

※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

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 of the following statements regarding cytoskeleton is correct?

- (1) ATP or GTP hydrolysis is required for microfilaments or microtubules assembly.
- (2) Tubulin isotypes differ primarily at their amino terminus.
- (3) Phosphorylation of lamins during mitosis drives the disassembly of the nuclear envelope.

- A. (1) only
- B. (1) and (2)
- C. (2) and (3)
- D. (1) and (3)
- E. All of above

2. Which of the following statements regarding G protein or G protein-mediated signal transduction is false?

- (1) GTP binds the beta subunit of the trimeric G proteins.
- (2) C-terminus of G protein-coupled receptor is on the cytoplasmic face of the membrane.
- (3) Epinephrine binding to the β -adrenergic receptor causes an activation of adenylyl cyclase through the activation of a stimulatory G protein.

- A. (1)
- B. (2)
- C. (3)
- D. (1) and (3)
- E. (2) and (3)

3. Acidification of endosomes is important in dissociating

- A. cholesterol from LDL.
- B. iron from transferrin.
- C. transferrin from the transferrin receptor.
- D. None of the above
- E. All of the above

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

- (1) A stem cell divides to a copy of itself and to a differentiated cell or a cell capable of differentiating into multiple cell types.
- (2) Differentiation potential high to low : pluripotent stem cells > totipotent stem cells > multipotent stem cells.
- (3) Induced pluripotent stem cells can differentiate into any of the 3 germ layer cells.

- A. (1)
- B. (2)
- C. (3)
- D. (1) and (3)
- E. (2) and (3)

5. In the mouse embryo, pluripotent stem cells are found in the

- A. inner cell mass.
- B. trophoctoderm.
- C. zona pellucida.
- D. blastocoel.
- E. inner cell mass and blastocoel.

6. Which of the following is not part of RNA processing in eukaryotes?

- A. Addition of a 5' cap
- B. Addition of a poly(A) tail
- C. Intron removal
- D. Splicing of exons
- E. Reverse transcription

7. Cellular iron homeostasis is accomplished by the coordinated regulated expression of the transferrin receptor and ferritin, which mediate iron uptake and storage, respectively. There are iron responsive element (IRE) in the 5' UTR of ferritin mRNA and in the 3' UTR of transferrin receptor mRNA. (1) IRE-binding proteins bind to IREs of ferritin mRNA to inhibit translation in lower iron concentration; (2) IRE-binding proteins bind to IREs of ferritin mRNA to inhibit translation in higher iron concentration; (3) IRE-binding proteins bind to IREs of transferrin receptor mRNA to stabilize mRNA in lower iron concentration; (4) IRE-binding proteins bind to IREs of transferrin receptor mRNA to stabilize mRNA in higher iron concentration. Which are correct?

- A. (1) and (3)
- B. (2) and (4)
- C. (1) and (4)
- D. (2) and (4)
- E. all are incorrect

8. The following: (1). histone acetylation; (2). H3K4me (histone3 lysine4 methylation); (3).H3K9me (histone3 lysine9 methylation); (4).H3K27me (histone 3 lysine 27 methylation); (5). DNA methylation; (6). HDAC (histone deacetylase); (7). HAT (histone acetyltransferase). Which are related to gene activation?

- A. (1), (2) and (7)
- B. (1), (3), (4) and (6)
- C. (1), (2), (3), (4), (5) and (6)
- D. (3), (4), (5) and (6)
- E. (1) and (7)

9. In prokaryotes, protein synthesis rates are limited by the rates of mRNA synthesis. RNA synthesis occurs at about 60 nucleotides/sec. Therefore, protein synthesis occurs at about _____ amino acids/sec.

