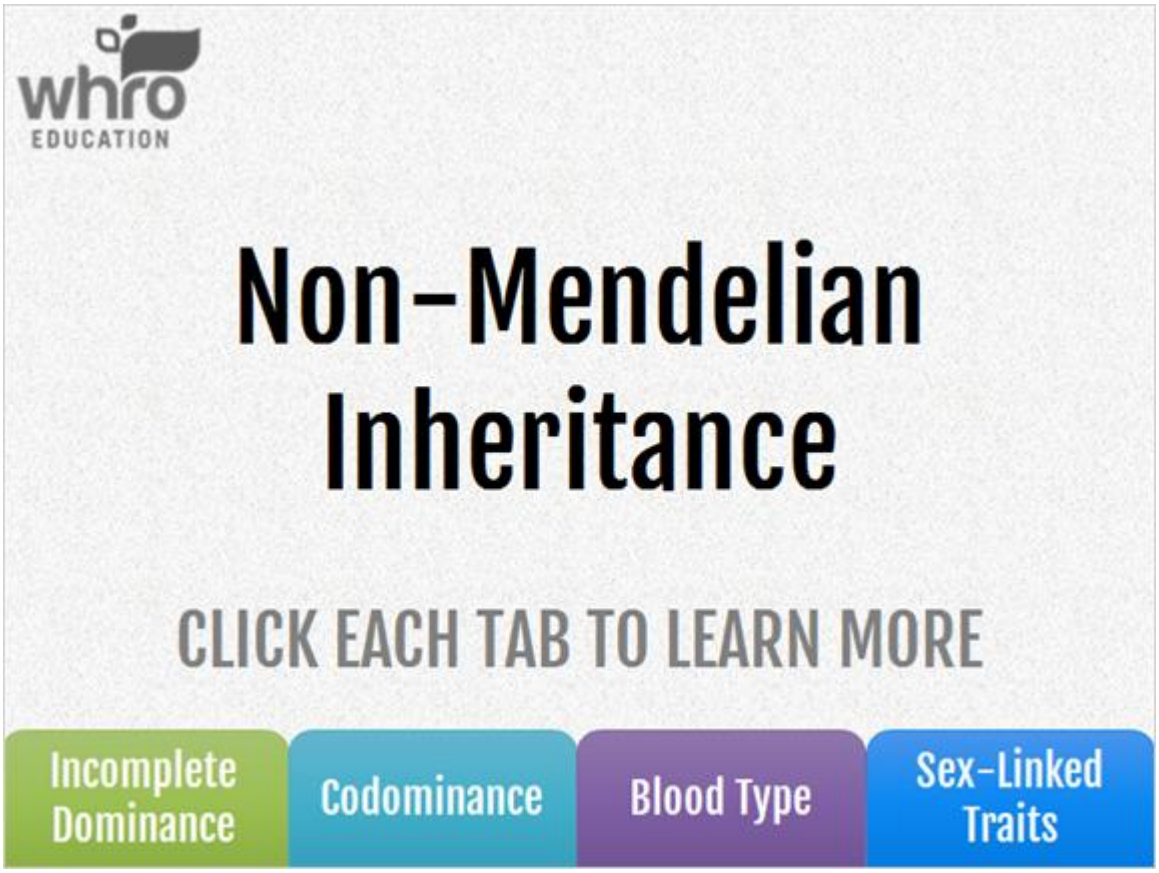
Module 5: Mendelian Genetics and Genetic Disorders
Topic 2 Content: Non-Mendelian Inheritance Notes



