

CAREER CONNECTION - Cytotechnologist

Have you ever heard of a medical test called a Pap smear (Figure 4.5)? In this test, a doctor takes a small sample of cells from the patient's uterine cervix and sends it to a medical lab. A cytotechnologist stains the cells and examines them for any changes that could indicate cervical cancer or a microbial infection.

Cytotechnologists (cyto- = “cell”) are professionals who study cells. They are trained to determine which cellular changes are normal and which are abnormal. Their focus is not limited to cervical cells. They examine cellular specimens that come from all organs. When they notice abnormalities, they consult a pathologist, a medical doctor who interprets and diagnoses changes in the body caused by disease.

Cytotechnologists play a vital role in saving people’s lives. When doctors discover abnormalities early, a patient’s treatment can begin sooner, which usually increases the chances of a successful outcome.

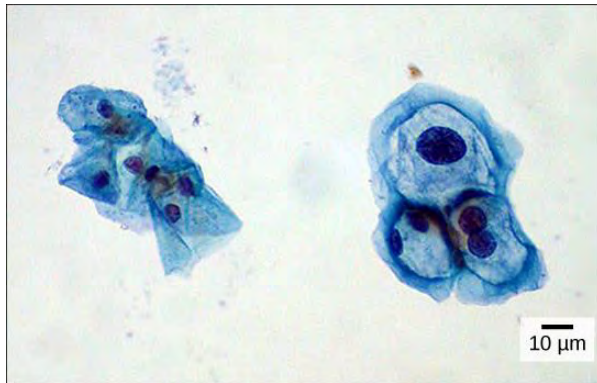


Figure 4.5 Uterine cervix cells, viewed through a light microscope, are from a Pap smear. Healthy cells are on the left. The cells on the right are infected with human papillomavirus (HPV). Notice that the infected cells are larger. (credit: modification of work by Ed Uthman, MD; scale-bar data from Matt Russell / [Biology 2E OpenStax](#))

Check your knowledge

There are many different types of microscopes. Which type of microscope will you be using in the laboratory for this course?

Answer: Compound light microscope

Section Summary

A cell is the smallest unit of life. Most cells are so small that they cannot be viewed with the naked eye. Therefore, scientists must use microscopes to study cells. The cell theory states that all organisms are composed of one or more cells, the cell is the basic unit of life, and new cells arise from existing cells.

Exercises

1. Which of the following statements is NOT correct?
 - a. Viruses display all the properties of life outside of a host cell.
 - b. New cells arise from existing cells.
 - c. Cytotechnologists study cells.
 - d. All organisms are composed of one or more cells.
2. The _____ is the basic unit of life.
 - a. organism
 - b. cell
 - c. tissue
 - d. organ
3. In your own words, briefly describe the cell theory.

Answers

1. (a)
2. (b)
3. The cell theory states that all living organisms are made of living cells and living cells come from other living cells. Cells are thought to be the most basic unit of life.

Glossary

cell theory: the biological concept that states that all organisms are composed of one or more cells, the cell is the basic unit of life, and new cells arise from existing cells

eukaryote: an organism with cells that have nuclei and membrane-bound organelles

microscope: the instrument that magnifies an object

prokaryote: a unicellular organism that lacks a nucleus or any other membrane-bound organelle

4.2 Comparing Prokaryotic and Eukaryotic Cells

Learning objectives

By the end of this section, you will be able to:

- *Compare and contrast prokaryotic cells and eukaryotic cells*
- *Name examples of prokaryotic and eukaryotic organisms*
- *Describe the relative sizes of different kinds of cells*
- *Be able to define and explain all bolded terms*

All cells share four common characteristics. First, all cells are enclosed within a plasma membrane, an outer layer that separates the cell's interior from its surrounding environment. Second, all cells contain cytoplasm, a jelly-like region within the cell where proteins and cell structures are found. Third, all cells have genetic material, such as DNA, which provides information necessary for the cell to remain alive. Finally, all cells have ribosomes, a non-membrane bound organelle, used to synthesize proteins. All cells also display the properties of life: order, response to stimuli, reproduction, evolution, growth and development, homeostasis, and energy processing.

Cells fall into one of two broad categories: prokaryotic cells or eukaryotic cells. Organisms in the domains Bacteria and Archaea are classified as prokaryotes (pro- = “before”; -kary- = “nucleus”) whereas cells of animals, plants, fungi, and protists are all eukaryotes (eu- = “true”). Although all prokaryotic and eukaryotic cells share the similarities discussed above, they also differ in several ways. Below, we will take a closer look at just how prokaryotic cells and eukaryotic cells differ from one another.

Components of Prokaryotic Cells

A **prokaryotic cell** is a simple, single-celled (unicellular) organism that lacks a nucleus or any other membrane-bound organelle. Like all cells, prokaryotes do contain DNA, which is usually organized in chromosomes. Prokaryotic chromosomes are typically circular and unpaired. Prokaryotic DNA is found in the central part of the cell: a darkened region called the **nucleoid** (Figure 4.6).

Figure 4.6 This figure shows the generalized structure of a prokaryotic cell. (credit: Parker et al. / [Microbiology OpenStax](#))

