單選題 (每題 4 分) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. Which property of phospholipids is most directly responsible for the formation of biological membranes?
   A. Their ability to form hydrogen bonds
   B. Their amphipathic nature
   C. Their negative charge
   D. Their high molecular weight
2. Which membrane protein function involves binding a specific ligand and initiating a cellular response?
   A. Transporter
   B. Structural anchor
   C. Enzyme
   D. Receptor
3. Which organelle is primarily responsible for protein modification and sorting?
   A. Rough endoplasmic reticulum
   B. Smooth endoplasmic reticulum
   C. Golgi apparatus
   D. Lysosome
4. Lysosomal enzymes are optimally active at low pH because:
   A. The cytosol is acidic
   B. The lysosome contains proton pumps
   C. They are synthesized in acidic conditions
   D. They are inactive at neutral pH due to inhibitors
5. Microtubules are composed of:
   A. Actin monomers
   B. Tubulin heterodimers
   C. Keratin proteins
   D. Spectrin repeats
6. Motor proteins that move toward the plus end of microtubules are typically:
   A. Dyneins
   B. Kinesins
   C. Myosins
   D. Intermediate filaments
7. The spindle assembly checkpoint ensures that:
   A. DNA replication is complete
   B. Centrosomes duplicate only once
   C. All chromosomes are properly attached to the spindle
   D. Cytokinesis occurs symmetrically
8. Apoptosis is best characterized by:
   A. Cell swelling and membrane rupture
   B. Inflammatory response
   C. Programmed cell death with DNA fragmentation
   D. Random degradation of cellular components
9. The TATA box is typically located:
   A. Within the coding sequence
   B. Upstream of the transcription start site

見背面

C. At the 3′ end of genes

D. In introns

10. Which RNA polymerase transcribes rRNA (28S, 18S, 5.8S)?

A. RNA polymerase I

B. RNA polymerase II

C. RNA polymerase III

D. Mitochondrial RNA polymerase

11. Alternative splicing increases proteomic diversity by:

A. Increasing mutation rates

B. Allowing one gene to produce multiple mRNAs

C. Enhancing translation efficiency

D. Preventing mRNA degradation

12. The 5′ cap of eukaryotic mRNA functions in:

A. Transcription termination

B. Splicing of introns

C. mRNA stability and translation initiation

D. Protein folding

13. Translation initiation in eukaryotes usually begins at:

A. The first AUG downstream of the cap

B. Any AUG codon

C. The longest open reading frame

D. The poly(A) tail

14. Which post-translational modification commonly targets proteins for degradation?

A. Phosphorylation

B. Glycosylation

C. Acetylation

D. Ubiquitination

15. The proteasome primarily degrades proteins that are:

A. Misfolded in the ER lumen

B. Tagged with ubiquitin in the cytosol

C. Located in lysosomes

D. Embedded in membranes

16. Receptor tyrosine kinases transmit signals mainly by:

A. Opening ion channels

B. Activating G proteins

C. Autophosphorylation and recruitment of adaptor proteins

D. Directly binding DNA

17. Second messengers such as cAMP function to:

A. Act as transcription factors

B. Amplify intracellular signals

C. Degrade signaling proteins

D. Block receptor binding

18. G-protein-coupled receptors are characterized by:

A. One transmembrane domain

B. Seven transmembrane helices

接次頁

C. Intrinsic kinase activity
D. Direct binding to DNA

19. Tight junctions primarily function to:
A. Anchor cells to the extracellular matrix
B. Allow direct cytoplasmic communication
C. Prevent leakage between epithelial cells
D. Provide mechanical strength

20. Stem cells are defined by their ability to:
A. Divide rapidly
B. Differentiate only once
C. Self-renew and differentiate into specialized cell types
D. Form tumors

簡答題 (共 4 題，每題 5 分)　※ 本大題請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Compare next-generation sequencing (NGS) with conventional DNA sequencing methods (such as Sanger sequencing). In your answer, discuss differences in throughput, cost, speed, accuracy, and typical applications.
2. Explain the process of RNA splicing in eukaryotic cells. In your answer, describe the roles of introns, exons, the spliceosome, and conserved splice-site sequences, and explain how alternative splicing increases protein diversity.
3. How do unicellular and multicellular organisms sense and respond to odorant molecules? Describe the key differences in the mechanisms used by these two types of organisms.
4. Design an experimental assay to demonstrate signal amplification in a cell signaling pathway (for example, a G protein–coupled receptor pathway). What would you measure, and how would the results illustrate signal amplification?

試題隨卷繳回