



SCIENCE

STUDENT BOOK

► **10th Grade | Unit 4**

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SCIENCE 1004

Cells

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LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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Cells

Introduction

Perhaps no field of investigation can better enable you to appreciate the creative work of God than the study of living things. In Psalm 105:2 we are told to speak of His wondrous works; and the study of the basic unit of life, the cell, will enable us to do just that. In this LIFEPAK® you will learn how all parts of the cell work together to keep it alive.

You will be introduced to some cells that are specialized in your body and that perform essential functions in your daily life. These cells work together to enable you to move your arms and legs, to digest your meals, to hear sounds, to breathe air, to think, and even to sit here and read this LIFEPAK.

As you go through this material, keep in mind that you are learning about something that resulted from the creative genius of a great God, Who deserves our praise, our love, and our lives.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAK. Each section will list according to the numbers below what objectives will be met in that section. When you have finished this LIFEPAK, you should be able to:

1. Contrast the two theories of the cell.
2. Operate a microscope correctly.
3. Identify the parts of the cell.
4. Describe the function of the cell parts.
5. Summarize how cells produce and store energy.
6. Contrast a plant cell with an animal cell.
7. Contrast the creationist view of cell origin with the evolutionist view.
8. Categorize cells according to their level of organization.
9. Describe the structure and function of some **specialized cells**.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

1. THE CELL: AN INTRODUCTION

Have you ever looked closely at an orange that has been cut in half? If you have, you have noticed that it is made up of many small units

like long, tiny balloons pulled tightly at two ends. These structures are called **cells**, and make up the basic unit of the living **organism**.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Contrast the two theories of the cell.
2. Operate a microscope correctly.
3. Identify the parts of the cell.

Vocabulary

Study these words to enhance your learning success in this section.

acellular organism
cell
cell theory
cell wall
cytoplasm
epidermis

life cycle
matter
nucleolus
nucleus
organism
organismal theory

plasma membrane
slime mold
starch
unicellular organism
vacuole

Note: All vocabulary words in this LIFEPAAC appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

THEORIES ON THE CELL

All organisms are made of **cells**. Some cells are independent life forms, like an amoeba. Others are a very small part of a larger structure, like a red blood cell. The cell is commonly accepted to be the basic building block of life, but another view has been expressed.

The cell theory. The first man to study cells was Robert Hooke (1635-1703), who noticed that cork had tiny “pores” or “cells.” In the nineteenth century two biologists, Schleiden

and Schwann, constructed the **cell theory**. This theory says that the basic unit of life is the cell and that all living organisms, both plants and animals, are composed of cells. The cell theory was well accepted, and most science textbooks today will present only this idea.

The cell theory is demonstrated by the **life cycle** of an organism called the **slime mold**. At one point in its life cycle, pairs of cells come together to form the whole organism.

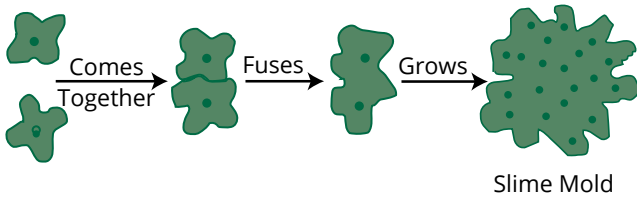


Figure 1 | Slime Mold

The organismal theory. A contrasting idea, the **organismal theory**, says that the basic unit of life is the creature, the organism itself, which may be divided into cells for efficiency. This idea is supported by the example of algae, *Caulerpa*, which is large enough to be seen without the use of a microscope, but which is not divided into cells, although it has many nuclei (singular, **nucleus**). It is a complete living unit.

The basic difference between the two theories is a philosophical one. Your preference can be determined by your answer to the following question: Is the amoeba **unicellular**

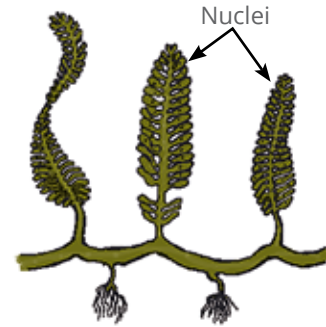


Figure 2 | Caulerpa

(one-celled) or is it **acellular** (no-celled)? If you say unicellular, you prefer the cell theory. If you say acellular, you prefer the organismal theory.

