Inside the Helix

Read a DNA model from its parts to its sequence.

BIO.2.a "Use a model to describe the structure and sequence of DNA, including nucleotide structure, base pairing, and the structure of the helix."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the three parts of a nucleotide and circle each base-pair rule. Number the descriptions of where the backbones and paired bases sit so you can check a DNA model.

What a Pond Sample Can Show

1. Imagine that a lab collects DNA from a drop of pond water. A scientist cannot see the molecule's details with an ordinary classroom microscope, so a model helps show what the molecule contains. DNA is built from repeating units called nucleotides. Each nucleotide has a phosphate group, a deoxyribose sugar, and one nitrogenous base. The base may be adenine (A), thymine (T), cytosine (C), or guanine (G). In a strand, the phosphate of one nucleotide bonds to the sugar of the next, forming a sugar-phosphate backbone. The bases project inward from that backbone.

2. DNA usually has two strands. Their sugar-phosphate backbones run along the outside of the molecule, while pairs of bases join across the inside. Adenine pairs with thymine, and cytosine pairs with guanine. These matches let the bases fit together in a consistent way. The two strands run in opposite directions, called antiparallel. They also coil around a shared axis, making a double helix. A flat sketch can show the order of the parts, but a three-dimensional model shows how the backbones wind around each other and the paired bases occupy the center.

3. The order of bases along one strand is its sequence. To record a sequence, follow a single backbone and read its bases in order; do not jump across each pair. Because pairing follows fixed rules, the bases on one strand determine the matching bases on the other. A change in one base can change information stored in DNA, even if the rest of the helix keeps its overall shape. In the pond sample, scientists might compare base sequences from two DNA fragments. Their models would help them distinguish a change in sequence from a change in the drawing's viewpoint.

2 ANSWER WITH EVIDENCE

Use the passage

1. In a nucleotide sketch, a base is attached directly to a phosphate group instead of to a sugar. What should you change to make the sketch accurate?

2. One DNA strand reads A C T G G A from left to right. Write the bases on the matching strand in aligned left-to-right order, and explain your choices.

3. A student records a strand's sequence by moving back and forth across paired bases. How should the student trace the model instead?

4. A model has two straight backbones with correctly paired bases between them. What must change to show DNA's three-dimensional shape, and what stays in the center?

3 YOUR TURN

Your own words

Draw your own model of a DNA segment with five base pairs. Invent one strand's sequence, show its matching strand and the helix's twist, and label a nucleotide's three parts, both backbones, and the paired bases. Below your drawing, write one sentence explaining how to read your sequence.

ANSWER KEY

Inside the Helix

PART 1 · READ AND MARK

Underline the three parts of a nucleotide and circle each base-pair rule. Number the descriptions of where the backbones and paired bases sit so you can check a DNA model. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In a nucleotide sketch, a base is attached directly to a phosphate group instead of to a sugar. What should you change to make the sketch accurate?	**Attach the base to the deoxyribose sugar. The phosphate helps link sugars along the backbone.**
2	One DNA strand reads A C T G G A from left to right. Write the bases on the matching strand in aligned left-to-right order, and explain your choices.	**T G A C C T. A pairs with T, and C pairs with G at each position.**
3	A student records a strand's sequence by moving back and forth across paired bases. How should the student trace the model instead?	**Follow one sugar-phosphate backbone and record the bases attached to that strand in order.**
4	A model has two straight backbones with correctly paired bases between them. What must change to show DNA's three-dimensional shape, and what stays in the center?	**The backbones must coil around a shared axis to form a double helix. The paired bases stay in the center.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

The drawing shows two twisting sugar-phosphate backbones with five paired bases between them. One strand reads G A A T C, and the aligned strand reads C T T A G. One nucleotide is labeled phosphate group, deoxyribose sugar, and base. Both backbones and the paired bases are labeled. Sentence: Follow one backbone to read its attached bases in order, rather than crossing to the other strand.

Accept any invented five-base sequence with its correctly aligned complement. The sketch should place the backbones outside, the paired bases inside, and show the strands twisting around each other.