## Overview:

In this lesson, students learn that individual cells are the building blocks of all living things. Microscopes help us to see these tiny wonders.

## Objectives:

The student will:
- use a microscope to view both plant and animal cells;
- diagram observations of plant and animals cells;
- name three parts common to both plant cells and animals cells; and
- construct a simple model of a cell.

## Targeted Alaska Grade Level Expectations:

***Science***

[5] SC2.3 The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by recognizing that organisms are composed of cells.

## Vocabulary:

**amyloplast** – found in the cytoplasm of some plant cells; transforms glucose into starch

**cell** – the basic unit of living matter in all organisms, consisting of cytoplasm enclosed within a cell membrane; all cells except bacterial cells have a distinct nucleus that contains the cell's DNA as well as other structures like mitochondria and the endoplasmic reticulum

**cell division** – the process by which a cell divides into two or more cells; cell division is the means of reproduction in organisms that reproduce asexually, as by fission or spore formation; in organisms that reproduce sexually, cell division is the source of all tissue growth and repair; the two main types of cell division are mitosis and meiosis

**cell membrane** – the thin membrane that forms the outer surface of the cyotoplasm of a cell and regulates the passage of material in and out of the cell; it is made up of proteins and lipids

**cell wall** – the layer on the outside of cells in plants, bacteria, fungi, and many algae; The cell wall gives shape and protects the cell

**centrosome** – located near the nucleus; involved in the regulation of cell division

**chloroplast** – a tiny structure in the cells of green plants that contains chlorophyll and creates glucose through photosynthesis

**chromosome** – a structure in all living cells that carries the genes that determine heredity; in all cells except bacterial cells, the chromosomes are thread-like strands of DNA and protein that are contained in the nucleus

**cytoplasm** – the jelly-like material that makes up much of a cell inside the cell membrane, and in eukaryotic cells, surrounds the nucleus; the organelles of the cell, such as mitochondria, are contained in the cytoplasm

**endoplasmic reticulum** – a network of membranes within the cytoplasm of many cells that is important in protein synthesis and involved in the transport of cellular material

**Gogli body** – also called Gogli apparatus; processes proteins and lipids in the cell

**lysosome** – a structure in the cytoplasm of many cells that is surrounded by a membrane and contains enzymes that digest food molecules

**mitochondria** – a structure in the cytoplasm of all cells except bacteria in which food molecules are broken down in the presence of oxygen and converted to energy

**nuclear membrane** – surrounds the nucleus, separating the nucleus from the cytoplasm

**nucleolus** – a structure located in the nucleus of a cell and involved in the formation of ribosomes, the sites of protein synthesis in cells

**nucleus** – the structure in the cytoplasm of a living cell that contains the cell's DNA and controls its metabolism, growth, and reproduction; a nucleus surrounded by a membrane is found in almost all the cells of eukaryotes and thus sets them apart from the cells of prokaryotes, such as bacteria, which do not contain nuclei

**ribosome** – a sphere-shaped structure within the cytoplasm of a cell that is composed of RNA and protein and is the site of synthesis; ribosomes are often attached to the membrane of the endoplasmic reticulum

**tissue** – a large collection of similar cells that together perform a specific function in an organism; the organs of the body and the parts of a plant are composed of many different kinds of tissues

**vacuole** – a space in a cell's cytoplasm that is surrounded by a membrane and filled with a watery fluid; the fluid stores food prior to digestion or waste products prior to excretion

## Whole Picture:

Scientist Robert Hooke first viewed cells, the building blocks of all living things, in 1665 when he used a microscope to examine cork. The small divisions he saw reminded him of the small rooms where monks lived called "cells." Now powerful microscopes reveal myriad shapes, sizes and kinds of cells in all plants and animals.

The body of an average adult human contains 60- to 90-trillion cells. Each one has a specific role, determined by specific programming locked in the cell nucleus. Each cell is surrounded by a membrane that allows water and nutrients to come in and also allows the cell to get rid of waste.

