Cell Cycle

Mitosis

Standard Biology/Life Science

CELL BIOLOGY

1. Fundamental life processes of plants and animals depend on a variety of chemic reactions, that are carried out in specialized areas the organism's cells. As a b for understanding this concept, students know

Concept

d. the Central dogma of molecular biology outlines the flow of information, from transcription of RNA in the nucleus to translation of proteins on ribosomes in the cytoplasm.

Vocabulary: Mitosis

Word Part	Meaning	Vocabulary Word
kines	to move	cytokinesis
inter	between	interphase
pro	before	prophase
ana	opposite	anaphase
meta	middle	metaphase
tele (o)	far, distant	telophase
chrom	color	chromosome
som	body	somatic
equa	equal	equator
centr	a point	centriole
mer (e)	part	centromere

Format

Word	Part of speech	Word parts
Definition		

cytokinesis		

interphase		

prophase		

anaphase		

metaphase		

telophase		

chromosome		

somatic		

equator		

centriole		

centromere		

Surface Area to Volume BLOCK Activity

Put the sugar cubes together to form the following blocks. DO NOT EAT THE CUBES!!

What would be the SURFACE AREA of each block?

Cubes per Side	L	W	# of sides	TOTAL
1				
2				
3				

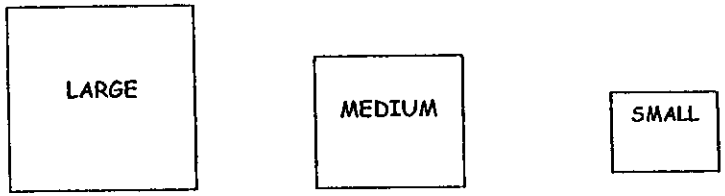
What would be the VOLUME of each block?

Cubes per Side	L	W	H	TOTAL	RATIO Surface area to Volume
1					
2					
3					

QUESTION: What happens tot he surface area, volume, and their ratio as the cell gets larger?

Magic Solution

1. Put the three cubes: large, medium, small in a plastic cup.
2. Pour the 'magic' solution over them and let it sit for 5 minutes.
3. Remove the cubes and cut them open with the knife.
4. Color the amount of diffusion observed.



Questions:

1. Which cube showed the most diffusion? How could you tell?

2. Which cube showed the least diffusion? How could you tell?

3. If each cube represented a cell, which cell might not be able to get the nutrients if need?

   How could it solve this problem?

4. What is the relationship between cell size and diffusion rate? WHY? Relate it to the Block activity

THE CELL CYCLE

1. The cells of all living things grow and multiply though a cycle that's made up of four phases. During three of these phases, the cell is growing and is metabolically active. During the fourth phase, it is undergoing division, which yields two new cells. In this plate, we examine the four phases of the cell cycle and note the important characteristics and subdivisions of each phase. A subsequent plate explores the phases of mitosis in detail.

2. The cell cycle takes place over different periods of time in different types of cells, and as you know, different types of cells coexist in many organisms. For example, in human fibroblast cells, the cell cycle may encompass about fifteen hours, while in brain cells, the cycle may take many years to complete.

3. The two major periods of the cell cycle are interphase and the M phase (also known as the phase of cell division (C)). As the plate indicates, interphase encompasses three smaller periods and is the period of time between cell division. The same bold color may be used for all three portions of interphase, and a different color should be used for the M phase. Reds, blues, greens, or purples are suggested.

4. During interphase, the cell is extremely active and carries on routine cellular and physiological activities. Foe examples, cells of the pancreas are actively producing insulin, which facilitates the passage of glucose molecules into the cell. During M phase of cell division, the rate of metabolism is reduced and the cell undergoes division to form tow cells.

5., Three shorter phases make up the interphase period of the cell cycle. The first phase is known as the G1 phase (D). During this time period, metabolism is occurring at a high rate, many proteins are synthesized, and cell growth is vigorous; the G stands for growth. The cell's organelles also increase in number of size.

6. The second phase of interphase is the S phase (E.) In the S phase, some activities related to cell division take place (S stands for synthesis). The cell's DNA replicates, ensuring that future cells obtain similar copies of its hereditary material, and proteins associated with the DNA are produced during this phase.

7. The cell prepares to reproduce during the G2 phase (F). More of the proteins that are essential for cell division are produced during this brief phase, and these proteins move to appropriate sites. The centrioles used for cell division complete their replication during this phase. In addition to these activities, the cell continues its growth and many of its physiological processes. Not all the cells continue the cell cycle at this point; some cells leave the cell cycle and do not undergo cell division. Red blood cells (erythrocytes) are an example.

8. At the conclusion of the G2 phase, the cell enters its M (mitosis) phase of cell division. This phase consists of two main processes: the first is mitosis (H), in which the chromosomes separate and segregate themselves on opposite sides of the cell, and the second is cytokinesis (G), in which the cell actually splits. The results of cytokinesis and mitosis are shown in the plate.

9. Mitosis occurs as a series of events that are separated into four phases, and the process is continuous through these four phases. During prophase (H), distinct chromosomes appear as a result of the uncoiling of the chromatin material (which is made up of DNA and protein). During metaphase (H2), the chromosomes line up along the equator. During anaphase (H3), the chromosomes separate, and one member of each pair moves to opposite poles of the cell. Lastly, during telophase (H4), the chromosomes arrive at the opposite poles of the cell and two distinct nuclei to form.

10. The processes that take place during the M phase of the cell cycle lead to new cells that are referred to as daughter cells. A single mother cell (a) has passed through the G1, S, and G2 phases and enters cell division to produce two daughter cells (b.) Each of the two new cells will now enter interphase and the cycle will be repeated.

