A Tour of the Cell

4

A sampling of the diversity of life on Earth might include a redwood tree, a jellyfish, a bacterium, a tiger, and a mushroom. At one time, living things seemed so varied that the only characteristic they were thought to have in common was a mysterious "vital force" that made them all alive. Then, with the invention of the microscope, biologists discovered cells. By the late nineteenth century, they realized that all living things are made of cells and that an organism is alive because its cells are alive. Even though the life of a redwood tree and that of a jellyfish seem quite different, these two organisms look and function much the same on the cellular level. Now we have electron microscopes, and we can zoom in on the intricate structures within a single cell. We can take cells apart and analyze their chemistry, or probe them with radioactive isotopes, antibodies, lasers, or fluorescent dyes. This chapter describes what these techniques have revealed about the life of a cell.

Organizing Your Knowledge

Exercise 1 (Modules 4.1 – 4.2)

Web/CD Activity 4A *Metric System Review*

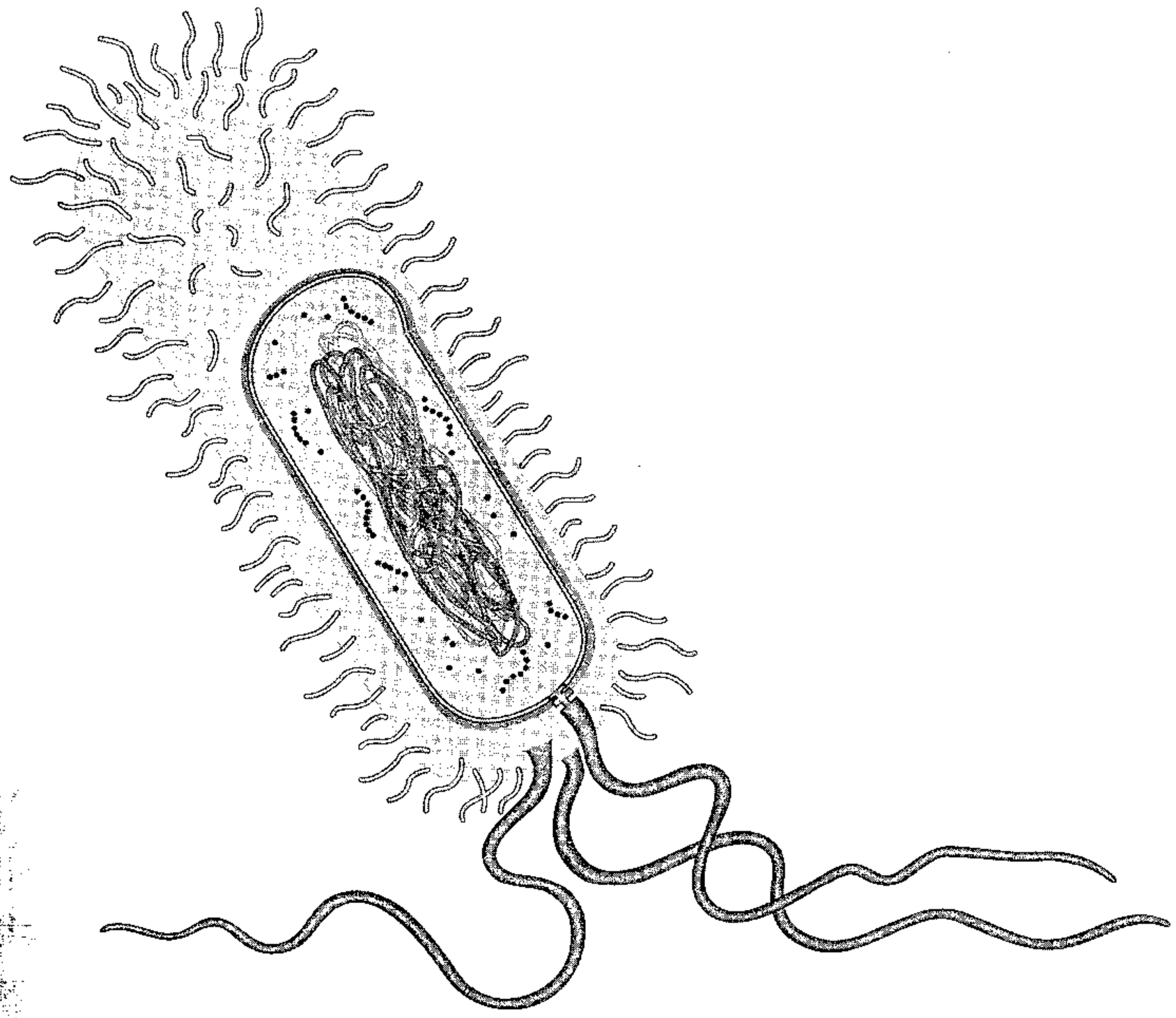
Use the information in the two modules and the chart in Module 4.2 to complete the following table comparing microscopes and the unaided human eye.

