Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Lab\_\_\_\_\_\_ Block\_\_\_\_\_\_

**Genetics, Traits & Alleles**

**Indiana Standard**B.5.6 Recognize that traits can be structural, physiological or behavioral and can include readily observable characteristics at the organismal level or less recognizable features at the molecular and cellular level.

+B.7.1 Distinguish between dominant and recessive alleles and determine the phenotype that would result from the different possible combinations of alleles in an offspring.

B.7.2 Describe dominant, recessive, codominant, sex-linked, incompletely dominant, multiply allelic, and polygenic traits and illustrate their inheritance patterns over multiple generations.

**Objectives**Name the founder of Genetics as Gregor Mendel

Give three examples of visible traits

Give three examples of behavioral traits

Give three examples of physiological traits

Explain that Scientists use alleles use to describe traits

Distinguish between dominant and recessive alleles

Explain what a trait looks like when the alleles are co-dominant

Explain what a trait looks like when the alleles are of incomplete dominance

Distinguish between heterozygous and homozygous alleles

Distinguish between genotype and phenotype

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTES:**

**Genetics:**

**Traits:**

**Allele:**

**Genotype:**

**Phenotype:**

**Dominant:**

**Recessive:**

**Co-dominance:**

**Incomplete Dominance:**

**Father of Genetics:**

**Answer the following questions from “What is a Trait”**

<http://learn.genetics.utah.edu/content/basics/oldtour/>

Give examples of physical traits (sometimes called structural traits):

Give examples of behavioral traits:

Give an example of a predisposition to a medical condition (physiological traits):

Can environmental factors change a trait?

What can a person do to reduce the risk of heart disease if they are genetically pre-dispositioned for it?

How many alleles do each of us have for a trait? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

What does the term **homozygous** mean?

Give an example of homozygous alleles:

What does the term **heterozygous** mean?

Give an example of heterozygous alleles:

Give an example of a dominant allele:

Give an example of a recessiveallele:

When heterozygous alleles are present, which trait is expressed (dominant or recessive)?

When parents pass alleles on to their offspring, how many does each parent pass?

Will all children of the same parents inherit the same set of alleles?

-------------END OF PRESENTATION ----------------

**Illustrate What You Have Learned:**

**Instructions**:

**BOX #1:** Decide on a trait you would like to illustrate.

*Note: for box #1 the trait should NOT be co-dominant or incompletely dominant.*

Draw both parents, using colored pencils or markers if needed.

Label their phenotypes.

Label their genotypes using one homozygous combination and one heterozygous combination.

The parents in your illustration have one offspring, illustrate this offspring.

Label the offspring’s genotype.

**BOX #2:** Show two parents and one offspring displaying co-dominant traits

**BOX #3:** Show two parents and one offspring displaying incomplete dominant traits

|  |  |  |
| --- | --- | --- |
| **#1 Dominant & Recessive** | **#2 Co-Dominance** | **#3 Incomplete Dominance** |
| Trait: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Trait: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Trait: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Traits, Offspring and Probability**

**Indiana Standard**  
+B.7.1 Distinguish between dominant and recessive alleles and determine the phenotype that would result from the different possible combinations of alleles in an offspring.

B.7.3 Describe the likelihood of the appearance of a specific trait in an offspring given the genetic make-up of the parents.

**Objectives**

Distinguish between dominant and recessive alleles

Distinguish between heterozygous and homozygous alleles

Distinguish between genotype and phenotype

Predict the phenotypes resulting from various combinations of offspring

Illustrate inheritance patterns over multiple generations

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTES:**

**Punnett Square:**

**Probability:**

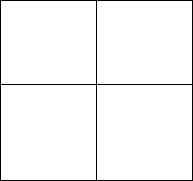
**Formula for Probability:**

**Monohybrid Cross:**

**Dihybrid Cross:**

**Punnett Square Practice:**

**First Generation (F1 Generation):**



**Calculate the probability\* of the following offspring in the F1 generation:**

AA offspring: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Aa offspring: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

aa offspring: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

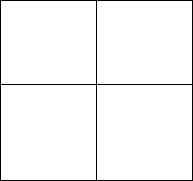
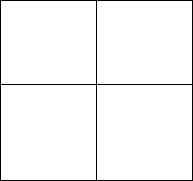
**Second Generation (F2 Generation):**

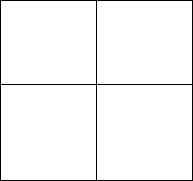
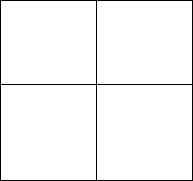
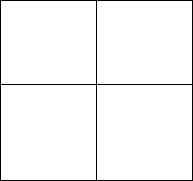
**Calculate the probability of the offspring in the F2 generation:**

AA offspring: \_\_\_\_\_\_\_

Aa offspring: \_\_\_\_\_\_\_\_

aa offspring: \_\_\_\_\_\_\_\_

****

**Genetic Crosses that Involve Two Traits**

Gray hair is dominant to white hair in rabbits.

