

Meiosis

3.3.1.1

Meiosis is a process that occurs during sexual reproduction. Meiosis divides the number of chromosomes found in the sperm and egg by one-half.

Upon successful completion of this unit, you should be able to do the following:

1. Explain how meiosis and sexual reproduction creates variation.
2. Explain how meiosis affects the gametes.
3. Describe and explain the process of crossing over.
4. Recognize that organisms have a specific number of chromosomes.
5. Be able to use the following terms correctly:

meiosis sexual reproduction sperm egg	Zygote gamete chromosome gene	crossing over variation mutation
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Meiosis

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Each chromosome has many, many genes on it. These **genes produce the traits** that the new offspring will have. In a family with many children, why don't the children look exactly alike? How can this be? **Meiosis has two important functions:**

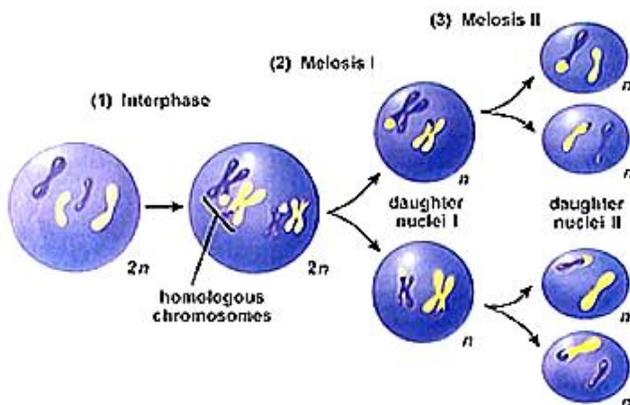
- 1) Meiosis produces **different** gene combinations in sperm and eggs so that there is **variation** in the offspring.
- 2) Meiosis also **reduces the number of chromosomes by $\frac{1}{2}$** so sperm and egg can unite to create a normal offspring.

REMEMBER THIS!!!

One of the important aspects of sexual reproduction is the fact that sorting and recombining genes during sexual reproduction increases the variations in offspring. In sexual reproduction the offspring are not the same as the parents and are not the same as each other unless they are identical twins.

Question 1. Why do human offspring not look exactly like their parents?

Meiosis is a process that takes a cell with *two sets* of chromosomes and produces **sex cells, or gametes** which have only *one set* of chromosomes. So **meiosis divides the chromosome number in half**. Why? If meiosis did not happen, then the offspring would inherit two sets of chromosomes from the father and two sets of chromosomes from the mother making a total of four sets of chromosomes. The normal offspring only has two sets of chromosomes. Therefore, **meiosis is important because it divides the number of chromosomes in half so the offspring only inherits two sets of chromosomes instead of four**. If the offspring inherited four sets, it would likely die before birth.



REMEMBER THIS!!!

Meiosis reduces the number of chromosomes by one half in the sperm and in the egg so the sperm and egg can combine to form a normal offspring with the required pair of chromosomes.

Normal cells have two sets of chromosomes. **Meiosis reduces the number of chromosomes to 1 set for each sperm and egg.** Then, when sperm and egg unite to form a zygote, the offspring have the required 2 sets of chromosomes. One set from the sperm (father) and one set from the egg (mother). Meiosis is very important for sexual reproduction. **Sexual reproduction occurs whenever a sperm is united with an egg. Sperm cells and egg cells are called gametes, or sex cells.** Meiosis is the process that reduces the chromosome number in sperm and egg cells so they can combine to provide the correct number of chromosomes for the offspring.

Question 2. What would happen during sexual reproduction if meiosis did not occur?

Interesting Scientific Fact: Most human cells have 46 chromosomes. Each human started from a single egg that had 23 chromosomes which was fertilized by a sperm cell that had 23 chromosomes. How did these egg and sperm cells form? They were formed by the process called meiosis.

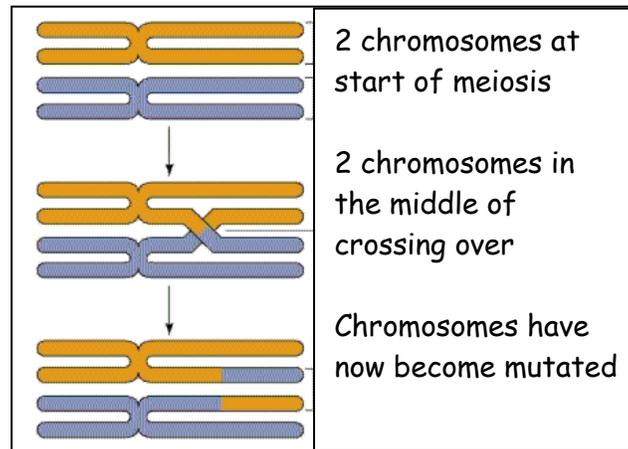
Each species has a unique number of chromosomes in their cells. Mosquitoes have 6 chromosomes in each cell. When mosquitoes make sperm or egg cells, meiosis reduces the chromosome number to 3. Dogs have 78 chromosomes in each cell. When dogs make sperm or egg cells, meiosis reduces the chromosome number to 39.

