

國立臺北科技大學九十九學年度碩士班招生考試

系所組別：3610 生物科技研究所甲組

第二節 分子生物學 試題

第一頁 共二頁

注意事項：

1. 本試題共二大題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

I. Multiple-choice questions: (Total 50%, 2% per each question)

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the **ONE** that is best in each case and then write on the answer sheet.

1. RNA molecules that exhibit catalytic activity are called (A) mRNA (B) tRNA (C) ribonucleases (D) ribozymes (E) restriction enzyme.
2. Which of the following hormones initiates biological actions by crossing the plasma membrane and then binding to a receptor? (A) Progesterone (B) Estradiol (C) Insulin (D) Epinephrine (E) Growth hormone.
3. Which of the following processes leads to formation of polytene chromosomes (giant chromosomes)? (A) Nondisjunction of chromatids during meiosis (B) Recombination between adjacent chromosome segments (C) Sister chromatid exchange (D) Inactivation of one chromosome of each homologous pair (E) Repeated replication without separation of chromatids.
4. Diacylglycerol (DAG) activates which of the following enzymes? (A) Protein kinase A (B) Protein kinase C (C) MAP kinase (D) Tyrosine kinase (E) Phosphorylase b kinase.
5. True statements about retrotransposons which answer is correct?
 - I. They replicate through an RNA intermediate.
 - II. They utilize reverse transcriptase for replication.
 - III. They may contain introns.

(A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, and III.

6. Cellular proteins destined for secretion are sorted and packaged in the (A) lysosomes (B) endosomes (C) cell membrane (D) *trans* Golgi network (E) peroxisomes.
7. Incubation of gram-negative bacteria with lysozyme in an isotonic medium causes rod-shaped bacteria to assume a spherical shape. The cause of this phenomenon is (A) absorption of medium (B) destruction of the cell wall (C) destruction of the cytoskeleton (D) damage to the nucleus membrane (E) change in gene expression.
8. Which of the following is true about a circular double-stranded DNA genome that is determined by chemical means to be 23 percent adenosine? (A) The genome is 11.5 % guanosine (B) The genome is 23 % guanosine (C) The genome is 27 % guanosine (D) The genome is 54 % guanosine (E) The base percent composition of guanosine in the genome cannot be determined from the information given.
9. The transfer of viral, bacterial, or both bacterial and viral DNA from one cell to another using a bacteriophage vector is called (A) induction (B) transfection (C) transformation (D) transposition (E) transduction.
10. In the classical model of transcriptional control described by Jacob and Monod, a repressor protein binds to (A) and enhancer (B) and AUG sequence (C) an operator (D) a ribosome-binding site (E) a TATA box.
11. All of the following are true about heterotrimeric G protein EXCEPT: (A) They bind either GDP or GTP (B) They have GTPase activity (C) They act as binary (on-off) switches (D) They help amplify a hormone's signal (E) They phosphorylate proteins.
12. The completion of the S phase of the cell cycle of a mammalian cell is marked by all of the following EXCEPT: (A) Histone content per cell is double that of cells in G1 (B) In replicated DNA, newly incorporated bases are paired with parental bases (C) Each replicated chromosome has four telomeres (D) Sister chromatids disjoin from one another (E) The nucleus contain the equivalent amount of DNA of a tetraploid cell in G1.
13. All of the following contribute to promoter binding by RNA polymerase in *E. coli* EXCEPT the (A) rho factor (B) -10 consensus sequence (C) -35 consensus (D) β' subunit of RNA polymerase (E) β subunit of RNA polymerase.

注意：背面尚有試題

14. "Zinc fingers" are important in cellular regulation because they are (A) at the catalytic site of many kinases (B) a structural motif in many DNA-binding proteins (C) characteristic of palindromic stretches of unique-sequence DNA (D) restricted to the cytoplasmic domain of growth-factor receptors (E) structures with high redox potential.

15. In prokaryotes, environmental sensing frequently involves regulatory proteins (two-component systems) that sense and respond to changes in surroundings. These two-component systems at involve which of the following?

I. Protein phosphorylation.

II. Transcriptional regulation.

III. Membrane proteins.

(A) I only (B) II only (C) III only (D) II and III only (E) I, II, and III.

16. Common lesions found in DNA after exposure to ultraviolet light are (A) pyrimidine dimers (B) single strand breaks (C) base deletions (D) purine dimers (E) transpositions.

17. Which of the following types of bonds or interactions are LEAST likely to be involved in stabilizing the three-dimensional folding of most proteins? (A) Hydrogen bonds (B) Electrostatic bonds (C) Hydrophobic interactions (D) Disulfide bonds (E) Ester bonds.

18. The amino acid sequence of a novel membrane protein contains four immunoglobulin-like domains and six fibronectin-like repeats. This protein is most likely a (A) cell adhesion molecule (B) hormone-responsive ion channel (C) G protein (D) protein-serine/threonine kinase (E) transcription factor.

19. All of the following components of a retrovirus are encoded by the viral genome EXCEPT (A) matrix proteins (B) viral RNA's (C) capsid proteins (D) envelope lipids (E) receptor-binding proteins.

20. Some viruses have increased the coding potential of their genome by (A) integrating into the host genome (B) using host ribosomes for translation (C) using alternative splicing sites (D) using a degenerate triplet code (E) covalently linking a protein to the genome.

21. The ability of yeast to produce invertase, an enzyme necessary to metabolize sucrose, was abolished by either of two mutations, m-1 and m-2, that arose spontaneously in two separate yeast cultures. A heterozygote formed by mating m-1 mutant cells with m-2 mutant cells would be expected to restore the yeast's ability to produce invertase if m-1 and m-2 are (A) mutation of two separate nonallelic genes (B) in the same

complementation groups (C) identical alleles of the same gene (D) suppressible by the same suppressor (E) both temperature-sensitive mutations.

22. All of the following processes occur in the mitochondria of mammalian cells EXCEPT (A) fatty acid biosynthesis (B) protein synthesis (C) DNA synthesis (D) beta oxidation of fatty acids (E) the citric acid cycle.

23. If the M-phase-promoting factor is injected into a *Xenopus* primary oocyte, which of the following occurs? (A) S phase begins (B) The oocyte enters G₀ (C) Apoptosis begins (D) The germinal vesicle (nucleus) breaks down (E) Mitosis is completed.

24. Which of the following best describes the function of the sigma subunit in the RNA polymerase of *E. coli*? (A) It is essential of elongation of the RNA transcript (B) It is essential for the recognition of and binding to the promoter sequence (C) It increases RNA polymerase binding to any DNA template (D) It is required for transcription termination (E) It keeps the core complex form dissociating.

25. A solution contains DNA polymerase I, Mg²⁺ salts of dATP, dGTP, dCTP, and dTTP, and an appropriate buffer. Which of the following DNA molecules would serve as a template for DNA synthesis when added to this solution? (A) A single-stranded closed circle (B) A single-stranded closed circle base-paired to a shorter linear strand with a 3'-terminal hydroxyl (C) A single-stranded closed circle base-paired to a shorter linear strand with a 3'-terminal phosphate (D) A double-stranded closed circle (E) A blunt-ended, double-stranded linear molecule with a 3'-terminal hydroxyl at each end.

II. Short answer questions: (Total 50%)

1. How does a fluorescence microscope work? Please try to describe or draw it according to the route of light. (10%)
2. In the cell cycle, which consists of four distinct phases, please try to describe it. (10%)
3. Please describe the criteria of mammalian cell-culture? (For example, growth medium, incubator,) (10%). How to use the laminar flow? (20%).