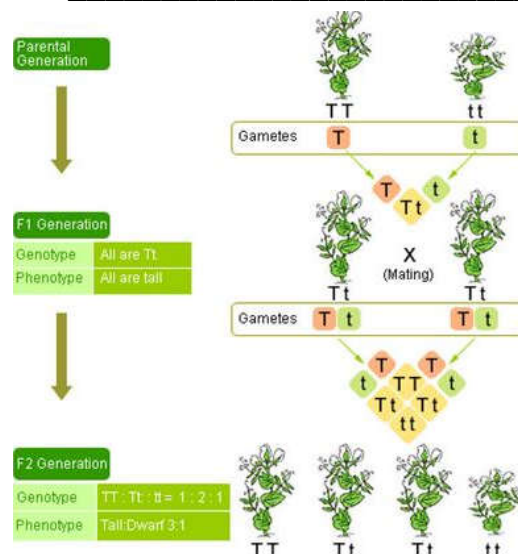## Introduction to Genetics & Heredity

Gregor Mendel

- Austrian monk who studied plants
- Because his work laid the foundation to the study of heredity, Mendel is referred to as

_____

Mendel's Pea Plant Experiments

- Created _____ strains by **self-pollination** (transfer pollen to the pistil of

the same plant). These strains were known as the _____ or _____

generation

- Mendel then **cross-pollinated** (transfer pollen from one plant to the pistil of a different

plant) these strains to create the _____ or _____ generation.

He noticed that all of the plants in this generation had _____.

- Mendel then cross-pollinated the F1 plants to create the _____ or _____

generation. He noticed that _____ from the parental generation showed

up again, but _____.

- Conclusions from Mendel's Pea Plant Experiments

  1. Each _____for each trait

     but only _____

  2. **Principle of Dominance**: _____

     and will hide the weaker or recessive factor when present

  3. **Principle of Segregation:** _____

Genetics Basics

Introduction
Heredity is the characteristics that are transmitted from 2 parents to their offspring. Depending on the **alleles** that are passed on by the parents, the offspring's **genes** will express certain **traits**. In this activity, you will work with your group to explore the basics of heredity.

Model 1: Genetics
Monstrous Nightmares: Monstrous Nightmares are dragons that are known for their fire breathing ability, but not all Nightmares can breathe fire. This dragon has a **gene** which controls the trait of fire breathing ability. There are 2 variations of that gene, the **F allele** and the **f allele**. The F allele expresses the trait of fire breathing ability. The f allele expresses the trait of not being able to breathe fire.

1. What is the gene in the paragraph above in charge of? _____

2. How do you represent the 2 alleles that control fire breathing ability? _____ & _____

3. What are the two variations of this trait that can be expressed?

    _____ and _____

4. Based on the information above, come up with a definition for a **GENE**.

5. Based on the information above, come up with a definition for an **ALLELE**.

6. Based on the information above, come up with a definition for a **TRAIT**.

Model 2: Heterozygous and Homozygous
Offspring get 1 copy of each chromosome from their parents. This also means that they get 1 copy of every gene from their parents (because genes are found on the chromosomes); the combination of alleles that an offspring get from its parents represents the offspring's genotype. Sometimes, the alleles that the offspring get are the same and sometimes they are different. When the two alleles are the same, they are called **homozygous** or purebred. When the two alleles are different, they are called **heterozygous** or hybrid. Label the following pairs of alleles are either homozygous (Hom) or heterozygous (Het).
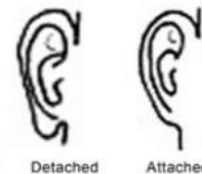
SS _____   ff _____   Hh _____   EE _____   Gg _____

Ll _____   hh _____   NN _____   ee _____   RR _____

1. Which genotypes would be considered purebred?

2. Which genotypes would be considered hybrid?

Model 3: Genotype and Phenotype

Gene A	
Genotype	Phenotype
LL	long eyelashes
Ll	long eyelashes
ll	short eyelashes

Gene B	
Genotype	Phenotype
EE	detached earlobes
Ee	detached earlobes
ee	attached earlobes

Detached   Attached

1. What do the two genes in the table above control?
    _____ & _____

2. What are the 2 alleles that control eyelash length? _____ & _____

3. What are the 2 alleles that control earlobes? _____ & _____

4. What is a genotype? (Use the terms: dominant, recessive, heterozygous, and homozygous)

5. What is a phenotype?

6. What determines phenotype?

Model 4: Dominant and Recessive

Human Genetics Key	
Capital letters represent **dominant** alleles; **lowercase** letters represent **recessive** alleles	
T =tongue rolling t = non tongue rolling	B = brown b = blue
D= Dimples d= no dimples	E= Detached earlobes e = attached earlobes
F= freckles f = no freckles	L = LONG eyelashes l = short eyelashes
W= widows peak w= no widows peak	H = hitchhikers thumb h = no hitchhikers thumb

Work with a partner to determine your dominant and recessive traits. Write your both genotype and phenotype.

