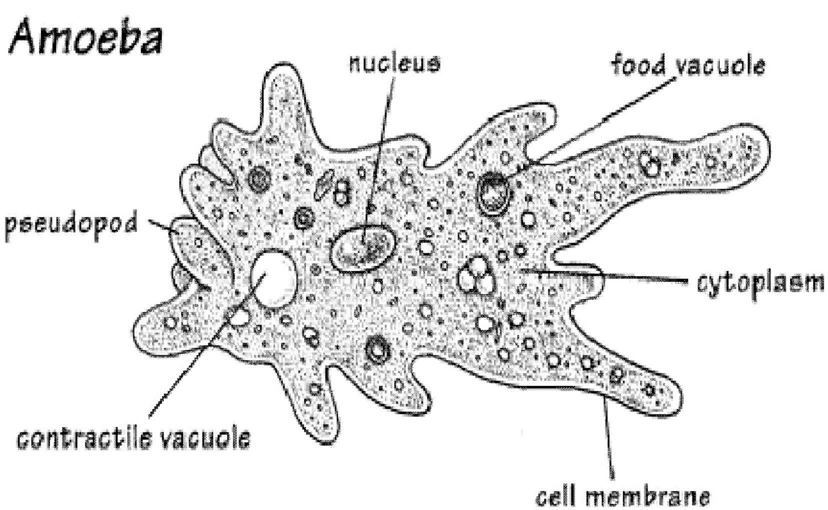
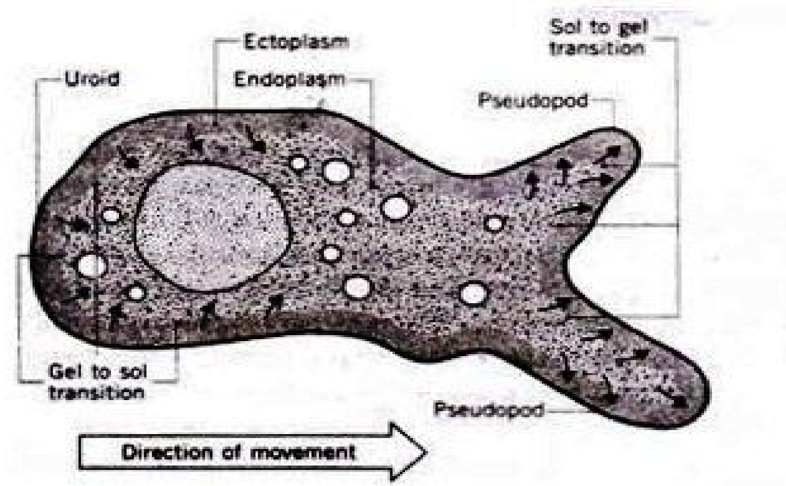
Locomotion in Protozoa

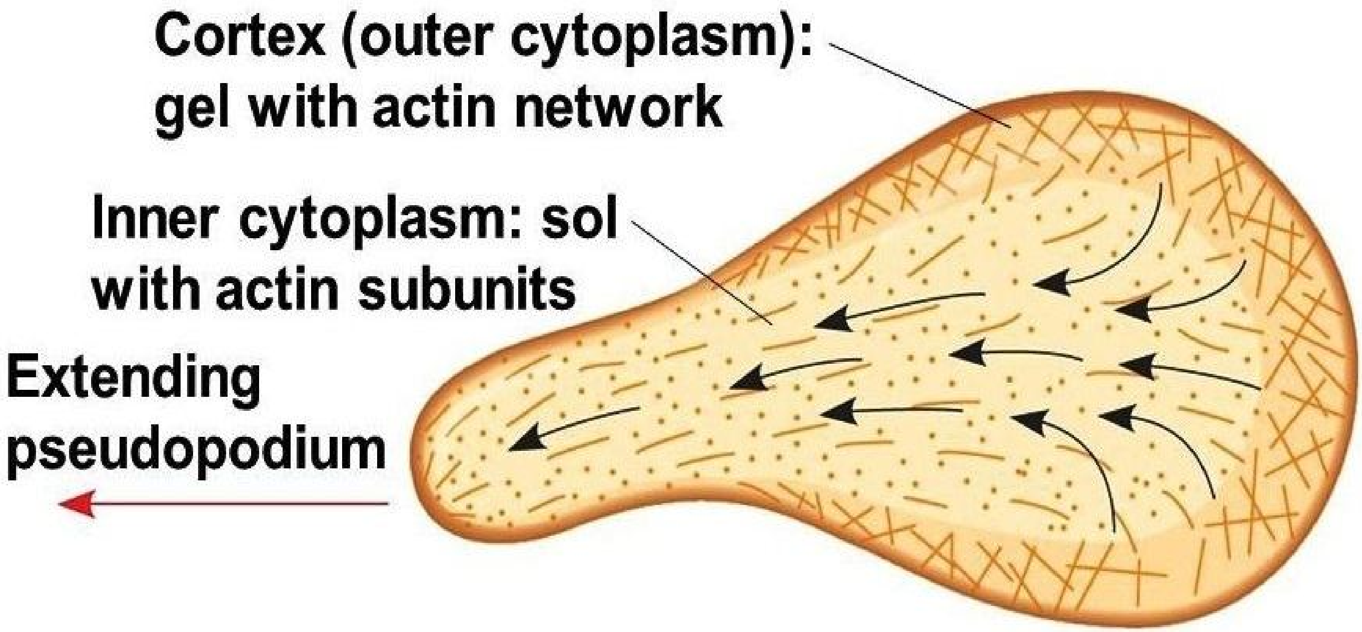
A. Amoeboid or Pseudopodial

B. Axonemal or Microfibrillar



Amoeboid movement

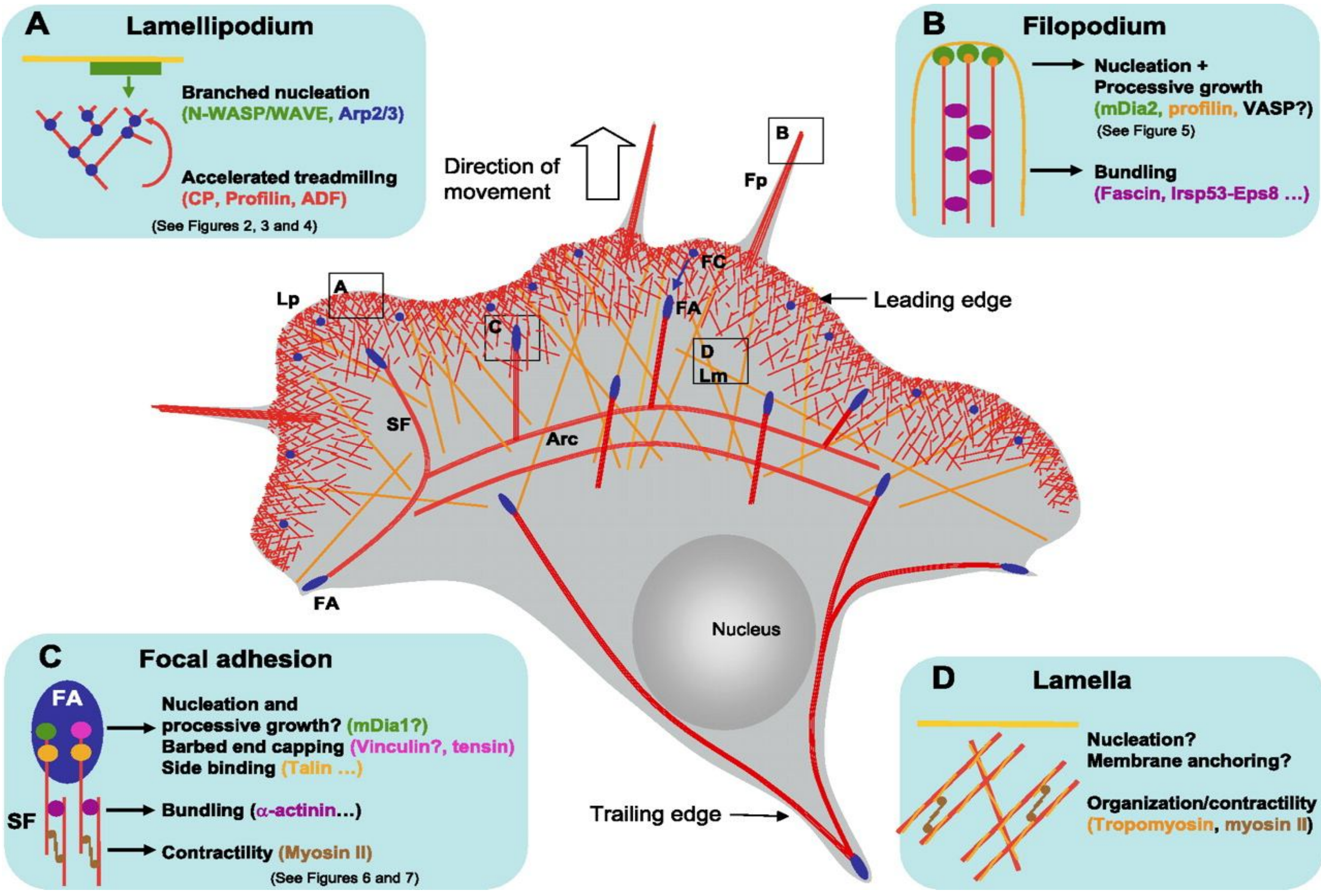




Amoeboid movement

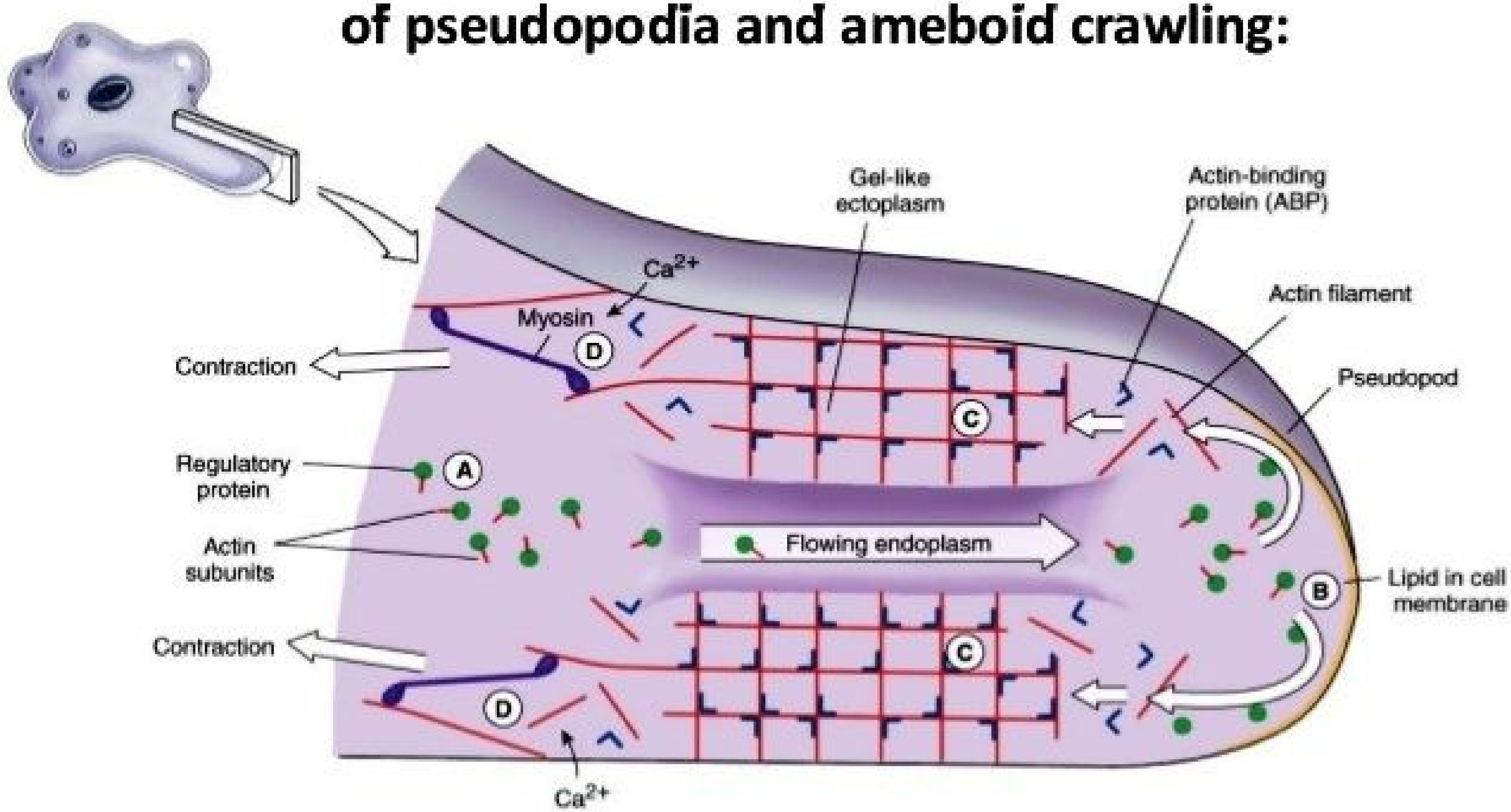
Cortex (outer cytoplasm) gel with **actin** network