## Materials:

- Microscopes (one per group)
- Glass slides with cover slips (two per group)
- Methylene blue
- Iodine solution
- Skin of one onion cut into one half-inch squares (one per group)
- Flat toothpicks (two per group)
- Zippered sandwich bag (one per student)
- Translucent gel, such as aloe vera gel
- Marble (one per student)
- Tri-colored rotini pasta (a few of each color per student)
- Shell pasta (a few per student)
- Lentil beans (a few per student)
- Lasagna noodles, cooked and cut into ½-inch sections (one per student)
- Pinto beans (a few per student)
- Permanent marker
- VISUAL AID: "What is it?"
- VISUAL AID: "Structure of Cells"
- STUDENT INFORMATION SHEET: "The Discovery of Cells"
- STUDENT LAB: "Viewing Cells Under a Microscope"
- TEACHER INSTRUCTION SHEET: "Making a Cell"

## Activity Preparation:

1. Prepare stations for small groups to complete the lab. Stations need a microscope, slides and cover slips, a small cup of water, pencils and copies of STUDENT LAB: "Viewing Cells Under a Microscope."
2. Prepare materials for making a cell models. See TEACHER INSTRUCTION SHEET: "Making a Cell." Prepare stations, make signs and copy "cell bucks" sheets on green paper. Students will cut them apart later. Prepare stations. Add a permanent marker to the cell membrane station for students to use to write their names.

## Activity Procedure:

1. Show VISUAL AID: "What is it?" Ask students if they can identify the images. The top is an image of red blood cells. The bottom is an image of wood cells. Ask students what is used to see things so small (a microscope). The structures seen in the images are called "cells."
2. Hand out STUDENT INFORMATION SHEET: "The Discovery of Cells." Choose a reading strategy best suited for the class. Read and discuss.
3. Show VISUAL AID: "Structure of Cells." Remind students all living things are made of cells. Animals and plants are made of cells. Today students will have a chance to look at some cells under a microscope – plant cells from onion skin and animal cells from their own cheeks. Review the visual aid, and discuss that cells are made of many different parts. Depending on student level, review the role of cell parts. (See Vocabulary section.)
4. Hand out STUDENT LAB: "Viewing Cells Under a Microscope." Tells students they must follow directions and teacher prompts. (NOTE: Provide the drops of color needed for the lab (methylene blue, iodine) when students are ready.) Complete the lab.
5. After lab clean up, explain now students will make a model of a cell. They will choose to make either a plant cell or an animal cell. The plant cell will add chloroplast, only found in plants. Explain the directions (see TEACHER INSTRUCTION SHEET: "Making a Cell") and hand out "cell bucks" to each student. As students cut them apart discuss the job of each cell part.
6. Allow students to complete cell construction. Review cell parts, using student models to highlight the cell parts.

## Extension Idea:

Look at other items of interest to students. For example, fish scales and feathers look very interesting under a microscope. Ask students to draw a picture of what they see with their normal vision, then what they see under a microscope. This translates well into an art project, as well.

## Answers:

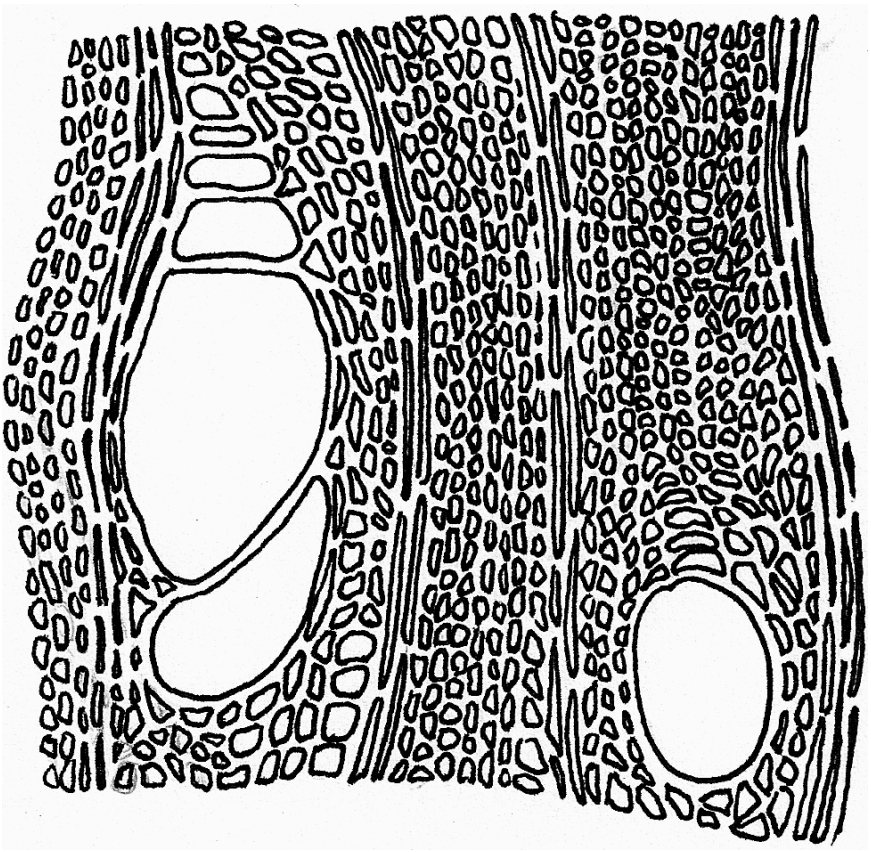
**STUDENT LAB: "Viewing Cells Under a Microscope"**

