

8. Well water should be tested regularly for bacteriological quality and for chemical contamination, if suspected. Well water should be tested immediately if there is any change in its clarity, colour, odour, or taste, or if there has been a change in the surrounding land. Depending on the province, free bacteriological testing of well water is done either by the provincial health laboratory in the area or by a certified private laboratory. A clean, sterile sample bottle and the necessary instructions are supplied. Two standard tests are performed to indicate fecal contamination: total coliforms and *Escherichia coli*. Test results for bacteria are usually available within one week; results for nitrate and fluoride content may take longer. Specific information on collecting samples and interpreting results is found on the *Nelson Science* Web site.

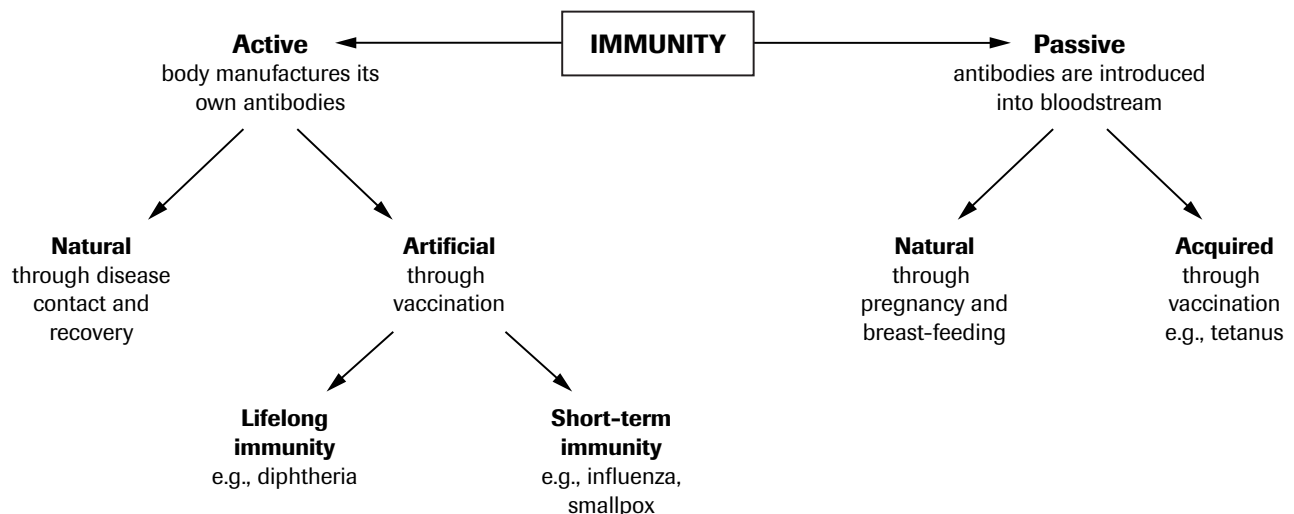
## 2.9 FIGHTING DISEASE

### SECTION 2.9 QUESTIONS

(Page 123)

#### Understanding Concepts

- The body defences that fight bacteria are: external defence (skin, sweat, specialized cells in nasal and pharynx passages, mucus, cilia, tears); lymphatic system defence (tonsils, adenoids, lymph nodes, thymus, spleen, Peyer's patches, appendix, bone marrow, lymphatic vessels, lymphocytes, macrophages); third line of defence (antigens, memory cells, plasma cells, antibodies).
- Lymphatic and circulatory systems are connected through a special circulatory system of vessels and nodes.
- macrophage: white blood cell produced in the bone marrow; circulates around the body to engulf and destroy foreign bodies
  - lymph: transparent fluid produced in the lymph nodes; contains lymphocytes
  - lymphocyte: white blood cell (plasma or memory) produced in the lymph nodes; can make antibodies when stimulated by antigens
  - antibody: protein molecule that inactivates a foreign substance by binding to its surface; produced in response to an antigen
- Disease organisms are transmitted through moisture droplets in the air, dust particles, direct contact, fecal contamination, animal bites, or wounds.
- Students should produce a simplified version of **Figure 4** on page 122 of the Student Text, beginning with the cut surface of the knee.
- Types of active and passive immunity:



- Antiseptics and disinfectants are both chemicals that destroy or impede the growth of disease-causing organisms. An antiseptic can be used on human skin without harming body cells; a disinfectant could harm human cells and is used on inanimate surfaces.