The Bible teaches that we are made of a body and a spirit. Without the spirit, the body is dead. You are not just a collection of cells, but a creature made in the likeness or image of your Creator. You have great worth, and what you call the life of your body is not a property of the **matter** making up your cells; but rather it is something God gave to man on the sixth day of the Creation week (Genesis 2:7) by breathing into man's body that He created.



Complete these activities.

- 1.1 Name the two theories relating to the cell. _____

- 1.2 Contrast these two ideas. _____

- 1.3 Why is slime mold an example for one of these theories? _____

- 1.4 Why is the algae *Caulerpa* an example of one of these theories? _____

- 1.5 How do you know that you are more than a collection of cells? _____

EXAMINATION OF THE CELL

A characteristic which separates the theoretical, and often erroneous, science of Aristotle from the science of today's classroom, hospital, and factory is recognition of the need for observation and experimentation. Virtually all you read in your text and reference books is the product of *observation* and *experimentation*.

Biology is very much an observational science. The microscope extends your power to see as pliers extend your power to hold. Science LIFE-PAC 1003 introduced you to the microscope, and Science LIFE-PAC 1004 applies what you have learned to the observation of cell detail.

Use of the microscope. Let's review techniques and principles on the use of a microscope.

1. When you carry your microscope, hold it by the arm with one hand and by the base with the other hand.
2. Orient your microscope and position the mirror so that light is focused into the low-power objective. If your microscope is electric, switch on the light. Look into the eyepiece to see that the field is brightly illuminated.
3. Place a prepared slide onto the stage and hold it down with slide clips.
4. Looking from the *side* of the microscope, lower the *low*-power objective using the coarse adjustment.
5. When the objective is as far down as it will go without damaging the slide or lens of the objective (about one to two millimeters separation), look into the eyepiece and begin to turn *upward* using the coarse adjustment until the image becomes visible.

