The Lowly Paramecium

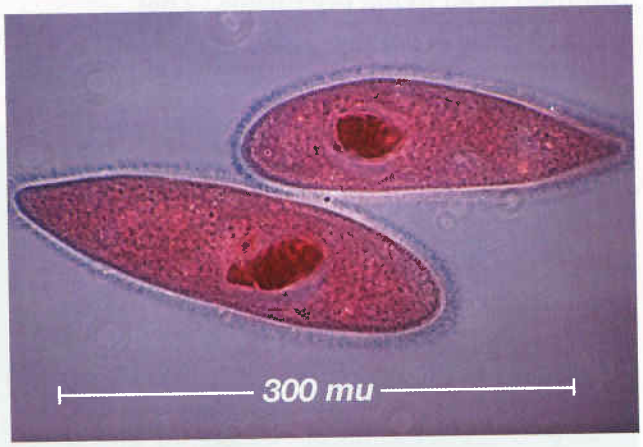
Paramecia (pair•uh•ME•see•uh) are one-celled, cigar-shaped organisms. They are members of a large group of tiny organisms called **protists** (PRO•teests). There are over 50,000 different kinds of protists—more kinds than all the reptiles, mammals, amphibians, fish, and birds combined.

We can be fairly certain that the first person to observe paramecia was Antoni van Leeuwenhoek, a Dutch biologist. In the mid-1600s he spent a lot of time looking at things through his simple microscopes. Leeuwenhoek reported tiny objects swimming around in drops of water. He called them animalcules, thinking they were tiny microscopic animals. Protists are not, however, animals. They are single-celled organisms living by themselves.

In plants, individual cells might specialize in making food or moving water. In animals, groups of cells might specialize in getting rid of waste, digesting food, or sensing the environment. In single-celled protists, a single cell must do all of the things that are done by the coordinated efforts of many cells in a plant or animal. Each protist has the ability to respond to its environment, obtain food, exchange gases, get rid of waste, grow, reproduce, and use water.

When you use a microscope at 400x, you can see several kinds of **organelles** inside the paramecium. Organelles are the paramecium's "guts." Each organelle does a specific job to help the paramecium stay alive. You have organs, such as a heart and kidneys, that do specific jobs in your body. The paramecium has vacuoles and mitochondria.

Paramecia are covered by rows of microscopic hairlike structures called **cilia** (SILL•ee•uh). *Cili* means small hair. Cilia move back and forth in a wavelike motion to move the paramecium through the water. Cilia are short, giving the paramecium a crew-cut look, and so fine



Two paramecia

that they are difficult to see even with a microscope at 400x. Cilia move water around the paramecium. If you watch closely, you might see tiny particles of debris moving in the water close to the paramecium. From this movement you can infer (figure out) that the cilia are moving, even if you cannot see them.

What Holds the Paramecium Together?

When you looked at a paramecium in class, you probably noticed shapes and textures inside the cell. There must be something

like skin surrounding the cell keeping the paramecium together. The paramecium's "skin" is called the **cell membrane.** Every cell has one, whether it is a free-living protist or a cell in a larger organism.

The membrane is one of the most important parts of the cell. The membrane defines the cell and keeps the guts on the inside, and everything else on the outside. If the cell membrane breaks, the cell quickly dies. A few materials, like water, oxygen, and carbon dioxide, can pass through the membrane, but most other materials cannot. So how does the paramecium get the food and other nutrients it needs to stay alive? How do they get into the cell?

How Do They Eat?

Single-celled organisms don't have mouths that open to take in food the way animals do. Paramecia do, however, have a place on the membrane, called the **oral groove,** for taking in food. This fold runs most of the length of one side of the cell. When the cilia move back and forth, they swish materials in the water into the oral groove.

If the material is nutritious, the sides of the groove fold over the food and pinch it off in a closed packet called a **food vacuole.** The food vacuole floats around inside the paramecium. When paramecia eat red-dyed yeast, you can see the circular red food vacuoles right through the cell membrane.

