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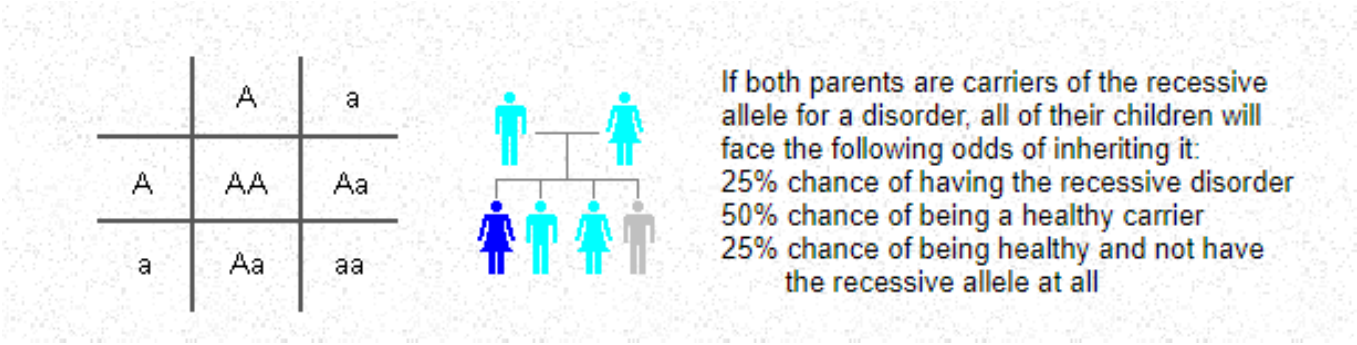
KIPP/2025/_____

Remote Learning Packet
Assignment #5.1

Review of Genetics and Punnett Squares

Why are Punnett Squares Useful?

The answer is that they can be used as predictive tools when considering having children. Let us assume, for instance, that both your cousin and her husband are carriers for a genetically inherited disease such as cystic fibrosis. Of course, they are worried about whether their children will be healthy and normal. For this example, let us define "A" as being the dominant normal allele and "a" as the recessive abnormal one that is responsible for cystic fibrosis. As carriers, your cousin and her husband are both heterozygous (Aa). This disease only afflicts those who are homozygous recessive (aa). The Punnett square below makes it clear that at each birth, there will be a 25% chance of having a normal homozygous (AA) child, a 50% chance of a healthy heterozygous (Aa) carrier child like your cousin and her husband, and a 25% chance of a homozygous recessive (aa) child who probably will eventually die from this condition.



Check your reading:

1. What is the allele that is responsible for cystic fibrosis? _____
2. Is that allele dominant or recessive? _____
3. What genotype must the baby have to be born with cystic fibrosis? _____

How to Fill Out a Punnett Square

Each Punnett Square describes how variations of a gene (alleles) could be inherited if two organisms sexually reproduce. Follow these steps to guide you about how to use a Punnett Square.

1. Name the alleles involved. Choose a letter to represent the alleles. Write the dominant allele with any capital letter, and the recessive allele with the same letter in lowercase. It doesn't matter which letter you choose.

- For example, call the dominant gene for black fur "F", and the recessive gene for yellow fur "f".

Sample Problem: *In seals, the gene for the length of the whiskers has two alleles. The dominant allele (W) codes long whiskers & the recessive allele (w) codes for short whiskers. What percentage of offspring would be expected to have short whiskers from the cross of two long-whiskered seals that are both heterozygous?*

Step #1 – Allele letters, traits
Long Whiskers – W
Short Whiskers – w

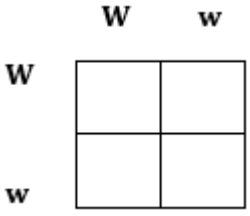
2. Check the parents' genotypes. Next, we need to know the genotype each parent has for that trait. Each parent has two alleles (sometimes the same one) for the trait, just like every sexual organism, so their genotype will be two letters long. Sometimes, you'll already know exactly what this genotype is. Other times, you'll have to work it out from other information:

- "Heterozygous" means it has two different alleles (Ff)
- "Homozygous dominant" means it has two copies of the dominant allele (FF).
- "Homozygous recessive" means it has two copies of the recessive allele (ff).

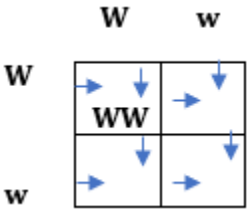
Step #2 – CROSS
Ww (heterozygous) X Ww (heterozygous)

3. Label the rows with one parent's genotype. Pick one parent – traditionally the female (mother), but either will work. Label the top of the square starting with the first row of the grid with one of that parent's genotype. Label the second row of the grid with the second genotype. Then repeat on the side of the square with the male parent.

Step #3 – PUNNETT SQUARE



4. Then fill out the square. Start in the first box. Look at the letter to its left, and the letter above it. Write both these letters in the empty box. Repeat for the remaining three boxes.



5. Interpret the Punnett square. The Punnett square shows us the likelihood of creating offspring with certain alleles. There are four different ways

the parents' alleles can combine, and all four are equally likely. This means that the combination in each box has a 25% chance to occur. If more than one box has the same result, add up these 25% chances together to get the total chance.

Step #4 – RESULT

	W	w
W	**WW**	**Ww**
w	**Ww**	**ww**

Genotypes	Fraction	Percentage	Phenotypes
WW	¼	25%	Long whiskers
Ww	2/4	50%	Long whiskers
ww	¼	25 %	Short whiskers

Now try one on your own!

1. In purple people eaters, the **one-horn trait is dominant and the no horns trait is recessive**. Use the letters H and h to represent the different traits for purple people eaters.

Follow the four steps, showing a cross of a female purple people eater that is **heterozygous for horns** with a male purple people eater that is **homozygous recessive.**

Step #1 – Allele Letters, traits
H= _____
h = _____

Step #2 – CROSS

_____ X _____
Female Genotype **Male Genotype**

Step #3 – PUNNETT SQUARE

Step #4 – RESULT

Genotypes	Fraction	Percentage	Phenotypes

2. In silkworms a single gene determines the color of the cocoon. The **Yellow cocoon allele is dominant**. It is indicated by "C". The **white allele is recessive**, and indicated by "c".

Determine the genotypes and phenotypes for the offspring if a homozygous dominant male (CC) crosses with a homozygous recessive female (cc).

Step #1 – Allele letters, traits
C= _____
c= _____

Step #2 – CROSS

_____ X _____
Female Genotype **Male Genotype**

Step #3 – PUNNETT SQUARE

Step #4 – Result

Genotypes	Fraction	Percentage	Phenotypes

3. In watermelons, a solid green color (G) is dominant to green stripes (g). Two solid green heterozygous watermelons are crossed, (Gg).

Step #1 – Allele letters, traits
G= _____
g= _____

Step #2 – CROSS

_____ X _____
Female Genotype **Male Genotype**

Step #3 – PUNNETT SQUARE

Step #4 – Result

Genotypes	Fraction	Percentage	Phenotypes

Which type of watermelon has the <u>greatest</u> chance of being produced by this cross?

A homozygous solid
B heterozygous solid
C homozygous striped
D heterozygous striped