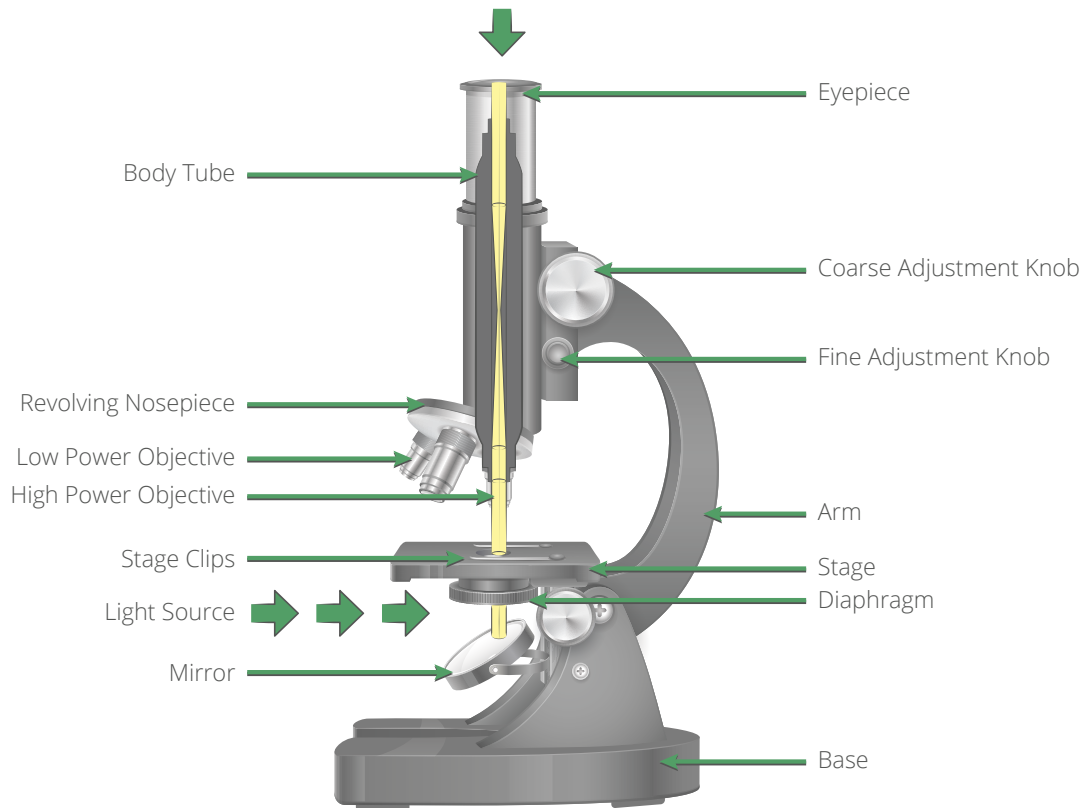


Figure 3 | Parts of a Microscope

6. Finish focusing using the *fine* adjustment.
7. If the field is too bright or too dark, adjust it by using the diaphragm, located under the stage.
8. Look to the *side* of the microscope and change from low power to medium power by turning the rotating nosepiece. The objective should click into place. Look through the eyepiece and focus, using the fine adjustment. *Never change objectives while looking into the eyepiece.* You might break the slide and damage the lens of the objective.
9. Go to the highest power by following the same method, being sure to prevent the objective lens from touching the slide. Develop the habit of observing slides with both eyes open to reduce the chance of your getting a headache from eye strain.



Answer this questions.

- 1.6 What two precautions must be taken to avoid damaging the microscope? _____

Complete these statements.

- 1.7 When focusing a microscope, start with _____ power.
- 1.8 The slide is held in place on the a. _____ by b. _____.
- 1.9 When bringing a visible image into focus, the _____ (coarse, fine) adjustment is used.

Onion skin epidermis. You can observe onion **epidermis** (*epi* = outer or over; *derma* = skin), the outer covering of cells, by quartering an onion and examining a leaf. One side is concave and the other is convex. The cells you will see are from the concave side. The plant **cell wall** is an outer covering of a fibrous material, which gives the plant support and rigidity.

The nucleus is an interior spherical structure which controls the cell's growth and reproduction. If you look carefully inside the nucleus, you may see the small, dark **nucleolus**. The **cytoplasm** includes all the cell's material outside the nucleus. Within the cytoplasm you should see large food storage structures called **vacuoles**.



Use the microscope to view onion skin cells.

These supplies are needed:

- | | |
|----------------------------|-----------------|
| ■ microscope | ■ forceps |
| ■ single-edged razor blade | ■ onion |
| ■ coverslip | ■ slide (clear) |
| ■ medicine dropper | ■ paper towel |
| ■ iodine stain | ■ water |

Follow these directions and complete the activities. Put a checkmark in the box when each step is completed.

- | | |
|---|---|
| ☐ 1. Use forceps to peel a thick layer of cells from the concave side of the leaf. Place the layer in a drop of water on a glass slide. Be careful to prevent the cells from rolling up. | ☐ 2. Place a coverslip over the cells and observe first under low power then under high power, <i>being careful not to crush the coverslip when changing objectives.</i> |
|---|---|

1.10 Describe the structures you observe before applying any stain. _____

- | |
|--|
| ☐ 3. Remove the slide from the microscope and apply iodine solution to the edge of the coverslip. Draw the stain onto the cells by touching a piece of paper toweling to the water at the opposite edge of the coverslip. |
| ☐ 4. Observe the cells under low and high power. |
| ☐ 5. Study the general diagram of the visible structures of the plant cell at this magnification. Make a list of the parts, then close your eyes and recite the list. |

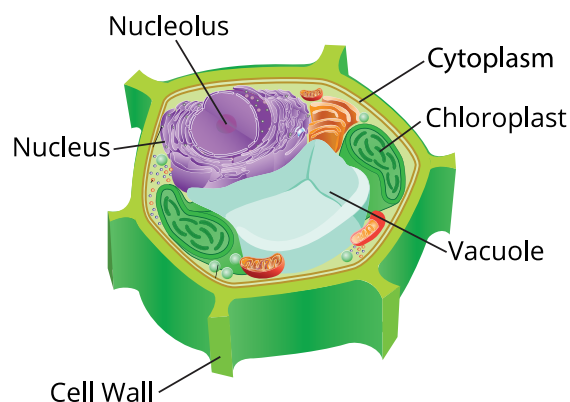


Figure 4a | Plant Cell at Low Magnification

Onion Skin Cells Experiment

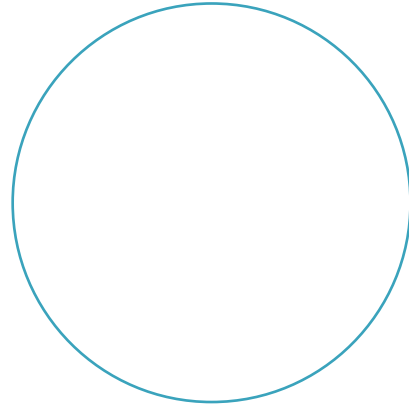
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1.11 As you learned in Science LIFEPAK 1002, iodine reacts with **starch** to give a blue-black color. Starch is a white substance which plants use to store food.

a. In what region of the cells is the stain darkest? _____

b. Why? _____

- ☐ 6. Draw three cells you observe under the microscope at *high* power. Label the structure you see. Do not draw any structure you do not actually see. Be sure to clean up properly after you have finished.



