

國立中興大學99學年度碩士班招生考試試題

科目：生物化學

系所：生物科技學研究所

本科目試題共 7 頁

選擇題 (每題1分，共20題20分)

- Which of these statements about the composition of membranes is true?
 - All biological membranes contain cholesterol.
 - Proteins are major components of all biological membranes.
 - The inner and outer membranes of mitochondria have same protein compositions.
 - The lipid composition of all membranes of eukaryotic cells is essentially the same.
 - The lipid:protein ratio varies from about 1:4 to 4:1
- In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
 - asparagine, serine, or threonine.
 - aspartate or glutamate.
 - glutamine or arginine.
 - glycine, alanine, or aspartate.
 - tryptophan, aspartate, or cysteine.
- An integral membrane protein can be extracted with:
 - a buffer of alkaline or acid pH.
 - a chelating agent that removes divalent cations.
 - a solution containing detergent.
 - a solution of high ionic strength.
 - hot water.
- A common cloning strategy for introducing foreign genes into plants with *Agrobacterium* employs all the following features except:
 - a selectable antibiotic marker such as kanamycin resistance.
 - a shuttle vector with 25 bp T-DNA repeats flanking the foreign gene of choice.
 - a Ti plasmid lacking its T-DNA segment.
 - active *vir* gene products from the altered Ti plasmid.
 - an ability to induce crown gall formation in infected leaves.
- When biological membranes are viewed with an electron microscope after freeze-fracturing, particles of various sizes stand out against a smooth background. Which statement below is correct?
 - Freeze-fracturing removes membrane proteins, leaving only the lipid bilayer visible.
 - Freeze-fracturing removes the lipid bilayer leaving only membrane proteins visible.
 - The particles are individual proteins or protein complexes.
 - The particles are the head groups of individual phospholipid molecules.
 - The particles represent only peripheral membrane proteins
- The technique known as two hybrid analysis for detecting interacting gene products depends on:
 - activation of DNA polymerase by the nearby binding of hybridizing protein complexes.
 - direct binding of a Gal4p activation domain to a DNA sequence in the promoter region.
 - having a promoter that responds directly to one of the two proteins whose interactions is being measured.
 - hybridization of DNA segments corresponding to the two genes being examined.
 - stimulation of transcription by interaction of two Gal4p domains via fused protein sequences.

7. According to the current model for HIV infection, which of the following is *not* involved in the process of membrane fusion?
- A) A cell surface co-receptor protein
 - B) A cell surface receptor protein
 - C) A viral glycoprotein complex
 - D) The viral envelope
 - E) The viral chromosome
8. Which one of the following analytical techniques does *not* help illuminate a gene's cellular function?
- A) DNA microarray analysis
 - B) Protein chip analysis
 - C) Southern blotting
 - D) Two-dimensional gel electrophoresis
 - E) Two-hybrid analysis
9. Scatchard analysis can provide information on:
- A) enzyme cascades.
 - B) enzyme mechanisms.
 - C) gated ion channels.
 - D) protein phosphorylation.
 - E) receptor-ligand interactions.
10. The alkaline hydrolysis of RNA does *not* produce:
- A) 2'-AMP.
 - B) 2',3'-cGMP.
 - C) 2'-CMP.
 - D) 3',5'-cAMP.
 - E) 3'-UMP.
11. Which of the following statements concerning signal transduction by the insulin receptor is *not* correct?
- A) Activation of the receptor protein kinase activity results in the activation of additional protein kinases.
 - B) Binding of insulin to the receptor activates a protein kinase.
 - C) Binding of insulin to the receptor does not result in a change in its quaternary structure.
 - D) The receptor protein kinase activity is specific for tyrosine residues on the substrate proteins.
 - E) The substrates of the receptor protein kinase activity are mainly proteins.
12. Triple-helical DNA structures can result from Hoogsteen (non Watson-Crick) interactions. These interactions are primarily:
- A) covalent bonds involving deoxyribose.
 - B) covalent bonds involving the bases.
 - C) hydrogen bonds involving deoxyribose.
 - D) hydrogen bonds involving the bases.
 - E) hydrophobic interactions involving the bases.