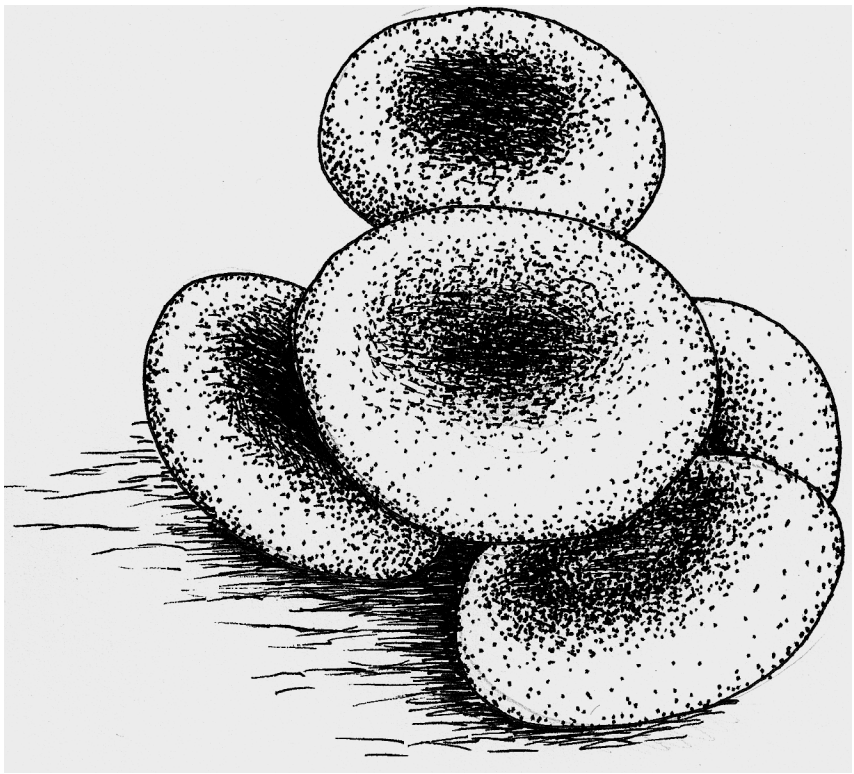
**Plant Cells**
Illustrations will vary.

