Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_

Using Punnett Squares to Predict Genotype and Phenotype Frequencies

Using Genetic Vocabulary:

1. Some people have attached ear lobes and others have “free” or unattached ear lobes. Free ear lobes are dominant so the allele for free ear lobes is “F” and the allele for attached ear lobes is “f”.

Complete the following table.

|  |  |  |
| --- | --- | --- |
| Genotype | Phenotype | Heterozygous or homozygous (include recessive or dominant for homozygous) |
| Ff |  |  |
|  |  | Homozygous dominant |
|  | Attached ear lobes |  |

**Complete or Make Punnett Squares to Answer the Following Questions:**

1. Use the selected traits in cats to answer the questions below.

|  |  |  |
| --- | --- | --- |
| Trait | Dominant Allele | Recessive Allele |
| Coat Length | http://www.nationalpetregister.org/photos-found/8912140600.jpg Short Hair (S) | http://www.allanimalsites.com/news/gallery/somali-cat/somali_cat_3.jpg Long Hair (s) |
| Tabby Stripes | http://upload.wikimedia.org/wikipedia/commons/4/46/Tabby-cat-domestic-shorthair-balthazar.jpg Tabby (T) | http://ophotostop.com/wp-content/uploads/2013/01/British-Shorthair-Cat.jpgStripeless (t) |
| Colorpoint (markings on nose, ears, paws and tail) | http://www.veanimals.com/images/stories/cat/european-short-haired-cat.jpg Normal (no colorpoint) (N) | [http://t1.gstatic.com/images?q=tbn:ANd9GcRwzpJJNfRuJB0CwFHaImO2bCIpXfw6ktWIyABcEKIPAIawS7iTZw](http://www.google.com/imgres?q=cat+colorpoint+markings&hl=en&safe=active&tbo=d&qscrl=1&rlz=1T4AURU_enUS501US501&biw=1140&bih=716&tbm=isch&tbnid=q6GVqL76SM_JPM:&imgrefurl=http://www.papaleng-amazing-animals.com/2012_03_01_archive.html&docid=uxCpmBbxBagA0M&imgurl=http://1.bp.blogspot.com/-gup8hewySOg/T27AjLr8AnI/AAAAAAAACvE/nQJPfL0_BQU/s1600/1c.jpg&w=640&h=488&ei=WCwAUb_TDI3-8ASp54GYCw&zoom=1&iact=rc&dur=465&sig=112159775744823101638&page=2&tbnh=134&tbnw=176&start=26&ndsp=31&ved=1t:429,r:27,s:0,i:166&tx=99&ty=64)Colorpoint (n) |

1. Cross a heterozygous short-hair (Ss) with another heterozygous short-hair (Ss).

|  |  |
| --- | --- |
|  |  |
|  |  |

Genotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A heterozygous tabby is crossed with a stripeless.

Genotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Show the possible offspring of a colorpoint and a homozygous normal.

Genotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. In humans, hitchhiker’s thumb is dominant over a straight thumb. The dominant allele is **H** and the recessive allele is **h**.
   1. Predict the phenotype and genotype frequencies for offspring when one parent is heterozygous and the other parent is homozygous dominant. Include a Punnett square.

Genotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Phenotype frequency \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Tell whether any of the offspring are “carriers” for a straight thumb and **explain** your answer.

1. In cattle, the hornless condition (H) is dominant and the horned condition (h) is recessive. A bull without horns is crossed with a cow with horns. Of the four offspring, one (1) is horned and three (3) are hornless. Determine the genotype of the bull and the cow.   
   Hint: draw a Punnett square and work backward.

Bull genotype: \_\_\_\_\_\_\_\_\_\_\_\_\_

Cow genotype: \_\_\_\_\_\_\_\_\_\_\_\_\_

1. Blood Type of Inheritance: In blood typing, the allele for type A and the allele for type B are codominant. The allele for type O is recessive. Using Punnett squares, determine the possible blood types of the offspring when:
   1. Father is type O; mother is type B homozygous.



|  |  |
| --- | --- |
|  |  |
|  |  |

* 1. Father is type A, heterozygous; mother is type B, heterozygous.



* 1. Father is type O; mother is type AB



* 1. Explain why blood type O is considered the universal donor?

1. **Color-blindness is sex-linked and recessive**.
   1. A woman who is color-blind has a mother with normal vision. Determine the genotype for both the mother and the father of the color-blind woman.
   2. Explain your answer.
2. Most house cats have long tails, but some are bob-tailed (have a short tail), and others are manx (have no tail). There are two alleles for tail length, a long-tail allele (L) and a no-tail allele (l).

|  |  |  |
| --- | --- | --- |
| Long tailed cat | Bob-tailed cat | Manx tailed cat |
| 2008oct11_patches | Japanese_Bobtail_Cat_Breed | manx |

* 1. Explain why some cats can be bob-tailed.
  2. Predict the phenotype and genotype percentages for offspring when a long-tailed cat is paired with a manx (no-tailed) cat. Include a Punnett square.  
     Hint: both of these cats are homozygous.
  3. Do any of the offspring have the same genotype as either parent? Explain why or why not.

EXTRA CREDIT or HONORS

Open Discovery Education, Biology, Heredity, Genetics, Explore tab, page 5 to learn how to do Punnet Squares for dihybrid crosses.

1. Use the cat traits table to determine phenotype and genotype frequencies in the following dihybrid crosses.

a. Cross a homozygous short hair, homozygous colorpoint ***with a*** homozygous long hair, homozygous normal.

Genotype frequency:

Phenotype frequency:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. A heterozygous tabby, heterozygous normal parent produces offspring with a stripeless, colorpoint parent.

Genotype frequency:

Phenotype frequecy:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |