SECTION

5.1 The Cell Cycle

FLORIDA STANDARDS
SC.912.L.16.14

KEY CONCEPT Cells have distinct phases of growth, reproduction, and normal functions.

The cell cycle has four main stages.

Cells grow and divide in a regular pattern, or cycle*. If you cut your finger, your cells grow and divide to make more cells. This is how your finger heals.

The **cell cycle** is a regular pattern of growth, DNA duplication*, and cell division* that occurs in eukaryotic cells. Recall that your cells are eukaryotic cells, and they have a nucleus. There are four main stages of the cell cycle:

- gap 1—normal growth
- synthesis—DNA is copied
- gap 2—more growth
- mitosis—nuclear division

Together, these three stages make up a part of the cell cycle called interphase.

Each stage is described below.

Gap 1 (G_1) In G_1 cells do their normal functions. For example, your muscle cells contract, and intestinal cells absorb nutrients.

Synthesis (S) *Synthesis* means "the combining of parts to make a whole." During the S stage, a cell puts together, or synthesizes, a whole copy of its nuclear DNA. In eukaryotes, DNA is in the nucleus. At the end of this stage, there are two complete sets of DNA in a cell's nucleus.

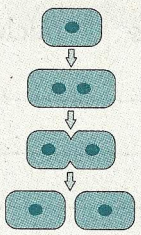
Gap 2 (G_2) In G_2 cells grow and continue their normal functions. If the cell is healthy, it will continue to the next stage.

Mitosis (M) There are two parts of this stage: mitosis and cytokinesis. **Mitosis** (my-TOH-sihs) is the division of the cell nucleus and the DNA inside it. **Cytokinesis** (SY-toh-kuh-NEE-sihs) is the division of the contents of the rest of the cell—the cytoplasm.

These four main stages are shown in the graph at the top of page 75.

VISUAL VOCAB

Mitosis is the division of the cell nucleus and its contents.

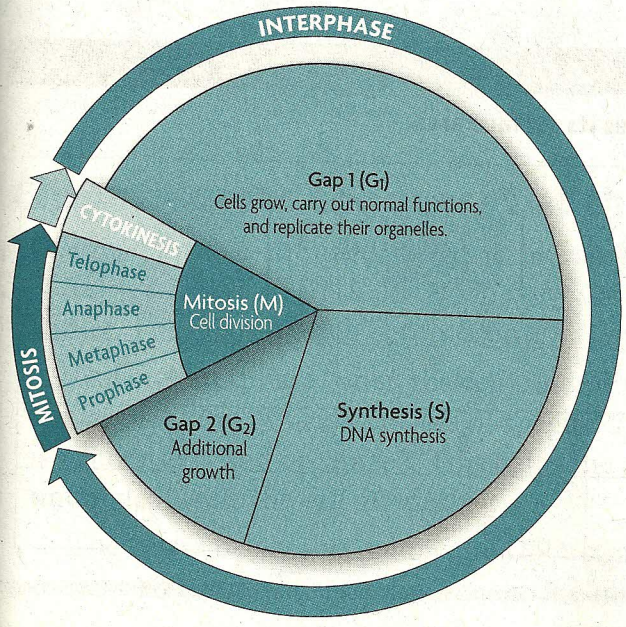


Cytokinesis divides the cell cytoplasm.

Daughter cells is a term to describe these resulting cells, but it does not mean that they are female.

*** ACADEMIC VOCABULARY**

cycle a pattern of events that is repeated
duplication the process of doubling, or copying
division separating



Cells grow and copy their DNA during interphase. During M stage, both the nucleus (in mitosis) and cytoplasm (in cytokinesis) are divided.

Visual Connection

See Figure 5.7, The Cell Cycle in Detail, in the student text, pg. 141

STANDARDS CHECK On the figure above, circle the terms for the four stages of the cell cycle.

Cells divide at different rates.

Different types of eukaryotic cells take different amounts of time to go through the cell cycle. The table at right lists the life span—or how long until a cell dies—for different types of human cells. Also, cells divide at different rates depending on a person's age. Children's cells divide faster than do cells in adults. In adults, many cells divide only if there is an injury or cell death.

INSTANT REPLAY How long does it take for a cell to go through the cell cycle?

_____

CELL LIFE SPAN

CELL TYPE	APPROXIMATE LIFE SPAN
Skin cell	2 weeks
Red blood cell	4 months
Liver cell	300–500 days
Intestine—internal lining	4–5 days
Intestine—muscle and other tissues	16 years

This chart shows the life span of five different types of human cells. Each type of cell divides at a different rate.

Cell size is limited.

A cell must be big enough to fit all of the molecules and organelles it needs to live. A cell also must be small enough to quickly transport nutrients and wastes into and out of the cell across the cell membrane. As a cell gets bigger, its volume* increases faster than its surface area*. If a cell gets too big, there is not enough surface area of the cell membrane to transport nutrients and wastes for such a big volume. The upper limit on cell size depends on its surface area-to-volume ratio. The surface area-to-volume ratio is the size of the surface area compared to the size of the volume.

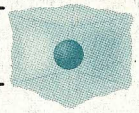
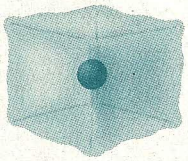
*** ACADEMIC VOCABULARY**

volume the amount of space in a three-dimensional object

surface area the total amount of area on the surfaces of an object

RATIO OF SURFACE AREA TO VOLUME IN CELLS

As a cell grows, its volume increases more rapidly than does its surface area.

Relative size	1 	2 	3 
Surface area (length × width × number of sides)	6	24	54
Volume (length × width × height)	1	8	27
Ratio of surface area to volume	$\frac{6}{1}$ = 6:1	$\frac{24}{8}$ = 3:1	$\frac{54}{27}$ = 2:1

INSTANT REPLAY

Can a cell get too big? Explain.

_____

5.1 Vocabulary Check

cell cycle
cytokinesis
mitosis

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold.**

Fill in the blanks with the correct term from the list above.

1. _____ is the division of the nucleus and its contents.
2. The _____ is a pattern of growth, DNA duplication, and division.
3. The division of the cell cytoplasm is called _____.

5.1 The Big Picture

4. During which stage of the cell cycle is DNA copied? _____
5. Do all cells take the same amount of time to divide? Explain. _____

_____

6. How does the surface area-to-volume ratio limit cell size? _____

_____