- The macrophage approaches the *E. coli* bacteria in the left photo. Its pseudopods engulf the bacteria and draw them into the cytoplasm (right photo) where they are digested. This same sequence of events occurs in the human immune system as macrophages engulf foreign bodies and destroy them with digestive enzymes.

### Making Connections

- Links to information about multiple sclerosis and rheumatoid arthritis are available on the *Nelson Science Web site*. The following is a sample answer for multiple sclerosis:

#### Sample answer: Multiple sclerosis (MS)

Multiple sclerosis is a chronic, inflammatory, autoimmune disease of the central nervous system (brain and spinal cord) that causes the destruction of the covering (myelin sheath) of the nerves. Plaques resulting from this inflammatory process that destroys normal, healthy myelin tissue are scattered throughout the central nervous system. These plaques block the ability of the nerves to transmit nervous system signals and can cause a wide range of neurological symptoms: loss of balance, impaired speech, extreme fatigue, double vision, and paralysis. The exact cause of MS is not known. Current belief is that MS results from an autoimmune response in someone genetically predisposed to develop an autoimmune disease, possibly triggered by a virus, chemical, or something in the person's environment. MS is the most common neurological disease affecting young adults in Canada, and Canadians have one of the highest rates of multiple sclerosis in the world. The disease can affect any age group. However, the diagnosis is most often made between 20 and 40 years of age, and women are twice as likely to develop MS as men. MS is more common in Caucasians than in those of African or Asian heritage.

## 2.10 TECH CONNECT: FUTURE VACCINES?

### TECH CONNECT 2.10 QUESTIONS

(Page 124)

#### Understanding Concepts

- Currently, most vaccines are delivered orally or by injection. Vaccines can be genetically engineered into foods, which are then eaten (e.g., banana with hepatitis vaccine, potato with cholera vaccine). Vaccines can also be absorbed through the skin or nasal passages.
- Students should produce a simplified version of **Figure 4**, page 122 of the Student Text, beginning with the vaccination site in step 1.
- The smallpox vaccine is made from a pathogen similar to the smallpox organism. The polio vaccine is made from a killed whole virus if it is injected, or from an attenuated virus if administered orally. The measles vaccine is attenuated—made from a living virus particle weakened by mutation or chemicals. Hepatitis B is a subunit vaccine and contains only a portion of the pathogen. Tetanus is a toxoid vaccine, containing modified toxins that can no longer cause disease.

#### Applying Inquiry Skills

- A small number of antibodies is formed by the immune system after the primary vaccination. Memory cells retain the ability to produce these antibodies, and this occurs on second exposure to the vaccine. A dramatic increase in antibody production is seen. Again, memory cells retain knowledge of antibody response and if the vaccinated individual is ever re-exposed to the disease organism, it would be quickly destroyed by the immune system.

#### Making Connections

- Eight viral diseases are documented on the WHO site, linked on the *Nelson Science Web site*: measles, diphtheria, influenza, hepatitis B, neonatal tetanus, pertussis, polio, and yellow fever.

#### Sample information pamphlet: Measles

Measles is one of the most readily transmitted communicable diseases. The measles virus is a member of the genus *Morbillivirus* in the family Paramyxoviridae. It is spread by droplets or direct contact with nasal or throat secretions of infected persons. Airborne spread or spread by articles freshly soiled with secretions of nose and throat is less common. Measles is the best known and most deadly of all childhood rash/fever illnesses. It is easily preventable by vaccination. Live attenuated viral vaccine is administered. One dose is given either intramuscularly or subcutaneously, followed by a second dose at least one month later. Infants are first vaccinated at 9–11 months in highly endemic countries; later in countries with high levels of control. The booster is not given if there has been a severe reaction to the previous dose. Pregnant women and people with congenital or acquired immune disorders (except HIV infection) are not vaccinated. Adverse reactions include malaise, fever, rash 5–12 days later, and, very rarely, encephalopathy and anaphylaxis.