

## 一、簡答題(65 points)：

1. Please explain the following terms: (each 3 points)

- (1) Alternative splicing
- (2) Genome editing by CRISPR
- (3) Hardy-Weinberg equilibrium
- (4) Metagenome
- (5) Phylogenetic species
- (6) Stramenopiles

2. How might the mitochondria and chloroplast of eukaryotic cells originate? What is the evidence? (6 points)

3. A retrovirus is a type of RNA virus that inserts a copy of its cDNA to the genome of the host. Please describe the cycle of retrovirus replication. (6 points)

4. Cell-surface transmembrane receptors play crucial roles in the biological systems of animals, plants, and microbes. Please describe three kinds of cell-surface transmembrane receptors and how they relay signals once bound with a signaling molecule (ligand). (9 points)

5. Alterations of chromosome number or structure can cause several genetic disorders.

Please explain the term 'aneuploidy' and list a disease related to aneuploid condition.

(2 points)

A diploid fruit fly has eight chromosomes. How many total chromosomes would be found in the following flies? (4 points)

- (1) Tetraploid:
- (2) Trisomy 2:
- (3) Monosomy 3:
- (4)  $4n+1$ :

6. Please describe three mechanisms that can cause the evolution of populations (i.e. alter the allele frequencies of a population over time). (6 points)

7. What is CRISPR-Cas system? Please describe how it works and its applications.

(4 points)

8. Fungi have specialized branching hyphae such as arbuscules, through which fungi exchange nutrients with their plant hosts. Such mutually beneficial relationships between fungi and plant roots are called mycorrhizae. Please describe two main types of mycorrhizal fungi. (4 points)

9. A plant's first line of defense against microbial infection is the physical barrier presented by the epidermis and periderm of the plant body. Once the physical lines of defense are breached, a plant's next lines of defense are two types of immune responses. Please describe what these two immune responses are. (6 points)

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二、選擇題(35 points, 1 pt/each) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. Which is NOT the digestive enzymes in the small intestine

- A. Bile salts
- B. Lactase
- C. Dipeptidase
- D. Pancreatic amylase
- E. Cytochrome c oxidase

2. Characteristic of simple epithelium is that they

- A. are arranged indiscriminately
- B. continue to divide and help in organ function
- C. make a definite layer
- D. None of above

3. Which description is NOT correct about Vitamin D

- A. Diet obtaining from egg yolk
- B. Deficiency resulting in bone deformities and softening
- C. Liver damage and anemia while deficiency
- D. Aids in absorption and use of calcium and phosphorus
- E. Important for cardiovascular functionality

4. Which is NOT the risk factor for high blood cholesterol and high blood pressure

- A. Fatty diet
- B. Lack of exercise
- C. Being male
- D. Aging
- E. High protein consuming

5. What is the function of the cilia in the trachea and bronchi

- A. to sweep air into and out of the lungs
- B. to increase the surface area for gas exchange
- C. to vibrate when air is exhaled to produce sounds
- D. to dislodge food that may has slipped past the epiglottis
- E. to sweep mucus with trapped particles up and out of the respiratory track

6. Which of the following initiates the process of blood clotting

- A. Damage to the lining of a blood vessel
- B. Exposure of blood to the air
- C. Conversion of fibrinogen to fibrin
- D. Attraction of leukocytes to a site of infection
- E. Conversion of fibrin to fibrinogen

7. All of the following statements about muscle contraction are true EXCEPT;

- A. The ends of actin filaments move closer together

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- B. Calcium-troponin binding precedes actin-myosin binding
  - C. Calcium-tropomyosin binding precedes actin-myosin binding
  - D. ATP hydrolysis precedes actin-myosin binding
  - E. The length of myosin filaments does not change
8. Eric's blood pressure is 150/90. The 150 indicates \_\_\_\_, and the 90 indicates \_\_\_\_
- A. pressure in the left ventricle.... pressure in the right ventricle
  - B. arterial pressure ... heart rate
  - C. pressure during ventricular contraction .... pressure during heart relaxation
  - D. systemic circuit pressure.... pulmonary circuit pressure
  - E. pressure in the arteries... pressure in the veins
9. Foreign molecules that evoke an immune response are called
- A. Pathogens
  - B. Antibodies
  - C. Lymphocytes
  - D. Histamines
  - E. Antigens
10. Which of the following is NOT part of the body's innate defense system?
- A. Natural killer cells
  - B. Antibodies
  - C. Interferons
  - D. Complement system
  - E. Inflammation
11. In each nephron of the kidney, the glomerulus and Bowman's capsule
- A. filter the blood and capture the filtrate
  - B. reabsorb water into the blood
  - C. break down harmful toxins and poisons
  - D. reabsorb ions and nutrients
  - E. refine and concentrate the urine for excretion
12. All of the following are functions of the liver except
- A. Detoxification of drugs and toxins
  - B. Synthesis of plasma (blood) proteins
  - C. Interconversion of glucose and glycol
  - D. Synthesis of urine
  - E. Synthesis of bile
13. The pancreas increases its output of insulin in response to
- A. an increase in body temperature
  - B. changing cycles of light and dark
  - C. a decrease in blood glucose
  - D. a hormone secreted by the anterior pituitary
  - E. an increase in blood glucose

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14. Which of the following hormones has the broadest range of targets?