ONE summary sentence of each paragraph.
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
Overall Summary

Lesson 8 DNA and Cell Division

Key Words

cell cycle:	process by which a cell grows, prepares for division, and divides to form two daughter cells
interphase:	part of the cell cycle during which a cell grows and copies its chromosomes
chromosomes:	cell structures made of DNA and proteins that contain hereditary information
mitosis:	part of the cell cycle during which a parent cell distributes its chromosomes to two daughter cells

KEY IDEAS

The cell cycle is the continuous process by which cells grow, prepare for division, and divide into two daughter cells. The daughter cells inherit chromosomes from the parent cell. The process of distributing chromosomes during cell division is called mitosis.

If you look at a picture of yourself as a toddler, you'll find that your body has changed dramatically since then. Your height and weight increased as you got older. Did you ever wonder why this happened? You grow partly because the number of cells that make up your body increases.

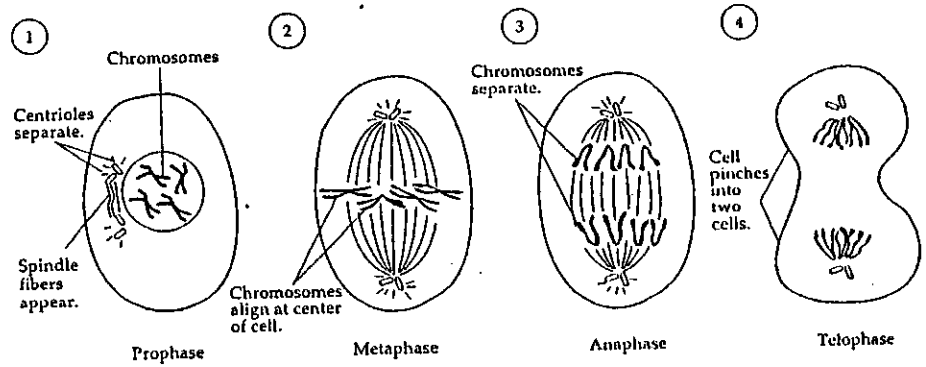
The Cell Cycle. Even as you read these words, the cells in your body are growing. Materials that flow into the cell cause it to increase in size. As a cell gets larger, substances have more difficulty moving through it. Yet, to function properly, the cell must be able to transport materials throughout itself. Every cell has a size limit, or a point at which it can no longer transport materials throughout itself. When the cell reaches this limit, it divides, forming two new cells. The term cell cycle (sehl SY-kuhl) is used to describe the continuous process by which cells grow, prepare for division, and divide into new cells called daughter cells.

Interphase. The stage of the cell cycle during which the cell grows and copies its chromosomes is called interphase (IHN-tuhr-fayz). This is the longest stage of the cell cycle. It is an active time before cell division.

Near the end of interphase, the cell makes a copy of its chromosomes. For example, a cell that contains 12 chromosomes before interphase would contain 24 chromosomes after interphase. Chromosomes (KROH-muh-sohmz) are large, threadlike structures located in the cell nucleus. Chromosomes contain hereditary information that is passed on to new cells. This hereditary information is carried on DNA molecules found inside each chromosome.

Mitosis. When a cell divides, it passes on copies of its DNA to its offspring through mitosis. Mitosis (my-TOH-sihs) is the process of the cell cycle in which chromosomes are distributed to two daughter cells. There are four stages of mitosis. Fig. 8-1 shows these stages in animal cells.

Fig. 8-1



Prophase: Organelles called centrioles help to separate the duplicated chromosomes. Two pairs of centrioles are found outside the nucleus in the cytoplasm. The centriole pairs move apart. As they separate, fine threads of protein called spindle fibers form between the centriole pairs. By the end of prophase, the centriole pairs are at opposite ends of the cell. The nuclear membrane disappears. The spindle fibers align between the centriole pairs.

Metaphase: In the second stage of mitosis, the chromosome pairs line up across the center of the cell. Each chromosome pair is attached to a spindle fiber.

Anaphase: During the third stage of mitosis, each chromosome pair separates to form two single chromosomes. The spindle fibers pull one chromosome from each pair to opposite ends of the cell. This forms two sets of single chromosomes.

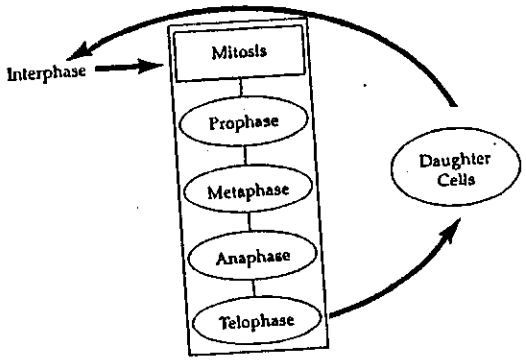
Telophase: In the last stage of mitosis, a nuclear membrane forms around each set of chromosomes. The spindle fibers disappear. Mitosis ends when the cell membrane begins to pinch the cell in two. This causes the cytoplasm to divide, forming two identical daughter cells.

☑ 1. How do spindle fibers help distribute chromosomes to daughter cells?

TAKE ANOTHER LOOK

Fig. 8-2 summarizes the cell cycle.

