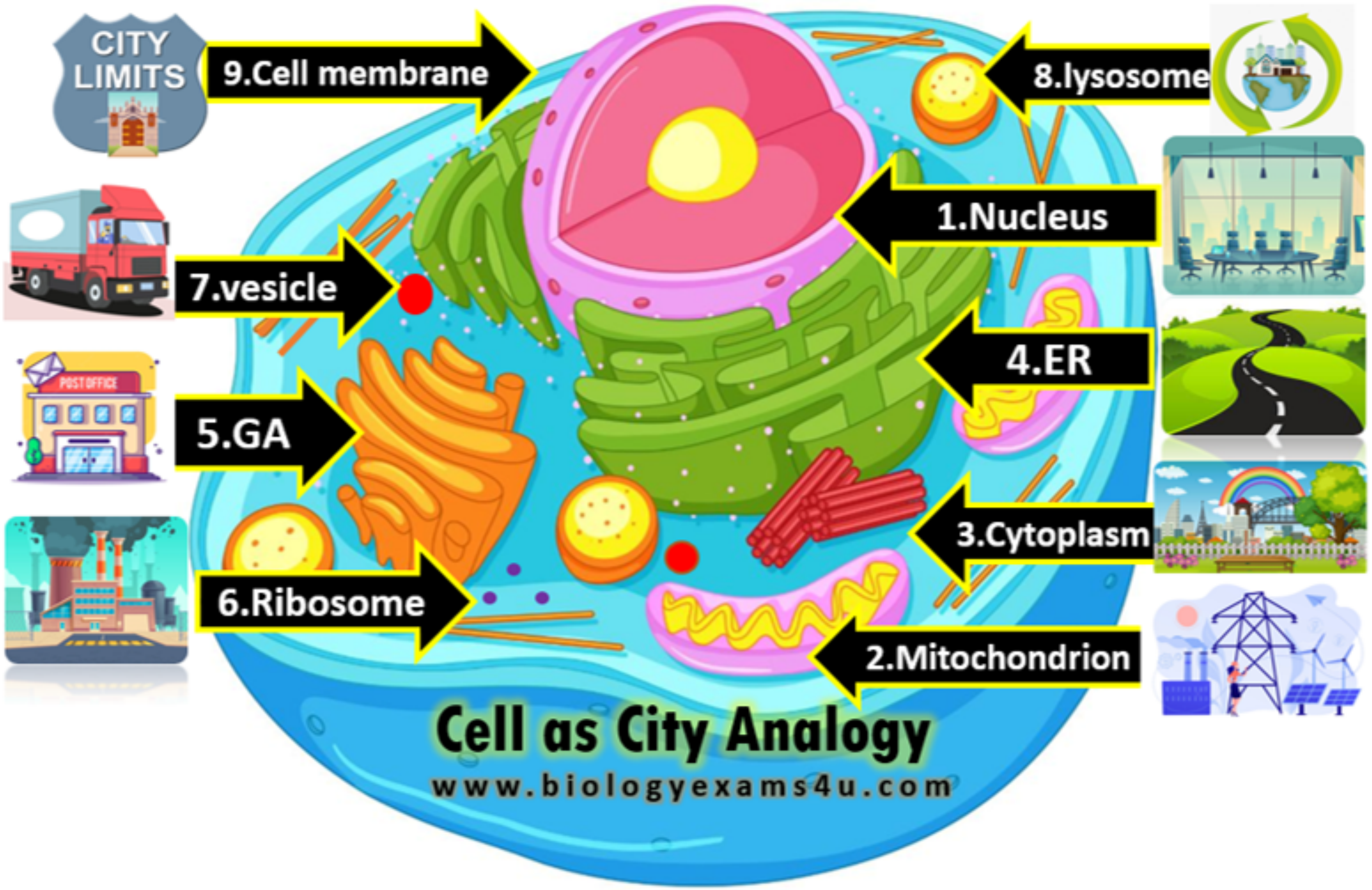
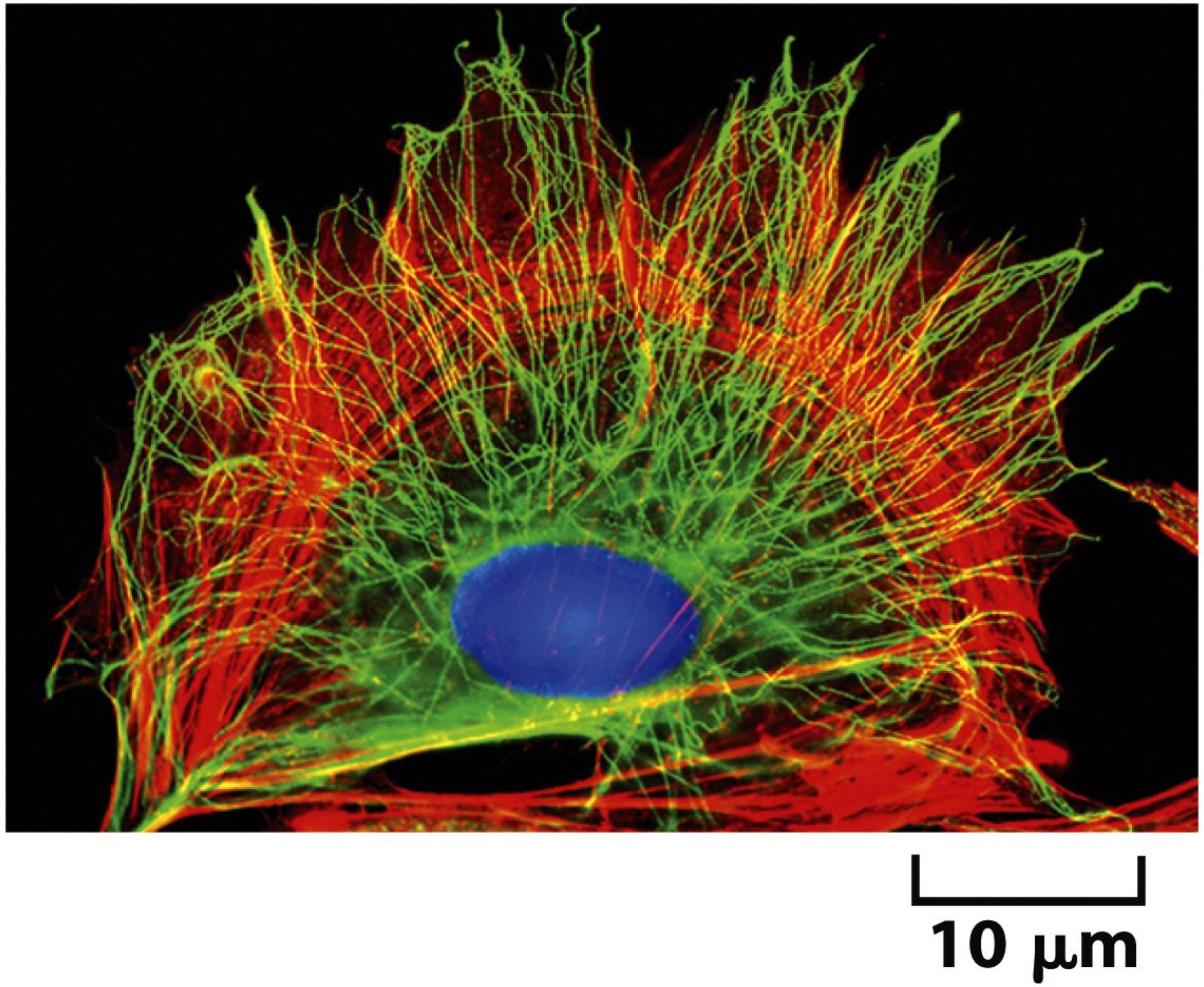
Different types of machines that make the cell function

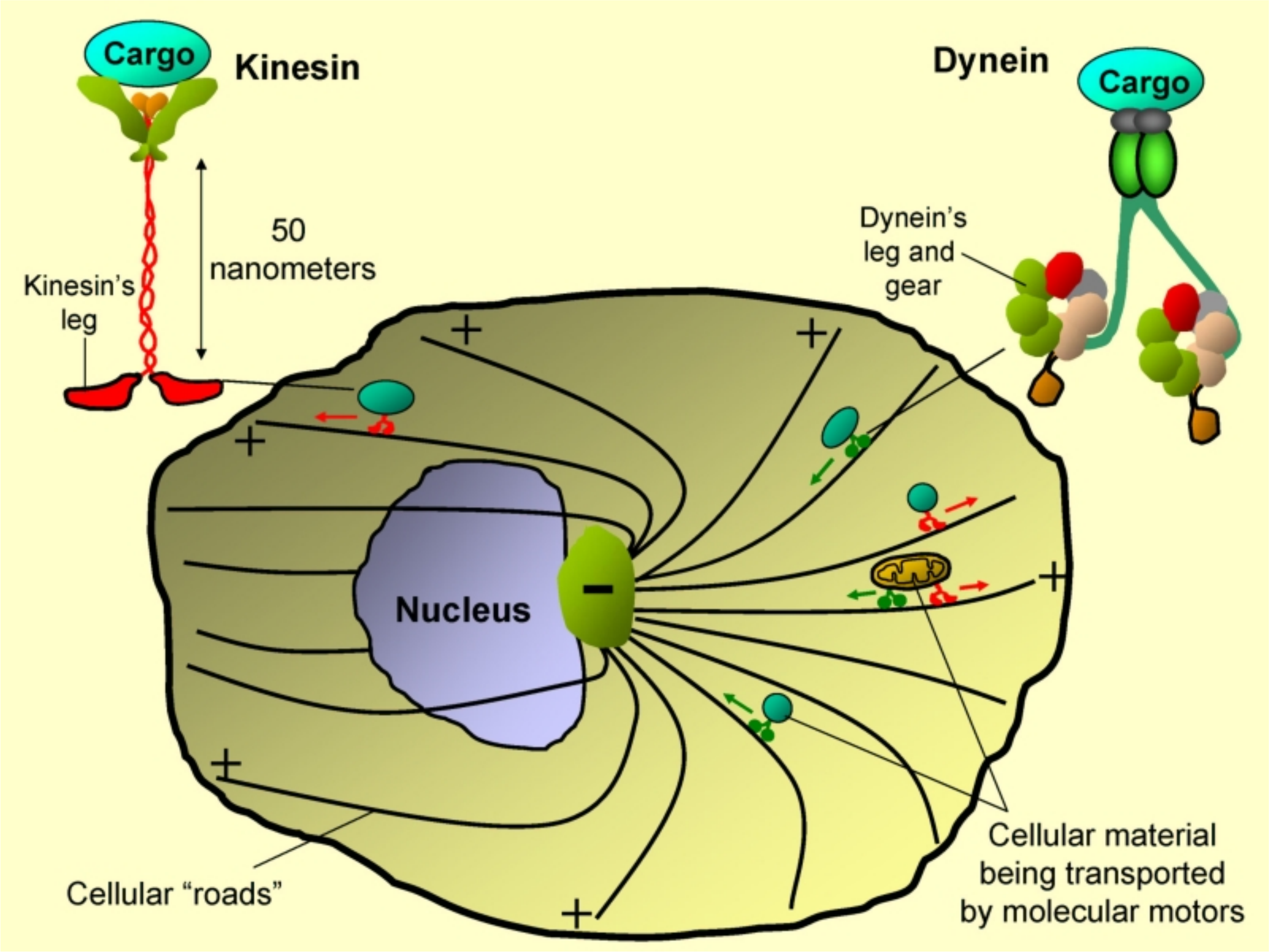


Imagine different types of machines and tools that you would need to make a city function!

