國立成功大學

111學年度碩士班招生考試試題

編　號：264

系　所：生物化學暨分子生物學研究所

科　目：分子生物學

日　期：0220

節　次：第 2 節

備　註：不可使用計算機

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※ 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。

一、填充題（12 分，每題 2 分）

Questions 1 – 6:

Different types DNA repair mechanisms use different enzymes. What are the key repair systems of these following enzymes? Please write down the specific repair mechanism for the following enzymes.

1. The uracil-DNA glycosylase UDG _____.

2. The Ku proteins Ku70 and Ku80 _____.

3. The RecA protein _____.

4. MutS, MutL, and MutH in *E. Coli* _____.

5. Rad51 _____.

6. DNA photolyases_____.

二、選擇題（6 分，每題 2 分）

7. Which of the following statements about DNA methylation is TRUE?

I. Methylation plays a role in genomic imprinting.
II. Methylation can influence gene regulation.
III. Methylation plays a role in restriction modification systems.
IV. Methylation occurs in prokaryotic cells, but not eukaryotic cells.

A. I, II, III, IV
B. I, II, III
C. II, III
D. II, III, IV
E. II only

8. Which of the following mechanisms is NOT involved in the generation of antibody diversity?

A. Recombination with excision of DNA between a V gene sequence and a J sequence
B. Splicing out of RNA sequences between a J region and a C region
C. Somatic hypermutation
D. Non-homologous end joining and DNA repair
E. Transposition

9. Which of the following statement about eukaryotic DNA replication is INCORRECT?

A. Only one DNA polymerase is required to propagate a replication fork.
B. The same polymerase in human is involved in proofreading and primer removal as well as lagging strand elongation.
C. The main DNA polymerase that elongates the leading strand has an intrinsicprocessivity factor.
D. Eukaryotes require two enzymes to remove RNA primers.
E. Chromatin must be removed in advance of replication forks and reassembled on daughter strands after the fork has passed through.

三、問答題（82 分，題分如題）

10. Replication of the E. coli circular duplex chromosome is initiated at the Ori^C, please describe the model of prokaryotic initiation (10 points).

11. Ames Test has been used as an approach to screening for mutagens. How does it work? Please describe the concept and procedures (10 points).

For questions 12 and 13,

Please see the following description. DNA is synthesized in the 5'-> 3' direction by DNA polymerases. At the replication fork, the leading strand is synthesized continuously in the same direction as replication fork movement; the lagging strand is synthesized discontinuously as Okazaki fragments, which are subsequently ligated.

12. What is Okazaki Fragment (4 points)?

13. How to isolate and purify these Okazaki Fragments from bacteria for downstream experiments? Please explain your approach and experimental design (8 points).

14. Please describe in detail the subunit compositions (or molecules) and their functions of an *E. coli* RNA polymerase holoenzyme. (10%)

15. Please describe in detail the mechanisms (or processes) of transcriptional and translational terminations in prokaryotic cells. (10%)

16. Please describe in detail first the structure and regulation of an *E. coli lac* operon, then the metabolic function of proteins encoded by this operon. (10%)

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17. Please compare in detail the differences of gene expression between prokaryotic and eukaryotic cells from the structures of gene, mRNA and protein levels. (10%)

18. Please compare in detail the differences between siRNA and miRNA induced gene silencing from the structures of siRNA and miRNA and the action mechanisms triggered by siRNA and miRNA. (10%)