- A. 10
- B. 15
- C. 20
- D. 30
- E. 60

10. Which is incorrect about transcription activators (or sequence-specific DNA-binding proteins) in eukaryotic cells?

- A. They contain DNA-binding domain and activation domain.
- B. They bind to enhancers.
- C. They interact with Mediators through activation domain.
- D. Their binding elements need to next to promoter for recruit RNA polymerase.
- E. They play key roles in control the transcription rate.

11. Which one is the product of cytosine deamination?

- A. Adenine
- B. Guanine
- C. Inosine
- D. Xanthine
- E. Uracil

12. The protein which marks proteins for degradation is called _____

- A. Chaperonin
- B. Ubiquitin
- C. Proteosomin
- D. Apoptosin
- E. adenosine

13. Which one is NOT a programmed cell death?

- A. Apoptosis

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- B. Necroptosis
- C. Necrosis
- D. Pyroptosis
- E. Phagoptosis

14. The central dogma does not include

- A. DNA replication
- B. RNA transcription
- C. rotein translation
- D. Reverse transcription
- E. Lysine sumoylation

15. Which one is NOT an unfolded protein response?

- A. endocytosis
- B. Increase chaperon protein expression
- C. Promote protein degradation
- D. Induce apoptosis
- E. Autophagy

16. Indicate which process NOT requires membrane fusion?

- A. Insulin-mediated blood glucose homeostasis
- B. Virus infection
- C. Cholesterol endocytosis
- D. Brain computation
- E. Muscle contraction induced by nerve stimulation

17. Indicate where is neurotransmitter stored?

- A. ER
- B. Golgi
- C. presynaptic endosome
- D. Synaptic vesicle
- E. presynaptic mitochondria

18. Indicate which organelles are mainly involved in protein N-glycosylation?

- (1). Nucleus
- (2). ER
- (3). Golgi
- (4). Mitochondria
- (5). Endosome

- A. (1), (2)

- B. (1), (3)
- C. (3), (4)
- D. (4), (5)
- E. (1), (5)

19. Indicate why the cell needs autophagy? (2 pts)

- (1). Remove damaged organelles
- (2). Remove damaged cytosolic proteins
- (3). Recycle cell materials
- (4). Facilitate protein transport
- (5). Enhance protein modifications

- A. (1), (2), (3), (4), (5)
- B. (1), (2), (4), (5)
- C. (1), (2), (4)
- D. (1), (2), (3)
- E. (3), (4), (5)

20. Typically, what is the biogenesis path for a plasma membrane integrated transmembrane protein?

- (1) ER
- (2) Golgi
- (3) Early endosome
- (4) Lysosome
- (5) Plasma membrane

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

21. Which of the following statements regarding ER or Golgi structure or function is correct?

- (1) The synthesis of fatty acids and phospholipids takes place in the smooth ER.
- (2) Rough ER synthesizes all proteins to be secreted from a cell.
- (3) COPI coat proteins mediate anterograde transport between the Golgi apparatus and other organelles.
- (4) The Golgi stacks receive proteins and lipids from the endoplasmic reticulum (ER) by the cis cisternae.
- (5) The presence of clathrin mediates vesicular transport from *trans*-Golgi to endosome.

- A. (1), (2), (3) and (4)
- B. (1), (2), (4) and (5)
- C. (2), (3), (4) and (5)

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D. (1), (2), (3) and (5)

E. (1), (3), (4) and (5)

22. Which of the following statements regarding endocytosis is correct?

(1) Receptor-mediated endocytosis requires microtubule.

(2) Cholesterol-binding protein caveolin containing pits involves in clathrin-mediated endocytosis.

(3) Clathrin-coated pits can concentrate large extracellular molecules that have different receptors responsible for the receptor-mediated endocytosis of ligands.

A. (1) only

B. (1) and (2)

C. (2) and (3)

D. (1) and (3)

E. All of above

23. Which of the following statements regarding cells of immune system is correct?

(1) Cells in the innate immune system use Pattern recognition receptors (PRRs) to recognize molecular structures that are produced by microbial pathogens.