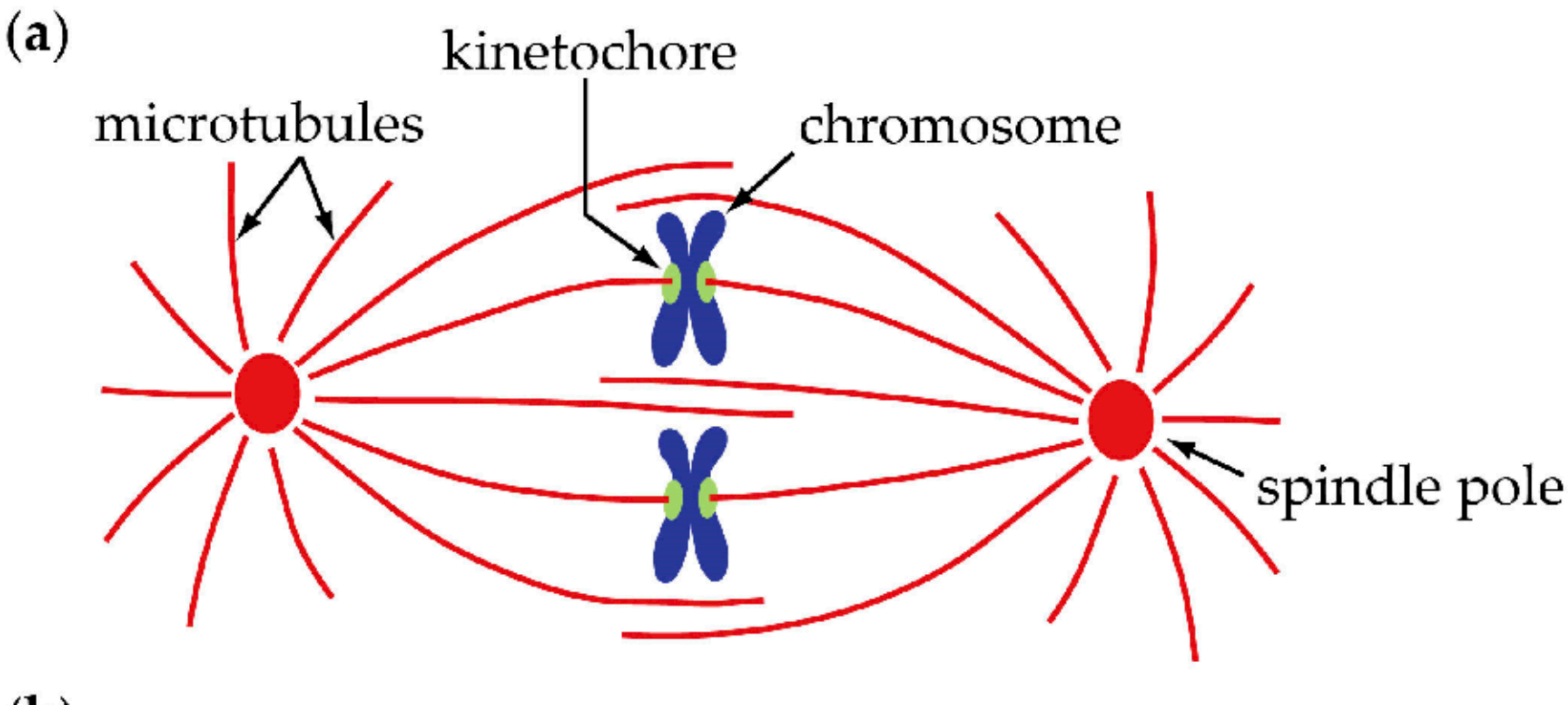
A view of the "city"



Two motors travelling along microtubule



Microtubule search and capture chromosomes



Outcome of this movement: quick control of spatial organization of molecules

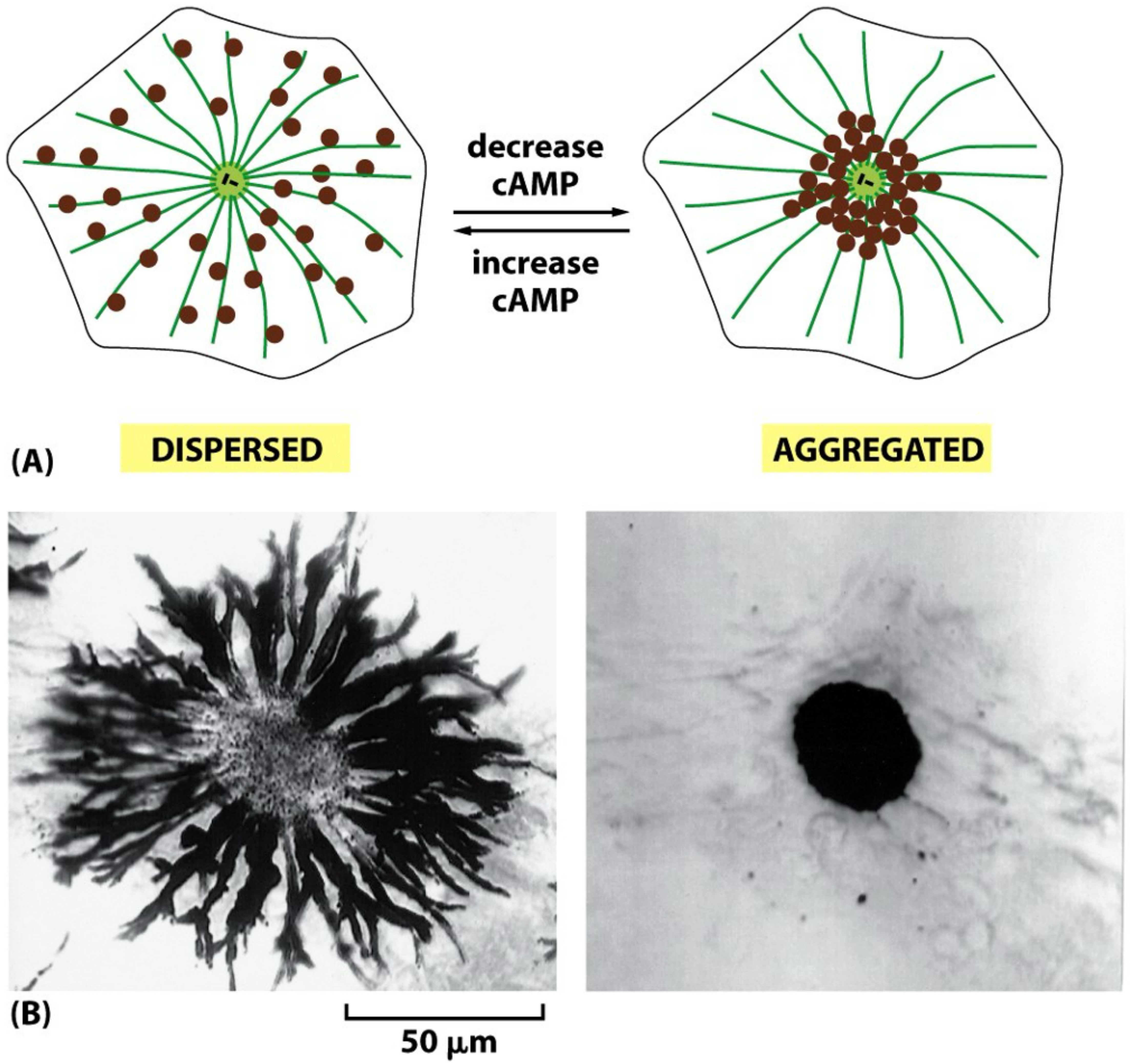
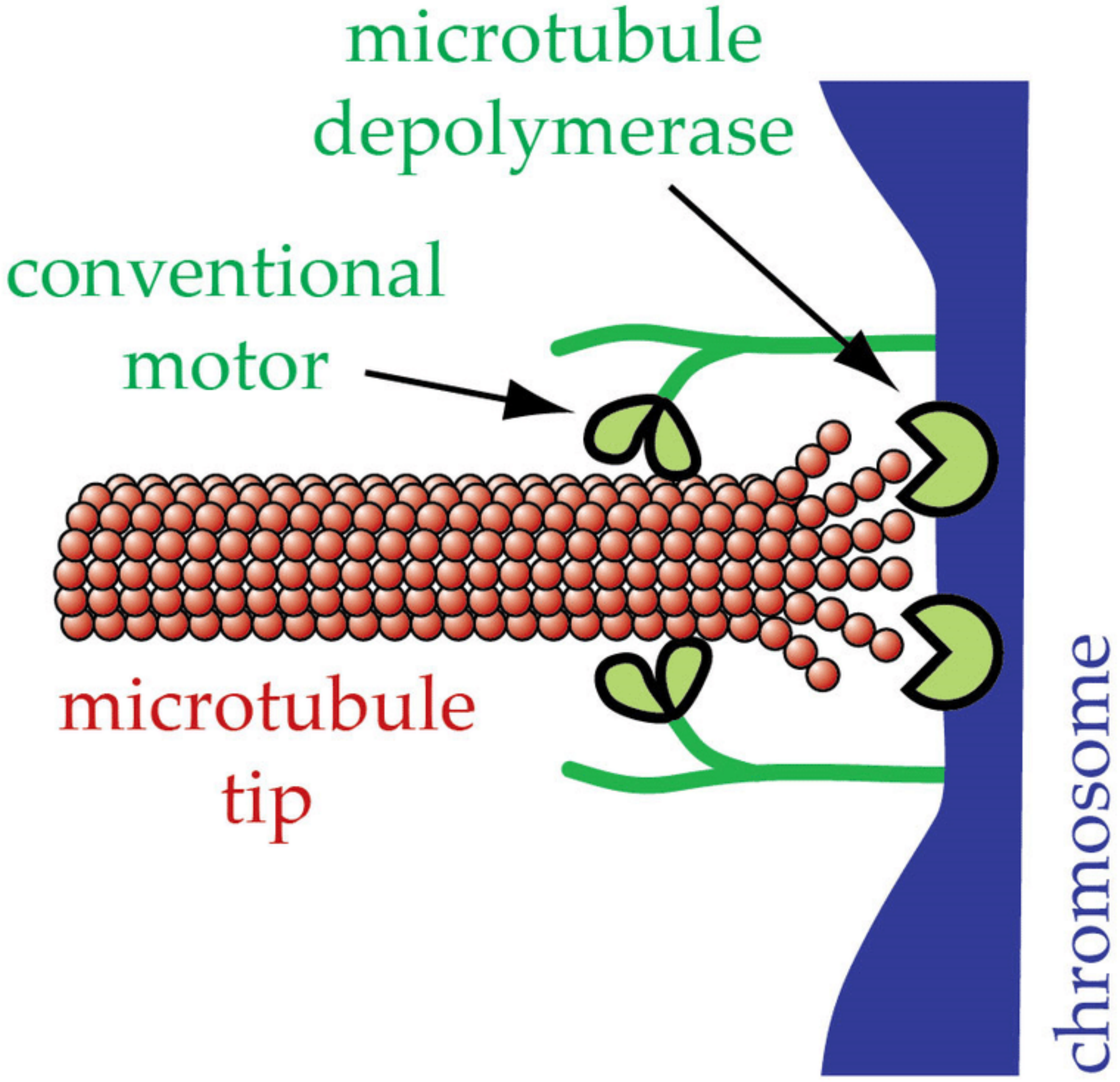


Figure 16-70 *Molecular Biology of the Cell* (© Garland Science 2008)

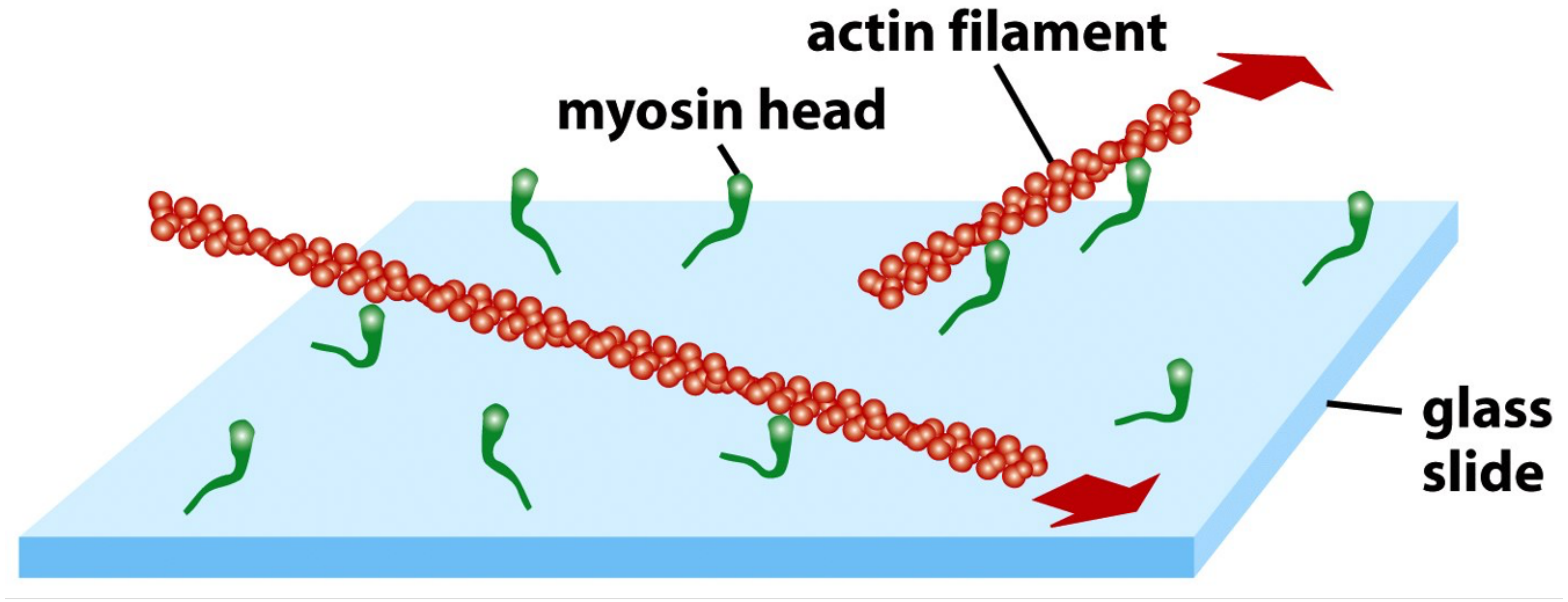
Figure 16–70 Regulated melanosome movements in fish pigment cells. These giant cells, which are responsible for changes in skin coloration in several species of fish, contain large pigment granules, or melanosomes *(brown)*. The melanosomes can change their location in the cell in response to a hormonal or neuronal stimulus. (A) Schematic view of a pigment cell, showing the dispersal and aggregation of melanosomes in response to an increase or decrease in intracellular cyclic AMP (cAMP), respectively. Both redistributions of melanosomes occur along microtubules. (B) Bright-field images of a single cell in a scale of an African cichlid fish, showing its melanosomes either dispersed throughout the cytoplasm *(left)* or aggregated in the center of the cell *(right)*. (B, courtesy of Leah Haimo.)