	Unaided Eye	*Light Microscope*	*Electron Microscope (SEM or TEM)*
Kind of radiation (beam) used	1.	2.	3.
Parts that focus beam	4.	5.	6.
Maximum magnification	7.	8.	9.
Smallest objects visible	10.	11.	12.
Size of smallest objects visible (resolving power)	13.	14.	15.
Limitations	16.	17.	18.

Exercise 3 (Module 4.4)

Web/CD Activity 4B *Prokaryotic Cell Structure and Function*

Label the following on this diagram of a prokaryotic cell: **capsule, cell wall, plasma membrane, nucleoid region, ribosome, prokaryotic flagella, pili.** Briefly state the function of each structure next to its label.



Exercise 4 (Modules 4.4 – 4.5)

Web/CD Activity 4B *Prokaryotic Cell Structure and Function*
Web/CD Activity 4C *Comparing Prokaryotic and Eukaryotic Cells*
Web/CD Activity 4D *Build an Animal Cell and a Plant Cell*

Examine the diagrams and text, and then compare the structures of the cells of prokaryotes, plants, and animals by checking off their characteristics below. You may want to revise or refer to this checklist as you complete the chapter.

Characteristic	*Prokaryote Cell*	*Plant Cell*	*Animal Cell*
Prokaryotic structure			
Eukaryotic structure			
Relatively large size			
Relatively small size			
Membranous organelles			
Plasma membrane			
Cell wall			
Cytoplasm			
Ribosomes			
Bacterial flagellum			
Nucleus			
Rough endoplasmic reticulum			
Smooth endoplasmic reticulum			
Golgi apparatus			
Lysosome			
Peroxisome			
Mitochondrion			
Chloroplast			
Central vacuole			
Cytoskeleton			
Flagellum			
Centriole			

Exercise 5 (Modules 4.6 – 4.14)

Web/CD Activity 4E *Role of the Nucleus and Ribosomes in Protein Synthesis*
Web/CD Activity 4F *The Endomembrane System*

Review the nucleus and the various structures that make up the endomembrane system by matching each phrase on the right with a structure from the list on the left. Answers can be used more than once.

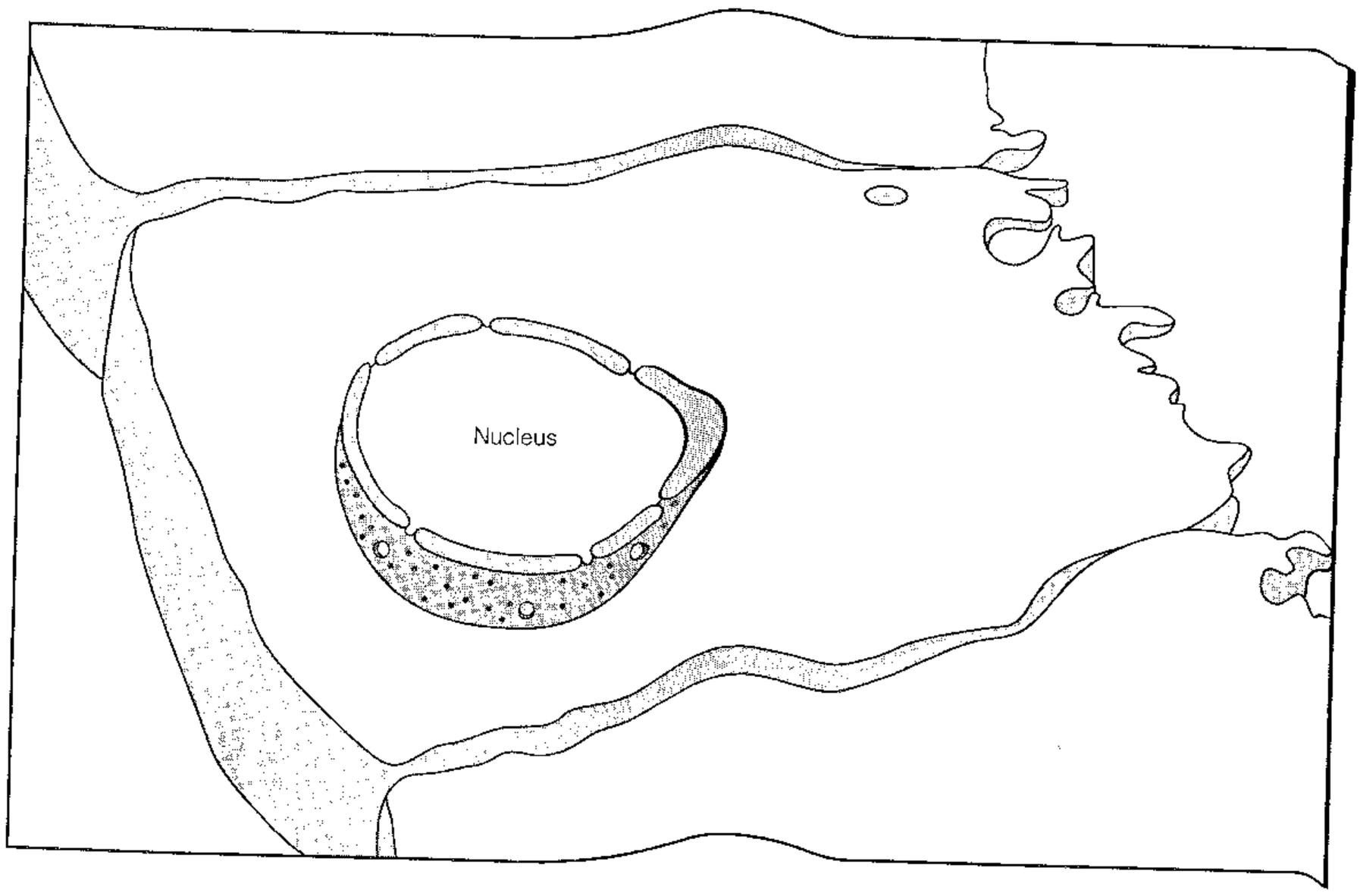
A. Nucleus
B. Transport vesicle
C. Central vacuole
D. Smooth ER
E. Lysosome
F. Golgi apparatus
G. Rough ER
H. Contractile vacuole
I. Ribosome