Fig. 8-2



Check Your Understanding

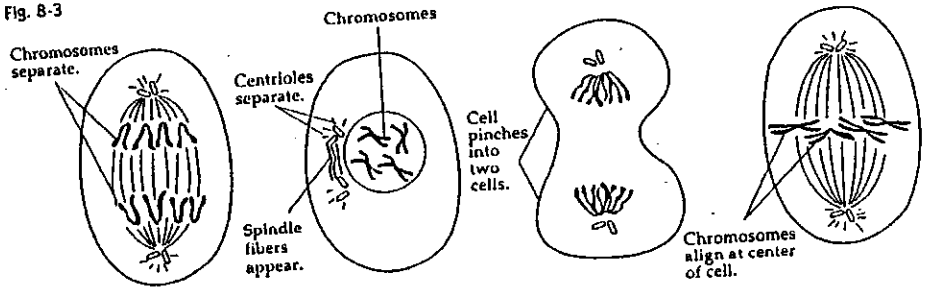
Write a sentence explaining the connection between each pair of words.

2. chromosomes, interphase _____

3. cell cycle, mitosis _____

4. Fig. 8-3 shows each of the four stages of mitosis. On each line, write the name of the stage shown. Then write the letters in the correct order of their occurrence.

Fig. 8-3



(a) _____ (b) _____ (c) _____ (d) _____

(e) Correct order of occurrence: _____

What Do You Know?

5. What is the cell cycle? _____

6. What causes cells to divide? _____

7. How is hereditary information passed from a parent cell to daughter cells? _____

8. What are the four stages of mitosis? _____

9. What is interphase? _____

10. If a parent cell contains eight chromosomes, how many chromosomes are present after interphase? Why?

So That's Mitosis!

DIRECTIONS: Can you describe the important events in mitosis yet? Read the following passage one time through, and then read it again answering the accompanying questions.

Mitosis is only a small portion of the overall cell cycle. Most of the cell's life is spent in interphase. During interphase, the cell carries out its normal functioning, whatever is the job of the cell. Also during interphase, the cell grows in size and manufactures DNA to make more chromosomes.

Cell division consists of mitosis (division of chromosomes) and cytokinesis(the actual separation of the cell into two new cells). Cell division only takes up about 10% of the life of the cell, with the remaining 90% in interphase. This includes the replication of chromosomes into homologues, each homologue having a pair of sister chromatids.

When mitosis begins, the chromosomes thicken enough so that the paired homologues and their sister chromatids are visible through a microscope (prophase). The chromosomes then move to and line up on the equator of the cell (metaphase). A spindle fiber from each pole attaches to each of the sister chromatids of every homologue. One sister chromatid moves to one pole and the other sister chromatid moves the other pole (anaphase). One of each homologue's sister chromatid clusters at the poles and preparations are made for the cell to separate into two cells (telophase). The cell membrane reforms around each of the two new cells and the two new cell actually separate (cytokinesis). Now there are two, independently functioning cells which will begin the growth process of interphase.

The cell cycle is completed many times, each time producing two cells from one. Because one of each of the sister chromatids of each homologous chromosome is taken into each new cell, the same genes are represented in each new cell. Thus, the two daughter cells as well as the mother cell appear and function identically. It is important to recognize that stages such as prophase and metaphase are just names representing the events at that particular time. Mitosis is a continued and gradual process, just as is adolescence. The names of the stages are simply used as reference points for the study of mitosis.

QUESTIONS:

1. What is the cell cycle?

2. What two important processes occur in the cell during interphase?

3. What happens generally during mitosis?

4. What happens to the chromosomes during prophase?

5. What happens to the chromosomes during metaphase?

6. What happens to the chromosomes during anaphase?

7. What happens to the chromosomes during telophase?

8. What happens to the cell during cytokinesis?

9. How are the daughter cells similar to the mother cell?

10. Why do cell need to divide instead of increasing in size?

11. What are two other reasons cells divide?

Name _____ Date _____ Class _____

In your textbook, read about cell size limitations.

Determine if the statement is true. If it is not, rewrite the italicized part to make it true.

1. Most *living cells* are between 2 and 200 μm in diameter. _____
2. Diffusion of materials over long distance is *fast*. _____
3. If a cell doesn't have enough *DNA* to make all the proteins it needs, the cell cannot live. _____
4. As a cell's size increases, its volume increases much *slower* than its surface area. _____
5. If a cell's diameter doubled, the cell would require *two* times more nutrients and would have *two* times more wastes to excrete. _____

In your textbook, read about cell reproduction.

Use each of the terms below just once to complete the passage.

nucleus	genetic material	chromosomes	packed
identical	chromatin	vanish	cell division

The process by which two cells are produced from one cell is called (6) _____. The two cells are (7) _____ to the original cell. Early biologists observed that just before cell division, several short, stringy structures appeared in the (8) _____. These structures seemed to (9) _____ soon after cell division. These structures, which contain DNA and became darkly colored when stained, are now called (10) _____. Scientists eventually learned that chromosomes carry (11) _____, which is copied and passed on from generation to generation. Chromosomes normally exist as (12) _____, long strands of DNA wrapped around proteins. However, before a cell divides, the chromatin becomes tightly (13) _____.

Name _____ Date _____ Class _____

In your textbook, read about the cell cycle and interphase.

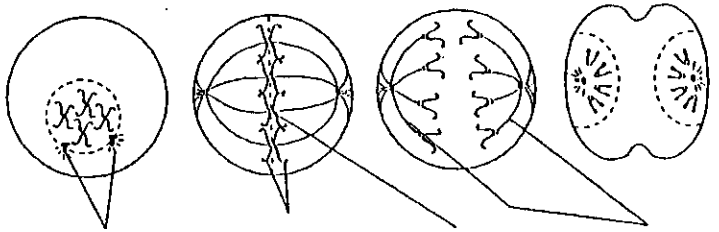
Complete the table by checking the correct column for each statement.

