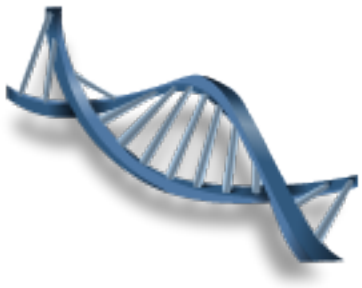
National Human Genome Research Institute

Genes in Motion: Mitosis
Lesson Guide



National Institutes of Health (NIH)

Department of Health and Human Services

Table of Contents

Background of Genes in Motion

The National Human Genome Research Institute's Education and Community Involvement Branch (ECIB) collaborated with the Liz Lerman Dance Exchange, a world renowned modern dance company located in Takoma Park, MD. This program was jointly funded by the National Human Genome Research Institute (NHGRI) and the NIH's Office of Science Education. At the time of the collaboration, the Dance Exchange was touring a performance entitled, *Ferocious Beauty: Genome*--a multi-media work about what's going on in the genomic science and its impact on our lives. The project fostered partnerships among a national group of scientists, bio-ethicists, researchers, clergy and artists who contributed their expertise.

In conjunction with *Ferocious Beauty: Genome*, the ECIB and Liz Lerman created a program for high school students entitled *Genes in Motion*. The program uses the methods established by the Liz Lerman Dance Exchange to teach genetics through movement, spoken word, and creative applications of technology. During a one day workshop students had the opportunity to work both with NHGRI researchers and Liz Lerman dancers and choreographers to explore genetic concepts.

The topics covered in this program are supported by national and state science standards outlined in Maryland, Virginia, and Washington D.C. Students attended one of four breakout sessions during the workshop:

- Mitosis
- Bioinformatics
- Induced Mutation
- Natural Mutation

These topics support materials currently taught in a high school biology classroom. In the following session descriptions, the standards covered in each session are outlined. Throughout the day, students learned specific science concepts in creative ways, such as through movement and spoken word. By the end of the day, the students created their own interpretations of the topics they had worked with throughout the workshop.

A short documentary video was created to give an overview of the *Genes in Motion* program. The video is available at www.genome.gov/26525978 where you can see how the students depicted mitosis through dance. The video is approximately 7 minutes long.

Genes in Motion: Mitosis
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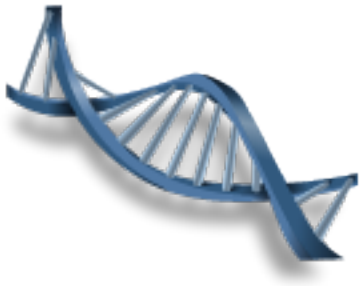


Background Information

Standards:

This lesson will address the following science content standards:

- The reproduction of cells and organisms accounts for the continuity of life.
- The work of a cell is carried out by many structures made up of a variety of molecules.
- Differentiation between the functions of mitosis and meiosis.
- Understanding the processes and functions of related structures found in unicellular and multicellular organisms.
- Illustration and explanation of how traits are passed from parent to offspring.

Learning objectives:

1. Students will have a better understanding of mitosis and they should be able to identify key elements in the process where things can be altered.
2. Students will be able to understand and investigate the verbs associated with the mitosis process and gain skills to embody the process in a group movement composition.
3. Students will be able to gain a sense of how the cell must sequence the many steps involved in mitosis to ensure division in order to understand the timing of the mitosis is extremely important.

Purpose:

The purpose of this activity is to teach genetics through movement, spoken word, and creative applications of technology.

Materials:

The following materials are needed:

- Brainstorm Mitosis Worksheet
- Brainstorm Mitosis Chart
- Mitosis PowerPoint (available at http://www.genome.gov/26525978)
- Dry Erase or Chalk Board
- Large Area to perform Mitosis

Time:

Estimated time to complete Activity One is 3-4 days based on 45 minute class periods.

Student Background:

Students should have knowledge of mitosis, this activity is meant to supplement the knowledge the students have and help them come to a better understanding of the process of mitosis.

