Section 1: The Cell Cycle

Study Guide A

KEY CONCEPT
Cells have distinct phases of growth, reproduction, and normal functions.

VOCABULARY

<table>
<thead>
<tr>
<th>cell cycle</th>
<th>cytokinesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>mitosis</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: The cell cycle has four main stages.

1. Put the letter from each of the following statements into the appropriate box to show what happens during the cell cycle.
   - a. G₁ (Gap 1): Cells grow, carry out normal functions, and copy their organelles.
   - b. G₂ (Gap 2): Cells go through additional growth.
   - c. M (Mitosis): Cells undergo cell division, which involves both mitosis and cytokinesis.
   - d. S (Synthesis): Cells replicated DNA.

2. The G₁ and G₂ stages got their names because scientists could not observe any activity going on in cells, so they thought there were ___________ in cellular activity.
3. Cells must pass through a critical checkpoint during which two stages of the cell cycle?
   a. M
   b. S
   c. G₁
   d. G₂

4. Where does DNA synthesis happen in eukaryotic cells?
   a. cytoplasm
   b. mitochondria
   c. nucleus
   d. Golgi apparatus

5. What two processes make up the M stage?
   a. fermentation
   b. mitosis
   c. glycolysis
   d. cytokinesis

**MAIN IDEA:** Cells divide at different rates.

6. Among different types of cells, the _______ stage of the cell cycle varies most in length.

7. Some scientists name the stage where cells carry out their normal functions but are unlikely to divide. The name they give this stage is _______.

8. Consider the following information:

   The rate at which a particular type of cell divides is linked to the body’s need for that cell type. Skin cells are typically exposed to more damaging conditions than are liver cells. Skin cells must be replaced more often than liver cells. Therefore, which of these statements is true?

   a. Skin cells and liver cells divide at the same rate.
   b. Liver cells divide more often than skin cells.
   c. Skin cells divide more often than liver cells.
   d. Neither skin cells nor liver cells divide.
MAIN IDEA: Cell size is limited.

9. Consider the following analogy to explain why cell size is limited. Then, circle the words or phrases in italics that best complete the statements explaining how this analogy relates to cells.

Movie theater A holds 1,000 people and has five exits. Movie theater B holds 100 people and has three exits. In an emergency, the people in theater B are able to get out more quickly.

To stay alive, a cell needs materials to move in and out across its membrane. As a cell grows bigger, its volume increases slower / faster than its surface area. At a certain point, the cell’s volume would be too small / too large compared to the area available for materials to move in and out.

10. Which typically increases faster as a cell grows, surface area or volume?

11. Circle the two things that must be coordinated for cells to stay the same size from generation to generation.
   a. division
   b. growth
   c. repetition
   d. size

Vocabulary Check
Fill in the blank with the word or phrase that best completes the sentence.

12. The word “cycle” in cell cycle refers to the ___________________________ of growth, DNA duplication, and cell division that occurs in eukaryotic cells.

13. The word cytokinesis has the prefix cyto- that refers to a cell and the suffix -kinesis that refers to division or movement. Therefore, cytokinesis is the process where a cell’s cytoplasm _________________.

14. The cell nucleus and its contents divide by a process called _______________.

Section 2: Mitosis and Cytokinesis

Study Guide A

KEY CONCEPT
Cells divide during mitosis and cytokinesis.

VOCABULARY

<table>
<thead>
<tr>
<th>chromosome</th>
<th>centromere</th>
<th>anaphase</th>
</tr>
</thead>
<tbody>
<tr>
<td>histone</td>
<td>telomere</td>
<td>telophase</td>
</tr>
<tr>
<td>chromatin</td>
<td>prophase</td>
<td></td>
</tr>
<tr>
<td>chromatid</td>
<td>metaphase</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: Chromosomes condense at the start of mitosis.

1. A chromosome is one long, continuous thread of __________ that has many genes and regulatory information.

2. Chromosomes condense at the start of mitosis so that they can be more easily ________________ between the two nuclei.

3. Chromosomes are not condensed during all stages of the cell cycle, because proteins need to be able to access _______________ during other stages of the cell cycle.

4. Make a sketch of how DNA goes from a long stringy form to a tightly condensed form. On the final stage (the condensed, duplicated chromosome), label the chromatid, telomere, and centromere.

