Euglena Viridis locomotion:

Shape:

Euglena viridis is elongated and spindle-shaped in appearance. The anterior end is blunt, the middle part is wider, while the posterior end is pointed.

Size:

Euglena viridis is about 40-60 microns in length and 14-20 microns in breadth at the thickest part of the body.

Pellicle:

The body is covered by a thin, flexible, tough and strong cuticular periplast or pellicle which lies beneath the plasma membrane. It has oblique but parallel striations called myonemes all round. But according to Chadefaud (1937), the pellicle is made of an outer thin layer epicuticle and inner thick layer cuticle.

Both the layers of pellicle are present all over the body but only the epicuticle ends into an anteriorly placed cytopharynx and reservoir.

The pellicle is composed of fibrous elastic protein but not of cellulose. The pellicle maintains a definite shape of the body, yet it is flexible enough to permit temporary changes in the body shape, these changes of shape are spoken of as metabody or euglenoid movements.

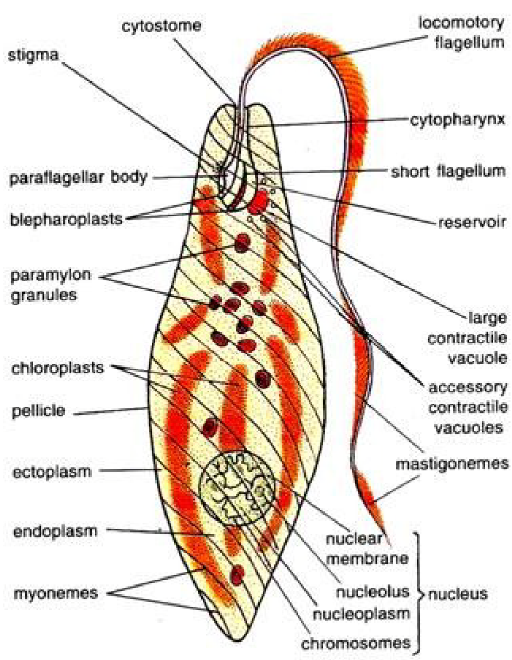

Fig. 12.1. *Euglena viridis.*

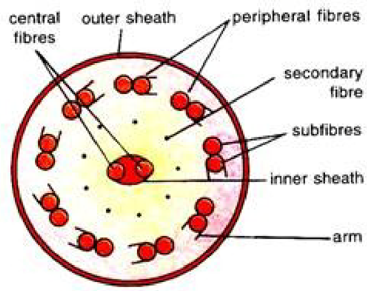

Fig. 12.2. *Euglena.* T.S. flagellum (diagrammatic).

Cytostome and cytopharynx:

At the anterior end is a funnel-shaped cytostome or cell mouth slightly to one side of the centre. Cytostome leads into a short tubular cytopharynx or gullet which, in turn, joins a large spherical vesicle, the reservoir or flagellar sac. The cytostome and cytopharynx are not used for ingestion of food but as a canal for escape of fluid from the reservoir.

Flagellum:

A single, long, whip-like flagellum emerges out of the cytostome through cytopharynx. The length of flagellum differs in different species of Euglena but in Euglena viridis it is as long as the body of the animalcule. It arises by two roots from the base of the reservoir from the side opposite to the contractile vacuole.

Each root springs from a blepharoplast (Gr., blepharon = eyelid; plastos = formed) or basal granule which lies embedded in the anterior part of the cytoplasm.

According to some workers, there are two flagella, one long and other short, each arising from a basal granule located in the cytoplasm at the base of the reservoir. The short flagellum does not extend beyond the neck of the reservoir and it often adheres to the long flagellum producing the appearance of bifurcation.

The flagellum consists of an outer contractile protoplasmic sheath and an inner elastic axial filament, the axoneme. The distal portion of the flagellum contains numerous minute fibres known as mastigonemes which project along one side of the sheath and, therefore, the flagellum is stichonematic type.

Electron structure of flagellum:

Electron microscopic study of the flagellum reveals that it consists of two central and nine peripheral fibrils. Each central fibril is single, while the peripheral fibrils are paired having two sub-fibrils in each.

One of the two sub-fibrils of each peripheral fibril bears a double row of short projections called arms; all the arms being directed in the same direction.

The two central fibrils are found enclosed in an inner membranous sheath. All the fibrils are enclosed within an outer protoplasmic sheath continuous with the cell membrane. There are nine secondary fibrils between central and peripheral fibrils.

All these fibrils fuse to join the blepharoplast or basal granule. Manton (1959) has suggested that mastigonemes, hair-like contractile fibres, arise from two of the nine peripheral fibrils.