Procedure:

This lesson is outlined using the 5E Instructional Model developed by the Biological Sciences Curriculum Study

Activity One:

Day One: Brainstorm Mitosis

Engage:

- The purpose of engagement is to capture student interest in the topic.
- The following introduction can be used:
    - Display an outline of the human body with lines draw separating different parts of the body.
    - Pose a theoretical question to the students, e.g. suppose that your hand or your arm or your foot was made of only one cell, what would happen if that cell stopped working or died?
        - Students should come up with answers such as: you would not have a hand or your arm would fall off.
    - Ask the students: How many cells are really in our bodies? There are approximately 100 trillion (100,000,000,000,000) cells in a human, now this is only an estimate because it would take a very long time to count every single cell.
    - Ask: What happens if just one cell dies in my hand, arm or foot? Do all the cells in my hand or foot die? Does my foot fall off? The obvious answer is no.
    - Ask: What does the body do to replace cells that die, whether they are in our hand or foot or elsewhere in out bodies? Other cells divide to fill in the space left by the cell that died.
    - Ask: What is this process called? Mitosis

Explore:

- The purpose of exploration is to provide students with cooperative activities that allow them to begin constructing concepts and developing skills.
- The following activity can be used: Brainstorm Mitosis (see Worksheet)
    - This activity reviews key points of each phase of mitosis and asks students to brainstorm ways in which they could perform or act out the steps of mitosis.
    - Each phase has a description of what takes place in a cell and clues to help students come up with ways to depict each step.
    - Students should work individually or in pairs to complete this activity. Challenge the student to come up with creative ways to act out the phases of mitosis.

Day Two: Brainstorm Mitosis & Mitosis Practice

Explain:

- The purpose of Explanation is for learners to articulate their ideas in their own words and listen critically to the ideas of others while the instructor clarifies concepts, corrects misconceptions and introduces scientific terminology.
- The following activity can be used: Brainstorm Mitosis (see Chart)

- This activity allows students to take their individual ideas for acting out mitosis and present them to the members of their group. After sharing their ideas in a group, the students will collaborate on how they will present all the phases of mitosis to their fellow classmates.
- Through this activity the students will create their own version to mitosis to perform for their classmates..
- After students have created there version of mitosis they should be given at least one class period (45 minutes) to practice their performance.

Day Three: Dancing Mitosis Performance

Elaborate:

- The purpose of elaboration is to help student correct any remaining misconceptions and generalize the concepts in a broader context.
- The following activity can be used: Dancing Mitosis
  - This class period will be devoted to each group performing their version of mitosis for their fellow classmates. Each performance should take no longer that 5-7 minutes and can be accompanied by music.
  - While watching each group's performance, students should see several different ways in which mitosis can be depicted with each carrying the same steps through out.
  - The performances should help clarify misconceptions that students may have and help bring their understanding of mitosis to a higher level.
  - Mitosis Gone Awry can also be performed at this step in the 5E Instructional Model if the students have a solid understanding of mitosis. Or Mitosis Gone Awry can be performed after the evaluation step once student understanding has been assessed.

Evaluate:

- The purpose of evaluation is for teachers and students to evaluate their understanding of concepts. Evaluation gives the students an opportunity to test their own understanding and skills.
- The following activity can be used:
  - Student can be given a formal assessment in the form of a quiz or test to assess their understanding of mitosis.
  - Students can be informally assessed through a class discussion after all the performances have taken place to assess their understanding of the material and to see if misconceptions have been corrected.
  - The teacher can also evaluate during the elaboration phase but using a rubric to assess their performance of mitosis.
- After complete of the evaluation Mitosis Gone Awry can before performed to further extend student understanding of mitosis and what happens when mistakes happen during the process.

Activity Two:

Use the slide set or Brief Description to facilitate a classroom discussion of the different and crucial steps of mitosis.

Question Ideas for Slide Set:
Slide 2: Discuss rhythmic movement with students. What does rhythmic movement mean?
Slide 4: Review of cell cycle. Ask students to visualize the cell cycle taking place.
Slide 7: Prophase is described as coil to shape. Ask students to brainstorm how this could be shown. How could we depict what is happening during prophase of mitosis using people?
Slide 9: Metaphase is described as align and attach. Ask student to brainstorm how this could be shown. How could we show the chromosomes lining up in a cell using people?
Slide 11: Anaphase is described as divide and drag. Ask students to brainstorm how this could be shown. How could we show how anaphase takes place using people?
Slide 13: Telophase is described as contract and expand. Ask students how this can be shown. Discuss terminology dual independence to check for understanding of terms.
Slide 15: Cytokinesis is described as separate and go your own way. Ask student how this could be shown. Discuss terminology independent twin cells, to review the result of cell division.

