

Cell Division

Strand Life Systems

Topic Investigating mitosis and meiosis

Primary SOL LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include

- cell structure and organelles;
- similarities and differences between plant and animal cells;
- development of cell theory; and
- cell division.

Related SOL LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include

- patterns of cellular organization and their relationship to life processes in living things.

Background Information

When introducing cell division to students, remind them that all cell organelles are present and performing their usual tasks. Cell division perpetuates life and allows for growth and reproduction of organisms. Cells go through a life cycle known as the cell cycle. The phases of the cell cycle are *interphase*, *mitosis*, and *cytokinesis*.

During interphase, the cell cycle's first phase, the cell grows to its mature size, makes a copy of its DNA, and prepares to divide into two cells. Interphase takes the most time to complete during the cell division process. The second phase of the cycle is mitosis. During mitosis, the cell's nucleus divides into two new nuclei, and one copy of the DNA is distributed into each of the two daughter cells. During the final phase of the cell cycle, cytokinesis, the cytoplasm divides, distributing the organelles into each of the two new cells.

The purpose of meiosis is to produce reproductive (sex) cells that carry half the genetic material of the parent. During meiosis, the chromosome pairs separate and are distributed to two different cells. The resulting sex cells have only half as many chromosomes as the other cells in the organism.

Materials

- Colored chalk
- Colored pencils
- Microscopes
- Onion root tip slides
- Diagrams of mitosis and meiosis
- Copies of handouts: "Stages of Mitosis," "Mitosis in Onion Cells," and "Meiosis" (attached)

Vocabulary

anaphase, cell, chromosomes, cytokinesis, cytoplasm, interphase, meiosis, metaphase, mitosis, nucleus, organelles, prophase, replication, telophase

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Use colored chalk or markers to draw the stages of mitosis on the board, using different colors for the chromosomes. Label each stage and the structures you have drawn. Then, go through each stage with students, describing the changes from one stage to the next. Give each student the “Stages of Mitosis” handout. Have students use colored pencils to draw each stage of mitosis as depicted in your drawing. Have them write a description of what happens at each stage.
2. Divide the class into pairs of students, and have each pair look at the onion root tip slide through the microscope and locate the different stages of mitosis. Have students use colored pencils to draw and label these actual stages of mitosis that they observe. Have students complete the “Mitosis in Onion Cells” handout.
3. Discuss the difference between mitosis and meiosis. Give each student a “Meiosis” handout. Make it clear that during meiosis, the chromosome pairs separate and are distributed to two different cells. The resulting sex cells have only half as many chromosomes as the other cells in the organism. Show diagrams of the stages of meiosis to compare to the stages of mitosis.

Assessment

- **Questions**
 - Why must your body make new cells?
 - What is the cell cycle?
 - What is mitosis?
 - Where along the root tip do the cells undergo mitosis?
 - Which stage of mitosis is seen most frequently in a cell undergoing mitosis? Why?
- **Journal/Writing Prompts**
 - Describe and illustrate the phases of the cell cycle.
 - Compare and contrast mitosis and meiosis.
 - Select a phase of mitosis or meiosis. If the phase were to be interrupted or disturbed in an organism, describe the impact (using scientific terms) you predict would occur for the organism.

Extensions and Connections (for all students)

- Have students act out the phases of mitosis, using pool noodles to represent chromosomes.
- Have students prepare and present to class, posters of the phases of mitosis, using colored yarn to represent the chromosomes.

Strategies for Differentiation

- Display “The Mitosis Song,” and have students sing it.

The Mitosis Song

(sung to the tune of “London Bridge Is Falling Down”)

In **mitosis** cells divide, cells divide, cells divide.
In mitosis cells divide, for cell reproduction.

In **interphase** chromosomes duplicate, duplicate, duplicate.
In interphase chromosomes duplicate, in mitosis.

In **prophase** we see chromosomes, see chromosomes, see chromosomes.
In prophase we see chromosomes, in mitosis.

In **metaphase** chromosomes all line up, all line up, all line up.
In metaphase chromosomes all line up, in mitosis.

In **anaphase** chromosomes move apart, move apart, move apart.
In anaphase chromosomes move apart, in mitosis.

In **telophase** there are two nuclei, two nuclei, two nuclei.
In telophase there are two nuclei, in mitosis.

In **cytokinesis** there are two new cells, two new cells, two new cells.
In cytokinesis there are two new cells, in mitosis.

Stages of Mitosis

Name: _____ Date: _____

Draw each phase in the box next to the correct label. Describe what occurs.

Interphase	Draw picture here.	Describe what occurs.
Prophase	Draw picture here.	Describe what occurs.
Metaphase	Draw picture here.	Describe what occurs.
Anaphase	Draw picture here.	Describe what occurs.
Telophase	Draw picture here.	Describe what occurs.
Cytokinesis	Draw picture here.	Describe what occurs.