Statement	Interphase	Mitosis
14. Cell growth occurs.		
15. Nuclear division occurs.		
16. Chromosomes are distributed equally to daughter cells.		
17. Protein production is high.		
18. Chromosomes are duplicated.		
19. DNA synthesis occurs.		
20. Cytoplasm divides immediately after this period.		
21. Mitochondria and other organelles are manufactured.		

In your textbook, read about the phases of mitosis.

Identify the following phases of mitosis. Use these choices: telophase, metaphase, anaphase, prophase. Then label the diagrams. Use these choices: sister chromatids, centromere, spindle fibers, centrioles.

22. _____ 23. _____ 24. _____ 25. _____



26. _____ 27. _____ 28. _____ 29. _____

Answer the question.

30. How does mitosis result in tissues and organs?

_____

_____

_____

ARE THERE MORE DIVIDING CELLS OR RESTING CELLS IN A ROOT TIP?

A plant grows in length at the tip of a stem and root. In the stem and root tip there is a small group of cells that divide many times; however, not all cells in these parts may be dividing. A dividing cell may be next to several resting cells and a resting cell can be surrounded by several dividing cells.

Cells in mitosis are different from resting cells. some parts of a cell are seen best only when a cell is dividing. These parts seem to disappear after a cell had divided.

Keywords: Define the following keywords:

Dividing cell _____

Resting cell _____

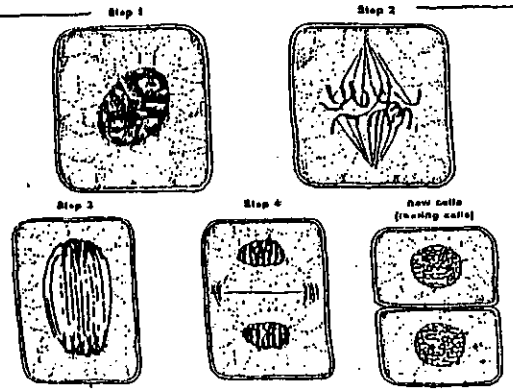
Root tip _____

Table 1

Steps of Mitosis	Number of Cells Seen
Prophase	
Metaphase	
Anaphase	
Telophase	
Interphase Resting Cells	
Total Cells Seen	

Figure 1

Student Drawings

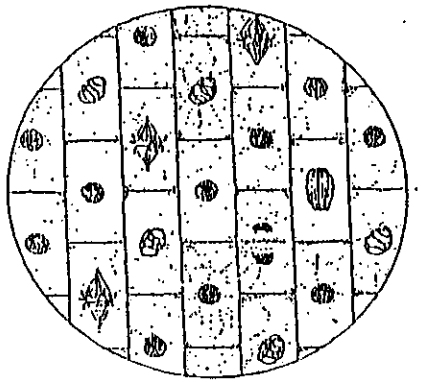


11. A biology student was looking at an onion root tip through the microscope and made a drawing of the cells she saw. Record on the chart how many cells you think she saw that were either resting cells or dividing cells.

Table 2 Cells seen by the student.

Steps of Mitosis	Number of Cells Seen
Prophase	
Metaphase	
Anaphase	
Telophase	
Interphase Resting Cells	
Total Cells Seen	

Figure 2



Questions

1. What part is seen in the resting cells that is missing in cells that ate dividing?

2. What parts are seen in dividing cells that are not visible in the resting cells?

3. Look at Figure 4 again. Why do you think new cells are sometimes called resting cells?

4. Which cells did you see more of in the onion root , dividing cells re resting cells?

5. Which step of mitosis was most common in the onion root?

6. Which step of mitosis was least common in the onion root?

7. Suppose you examined another root tip and saw that half of the cells were dividing. Would this root be growing faster or slower than the one you examined in this exercise? Explain your response.

Animal Mitosis

INTRODUCTION

a. The process of cell development described in this set is called

_____

b. The specimen studied is the egg sac of the ascaris worm. Why?

_____

_____

SLIDE 1 - THE ZYGOTE

a. This slide shows the zygote -- the fertilized egg of the ascaris. How many masses of chromatin can you see in the cell?

_____

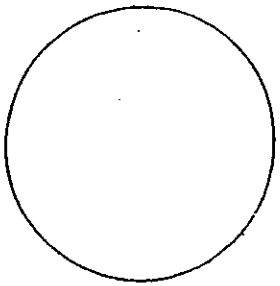
b. Where did these masses come from? _____

_____

_____

c. The amount of hereditary material supplied by each parent of the ascaris is (equal) (not equal). Underline your choice.

SLIDE 2 - PRO-METAPHASE



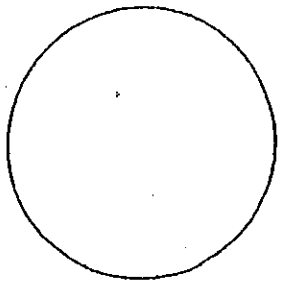
a. Draw what you see in this slide.

b. How many chromosomes can you see? _____

c. Each parent supplied _____ chromosomes to form the zygote.

d. Label the chromosomes supplied by the sperm

SLIDE 3 - METAPHASE



a. Draw what you see in this slide.

b. Label the equatorial plate; a centriole; spindle fibers.

SLIDE 4 - METAPHASE - POLAR VIEW

a. How does this picture differ from that in slide 3?

_____

_____

_____

b. In this slide the chromosomes are seen as they lie flat on the

_____ plane.

SLIDE 5 - EARLY ANAPHASE

a. How many chromosomes are shown in this slide? _____ (Hint: Compare with slide 3)

b. The number of chromosomes in this slide contain enough hereditary material for _____ cells.

