

## ANSWERS TO EXERCISES

- |                                 |                  |                               |
|---------------------------------|------------------|-------------------------------|
| 1. mitochondrion                | 22. eukaryotic   | 45. outer membrane            |
| 2. cytoplasm                    | 23. prokaryotic  | 46. inner membrane            |
| 3. lysosome                     | 24. eukaryotic   | 47. intermembrane compartment |
| 4. smooth endoplasmic reticulum | 25. prokaryotic  | 48. matrix                    |
| 5. rough endoplasmic reticulum  | 26. both         | 49. cristae                   |
| 6. plasma membrane              | 27. eukaryotic   | 50. d                         |
| 7. nucleus                      | 28. chloroplasts | 51. b                         |
| 8. nucleolus                    | 29. chloroplasts | 52. c                         |
| 9. chromatin                    | 30. mitochondria | 53. a                         |
| 10. Golgi complex               | 31. both         | 54. e                         |
| 11. false, prokaryotic          | 32. chloroplasts | 55. d                         |
| 12. true                        | 33. mitochondria | 56. a                         |
| 13. false, nucleus              | 34. both         | 57. c                         |
| 14. true                        | 35. mitochondria | 58. b                         |
| 15. false, chloroplasts         | 36. chloroplasts | 59. b                         |
| 16. false, smooth               | 37. chloroplasts | 60. a                         |
| 17. false, plants               | 38. mitochondria | 61. c                         |
| 18. false, plant                | 39. both         | 62. d                         |
| 19. true                        | 40. cilia        | 63. b                         |
| 20. false, shorter              | 41. both         | 64. b                         |
| 21. prokaryotic                 | 42. flagella     | 65. c                         |
|                                 | 43. cilia        | 66. d                         |
|                                 | 44. both         | 67. a                         |
68. Cells seldom grow this large because of two factors. First, a cell this size would have too much volume for the amount of surface area present, so that not enough plasma membrane area would be present for the movement of molecules into and out of such a giant cell. Second, the time it would take for molecules deep inside such a cell to move to the surface or vice versa would be extremely long because diffusion over relatively long distances is too slow to support life processes.

69. Mitochondria, because all the processes affected require energy and mitochondria are the chief organelles where the energy in sugar is converted into cellular energy in the form of ATP molecules.
70. Since bacteria can produce resting cells called endospores with thick coatings they have the capacity to withstand extremely harsh conditions, it is not very surprising that they could survive on the lunar surface.
71. Plant and animal cells share the following organelles: nucleus with chromosomes and nucleolus, plasma membranes, rough and smooth endoplasmic reticulum, ribosomes, vesicles, Golgi complexes, lysosomes, food vacuoles, mitochondria, and the cytoskeleton. Plants alone have plastids (including chloroplasts), cell walls, and central vacuoles; animal cells alone have cilia and flagella, contractile vacuoles, and centrioles.
72. Chloroplasts and mitochondria are about the size and shape of large bacteria. Each has circular chromosomes made up of DNA only, like bacteria. Each has simple ribosomes resembling those of bacteria.
73. The growth of muscle cells caused by repeated, vigorous exercise would be accompanied by increased amounts of proteins and cell membranes, produced by more ribosomes and Golgi complexes. Microfilaments, made of actin protein, would increase as well. The number of mitochondria also should increase to provide more energy for muscle contraction and other cellular activities.
74. For the smaller cell, the surface area is 144 square micrometers, the volume is 64 cubic micrometers, and the ratio of surface area to volume is 2.25. For the larger cell, the surface area is 384 square micrometers, the volume is 512 cubic micrometers, and the ratio of surface area to volume is 0.75. The smaller cell has the greater surface-to-volume ratio, which would allow it to exchange materials more readily with its surroundings. As cells grow larger, the volume grows more quickly than the surface area, putting larger cells at a severe disadvantage.
75. The number of cells in a little finger is surprisingly high. Let's say a little finger is 55 millimeters tall and 10 millimeters in radius (half of its diameter). Multiply these numbers by 1000 to convert them into micrometers. So, the volume of this little finger is  $3 \times [(10,000)^2] \times 55,000 = 3 \times 100,000,000 \times 55,000 = 16,500,000,000,000$ , or 16.5 trillion cubic micrometers. If each cell is 1000 cubic micrometers, there are 16,500,000,000 or 16.5 billion cells in a little finger. Imagine how many cells there are in an adult human body!
76. Scientists think that lysosomes may be important in understanding cellular (and organismal) deterioration as aging occurs. As cells age, they may be subject to degeneration due to the breakdown of the lysosome membrane. If the lysosome membrane begins to leak, digestive enzymes may be released into the cytoplasm, slowly killing the cell by digesting its organelles. Being able to control the stability of the lysosome membrane may be the key to slowing the aging process.
77. According to the European Network Project in Biotechnology, environments that are considered by humans to be extreme, are colonized by special microorganisms which are adapted to these ecological niches. These organisms are called extremophiles and may be divided into five categories: thermophiles, acidophiles, alkaliphiles, halophiles and psychrophiles, clearly indicating the nature of habitats used