

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：生物化學【生醫所碩士班】

題號：427001

※本科目依簡章規定「不可以」使用計算機

共 1 頁第 1 頁

請注意：考生請勿在試題紙上作答

一、問答題 Simple questions : (80%)

Q1: What are the cellular functions of cytoplasmic filaments? Please list three general types of cytoplasmic filaments. (10%)

Q2: In enzymology, what is  $V_{max}$ ? What is  $K_m$ ? What is the importance of  $V_{max}$  and  $K_m$  in enzyme kinetics? Please describe the relationship between  $K_m$  and  $V_{max}$  of a given enzyme. (10%)

Q3: What are the functions of ApoE in lipoprotein metabolism? Please compare the differences of chylomicron and VLDL. (10%)

Q4: Please describe the cellular and physiological functions of cholesterol. (10%)

Q5: Please describe the biochemical processes glycolysis and gluconeogenesis. Gluconeogenesis and glycolysis are reciprocally regulated. Please explain what this means and list the regulating molecules. (10%)

Q6: What is the tricarboxylic acid cycle (TCA cycle)? How is the TCA cycle regulated, which are the key enzymes? (10%)

Q7: Please describe the structure of a tRNA molecule. What parts of the tRNAs interact with the 30S subunit of ribosome and with the 50S subunit of ribosome? (10%)

Q8: Please describe the difference between the beta oxidation and fatty acid synthesis. (10%)

二、名詞解釋：Please define the following terms : (20%)

1. Chaperone (4%)
2. RNA editing (4%)
3. Ketone bodies (4%)
4. Histone code (4%)
5. Synthetic lethality (4%)



# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：細胞分子生物學【生醫所碩士班】

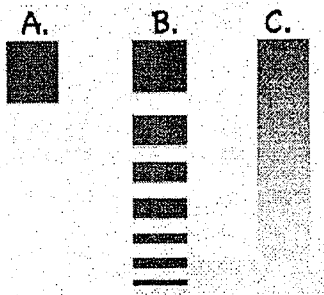
題號：427002

※本科目依簡章規定「不可以」使用計算機

共 5 頁第 1 頁

說明：本試卷為單選題，計 50 題（每題二分）。

1. What part of the cell is responsible for breaking down and digesting things? (A) Ribosome; (B) Lysosomes; (C) Endoplasmic reticulum; (D) Vacuole; (E) Mitochondrion.
2. Which of the following would you NOT find in a bacterial cell? (A) DNA; (B) RNA; (C) Cell membrane; (D) Golgi apparatus; (E) Ribosome.
3. What part of the cell serves to process, package and export proteins? (A) Mitochondrion; (B) Endoplasmic reticulum; (C) Nucleolus; (D) Nucleus; (E) Golgi apparatus.
4. Which of the following is NOT an accurate description of a chromosome? (A) It is a colored body localized in the nucleus; (B) It is a protein and nucleic acid complex; (C) It is the cellular structure that contains the genetic material; (D) In eukaryotes, it is composed of many DNA molecules attached end to end; (E) DNA is compacted in chromosomes in high order structure.
5. A centriole is an organelle that is (A) Present in the center of a cell's cytoplasm; (B) Composed of microtubules and important for organizing the spindle fibers; (C) Surrounded by a membrane; (D) Part of a chromosome; (E) Part of nucleus.
6. All peroxisomes carry out the function? (A) Breakdown fats and amino acids into smaller molecules that can be used for energy production by mitochondria; (B) Digest macromolecules using the hydrolytic enzymes they contain; (C) Synthesize membrane components such as fatty acids and phospholipids; (D) Control the flow of ions into and out of the cell; (E) Convert fatty acids into fat.
7. What determines which traits an organism will have? (A) the nucleus; (B) cytoplasm; (C) the mitochondrion; (D) protein; (E) DNA.
8. Cytoplasm is made of mostly of (A) Water; (B) Gelatin; (C) Collagen; (D) Vitamins; (E) Gelatin.
9. The cell cycle consists of: (A) Mitosis and cell death; (B) Mitosis; (C) Mitosis and meiosis; (D) Meiosis; (E) Interphase, mitosis and cytokinesis.
10. Regulators of cell cycle include which of the following: (A) Caspases; (B) PARPs; (C) CD95; (D) CDKs/cyclins; (E) Cytochrome c.
11. Which lane below shows the DNA of a cell undergoing apoptosis? (A) A (B) B (C) C



