Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_\_\_

Linkage Practice

1. In an imaginary species called CHNOPS, there are three pairs of homologous chromosomes. While observing CHNOPS, you notice that some individuals have orange fur and some have blue fur. You also notice that some individuals have one horn and others have two horns. Your supervising biologist informs you that orange fur is dominant and that having two horns is dominant. She also mentions that no one has yet worked on figuring out which genes are on which chromosome.  
     
   A) You obtain a blue furred, single-horn individual and cross it with an individual who is known to be heterozygous for both genes. If these genes are on separate chromosomes, what is the expected phenotypic ratio of the offspring?  
   **25% orange, 2 horns 25% orange, one horn   
   25% blue, 2 horns 25% blue, one horn**  
     
     
     
     
     
   B) CHNOPS, luckily, have huge litters of offspring. This makes genetic analysis easy. From your cross, you obtain 100 offspring. Of these 100, 53 have orange fur and two horns while 57 have blue fur and one horn. Not a single offspring has orange fur and one horn, and no offspring has blue fur and two horns. Draw a conclusion from this data.  
   **The gene for fur color must be on the same chromosome as the gene for horn number.**  
     
     
   C) Draw the parents’ relevant homologous chromosomes below and label the alleles.  
   **Blue furred, single horn parent: Orange fur, 2 horn parent:**  
   **(\_\_b\_\_\_\_\_\_\_\_\_\_\_\_\_h\_\_) (\_\_B\_\_\_\_\_\_\_\_\_\_\_\_\_H\_\_)**  
   **(\_\_b\_\_\_\_\_\_\_\_\_\_\_\_\_h\_\_) (\_\_b\_\_\_\_\_\_\_\_\_\_\_\_\_h\_\_)**  
   D) The supervising biologist is intrigued by your findings and replicates your experiment. The CHNOPS that she crosses are genetically identical to the CHNOPS that you crossed, although these parents produce 120 offspring. Of the 120, 55 have orange fur and two horns. 52 have blue fur and one horn. 6 have orange fur and one horn, and 7 have blue fur and two horns. You are disappointed because these results seem to conflict with your conclusion, but the biologist assures you that you’re still right. What happened?  
   **There must have been some crossing over in order to get these new phenotypes.**
2. It’s several years later and you are working on your PhD in molecular biology. Much more has been established about the CHNOPS chromosomes since the first cross you set up. You know that on chromosome 2, there are genes for eye color (E), fur type (F), and tail length (T). Pink eyes are dominant and yellow eyes are recessive. Wavy fur is dominant and curly fur is recessive. Long tails are dominant and short tails are recessive. You have a male CHNOPS and a female CHNOPS with the following pairs of chromosome 2:  
   Male: Female:  
   (\_\_\_\_E\_\_\_\_\_\_\_f\_\_\_\_\_\_\_\_t\_\_\_) (\_\_\_\_e\_\_\_\_\_\_\_f\_\_\_\_\_\_\_\_t\_\_\_)

(\_\_\_\_e\_\_\_\_\_\_\_F\_\_\_\_\_\_\_T\_\_\_) (\_\_\_\_e\_\_\_\_\_\_\_f\_\_\_\_\_\_\_ T\_\_\_)

1. What are the phenotypes of these CHNOPS?  
   **Male: Pink eyes, wavy fur, long tail**  
   **Female: yellow eyes, curly fur, long tail**
2. Find the phenotypic ratio of the offspring. Assume that there is no crossing over.  
   **1/4 pink eyes, curly fur, short tail**  
   **1/2 yellow eyes, wavy fur, long tail**  
   **¼ pink eyes, curly fur, long tail**
3. Which is more likely: that these parents produce a baby CHNOPS with yellow eyes and a short tail, or that these parents produce a baby CHNOPS with yellow eyes and curly fur? Explain.  
   **It is more likely to get yellow eyes and a short tail because the yellow eyes and short tail are farthest apart on the chromosome. This means that the probability of crossing over happening between those two genes is much higher than the probability of crossing over between the eye color/fur type genes.**