Onion Skin Cells Experiment



Human cheek cells. The outer surface of these cells is not as thick as those of the onion because animal cells do not contain a cell wall. Animals and humans have bones or shells to give them support and don't need to be

supported or made rigid by the cell walls as do plants. A **plasma membrane** is the outer covering which allows some materials into the cell and excludes other materials.

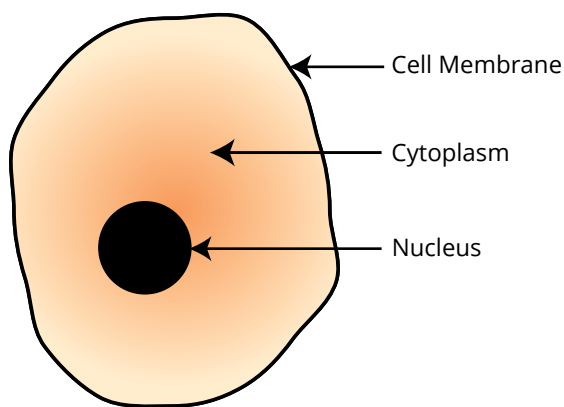
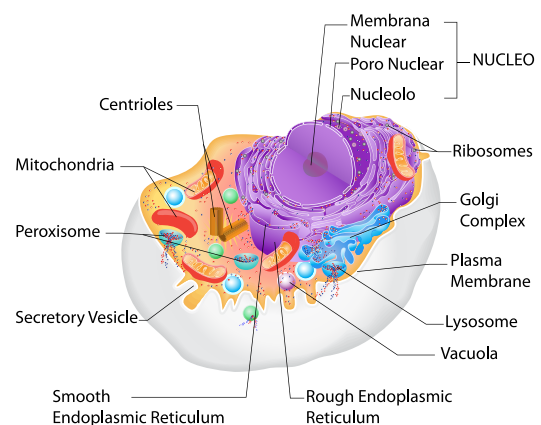


Figure 4b | Animal cell at low magnification



| Animal cell detail



Use the microscope to view cheek cells.

In this experiment you will follow the same steps as with the onion cells. This time you will be observing human cells instead of plant cells. Both human and animal cells have essentially the same characteristics.

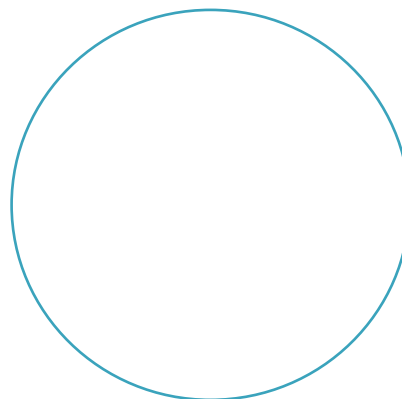
These supplies are needed:

- microscope
- methylene blue stain
- slide
- medicine dropper
- toothpick
- coverslip
- water

Follow these directions and complete the activities. Put a check mark in the box when each step is completed.

- ☐ 1. Scrape the inside of your cheek gently with the side of a toothpick. Carefully smear this mixture of cells and saliva onto a clean glass slide.
- ☐ 2. Add a drop of water and a drop of the stain methylene blue. Allow the stain to stand for about one minute. Cover with a coverslip.
- ☐ 3. Observe under low power as you did with the onion cells.
- ☐ 4. Proceed to observe the cells under high power, being careful not to break the slide with the objective when changing from low to high power.

1.12 Draw several of these cells and label the *plasma membrane*, *cytoplasm*, and *nucleus*.



1.13 Compare and contrast the characteristics of the onion cells and your cheek cells.

Cheek Cells Experiment

(Continued on next page)

1.14 How are these cheek cells different from each other and how are they similar?

Gather information from other sources and answer the following questions.

