Science: Biology

Meiosis

In order for **eukaryotes** (multicellular, nucleated organisms) to reproduce sexually they must go through a specific cell division process called **meiosis**. The result of which produces either **sperm (males)** or **egg cells/ova (females)**, both are referred to as **gametes** or sex cells. Plants also utilize meiosis for sexual reproduction, but first produce spores in which gametes will be produced from. The meiotic process occurs in two separate processes known as **meiosis I** and **meiosis II**. During meiosis I chromosomes match up and exchange genetic material through a process known as **crossing over**. Following crossing over, each pair of chromosomes (**sister chromatids**) will then divide equally into two cells. Meiosis II begins just after meiosis I finishes, this process is very similar to mitosis. In meiosis II, the chromosomes split apart and the two cells formed in meiosis I then divide again. The result is 4 total cells, each with genetically distinct chromosomes. Both processes are explained further below.

Meiosis I begins with a normal cell containing 23 pairs of **homologous** (genetically identical) **chromosomes** (**diploid, 2n**), or 46 individual chromatids. The first part of meiosis, meiosis I, divides a diploid cell into two **haploid cells (n)**. Haploid cells contain 23 chromosomes, none of them being part of a pair.

Prophase I

This is the longest phase and comprises an integral step in completing meiosis, the exchange of DNA. Homologous chromosomes will duplicate, pair up, and exchange DNA in a process known as homologous recombination, or crossing over. The exchange of DNA is what causes genetic variation, or differences in the genetic makeup from individual to individual. The point at which the chromosomes cross-over is defined as the chiasma.

Metaphase I

Once the homologous chromosomes have exchanged DNA, they line up along the metaphase plate in a non-specific way and attach to the spindle fibers that are extending from the centrioles located at the poles. In addition, the nuclear membrane will disappear.

Anaphase I

The sister chromatids are now pulled apart from each other through the shortening of spindle fibers and begin to make their way towards the poles of the cell. Later in anaphase the cell membrane will begin to constrict.

Telophase I

This is the last phase of meiosis I, once the chromosomes have reached the poles of the cell the first meiotic division has successfully finished. The cellular membrane will finish its constriction and the nuclear membrane will reappear, surrounding each group of chromosomes (haploid). In addition, the spindle fibers that attach the sister chromatids to the centrioles will disappear.