

- Use the ATP in its cytosol to generate force all the way along their length
 - Bacterial flagella is entirely driven by the rotary motor at its base that functions through PMF
- They are motile and designed to
 - Move the cell itself
 - Move substances over and around the cell
- The movement of a flagellum is produced by the bending of its axoneme
- Grow from basal bodies that are closely related to centrioles
- If flagella are sheared from the cell, they rapidly reform by elongating from structures called basal bodies
- Flagella are lesser in number and larger in contrast to cilia (up to 1000 μm)
 - They exist in motile cells such as the male gamete spermatozoon

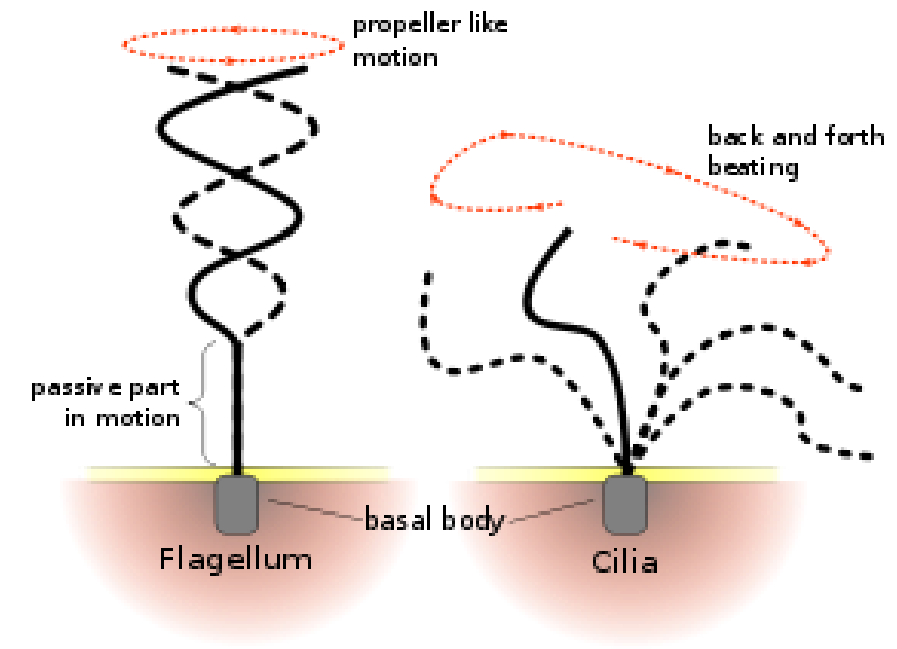
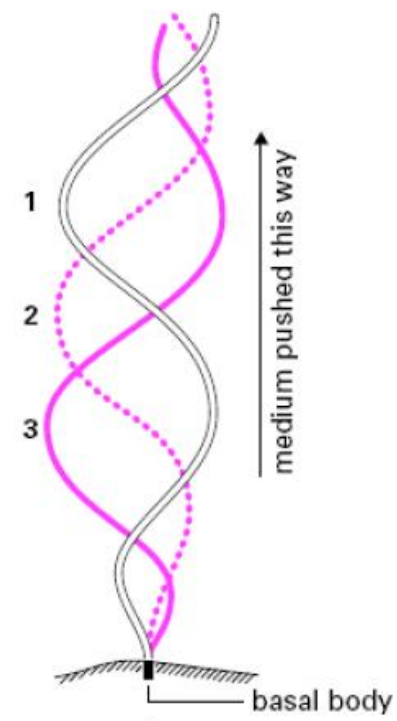
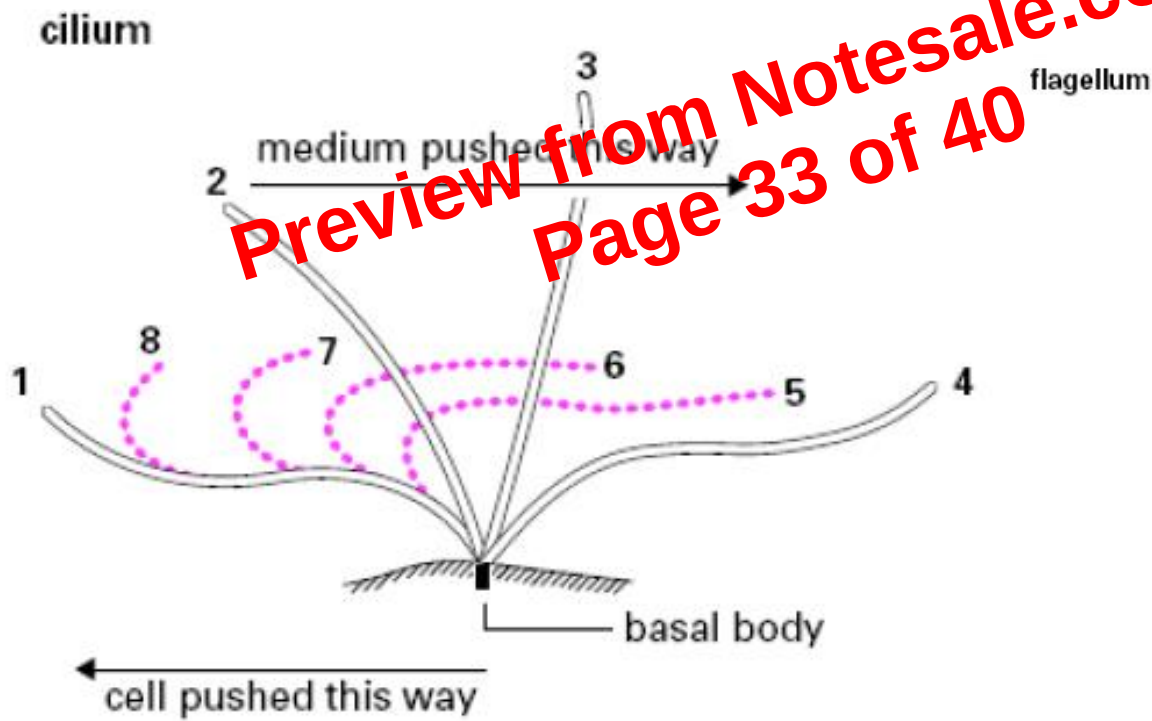
Ciliary / flagellar dynein in axoneme drives the movements of cilia and flagella

