

## CILIA AND FLAGELLA

- Cilia (sing.: cilium) and flagella (sing.: flagellum) are hair-like **outgrowths of the cell membrane**. ( motile appendages on the free surface of the cells).
- There is **no clear morphological and physiological difference between cilia and flagella** except that of size .when they are a few ( 1,2 or 4 in number) and longer, they are called flagella, but when they are numerous and relatively short , they are called cilia.
- **Flagella** exhibit undulating motion and **beat independently**, whereas **cilia** beat perpendicularly in **metachronous** ( cilia of a row beating one after the other ) or in **synchronous** rhythm ( all cilia of a row beating simultaneously).

### Occurrence of cilia and flagella :-

**Cilia**- in all **ciliated protozoans** ( *Paramecium*), on the body surface of **larvae of annelids, molluses** and **echinoderms** and **on the epithelial lining of windpipe, fallopian tube** etc.

**Flagella** - **protozoans of the class Flagellata**, choanocytes of sponges , **sperm cell of animal** ,**zoospore and gametes of algae and fungi**

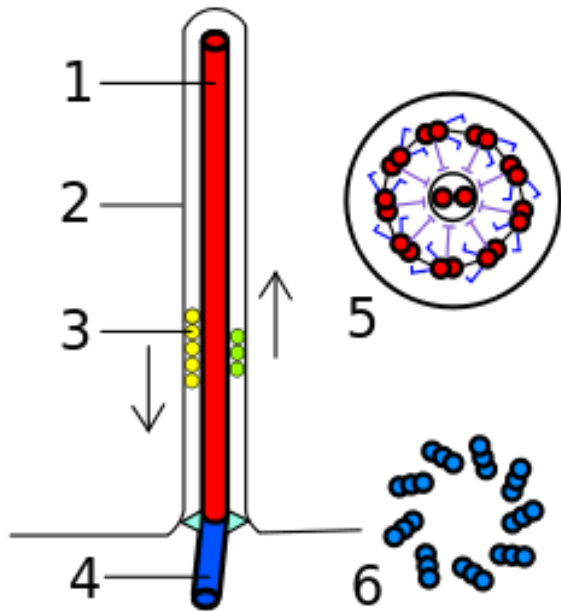
### Chemical composition

Cilia and flagella are formed of **protein** ( 70-84 % , mainly tubulin, dynein, and nexin)  
**Lipid** (13-23 %) and **carbohydrates** ( 1-6 % ).

### Ultrastructure of cilia and flagella

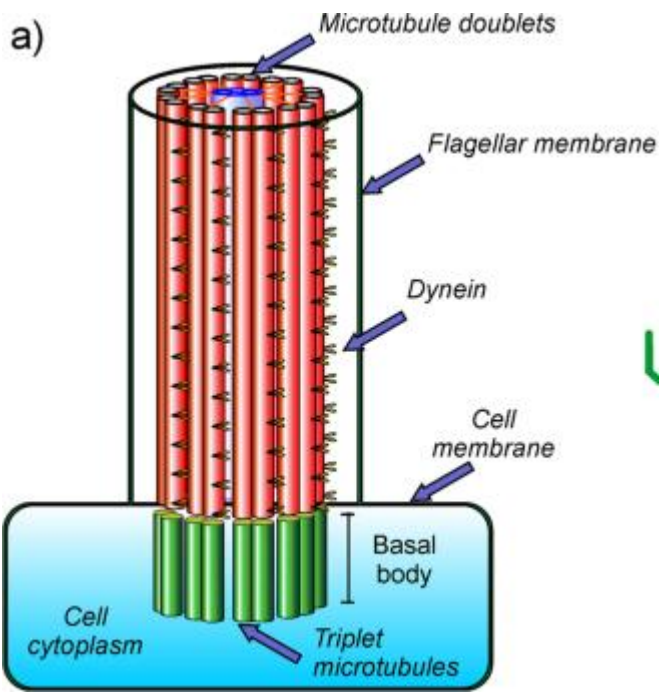
The electron microscopic study of a cilium or the flagellum show that -----

- they are covered with plasma membrane.
- **Their core called the axoneme**, possesses a number of microtubules running parallel to the long axis.
- **The axoneme usually has nine doublets of radially arranged peripheral microtubules**, and a **pair of centrally located microtubules**. Such an arrangement of axonemal microtubules is referred to as the **9+2 array**.
- The central tubules are connected **by a double bridges** and is also enclosed by a central **sheath**. The central sheath is connected to one of the tubules of each peripheral doublets by a **radial spoke**. Thus, there are nine radial spokes
- **The peripheral doublets are also interconnected by linkers**.
- Both the cilium and flagellum emerge from centriole-like structure called **the basal bodies**.

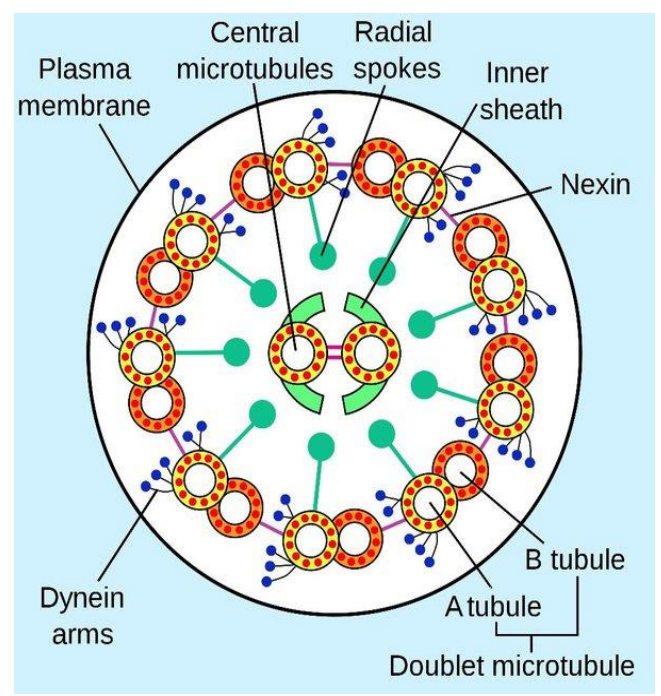


Eukaryotic flagellum.

1. Axoneme,
2. Cell membrane,
3. IFT (intraflagellar transport),
4. basal body,
5. cross section of flagellum,
6. triplets of microtubules of basal body.



Attachment of flagella/cilia on cell membrane



Cross section of cilia/flagella