

9. The shoot tip of an emerging maize seedling is protected by  
(A) hypocotyl (B) coleoptile (C) epitocyl (D) plumule (E) both A and D
10. Protoplasts are plant cells that lack \_\_\_\_\_.  
(A) starch (B) cell walls (C) nuclei (D) chloroplasts (E) plasma membrane
11. What is the common feature of connective tissues in animals?  
(A) cuboidal shape (B) the ability to produce hormone  
(C) the ability to contract (D) the presence of an extracellular matrix  
(E) the presence of tight junction
12. The  $\text{Na}^+/\text{K}^+$  ATPase pump is  
(A) important for long-term maintenance of resting potential  
(B) important only at the synapse (C) not required for action potential firing  
(D) used to stimulate graded potentials (E) localized to mitochondria
13. Which of the following is true about lipophilic hormones?  
(A) They are freely soluble in the blood and crossing plasma membrane  
(B) They bind to membrane receptors  
(C) They cannot enter their target cells  
(D) They have a direct effect on gene expression  
(E) No transport protein is required for their delivery in blood.
14. Motor neurons stimulate muscle contraction via the release of \_\_\_\_\_.  
(A) ATP (B)  $\text{Ca}^{2+}$  (C) acetylcholine (D) glutamine (E) G-proteins
15. Which of the following is not involved in the innate immunity?  
(A) Complement system (B) Phagocytic cells  
(C) Mucosal epithelial surfaces (D) Lymphocytes  
(E) Toll-like receptors recognize LPS.
16. The nucleotide sequence of a DNA reading frame is 5'GTA3'. A messenger RNA molecule with a complementary codon is transcribed from the DNA. In the process of protein synthesis, a transfer RNA pairs with the mRNA codon. What is the nucleotide sequence of the tRNA anticodon?  
(A) 5'CAT3' (B) 5'CAU3' (C) 5'GUA3' (D) 5'UAC3' (E) 5'AUG3'
17. A cell biologist measured the amount of DNA in cells growing in the laboratory and found that the quantity of DNA in a cell doubled \_\_\_\_\_.  
(A) Between prophase I and prophase II of meiosis  
(B) between prophase and anaphase of mitosis  
(C) between M phase and G1 phase of the cell cycle  
(D) between G1 and G2 phase of the cell cycle  
(E) between day and night

18. In which cell would you find the most rough ER?
- (A) ovarian cells that produce estrogen (B) muscle cells in the thigh of a marathon runner  
(C) brain of a mammal (D) pancreatic cells that secretes digestive enzyme  
(E) white blood cell that engulfs bacteria
19. Foreign molecules that elicit an immune response are called \_\_\_\_\_
- (A) major histocompatibility complex (MHC) (B) histamines  
(C) antibodies (D) antigens (E) complements
20. A freshwater fish would be expected to \_\_\_\_
- (A) produce abundant quantities of dilute urine  
(B) pump salt out through its gills  
(C) have scales and a cover of mucus that reduce water loss to the environment  
(D) absorb water through its gills  
(E) do all of the above

二、解釋名詞 (每題4分, 20%)

1. Second messenger
2. Gastrin
3. Acrosome reaction
4. SNP
5. Horizontal gene transfer

三、問答題 (每題 10 分, 20%)

1. 請說明魚類的循環系統，並比較魚類與兩生類以及哺乳類循環系統的異同之處。
2. 何謂 Central dogma? 並以此為基礎，解釋真核細胞的基因表現於 central dogma 各階段的調控方式。

一、單選題 (每題3分, 60%) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. Which of the following events occurred first in eukaryotic evolution?
  - (A) Endosymbiosis and chloroplast evolution
  - (B) Formation of multicellular organism
  - (C) Endosymbiosis and mitochondria evolution
  - (D) Compartmentalization and formation of the nucleus
  - (E) Formation of cell wall
2. In terms of numbers of species, the most successful phylum on the planet is the
  - (A) Echinidermata
  - (B) Mollusca
  - (C) Arthropoda
  - (D) Annelida
  - (E) Bryozoa
3. Which of the following plant cell type is mismatched to its function?
  - (A) Phloem—serves as part of the bark
  - (B) Xylem—conducts mineral nutrients
  - (C) Parenchyma—performs photosynthesis
  - (D) Trichomes—reduces evaporation
  - (E) Sclerenchyma—nutrients storage
4. The water potential of a plant cell is the
  - (A) difference between membrane potential and gravity
  - (B) sum of the membrane potential and gravity
  - (C) difference between pressure potential and solute potential
  - (D) sum of the pressure potential and solute potential
  - (E) none of the above
5. In a  $C_4$  plant, the Calvin cycle occurs in
  - (A) vacuoles
  - (B) the epidermis
  - (C) vascular tissue
  - (D) mesophyll cells
  - (E) bundle sheath cells
6. Which of the following is NOT a secondary metabolite?
  - (A) Morphine
  - (B) paclitaxel (Taxol)
  - (C) quinine
  - (D) glucose
  - (E) ephedrine
7. In angiosperms, each pollen grain produces two sperm. What do these sperm do?
  - (A) Each one fertilizes a separate egg cell.
  - (B) Both fertilize a single egg cell
  - (C) One fertilizes an egg, and the other is kept in reserve.
  - (D) One fertilizes an egg, and the other fertilizes a cell that develops into stored food
  - (E) One fertilizes an egg, and the other disappears after pollination
8. Which of the following hormone can be used to produce seedless fruits?
  - (A) auxin
  - (B) cytokinin
  - (C) ethylene
  - (D) abscisic acid
  - (E) gibberellin