How chameleons change color?

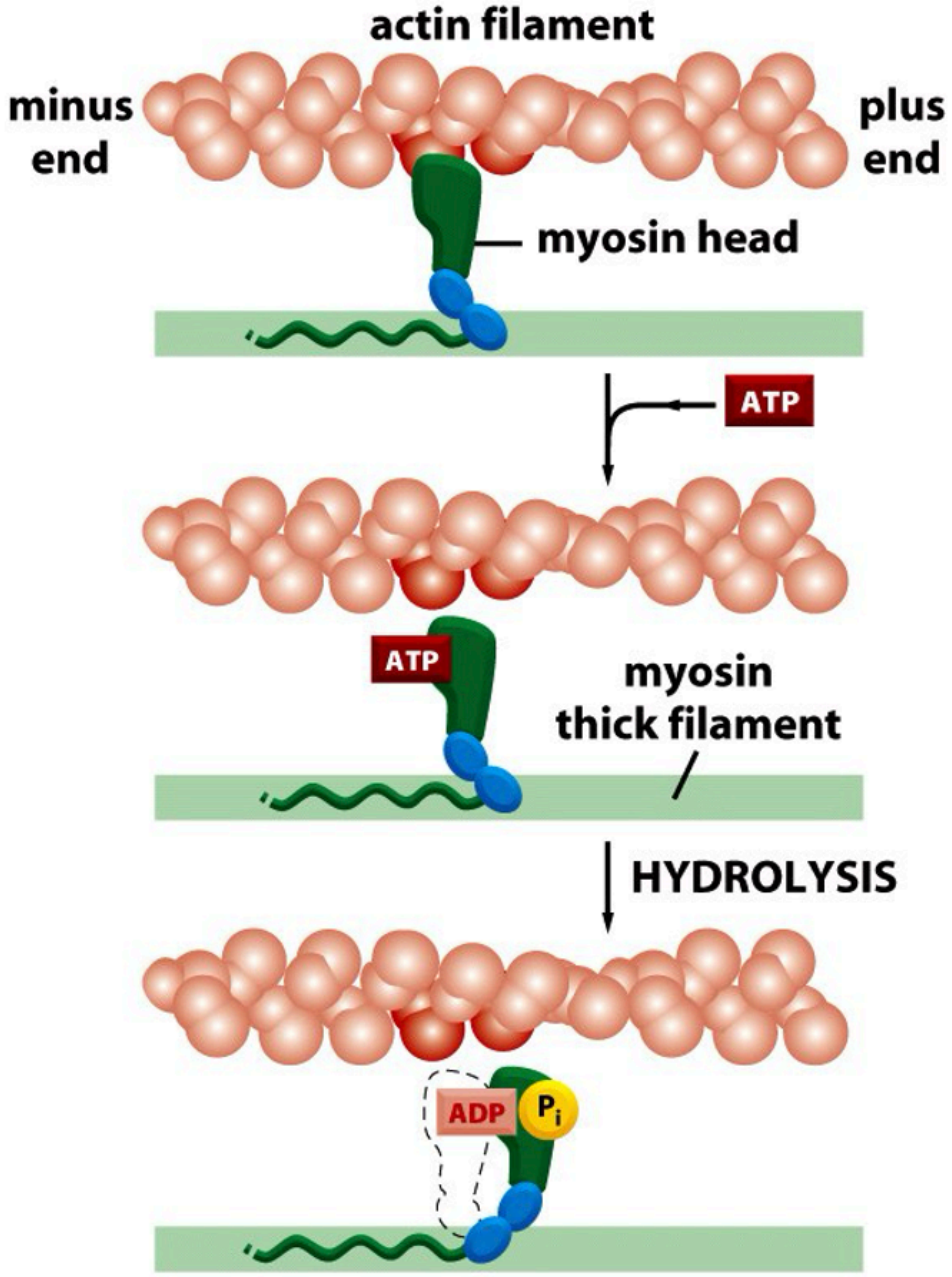
These motors pull chromosomes during cell division, in conjunction with microtubule depolymerisation



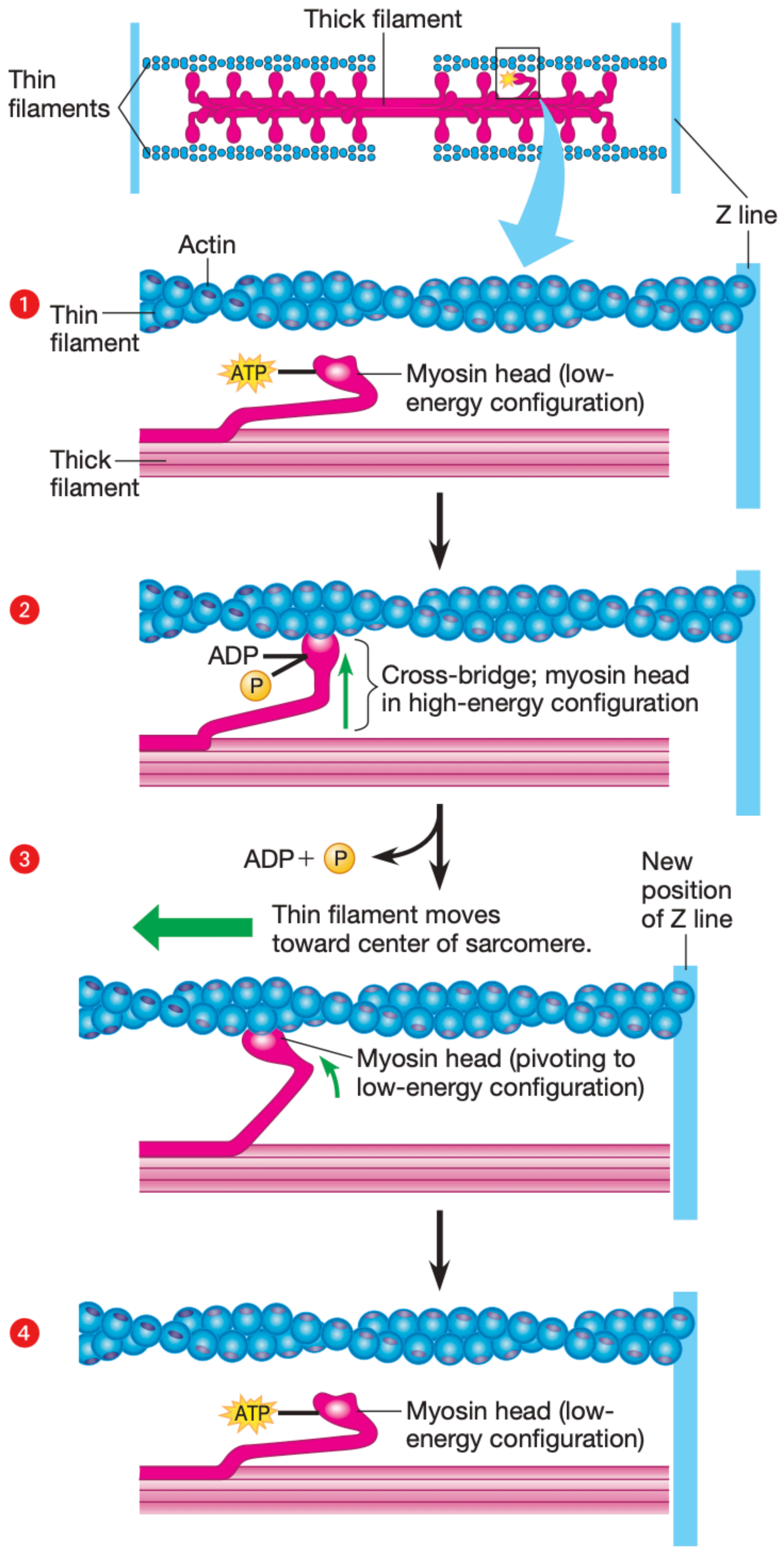
Myosin: a motor family that binds to actin



