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Duplicate and Divide

How is it that organisms grow larger or heal damaged tissues and organs? Cells inside organisms do not grow larger and larger as the organism ages; if that were the case, cells would not be microscopic like we discovered them to be in the last unit we studied. Instead, cells go through the **cell cycle** made up of two main components—**interphase** and **cell division.**

During **interphase**, the cell will spend the majority of its life here performing the life processes and then important changes will occur in the genetic material during this phase. The process of dividing up the genetic material is called **cell division**—to create body cells like skin, teeth, hair, liver or brain for example in humans, **mitosis** will occur, but to create sex cells like sperm and egg cells in humans for example, **meiosis** will occur. Mitosis and meiosis are both a form of **asexual reproduction**.

Regardless of the type of cell division, both are complex processes that help living things grow, reproduce, heal damaged tissues and develop into mature organisms, so let's take a closer look at how cells duplicate then divide!

Focus Questions

1) How do cells create genetically identical offspring (daughter cells) as a result of mitosis?
2) What are the main differences between the processes of mitosis and meiosis?

Background Information

Chromosomes—

- Each chromosome consists of a long, tightly coiled molecule of _____.
- Every _____ has a specific, characteristic _____ of chromosomes. (Humans—46, Tomato—24, Moth—224)
- Chromosomes come in _____—one set from the _____ parent and one from the _____ parent.
- A section of a chromosome (piece of the DNA) is called a _____ and is responsible for an individual _____ of the organism.
- Both members of a _____ of chromosomes have genes for the same _____ in the same _____. Therefore, there are _____ genes for the same trait in every cell of the organism.

Cell Cycle

Interphase—Most of the _____ of the cell is spent in interphase (about 90%)

- Grows in _____
- Carries out the life _____
- _____ (doubles) the chromosomes—also known as DNA synthesis
- Prepares for cell _____

Mitosis—Nuclear division followed by cell division when chromosomes are _____ divided into two new _____ cells having the _____ number of chromosomes—diploid. There are 4 stages:

1. **Prophase—**
    a. Nuclear membrane disappears
    b. Chromosomes become _____
2. **Metaphase—**
    a. Chromosomes with their attached copies (sister chromatids joined together by a centromere) line up along the _____ of the cell
    b. Spindle fibers are attached to the chromosomes

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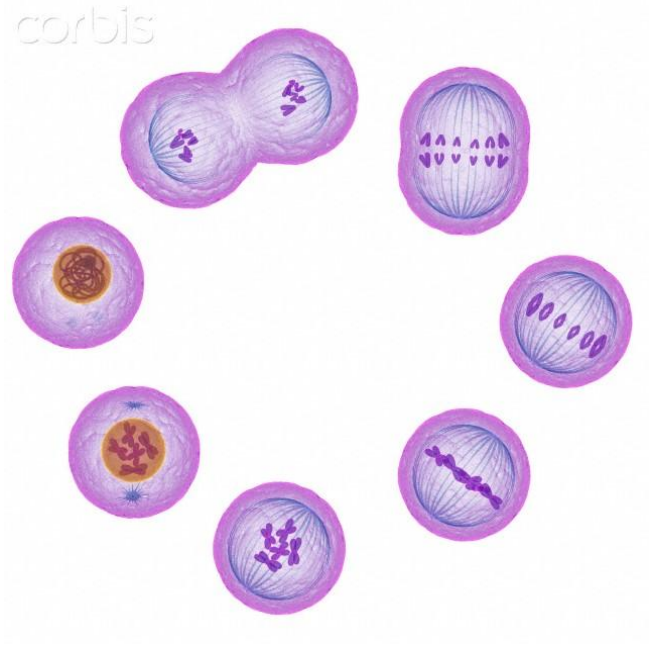
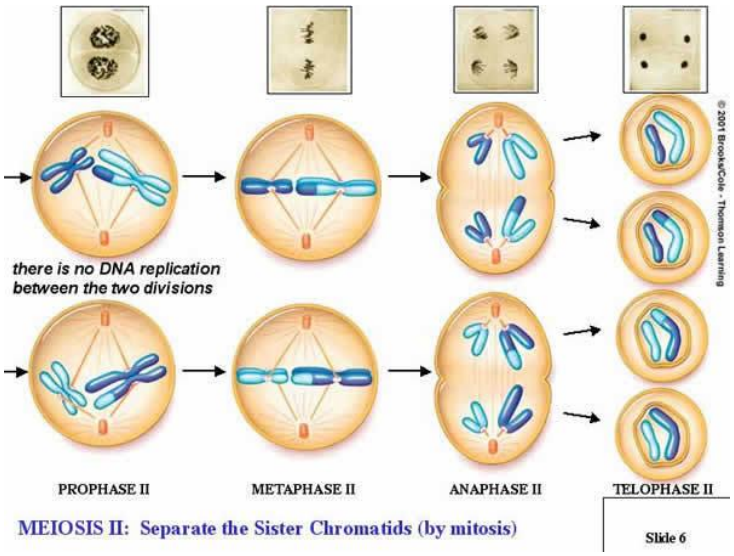
3. **Anaphase—**
    a. Sister chromatids move _____
    b. The cell plate may begin to form in a plant cell or pinching of the cell membrane may be visible in an animal cell
4. **Telophase—**
    a. Sister chromatids are at opposite ends of the cells
    b. Nuclear membrane begins to reform
    c. Spindle fibers disappear
    d. Evidence of a cell _____ between nuclei in a plant cell or cytoplasm is _____ apart between the two new nuclei in an animal cell…there are _____ new cells



