Airway Defense Team

Use cell structures as evidence for how the airway clears particles.

BIO.1 "Engage in evidence-based argument to relate a cell's function to the structure, function, and diversity of its components."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB In paragraphs 2 and 3, underline at least two cell components in each paragraph, circle the job each helps perform, and give each matching pair the same number.

Two Cells, One Airway

1 A breath can bring dust and bacteria into the airways. The trachea, or windpipe, has a living lining that helps keep these particles from reaching deeper parts of the lungs. Two neighboring cell types do different jobs in this lining. Goblet cells release mucus, a sticky fluid that traps particles. Ciliated cells move that mucus toward the throat, where it can be swallowed or coughed out. Both types have a cell membrane, a nucleus, and other shared parts, but the amount and arrangement of some components differ. Their different designs make a joint defense possible.

2 A ciliated cell has many short, hairlike cilia on its exposed surface. These cilia beat in coordinated waves, pushing the mucus layer in one direction. Inside each cilium, protein structures slide against one another to create motion. That motion requires ATP, a molecule cells use to transfer energy. Mitochondria produce much of the ATP used by these cells. If a toxin stopped the cilia from beating, mucus could remain in place even if goblet cells kept making it. Dust and bacteria trapped in that mucus would then be harder to clear from the airway.

3 A goblet cell has a different emphasis: it makes and releases large amounts of mucins, proteins that give mucus its slippery, sticky properties. Ribosomes on rough endoplasmic reticulum build these proteins. The Golgi apparatus modifies and sorts them, and membrane-bound vesicles carry them to the cell surface for release. A goblet cell cannot replace the sweeping motion of a ciliated cell, just as a ciliated cell cannot supply the same amount of mucus. If goblet cells released too little mucus, moving cilia would have less material to carry, and more particles could reach the delicate tissues below.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do cilia and mitochondria work together to help a ciliated cell clear particles?

2. Use two components named in paragraph 3 to explain how a goblet cell makes and releases mucus.

3. A toxin stops cilia from beating, but goblet cells keep making mucus. Why might particles remain in the airway?

4. A researcher finds more rough endoplasmic reticulum in goblet cells than in nearby ciliated cells. What evidence from the passage makes this difference reasonable?

3 YOUR TURN

Your own words

Imagine an airway lining with only one kind of cell. Propose two components from the passage that each cell would need to both trap particles and move them toward the throat. Explain how each component helps and why either one alone would not do both jobs.

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PART 1 · READ AND MARK

In paragraphs 2 and 3, underline at least two cell components in each paragraph, circle the job each helps perform, and give each matching pair the same number. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do cilia and mitochondria work together to help a ciliated cell clear particles?	**Cilia beat to push particle-filled mucus toward the throat. Mitochondria produce much of the ATP needed for that motion.**
2	Use two components named in paragraph 3 to explain how a goblet cell makes and releases mucus.	**For example, ribosomes on rough endoplasmic reticulum build mucins, and vesicles carry them to the cell surface for release.**
3	A toxin stops cilia from beating, but goblet cells keep making mucus. Why might particles remain in the airway?	**The mucus can still trap particles, but without beating cilia it may remain in place instead of moving toward the throat.**
4	A researcher finds more rough endoplasmic reticulum in goblet cells than in nearby ciliated cells. What evidence from the passage makes this difference reasonable?	**Goblet cells make large amounts of mucins, and ribosomes on rough endoplasmic reticulum build those proteins. Ciliated cells mainly move mucus.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would give each cell many cilia and abundant rough endoplasmic reticulum. The rough endoplasmic reticulum would help make mucins for mucus that traps particles, while the cilia would move the mucus toward the throat. Without enough mucins, fewer particles would be trapped, and without beating cilia, the mucus could remain in place.

Accept other supported pairs of components if the response explains both trapping and movement. For example, a student may choose vesicles for mucin release and cilia for movement.