Cells; what you need to know

P 66 cell parts, structure function, diagram

P 67-68 plasma membrane: Fluid-mosaic model:
lipid bilayer made of phospholipids and some cholesterol
with polar "head" (hydrophilic) and
nonpolar tail (hydrophobic)
studded throughout are proteins and carbohydrate chains
integral protein: go through membrane; provide channels for transport; or carriers
receptor proteins for hormones or other chemical messengers
peripheral protein: attached to outside or inside; support structure, enzymes, mechanical functions
glycoproteins: have branching carbohydrate structure called glycocalyx used in cell recognition

p 69-71 membrane junctions: most cells in the body are "knit" together in tight communities
glycoproteins "stick" cells together; cells shape let them fit together
membrane junctions:
tight junctions: proteins fuse to prevent molecules from passing through extracellular space
desmosomes: complex structure binds adjacent cells and contribute to internal network that distributes tension; prevents tears in certain tissues
gap junctions: allow substance to pass from one cell to next
see diagram p 70

P 71-72 diffusion
Concentration gradient; simple, facilitated

P 72-75 osmosis
Hypertonic
Isotonic
Hypotonic

P 75-81 Active transport
Sodium-potassium pump; *see fig 3.10 p 76*
Vesicle transport
Exocytosis, endocytosis, phagocytosis

Table 3.2 p 80

P 81-83 membrane potential: determined mainly by Na^+ and K^+

P 83-84 CAMS: cell adhesion molecules
Membrane receptors: Contact signaling, electrical signaling, chemical signaling

P 84-97 cytoplasm and cytoplasmic organelles

P 97-101 cell cycle Fig 3.28 Interphase- G_1, S, G_2 DNA replication
Mitosis

P 101 -111 Protein Synthesis

P 111 Extracellular material

P 111-112 Developmental aspects of Cells

- Differentiation
- Hyperplasia
- Atrophy
- Cell aging:
  - Free radicals
  - Radiation and chemicals
  - Immune system
  - Telomeres

Chapter 3 review packet

- P54 all
- P55-56, B & C, #4-9 and fig 3.3
- P 58 all
- P59-60#7 1-12, define cytosol
- P61 diagram of cell
- P62 structure/function/location

The Plasma Membrane: Structure and Functions

1. Figure 3.1 is a diagram of a portion of a plasma membrane. Select four different colors and color the coding circles and the corresponding structures in the diagram. Then respond to the questions that follow, referring to Figure 3.1 and inserting your answers in the answer blanks.

