Cells

Discovery of Cells

The first time the word cell was used to refer to these tiny units of life was in 1665 by a British scientist named Robert Hooke. Hooke was one of the earliest scientists to study living things under a microscope. The microscopes of his day were not very strong, but Hooke was still able to make an important discovery. When he looked at a thin slice of cork under his microscope, he was surprised to see what looked like a honeycomb. Hooke made the drawing in the Figure below to show what he saw. As you can see, the cork was made up of many tiny units, which Hooke called cells.

Cork Cells. This is what Robert Hooke saw when he looked at a thin slice of cork under his microscope. What type of material is cork? Do you know where cork comes from?

Soon after Robert Hooke discovered cells in cork, Anton van Leeuwenhoek in Holland made other important discoveries using a microscope. Leeuwenhoek made his own microscope lenses, and he was so good at it that his microscope was more powerful than other microscopes of his day. In fact, Leeuwenhoek’s microscope was almost as strong as modern light microscopes.

Using his microscope, Leeuwenhoek discovered tiny animals such as rotifers. Leeuwenhoek also discovered human blood cells. He even scraped plaque from his own teeth and observed it under the microscope. What do you think Leeuwenhoek saw in the plaque? He saw tiny living things with a single cell that he named “animalcules” (“tiny animals”). Today, we call Leeuwenhoek’s animalcules bacteria.

The Cell Theory

The Cell Theory is one of the fundamental theories of biology. For two centuries after the discovery of the microscope by Robert Hooke and Anton van Leeuwenhoek, biologists found cells everywhere. Biologists in the early part of the 19th century suggested that all living things were made of cells, but the role of cells as the primary building block of life was not discovered until 1839 when two German scientists, Theodor Schwann, a zoologist (studies animals), and Matthias Jakob Schleiden, a botanist (studies plants), suggested that cells were the basic unit of structure and function of all life. Later, in 1858, the German doctor Rudolf Virchow observed that cells divide to produce more cells. He proposed that all cells arise only from other cells. The collective observations of all three scientists form the Cell Theory, which states that:

- all organisms are made up of one or more cells,
- all the life functions of an organism occur within cells,
• all cells come from preexisting cells.

Cell Diversity

Cells with different functions often have different shapes. For example, the job of the nerve cell is to carry messages to other cells. The nerve cell has many long extensions that reach out in all directions, allowing it to pass messages to many other cells at once. Pollen grains have spikes that help them stick to insects such as bees. How do you think the spikes help the pollen grains do their job? (*Hint:* Insects pollinate flowers.)

Four Common Parts of a Cell

Although cells are diverse, all cells have certain parts in common. The parts include a plasma membrane, cytoplasm, ribosomes, and DNA.

1. The **plasma membrane** (also called the **cell membrane**) is a thin coat of lipids that surrounds a cell. It forms the physical boundary between the cell and its environment, so you can think of it as the “skin” of the cell.

2. **Cytoplasm** refers to all of the cellular material inside the plasma membrane, other than the nucleus. Cytoplasm is made up of a watery substance called **cytosol**, and contains other cell structures such as ribosomes.

3. **Ribosomes** are structures in the cytoplasm where proteins are made.

4. **DNA** is a nucleic acid found in cells. It contains the genetic instructions that cells need to make proteins.

These parts are common to all cells, from organisms as different as bacteria and human beings. How did all known organisms come to have such similar cells? The similarities show that all life on Earth has a common evolutionary history.
Task 1: Questions

1. Who coined the term *cell*, in reference to the tiny structures seen in living organisms?

2. Who identified *animalcules*? What are *animalcules*?

3. What are the three main parts of the cell theory?

4. List the four parts common to all cells.

5. What are the cell structures where proteins are made?

6. What is the role of DNA?
Task 2: Using Models

Model 1: Three Types of Bacterial Cells

1. The 3 bacterial shapes in Model 1 are referred to as a coccus (sphere), spirillum and bacillus (rod). Label the diagrams in the model with the correct descriptions.

2. What is represented by the small dots found in each of the bacteria cells? What is the function of these organelles (hint: in the reading)?

3. What is the name of the outermost layer that forms a boundary around the outside of each cell?

4. How is the DNA described? What do you think this means?

Model 2: Animal and Plant Cell

1. List 3 differences (other than shape) between an animal and a plant cell.

2. Where do you find the DNA in each cell?

3. Do both cells have a nucleus?

4. What is different about the outermost boundary in a plant cell compared to an animal cell?
Task 3: Specialized Cells Chart

Read the info below. Then, complete the chart by choosing the cell type from the word bank and the function from the list.

Your body has many different kinds of cells, but they all work together. Each type of specialized cell is a particular shape and size that help it perform its special function. Red blood cells have rounded edges that allow them to flow easily through blood vessels. They also do not contain a nucleus, which gives them more room for hemoglobin- which helps transport oxygen. Fat cells can swell up with fat in order to store energy for the body. Skin cells are flat and grow in layers to cover and protect the body. Bone cells contain structures to store calcium and also to make the cell rigid and strong in order to support the weight of our bodies. Inner ear cells have tiny little hairs that stick out from the top of the cell to detect small vibrations in the air that we can interpret as sound. Skeletal muscle cells are connected to bones and can contract to allow movement. Cardiac muscle cells have a single nucleus and are connected in a way that allows them to contract quickly and repeatedly. Smooth muscle cells are short and work under involuntary control. Nerve cells are long and thin, with lots of whisker-like projections, allowing them to pick up and send electrical signals quickly throughout the entire body.

<table>
<thead>
<tr>
<th>Red Blood</th>
<th>Nerve</th>
<th>Skin</th>
<th>Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone</td>
<td>Inner Ear Hair</td>
<td>Skeletal Muscle</td>
<td>Smooth Muscle</td>
</tr>
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**FUNCTIONS:**

A. store calcium and provide support to the body
B. You can voluntarily tell it to contract/relax to allow limbs to move
C. involuntarily contracts the inner organs
D. deliver oxygen to cells and removes carbon dioxide
E. covers the body to protect it and prevent water loss
F. sends messages from the body to the brain and back
G. can swell up and store energy
H. detect vibrations and allow us to hear