Design Against Division

Trace how engineers test and improve a targeted cancer drug.

HAP.2.3 "Enrichment: Use an engineering design process to research and develop medications (i.e., targeted cancer therapy drugs) that target uncontrolled cancer cell reproduction.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the drug's target, circle the design requirements, and number the test and revision steps in order. Use your marks to track how each decision responds to evidence.

A Drug Designed to Interrupt a Signal

1. Some lung cancer cells carry a change in EGFR, a protein that helps control cell division. The changed protein can keep sending a growth signal when it should stop. A drug that blocks that signal might slow the cancer cells, but healthy cells also use EGFR. Researchers therefore set two requirements for a new drug: it must strongly reduce division in cells with the changed EGFR and cause as little harm as possible to healthy cells. They also need a way to check whether the drug keeps working if cancer cells change over time.

2. An engineering team designs two test molecules that attach to EGFR. In a laboratory, the team exposes groups of cancer cells with changed EGFR and groups of healthy cells to each molecule. Molecule A barely slows the cancer cells. Molecule B slows them sharply, but many healthy cells are harmed too. Neither molecule meets both requirements, so the team does not treat B as a finished drug. Instead, the team revises B's structure, aiming to make it attach more readily to the changed EGFR than to the usual version.

3. The revised molecule must be tested against both cell groups again. Researchers would compare cell division and cell survival with untreated groups, then check whether its effects hold across a range of doses. They would also test cancer cells that no longer respond, since a new change in EGFR could make the drug less effective. Only promising laboratory results would justify further safety studies before tests in people. This cycle of designing, testing, and revising cannot guarantee a cure, but it helps researchers reject drugs that fail or cause unacceptable harm.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why must the team test the molecule on healthy cells as well as cancer cells?

2. How does the first test show that neither molecule meets the design requirements?

3. What change does the team aim to make to B, and which test would show whether the change helped?

4. Why should researchers test cancer cells that no longer respond before moving toward tests in people?

3 YOUR TURN

Your own words

Imagine a different tumor whose cells carry a surface tag that nearby healthy cells lack. Propose a drug design that uses the tag to reduce tumor cell division, name one safety requirement, and describe a lab test and a revision you would make if the test reveals a problem.

Design Against Division

PART 1 · READ AND MARK

Underline the drug's target, circle the design requirements, and number the test and revision steps in order. Use your marks to track how each decision responds to evidence. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why must the team test the molecule on healthy cells as well as cancer cells?	**Healthy cells also use EGFR, so a molecule that slows cancer cells might harm healthy cells.**
2	How does the first test show that neither molecule meets the design requirements?	**A barely slows the cancer cells. B slows them sharply but harms many healthy cells.**
3	What change does the team aim to make to B, and which test would show whether the change helped?	**The team aims to make B attach more readily to changed EGFR than to usual EGFR. It should test the revised molecule on both cancer and healthy cells and compare division and survival with untreated groups.**
4	Why should researchers test cancer cells that no longer respond before moving toward tests in people?	**A new change in EGFR could make the drug less effective, so researchers need to check whether it still works against those cells.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would design a drug that attaches to the tumor's surface tag and delivers a substance that interrupts cell division. It should slow tumor cells without seriously harming nearby healthy cells. I would compare division and survival in tagged tumor cells, healthy cells without the tag, and untreated groups. If healthy cells were harmed, I would revise the drug to make it attach more selectively to the tag, then repeat the test.

For Part 3, accept other plausible designs that use the surface tag and include a measurable safety requirement, a comparison test, and a revision tied to a possible result. Students need not name a real drug.