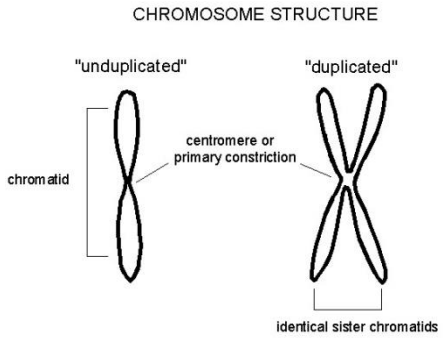
MITOSIS AND MEIOSIS

Nearly all human cells contain 46 chromosomes arranged in 23 pairs. Males have an XY pair and females have an XX pair. Cells with 46 chromosomes are called diploid cells, with 46 being the diploid number. Sex cells however, only have half this number and they're called haploid cells.

Mitosis

Diploid cells divide by mitosis and produce two cells which contain identical sets of chromosomes. When a parent cell divides it produces daughter cells. These are genetically identically to the parent cell. The stages of mitosis are as follows:



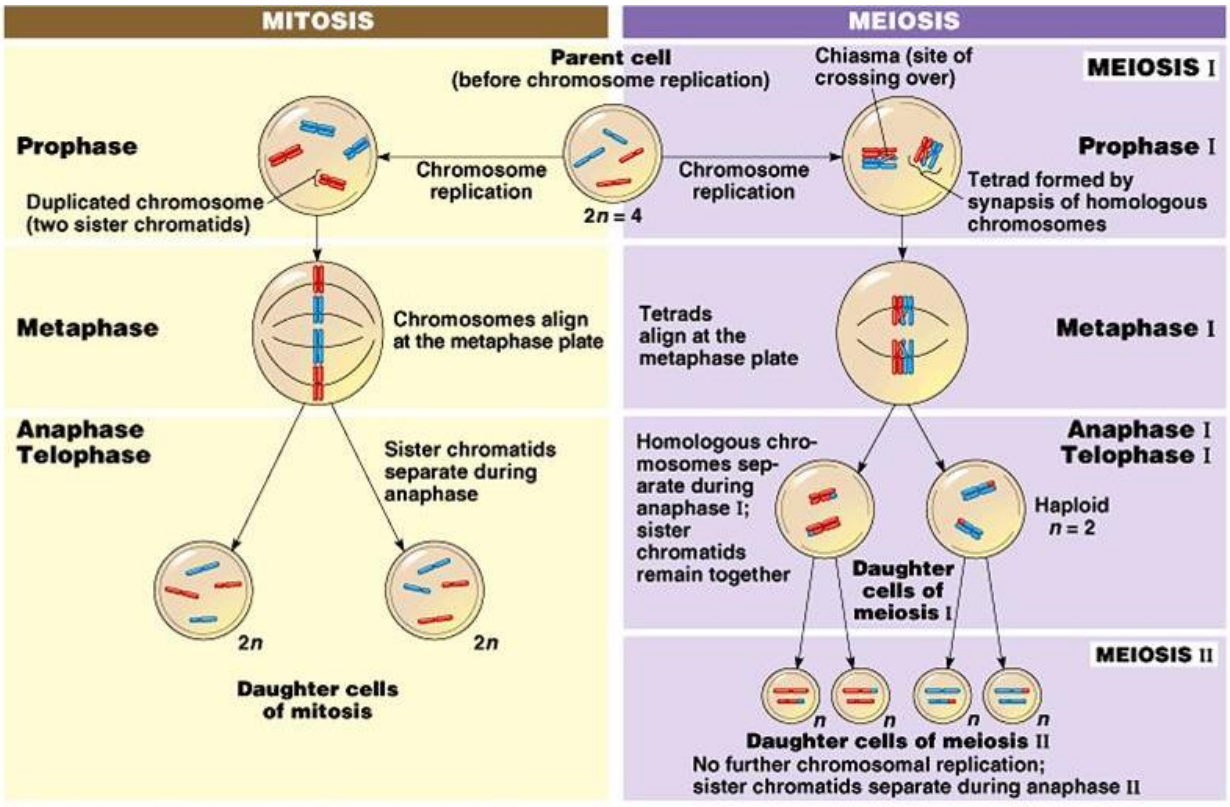
1. Chromosomes are copied as the DNA replicates and more histones (proteins the DNA coils around) are made. Each chromosome gets a sister chromatid which are joined together by a centromere.
2. Prophase – the nuclear membrane breaks down.
3. Metaphase – the spindle forms and the chromatids attach themselves to the spindle fibres by their centromeres.
4. Anaphase – the spindle fibres shorten and pull the chromatids of each chromosome to opposite ends of the cell (basically the chromosome splits into half).
5. Telophase – two nuclei form at the poles of the cell, each with a copy of the chromosome from the parent cell and the cell splits.

Meiosis

Meiosis produces four cells, each with the haploid number of chromosomes, resulting genetic variation in the cells. The stages of meiosis are as follows:

1. Each chromosome copies itself and results in having a sister chromatid.
2. The parent cell then splits, and results in two daughter cells.
3. The resulting daughter cells split once again and one chromatid from each chromosome ends up in each daughter cell.

If asked to predict the number of possible combinations of chromosomes, use the formula 2^n where n = number of pairs of chromosomes.



Random fertilization produces genetic variation of offspring. Using a 'low' estimate of about 8.5 million different types of human sex cells means there can be 8.5 million types of sperm and ova. When fertilization takes place, the number of possible combinations of chromosomes in the zygote is 8.5 million x 8.5 million = 72 trillion.

Identical twins are formed from the same zygote. The zygote then divides by mitosis, and the two genetically identical cells that are formed, separate, and behaves like an individual zygote. Non-identical twins develop from different zygotes.
Variation within a species can be genetic, environmental, or a combination of both.