Molecular Mechanism of Amoeboid Locomotion



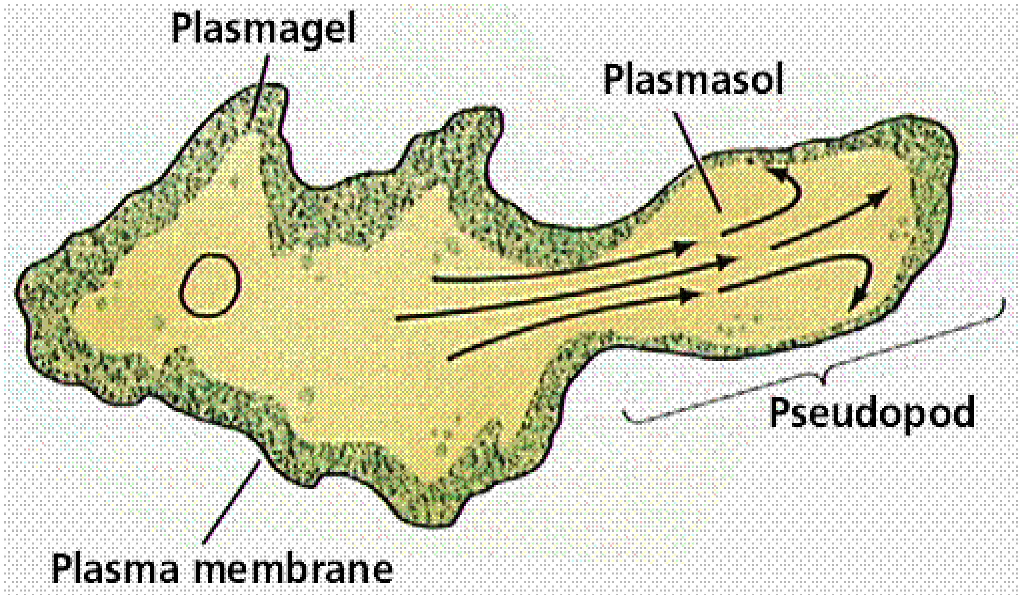
Role of Actin, Myosin & Ca-ion

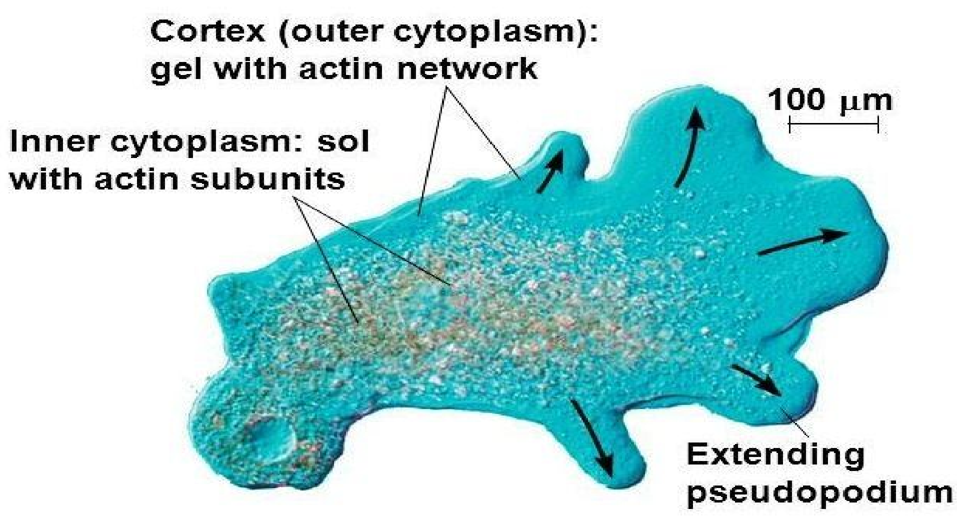
Consensus model to explain extension and withdrawal of pseudopodia and ameboid crawling:



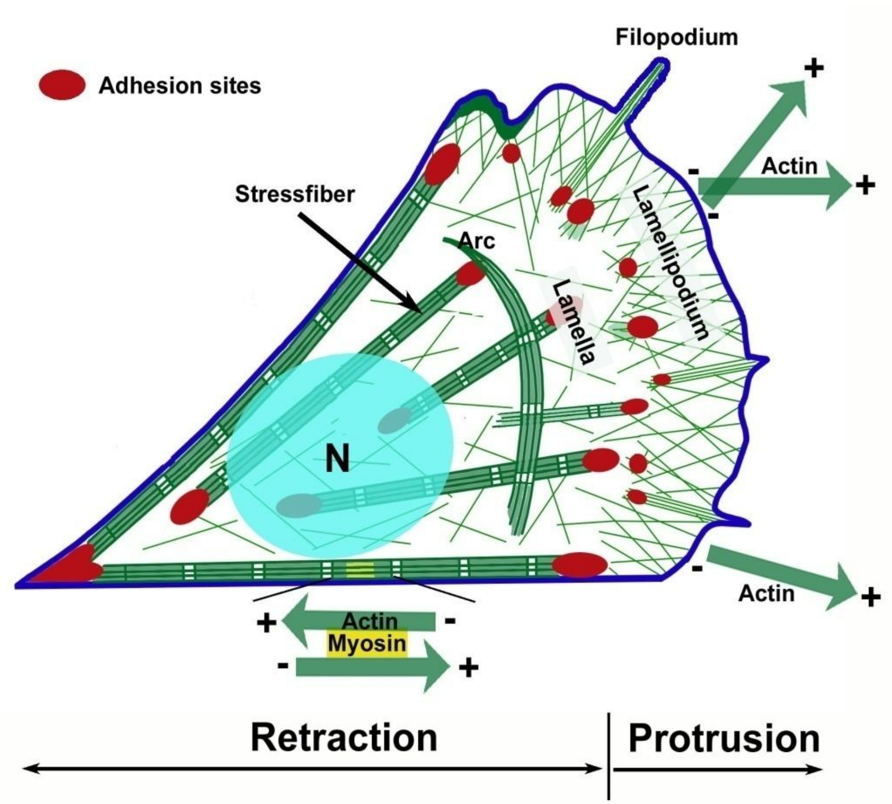
Ca2+ activate actin-severing protein

Amoeboid Locomotion : Mechanism

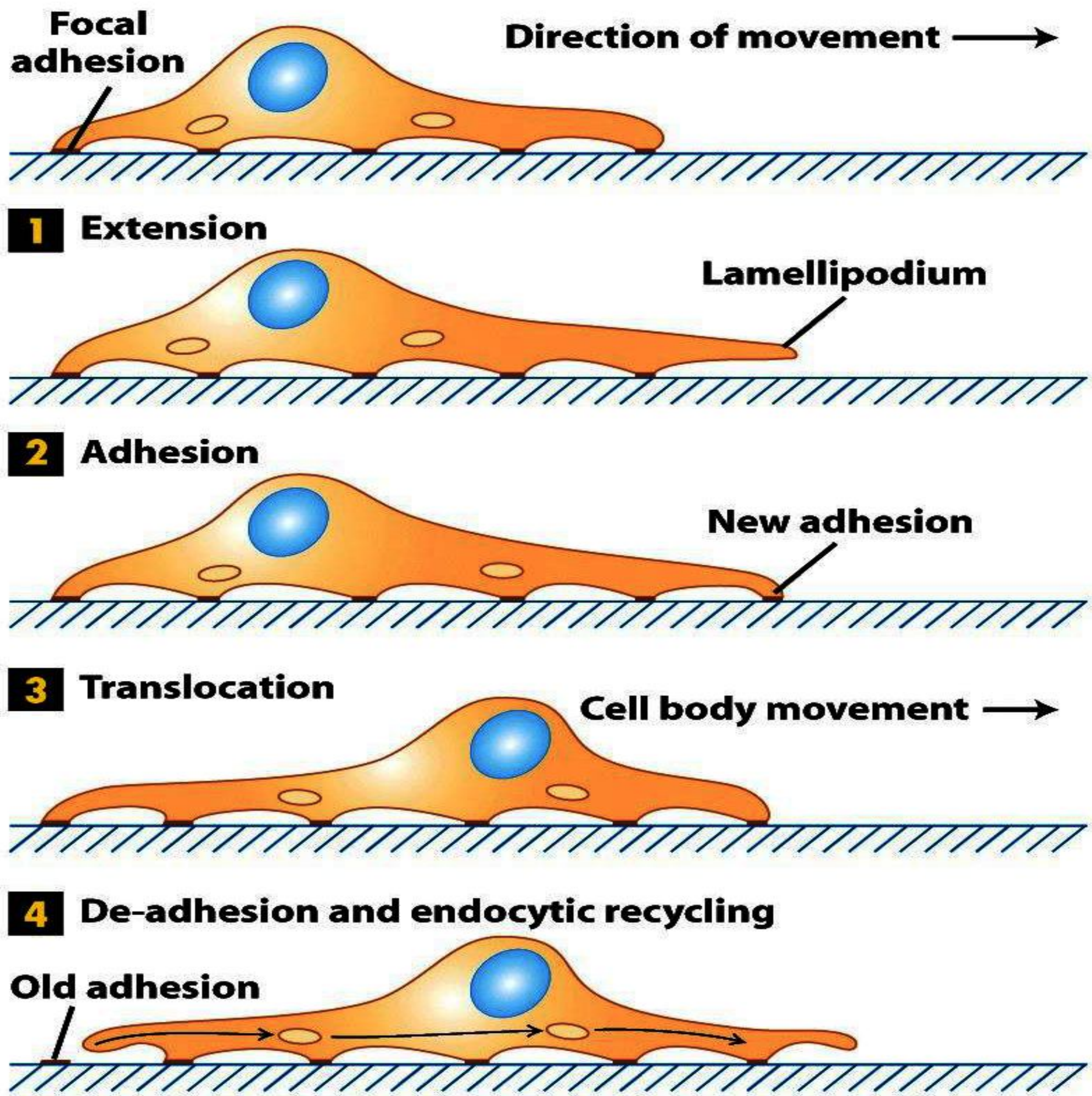




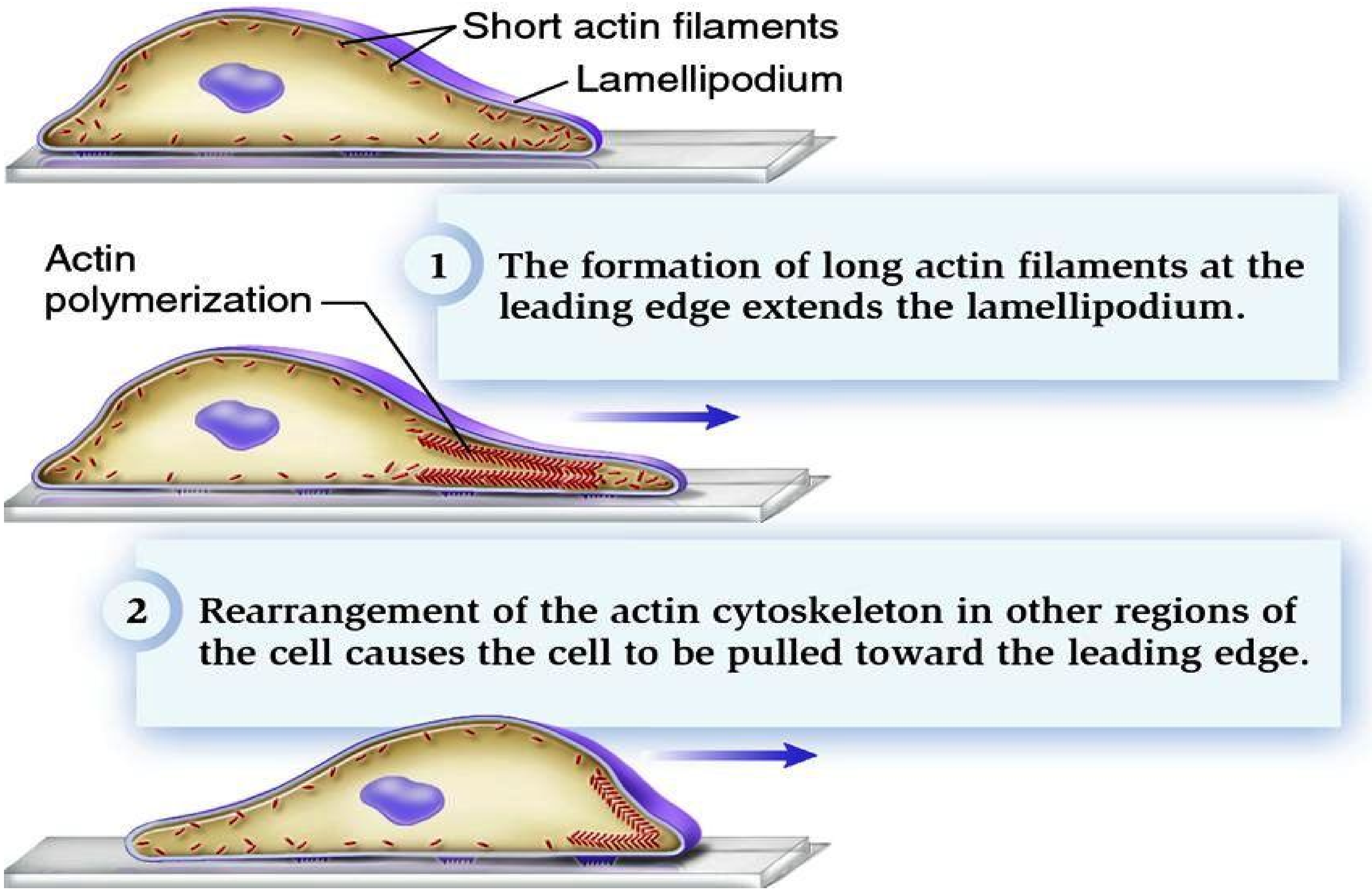
Amoeboid movement



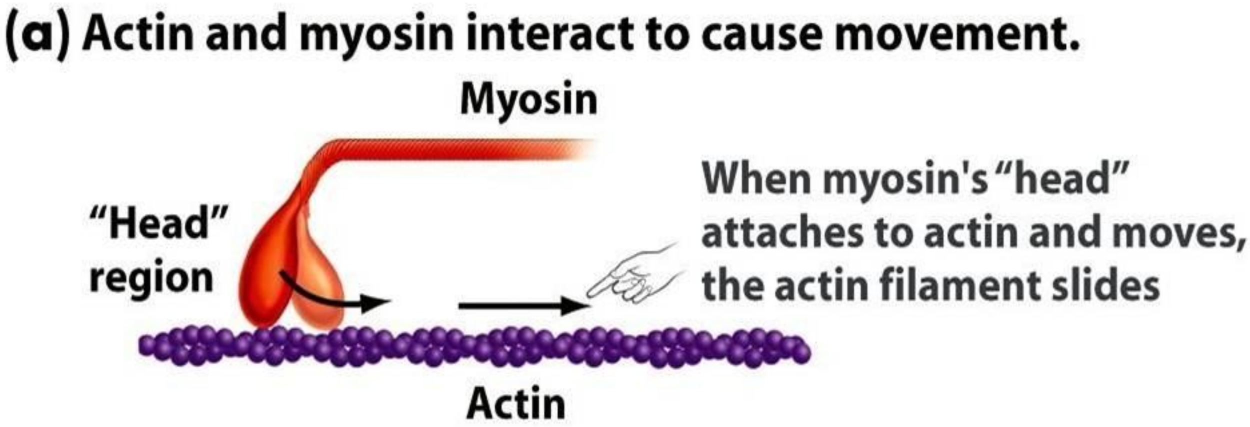
Amoeboid Locomotion: a Model presentation

