

Name: _____ Date: _____

Answer Key: Horizontal Gene Transfer and Microbial Pathogenesis Quiz for Grade 11

Analyze how conjugation, transformation, and transduction drive rapid evolution in bacterial populations facing selective pressures like antibiotic resistance.

1. An environmental microbiologist discovers a strain of 'Deinococcus radiodurans' that has incorporated DNA from a lysed neighboring cell in its soil habitat. Which mechanism of horizontal gene transfer occurred?

Answer: B) Bacterial Transformation

Transformation is the process where competent bacteria take up free, 'naked' DNA fragments from their immediate environment, often released by the lysis of other cells.

2. In the process of _____, a bacteriophage acts as a vector to transport genetic material from a donor bacterium to a recipient bacterium.

Answer: A) Specialized Transduction

Transduction involves the movement of bacterial DNA via a virus (bacteriophage). In specialized transduction, specific host genes are packaged into the viral capsid during the lysogenic cycle.

3. Prions are considered microorganisms because they possess a simplified genomic structure consisting of single-stranded RNA.

Answer: B) False

Prions are infectious protein particles that contain no nucleic acids (DNA or RNA) and are smaller than the smallest viruses; they are not classified as microorganisms.

4. Why is 'Agrobacterium tumefaciens' a critical tool in agricultural biotechnology for creating transgenic crops?

Answer: B) It uses a T-DNA plasmid to insert genes into the host genome.

Agrobacterium tumefaciens naturally performs inter-kingdom gene transfer by moving its Ti-plasmid DNA into plant cells, making it a perfect vector for genetic engineering.

5. During bacterial conjugation, a donor cell (F+) uses a _____ to establish a physical connection with a recipient cell (F-) for plasmid transfer.

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Answer: C) Sex pilus

The sex pilus is a specialized appendage produced by cells containing the F-plasmid that pulls the recipient cell close to allow for the transfer of genetic material.

6. Gram-positive bacteria possess an outer lipopolysaccharide (LPS) membrane that prevents the crystal violet stain from reaching the peptidoglycan layer.

Answer: B) False

Gram-positive bacteria lack an outer membrane but have a thick peptidoglycan layer that traps the crystal violet stain; it is Gram-negative bacteria that have the LPS outer membrane.

7. In a clinical setting, a patient is infected with a bacterium that produces beta-lactamase. How does this enzyme contribute to the microorganism's survival?

Answer: C) It chemically degrades penicillin-class antibiotics.

Beta-lactamase is an enzyme that provides antibiotic resistance by breaking the beta-lactam ring of molecules like penicillin, rendering the drug ineffective.

8. The use of 'Magnetospirillum' species in bioremediation is unique because they contain _____, which are organelles that sense magnetic fields.

Answer: A) Magnetosomes

Magnetosomes are membrane-bound crystals of magnetic iron minerals that allow bacteria to align with and move along magnetic field lines (magnetotaxis).

9. Which of the following best describes the metabolic strategy of a chemoautotroph found in deep-sea hydrothermal vents?

Answer: B) Deriving energy from inorganic chemicals and carbon from CO₂.

Chemoautotrophs use inorganic compounds (like hydrogen sulfide) as an energy source to fix carbon dioxide into organic molecules, supporting ecosystems without sunlight.

10. Reverse transcriptase is an enzyme used by retroviruses to synthesize DNA from an RNA template, a process that violates the traditional 'Central Dogma' of biology.

Answer: A) True

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The traditional Central Dogma states DNA flows to RNA to protein. Retroviruses use reverse transcriptase to reverse this flow (RNA to DNA), allowing their genome to integrate into the host's DNA.