Non-Mendelian Inheritance

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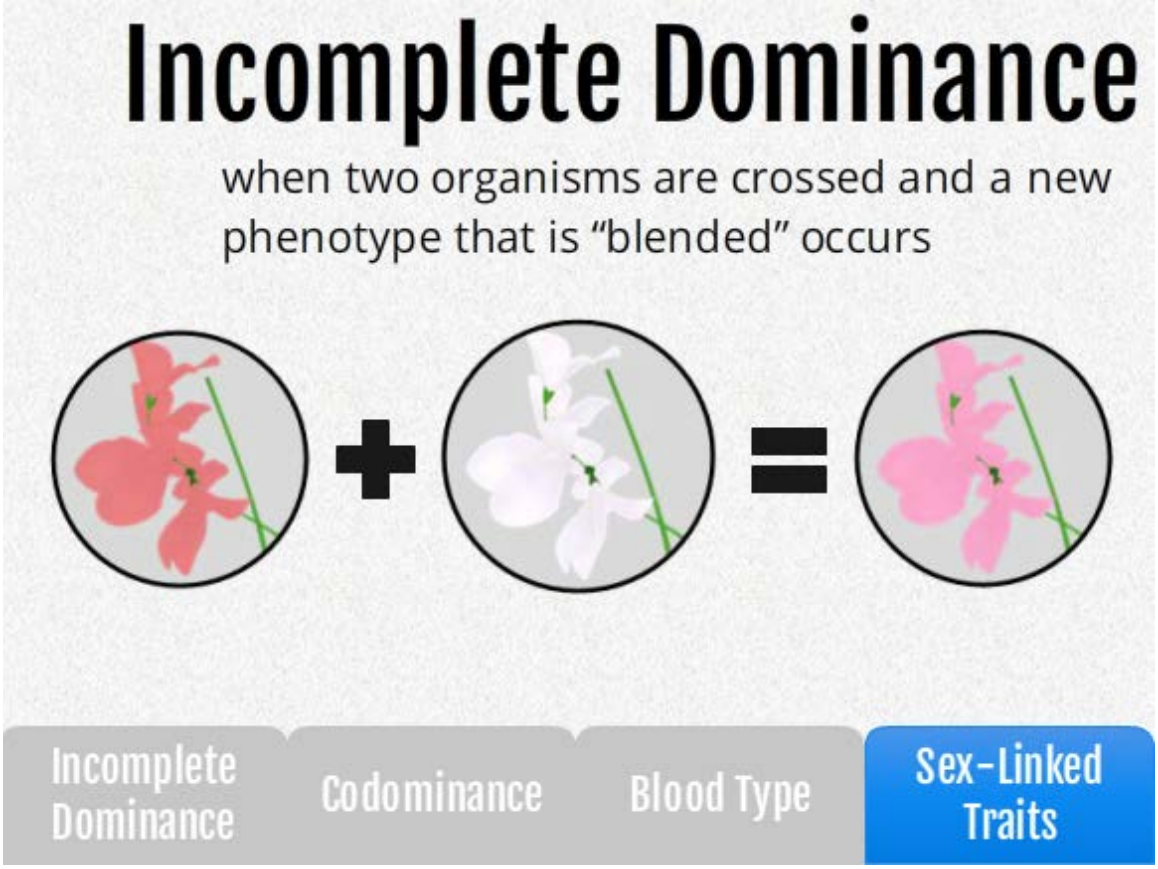
Incomplete Dominance



Incomplete dominance occurs when two organisms are crossed and a new phenotype is created. The offspring has a phenotype that is a combination, or "blend," of the two parent phenotypes. For example, in a cross between a white flower and a red flower, the heterozygous offspring will yield a pink phenotype. In this type of cross, neither allele is completely dominant.

Incomplete dominance can be expressed in a Punnett square. The red flower has the genotype *RR* and the white flower has the genotype *WW.* Both of the flowers are homozygous, but their genotypes contain different letters.

After the first generation, you will see that the offspring has a one-hundred percent chance of having the heterozygous genotype *RW*. This means the offspring will have pink flowers.

After the second generation, you will see that the offspring have a twenty-five percent chance of having red flowers, a fifty percent chance of having pink flowers, and a twenty-five percent chance of having white flowers. The second generation has a genotypic and phenotypic ratio of 1:2:1.

