Name _____ **Period** _____

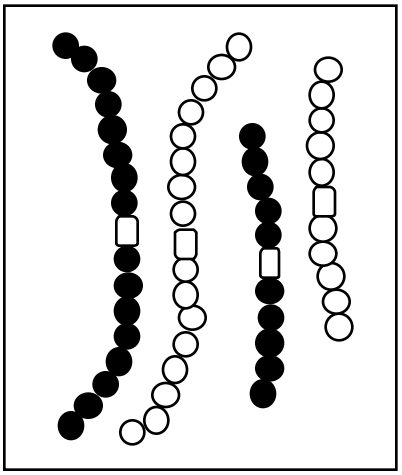
AP Biology **Date** _____

LAB ____. MEIOSIS

While asexual reproduction in multicellular organisms is accomplished through mitosis. Sexual reproduction requires a special form of cell division, called **meiosis**. Meiosis provides a reduction division process that reduces chromosome number by half to make **haploid** (1n) cells. In this way, **gametes** (or sex cells: sperm and egg) are formed that have half the number of chromosomes as body (or somatic) cells. This allows gametes to combine during **fertilization** which restores the **diploid** (2n) number of chromosomes in the **zygote**. Consequently as the zygote undergoes mitosis, it produces diploid clone cells developing into the new multicellular organism.

PART 1. SIMULATING MEIOSIS

1. Using the pop-it beads provided by your teacher to model chromosomes, demonstrate your understanding of the process of meiosis. Begin with a cell with 4 chromosomes (2 pairs of homologous chromosomes, therefore the diploid number = 4). Distinguish the pairs of chromosomes from each other by size (one pair long and one pair short). Distinguish the members of each homologous pair by color. The magnet will represent the centromere. Use construction paper to represent the rest of the cell. Demonstrate to your teacher the process of meiosis in this cell. Do not forget to include crossing over.



Teacher's initials _____

PART 2. COMPARING MEIOSIS AND MITOSIS

Compare mitosis and meiosis for each of the following factors.

	Mitosis	Meiosis
Chromosome number of parent cell (ploidy state)		
Number of DNA replications		
Number of divisions		
Number of daughter cells produced		
Chromosome number of daughter cells		
Purpose/function		

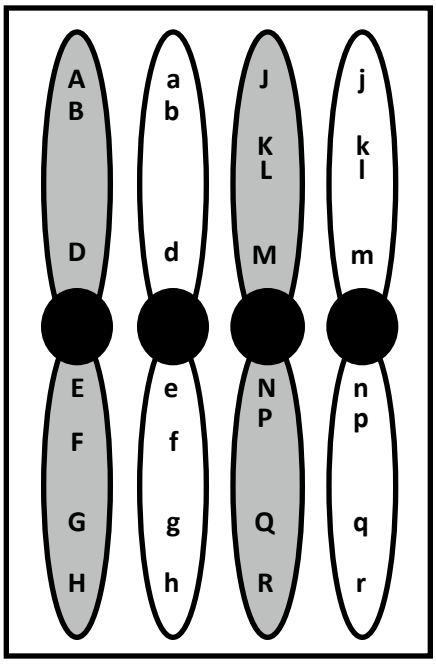
PART 3. REPRESENTING MEIOSIS

Clearly draw the phase of meiosis using a model cell with a diploid number of 2. Clearly show the number of cells produced and the chromosome number of each new cell.

Interphase 1	**Prophase 1**	**Metaphase 1**
Anaphase 1	**Telophase 1**	**Prophase 2**
Metaphase 2	**Anaphase 2**	**Telophase 2 & Cytokinesis**

PART 4. SIMULATING CROSSING OVER

Crossing over is a unique event of meiosis. It occurs during **Prophase 1** when the homologous pairs of duplicated chromosomes pair up in **tetrads**. Sister chromatids entangle and break and re-fuse onto the chromatid of their homologous pair, thereby swapping alleles between chromosomes. Crossover events are common; they happen to every chromosome, during every meiosis. They create an infinite genetic variety in the gametes produced. This genetic variation provides a rich palette of unique traits for natural selection in an ever-changing environment.



1. Your teacher will provide you with 4 chromosomes from a model organism printed on cardstock. Two chromosomes are blue to represent the ones that originally came from the father. Two chromosomes are pink to represent the ones that originally came from the mother. For this simulation, each parent provided a purely homozygous genotype. One parent provided chromosomes that only included the dominant alleles ***ABDEFGHJKLMNPQR***. The other parent provided chromosomes that only included the recessive alleles ***abdefghjklmnpqr***. Therefore our model organism was a heterozygote with the genotype ***AaBbDdEeFfGgHhJjKkLlMmNnPpQqRr***.

2. The chromosomes will have already replicated during S phase of Interphase of Meiosis 1

3. Cut out all eight of the chromosomes.

4. Set the chromosomes up in homologous pairs by taping them side-by-side at their centromeres. Now align them as tetrads as they would be in Prophase 1.

5. By cutting and taping back together your chromosomes, perform a crossover event for each arm of each chromatid in the center of the tetrad. This will mean you will perform *four* crossovers. Choose the cross over site at random, but do not cut in the middle of a gene. Show the crossover products to your teacher.

6. Now complete meiosis and record the genotype of the gametes produced in the table below.

Gametes that would have been produced without crossing over	

Gametes produced with crossing over

SUMMARY QUESTIONS

1. How do meiosis 1 and meiosis 2 differ?

_____

_____

_____

2. Why is meiosis important for sexual reproduction?

_____

_____

_____

3. What was the difference between the gametes produced without crossing over and the ones produced with crossing over?

_____

_____

4. Did your cross over event produce the same gametes as the other lab groups in class?

_____

5. In what way is crossing over important for sexual reproduction?

_____

_____

_____

6. Was there a greater chance to cross over between some pairs of alleles than between others? Explain.

_____

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