

單選題 共 40 題 (A) (B) (C) (D) (E) 5 選 1 答錯不倒扣

第 1 至 20 題 每題 2 分 第 21 至 40 題 每題 3 分

1. Which is **incorrect** about mRNA vaccine?

- A. The mRNA can be synthesized in vitro using bacteriophage T7 RNA polymerase.
- B. The mRNA contains 5'-cap, 5'-UTR, a coding region and 3'-UTR.
- C. The negative charge of the mRNA should be neutralized by positive charge molecules for delivery.
- D. The mRNA is delivered into the cytosol of cells and translated by the ribosome.
- E. The mRNA will enter nuclei and integrate into chromosomes for long-term expression.

2. Which description is **incorrect** to transcription factors?

- A. A transcription factor contains DNA binding domain and transactivation domain.
- B. An acidic domain is a DNA binding domain.
- C. A proline-rich domain is a transactivation domain
- D. The hydroxylation in the proline residue of the transcription factor HIF-1 $\alpha$  leads to protein degradation.
- E. The leucine-zipper is a domain for dimer formation.

3. Which RNA is **not** transcribed by eukaryotic RNA polymerase II (Pol II)?

- A. Messenger RNA
- B. Transfer RNA
- C. Micro RNA
- D. Long non-coding RNA
- E. Circular RNA

4. Which part of the ribosome is responsible for decoding?

- A. 23S    B. 16S    C. 5S    D. 60S    E. 50S

5. What is the universal sequence of tRNAs?

- A. 5'-UUC
- B. 5'-CCG
- C. 5'-UCA
- D. 5'-UUG
- E. 5'-CCA

6. A type of cell called the lymphocytes makes proteins that are exported from the cell. You can track the path of these proteins by using pulse-chase experiment with radioisotope-labeled proteins to demonstrate the classic secretory pathway in cells. Which of the following might be the classic secretory pathway for those polypeptides to be sorted out?

- A. rough ER --- lysosome --- plasma membrane
- B. smooth ER --- Golgi --- plasma membrane
- C. nucleus --- rough ER --- Golgi --- plasma membrane
- D. rough ER --- Golgi --- plasma membrane
- E. rough ER --- mitochondria --- Golgi --- plasma membrane

見背面

題號： 415

國立臺灣大學 111 學年度碩士班招生考試試題

科目： 細胞與分子生物學

節次： 7

題號： 415

共 7 頁之第 2 頁

7. A cell containing sodium ions at a concentration of 0.05 mM lives in a pond containing 0.005 mM of sodium ions. Evidently, sodium ions are entering the cell by
- simple diffusion
  - osmosis
  - active transport
  - facilitated diffusion
  - endocytosis
8. Particle A is observed to be brought into the cell through endocytosis. This means that the destination of particle A is most likely
- one of the membrane-bound organelles because vesicles aren't involved
  - one of the membrane-bound organelles because it is being transported via a vesicle
  - the cytosol because it is being transported via a vesicle
  - the cytosol because vesicles aren't involved
  - the cytosol because membrane deformation is being achieved
9. Which of the following statements regarding second messenger is correct?
- A hormone that acts on a target cell, not one of the releasing factors or trophic hormones that act on specific endocrine glands
  - A substance that brings about a desired effect in a cell as a result of a hormone binding to its receptor on the cell surface
  - A hormone that affects the DNA of the target cell
  - None is correct
  - All are correct
10. Which of the following shows the correct order of action potential generation of a neuron?
- Gated  $\text{Na}^+$  channel open > Gated  $\text{K}^+$  channel open >  $\text{Cl}^-$  channel open
  - Voltage change > Gated  $\text{K}^+$  channel open > Gated  $\text{Na}^+$  channel open
  - Voltage change > Gated  $\text{Na}^+$  channel open > Gated  $\text{K}^+$  channel open
  - None of above
  - All of above
11. Which one participates in the progression of M phase in mitosis?
- Cyclin A
  - Cyclin B
  - Cyclin D
  - Cyclin E
  - None of these
12. Okazaki fragment is found in
- Replication origin
  - Kinetochore
  - Leading strand
  - Lagging strand
  - None of these

接次頁

題號： 415

國立臺灣大學 111 學年度碩士班招生考試試題

科目： 細胞與分子生物學

題號： 415

節次： 7

共 7 頁之第 3 頁

13. Which one is involved in the innate immune response?

- A. CD8+ cytotoxic T cell
- B. CD4+ helper T cell
- C. B220+ B cell
- D. Natural killer cell
- E. Regulatory T cell

14. Which of the following triggers apoptosis?

- A. Fas ligand
- B. NGF
- C. TNF $\alpha$
- D. Insulin
- E. A and C

15. Which of the following leads to a point mutation?

- A. DNA single-strand break
- B. benzo(a)pyrene conversion of guanine to a thymine base
- C. DNA double-strand break
- D. A, B, and C are correct
- E. A and C are correct

16. Which of the following manipulations or procedures used in current recombinant DNA technology commonly relies on an enzyme?

