

國立臺灣海洋大學 101 學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目：分子生物學

系所名稱：生物科技研究所碩士班甲組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

一 複選題 (注意：全答對才給分，部份答對不給分) (每題 3 分, 計 15 分)

1. The anticodon of a tRNA is 5'CAU. What codon(s) can be theoretically recognized by this tRNA?
a. 5'CAA b. 5'CAC c. 5'AUG d. 5' GUG e. 5'GUA
2. Components required for peptide chain initiation are:
a. ATP. b. 30S and 50S ribosomal subunits.
c. initiation factors. d. f-Met-tRNA_i^{fMet}. e. mRNA.
3. What are true of the following statements about transfer RNA (tRNA) molecules
a. they contain an anticodon triplet of bases at the 5' end of the molecule that is complementary to the triplet codon on messenger RNA (mRNA)
b. they have extensive intrachain hydrogen bonding
c. the amino acid is attached to the 2' or 3' position of the 3'-terminal adenosine
d. they have binding sites for a specific amino acid, a specific aminoacyl transferase, the ribosome, and a specific codon on mRNA
e. they contain a number of bases that have been modified post-transcriptionally
4. The forms of post-translational processing are:
a. limited proteolytic cleavage.
b. signal sequences removal.
c. phosphorylation.
d. peptide bond cross-linking.
a. glycosylation
5. The genetic code has the following characteristics:
a. It is not overlapping.
b. It is read 5' to 3'.
c. It is read from a fixed starting point without punctuation.
d. It is degenerate.
e. Three bases codes for one amino acid

二 單選題 (每題 2 分 計 10 分)

1. Termination of translation in prokaryotic cells requires:

- A. binding of the terminator tRNA to the termination codon.
- B. displacement of EF-G by EF-Tu:aminoacyl-tRNA
- C. ternary interaction of the release factor and the termination tRNA with the termination codon.
- D. interaction of release factors with the termination codon.
- E. release factor interaction with the Shine-Dalgarno sequence and subsequent dissociation of the two ribosomal subunits.

2. Eukaryotic secretory proteins are synthesized and translocated via the endoplasmic reticulum. Order the following sequence of events for this process.

- A. SRP binds signal sequence and subsequently binds SRP-receptor.
 - B. glycosylation in the ER lumen.
 - C. signal sequence synthesis on ribosomes.
 - D. signal sequence removed.
 - E. ribosome dissociates.
- A. A, C, E, B, D B. A, C, B, D, E C. C, A, D, B, E
D. C, D, A, B, E E. C, B, D, E, A

3. Which of the following statements is FALSE?

- A. Cro protein prevents transcription of P_{RM} preventing the synthesis of lambda repressor.
- B. Cro protein inhibits the expression of early genes from both P_L and P_R .
- C. Cro protein binds to the same operators as the lambda repressor.
- D. Cro protein has a higher affinity for O_{R3} than O_{R2} and O_{R1} .
- E. None of the above

4. Operons are a(n) _____ sequence lying adjacent to the DNA being transcribed and are composed of a promoter located next to a(n) _____ that interacts and is controlled by a(n) _____ protein.

- A. initiation; operator; repression B. operator; repressor; regulatory
- C. regulatory; repressor; activator D. regulatory; operator; regulatory
- E. none are true

5. The recurring structural feature in DNA-binding proteins is the presence of _____ segments that fit into the _____ groove of B-DNA.

- A. α -helix; major B. β -sheet; major C. β -turn; minor
- D. β -barrel; minor E. all are true

三. 單選題 (每題 3 分 計 24 分)

1. In both eukaryotes and prokaryotes, gene expression is primarily regulated at the level of

- A) protein stability.
- B) translation.
- C) mRNA stability.
- D) mRNA splicing.
- E) transcription.

2. DNA microarrays have made a huge impact on genomic studies because they

- A) allow physical maps of the genome to be assembled in a very short time.
- B) can be used to eliminate the function of any gene in the genome.
- C) dramatically enhance the efficiency of restriction enzymes.
- D) can be used to introduce entire genomes into bacterial cells.
- E) allow the expression of many or even all of the genes in the genome to be compared at once.