SLIDE 6 - ANAPHASE

a. The chromosomes in this slide have separated to form _____ groups. Each group contains _____ chromosomes.

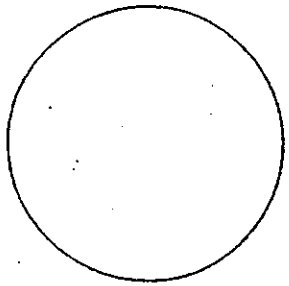
b. Why do some of the chromosomes appear to be beaded in places?

_____

_____

_____

SLIDE 7 - TELOPHASE



a. Draw what you see in this slide.

b. The two groups of chromosomes are (still connected) (completely apart from each other). Underline your choice.

c. What is happening to the cell membrane?

_____

_____

SLIDE 8 - LATE TELOPHASE

a. How many cells are seen in this slide? _____

b. How do these cells compare with the cell in slide 1?

_____

c. How many chromosomes are involved in human mitosis? _____

Part 1 Mitosis

1. The state of mitosis seen here is called _____.

2. Chromatin shortens and thickens to form these distinct structures called _____.

3. DNA is replicated during the stage between cell divisions called _____.

4. True or False: The division of the cytoplasm following mitosis is called cytokinesis.

5. The first stage of mitosis, the stage when the nuclear membrane begins to be reabsorbed into the cell, is called _____.

Part 2 Meiosis

1. As a result of meiosis, sex cells are formed that have _____ the number of chromosomes of body cells.

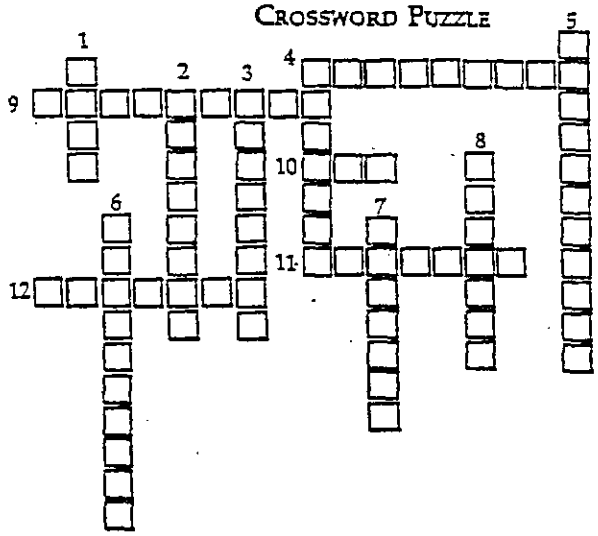
2. True or False: Pairs of identical chromosomes are also called homologous chromosomes.

3. True or False: Normal body cells are diploid because they possess one of each different chromosomes.

4. True or False: During meiosis, the DNA is replicated twice.

5. True or False: In plant and animal cells, meiosis occurs only in germ cells.

Mitosis and Meiosis
Crossword Puzzle



Down

1. Only _____cells can undergo meiosis.
2. When a cell first starts to undergo mitosis, it loses its nuclear membrane and chromosomes are formed from chromatin. This stage of mitosis is called _____.
3. Chromosomes move rapidly toward the mitotic centers during _____.
4. Sperm and egg cells result from a special type of cell division called _____.
5. DNA undergoes a process called _____when it is duplicated.
6. When a cell is not undergoing the process of mitosis, it is in a stage called _____.
7. If an organism possesses just four different kinds of chromosomes and yet its cells have a total of eight chromosomes, eight would be its _____number of chromosomes.
8. For the organism described above in the previous question, its _____number of chromosomes is four.

Across

4. Duplicated chromosomes are arranged in the middle of the spindle during _____.
9. The stage of mitosis that happens at the same time the cytoplasm divides is called _____.
10. Eggs are also called _____.
11. The arrangement of microtubules that become visible during mitosis and that separate the chromosomes into equal groups is called the _____.
12. Telophase is the final stage of _____.

Meiosis

Standard GENETICS

2. **Mutation and sexual reproduction lead to genetic variation in a population.** As a basis for understanding this concept, students know:

Concepts

a. meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and are segregated randomly during cell division to produce gametes containing only one chromosome of each type.

b. that only certain cells in a multicellular organism undergo meiosis.

So That's Meiosis!

DIRECTIONS: Can you describe the important events in meiosis yet? Read the following passage one time through, and then read it again answering the accompanying questions?

Meiosis takes place in gametes (sex cells), rather than somatic (body cells). The daughter cells are haploid (1N) meaning there is one chromosome from each homologous pair. Meiosis is divided into two sequences: meiosis I and meiosis II. During interphase in meiosis I, the chromosomes are replicated and become large enough to be visible under a classroom microscope. In prophase I, segments of homologous chromosomes can become exchanged, a process called crossing over. This is a possible source of variation of offspring. In metaphase I, the chromosomes line up at an imaginary equator. Each member of a pair of chromosomes (a homologue) is also made up of two sister chromatids. This gives the appearance of four chromosomes of the same kind. In meiosis I each homologous chromosome of each chromosome pair stays together until anaphase I. During anaphase I, the homologous pairs separate, one of each pair going to one pole and the other going to the opposite pole. Each of these different homologues will eventually end up in a different sperm or egg cell. Why? Because if an individual is heterozygous for a trait that is located on a given pair of homologous chromosomes, different alleles for this trait will appear in the sperm or egg cells. This is one of the evolutionary causes of variation in the next generation.

