**Meiosis Pipe Cleaner Lab**

**Background:** Meiosis is the division of the nucleus (and the chromosomes inside of it) in sex cells. One cell divides to form 4 cells with a lower chromosome number. This process happens continuously in all living things that are made up of more than one cell, after puberty. In males, the process will lead to the formation of sperm cells, and in females, meiosis leads to the formation of one egg cell at a time.

**Objective:** To model the various stages of Meiosis using two different colors of pipe cleaners.

**Materials:**

- 2 strands of different color pipe cleaner

- beads of two different colors

- Colored pencils

**INTERPHASE:**

**Questions:**

1. What happens during the G1 and G2 phases of interphase? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What happens during the S phase of interphase? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What links together the two sister chromatids after DNA replication? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What are homologous chromosomes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- **Obtain two strands of two different colored pipe cleaners. Cut the strands so you get**:

o 2 long strands of each color

o 2 short strands of each color

5. Which color pipe cleaner represents maternal chromosomes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Which color pipe cleaner represents paternal chromosomes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**- Now you are going to help your cell go through the S phase and you are going to replicate or copy the chromosomes!!!!**

o Link 2 of the long strands of the same color together by twisting the pipe cleaners together (the twist should represent the CENTROMERE)

o Repeat for small strands of all colors.

o Once completed with this step you should have two large double chromosomes, and two small double chromosomes.

o Now add a blue bead to the bottom right leg of your blue chromosomes (X’s) and add a pink bead to the bottom right leg of your pink chromosomes (X’s)

These beads represent a section of DNA (gene)

7. How many total chromosomes does our parent cell therefore have? (hint: count the number of X’s) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MEIOSIS 1:**

**Questions:**

8. What is the first stage of meiosis 1 called? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Where do your homologous chromosomes originally inherit (come) from?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. What is a tetrad? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. What is crossing over? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**- Draw one large cell with chalk in the center of your table and place your chromosomes inside of the cell.**

**- You are now in Prophase 1.**

o First you need to make sure that your homologous chromosomes have found one another and are placed next to one another in the cell

**Hint: homologous chromosomes are the same size**

o Next you need to demonstrate crossing over. Remove the small blue bead from the bottom of the large blue chromosome and remove the small pink bead from the bottom of the large pink chromosome. Then place the blue bead on the pink chromosome and the pink bead on the blue chromosome. (Repeat for small chromosomes!)

**This represents crossing over!!**

o Draw what you see on your lab report:

**Title the picture: PROPHASE 1**

**Label: HOMOLOGOUS CHROMOSOMES, CENTROMERES, TELL ME WHICH COLOR PIPE CLEANER IS MATERNAL AND WHICH IS PATERNAL**

12. What happens during Metaphase 1?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- **You are now in Metaphase 1.**

o Line up the homologous chromosomes in the center of the cell.

o Draw what you see on your lab report:

**Title the picture: METAPHASE 1**

**Label: HOMOLOGOUS CHROMOSOMES, CENTROMERES**

**- You are now in Anaphase 1.**

o Pull one homologous chromosome to one side of the cell and the other homologous chromosome to the other side of the cell.

o Repeat for the other set of homologous chromosomes.

**- You are now in Telophase 1 and Cytokinesis.**

o **Draw two new daughter cells.**

o You should have two chromosomes in one cell and two chromosomes in the other cell. (The chromosomes in each daughter cell should be made of different sizes of pipe cleaners!!)

13. After Anaphase 1 have the centromeres (pipe cleaners) been split? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. How many daughter cells do you end up with after Telophase 1? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15. Is it possible to have all the same color pipe cleaners in the same daughter cell? \_\_\_\_\_\_

16. Why is it bad to have all the pipe cleaners the same color? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MEIOSIS 2:**

**Questions:**

17. During Meiosis 2 what will happen to the sister chromatids?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

18. What other process is Meiosis 2 very similar too? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- **You are now in Prophase 2.**

o Draw what you see on your lab report:

**Title the picture: PROPHASE 2**

**Label: SISTER CHROMATIDS, CENTROMERES, DAUGHTER CELLS**

19. What happens during Metaphase 2?

**- You are now in Metaphase 2.**

o Line up the sister chromatids in the center of both daughter cells.

o Draw what you see on your lab report:

**Title the picture: METAPHASE 2**

**Label: SISTER CHROMATIDS, CENTROMERES**

- **You are now in Anaphase 2.**

o Pull the sister chromatids apart (breaking the bond made by the twisting of the pipe cleaners)

**- You are now in Telophase 2 and Cytokinesis.**

o **Draw four new daughter cells on your lab report.**

o Place the correct number of chromosomes in the daughter cells.

20. After Anaphase 2 have the centromeres (pipe cleaners) been split?

21. How many daughter cells do you end up with after Telophase 2?

o Draw what you see on your lab report:

**Title the picture: TELOPHASE 2**

**Label: CHROMOSOMES, DAUGHTER CELLS**

**CONCLUSION QUESTIONS: WRITE IN COMPLETE SENTENCES!!!!!!!!**

1. How many chromosomes did your original parent cell have (at the beginning of the lab)?

2. Was this parent cell diploid or haploid?

3. How many chromosomes did each of your daughter cells have (at the end of the lab)?

4. Were the daughter cells diploid or haploid?

5. If human somatic cells have 46 chromosomes, how many chromosomes do human gametes have?

6. Are human gametes haploid or diploid?

7. Are human somatic cells haploid or diploid?

8. Are fertilized eggs haploid or diploid?