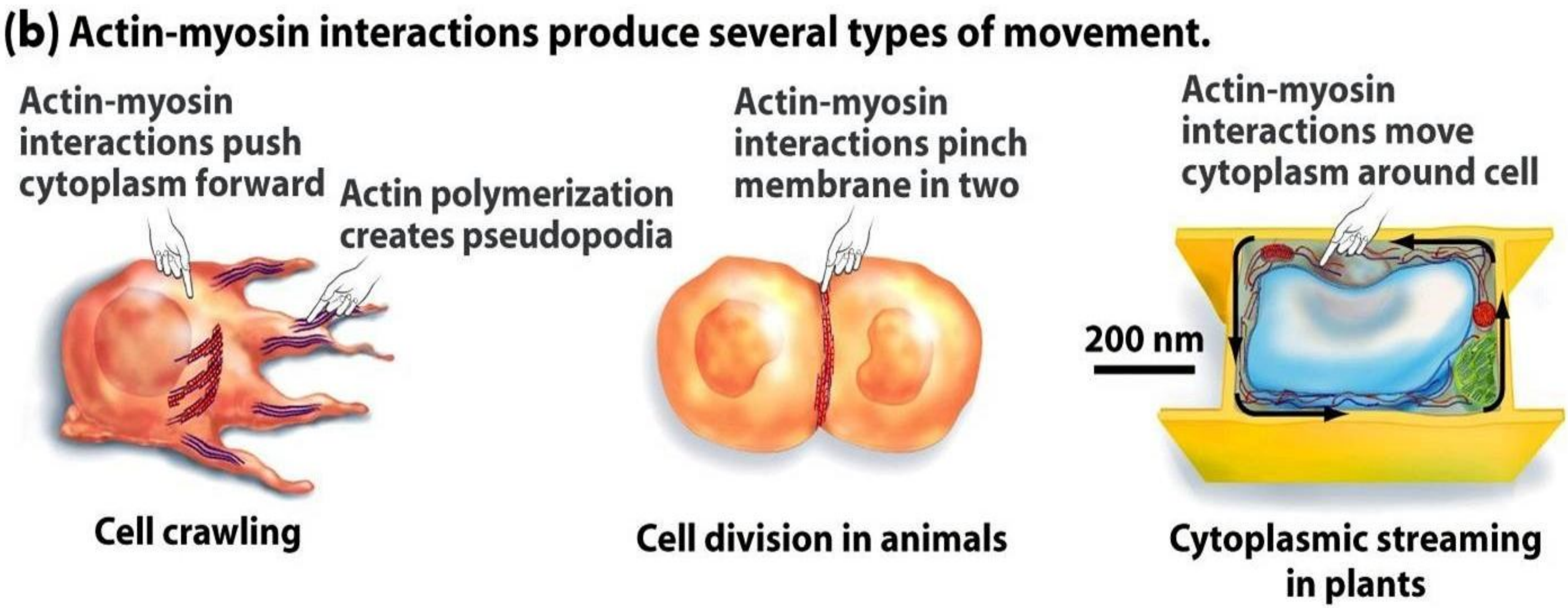


Molecular explanation of Pseudopodial locomotion

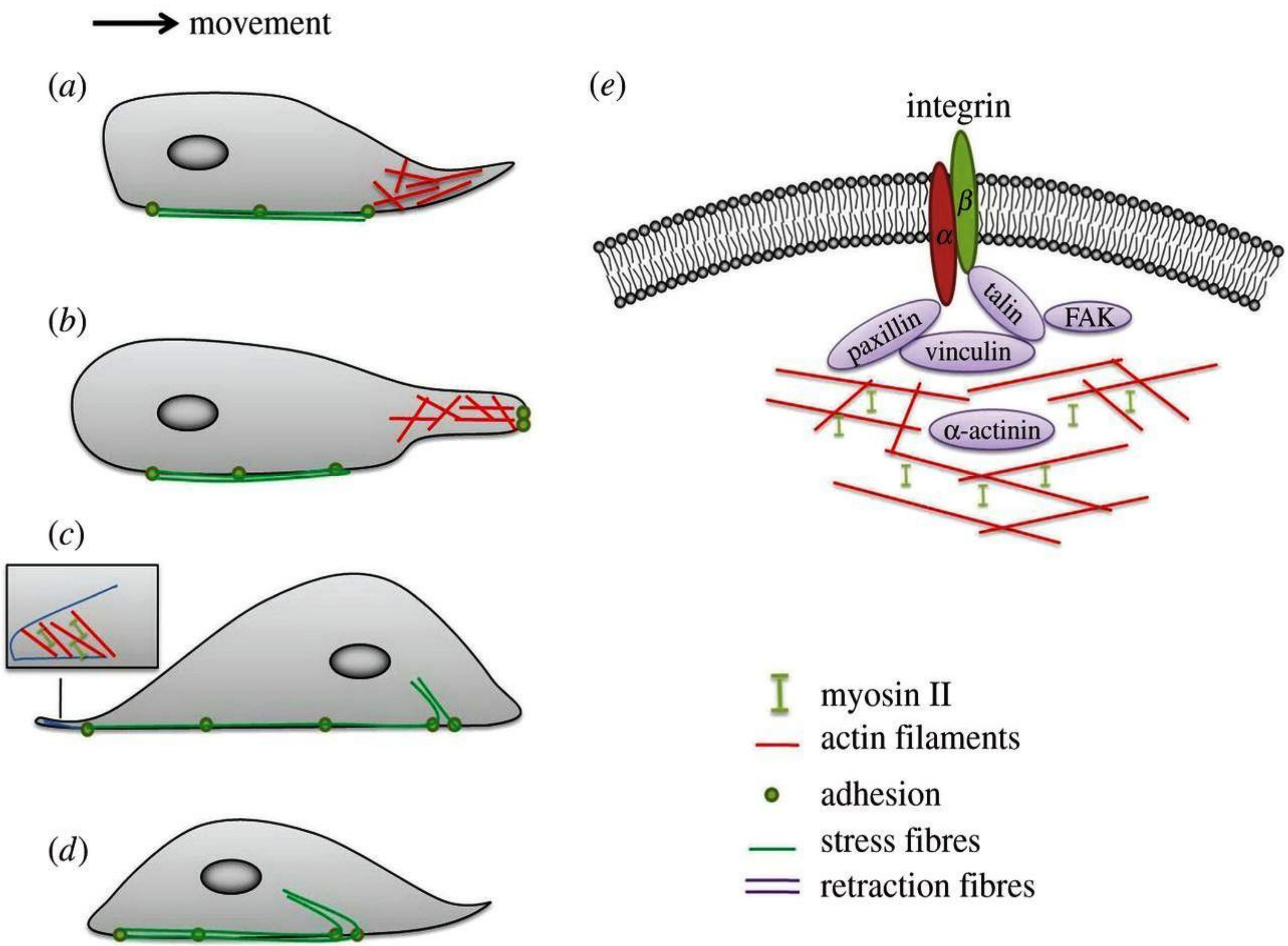


Actin & Myosin Interaction

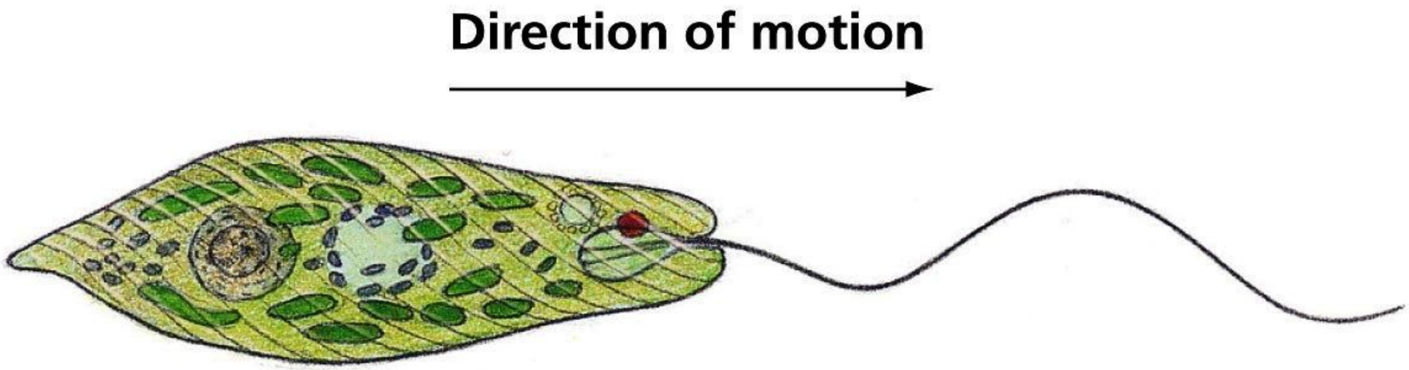




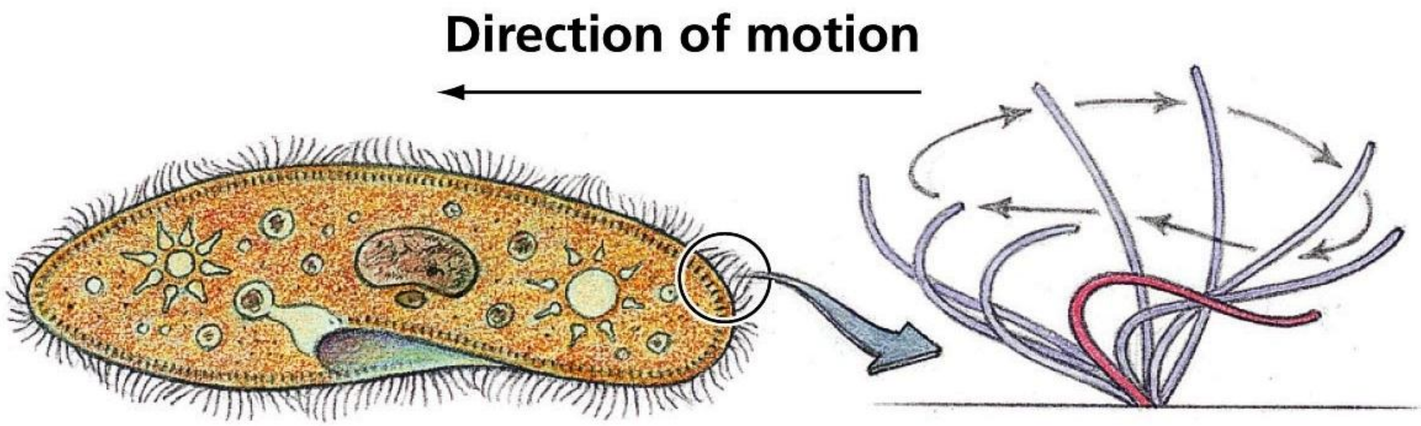
Sol-gel (forward) or Gel-sol (backward) conversion: Molecular modeling



