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Lab Time/Date 8:30-5pm

The Cell: Anatomy and Division

Anatomy of the Composite Cell

1. Define the following terms:

organelle: Intracellular structure that performs specific functions for the cell

cell: the structural and functional unit of all living cells

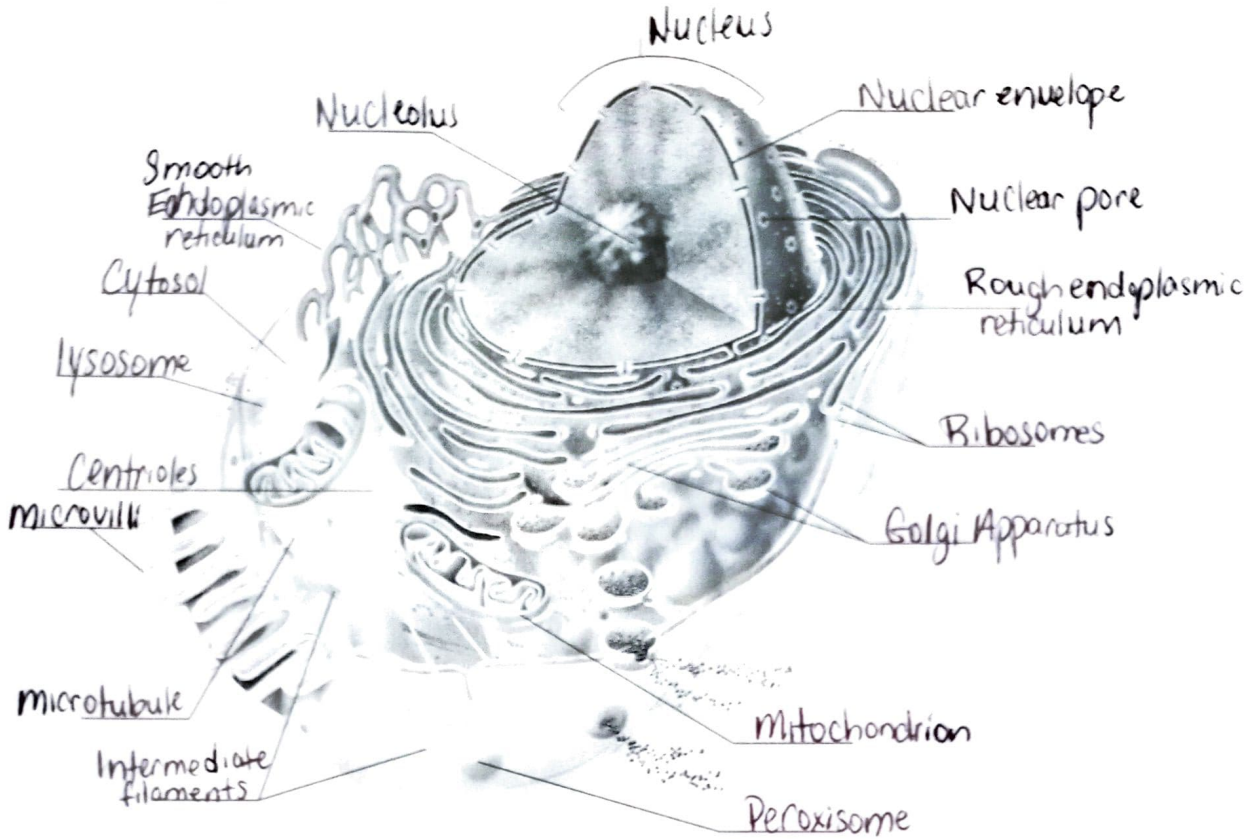
2. Although cells have differences that reflect their specific functions in the body, what functions do they have in common?

maintain boundaries, metabolize, reproduce, grow, move and respond to stimulus

3. Identify the following cell parts:

- | | |
|--------------------------|--|
| <u>plasma membrane</u> | 1. external boundary of cell; regulates flow of materials into and out of the cell; site of cell signaling |
| <u>lysosome</u> | 2. contains digestive enzymes of many varieties; "suicide sac" of the cell |
| <u>mitochondria</u> | 3. scattered throughout the cell; major site of ATP synthesis |
| <u>microvilli</u> | 4. slender extensions of the plasma membrane that increase its surface area |
| <u>inclusions</u> | 5. stored glycogen granules, crystals, pigments, and so on |
| <u>Golgi apparatus</u> | 6. membranous system consisting of flattened sacs and vesicles; packages proteins for export |
| <u>nucleus</u> | 7. control center of the cell; necessary for cell division and cell life |
| <u>centrioles</u> | 8. two rod-shaped bodies near the nucleus; associated with the formation of the mitotic spindle |
| <u>nucleolus</u> | 9. dense, darkly staining nuclear body; packaging site for ribosomes |
| <u>microfilaments</u> | 10. contractile elements of the cytoskeleton |
| <u>Rough ER</u> | 11. membranous system; involved in intracellular transport of proteins and synthesis of membrane lipids |
| <u>Ribosomes</u> | 12. attached to membrane systems or scattered in the cytoplasm; site of protein synthesis |
| <u>chromatin threads</u> | 13. threadlike structures in the nucleus; contain genetic material (DNA) |
| <u>peroxisome</u> | 14. site of free radical detoxification |