◯ Phospholipid molecules ◯ Carbohydrate molecules

◯ Protein molecules ◯ Cholesterol molecules

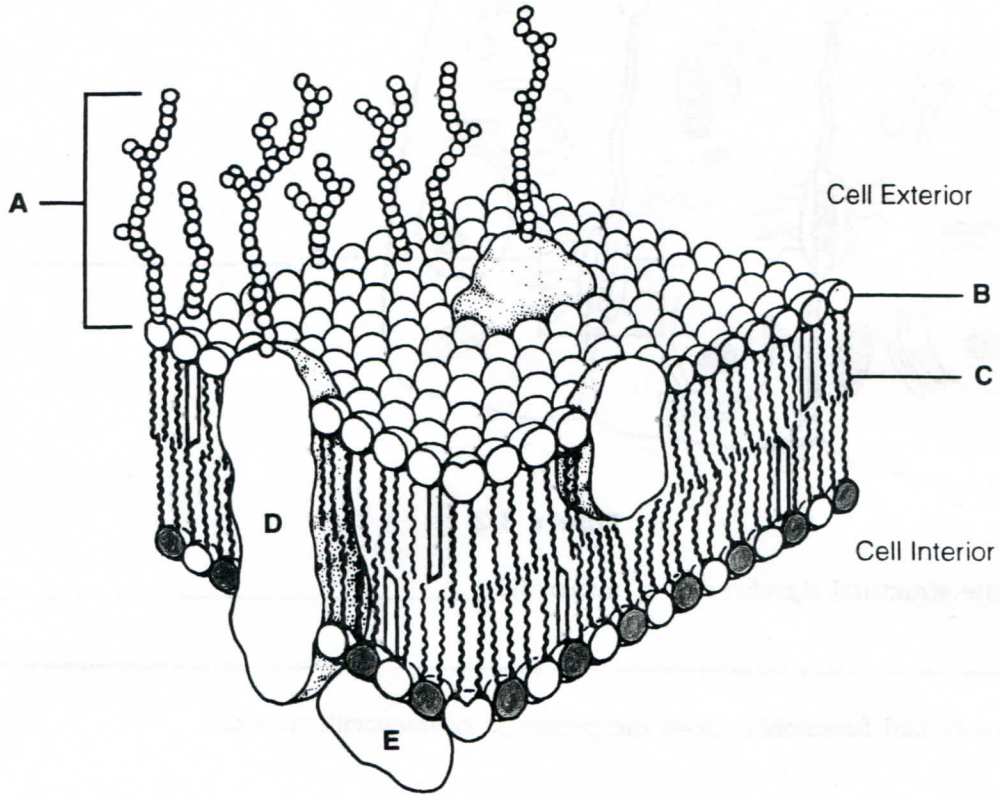

Figure 3.1

1. What name is given to this model of membrane structure? _____

2. What is the function of cholesterol molecules in the plasma membrane? _____

_____

3. Name the carbohydrate-rich area at the cell surface (indicated by bracket A). _____

4. Which label, B or C, indicates the nonpolar region of a phospholipid molecule? _____

5. Does nonpolar mean hydrophobic or hydrophilic? _____

6. Which label, D or E, indicates an integral protein and which a peripheral protein? _____

_____

2. Label the specializations of the plasma membrane, shown in Figure 3.2, and color the diagram as you wish. Then, answer the questions provided that refer to this figure.

