Name _____ Period_____Date_____

ADDITIONAL INVESTIGATION

Animating Mitosis

Teacher Notes

TIME 45 minutes

TEACHER PREPARATION 

STUDENT DIFFICULTY 

Purpose: Understand how mitosis proceeds from one stage to the next

Overview: Students will compile a flipbook representing mitosis in action. The activity involves drawing and labeling each of the main steps of the cell cycle, and adding intermediate steps to help animate the process.

LAB PREPARATION

- You may wish to demonstrate what a flipbook does.
- Remind students that for the flipbook to work, their diagrams should be approximately the same size and located in roughly the same area of the index card. This will make the flipbook transitions go more smoothly.

LAB MANAGEMENT

Point out that the diagram uses only three pairs of chromosomes to show the mitotic stages. Inform them that they should do the same to avoid overcrowding.

POST-LAB DISCUSSION

Students may want to watch real cells undergo mitosis. Short, time-lapse films are viewable on the Web.

ANSWERS

Analyze and Conclude

1. 23 pairs in daughter cells; the number of chromosomes is preserved in mitosis
2. The cell plate; it would form in the center of the cell and grow outward until it formed the cell wall.
3. The sister chromatids would not be pulled apart and the cell would fail to divide, resulting in a cell with double the normal number of chromosomes.
4. Using more cards between stages also made the stage look like it lasted longer.

5. Anaphase; from left to right, the structures are the spindle fibers, chromatids, and centrioles.
6. By helping to prevent the loss of genes at the ends of DNA molecules, telomeres help ensure that DNA is replicated correctly in each successive round of mitosis. This helps prevent abnormal growth or early death of the cell.

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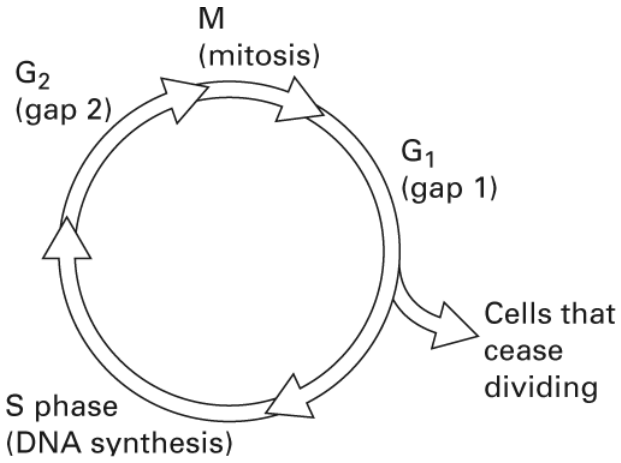
ADDITIONAL INVESTIGATION

Animating Mitosis

In nature, the events leading up to the production of the two new daughter cells during the process of cell division are continuous, but it is often necessary—and easier—to discuss the process as a series of separate steps.

In this lab, you will create a flipbook that animates the stages of mitosis in an animal cell so that they flow from one to the next as they would in real life. The diagram shows the stages of a cell's life cycle.



MATERIALS

- 40+ index cards
- colored pencils
- hole punch
- 2 8-inch pieces of string
- scissors

