# Modern Genetics

## Section I: Complex Patterns of Inheritance

It was not until many years after Mendel's death that the significance of his work was fully recognized. Biologists eventually realized that his experiments with pea plants applied not only to plants, but also to animals and humans. The patterns of inheritance he described closely matched the behavior of chromosomes during cell division. However, scientists also discovered exceptions to Mendel's principles, showing that inheritance can be more complex than his original findings suggested.

Many traits are produced by the interaction of multiple genes. **Polygenic inheritance** occurs when a trait is controlled by two or more genes, called polygenes. These genes combine to produce a wide range of possible characteristics. A common example is human skin color, which is determined by the amount of the pigment melanin and the number of dark alleles a person inherits.

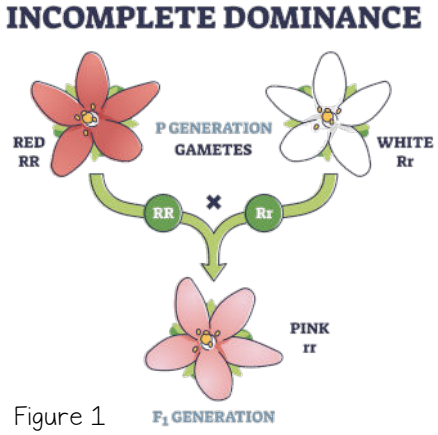

Figure 1

Some traits do not follow simple dominant and recessive patterns. In **incomplete dominance**, neither allele is completely dominant over the other. As a result, the phenotype of a heterozygous organism is a blend of both parents' traits. As shown in Figure 1, when a red flower is crossed with a white flower, the offspring are pink.

In contrast, **codominance** occurs when both alleles are fully expressed simultaneously. Human blood type is an example of codominance. The A and B alleles are both dominant, so when they are inherited together, they produce the AB blood type, as seen in the chart. There are three alleles for blood type—A, B, and O—and each person inherits one allele from each parent. This results in four possible phenotypes: A, B, AB, and O.

| PARENT 1 | | AB | AB | AB | AB | B | A | A | O | O | O |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PARENT 2 | | AB | B | A | O | B | B | A | B | A | O |
| Possible Blood Type of Child | O | | | | | ● | ● | ● | ● | ● | ● |
| | A | ● | ● | ● | ● | | ● | ● | | ● | |
| | B | ● | ● | ● | ● | ● | ● | | ● | | |
| | AB | ● | ● | ● | | | ● | | | | |

Figure 2

Like blood type, many traits are controlled by **multiple alleles**, meaning that more than two alleles exist for a single gene within a population. For example, a rabbit's coat color can be determined by four different alleles of one gene, leading to several possible coat colors.

Humans, like many animals, have a pair of sex chromosomes—X and Y—that determine whether an individual is male or female. An individual with **XY chromosomes is male**, while an individual with **XX chromosomes is female**. Humans have a total of 23 pairs of chromosomes. Twenty-two of these pairs are called **autosomes**, which are non-sex

# Modern Genetics

## Section I: Complex Patterns of Inheritance Cont.

chromosomes and are homologous in both males and females. The remaining pair consists of the sex chromosomes.

A gene that is located on a sex chromosome is called a **sex-linked trait**. These traits are often associated with genes found on the X chromosome. Examples of sex-linked traits include color blindness, hemophilia, and muscular dystrophy. Because males have only one X chromosome, they are more likely to express these traits if they inherit the gene.

Review:

1. Identify an example of polygenic inheritance.
2. How many possible blood types are there?
3. What is an autosome?