

Section 16.1 Review Answers

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1. As a seedling grows into a tree, the size of the plant increases. To accommodate this growth, cells must divide, rather than simply grow larger. As a cell grows in size, the volume of its cytoplasm increases at a faster rate than the surface area of its plasma membrane. A cell absorbs nutrients and excretes wastes through its plasma membrane. As the volume of the cytoplasm increases, more materials must pass through this membrane. If a cell continues to grow in size, its plasma membrane becomes too small to meet its metabolic needs. New growth, therefore, must come from the addition of new cells. Another reason cells must divide as a seedling matures is that different cell types are required to meet the structural and metabolic needs of the plant (i.e. the cells that make up bark, leaves, roots, etc. all differ). Cell division is necessary to produce these differentiated cells.
2. As microscopes and their lenses became further developed, greater magnification followed; new synthetic stains that specifically stained the chromatin in the nucleus made it possible to identify the chromatin and observe its behaviour during mitosis.
3.
 - G1 (Gap 1 or Growth 1) phase: The first growth stage in which rapid growth and metabolic activity occurs.
 - S phase: The synthesis phase in which a duplicate set of DNA is produced.
 - G2 (Gap 2 or Growth 2) phase: A second growth phase in which the cell rebuilds its energy reserve and produces the numerous proteins and other substances required for mitosis and cytokinesis.

- Mitosis: The division of the cell nucleus and its genetic material.
 - Cytokinesis: The division of the cytoplasm and the organelles into two daughter cells.
4. (a) Haploid cells have one set of unpaired chromosomes. Diploid cells have one set of paired homologous chromosomes.
(b) Chromatin is the diffuse DNA and associated proteins the exists in interphase. A chromosome is the highly coiled and condensed chromatin that is visible during mitosis.
(c) The XX chromosomes are the homologous chromosomes found in female organisms. The X and Y chromosome are nonhomologous chromosomes found in male organisms.
 5. Each chromosome of a homologous pair has: 1. the same length and size, 2. the same banding pattern when stained, and 3. the same genes at the same loci, although alleles differ.
 6. The chromatin is replicated during the S (synthesis) phase of the cell cycle to create two identical chromosomes.
 7. A human cell with an X and Y chromosome came from a male because the Y chromosome is the human male sex chromosome. The cell is somatic because it has 22 pairs of autosomes. It is diploid because it has 46 chromosomes (22 homologous pairs and an X and Y chromosome).