

Name: _____ Date: _____

Invisible Giants: The High-Stakes 11th Grade Microbiology Challenge

Learners synthesize metabolic pathways and evaluate pathogenicity mechanisms within complex microbial ecosystems to conclude their advanced cellular biology unit.

1. A researcher discovers a soil bacterium that utilizes H₂S as an electron donor and CO₂ as a carbon source. How should this organism be categorized based on its metabolic requirements?

- A. Photoheterotroph
- B. Chemolithoautotroph
- C. Chemoorganoheterotroph
- D. Mixotroph

2. Reverse transcriptase is an enzyme unique to retroviruses that allows them to bypass the Central Dogma of Molecular Biology by synthesizing DNA from an RNA template.

- A. True
- B. False

3. When measuring microbial growth in a closed system, the stage characterized by a high rate of horizontal gene transfer and peak metabolic activity is labeled the _____ phase.

- A. Lag
- B. Stationary
- C. Log (Exponential)
- D. Death (Decline)

4. A patient is infected with a pathogen that utilizes Type III Secretion Systems (T3SS) to inject effector proteins into host cells. Which organism is most likely responsible?

- A. Gram-positive *Staphylococcus aureus*
- B. Gram-negative *Pseudomonas aeruginosa*
- C. The fungus *Candida albicans*
- D. The protozoan *Plasmodium falciparum*

5. Archaea differ significantly from Bacteria in their membrane composition; specifically, Archaea utilize _____ bonds to link glycerol to isoprenoid side chains.

- A. Ester
- B. Peptide
- C. Ether
- D. Glycosidic

6. Bacteriophages undergoing the lysogenic cycle immediately cause the lysis of the host cell to release new virions.

- A. True

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B. False

7. Which of the following describes the role of 'quorum sensing' in microbial populations?

- A. The detection of nutrient scarcity to trigger endospore formation
- B. Chemical signaling to coordinate group behaviors like biofilm production
- C. A mechanism for repairing thymine dimers caused by UV radiation
- D. The process by which facultative anaerobes switch to fermentation

8. In the context of the Nitrogen Cycle, the process of _____ involves the biological reduction of nitrate (NO₃⁻) to nitrogen gas (N₂) by facultative bacteria.

- A. Nitrification
- B. Nitrogen Fixation
- C. Ammonification
- D. Denitrification

9. Prions are infectious agents composed entirely of misfolded proteins and lack any nucleic acid component.

- A. True
- B. False

10. How does the CRISPR-Cas9 system function naturally within a bacterial cell?

- A. As a metabolic pathway for degrading complex plastics
- B. As an adaptive immune system against bacteriophage infections
- C. As a mechanism for high-speed flagellar rotation
- D. As a structural component of the secondary cell wall