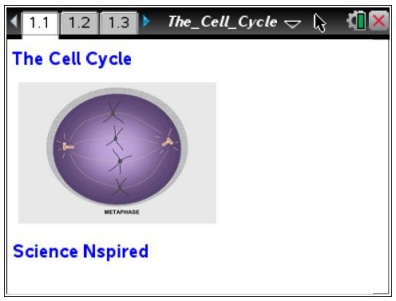
The Cell Cycle

Student Activity

Name _____

Class _____

Open the TI-Nspire document *The_Cell_Cycle.tns.*



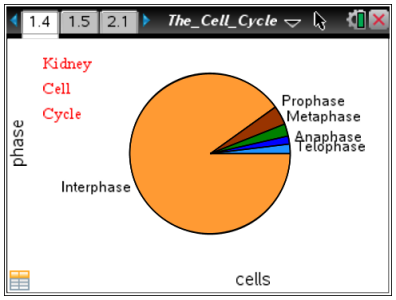
Did you know that you are a product of mitosis? Your hair, skin and fingernails are constantly being replaced at a rapid rate; in fact, the outer layer of your skin will all be new in just 3 weeks from now! But this is not true for all of your cells. Most of your nerve cells stopped reproducing after you were a few months old. The life span of your red blood cells is only about 120 days, while the cells of liver tissues can take up to a year to reproduce!

Move to page 1.2 and 1.3.

The **cell cycle** has two main phases: **interphase** and **mitosis**. Most of the cell's life is spent in interphase. During this time, the cell performs its normal cell activities (kidney or liver functions, for example). Mitosis is the process of cell division, when one cell replicates its DNA and other cell parts, and then divides into two identical cells. Mitosis leads to growth or replaces dead cells. The process of mitosis takes about the same amount of time in every of the type of cell. Interphase times change, as you'll soon see.

In this activity, you will learn how to identify the changes that occur in a cell during its reproduction. You will also correlate these changes to the duration of specific phases within the cell cycle.

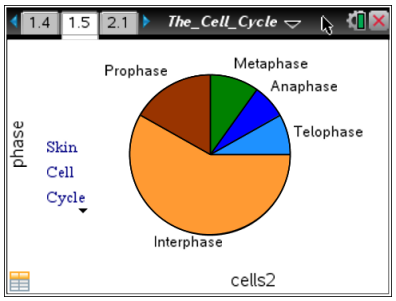
Move to pages 1.4 and 1.5. Answer questions 1 - 10 here.



1. Pages 1.4 and 1.5 show pie charts of the cell cycles of kidney cells and skin cells. Look at both charts. Remember that the process of mitosis, (which includes **prophase**, **metaphase**, **anaphase** and **telophase**), takes about the same amount of time in both kidney cells and skin cells.

   It is the interphase times that vary from cell type to cell type.

   In a sample of cells, the number of cells that are in each phase is proportional to the time spent on that phase in the cycle for that type of cell. If you also know the time spent in one of the phases, you can then estimate how much time cells spend in each of the other phases of the cycle.



Q1. Select each phase in the Kidney Cell Cycle pie chart. You will see the number of cells in the sample that are in each of the different phases. Record the number of cells in each phase in the table the follows. Add the number of cells in prophase,

metaphase, anaphase, and telophase to find the total number of cells in mitosis. Then do the same for the Skin Cell Cycle pie chart.

iPad Tip: To see the number of cells in the sample that are in a particular phase, tap on each phase in the pie chart.

Phase	Kidney	Skin
Prophase		
Metaphase		
Anaphase		
Telophase		
Total in Mitosis		
Interphase		

Q2. Suppose the mitosis portion of the cell cycle lasts for 24 hours in both kidney cells and skin cells. Estimate how long interphase lasts in each cell by solving the proportion for *x*, the number of hours of interphase.

$$\frac{\#\text{ of cells in mitosis}}{\#\text{ of cells in interphase}} = \frac{24}{x}$$

Note: Remember your answer is in hours. Divide it by 24 to also see how many days it lasts.

