

Reflect

How do we know that all things are made of cells? Have you ever used a microscope to observe cells? Can you imagine a time when very few people had access to microscopes or even knew what they were? At one point in history, cells were not common knowledge. How the body worked, that it is made up of small parts capable of living on their own—that was scientific knowledge that had to be unveiled over time. The knowledge we have about cells and how they work developed and became more complex as microscopes became better and more widely available.



Students commonly use microscopes today.

Today, we take for granted that microscopes are available in science classrooms in very large numbers. Almost every adult has used a microscope and has used one to see cells, often many different kinds of cells. Once microscopes did not exist, cells were not known about, and the process of learning about them took the efforts of many people over a long time to advance scientific knowledge about cells to where it is today.

What are cells?

Cells are what all living things are made up of, the smallest unit that can be said to be alive. From bacteria, to the largest oak tree you have ever seen, to the biggest blue whale that swims in the oceans, all living things are made up of cells. Some **organisms** are made up of many cells and are called multicellular organisms. Other organisms consist of just a single cell, but both single-celled and multicellular organisms are still considered living things.



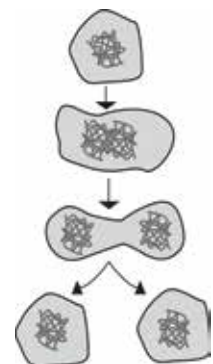
Cells can be very basic or more complex.

cell – the basic structural and functional unit of all organisms

organism – an individual form of life

One common feature of all cells is the ability to **reproduce**. All cells come from other preexisting cells. When a cell is ready to reproduce, it duplicates its contents, then divides into two similar (and sometimes exact duplicate) cells.

reproduce – the process cells use to duplicate their contents to form multiple similar cells



Cellular reproduction is a common ability amongst all cells.

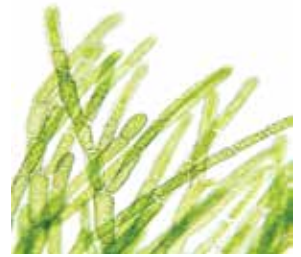
All the above facts about cells form what is called the scientific theory of cells, or cell theory. There are three core principles of cell theory:

- All organisms are composed of one or more cells.
- Cells are the basic structural and functional unit of all living things.
- All cells come from preexisting cells.

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How was cell theory discovered?

The discovery of cell theory begins with the invention of the microscope. The development of a microscope started with a man who worked in the fabric industry. This was at a time when fabrics were made by hand and not by machines. The sign of a good fabric was how tightly woven the strands were. So, the man made a **lens** and used it to be able to look at the fabric his workers were making. This was more than just a magnifying glass—it could let him see the fabric over 200 times more closely than he could see it with just his eyes. This led him to make more lenses and start investigating the world around him. He looked at pond water, blood, muscle cells, leaves, and many other things.



Early microscopes helped scientists see cells for the first time.

lens – a piece of material that can focus a light beam

Over the decades that followed, scientists made better and better microscopes and learned how to make them more cheaply (but kept the quality and usefulness high). Other scientists went beyond just looking at things, proving scientific principles. For instance, one proved that all plants are entirely made of cells. Another proved that all parts of animals are entirely made of cells. Together, they published their proof that all organisms are entirely made of cells. Some other scientists discovered that all cells can divide and that this is what gives us more cells. Based on these discoveries, scientists concluded that cells are the basic building blocks of all living things. The combination of these discoveries is what defines the scientific theory of cells.

What Do You Think?

While all organisms are unique in their own ways, they all have common characteristics. What types of features do you think all organisms would share? (Hint: cell theory gives us some characteristics of organisms.)

One common characteristic of all organisms is that they are all made up of cells, and these cells are the basis of life in each organism. As we learned earlier, some organisms may have millions of cells, while other organisms may only contain a single cell; however, in each case, the cell is the basic structural and functional unit of the organism.

Another feature of organisms is the ability to reproduce. As cell theory states, all cells come from preexisting cells. Since the cell is the fundamental building block of all organisms, then all organisms must also have the ability to reproduce.

Can you think of other characteristics that pertain to all organisms? List them below.

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Look Out

Can an organism really consist of only a single cell? It may be hard to imagine an entire organism only having one cell, since the only organisms we can see with our naked eye are made up of thousands or millions of cells. However, there are many examples of single-celled organisms that we encounter in everyday life.



Bacteria (left) and algae (right) are two common single-celled organisms.



Most bacteria, which cause infections and illnesses, are single-celled organisms. Yeast, which is used in baking, and algae are other examples of single-celled organisms. While these organisms are very simple, they still share many characteristics with their more complex counterparts and are classified as living things.

What Do You Know?

Do you know the three core principles of cell theory? Write them below.

1. _____

2. _____

3. _____

Try Now

Imagine you are talking with your friend who has never heard of cell theory. On another sheet of paper, create a story that describes how you would explain to your friend cell theory and how it was developed. Draw pictures, if needed, to help your explanation.

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Connecting With Your Child

Help your child better understand cell theory. Use clay or Play-Doh to create your own “multicellular organism.” Take a single block of clay or Play-Doh and tell your child it represents a cell. Break the single block in half, creating two smaller blocks. Continue to split the blocks in half, until you have created many different, smaller blocks. Explain to your child that this represents cells reproducing. This is a characteristic that all cells possess.

Now, place these smaller blocks together to create a larger block, while maintaining the individual size and shape of each smaller block. Explain to your child that each small block represents a cell, and the larger block you created represents a multicellular organism. Help your child understand that the “organism” is made up of cells and that these cells are the basic structural and functional unit of the “organism.” These two facts are true of every organism.

Here are some questions to discuss with your child during the activity:

1. How does this activity represent cell theory?
2. Where did the smaller “cells” you created come from? Would it have been possible to make your “multicellular organism” if the original single “cell” had not reproduced?
3. Why are cells the basic unit of life?