**Genetics Problems**

1. Two black female mice are crossed with the same brown male mouse. Based on the information shown in the table below, answer the following questions:

|  |  |
| --- | --- |
| P1 generation | F1 generation |
| Female A x male A | 9 black, 7 brown |
| Female B x male A | 14 black, 0 brown |

1. What are the genotypes of each parent? Show evidence.
2. Which trait is dominant? Show evidence.
3. Is the dominance of the trait in (b) completely dominant, incompletely dominant, or

co-dominant? Show evidence.

1. In tomatoes, there are two alleles that affect stem color, one purple (P) and one green (p). The following crosses are performed with these results

**parental phenotype offspring phenotypes**

1. purple x green 422 purple, 417 green

2. purple x purple 426 purple, 135 green

3. purple x green 953 purple, 0 green

4. purple x green 404 purple, 387 green

What is the phenotype of the purple parent in cross number 4? Using evidence you collected from the information that you have explain why?

1. A woman with type AB blood is married to a man with type O blood. She has a child

with type A blood. In a divorce suit, the man claims that the child cannot be his biological child because neither he nor the woman have type A blood. Based solely on the information stated here, does the science of genetics support the man’s claims?

Why, Why not?

1. A man with type AB blood is married to a woman with type O blood. They have two natural children, and one adopted child. The children's blood types are: A, B, and O. Which child was adopted? Prove your answer by using genetics concepts.
2. You are a doctor in the emergency room. A young man comes in with a javelin stuck through his stomach. He needs a blood transfusion right away and there is no time to get blood from the local blood bank or to test his blood. His family is in the waiting room and is volunteering to give blood. The terrifying mom says my kids have different blood types but I don’t remember them. Given the following information, explain who should donate the blood? Show evidence

Mom – AB Dad – B Sister – A Brother – B

1. In fruit flies, red eyes are dominant over sepia (brownish) eyes. Being the great genetic student that you are, you happen to have a culture of pure red eye and pure sepia eye flies in your laboratory. While working in your lab late one night, a cute, fuzzy, and fantastically friendly, red eyed fruit fly came in for a crash landing on your banana. Wanting (naturally) to know more about your new friend genotype. Explain the technique you will perform to decide the genotype of your little, buzzing buddy.
2. Let’s say you decide to make your living as a mink farmer. In mink, black fur is dominant over white fur. Since the market for black mink coats is higher than white mink, you (being the entrepreneur that you are) decide to only raise black mink. Everything is going well but the guy you bought your mink from seemed a little crooked! You want to make sure they are pure breeds. Explain how the science of genetics helps you to do so.
3. In monsters having Teeth (T) is dominant and no teeth (t) is recessive



A man has a monster with teeth and would like to breed it to start a monster theme park. Monsters without teeth are more costly to care for because they need special food and they aren’t scary enough to work in your park, so you want to make sure you produce only monsters WITH TEETH. As a geneticist, what your advice will be?

1. In a laboratory population of diploid, sexually reproducing organisms a certain trait is studied. This trait is determined by a single autosomal gene and is expressed as two phenotypes A and B. A new population was created by crossing 51 pure breeding (homozygous) A individuals with 49 pure breeding (homozygous) B individuals. After four generations, the following results were obtained.

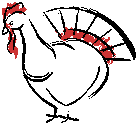
|  |  |  |  |
| --- | --- | --- | --- |
| Number of Individuals | | | |
| Generation | A | B | Total |
| 1 | 51 | 49 | 100 |
| 2 | 280 | 0 | 280 |
| 3 | 240 | 80 | 320 |
| 4 | 300 | 100 | 400 |
| 5 | 360 | 120 | 480 |

* 1. Identify an organism that might have been used to perform this experiment, and explain why this organism is a good choice for conducting this experiment.
  2. On the basis of the data, propose a hypothesis that identifies the pattern of inheritance and the dominant and recessive phenotypes.
  3. According to your hypothesis, explain the change in phenotypic frequency between generation 1 and generation 3.
  4. Draw punnett squares that show the first, second, and third generation.

