

Student Exploration: Cell Division

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

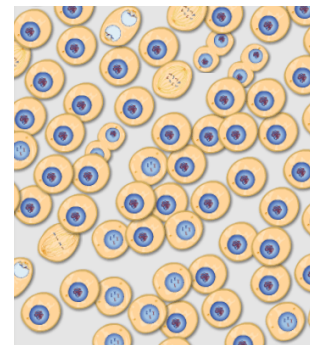
1. What is the purpose of this activity?

2. Cells reproduce by splitting in half, a process called **cell division**. What do cells need to do between divisions to make sure that they don't just get smaller and smaller?

3. The genetic information of a cell is carried in its **DNA** (short for deoxyribonucleic acid). What do cells need to do between divisions to make sure that a full set of DNA gets passed on to each daughter cell?

Gizmo Warm-up


On the SIMULATION pane of the *Cell Division* Gizmo™, check that the **Cycle Length** is set to 12 hours. Click **Play** (▶), observe until the maximum number of cells is shown, and then click **Pause** (⏸).



1. Look at the cells. Do they all look the same? _____
2. Cells that are in the process of dividing are said to be in **mitosis** or **cytokinesis**. Cells that are not dividing are in **interphase**.

Check the **Magnify** box and move the cursor over the cells.

- A. Of the 100 cells shown, how many are in the process of dividing? _____
- B. Select the BAR CHART tab, and turn on **Show numerical values**. How many cells are in the interphase stage of their life cycle? _____
- C. Based on these two observations, would you say that a cell spends most of its life cycle in interphase or in mitosis/cytokinesis? _____

Activity A: Phases of the cell cycle	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Click Reset (↺). • Select the DESCRIPTION tab. • Click on the right arrow once so that Interphase is shown. 	
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Question: What are the stages of the cell cycle?

1. Summarize: On the DESCRIPTION pane, read about each phase in the cell cycle. In the spaces below, sketch the cell in each phase and summarize what occurs in 10 words or less.

Phase	Sketch	Summary
Interphase		
Prophase		
Metaphase		
Anaphase		
Telophase		
Cytokinesis		



2. Analyze: Use your summaries and the Gizmo to answer the following questions:

A. What are the 4 phases of mitosis? _____,
_____, _____, _____

B. During which phase do the chromosomes condense? _____

C. What is the relationship between a **chromatid** and a **chromosome**? _____

D. In which phase are **chromatids** pulled apart? _____

E. What is the function of the **centrioles**? _____

F. In which phase do nuclear membranes reform? _____

G. In what phase do chromosomes line up in the middle of the cell? _____

3. Think and discuss: After mitosis, how are the two daughter cells related to each other?

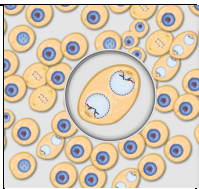
4. Think and discuss: How are the daughter cells related to the original mother cell?

5. Think and discuss: Why is it important that the cell's DNA is duplicated before cell division (in S phase)?

6. Think and discuss: Why is it important for the cell to synthesize new organelles before cell division (in G2)?

7. Challenge: Human cells have 46 chromosomes. At the end of cytokinesis, how many chromosomes will be found in each cell? Explain.



Activity B: Duration of phases	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Click Reset. • Select the TABLE tab. 	
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Question: What is the relative duration of each phase of the cell cycle?

1. Collect data: Set the **Cycle Length** to 10 hours and click **Play**. Click **Pause** when the maximum number of cells has been reached. On the **TABLE** tab, click **Record data**.

Record the number of cells in each phase of the cell cycle in the table below. Then click **Play**, wait for a while, and click **Record data** again. Repeat this process until you have recorded four sets of results, and then find the average number of cells in each phase.

Trial	Interphase	Prophase	Metaphase	Anaphase	Telophase	Cytokinesis
1						
2						
3						
4						
Avg.						

2. Analyze: Which phase of the cell cycle is longest? _____ Shortest? _____

Explain your answers: _____

3. Calculate: Use your data to estimate the duration of each phase of the cell cycle. For example, if 8% of cells were in prophase and the cell cycle was 10 hours long, then prophase would last 8% of 10 hours, or 48 minutes.
 - $0.08 \times 10 = 0.8$ hours
 - $0.8 \times 60 = 48$ minutes

Use percentages to estimate the time of each phase of the cell cycle. Show your work.

Interphase: _____

Prophase: _____

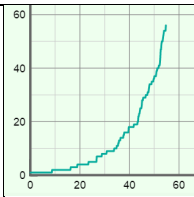
Metaphase: _____

Anaphase: _____

Telophase: _____

Cytokinesis: _____



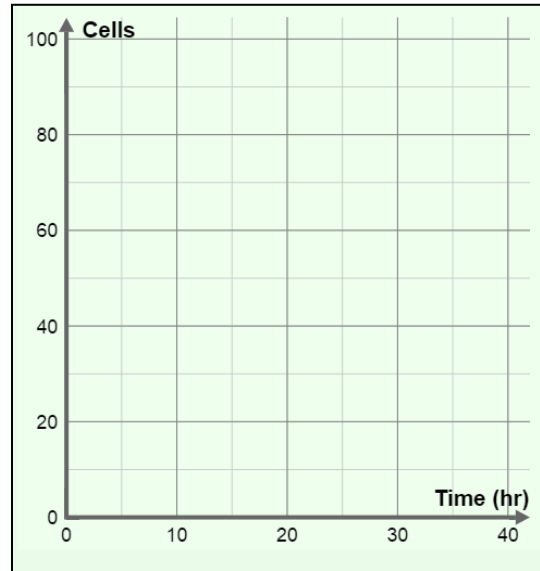
<p>Extension: Cell populations</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> • Click Reset. • Select the GRAPH tab. • Set the Cycle Length to 5 hours. 	
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Question: How quickly do cells multiply?

1. Collect data: Click **Play** to start a new simulation. Click **Pause** when the maximum number of cells is reached. View the total number of cells on the GRAPH tab. (Click the “-” button until the whole graph is visible.)

Draw a sketch of this graph here.

What is the general shape of the graph?



2. Analyze: Look closely at the graph.

B. How long did it take to grow from 1 to 20 cells? _____

C. How long did it take to grow from 80 to 100 cells? _____

D. Is the rate of cell growth is increasing or decreasing? Explain.

3. Extend your thinking: In living organisms, the cell cycle is closely regulated. What happens if cell division is *not* controlled?