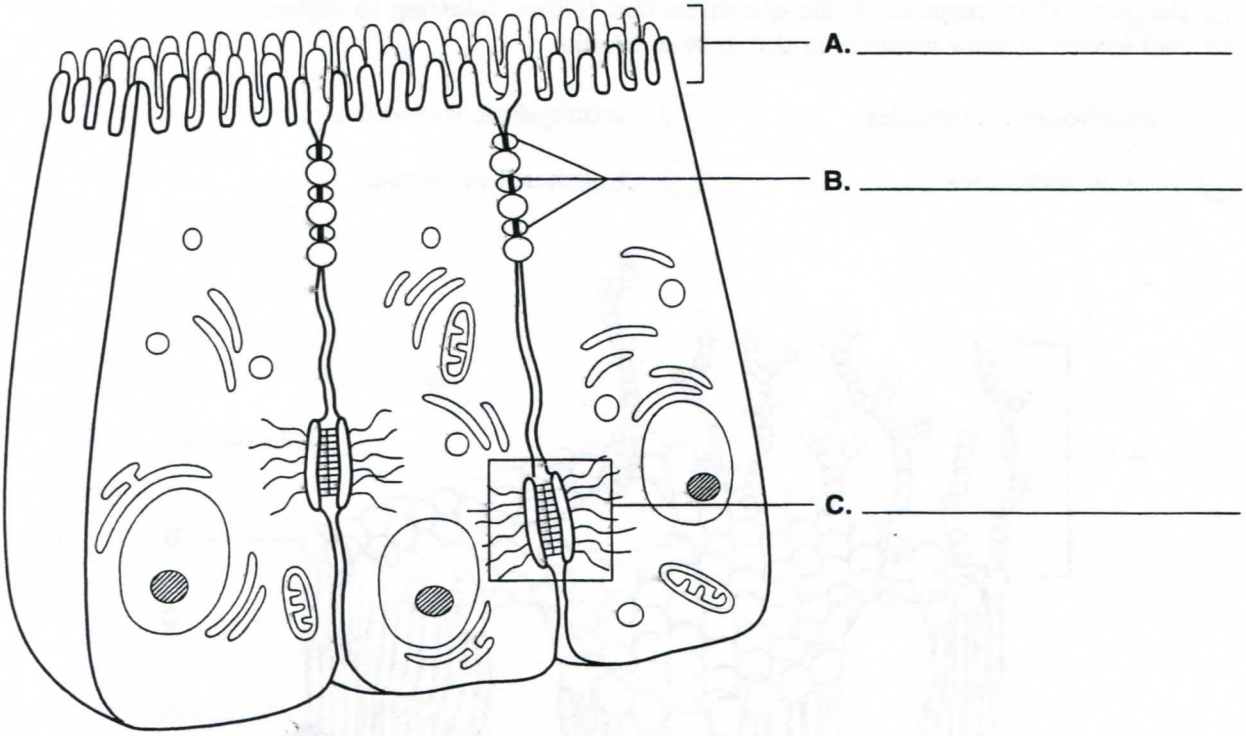

Figure 3.2

1. What is the structural significance of microvilli? _____

   _____

2. What type of cell function(s) does the presence of microvilli typically indicate? _____

3. What protein acts as a microvilli "stiffener"? _____

4. Name two factors in addition to special membrane junctions that help hold cells together. _____

5. Which cell junction forms an impermeable barrier? _____

6. Which cell junction is a buttonlike adhesion? _____

7. Which junction has linker proteins spanning the intercellular space? _____

8. Which cell junction (not shown) allows direct passage from one cell's cytoplasm to the next? _____

9. What name is given to the transmembrane proteins that allow this direct passage? _____

3. Figure 3.3 is a simplified diagram of the plasma membrane. Structure A represents channel proteins constructing a pore, structure B represents an ATP-energized solute pump, and structure C is a transport protein that does not depend on energy from ATP. Identify these structures and the membrane phospholipids by color before continuing.