Brief Description of Mitosis:

Mitosis is a complicated process that often times confuses and baffles those that have to learn its steps. Although the process can be confusing, it is essential that students of biology understand the process in order to better comprehend how cells are able to regenerate and how the hereditary material is duplicated and passed on to daughter cells.

Overview:
The cell cycle encompasses the stages of cell division when one cell becomes two cells, each one identical to the original cell. The cell cycle can be divided into three major phases:
• Interphase – The cell is getting ready to divide. It grows in size and all DNA is replicated. When the environment is favorable, a cell can proceed into mitosis.
• Mitosis – Duplicate chromosomes (sister chromatids) are aligned at the center of the cell, and then separated to opposite ends of the cell in preparation for division of the cytoplasm (the watery or fluid part of the cell).
• Cytokinesis – The cytoplasm of the cell is separated when the cell membrane is pinched inward at the center. Two daughter cells are formed and each is identical to the original cell.

Mitosis:
Mitosis is the process in which identical chromosomes are aligned and pulled apart by fibers (microtubules), just before the cytoplasm divides. The phases of mitosis ensure each new cell will have equal/identical DNA after division. The phases of mitosis are:
• Prophase – DNA condenses into chromosomes, nuclear envelope disappears
• Metaphase – Identical chromosomes (sister chromatids) align at the center of the cell (equatorial plate). Sister chromatids are held together by a centromere.
• Anaphase - Centromeres divide (one for each chromatid). Sister chromatids separate. Microtubules form spindle fibers that attach to the centromere of each sister chromatid pulling them to opposite ends of the cell. The cell becomes elongated.
• Telophase – Chromatids arrive at opposite poles. Nuclear envelopes form around them and the DNA loosens and expands.
• Cytokinesis - cell membrane pinches inward to divide the cytoplasm forming two daughter cells that are genetically identical to the original cell.

Cell Cycle Control:

The cell cycle is controlled by “Stop” and “Go” proteins that signal the cell to stop or proceed through cell division. These proteins work at checkpoints in the cell cycle.
There are two major checkpoints:
1) G1 checkpoint (in interphase) – Cells make sure that the DNA is not damaged, and that there is enough energy and other proteins required to complete the cell cycle. If the cell is not ready, “Stop” proteins signal the cell to enter a resting phase called G0 (G zero). If conditions are favorable, “Go” proteins signal the cell to proceed through the cell cycle.
2) G2 checkpoint (in interphase) – Cells make sure that all the DNA is replicated without errors, and that the environment is favorable for mitosis. If conditions are favorable, “Go” proteins signal the cell to proceed into mitosis. “Stop” proteins function here when needed.

Sometimes things are altered in cell division. If conditions are not good at the checkpoints, such as damaged DNA, the cell can try to repair the damage. If it cannot repair the DNA, the cell will undergo programmed cell death (Apoptosis). If it does not undergo apoptosis, then the uncontrolled cell growth can result in cancer. If a “Go” or “Stop” protein gets damaged (such as by a genetic mutation), the result could be uncontrolled cell division. Uncontrolled cell growth can result in cancer or tumor formation.

Estimated time to complete Mitosis Review: 1 class period (45 minutes)

Suggested Activity to Perform Mitosis:
After reviewing mitosis and having the students brainstorm about what they believe each part of mitosis would look like it is time for the students to “perform” mitosis. The students should be split into two groups, one group to perform mitosis successfully and one group to perform mitosis unsuccessfully. The students should use the information reviewed and the ideas that had been brainstormed to create their performance. Review with the students what should be seen in each phase using the *Description of Choreography/Movement*. The Dance terminology has been defined below.
Example: Prophase is described as Coil to shape, therefore students should be able to show us this happening by shaping their bodies and using different heights (levels) to sculpt or move each other into chromosomes.

