國立臺灣海洋大學114學年度碩士班考試入學招生考試試題

考試科目：分子生物學

學系組名稱：食品科學系碩士班生物科技組

1.答案以橫式由左至右書寫在**答案卷**上。2.請依題號順序，並標示題號作答。

Section I: Definitions (11 points)

1. Introns and exons (in RNA primary transcript). (3 pts)
2. Start and stop codons (in translation). (3 pts)
3. DNA replication fork: Define what a replication fork is, describe its main components (leading strand, lagging strand, associated proteins). (5 pts)

Section II: Essay Questions (15 points)

1. Describe the function of ribosome, mRNA, and ribosomal binding site in protein biosynthesis. (4 points)
2. DNA Repair Mechanisms: Please describe DNA repair pathways: nucleotide excision repair and homologous recombination. (5 pts)
3. Describe at least three common post-translational modifications. Discuss how they can alter protein function, stability, or localization. (6 pts)

Section III: Single-Choice Questions (24 points)

1. Which of the following enzymes is primarily responsible for unwinding the DNA helix during replication?

A. DNA ligase

B. Helicase

C. DNA polymerase I

D. Topoisomerase II

2. In prokaryotic transcription, the σ (sigma) factor is crucial for:

A. Elongation of the transcript

B. Initiation by recognizing promoter regions

C. Termination of transcription

D. Adding the 5′ cap to mRNA

3. Which of the following is the primary function of RNA splicing?

A. To remove introns and join exons together

B. To translate mRNA into protein

C. To add a poly-A tail to the mRNA

D. To unwind the DNA helix for transcription

4. Okazaki fragments occur because:

A. The replication fork only opens in one direction.

B. RNA primers cannot be removed from DNA.

C. DNA polymerase can only synthesize DNA in the 5′→3′ direction.

D. DNA polymerase synthesizes both leading and lagging strands continuously.

5. Which of the following best describes the wobble hypothesis in translation?

A. A single tRNA can recognize multiple codons due to flexible base pairing at the 3′ end of the codon.

B. The hydrogen bonds between tRNA and mRNA fluctuate heavily.

C. Only the first base of the anticodon is critical for codon recognition.

D. rRNA is responsible for recognizing stop codons.

6. What is the primary role of EF-Tu and EF-G in bacterial translation?

A. Both EF-Tu and EF-G are involved in ribosome assembly and recycling

B. EF-Tu catalyzes peptide bond formation, while EF-G unwinds mRNA

C. EF-Tu terminates translation, while EF-G initiates it

D. EF-Tu delivers aminoacyl-tRNA to the ribosome, while EF-G facilitates translocation

7. In the context of food science, which of the following statements is TRUE regarding genetically modified organisms (GMOs)?

A. GMOs do not contain any DNA.

B. GMOs are developed only for ornamental plants.

C. GMOs can be engineered for higher nutritional content or resistance to pests.

D. GMOs are never allowed in food production.

8. When considering the central dogma in the context of protein synthesis:

A. mRNA is replicated to produce identical copies of DNA.

B. Protein is first converted into RNA, then back to DNA.

C. Protein is always the end point in the flow of genetic information

D. DNA is transcribed into mRNA, which is translated into protein.

Section IV: Short Answer Questions (50 points)

1. Please define negative autoregulation and retroregulation, and explain how they work. (10 points)

2. Please describe the key differences in transcriptional regulation between eukaryotic and prokaryotic organisms. (10 points)

3. Please explain what CRISPR is and describe how E. coli uses the CRISPR system to protect itself from reinfection by previously encountered viruses. (10 points)

4. Please describe the biogenesis of miRNA and explain how it regulates gene expression. (10 points)

5. Please define positional information and explain its role in development. (10 points)