Cell Motility

Prof. Alp CAN

Department of Histology and Embryology

www.alpcan.com

Motile Structures in Cells

Motile=Moving; Motility=Movement

- Cilia (fast moving cell protrusions)
  - Epithelial cells
- Flagella (whip-like cell protrusions)
  - Tail of spermatozoa (sperm cells)
- Cytoplasmic vesicles and some organelles
  - Axonal transport, Vesicle transport along Golgi cisternae
  - Transport of endocytotic, exocytotic and pinocytotic vesicles
  - Transport (tracking) of chromosomes
  - Actin-myosin interaction in muscle contraction
- Cell movements
  - Cell migration (especially in embryonic period)
  - Chemotaxis

Questions

- How do the cells and organelles move?
- What makes them moving?
- What controls their movement?
- Where does the energy come from?

Motor Proteins

They carry cargo along microfilaments and microtubules (organelles, Golgi stacks, secretory vesicles etc.)
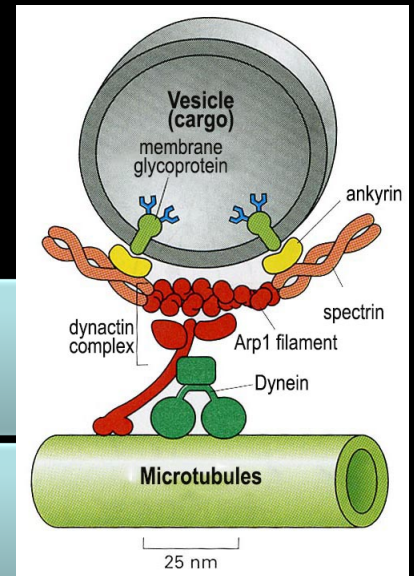
They bind to cytoskeletal elements from their head region (motor region)
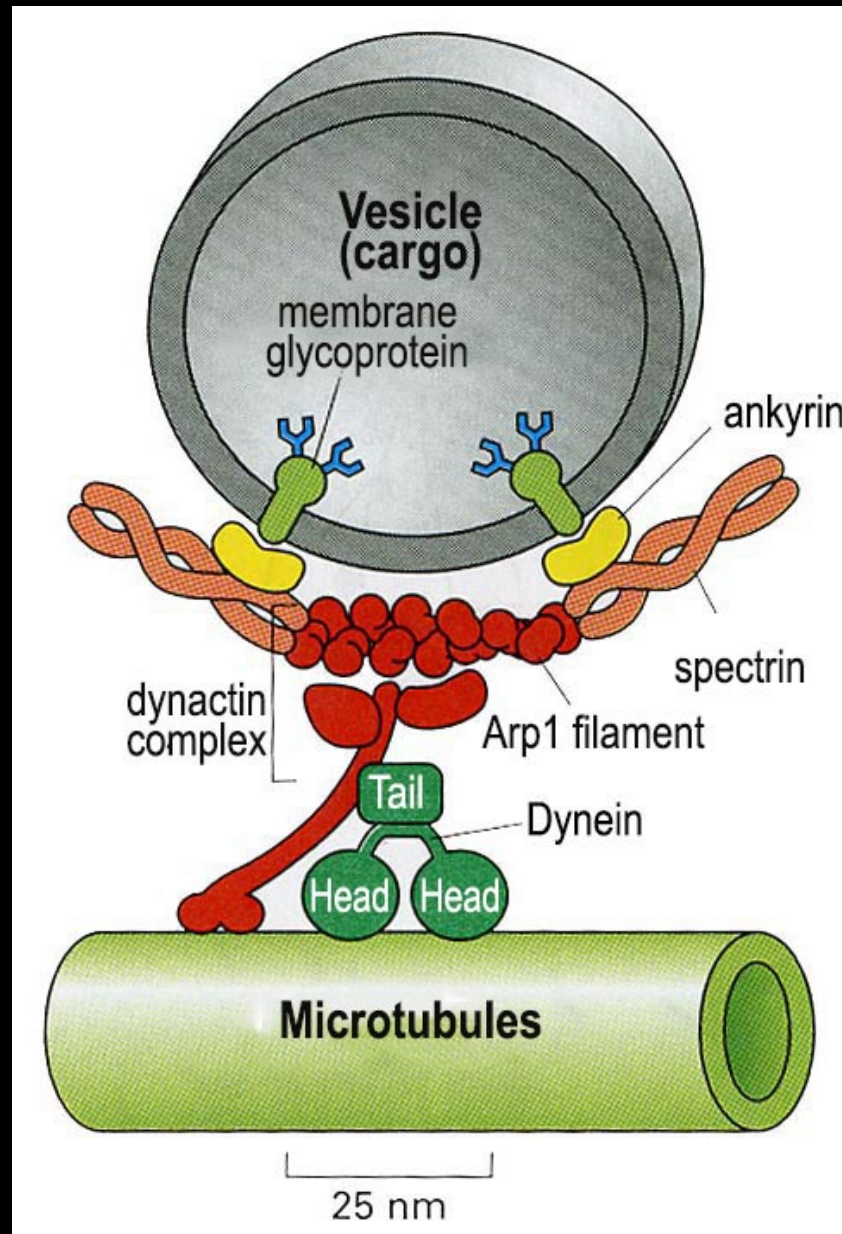
They bind to cargo molecule by their tail region