◯ Pore ◯ Solute pump ◯ Passive transport pump ◯ Phospholipids

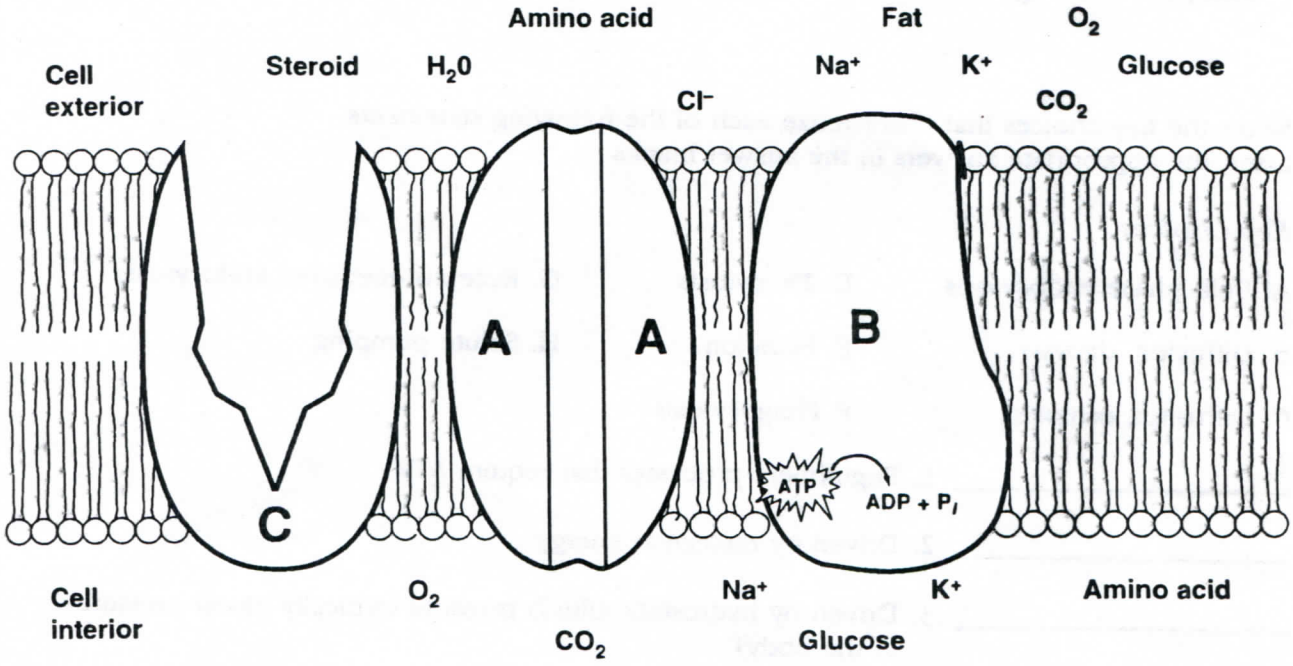

Figure 3.3

Now add arrows to Figure 3.3 as instructed next: For each substance that moves through the plasma membrane, draw an arrow indicating its (most likely) direction of movement (into or out of the cell). If it is moved actively, use a red arrow; if it is moved passively, use a blue arrow.

Finally, answer the following questions referring to Figure 3.3:

1. Which of the substances shown move passively *through the lipid* part of the membrane? _____

2. Which of the substances shown enter the cell by attachment to a passive-transport protein carrier? _____

3. Which of the substances shown moves passively through the membrane by moving through its pores? _____

4. Which of the substances shown would have to use a solute pump to be transported through the membrane? _____

4. Select the key choices that characterize each of the following statements. Insert the appropriate answers in the answer blanks.

Key Choices

A. Bulk phase endocytosis
B. Diffusion, dialysis
C. Diffusion, osmosis
D. Exocytosis
E. Filtration
F. Phagocytosis
G. Receptor-mediated endocytosis
H. Solute pumping

_____ 1. Engulfment processes that require ATP

_____ 2. Driven by molecular energy

_____ 3. Driven by hydrostatic (fluid) pressure (typically blood pressure in the body)

_____ 4. Moves down (with) a concentration gradient

_____ 5. Moves up (against) a concentration gradient; requires a carrier

_____ 6. Uses a clanthrin coated vesicle ("pit")

_____ 7. Typically involves *coupled systems*; that is, symports or antiports

_____ 8. Examples of vesicular transport

_____ 9. A means of bringing fairly large particles into the cell

_____ 10. Used to eject wastes and to secrete cell products

5. Figure 3.4 shows three microscope fields containing red blood cells. Arrows indicate the direction of net osmosis. Select three different colors and use them to color the coding circles and the corresponding cells in the diagrams. Then, respond to the questions below, referring to Figure 3.4 and inserting your answers in the spaces provided.

