

國立臺灣海洋大學 106學年度研究所碩士班招生考試試題

考試科目：分子生物學

系所名稱：食品科學系碩士班生技組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

PartA: Please provide appropriate answers for the following 10 questions: (total 50%)

1. Intergenic sequences make-up >60% of the human genome. Where do these intergenic sequences come from and what are some of their functions? (5%)
2. In *E. coli*, DNA polymerase I possesses 5' exonuclease and 3' exonuclease activities, whereas DNA polymerase III possesses 3' exonuclease activity. Explain the functionality behind the differences in exonuclease activities associated with these two DNA polymerases. (5%)
3. Aside from DNA damage tolerance, name the repair pathway that potentially introduces mutations. Describe how this pathway introduces mutations. (5%)
4. You are considering two alleles of one specific gene. Describe what feature with respect to the DNA distinguishes one allele from the other. Are the two alleles homologous? (5%)
5. Explain the major features in the cycle of recombination that distinguishes DNA transpositions from retrotransposons. (5%)
6. In a genetic screen, researchers isolated mutants of *E. coli* that constitutively expressed the genes from the *araBAD* operon. Describe what constitutive expression means in terms of the *araBAD* operon? And, give an example of a mutation that could lead to constitutive expression of the *araBAD* genes. (Name the region of DNA or gene encoding a specific protein.) (5%)
7. A list of the steps for chromatin immunoprecipitation (ChIP) in the incorrect order follows. Provide the proper order for the steps of ChIP by listing the letter of each step. (5%)
 - A. Immunoprecipitate DNA-protein complex.
 - B. Amplify DNA by PCR.
 - C. Add antibody specific to one protein.
 - D. Cross-link proteins to DNA fragments.
 - E. Remove proteins.
8. Label the statement as true or false. Pre-miRNAs are present only in introns. Explain your answer. (5%)
9. Explain the significance of induced pluripotent stem (iPS) cells that function like pluripotent inner cell mass (ICM) cells. (5%)
10. The DNA-binding protein ComK is a master regulator for competence of *Bacillus subtilis*. What property of ComK binding to the promoter for *comK* allows regulatory circuit to be a bistable switch? (5%)

PartB:

1. Single choice questions. (20%)

(1) CRISPR-Cas9 is a technology that enables scientists to

- (a) edit parts of the genome.
- (b) solve protein structures.
- (c) grow beneficial microorganisms in human guts
- (d) increase resistance against viral infections
- (e) help DNA transcription

(2) Which of the followings does not likely lead to production of new polypeptides

- (a) Missense mutation in ORF
- (b) Single nucleotide deletion in ORF
- (c) Nonsense mutation
- (d) Frameshift shift mutation
- (e) None of the above

(3) Which of the followings could confer ionic bonds in proteins

- (a) Cys, Cys
- (b) Asp, Lys
- (c) Ser, Thr
- (d) Glu, Asp
- (e) Cys, His

(4) DNA melting is

- (a) the cleavages in DNA sequences
- (b) the openings in DNA duplexes
- (c) the interaction between DNA and RNA
- (d) the homologous recombination in DNA
- (e) a technique to decipher DNA double helical structures

(5) A bacterial plasmid can not

- (a) replicate on its own in cells
- (b) transfer between cells via conjugation
- (c) co-reside with other plasmids which have the same origin of replication
- (d) carry antibiotic resistance genes

(e) be used as vectors in molecular cloning

(6) Which of the followings regarding helix-turn-helix motif is not correct

- (a) It can bind with DNA major grooves
- (b) A structural motif
- (c) Alpha helices is the only protein secondary structures
- (d) Normally found in DNA binding proteins
- (e) None of the above

(7) Translation elongation factors EF-Tu/eEF1 can

- (a) combine with the core enzyme to confer specific binding to a promoter
- (b) be used by ribosome as energy for polypeptide elongation
- (c) help to recognize ribosomal binding site/5' Cap of mRNA
- (d) escort amino-acyl tRNA to the A site of ribosome
- (e) None of the above

(8) Which of the followings is not true regarding histone proteins

- (a) In a nucleosome, eukaryotic DNA is wrapped around histone proteins
- (b) A nucleosome contain two copies each of histones H2A, H2B, H3 and H4
- (c) Histones are rich in basic amino acids that are usually associated with DNA
- (d) Histone acetylation is generally irreversible
- (e) None of the above

(9) Which of the followings is not the consensus sequences for primary transcript splicing by U2 spliceosome?

- (a) branch site
- (b) polypyrimidine tract
- (c) 5' splice site
- (d) 3' splice site
- (e) free guanosine

(10) Which of the followings regarding A-to-I RNA editing is incorrect?

- (a) Catalyzed by Adenosine DeAminase acting on RNA enzymes
- (b) Hydrolytic deamination of Adenosine to Inosine
- (c) Reversible

- (d) Relatively frequent in human than in other organisms
- (e) Co-transcriptional

2. Please define the following terms briefly. (15%)

- (1) Gene
- (2) Nonsense-mediated mRNA decay
- (3) Wobble base pair
- (4) Upstream open reading frame
- (5) Quaternary structures of Proteins

3. Assay questions. (15%)

- (1) The 2016 Nobel Prize in Physiology or Medicine is awarded to Yoshinori Ohsumi for his discoveries of mechanisms for autophagy. Please explain autophagy.
- (2) Please describe restriction enzymes and its application in molecular biology.
- (3) Please describe prokaryotic and eukaryotic ribosomes and their biological functions.