The Scrape Route

Trace fluid flow and compare immune defenses

HAP.11 "Students will investigate the structures and functions of the lymphatic system, including the cause and effect of diseases and disorders. Analyze the functions of leukocytes, lymph, and lymphatic organs in the immune system..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the first mention of each stop on the fluid route: blood capillaries, tissue spaces, lymphatic capillaries, lymphatic vessels, and lymph nodes. At each stop, circle the nearby action that tells what fluid or immune cells do there.

What Happens After a Scrape?

1. While Maya cleans a small scrape, fluid leaves blood capillaries and enters the tissue spaces around the cut. This fluid delivers materials to cells, but some remains outside the bloodstream. Lymphatic capillaries collect the extra fluid, now called lymph. Lymphatic vessels carry lymph to lymph nodes, where immune cells inspect it for signs of microbes from the scrape. The fluid eventually returns to the bloodstream. This one-way route helps prevent swelling and returns water and proteins to the cardiovascular system. Blood delivers supplies to tissues, while the lymphatic system recovers fluid and monitors it for threats.

2. At the scrape, a damaged skin barrier gives microbes a way in. Neutrophils reach the tissue quickly and engulf microbes; monocytes arrive later and can develop into macrophages that engulf them too. These actions are nonspecific defenses because they attack many kinds of intruders without targeting one antigen. In a lymph node, B lymphocytes that recognize an antigen carried from the scrape in lymph can multiply and become plasma cells, which release specific antibodies into body fluids. T lymphocytes that recognize the antigen can become cells that kill infected body cells. These targeted actions are specific defenses, and some activated lymphocytes become long-lived memory cells.

3. If Maya has never encountered this antigen, activating the matching lymphocytes takes time; this is a primary immune response. If memory cells already exist, they react faster on a later exposure, producing a secondary response. A vaccine can create memory without causing the disease it is designed to prevent. By contrast, antibodies passed through the placenta from a pregnant person to a fetus provide passive protection right away, but those borrowed antibodies fade and do not create the fetus's own memory cells. The spleen filters blood for threats, while the thymus supports T lymphocyte development. Neither replaces lymph nodes, which inspect lymph.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does the lymphatic route help both the tissues around Maya's scrape and her cardiovascular system?

2. How do neutrophils at Maya's scrape and B lymphocytes in a lymph node respond differently to microbes from the scrape?

3. After recognizing an antigen, how do B and T lymphocytes carry out different specific defenses?

4. Why is a response to the same antigen usually faster the second time than the first?

3 YOUR TURN

Your own words

A newborn has temporary antibodies from a parent, while an older sibling receives a vaccine. In four sentences, compare how each gains protection and predict what happens when the borrowed antibodies fade or the sibling encounters the antigen again. Include the role of lymphocytes.

The Scrape Route

PART 1 · READ AND MARK

Underline the first mention of each stop on the fluid route: blood capillaries, tissue spaces, lymphatic capillaries, lymphatic vessels, and lymph nodes. At each stop, circle the nearby action that tells what fluid or immune cells do there. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does the lymphatic route help both the tissues around Maya's scrape and her cardiovascular system?	**Lymphatic capillaries collect extra fluid from the tissues, helping prevent swelling. Lymphatic vessels eventually return that fluid, including water and proteins, to the bloodstream.**
2	How do neutrophils at Maya's scrape and B lymphocytes in a lymph node respond differently to microbes from the scrape?	**Neutrophils quickly engulf microbes as a nonspecific defense. B lymphocytes recognize an antigen carried to a lymph node in lymph and can become plasma cells that release specific antibodies.**
3	After recognizing an antigen, how do B and T lymphocytes carry out different specific defenses?	**B lymphocytes can become plasma cells that release antibodies into body fluids. T lymphocytes can become cells that kill infected body cells.**
4	Why is a response to the same antigen usually faster the second time than the first?	**The first response can produce long-lived memory cells. Those cells react faster when the antigen appears again.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The newborn receives antibodies through the placenta, so protection begins right away but fades as those antibodies disappear. The newborn does not gain memory cells from those borrowed antibodies. The vaccine prompts the older sibling's lymphocytes to form memory cells. If the sibling encounters that antigen again, the memory cells support a faster secondary response.

Accept answers that distinguish temporary passive protection from vaccine-induced memory. Students should connect the later, faster response to memory lymphocytes rather than to borrowed antibodies.