AXONEMES : Flagellum & Cilium

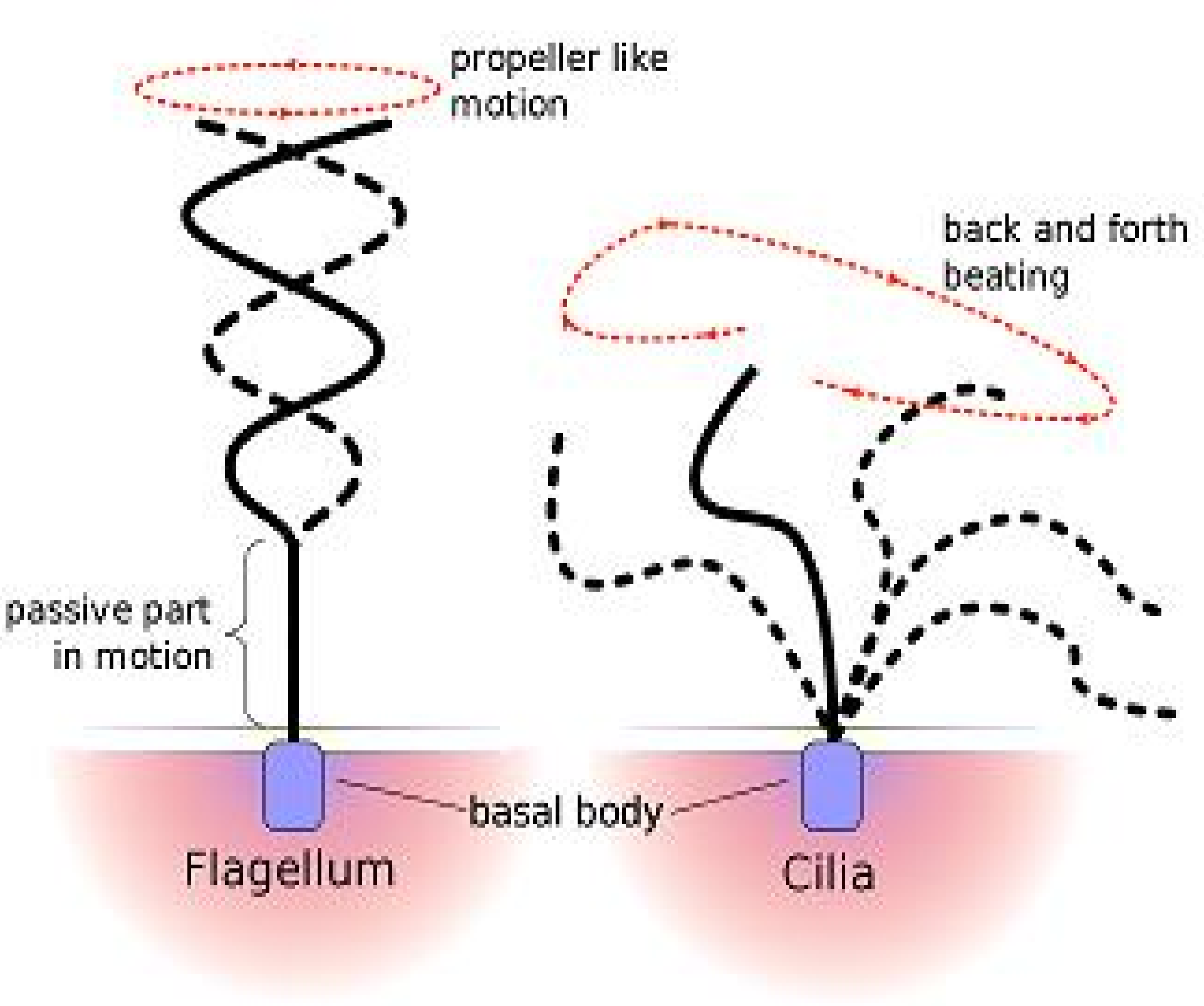


(a) Flagella



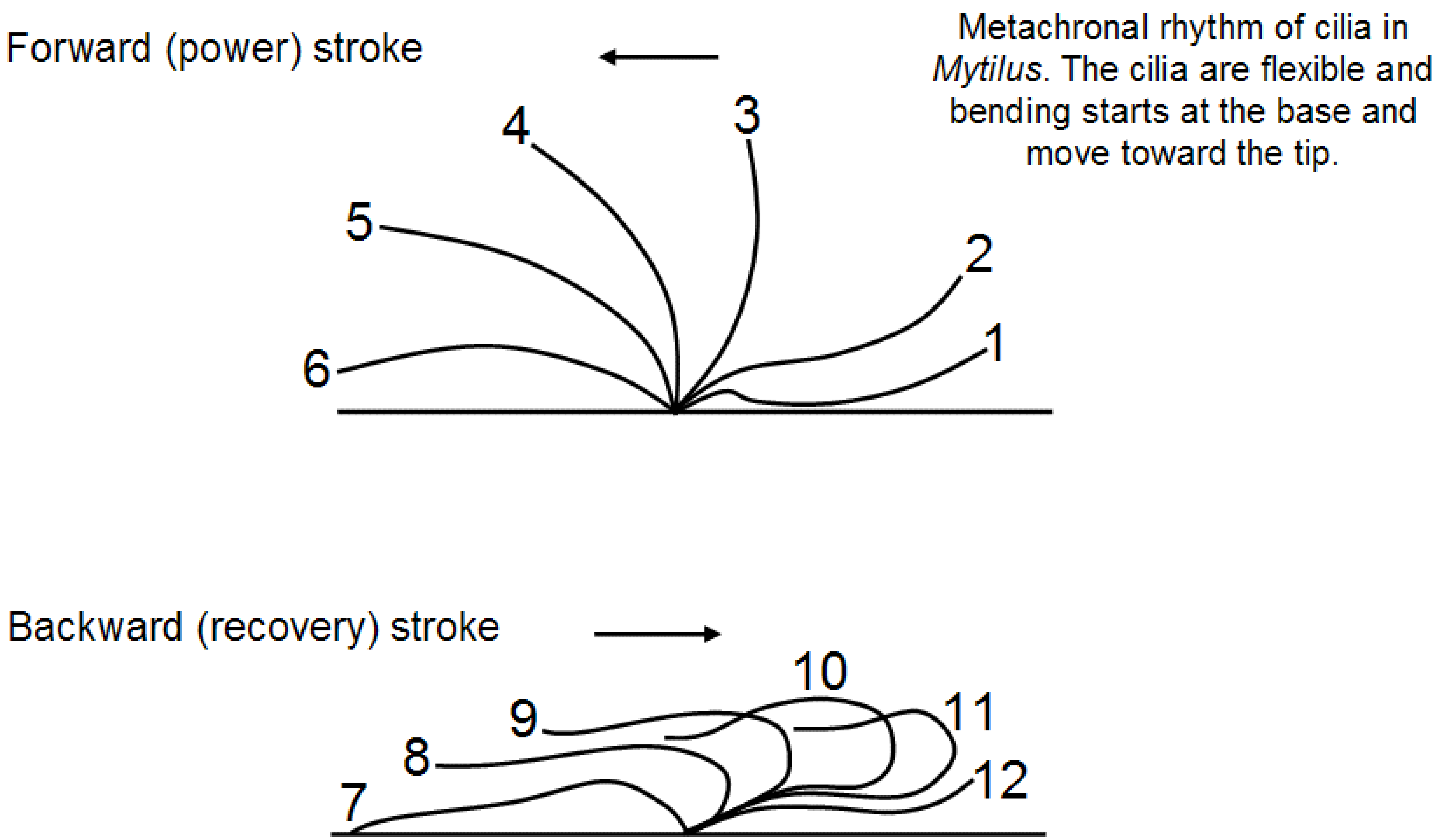
(b) Cilia

Axonemes: Flagellum & Cilium

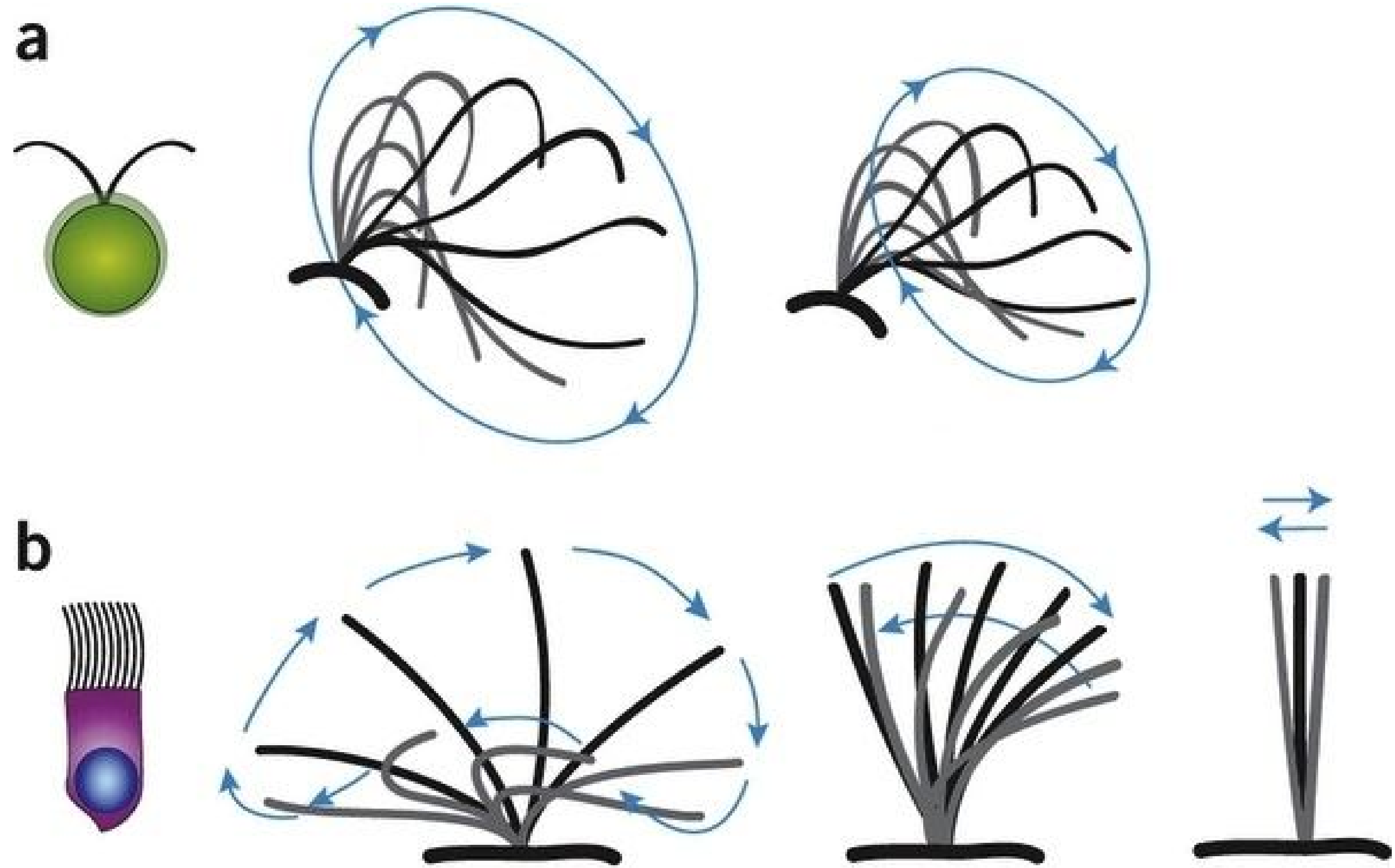


Propeller Motion & Back-forth Motion

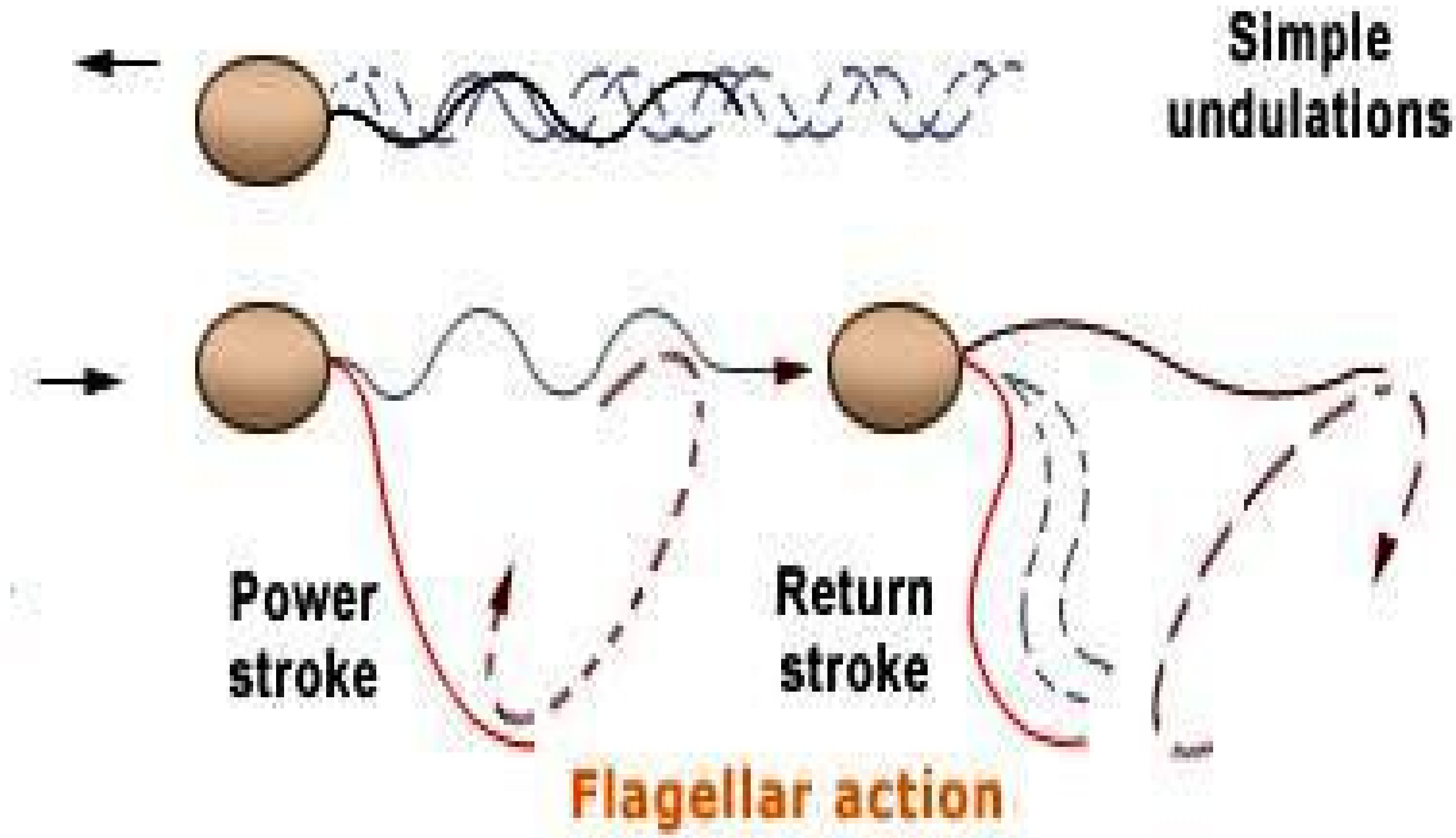
Forward & Backward Stroke by Cilia



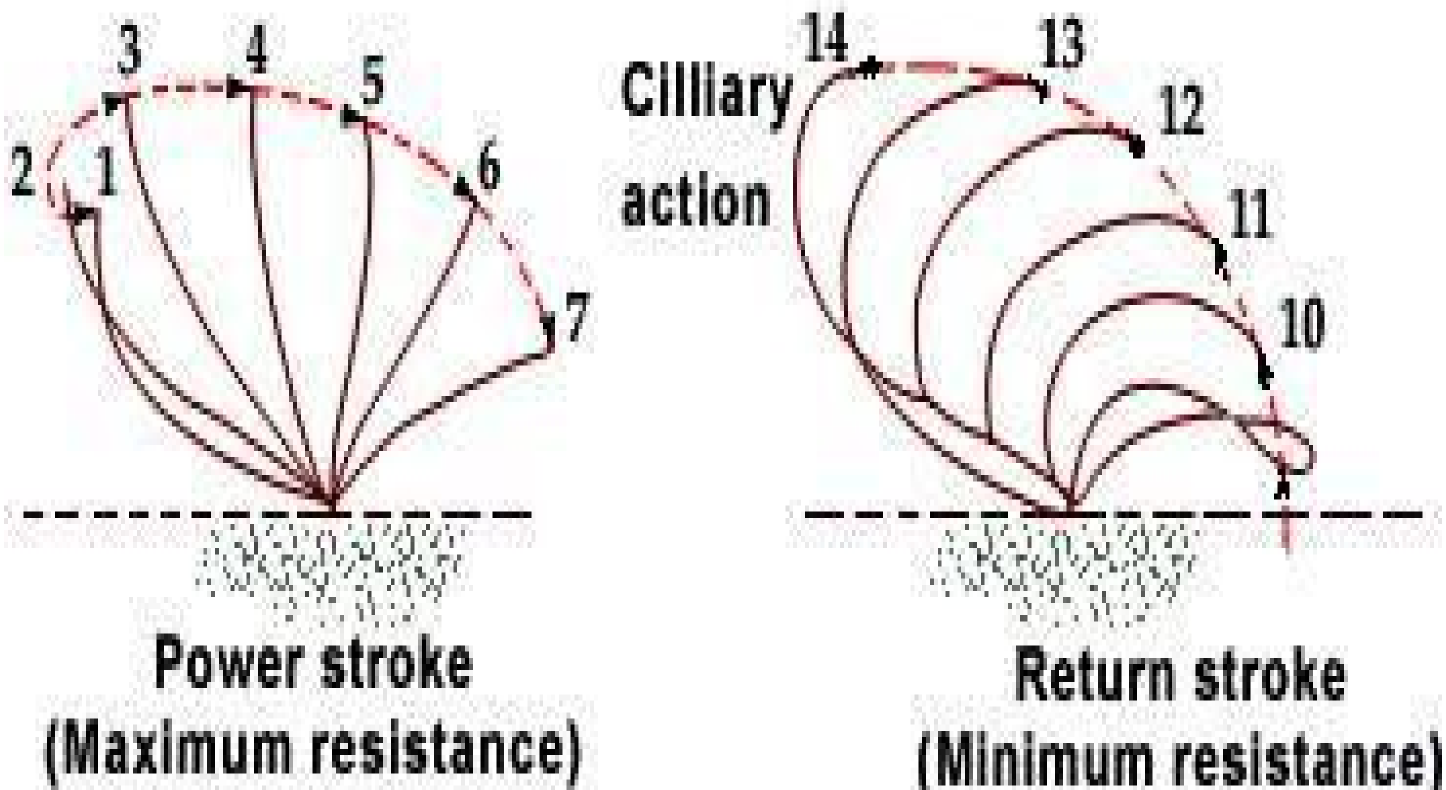