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Study Guide A

Section 2: Mitosis and Cytokinesis
MAIN IDEA: Mitosis and cytokinesis produce two genetically identical daughter cells.

Circle the word or phrase that best completes the statement.

5. Interphase prepares a cell to divide by duplicating / removing its DNA and organelles.

Make up a short sentence or phrase to help you remember the order of the steps of mitosis: prophase, metaphase, anaphase, telophase.

6. ____________________________________________________________

7. Sketch the four phases of mitosis and one phase of cytokinesis. Add the labels Anaphase, Metaphase, and Telophase to the appropriate boxes.

8. Cytokinesis differs between animal and plant cells. In animal cells, the membrane pinches together to form a cleavage furrow. In plant cells, the membrane cannot pinch together because of the _________________. Instead, a _________________ is laid down between the two nuclei. This structure develops into the new cell walls and cell membranes.

Vocabulary Check

Circle the word that best completes the statement.

9. DNA wraps around organizing proteins called chromosomes / histones.

10. The suffix -tin indicates that something is stretched and thin. Keratin / Chromatin is the loose combination of DNA and proteins that looks sort of like spaghetti.

11. Sister chromatids meet at the centromere / telomere, which looks pinched.

12. The ends of DNA molecules form structures called centromeres / telomeres that help prevent the loss of genes.
Section 3: Regulation of the Cell Cycle

Study Guide A

KEY CONCEPT
Cell cycle regulation is necessary for healthy growth.

VOCABULARY

<table>
<thead>
<tr>
<th>growth factor</th>
<th>benign</th>
<th>carcinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>apoptosis</td>
<td>malignant</td>
<td>metastasize</td>
</tr>
</tbody>
</table>

MAIN IDEA: Internal and external factors regulate cell division.

Place each phrase from the box in the correct location to complete the concept map, which shows important ideas about growth factors.

| specific cells | platelet-derived growth factor | cell division |

**Growth factors** stimulate

1. **many cell types**

2. **cycling cells**

3. **erythropoietin**

Use the word bank to complete the sequence diagram below.

| kinases | cell division | phosphorylate | cyclins |

4. **activate**

5. **result in**

6. **target molecules**

7. **...**
8. What is apoptosis?
   a. programmed cell division
   b. programmed cell death
   c. abnormal cell function
   d. abnormal cell growth

MAIN IDEA: Cell division is uncontrolled in cancer.

9. If cell division is not properly regulated, the result may be a type of disease called ________________.

10. Complete the concept map below about cancer cells by selecting from the following words:

<table>
<thead>
<tr>
<th>benign</th>
<th>carcinogen</th>
<th>malignant</th>
<th>metastases</th>
<th>tumors</th>
</tr>
</thead>
</table>

Cancer cells
draw

Vocabulary Check

Circle the word or phrase that best completes the statement.

11. Metastasize means to shrink and die / spread and grow by breaking away from a tumor.

12. A substance known to produce or promote the development of cancer is called a carcinogen / growth factor.

13. Draw a cartoon to help show the difference between benign and malignant.
KEY CONCEPT
Many organisms reproduce by cell division.

VOCABULARY

| asexual reproduction | binary fission |

MAIN IDEA: Binary fission is similar in function to mitosis.

1. Offspring resulting from asexual reproduction and those resulting from sexual reproduction differ in one major way. The difference is that asexual reproduction produces genetically identical / unique offspring, while sexual reproduction produces genetically identical / unique offspring.

Place the statements below in the correct order of the steps of binary fission. Sketch a diagram in each box to show what occurs at each step.

a. As the cell elongates, the chromosomes separate.

b. The bacterial chromosome is copied. Both copies attach to the cell membrane.

c. The membrane is pinched inward and a new wall is laid down.

2. _______________________________
   _______________________________
   _______________________________

3. _______________________________
   _______________________________
   _______________________________

4. _______________________________
   _______________________________
Place a check mark in the appropriate box to indicate whether each of the following statements is an advantage or a disadvantage of asexual reproduction.

