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SECTION
6.6

MEIOSIS AND GENETIC VARIATION
Reinforcement

KEY CONCEPT Independent assortment and crossing over during meiosis result in genetic diversity.

In organisms that reproduce sexually, the independent assortment of chromosomes during meiosis and the random fertilization of gametes creates a lot of new genetic combinations. In humans, for example, there are over 64 trillion different possible combinations of chromosomes. Sexual reproduction creates genetically unique offspring that have a combination of both parents' traits. This uniqueness increases the likelihood that some organisms will survive or even flourish in changing conditions.

Genetic diversity is further increased through crossing over. **Crossing over** is the exchange of segments of chromosomes between homologous chromosomes. It happens during prophase I of meiosis I when homologous chromosomes pair up with each other and come into very close contact. At this stage, the chromosomes have already been duplicated. Part of a chromatid from each homologous chromosome may break off and reattach to the other chromosome.

Crossing over is more likely to occur between genes that are far apart from each other on a chromosome. The likelihood that crossing over will happen is much less if two genes are located close together. Thus, genes that are located close together on a chromosome have a tendency to be inherited together, which is called **genetic linkage**. Most of the traits that Mendel studied were located on separate chromosomes, and so they assorted independently. When genes are on the same chromosome, however, their distance from each other is a large factor in how they assort. If they are far apart, crossing over is likely to occur between them and so they will assort independently. If they are close together, they are unlikely to be separated by crossing over and so they will not assort independently.

1. What factors contribute to genetic diversity?

2. What is crossing over?

3. If two genes are located close together on the same chromosome, are they likely to follow Mendel's law of independent assortment? Explain.
