Meiosis and Genetic Variation

Meiosis increases genetic variation in organisms that undergo sexual reproduction. Meiosis is similar to mitosis in that chromosomes replicate and divide into daughter cells. However, during meiosis,cells undergo two divisions (meiosis I and II) resulting in daughter cells with half the number of chromosomes as the parent cell, which is called haploid. These cells are the gametes, or sex cells, referred to as sperm and egg. When eukaryotes reproduce sexually, the gametes from each parent join together. The two haploid cells combine, giving the offspring a complete set of chromosomes, which is called diploid.

Sexual reproduction creates greater genetic variety in two ways. First, an offspring inherits DNA from both of its parents. This causes new random combinations of alleles, resulting in a variety of traits that differ from the mother and the father. Since genes are randomly assorted when they are passed to offspring, even two siblings have different combinations of genes and traits from the same set of parents. Only identical twins have exactly the same DNA.

Meiosis also contributes to genetic variation through crossing over. During one phase of meiosis, homologous chromosomes—pairs of chromosomes containing the same genes, but possibly different alleles—line up at the center of the cell. When this happens, sections of the homologous chromosomes can cross over and switch position from one chromosome to the other. This results in a reshuffling of genes on the individual chromosomes, which provides an even greater variety of genetic combinations that can be passed on to offspring.

Sexual reproduction is beneficial to organisms because it increases genetic variation, but asexual reproduction has advantages as well. In asexual reproduction, a single parent produces offspring that are genetically identical to the parent and to one another. This type of reproduction is mostly associated with prokaryotes. Other simple life forms such as the hydra and sponge may reproduce sexually or asexually at various stages of their lives.

Although genetic variation is compromised in asexual reproduction, there are benefits to the parent organism. Animals that are immobile, such as sponges, would have great difficulty finding a mate. Asexual reproduction allows them to produce offspring without having to travel. Another advantage is that in asexual reproduction the parent expends much less energy compared to sexual reproduction. This allows organisms to produce many offspring without greatly taxing their energy or time. Finally, in a stable environment, asexual reproduction produces offspring with the necessary genetic traits to survive and thrive in their environment.

- **What is meiosis?**

- **Why is meiosis important for sexual reproduction?**

- **Why would having a variety of traits in offspring be beneficial?**