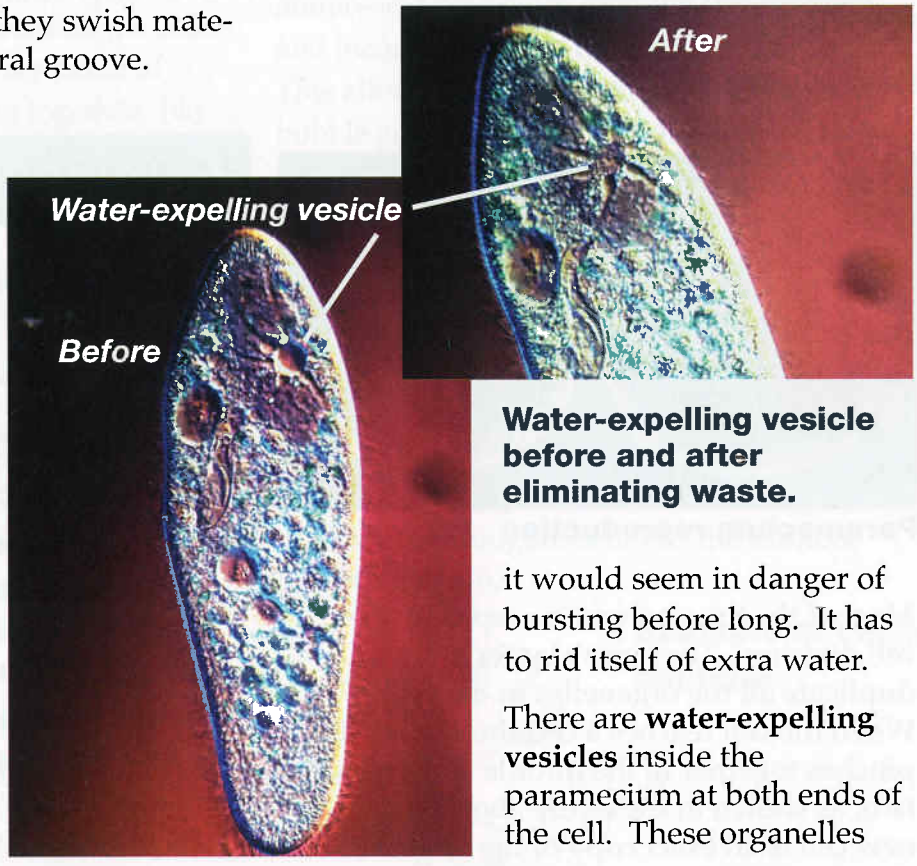
The food is broken down by **digestive enzymes** (chemicals that digest food) while it is inside the food vacuole. The digested food moves out through the walls of the vacuole, making it available to the other parts of the cell for energy and to make new cell parts.

As the food is digested, the food vacuole becomes smaller and smaller. Finally, when the cell has digested all the valuable nutrients from the food, the vacuole moves to the cell membrane, and the leftover waste is dumped out of the cell through the membrane.

The paramecium takes food in and dumps waste out without ever opening the cell wall to expose the inside of the cell to the outside environment.

Paramecia Drink, Too

Cells are constantly taking in water from their surroundings. All cells need a fresh supply of water in order to use energy, repair worn parts, and do all of the other things that have to be done inside the cell. But with water constantly entering the cell, it would seem in danger of bursting before long. It has to rid itself of extra water.



Water-expelling vesicle before and after eliminating waste.

There are **water-expelling vesicles** inside the paramecium at both ends of the cell. These organelles

collect the extra water in the cell, along with some of the waste, and dump it out of the cell. They function very much like the kidneys in your body. You may have seen water-expelling vesicles in the paramecia you studied. They look like little clear circles. They grow larger for several seconds and then suddenly become small again as the water is dumped out through a tiny pore.

Response to the Environment

Paramecia do not have any way to sense light in their surroundings, but they do respond to their surroundings. They swim constantly, searching for food. One of the few times they stop is when they are feeding. They usually avoid very cold or hot areas, or chemicals that would harm them, by swimming away from the danger area. Sometimes their behavior is almost comical. You may have observed them swim straight on until they bump smack into something, then back up, turn, and swim off in another direction. Not altogether graceful, but effective.

Reproduction

Paramecium reproduction

Most of the time paramecia reproduce by cell division. They grow larger and duplicate all the organelles in the cell. When the cell reaches a certain size, it pinches together in the middle and splits in two, as shown in the figure above. Each new cell is an exact copy of the original, except half as big. They are called **daughter cells,** and the original is called the mother cell. Even though they are called mother and daughter, they are not females. Unlike most plants and animals, there are no male and female protists, and sexual reproduction happens only occasionally.

The new daughter cells immediately start doing the things all organisms do. They take in food and water and expel waste chemicals and gases. The food provides the energy for life and the building materials to grow. As the paramecia zip through their watery environment, they are constantly responding to food, dangerous chemicals, and high temperatures to improve their chances of survival.

The lives of paramecia and humans are as different as two lives can be. But, as different as we are from these tiny, invisible protists, it is amazing to think about how many ways we are just the same. There are important similarities that tie all organisms on Earth together.

Paramecium Questions

1. *Why is the cell membrane important?*
2. *What are two functions of the cilia?*
3. *What are the functions of the water-expelling vesicle? What would happen to the paramecium if the water-expelling vesicle stopped working?*
4. *What is the evidence that paramecia are living? Give examples of how they do each of the functions of living things.*