Prophase

Prophase is the first phase of cell division, and varies in mitosis and in meiosis. However, there are three key similarities in both types of replication. The nuclear membrane disintegrates, centrioles migrate to opposite cell ends and spindle apparatus form in preparation for chromosome separation. In meiosis I prophase, the cell is diploid meaning it has one copy of each chromosome from each parent, resulting in double the amount of genetic information. Those two chromosomes, one from each parent, are called homologous chromosomes because they code for the same set of genetic information but have potentially different alleles because each is from a different parent. Homologous chromosomes are paired together in meiosis I prophase, resulting in a process called synapsis where similar regions of the chromosomes overlap. Because the regions that code the same genes overlap, chromosomes can undergo "crossing over" in which they swap sections of genetic information resulting in genetic diversity. They are said to be in tetrads, where four chromatids (two sister chromatids) are closely associated with each other. In meiosis II prophase, the cell is haploid because each daughter cell received either the mom's or dad's chromosome for each of the 23 chromosomes. This means that for each chromosome (1 to 23), there is only one allele present in the cell. The sister chromatids of one of the homologous chromosome pair are now the paired units in meiosis II prophase. The sister chromatids are eventually separated into individual chromatids. Finally, in mitosis prophase, the cell is diploid because human somatic cells are diploid and have both the mom's and dad's set of chromosomes. However, sister chromatids are the paired units and homologous chromosomes DO NOT pair together. This means that each daughter cell will get one copy of mom's chromatids and one copy of dad's chromatids, resulting in genetically identical daughter cells.

PLAY PICMONIC

Nuclear Membrane Disintegrates

Nuclear-balloons flying away

In the beginning of prophase for both types of cell division, the nuclear membrane disintegrates allowing for splitting of genetic material.

Centrioles Migrate

Cent-trolls Sliding

Centrioles are groups of microtubules that, in both types of cell division, migrate to different poles and attach to chromosomes.

Spindle Apparatus Forms

Spindle with Fibers

A spindle apparatus is fundamentally comprised of spindle microtubules and hundreds of proteins that, in both types of cell division, help separate chromosomes during cell division.

Meiosis I starts Diploid

Mouse-rose (1) Wand with Diaper-plaid-chromosomes

In the Prophase stage of Meiosis I, the cell starts out as diploid. Meiosis is a type of cell division that is necessary for sexual reproduction, and begins with diploid germ cells.

Homologous Chromosomes form Tetrads

Home-of-logs Chromosomes with Tetris

In Meiosis I Prophase, homologous chromosomes are paired together. Homologous chromosomes are two pairs of sister chromatids that code the same set of genetic information but have different alleles. This is because one copy comes from the mother, while another copy comes from the father. Two homologous chromosomes closely associated is called a tetrad, because there are four chromatids.

Tetrads Cross Over

Tetris-chromosomes Crossing

Crossing over is the process whereby homologous chromosomes, in a tetrad formation, exchange equivalent nucleotide sequences. Keep in mind that sister chromatids on the same chromosome do not exchange sequences because two sister chromatids are genetically identical prior to any crossing over occuring. It only occurs between two adjacent homologous chromosomes.

Meiosis II starts Haploid

Mouse-rose in (2) Tutu with Hat-plaid chromosomes

In Meiosis II Prophase, the cell is haploid. This is because in meiosis I, homologous chromosomes were lined up such that each new cell got either mom's chromosome or dad's chromosome for each of the 23 chromosomes. Thus, the new cells have a mix of genetic information from both parents, but only have 1 allele for each gene.

Mitosis starts Diploid

Mitt-toes with Diaper-plaid Chromosomes

In Mitosis Prophase, the cell is diploid. This is the case in humans, where most human cells are diploid other than gametes and undifferentiated stem cells. The goal of mitosis is to produce two identical daughter cells.

Sister Chromatid Pairs Stay Separated

Sister Chrome-kid Pairs Stay Separated

Sister chromatid pairs stay separated in meiosis II and mitosis. In meiosis II, the homologous chromosomes have already been separated so tetrads cannot form. In mitosis, tetrads can form but do NOT form because the goal is to produce genetically identical daughter cells that have a copy of DNA from both original parents of the dividing cell.