(1) Multiple-choice 單選題 (32%; 2%/each)

1. Which of the following type of RNA has catalytic activity:
   (a) Transfer RNA
   (b) Ribozymes
   (c) Messenger RNA
   (d) Small nuclear RNA
   (e) Micro RNA

2. Topoisomerases in eukaryotes are able to:
   (a) Extend DNA in a 5' to 3' direction
   (b) Separate double stranded DNA into two single strands
   (c) Nick DNA to relieve supercoiling
   (d) Bind to the replication fork and stabilize polymerase
   (e) Generate Okazaki fragments during DNA replication

3. Cis regulatory elements are always
   (a) Located on a different chromosome to the transcribed gene
   (b) Within 100 kb of the promoter of the transcribed gene
   (c) More than 100 kb away from the promoter of the transcribed gene
   (d) Located on the same chromosome to the transcribed gene
   (e) Located on the homologous chromosome to the transcribed gene

4. Double stranded DNA molecules are unwound by:
   (a) DNA topoisomerase enzymes
   (b) DNA helicase enzymes
   (c) DNA polymerase enzymes
   (d) DNA restriction endonuclease enzymes
   (e) DNA kinase enzymes

5. Which of the following types of RNAs is thought to play a catalytic role in protein synthesis?
   (a) rRNA
   (b) mRNA
   (c) tRNA
   (d) snRNA
   (e) microRNA

6. Alternative splicing can **NOT** result in which of the following?
   (a) Production of different mRNA molecules from the same gene
   (b) Production of different proteins from the same gene
   (c) Production of two or more proteins that differ in their function
   (d) Production of novel peptide domains
   (e) None of above

7. Most eukaryotic RNA consists of coding regions, called____
   (a) Introns
   (b) Exons
   (c) ORF
   (d) Spliceosome
   (e) Codons

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8. Codons that specify the same amino acid are said to be:
   (a) Wobbly
   (b) Isoaccepting
   (c) Hypothetical
   (d) Synonymous
   (e) Anonymous

9. A change in a DNA sequence that has no effect on the expression or functioning of any gene or gene product
   (a) Transition
   (b) Transversion
   (c) Nonsense mutation
   (d) Silent mutation
   (e) Missense mutation

10. All transposons encode a _____ which catalyzes the insertion
   (a) DNA glycosylase
   (b) Excisionase
   (c) Transposase
   (d) DNA polymerase
   (e) Integrase

11. Name the repair system for UV mediated damage of DNA?
   (a) Exchange of homologous segments
   (b) DNA glycosylase
   (c) Nucleotide excision repair
   (d) Photoreactivation
   (e) Homologous recombination

12. Which is correct for SOS repair
   (a) RecA protein participates
   (b) A free radical mechanism is involved
   (c) The repair enzyme functions only once
   (d) No bases or nucleotides are removed
   (e) Gene conversion

13. Which of the following is true for the RNA polymerase activity:
   (a) DNA dependent DNA synthesis
   (b) Direct repair
   (c) DNA dependent RNA synthesis
   (d) RNA dependent RNA synthesis
   (e) RNA dependent DNA synthesis

14. Which of the following is used to describe the time taken by RNA polymerase to leave the promoter?
   (a) Promoter clearance time
   (b) Abortive initiation
   (c) Elongation factor
   (d) Mean time
   (e) Termination

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15. Which of the following group of introns form stable lariat structure?
(a) Group I intron
(b) Group II intron
(c) Nuclear intron
(d) Group III intron
(e) Group IV intron

16. Mark the one, which is NOT a stop codon?
(a) UAA
(b) UAG
(c) UGA
(d) GGA
(e) AUG

(2) Answer the following questions (18%)

1. What can be the advantages of having an universal genetic code among various species. (4%)

2. Difference between intragenic suppression and intergenic suppression. (4%)

3. Please tell the role of the sigma (σ) factor in prokaryotes. (4%)

4. Please briefly describe how the polypeptide elongates and what are the roles of two elongation factors? (6%)

(3) Define the following terms: 18%

1. Nucleosomes
2. Histone deacetylase
3. Riboswitch
4. Nonsense-mediated decay
5. CI protein of lambda phage
6. Dicer

(4) Answer the following questions (32%)

1. List proteins involved in the DNA replication in *E. coli* and explain their functions. (8%)

2. Describe the mechanisms of RNA interference (RNAi) in prokaryotes and eukaryotes. (8%)

3. Describe how the *trp* operon of *E. coli* is regulated by attenuation. (8%)

4. How do eukaryotic cells react to integrated stress, such as viral infection or starvation at the translational level? (8%)

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