

**Biology: Modeling Meiosis Activity****Background**

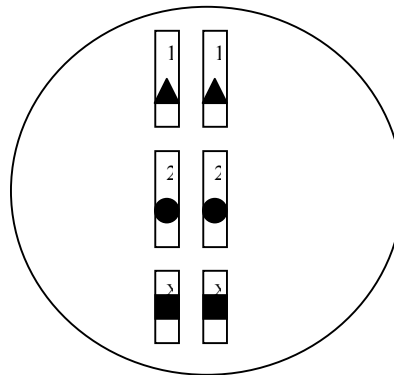
This activity is designed to help you understand the process of meiosis. You will be using manipulatives to act out a simplified version of meiosis as it would happen during the formation of a sperm or egg cell. You will begin with a representation of a cell located in the ovary or testis. You will follow this cell as it becomes an egg or sperm. Then you will fuse one of these eggs or sperm with the gamete of another group to create an offspring.

**Before Meiosis: Interphase**

**Procedure:** Look at the contents of the bag given to you. This bag represents a cell in the testes (male) or ovaries (female) of an organism that has three homologous pairs of chromosomes. Two pairs are autosomes and the third pair are the sex chromosomes. Each chromosome is labeled (1, 2, or X,Y).

Lay out the chromosomes as you see in the drawing below. (You will still have some left in your bag) Place a piece of yarn around them to represent your nuclear membrane.

**Data:** Draw a circle around a homologous pair of chromosomes.

**Analysis**

1. How many maternal chromosomes are in this cell (ie: How many came from its mother)?
2. How many paternal chromosomes are in this cell (ie: How many came from its father)?
3. Is this cell diploid or haploid/ monoploid?
4. For this organism,  $2N =$  \_\_\_\_\_  $N =$  \_\_\_\_\_

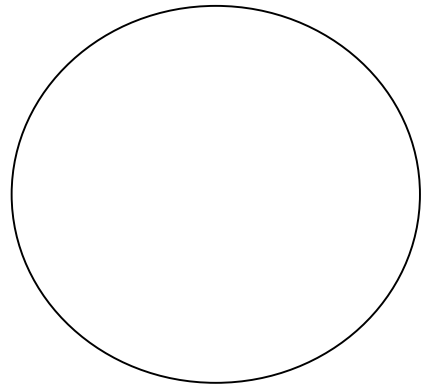
**DNA synthesis:**

**Procedure:**

This cell is about to undergo meiosis. But before it can, its chromosomes must replicate, or copy themselves. To simulate replication, obtain identical chromosomes from the bag and attach them to make duplicated chromosomes (two sister chromatids attached at a centromere).

**Data:**

Draw what is on your desk now in the circle. Include the labels on each chromosome.

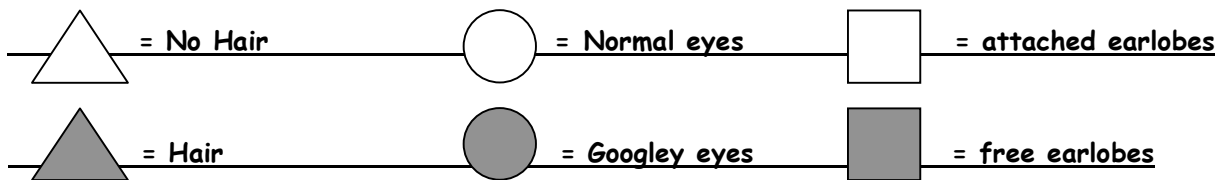


**Analysis:**

1. How many chromosomes are present in this cell? \_\_\_\_\_
2. How many sister chromatids are in this cell? \_\_\_\_\_

*Note that chromosomes with the same number carry the same type of genes (represented by shapes on the chromosomes), but the alleles (versions of the gene) may be different, (represented by the different colors of those shapes).*

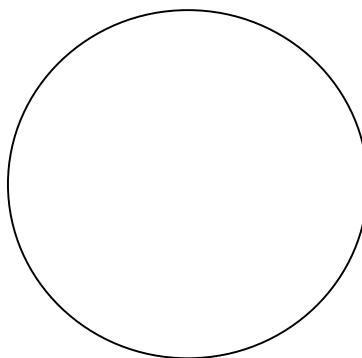
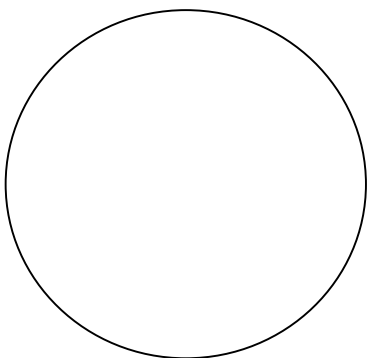
**The following information is true for this organism:**



**Modeling the Process: Meiosis I**

**Procedure:** Line up **homologous chromosomes** on opposite sides of the equatorial plate. Pull each member of a homologous pair in opposite directions away from the equatorial plate. Simulate the formation of 2 daughter cells.