Myosin uses ATP hydrolysis and pushes Actin



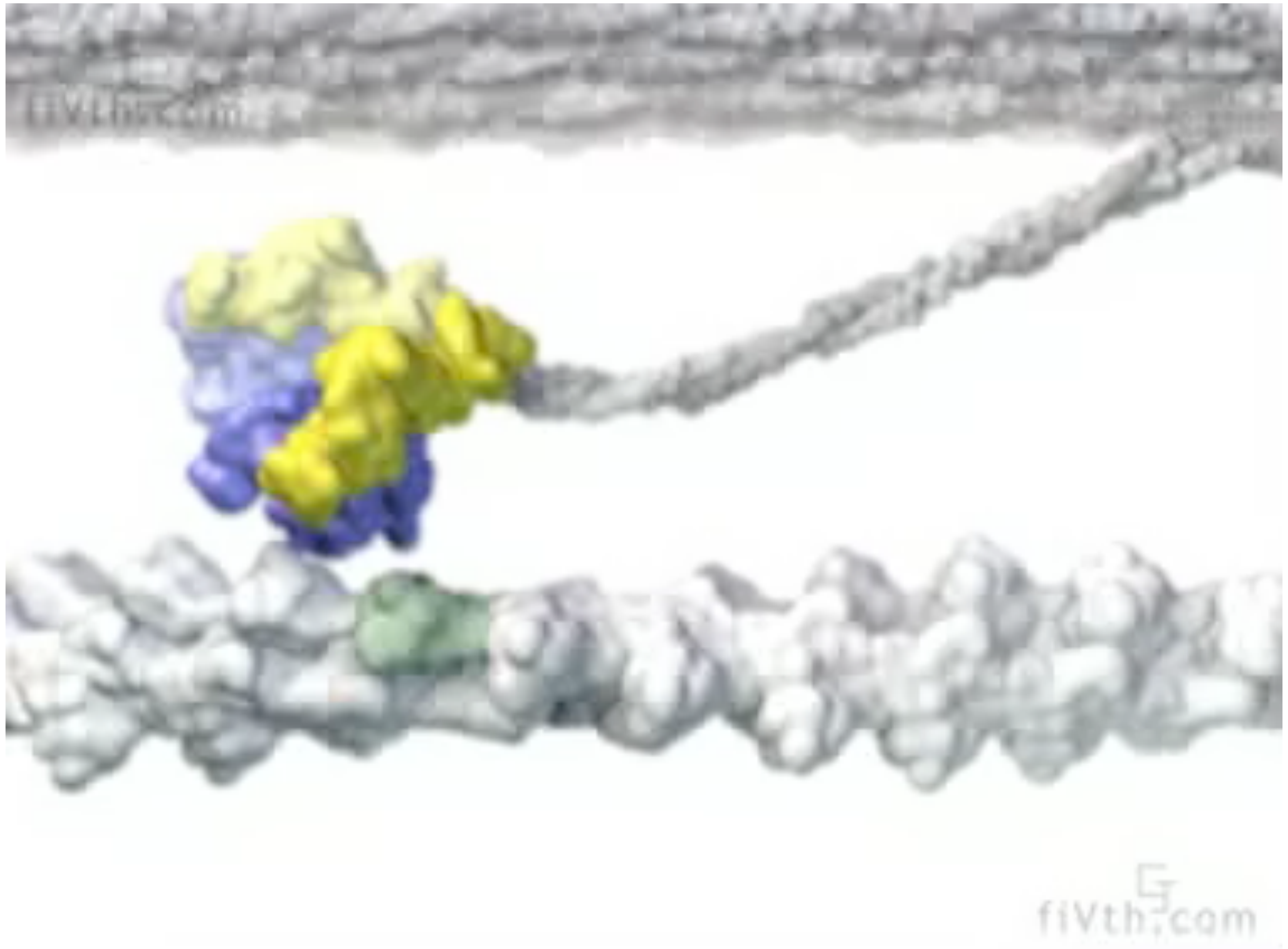
Myosin pushing actin



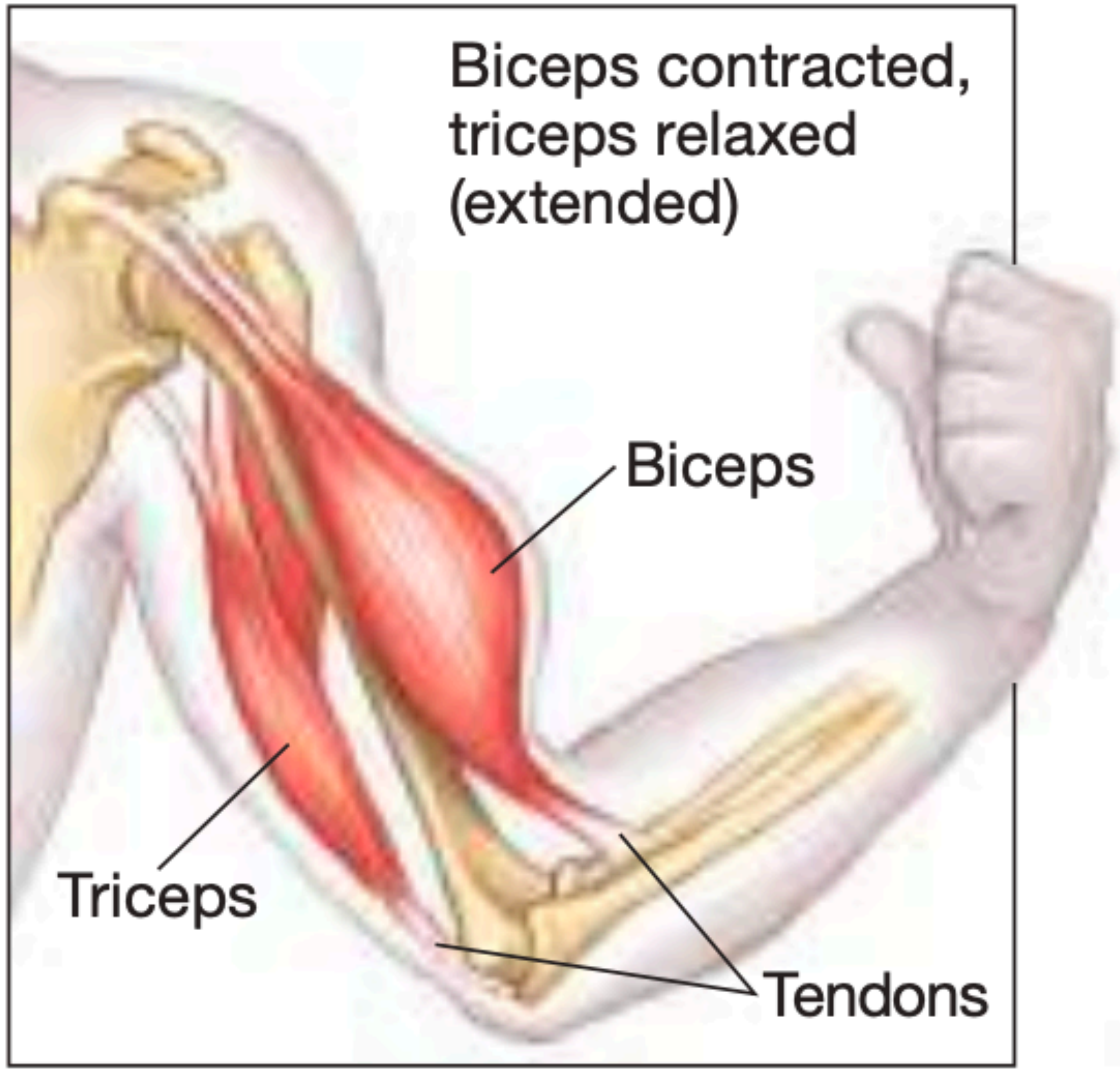
▲ **Figure 30.9B** **The mechanism of filament sliding**

TRY THIS **At each step, describe in your own words the action of the myosin head.**

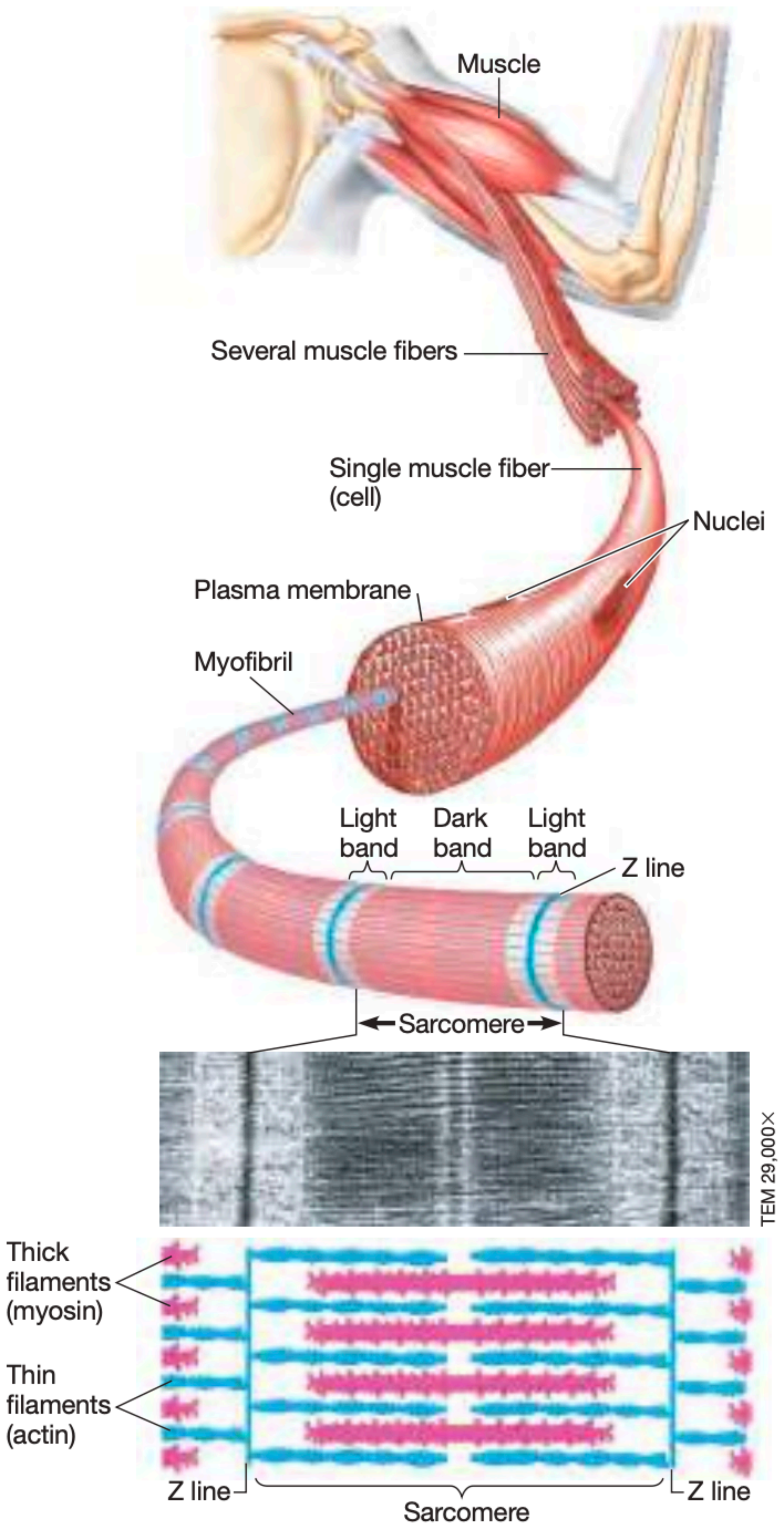
Myosin



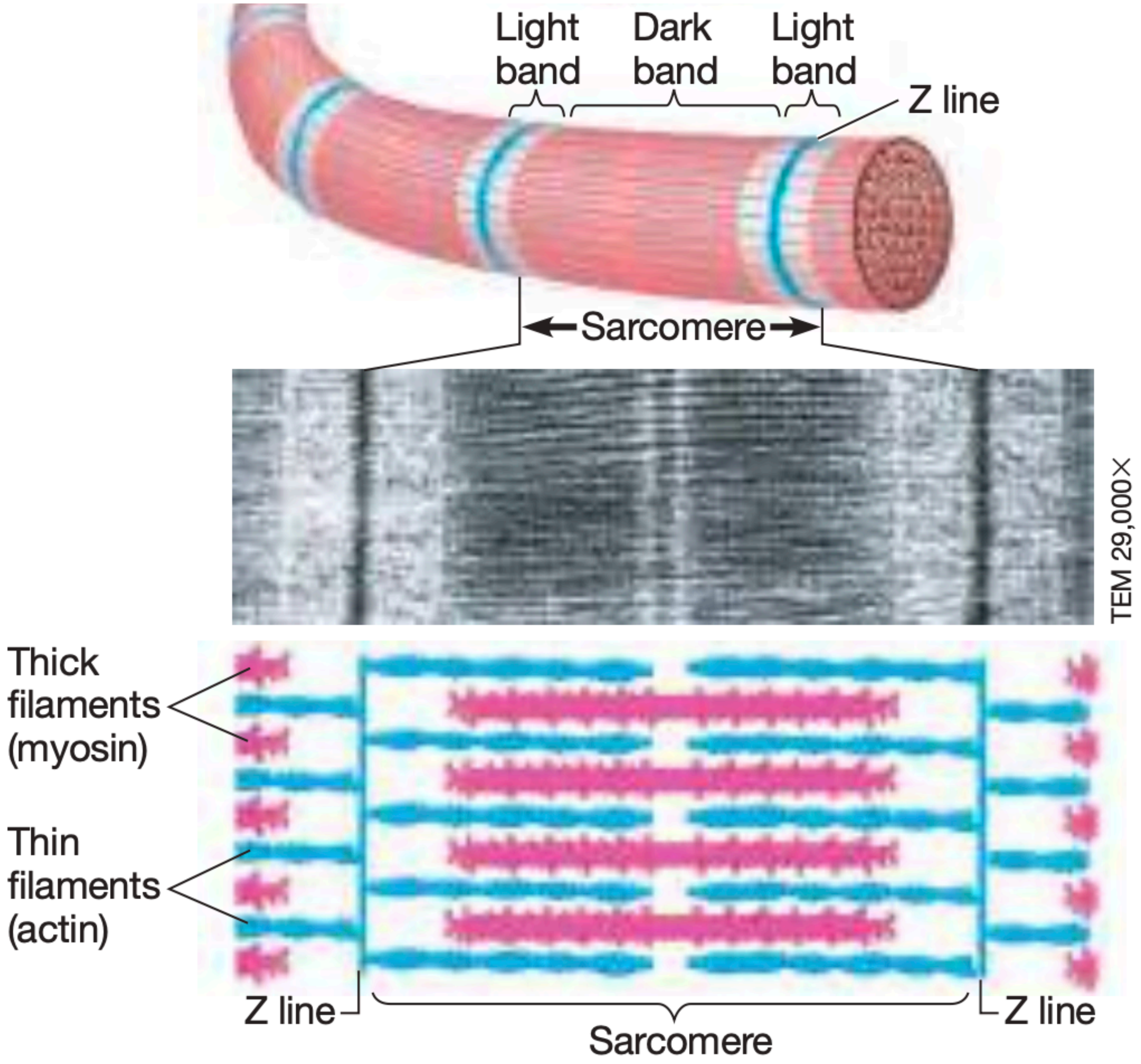
How do our muscles work? Generate force?



Actin and myosin together make the muscle work!