- |                               |  |
|-------------------------------|--|
| 1. Nucleic acid hybridization | 4. Cleavage of DNA at specific sites                 |
| 2. DNA sequencing             | 5. Synthesis of DNA of any desired specific sequence |
| 3. DNA ligation               | 6. DNA cloning                                       |

- A. 1, 2, 3 and 4
- B. 2, 3, 4 and 5
- C. 1, 3, 4 and 6
- D. 2, 3, 4 and 6
- E. All

17. How are antibody-producing hybridoma cell lines immortalized to provide an unlimited source of monoclonal antibodies?

- A. By overproduction of introduced oncogenes
- B. By cell fusion
- C. By ectopic expression of telomerase
- D. By irradiation
- E. By transformation with a retrovirus

18. The genetic code is said to be degenerate, which means that:

- A. Each codon codes for more than one amino acid.
- B. An anticodon can interact with more than one codon in the mRNA in which the codon may differ in any or all of the three nucleotides.
- C. Most amino acids are coded for by more than one codon.
- D. The code is universally used by virtually all species.
- E. None are true.

見背面

19. The vast diversity of immunoglobulin sequences is explained by:

- A. DNA rearrangement.
- B. large sections of DNA devoted to immunoglobulin formation.
- C. susceptibility of the immunoglobulin genes to mutation.
- D. sensitivity of formed immunoglobulin proteins to environmental factors.
- E. All of the above.

20. Single-stranded DNA-binding proteins (SSBs) are:

- A. substrates for DNA ligases.
- B. supercoil stabilizing bodies.
- C. single-stranded bodies called Okazaki fragments.
- D. single-stranded DNA binding proteins that prevent re-annealing.
- E. nucleases that hydrolyze single-stranded RNA primers.

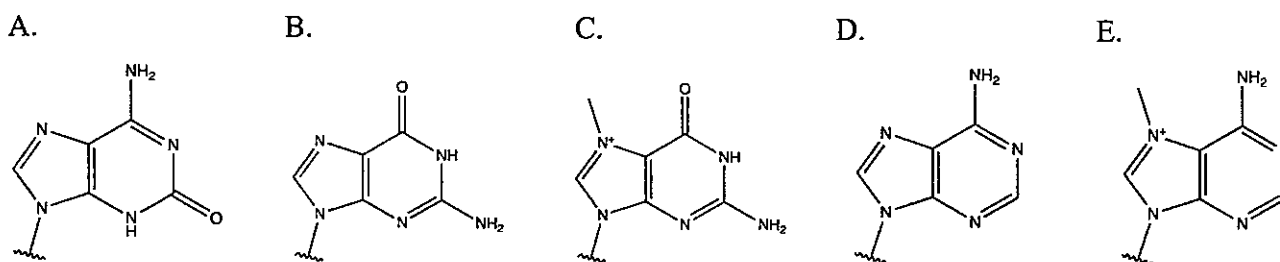
21. Which is correct about epigenetic regulation?

- A. DNA methylation is a forever marker on genomes for gene repression.
- B. The histone acetylation would compact the nucleosome structure for gene repression.
- C. The N-terminus of histones contains many amino acids with positive charges such as asparagine and glutamine.
- D. The gene expression can be switched on and off by the histone acetyltransferase and the histone deacetylase, respectively.
- E. All amino acids of histones with methylation result in gene silencing.

22. Which is **incorrect** about pre-mRNA splicing?

- A. Pre-mRNAs contain introns and exons, and most of introns are longer than exons.
- B. Pre-mRNA splicing is catalyzed by the spliceosome, a large RNA-protein complex.
- C. Many non-coding RNAs are involved in pre-mRNA splicing.
- D. Pre-mRNAs are bound by spliceosome and transferred to cytosol for splicing.
- E. The various spliceosomal complexes during splicing cycle are demonstrated by cryoEM.

23. Which structure is correct for the nucleobase of the 5'-cap of eukaryotic mRNA?



24. There is a preinitiation complex of the eukaryotic ribosome formed before translation. What could be the component within this complex?

- A. 60S
- B. eIF2•ATP+Met-tRNA<sup>iMet</sup>
- C. eIF1B
- D. 18S
- E. GDP

25. Which of the following statement(s) is correct regarding to the membrane transport?

1. Integral membrane protein is likely to contain one or more hydrophobic segments, 20-30 amino acids long.
2. Exocytosis involves the cell engulfing matter from the outside environment.
3. The voltage-gated potassium channels associated with an action potential provide an example of coupled transport

- A. 1 and 3  
B. 2 and 3  
C. 1 only  
D. 1 and 2  
E. All of above are correct.

26. You are studying the entry of a molecule into red blood cells. You determine the rate of movement across the membrane under a variety of conditions and carry out the following results:

1. The molecules can move across the membrane in either direction.
2. The molecules always move down their concentration gradient.
3. No energy source is required for the molecules to move across the membrane.
4. As the difference in concentration across the membrane increases, the rate of transport reaches a maximum.

The mechanism used to get this molecule across the membrane is most likely:

- A. simple diffusion.  
B. facilitated diffusion.  
C. active transport.  
D. pinocytosis.  
E. There is not enough information to determine a mechanism.