(2) Dendritic cells, macrophages, monocytes, neutrophils and epithelial cells, all belong to the innate immune system.

(3) Innate immune cells are also important mediators in lymphoid organ development and the activation of the adaptive immune system.

(4) Helper T cells only recognize antigens coupled to Class I MHC molecules, while Killer T cells and regulatory T cells only recognize antigens coupled Class II MHC molecules.

(5) Helper T cells regulate both the innate and adaptive immune responses and help determine which immune responses the body makes to a particular pathogen.

A. (2), (3), (4) and (5)

B. (1), (2), (3) and (4)

C. (1), (2), (4) and (5)

D. (1), (3), (4) and (5)

E. (1), (2), (3) and (5)

24. Which of the following statements regarding RNA sequencing (RNA-seq) is correct?

(1) RNA-seq can be used to perform transcriptional profiling, SNP identification, RNA editing and differential gene expression

analysis.

- (2) RNA-seq can detect transcripts from organisms with previously undetermined genomic sequences.
- (3) RNA-seq sequencing adapters are added to each end of the RNA fragments before library preparation.

- A. (1) only
- B. (2) only
- C. (3) only
- D. (1) and (2)
- E. (2) and (3)

25. Which of the following statements regarding Transposable elements (TEs) is correct?

- (1) TEs are DNA sequences that have the ability to change their position within a genome.
- (2) Retrotransposons mobilize through a RNA intermediate being reverse-transcribed by the reverse transcriptase encoded by the retrotransposons themselves.
- (3) All DNA transposons are mobilized via DNA intermediates being cut-and-paste to new locations in the genome.

- A. (1) only
- B. (2) only
- C. (3) only
- D. (1) and (2)
- E. (2) and (3)

26. Dr. Robert Roeder discovers three DNA-dependent RNA polymerases from developing sea urchin embryos in 1969. Which description about his study is incorrect?

- A. RNA polymerase I is located in nucleoli.
- B. RNA polymerase I and II are sensitive to α -amanitin.
- C. RNA polymerase III synthesizes tRNA and rRNA 5S.
- D. The purification of polymerases is interfered by the nucleosomes.
- E. Dr. Roeder develops cell-free reconstitution systems to study transcription and finds other factors are needed for RNA transcription.

27. In humans it is estimated that at least 90% of the genome is transcribed, with only 2% translated into proteins. There are many non-coding RNAs in cells, and one class is long non-coding RNA (lncRNA). Which description is incorrect about lncRNAs?

- A. LncRNAs are defined as transcripts longer than 200 nucleotides with no apparent protein-coding capacity.
- B. They usually are spliced, capped and polyadenylated.
- C. The circular RNA (circRNA) does not belong to lncRNAs.
- D. They are poorly conservative.

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- E. One X chromosome inactivation in female is an effect of lncRNAs.
28. The lac operon (lactose operon) is an operon required for the transport and metabolism of lactose in *Escherichia coli*.
- A. There are lacZ, lacY and lacA genes in lac operon and they are transcribed independently.
 - B. The lac repressor encoded by lacI gene is constitutively expressed.
 - C. In the presence of glucose, the catabolite activator protein (CAP) is activated to increase LacZ expression.
 - D. Lactose is a disaccharide, which can be cleaved by LacZ into fructose and galactose.
 - E. RNA polymerase binds to operator in the absence of lactose.
29. The methods: (1). Northern blotting; (2). RT-qPCR; (3). Southern blotting; (4). RNase protection assay; (5). cDNA microarray; (6). RNA-seq. What can be used for RNA quantification?
- A. (1), (2), (5) and (6)
 - B. (1), (2), (4), (5) and (6)
 - C. (1), (2), (3), (5) and (6)
 - D. (2), (3), (4), (5) and (6)
 - E. (2), (4), (5) and (6)
30. What is not the unfolding protein response?
- A. IRE1 (Inositol-requiring protein 1) is phosphorylated and served as a kinase.
 - B. IRE1 is an RNase for specific splicing of Xbp1 mRNA.
 - C. PERK (RNA-like ER kinase) is activated to phosphorylate eIF2 α
 - D. The translation of all proteins is shutdown.
 - E. ATF6 (activating transcription factor 6) is cleaved and transported into nucleus.
31. Which component is NOT in the Crispr/Cas9 complex?
- A. Cas9 nuclease
 - B. crRNA
 - C. TracrRNA
 - D. 5'-3' exonuclease
 - E. Protospacer adjacent motif (PAM)
32. Which one can positively regulate the transcription elongation?
- A. CREB
 - B. NELF
 - C. p-TEF
 - D. N-terminal domain of RNA Pol II
 - E. p53
33. HR and NHEJ are essential for DNA double strand break repair (DSBR). Which combination could cause synthetic lethality?
- A. BRCA1 mutation and PARP inhibitor