**Data:** Draw what you have on your table .



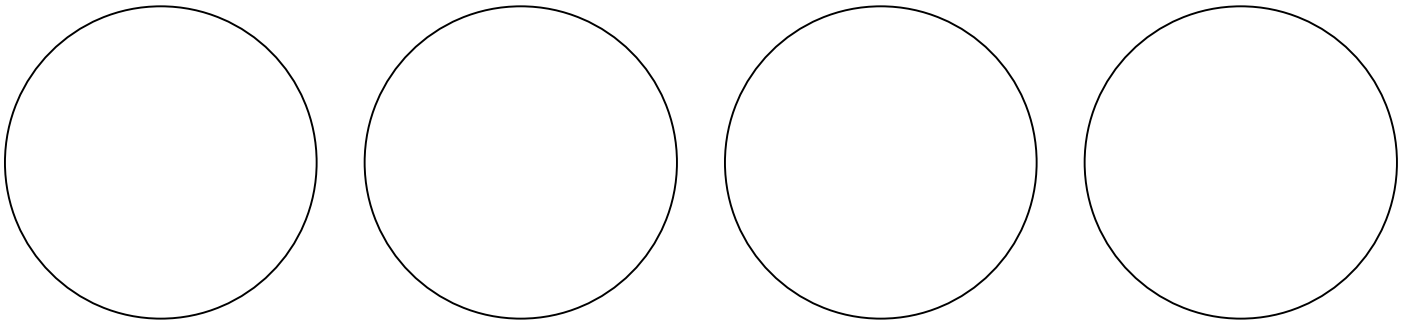
**Analysis**

1. How many **homologous** pairs are in each daughter cell now? \_\_\_\_\_
2. How many chromosomes are in each cell? \_\_\_\_\_

### Modeling the Process: Meiosis II

**Procedure:** Now make the two daughter cells divide again, producing 4 gametes (sperm or egg) For each of the 2 cells, line the sister chromatids up on opposite sides of an equatorial plate. Pull the sister chromatids towards opposite poles.

**Data:** Draw what you have on your table below.



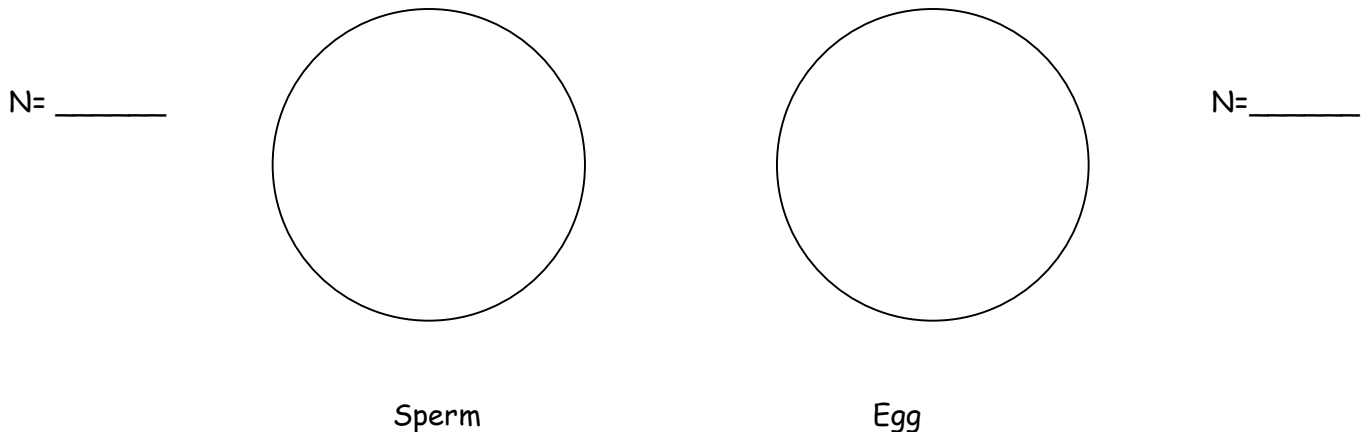
### **Analysis**

1. How many cells did you begin with?
2. How many cells (gametes) are there now?
3. Are the cells haploid/ monoploid or diploid?
4. How many homologous pairs are in each gamete? Explain:
5. Are all of the new cells identical? Why or why not?
6. Did you make an egg cell or a sperm cell? \_\_\_\_\_ How do you know?

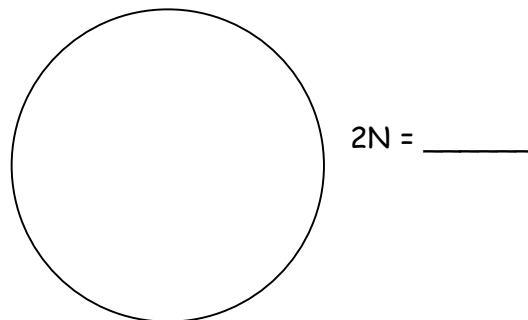
## Fertilization

**Procedure:** Each student in the group needs to randomly pick one of the gametes. If it is a sperm, you must find an egg to fertilize (from another group) and vice versa. You will complete the rest of the lab together. You will fuse the two gametes to produce a zygote (fertilized egg), which can develop into an offspring.

**Data:** Before combining with another gamete, draw the chromosomes of the egg and the sperm below.



After you have fused the sperm and egg cell, organize the chromosomes in homologous pairs. Draw what you have below.



## Analysis Questions:

1. Remember that each of the shapes represents versions of genes. What traits will the new offspring have?
2. If you had chosen a different gamete or the other student had, would the offspring have the same traits?
3. How many different possible combinations of traits were there with the original parents?
4. Why do you suppose that meiosis is more valuable to a species than mitosis as a means of reproduction?

## **Conclusion:**

Summarize the process of meiosis in your own words. This should be one well written paragraph no fewer than 5 sentences. Include the terms meiosis, fertilization, gamete, homologous chromosome and sister chromatids in your summary.