Question 3. If an organism has 88 chromosomes in a normal cell, how many chromosomes would it have in each sperm? _____
in each egg? _____

A Special Type of Meiosis Produces a Natural Mutation: Crossing Over.

Usually all of the genes on a chromosome are inherited together. However, one way variation is produced is by a process called *crossing over*. *Crossing over* is just that. During meiosis, for some unknown reason, occasionally a chromosome will not line up correctly to be divided in half. Often a piece of a

chromosome will *cross over*, and lie over another chromosome and then become a part of that chromosome. When this happens, **the piece that crossed over becomes inherited as a new piece of chromosome**. This creates a mutation. A mutation is a process that happens when something unusual happens during meiosis. So **during crossing over, the offspring contain a mutation and are different than the parent**. Sometimes the mutation is lethal. At other times the offspring appears to be perfectly normal.



Question 4. Explain how crossing over occurs and what impact it has on the offspring.

SUMMARY

There are over 8 million different kinds of egg or sperm made by one human parent due to the different ways chromosomes can be separated.

Meiosis and sexual reproduction are very important processes for they produce **variation in offspring**. Variation is very important to the survival of species in a changing environment. The ability to survive in a changing environment is the basis of Natural Selection - something you'll learn more about later.

Meiosis creates sperm and egg with $\frac{1}{2}$ the number of chromosomes as the other cells. Because of this, sperm and egg can unite to form offspring with the correct number of chromosomes.

Meiosis :Test Yourself

Matching

- | | |
|-----------------------------|---|
| _____ 1. meiosis | a. a sperm or egg cell |
| _____ 2. gamete | b. 3 chromosomes |
| _____ 3. human body cell | c. 6 chromosomes |
| _____ 4. human gamete | d. 23 chromosomes |
| _____ 5. mosquito body cell | e. produces variation in gametes |
| _____ 6. mosquito gamete | f. 39 chromosomes |
| _____ 7. dog body cell | g. 46 chromosomes |
| _____ 8. dog gamete | h. process that produces gametes with only one set of chromosomes |
| _____ 9. crossing over | i. 78 chromosomes |

True or False

- _____ 1. Meiosis is a process that is very important for sexual reproduction.
- _____ 2. Meiosis is a process that is very important for asexual reproduction.
- _____ 3. Gametes are sperm or egg cells.
- _____ 4. Meiosis is a process that produces gametes with four sets of chromosomes.
- _____ 5. Meiosis is a process that produces gametes with two sets of chromosomes.
- _____ 6. Meiosis is a process that produces gametes with one set of chromosomes.
- _____ 7. Human sperm cells contain 46 chromosomes.
- _____ 8. Human egg cells contain 23 chromosomes.
- _____ 9. Mosquito egg cells have 3 chromosomes.
- _____ 10. Dog gametes have 39 chromosomes.
- _____ 11. Each chromosome has one gene on it.
- _____ 12. Each chromosome has many genes on it.
- _____ 13. Crossing over is a process that occurs during meiosis.
- _____ 14. Crossing over makes all eggs exactly alike.
- _____ 15. Crossing over makes gametes from one parent different.

Fill in the Blank

- | | | |
|-------------|---------------------|---------------|
| meiosis | sexual reproduction | sperm |
| egg | one set | two sets |
| chromosomes | genes | crossing over |

gametes

1. Most organisms use _____ to produce offspring.
2. Sexual reproduction occurs when a _____ cell and an _____ cell are united.
3. Most cells in an organism have _____ of chromosomes.
4. However sperm and egg cells, also called _____, only have _____ of chromosomes.
5. _____ is the process that makes reproductive cells that only have one set of chromosomes.
6. _____ are in the nucleus of cells.
7. There are thousands of _____ on each chromosome.
8. Meiosis produces different combinations of chromosomes in each gamete so that the offspring differ. _____ also makes gametes different by separating genes that are connected on the same chromosome.

Answer the Following:

1. What is another word for sperm and egg cells?
2. How many sets of chromosomes are in one egg or sperm cell?
3. What process makes gametes?
4. Describe and explain the process of Meiosis - You may create a drawing if necessary. You may use a fictional organism with 50 chromosomes as an adult to help in your description.
5. On a separate sheet of paper, draw a picture or series of pictures that describes crossing over. Provide an explanation after processing. Explain why there is a mutation.

Meiosis
Answer Sheet

Question 1. Why do human offspring not look exactly like their parents?

Question 2. What would happen during sexual reproduction if meiosis did not occur?

Question 3. If an organism has 88 chromosomes in a normal cell, how many chromosomes would it have in each sperm? _____
in each egg? _____

Question 4. Explain how crossing over occurs and what impact it has on the offspring.