- A. ADH
- B. TSH
- C. ACTH
- D. Oxytocin
- E. Epinephrine

15. Which of the following hormones have antagonistic effects?

- A. Parathyroid hormone and calcitonin
- B. Glucagon and thyroxine
- C. Growth hormone and epinephrine
- D. ACTH and cortisone
- E. Epinephrine and norepinephrine

16. Cytotoxic T cells are able to recognize and attack cancer cells because

- A. Cancer changes the surfaces of cancerous cells
- B. B cells help them
- C. Cancer is the bacterial infection
- D. Cancer cells release antibodies into the blood
- E. Cancer is an autoimmune disease

17. Negative-feedback mechanisms are:

- A. Most often involved in maintaining homeostasis
- B. Activated only when a variable rises above a set point
- C. Analogous to a furnace that produces heat
- D. Involved in contractions during childbirth
- E. Found only in birds and mammals

18. The energy content of fats

- A. is released by bile salts
- B. may be lost unless an herbivore eats some of its feces
- C. is more than two times that of carbohydrates or proteins
- D. can reverse the effects of malnutrition
- E. Both C and D are correct

19. Which of the following is mismatched with its function?

- A. Most B vitamins – coenzymes
- B. Vitamin E – antioxidant
- C. Vitamin K – blood clotting
- D. Iron – component of thyroid hormones
- E. Phosphorous –bone formation, nucleotide synthesis

20. Which organ receives only oxygenated blood?

- A. Lung
- B. Liver

C. Spleen

D. Gill

21. Which one of the following mammalian cells is not capable of metabolizing glucose to carbon dioxide aerobically?

A. Liver cells

B. Red blood cells

C. White blood cells

D. Un-striated muscle cells

22. Uric acid is the chief nitrogenous wasters in

A. frog

B. birds

C. fishes

D. man

23. The functional unit of contractile system in striated muscle is

A. myofibril

B. cross bridges

C. Z band

D. Sarcomere

24. Consider a drug that inhibits the acetylcholine receptor in the neuromuscular junction. Which of the following would be a likely side effect of this drug?

A. Depolarization of the muscle cell membrane

B. Increased muscular contraction strength

C. Muscle relaxation

D. Increased muscle response time

25. Major cytoskeletal protein in microvilli, filopodia, contractile rings, and growth cones

A. Actin

B. Tubulin

C. Troponin

D. Calmodulin

E. Fibronectin

26. What is the name of the iron-containing protein that gives red blood vessel their color?

A. Hemocyanin

B. Pyrite

C. Hemoglobin

D. Myoglobin

27. Cornea transplant in humans is almost never rejected. This is because

A. it is composed of enucleated cells

B. it is a non living layer

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- C. it has no blood supply  
D. its cells are least penetrable by bacteria
28. During the propagation of a nerve impulse, the action potential results from the movement of  
A.  $K^+$  ions from intracellular fluid to extracellular fluid  
B.  $K^+$  ions from extracellular fluid to intracellular fluid  
C.  $Na^+$  ions from extracellular fluid to intracellular fluid  
D.  $Na^+$  ions from intracellular fluid to extracellular fluid
29. Alzheimer's disease in human is associated with the deficiency of  
A. Dopamine  
B. Glutamic acid  
C. Acetylcholine  
D. Gamma aminobutyric acid
30. The cells responsible for color vision in vertebrates are called  
A. Rod cells  
B. Cone cells  
C. Bipolar cells  
D. Cupula cells  
E. Ampullae
31. During depolarization  
A.  $Na^+$  moves out of the neuron  
B.  $K^+$  moves into the neuron  
C. Organic ions move out of the neuron  
D. All of the above  
E. None of the above
32. Which of the following statements about prostaglandins is true?  
A. They are one of the types of target cells  
B. They are produced by endocrine glands.  
C. They travel throughout the body by circulating in the blood.  
D. All of the above are true.  
E. None of the above is true.
33. Type I diabetes mellitus is caused by a deficiency of  
A. exercise  
B. glucagon  
C. glucose  
D. glycol  
E. insulin

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科目： 普通生物學(C)

題號：316

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34. Nerve impulses are normally carried toward a neuron cell body by the neuron's

- A. Synaptic cleft
- B. Axon
- C. Hormones
- D. Dendrites

35. In sensory neurons, stimuli are received by the

- A. Axons
- B. Dendrites
- C. Cell body
- D. Myelin

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