Model presentation of Flagellar vs. Ciliary Motion



Undulatory Motion & Power-return Stroke



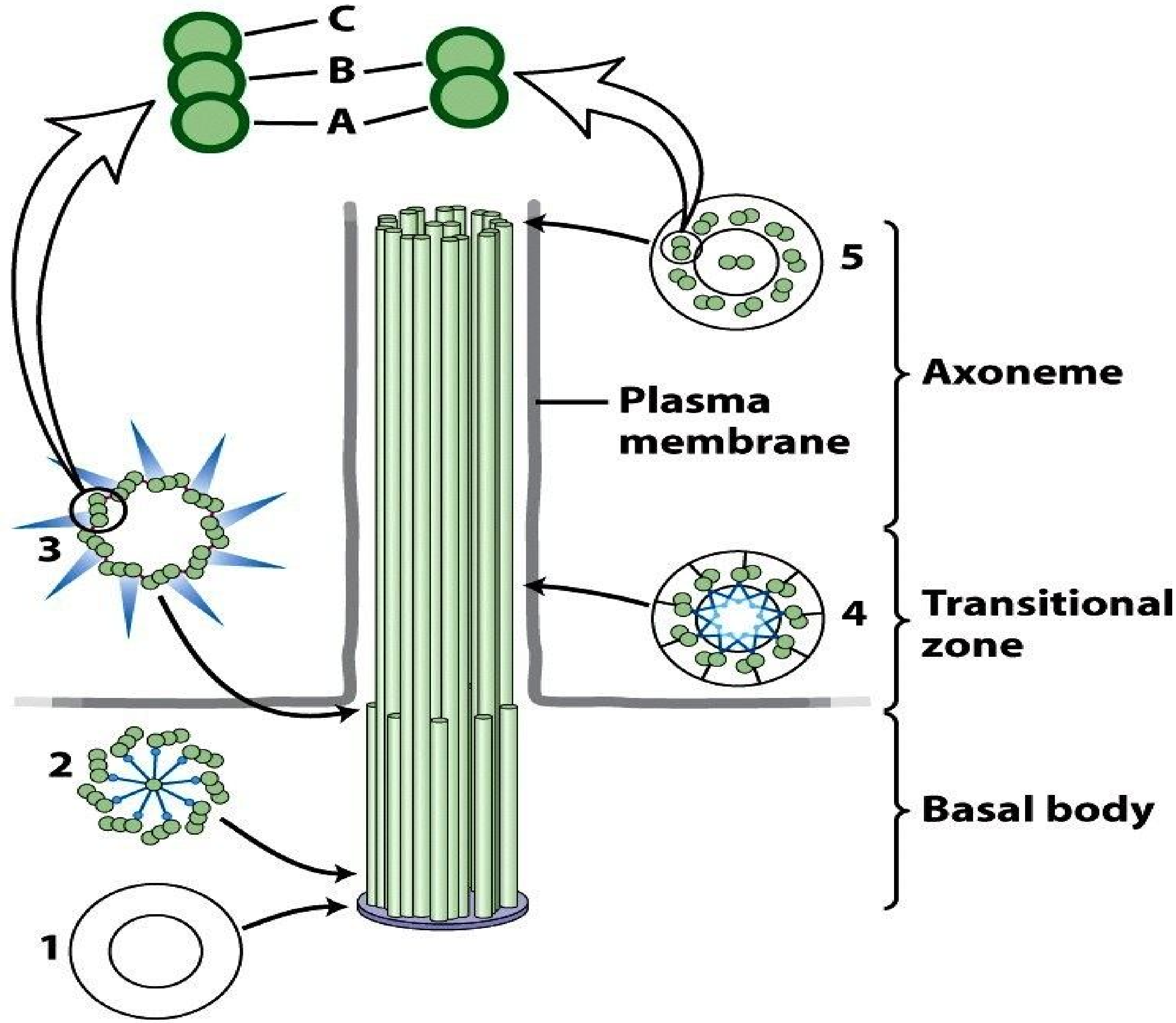
Ciliary Locomotion

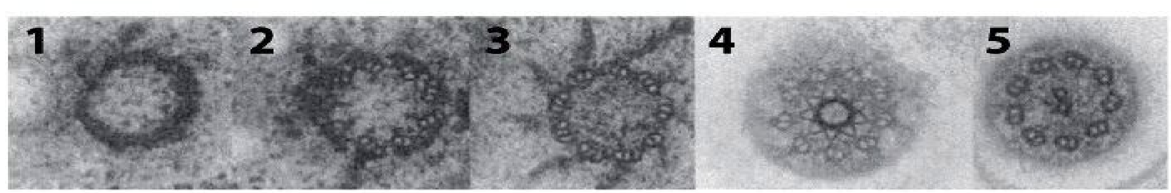


Effective stroke (a) and recovery stroke (b) of a cillium

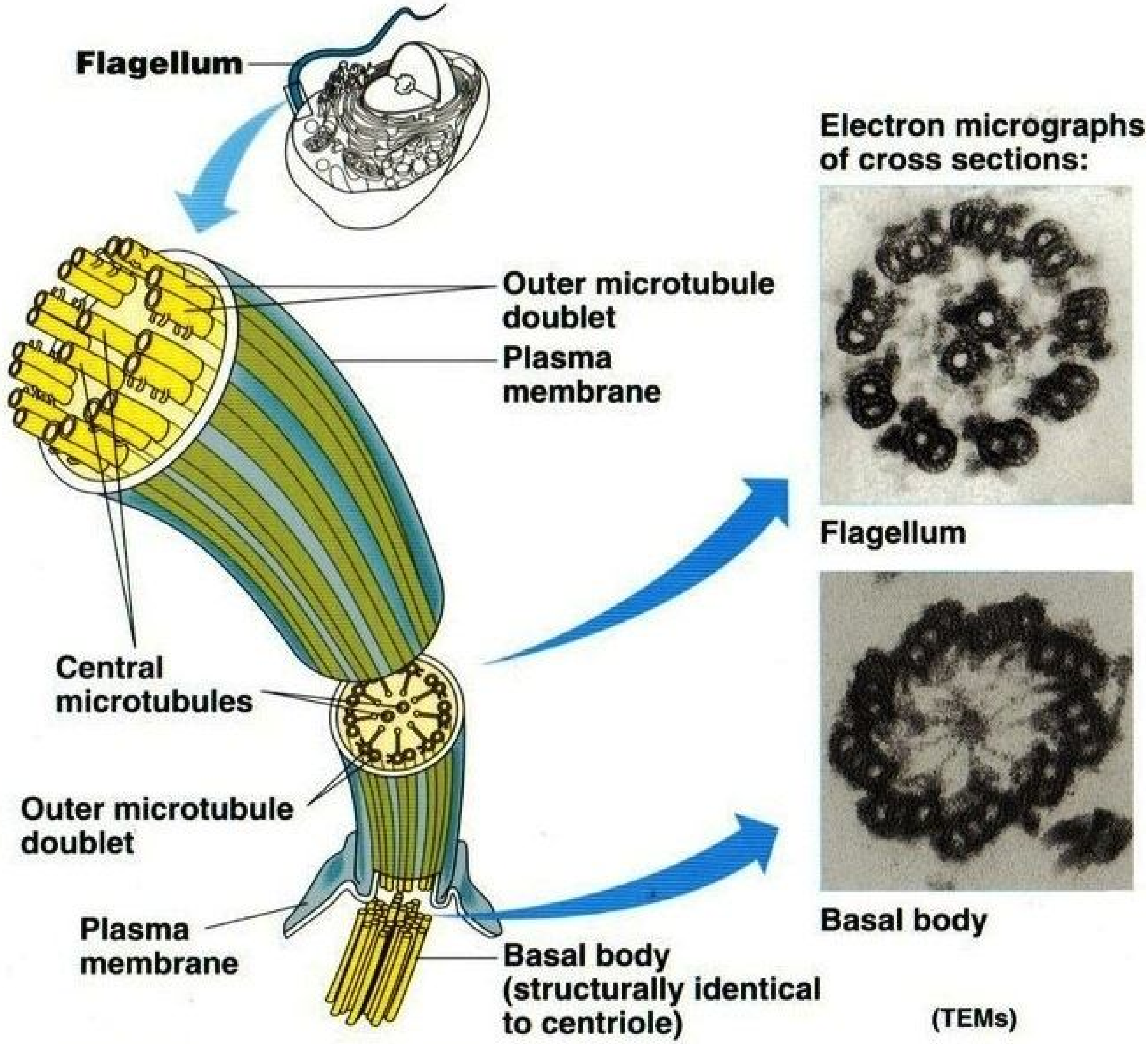
<u>Structural Model of Axoneme</u>:

