Chapter 4 General Science

Cells and Life

**cell**- the smallest, most basic unit of life.

**element**- matter that is only made of one kind of atom

**chemical bond**- a force that holds atoms together

**molecule**- two or more atoms that are joined by chemical bonds

**cytoplasm**- the watery substance in a cell

**cell membrane**- the thin covering that holds a cell together

**nucleus**- the part of a cell that controls all the other parts (plural, nuclei)

**vacuole**- an enclosed space in a cell that stores food molecules, water, and waste

**mitochondrion**- a cell part that helps the cell store and use energy (mitochondria)

**cellular respiration**- the process cells use to release energy from food molecules

**cell wall**- the thick covering around a plant cell membrane

**chloroplast**- a plant cell part that stores green material called chlorophyll

**chlorophyll-** the green material inside chloroplasts that absorbs sunlight so plants can make their own food

**DNA**- a molecule in the nuclei of cells that controls many of the characteristics of living things

**The Discovery of the Cell**

\* A microscope is a tool for viewing objects too small to be seen by the eyes alone. The first microscope was invented nearly 400 years ago. It opened up a whole new world to scientists. How might this be improving science? Are there negatives?

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\* A microscope has many parts. The **stage** is a platform where the object to be viewed is placed. The **eyepiece** is the part that you look through. It contains a **lens** that magnifies the image of the object. The **objectives** also have lenses that magnify. The **coarse-** and **fine-adjustment knobs** are used to move the stage up and down. This makes the object appear clearer.

\* In 1865, the English scientist Robert Hooke used a microscope to look at a piece of tree bark. Through the microscope, he saw what looked like many small boxes. Hooke thought that the boxes looked like the small boxes looked like the small rooms that monks live in. These rooms are called cells. So Hooke called the boxes that he saw in the tree bark “cells.”

\* Robert Hooke studied many plants under the microscope. They all seemed to have cells. Hooke’s discovery proved to be very important. We know that the **cell** is the smallest, most basic unit of life.

**Atoms and Elements**

\* Cells are made of matter. Everything, living or nonliving, is matter. All matter on Earth is made of atoms. Name as many things made of matter in two minutes. Go!

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\* Matter that is made of only one kind of atom is called an **element**. There are 112 different elements. Some are made only in laboratories, but most elements are found in nature. Oxygen, carbon, helium, and hydrogen are a few examples of elements. The **Periodic Table of Elements** lists all of the elements and categorizes them as we will discuss later.

\* Your body is 65% oxygen, 18% carbon, and 10% hydrogen. The other 7% of the human body is made of small amounts of other elements, such as nitrogen, calcium, and phosphorus.

\* Often, two or more atoms are joined together by **chemical bonds**. A water **molecule** forms when two hydrogen atoms join an oxygen atom.

**The Building Blocks of Life**

\* Everything in the universe is made of atoms. But only living things have cells. Cells are the building blocks of life. Think of how bricks are put together to make a house. In this same way, cells are put together to make a living thing.

\* A cell is like a very tiny water balloon. It is watery inside and has a thin outer covering. All living things, including ants, flowers, and people, are made of cells.

\* Although you cannot see most cells without a microscope, they are much bigger than atoms and molecules. Many molecules make up a cell.

\* Your body is about 65% water. It is the most abundant substance in the human body. The body also combines different elements to form carbohydrates, fats, and proteins.

\* Your body has about 100 trillion cells. This is 20,000 times greater than the number of people in the world. However, many organisms are made of just one cell. These simple organisms can only be seen with a microscope.

\* Water molecules are bigger than air molecules. Knowing this, Wilbert Gore and his son Bob had an idea. Why not make cloth and weave it too tight to let in water but loose enough to let out air molecules? The cloth would be waterproof. It would also “breathe,” meaning it would let hot air out. If you have ever worn rubber rain gear, you know what a good idea this cloth was! The cloth is used in tents, jackets, blankets, and other materials.

**4-2 Understanding Cells**

\* Most of a cell is made up of a watery, sometimes gooey substance called **cytoplasm**. Other parts of the cell float around in the watery cytoplasm.

\* All cells are surrounded by a **cell membrane**. The cell membrane lets food molecules and other materials pass into the cell. It also lets water pass out of the cell.

\* Near the center of the cell is the **nucleus**. It is the cell’s “command post.” **Vacuoles** are used to store food, water molecules, and waste. A vacuole acts as a storeroom for the cell.

\* The cells also contain a **mitochondrion**. These are the powerhouses of cells.

\* Each cell in your body has all the characteristics of life. A cell can get and use food. It can move and grow. A cell can also reproduce and respond to the environment. To do these things, a cell needs energy.

**How do Cells get Energy?**

\* Cells get their energy from food. Food molecules pass through the cell membrane into the cytoplasm. Then the molecules are broken down in the mitochondria.

\* Cells use oxygen to release energy from food molecules. The oxygen gets into the cells through the cell membrane. The process cells use to release energy from food is called **cellular respiration**.

\* Cellular respiration also produces certain **byproducts**. Byproducts are products that are not needed by the cell. They are leftovers. These byproducts leave the cell through the cell membrane. Cells use sugar glucose during cellular respiration.

**Plant Cells and Animal Cells**

\* Plant cells are different from animal cells in a few important ways. First, a plant cell has a **cell wall**. It is harder and stronger than the cell membrane.

\* Plant cells usually have much bigger vacuoles than animal cells do. This is because plant cells must store a lot of water. Animal cells can have many small vacuoles.

\* Another important difference is that plant cells have **chloroplasts**. These contain **chlorophyll**. It absorbs sunlight. Plants use sunlight to make their own food.

\* The cell walls of woody plants give the plant its hardness and strength. Cell membranes of animal cells are thin two-layered structures that are tough enough to protect the cells.

\* Cells come in different sizes. The largest cell is the yolk of an ostrich egg. It is about the size of a baseball. Bacteria are tiny single-celled organisms. Hundreds of bacteria could fit on the period at the end of this sentence. Human cells range from 1mm to 9 cm long. That is a huge difference.

**DNA: A Code for Life**

\* Inside the nucleus of all cells is a very important molecule called **DNA**. DNA controls many of the characteristics of living things. It is one of the largest molecules found in living things. Thousands of smaller molecules join together in a certain order to make DNA. The order of the molecules makes up a kind of “life code” that controls all the activities of the cell.

\* A DNA molecule is double-shaped and consists of thousands of units called nucleotides. The sequences of nucleotides form the DNA code. The code in DNA controls how cells will grow and multiply. DNA controls whether an organism will grow into an anteater, a human, or any other kind of life form. DNA controls person’s eye color, height, and everything else about you.

\* Today, information about DNA is being used in criminal courts. Since every person has a different DNA code, scientists can identify people by the DNA in their cells. Sometimes, a person can be found guilty or innocent of a crime based on the information about his or her DNA.

\* Sponges are animals that live on the ocean floor. They are simple animals. Yet, thanks to their DNA, sponges can do some amazing biological tricks. If a person loses an arm or a leg, they cannot grow a new one. A sponge can grow new parts. If a sponge is cut off, the cells reproduce to replace that part. In fact, if you were to cut a sponge into many pieces, each piece would grow into a completely new sponge.

Complete *ON-THE-JOB Science Histologic Technician* on page 59.

Here are some fun facts on DNA <http://chemistry.about.com/od/lecturenoteslab1/a/10-Interesting-Dna-Facts.htm>

Here are 17 MORE interesting fun facts about DNA

<http://holykaw.alltop.com/17-interesting-facts-about-dna>