

考 試 科 目	細胞與分子生物學	所 別	8151 神經科學研究所	考 試 時 間	3 月 7 日 (日) 第 3 節
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一、選擇題 (每題 2 分) 本科目之選擇題請在答案卡上作答

01. A mutation in one gene that counteracts the effects of a mutation in another gene is known as a (a) temperature-sensitive mutation. (b) recessive mutation. (c) conditional mutation. (d) suppressor mutation.
02. A DNA sequencing reaction contains which of the following? (a) dideoxynucleoside triphosphates. (b) deoxynucleoside triphosphates. (c) DNA polymerase. (d) b and c. (e) all of the above.
03. In RNA interference studies, the double-stranded RNA. (a) disrupts the target DNA sequence. (b) results in the destruction of the target mRNA. (c) destroys the target protein. (d) all of the above.
04. DNA that is transcriptionally active (a) is more susceptible to DNase I digestion. (b) is tightly packed into a solenoid arrangement. (c) contains unacetylated histones. (d) is more condensed than nontranscribed DNA.
05. All the following statements about heterochromatin except (a) It is a dark-staining area of a chromosome. (b) It is usually transcriptionally active. (c) It is often simple sequence DNA. (d) It is a region of condensed chromatin.
06. Which of the following is not a step in the run on transcription assay? (a) isolation of nuclei. (b) incubation with ³²P-labeled ribonucleoside triphosphate. (c) exposure of cells to a labeled RNA precursor. (d) hybridization of labeled RNA to cloned cDNAs.
07. Indicate the order in which the following steps occur in the production of a mature mRNA. (a) initiation of transcription, splicing, addition of 5' cap, addition of poly(A) tail, transport to cytoplasm. (b) initiation of transcription, addition of 5' cap, splicing, addition of poly(A) tail, transport to cytoplasm. (c) initiation of transcription, addition of poly(A) tail, addition of 5' cap, splicing, transport to cytoplasm. (d) initiation of transcription, addition of 5' cap, addition of poly(A) tail, splicing, transport to cytoplasm.
08. The fluorescent properties of dyes such as fura-2 can provide information on the (a) location of specific proteins. (b) concentration of Ca²⁺ ions in specific regions of the cell. (c) the amount of DNA in a cell. (d) volume of a cell.
09. Glycolipids and glycoproteins are especially abundant in the (a) nucleus. (b) mitochondrial inner membrane. (c) cytosol. (d) plasma membrane.
10. Which of the following modification marks a protein for degradation in proteasomes? (a)

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- phosphorylation (b) ubiquitinylation (c) acetylation (d) glycosylation (e) all of the above
- Which of the following organs is an ectodermal derivative? (a) blood (b) hair (c) heart (d) liver (e) skull
 - Which of the following lists the events of skeletal muscle development in the correct order? (a) differentiation, proliferation and/or migration, determination. (b) determination, differentiation, proliferation and/or migration. (c) proliferation and/or migration, determination, differentiation. (d) determination, proliferation and/or migration, differentiation. (e) differentiation, determination, proliferation and/or migration.
 - Which of the following are pro-apoptotic proteins? (a) Bad (b) Bax (c) Bcl-2 (d) a and b (e) a and c
 - These cells synthesize most of the proteins and mRNA molecules necessary for the early stages of embryogenesis. (a) oocytes. (b) nurse cells and follicle cells. (c) stem cells. (d) germ cells.
 - In a human brain, the number of glial cells is (a) about 1/10 the number of neurons. (b) about the same as the number of neurons. (c) about 10 times the number of neurons. (d) about 100–200 times the number of neurons.
 - The resting potential of a typical neuron is (a) -60 mV (b) 0 mV (c) 20 mV (d) 50 mV
 - During an action potential, which happens first? (a) opening of voltage-gated Na⁺ channels. (b) closing of voltage-gated Na⁺ channels. (c) opening of voltage-gated K⁺ channels. (d) closing of voltage gated K⁺ channels.
 - Repolarization during the refractory period is largely due to (a) opening of non-voltage-gated K⁺ channels. (b) opening of voltage-gated K⁺ channels. (c) opening of voltage gated Na⁺ channels. (d) the action of the Na⁺/K⁺ pump.
 - Which of the following is characteristic of malignant tumors? (a) localized to tissue of origin (b) metastatic (c) well differentiated (d) b and c (e) all of the above
 - Which of the following promotes angiogenesis? (a) EGF (b) PDGF (c) TGF (d) VEGF (e) all of the above
 - All the following statement(s) about cholera toxin are true except (a) It chemically modifies the G_{as} protein. (b) It is a G protein-coupled receptor. (c) It prevents hydrolysis of bound GTP to GDP. (d) It leads to continuous activation of adenylyl cyclase.

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22. After a meal, when blood glucose rises, circulating insulin binds to insulin receptors on various cell types and reduces blood glucose levels by (a) fusion of intracellular vesicles containing GLUT4 glucose transporters with the plasma membrane. (b) stimulation of the conversion of glucose to glycogen. (c) inhibition of glucose synthesis from smaller molecules. (d) all of the above.
23. Binding of hormone to a receptor tyrosine kinase causes all of the following except (a) dimerization of the receptor. (b) autophosphorylation of the receptor. (c) activation of Ras through an interaction with GRB2 and Sos. (d) hydrolysis of GTP bound to Ras.
24. Which of the following are enzyme pairs that catalyze opposite reactions? (a) MEK and MAP kinase. (b) NF- κ B and I- κ B. (c) PI-3 kinase and PTEN phosphatase. (d) JAK kinases and STATs. (e) none of the above.
25. Which of the following signaling pathways can be activated by cytokines? (a) JAK/STAT (b) PI-3 kinase (c) Ras/MAP kinase (d) a and b (e) all of the above

二、問答題 (每題 10 分)

01. Please describe how the electrophoretic mobility shift assay (EMSA) and the DNase I footprinting techniques are used to identify DNA-protein interactions.
02. Please explain the role of mitochondria in apoptosis.
03. Action potentials are propagated in only one direction, down the axon. Please explain how the absolute refractory period of the voltage-gated Na^+ channels and the brief hyperpolarization resulting from K^+ efflux produces this outcome?
04. Please summarize the steps in the cycling of GTPase switch proteins from active to inactive states.
05. Please describe the mechanism by which Ras is cycled from its active to inactive form.