13. Protein kinase A (PKA) is:
- A) allosterically activated by cyclic AMP.
 - B) affected by cyclic AMP only under unusual circumstances.
 - C) activated by covalent binding of cyclic AMP.
 - D) competitively inhibited by cyclic AMP.
 - E) noncompetitively inhibited by cyclic AMP.
14. Compounds that generate nitrous acid (such as nitrites, nitrates, and nitrosamines) change DNA molecules by:
- A) breakage of phosphodiester bonds.
 - B) deamination of bases.
 - C) depurination.
 - D) formation of thymine dimers.
 - E) transformation of A → T.
15. The specificity of signaling pathways includes all of the following *except*:
- A) flippase-catalyzed movement of phospholipids from the inner to the outer leaflet.
 - B) migration of signal proteins into membrane rafts.
 - C) phosphorylation of target proteins at Ser, Thr, or Tyr residues.
 - D) the ability to be switched off instantly by hydrolysis of a single phosphate-ester bond.
 - E) the assembly of large multiprotein complexes.
16. In DNA sequencing by the Sanger (dideoxy) method:
- A) radioactive dideoxy ATP is included in each of four reaction mixtures before enzymatic synthesis of complementary strands.
 - B) specific enzymes are used to cut the newly synthesized DNA into small pieces, which are then separated by electrophoresis.
 - C) the dideoxynucleotides must be present at high levels to obtain long stretches of DNA sequence.
 - D) the role of the dideoxy CTP is to occasionally terminate enzymatic synthesis of DNA where Gs occur in the template strands.
 - E) the template DNA strand is radioactive.
17. Which of the following statements concerning cyclin-dependent protein kinases is *not* correct?
- A) Each type of cell contains more than one specific form (isozyme).
 - B) Their activity fluctuates during the cell cycle.
 - C) Their activity is regulated by changes in gene expression, protein phosphorylation, and proteolysis.
 - D) Their activity is not regulated by cyclins.
 - E) They can alter the activity of proteins involved in the progression of cells through the cell cycle.
18. Which of the following is a dominant feature of the outer membrane of the cell wall of gram-negative bacteria?
- A) Amylose
 - B) Cellulose
 - C) Glycoproteins
 - D) Lipopolysaccharides
 - E) Lipoproteins

19. Why is it *surprising* that the side chains of tryptophan residues in proteins can interact with lectins?
- because the side chain of tryptophan is hydrophilic and lectins are hydrophobic.
 - because the side chain of tryptophan is (-) charged and lectins are generally (+) charged or neutral.
 - because the side chain of tryptophan can make hydrogen bonds and lectins cannot.
 - because the side chain of tryptophan is hydrophobic and lectins are generally hydrophilic.
 - None of the above.
20. Proto-oncogenes can be transformed to oncogenes by all of the following mechanisms *except*:
- chemically induced mutagenesis.
 - chromosomal rearrangements.
 - elimination of their start signals for translation.
 - during a viral infection cycle.
 - radiation-induced mutation.




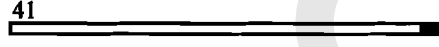

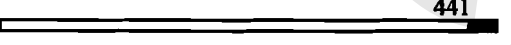
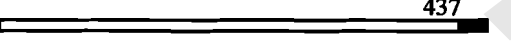
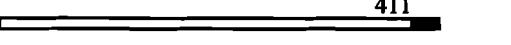

填充題 (限用英文作答，每小題1分，共15小題15分)

21. Match the compounds on the left with the important roles they play listed on the right. (Answers are used only once.) (6 points, 1 point for one space)
- | | | |
|--------------------|-------|---|
| (a) prostaglandins | _____ | a plant signal |
| (b) sphingolipids | _____ | necessary for sight |
| (c) thromboxanes | _____ | mediates pain and inflammation |
| (d) vitamin A | _____ | important component of myelin membranes |
| (e) ethylene | _____ | oxidation-reduction cofactor |
| (f) vitamin K | _____ | blood clotting |
22. Distinguish between simple diffusion (SD), facilitated diffusion (FD), and active transport (AT) across a membrane for the following questions (more than one may be true). (4 points, 1 point for one question)
- Which processes are energy dependent?
 - Which processes need some kind of carrier protein(s)?
 - Which processes can be saturated by substrate?
 - Which processes can establish a concentration gradient?
23. Compounds that contain a nitrogenous base, a sugar, and a phosphate group are called (a) _____. Two purines found in DNA are (b) _____ and _____. A pyrimidine found in all DNA but in only some RNA is (c) _____. In DNA, the base pair (d) _____ is held together by three hydrogen bonds; the base pair (e) _____ has only two such bonds.