1. In dogs, there is a hereditary deafness caused by a recessive gene, “d.” A kennel owner has a male dog that she wants to use for breeding purposes if possible. The dog can hear, so the owner knows his genotype is either DD or Dd. If the dog’s genotype is Dd, the owner does not wish to use him for breeding so that the deafness gene will not be passed on. This can be tested by breeding the dog to a deaf female (dd). Draw the Punnett squares to illustrate these two possible crosses.

In each case, what percentage/how many of the offspring would be expected to be hearing?Deaf? How could you tell the genotype of this male dog? Also, using Punnett square(s), show how two hearing dogs could produce deaf offspring.Top of Form

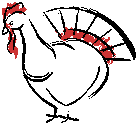
1. If two hearing dogs were both Dd, what kind(s) of gametes (eggs/sperm) could each produce?   
   Draw a punnett square that show their offspring if they are bred with each other.
2. Gray feathers are dominant over white in turkeys. Fill in the allele combinations for each turkey in the cross below. You will need to determine the CORRECT letter to represent the alleles (complete the key first):

 X j0250585

Gray = \_\_\_\_

White = \_\_\_\_

\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

j0250585 j0250585  j0250585

\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

Use complete sentences and punnett square(s)to answer the following:

1. Is the white turkey in the P generation heterozygous or homozygous? How do you know?

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1. Is the gray turkey in the P generation heterozygous or homozygous? How do you know?

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1. If the gray turkey in the P generation was homozygous, what would you expect the offspring to look like? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Problem: In fruit flies, the gene for normal wings is dominant over the gene for stubby wings. A heterozygous male fly is mated with a stubby winged female, and 200 offspring were counted about two weeks later.
3. According to the laws of probability and inheritance, what would the expected ratio be of normal to stubby winged flies?
4. Of the 200 offspring counted, 95 had normal wings and 105 had stubby wings. How far off from the expected is your data?
5. What is the genotypic ratio for the above cross? What is the phenotypic ratio?
6. What are the chances of obtaining a fly with stubby wings?
7. What are the chances of obtaining two flies in a row with stubby wings?
8. If the first two flies had stubby wings what are the chances of the third fly having stubby wings?
9. A woman with type A blood is claiming that a man with type AB blood is the father of her child, who is also type AB. Could this man be the father? Show the possible crosses; remember the woman can have AO or AA genotypes. It is possible. The mother can be either AA or AO and still produce a child with type AB blood from that father.
10. Four newborn babies in the delivery room of the hospital at the same time were

mixed up by the nurse who attached the wristbands. The blood types of the four babies were know to be AB, O, A and B. How did the doctors find out which baby belongs to which set of parents?

Parents 1 had blood types O and AB

Parents 2 had blood types AB and B

Parents 3 had blood type O

Parents 4 had blood types O and A

1. Who are the parents of Baby with blood type AB?
2. Who are the parents of Baby with blood type B?
3. Who are the parents of Baby with blood type A?
4. Who are the parents of Baby with blood type O?
5. Adrienne and Jason were at the hospital to have a baby. Jason has blood type A and Adrienne has blood type AB. The hospital brings a child to them that they believe is not theirs. The blood test shows the baby is homozygous A. Will they be suing the hospital? Explain your answer.
6. Will claims he is the father of Sara’s child. Sara says there is no way, that Jacob is the father of her child. Will decides to take her to court, the judge orders blood tests and the following information is found.

Sara has heterozygous A blood

Jacob has homozygous B blood

Will has AB blood

The baby has O blood

**Test Cross**

INTRODUCTION:

TEST-CROSS RULES:

A. Always cross the unknown genotype with a homozygous recessive

B. Observe (count) large numbers of offspring to ensure accuracy in determining the unknown genotype.

PROBLEMS:

