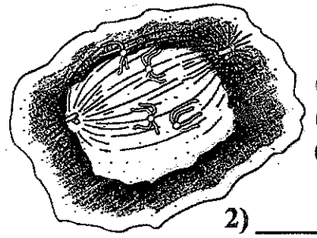
CELLULAR REPRODUCTION

OBJECTIVE #8 Describe the stages of the cell life cycle, including mitosis, interphase, and cytokinesis, and explain their significance.
OBJECTIVE#10 Define differentiation and explain its importance.

A. The Cell Life Cycle (Figure 3.20 pg. 83)

1. _____
   a. **Definition: stage in life cycle of cell when _____ uncoil and all _____ cell functions are being performed**
   b. **Length _____ among cell types**
   c. **Phases**
      1) **Phase _____:**
         a) _____
         b) **certain digestive tract cells go through this every few days**
         c) **some cells only after injury**
      2) **Phase _____: (synthesis):**
         a) _____
         b) _____
         c) **takes about 6-8 hours**
      3) **Phases _____:**
         a) _____
         b) _____

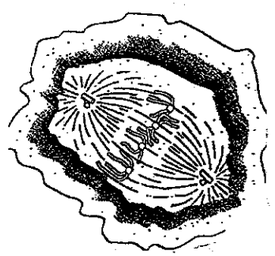
2. _____
   a. **Definition: division of a somatic cell to form two identical daughter cells; primary mechanism of tissue growth**
   b. **Stages**
      1) _____
         a)**Definition: stage of mitosis when chromosomes become visible**
         b) **Major events**
            (1) **chromosomes _____; 2 copies (_____) connected at _____**
            (2) **nucleoli _____**

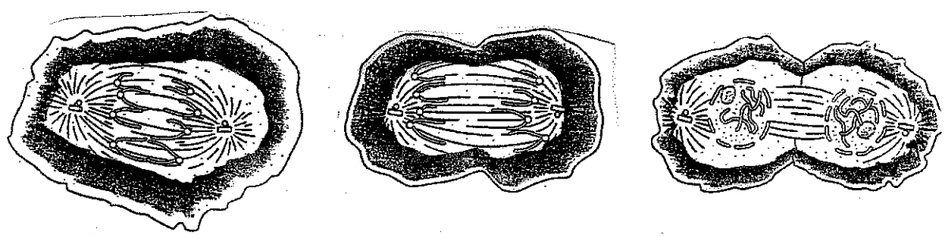


(3) _____ move to opposite poles
(4) _____ extend btw. centrioles
(5) nuclear envelope _____

2) _____
a) Definition: stage in mitosis when chromosomes _____
b) Major events: _____ align at the metaphase plate, a narrow central zone midway between centrioles

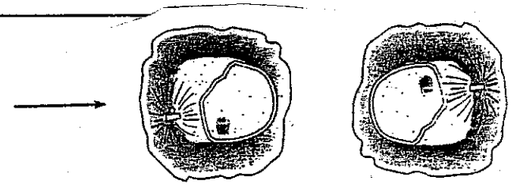
3) _____
a) Definition: stage in mitosis when duplicate chromosomes move to opposite poles of cell
b) Major events:
(1) _____
(2) microtubules _____ daughter chromosomes toward _____of cell





4) _____
a) Definition: stage in mitosis when newly formed cells separate
b) Major events
(1) nuclear membrane _____
(2) nuclei _____
(3) chromosomes elongate (gradually uncoil) and fine filaments of _____
(4) nucleoli _____

3. Cytokinesis : aka _____
a. definition: the cytoplasmic mvmt. that separates two daughter cells at the completion of mitosis
b. begins during late anaphase when cell membrane starts to constrict
c. _____ forms
d. cells may differ slightly in _____ of organelles but have identical _____



4. _____
   a. definition: _____
   b. a key process in homeostasis

5. Cell _____
   a. Definition: the gradual appearance of characteristic _____ _____during development as the result of _____ _____
   b. Some of the DNA information is expressed while other information is repressed
   c. By birth, a human has 260+ types of specialized cells
   d. Example: in bone cells, information for bone cell function is expressed while nerve cell information is repressed
   e. stem cell: _____