Description of Choreography/Movement:

Students learn and practice key choreographic concepts of shape, level, and space through a series of improvisational structures. Through the use of physical partnering and theme and variation, participants explore and understand the essential verbs from the phases of mitosis.

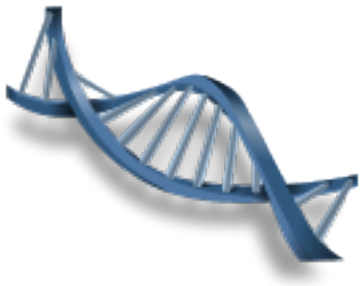
- Prophase: Coil to shape
  - *Students explore the choreographic concept of **shape and level**, and then apply partnering skills to sculpt each other into condensed forms representing chromosomes*
- Metaphase: Align and attach
  - *Line up, pass through: Students explore the choreographic concept of **space** through an improvisational structure of creating and moving through lines in space*
  - *Attach: Students further **partnering skills** by discovering aesthetic ways to connect*

- Anaphase:
    - *Divide and Drag: Students further explore **weight sharing skills**, finding safe ways to embody these verbs*
- Telophase:
    - *Contract and Expand: Students investigate these verbs and practice **theme and variation** in solo and group forms*

Students should collaboratively create 2 two minute compositions (a successful mitosis process and, an unsuccessful mitosis process) that physically represent the process using skills taught. Students must thoroughly understand the process and its phases to complete the dance.

Estimated time to complete Mitosis Performance: 2-3 class period (90-135 minutes)

Genes in Motion: Mitosis
Student Guide



Brainstorm: Mitosis!!

Mitosis is a complicated process that often times confuses and baffles those that have to learn its steps. Although the process can be confusing, it is essential that students in biology understand the process in order to better comprehend how cells are able to regenerate and how the hereditary material is duplicated and passed on to daughter cells.

Through this activity you will be able to review mitosis and perform each phase of mitosis with your classmates! So put on those thinking caps and get ready!

Part One:

Overview:

The cell cycle encompasses the stages of cell division when one cell becomes two cells, each one identical to the original cell. The cell cycle can be divided into three major phases:

- Interphase – The cell is getting ready to divide. It grows in size and all DNA is replicated. When the environment is favorable, a cell can proceed into mitosis.
- Mitosis – Duplicate chromosomes (sister chromatids) are aligned at the center of the cell, and then separated to opposite ends of the cell in preparation for division of the cytoplasm (the watery or fluid part of the cell).
- Cytokinesis – The cytoplasm of the cell is separated when the cell membrane is pinched inward at the center. Two daughter cells are formed and each is identical to the original cell.

Get Ready To…

Brainstorm!!

Mitosis: Mitosis is the process in which identical chromosomes are aligned and pulled apart by fibers (microtubules), just before the cytoplasm divides. The phases of mitosis ensure each new cell will have equal/identical DNA after division. The phases of mitosis are:

- **Prophase** – DNA condenses into chromosomes, nuclear envelope disappears

  Brainstorm: Prophase can be described as coil to shape, using your knowledge of mitosis, how could we perform prophase?

- **Metaphase** – Identical chromosomes (sister chromatids) align at the center of the cell (equatorial plate). Sister chromatids are held together by a centromere.

  Brainstorm: Metaphase can be described as align and attach, how can we use these words and what we know about metaphase, to perform this phase?

- **Anaphase** - Centromeres divide (one for each chromatid). Sister chromatids separate. Microtubules form spindle fibers that attach to the centromere of each sister chromatid pulling them to opposite ends of the cell. The cell becomes elongated.

  Brainstorm: Anaphase is described as divide and drag, how could we use these words to perform this phase?

- **Telophase** – Chromatids arrive at opposite poles. Nuclear envelopes form around them and the DNA loosens and expands.

  Brainstorm: Telophase is described as contract (nuclear envelope) and expand (DNA). Using your knowledge of this phase how could we perform this phase?

- **Cytokinesis** - cell membrane pinches inward to divide the cytoplasm forming two daughter cells that are genetically identical to the original cell.

  Brainstorm: Cytokinesis is described as separate and go your own way, using your knowledge of mitosis, how could we perform prophase?