Cytokinesis—_____ division of the cytoplasm and the creation of two new identical cells. The new cells enter interphase and _____ the cell cycle all over _____.

Any changes to genes (known as mutations) can be passed on to new _____ cells during mitosis and can also occur at random during the cell division process.

Meiosis—Occurring only in the _____ organs of an organism, this is nuclear division followed by cell division when chromosomes are divided into four new _____ cells having _____ number of chromosomes—_____. New organisms can be created when these reproductive cells combine and develop a new individual through _____ reproduction. This kind of reproduction is most commonly observed in complex organisms in the plant and animal kingdoms.



Any changes to genes (known as mutations) in reproductive cells during meiosis would be present in every cell of the new offspring created by them.

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Observing Mitosis

Materials

Prepared slide—root tip
Microscope

Directions

Step 1 Place the prepared slide on the microscope stage and focus using low power first.

Step 2 Find and focus in medium, then high power and look for cells in various stages of the cell cycle. It is best to look towards the bottom of the sample where the cells are the smallest.

Step 3 For each of the cell stages listed in the chart below, draw the cell in the appropriate stage and name the feature you looked for to identify a cell in that stage.

Cell Stage	Drawing	Identifying Feature	Hint to Remember
interphase			
prophase			
metaphase			
anaphase			
telophase			

Analysis

1) In which stage are the chromosomes first visible?

2) In what stage do chromosomes move to the center and then begin to move to opposite end of the cell?

3) In what stage were the majority of the cells you observed in? Why do you suppose this is?

4) Was meiosis visible in this sample of root tip? Why or why not?

5) Why do you think root tip cells are a good choice to use when studying mitosis?

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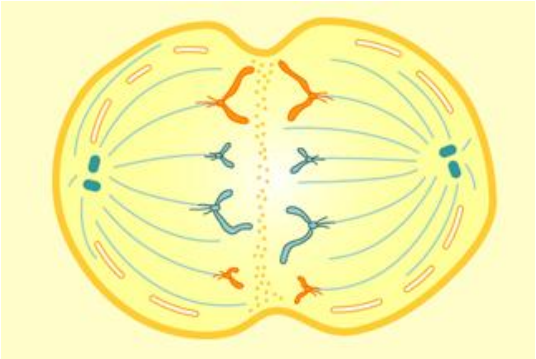
Application

1) a) Based on what you have learned about mitosis, is this a plant or an animal cell?



b) What would happen next for this cell…how do you know?

Fruit flies have 8 chromosomes in their cells.

2) A fruit fly damages his wing and has to repair it by making new wing cells, how many chromosomes would each new wing cell have after mitosis?

3) In order to reproduce, the female fruit fly needs to produce reproductive cells called egg cells.

a) During what cell division process are egg cells made?

b) How many chromosomes will each egg cell have?

c) After reproductive cells combine, a new organism is created. In the case of the fruit fly, how many chromosomes will the offspring (baby) have in each body cell? How do you know?