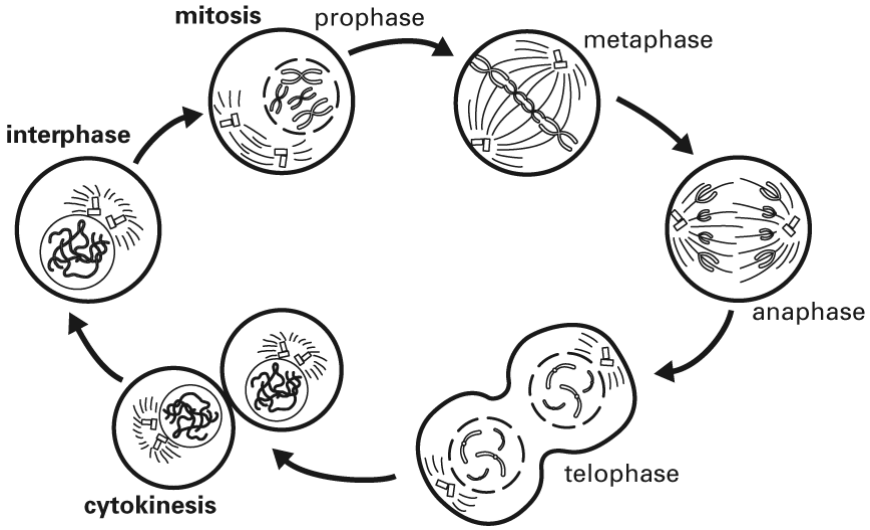
PROCESS SKILLS

- Observing
- Inferring
- Communicating

PROCEDURE

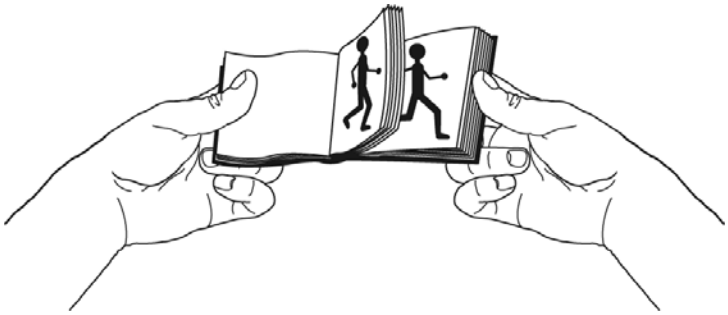
1. Study the drawing of the stages of mitosis in the diagram below. You should be familiar with prophase, metaphase, anaphase, telophase, and cytokinesis before beginning the lab.

2. Using colored pencils, copy the drawings of each of the stages of mitosis on four index cards. Use different colors to show all of the following parts: chromatin, chromosomes, sister chromatids, spindle fibers, centrioles, new nuclear membranes, centromere, and daughter cell. The colors for each part should remain the same on each card. Each of your drawings should show the cell at the same size. They should also be in the same position on the card.



3. Choose a fifth and sixth card. Copy the drawings of a cell during cytokinesis and interphase.
4. Look at your drawings of interphase and prophase. A lot of action has taken place between these two stages. In a fixed location (such as the upper left-hand corner), number the interphase card "1" and place it facedown on your desk.
5. On separate index cards, draw the movement from interphase to prophase. Since you are making a flipbook, remember that the more drawings you make, the smaller the differences between each drawing. Your animation will be smoother. In the same fixed spot, number each of the cards in the order they will appear. This will help keep your cards in order.
6. As you complete each drawing, number it and place it facedown on top of the card pile.
7. Now look at prophase and metaphase. Repeat steps 4 through 6, this time showing what happens as the cell moves from prophase to metaphase.
8. Repeat steps 4 through 6 showing the cell moving from metaphase to anaphase, anaphase to telophase, and telophase to cytokinesis. Remember to number each card and place it upside down on your pile as you finish it.
9. Once you have finished the cards, turn them over. Now interphase will be on top.
10. Check that all the cards are in the correct numeric order.

11. Punch two holes on the left-hand side of the cards. The holes should line up as they do in a spiral notebook. As you finish punching the cards, place them back face down on your desk. This will ensure that interphase will be your first card.
12. Check once more to make sure that your cards are in order. Then, cut two pieces of string with your scissors. Tie a string through each of the holes, and tie them loosely.
13. Flip your book!



Example of a flip book used to show motion

ANALYZE AND CONCLUDE

1. **Compare** A human somatic cell has 23 pairs of chromosomes. How many chromosomes are in each daughter cell after mitosis?

_____

_____

2. **Infer** If you had instead shown mitosis in a plant cell, which feature would you have to change and how would you show it?

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_____

3. **Infer** What would happen if spindle fibers did not form during mitosis?

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4. **Describe** Using more cards between stages made your animation smoother. What other effect did it have?

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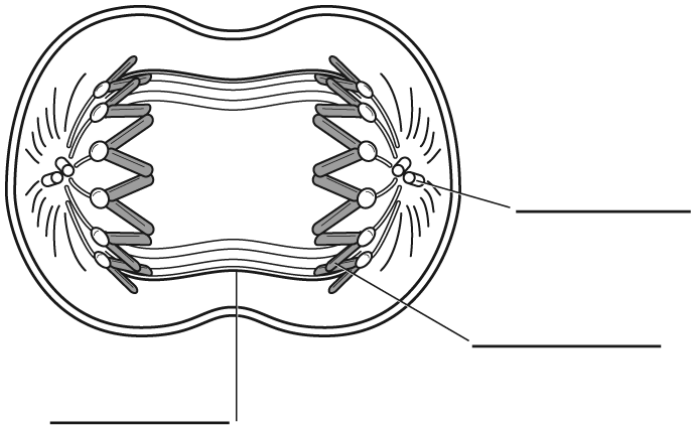
Animating Mitosis *continued*

5. Analyze The drawing below shows a cell during a stage of mitosis. Name the stage, and label the parts.



6. Apply How are telomeres related to the health of the cell?