T.S. or C.S. through different zones

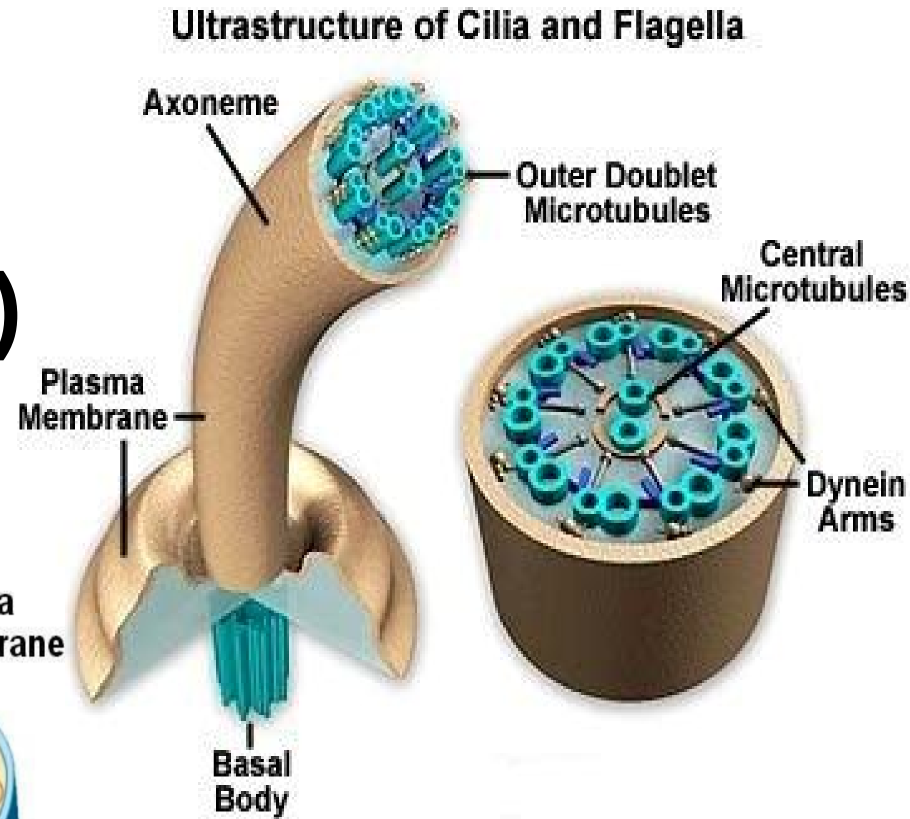


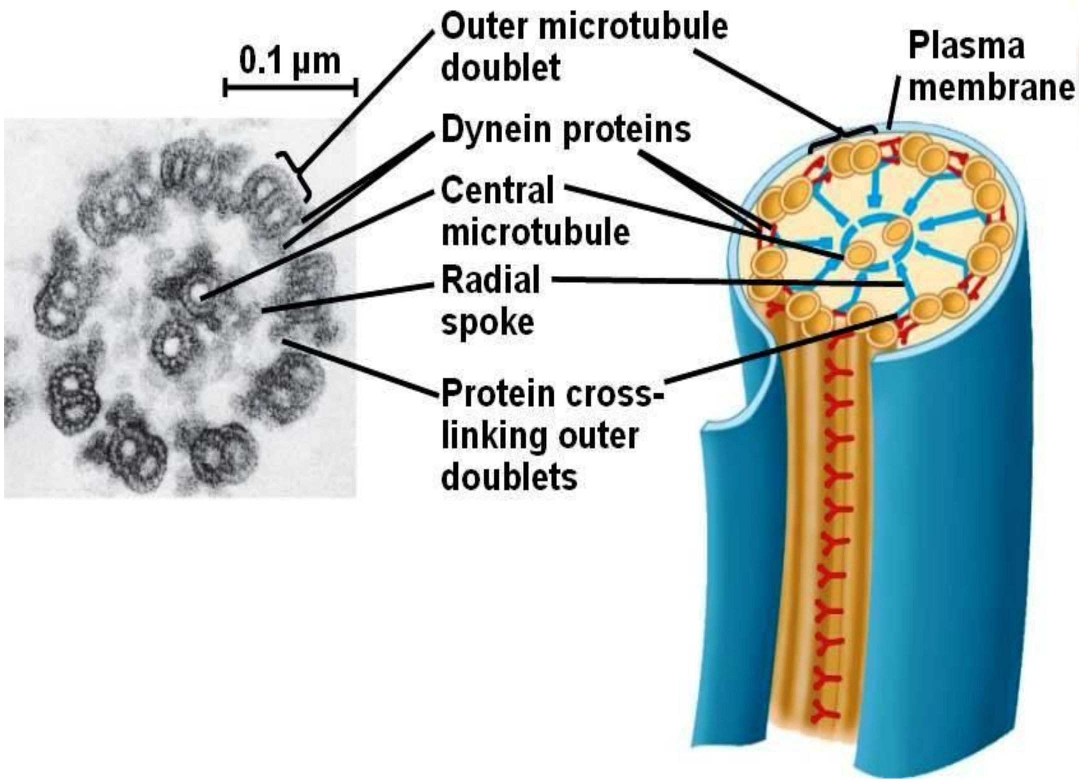


Ultrstructure of Flagellum or Cilium

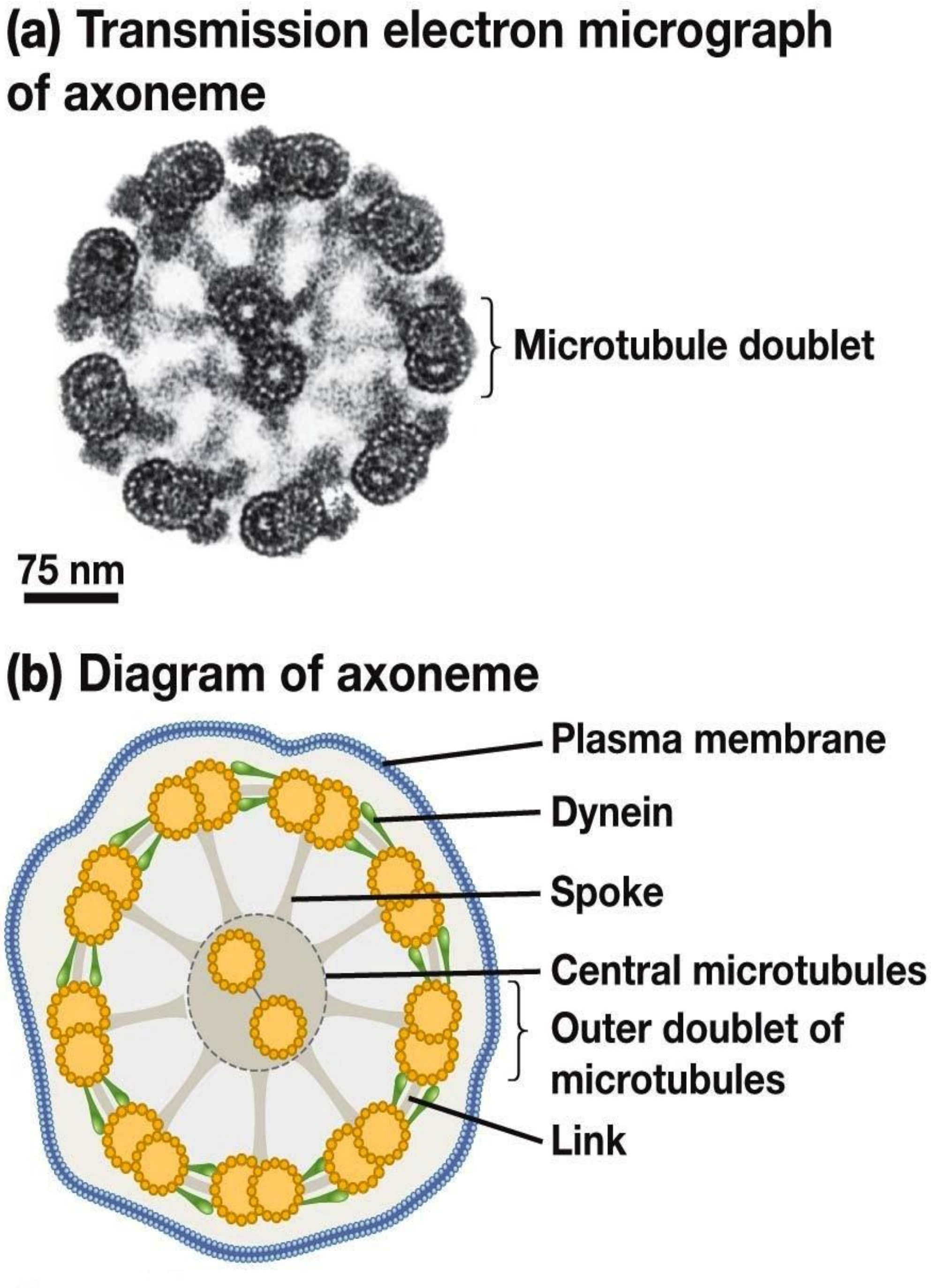


C.S. or T.S. of Axoneme
(Cilium or Flagellum)

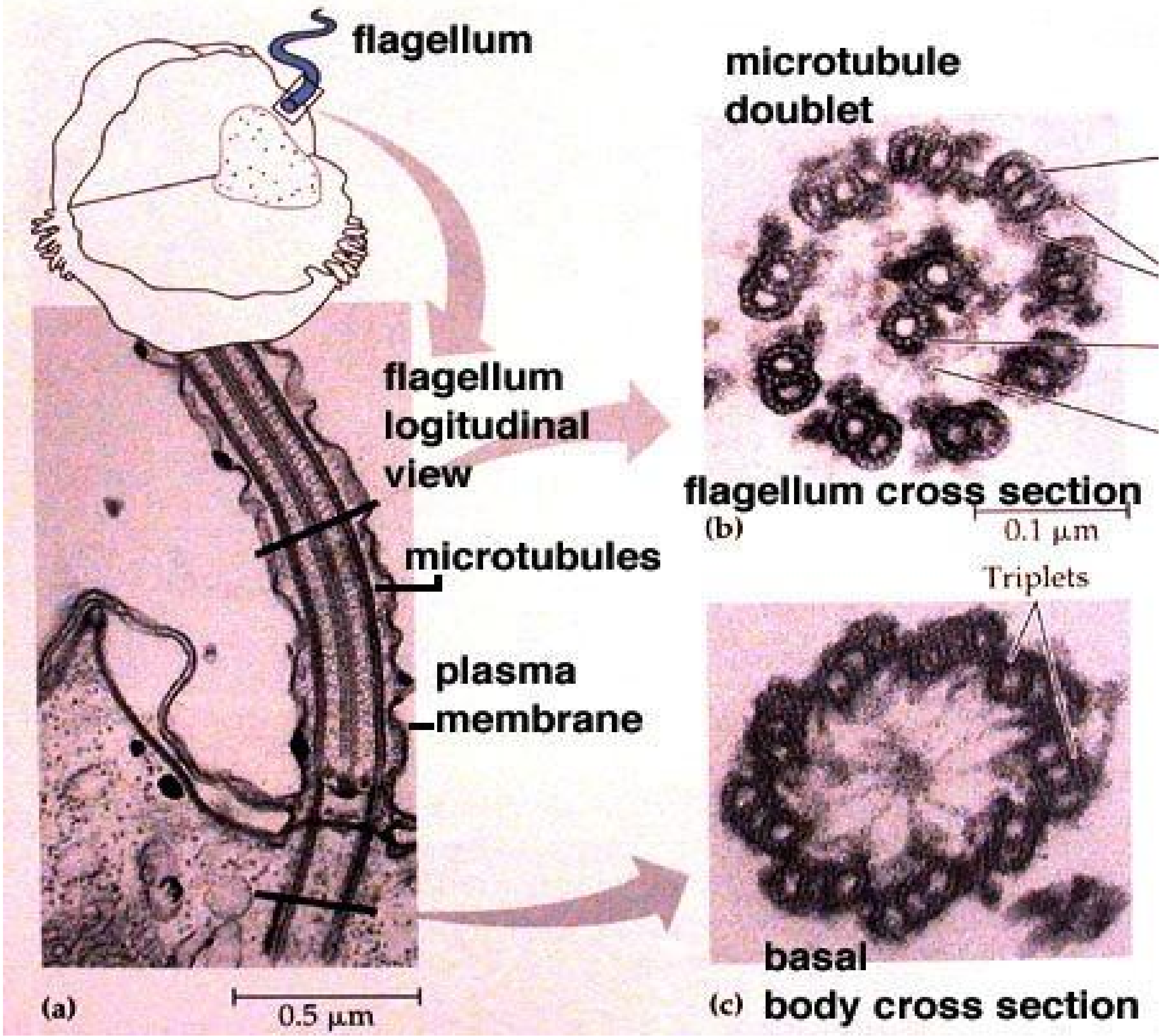




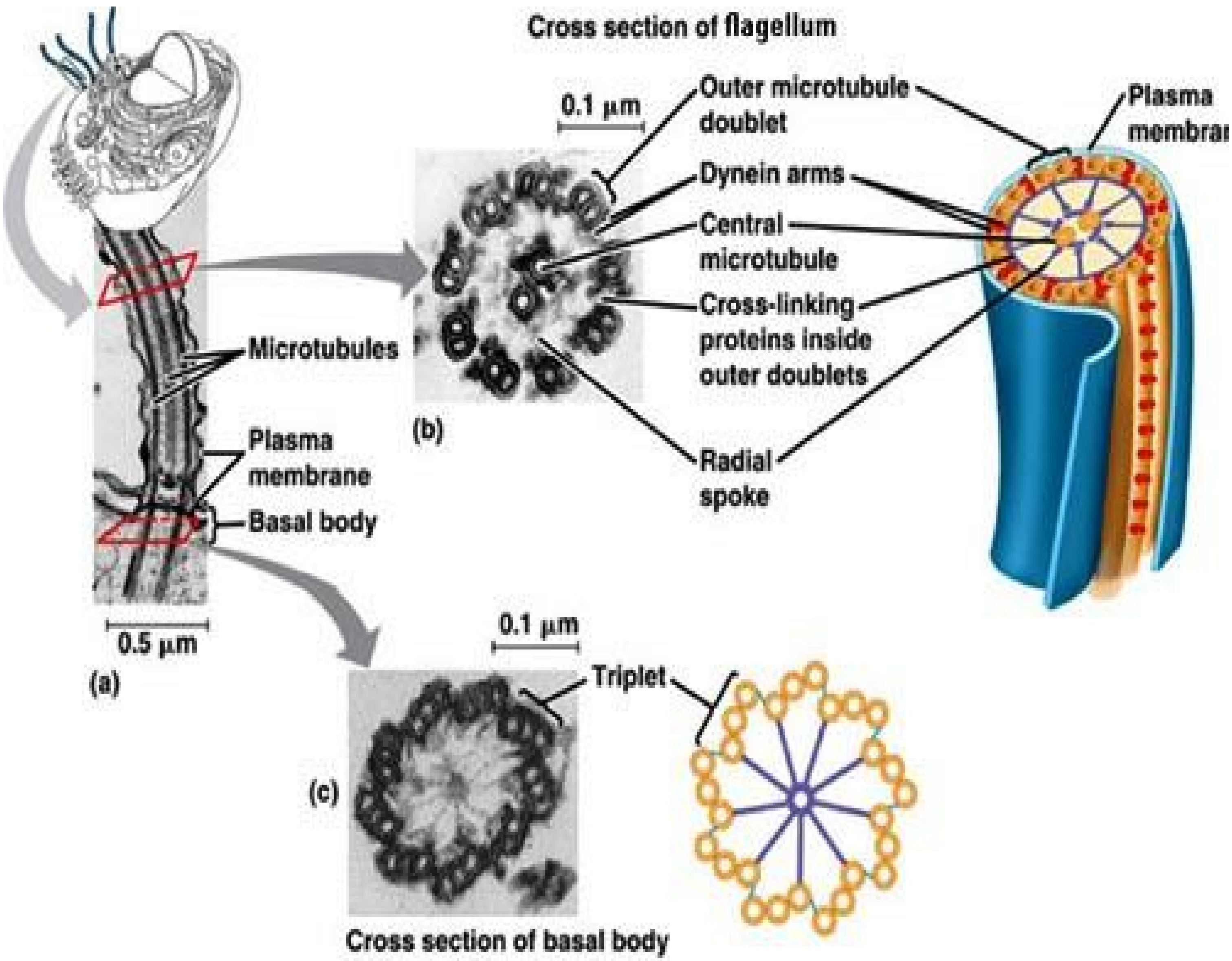
9+2 Arrangement of Microtubules in Axoneme



Ultrustructure of exoneme in L.S. & T.S.

