

Meiosis and Sex Determination

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- 1. Overview and Rationale: *Using manipulatives the student will be able to describe the major events in meiosis and how these event are responsible for genetic variation and sex determination.***
2. Objective/Outcome
 - a. *be able to describe the major steps in meiosis***
 - b. *explain how genetic variation can occur within gamete formation***
 - c. *explain how meiosis in males determines the sex of the offspring***
3. Timeframe:
One class period 45-60 minutes
4. Content Area
Biology/ genetics
5. Content of DVD used
Deciphering the language of sex-chapter 31 –animation meiosis
6. Correlation with Standards
Biology: Cell division through meiosis-sex determination
7. Materials
 - a. *DVD***
 - b. *Sex and Gender DVD***
 - c. *Manipulatives (beaded chromosomes)***
8. Procedure
After watching chapter 31, the students will perform activity on meiosis
9. Homework: ***read text on meiosis***

10. Assessment: ***answer the questions of the activity.***
11. Modifications for Honors/SPED/Gifted: ***using the activity try to explain where in the process of meiosis, what is the most likely place for trisomy and chromosomal deletions likely to occur?***
12. Extension: ***If one sperm cells has two XX, what is the likely composition of the other three sperms form this meiotic event. Explain your answer based on the activity.***
13. References/Resources

Essential questions to be answered before performing the activity:

1. How is chromosomal reduction accomplished?
2. How does genetic variation occur in gamete formation?
3. What are the events that occur in each of the two steps of meiosis?
4. How many gametes are produced from a meiotic event?

Materials:

Teacher note: This activity requires that chromosomes be constructed using metal wire and beads. Both the wire and the beads can be bought in any toy/craft store. A pre-activity is the students constructing the chromosomes. Select a particularly distinct bead to represent the centromeres and each bead thereafter represents specific genes. These beads (genes) can then be manipulated to demonstrate events in meiosis and mitosis.

Beaded chromosomes

DVD player

DVD *The meaning of sex and gender*

Procedure:

Carefully watch the DVD player and answer the following questions:

1. What is the normal chromosome number for humans?

2. What are the two things that happen in meiosis?

Simulation of Meioses

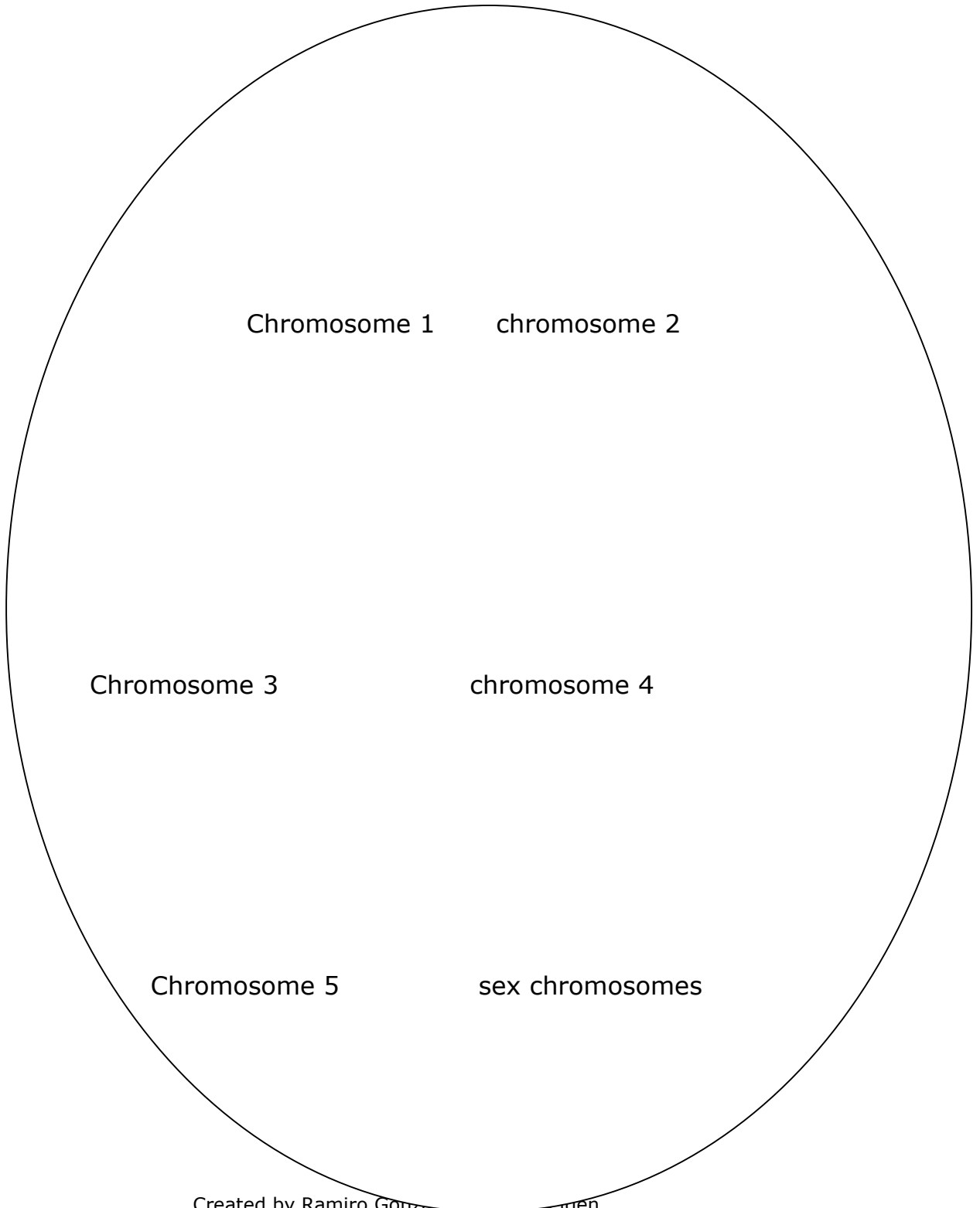
Step One:

Observe that each chromosome has a **homolog**, which is a mate that looks very much like it.

- Arrange the homologs side-by side in figure one. You should have 10 chromosomes that look identical except for color, (**the green are mother's contribution, the blue represent father's contribution**). You should have a set that is not homologs, these are **the sex determining chromosomes**. The gold bead in each chromosome is a **centromere**. The chromosomes that are not sex determining chromosomes are called **autosomes**.

1. In our model what do the beads represent? _____
2. Compare and contrast the X and Y chromosomes models given.

Figure One:
Arrange the chromosomes in the oval provided; arrange them from tallest to shortest.



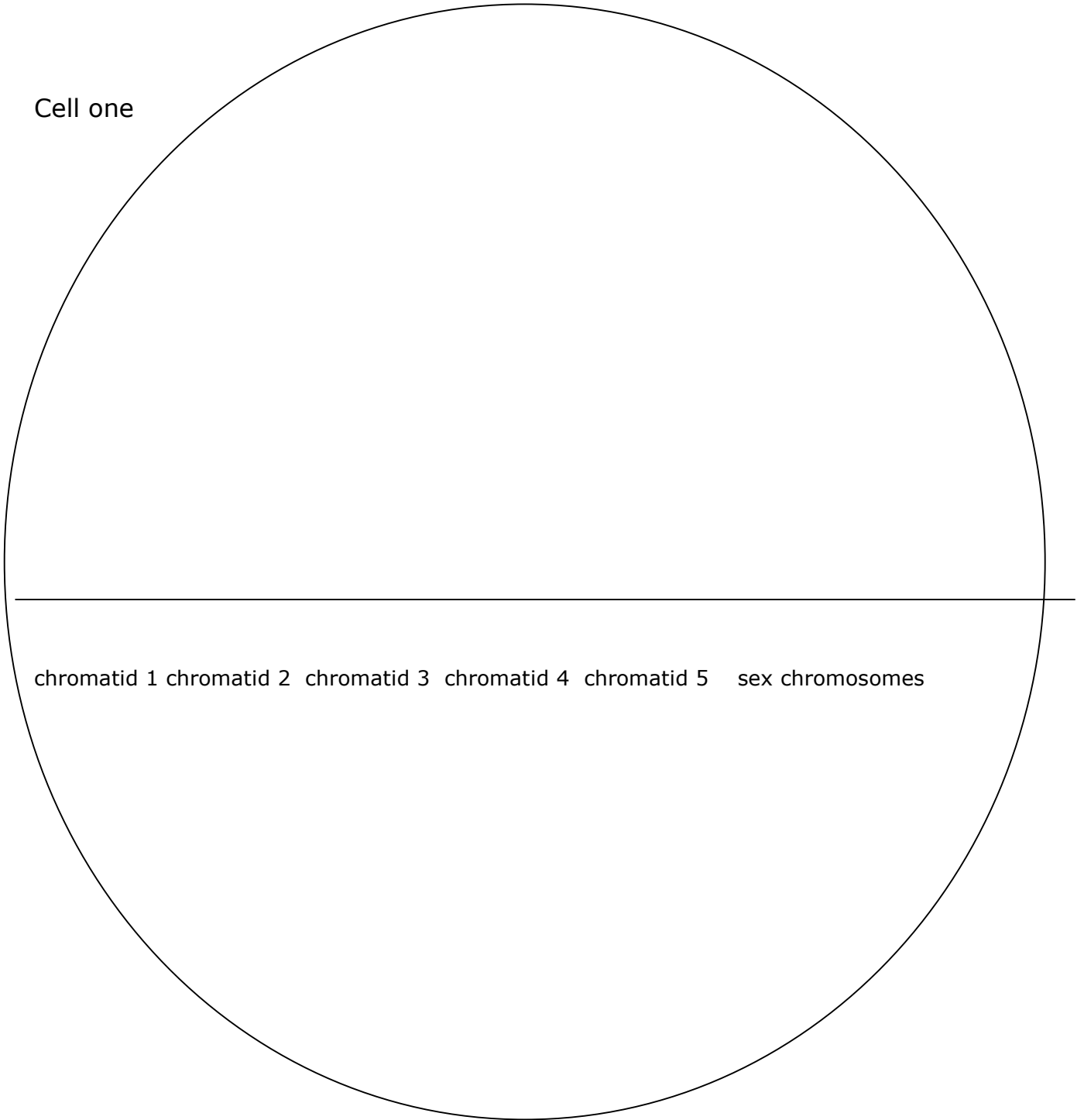
2. What structures helped you determine which chromosomes were homologous?

The beginning of meiosis is characterized by each chromosome making a copy of itself and copy remaining by its side, these are called **tetrads**.

- Using the remaining chromosomes arrange them so that tetrads are made. Use a small piece of wire to tie the sister chromatids together, tie them at the centromeres. How many chromosomes are now? _____ The cell has gone from the diploid ($2n$) to the tetraploid number ($4n$).
 - Observe the DVD before performing the next operation. The DVA is animation is explaining a process called **crossing over** in which sister chromatids exchange genetic material. This crossing over occurs in all chromosomes and may occur at many different locations throughout the sister chromatids. Now using your chromosomes perform crossing over in all chromosomes. In this activity crossing over is performed by exchanging beads from one chromatid to its neighbor. Only the inner two chromatids exchange material, the outer two are not involved.
3. Based on the animation, what might the red bead on the Y chromosome represent? _____
4. Examine the X and Y Chromosomes, based on the animation and your model chromosomes, which parts of the chromosomes are available for crossing over?
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5. After crossing over what percent of the chromosomes are now different from the original? _____
- Arrange the chromatids horizontally on figure two. This will mark the process of separation of sister chromatids into two new cells.

Figure two: arrange the chromatids along the equator.

Cell one



Cell two

- Move the chromatids so that each new cell has a pair of chromatids.
6. How are the two new cells similar to the original cell? How are they different?
-
7. At this point which has occurred, genetic variation or a reduction of chromosome numbers? _____

Step Two: Second cell division

- Arrange the chromatids along the equator (Figure 3 and 4) of two cells and remove the tie and separate the chromatids so that each chromatid moves to the opposite end of the cells. This will result in the production of four cells.
8. There are now four new cells, how are these new cells different from the original cell from the start of this activity?

9. How are the new cells from each other, explain how the difference if any can be.

10. There where to cell division place a number one if it occurred in the first cell division or a number two if it occurred in the second cell division or 1 and 2 if it occurred in both cell divisions.

