COYOTE MEIOSIS LAB

Introduction:

Meiosis is the process that produces sex cells or gametes. In doing so it takes a diploid cell, duplicates its chromosomes then after two rounds of division creates four cells with only one set of chromosomes each (haploid). In today's lab, you will practice the stages of meiosis using strings of beads as models of chromosomes. You will label genes, perform meiosis and then do fertilization. Your result will be zygotes that grow into pups with various inherited traits (use your imagination). Finally you will investigate the survival chances of the pups in certain environments.

Before proceeding, please define these useful terms:

Diploid _____

Haploid _____

Genotype _____

Phenotype _____

Allele _____

Dominant _____

Recessive _____

Sister chromatid _____

Chromosomes _____

Non-replicated chromosome _____

Replicated chromosome _____

Materials Needed:

12 magnets (centromeres)
48 beads of one color, 48 beads of a different color
a roll of removable tape

Procedure:

1. Assume that the coyote's chromosome number is 3. Set up half of the beads exactly as follows. There will be two large chromosomes (one of each color) with 6 beads on one arm and 5 on the other, two medium chromosomes with 3 and 5 beads on their arms and two small chromosomes with 2 and 3 beads.

Note that there are six chromosomes that compose 3 homologous pairs. Each homologous pair consists of a **maternal** chromosome (your coyote received it from its mother's egg) and a **paternal** (your coyote received it from its father's sperm). Make sure to use one color for maternal, another color for paternal.

2. Now construct the genotype of your parent coyote as follows. Use a thin strip of tape to label all genes (three homologous pairs, both chromosomes) with the gene symbols and at exactly the positions shown below. Assign alleles to the genes by flipping a coin to determine whether the dominant or recessive allele will be used for each gene. Remember, the letter for the particular trait has to be the same on each partner in a homologous pair (they must both be L's for example) but they don't have to be the same case. The maternal chromosome could have a lower case "l" while the paternal could be an upper case "L". They may be the same too. It just depends upon the flip of the coin. Below are the traits each allele for the genes create.

Gene 1, Leg length
L = long legs
l = short legs

Long legs are useful for running after large, fast prey but not for stalking small prey in short vegetation.

Gene 2, Ear size
E = large ears
e = small ears

Large ears are good for hearing but bad in very windy climates when ear infections can occur.

Gene 3, Coat color
D = dark coat
d = light coat

Coat color could contribute to staying cool or warm or help hide in dark or light environments.

Gene 4, Vision
G = good daytime vision only
g = good nighttime vision only

Gene 5, Claw growth rate
R = slow growing
r = fast growing

Fast growing claws are for digging since that wears them down but can be detrimental for animals living in an environment where they do not wear down.

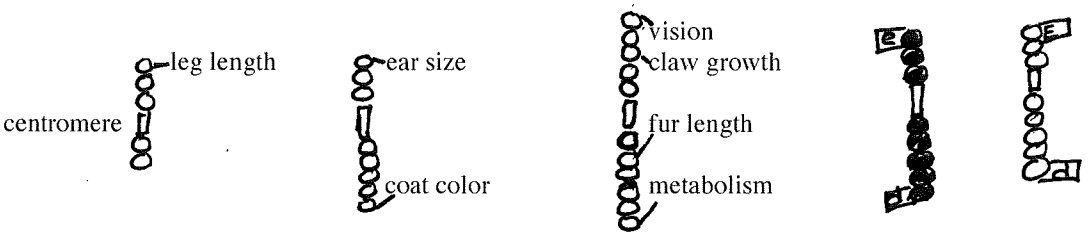
Gene 6, Fur length
F = long fur
f = short fur

Gene 7, Metabolism of pronghorn protein
M = yes
m = no

Meat is meat, but to show that not all traits are outwardly visible we will assume a special enzyme is needed to digest pronghorn antelope meat. If pronghorn are NOT a usual prey item then making this enzyme will waste energy and be detrimental to the coyote.

Gene Positions

For example:



Record the genotype and phenotype for each trait of your coyote in a table in your lab notebook. Set up your table like this.

Trait	Genotype	Phenotype
Leg length		
Ear size		
Coat color		
Vision		
Claw Growth		
Fur length		
Meat metabolism		

3. Now replicate your chromosomes exactly so that you have two of each color and size. Also replicate the labels. If your small green chromosome has an "L" its sister chromatid **must** also have an upper case "L" since they are exact copies not just homologous pairs. Centromeres will now consist of two magnets joined together. The sister chromatids are the same color and the letters must be the same "case" The letters can be the same or different between maternal and paternal chromosomes.

4. Use the description of the phenotypes for the alleles to help you make a drawing of your parent coyote in your lab notebook. Remember the phenotype (appearance) is dependent upon the genotype (dominance, recessiveness of alleles).

5. Now assume that the chromosomes you made are from a testis or ovary cell of an adult coyote. Go through the steps of meiosis. Use your textbook examples to guide you through the steps. Do one cross over (one chromosome arm) per homologous pair. Your result will be 4 haploid gametes.

6. Now you are ready to do what gametes do best! Fertilization! Find another "receptive group" and mate. To mate give two of your gametes to the other group and take two of theirs. Take one of your remaining two gametes and combine it with one of the gametes that you received from the other group. Do the same for the other pair of

gametes. When you combine one of your gametes with one of theirs you have created the genotype of a new individual coyote pup.

7. Record the genotypes and phenotypes of each of your two pups in another table in your lab notebook.

8. Make another table like this.

Trait	Pup 1 Genotype	Pup 1 Phenotype	Pup 2 Genotype	Pup 2 Phenotype
Leg length				
Ear size				
Coat color				
Vision				
Claw growth				
Fur length				
Metabolism				

9. As a class we will discuss the adaptations (phenotypes) that best fit with either of two separate environments and predict the survival and reproductive success of each of your coyotes (parent, pup 1, pup 2.) Make another table like this.

Trait	Pup 1 PV	Pup 1 MM	Pup 2 PV	Pup 2 MM	Parent PV	Parent MM
Leg length						
Ear size						
Coat color						
Vision						
Claw growth						
Fur length						
Metabolism						
Total +						
Survival?						

10. In your lab notebook answer the following questions based on the results of your experiment by writing a **one-page analysis** of your results.

    Did meiosis and sexual reproduction result in pups with genetic diversity?

    How did the phonotypes differ among the parent, pup 1 and pup 2?

    How did the diversity or lack of diversity affect the survival of the three coyotes in each environment?