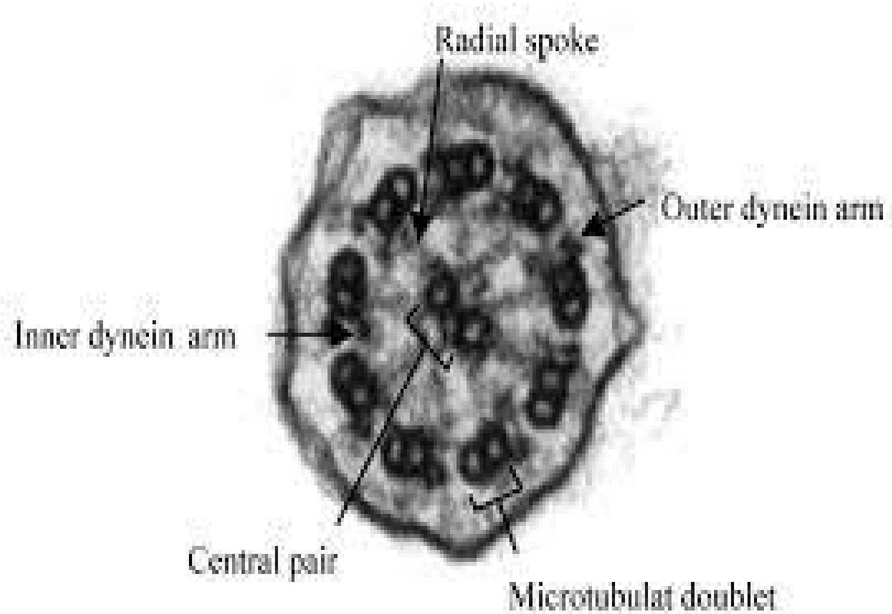


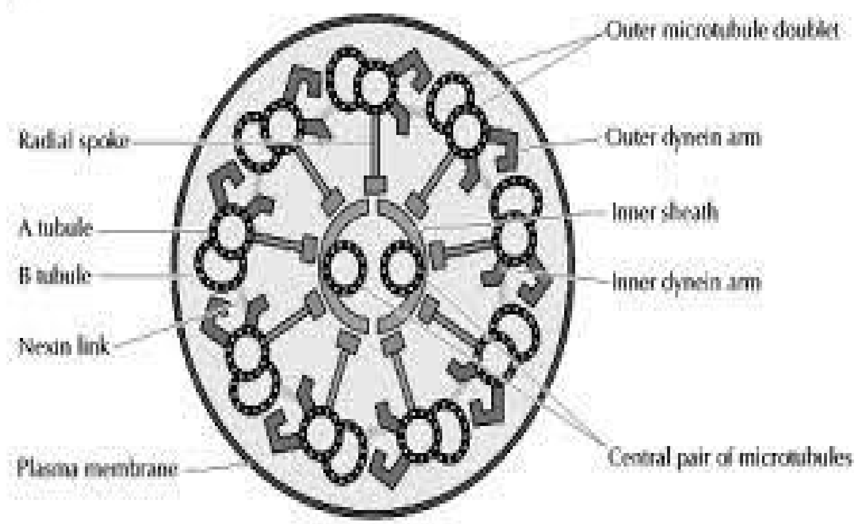
Cross Section of Axoneme



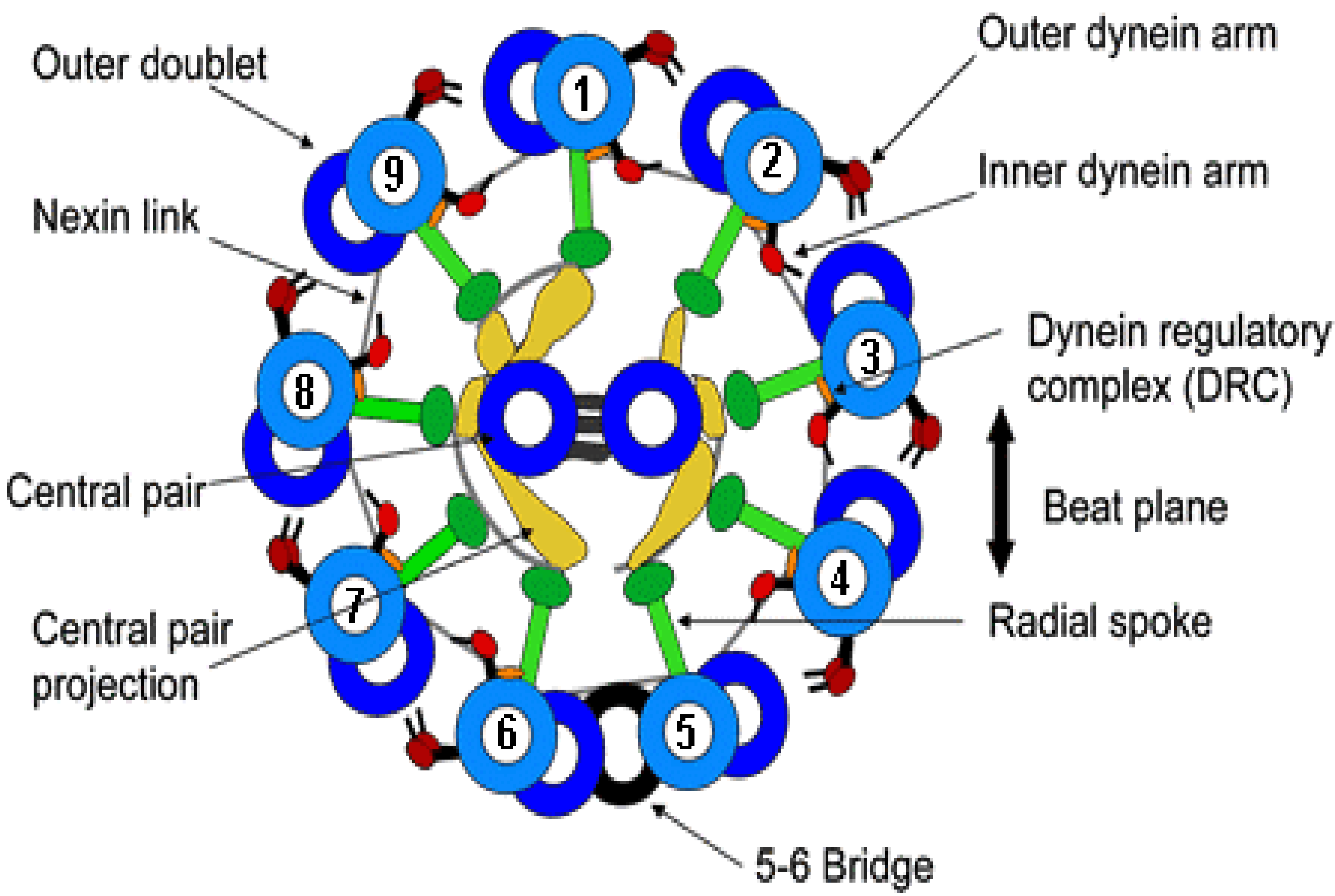
Cross Section of Axoneme

A. Real figure B. Model figure

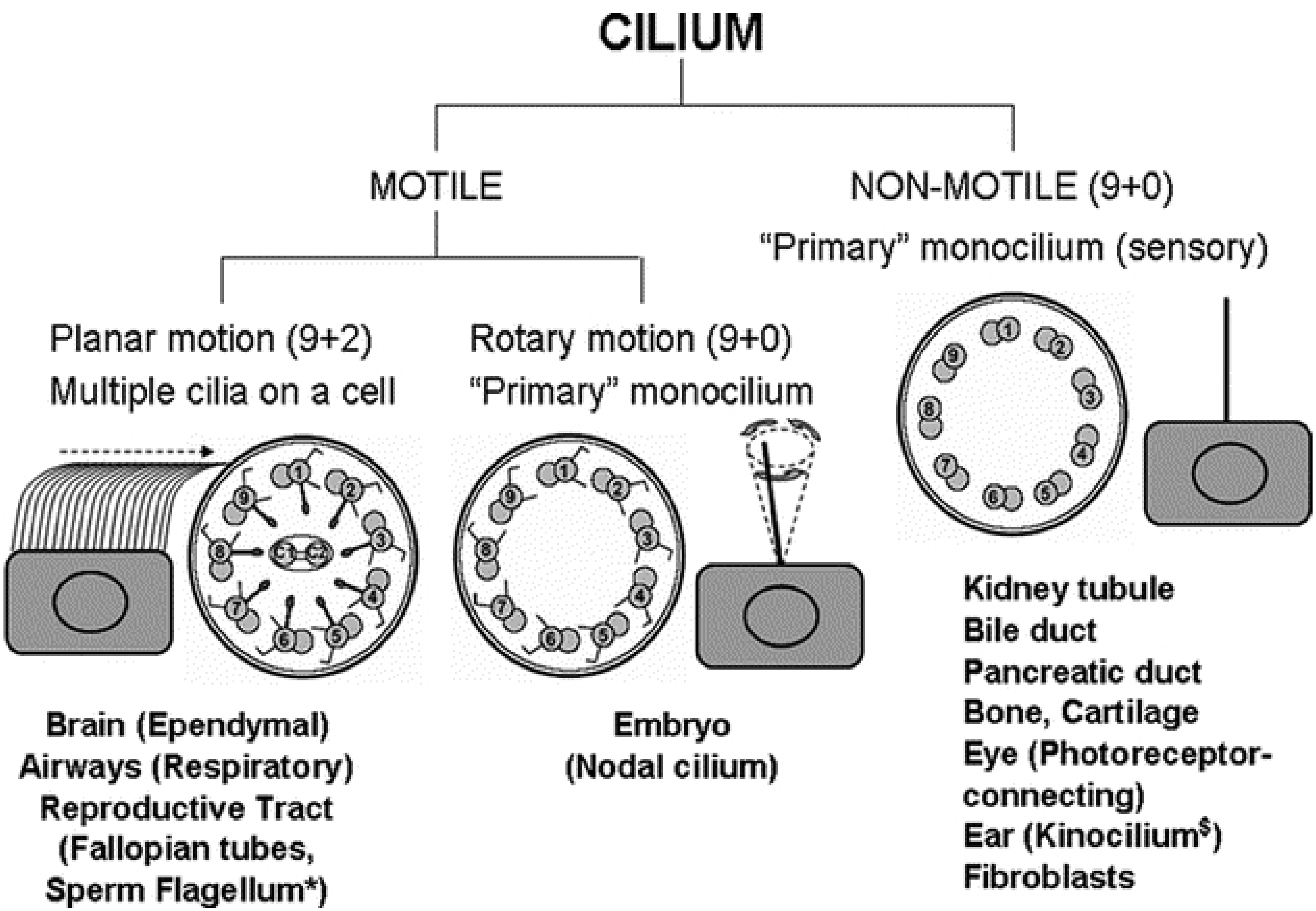




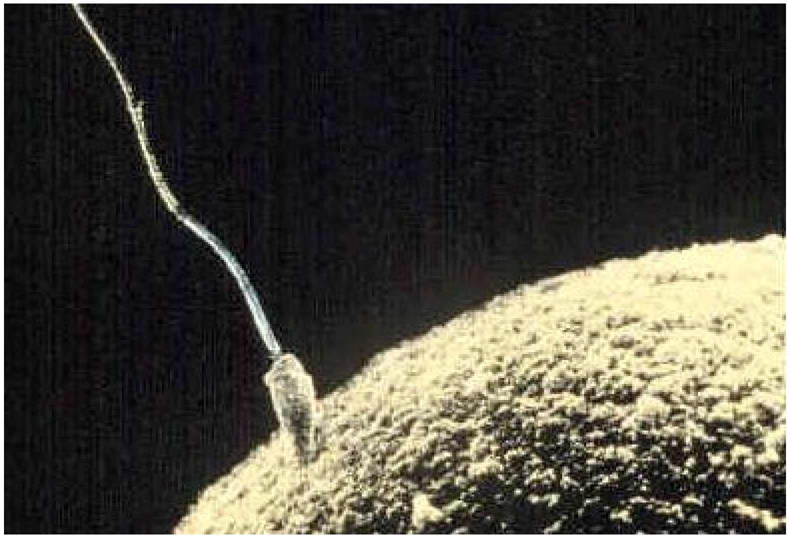
Details of microtubular arrangement: a Model

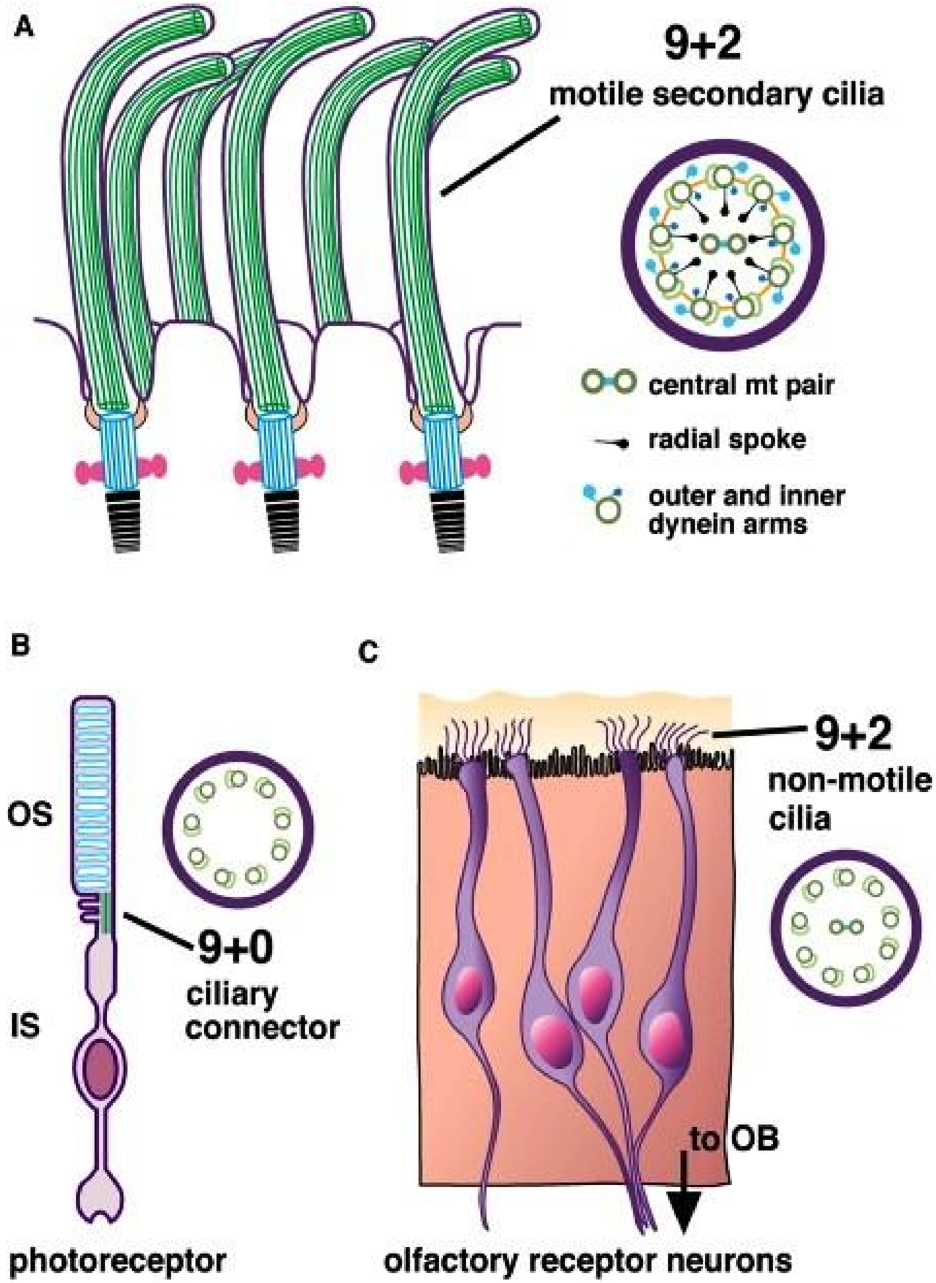


Deviation from (9+2) to (9+0) arrangement and lack of Dyneins that result to Ciliopathy