Part Two:

Cell Cycle Control:

The cell cycle is controlled by "Stop" and "Go" proteins that signal the cell to stop or proceed through cell division. These proteins work at checkpoints in the cell cycle.

There are two major checkpoints:

1) G1 checkpoint (in interphase) – Cells make sure that the DNA is not damaged, and that there is enough energy and other proteins required to complete the cell cycle. If the cell is not ready, "Stop" proteins signal the cell to enter a resting phase called G0 (G zero). If conditions are favorable, "Go" proteins signal the cell to proceed through the cell cycle.
2) G2 checkpoint (in interphase) – Cells make sure that all the DNA is replicated without errors, and that the environment is favorable for mitosis. If conditions are favorable, "Go" proteins signal the cell to proceed into mitosis. "Stop" proteins function here when needed.

   Brainstorm: Why are these "checkpoints" important for the cell? What would happen if something went wrong?

Mitosis Gone Awry: Sometimes things are altered in cell division. If conditions are not good at the checkpoints, such as damaged DNA, the cell can try to repair the damage. If it cannot repair the DNA, the cell will undergo programmed cell death (Apoptosis). If it does not undergo apoptosis, then the uncontrolled cell growth can result in cancer. If a “Go” or “Stop” protein gets damaged (such as by a genetic mutation), the result could also be uncontrolled cell division which can result in cancer or tumor formation.

Brainstorm: Using the information gathered about mitosis and the cell cycle how could we act out Mitosis gone wrong?

Brainstorm: Mitosis!!

Directions: Now that we have put together all of the pieces of mitosis and worked our brains to come up with ways to perform mitosis, its time to put everything together! You will be assigned to a group; your group will either be responsible for performing Mitosis (without errors) or Mitosis Gone Awry. With your assigned group you are going to collect everyone's ideas and place them in the appropriate columns in the Brainstorm: Mitosis Chart. Once the ideas have been collected your group needs to work together to come up with a way to perform mitosis for your fellow classmates.

 Prophase: Brainstorm	 Metaphase: Brainstorm	 Anaphase: Brainstorm

Telophase: Brainstorm	Cytokinesis: Brainstorm

Something to think about:

Prophase: Coil to shape

Metaphase: Align and attach

Anaphase: Divide and drag

Telophase: Contract and expand

Cytokinesis: Separate and go your own way.

Brainstorm: Mitosis Gone Awry!!

Mitosis Gone Awry: Brainstorm

Something to think about:

G1 Checkpoint: Check DNA for damage, cell energy, and proteins.

G2 Checkpoint: Check replicated DNA, environment

Apoptosis: Cell Death

Mitosis Background Information

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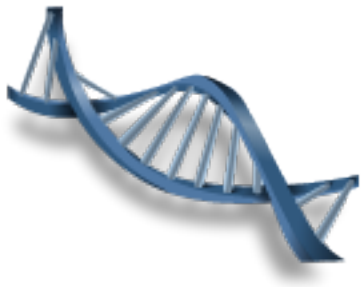
Genes in Motion: Mitosis Resources



Resources

a. Genes In Motion: Mitosis Performance Rubric
b. Assessment Answer Key
c. Student Assessment
d. Introduction to Dance
e. Definitions of Dance Terminology
f. Mitosis PowerPoint
g. Human Body Outline
h. Interdisciplinary Lessons of Biology & Fine Arts
i. BSCS 5E Instructional Model, National Science Teacher Association

Genes In Motion: Mitosis

Student Name: _____

CATEGORY	4	3	2	1
Sequence of Mitosis	Performs Mitosis in correct sequence leaving out no important parts of the process.	Performs Mitosis in sequence with 1-2 omissions.	Performs Mitosis with several omissions, but maintains sequence of the phases of mitosis.	Performs Mitosis out of sequence.
Phase Shifting	Shifts phases smoothly almost all the time. It is very easy for the audience to tell which phase of mitosis is taking place.	Shifts phases pretty well. It is usually easy for the audience to tell which phase of mitosis is taking place.	Tried to do phase shifting, but it wasn't very successful. It often was hard for the audience to tell which phase of mitosis is taking place.	Did not attempt phase shifting. It was very difficult for the audience to tell which phase of mitosis is taking place.
Movements	Connections between phases and concepts of mitosis are creative, clearly expressed and appropriate.	Connections between phase and concepts of mitosis are clearly expressed and appropriate.	Connections between phases and concepts of mitosis are sometimes hard to figure out. More detail or better transitions are needed.	The phases and concepts of mitosis seem very disconnected and it is very difficult to figure out the process.
Duration of Performance	The performance lasts 4-7 minutes.	The storytelling lasts 3-4 minutes.	The storytelling lasts 2-3 minutes	The storytelling lasts less than 2 minutes or more than 7 minutes.
Comments				

