

國立成功大學

113學年度碩士班招生考試試題

編 號：294

系 所：醫學檢驗生物技術學系

科 目：分生與細胞生物

日 期：0202

節 次：第 1 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Question 1 [10 points]

Consider the following DNA fragment that requires enzyme digestion for cloning:

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5' ... ATCGATAATGCGAATTGACATAGATATCATTTGGACC ... 3'
      |1   |   |10  |   |20  |   |30  |
3' ... TAGCTATTACGCTTAAGCTGTATCTATAGTAAACCTGG ... 5'
  
```

Below are the recognition sites of two of restriction enzymes, EcoRI and EcoRV.

EcoRI:

5'... GA[▼]AATTC...3'

EcoRV:

5'... GAT[▼]ATC...3'

- EcoRI generates fragments with "sticky ends." Please illustrate both double-strand fragments that result from digestion when EcoRI is used.
- EcoRV produces fragments with "blunt ends." Please depict both double-strand fragments that are obtained after digestion with EcoRV.

Question 2 [10 points]

Detail the principle and methodology of Sanger sequencing. How does this technique facilitate the determination of nucleotide sequences in DNA? Discuss the advantages and limitations of Sanger sequencing in comparison to next-generation sequencing technologies.

Question 3 [10 points]

Compare the forward genetics and reverse genetics approaches in the study of gene function. How do these methods differ in terms of their strategies, methodologies, and applications in molecular biology research?

Question 4 [10 points]

Provide definitions and distinctions between frame shift mutations and other frequently encountered genetic mutation types, such as point mutations encompassing missense, nonsense, and silent mutations.

Question 5 [10 points]

Outline the stages of the cell cycle, including G1, S, G2, and M phases. Discuss the role of cyclins and cyclin-dependent kinases (CDKs) in the regulation of the cell cycle. How do checkpoints ensure the fidelity of cell division?

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Question 6 [7 points]

Elucidate the central dogma of molecular biology. How does it describe the flow of genetic information within a biological system?

Question 7 [12 points]

Characterize the molecular composition and the structural characteristics of a chromosome.

Question 8 [24 points]

Detail the methodological steps involved in conducting a (1) western blot analysis, (2) real-time PCR, and (3) reverse transcription PCR (RT-PCR). What are the specific purposes of each technique in molecular biology research?

Question 9 [7 points]

Distinguish DNA and RNA in terms of their chemical structure, stability, functionality, and roles within the cell.