- B. EGFR mutation and BRAF inhibitor
- C. p53 mutation and Chk1 inhibitor
- D. RB mutation and cdk inhibitor
- E. Kras mutation and AKT

34. Which one is NOT involved in ER to Golgi vesicle trafficking?

- A. Sar1 GTPase
- B. Clathrin
- C. GTPase activating protein
- D. Coat proteins
- E. SNARE

35. Which condition can increase the activity of hypoxia-inducing factor (HIF)?

- A. Pain tolerance
- B. Transcription attenuation
- C. Cell proliferation
- D. Protein translation
- E. Microenvironment and high altitude

36. In the cell, what ion concentration gradients should be maintained?

- (1) calcium
- (2) chloride
- (3) sodium
- (4) potassium

- A. (1), (2), (3), (4) are low in intracellular space and high in extracellular space.
- B. (1), (2), (3), (4) are high in intracellular space and low in extracellular space.
- C. (1), (2) are low in intracellular space and high in extracellular space. But 3,4 are opposite.
- D. (1), (2), (3) are low in intracellular space and high in extracellular space. But 4 is opposite.
- E. (1), (2), (4) are low in intracellular space and high in extracellular space. But 3 is opposite.

37. Indicate which path a cell generally uses to degrade plasma membrane associated receptors?

- (1) Plasma membrane
- (2) Early endosome
- (3) Recycling endosome
- (4) Late endosome
- (5) Lysosome

- A. (1)>(2)>(3)>(4)
- B. (1)>(3)>(4)>(5)
- C. (1)>(2)>(4)>(5)
- D. (1)>(4)>(2)>(5)

E. (1)>(4)>(3)>(5)

38. Indicate which cellular machines participate in degrading damaged "intracellular proteins"?

- (1). Autophagosome
- (2). ER
- (3). Golgi
- (4). Endosome
- (5). Proteasome

- A. (1), (2)
- B. (2), (3)
- C. (3), (4)
- D. (4), (5)
- E. (1), (5)

39. Indicate what are the functions of multivesicular body?

- (1). Protein synthesis
- (2). Protein phosphorylation
- (3). Protein transport
- (4). Protein secretion
- (5). RNA degradation

- A. (1), (2)
- B. (2), (3)
- C. (3), (4)
- D. (4), (5)
- E. (1), (5)

40. Indicate which order is correct when an action potential propagates?

- (1). voltage-gated sodium channel is opened
- (2). voltage-gated sodium channel is closed
- (3). voltage-gated calcium channel is opened
- (4). voltage-gated calcium channel is closed
- (5). voltage-gated potassium channel is opened
- (6). voltage-gated potassium channel is closed

- A. (1)>(2)>(3)>(4)
- B. (1)>(5)>(2)>(6)
- C. (1)>(3)>(4)>(6)
- D. (2)>(3)>(4)>(6)
- E. (1)>(3)>(5)>(6)

試題隨卷繳回