

Mitosis and Meiosis

- I. These two processes function to pass chromosomes from one cellular generation to the next in a very carefully controlled manner.
- II. Mitosis and Meiosis are both correctly described as **nuclear** division; they are never correctly called **cell** division, or any kind of reproduction. It is possible (and often quite normal) for nuclei to divide when cells don't. And organisms reproduce; nuclei and cells divide.
- III. **Mitosis**
 - A. Mitosis is the division of a nucleus to produce two genetically identical daughter nuclei.
 - B. Mitosis is utilized for any function which requires the production of more cells with identical genetic information. These processes include the vast majority of cell production during the growth of an organism, the cell division needed for healing and repair, and the division of nuclei when an organism is in the process of asexual reproduction. Note: Mitosis is not asexual reproduction, nor can it be called asexual cell (or even nuclear) division.
 - C. Because the vast majority of the cells in a multicellular organism were produced by mitotic cell division, those cells all have identical nuclei. They obviously don't all look or function alike. Cells mature through a process called **differentiation** in which select sets of genes are turned on and off, resulting in changes in the structure and function of the cell.
- IV. **Meiosis**
 - A. Meiosis is the division of one diploid (usually) nucleus to produce four haploid (usually) nuclei, all genetically different. Though the vast majority of the time the chromosome number reduction is from diploid to haploid, in some cases it may be from, say, hexaploid (eg., wheat) to triploid.
 - B. Meiosis performs a key task necessary in a sexual life cycle. Since fertilization (which is the actual sexual event in the life cycle) automatically doubles chromosome number by combining the chromosomes of an egg and a sperm, it is essential that some event occur somewhere in the life cycle which reduced the chromosome number to compensate.
 - C. Though Meiosis is part of a sexual life cycle, it is not ever correctly described as, for instance, "sexual cell division," and certainly not as "sexual reproduction." It is the life cycle, and specifically the fertilization event, which constitute sexual activity, not Meiosis.
 - D. In animal life cycles, the meiotic cell division in the life cycle immediately precedes the development of gametes (eggs and sperm). However, this need not at all be the case. Plants have a somewhat different sexual life cycle from animals which includes all of the same events, including Meiosis, production of gametes, and fertilization, but also includes an additional phase **between** Meiosis and gamete production.
- V. There are three differences between what Mitosis accomplishes and what Meiosis accomplishes.
 - A. Mitosis divides one nucleus into two; Meiosis divides one nucleus into four.
 - B. Mitosis conserves chromosome number; Meiosis reduces it in half (usually from diploid to haploid).
 - C. Mitosis produces genetically identical daughter nuclei; Meiosis produces genetically different daughter nuclei.
- VI. Errors in nuclear division can produce **chromosome anomalies**.
 - A. Nuclei whose chromosomes do not form normal sets (eg, which have extra or missing chromosomes in one or more of the chromosome sets) are **aneuploid**.
 1. Aneuploidies typically result from **nondysjunction** in either Meiosis I or Meiosis II.
 2. If a nucleus which should be diploid has three of a chromosome instead of the normal two, that nucleus is **trisomic**. For example, if the nucleus of a human cell has three of chromosome 18, that would be trisomy 18. This term is also used for an organism, all of whose cells are trisomic. Trisomy 21 can refer to a human, all of whose cells have three twenty-first chromosomes instead of the expected two.
 3. If a nucleus which should be diploid has only one of a chromosome instead of the normal two, that nucleus is **monosomic**. An individual may be described as monosomic if all (or most) of the