Locomotion in Euglena Viridis:

There are two methods of locomotion in Euglena Viridis, viz,:

(i) Flagellar movement

(ii) Euglenoid movement

(i) Flagellar Movement:

Vickerman and Cox (1967) have suggested that the flagellum makes direct contribution to locomotion. However, several theories have been put forth to explain the mechanism of flagellar movement. Butschli observed that the flagellum undergoes a series of lateral movements and in doing so, a pressure is exerted on the water at right angles to its surface.

This pressure creates two forces one directed parallel, and the other at right angles, to the main axis of the body. The parallel force will drive the animal forward and the force acting at right angles would rotate the animal on its own axis.

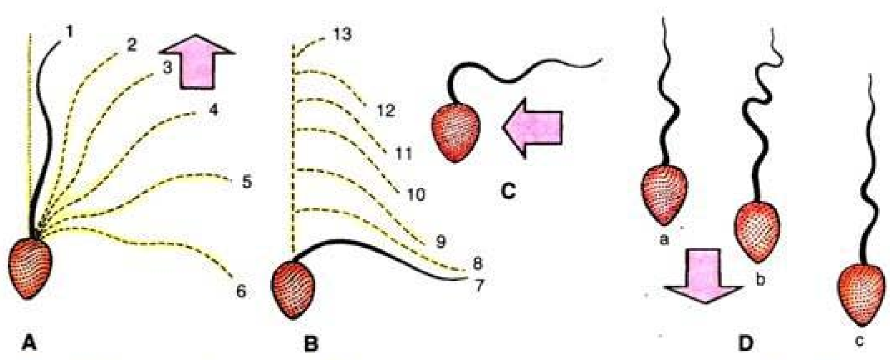

Fig. 12.5. Action of flagellum. A—Recovery stroke, successive stages from 1 to 7; B—Effective stroke, successive stages 8 to 13.

Gray (1928) suggested that a series of waves pass from one end of the flagellum to the other. These waves create two types of forces, one in the direction of the movement and the other in the circular direction with the main axis of the body. The former will drive the animal forward and the latter would rotate the animal.

For quite a long time it was generally presumed that the flagellum is directed forwards during flagellar movement but now it is generally agreed that the flagellum is straight and turgid in effective stroke and dropped backwards in the recovery stroke.

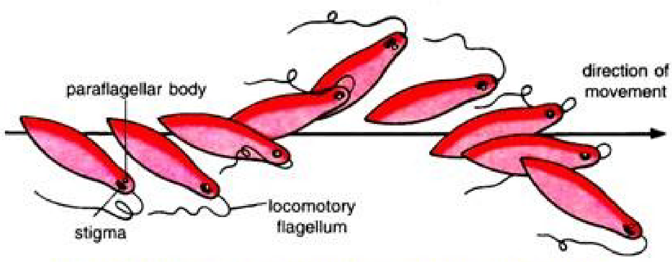

Fig. 12.6. *Euglena*. Successive stages in flagellar movement.

Lowndes (1941-43) has pointed out that the flagellum is directed backwards during locomotion. According to Lowndes, a series of spiral waves pass successively from the base to the tip of the backwardly directed flagellum at about 12 per second with increasing velocity and amplitude.

The waves proceed along the flagellum in a spiral manner and cause the body of Euglena to rotate once in a second. Thus, in its locomotion, it traces a spiral path about a straight line and moves forward. The rate of movement is 3 mm per minute.

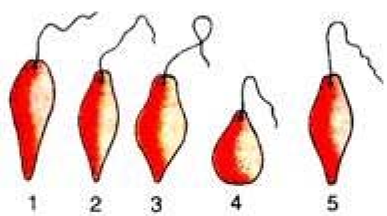

Fig. 12.7. *Euglena*. Stages of euglenoid movement.

However, movement of flagellum is related to the contraction of its all fibrils. The energy for the contraction of these fibrils is derived from ATPs formed in the mitochondria of blepharoplasts.

(ii) Euglenoid Movement or Metaboly:

Euglena sometimes shows a very peculiar slow wriggling movements. A peristaltic wave of contraction and expansion passes over the entire body from the anterior to the posterior end and the animal moves forward. The body becomes shorter and wider first at the anterior end, then in the middle and later at the posterior end.

This type of movement is called euglenoid movement by which slow and limited movement occurs. Euglenoid movements are g brought about by the contractions of cytoplasm or by the contractions of myonemes present in the cytoplasm below the pellicle.

Euglenoid movement.