The basic unit of structure and function in the human body is the cell. Each of a cell's parts, or organelles, as well as the entire cell, is organized to perform a specific function. Cells have the ability to metabolize, grow and reproduce, move, and respond to stimuli. The cells of the body differ in shape, size, and in specific roles in the body. Cells that are similar in structure and function form tissues, which, in turn, construct the various body organs.

Student activities in this chapter include questions relating to the structure and function of the generalized animal cell and to the general arrangement of tissues and their contribution to the activities of the various body organs.

**CELLS**

**Overview**

1. Answer the following questions by inserting your responses in the answer blanks.

   ________________ 1. 1-4. Name the four elements that make up the bulk of living matter.

   ________________ 2.

   ________________ 3.

   ________________ 4. 5. Name the single most abundant material or substance in living matter.

   ________________ 5.

   ________________ 6.

   ________________ 7. 6. Name the trace element most important for making bones hard.

   ________________ 8. 7. Name the element, found in small amounts in the body, that is needed to make hemoglobin for oxygen transport.

   ________________ 9.

   ________________ 10. 8-12. Although there are many specific "jobs" that certain cells are able to do, name five functions common to all cells.

   ________________ 11.

   ________________ 12.
13–15. List three different cell shapes.

16. Name the fluid, similar to seawater, that surrounds and bathes all body cells.

17. Name the flattened cells, important in protection, that fit together like tiles. (This is just one example of the generalization that a cell’s structure is very closely related to its function in the body.)

**Anatomy of a Generalized Cell**

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

<table>
<thead>
<tr>
<th>Cell structure</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysosomes</td>
<td>Scattered throughout the cell</td>
<td>Control release of energy from foods; form ATP</td>
</tr>
<tr>
<td></td>
<td>Projections of the plasma</td>
<td>Increase the membrane surface area</td>
</tr>
<tr>
<td></td>
<td>membrane</td>
<td></td>
</tr>
<tr>
<td>Golgi apparatus</td>
<td>Two rod-shaped bodies near the</td>
<td>Direct formation of the mitotic spindle</td>
</tr>
<tr>
<td></td>
<td>nucleus</td>
<td></td>
</tr>
<tr>
<td>Nucleus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nucleolus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth ER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough ER</td>
<td>Attached to membrane systems</td>
<td>Synthesize proteins</td>
</tr>
<tr>
<td></td>
<td>or scattered in the cytoplasm</td>
<td></td>
</tr>
<tr>
<td>Chromatin</td>
<td>Scattered in cytoplasm</td>
<td>Detoxify alcohol, hydrogen peroxide, etc.</td>
</tr>
<tr>
<td>Inclusions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Using the following list of terms, correctly label all cell parts indicated by leader lines in Figure 3-1. Then select different colors for each structure and use them to color the coding circles and the corresponding structures in the illustration.

- Plasma membrane
- Centriole(s)
- Chromatin thread(s)
- Golgi apparatus
- Microvilli
- Mitochondrion
- Nuclear membrane
- Nucleolus
- Rough endoplasmic reticulum (ER)
- Smooth endoplasmic reticulum (ER)

Figure 3-1
Cell Physiology

Membrane Transport

4. A semipermeable sac, containing 4% NaCl, 9% glucose, and 10% albumin, is suspended in a solution with the following composition: 10% NaCl, 10% glucose, and 40% albumin. Assume the sac is permeable to all substances except albumin. Using the key choices, insert the letter indicating the correct event in the answer blanks.

**Key Choices**

A. Moves into the sac  
B. Moves out of the sac  
C. Does not move

1. Glucose  
2. Water  
3. Albumin  
4. NaCl

5. Figure 3–2 shows three microscopic fields (A–C) containing red blood cells. Arrows indicate the direction of net osmosis. Respond to the following questions, referring to Figure 3–2, by inserting your responses in the spaces provided.

1. Which microscopic field contains a hypertonic solution? ____________________________

   The cells in this field are said to be ____________________________

2. Which microscopic field contains an isotonic bathing solution? ____________________________

   What does isotonic mean? ____________________________

3. Which microscopic field contains a hypotonic solution? ____________________________

   What is happening to the cells in this field and why? ____________________________

![Figure 3-2](image-url)
6. Select the key choices that characterize each of the following statements. Insert the appropriate letter(s) or corresponding term(s) in the answer blanks.

**Key Choices**

A. Diffusion, simple  
B. Diffusion, osmosis  
C. Endocytosis  
D. Exocytosis  
E. Filtration  
F. Solute pumping

1. Require ATP (cellular energy)  
2. Driven by kinetic energy of the molecules  
3. Driven by hydrostatic (fluid) pressure  
4. Follow a concentration gradient  
5. Proceeds against a concentration gradient; require(s) a carrier  
6. A means of secreting cell products  
7. Moves water through a semipermeable membrane  
8. Transports amino acids, some sugars, and Na⁺ through the plasma membrane  
9. Provides for cellular uptake of solid or large particles from the cell exterior  
10. Moves small or lipid-soluble solutes through the membrane  
11. Includes phagocytosis, pinocytosis, and a receptor-mediated form.

7. Figure 3-3 represents a portion of a plasma membrane. Select two different colors for lipid and protein molecules. Color the coding circles and the corresponding molecules in the illustration. Then add a colored arrow for each substance shown inside and outside the cell indicating (a) its direction of transport through the membrane; and (b) its means of transport (that is, either directly through the lipid portion or by attachment to a protein carrier).

- Lipid molecules
- Protein molecules

Two types of molecules not shown here that contribute to plasma membrane structure are _____________ and _____________.

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**Figure 3-3**