How Reproductive Cells (Gametes) Are Made:
(page 470)

Reproducing sexually means we have to cut the amount of genetic material from the regular full complement of DNA (found in any “diploid cell” (2N)) down to a half set (inside any “haploid cell” (N)). This allows haploid sperm to fertilize haploid egg (ovum) to make a diploid zygote. 

(N + N = 2N)

Meiosis....

The process of making haploid sperm and egg cells inside reproductive organs. Spermatogenesis in males, oogenesis in females. It is made up of 2 “divisions”...meiosis I and meiosis II....

Meiosis I -

“the reduction division”....a diploid cell pulls the DNA set in half to become haploid. Consists of Interphase1, Prophase1, Metaphase1, Anaphase1, and Telophase1. Pairs of chromosomes “Cross over” and are then separated.
**MEIOSIS I**

**Prophase I (late)**
- Spindle apparatus forms.
- Nuclear envelope fragments.
- Spindle fibers attach to kinetochores on each chromosome.

**Anaphase I**
- Homologous chromosomes separate to opposite poles of cell.

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**Nucleus**

**Spindle fibers**

**Nuclear envelope**

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**Prophase I (early)**
- Synapsis and crossing over occur. Chromosomes condense, become visible.

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**Metaphase I**
- Paired homologous chromosomes align along equator of cell.

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**Telophase I**
- Nuclear envelopes partially assemble around chromosomes, which may temporarily decondense. Spindle disappears. Cytokinesis divides cell into two.
Meiosis II - looks like mitosis...pulling apart individual chromosomes into individual chromatids. There may or may not be a second “interphase stage”, depending on the species. Followed by Prophase 2, Metaphase 2, Anaphase 2, and Telophase 2 - resulting in FOUR HAPLOID DIFFERENT CELLS BEING MADE.
An overview of cells, chromatin, chromosomes, and genes...

Chromatin -
Chromosomes -
  Unreplicated-
  Replicated-
Gene -
Proteins -
Traits -

Human chromosomes -
  46 in a human diploid cell (body, or somatic, cells...arranged in 23 pairs), 23 in a human haploid cell (sex cell, or germ cell, ie. Sperm and ovum)

- first 22 pairs are **autosomes**...control body traits, each pair contains a maternal chromosome and a paternal chromosome
- last pair are **sex chromosomes**...XX is female, XY is male. Mommy gave you an “X”. Daddy gave you a “Y” if you’re male or an “X” if you’re female.
An orderly arrangement of somebody’s chromosome set is called a “karyotype”, looks like...

Normal Male-

Normal Female-
Meiosis I:

Interphase I -
chromatin $\Rightarrow$ 46 chromatids $\Rightarrow$ replicate $\Rightarrow$ 46 c’somes
(form 22 matching pairs...each with one maternal and one paternal, and one pair of sex chromosomes...a maternal X and a paternal _____ ?)

Prophase I -
pairs of matching c’somes carrying the same trait info come together (homologous chromosome pair = a “tetrad”)

[Diagram of chromosomes with annotations such as Centromere, Sister chromatids, Pair of homologous chromosomes]
Chromatids may carry different forms of the same trait, called “alleles”.

At this time, “crossing over” may occur between chromatids, parts of the c’some break off and reattach on a different chromatid...greatly increasing variety by making new combinations of genes. Mixes up mom’s and dad’s genes to make your own sex cells.