

Chapter 11

MITOSIS AND CELLULAR REPRODUCTION

OVERVIEW: Cells multiply by replicating DNA in cells and producing identical daughter nuclei for each of two daughter cells by mitosis. Mitosis begins with replicated DNA being condensed into chromosomes, consisting of two chromatids, each carrying one copy of the replicated DNA. Spindle fibers attach to each chromosome at a centromere which allows for separation of the sister chromatids, each being drawn apart by contracting spindle fibers to contribute DNA to one of two daughter nuclei. Each daughter nucleus occupies a new daughter cell after cytoplasmic division. Cellular reproduction is important to growth, maintenance and repair of tissues, and asexual reproduction (*e.g.* cloning).

STRATEGY: Continue reading in Chapter 11 (*i.e.* what you began in Assignment #19), beginning with page 223 and read to page 231.

BOARDS, NAILS:

chromosome	chromatids	interphase (<i>inter</i> =
homologous pairs	centromere	prophase (<i>pro</i> =
genome	spindle fibers	metaphase (<i>meta</i> =
DNA replication	cytoplasmic division	anaphase (<i>ana</i> =
	asexual reproduction	telophase (<i>telo</i> =

LEARNING GOALS:

1. Select several pairs or larger groups of the above terms that you will most likely confuse and develop ways of distinguish them.
2. How does complementary pairing of nitrogen bases in DNA function in DNA replication?
3. Define each and describe the relationship between newly replicated DNA, chromatids, centromeres, and chromosomes.
4. Describe the events in the progression of mitosis from prophase to the appearance of daughter nuclei. [If you haven't already done so, write the meanings of the Latin prefixes above.]
5. Considering the submicroscopic, molecular nature of the DNA and the fact that, for example the human genome consists of a one-meter length of DNA (if joined together from each of the chromosomes) suggest the "design and purpose" that may be evident in mitosis. For example, the condensation of DNA into chromosomes, the centromeres to hold chromatids temporarily, and the spindle fibers to guide movement.
6. List and discuss three roles of mitosis and cytoplasmic division (cell reproduction) in the life span of organisms. Which of the three is not naturally possible in humans? Why not, do you suppose?

INTERNET: See "BIO 100 Web Links" Page, Assignment #20 for graphics (some animated) about cell reproduction.

STUDY OUTLINE: Reproduction of Cells – Mitosis and Cytoplasmic Division

I. CELLULAR REPRODUCTION – Involves MITOSIS and CYTOPLASMIC DIVISION

II. PROGRESSION OF EVENTS:

A. DNA REPLICATION

B. PROPHASE – BEGINNING OF MITOSIS – formation of chromosomes:

1. CHROMOSOMES – condensed (shortened) into microscopically visible bodies, each with

a. TWO CHROMATIDS – representing one copy of the replicated DNA

b. SPINDLE FIBERS – attached to chromatids at the CENTROMERE; serving to guide chromosomes during mitosis

C. METAPHASE – chromosomes align along middle of the spindle apparatus

D. ANAPHASE – spindle fibers contract and separate chromatids at the centromere

1. CHROMATIDS now called CHROMOSOMES when separated from each other

2. CHROMOSOMES then drawn apart, and destined to enter two DAUGHTER NUCLEI

E. TELOPHASE – chromosomes uncoil and daughter nuclei become distinct organelles with membrane surrounding DNA

F. CYTOPLASMIC DIVISION provides separate cellular compartment around each daughter nucleus – two cells have formed from one.

III. IMPORTANCE OF MITOSIS AND CYTOPLASMIC DIVISION:

A.

B.

C.