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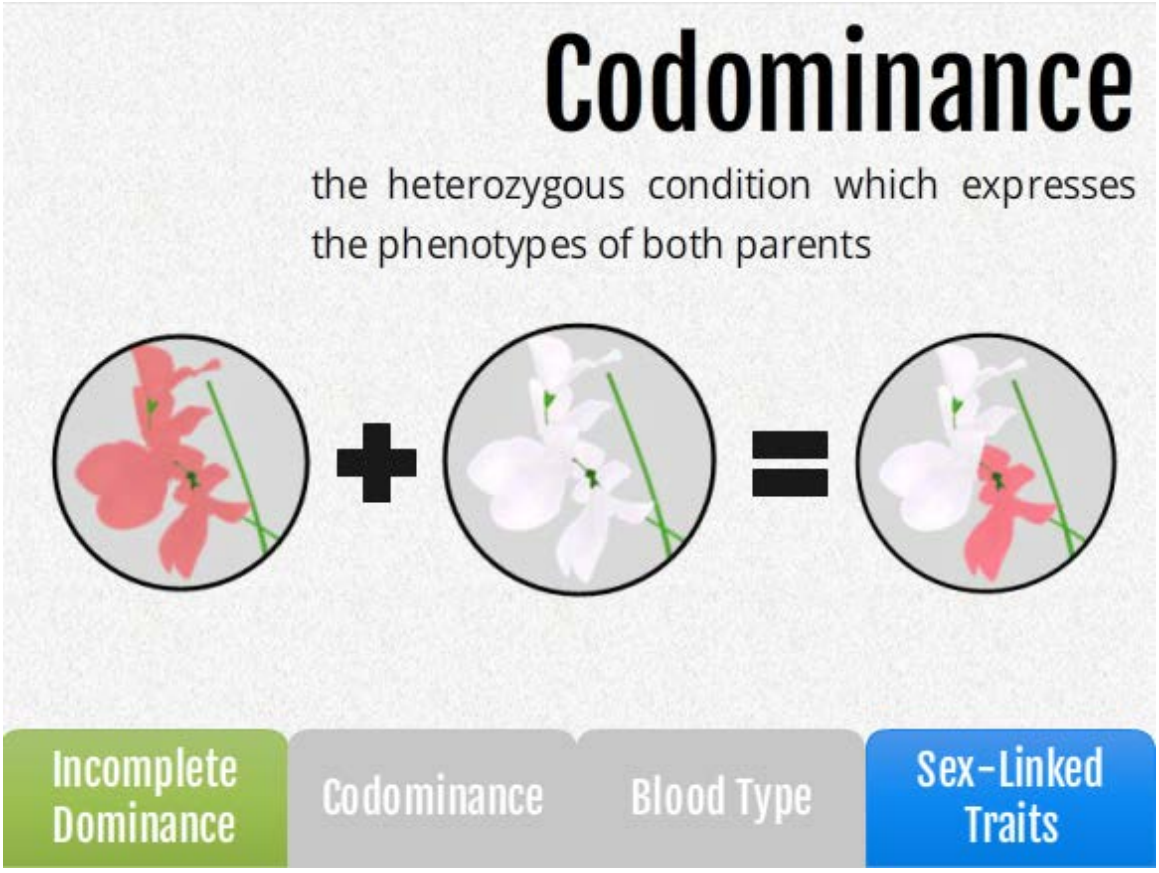
Codominance



Codominance is when two organisms cross and an offspring in the heterozygous condition expresses the phenotypes of both parents. For example, a red flower crossed with a white flower would produce a heterozygous red and white striped flower. In this type of cross, the alleles share dominance.

Codominance can be expressed in a Punnett square. The red flower has the genotype *RR* and the white flower has the genotype *WW.* Both of the flowers are homozygous, but their genotypes contain different letters.

After the first generation, you will see that the offspring have a one-hundred percent change of having the heterozygous genotype *RW*. This means that the offspring express codominance with red and white flowers.

After the second generation, you will see that the offspring has a twenty-five percent chance of having red flowers, fifty percent chance of expressing codominance, and twenty-five percent chance of having white flowers. The second generation has a genotypic and phenotypic ratio of 1:2:1.