Rubric Made Using: **RubiStar (http://rubistar.4teachers.org)**

Mitosis Assessment: Answer Key

Answers are italicized, underlined and in bold.

Directions #1-8: Select the answer that best suits the question or statement.

1. The process of mitosis ensures that:
   a. each new cell is genetically different from its parent
   b. each new cell receives the proper number of chromosomes
   c. cells will divide at the appropriate time
   d. DNA is replicated without errors

2. The image illustrates what phase of mitosis
   a. Anaphase
   b. Telophase
   c. Metaphase
   d. prophase

3. Which of the following is NOT part of mitosis?
   a. prophase
   b. metaphase
   c. Telophase
   d. interphase

5. A cell that has 20 chromosomes undergoes mitosis. Which of the following is true?
   a. two daughter cells will be created, each have 20 chromosomes
   b. two daughter cells will be created, each have 40 chromosomes
   c. 4 daughter cells will be created, each having 10 chromosomes
   d. 2 daughter cells will be created, each having 10 chromosomes

6. A spindle forms during which phase?
   a. G2
   b. Interphase
   c. Prophase
   d. metaphase

7. Most cells spend their lives in:
   a. prophase
   b. metaphase
   c. interphase
   d. telophase

8. Cytokinesis begins during which phase?
   a. Telophase
   b. synthesis phase
   c. anaphase
   d. metaphase

Directions # 9-13: Identify each phase described in each statement. Some phases may be used more than once.

9. Some 90 percent of a cell's time in the normal cellular cycle may be spent in this phase
Interphase

10. In this phase of mitosis, the chromatin condenses into discrete chromosomes. The nuclear envelope breaks down and spindles form at opposite poles of the cell
Prophase

11. Cytokinesis occurs during this stage of mitosis
Telophase

12. In this phase, chromosomes align at the metaphase plate at right angles to the spindle poles.
Metaphase

13. In this phase, the paired chromosomes separate and begin moving to opposite ends (poles) of the cell.
Anaphase

Directions #14-16: Identify the phases shown in the following Images.

14. Identify the phase of mitosis:

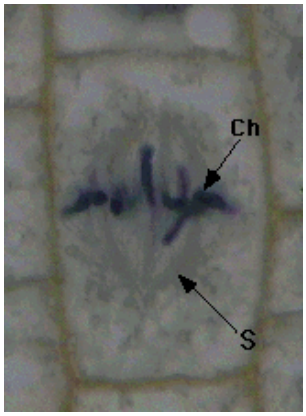
a. prophase
b. Telophase
c. anaphase

15. Identify the stage of mitosis:

a. metaphase
b. anaphase
c. Telophase

16. Identify the stage of mitosis:

a. Prophase
b. Metaphase
c. interphase



Images courtesy of The Entangled Bank

Ch = chromosome, S = spindle

Directions #17-20: Match the terms on the left with the definitions on the right.

17. Prophase ***(D)***	A. Phase where chromosomes split apart
18. Metaphase ***(C)***	B. Phase where cell plate or furrowing occurs
19. Anaphase ***(A)***	C. Phase where chromosomes line up on the equator
20. Telophase ***(B)***	D. Phase where nuclear membrane disappears

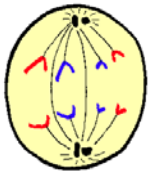
Name: _____
Date: _____
Period: _____

Mitosis Assessment

Directions #1-8: Select the answer that best suits the question or statement.