Mitosis in Onion Cells

Name: _____ Date: _____

Introduction

Mitosis can be observed in cells that are in a state of growth. In this lab, you will observe cells and identify which stage of cell division the cells are in. Remember, interphase is an important part of the cell cycle but is not technically a part of mitosis. Many of the cells you will be looking at are in interphase.

Procedure

You will be given a slide of *Allium*, which is an onion root tip. Growth occurs when cells divide, so the root tips should have several cells in the process of cell division. View the root tip under the microscope, and search for organized blocks of cells where nuclei are plainly visible. Most activity will be occurring at the tip of the root. Move the slide around until you find a good spot that shows the cells in various stages of mitosis.

Stage	Sketch of what you observe from the slide
Interphase	
Prophase	
Metaphase	
Anaphase	
Telophase	
Cytokinesis	

Analysis

1. Why is the onion root a good specimen for studying mitosis?

2. In which stage of the cell cycle were the majority of the cells in your specimen?

3. In onion cells, interphase lasts about 15 hours, and mitosis takes up 80 minutes. Assuming that each stage of mitosis takes the same amount of time, how many hours old is a cell that is just starting anaphase?

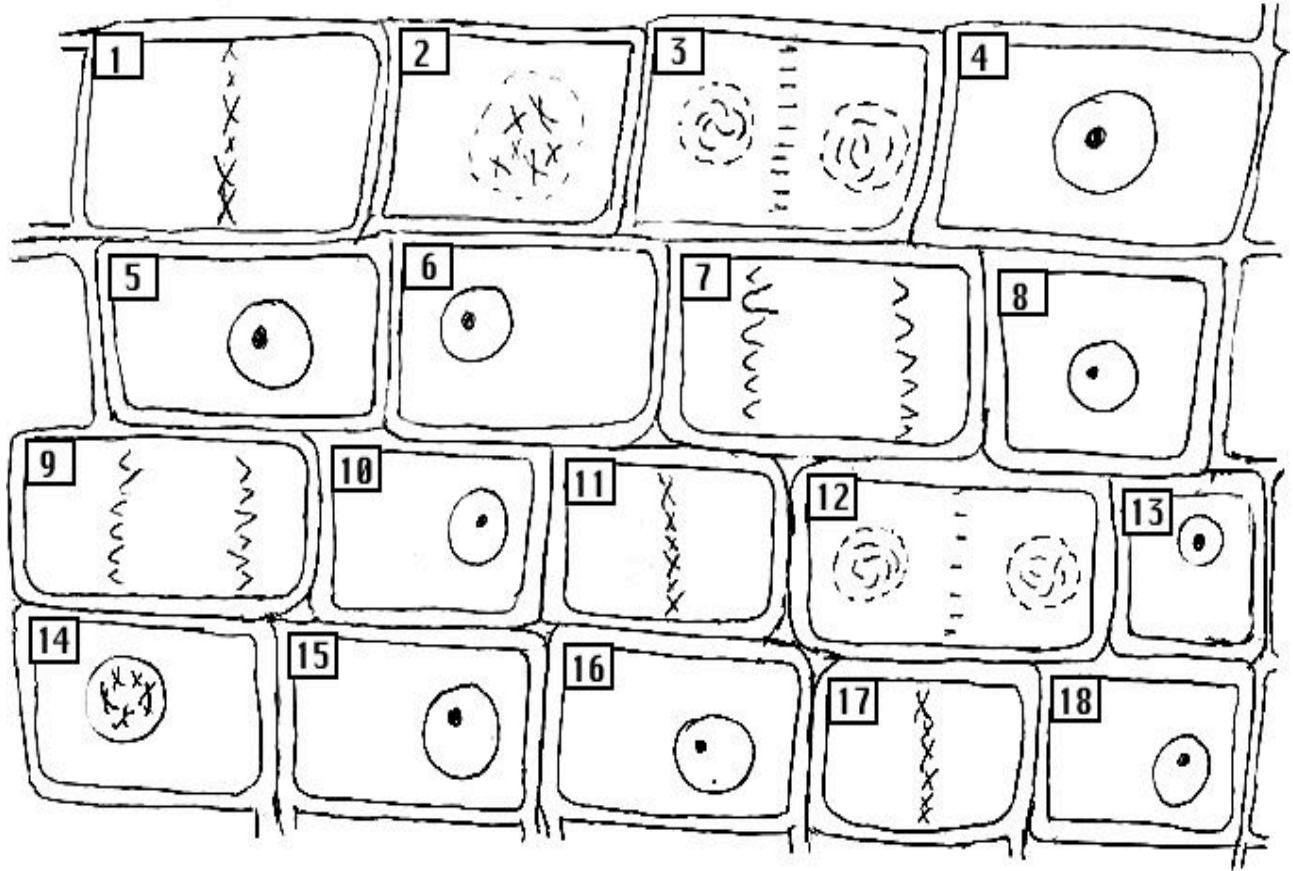
4. Sketch one cell in any stage of mitosis. Label the stage and any cell structures that are visible. The spindle fibers and chromosomes should be visible.

