

Genetics: Monohybrid Crosses

Name _____

Use the information provided and your knowledge of genetics to answer each question.

1. For each genotype below, indicate whether it is a heterozygous (He) OR homozygous (Ho).

TT _____ Bb _____ DD _____ Ff _____ tt _____ dd _____
Dd _____ ff _____ Tt _____ bb _____ BB _____ FF _____

Which of the genotypes in #1 would be considered purebred? _____

Which of the genotypes in #1 would be hybrids? _____

Mendel discovered many key principles of genetics by performing experiments with pea plants.

2. Determine the phenotype for each genotype using the information provided about pea plants.

Yellow seed color is dominant to green.

YY _____ Yy _____ yy _____

Round seed shape is dominant to wrinkled seed shape.

RR _____ Rr _____ rr _____

3. For each phenotype, give the genotypes that are possible for the pea plants.

Tall (T) is dominant to short (t).

Tall = _____ Short = _____

Purple flower color (P) is dominant to white (p).

Purple flowers = _____ White flowers = _____

4. Tay Sachs disease is a fatal genetic disease that causes fats to build up in the brain, killing brain cells and leading to a progressive loss of function. Both Linda and James are heterozygous for Tay Sachs. Perform a cross of Linda and James that shows their possible offspring. Show all of your work below and answer the questions:

A. What are the chances of a child with no Tay Sachs? ____ out of ____ or ____%

B. What are the chances of a child with Tay Sachs? ____ out of ____ or ____%

5. Huntington's disease is a dominant trait that causes the production of a faulty protein that causes the brain to degenerate in middle-aged adults. Tom is heterozygous for Huntington's disease and his wife, Jessica, is homozygous for the normal allele. Perform the cross of Tom and Jessica and show your work.

A. List the expected genotype and phenotype ratios for their children.

B. What are the chances of a child with Huntington's ____ out of ____ or ____%

6. Cystic fibrosis is a progressive, genetic disease that causes persistent lung infections and limits the ability to breathe over time, due to the production of a defective transport protein. A young couple, Sara and Alex, comes to get genetic counseling to find out the chances that they could have a child with cystic fibrosis. Sara is homozygous for the normal allele and Alex is a carrier of the cystic fibrosis allele. How would you advise them if you were their genetic counselor? Show your work and explain.

7. Fruit flies are very useful model organisms that have been used to study genetics. One mutant trait in fruit flies is called "eyeless" because it causes flies to have no eyes. In crossing an eyeless fly with a normal fly, all offspring have eyes.

A. What does this tell us about the "eyeless" allele?

B. Cross an eyeless fly with a heterozygous fly, showing your work.

C. What is the genotype ratio of the offspring?

D. What is the phenotype ratio of the offspring?



8. A curly-winged fruit fly is crossed with a normal fruit fly and all of the offspring have curly wings.

A. What does this tell us about the "curly wing" allele?



B. What are the possible offspring of a cross between a curly-winged fly and a normal fly? Write out all possible genotype and phenotype ratios. Explain your reasoning.

Bikini Bottom Genetics

Answer Key

1. $\begin{matrix} \text{Ho} & \text{He} \\ \text{He} & \text{Ho} \end{matrix}$ $\begin{matrix} \text{Ho} & \text{He} \\ \text{He} & \text{Ho} \end{matrix}$ $\begin{matrix} \text{Ho} & \text{Ho} \\ \text{Ho} & \text{Ho} \end{matrix}$

Purebreds - TT, DD, BB, FF, ff, dd, bb, tt

Hybrids - Dd, Bb, Ff, Tt

2. $\begin{matrix} \text{Yellow body} \\ \text{Square shape} \end{matrix}$ $\begin{matrix} \text{Yellow body} \\ \text{Square shape} \end{matrix}$ $\begin{matrix} \text{Blue body} \\ \text{Round shape} \end{matrix}$

3. Tall - TT or Tt Short - tt
Pink - PP or Pp Yellow - pp

4. $\begin{matrix} & s & s \\ S & Ss & Ss \\ s & ss & ss \end{matrix}$ A. SS - square shape, Ss - square shape, and ss - round shape
B. 2 out of 4 or 50%
C. 2 out of 4 or 50%

NOTE: Some of your students may feel that the roundpants gene should be the dominant trait as SpongeBob's TV parents are both roundpants. However, these are only his parents on the TV show and his real parents are both heterozygous for squarepants.

5. $\begin{matrix} & P & p \\ P & PP & Pp \\ p & Pp & pp \end{matrix}$ A. PP - pink body, Pp - pink body, and pp - yellow body
B. 3 out of 4 or 75%
C. 1 out of 4 or 25%

6. $\begin{matrix} & B & b \\ B & BB & Bb \\ b & Bb & bb \end{matrix}$ A. Bb - light blue skin
B. 100%
C. 0%
D. Squidward's children would not be considered purebred, since each would have a gene pair made up of a dominant gene and a recessive gene.

7. $\begin{matrix} & T & t \\ T & TT & Tt \\ T & TT & Tt \end{matrix}$ A. TT - tall eyeballs or Tt - tall eyeballs
B. The hospital must have made a mistake, since the genotype "tt" would not be possible based on the genotypes of Mr. and Mrs. Krabbs.
NOTE: Students may come up with other possible scenarios, such as Mr. Krabbs not really a homozygous tall-eyed crab or a mutation. A few of my students suggested that Mr. Krabbs might not be the father!

NOTE: Some of your students may comment that Mr. Krabbs had a whale as a daughter. However, this was only for the TV show. He is happily married to a beautiful crab in real life and has beautiful crab children. (Ok, so it's not "real" life!)