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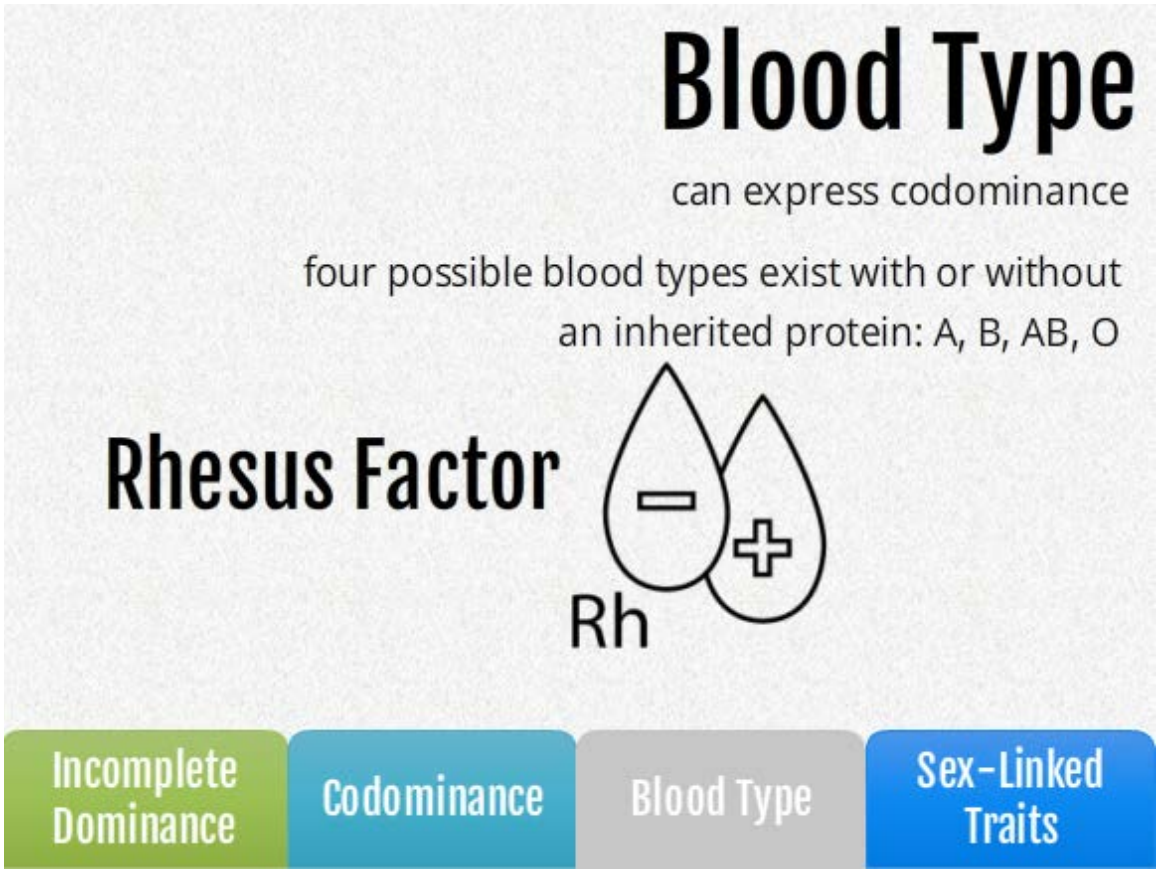
Blood Type



Human blood type can express codominance. Your blood type can be figured out using a Punnett square. Blood types are inherited traits from your parents and cannot change during a person's lifetime. There are four possible blood types a person can have: A, B, AB, and O. An inherited protein found on the surface of your blood cells determines if your blood is positive. If you lack that protein, your blood is negative. Whether an offspring contains or does not contain the inherited protein is called the rhesus, or Rh, factor. The Rh factor will also be determined in the dihybrid cross with blood type.

After you complete the Punnett square, there are four of each of the blood types represented as phenotypes. This has a phenotypic ratio of 1:1:1:1. The ratio for the Rh factor is much different. Twelve of the phenotypes are positive, while only four are negative. This has a phenotypic ration of 3:1.

