The Copying Test

Use DNA band patterns to test competing replication models.

GEN.1B.1 "Compare and contrast various proposed models of DNA replication (i.e., conservative, semi-conservative, and disruptive). Evaluate the evidence used to determine the mechanism of DNA replication."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each model's explanation of where old DNA goes. Circle the band patterns the researchers actually observed, and label those results 1 and 2 to show the order of the evidence.

How Does DNA Keep Its Past?

1. Imagine two identical DNA ladders being copied inside a cell. Before scientists could watch the process directly, they proposed three ways the old DNA might end up in the copies. In conservative replication, the original double helix stays together, and an entirely new double helix forms. In semi-conservative replication, the original strands separate, and each pairs with a new strand. In disruptive replication, often called dispersive replication, each strand in both finished molecules contains alternating stretches of old and new DNA. All three models produce two double helices, but they distribute the original material differently.

2. To test these ideas, Matthew Meselson and Franklin Stahl grew bacteria in a medium containing a heavy form of nitrogen, which became part of their DNA. They then moved the bacteria to a medium with light nitrogen. After each round of DNA copying, they collected DNA and spun it in a density gradient. Heavy DNA formed a band lower in the tube than light DNA; DNA with a density between them formed an intermediate band. A band's position revealed DNA density, not which specific strand or stretch was old. This made the experiment a test of model predictions, not a direct movie of copying.

3. After one round in light nitrogen, conservative replication predicts separate heavy and light bands. Both semi-conservative and disruptive replication predict one intermediate band, and that is what the researchers observed. After two rounds, semi-conservative replication predicts an intermediate band and a light band: some molecules still have one whole old strand, while others have none. Disruptive replication instead predicts one band that shifts toward the light position, because old DNA is spread among all molecules. The researchers observed distinct intermediate and light bands. Their second result separated two models that the first result could not distinguish.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do semi-conservative and disruptive replication differ in the way they place old DNA in the new molecules?

2. What bands would conservative replication predict after one round, and how does that compare with the observed result?

3. A scientist examines only the first-round result and claims it identifies one replication model. Why is that claim not supported?

4. Why do the two bands observed after round two support semi-conservative replication over disruptive replication?

3 YOUR TURN

Your own words

Invent a fictional lab result that would favor disruptive replication instead of semi-conservative replication. In four sentences, describe the bands after each of two rounds and explain how your results rule out the other two models.

The Copying Test

PART 1 · READ AND MARK

Underline each model's explanation of where old DNA goes. Circle the band patterns the researchers actually observed, and label those results 1 and 2 to show the order of the evidence. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do semi-conservative and disruptive replication differ in the way they place old DNA in the new molecules?	**Semi-conservative replication keeps each old strand whole and pairs it with a new strand. Disruptive replication mixes old and new stretches within each strand.**
2	What bands would conservative replication predict after one round, and how does that compare with the observed result?	**It predicts separate heavy and light bands, but the researchers observed one intermediate band.**
3	A scientist examines only the first-round result and claims it identifies one replication model. Why is that claim not supported?	**Both semi-conservative and disruptive replication predict the observed intermediate band after one round.**
4	Why do the two bands observed after round two support semi-conservative replication over disruptive replication?	**Semi-conservative replication predicts separate intermediate and light bands. Disruptive replication predicts one band that shifts toward the light position.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In my fictional experiment, round one produces one intermediate band. Round two produces one band that is still intermediate but closer to the light position, with no separate light band. The first result rules out conservative replication, which predicts separate heavy and light bands. The second favors disruptive replication over semi-conservative replication because it shows one shifting band rather than distinct intermediate and light bands.

Accept descriptions of disruptive replication as dispersive replication. For Part 3, the invented first-round result must exclude the conservative model, and the second-round result must distinguish disruptive from semi-conservative replication.