1. In fruit flies, red eyes are dominant over sepia (brownish) eyes. Being the great genetic student that you are, you happen to have a culture of pure red eye and pure sepia eye flies in your laboratory. While working in your lab late one night, a cute, fuzzy, and fantastically friendly, red eyed fruit fly came in for a crash landing on your banana. Wanting (naturally) to know more about your new friend, you decide to run a test-cross on your little, buzzing buddy.
   1. Give the phenotypes of the flies in your test-cross:\_\_\_\_\_\_\_\_\_\_\_X\_\_\_\_\_\_\_\_\_\_\_
   2. If all of the offspring turn out to be red-eyed (all 347 of them!!!) what would the genotypes of the flies used in your test-cross? (Use “R” and “r”)

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\_\_\_\_\_\_\_\_\_\_\_X\_\_\_\_\_\_\_\_\_\_ Diagram the cross:

Genotypic ratio= \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio=\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. If about 179 of the 347 show up with sepia eyes, what was the actual genotype of your new found friend? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Let’s say you decide to make your living as a mink farmer. In mink, black fur is dominant over white fur. Since the market for black mink coats is higher than white mink, you (being the entrepreneur that you are) decide to only raise black mink. Everything is going well but the guy you bought your mink from seemed a little crooked! You want to make sure they are pure breeds so you run a test-cross.
   1. Give the phenotypes of the mink in your test-cross:\_\_\_\_\_\_\_\_\_\_\_\_X\_\_\_\_\_\_\_\_\_\_\_
   2. In your first test-cross, 30 out of 60 offspring are black and the rest are white! No wonder you got such a good deal! What are the genotypes of the mink used in your test-cross? (Use “B” and “b”)

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\_\_\_\_\_\_\_\_\_\_\_X\_\_\_\_\_\_\_\_\_\_ Diagram the cross:

Genotypic ratio=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Was the black-furred mink you chose for your test-cross a pure breed? What is his genotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Since you have many mink and there may only be one bad one in the bunch, you decide to do a second test-cross on a different mink. This time out of 55 offspring, every last one is black! What are the genotypes of the mink used in this test-cross?

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\_\_\_\_\_\_\_\_\_\_\_X\_\_\_\_\_\_\_\_\_\_ Diagram the cross:

Genotypic ratio=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotypic ratio=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Are you still in the mink business? Or is fake fur the way to go? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Hearing (D) in dogs is DOMINANT. Deafness(d) in puppies is caused by a recessive gene. Deaf puppies have the genotype dd.

You have a hearing dog. What are its possible genotypes?\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_

The dog that you use to do a test cross should have:  
 genotype? \_\_\_\_\_\_\_ phenotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Show the results of test crossing BOTH OF THE POSSIBLE PARENT GENOTYPES:

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An actual test cross results in a litter with:  
 12 hearing puppies and 3 deaf puppies.

What is the genotype of your parent dog? \_\_\_\_\_\_\_\_\_\_\_\_

\* \* \* \* \* \* \* \* \* \* \* \* \* \*

Firebreathing (F) is dominant in dragons. NON-firebreathing (f) is recessive.



You have a firebreathing dragon. What are its possible genotypes?

\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_

The dragon you should use to do a test cross should have:  
 genotype? \_\_\_\_\_\_\_ phenotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Show the results of test crossing BOTH OF THE POSSIBLE PARENT GENOTYPES:

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An actual test cross results in a litter with:

6 firebreathing dragons   
 1 NON-firebreather

What is the genotype of your firebreathing dragon? \_\_\_\_\_\_\_\_\_

THINK CAREFULLY ON THIS ONE!

In MONSTERS having TEETH (T) is DOMINANT and NO TEETH (t) is RECESSIVE



You have a monster with teeth and would like to breed it to start a monster theme park. Monsters without teeth are more costly to care for because they need special food and they aren’t scary enough to work in your park, so you want to make sure you produce only monsters WITH TEETH.

Tell the genotype of the monster you should use to do a test cross. \_\_\_\_\_\_\_\_

What is its PHENOTYPE? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Show the results of test crossing BOTH OF THESE POSSIBLE PARENT GENOTYPES:

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An actual test cross results in a litter with:

2 monsters WITH TEETH

Can you tell the genotype of your parent monster? \_\_\_\_\_\_\_\_\_

EXPLAIN YOUR ANSWER \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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