12. CD95 and TNFR1 are examples of (A) Caspases; (B) Stem cells; (C) Cellular FLICE inhibitory protein; (D) Death receptors; (E) Death ligands.
13. Which specialized cell does not have a nucleus? (A) Sperm cell; (B) Egg cell; (C) Nerve cell; (D)

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：細胞分子生物學【生醫所碩士班】

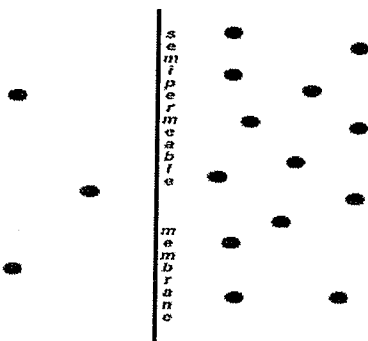
題號：427002

※本科目依簡章規定「不可以」使用計算機

共 5 頁第 2 頁

White blood cell; (E) Red blood cell.

14. Cancer cells are able to spread to distant parts of the body and form tumors there (metastasize), because (A) They secrete enzymes that digest their underlying basal lamina; (B) They can enter adjacent blood vessels and travel to distant site; (C) They can secrete factors that destroy neighbor blood vessels; (D) They are unable to adhere to surrounding tissues; (E) They can move freely to other tissues.
15. Which immunoglobulin is the major component of antibody? (A) IgA; (B) IgD; (C) IgE; (D) IgG; (E) IgM.
16. What does 'pluripotent' mean? (A) Ability of a single cell to develop into an embryonic or adult stem cell; (B) Ability of a single stem cell to develop into many different cell types of the body; (C) Ability of a single embryonic stem cell to develop into an adult stem cell; (D) Ability of a single stem cell to heal different types of disease; (E) Ability of a single stem cell to make a new life.
17. Which of the following stem cell therapies are routinely used to treat diseases today? (A) Adult stem cell transplant: bone marrow stem cells; (B) Adult stem cell transplant: peripheral blood stem cells; (C) Blastocyst embryonic stem cells transplant: neural stem cells; (D) Blastocyst embryonic stem cells transplant: hematopoietic stem cells; (E) Umbilical cord blood stem cell transplant.
18. Movement of the small molecules from left to right across the membrane (A) Requires energy; (B) Passive transport; (C)  $\text{Na}^{2+}$ ; (D)  $\text{K}^{+}$ ; (E)  $\text{Cl}^{-}$ .



19. For meiosis, cross-over occurs during (A) Anaphase 1; (B) Metaphase 1; (C) Prophase 1; (D) Prophase 2; (E) Anaphase 2.
20. Which molecule serves to destabilize the DNA helix in order to open it up, creating a replication fork? (A) DNA polymerase; (B) DNA ligase; (C) DNA helicase; (D) Single strand binding protein; (E) DNA gyrase.
21. The discovery of Okazaki fragments suggested that DNA synthesis is sometimes, (A) Semiconservative; (B) Continuous; (C) discontinuous; (D) 3' to 5'; (E) Randomly.
22. An alternation in a nucleotide sequence that changes a triplet coding for an amino acid into a termination codon. (A) Nonsense mutation; (B) Single nucleotide polymorphism; (C) Mutagenesis; (D) Dimer formation; (E) Missense mutation.
23. What enzyme is responsible for proofreading repair after replication? (A) ligase; (B) DNA polymerase; (C) Glycolyase; (D) RNA polymerase; (E) Primase.
24. Studies involving fusion of cells from individuals with *xeroderma pigmentosum* have identified 7

