※ 以下題目請作答於試卷內之「選擇題作答區」

I. 選擇題 (每題 3 分，某些題目可能有一個以上的答案) (18%)

1. A drug that interferes with microtubule assembly is likely to disrupt
   A) transcription C) mitosis E) translation
   B) DNA replication D) meiosis

2. If the coding strand of a gene has a sequence of 5'-GCGTAA-3', what would be the corresponding sequence in the transcribed RNA from 5' to 3'?
   A) TTACGC C) GCGUAA E) GCG
   B) UUACGC D) GCGTAA

3. Genetic drift resulting from a disaster that drastically reduces population size is called
   A) natural selection C) nonrandom mating E) founder effect
   B) inbreeding D) bottleneck effect

4. Which of the following techniques can be used to monitor global gene expression of a genome?
   A) NMR C) PCR E) Northern blot
   B) Southern blot D) DNA microarray

5. Red-green color blindness is a sex-linked recessive trait. From a marriage between a woman heterozygous for this color blindness gene and a normal vision man, what is the prediction of color vision for their children?
   A) half of the boys are color blind
   B) all the boys are normal vision
   C) half of the girls are color blind
   D) half of the girls are heterozygous carrier
   E) all the girls are normal vision

6. Which of the following classification is able to cover all species:
   A) Bacteria and Archaea D) Protitista and Fungi
   B) Prokaryote and Eukaryote E) Bacteria, Plantae, and Animalia
   C) Plantae and Animalia

II. 單選題 (Select the one that is best in each case) (每題 2 分) (30%)

7. When conditions cause the hemoglobin-oxygen dissociation curve to shift to the right, there is greater _____.
   A) unloading of carbon dioxide to the tissues
   B) unloading of oxygen in the lungs
   C) unloading of oxygen to the tissues
   D) pH produced by the respiring tissues

8. Suppose that all the calcium could be removed from the extracellular fluid surrounding a neuron. Such removal would inhibit the ability of a neuron to
   A) produce action potentials. C) produce synaptic potentials
   B) release neurotransmitter. D) degrade neurotransmitters.

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9. If, during protein starvation, the osmotic pressure on the venous side of capillary beds drops below the hydrostatic pressure, then
   A) plasma proteins will escape through the endothelium of capillaries.
   B) hemoglobin will not release oxygen.
   C) fluid will tend to accumulate in tissues.
   D) the volume of blood will increase.
10. How do action potentials relay different intensities of information?
   A) by changing in amplitude relative to the strength of the stimulus
   B) by changing in conduction velocity relative to the strength of the stimulus
   C) by changing in frequency relative to the strength of the stimulus
   D) by changing in duration relative to the strength of the stimulus
   E) by changing in shape relative to the strength of the stimulus
11. Only certain organs called as the target organs respond to the presence of a specific hormone because
   A) only those organs are attached to the endocrine gland
   B) only those organ cells have the appropriate receptors
   C) only those organs allow the hormone to enter their cells
   D) they are the first organs along the hormone's circulatory path
   E) if enough time is allowed, all organs respond to the hormone
12. Which of the following is an example of sensory adaptation of receptors?
   A) going into deep sleep
   B) distinguishing between different colors
   C) ignoring the shoes on your feet
   D) ignoring a boring lecture
   E) detecting sound and light simultaneously
13. In which of the following vessels is the blood pressure lowest?
   A) arteries in the head
   B) arteries in the foot
   C) capillaries in the head
   D) veins in the head
   E) veins in the foot
14. The secretory phase of the menstrual cycle
   A) is associated with dropping levels of estrogen and progesterone.
   B) is when the endometrium begins to degenerate and menstrual flow occurs.
   C) corresponds with the luteal phase of the ovarian cycle.
   D) corresponds with the follicular phase of the ovarian cycle.
15. Two species of cuckoo doves live in a group pf islands off the coast of New Guinea. Out of 33 islands, 14 have one species, 6 have the other, 13 have neither, and none of both. What might best explain this? The two species of birds could
   A) be on different trophic levels
   B) have different niches
   C) have similar niches
   D) be detritivores
   E) be keystone predators

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16. Arrange the following stages of fertilization and early development into a proper sequence.
    I. onset of new DNA synthesis
    II. cortical reaction
    III. first cell division
    IV. acrosomal reaction; plasma membrane depolarization
    V. fusion of egg and sperm nuclei complete
    A) V, I, IV, II, III C) IV, II, V, I, III
    B) IV, II, I, V, III, D) III, V, I, IV, II
17. A freshwater fish tends to _____ water by osmosis. As a consequence, its kidneys excrete _____.
    A) gain ---- large amounts of dilute urine
    B) lose ---- small amounts of concentrated urine
    C) gain ---- large amounts of concentrated urine
    D) lose ---- large amounts of dilute urine
    E) gain ---- small amounts of concentrated urine
18. Keystone species are those species _____.
    A) whose absence would cause major disruption in an ecosystem
    B) that live primarily on or under rocks and stones
    C) that have provided key foods and medicines
    D) with the largest number of individuals in an ecosystem
    E) that none of the above applies to
19. A population grows rapidly at first and then levels off at carrying capacity if it is
    A) limited by density-independent factors.
    B) limited by density-dependent factors.
    C) An opportunistic species.
    D) limited by density-dependent or density-independent factors.
    E) Relatively unaffected by limiting factors.
20. A cat learns to come running into kitchen when it hears the electric cane opener. This is an example of
    A) habituation C) association learning E) insight learning
    B) imprinting D) optimal foraging
21. Which of the following suggests that some animals have an internal bioclock?
    A) Some animals can sense changes in the Earth's magnetic field.
    B) A crab that is moved away from the shore can still sense the tides.
    C) An animal kept in constant light stops ovulating.
    D) Many animals become active at dawn and settle down at sunset.
    E) Rats kept in constant darkness show a daily rhythm of activity.

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※ 以下題目請於試卷內之「非選擇題作答區」依序作答，並標明題號

III. 將下列事件依照先後次序排列 (10%)

1. _e_、___、___、___、___、___ (5 分)
   a. The myosin head binds to the active site on the actin.
   b. ATP is split and the myosin head cocks.
   c. The myosin head unbinds from actin.
   d. The myosin head has a power stroke, pulling the actin filament.
   e. ATP binds to a myosin head.
   f. ADP and Ⓟ are released from the myosin head

2. _e_、___、___、___、___、___ (5 分)
   a. platelets stick to exposed collagen and release chemicals.
   b. fibrin is formed.
   c. prothrombin is converted into thrombin.
   d. prothrombin converting factor is formed.
   e. damage to the endothelium of vessels.
   f. platelet plug forms.

IV. 問答題 (42%)

1. What's the fundamental property of DNA molecule that makes self-duplication of DNA possible? (7 分)
2. Define these three terms: gene, allele and locus. (9 分)
3. Describe the theory of "chemiosmosis". (8 分)
4. In a population that is in Hardy-Weinberg equilibrium, the proportion of homozygotes for a recessive allele in the population is 25%. What is the frequency of this recessive allele? (4 分)
5. What is the protein structure that locates at chromosomes and provides the attachment site to spindle microtubule? (4 分)
6. Why initiation of action potentials follows the all-or-none principle? (5 分)
7. Your 5-year-old cousin comes home from day care with chicken pox, which is caused by a virus. She gets the disease, but you don't, although you had it when you were her age. Specifically, what cells help you stay well? Briefly explain how these cells work to prevent you from showing symptoms of chicken pox. (5 分)

試題隨卷繳回