When meiosis II begins, the homologous pairs with their sister chromatids have separated into different cells. The major event in Meiosis II occurs during anaphase II. This is when the sister chromatids separate, producing only one sister chromatid from each original chromosome pair in each new egg or sperm. Note that at the end of meiosis, each of four resulting daughter cells has only one chromosome and this chromosome is not paired with its homologue. In the human, sperm and egg cells have only 23 chromosomes. All other human cells, including a newly formed fertilized egg, have 23 pairs of chromosomes (46). Another function of meiosis II is to produce lots of sperm or egg cells.

1. In what type of cells does meiosis occur?

2. How many chromosomes from each homologue are there in daughter cells?

3. What important event occurs in prophase I?

4. What important event occurs in anaphase I?

5. What is the evolutionary significance of meiosis I?

6. If each human sperm and egg had the same number of chromosomes as all the other cells, how many chromosomes would be present in a fertilized egg? What is the problem with this?

7. Why does meiosis I separate the pair of homologous chromosomes into different cells?

8. Why does meiosis II separate the sister chromatids into different cells?

9. How many sperm and egg cells does meiosis produce? Why is this important?

Lesson 10 Sex Cells and Meiosis

Key Words

gametes: sex cells
egg: female sex cell
sperm: male sex cell
haploid number: number of chromosomes found in a gamete
diploid number: number of chromosomes found in the body cells of an organism
meiosis: type of cell division that produces gametes

KEY IDEAS

During sexual reproduction, two sex cells join. Each sex cell contains half the number of chromosomes found in the body cells of the parents. The process in which the number of chromosomes in a cell is reduced by half is called meiosis.

Our bodies consist of millions of cells. However, all humans begin life as only one cell. The one cell is formed by the joining of two sex cells: one from the mother and one from the father. After 36 hours, the cell divides to form two cells. Five days after the first cell formed, it has divided enough times to produce 120 cells.

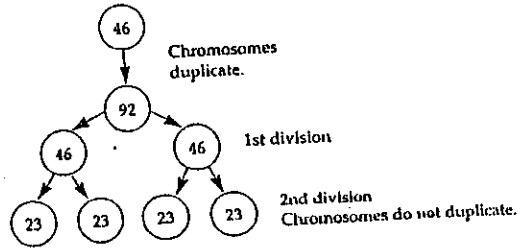
Sex Cells. All organisms that reproduce sexually produce sex cells called gametes (GAM-eets). Female gametes are called egg (ehg) cells. Male gametes are called sperm (sperm) cells. Each gamete contains half the number of chromosomes as the body cells of the organism. The number of chromosomes in a gamete is described as the haploid number (HAP-loid NUM-buhr).

A single body cell from a particular organism contains a certain number of chromosomes. For example, human body cells contain 46 chromosomes each. The body cells of a dog contain 78 chromosomes each. An earthworm's body cells hold 36 chromosomes. The number of chromosomes in a single body cell of an organism is called the diploid number (DIHP-loid NUM-buhr). Since the body cell of a spider plant contains 24 chromosomes, its diploid number is 24.

1. How do gametes differ from body cells? _____

Meiosis and Chromosomes! The kind of cell division by which diploid cells produce haploid gametes is called meiosis (my-OH-sihs). Meiosis occurs in two stages. The first stage resembles mitosis. In this stage, the chromosomes in the parent cell duplicate, or make exact copies of each other. When this cell divides, each of the two resulting daughter cells contains the same number of chromosomes as the original parent cell.

Fig. 10-1 Meiosis in a human cell



In the second stage of meiosis, each daughter cell divides a second time. Unlike mitosis, this second cell division does not begin with duplicating the chromosomes. Thus, when the daughter cells divide, each of the four cells produced has half as many chromosomes as the original parent cell. Fig. 10-1 shows meiosis in a human cell.

By dividing twice, the original diploid cell produces haploid gametes. When two such gametes join during sexual reproduction, they form a single cell that again has a diploid number.

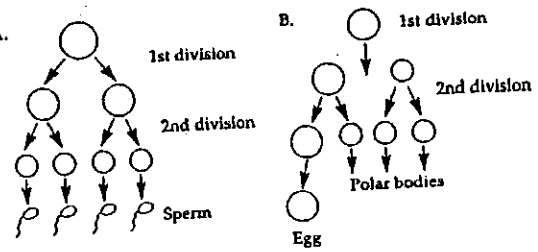
Sperm and Eggs. During meiosis, a single cell divides twice to form four daughter cells. In males, meiosis produces four sperm cells of almost equal size. In females, meiosis produces four cells of varying size. One cell receives most of the cytoplasm, making it much larger than the other three cells. The large cell becomes the female gamete, or egg cell. The three smaller cells are called polar bodies. Polar bodies are not involved in sexual reproduction.

Occasionally, something goes wrong during meiosis. The parent cell does not separate evenly, causing a daughter cell to have an abnormal number of chromosomes. If this gamete joins with a normal gamete during sexual reproduction, the new cell that forms lacks the diploid number. An organism that develops from this cell will have a genetic disorder.

TAKE ANOTHER LOOK

Fig. 10-2 shows the differences that occur in the formation of sperm and eggs.

Fig. 10-2



Check Your Understanding

Write a sentence explaining the connection among each group of words.

2. gametes, egg cell, sperm cell _____

3. diploid, haploid, meiosis _____

Complete the following passage using words from the list below.

divisions *diploid number* *egg* *four* *gamete*
haploid number *meiosis* *polar bodies* *two*

The (4)_____ of an organism is twice its (5)_____. A (6)_____ contains half the number of chromosomes found in the body cells of an organism. Gametes are formed through (7)_____. In this process, a parent cell undergoes two (8)_____. The first stage of meiosis produces (9)_____ daughter cells. In males, the second stage of meiosis results in (10)_____ sperm cells. In females, one (11)_____ cell and three (12)_____ are formed.

