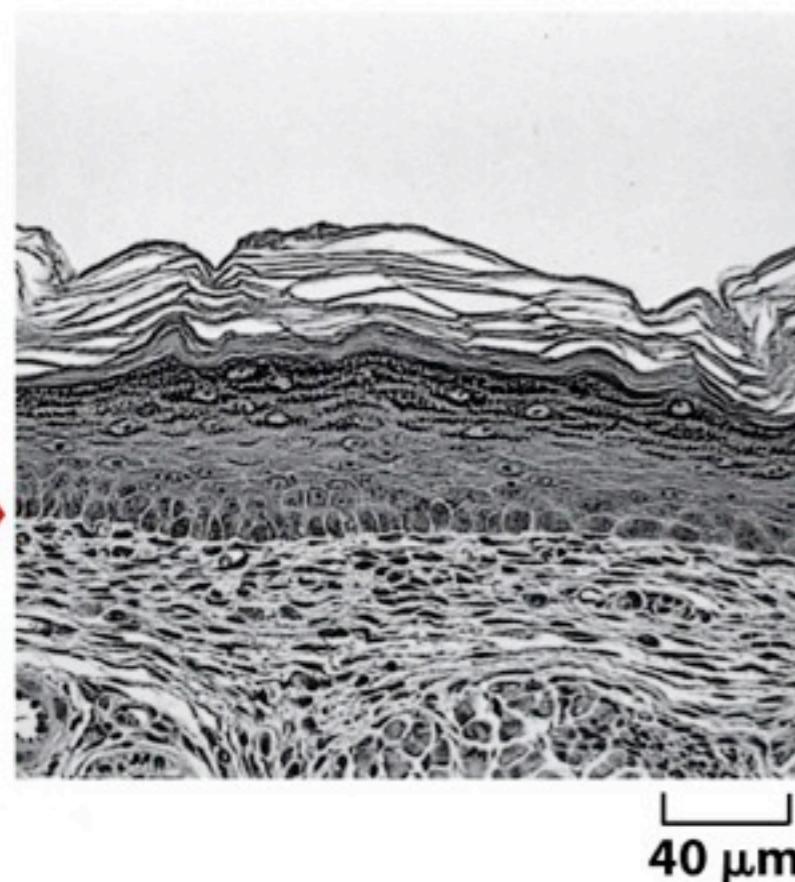


Laminopatie



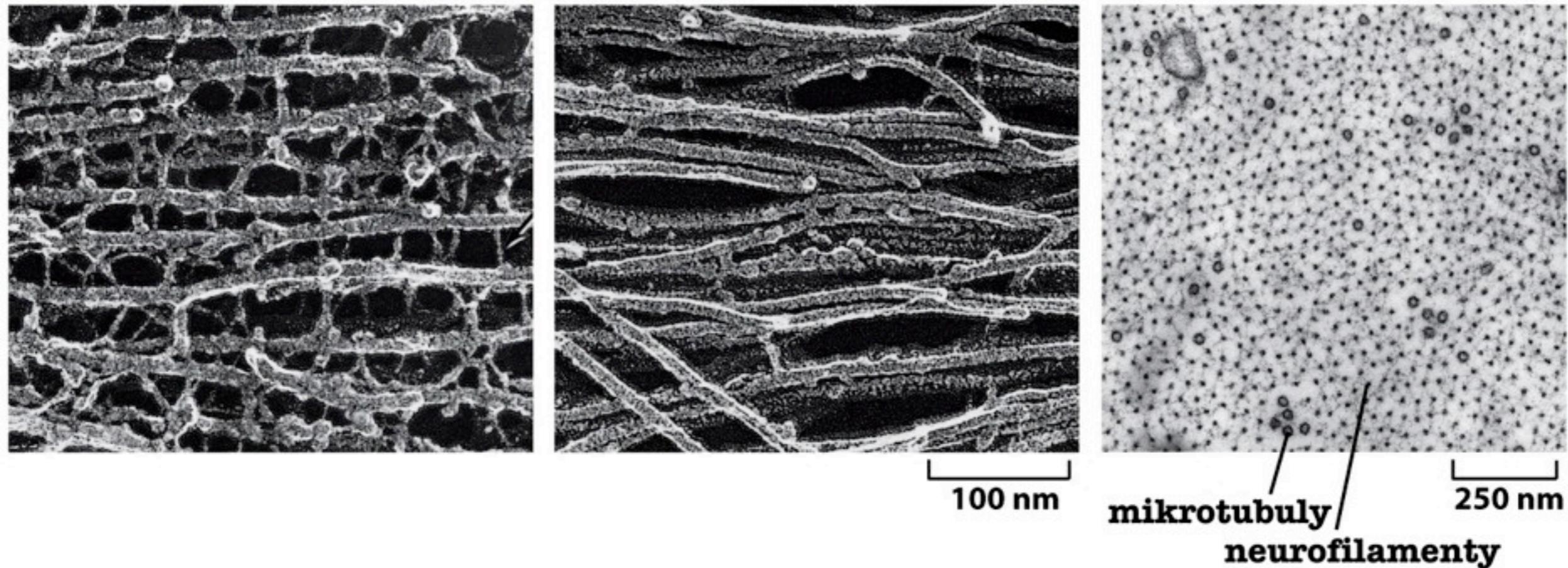
(c,d) Hutchinson-Gilford progeria syndrome (HGPS)

Mutácie v génoch kódujúcich keratín spôsobujú choroby



epidermolysis bullosa simplex

Neurofilamenty



Akrylamid - neurotoxin

amyotrophic lateral sclerosis (ALS, or Lou Gehrig's Disease) - genetické ochorenie, nadexpresia, akumulácia a abnormálne skladanie neurofilamentov