

# Cellular Adaptations

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## Cellular Adaptations

- Many unicellular (single celled) organisms have cellular adaptations to help them survive in particular environments.
- Prokaryotes (ex. Bacteria)
- Eukaryotes (ex. Amoeba, Paramecium, or Euglena)

## Cilia

- Cilia is Latin for "eyelashes."
- Common in single-cell organisms, like Paramecium
- These hair-like structures beat like boat oars to move an organism around or to move/transport substances near or around the cell.

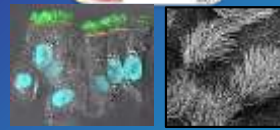
- Cilia are present on some cells in the human body. Some tissues in the body, such as the Fallopian tubes in women and the trachea have a special type of cilia that help transport substances along the tissues' surfaces.



Didinium attacking Paramecium

## Cilia

### Cilia in Human Respiratory Tract



### Cilia in Paramecium



## Flagella

- Flagella move a cell around by rotation, much like the propeller in a motor boat would.
- Flagella are found on many bacteria, unicellular Eukaryotes like Euglena, and in the spermatozoa of multicellular animals.



## Cilia and Flagella

<http://www.youtube.com/watch?v=sZIDAAu2oZ0>

## Pseudopods

- Pseudo means “false” • Pod means “foot”
- The false foot is a temporary projection of the cytoplasm of certain cells that **functions in locomotion and phagocytosis** (capturing prey).
- Most commonly used by Amoebas

White Blood Cell



## Amoeba Pseudopod

<http://www.youtube.com/watch?v=pvOz4V689gk>

## Contractile Vacuole

- Freshwater organisms, like Paramecium or Amoeba, live in hypotonic environments. This results in the osmotic movement of water into the cell.
- These organisms have adapted specialized organelles called **contractile vacuoles** to **maintain homeostasis by regulating water pressure** (osmoregulation).



Paramecium

VACUOLE



Amoeba

## Contractile Vacuole in Paramecium

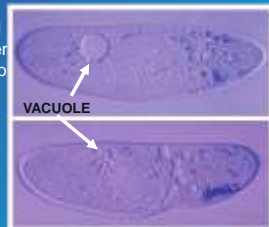
<http://www.youtube.com/watch?v=vk5NFSvp8IY>

## Contractile Vacuole

### Controlling Water

[Contractile Vacuole in Paramecium](#)

- A contractile vacuole is surrounded by radial canals which absorb water from the cytoplasm and move it into the contractile vacuole. Once filled with water, the contractile vacuole contracts and forces the water out of the cell. Upon relaxation, the vacuole refills and then repeats its pumping activity.



VACUOLE

## Eyespot

- Eye spot is a small area of light-sensitive pigment cells that cover a sensory nerve.
- **Eyespots function in detecting light.** This adaptive structure helps photosynthetic Eukaryotes that depend on sunlight for nourishment.
- Eyespot-mediated light perception helps the organism find an environment with optimal light conditions for photosynthesis



Eyespot

## Eyespot in Euglena

<http://www.youtube.com/watch?v=Zhn1ZFkDyg>

Euglena Video Clip

## Eyespot



- Eyespots are common in unicellular photosynthesizing Eukaryotes like Euglena or green-algae.

PLANARIAN  
(multicellular)



## Adaptive Behaviors

## Phototaxis

- Phototaxis is the movement of organisms towards light.
- This is advantageous for photosynthetic organisms as they can move themselves efficiently to receive the most light.
- Phototaxis is called 'positive' if the movement is in the direction of increasing light intensity and 'negative' if the direction is opposite.
- Phototaxis is performed mostly by photosynthetic unicellular organisms like algae or Euglena.

## Phototaxis in Daphnia

<http://www.youtube.com/watch?v=XmajoRnBW30>

## Chemotaxis

- Chemotaxis is the directed movement of organisms in response to a chemical stimulus.
- Moving toward food or oxygen (positive taxis)
- Moving away from toxic substances (negative taxis)
- Several kinds of receptor molecules that detect specific substances are located on the cell surfaces.
- Chemotaxis is performed by bacteria, white blood cells, sperm cells, and other single celled Eukaryotes like Amoeba.

## Neutrophil Chemotaxis

Most abundant white blood cell in our body

Immunity!

<http://www.youtube.com/watch?v=ZUUfdP87Ssg>