Complete exercises 13 – 17 by adding the correct number to the sentences. Using the fruit fly as an example.

13. If the body cell of a fruit fly contains 8 chromosomes, its diploid number is _____.

14. The haploid number of a fruit fly is _____.

15. When a body cell doubles its chromosome number to begin meiosis, it contains _____ chromosomes.

16. Cells produced by the first division of meiosis contain _____ chromosomes.

17. Cells produced by the second division of meiosis contain _____ chromosomes.

What Do You Know?

18. Explain the difference between a body cell and a sex cell.

19. If the body cell of a grasshopper contains 24 chromosomes, how many chromosomes does the egg cell of a female grasshopper contain? Explain how you determined your answer.

20. How is the number of sperm cells and egg cells produced by meiosis different?

21. Explain how mitosis and meiosis are alike.

22. Explain how mitosis and meiosis are different.

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In your textbook, read about genes, chromosomes, and numbers.

Examine the table. Then answer the questions.

Chromosome Numbers of Some Common Organisms

Organism	Body Cell ($2n$)	Gamete (n)
Human	46	23
Garden pea	14	7
Fruit fly	8	4
Tomato	24	12
Dog	78	39
Chimpanzee	48	24
Leopard frog	26	13
Corn	20	10

1. What is the diploid number of chromosomes in corn?

_____

2. What is the haploid number of chromosomes in corn?

_____

3. Is the chromosome number related to the complexity of the organism?

_____

4. How many pairs of chromosomes do humans have?

_____

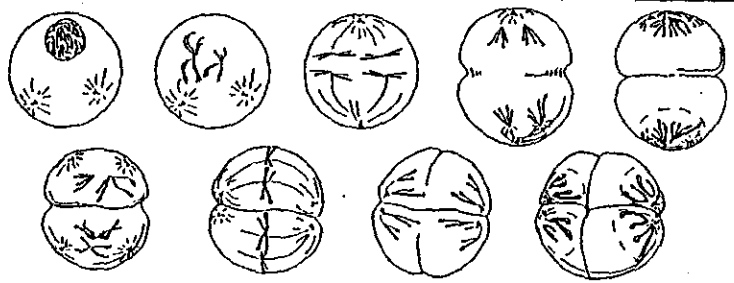
5. What process maintains a constant number of chromosomes within a species?

_____

In your textbook, read about the phases of meiosis.

Label the diagrams below. Use these choices: Metaphase I, Metaphase II, Interphase, Telophase I, Telophase II, Anaphase I, Anaphase II, Prophase I, Prophase II.

6. _____ 7. _____ 8. _____ 9. _____ 10. _____



11. _____ 12. _____ 13. _____ 14. _____

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The following statements describe interphase and and meiosis I. *Identify each phase. Then place them in sequential order using the numbers 1 through 5. Use 1 for the phase that occurs first and 5 for the phase that occurs last.*

Statement	Name of Phase	Sequence
15. Homologous chromosomes line up at the equator in pairs.		
16. The cell replicates its chromosomes.		
17. *Homologous chromosomes separate and move to opposite ends of the cell.*		
18. The spindle forms, and chromosomes coil up and come together in a tetrad; crossing over may occur.		
19. Events occur in the reverse order from the events of prophase I. Each cell has only half the genetic information; however, another cell division is needed because each chromosome is still doubled.		

In your textbook, read about how meiosis provides for genetic variation and about mistakes in meiosis.

For each statement below, write <u>true</u> or <u>false</u>.

_____ 20. Reassortment of chromosomes can occur during meiosis by crossing over or by independent segregation of homologous chromosomes.

_____ 21. Genetic recombination is a major source of variation among organisms.

_____ 22. The *random segregation* of chromosomes during meiosis explains Mendel's observation that genes for different traits are inherited independently of each other.

_____ 23. Nondisjunction always results in a zygote with an extra chromosome.

_____ 24. Down syndrome is a result of polyploidy.

_____ 25. Mistakes in meiosis can occasionally be beneficial.

Vocabulary: Meiosis/Reproduction

Word Part	Meaning	Vocabulary Word
meio	diminish	meiosis
-zyg/-zygo	joined	zygote
gamet	Wife/husband	gamete
Som-	Body	Somatic
Com	With, together	Recombination
		Sperm
		Ova

