

Title: Cell Cycle Portfolio

Grade Ranges:

K-4
 5-8
 9-12

Subject Tag:

Science: Biology

Synopsis:

The cell cycle portfolio offers a unique way of allowing students to learn about the cell cycle at their own pace. Five stations are set up around the classroom, and students move around to all of the different stations to investigate independently or with peers. Different learning styles are addressed through the use of microscopes, technology, and hands-on manipulatives.

Keywords:

cell cycle, mitosis, interphase, prophase, metaphase, anaphase, telophase, plant cells, animal cells, cell division, chromosomes

Body:

1. Set up a variety of stations around the classroom. At each station put a folder containing specific instructions and enough copies of the activity for each student. The procedure for each station is explained following Step 4 of the general explanation.
 - Station #1 – Cell Cycle Notes Outline
 - Station #2 – Observing Mitosis in Plant and Animal Cells (Microscope)
 - Station #3 – Online Onion Root Tip: Phases of Mitosis
 - Station #4 – Vocabulary Memory Game
 - Station #5 – Investigating Cell Cycle Control (reinforcement guide from textbook)
 - Include more stations if you have additional time and resources!
2. Students each have their own folder for completed work. As they rotate through the stations at their own pace, they should follow directions provided, complete activity sheets found in the station folders, and place them in their own folders.
3. Allow students to go through the stations in any order and at their own pace, but set a maximum number of students per station at a time to avoid confusion and excess talking.
4. After the students have completed all activities at all stations, they will be allowed to use their folder and its contents for the assessment activity.

Related Links:

The Biology Project

www.biology.arizona.edu

Maintained by the University of Arizona, this web site contains a wealth of biology information including: Cell Cycle, Mitosis, and Cell Division.

Features:

Contains special education tips
 Quick Activity
 Requires Internet access for students to complete

Objectives:

1. Students will be able to identify stages of the cell cycle in whitefish blastula and onion root tips.
2. Students will be able to list and describe steps of the cell cycle.
3. Students will be able to work independently.

Standards:

NY: Living Environment 4.4 The continuity of life is sustained through reproduction and development.

Living Environment 4.5 Organisms maintain a dynamic equilibrium that sustains life.

NYC: S2a The cell, such as cell structure and function relationships; regulation and biochemistry; and energy and photosynthesis. **S2b** Molecular basis of heredity, such as DNA, genes, chromosomes, and mutations. **S5f** Works individually and in teams to collect and share information and ideas. **S6a** Uses technology and tools to observe and measure objects, organisms, and phenomena directly, indirectly, and remotely, with appropriate consideration of accuracy and precision. **S6d** Acquires information from multiple sources, such as print, the Internet, computer data bases, and experimentation.

CT: 1. The Nature of Science. Students will experience an inquiry-based learning environment in which they are free to ask questions, seek information and validate explanations in thoughtful and creative ways. Students will also understand that the processes, ways of knowing and conceptual foundations of science are interdependent and inextricably bound. **4. Units of Structure and Function.** Students will understand that living things share common materials and structures which perform basic life functions.

NJ: Science Standard 5.4: All students will develop and understanding of technology as an application of scientific principles. **5.6:** All students will gain an understanding of the structure, characteristics, and basic needs of organisms. **Cross-Content Workplace Readiness Standard 2:** All students will use technology information and other tools. **4:** All students will demonstrate self-management skills.

Prerequisite Skills:

1. Students should know how to use a compound light microscope.
2. Students should know how to search for a specific web site on the Internet.
3. Students should know how to make basic microscope drawings.

Time Required:

three to four class periods, including assessment (can be modified based on specific needs)

Technology and Materials Needed:

1. compound light microscopes (at least six)
2. set of whitefish blastula slides
3. set of onion root tip slides
4. Internet connection
5. biology textbook (for each student)
6. teacher resource book for textbook (source of worksheets)
7. memory game (can be easily made with construction paper)

Procedures:

1. Station #1 – Cell Cycle Notes Outline: Prepare an outline of notes corresponding to the Cell Cycle Chapter in your students' textbook. The students can then easily read along in their text while filling in the outline. A sample outline (Handout 1) is included for Station #1.
2. Station #2 – Set up six or more microscopes and provide whitefish blastula and onion root tip slides for students to use. Include the accompanying worksheet (Handout 2) — or a modified version — in the station folder, and have the students follow the instructions.
3. Station #3 – Set up as many Internet connections as possible in your classroom. If this is not an option, arrange for a few students at a time to visit the computer lab. Include the accompanying worksheet (Handout 3) — or a modified version — in the station folder and have the students follow the instructions.
4. Station #4 – Make two to three memory games ahead of time. These are easy to make by cutting out the accompanying vocabulary words (Teacher Download 1) and putting them on construction or other colored paper. Each game contains cards with vocabulary and definitions. Students will follow the instructions at this station (Handout 4) and complete a vocabulary quiz (sample, Teacher Download 2) to demonstrate that they know the cell cycle terms.
5. Station #5 – Use your teacher resource book to come up with a station for investigating control of the cell cycle. A worksheet on cancer or oncogenes can be effective. If you have slides of different cancers, you can even incorporate these into the station. Be creative!

Assessment Criteria:

1. On the last day of the activity, when all students have been given adequate time to complete the station work, give an in-class assessment using a variety of items including: slides, Internet, and compare/contrast questions.
2. In addition to the assessment mentioned above, students will turn in their portfolios with all of the completed work from each station. This can serve as an equal portion of their grade.