▲ **Figure 30.8** **The contractile apparatus of skeletal muscle**

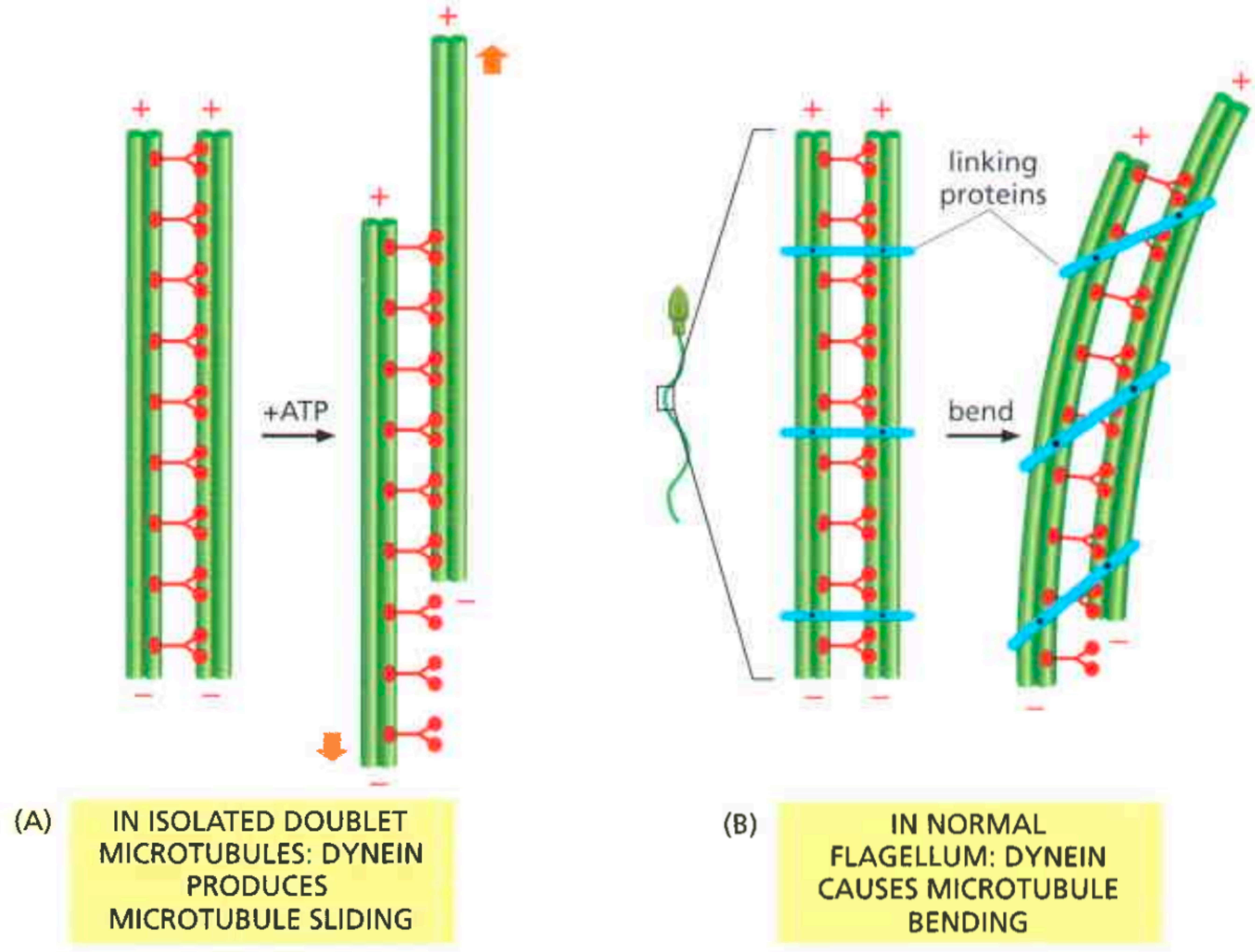


▲ **Figure 30.8** **The contractile apparatus of skeletal muscle**

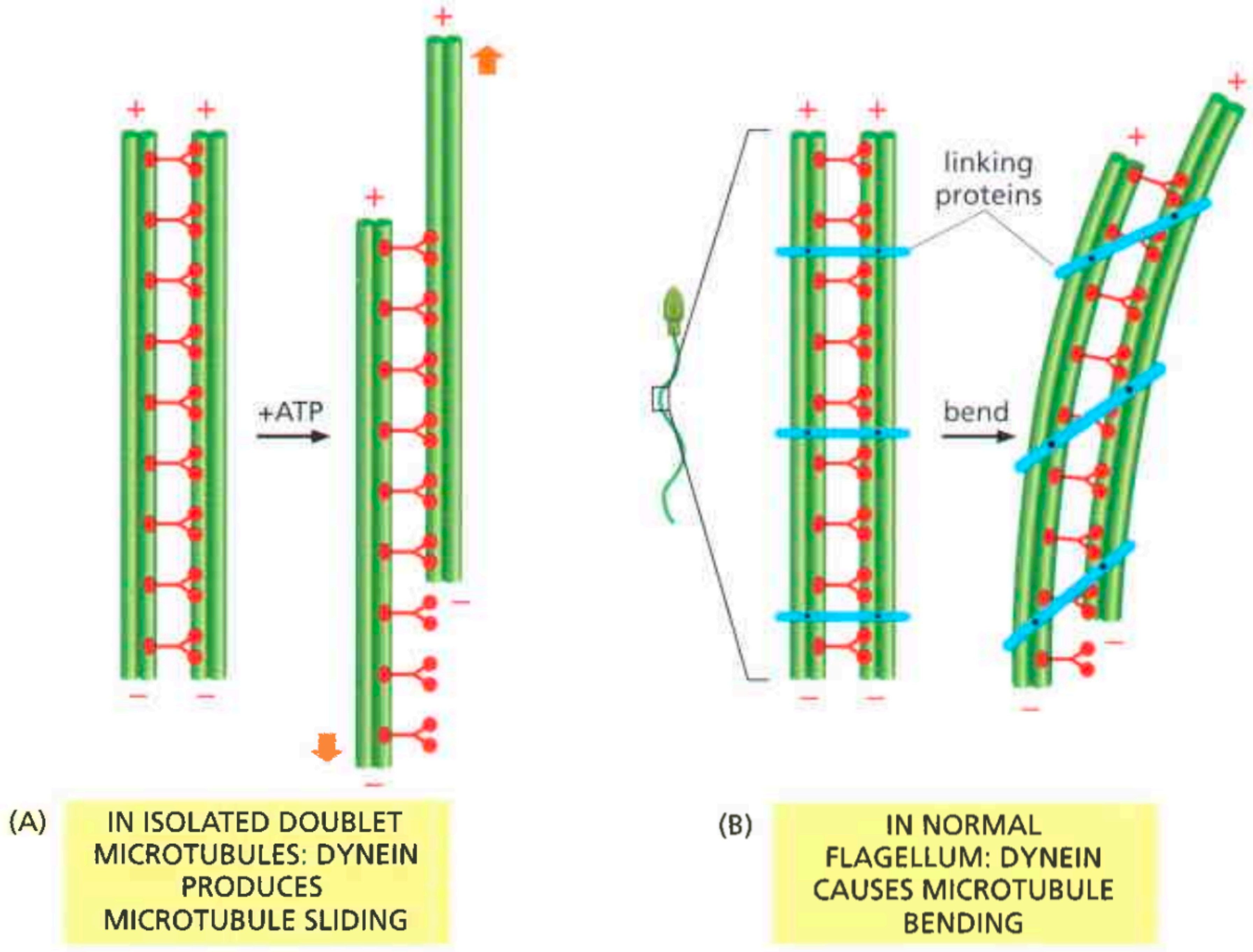
Some ingredients —modules— that make more complex machines

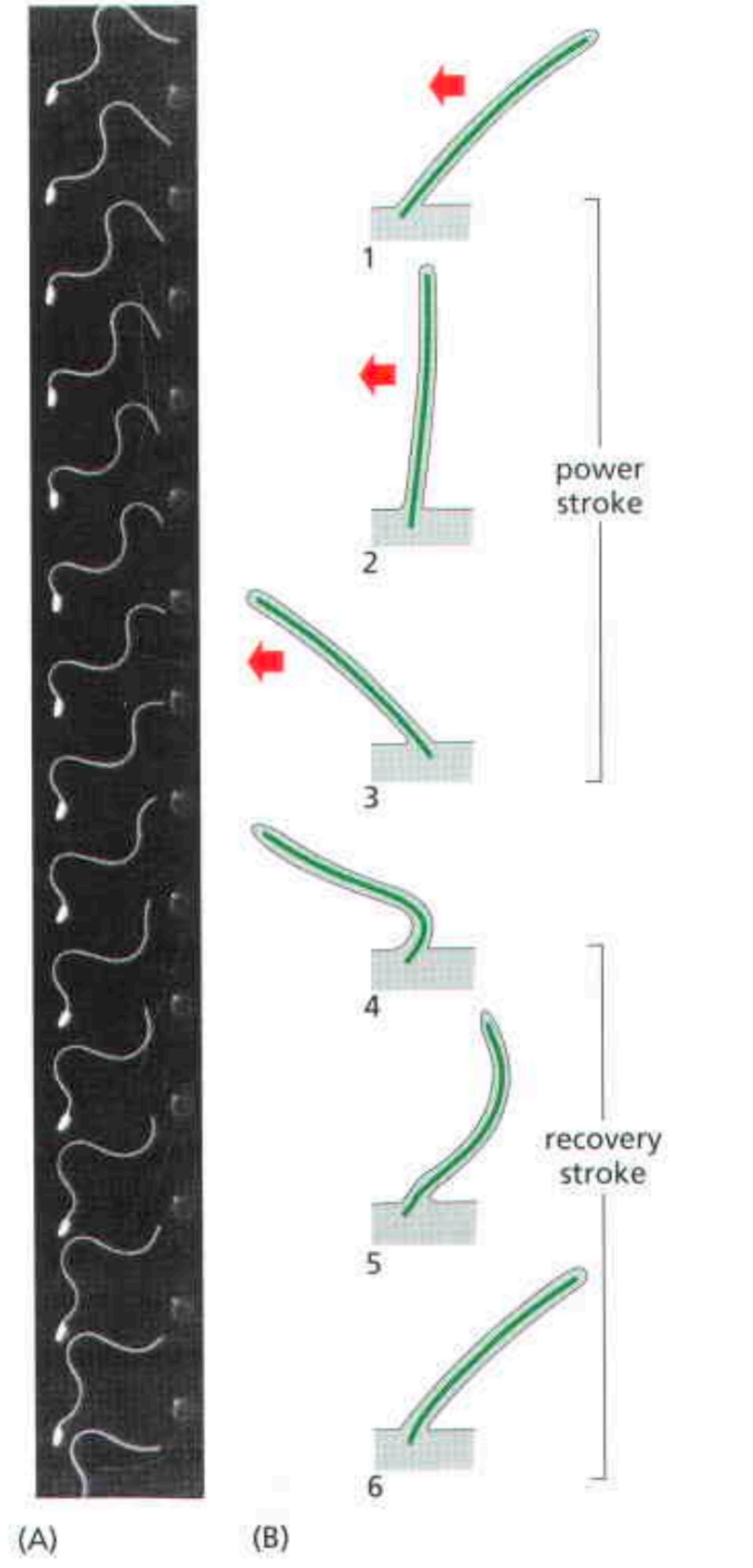
- Conformational change in single proteins (remember: free energy diagram)
- Cooperativity among the proteins
- Filaments like: Microtubule/Actin
- Molecular motors Motors like: Kinesin/Dynein/Myosin
- Concentration gradient of charges