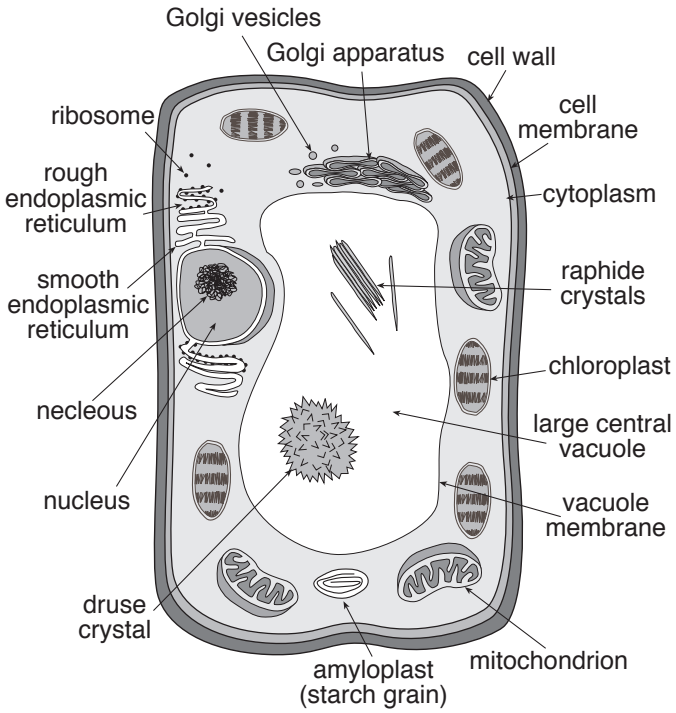
1. – 3. Answers will vary
4. Should indicate plant cells do not all look the same because plants come in a variety of types and colors.

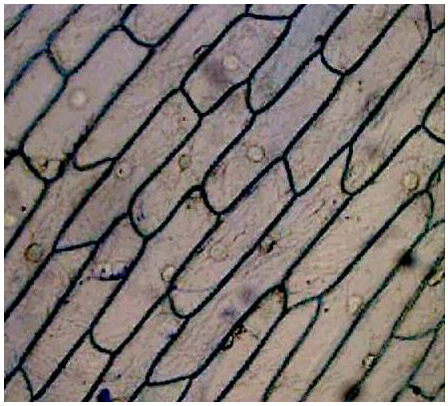
**Animal Cells**
Illustrations will vary.

1. – 3. Answers will vary
4. Should indicate animal cells do not all look the same because there are so many different types of cell with different functions.

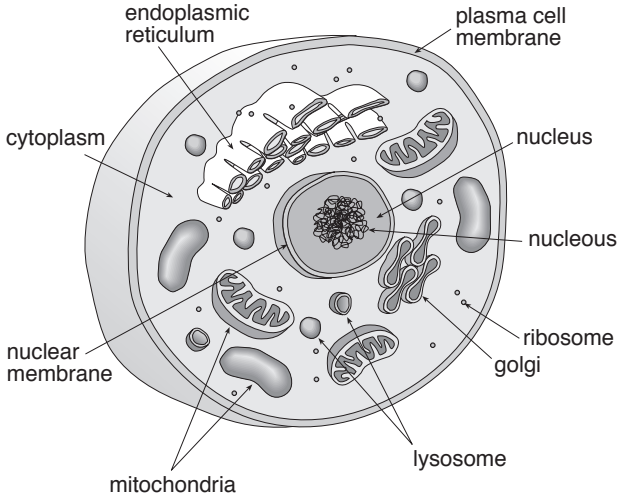


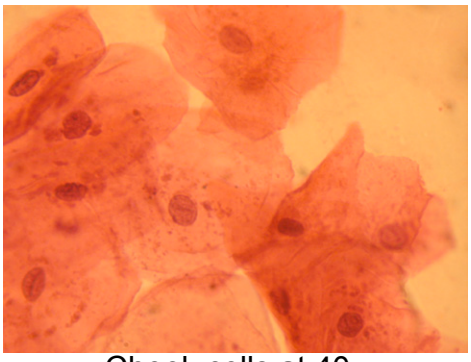




Onion skin at 40x magnification.

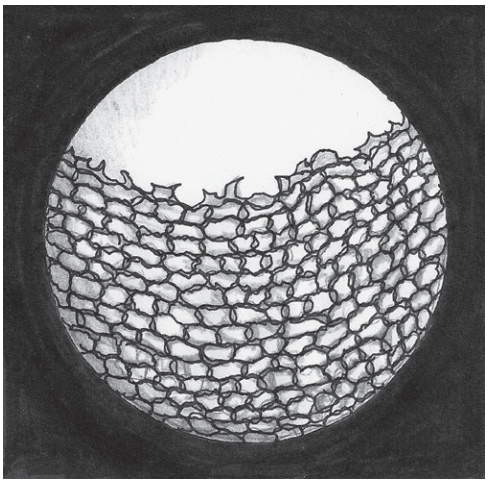


Cheek cells at 40x magnification.