簡答題 (共2小題15分)

24. (5分) Compare and contrast symport and antiport. Which term best describes the transport system mediated by the Na^+K^+ ATPase and why?

25. (10分) 下圖是研究病毒結構蛋白452H(H是因其蛋白之C端多接六個Histidine)能否組裝成次病毒顆粒(簡稱SVP)的一結果整合。簡單描述所得之結論及如何得到此結論(指所用之實驗方法及策略)。

| | Names | Amino acids deleted | EM analysis of SVP |
|---|----------|---------------------|--------------------|
|  | N5-452H | 2-5 | ~ 25 nm |
|  | N10-452H | 2-10 | No particles |
|  | N20-452H | 2-20 | No particles |
|  | N40-452H | 2-40 | No particles |
|  | 452H | 0 | ~ 25 nm |
|  | 441H | 442-452 | ~ 25 nm |
|  | 437H | 438-452 | ~ 25 nm |
|  | 411H | 412-452 | No particles |
|  | 399H | 400-452 | No particles |

國立中興大學99學年度碩士班招生考試試題

科目：生物化學

系所：生物科技學研究所

本科目試題共7頁

Single choice: 2 points for each question (單選題 每題 2 分) (30%)

26. Lipids (fatty acids) are mainly synthesized in (A) cytosol (B) nucleus (C) mitochondria (D) peroxisome (E) ribosome
27. Acetate units committed to fatty acid synthesis by formation of (a) acetyl-CoA (b) palmitoyl-CoA (c) propionyl-CoA (d) succinyl-CoA (e) malonyl-CoA
28. Lipoprotein is a (a) lipid (b) protein (c) subcellular particle (d) cell (e) tissue
29. Dietary triacylglycerol is absorbed in the small intestine in the form of fatty acids and (a) triacylglycerol (b) diacylglycerol (c) monoacylglycerol (d) glycerol (e) acetyl-CoA
30. Which one is not included in ketone bodies (a) acetate (b) acetone (c) acetoacetate (d) β -hydroxybutyrate
31. Gout is resulted from an excess of which compound in body fluids (a) uric acid (b) urea (c) urine (d) purine (e) pyrimidine
32. Cori cycle refers to (a) convert glutamate from glutamine and α -ketoglutarate (b) convert propionyl-CoA to succinyl-CoA (c) convert pyruvate to oxaloacetate (d) convert NADH to NADPH (e) convert lactate to glucose
33. Which compound is not involved in urea cycle? (a) aspartate (b) glutamate (c) fumarate (d) arginine (e) ornithine
34. Pentose phosphate pathway occurs in (a) cytosol (b) nucleus (c) mitochondria (d) ER (e) ribosome
35. Glyoxylate cycle in plants is to save which element. (a) C (b) H (c) O (d) N (e) P
36. The α -amino group for all amino acids is derived from (A) glutamine (B) glutamate (C) asparagine (D) aspartate (E) arginine
37. Yeast two-hybrid analysis is used to study the interaction of a desired protein with (A) another protein (B) DNA (C) RNA (D) carbohydrate (E) organic compound.
38. The percentage of human genome corresponding to translated proteins is around (A) 1% (B) 10% (C) 30% (D) 50% (E) 80%.
39. Which compound is NOT present in TCA cycle (A) citrate (B) isocitrate (C) succinate (D) acetoacetate (E) oxaloacetate
40. Pencicillin kills bacteria by preventing the synthesis of bacterial (A) protein (B) DNA (C) RNA (D) cell wall (E) cell membrane.

國立中興大學99學年度碩士班招生考試試題

科目：生物化學

系所：生物科技學研究所

本科目試題共 7 頁

Answer the following questions briefly 簡答題 (20%)

41. Many of the most widely used herbicides inhibit the synthesis of aromatic amino acids. Explain why these compounds are safe to use near animals. (5%)
42. Explain why a high concentration of ammonia decreases the rate of the TCA cycle. (5%)
43. Explain the advantages why (A) secondary messengers are generally degraded rapidly after synthesis? (B) hormone regulation occurs in a cascade reaction instead of conducting the target enzyme, the last enzyme in the cascade reaction? (10%)