1.15 Why do plant cells have a cell wall and animal cells do not?

1.16 How do the structures of the slime molds differ from those of cellular organisms?

TEACHER CHECK

initials

date

Cheek Cells Experiment



Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1

Match the following items (each answer, 2 points).

- | | | | | |
|--------------|-------|-------------------|----|---|
| 1.01 | _____ | epidermis | a. | all cellular material outside the nucleus |
| 1.02 | _____ | plasma membrane | b. | slime mold's life cycle |
| 1.03 | _____ | nucleus | c. | outer covering around plant cell made of fibrous material |
| 1.04 | _____ | vacuole | d. | an outer covering of cells |
| 1.05 | _____ | cytoplasm | e. | the <i>Amoeba</i> |
| 1.06 | _____ | organism | f. | small structure(s) within nucleus |
| 1.07 | _____ | cell theory | g. | control center of the cell |
| 1.08 | _____ | cell wall | h. | structure of <i>Caulerpa</i> |
| 1.09 | _____ | organismal theory | i. | large storage structures |
| 1.010 | _____ | nucleolus | j. | controls what comes into and goes out of the cell |
| | | | k. | all cellular material inside the nucleus |

Write the letter of the correct answer in the blank (each answer, 2 points).

- 1.011** To *complete* the focusing of a specimen under the microscope when the specimen is visible to your eye through the eyepiece, you must use the _____.
 a. low-power objective b. high-power objective
 c. fine adjustment d. coarse adjustment
- 1.012** You can change the power of the objective by _____.
 a. adjusting the coarse adjustment b. turning the rotating nosepiece
 c. turning the eyepiece d. moving the diaphragm
- 1.013** Once the specimen is in focus, the amount of light reaching the specimen can be changed by using the _____.
 a. diaphragm b. fine adjustment
 c. rotating nosepiece d. eyepiece

- 1.014** When using the coarse adjustment, _____.
a. never take your eyes from the eyepiece
b. turn off the light to avoid damage to the specimen
c. always turn the coarse adjustment downward toward the slide while looking through the eyepiece
d. look to the side of the microscope when turning coarse adjustment downward
- 1.015** When carrying the microscope, hold it _____.
a. using both hands on the bottom
b. using one hand on the barrel and one on the base
c. just by the arm to prevent damage
d. both by the arm and by the base
- 1.016** One difference between human cheek cells and onion cells is _____.
a. the presence of cytoplasm
b. the absence of a nucleus in the plant cells
c. the absence of a cell wall in human cells
d. neither a, b, nor c
- 1.017** When focusing a microscope, one first uses _____.
a. low power
b. high power
c. it does not matter what power is used first
d. middle range power if there are three objectives
- 1.018** The purpose of adding iodine to the plant cells was _____.
a. to soften the cell wall to allow more accurate observation
b. to cause the cells to swell so the structures would be larger
c. to form a dark color by reacting with starch
d. a, b, and c
- 1.019** The Bible teaches that _____.
a. life is a property of matter
b. God made our spirits and formed our body around them
c. matter evolved, but our spirits were created
d. our bodies were created, then had life breathed into them
- 1.020** Schleiden and Schwann believed that _____.
a. organisms were the basic unit of life
b. both cells and organisms were basic units of life
c. the questions of the basic unit of life were too abstract to answer
d. neither a, b, nor c

Write the correct answer in each blank (each answer, 3 points).

- 1.021** Two theories relate to the basic unit of life. One is the cell theory which says that
a. _____ ,
and the other is the organismal theory which says that b. _____ .
- 1.022** The Bible says that man was created in the _____
of God, and therefore has great value, and is a lot more than just the cells which make up
his body.
- 1.023** The slide is placed onto the a. _____ and held down
using b. _____ .
- 1.024** The amount of light coming through the slide can be regulated by using the _____ .
- 1.025** The lens nearest the object being studied is the _____ lens.
- 1.026** Two or three interchangeable lenses are mounted on the _____ .
- 1.027** The spherical object within a cell which controls its activity is the _____ .
- 1.028** The other part of the cell is the _____ which is all the
cellular material outside the structure that controls the cell's activities.

Answer this question (this answer, 5 points).

- 1.029** What region of the plant cell stains darkest with iodine and why? _____

60
75

SCORE

TEACHER

initials

date



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