

TIPS TO ACTIVATE CRITICAL THINKING WITH MULTIPLE CHOICE

INTRODUCTION

Multiple choice is great to assess a breadth of knowledge. And, done right, multiple choice can activate critical thinking too. Here are 7 strategies that have helped us with the development of questions for the REAL Science Challenge contests.

Strategy 1: Answers must all sound plausible.

Strategy 2: Have more than 1 right answer

Strategy 3: Instead of restating the textbook, provide alternate examples

Strategy 4: Have answers that include a justification

Strategy 5: “All of the above” or “None of the above” cannot be an answer

Strategy 6: Answers should not have words like “never” or “always”

Strategy 7: Keep the lengths of each multiple choice answer the same.

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PRACTICE PASSAGE

Antibiotics help fight infections by killing the bacteria causing the infection. Antibiotics are able to target and kill bacterial cells instead of human cells because of differences between bacterial and human cells. The following 3 classes of antibiotics kill bacterial cells using the principle stated above.

Beta-Lactam

This class of antibiotic kills bacteria that are surrounded by cell wall. Bacterial cell walls are built by linking molecules together. Beta-Lactam antibiotics block molecules from linking. As a result, bacteria missing their cell walls are prone to bursting when the pressure within the cell builds up and becomes too much.

Microlides

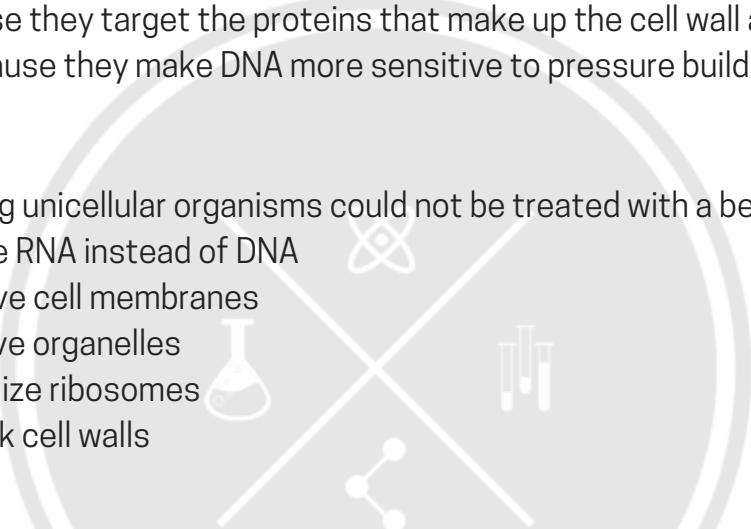
This class of antibiotic kills bacteria by targeting its ribosomes, the organelles essential to protein-building. Microlides block ribosomes from building proteins. Since proteins do all cell work, bacterial cells that cannot build proteins cannot survive.

Quinolones

This class of antibiotic kills bacteria by targeting the proteins used in DNA replication. When bacteria start to copy their DNA, quinolones cause the strands to break. Quinolones also prevent the broken strands from being repaired. Without intact DNA, bacteria cannot live or reproduce.

Source: University of Utah, What is an Antibiotic? Retrieved from <http://learn.genetics.utah.edu/content/microbiome/antibiotics/>

1. Which of the following would be classified as a beta-lactam?
 - a) An antibiotic that increases the chance of bacteria breaking apart when water rushes in.
 - b) An antibiotic that prevents bacteria from making copies of its own genetic material
 - c) An antibiotic that disrupts the interaction between proteins and the cell's genetic material
 - d) An antibiotic that makes bacterial cell walls stronger, more resilient and more flexible
 - e) An antibiotic that prevents the molecules that make up ribosomes from fusing together.

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2. A new type of antibiotic targets proteins that attach to the genetic material of bacteria. Because of this, bacteria are less likely to replicate its circular chromosome. What type of antibiotic could this antibiotic be classified as?
- a) Microlides because they target the formation of proteins necessary for cell function
 - b) Microlides because they target the ribosomes that make proteins that support DNA
 - c) Quinolones because they decrease the likelihood of successful genetic material replication
 - d) Quinolones because they target the proteins that make up the cell wall and organelles.
 - e) Beta-lactams because they make DNA more sensitive to pressure build up in the cell
3. Which of the following unicellular organisms could not be treated with a beta-lactam?
- a) organisms that use RNA instead of DNA
 - b) organisms that have cell membranes
 - c) organisms that have organelles
 - d) organisms that utilize ribosomes
 - e) organisms that lack cell walls
4. A new breed of bacteria is observed to be resistant to microlide and quinolone antibiotics. What might be the cause of this resistance?
- a) the bacteria is able to create proteins using a process that does not require ribosomes
 - b) the bacteria has a cell wall that is made up of a different molecular composition
 - c) the bacteria has alterations to its DNA that make it more susceptible to replication errors.
 - d) the bacteria has chromosomal deletions that prevent the genetic material from breaking
 - e) the bacteria has is able to patch and support parts of the cell wall that are weak or altered.

Answers: 1. A; 2. C; 3. E; 4. A, D