◯ Water moves into the cells

◯ Water enters and exits the cells at the same rate

◯ Water moves out of the cells

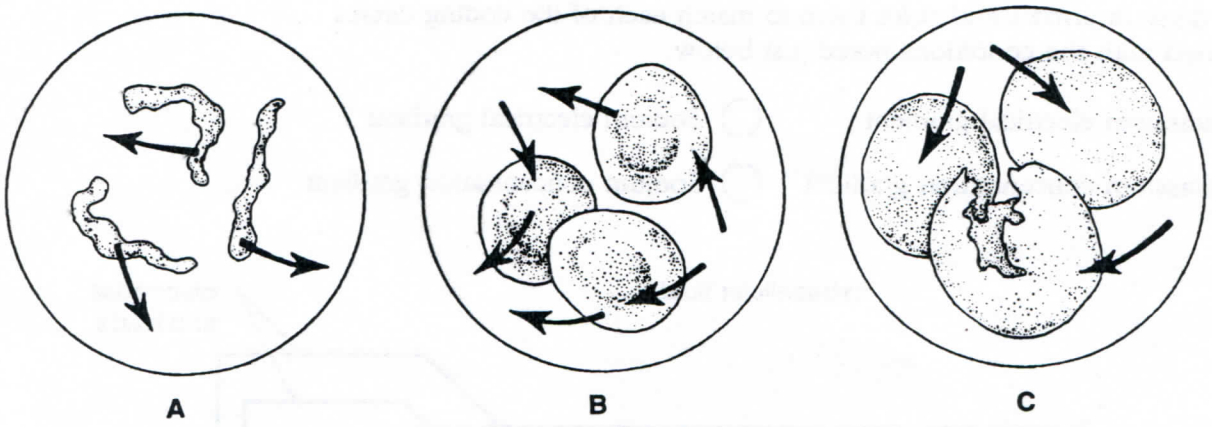

Figure 3.4

1. Name the type of tonicity illustrated in diagrams A, B, and C.

A. _____ B. _____ C. _____

2. Name the terms that describe the cellular shapes in diagrams A, B, and C.

A. _____ B. _____ C. _____

3. What does *isotonic* mean? _____

4. Why are the cells in diagram C bursting? _____

_____

5. What is the difference between tonicity and osmolarity? _____

_____

6. The differential permeability of the plasma membrane to sodium (Na^+) and potassium (K^+) ions results in the development of a voltage (resting membrane potential) of about –70 mV across the membrane as indicated in the simple diagram in Figure 3.5.

First, draw in some Na^+ and K^+ ions in the cytoplasm and extracellular fluid, taking care to indicate their *relative* abundance in the two sites.

Second, add positive and negative signs to the inner and outer surfaces of the "see-through" cell's plasma membrane to indicate its electrical polarity.

Third, draw in arrows and color them to match each of the coding circles associated with the conditions noted just below.

◯ Potassium electrical gradient ◯ Sodium electrical gradient

◯ Potassium concentration gradient ◯ Sodium concentration gradient

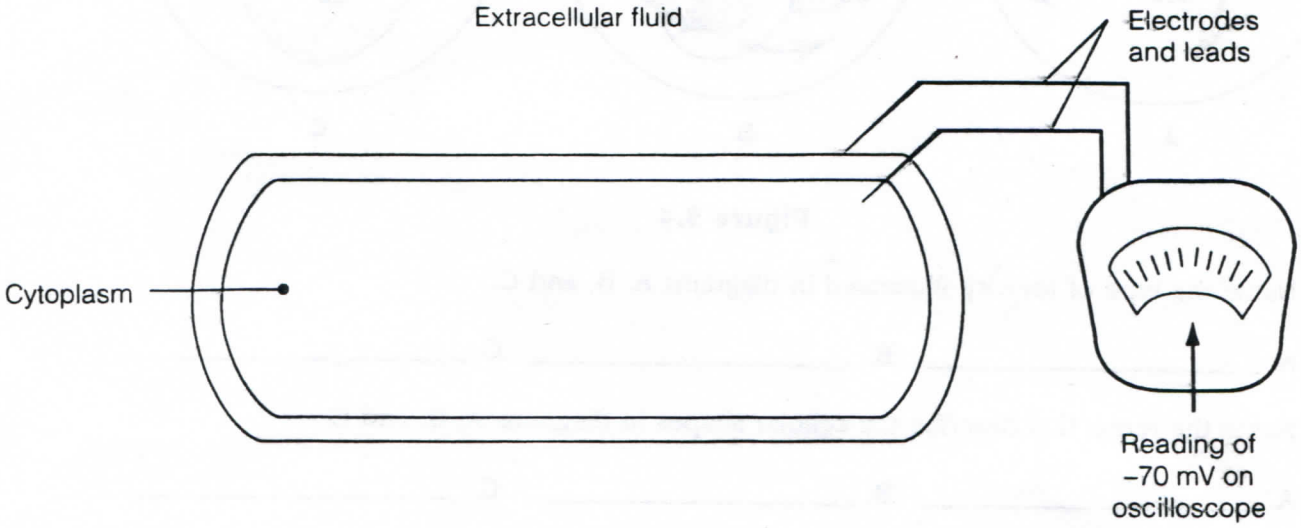

Figure 3.5

7. Referring to plasma membranes, circle the term or phrase that does not belong in each of the following groupings.

1. Fused protein molecules of adjacent cells Tight junction Lining of digestive tract

   Communication between adjacent cells No intercellular space

2. Lipoprotein filaments Binding of tissue layers Heart muscle

   Impermeable junction Desmosomes

3. Impermeable intercellular space Molecular communication Embryonic cells
Gap junction Protein channel

4. Resting membrane potential High extracellular potassium ion (K^+) concentration
High extracellular sodium ion (Na^+) concentration Nondiffusible protein anions
Separation of cations from anions