Cilia/flagellum: machines made combining many microtubules and Dyneins

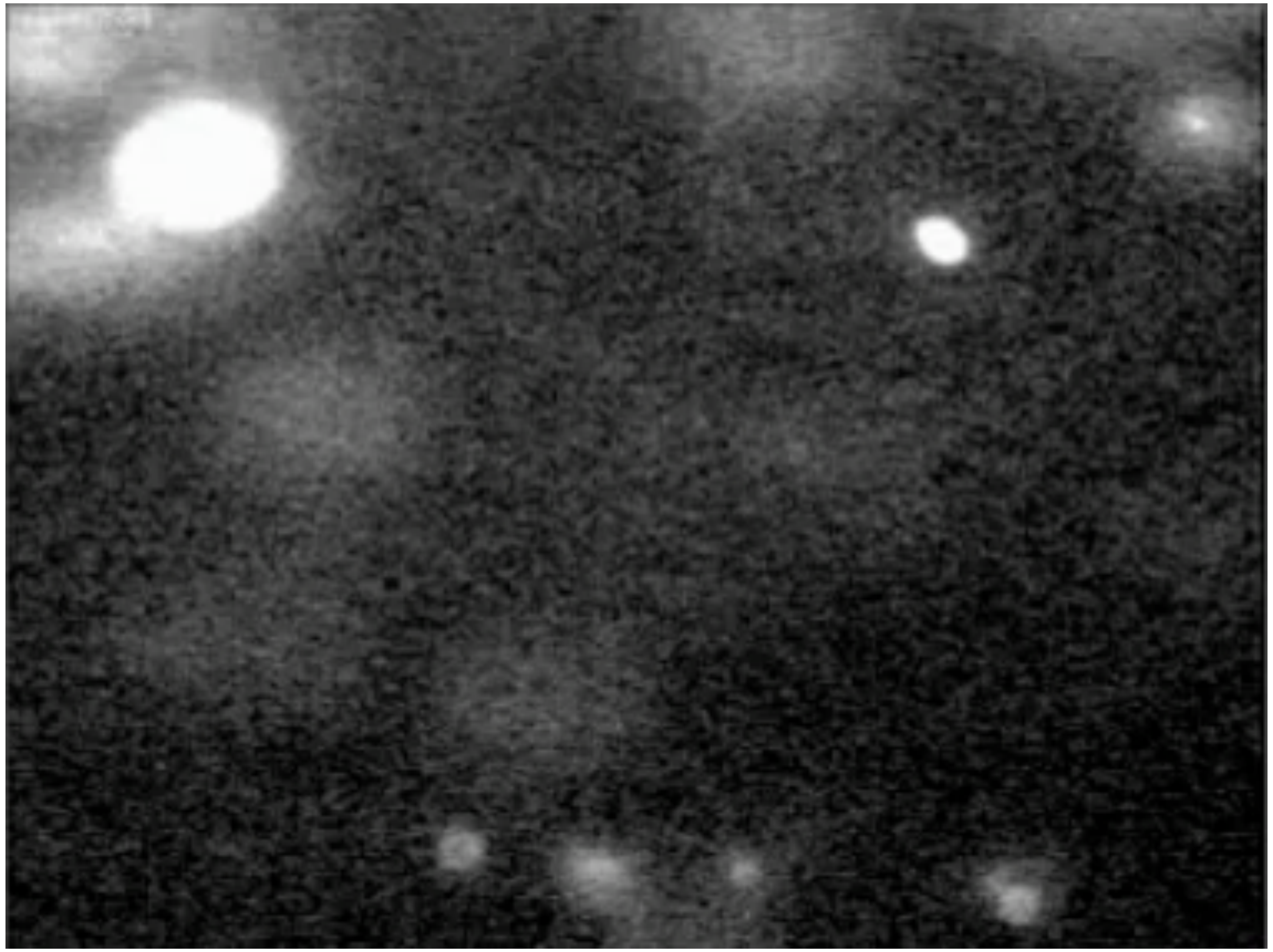


Cilia/flagellum: machines made combining many microtubules and Dyneins

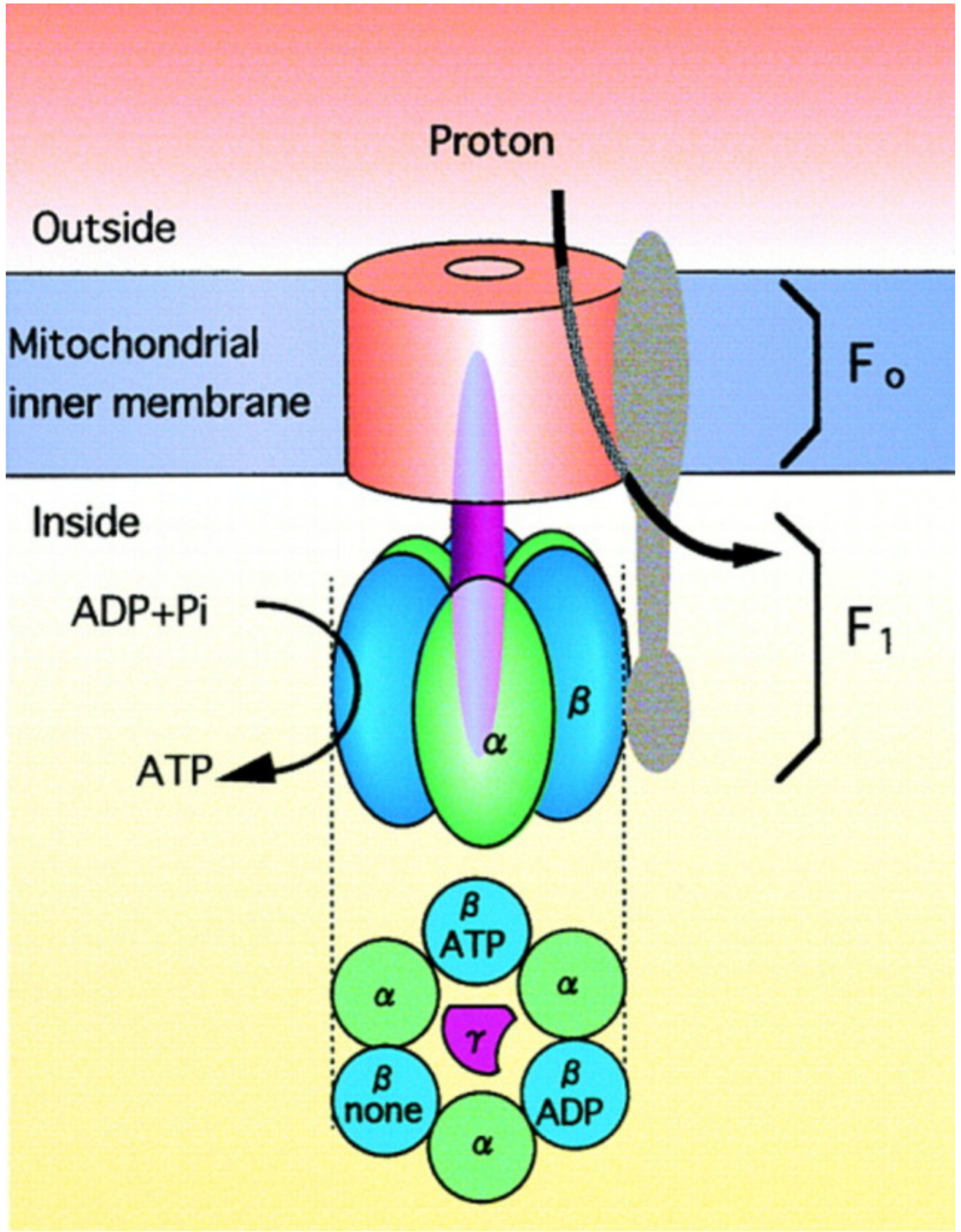




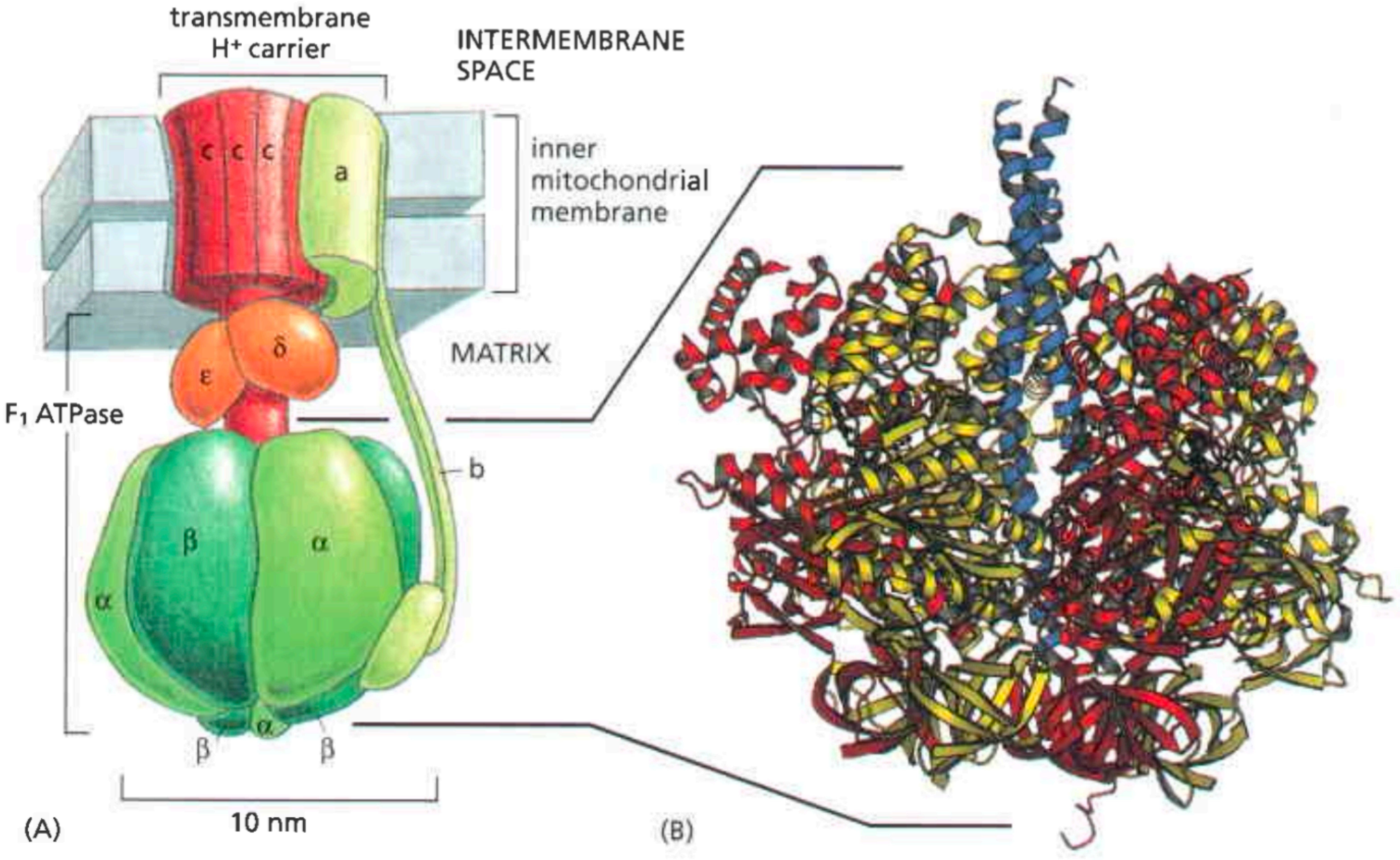
Bacterial flagellum rotation leads to motion



