Name _____ Date _____ Class _____

SECTION 3-2 **SECTION SUMMARY**

Probability and Genetics

Guide for Reading

- How do the principles of probability help explain Mendel's results?
- How do geneticists use Punnett squares?

Probability is the likelihood that a particular event will occur. The principles of probability predict what is *likely* to occur, not necessarily what *will* occur. For example in a coin toss, the coin will land either heads up or tails up. Each of these two events is equally likely to happen. In other words, there is a 1 in 2 chance that a tossed coin will land heads up, and a 1 in 2 chance that it will land tails up. A 1 in 2 chance can be expressed as a fraction, $\frac{1}{2}$, or as a percent, 50 percent. The result of one coin toss does not affect the results of the next toss. Each event is independent of another.

When Gregor Mendel analyzed the results of his crosses in peas, he carefully counted all the offspring. Over time, he realized that he could apply the principles of probability to his crosses. **Mendel was the first scientist to recognize that the principles of probability can be used to predict the results of genetic crosses.**

A tool that applies the laws of probability to genetics is a Punnett square. A **Punnett square** is a chart that shows all the possible combinations of alleles that can result from a genetic cross. **Geneticists use Punnett squares to show all the possible outcomes of a genetic cross and to determine the probability of a particular outcome.** In a Punnett square, all the possible alleles from one parent are written across the top. All the possible alleles from the other parent are written down the left side. The combined alleles in the boxes of the Punnett square represent all the possible combinations in the offspring.

Two useful terms that geneticists use to describe organisms are genotype and phenotype. An organism's **phenotype** is its physical appearance, or its visible traits. An organism's **genotype** is its genetic makeup, or allele combinations. When an organism has two identical alleles for a trait, the organism is said to be **homozygous.** An organism that has two different alleles for a trait is said to be **heterozygous.**

For all of the traits in peas that Mendel studied, one allele was dominant while the other was recessive. This is not always the case. In an inheritance pattern called **codominance,** the alleles are neither dominant nor recessive. As a result, both alleles are expressed. For example, in Erminette chickens, the alleles for feather color are codominant. Heterozygous chickens (F^BF^W) have both black and white feathers. Codominant alleles are written as capital letters with superscripts to show that neither is recessive.