

Immune Response

- 1 White blood cells are most closely associated with which two body systems?
 - (1) circulatory and digestive
 - (2) immune and circulatory
 - (3) digestive and excretory
 - (4) excretory and immune
- 2 The diagnostic test for HIV, the virus that causes AIDS, involves testing the blood for antibodies associated with this pathogen. Antibodies are produced when the body
 - (1) stimulates enzyme production
 - (2) secretes specific hormones
 - (3) detects foreign antigens
 - (4) synthesizes microbes
- 3 A student infected by a common cold virus ran a low-grade fever. After a few days, the student's temperature returned to normal and the student was free of cold symptoms. The fever served as
 - (1) an antigen in the circulatory system
 - (2) an immune response to a pathogen
 - (3) a biological catalyst
 - (4) a weakened pathogen
- 4 When people receive organ transplants, they often need to take medications that decrease immune responses because
 - (1) transplanted organs contain antigens that can trigger white blood cell activity
 - (2) hormones present in replacement organs prevent the synthesis of antibiotics
 - (3) transplanted organs produce their own antibiotics
 - (4) antigens present in these organs attack antibodies already present in the blood
- 5 Recently, a human trachea (a respiratory organ) was produced by using a patient's own stem cells. The benefit of using the patient's own cells to produce a trachea instead of receiving one from a donor is that
 - (1) there will be more enzymes produced to help maintain homeostasis in the trachea
 - (2) there will be an increase in the quantity of antibodies that the patient produces in response to the new trachea
 - (3) there is less of a chance that the patient's immune system will attack the trachea
 - (4) there will be a greater response to any infectious agent that may enter the body
- 6 SCIDS (Severe Combined Immunodeficiency Syndrome) is a disorder where a genetic mutation inhibits the production and functioning of T-cells. T-cells are special types of white blood cells that play a role in the body's immune response. A possible symptom of SCIDS would be an increase in the
 - (1) number of antigens produced
 - (2) red blood cell count
 - (3) number of infections by pathogens
 - (4) ability to maintain homeostasis
- 7 An organ, such as a kidney, used for transplant needs to be tested for compatibility with the person who is to receive the organ. If this is not done, the
 - (1) donated organ might attack the body
 - (2) donated organ might attack the immune system
 - (3) immune system might attack its own body cells
 - (4) immune system might attack the donated organ

- 8 An immune response is primarily due to the body's white blood cells recognizing
- (1) a hormone imbalance (3) foreign antigens
- (2) abiotic organisms (4) known antibiotics

9 The diagram below represents a microscopic view of blood.



- Cell A protects the body by producing specific chemicals in response to pathogens. Cell A is
- (1) a red blood cell
- (2) a bacteria cell
- (3) an insulin-producing cell
- (4) a white blood cell

10-12 A student was visiting a friend at her home. Her friend owned two cats. After playing with the cats for a while, the student began to sneeze. Her nose began to run and her eyes became red, watery, and itchy. It also became hard for her to breathe. A few minutes after leaving her friend's home, the symptoms disappeared.

Provide a biological explanation for the symptoms the girl developed at her friend's house. In your response, be sure to:

- identify the body system that was responsible for triggering the reaction she experienced [1]
- identify the type of reaction the student was most likely experiencing [1]
- state one reason why her symptoms are not likely due to an infectious agent [1]

Base your answers to questions 13 on the data table below and on your knowledge of biology.

Vaccines Received by Children

Patient	Measles Vaccine	Polio Vaccine
child A	✓	
child B	✓	✓
child C		✓

13 Identify the system that will directly respond to these vaccines, and state the specific expected response. [1]

System: _____

Response: _____

Base your answers to questions 14 on the information below and on your knowledge of biology.

Battling Cancer with T-cell Therapy

One reason that cancer is able to spread through tissues and organs is that cancer cells are actually the patient's own cells. The immune system of the patient does not recognize these cancer cells as foreign and, therefore, does not reject and destroy them.

Over the past eight years, immunologists have been developing a treatment for B-cell leukemia that involves using genetically engineered T cells to recognize and destroy B cells, all of which carry a protein, CD19. CD19 is found on the surface of both healthy and cancerous B cells. B cells are immune system cells that produce antibodies.

The procedure used in this treatment is outlined below:

1. T cells are removed from the patient with B-cell leukemia.
2. The T cells are genetically engineered to recognize the CD19 protein.
3. The patient is injected with the engineered T cells, which attach to cells with CD19 and destroy them.
4. The engineered T cells destroy both cancerous and healthy B cells.

This procedure has been successful in several patients. Currently, studies are continuing with more B-cell leukemia patients. It is hoped that the studies will be expanded to include other types of cancer, and that this treatment will be available to treat a variety of cancers in the future.

