

Cell division



Name: _____ Date: _____

Student Exploration: Cell Division

Vocabulary: cell division, centriole, centromere, chromatid, chromatin, chromosome, cytokinesis, DNA, interphase, mitosis

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

1. 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? They need to grow

2. 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? They need to make a copy of their
dna_____

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? yes_____

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?

_____5_____

B. Select the BAR CHART tab, and turn on Show numerical values. How many cells are in the interphase stage of their life cycle?

_____87_____

C. Based on these two observations, would you say that a cell spends most of its life cycle in interphase or in mitosis/cytokinesis? _____yes_____

Activity A:

Phases of the cell cycle Get the Gizmo ready: • Click Reset (). • Select the DESCRIPTION tab. • Click on the right arrow once so that Interphase is shown.

Question: What are the stages of the cell cycle?

1. Observe: Click Play and hold the cursor over the cell. Observe the cell as it divides several times. (This happens quickly!) What do you notice happening during this process? DNA is copied, chromatids appear, the cell pulls apart_____

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2. 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 your own words.

Phase Sketch Summary Interphase

The cell grows and develops, developing organelles and copying its

DNA Prophase

The nuclear membrane dissolves away, the chromatin condenses into chromosomes. Spindle fibers form between the centrioles, which move to opposite ends of the cell. Metaphase

The spindle fibers pull the chromosomes to line them up on the equator.

Anaphase

The chromosomes are split apart by the fibers, and the chromatids move to opposite sides of the cell. Telophase

A nucleus forms around each of the chromosomes and they unwind into chromatin. Cytokinesis

The cell membrane pinches and divides the cell into two daughter cells.

(Activity A continued on next page)

Activity A (continued from previous page)

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

A. What are the four phases of mitosis? ___ prophase _____,
_____ metaphase _____, ___ anaphase _____, ___ Telophase ___

B. During which phase is the DNA duplicated? ___ interphase _____

C. What is the relationship between chromatin and chromosomes?

__Chromatin is the unwinded, loose DNA. Chromosomes form when chromatin condenses. ____

D. In which phase are chromatids pulled apart?

____anaphase_____

E. What is the role of the centrioles? ____they produce the spindle fibers and pull apart the chromosomes_

F. In which phase does a new nuclear membrane develop? __ Telophase

G. A cell has a single line of chromosomes. What is the phase?

__metaphase_____

H. During which three phases are individual chromosomes no longer visible?

____interphase____, ____telophase____, ____ Cytokinesis _____

4. Think and discuss: Why is it important that the cell's DNA is duplicated before cell division?

__This is important because each new cell need to have the same amount of DNA, or they will be different and cells will keep on becoming more and more incomplete with each division_____

5. Challenge: Human cells have 46 chromosomes. Each chromosome consists of a pair of identical chromatids attached together by a structure

called a centromere. At the end of cytokinesis, how many chromatids will be found in each daughter cell? Explain.

___There will be 0 because during telophase (before cytokinesis), the chromatids dissolve into chromatin.

Activity B:

Duration of phases Get the Gizmo ready: • Click Reset. • Select the TABLE tab.

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	97	1	0	1	0	0
2	12	80	8	3	1	3
3	53	94	2	0	0	2
4	24	87	5	0	2	3

Avg.

2. Analyze: Which phase of the cell cycle is longest? interphase Shortest? metaphase Explain your answers: Cells spend lots of time in interphase, so it we see a large number of them in interphase at any given moment,

such as this one. Cells spend less time in metaphase, so the chance that we see many cells in that phase is very small. _____

3. Calculate: You can use your data to estimate the duration of each phase of the cell cycle. For example, if 8% of the cells were in prophase and the cell cycle was 10 hours long, then prophase would last 8% of 10 hours, or 0.8 hours (48 minutes).

Use percentages to estimate the duration of each phase of the cell cycle.

Show your work.

Interphase: _____

Prophase: _____

Metaphase: _____

Anaphase: _____

Telophase: _____

Cytokinesis: _____

Extension:

Cell populations Get the Gizmo ready: • Click Reset. • Select the GRAPH tab. •

Set the Cycle Length to 5 hours.

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?

_____parabola_____

2. Analyze: Look closely at the graph.

A. About how long did it take to grow the first 20 cells?

_____25_____

B. About how long did it take to grow the last 20 cells? _____2

min_____

C. Would you say the rate of cell growth is increasing or decreasing? Explain.

_____It is increasing because it requires less and less time to produce 20 cells. Plus the graph of the growth increases in slope continuously. _____3.

Extend your thinking: In living organisms, the cell cycle is closely regulated.

What do you think will happen if cell division is not controlled?

_____If it is not controlled, cells can either produce too many cells too quickly, which can form abscesses and masses in the body, which can pressure and harm other parts and block functions.. If they produce too little, the body will be deprived of cells that complete a certain function, which would harm homeostasis. _____

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