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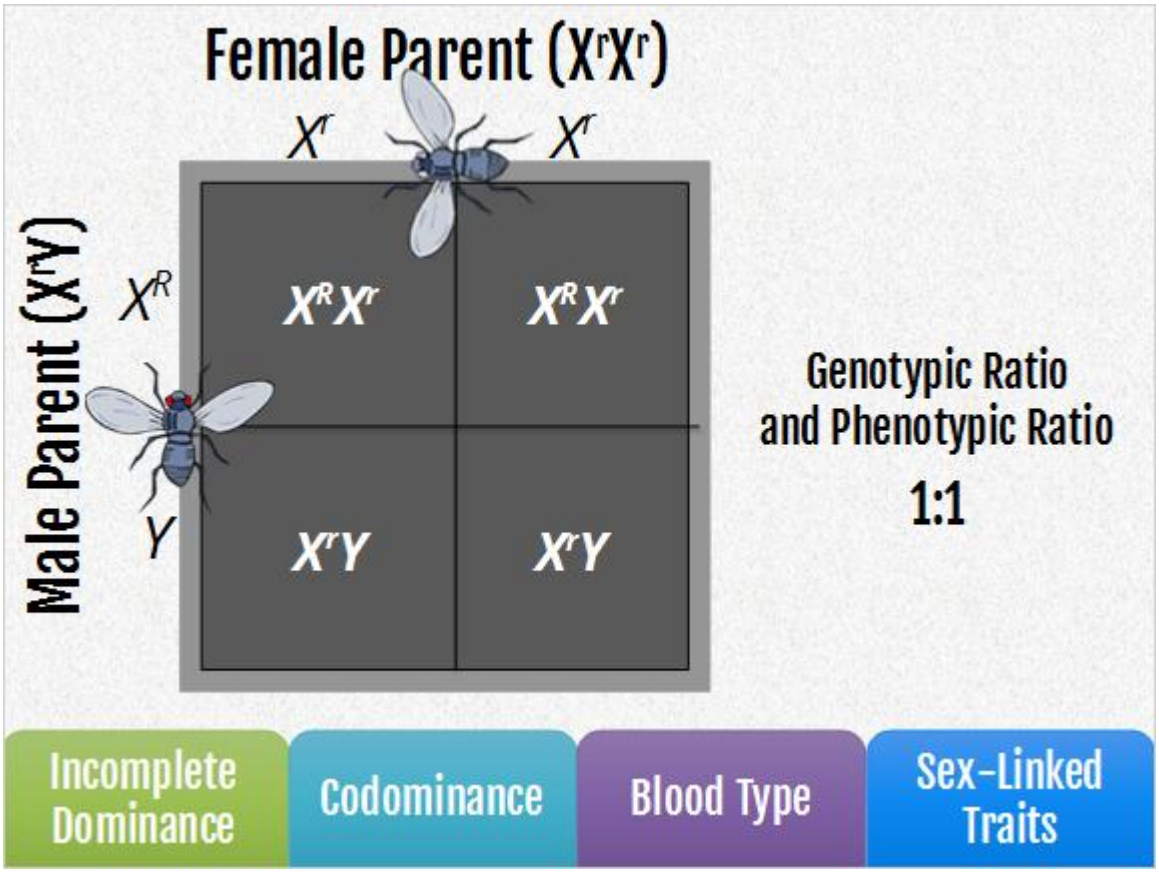
Sex-Linked Traits



Sex-linked traits are traits that are carried on the X or the Y chromosomes. Individuals with two X chromosomes are female and individuals with one X and one Y chromosome are male. Traits linked to the Y chromosome are only passed on to male offspring by their fathers, and traits linked to the X chromosome may be passed on to male or female offspring by their mothers. Some sex-linked traits in humans include red-green color blindness, hemophilia, and male pattern baldness. Those traits are linked to the X chromosome. An example of a Y-linked trait is hairy ears.

This Punnett square is a monohybrid cross of a sex-linked trait. In fruit flies, eye color is a sex-linked trait. Red is dominant to white. The Punnett square represents a cross between a white-eyed female and a red-eye male. The female genotype is XrXr, and the male genotype is XRY. The offspring, or F_1 generation, have a fifty-percent chance of having white eyes and a fifty-percent chance of having red eyes. The first generation has a genotypic and phenotypic ratio of 1:1.

Please note, this is an example of a dominant trait for red-eye color. Some sex-linked traits, like red-green color blindness and hemophilia in humans, are recessive and the recessive allele has to be on both X chromosomes for the female to express the trait.