Where Viruses Branch

Use shared traits to test a claim about the tree of life.

BIO.13 "Analyze and interpret data to support hypotheses of common ancestry and biological evolution illustrated by cladograms and phylogenetic trees. a..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB In the table, number the three cellular groups that share a tree-building clue and circle two virus features that support a separate category. In the passage, underline one sentence that limits what the evidence can show.

Can Viruses Fit on the Tree of Life?

(1) Scientists build a tree of life by comparing inherited DNA sequences in cells. One useful set of clues comes from genes for ribosomal RNA, a part of the machinery that makes proteins. Bacteria, archaea, and eukaryotes all have ribosomes. Differences in their ribosomal RNA sequences help scientists infer where branches split and which groups share a more recent ancestor.

(2) A virus carries genetic material inside a protein coat, and some have an outer membrane. It has no ribosomes and must use a host cell's machinery to make new virus particles. The table compares features relevant to placing groups on a tree. A shared feature alone is not enough to establish branching order; scientists compare related inherited sequences.

TRAITS OF FOUR GROUPS

Group	Made of cells?	Ribosomes?	Ribosomal RNA genes?	Genome
Bacteria	Yes	Yes	Yes	DNA
Archaea	Yes	Yes	Yes	DNA
Eukaryotes	Yes	Yes	Yes	DNA
Viruses	No	No	No	DNA or RNA

(3) Data support placing viruses apart from cellular life, but not because viruses lack genes. Their genes can change over generations, and viral lineages evolve. Yet viruses lack the ribosomal RNA genes used to compare the three cellular groups. Without those sequences, the table cannot place viruses on the cellular tree or establish a single origin for viruses.

2 ANSWER WITH EVIDENCE

Use the passage

1. Which three groups could scientists compare using ribosomal RNA genes, and what could differences in those genes help scientists infer?

2. Use two features in the table to support placing viruses in a separate category from cellular life.

3. A student claims that viruses cannot evolve because they have no genes. Evaluate the claim using evidence from the passage and table.

4. A student puts viruses on a branch next to eukaryotes because both have genes. Does the evidence support that placement? Explain.

3 YOUR TURN

Your own words

Researchers discover a cell with its own ribosomes and ribosomal RNA genes, but it can multiply only inside animal cells. Write four sentences evaluating whether its need for a host makes it a virus, explaining how scientists could investigate its ancestry, and stating one conclusion they cannot yet make.

Where Viruses Branch

PART 1 · READ AND MARK

In the table, number the three cellular groups that share a tree-building clue and circle two virus features that support a separate category. In the passage, underline one sentence that limits what the evidence can show. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Which three groups could scientists compare using ribosomal RNA genes, and what could differences in those genes help scientists infer?	**Bacteria, archaea, and eukaryotes. Sequence differences could help infer branching relationships and which groups share a more recent ancestor.**
2	Use two features in the table to support placing viruses in a separate category from cellular life.	**Unlike the three cellular groups, viruses are not made of cells and have no ribosomes. Their lack of ribosomal RNA genes is also valid evidence.**
3	A student claims that viruses cannot evolve because they have no genes. Evaluate the claim using evidence from the passage and table.	**The claim is incorrect. Viruses have DNA or RNA genomes, and their genes can change over generations.**
4	A student puts viruses on a branch next to eukaryotes because both have genes. Does the evidence support that placement? Explain.	**No. Sharing genes does not establish branching order, and viruses lack the ribosomal RNA genes used here to compare cellular branches.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Needing an animal cell does not by itself make the new cell a virus. Its own ribosomes and ribosomal RNA genes support placing it with cellular life. Scientists could compare its ribosomal RNA gene sequence with those of bacteria, archaea, and eukaryotes to investigate its ancestry. The facts given do not show which cellular group is its closest relative.

For the marking job, accept any numbering of the three cellular groups and any two virus traits that distinguish viruses from them. For Your Turn, accept a qualified conclusion that uses sequence comparison rather than host dependence alone to investigate ancestry.