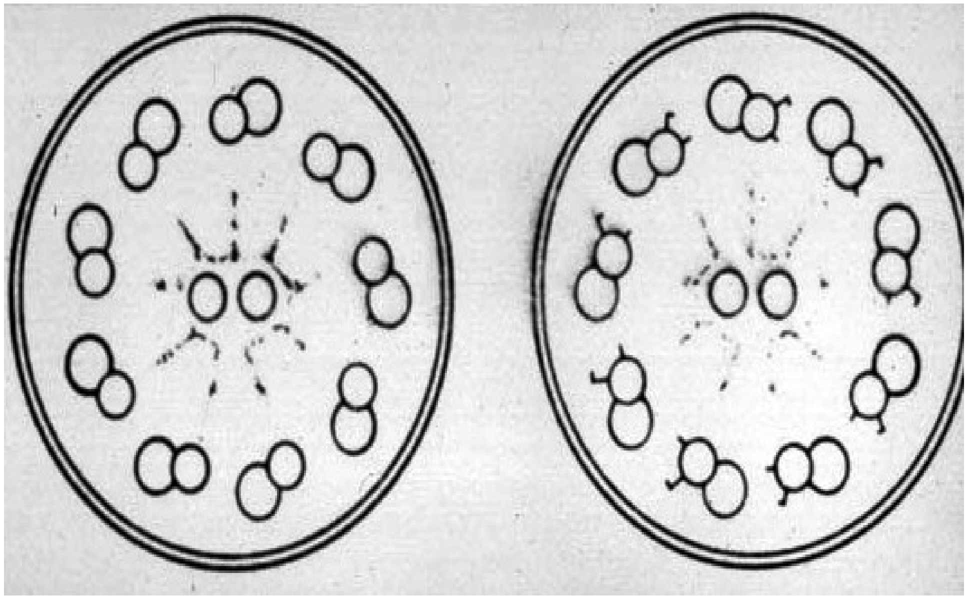


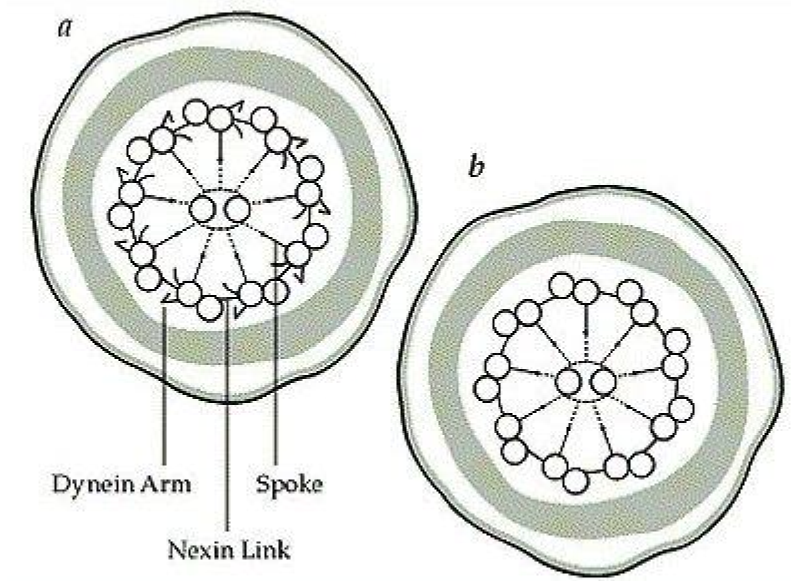
Human cilium & Flagellum

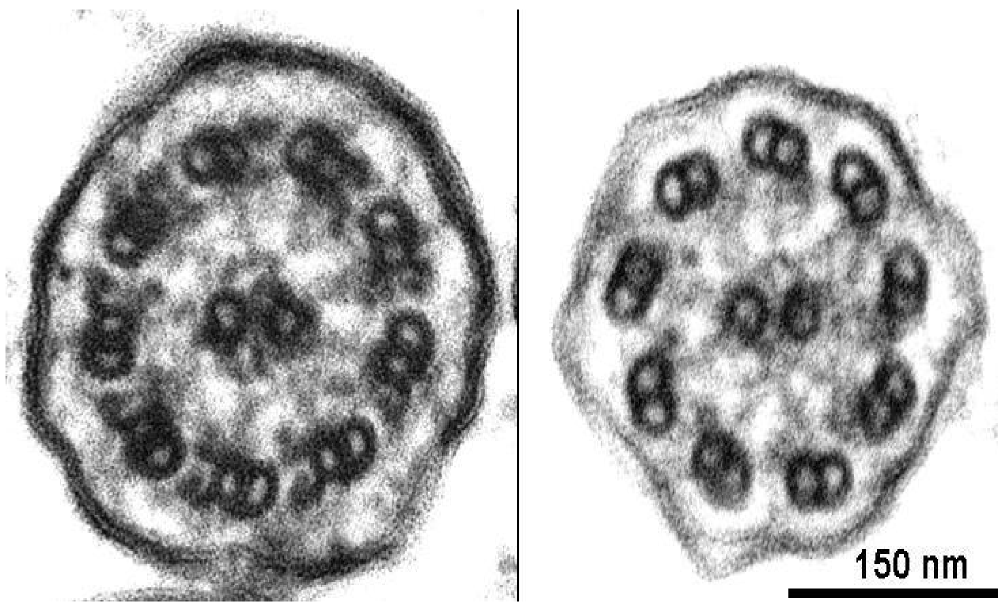




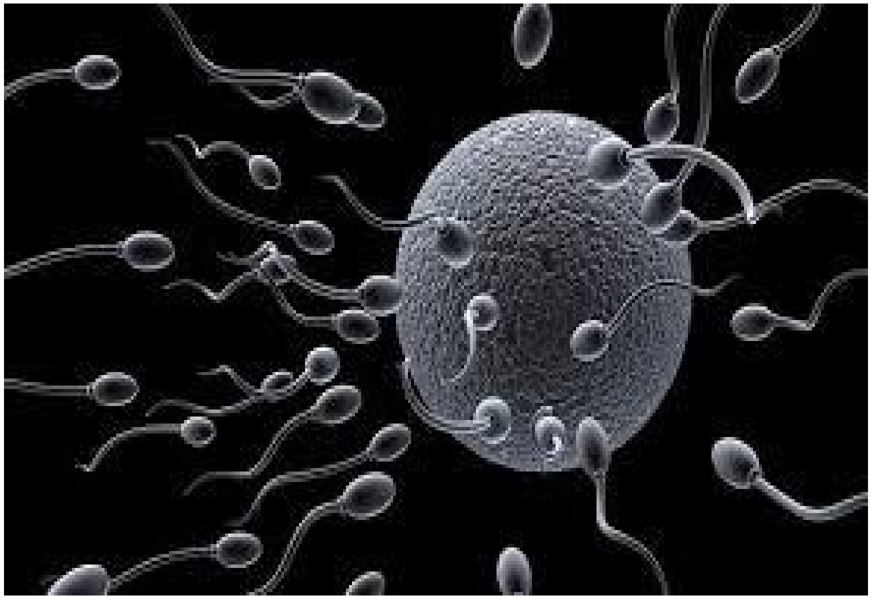
Abnormal Axonemal Configuration

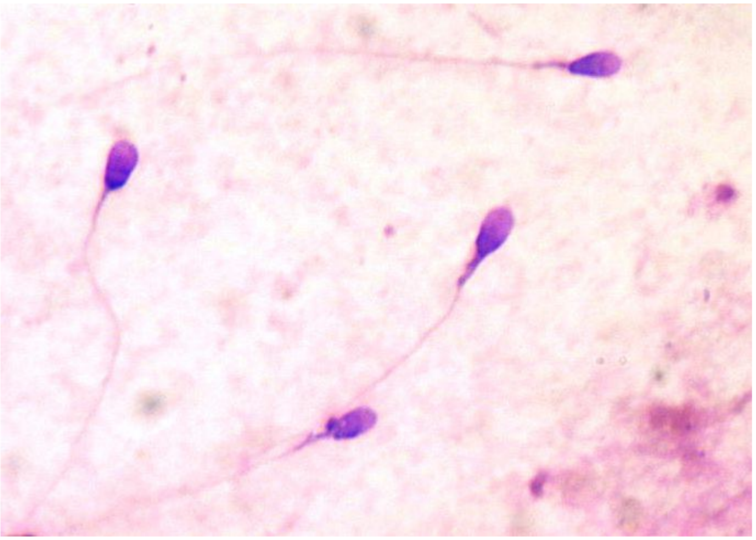


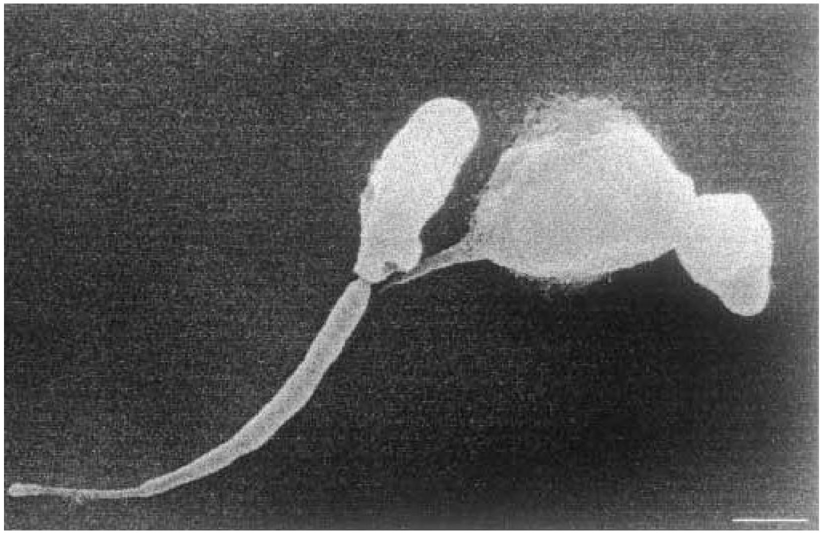




Normal *vs.* Abnormal Sperm
Stumpy tail Syndrome *or* Kartagener syndrome







Axonemal Dysfunction

Dysfunction of the axonemal structure has been linked to the emerging class of disorders collectively known as CILIOPATHIES, which includes Primary ciliary dyskinesia (PCD)/Kartagener syndrome, Bardet-Biedl syndrome, hydrocephalus, polycystic kidney disease, polycystic liver disease, nephrolithiasis, Meckel-Gruber syndrome and Joubert syndrome.

PCD is a genetically heterogeneous disorder affecting motile cilia which are made up of approximately 250 proteins. Around 90% of individuals with PCD have ultrastructural defects affecting protein(s) in the outer and/or inner **dynein arms** which give cilia their motility, with roughly 38% of these defects caused by mutations on **two genes**, DNAI**1** and DNAH**5**, both of which code for proteins found in the ciliary outer dynein arm.

Primary ciliary dyskinesia (PCD)

Immotile Ciliary Syndrome (ICS)

Ultrastructural and functional defects of cilia result in the lack of effective ciliary motility, causing abnormal mucociliary clearance. This leads to recurrent or persistent respiratory infections, *sinusitis*, *otitis media*, and *male infertility*. Primary ciliary dyskinesia (PCD), also known as immotile ciliary syndrome (ICS), is a rare, ciliopathic, autosomal recessive genetic disorder that causes a defect in the action of the cilia lining the respiratory tract (lower and upper, sinuses,Eustachian tube, middle ear) and fallopian tube, as well as the flagella of sperm cells. In 50% of the patients, ICS is associated with *situs inversus*.

Kartagener Syndrome

- In 1933, Kartagener described a unique syndrome characterized by the triad of *situs inversus*, *chronic sinusitis*, and *bronchiectasis*, later termed as Kartagener syndrome. The moveable tails of sperm (flagella) are often also affected. Abnormality in sperm motility may result in male infertility.
- Male infertility is a common sign of Kartagener syndrome present in men. Women with Kartagener syndrome are often infertile because of ciliary immotility or immobility in/of the lining of the Fallopian tubes.

SEE YOU NEXT TIME

THANKS

Uploaded on 16-01-2019

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Zoology Deptt

Sept, 2018