- The most important of the accessory proteins is ciliary / flagellar dynein
- Heads of dynein interact with adjacent MTs to generate a sliding force between the MTs
- Because of the multiple links that hold adjacent MT doublets together, what would be a sliding movement between free MTs is converted to a bending motion
- Like cytoplasmic dynein, ciliary / flagellar dynein has
 - A motor domain, which hydrolyzes ATP to move along a MT toward its minus end
 - A tail region that carries a cargo, which in this case is an adjacent MT
- Tail of ciliary / flagellar dynein binds only to the A tubule and not to the B tubule, which has a slightly different structure

- **Sliding filament model of bending**

- Molecules of ciliary / flagellar dynein form bridges between the circumference of the axoneme
- Dynein arms have ATPase activity
 - It converts the energy released by ATP hydrolysis into the mechanical work of ciliary and flagellar beating
- When the motor domain of dynein is activated, the dynein molecules attached to the MT doublet attempt to walk along the adjacent MT doublet
 - In the presence of ATP, they can move from one tubulin to another
 - Dynein thus enable the MTs to slide along one another

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Beating of cilia and wavelike motion of flagella

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Intraflagellar (IFT) / Intraciliary (ICT) transport

Intraflagellar / intraciliary transport (IFT / ICT)

- **Bidirectional motility** called IFT / ICT plays an essential role to **move the building materials (tubulin)** from cell body to the assembly site and **disassembled material** to be **recycled** from tip back to cell body
- By regulating the equilibrium between these two processes, the **length of flagella / cilia can be maintained dynamically**
- Motor proteins help in IFT / ICT
 - **Kinesin and Cytoplasmic dynein**
- Outward transport = **Anterograde** transport
- Inward transport = **Retrograde** transport
- Action already studied in MTs

