Chapter 13- Meiosis and Sexual Life Cycles

(Key Concepts are Underlined)

An Introduction to Heredity

Offspring acquire genes from parents by inheriting chromosomes

Genes- hereditary units, or segments of DNA, which code for specific proteins

Locus- specific location of gene along chromosomal DNA

Like begets like, more or less: a comparison of asexual and sexual reproduction

Asexual reproduction- single individual passes along all of its genes to its offspring (a clone)

Sexual reproduction- two parents give rise to offspring with unique combinations of their genes (generates variation)

The Role of Meiosis in Sexual Life Cycles

Fertilization and meiosis alternate in sexual life cycles

Life cycle- generation-to-generation sequence of stages in the reproductive history of an organism

Karyotype- picture arrangement of chromosome pairs (or **homologous pairs**, or homologues); homologues carry genes controlling the same inherited characters

Sex chromosomes- *X* and *Y* chromosomes

Autosomes- all other chromosomes (excluding sex chromosomes)

Haploid cell (1n) - cell with single chromosome set (e.g. gametes)

Fertilization- or syngamy, union of gametes

Diploid cell (2n) - cell with two sets of chromosomes **[**e.g. humans, 2(23) = 46 chromosomes]
Zygote- fertilized egg
- there are three types of sexual life cycles, which differ in timing of meiosis and fertilization (e.g. **alternation of generation** of plants and some algae)
Sporophyte- multicellular diploid stage of sexual life cycle
Gametophyte- multicellular haploid stage of sexual life cycle

<u>Meiosis reduces chromosome number from diploid to haploid: *a closer look*</u>
Mitosis vs. Meiosis- meiosis reduces the chromosome number in half (chromosome number is conserved in mitosis)
Meiosis I- homologues pair (called **synapsis**) as a **tetrad**; crossing over of *nonsister* chromatids occurs in regions called **chiasmata**; homologues separate, as opposed to sister chromatids in mitosis; results in two cells with half the chromosome number of parent cell

Interphase I
Prophase I
Metaphase I
Anaphase I
Telophase I and Cytokinesis

Meiosis II- sister chromatids separate; DNA does not replicate between Meiosis I and II; results in four cells with half the chromosome number of parent cell

Prophase II
Metaphase II
Anaphase II
Telophase II and Cytokinesis

Origins of Genetic Variation

Sexual life cycles produce genetic variation among offspring

Independent Assortment of Chromosomes- the orientation of the homologous chromosomes on the metaphase plate in Meiosis I is random; number of combinations of possible gametes formed by meiosis is 2^n, where n represents the number of sets of chromosomes or haploid number (e.g. humans = 2^{23} = approximately 8 million)

Crossing Over- produce chromosomes with combined genes inherited by both parents via the exchange of homologous portions of two nonsister chromosomes during prophase of meiosis I; increases genetic variability of gametes

Random Fertilization- without considering crossing over, any two parents will produce a zygote with any of about 64 trillion diploid combinations (8 million possible sperm cells x 8 million possible ova)

Evolutionary adaptation depends on a population's genetic variation