14 Explain why these specific T cells can be used for B-cell leukemia treatment. [1]

Base your answers to questions 15 on the information below and on your knowledge of biology

Fungi are interesting organisms that interact with humans in many ways. Yeasts are fungi used in the food industry to produce products such as bread and certain beverages. Some fungi are valuable in medicine. For example, the drug cyclosporine, which is capable of suppressing the response of the immune system to foreign antigens, and the antibiotic penicillin are both products from fungi. Other fungi are less welcomed by humans. The irritation of athlete's foot is caused by a fungus, and a number of allergies are caused by reproductive spores released by fungi.

15 Describe the role of a drug like cyclosporine when transplanting organs from one person to another person. [1]

Base your answers to questions 16 on the illustration and information below and on your knowledge of biology. The illustration is of a Tasmanian devil.



Source: <http://www.statelibrary.tas.gov.au>

The Tasmanian devil is the largest surviving carnivorous marsupial in Australia. It is in danger of extinction due to an unusual type of cancer called Devil Facial Tumor Disease (DFTD). It can be passed from one individual to another through wounds that occur when they fight over food. Tumor cells in the mouth of an infected animal break off and enter the wound on an uninfected animal. The tumor cells multiply in the body of the newly infected devil, forming new tumors that eventually kill the animal.

Recent research has shown that the immune system of a Tasmanian devil accepts tumor cells from another devil as if they were cells from its own body. The tumor cells are ignored by the immune system. No immune response develops against them, and the cancerous cells multiply. Scientists predict that DFTD could wipe out all the remaining Tasmanian devils in 25 years, unless a treatment is developed.

- 16 Using the terms antigens and antibodies, explain why the tumor cells are ignored by the immune system in Tasmanian devils. [1]
- 17-20 The immune system protects against foreign substances and even some cancers. Explain how the immune system functions. In your answer, be sure to:
- identify one way the immune system fights pathogens [1]
 - identify the substance in a vaccine that stimulates the immune system [1]
 - describe the response of the immune system to the vaccine [1]
 - identify one disease that damages the immune system and state how it affects this system [1]

Answer Keys

- 1 2
- 2 3
- 3 2
- 4 1
- 5 3
- 6 3
- 7 4
- 8 3
- 9 4

10-12 The student's response to the bulleted items in the question need not appear in the following order.

- 10. Allow 1 credit for identifying the body system that was responsible for triggering the reaction she experienced as the immune system.
- 11. Allow 1 credit for identifying the type of reaction the student was most likely experiencing.
- Acceptable responses include, but are not limited to:
 - — an allergic reaction or allergy
 - — an immune response to a usually harmless substance
- 12. Allow 1 credit for stating one reason why her symptoms are not likely due to an infectious agent.
- Acceptable responses include, but are not limited to:
 - — An infection would probably take longer to develop.
 - — An infection by a pathogen would probably not end so suddenly.
 - — The symptoms went away when she left her friend's house.

13 Allow 1 credit. Acceptable responses include, but are not limited to:

- System:
 - — Immune system
- Response:
 - — make antibodies
 - — increase white blood cell production
 - — produces cells that engulf the virus/pathogen

14 Allow 1 credit. Acceptable responses include, but are not limited to:

- — They will recognize the CD19 protein/antigen on the B cells and destroy the B cells.
- — They can be used to destroy any cell with the CD19 protein on its surface.
- — They recognize the antigen on the surface of the B cells.
- — They can kill/destroy B cells.

15 Allow 1 credit. Acceptable responses include, but are not limited to:

- — The transplanted organ contains foreign antigens. Cyclosporine suppresses the immune response to these antigens.
- — It stops rejection of the organ.
- — It suppresses the response of the immune system.

16 Allow 1 credit. Acceptable responses include, but are not limited to:

- — The tumor cells might lack antigens that the antibodies can recognize and attack.
- — The antigens on the surface of the tumor cells could be interpreted by the immune system as being on cells that are not harmful and therefore do not form antibodies to attack them.
- — The cancer cells might not have any antigens on their surfaces. Without antigens, antibodies will not attack.
- Note: Do not allow credit if the student does not answer the question using the terms antigens and antibodies.

17-20 The student's response to the bulleted items in the question need not appear in the following order.

- 17. Allow 1 credit for identifying one way the immune system fights pathogens. Acceptable responses include, but are not limited to:
 - — White blood cells engulf pathogens.
 - — Antibodies fight invaders.
 - — produces antibodies
- 18. Allow 1 credit for identifying the substance in a vaccine that stimulates the immune system. Acceptable responses include, but are not limited to:
 - — dead/weakened pathogen
 - — antigens
 - — a small piece of the virus/viral coat
- Note: Do not accept “a little bit of the disease” or “a small amount of the virus.”
- 19. Allow 1 credit for describing the response of the immune system to the vaccine. Acceptable responses include, but are not limited to:
 - — The vaccine stimulates the immune system to produce antibodies.
 - — It causes the body to make antibodies.
- 20. Allow 1 credit for identifying one disease that damages the immune system and for stating how it affects this system. Acceptable responses include, but are not limited to:
 - AIDS/HIV
 - — attacks the immune system so it cannot fight off diseases
 - cancer/leukemia
 - — destroys immune system cells, which weakens immune responses