# THE DISCOVERY OF CELLS

STUDENT INFORMATION SHEET



It might seem like old news to say that all living things are made up of cells, but people didn't always know that. It took the invention of special tools that magnified tissue for scientists to see what things were made of. That didn't happen until the 1600s.

In 1665 Robert Hooke, an English scientist, used the new invention, called a microscope, to look at a thin slice of cork. What he saw amazed him. The cork looked like it was made of small squares similar to the cells lived in by monks.

Hooke's work inspired many more scientists to look at things under a microscope. In 1682 Anton van Leeuwenhoek, a Dutchman, looked at blood, rainwater and scrapings from teeth. He saw living cells – even some bacteria.

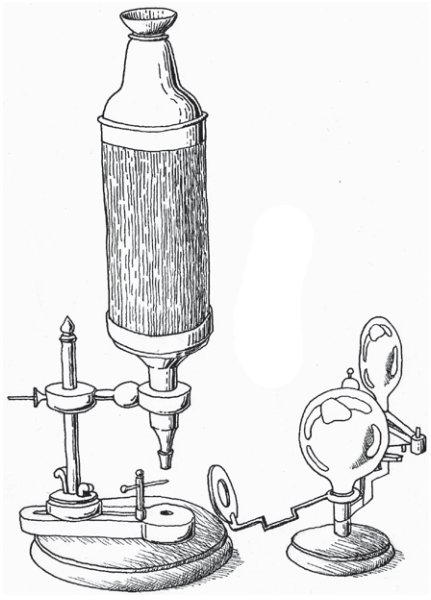
Scientists studied all kinds of cells for the next two centuries. Then Matthias Schleiden and Theodor Schwann studied what people had learned before then continued to study even more. In 1838 they proposed what is called Cell Theory.

Cell Theory says:

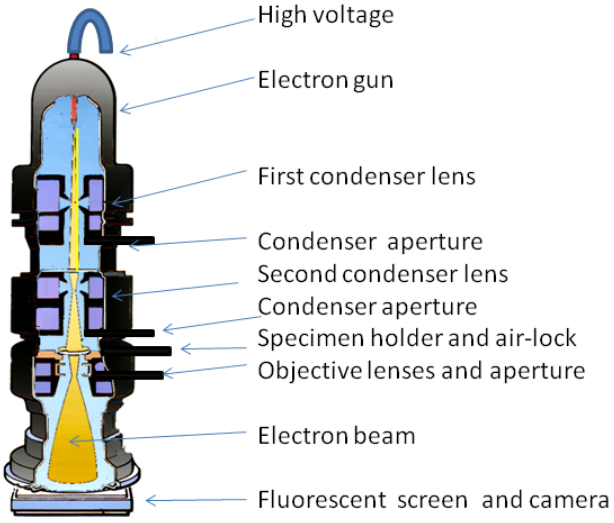
- All life forms are made from cells.
- All cells come from other cells.
- The cell is the smallest form of life.

Cell theory formed the basis for modern biological science! Things have come a long way in the last 200 years. Scientists have powerful instruments to learn about cells.

Microscope used by Robert Hooke



Modern-Day Electron Microscope



**NAME:** _____

# VIEWING CELLS UNDER A MICROSCOPE

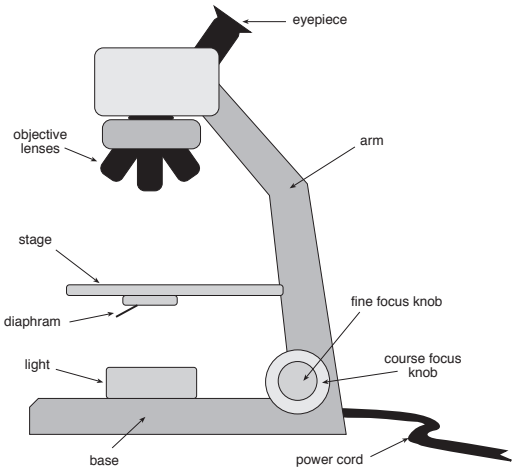


**Plant Cells**

**Procedure:**

1. Prepare a microscope slide to view plant cells.
   - Add a drop of water to the center of the slide.
   - Place a ½ inch piece of onion skin over the drop of water. Use a toothpick to position if necessary.
   - Add a drop of iodine solution (teacher).
   - Place the cover slip over the onion skin.

