

Section 9.4 Questions (page 359)

1. Bacteria lack a nuclear membrane, protists are eukaryotic cells (have a nuclear membrane).
2. Most protists are microscopic, unicellular, and found in both fresh and salt water.
3. Cilia are hairlike structures used by microorganisms for movement or to attach themselves to a substrate. Cilia are synchronized for swimming, like oars or the arms of a swimmer. A flagellum is a whip-like tail, that moves in a corkscrew motion. The flagellum is much longer than the cilia.
4. Asexual reproduction in a paramecium involves binary fission, producing identical offspring. Sexual reproduction in paramecia involves conjugation, the end products are organisms that exhibit genetic diversity. In conjugation, two paramecia join and exchange genetic material, after which the daughter cells undergo fission.
5. A cyst is a protective covering that allows the organisms to enter a type of suspended animation, until environmental conditions become favorable.
6. (a) When used to refer to a slime mould, the term plasmodium refers to a mass of cells, such as that formed by *Dictyostelium*, a slime mold that forms a plasmodial mass that acts like a single organism.
(b) When used to refer to an animal-like protist, the term plasmodium refers to a malaria-producing sporozoan, *Plasmodium vivax*.
7. Insect vectors carry a pathogenic microorganism. A viral vector carries nucleic acids, often DNA.
8. Oxygen levels would drop during the summer and the primary food source would be removed.
9. (a) In 1999 the Southern Ocean was fertilized with iron. Scientists had theorized that phytoplankton growth, which is usually limited by nitrogen, phosphorous, and silicon content, was limited in the Southern Ocean by the availability of iron. When iron was added to an area of the ocean 8 kilometres in diameter, scientists observed a dramatic increase in the abundance of phytoplankton, an organism that absorbs carbon dioxide. Carbon dioxide is a greenhouse gas; scientists hope that further experiments might lead to a reduction of carbon dioxide in the atmosphere. However, the long term effects of this technique are not understood, and further research of iron fertilization in the Antarctic is scheduled for January of 2002.
(b) No, it is too costly and the long-term effects of high algae population are not known. Also, there will probably be an increase in the populations of organisms that eat algae, which will lower the algal population again.

Chapter 9 Review (page 361)

1. Classification keys help biologists identify organisms quickly and accurately. This helps biologists communicate about the organism or ecosystem.
2. In support of the claim that viruses are nonliving, one might argue that viruses are not cells: they have no nucleus, cytoplasm, nor cellular organelles. Viruses have no cellular respiration, do not exchange gases, and do not feed or reproduce (outside of a host).
A refutation of the claim that viruses are nonliving might argue that viruses contain genetic material, viruses are capable of reproduction (when inside a host cell), and viruses exhibit genetic variation over time.

3. Viruses are like other organisms in that they can replicate genetic material (inside a host), and they are composed of protein. Viruses are different from other organisms in that viruses are not cellular, they lack many of the cellular structures.
4. Many factors help explain why some diseases progress at a slower rate. The viral genes may be implanted in an inactive segment of the host's DNA, or the viral genes may duplicate at a much slower rate. Viruses that undergo a lysogenic cycle would remain in a latent state before lysis. Many diseases that develop quickly do so because the viral RNA enters the host cell's cytoplasm, affecting the synthesis of protein at the ribosomes.
5. The viral genes of lysogenic viruses are incorporated into the DNA of the host. There is hope that they might help rewrite defective genes.
6. Because viruses are not living cells, antibiotics are incapable of interfering with the metabolic activities associated with living cells.
7. Without oxygen-producing bacteria, such as the cyanobacteria, aerobic organisms would not exist. Anaerobic organisms tend to be much simpler. Anaerobic respiration provides much less energy. That means less movement, and simpler forms of life.
8. It would be desirable for operating rooms and meat processing plants to be bacteria free. A bacteria-free environment would be undesirable in environments used for tanning leather, making yogurt, buttermilk, and the treatment of sewage; bacteria are an important part of these processes.
9. Viral pneumonia can not be treated with antibiotics because viruses are not cells. The body must produce antibodies, which identify the virus. Once tagged, white blood cells can engulf and destroy the virus.
10. Eubacteria have no true nucleus and a limited number of organelles. Protists are more complex – some are even multicellular.
11. Some protists, like the paramecium, have a fixed shape and specialized structures. The presence of structures like a gullet, cilia, contractile vacuoles, and trichocysts are characteristics of a complex organism.
12. Parasitic sporozoans rely on a vector to enter a new area. The rate of reproduction is regulated by the health of the host. If the host dies, the sporozoan's life cycle may end.
13. Antibiotics might kill both harmless and beneficial bacteria. Antibiotics must be used rarely. Antibiotics can be developed to attack specific (harmful) bacteria.
14. The bacterial spores allow the bacteria to enter a type of suspended animation until conditions, once again, become favorable. This allows the pathogenic bacteria to survive harsh environmental conditions.
15. The fossilized bacteria are very small, and generally, in the lower reaches of the earth's surface.
16. Paramecia have cilia, specialized structures for cellular movement. In a paramecium, trichocysts are specialized structures for defense, contractile vacuoles control water content, and there are specialized structures in regions of the cell membrane.
17. Plantlike protists, like algae, can be used as a source of oxygen for ecosystems, a source of food for people and other organisms, and as a source of medicines.
18. No, the botulism toxins may remain, even though the bacterial cells have been destroyed. In many situations the bacterial cells will even form spores. The poisonous

wastes (toxins) released from the bacteria cause nerve problems. The toxins have not been eliminated.