Format

Word	Part of speech	Word parts
Definition		

Meiosis		

Zygote		

Gamete		

Somatic		

Recombination		

Sperm		

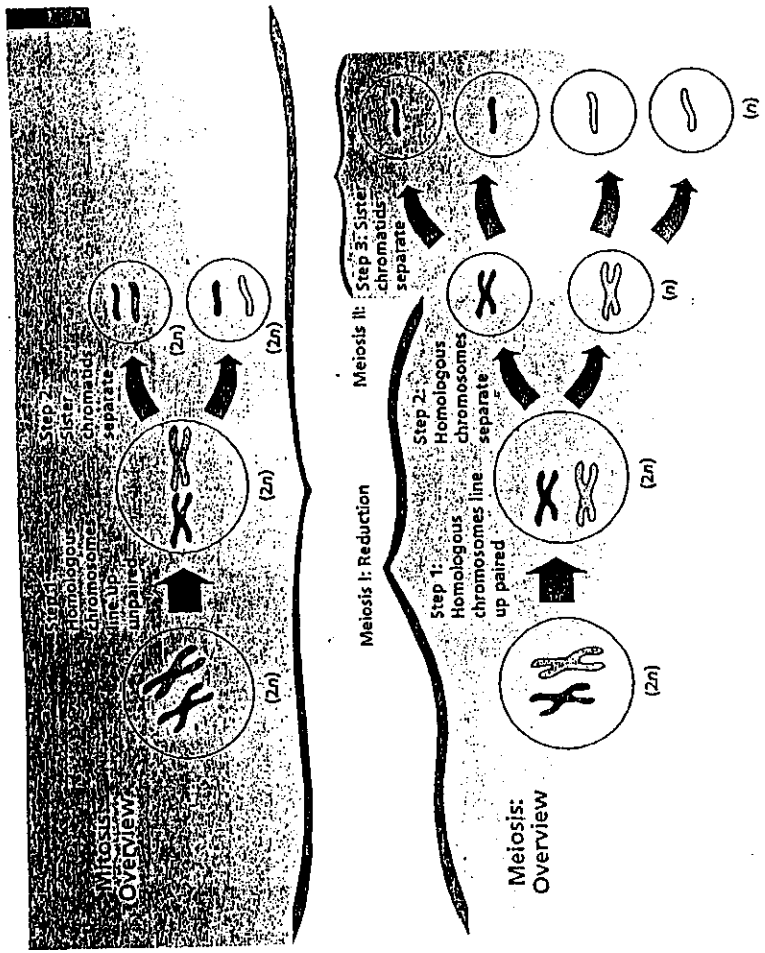
Ova		

Name Date Class

Reteaching Skills

Transparency 17 Mitosis Versus Meiosis

Use with Chapter 10, Section 10.2



Name Date Class

Reteaching Skills

Worksheet 17 Mitosis Versus Meiosis

Use with Chapter 10, Section 10.2

1. Define these terms.
   a. homologous chromosomes

   b. sister chromatids

2. Mitosis is a process of *cell replication*. Explain what this statement means.

3. Meiosis is a process of *cell reduction*. Explain this statement.

4. Which part of meiosis is similar to mitosis?

5. Identify whether each process below occurs during mitosis, meiosis, or both.
   a. Sister chromatids separate.

   b. Haploid cells are formed.

   c. Cell division occurs once.

   d. Homologous chromosomes pair.

   e. Four cells are the final result.

   f. Cell division occurs twice.

   g. Replicated chromosomes line up in the middle of the spindle.

   h. Two cells are the final result.

   i. Diploid cells are formed.

6. Define crossing over. When does it occur?

Mitosis/Meiosis

Process	Mitosis	Meiosis
In what cells does it occur?		
What is it's purpose?		
How many daughter cells are produced?		
Genetic likeness of daughter cells to parent cell		
Parent cell type (haploid/diploid)		
Daughter cell type (haploid/diploid)		
Number of nuclear divisions		

Mitosis vs. Meiosis Poster

Objective: To demonstrate an understanding of mitosis and meiosis by comparing and contrasting them.

Directions:

1) Turn paper sideways and draw a line down the middle.
2) Label one side Mitosis and the other Meiosis.
3) Using written words and pictures include the following information:
   - *purpose of mitosis/meioisis*
   - *correct sequence of mitosis (diagram)*
   - *correct sequence of meiosis (diagram)*
   - *number of daughter cells produced for each*
   - *parent/daughter cell type(haploid/diploid) for each*
   - *genetic likeness for each*
   - *number of nuclear divisions for each*
4) Use color and make poster easy to read.
5) Glue rubric on back.
6) Make sure groups member names are on poster & turn in.

Mitosis vs. Meiosis Poster Rubric

	2	1	0
Title	Title is easy to read	Title is somewhat clear	Title is not provided or illegible
Purpose	Purpose of mitosis and meiosis are thorough and correct	Purpose of mitosis and meiosis are somewhat correct	Purpose of mitosis and meiosis are not provided or not correct
Correct sequence of mitosis (Diagram)	Mitosis is correctly diagrammed	Mitosis is somewhat diagrammed	Mitosis is not correctly diagrammed or present
Correct sequence of meiosis (diagram)	Meiosis is correctly diagrammed	Meiosis is somewhat diagrammed	Meiosis is not correctly diagrammed or present
Daughter cells	Poster depicts the number of daughter cells at the end of mitosis and meiosis	Poster somewhat depicts the number of daughter cells at the end of mitosis and meiosis	Poster does not depict the number of daughter cells at the end of mitosis and meiosis
Haploid or Diploid	Parent cell type and daughter cell type (haploid or diploid) are correct	Parent cell type and daughter cell type (haploid or diploid) are somewhat correct	Parent cell type and daughter cell type (haploid or diploid) are NOT correct
Genetic likeness	Genetic likeness between the daughter cells to parent cells is correctly described	Genetic likeness between the daughter cells to parent cells is somewhat described	Genetic likeness between the daughter cells to parent cells is not described or incorrect
Number of nuclear division	Number of nuclear divisions in meiosis and mitosis are correct and easy to find on poster	Number of nuclear divisions in meiosis and mitosis are somewhat correct	Number of nuclear divisions in meiosis and mitosis are NOT correct
Color	Poster is colorful and easy to read	Poster is somewhat colorful, but might be difficult to read	Poster is not colorful (less than 2 colors) and may be difficult to read
Neatness	Poster exhibits neatness	Poster exhibits some neatness	Poster is messy or unprofessional
Spelling	Poster exhibits no spelling errors	Poster exhibits some spelling errors	Poster exhibits many spelling errors
Rubric	Rubric is glued on back and names are provided		Rubric is not glued on back

Name of Group Members: _____Period:_____

Total Points: _____/20 x 1.5 = _____