5. Which stage of mitosis is the easiest (in your opinion) to see on the slide? What about it makes it easy to identify?

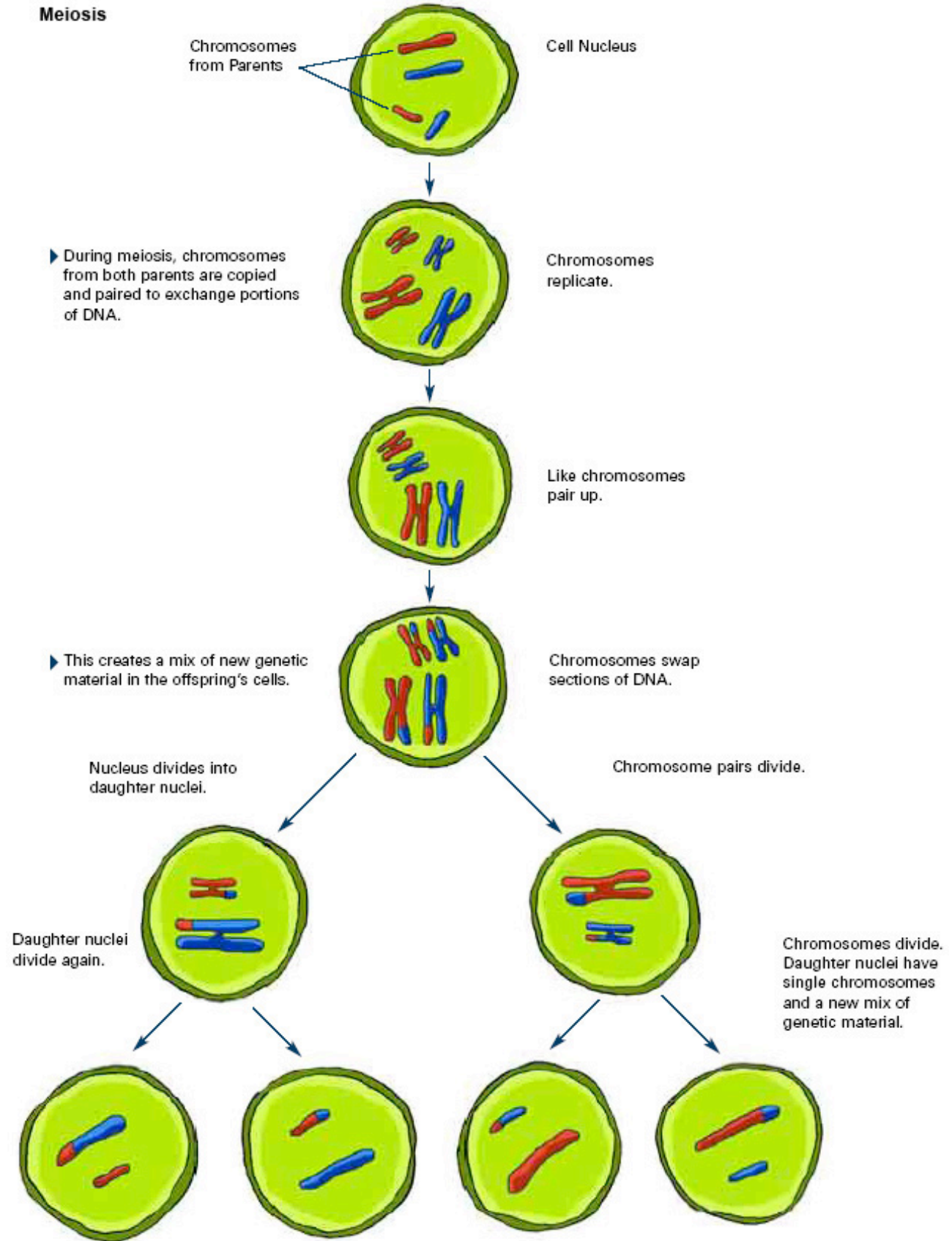
Onion Cell Mitosis

Name: _____ Date: _____

Identify the phases of the cell cycle shown below:



- | | |
|----------|-----------|
| 1. _____ | 10. _____ |
| 2. _____ | 11. _____ |
| 3. _____ | 12. _____ |
| 4. _____ | 13. _____ |
| 5. _____ | 14. _____ |
| 6. _____ | 15. _____ |
| 7. _____ | 16. _____ |
| 8. _____ | 17. _____ |
| 9. _____ | 18. _____ |



Credit: <http://publications.nigms.nih.gov/thenewgenetics/chapter1.html>