

- Step 1** When a virus infects body cells, the infected cells display the viral antigen on their surfaces.
- Step 2** Macrophages engulf the virus and display the viral antigens on their surfaces.
- Step 3** Receptor proteins on helper T cells bind to the viral antigen displayed by the macrophages. The macrophages release a protein called interleukin-1 (*ihn tuhr LOO kihn*).
- Step 4** Interleukin-1 activates helper T cells, but helper T cells do not attack pathogens directly. Instead, helper T cells activate cytotoxic T cells and B cells. Stimulation by interleukin-1 causes helper T cells to release interleukin-2. Interleukin-2 stimulates further division of helper T cells and cytotoxic T cells, amplifying the body's response to the infection.
- Step 5** Interleukin-2 released by helper T cells also activates B cells. Activated B cells divide and develop into plasma cells. **Plasma cells** are cells that release Y-shaped antibodies into the blood. An **antibody** is a defensive protein produced upon exposure to a specific antigen, which can bind to that antigen.
- Step 6** Plasma cells divide repeatedly and make large numbers of antibodies. Plasma cells release antibodies into the bloodstream where they attach to the viruses. Antibodies bind to the viral antigen and mark the virus for destruction.
- Step 7** The binding of antibodies cause viruses and antigens to stick together, forming clumps that can be easily identified and destroyed by macrophages.
- Step 8** Activated cytotoxic T cells destroy infected cells by puncturing their cell membranes. Your body makes millions of different T cells, each with receptor proteins that bind to a specific antigen. Receptor proteins on cytotoxic T cells bind to the viral antigen displayed by infected cells. For example, any of your body's cells that bear traces of an influenza virus will be destroyed by cytotoxic T cells with receptor proteins that bind to the antigen of that virus. 1 2

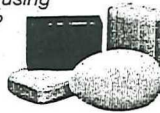
### Real Life

#### How often do you wash your hands?

Hand washing is an effective way to prevent the spread of disease. A recent study found that only 68 percent of adults wash their hands after using public restrooms.

#### Inferring Relationships

Why is it crucial that food preparers wash their hands after using a restroom?



### Study TIP

#### Reading Effectively

Antigens trigger an immune response. Remember that an antigen is an *antibody-generating substance*.

## Section 2 Review

- 1 List the different kinds of white blood cells involved in the immune response. 10A 10B
- 2 Describe how white blood cells recognize and bind to pathogens. 10A 10B
- 3 Compare the roles of B cells and T cells in the immune response. 10A
- 4 Recognizing Relationships Explain the role of helper T cells in the immune response. 10A
- 5 Critical Thinking Predicting Outcomes How would an enzyme that destroys interleukins affect the immune response? 10A 10B
- 6 TAKS Test Prep Which cells produce antibodies and release them into the blood? 10A 10B  
 A cytotoxic T cells    C plasma cells  
 B helper T cells    D macrophages

# Active Reading

## Section: Immune Response

Read the passage below. Then answer the questions that follow.

White blood cells are produced in bone marrow and circulate in blood and lymph. Of the approximately 100 trillion cells in your body, about 2 trillion are white blood cells. Four main kinds of white blood cells participate in the immune response: macrophages, cytotoxic T cells, B cells, and helper T cells. Each kind of cell has a different function. **Macrophages** consume pathogens and infected cells. **Cytotoxic T cells** attack and kill infected cells. **B cells** label invaders for later destruction by macrophages. **Helper T cells** activate both cytotoxic T cells and B cells. These four kinds of white blood cells interact to remove pathogens from the body.

### SKILL: ORGANIZING INFORMATION

In the space provided, write the letter of the term or phrase that best matches the description. Some choices may be used more than once.

- |          |   |                      |
|----------|---|----------------------|
| <u>C</u> | 1. label invaders for later destruction | a. helper T cells    |
| <u>B</u> | 2. consume pathogens                    | b. macrophages       |
| <u>D</u> | 3. kill infected cells                  | c. B cells           |
| <u>A</u> | 4. activate B cells                     | d. cytotoxic T cells |
| <u>B</u> | 5. consume infected cells               |                      |
| <u>A</u> | 6. activate cytotoxic T cells           |                      |

In the space provided, write the letter of the term or phrase that best completes the statement.

- B 7. A ratio of white blood cells to body cells shows one white blood cell to
- 10 body cells.
  - 50 body cells.
  - 1,000 body cells.
  - 5,000,000 body cells.