GENETICS
When you were formed, you inherited DNA from your father and mother in the form of chromosomes.

You inherited 23 chromosomes from your mother and 23 chromosomes from your father.

You have 46 chromosomes in all.
Chromosomes contain genes.

**Genes** give your cells the instructions for cell processes.

**Genes** decide what traits you will exhibit.

**Alleles** are different copies of genes that you can inherit from your parents.
DEFINITIONS

- **DNA** – deoxyribonucleic acid, nucleic acid that contains genetic instructions

- **Genes** – DNA sequences that code for different proteins

- **Allele** – a copy of a gene

- **Chromosomes** – bundles of DNA that make up your genome, where genes are located
**DEFINITIONS**

- **Genome** - all of the DNA you contain

- **Dominant allele** – allele whose phenotype is expressed in homozygous and heterozygous form

- **Recessive allele** – allele whose phenotype is only expressed in the homozygous form
DEFINITIONS

- **Genotype** – genetic constitution of an individual, the types of genes and alleles found in an individual

- **Phenotype** – trait, or observable characteristic in an individual that is based on his/her genetic makeup
**Punnett Square** – a tool used by scientists to predict phenotypes of organisms based on allele combinations
Heterozygous – exhibiting two (2) different copies of a gene

Homozygous – exhibiting two (2) identical copies of a gene
DEFINITIONS

- **Diploid cell** – cell that contains two (2) copies of each chromosome
- **Haploid cell** – cell containing only one copy of each chromosome
- **Gamete** – haploid sex cell
PUNNETT SQUARE

A  a

A  AA  Aa

a  Aa  aa
PROBLEM 1:

Determine if the following genotypes are homozygous or heterozygous:

- \( BB = \) _____________________
- \( Bb = \) _____________________
- \( Bb = \) _____________________
PROBLEM 2:

Using the Punnett Square above, determine the phenotypes (colors) for each of the following genotypes.

- BB = ______________________
- Bb = ______________________
- Bb = ______________________
PROBLEM 3:

- What is the probability that you will get a white flower when heterozygous pea plants cross?

- How do you determine probability?

- Do you remember the formula for determining the probability of an event?
PROBLEM 3

\[ P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}} \]

White flower: ____________

Purple flower: ____________
Imagine that you are crossing a heterozygous plant (Bb) with a homozygous recessive plant (bb).

Predict the types of offspring that can occur by filling in the blanks in the Punnett Square.
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Imagine that you are crossing a heterozygous plant (Bb) with a homozygous dominant plant (BB).

Predict the types of offspring that can occur by filling in the blanks in the Punnett Square.
Problem 6:

- Make up your own parental genotypes for the pea plants and determine what types of offspring they will have.

- Fill in the blanks in the Punnett Square.
### PUNNETT SQUARE

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NOW LET’S INVESTIGATE!

YOU WILL LEARN ABOUT YOUR GENES AND THOSE OF YOUR CLASSMATES BASED ON YOUR PHENOTYPES.
What is a phenotype?

A phenotype is a trait, or observable characteristic in an individual that is based on his/her genetic makeup.
1st Phenotype: “The Rolling Tongue”

- This trait is dominant and will appear if you are homozygous dominant (TT) or heterozygous (Tt).
This Punnett Square shows that both parents are heterozygous.
What is the probability that their offspring will be able to roll their tongues?

Write the probability as a fraction.________

Change the fraction to a percent._______
Let’s assume that both of your parents are heterozygous. Make predictions based on the information the Punnett Square gives you.

We will determine the percentage of students in your class that should be able to roll their tongues.
TONGUE ROLLERS

- Predict the percent of Tongue Rollers in the class. They will be a (TT or Tt).

- What percent did you predict?_______
Now let’s do an experiment.

Survey your class. How many students are there in your class? __________

How many of these students can roll their tongues? __________
What is the actual percent of tongue rollers in the class? ______________

How does this percent compare with the predicted percent? __________
Our classroom is a sample of the entire Chinese population.

Based on the numbers we found in our class, we can predict the number of Chinese people who are tongue rollers.
Predict How Many Chinese People Are Tongue Rollers.

- Statistical records from July, 2008, show that the population of China is 1,330,044,544 people.
- Can you figure our mathematically how many Chinese people can roll their tongues?
- Yes! Let’s see how.
PROPORTIONS

- Make a prediction using a proportion.

\[
\frac{\text{Tongue Rollers in Class}}{\text{Total Students in Class}} = \frac{\text{Tongue Rollers in China}}{\text{Total population in China}}
\]

How many tongue rollers do you predict there are in China?
This trait is recessive and will only show up if you are homozygous recessive (ee).
This Punnett Square shows that both parents are heterozygous.
Assume that both of your parents are heterozygous.

Use the information the Punnett Square gives you.

What is the percentage of people in your class who should have attached earlobes?
Survey your class. How many students are there?________

How many students have attached earlobes?________

What is the actual percentage of students in your class with attached earlobes?________
Our classroom is a sample of the whole Chinese population.

Predict the number of Chinese people with attached earlobes.

Use 1,330,044,544 as the population of China.
Use a proportion to determine the amount of people in China with attached earlobes.

How many Chinese people do you predict have attached earlobes?
Fold your hands together by interlocking your fingers. Which thumb is on top?
PUNNETT SQUARE
Can you determine which trait is dominant and which trait is recessive?

We have two (2) traits, right thumb on top and left thumb on top.
Survey your class. How many students are there in your class?_____

How many students have right thumb on top?_____

How many students have left thumb on top?_____

USE YOUR MATH!

- What percent of the class has right thumb on top?_____

- What percent has left thumb on top?______
Based on the percents you found in your class, which trait do you think is dominant?_______

Which trait is recessive?________
Assume that all of your parents are heterozygous for the trait (Ii).

Determine which trait is dominant.

If the _________ thumb is on top, you are dominant (____,____).

If the _________ thumb is on top, you are recessive (____,____).
The actual dominant trait is________
Some people can taste a chemical called: Phenylthiourea-Phenylthiocarbamide (PTC), and others cannot.
Based on how many of your classmates can taste this chemical, determine whether the ability to taste PTC strips is a dominant or recessive trait.

Use a capital P and a lowercase p to construct your own Punnett Square for PTC taste.
If we assume that all parents are heterozygous for the ability to taste PTC, what is the dominant trait?

What is the recessive trait?
PUNNETT SQUARE
Predict the percentage of Chinese people who should be able to taste PTC based on the number of your classmates that can taste PTC.
We can make this prediction using a Proportion.

\[
\frac{\text{PTC tasters in class}}{\text{Students in class}} = \frac{\text{PTC tasters in China}}{\text{Population in China}}
\]
Now let’s look at hairline.

If your hair has a downward V shape, you possess at least one dominant allele (W).

Draw a Punnett Square to illustrate what would happen if one of your parents was homozygous dominant (WW) and the other parent was homozygous recessive (ww).
Assume that all Chinese people have one parent who is homozygous dominant (WW) and one parent who is homozygous recessive (ww).

Predict the percentage of Chinese people who would have a widow’s peak.
We can make this prediction using a proportion.

\[
\frac{\text{Widow's Peaks in class}}{\text{# of students in class}} = \frac{\text{Widow's Peaks in China}}{\text{# of people in China}}
\]
Draw a Punnett Square to illustrate what would happen if one of your parents was heterozygous (Ww) for this allele, and one of your parents was homozygous recessive (ww).

What results did you find?