5. –50 to –100 millivolts Electrochemical gradient Inside membrane negatively charged
K^+ diffuses across membrane more rapidly than Na^+ Protein anions move out of cell

6. Active transport Sodium-potassium pump Polarized membrane
More K^+ pumped out than Na^+ carried in ATP required

7. Carbohydrate chains on cytoplasmic side of membrane Cell adhesion
Glycocalyx Recognition sites Antigen receptors

8. Facilitated diffusion Nonselective Glucose saturation Carrier molecule

9. Clathrin-coated pit Exocytosis Receptor-mediated High specificity

10. CAMs Membrane receptors G proteins Channel-linked proteins

11. Second messenger NO Ca^{2+} Cyclic AMP

12. Cadherins Glycoproteins Phospholipids Integrins

The Cytoplasm

1. Define *cytosol.* _____

_____

2. Differentiate clearly between *organelles* and *inclusions.* _____

_____

_____

_____

3. Using the following terms, correctly label all cell parts indicated by leader lines in Figure 3.6. Then select different colors for each structure and use them to color the coding circles and the corresponding structures in the illustration.

- ◯ Plasma membrane
- ◯ Mitochondrion
- ◯ Nuclear membrane
- ◯ Centrioles
- ◯ Chromatin threads
- ◯ Nucleolus
- ◯ Golgi apparatus
- ◯ Microvilli
- ◯ Rough endoplasmic reticulum (rough ER)
- ◯ Smooth endoplasmic reticulum (smooth ER)