4. In the following diagram, label all parts provided with a leader line.



Differences and Similarities in Cell Structure

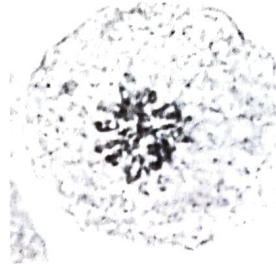
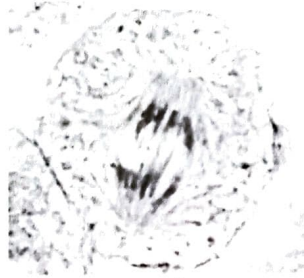
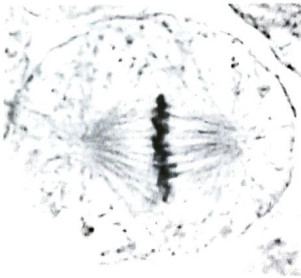
5. For each of the following cell types, list (a) one important structural characteristic observed in the laboratory, and (b) the function that the structure complements or ensures.

- | | |
|---------------------|--|
| squamous epithelium | a. cells fit closely together |
| | b. lining or covering tissue |
| sperm | a. has a tail or flagellum |
| | b. allows sperm to propel itself to an egg |
| smooth muscle | a. cells have an elongated shape |
| | b. long axis allows a greater degree of shortening |
| red blood cells | a. donut-shaped |
| | b. allows for transport of oxygen |

6. What is the significance of the red blood cell being anucleate (without a nucleus)? Without a nucleus the cell cannot manufacture new proteins
 Did it ever have a nucleus? (Use an appropriate reference.) Yes If so, when? Before its release into the bloodstream
7. Of the four cells observed microscopically (squamous epithelial cells, red blood cells, smooth muscle cells, and sperm), which has the smallest diameter? sperm Which is longest? smooth muscle cells

Cell Division: Mitosis and Cytokinesis

8. Identify the three phases of mitosis in the following photomicrographs.



- a. metaphase b. anaphase c. prophase

9. What is the importance of mitotic cell division? Body growth and repair of damaged tissue

10. Draw the phases of mitosis for a cell that contains four chromosomes as its diploid or $2n$ number.

11. Complete or respond to the following statements:

Division of the 1 is referred to as mitosis. Cytokinesis is division of the 2. The major structural difference between chromatin and chromosomes is that the latter are 3. Chromosomes attach to the spindle fibers by undivided structures called 4. If a cell undergoes mitosis but not cytokinesis, the product is 5. The structure that acts as a scaffolding for chromosomal attachment and movement is called the 6. 7 is the period of cell life when the cell is not involved in division. Two cell populations in the body that do not routinely undergo cell division are 8 and 9.

1. nucleus
2. cytoplasm
3. coiled/condensed
4. centromeres
5. a binucleate cell
6. spindle
7. interphase
8. neurons
9. skeletal and cardiac muscle cells

12. Using the key, categorize each of the events described below according to the phase in which it occurs.

Key: a. anaphase b. interphase c. metaphase d. prophase e. telophase

- d 1. Chromatin coils and condenses, forming chromosomes.
- a 2. The chromosomes are V shaped.
- e 3. The nuclear envelope re-forms.
- e 4. Chromosomes stop moving toward the poles.
- c 5. Chromosomes line up in the center of the cell.
- d 6. The nuclear envelope fragments.
- d 7. The mitotic spindle forms.
- b 8. DNA synthesis occurs.
- b 9. Centrioles replicate.
- d 10. Chromosomes first appear to be duplex structures.
- d 11. Chromosomal centromeres are attached to the kinetochore fibers.
- e 12. Cleavage furrow forms.
- a and d 13. The nuclear envelope(s) is absent.

13. What is the physical advantage of the chromatin coiling and condensing to form short chromosomes at the onset of mitosis?

shorter, compact bodies are mechanically easier to manipulate during mitosis than are long chromatin threads