Recommended Lesson Plan Review Date:

Review Comments:

Check Web sites.

Name: _____
Date: _____ Per: _____

Station 1: Cell Cycle Outline

Use the following outline to take notes on the “Phases of Mitosis.”

PROPHASE

Brief Description (What’s happening?)

New Vocabulary (Define! Drawings may be helpful!)

Chromatin

Sister chromatids

Centromere

Centrioles

Spindle

METAPHASE

Brief Description

New Vocabulary

Equator

ANAPHASE

Brief Description

Name: _____
Date: _____ Per: _____

Station 2: Observing the Cell Cycle in Plant and Animal Cells

At this station you will observe the different phases of the cell cycle in onion root tips and whitefish blastula cells. You should view AT LEAST five different phases of the cell cycle and make sketches in the space provided below. Please include a few animal and plant cells in your collection of sketches!

3. Neatly label the following structures (if they are visible):

chromosomes

cell wall

spindle fibers

nuclear membrane

cleavage furrow

4. In the blanks provided, indicate the phase of the cell cycle the cell is undergoing.

5. Identify whether the slide represents an animal cell or a plant cell.

--	--	--

A

B

C

Phase: _____

Phase: _____

Phase: _____

Type of cell: _____

Type of cell: _____

Type of cell: _____

--	--

D

E

Phase: _____

Phase: _____

Type of cell: _____

Type of cell: _____

Questions: Answer the questions below on the back of this worksheet. Please use complete sentences.

1. What is the importance of mitosis to unicellular organisms?
2. What is the importance of mitosis to multi-cellular organisms?
3. Why are onion root tip cells and whitefish blastula cells often used to view cell division?

Name: _____

Date: _____ Per: _____

Station 3

ONLINE ONION ROOT TIP: PHASES OF THE CELL CYCLE

For the following activity, go online and view cells undergoing mitosis. You will need to complete the following chart for your portfolio.

Procedure:

6. Go to www.biology.arizona.edu.
7. Click on "Cell Biology."
8. Click on "Online Onion Root Tip: Phases of the Cell Cycle."
9. Read all of the introductory information and keep clicking NEXT until you reach the Data Table.
10. Identify the correct phase of mitosis as the cells come into view.
11. Fill out the following chart as you go.
12. Answer the questions that follow.

	Interphase	Prophase	Metaphase	Anaphase	Telophase	Total
# of cells						36
% of cells						100%

Questions: Answer the following questions on the back of this worksheet.

4. According to your chart, in which phase of the cell cycle do cells spend the most time? Explain.
5. According to your chart, in which phase of the cell cycle do cells spend the least amount of time? Explain.
6. Do these predictions make sense in light of what you already know about the cell cycle? Why or why not?

STATION #4

THE MEMORY GAME

1. Place all of the cards face down.
2. Flip over two cards.
3. If you have a match (a vocabulary term with the correct definition), you may remove both cards from the board.
4. If you do not have a match, it is the other person's turn, but you should remember where the cards are so that later in the game you can make a match.
5. Repeat steps 2-4 until all matches have been made.
6. The winner is the person with the most matches.
7. Complete the review "quiz" for your portfolio.

Vocabulary for Memory Game

PROPHASE

CENTRIOLE

METAPHASE

CENTROMERE

ANAPHASE

SPINDLE

TELOPHASE

CHROMATID

INTERPHASE

EQUATOR

MITOSIS

CYTOKINESIS

CHROMOSOME

CHROMATIN

_____ **First and longest phase of mitosis; chromatin coils into visible chromosomes**

_____ **Shortest phase of mitosis; chromosomes move to the equator; chromatids are attached by centromeres**

_____ **Centromeres split and chromatid pairs are pulled apart**

_____ **Final phase of mitosis; nuclear membrane begins to reappear; new cells prepare for their new independent existence**

_____ **Busiest phase of the cell cycle; includes growth and DNA replication**

_____ **Division of the nuclear material; two new daughter cells formed that are identical to the mother**

_____ **Division of the cytoplasm**

_____ **Tangled mass of DNA and proteins; state of DNA during interphase**

_____ **Structure that contains DNA; appears right before cellular division and vanishes following cell division**

_____ **Structures found in animal cells that duplicate during interphase and move to opposite poles during prophase**

_____ **Cell structure that joins two sister chromatids of a chromosome**

_____ **Cell structures composed of microtubule fibers; “pull” apart sister chromatids**

_____ **Identical halves of a duplicated parent chromosome; held together by a centromere**

_____ **Midline of a cell during division**

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Type of cell: _____

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ANAPHASE

Brief Description

TELOPHASE

Brief Description

CYTOKINESIS

Brief Definition

Describe the difference between animal and plant cell cytokinesis. Be specific!

Additional Questions:

1. What is the result of mitosis?
2. In a multi-cellular organism, describe two cellular specializations that result from mitosis.

Sample Cell Cycle Quiz

_____ First and longest phase of mitosis; chromatin coils into visible chromosomes

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- B. CENTRIOLE
- C. CENTROMERE
- D. CHROMATID
- E. CHROMATIN
- F. CHROMOSOME
- G. CYTOKINESIS
- H. EQUATOR
- I. INTERPHASE
- J. METAPHASE
- K. MITOSIS
- L. PROPHASE
- M. SPINDLE
- N. TELOPHASE