11.1D: Comparing Meiosis and Mitosis

Mitosis and meiosis share some similarities, but also some differences, most of which are observed during meiosis I.

Learning Objectives

• Compare and contrast mitosis and meiosis

Key Points

• For the most part, in mitosis, diploid cells are partitioned into two new diploid cells, while in meiosis, diploid cells are partitioned into four new haploid cells.

• In mitosis, the daughter cells have the same number of chromosomes as the parent cell, while in meiosis, the daughter cells have half the number of chromosomes as the parent.

• The daughter cells produced by mitosis are identical, whereas the daughter cells produced by meiosis are different because crossing over has occurred.

• The events that occur in meiosis but not mitosis include homologous chromosomes pairing up, crossing over, and lining up along the metaphase plate in tetrads.

• Meiosis II and mitosis are not reduction division like meiosis I because the number of chromosomes remains the same; therefore, meiosis II is referred to as equatorial division.

• When the homologous chromosomes separate and move to opposite poles during meiosis I, the ploidy level is reduced from two to one, which is referred to as a reduction division.
Key Terms

- **reduction division**: the first of the two divisions of meiosis, a type of cell division
- **ploidy**: the number of homologous sets of chromosomes in a cell
- **equatorial division**: a process of nuclear division in which each chromosome divides equally such that the number of chromosomes remains the same from parent to daughter cells

Comparing Meiosis and Mitosis

Mitosis and meiosis are both forms of division of the nucleus in eukaryotic cells. They share some similarities, but also exhibit distinct differences that lead to very different outcomes. The purpose of mitosis is cell regeneration, growth, and asexual reproduction, while the purpose of meiosis is the production of gametes for sexual reproduction. Mitosis is a single nuclear division that results in two nuclei that are usually partitioned into two new daughter cells. The nuclei resulting from a mitotic division are genetically identical to the original nucleus. They have the same number of sets of chromosomes, one set in the case of haploid cells and two sets in the case of diploid cells. In most plants and all animal species, it is typically diploid cells that undergo mitosis to form new diploid cells. In contrast, meiosis consists of two nuclear divisions resulting in four nuclei that are usually partitioned into four new haploid daughter cells. The nuclei resulting from meiosis are not genetically identical and they contain one chromosome set only. This is half the number of chromosome sets in the original cell, which is diploid.

![Diagram comparing meiosis and mitosis](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/11%3A_M…)
kinetochore fibers from opposite spindle poles attached to each kinetochore of a homolog in a tetrad. All of these events occur only in meiosis I.

When the tetrad is broken up and the homologous chromosomes move to opposite poles, the ploidy level is reduced from two to one. For this reason, meiosis I is referred to as a reduction division. There is no such reduction in ploidy level during mitosis.

Meiosis II is much more similar to a mitotic division. In this case, the duplicated chromosomes (only one set, as the homologous pairs have now been separated into two different cells) line up on the metaphase plate with divided kinetochores attached to kinetochore fibers from opposite poles. During anaphase II and mitotic anaphase, the kinetochores divide and sister chromatids, now referred to as chromosomes, are pulled to opposite poles. The two daughter cells of mitosis, however, are identical, unlike the daughter cells produced by meiosis. They are different because there has been at least one crossover per chromosome. Meiosis II is not a reduction division because, although there are fewer copies of the genome in the resulting cells, there is still one set of chromosomes, as there was at the end of meiosis I. Meiosis II is, therefore, referred to as equatorial division.