27. Which of the following statement(s) regarding cytoskeleton is correct?

1. made from the repetitive assembly and disassembly of dynamic protein components
2. comprising the cytoskeleton are microtubules, intermediate filaments, and actin filaments
3. in neurons, intermediate filaments is also called neurofilaments

- A. All of above are correct  
B. 1 and 3 are correct  
C. 2 and 3 are correct  
D. 3 only is correct  
E. 2 only is correct

28. Which of the following statements regarding stem cells is correct?

1. Stem cells can do asymmetric cell division.
2. Cord blood stem cells are pluripotent.
3. Induced pluripotent stem cells can differentiate into any of the three germ layer cells.

- A. 1 and 2  
B. 1 and 3  
C. 2 and 3  
D. None of above  
E. All of above

見背面

題號： 415

國立臺灣大學 111 學年度碩士班招生考試試題

科目： 細胞與分子生物學

節次： 7

題號： 415

共 7 頁之第 6 頁

29. Which of the following statements regarding cell-cell and cell-matrix adhesion is **incorrect**?
1. The major families of cell surface adhesion molecules include integrins.
  2. Vertebrate gap junctions are composed of adherins.
  3. A tight junction is made up of integrins.
  4. NCAMs, a group of cell-adhesion proteins belonging to the Ig superfamily, bind to proteoglycans.
- A. 1 and 2  
B. 1 and 3  
C. 2 and 3  
D. None of above  
E. All of above
30. Which one mainly regulates the replication stress in the S phase?
- A. ATM  
B. ATR  
C. DNA-PKcs  
D. Aurora A  
E. APC/C
31. Which one can be used in cancer immunotherapy?
- A. Anti-PD1 antibody  
B. Anti-PDL1-antibody  
C. Anti-CTLA4 antibody  
D. CAR-T  
E. All of these
32. In the large-scale production of a particular human protein in *E. coli* cells, the cDNA corresponding to the protein was modified so that the expressed protein would have six histidine residues at the N-terminus. The purpose of this modification was to
- A. facilitate transfer of the cDNA into the *E. coli* cells.  
B. provide a promoter for the transcription of the cDNA in *E. coli*.  
C. facilitate purification of the expressed protein though binding to an affinity column containing chelated nickel atoms.  
D. prevent degradation of the expressed protein by *E. coli* proteases.  
E. facilitate translation rate.
33. In RNA interference studies, the double-stranded RNA
- A. disrupts the target DNA sequence.  
B. results in the destruction of the target mRNA.  
C. destroys the target protein.  
D. all of the above  
E. none of the above
34. In two-dimensional gel electrophoresis, proteins are first resolved by \_\_\_\_\_ and then by \_\_\_\_\_.
- A. IEF; gel filtration  
B. SDS-PAGE; affinity chromatography  
C. SDS-PAGE; ion exchange  
D. IEF; SDS-PAGE  
E. gel filtration; SDS-PAGE

接次頁

35. Which of the following statements regarding Glycolipids (such as gangliosides) is correct?

1. contain oligosaccharide chains with negatively charged residues.
2. constitute about 20% of the total lipid mass in the plasma membrane of neurons.
3. affect the electrical environment of the membrane.
4. found in the extracellular leaflet (facing away from the cytosol) in the cellular membranes.

- A. 1 only
- B. 2 and 4
- C. 1, 3 and 4
- D. 2 and 3
- E. All

36. Which of the following ions is the intracellular concentration typically higher than the extracellular concentration?

1. Sodium
2. Potassium
3. Chloride
4. Calcium
5. Magnesium

- A. 1 only
- B. 2 only
- C. 1 and 5
- D. 2 and 3
- E. 4 and 5

37. Which of the following is a pump that hydrolyzes two ATP molecules per transport cycle?

- A. The multidrug resistance protein
- B. The Na<sup>+</sup>-K<sup>+</sup> pump
- C. The V-type ATPase
- D. The Ca<sup>2+</sup>-pump
- E. The cystic fibrosis transmembrane conductance regulator protein

38. All may be RNA polymerase II promoter constituents **except**:

- A. the core element where general transcription factors (GTFs) bind.
- B. where enhancers bind transcriptional activators.
- C. where silencers bind repressors.
- D. a TATA box indicating the transcription start site.
- E. All can be constituents.

39. The Shine-Dalgarno sequence found in prokaryotic systems resides on the \_\_\_\_\_ end of \_\_\_\_\_ and is the \_\_\_\_\_ site.

- A. 3'; peptidyl-tRNA; formyl transferase
- B. 5'; DNA; polymerase binding
- C. 3'; rRNA; initiation factor binding
- D. 5'; mRNA; ribosome binding
- E. 3'; aminoacyl-tRNA; formyl methionine binding

40. The actual peptide bond-forming step in translation is referred to as \_\_\_\_\_, and is catalyzed by \_\_\_\_\_.

- A. peptide bond-formation; peptidase
- B. transpeptidation; transpeptidase
- C. peptidyl transfer; peptidyl transferase
- D. translocation; translocase
- E. None of the above.

試題隨卷繳回