Stopping the Spread

Trace how immune defenses work together against a virus.

HS-AP9-4 "Construct an explanation for defense against foreign pathogens using cellular and non-cellular components of the immune response."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the names of at least three defending cell types, circle mucus and antibodies, and number four actions in the order they help contain the virus.

A Flu Virus Meets Its Defenses

1. On a winter bus, a passenger breathes in droplets carrying an unfamiliar flu virus. Sticky mucus in the nose and airways traps many virus particles, and airway cells bearing tiny moving cilia sweep the mucus toward the throat. These barriers lower the number of particles that reach other living cells. Some viruses still enter airway cells and use those cells to make copies. Nearby macrophages engulf loose particles and debris from damaged cells. An infected cell also releases chemical signals that draw more immune cells to the area. The first defenses act quickly, but they cannot always stop the infection alone.

2. A dendritic cell collects pieces of the virus, called antigens, and travels through a lymphatic vessel to a nearby lymph node. There, it displays the antigens to helper T cells that recognize this virus. Activated helper T cells send signals that help matching B cells multiply. The B cells develop into plasma cells that release antibodies, proteins shaped to bind this virus. Antibodies attach to virus particles outside cells and can block their entry into new cells. They also tag those particles for removal by phagocytes such as macrophages. This response targets the virus more precisely than the first barriers did.

3. Antibodies cannot reach viruses already reproducing inside airway cells. Instead, infected cells display viral fragments on their surfaces. Activated cytotoxic T cells that recognize those fragments kill the infected cells, cutting off places where the virus can multiply. Macrophages then clear some of the dead cells and debris. After the infection subsides, some virus-specific B and T cells remain as memory cells. If the same virus appears again, these cells can respond faster, although a changed virus may escape some recognition. Defense depends on linked actions: barriers slow entry, immune cells locate and destroy threats, and antibodies work outside cells.

2 ANSWER WITH EVIDENCE

Use the passage

1. Explain how mucus, cilia-bearing airway cells, and macrophages work in sequence to limit the virus.

2. How does a dendritic cell help lead to the production of antibodies?

3. Explain why the body uses both antibodies and cytotoxic T cells against this virus.

4. If the same virus returns later, how can the response change, and why might a changed virus be harder to stop?

3 YOUR TURN

Your own words

A virus enters through a small cut on a finger. Write five or six sentences explaining a possible chain of defense, including the breached barrier, at least two immune cell types, one non-cellular defense, and what happens to viruses outside cells and inside infected cells.

ANSWER KEY

Stopping the Spread

PART 1 · READ AND MARK

Underline the names of at least three defending cell types, circle mucus and antibodies, and number four actions in the order they help contain the virus. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Explain how mucus, cilia-bearing airway cells, and macrophages work in sequence to limit the virus.	**Mucus traps virus particles, cilia-bearing cells move the mucus toward the throat, and macrophages engulf loose particles that get past the barriers.**
2	How does a dendritic cell help lead to the production of antibodies?	**It carries viral antigens to a lymph node and displays them to helper T cells. Activated helper T cells help matching B cells multiply and become antibody-producing plasma cells.**
3	Explain why the body uses both antibodies and cytotoxic T cells against this virus.	**Antibodies bind virus particles outside cells and can block their entry into new cells. Cytotoxic T cells kill infected cells, where antibodies cannot reach the reproducing virus.**
4	If the same virus returns later, how can the response change, and why might a changed virus be harder to stop?	**Virus-specific memory B and T cells can respond faster to the same virus. A changed virus may escape some of their recognition.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A cut breaks the skin barrier, allowing a virus to enter tissue in the finger. Macrophages engulf loose virus particles, while a dendritic cell carries viral antigens to a lymph node. There, helper T cells help matching B cells become plasma cells that release antibodies. These antibodies bind free virus particles and help prevent them from entering more cells. If finger cells become infected, cytotoxic T cells recognize viral fragments on their surfaces and kill those cells, limiting further virus production.

Accept other accurate sequences that connect a breached barrier to cellular and non-cellular defenses. Responses should distinguish free virus particles from virus reproducing inside infected cells.