____ 1. Lipids manufactured here
____ 2. Small structure that makes protein
____ 3. Contains chromatin
____ 4. Sac of enzymes that digest things
____ 5. Carries secretions for export from cell
____ 6. Breaks down drugs and toxins in liver
____ 7. Makes cell membranes
____ 8. Cell control center
____ 9. Numerous ribosomes give it its name
____ 10. "Ships" products to plasma membrane, outside, or other organelles
____ 11. May store water, needed chemicals, wastes, pigments in plant cell
____ 12. Buds off from Golgi apparatus
____ 13. Defective in Pompe's disease and Tay-Sachs disease
____ 14. Proteins made here for secretion from cell
____ 15. Pumps out excess water from some cells
____ 16. Nonmembranous organelle
____ 17. Takes in transport vesicles from ER and modifies their contents
____ 18. Digests food, wastes, foreign substances
____ 19. Surrounded by double layer of membrane with pores
____ 20. How proteins, other substances get from ER to Golgi apparatus

Exercise 6 (Modules 4.7 – 4.14)

Web/CD Activity 4E *Role of the Nucleus and Ribosomes in Protein Synthesis*
Web/CD Activity 4F *The Endomembrane System*

Sketch and label the endomembrane system on this diagram. Include **rough ER, smooth ER, ribosomes, Golgi apparatus, lysosome, nuclear envelope,** and **transport vesicles.** (1) Trace the path of a protein from its site of manufacture to the outside of the cell with a red arrow. (2) Trace the path of a protein incorporated into a lysosome in blue. (3) Trace the path of a protein incorporated into the plasma membrane in green. (4) Trace the path of a lipid secreted from the cell in yellow.



Exercise 7 (Modules 4.15 – 4.16)

Web/CD Activity 4G *Build a Chloroplast and a Mitochondrion*

Both mitochondria and chloroplasts are energy converters, but their functions are quite different. Compare them by filling in the chart below.

	Chloroplast	*Mitochondrion*
Found in the following organisms . . .		
Carries out process of . . .		
Converts energy of . . .		
Into chemical energy in . . .		

Exercise 8 (Modules 4.17 – 4.18)

Web/CD Activity 4H *Cilia and Flagella*

Compare the components of the cytoskeleton by indicating with a checkmark which of the following are characteristics of microfilaments, intermediate filaments, or microtubules.

	Microfilaments	*Intermediate Filaments*	*Microtubules*
Hollow tubes			
Solid rods			
Ropelike structure			
Made of tubulin			
Made of actin			
Made of fibrous proteins			
Help cell change shape			
Reinforcing rods, anchor organelles			
Act in muscle cell contraction			
Move chromosomes			
Act as tracks for organelle movement			
Give cell rigidity, shape			
In cilia			
In flagella			
In centrioles			
9 + 2 pattern			

Exercise 9 (Module 4.19)

Web/CD Activity 4I *Cell Junctions*

Match each of the cell surface characteristics or structures on the left with a phrase on the right.

Tight junction
Plasmodesma
Anchoring junction
Cell wall
Communicating junction
Extracellular matrix

____ 1. Channel between animal cells
____ 2. Rigid cellulose covering of plant cell
____ 3. Link animal cells in leakproof sheet
____ 4. Channel between plant cells
____ 5. Connects animal cells, leaving space between them
____ 6. Sticky layer holds animal cells together

Exercise 10 (Module 4.20 and Summary)

Web/CD Activity 4J *Animal Cell Structure and Function*
Web/CD Activity 4K *Plant Cell Structure and Function*

Label the organelles listed in Module 4.20 on these diagrams of animal and plant cells. (If you get stuck, refer to Module 4.5.) Try to group your labels according to the functional categories in Module 4.20 so that you can circle and label each category. Complete your diagrams by putting red boxes around the names of structures found in animal cells but not in most plant cells. Put green boxes around the names of structures found in plant cells but not in animal cells.