Clues in DNA

Use experimental evidence to explain DNA's structure and function.

GEN.1A "Students will demonstrate that all cells contain genetic material in the form of DNA. Model the biochemical structure, either 3-D or computer-based, of DNA based on the experimental evidence available to Watson and Crick (Chargaff, 1950…"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what each experiment showed about DNA. Circle the two findings that helped scientists build a model of its structure.

From Pale Strands to a Double Helix

1. At the boundary between cold ethanol and a mashed strawberry mixture, pale strands gather on a stirring rod. Those strands include DNA released from strawberry cells. In an extraction, detergent breaks open cells and their nuclei, salt helps DNA gather together, and ethanol makes DNA separate from the watery mixture. The same basic steps can release DNA from mushroom cells or cells scraped gently from a cheek. The visible yield may differ because samples contain different numbers of cells and other materials. A smaller clump does not mean a cell type lacks DNA. It may reflect the sample or how well its cells were broken open.

2. In 1928, Frederick Griffith injected mice with harmless living bacteria and heat-killed disease-causing bacteria. He later recovered living disease-causing bacteria, suggesting that material from the dead cells had passed on a trait. In 1944, Oswald Avery, Colin MacLeod, and Maclyn McCarty tested that material. Destroying DNA stopped the change, but destroying proteins did not. In 1952, Alfred Hershey and Martha Chase tracked labeled DNA and protein from viruses that infect bacteria. Viral DNA entered the bacterial cells, while most viral protein stayed outside. Together, these experiments built the case that DNA, rather than protein, carries heritable information.

3. What shape could a molecule carrying inherited information have? In 1950, Erwin Chargaff reported that DNA samples have matching amounts of A and T, and of C and G. Beginning in 1951, Rosalind Franklin used X-ray diffraction to investigate DNA. Her data revealed a helical shape and helped measure its dimensions. Watson and Crick used these clues to propose two strands with paired bases, A with T and C with G, in 1953. Complementary pairing lets each strand guide copying of the other. The order of bases in protein-coding genes provides instructions for making proteins; other DNA regions have different roles, including helping control gene activity.

2 ANSWER WITH EVIDENCE

Use the passage

1. A mushroom sample produces less visible DNA than a strawberry sample. Why is this not evidence that mushroom cells lack DNA?

2. How did the 1944 experiment build on the change Griffith observed in bacteria?

3. How did the Hershey and Chase results add to the case that DNA carries heritable information?

4. Which finding from Chargaff and which finding from Franklin helped shape the DNA model? Name one function the resulting structure supports.

3 YOUR TURN

Your own words

Draw your own DNA model with two labeled strands, three labeled base pairs, and a note showing that the strands twist. Write two sentences: connect your base pairs to Chargaff's results, then explain how the structure supports copying.

ANSWER KEY

Clues in DNA

PART 1 · READ AND MARK

Underline what each experiment showed about DNA. Circle the two findings that helped scientists build a model of its structure. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	A mushroom sample produces less visible DNA than a strawberry sample. Why is this not evidence that mushroom cells lack DNA?	**Visible yield can differ because of the number of cells, other materials in the sample, or how well the cells were broken open.**
2	How did the 1944 experiment build on the change Griffith observed in bacteria?	**Griffith observed that a trait passed to living bacteria. Avery, MacLeod, and McCarty found that destroying DNA stopped that change, while destroying proteins did not.**
3	How did the Hershey and Chase results add to the case that DNA carries heritable information?	**Viral DNA entered bacterial cells, while most viral protein stayed outside. This supported DNA, rather than protein, as the material passed into the cells.**
4	Which finding from Chargaff and which finding from Franklin helped shape the DNA model? Name one function the resulting structure supports.	**Chargaff found matching amounts of A and T and of C and G. Franklin's data revealed a helix and helped measure its dimensions. Complementary base pairing lets each strand guide copying of the other.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The sketch shows two twisting strands joined by A-T, C-G, and T-A pairs. Chargaff's matching amounts of A and T and of C and G support these pairs. Each strand can guide a new complementary strand during copying.

Accept any three correctly labeled A-T or C-G pairs in the model. The copying explanation should connect complementary pairing to forming a new strand.