2. Look at the cells under the microscope.
   - Gently place the slide on the stage of the microscope.
   - Use the focus knobs (found on the side of most microscopes) to focus on the onion skin and find the cell divisions.
   - Draw what you see in the space below:




Answer the following:

1. About how many cells can you see?_____

2. What is the basic shape of each cell? _____

3. Can you see the nucleus? _____

4. Do you think that all plant cells look the same? Why or why not? _____

_____

_____

**NAME:** _____

# VIEWING CELLS UNDER A MICROSCOPE



**Animal Cells**

**Procedure:**

1. Prepare a microscope slide to view animal cells.
   - Add a drop of water to the center of the slide.
   - Using a flat toothpick, scrape the inside of your cheek. Spread the tissue in the drop of water.
   - Add a drop of iodine solution (teacher).
   - Place the cover slip over the cheek tissue.

2. Look at the cells under the microscope.
   - Gently place the slide on the stage of the microscope.
   - Use the focus knobs (found on the side of most microscopes) to focus on the onion skin and find the cell divisions.
   - Draw what you see in the space below:

Answer the following:

1. About how many cells can you see?_____

2. What is the basic shape of each cell? _____

3. Can you see the nucleus? _____

4. Do you think that all human tissue cells look the same? Why or why not? _____

_____

_____

Making a model cell is a fun, engaging project. Use the following as a guide to making a cell model. (NOTE: Emphasize how structure is related to function, since both activities are based on visual observations.)

**Materials:**

- Zippered sandwich bag (one per student)
- Translucent gel, such as aloe vera gel
- Marble (one per student)
- Tri-colored rotini pasta (a few of each color per student)
- Shell pasta (a few per student)
- Lentil beans (a few per student)
- Lasagna noodles, cooked and cut into ½-inch sections (one per student)
- Pinto beans (a few per student)
- Labels next to the materials needed for cell construction
- Cell buck for students to use to purchase cell parts
- Color copies of VISUAL AID: "Structure of Cells" (one per student)

Glue the labels below to a sign or make your own.

| | |
|---|---|
| **cell membrane**<br>**(one bag)** | **endoplasmic reticulum** |
| **cytoplasm**<br>**(1/2 cup)** | **Golgi body**<br>**(3 rotini noodles)** |
| **nucleus**<br>**(1 marble)** | **mitochondria**<br>**(3 rotini noodles)** |
| **chloroplast**<br>**(3 rotini noodles)** | **vacuoles**<br>**(4 shell noodles)** |
| **lysosomes**<br>**(5 pinto beans)** | **ribosomes**<br>**(6 lentil beans)** |

**Directions:**
Set out materials and labels at stations. Label the material by its function in the cell. Explain students will make a model cell. They must choose either an animal cell or a plant cell. Only the plant cells will collect chloroplast.

**Directions:** Using green copy paper, make copies of these "cell bucks" for students to use to exchange for cell parts at each station.

| | |
|---|---|
| **cell membrane**<br>(one sandwich bag)<br><br>the outer surface of the cell | **endoplasmic reticulum**<br>(one piece of ½ inch lasagna)<br><br>transports material around the cell |
| **cytoplasm**<br>(1/2 cup)<br><br>jelly-like material inside the cell membrane that supports the cell body | **Golgi body**<br>(3 tan rotini pasta noodles)<br><br>processes proteins in the cell |
| **nucleus**<br>(1 marble)<br><br>control center of the cell | **mitochondria**<br>(3 orange rotini pasta noodles)<br><br>turns food into energy |
| **chloroplast**<br>(3 green rotini pasta noodles)<br><br>only in plants; makes chlorophyll | **vacuoles**<br>(4 shell pasta noodles)<br><br>storage space in the cell's cytoplasm |
| **lysosomes**<br>(5 pinto beans)<br><br>digests food molecules | **ribosomes**<br>(6 lentils)<br><br>contain RNA, essential for life |