



Chapter 11 Project

Modeling Meiosis

Project Goal + Timeline

In this project, we will be reviewing your knowledge on meiosis and sexual reproduction. You'll do this by modeling the process of meiosis using beads, string, and magnets. This project should be completed by yourself or within a group in a two-hour time frame.

Directions

Part 1: Create Chromosome Models

First, you'll construct your chromosome models. In Steps 1 and 2, you'll create two homologous, large chromosomes. In Steps 3 and 4, you'll create two homologous, small chromosomes.

1. Attach 5 yellow pop beads to each side of the magnetic centromere. When you are done, you should have a string of 10 yellow pop beads with the magnetic centromere in the middle. Then repeat this process to create two identical sister chromatids of a single chromosome.
2. Repeat the previous step with red beads. This step will create two identical sister chromatids of a chromosome homologous to that created in Step 1.
3. Repeat Step 1, except use 3 yellow beads on one side of the magnetic centromere and 2 on the other side. When you are done, you should have a string of 5 beads with the magnetic centromere between the third and fourth bead. Then repeat this process to create two identical sister chromatids of a single chromosome.
4. Repeat Step 3 with red beads. This step will create two identical sister chromatids of a chromosome homologous to that created in Step 3.

After completing the steps, you'll be able to model a parental cell containing 2 pairs of homologous chromosomes (one large chromosome and one small chromosome). Use a piece of string to make a large circle around your chromosomes. Clump your chromosomes together (like chromatin). The entire model represents the chromosomes in a cell during interphase.

Part 2: Model Meiosis

You're starting with a parental cell with 2 pairs of homologous chromosomes. You'll use your chromosomes to model each phase of meiosis I and II. As you model each phase, sketch your model in the appropriate cell in Table 1.

1. Model each of the following stages of meiosis I.
 - Prophase I:
 - Condense your chromatin into chromosomes connected at their centromeres. You should create four condensed chromosomes (one large red, one large yellow, one small red, one small yellow).
 - Model chromosomal crossover between chromatids of the homologous pairs. Exchange beads from one chromatid on the large, yellow chromosome with beads from one chromatid on the large, red chromosome. Likewise, exchange beads from one chromatid on the small, yellow chromosome with one chromatid on the small, red chromosome. This exchange should generate non-identical sister chromatids.
 - Metaphase I: Line the homologous chromosomes up on the center of the cell (the two large, homologous chromosomes together and the two small, homologous chromosomes together).
 - Anaphase I: Pull one homologous chromosome from each of the large and small pairs to opposite sides of the cell.
 - Telophase and Cytokinesis I: Use the string to form two circles, one around each set of chromosomes.

TABLE 2

	Mitosis	Meiosis
Chromosome number of parent cells (n or $2n$)		
Number of daughter cells produced		
Chromosome number of daughter cells (n or $2n$)		
Present in sexual or asexual reproduction		
Crossing over		

Project Materials

- 1 data table and corresponding questions
- Pop beads of two different colors
- Magnetic centromeres
- String
- Scissors
- Pen or pencil



Student Checklist

- ☐ Model meiosis I and II
- ☐ Complete Table 1
- ☐ Complete meiosis review questions
- ☐ Complete Table 2