Kidney Cell _____ Skin Cell _____

Q3. Mitosis includes 4 mitotic phases: prophase, metaphase, anaphase and telophase. Estimate how long each of the 4 mitotic phases lasts in skin cell mitosis. Use the formula below.

$$\frac{\#\text{ of cells in phase}}{\text{total }\#\text{ of cells in mitosis}} \times 24$$

Prophase _____ Metaphase _____ Anaphase _____ Telophase _____

Q4. How long is each of the 4 phases in kidney cell mitosis?

Prophase _____ Metaphase _____ Anaphase _____ Telophase _____

Q5. Estimate the length of one entire cell cycle (mitosis and interphase combined) in each of the cell types in the activity.

Kidney Cell _____ Skin Cell _____

Q6. You're looking in a microscope at a tissue sample of living cells. In which stage of the cell cycle would you expect to find the most cells? In which stage would you expect to find the fewest cells?

Most _____ Fewest _____

Q7. Which of the two types of cells, kidney or skin, divides more often? Explain.

Q8. The process of mitosis produces new body cells for you. What are two reasons your body needs to produce new cells?

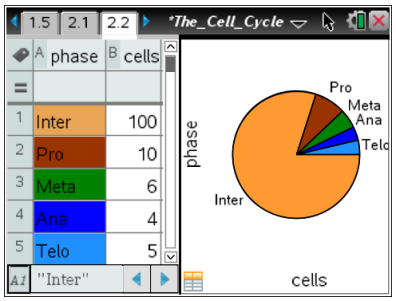
Q9. When, (at what stages), during a human's lifetime, would you expect to find lots and lots of cells undergoing mitosis? When would you expect to find fewer? Explain both of your answers.

Q10. Interphase is an equally important part of the cell cycle. It is when the cell really does its regular job, such as filtering blood for kidney cells or digesting food in the stomach. During this time, the cell can consume energy and can perform cell functions. Based on what you now know about the cell cycle, what might happen if interphase did not have enough time before mitosis?

Move to pages 2.1 and 2.2.

A student looked at an onion root tip under a microscope and counted the cells in each phase of the cell cycle. She entered the numbers into a spreadsheet and used those numbers to make a pie chart showing the proportion of time that the onion root tip cell spent in each phase. Look at page 2.2 to see her results.

2. If possible, and as instructed by your teacher, do the actual cell counts and enter YOUR values in the spreadsheet column named "cells".



To do this, use the arrow keys to move to the appropriate spreadsheet cell and enter your value for that phase. Continue until you have entered the values for all 5 phases. Watch the pie chart adjust as you enter your numbers.

iPad Tip: To modify the spreadsheet, double-tap on the appropriate cell and enter the value. Observe the changes in the pie chart as they enter new values.

Q11. The entire cell cycle in an onion root tip cell lasts for about 24 hours. Based on your cell counts (or the student's cell counts on page 2.2), how long does the entire process of mitosis last? How long do each of the 5 phases of the cell cycle last? Explain how you solved for your answers.

Move to pages 3.1 and 3.2. Answer questions 12 - 19 here and/or in the .tns file.

3. Move to page 3.1 and read the information on that page. Then proceed to page 3.2 for the simulation. You may watch the simulation as many times as necessary.

Q12. Which important event does **NOT** happen during mitosis?

A. DNA is moved into new cells.
B. DNA is copied.
C. The nuclear membrane disappears.
D. DNA compacts into structures called chromatids.

Q13. During which phase does the nuclear membrane disappear?

A. prophase
B. metaphase
C. anaphase
D. telophase

Q14. In the cell shown, how many PAIRS of chromosomes (called sister chromatids) are present?

A. 1 B. 2 C. 3 D. 4

Q15. One round of the cell cycle makes two new cells. How many cells do you have after 5 rounds of the cell cycle?

A. 10 B. 25 C. 64 D. 120

Q16. During which phase do the chromatids separate from one another?

A. prophase B. metaphase C. anaphase D. telophase

Q17. At the end of the cell cycle shown, how many chromosomes are present in each "new" cell?

A. 2 B. 4 C. 6 D. 8

Q18. If you had been watching a simulation of a human cell cycle, how many chromosomes would have been present in each new cell?

A. 16 B. 23 C. 46 D. 92

Q19. What might be the outcome for a cell that doesn't properly finish anaphase?

A. DNA breaks instead of being neatly pulled apart.
B. Chromosomes are not evenly divided into new cells.
C. No nuclear envelope forms.
D. There is not enough DNA for two daughter cells.