3. The major advantage of using artificial chromosomes such as YACs and BACs instead of plasmids for cloning genes is that

- A) plasmids are unable to replicate in cells.
- B) YACs and BACs can carry much larger DNA fragments than plasmids can.
- C) YACs and BACs can be used to express proteins encoded by inserted genes, but plasmids cannot.
- D) only one copy of a plasmid can be present in any given cell, whereas many copies of a YAC or BAC can coexist in a single cell.
- E) all of the above

4. Proto-oncogenes can change into oncogenes that cause cancer. Which of the following best explains the presence of these potential time bombs in eukaryotic cells?

- A) Proto-oncogenes are genetic "junk."
- B) Cells produce proto-oncogenes as they age.
- C) Proto-oncogenes are mutant versions of normal genes.
- D) Proto-oncogenes normally help regulate cell division.
- E) Proto-oncogenes first arose from viral infections.

5. A biochemist isolates and purifies various molecules needed for DNA replication. When she adds some DNA, replication occurs, but each DNA consists of a normal DNA strand paired with numerous segments of DNA a few hundred nucleotides long. What has she probably left out of the mixture?

- A) primase
- B) DNA ligase
- C) DNA polymerase
- D) nucleotides
- E) Okazaki fragments

6. Which of the following best describes the complete sequence of steps occurring during every cycle of PCR?

1. The primers hybridize to the target DNA.
2. The mixture is heated to a high temperature to denature the double stranded target DNA.
3. Fresh DNA polymerase is added.
4. DNA polymerase extends the primers to make a copy of the target DNA.

A) 3, 4, 1, 2 B) 1, 3, 2, 4 C) 2, 3, 4 D) 3, 4, 2 E) 2, 1, 4

7. The table below indicates the exons present in six different genes. Gene 1, for example, contains exons A, B, C, and D, in this order, and gene 2 has a similar structure, although exons A and B have been replaced by related but distinct versions called A' and B'.

Gene	Exons
1	A-B-C-D
2	A'-B'-C-D
3	A-B'-C-D
4	A-A-B-C-D
5	A-B-C-D'
6	E-F-B-G

Gene 6 is mostly unrelated to the other genes, except for the presence of exon B. This is most likely a product of _____

- A) translocation.
- B) exon duplication.
- C) exon shuffling.
- D) polyploidy.
- E) gene duplication.

8. What is the most logical sequence of steps for splicing foreign DNA into a plasmid and inserting the plasmid into a bacterium?

- I. Transform bacteria with recombinant DNA molecule.
- II. Cut the plasmid DNA using restriction enzymes.
- III. Extract plasmid DNA from bacterial cells.
- IV. Hydrogen-bond the plasmid DNA to nonplasmid DNA fragments.
- V. Use ligase to seal plasmid DNA to nonplasmid DNA. _____

- A) I, II, IV, III, V
- B) III, II, IV, V, I
- C) IV, V, I, II, III
- D) II, III, V, IV, I
- E) III, IV, V, I, II

四 問答題 (共 51分)

1. Alternative splicing為真核生物將一基因之precursor mRNA進行剪接以產生不同蛋白質之彈性程序。現已知一基因全長 5,000 nucleotides，而此基因包括6個exon，每一exon之長度分別為:exon 1(450 nt)、exon 2 (210 nt)、exon 3 (690 nt)、exon 4 (120 nt)、exon 5 (150 nt)、exon 6 (486 nt)。此基因可藉alternative splicing產生3種splice variants，最後轉譯出3個polypeptide其分子量分別為46,420、64,020與44,220 Da，請推測此3個polypeptide分別由那些exon調控產生？(15分)

2. 請說明真核生物之DNA如何與histone複合體結合形成nucleosome (5分)

3. 如將分裂中之細胞以特殊之染劑進行染色，會發現細胞核內有兩羣染色深淺不一致之chromatin分別為euchromatin與heterochromatin，請問此兩種chromatin產生之原因為何？(6分)

4. 阿豪想瞭解肝癌發生的機制以及某種海藻萃取的”精華露”是否對癌細胞生長的影响，因此他想以老鼠進行動物實驗，分析肝細胞癌化後各基因的變化，並且想瞭解海藻精華露是否對癌細胞產生影响。請幫阿豪設計一套實驗的流程，並說明這些實驗的原理與目的。(10分)

5. 請說明下列細胞訊息傳遞與細胞週期相關蛋白(分子)的功能/作用機制(15分)

- (a) cyclin dependent kinase
- (b) adenyl cyclase
- (c) Wnt
- (d) IKB
- (e) MAP kinase