<table>
<thead>
<tr>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. All organisms can potentially reproduce.</td>
<td></td>
</tr>
<tr>
<td>6. Asexual reproduction can be more efficient under ideal circumstances.</td>
<td></td>
</tr>
<tr>
<td>7. Identical offspring all respond in the same way to the environment.</td>
<td></td>
</tr>
<tr>
<td>8. Energy is not used to find or attract a mate.</td>
<td></td>
</tr>
<tr>
<td>9. It is not necessarily more efficient than sexual reproduction.</td>
<td></td>
</tr>
<tr>
<td>10. The population may lack the variety to survive in changing conditions.</td>
<td></td>
</tr>
</tbody>
</table>

**MAIN IDEA:** Some eukaryotes reproduce through mitosis.

Circle the word or phrase that best completes the statement.

11. If a eukaryotic organism reproduces through mitosis, the offspring and the parent organism are genetically different / identical.

12. Mitotic reproduction is most common in simpler / more complex plants and animals.

13. Three examples of mitotic reproduction are __________________________, __________________________, and _______________________________.

14. Circle all of the possible ways that a sea anemone can reproduce.
   a. sexually
   b. asexually by dividing in half
   c. asexually by breaking off small pieces from its base
Vocabulary Check

Fill in the blank with the word or phrase that best completes the sentence.

15. Binary fission is the division of a single-celled organism into ________
roughly equal parts. This result is shown by the letters “bi” at the
beginning of “binary.”

Write another word that starts with “bi.” Write down how the meaning of your
word is similar to the meaning of “binary.”

_______________________________________________________________
_______________________________________________________________

16. The creation of offspring from only one parent organism is called
_____________________________________________________________.


Section 5: Multicellular Life

Study Guide A

KEY CONCEPT
Cells work together to carry out complex functions.

VOCABULARY

<table>
<thead>
<tr>
<th>tissue</th>
<th>organ system</th>
<th>stem cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>organ</td>
<td>cell differentiation</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: Multicellular organisms depend on interactions among different cell types.

Complete the diagram below, which represents organization in multicellular organisms.

Cells

1. make up 2. make up

3. make up

There are several types of tissues found in plants. Two examples are _________________ tissue and _________________ tissue.

Two examples of organ systems found in plants are the _________________ system and the _________________ system.

Circle the two statements that accurately complete the sentence.

An organism benefits from organ systems that work together and communicate, because these systems help an organism to

a. maintain heterogeneity.

b. maintain homeostasis.

c. carry out cell differentiation.

d. carry out complex, specialized functions.
MAIN IDEA: Specialized cells perform specific functions.

7. What is the process by which unspecialized cells develop into specialized cells?
   a. cell development
   b. cell differentiation
   c. cell expansion
   d. cell unification

8. Is the following statement true or false?
   All cells have the same DNA, but different types of cells express different sets of genes.

9. What role does cell location play within a developing embryo?
   a. It helps determine how the cell will grow.
   b. It helps determine how the cell will function.
   c. It helps determine how the cell will differentiate.
   d. It helps determine how the cell will communicate.

MAIN IDEA: Stem cells can develop into different cell types.

10. Use the words below to complete the Concept Map about stem cell classification.

<table>
<thead>
<tr>
<th>embryonic</th>
<th>multipotent</th>
<th>origin</th>
<th>pluripotent</th>
<th>totipotent</th>
</tr>
</thead>
</table>

   Stem cells
   can be classified by potential
   e.g. e.g. e.g.

   a. 
   b. 
   c. 
   d. 
   e. 

Circle the word or phrase that best completes the statement.

11. Stem cells have three identifying characteristics:
    i. They divide and renew themselves for short / long periods of time.
    ii. They remain differentiated / undifferentiated in form.
    iii. They develop into a variety of specialized / unspecialized cell types.
12. Place a check mark in the appropriate box to indicate whether the following statements are advantages of using adult stem cells or advantages of using embryonic stem cells.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Adult stem cells</th>
<th>Embryonic stem cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>They can be grown indefinitely in culture.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>They do not raise as many ethical concerns.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>They could avoid rejection issues when used in a patient.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>They can develop into virtually any type of cell.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vocabulary Check**

Circle the word that best completes the statement.

13. Cell differentiation is the process by which a(n) specialized / unspecialized cell becomes specialized / unspecialized.

14. Write the following words in order from the largest structure to the smallest structure: cell, organ, organ system, tissue.

_______________________________________________________________
_______________________________________________________________