19. It is unlikely that viruses were the precursors of life on this planet. Viruses cannot reproduce without a host, and so could not have been the first organisms.
20. The protozoans and termite have a mutualistic relationship. The termite is provided with nutrients and the protozoan is provided a home, protection, and food.
- 21.

	Bacteria	Protist
Cell size	very small	much larger, some are visible
Nucleus with membrane	absent	present
Cell membrane	present	present
Cell type	prokaryotic	eukaryotic
Organelles with membranes	absent	present
Cellular respiration	both aerobic and anaerobic	aerobic
Photosynthetic	some examples	some examples
Saprophytic	some examples	none
Holozoic	none	some examples
Asexual reproduction	binary fission	binary fission, budding, fragmentation

22. Freezing is reasonably expensive, will change the taste of some foods, limited shelf life. While canning allows for a long preservation time, cans can leave a taste and will change the quality of some foods. Dehydration also provides for a long shelf life, but is expensive, will change the taste of food, and removes many minerals and vitamins. Pickling and salting are both inexpensive, but will alter food taste. Irradiation of foods is a method of food preservation that involves bombarding food with some form of radiant energy, X-ray, ultraviolet radiation. Irradiation rids fruits and vegetables of insects, but is expensive and the long term effects of radiation are not known.
23. Viruses alter DNA in host cells, but many other environmental factors can cause the same problem (sunlight, cancer-causing chemicals etc). The altered DNA is a mutation that removes the ability of the cell to regulate cell division, which in turn causes cancer. Scientists find it difficult to link a single cause (a virus, or other environmental factor) with a single effect (cancer).
24. Today, all identified viruses only reproduce in host cells. If a virus is found that is capable of reproduction outside a cell it must be considered a life-form.
25. (a) Antibiotics are used more frequently, more exposure to the drugs has removed the weaker bacteria from the population, leaving a more resistant organism.
(b) Decrease the use of antibiotics, until it is known that the source of an infection is cellular and not viral. Develop a method to ensure that patients take the complete antibiotic treatment. A major problem is people who stop taking the antibiotics as soon as they feel better. This leaves a few resistant pathogens in their bodies, which then spread to new hosts.

26. Red tides are caused by organisms called Dinoflagellates. They are marine and photosynthetic. During warm, sunny seasons, they can reproduce extremely rapidly and form huge, local populations, called algal blooms. At times, the population is visible and coloured red. Dinoflagellates produce a neurotoxin. This accumulates in filter feeders, such as shellfish like clams. The toxins are lethal to marine fish and humans who eat the shellfish. Pollution of coastal waters, especially nitrates, is believed to be a major factor in algal blooms. Global warming may also be a factor. Major storms mix up the seawater to great depths, adding warmer water and more oxygen to deeper depths and bringing nutrients from the bottom sediments to the surface. Control of pollutants is the only action being taken to prevent red tides. In limited areas of aquaculture, such as oyster beds, spraying anti-algal chemicals has had some success in limiting the damage done.

Chapter 10

Fungi and Plants

Reflect on Your Learning (page 362)

1. People rely on plants for food, building products, fiber for clothing, medicines, and their process of photosynthesis provides oxygen for the planet.
2. Historically, humans relied on about 200 different species of plants. Today we rely heavily on about 20 different species – wheat, rice, barley, and corn being the most common. This has reduced the number of species that grow in a given area. Plants are selected for nutritional value, rapid growth, and resistance to disease. Less productive or desired species are replaced with those that are of greater economic value. Farmers even chose specific plants with desired traits within a species. By raising crops that are genetically uniform, farmers could be risking our food supply. This reduces the genetic diversity within a species. Plants selected for rapid growth and desired aesthetic qualities may not be ideally suited to withstand disease and other negative environmental conditions. The reduction of genetic diversity may also have an impact should environmental conditions change rapidly. Global warming might cause such a change.
3. Answers will vary. Students may discuss how changes in mean temperature affect plant growth. Changes in rainfall or groundwater will also affect the types of plants that grow in an area.
4. Aquatic plants had to develop an extensive and large root system to stay fixed in the soil and to obtain water and nutrients from deep within the ground. Therefore, they had to develop rigid structural tissues. The evolution of a waxy cuticle and stoma in leaves to help prevent water loss is another adaptation. Other adaptations are the various reproductive strategies that have evolved such as nectar, colourful flowers, pollen, fruit, spores, and seeds with protective coats.

Investigation 10.2.1 (pages 367-369)

- (d) Warm temperatures favour mould growth.
- (e) Cold temperatures and light seem to inhibit mould growth.
- (f) The controls in this investigation are the containers in which the bread has not been moistened with water.
- (g) Containers were kept shut to avoid allergic reactions, to ensure constant and controlled moisture, and to avoid the introduction of new mould spores or other nutrients. If containers were not kept shut, the moisture levels would have changed, and different varieties of mould may have appeared.
- (h) Some breads have mould inhibitors added, which may account for some differences.
- (i) No mould forming in any of the containers may be a result of no mould spores having been present, inadequate nutrients or moisture, or colonization of the bread by a competing organism.
- (j) Possible sources of error include differences in the initial mould content of the bread pieces, different moisture levels in the bread pieces, inadequate seals on the containers, and measurement error.