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：細胞分子生物學【生醫所碩士班】

題號：427002

※本科目依簡章規定「不可以」使用計算機

共 5 頁第 3 頁

- different genes that can cause the disease. A patient comes to you with an apparent case of *xeroderma pigmentosum*. You decide to fuse cells from this patient with existing cell lines derived from other patients. You discover that when you fuse cells from your patient X, the hybrid fusion product does not repair UV damage. If patient X is deficient in the protein that binds to thymine dimer, XPA, you conclude (A) Your patient is deficient in a different aspect of the repair process; (B) Your patient has acquired a mutagenic virus; (C) Your patient has suffered at least 5 mutations; (D) Your patient has a new gene; (E) Your patient is also deficient in this gene product.
25. The wobble hypothesis states that (A) There are too many tRNAs present to account for the number of amino acids; (B) tRNAs wobble when attached to an mRNA; (C) An mRNA codon may pair with more than one transfer RNA; (D) An mRNA codon can pair with only a single tRNA; (E) Several mRNA codons may pair with a single tRNA.
26. You set up an experiment in which a piece of eukaryotic DNA is hybridized to its messenger RNA. You examine the product with an electron microscope, you will see (A) Loops appear along the RNA strand; (B) Loops appear along the DNA strand; (C) Both strands pair exactly but are of differing lengths; (D) Both strands pair exactly and are of the same length; (E) One clot.
27. The enzyme that catalyzes the formation of the peptide bond is called? (A) Aminoacyl-tRNA; (B) RNA polymerase; (C) Ribosyl transferase; (D) Protein synthase; (E) Peptidyl transferase.
28. Which of the following statements is true regarding introns? (A) Introns are the parts of mRNA that are translated; (B) Introns have no function; (C) In general, human genes have fewer introns than genes of other organisms; (D) Introns may be involved in exon shuffling; (E) Introns are evolutionary garbage.
29. You observe organelles moving within the cytoplasm of a cell and conclude that this movement must be associated with either microtubules or actin filaments. The reason that intermediate filaments could not be associated with this phenomenon is because (A) They are not intrinsically polar; (B) They can't disassemble; (C) They can't interact with membranes; (D) They are found only at certain cell junctions; (E) The cell can not control their assembly.
30. Which of the following is NOT a component of the nucleosome core? (A) Histone H1; (B) Histone H2A; (C) Histone H2B; (D) Histone H3; (E) Histone H4.
31. Nuclear pores (A) Are comprised of fewer than 10 different proteins; (B) Are found exclusively in the outer leaflet of nuclear envelope; (C) Regulate the transport of both proteins and RNAs; (D) Prevent the passive of lamin proteins from the cytoplasm into the nucleus; (E) Allow export to the cytoplasm of materials produced by the rough endoplasmic reticulum.
32. Smooth endoplasmic reticulum is abundant in some specialized cells, for example, (A) Heart; (B) Brain; (C) Kidney; (D) Bladder; (E) Liver.
33. The epithelial cell junctions that, respectively, (1) restrict the extracellular movement of molecules across an epithelium, (2) maintain tissue integrity and strength, and (3) allow the passage of small molecules between adjacent cells are? (A) Gap junctions, desmosomes, tight junctions; (B) Desmosomes, tight junctions, gap junctions; (C) Tight junctions, gap junctions, tight junctions; (D) Tight junctions, desmosomes, gap junctions; (E) Gap junctions, tight junctions, desmosomes.
34. Genes determine the anterior-posterior and the dorsal-ventral axes are called (A) Pair-rule genes; (B) Gastrulation genes; (C) Imprinting genes; (D) Homeotic genes; (E) Imaginal genes.