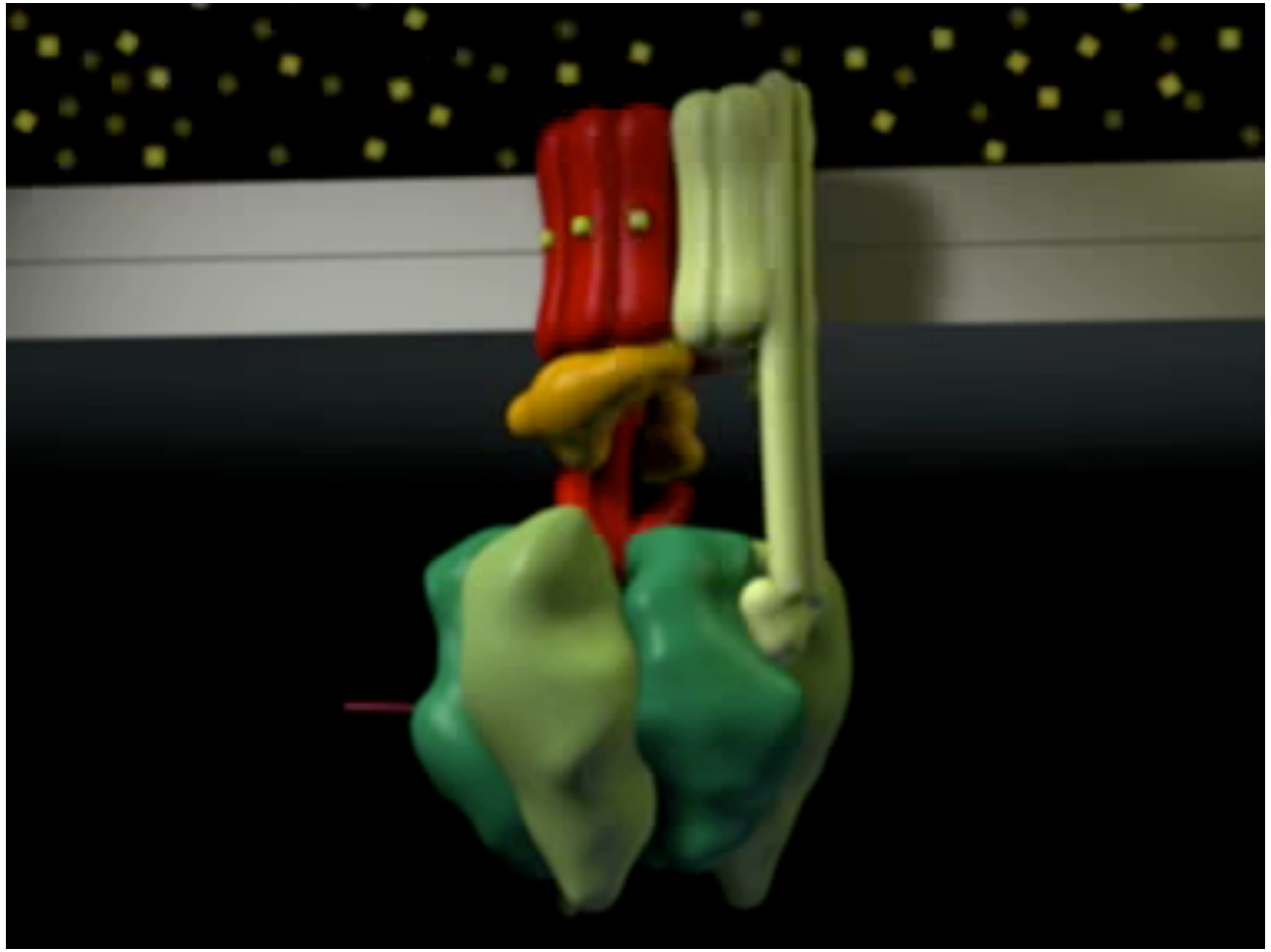
The amazing F0-F1 motor that makes ATP



The amazing F0-F1 motor that makes ATP

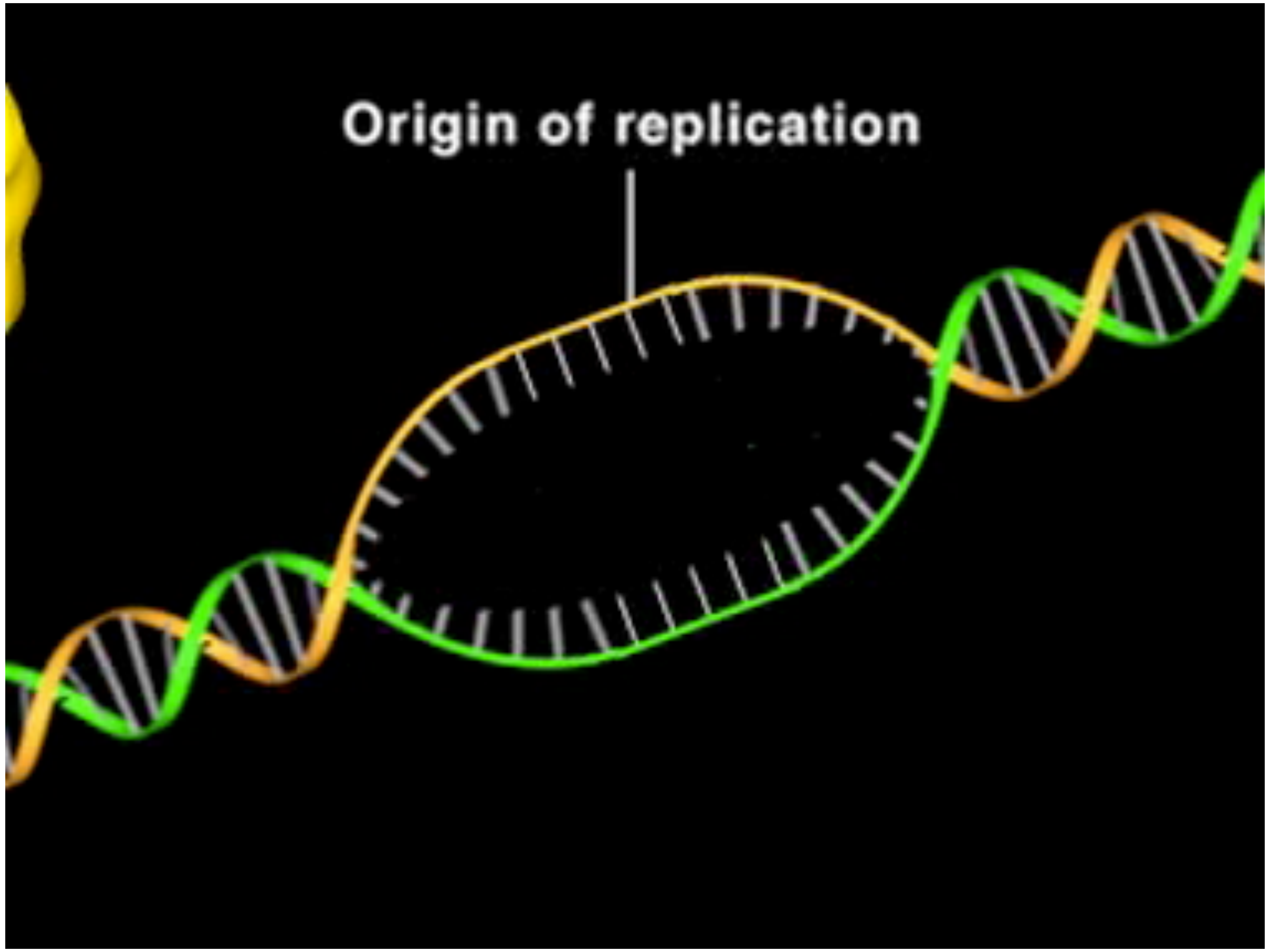


F0-F1 motor produces ATP from proton current

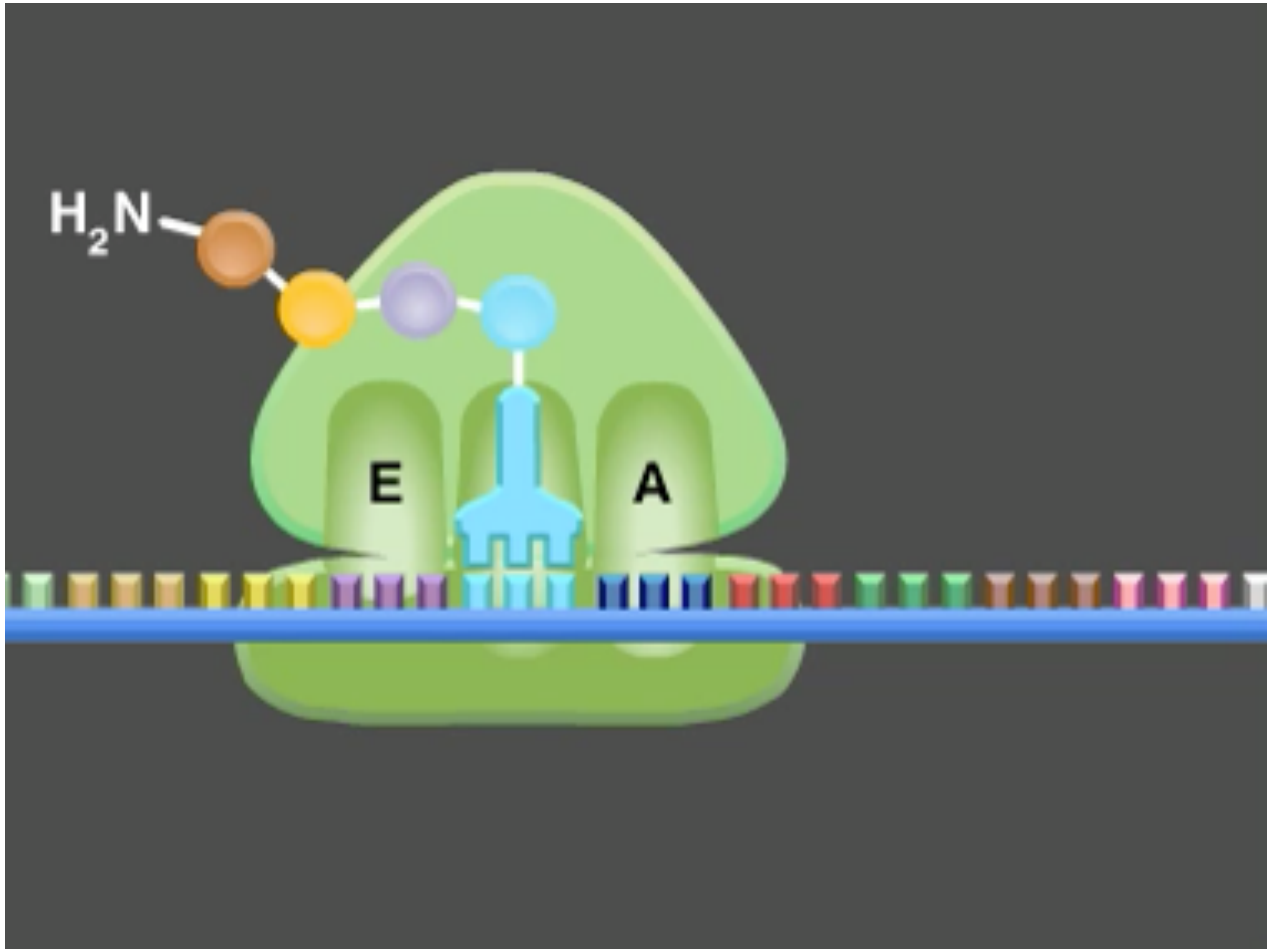


Replication machinery

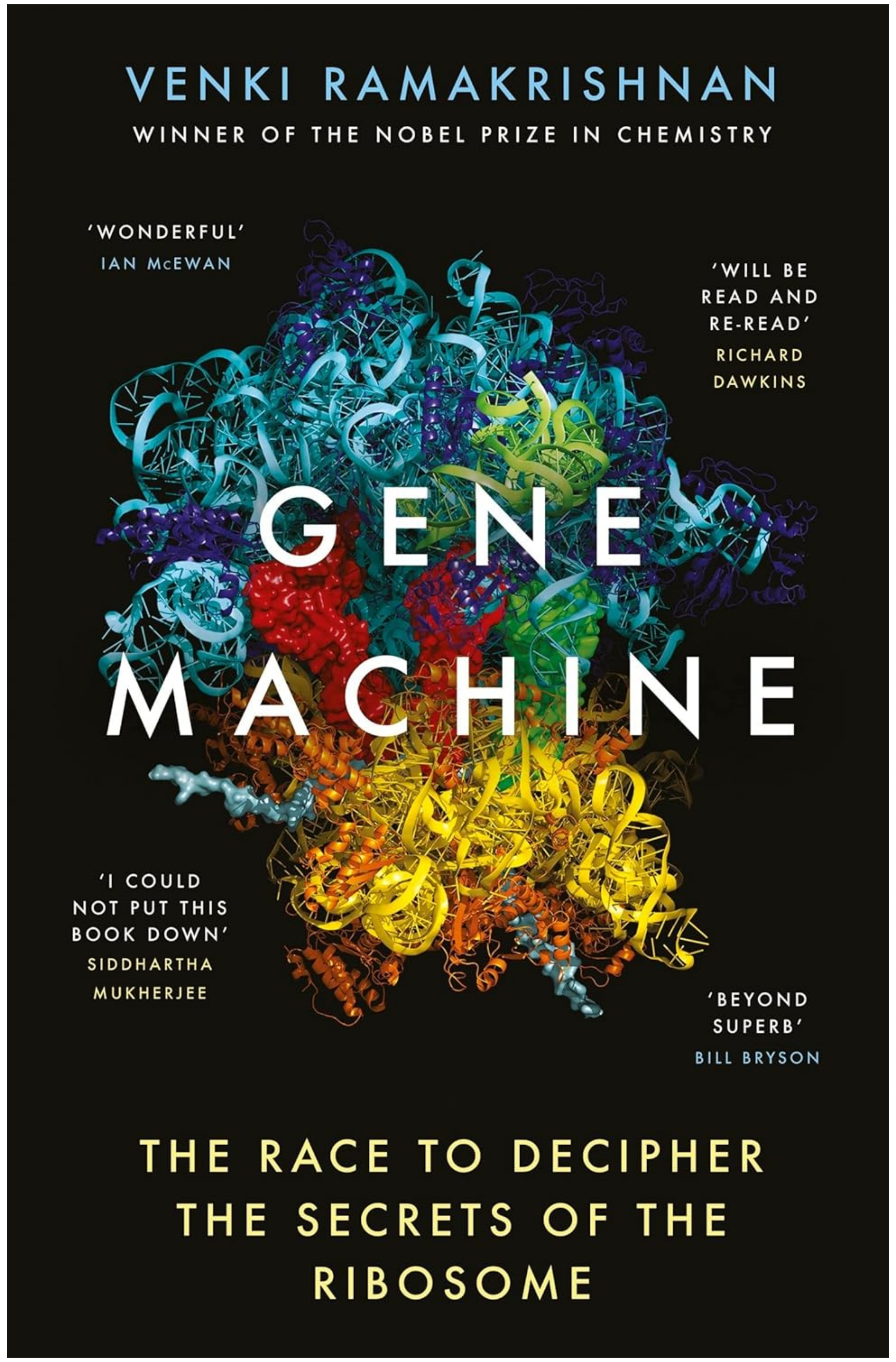
DNA Helicase: machine that separates DNA strands during replication



