Sexual Reproduction

- The process of producing offspring by means of two parents each contributing half the genetic information to the offspring.
Sexual Reproduction

- Involves the union (fertilization) of two sex cells (called gametes).
- The female gamete (egg in humans) and the male gamete (sperm in humans) unite to form a zygote (a fertilized egg).
Meiosis

- A special type of cell division necessary for sexually reproducing organisms.
Cells (gametes) produced via meiosis contain half the number of chromosomes as the parent cell and are therefore referred to as haploid cells (in humans n=23).

Cells that have the full set of chromosomes are said to be diploid (in humans 2n=46).
Cells that have the full set of chromosomes are said to be diploid (in humans 2n=46).

So we can define Meiosis as a special type of cell division which produces haploid cells called gametes.
Comparing Mitosis to Meiosis

MEIOSIS

- Synapsis and crossing over occur
- Homologues align independently
- Homologues separate
- Daughter cells form
- Daughter chromosomes separate
- Daughter nuclei are not genetically identical to parent cell

MITOSIS

- Chromosomes align at the metaphase plate
- Daughter chromosomes separate
- Daughter cells form
- Daughter nuclei are genetically identical to parent cell
Meiosis I

interphase I

prophase I

Chiasmata
Spindle
Microtubule attached to kinetochore
Metaphase plate

Chromatin
centrosomes (with centriole pairs)
Nuclear envelope
Sister chromatids
Tetrad
Centromere (with kinetochore)

Homologous chromosomes pair and exchange segments
Synapsis - pairing of homologs to form tetrad
Tetrads line up
Pairs of homologous chromosomes split up

metaphase I

anaphase I

Sister chromatids remain attached
**Meiosis I**
- Telophase & cytokinesis

**Meiosis II**
- Prophase II
- Metaphase II
- Anaphase II
- Telophase II

**Cleavage furrow**
- Cleavage furrow is formed, leading to the separation of the nascent cells.

**Two haploid cells form; chromosomes are still double**
- During another round of cell division, the sister chromatids finally separate; four haploid daughter cells result, containing single chromosomes.

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The process of homologous chromosomes exchanging sections of DNA during Prophase I of Meiosis.

This dramatically increases the variability of the gametes produced by any given individual.
Spermatogenesis and Oogenesis

(a) Gamete formation in the male

Spermatocyte (diploid) → Meiosis I → Meiosis II → Spermatids (haploid) → Sperm cells (haploid)

(b) Gamete formation in the female

Oocyte (diploid) → Meiosis I → Meiosis II → Egg cell (haploid)

Polar bodies (haploid)
Normal Human Karyotype

1  2  3  4  5  6  7  8

9  10 11 12 13 14 15 16

17 18 19 20 21 22 XX XY