They always move to one (+ or -) direction

They hydrolize ATP for energy utilization

Some of them provides sliding of cytoskeletal filaments along other filaments (eg; contraction)

Interactions of head and tail regions of a motor protein

Microfilament motor proteins	Microtubule motor proteins

Myosin-1 (non-muscle myosin)
- in all cells

Myosin-2 (muscle myosin)
- in muscle cells and during cytokinesis

Kinesin
- Saltatory movements hareket, mitosis, meiosis
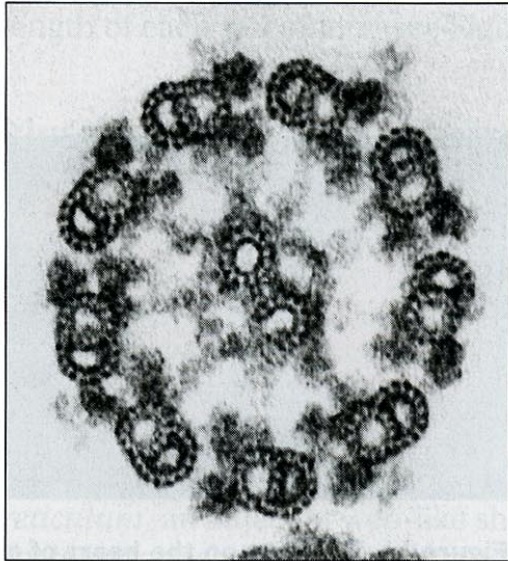- carry to (+) end