1. The process of mitosis ensures that:
   a. each new cell is genetically different from its parent
   b. each new cell receives the proper number of chromosomes
   c. cells will divide at the appropriate time
   d. DNA is replicated without errors

2. The image illustrates what phase of mitosis:



   a. Anaphase
   b. Telophase
   c. Metaphase
   d. prophase

3. Which of the following is NOT part of mitosis?
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   c. Telophase
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5. A cell that has 20 chromosomes undergoes mitosis. Which of the following is true?
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   c. 4 daughter cells will be created, each having 10 chromosomes
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   b. metaphase
   c. interphase
   d. telophase

8. Cytokinesis begins during which phase?
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   b. synthesis phase
   c. anaphase
   d. metaphase

Directions # 9-13: Identify each phase described in each statement. Some phases may be used more than once.

9. Some 90 percent of a cell's time in the normal cellular cycle may be spent in this phase

_____

10. In this phase of mitosis, the chromatin condenses into discrete chromosomes. The nuclear envelope breaks down and spindles form at opposite poles of the cell

_____

11. Cytokinesis occurs during this stage of mitosis

_____

12. In this phase, chromosomes align at the metaphase plate at right angles to the spindle poles.

_____

13. In this phase, the paired chromosomes separate and begin moving to opposite ends (poles) of the cell.

_____

Directions #14-16: Identify the phases shown in the following Images.

14. Identify the phase of mitosis:

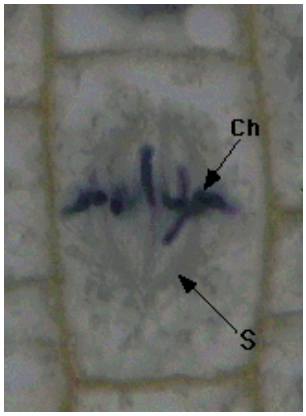
a. prophase
b. Telophase
c. anaphase

15. Identify the stage of mitosis:

a. metaphase
b. anaphase
c. Telophase

16. Identify the stage of mitosis:

a. Prophase
b. Metaphase
c. interphase



Images courtesy of The Entangled Bank

Ch = chromosome, S = spindle

Directions #17-20: Match the terms on the left with the definitions on the right.

17. Prophase	A. Phase where chromosomes split apart
18. Metaphase	B. Phase where cell plate or furrowing occurs
19. Anaphase	C. Phase where chromosomes line up on the equator
20. Telophase	D. Phase where nuclear membrane disappears