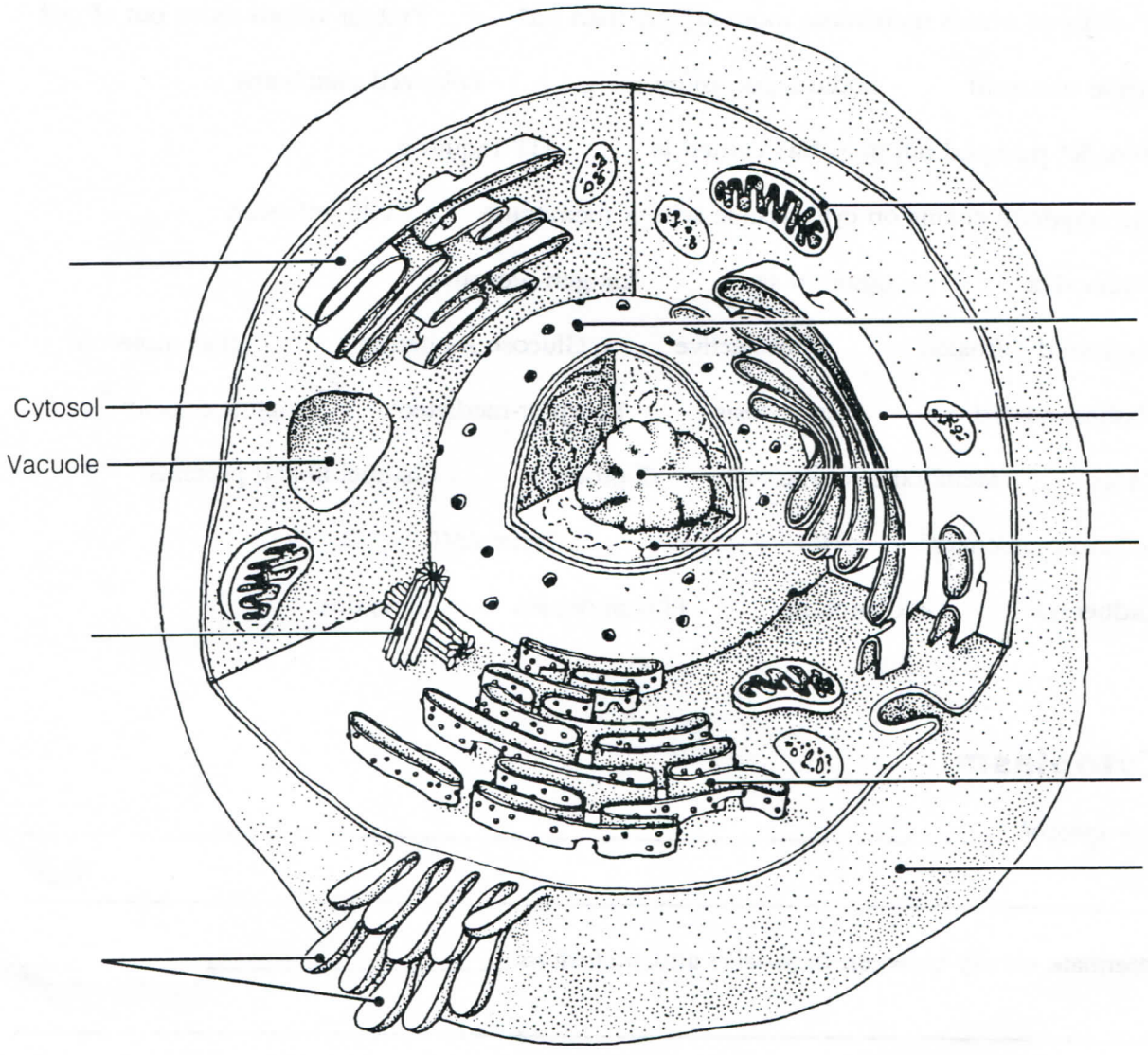

Figure 3.6

4. Complete the following table to fully describe the various cell parts. Insert your responses in the spaces provided under each heading.

Cell structure	Location	Function
	External boundary of the cell	Confines cell contents; regulates entry and exit of materials
Lysosome		
	Scattered throughout the cell	Controls release of energy from foods; forms ATP
	Projections of the plasma membrane	Increase the membrane surface area
Golgi apparatus		
	Two rod-shaped bodies near the nucleus	"Spin" the mitotic spindle
Smooth ER		
Rough ER		
	Attached to membranes or scattered in the cytoplasm	Synthesize proteins
		Act collectively to move substances across cell surface in one direction
	Internal structure of centrioles; part of the cytoskeleton	
Peroxisomes		
		Contractile protein (actin); moves cell or cell parts; core of microvilli
Intermediate filaments	Part of cytoskeleton	
Inclusions		

5. Relative to cellular organelles, circle the term or phrase that does not belong in each of the following groupings.

1. Peroxisomes Enzymatic breakdown Centrioles Lysosomes
2. Microtubules Intermediate filaments Cytoskeleton Cilia
3. Ribosomes Smooth ER Rough ER Protein synthesis
4. Mitochondrion Cristae Self-replicating Vitamin A storage
5. Centrioles Basal bodies Mitochondria Cilia Flagella
6. ER Endomembrane system Ribosomes Secretory vesicles
7. Nucleus DNA Lysosomes Mitochondria

6. Name the cytoskeletal element (microtubules, microfilaments, or intermediate filaments) described by each of the following phrases.

_____ 1. give the cell its shape

_____ 2. resist tension placed on a cell

_____ 3. radiate from the cell center

_____ 4. interact with myosin to produce contractile force

_____ 5. are the most stable

_____ 6. have the thickest diameter

7. Different organelles are abundant in different cell types. Match the cell types with their abundant organelles by selecting a letter from the key choices.

Key Choices

A. mitochondria C. rough ER E. microfilaments G. intermediate filaments

B. smooth ER D. peroxisomes F. lysosomes H. Golgi apparatus

_____ 1. cell lining the small intestine (assembles fats)

_____ 2. white blood cell; a phagocyte

_____ 3. liver cell that detoxifies carcinogens

_____ 4. muscle cell (contractile cell)

_____ 5. mucus–secreting cell (secretes a protein product)

_____ 6. cell at external skin surface (withstands friction and tension)

_____ 7. kidney tubule cells (makes and uses large amounts of ATP)