Dynein$_{Cytoplasmic}$
- Saltatory movements hareket, mitosis, meiosis
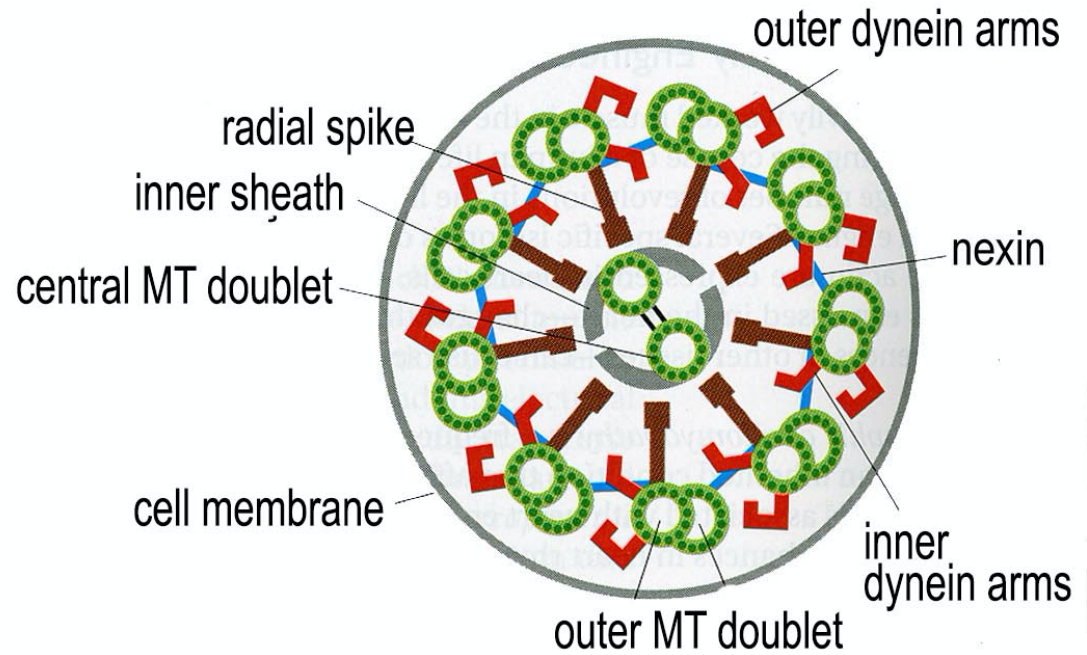- carry to (-) end
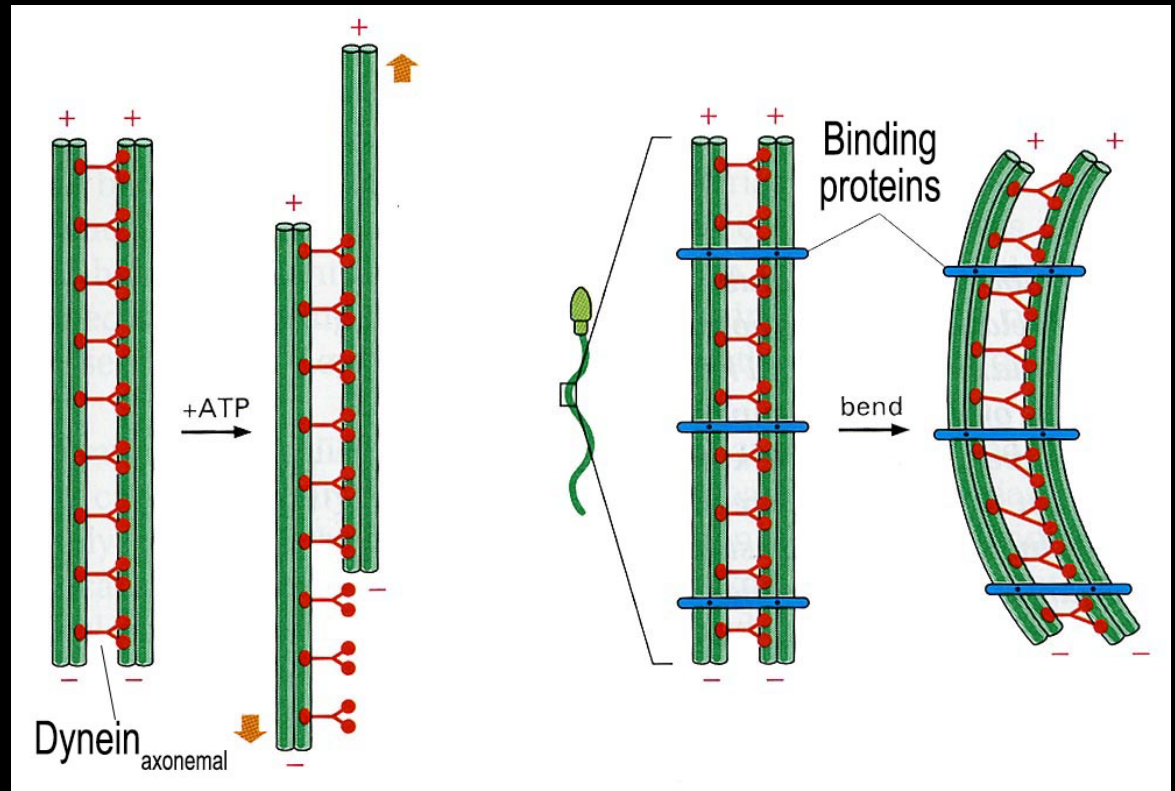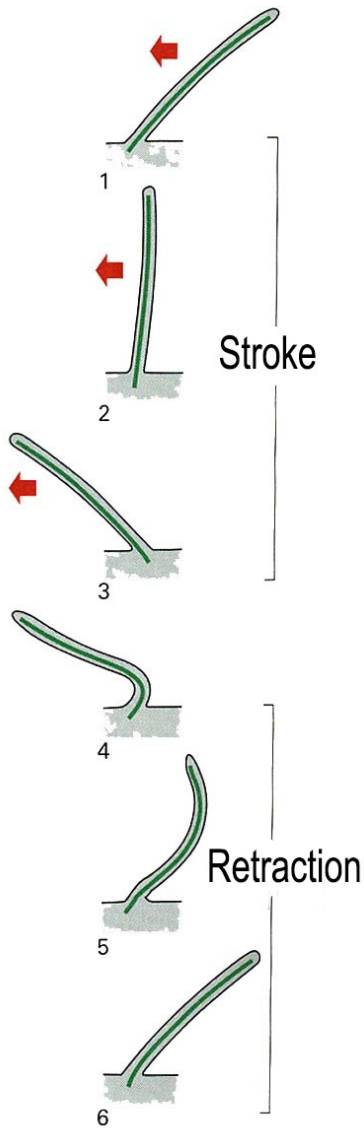
Dynein$_{Axonemal}$
- Cilia, flagella, spermatozoa

Cilium / Flagellum Structure

100 nm

outer dynein arms

radial spike

inner sheath

central MT doublet

nexin

cell membrane

inner dynein arms

outer MT doublet

Alberts, 2015

Cilium / Flagellum Movement

Bending of cilia
instead of up & down movement
due to binding proteins

Chemotaxis

- Cell migration towards a chemical agent
- Cell migration in embyonic development
- Fertilization
- Inflammation and immunity

Neutrophil chemotaxis