Black eyes are dominant to red eyes in rabbits.

GG = gray hair

Gg = gray hair

gg = white hair

BB = black eyes

Bb = black eyes

bb = red eyes

What are the phenotypes of rabbits that have the following genotypes?

Ggbb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ggBB \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ggbb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ GgBb \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A male rabbit with the genotype GGbb is crossed with a female rabbit with the genotype ggBb.

Set up a Punett square to determine the phenotypes and proportions of offspring.

How many out of 16 have gray fur and black eyes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many out of 16 have gray fur and red eyes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many out of 16 have white fur and black eyes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many out of 16 have white fur and red eyes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Trait Lab**

**Objectives**

Determine personal phenotypes and genotypes for some observable traits.

Determine the frequencies (%) of dominant and recessive traits in a population.

**Procedure**

You will determine your phenotype and try to determine your genotype for the traits listed below. Remember, if you show a dominant trait, you may be homozygous or heterozygous for that trait. Suppose, however, that one of your parents show the recessive trait. In that case, the parent would have passed on a gene for the recessive trait and you would be heterozygous for that trait. If neither of your parents shows the recessive trait, you may not know if you are heterozygous or homozygous dominant for that trait. In that case, put both possible genotypes (heterozygous and homozygous dominant). The chart below, write “yes” if a recessive trait is expressed, write “no” if it is not.

|  |  |  |  |
| --- | --- | --- | --- |
| **Trait** | **Recessive Trait Expressed? (yes or no)** | **Phenotype** | **Possible Genotypes** |
| **Ear lobes (E):** Free ear lobes have at least one dominant allele. People with attached earlobes are recessive. |  |  |  |
| **Eye color (B):** Inheritance of eye color is controlled by multiple genes, but people having the homozygous recessive genotype have blue eyes. People who have a dominant allele may have different shades of brown, hazel, or green eyes. |  |  |  |
| **Widow’s Peak (W)**: A hairline that forms a downward point in the middle of the forehead is caused by a dominant allele. A smooth hairline is caused by a recessive genotype. |  |  |  |
| **Tongue roller (T)**: A dominant allele gives some people the ability to roll their tongues into a “U” shape when it is extended. People with the recessive alleles cannot roll their tongues. |  |  |  |
| **Bent Little Finger (L):** A dominant allele results in the end joint of the little finger of each hand bending inward. Straight little fingers are a result of the recessive genotype. Place your hands on a flat surface, palms down, and relax. Check to see if the first joints of your little fingers are bent or straight. |  |  |  |

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| --- | --- | --- | --- |
| **PTC Taster (P):** Individuals who can taste the bitter chemical phenylthiocarbamide, PTC, have at least one dominant allele. Those with the recessive genotype cannot taste it. Taste the strip of control paper. Then taste the strip of PTC Paper to see if there is a difference or not. |  |  |  |
| **Mid-Digital Hair (H):** Individuals who have hair on the middle joints of their fingers have at least one dominant allele. Those with two recessive alleles do not have hair on the joint. |  |  |  |
| **Hitchhiker’s thumb (J):** A person that can bend the last joint of the thumb backwards to approximately a 45 degree angle has the recessive genotype while an individual that cannot do it has at least one dominant allele. |  |  |  |
| **Index Finger Length (I):** If the index finger is shorter than the ring finger (index finger is the pointer finger), you have a dominant allele. If not, you have a recessive allele. |  |  |  |
| **Left-over-right thumb crossing (Q):** When the hands are folded in a natural fashion, the left thumb crosses the right thumb is a dominant genotype. If reversed, a recessive genotype is present. |  |  |  |

**Pedigree**

**Instructions**: Make a Pedigree Key

Symbol for male:

Symbol for female:

Recessive male:

Recessive female:

Note: Individuals with recessive traits are “carriers”

Male carrier:

Female carrier:

**Instructions:** Choose one of your traits and illustrate it on a pedigree chart. Show you, your siblings, your parents, your hypothetical spouse, and two hypothetical offspring. If you do not know your parents’ phenotypes, you may make them up.

**Pedigree**

**End Notes**

**Indiana Standards**

B.5.5 Understand that proteins are responsible for the observable traits of an organism and for most of the functions within an organism. - Covered Cellular Chemistry Unit and Molecular Basis of Heredity Unit

+B.7.4 Explain the process by which a cell copies DNA and identify factors that can damage DNA and cause changes in its nucleotide sequence. – This was covered with Standard 5, Molecular Basis of Heredity Unit

B.7.5 Explain and demonstrate how inserting, substituting or deleting segments of a DNA molecule can alter a gene, which is then passed on to every cell that develops from it and that the results may be beneficial, harmful or have little or no effect on the organism. – This was covered with Standard 5, Molecular Basis of Heredity Unit