Introduction to Dance

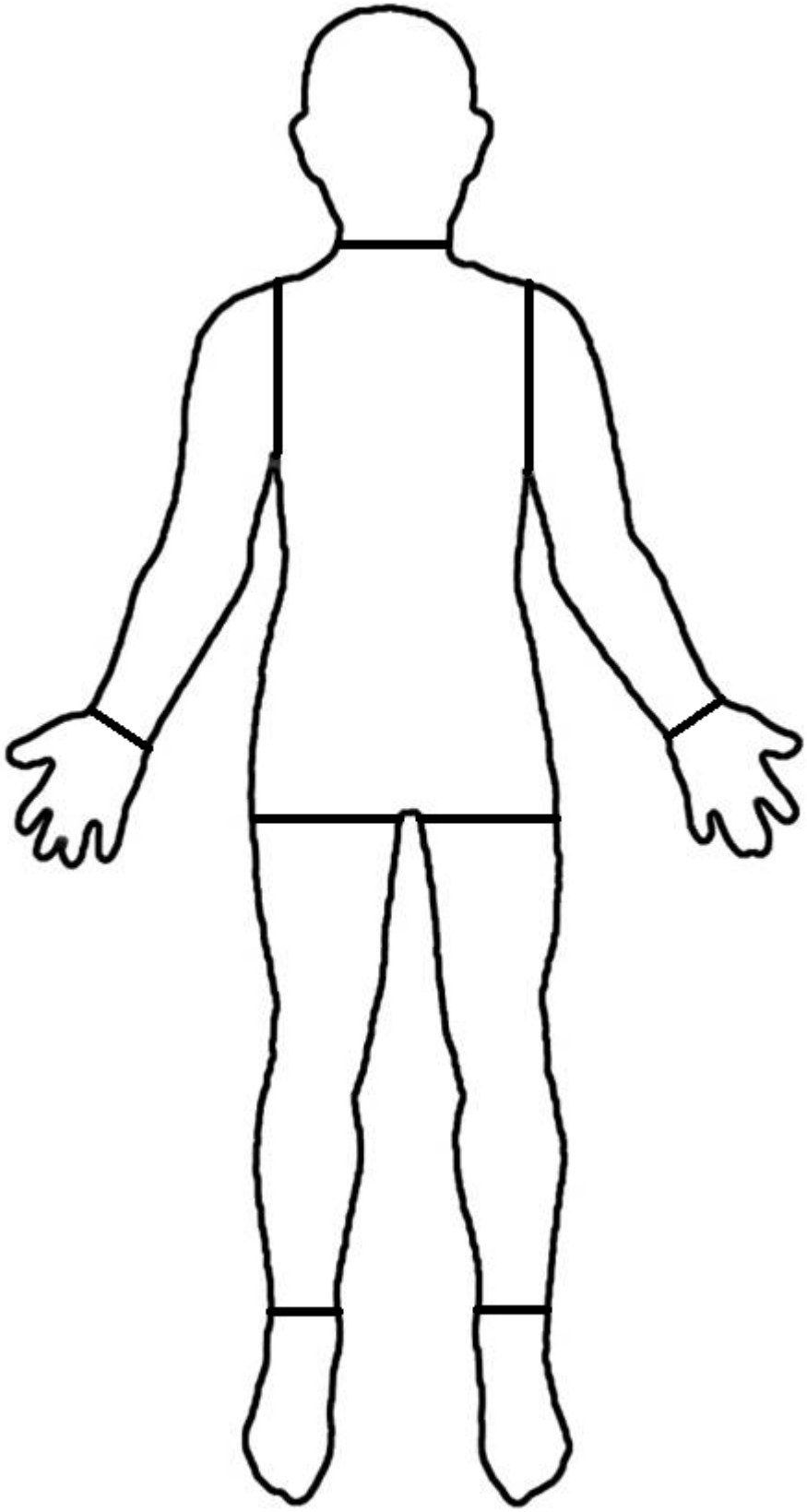
Dance can be defined as many different things, even in the dictionary dance does not have just one definition. Dance can be defined as to move rhythmically usually to music, using prescribed or improvised steps and gestures, to bob up and down, a series of motions and steps, usually performed to music by the American Heritage Dictionary. This is only 3 of the 12 definitions listed in that dictionary. No one definition is all encompassing for dance. Everyone can have their own idea of what dance is.

For this activity, movements will be used to "dance" mitosis for your fellow classmates. Each person will have to discover ways to portray each step of mitosis when it works and when it does not work. The students will do this by learning about basic dance concepts.

Definitions of Dance Terminology

Improvise: to create extemporaneously (without practice or preparation), usually done with a structure, intent, or outcome in mind.
Level: The height at which a person is dancing or moving.
Partnering skills: The act of participating as a partner. The particular skills and techniques used for dancing with a partner or choreographing for partners, such as lifting, balancing, and sharing weight.
Shape: The form that your body takes while dancing or moving.
Space: A defined extent in three dimensions, particularly as employed as an element in dance or movement, the distances between other people or things.
Theme: a repeated idea, the message, the significant idea; a movement or musical phrase, often straightforward in style and structure, on which a series of variations is based.
Variation: a repetition of a movement or a tool which changes one or more aspects of the original.

Human Body Outline



Interdisciplinary Lessons of Biology & Fine Arts

1. Daily Lesson Plan from The New York Times Learning Network
    a. Scientific Scenes: *Creating Plays That Allow Scientists to Observe the Consequences of Their Work*
    http://www.nytimes.com/learning/teachers/lessons/20031111tuesday.html?searchpv=learning_lessons
    b. The ABC's of DNA: *Learning the Basics of Genetics*
    http://www.nytimes.com/learning/teachers/lessons/20010213tuesday.html?searchpv=learning_lessons

2. Access Excellence: Activities Exchange
    a. Transcription Translation Tango
    http://www.accessexcellence.org/AE/AEC/AEF/1994/morris_transcription.php
    b. Turkeys in the Cell – The meiosis Square Dance
    http://www.accessexcellence.org/AE/AEPC/WWC/1991/meiosis_dance.php