

八十六學年度輻射生物研究所系(所) \_\_\_\_\_ 組碩士班研究生入學考試

組 生物學

科號 4102 共 三 頁第 1 頁 \*請在試卷【答案卷】內作答

**Part 1: (50%)**

1. What is the "primary structure" of a protein? (2%)
2. Please define and describe the functions of lysosome, peroxisome and glycoxysome. (6%)
3. What are symport and antiport? In the intestinal epithelial cells, the transports of amino acids, glucose, calcium and protons are linked to that of sodium. Indicate the relationship between sodium and each of them. (6%)
4. Almost all of the proteins in the cells can be resolved by electrophoresis. How can it be done (method and principle)? (3%)
5. The high fidelity of DNA replication requires a "proofreading" mechanism. Please describe this mechanism. (3%)
6. True or false. (5%)
  - a. Membrane proteins are amphipathic molecules that spontaneously form bilayers.
  - b. The lipid bilayer is an one dimensional fluid.
  - c. The fluidity of a lipid bilayer is independent of its composition
  - d. The lipid bilayer of the plasma membrane is asymmetrical.
  - e. Membrane proteins are hold in the bilayer by hydrophobic interactions with lipid.
7. What are the differences of ribosome and initial methionine between prokaryotes and eukaryotes during protein synthesis? (4%)
8. Explain three different strategies of chemical signaling between cells. (6%)
9. Define extracellular matrix and connective tissue. (4%)
10. List the major types of protein that act at a DNA replication fork. (5%)
11. What is the mechanism for myosin heads to "walk" along actin filament in muscle contraction? (6%)

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**Part 2: (25%)**

1. To study biological reaction, we employ intensively spectroscopy. Please indicate the difference in measurements of the light reactions, such as photosynthesis:
  - (a). Absorption spectra
  - (b). Action spectra
  - (c). Difference spectra (6 %)
2. Please show the Nerst equation which states that at the equilibrium the difference in concentration of an ion between two compartments is balanced by the voltage difference between compartments. (4 %)
3. Please show the physiological effects of plant hormone auxin. (5 %)
4. Please explain briefly:
  - (a). Oxidative phosphorylation.
  - (b). Substrate-level phosphorylation
  - (c). Photophosphorylation
  - (d). Protein phosphorylation (4 %)
5. Please describe briefly the mechanism of an action potential of a neuron. (6 %)

**Part 3: (25%)**

1. Please select right answers: 12%

1. The blastodisc of a chicken egg is equivalent to the (a) zygote (b) egg nucleus (c) morula (d) blastula (e) gastrula.
2. Which of the following is a pair of structures that do not have a direct anatomical connection with each other? (a) lung and coronary artery (b) urinary bladder and urethra (c) metatarsals and phalanges (d) gallbladder and bile duct (e) epididymis and vas deferens.
3. A disease that should be of special concern to pregnant women because it often causes defects in the fetus is (a) malaria (b) poliomyelitis (c) rubella (d) typhus fever (e) tuberculosis.
4. Which of following immunoglobulin (Ig) classes are expressed in two forms: secreted and membrane-bound antibody? (a) IgA (b) IgD (c) IgE (d) IgG (e) IgM.

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5. Which of these are called primary lymphoid organs ? (a) spleen (b) thymus (c) bone marrow (d) Peyer's patches (e) tonsils

6. All of the following are true about oncogenes EXCEPT

- (a) oncogenes are related to initiation of cancer.
- (b) oncogenes never have normal functions in cells
- (c) some cancer-causing viruses can carry oncogenes.
- (d) at least some oncogenes carry codes for building protein.
- (e) oncogenes may be present in cells without transforming them to the cancerous condition.

II. Answer questions after reading story "The birth of a baby lamb, Dolly" (Rewritten from recent research reports and news magazines), 13%

Cells taken from mammary gland of a 6-year old Finn Dorset ewe (雌羊) were placed in a culture with very low nutrients. Thus starved, the cells stop dividing and switch off their active genes. Meanwhile an unfertilized egg cell is taken from a Scottish Blackface ewe. The nucleus (with its DNA) is sucked out, leaving an empty egg cell containing all the cellular machinery necessary to produce an embryo. The two cells are placed next each other, and an electric pulse causes them to fuse together like soap bubbles. A second pulse provides cells the burst of energy to start cell division. About six days later, the resulting embryo is implanted in the uterus of another Blackface ewe. After a gestation period, the pregnant Blackface ewe gives birth to a baby Finn Dorset lamb, name Dolly, that is genetically identical to the original donor after PCR analysis in using several ewe-specific microsatellites (or probes, or markers).

Questions:

1. How many ewes were involved in this recent study?
2. What kind of donor cells and recipient cells were used in this study?
3. (3.1). At which stages (Go, G1, S, G2 or Mitosis), donor cells were used in cell fusion study ? (3.2). What possible reason(s) researchers prefer to use donor cells at specific stage(s)? (3.3). Which procedure was used to allow these cells to reach these stage(s) ?
4. Is all of the genetic material in baby lamb, Dolly (her name), identical to her original donor according to the report? Why ?
5. Do you think it is possible to rescue a precious bisexual animal population from only female (all males died by accident) or male (all females died by accident) animals after reading this research story ?