

College-level Assessment on Shuttle Vectors

1. What is a shuttle vector?
 - a. A vector used for cloning genes in plants.
 - b. A vector that can be introduced into two or more different host organisms.
 - c. A vector specifically designed for mammalian cell transformation.
 - d. A vector used for gene expression in *E. coli* only.

2. Why is *E. coli* commonly used as one of the host organisms for shuttle vectors?
 - a. *E. coli* is easy to culture and handle in the lab.
 - b. *E. coli* is the only organism capable of maintaining shuttle vectors.
 - c. *E. coli* has a high transformation efficiency.
 - d. *E. coli* is the most common organism used in biotechnology.

3. What is the main purpose of an expression vector?
 - a. To clone genes for sequencing purposes.
 - b. To produce the protein encoded by a cloned gene in the transformed host.
 - c. To create libraries of DNA fragments.
 - d. To introduce foreign DNA into a bacterial cell.

4. What are expression libraries used for?
 - a. Identifying clones containing the cDNA of interest.
 - b. Producing pharmaceutically active proteins.
 - c. Transcribing and translating foreign DNA in *E. coli*.
 - d. Expressing genes in plant cells.

5. Which of the following features is NOT found in an expression vector?
 - a. Promoter upstream of the multiple cloning site.
 - b. Transcription terminator downstream of the multiple cloning site.
 - c. Shine-Dalgarno sequence for translation initiation.
 - d. Restriction site for DNA insertion.

6. What is the role of reverse transcriptase in gene expression?

- a. It produces a double-stranded DNA copy of the mRNA.
- b. It cleaves the protein at specific amino acid sequences.
- c. It adds restriction site linkers to the cDNA ends.
- d. It translates the mRNA into protein.

7. How is a cDNA inserted into an expression vector for cloning?

- a. By adding restriction site linkers to each end of the cDNA.
- b. By using reverse transcriptase to generate a double-stranded DNA copy.
- c. By ligating the cDNA directly into the vector's multiple cloning site.
- d. By adding a Shine-Dalgarno sequence to the 5' end of the cDNA.

8. Which of the following is NOT a required sequence feature in an expression vector?

- a. Promoter.
- b. Polyadenylation site.
- c. Shine-Dalgarno sequence.
- d. Terminator.

9. What are tags used for in protein expression?

- a. To facilitate protein purification.
- b. To enhance translation of the mRNA in *E. coli*.
- c. To insert foreign DNA into a vector.
- d. To identify the correct recombination DNA molecule.

10. Why are shuttle vectors useful in gene cloning experiments?

- a. They simplify the initial stages of the experiment.
- b. They can transfer DNA between different bacterial species.
- c. They allow for the study of gene structure and function.
- d. They enhance the expression of recombinant proteins.

11. Apart from *E. coli*, which bacterium has cloning vectors developed for it?

- a. Bacillus.
- b. Streptomyces.
- c. Pseudomonas.
- d. All of the above.

12. When are eukaryotic hosts preferred in gene cloning experiments?

- a. When studying gene structure and function.
- b. When synthesizing recombinant proteins.
- c. When isolating and analyzing DNA fragments.
- d. When using transformation as the method of DNA uptake.

13. What is the significance of the yeast *Saccharomyces cerevisiae* in biotechnology?

- a. It is used for brewing and bread making.
- b. It is a common host organism for producing pharmaceuticals.
- c. It has a plasmid called 2 μ m that is commonly used in cloning.
- d. It is capable of taking up DNA molecules from the medium.

14. What does the term "cloning" specifically refer to in gene cloning experiments?

- a. The construction of recombinant DNA molecules.
- b. The transformation step using bacteria.
- c. The replication of DNA in the host cell.
- d. The analysis of DNA fragments.

15. What is the process of transferring small, extracellular pieces of DNA between organisms called?

- a. Transformation.
- b. Transfection.
- c. In vitro packaging.
- d. DNA sequencing.

16. What is the difference between transformation and transfection?

- a. Transformation involves the uptake of DNA by bacterial cells, while transfection involves the uptake of phage DNA.
- b. Transformation is the transfer of DNA between different bacterial species, while transfection involves the transfer of DNA from bacteria to eukaryotic cells.
- c. Transformation is induced by heat shock, while transfection occurs naturally.
- d. Transformation can occur in vitro, while transfection can only occur in vivo.

17. Which method involves introducing a recombinant DNA molecule constructed with a phage vector into a bacterial cell?

- a. Transformation.
- b. Transfection.
- c. In vitro packaging.
- d. PCR amplification.

18. What is the main purpose of introducing recombinant DNA molecules into living cells?

- a. To produce clones for DNA sequencing.
- b. To express recombinant proteins.
- c. To create libraries of DNA fragments.
- d. To study the basic features of molecular biology.

19. Which of the following organisms is the most commonly used host organism for gene cloning experiments?

- a. Streptomyces.
- b. Pseudomonas.
- c. *Saccharomyces cerevisiae*.
- d. *Escherichia coli*.

20. Which is NOT a characteristic of the 2 μ m plasmid found in *Saccharomyces cerevisiae*?

- a. It is present in most strains of *S. cerevisiae*.
- b. It is one of the few plasmids found in eukaryotic cells.
- c. It is used for synthesizing recombinant proteins.
- d. It is used for cloning vectors in yeast.

Answer Key (Always review AI generated answers for accuracy - Math is more likely to be inaccurate)

b

a

b

a

d

a

a

c

a

b

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b

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