My dominant traits are:		My recessive traits are:	
phenotype	predicted genotype	phenotype	genotype

Why can you only **predict** your genotype if you are dominant for a particular trait?

~~~~~~

Punnett Squares

- Diagrams that use probability to _____
- How to set up a Punnett Square:

Examples:

1. B= Brown eyes   b= blue eyes

Mom= Bb   Dad= BB What are the eye color possibilities if they chose to have children?

   <u>Genotypes</u>   <u>Phenotypes</u>

2. What are the eye color possibilities if two heterozygous individuals have children?

   <u>Genotypes</u>   <u>Phenotypes</u>

Bikini Bottom Genetics   Name _____

Scientists at Bikini Bottoms have been investigating the genetic makeup of the organisms in this community. 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? _____

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

   Yellow body color is dominant to blue.

   YY _____   Yy _____   yy _____

   Square shape is dominant to round.

   SS _____   Ss _____   ss _____

3. For each phenotype, give the genotypes that are possible for Patrick.
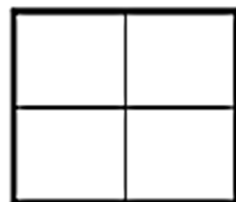
   A tall head (T) is dominant to short (t).

   Tall = _____   Short = _____

   Pink body color (P) is dominant to yellow (p).

   Pink body = _____   Yellow body = _____

4. SpongeBob SquarePants recently met SpongeSusie Roundpants at a dance. SpongeBob is heterozygous for his square shape, but SpongeSusie is round. Create a Punnett square to show the possibilities that would result if SpongeBob and SpongeSusie had children. HINT: Read question #2!
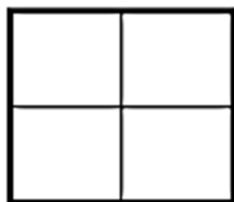
   A. List the possible genotypes and phenotypes for their children.

   B. What are the chances of a child with a square shape? _____ out of _____ or _____%

   C. What are the chances of a child with a round shape? _____ out of _____ or _____%

5. Patrick met Patti at the dance. Both of them are heterozygous for their pink body color, which is dominant over a yellow body color. Create a Punnett square to show the possibilities that would result if Patrick and Patti had children. HINT: Read question #3!
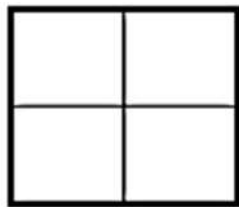
   A. List the possible genotypes and phenotypes for their children.

   B. What are the chances of a child with a pink body? _____ out of _____ or _____%

   C. What are the chances of a child with a yellow body? _____ out of _____ or _____%

6. Everyone in Squidward's family has light blue skin, which is the dominant trait for body color in his hometown of Squid Valley. His family brags that they are a "purebred" line. He recently married a nice girl who has light green skin, which is a recessive trait. Create a Punnett square to show the possibilities that would result if Squidward and his new bride had children. Use B to represent the dominant gene and b to represent the recessive gene.

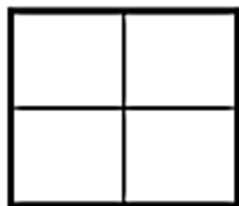A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with light blue skin? _____%

C. What are the chances of a child with light green skin? _____%

D. Would Squidward's children still be considered purebreds? Explain!

7. Assume that one of Squidward's sons, who is heterozygous for the light blue body color, married a girl that was also heterozygous. Create a Punnett square to show the possibilities that would result if they had children.
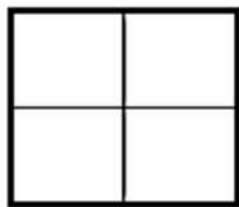
A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with light blue skin? _____%

C. What are the chances of a child with light green skin? _____%

8. Mr. Krabbs and his wife recently had a Lil' Krabby, but it has not been a happy occasion for them. Mrs. Krabbs has been upset since she first saw her new baby who had short eyeballs. She claims that the hospital goofed and mixed up her baby with someone else's baby. Mr. Krabbs is homozygous for his tall eyeballs, while his wife is heterozygous for her tall eyeballs. Some members of her family have short eyes, which is the recessive trait. Create a Punnett square using T for the dominant gene and t for the recessive one.

A. List the possible genotypes and phenotypes for their children.

B. Did the hospital make a mistake? Explain your answer.