Translation: making protein from mRNA

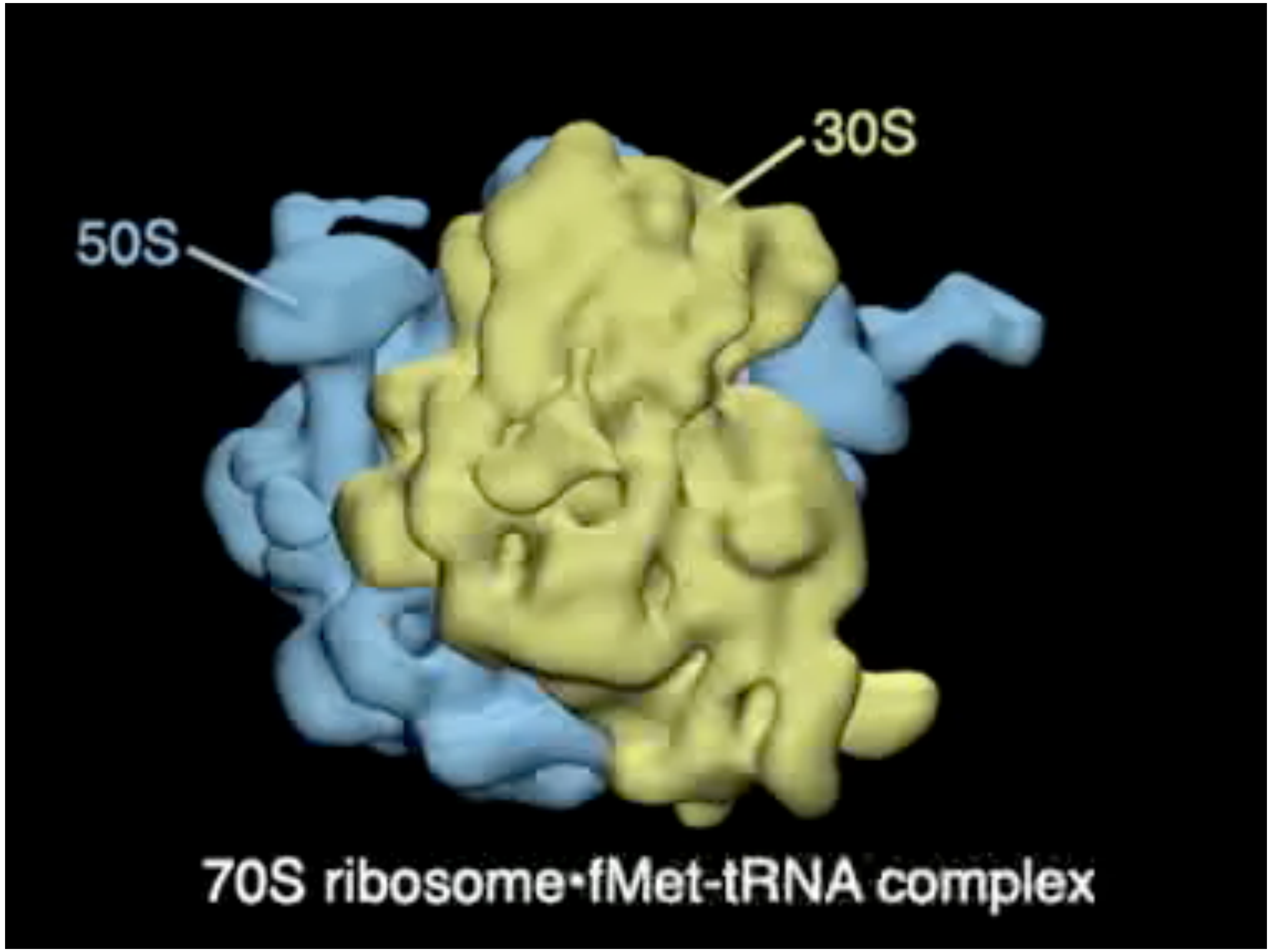


The Gene machine: Venki Ramakrishnan and Nobel Prize

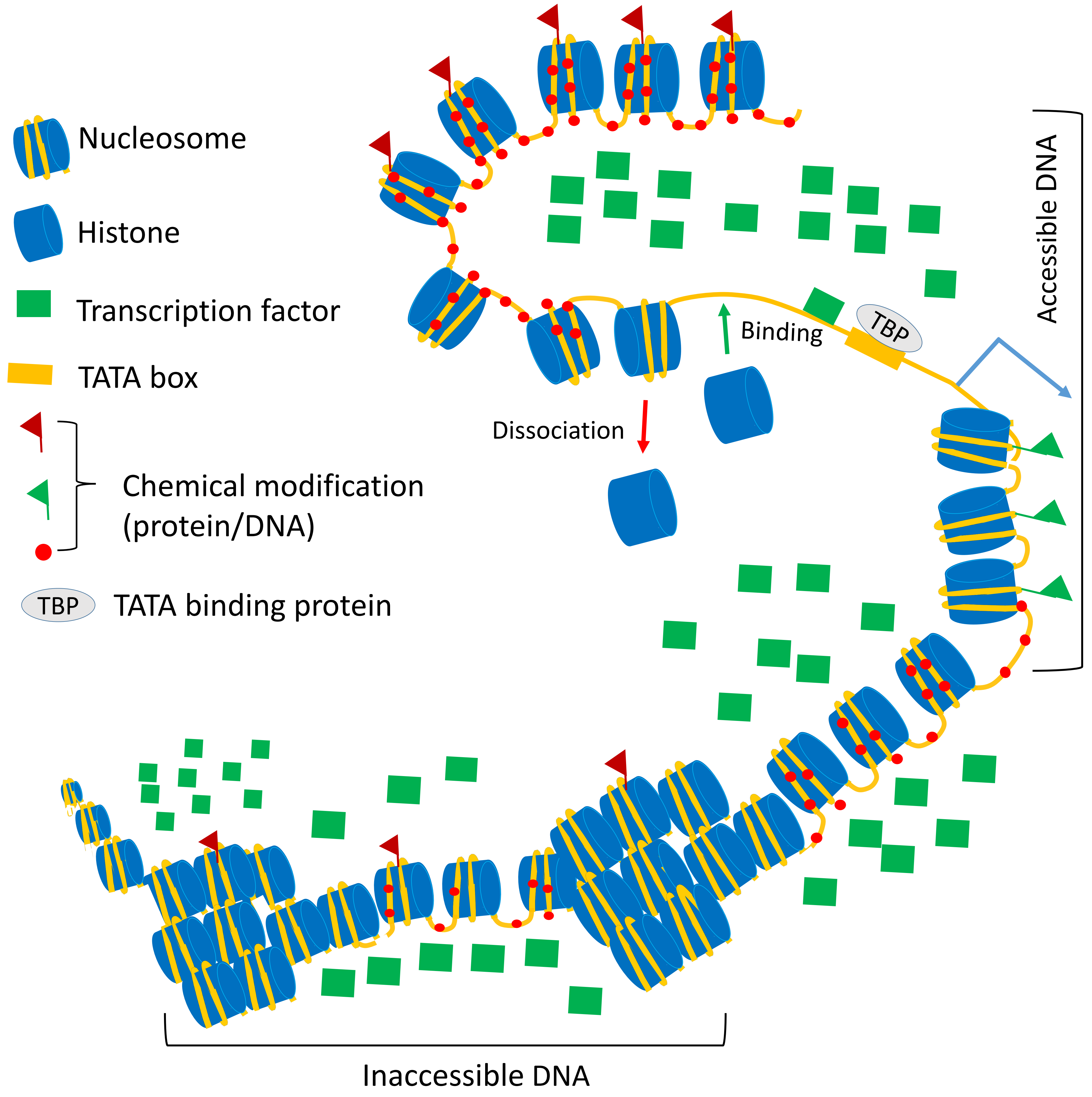


Found structure of ribosome machine and how it works

Translation machinery: Ribosome machine



Motors that reorganise proteins on DNA to switch on switch of one reading



Motors that reorganise proteins on DNA to switch on switch off reading

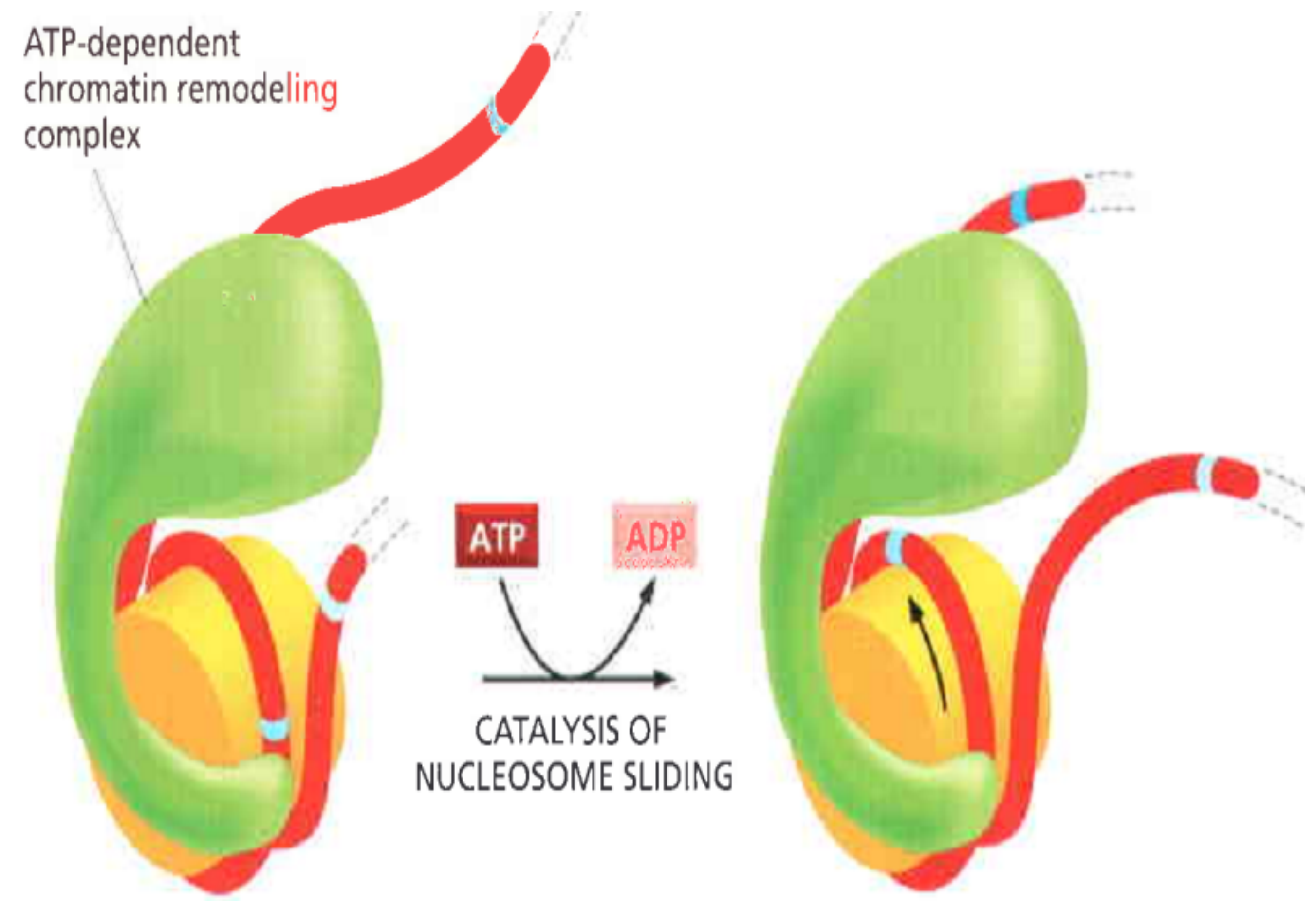
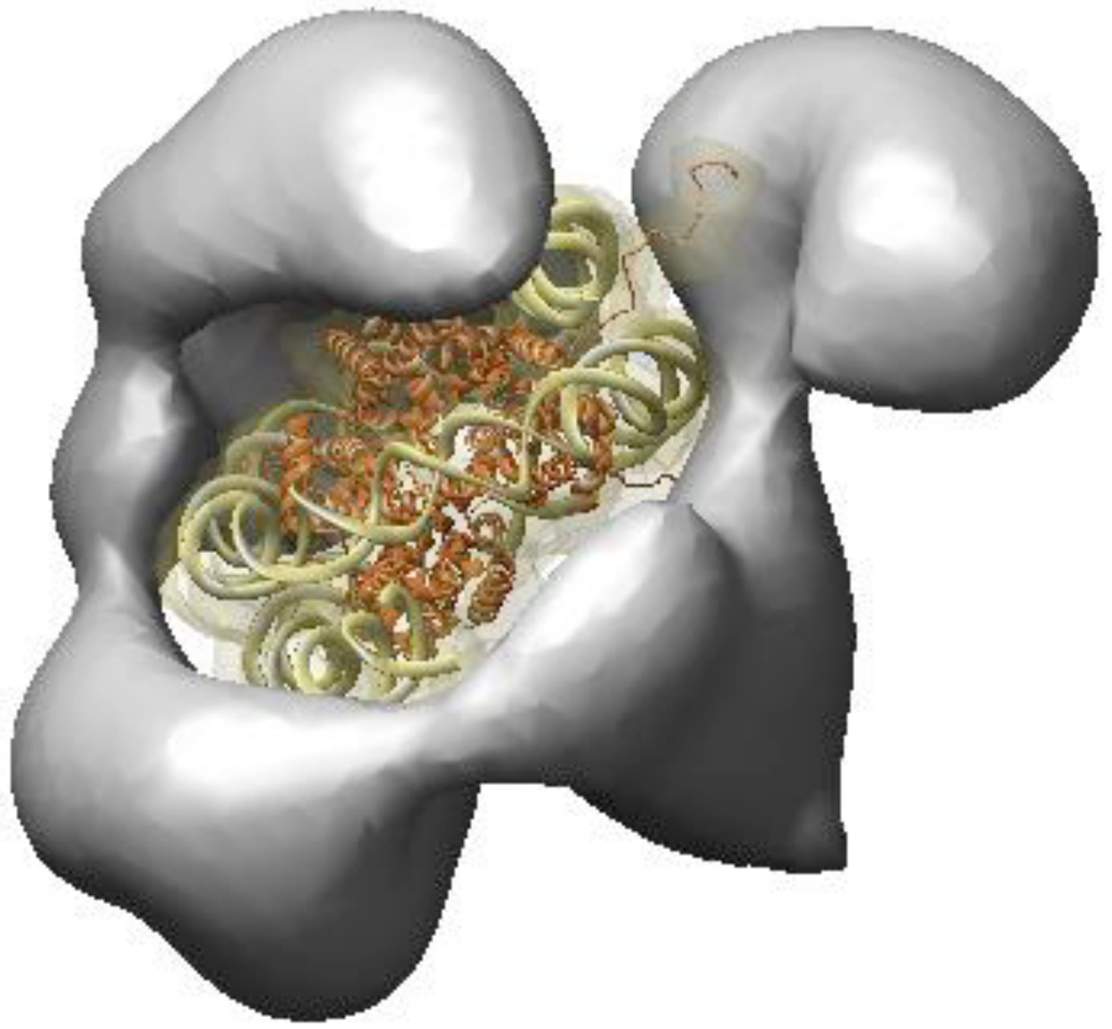


Figure: *Molecular Biology of the Cell* (© Garland Science 2008)

ATP-dependent
sliding
(candidates: yeast ISWI,
ACF etc — ISWI family)



ATP-dependent
disassembly
(candidate: RSC,
SWI/SNF family)

How does evolution produce such complex machines?

Is it like a blind watchmaker?

Can a randomly typing monkey produce Shakespeare?

Power of Natural selection