- _____ a. tetrads are formed
- _____ b. crossing over
- _____ c. chromosomal number reduction occurred (haploid)
- _____ d. sister chromatids separate
- _____ e. two diploid cells are produced
- _____ f. four haploid cell are produced
- _____ g. genetic variation resulted

11. How many sperm cells are produced as a result of meiosis?

12. How many cells produced from meiosis carry a Y chromosome?
_____ How many Carry an X chromosome. _____

Figure 3

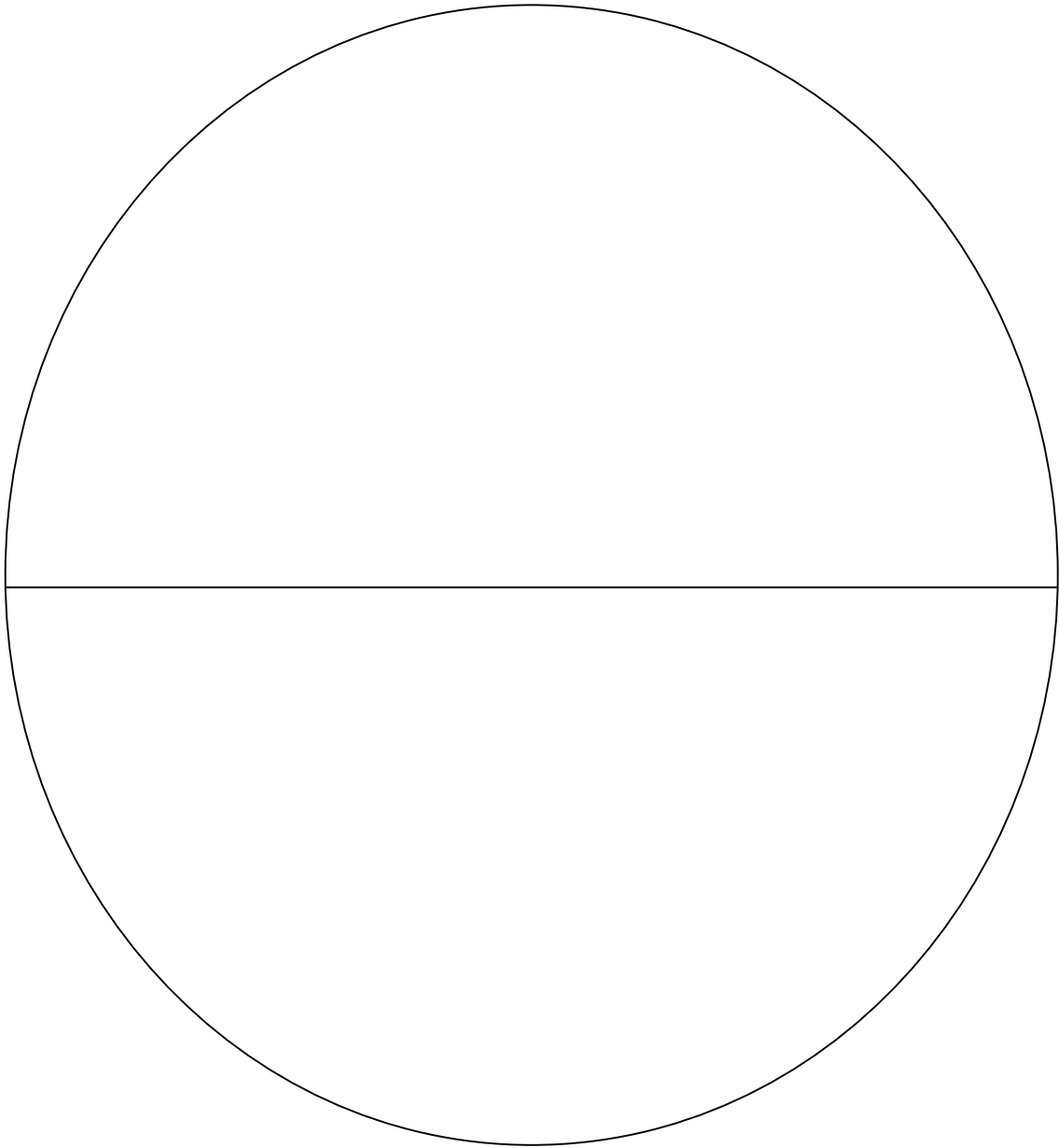
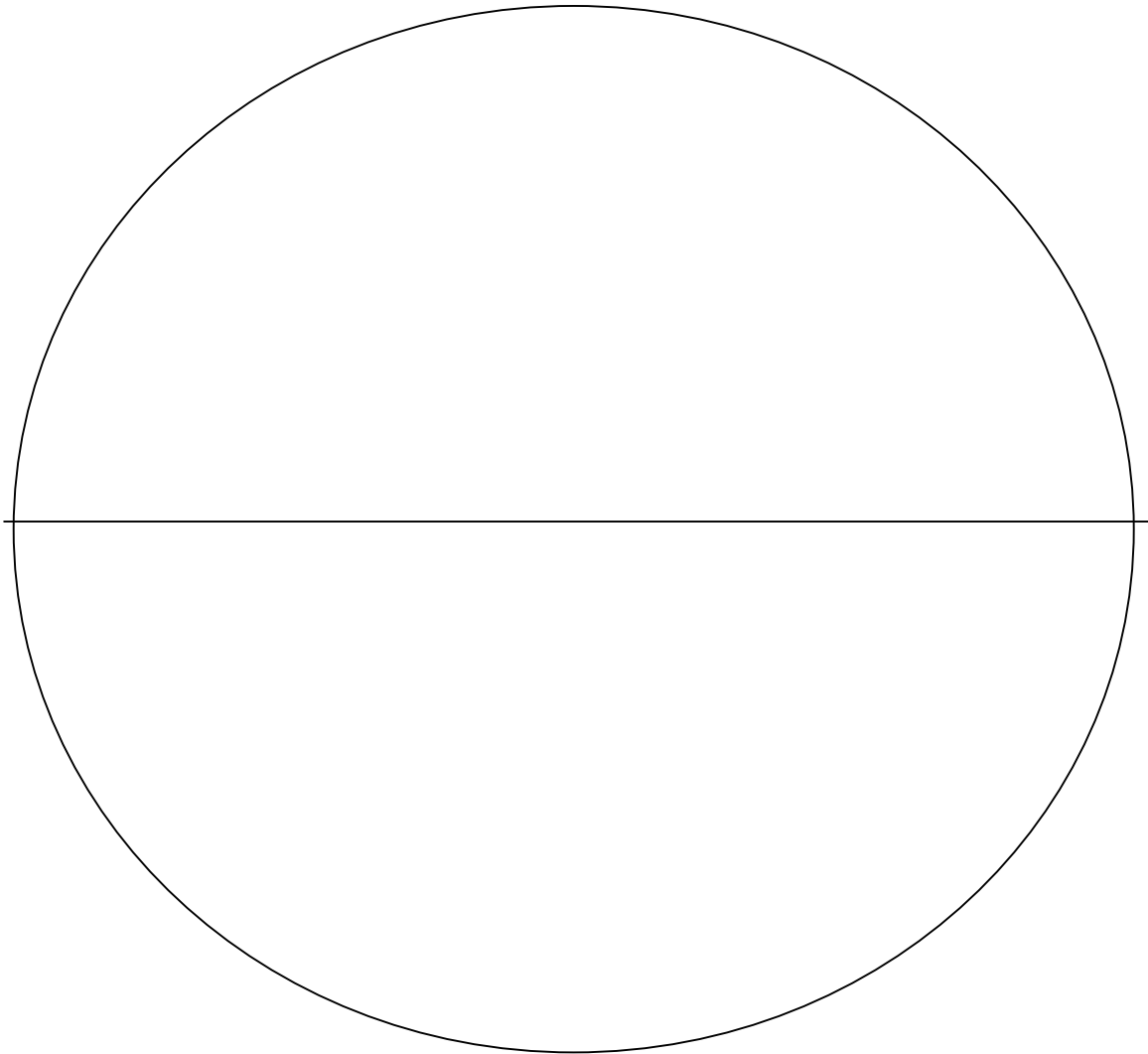


Figure Four



Name _____

Activity One: "What am I"

Are you a boy or a girl and how do you know?	When in your development did you become a boy or a girl?	What determines you as a boy or a girl?

What is the minimum requirement needed to be a male? To be a female?

Week one:

- Cells
- Organelles
- Nucleus
- Chromosomes and genes

Week two

- DNA
- Gene expression
- Cell division/mitosis/meiosis
- Haploid and diploid cells

Week three
Begin genetics
Mendel/fruit flies
Problems

Week four

Revisit sex determination –autosomes and sex chromosomes