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：細胞分子生物學【生醫所碩士班】

題號：427002

※本科目依簡章規定「不可以」使用計算機

共 5 頁第 4 頁

35. How do most hydrophobic chemical messengers get transported to a target cell? (A) They bind to carrier proteins in the blood; (B) They dissolve easily in the circulatory fluids; (C) They bind to hormones in the blood; (D) They move from cell to cell through gap junctions; (E) They move from cell to cell through ion channels.
36. Scientists hypothesize that cell signaling in animals evolved from (A) Ancestral ion channel receptors in bacteria; (B) Mitochondrial signaling pathways; (C) Ancestral mechanisms that unicellular organisms use to sense their environment; (D) Phosphate signaling pathways in plants; (E) Autophagy pathway.
37. Which of the following is an effector that generates intracellular second messengers? (A) Enzymes; (B) Ion channels; (C) GTP-alpha; (D) A and B; (E) All of the above.
38. What do lipid-soluble drugs, steroids and thyroid hormones bind to? (A) Cytokine receptors; (B) Intracellular receptors; (C) Tyrosine kinase receptors; (D) G-protein-couple receptors; (E) Transmembrane ion channels.
39. The BCL2-family of mitochondrial proteins promotes and inhibits apoptosis by regulating the release of what from mitochondria? (A) Caspase 9; (B) Caspase 8; (C) Cytochrome c; (D) Caspase 3; (E) APAF-1.
40. Cells use different signaling strategies to achieve different goals. In hormonal signaling, (A) Numerous cells can receive and respond to a signal produced in their vicinity; (B) The signal can be directed to a very specific target because a narrow space separates the target cell from the transmitting cell; (C) A concentration gradient between the signaling cell and its target cell is established, causing cells along the gradient to respond in different ways; (D) Specialized cells release hormone molecules into the circulatory system, permitting distant cells to be affected; (E) Special molecules are passed through cell junctions.
41. Nitric oxide is unusual among animal signal molecules in that it? (A) Enters the cell via protein channel; (B) Acts by directly binding to DNA; (C) Binds to both membrane receptors and cytoplasm receptor; (D) Is a gas; (E) Activates proteins by removing phosphate.
42. Cells of gastrointestinal (GI) tract and cells of the heart respond differently to epinephrine because? (A) There are differences in the proteins found in the two types of cells; (B) The GI tract does not have epinephrine receptors; (C) In cells of the GI tract epinephrine operates via a cytosolic receptor, whereas in cells of the hear epinephrine acts via a plasma membrane receptor; (D) The concentration of  $Ca^{2+}$  is lower in the cytosol of GI-tract cells the in the cytosol of heart cells; (E) Cells of the GI tract lack cAMP.
43. Cell adhesion to the extracellular matrix (ECM) glycoprotein fibronectin can involve (A) The binding of select immunoglobulin superfamily members (IgSF) to the Arg-Gly-Asp (RGD) sequence in fibronectin; (B)  $Ca^{2+}$  independent binding of selectins to the RGD sequence in fibronectin; (C)  $Ca^{2+}$  dependent binding of selectins to the RGD sequence in fibronectin; (D) The binding of integrin to RGD sequence in fibronectin; (E)  $Ca^{2+}$  dependent binding of selectins to specific carbohydrate groups on the fibronectin glycoprotein.
44. In biology, i.e., living cells, acetylation occurs as a cotranslational and post-translational modification of proteins, for example (A) Chromatin; (B) Histone H1; (C) Histone H2; (D) Histone H3; (E) Histone H4.

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：細胞分子生物學【生醫所碩士班】

題號：427002

※本科目依簡章規定「不可以」使用計算機

共 5 頁第 5 頁

45. Which of the following post-translational modification is involved in peptide molecule targeted protein degradation? (A) Ubiquitination; (B) Nitrosylation; (C) Acetylation; (D) Phosphorylation; (E) Sumoylation.
46. If the *p53* gene in a cell is mutated, which of the following situations may occur? (A) Cells are marked for apoptosis; (B) Cells cannot pass the G<sub>1</sub>/S checkpoint; (C) The G<sub>0</sub> checkpoint won't work properly; (D) Cells with damaged DNA may proliferate in an uncontrolled manner; (E) Cells cannot pass the M checkpoint, no matter what.
47. One known cyclin-dependent kinase inhibitor is (A) p53; (B) RB1; (C) CHEK1; (D) CHEK2; (E) p27 (CDKN1B).
48. Targeting the epidermal growth factor receptor (EGFR) tyrosine kinase, approved in the United States for non-small cell lung cancer is (A) Gefitinib; (B) Gleevec; (C) Erbitux; (D) Avastin; (E) Cetuximab.
49. Why swine flu (H1N1) infected human? (A) H1N1 infected all species; (B) H1, H2 and H3 infected human; (C) H1N1 originated from 1918 Spanish flu; (D) N1N1 is a B type flue; (E) N1 upper respiratory tract.
50. The Nobel Prize in Physiology or Medicine 2012 'for the discovery that mature cells can be reprogrammed to become pluripotent' was awarded to (A) Serge Haroche; (B) Robert J. Lefkowitz and Brian K. Kobilka; (C) Mo Yan; (D) David J. Wineland; (E) Sir John B. Gurdon and Shinya Yamanaka.

