

一、選擇題（單選，共十一題，每題二分，答錯倒扣 0.5 分）

1. The role of topoisomerases in DNA replication is
 - A. to stabilize double-stranded regions in the DNA
 - B. to relieve induced strain in the DNA
 - C. to unwind the replication fork
 - D. to ligate the nicks between Okasaki fragments following removal of the RNA primer
 - E. to prevent the strands from reassociating until after the replisome has sufficiently moved down the template

2. What is meant by the statement that DNA synthesis is discontinuous?
 - A. Replication of different regions of the DNA occurs at different times.
 - B. One direction of synthesis from an origin of replication is carried out following completion of synthesis in the opposing direction.
 - C. One strand of the DNA duplex is replicated in short stretches as opposed to continuously as for the opposite strand of the duplex.
 - D. One chromosome is replicated at a time before the enzymatic machinery can begin the replication of additional chromosomes.
 - E. The order of events requires that the helix must first be unwound, then single stranded regions stabilized by protein binding then an RNA primer synthesized prior to actual DNA synthesis.

3. A genomic DNA was treated with *EcoRI* restriction enzyme, which has hexanucleotide recognition sequence. Assuming a random distribution of the sites, this sequence would be expected to occur every how many bp?
 - A. 24
 - B. 256
 - C. 1024
 - D. 1296
 - E. 4096

(背面仍有題目,請繼續作答)

4. The biological role of restriction enzymes in bacteria is to
- A. degrade foreign DNA that enters a bacterium
 - B. make bacteria resistant to antibiotics
 - C. restrict the size of DNA in bacteria
 - D. aid recombinant DNA research
 - E. restrict the damage to DNA by UV light
5. DNA replication:
- A. is bidirectional proceeding from a single initiation point on each chromosome in eukaryotic cells.
 - B. is unidirectional in prokaryotic cells.
 - C. does not require ATP.
 - D. is initiated on RNA primers.
 - E. involves the formation, and not the cleavage, of phosphodiester bonds.
6. Xeroderma pigmentosum is a genetic disease characterized by:
- A. loss of melanin pigment in the skin.
 - B. hyper-proliferation of dermal fibroblasts.
 - C. a defect in DNA repair-replication.
 - D. overexpression of melanin pigment in the skin.
 - E. none of the above.
7. Most mRNA molecules formed in the nucleus of an animal cell undergo which of the following ?
- A. The formation of a large precursor RNA is followed by exon rearrangement to yield the mature mRNA.
 - B. Nuclear processing mechanisms modify both the 5' and 3' ends.
 - C. Transport out of the nucleus for intron removal.
 - D. Cytoplasmic processing of the 5' and 3' ends.
 - E. Removal of the poly (A) tail following completion of translation.

8. Eukaryotic translation differs from that of prokaryotes in several ways:
- A. The initiating codon frequently differs from AUG.
 - B. There are many more releasing factors, a number of which dissociate into subunits that participate in control of the process.
 - C. There are many more initiating factors, several of which dissociate into subunits.
 - D. Prokaryotic translation requires an RNA cap binding factor.
 - E. Eukaryotic translation requires GTP to charge the tRNAs instead of ATP.
9. Synthesis of tryptophan in *E. coli* is inhibited by:
- A. repressor binding of tryptophan.
 - B. reduced levels of charged trp-tRNAs.
 - C. decreased levels of glucose leading to an increase in cAMP levels.
 - D. repressor release of tryptophan.
 - E. binding of CRP-cAMP to the trp operon.
10. *E. coli* cells grown on a mixture of glucose and lactose selectively use glucose because:
- A. lactose provides less energy than glucose.
 - B. CAP is not present when glucose is available.
 - C. glucose lowers cAMP levels, which reduces the level of the cAMP-CAP complex.
 - D. lactose cannot enter the cells, owing to glucose-induced inhibition of the lactose transporter.
 - E. the synthesis of the lac repressor is elevated in the presence of glucose.
11. Proteins that are destined to be secreted from the cell:
- A. are synthesized on the rough endoplasmic reticulum.
 - B. are synthesized on the smooth endoplasmic reticulum.
 - C. are synthesized on the Golgi apparatus.
 - D. contain a leader region rich in acidic amino acids.
 - E. contain a leader region rich in basic amino acids.

二、配合題 (單選, 共五題, 每題一分, 答錯倒扣 0.25 分)

Directions (item 12-16): Match each of the following lettered key phrases with the numbered description that BEST fits. Each key phrase is used once:

- A. eEF-2 and GTP.
 - B. aminoacyl-tRNA and GTP.
 - C. eRF and GTP.
 - D. Peptidyl transferase.
 - E. P site.
12. Identified by a met-tRNA^{met} on an initiated ribosome.
 13. External protein that alters the reaction usually catalyzed by peptidyl transferase.
 14. Unable to function without eEF-1 α .
 15. Necessary for translocation.
 16. Of ribosomal origin.

三、簡答題及問答題

17. As a general rule, RNA viruses accumulate mutations at a more rapid rate than DNA viruses. Propose a hypothesis to explain this observation. (3%)
18. How does proofreading activity distinguish the strand of DNA that contains the incorrect nucleotide sequence? (4%)
19. DNA contains thymine rather than uracil as a base. Why is the use of thymine rather than uracil in DNA essential for the correct repair of deaminated cytosine in DNA? (4%)

20. RNAs that are capable of self-splicing have been referred to as catalytic RNAs. Discuss how these RNAs are similar to and different from protein enzymes. (4%)
21. Signal transduction is one mechanism for regulating transcription. Describe one example of gene activation that depends on a signal-transduction pathway involving a transcription factor. (4%)
22. List four types of DNA repair systems that are involved in the repair of thymine dimers. (4%)
23. Please describe how to make up a cDNA library which expressed in the coat of phage and its possible application. (10%)
24. To study tumor biology, it is important to identify specific genes which appeared or disappeared only in tumor cells, but not in normal cells. Please describe the methods to fish out these specific genes. (8%)
25. It is also important to recognize specific genes which have changed their regulation of gene expression between tumor cells and normal cells on the study of tumor biology. Please describe how to identify these specific genes. (8%)
26. Ian Wilmut *et al.* at Roslin Institute and PPL Therapeutics Edinburgh in U.K. reported the success to construct a transgenic sheep using nucleus transfer technology from adult sheep mammary tissue. Please describe how did they make up the sheep named Dolly. (8%)

27. Please describe all the inducible systems available today including tetracycline system. (8%)

28. To understand the regulation of a specific gene expression, we usually investigate the expression of reporter genes instead of the gene to be studied itself. Please describe all the reporter genes you know.(8%)