B. Abnormal Growth and Division
   1. _____
      a. definition: mass or swelling produced by _____ _____
      b. _____ : abnormal cells confined w/i a connective tissue capsule
      c. malignant : _____
      d. *primary* tumor: _____
      e. invasion: _____
      f. _____: migration which produces secondary tumors
   2. Cancer: illness resulting from _____ of _____

ORGANIZATION OF THE BODY
CELL DIVISION / MITOSIS *

CN 10

1. Complete each phase before going to the next. Reading the appropriate portion of the text will help you understand the meaning of each phase as you draw it. Structures are not repeatedly labeled in each succeeding phase; just color as you did in the preceding phase.
2. Use the same colors for cell membrane, nuclear membrane, nucleolus, and centrioles as were used on the plate of the generalized cell.
3. The colors used for structures e–e^2 should be strongly contrasted from the colors used for f–f^2 in order to better perceive how they are arranged and segregated. These colors do not reflect differences in quality of the chromatids/chromosomes.
4. We recommend that you use a gray color for d and d^1 so as not to confuse with structures e–e^2 and f–f^2.
5. You can color a line through the spindle fibers (j) rather than color each dot.

CELL MEMBRANE$_a$
NUCLEAR MEMBRANE$_b$
NUCLEOLUS$_c$
CHROMATIN$_{d^*}$/CHROMOSOMES$_{d^{1*}}$
CHROMATIDS$_e$/CHROMOSOMES$_{e^1}$
CHROMATIN$_{e^2}$
CHROMATIDS$_f$/CHROMOSOMES$_{f^1}$
CHROMATIN$_{f^2}$
CENTROMERES (KINETOCHORES)$_g$
CENTRIOLES$_h$
ASTERS$_i$
SPINDLE FIBERS$_j$

A vital characteristic of all living things is the ability to reproduce its kind. Living things are composed of cells, and it is cells that reproduce, in a process of duplication and division called mitosis. Some cells reproduce regularly and frequently (epithelial and connective tissue cells) and others experience division only under specific circumstances, if at all (nerve cells). Failure of certain cells to grow and divide generally constitutes atrophy (without growth). Uncontrolled mitoses constitute cancer.

The drawings primarily reflect changes in the nucleus, because the significance of mitosis lies in the duplication and subsequent division of DNA, the genetic material. Mitosis usually occurs rapidly—within minutes. The period between successive divisions is called *interphase*. It is during this period that the DNA (in chromatin) is doubled preparatory for the next mitosis. The observed nuclear changes during cell division are described by phases:

Prophase: *dispersed chromatin* (d*) begins to thicken, shorten, and coil, forming condensed chromatin or *chromosomes* (d^{1*}). There are 46 of them. Each chromosome (only 4 are shown for simplification) consists of 2 *chromatids* (e and f) connected by a *centromere* (g). Each chromatid has the equivalent DNA of a chromosome, and will be called a chromosome in anaphase, as you will see. Note in your coloring, that one chromatid (e) of each of the 4 chromosomes is destined for one *daughter cell*, and one (f) is destined for the other daughter cell. As prophase ends, the *nucleolus* disappears and the *nuclear membrane* dissolves. In the cytoplasm, 2 pairs of *centrioles*, having duplicated in interphase, project *asters* of microtubules; the pairs head for opposite poles of the dividing cell.

Metaphase: strands of microtubules *(spindle fibers)* project across the cell center from one pair of centrioles to the other. 46 pairs of chromatids and their centromeres (4 shown here) begin to group on the spindle fibers in the cell center.

Anaphase: the centromeres divide, each daughter centromere attached to one of the two chromatids. The chromatids are no longer paired. They are rightfully called *chromosomes* now (e^1, f^1), and there are 46 of them being drawn to each pole of the dividing cell by their centromere. (4 are shown here going to each of the two poles). Anaphase ends when the new daughter chromosomes arrive at their respective poles.

Telophase: the cytoplasm begins to cleave, pinching the dividing cell into two new cells. In each new cell the nucleolus and nuclear membrane are reconstituted. The chromosomes begin to disperse as the centromeres disappear. The cytoplasmic organelles are segregated into the two daughter cells as the cleavage of the cytoplasm is rapidly completed. The daughter cells, like their "mother cell" before them, will remain in interphase until their "time" arrives.