國立臺灣海洋大學103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：生命科學暨生物科技學系碩士班甲組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

I. 選擇題（40%）

Choose the one alternative that best completes the statement (20%)

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

9) Assume that you are trying to insert a gene into a plasmid. Someone gives you a preparation of genomic DNA that has been cut with restriction enzyme X. The gene you wish to insert has sites on both ends for cutting by restriction enzyme Y. You have a plasmid with a single site for Y, but not for X. Your strategy should be to

A) cut the DNA again with restriction enzyme Y and insert these fragments into the plasmid cut with the same enzyme.

B) insert the fragments cut with X directly into the plasmid without cutting the plasmid.

C) cut the plasmid with restriction enzyme X and insert the fragments cut with Y into the plasmid.

D) cut the plasmid with enzyme X and then insert the gene into the plasmid.

E) cut the plasmid twice with restriction enzyme Y and ligate the two fragments onto the ends of the DNA fragments cut with restriction enzyme X.

10)How does a genomic library differ from a cDNA library?

A)A genomic library contains only noncoding sequences, whereas a cDNA library contains only coding sequences.

B)The genomic library can be replicated but not transcribed.

C)A genomic library can be made using a restriction enzyme and DNA ligase only, whereas a cDNA library requires both of these as well as reverse transcriptase and DNA polymerase.

D)The genomic library contains only the genes that can be expressed in the cell.

E)A genomic library varies, dependent on the cell type used to make it, whereas the content of a cDNA library does not.

11) All are true for the "wobble position" EXCEPT:

A) It is the third base of the codon.

B) A certain amount of play might occur in base pairing at this position.

C) The first-base anticodon U could recognize either an A or G in the wobble position.

D) The first-base anticodon G could recognize either a U or C in the wobble position.

E) All are true.

12) The appropriate order for the basic steps of protein synthesis are:

A) The elongation reaction transfers the peptide chain from the peptidyl-tRNA in the P site to the aminoacyl-tRNA in the A site.

B) The P site is occupied by peptidyl-tRNA carrying the growing polypeptide chain.

C) Binding of mRNA by the small subunit followed by association of a particular initiator aminoacyl-tRNA that recognizes the first codon.

D)The large ribosomal subunit joins the initiation complex, preparing it for the elongation stage.

E) The new, longer peptidyl-tRNA moves from the A site into the P site as the ribosome moves one codon further along the mRNA.

A. A, C, E, B, D B. B, E, C, D, A C. C, D, A, B, E

D. D, C, E, B, A E. C, D, B, A, E

13) All are components required for peptide chain initiation EXCEPT:

A) mRNA.

B) 30S and 50S ribosomal subunits.

C) initiation factors.

D) GTP and f-Met-tRNA$_i^{fMet}$.

E) all are true.

14) GTP hydrolysis is essential for all of the following EXCEPT:

A) the formation of the initiation complex (translationally active 70 S ribosome complex).

B) the elongation step of translation.

C) the translocation step of translation.

D) the binding of release factors to the ribosome.

E) all utilize GTP hydrolysis

15) Termination of translation in prokaryotic cells requires:

A) binding of the terminator tRNA to the termination codon.

B) interaction of release factors with the termination codon.

C) ternary interaction of the release factor and the termination tRNA with the termination codon.

D) release factor interaction with the Shine-Dalgarno sequence and subsequent dissociation of the two ribosomal subunits.

E) displacement of EF-G by EF-Tu:aminoacyl-tRNA.

16) The information for folding each protein into its unique three-dimensional architecture resides within its _____.

A) primary structure

B) amino acid content
C) content of hydrophobic amino acids
D) content of basic amino acids
E) none are true

17) _____recognize the sorting signals as they emerge from the ribosome and together with _____deliver the nascent protein chain to specific membrane complexes called ____ that mediate integration into and across the membrane.

A) Signal recognition particles; signal receptors; translocons
B) Signal receptors; translocons; signal recognition particles
C) Translocons; signal recognition particles; signal receptors
D) Signal receptors; signal recognition particles; translocons
E) Translocons; signal receptors; signal recognition particles

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

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

A. A, C, E, B, D B. C, D, A, B, E C. C, A, D, B, E
D. A, C, B, D, E E. C, B, D, E, A

19) Protein degradation is compartmentalized either in macromolecular structures known as _____ or in degradative organelles such as _____.

A) ribosomes; endoplasmic reticulum
B) ribosomes; Golgi
C) proteosomes; mitochondria
D) proteosomes; lysosomes
E) lysosomes; endoplasmic reticulum

20) The appropriate sequence for ubiquitination of proteins to be degraded is:

A) multiple ubiquitinations may occur on a protein substrate,
B) ubiquitin-protein ligase (E_3) transfers ubiquitin to free amino groups on the protein,
C) E_3 selects a protein for degradation by the nature of the N-terminal amino acid,
D) ubiquitin-carrier protein (E_2) picks up ubiquitin,
E) ubiquitin-activating enzyme (E_1) attaches via ATP-dependent formation of thioester bond to C-termini of ubiquitin,

A. A, C, B, D, E B. E, D, A, B, C C. D, E, C, A, B

D. C, E, D, B, A E. E, D, C, B, A

II. 問答題 (60%)

1. 請說明下列各項細胞內的分子/結構如何影響基因的活性 (20%)
   a) heterochromatin
   b) TATA binding protein
   c) spliceosome
   d) microRNA
   e) DNA methyltransferase

2. 在真核細胞中，除了 transcription 之外，請舉出 5 種其它的基因調控機制。(8%)

3. 請解釋下列各名詞及其生物功能/機制或技術原理 (32%)
   a) the sigma subunit of *E.coli* RNA polymerase
   b) histone acetyl transferase
   c) DNA topoisomerase II
   d) Yeast two hybrid assay
   e) Lac operon in *E.coli*
   f) Single-strand DNA binding protein
   g) Chromatin immunoprecipitation
   h) Homologous recombination