

## What Makes You- You!

### Learning Objectives:

- Understand why there are differences in humans from the size of their shoes to their ability to taste bitterness.
- Learn Mendel's principle of segregation and independent assortment, probability within heredity, and the behavior of heredity.
- Identify genetic variation between humans.

### Key Vocabulary:

- Chromosomes
- Genotypic ratio
- Phenotypic ratio
- Mendelian traits
- Punnett Square
- Recessive
- Dominant
- Genes
- Alleles

### INTRODUCTION (15 MIN. OPEN DISCUSSION)

**Look at the person next to you and name the differences you can see.**

#### Sample answers

- Different color eyes
  - blue eyes, brown eyes, grey eyes, eyes that change color in the sunlight, green eyes, hazel eyes
- Different height
  - 5"3', 6"3', 5"5'
- Different skin color
  - tan, brown, light, no pigmentation(albino)- yellow labradors
- Different hair
  - curly, straight, thin, wavy, blonde, dark brown, black, strawberry blonde
- Different nose
  - wide, narrow, a bridge
- Different shoe size
  - Size 7, 8, 11, 13, 5. Did you know you could modify your foot size by foot binding (but do not try it at home)!
- Different weight
  - underweight, overweight, just right

All of these differences on how you look are called traits and the reason why you have them is through heredity and it is inherited during meiosis aka when you were being made in your mother's uterus, or in a test tube.

**How did these differences occur? Mutations! Every single one of us, yes even Jennifer Lopez, share 99.999% of the same genetic code with just a 0.001% difference caused by mutations. Out of 3 billion nucleotides that make our DNA in each and every single cell that's a 3 million nucleotide difference!**

**What is a gene?** *An inherited factor that determines a characteristic*

**What is an allele?** *Different variations of a gene*

**So what is the difference between a gene and an allele?** Here's a good way to categorize the two. Dog and cats are two different *genes* and the different breeds of each are the *alleles*. Soooo, a gene is the characteristic, such as eye color or skin color, and the allele are all the version of the gene that could be expressed.

**So how do we know about from genes and alleles?**

Well, apart from very extensive research, an Austrian monk named Gregor Mendel set the laws of how we understand inheritance today. Through his experimentation with pea plants, Mendel understood that offspring took on a mixture of the characteristics from their parents and coined the terms *dominant* and *recessive* for the most and least observed traits, respectively.

**This makes inheritance predictable!**

**Well, how the heck do we do that?** A Punnett Square is a square diagram that is used to predict an outcome of a particular cross or breeding experiment.

Genotype



Phenotype



**Pictures are worth a thousand words but these don't explain anything. Let's talk about it.**

The *genotype* is the collection of traits that we inherit from our parents, stored and accessible in our chromosomes. The *phenotype* is how and which of these traits are expressed, or the physical manifestation of the traits.

15-20 min  
Background  
Info.

**Do you think our genotypes and phenotypes are the same?** No! Our phenotypes don't necessarily show our genotype. Don't judge a book by its cover, amirite?

	<b>A</b>	<b>a</b>
<b>B</b>	AB	aB
<b>b</b>	Ab	ab

**AB:** both alleles homozygous dominant  
**aB, Ab:** both alleles heterozygous  
**ab:** both alleles homozygous recessive

## Introduction to PTC Experiment

### How do you ask a question scientifically?

Why are clouds in the sky? *vs.* Why does it rain *when* there are clouds in the sky? A scientific question should be posed with empirical knowledge backing it. So to say, asking a question from prior observation.

### Then formulate a hypothesis.

Identify variables that could affect the outcome of your question and make a prediction using information about the subject.

Ex. If skin cancer is related to ultraviolet light, then people with a high exposure to UV light will have a higher frequency of skin cancer.

### Set a control and set the variables to change throughout the experiment. Does anyone know the two different types of variables?

#### Sample answers:

- independent variable, what I change
- dependent variable, what I observe

**Research, research, research!** It is important to have background knowledge before you start the experiment. Today, we will be testing the PTC compound and generating a conclusion to understand phenotypes within a our classroom. But first, let's learn about PTC.

PTC taste extremely bitter to some and to some others, tastes like nothing. This ability/ inability to taste bitterness is caused by an allele (can we remember what an allele is?) located on the TAS2R38 gene-- one of the genes responsible for a receptor protein that binds to PTC causing the bitter taste.

## PHENOTYPE EXPLORATION AND EXPERIMENT

Materials:	Procedure:
PTC Tasting Paper ~0.007 mg per strip	1. Separate the students into groups of 4.
Tonic water with quinine	2. Have the groups write down their observations of the materials about to be given. (How do they taste, do they eat them often, are they healthy for you?)
Bottled Water	3. Have the groups choose the materials they will choose for their experiment.
28 gram small cups	4. Have the students write down a question regarding the materials they have chosen and their knowledge behind PTC and genetic variation.
Control (tasteless) tasting paper	5. Have the students develop a hypothesis of what will happen when they administer the materials to the class.
Dark chocolate 78% cocoa	6. Have the students develop a method to prove or reject their hypothesis. Make sure they include variables and controls (i.e. variables- PTC and kale; controls- tomato juice and tasteless strip).
White chocolate	7. Let the experiments begin! Walk around and make sure they are sticking to the scientific method, variables, that they differentiate between control, dependent, and independent variables.
Kale	8. Allow the students to collect their data of which students were tasters or nontasters and if the data proves or rejects their hypothesis.
Tomato Juice	9. Allow the students to come up to the class and tell their findings to the class.

**Reinforcement.** Take the 30 minutes of waiting as an opportunity for students to share their hypothesis and back up their statements using the appropriate background information. Refer the students to current careers and statistics by using <https://www.onetonline.org/> and <https://www.usajobs.gov/> for government jobs relating to genetics.

**Wrap-Up!** After the students have written down their observations and completed a concluding discussion about the results, review the learning objective by asking the students what new information they have learned and reviewing the key vocabulary words.