

試題請務必連同試卷交回。

單選題 (每題 2 分)

SIMPLE-CHOICE QUESTIONS

Identify the correct statement. Gain two points for each correct answer.

1. If you performed indirect immunofluorescence with an anti gamma-tubulin antibody, where would you see fluorescence?
 - (A) Along the length of the microtubules.
 - (B) Along the length of the microtubules AND at the two MTOCs.
 - (C) At the two MTOCs (microtubule-organizing centers).
 - (D) At the axon terminal.

2. SRP receptors are located in the:
 - (A) plasma membrane.
 - (B) cytoplasm.
 - (C) nucleus.
 - (D) endoplasmic reticulum.

3. Proteins targeted to the mitochondria are made on:
 - (A) ribosomes bound to the mitochondria.
 - (B) ribosomes bound to the ER.
 - (C) ribosomes bound to the golgi.
 - (D) ribosomes free in the cytoplasm.

4. The phosphocholine portion of phosphatidylcholine is:
 - (A) the amphipathic part of the molecule.
 - (B) the hydrophobic part of the molecule.
 - (C) the hydrophilic part of the molecule.
 - (D) the micelle.

5. Growing microtubule ends are typically associated with:
 - (A) a GTP cap.
 - (B) a GDP cap.
 - (C) α -tubulin.
 - (D) phalloidin.

6. A common feature of mitochondrial, chloroplast, peroxisome and nuclear proteins is:
 - (A) They all have N-terminal signal sequences.
 - (B) They all translocate to their target tissue as folded proteins.
 - (C) They all are translated completely in the cytoplasm.
 - (D) Their signal sequences are removed.

7. A characteristic of nuclear localization sequences is:
 - (A) hydrophobic amino acid residues.
 - (B) basic amino acid residues.
 - (C) acidic amino acid residues.
 - (D) N-terminal location.

(背面仍有題目, 請繼續作答)

8. Microfilaments are involved in all EXCEPT:
- (A) microvilli formation.
 - (B) muscle contraction.
 - (C) mitosis.
 - (D) cytokinesis.
9. Desmosomes and hemidesmosomes:
- (A) Both stabilize cell structure through linkages to intermediate filaments.
 - (B) Both involve the use of membrane-spanning cadherins.
 - (C) Differ with respect to the types of cells that they "spot weld" together.
 - (D) Both are capable of associating with extracellular matrix components.
10. cAMP:
- (A) Is generated by adenylyl cyclase, which links causes two molecules of ATP to react with each other in a "head to tail" arrangement, where each 5' phosphate is linked to the 3'hydroxyl of the other molecule.
 - (B) Stimulates the A-kinase (cAMP-dependent protein kinase) by binding to and activating the catalytic subunits of the kinase.
 - (C) Is converted to AMP by phosphodiesterase.
 - (D) Production is reduced or eliminated when GTP binds to G α .
11. Which of the following does NOT contribute to the entry of cells into G₀ phase?
- (A) TGF- β
 - (B) MPF
 - (C) Contact inhibition
 - (D) Nutrient deprivation
12. Which of the following is NOT true of viruses?
- (A) They depend upon the host cell for their energy and use the host's translational machinery.
 - (B) They reproduce by assembly of subcomponents.
 - (C) They often consist of a protein coat surrounding a nucleus and cytoplasm.
 - (D) Some have RNA as their genetic material.
13. When you break down nucleic acids, you would get:
- (A) fatty acids and glycerol.
 - (B) six-carbon sugars.
 - (C) amino acids.
 - (D) purines and 5-carbon sugars.
14. Hyaluronan, cellulose and chitin are all:
- (A) extracellular polysaccharides.
 - (B) forms of fat.
 - (C) cytoskeletal proteins.
 - (D) polysaccharides used for intracellular nutrient storage.
15. The intracellular levels of potassium in a living cell would best be determined by:
- (A) microelectrodes.
 - (B) microinjection.
 - (C) differential centrifugation.
 - (D) HPLC.

編號：G 91

系所：生物科技研究所甲組，2組

科目：細胞生物學

16. In a neurobiology class, you might use the sciatic nerve from a freshly killed frog that you maintain in a supportive medium to study nerve impulses. The nerve would be considered a(n):
- (B) primary culture.
 - (C) cell line.
 - (D) explant.
 - (E) secondary culture.
17. Scanning electron microscopy is for:
- (A) visualizing cell components that bind antibody-linked dyes.
 - (B) 3-dimensional shape of a protein deduced from the scatter of short-wavelength radiation as it passes through the protein when it is in a regular array.
 - (C) 2-dimensional images enhanced by removal of blurry background.
 - (D) 3-dimensional images from electrons bouncing off the surface.
18. What would lake water be considered in relation to the osmotic condition inside the cell if you put red blood cells in the Great Salt Lake?
- (A) hypertonic
 - (B) hypotonic
 - (C) isotonic
 - (D) none of the above
19. LDL binds to its receptor. Which of the following statements about this is true?
- (A) After binding a LDL, the LDL receptors are immobilized in excedrin-coated pits.
 - (B) Receptors are degraded as a result of endocytosis.
 - (C) Cholesterol is released from the LDL inside the endosome, due to the action of enzymes found there.
 - (D) The receptor directly translocates LDL into the cytoplasm by a flip-flop mechanism.
20. A cell brings in sodium with the gradient, and at the same time brings in glucose against the gradient, using the same carrier protein.
- (A) This process is called symport.
 - (B) This is an example of active transport.
 - (C) Since no ATP is used, it is facilitated diffusion.
 - (D) Both (A) & (B) are correct.
21. Choose a FALSE statement. A recombinant fusion protein could potentially be used to:
- (A) determine the subcellular localization of the protein you are studying.
 - (B) isolate the gene that encodes your protein of interest (i.e. the protein you have included in your fusion).
 - (C) rapidly purify large quantities of the protein from a host cell (e.g. from bacteria).
 - (D) identify mammalian proteins that interact with the mammalian protein that you are studying.
22. Concerning the promoter regions of genes:
- (A) TATA boxes can occur either upstream or downstream of coding regions.
 - (B) TATA boxes are recognized and bound directly by RNA polymerase II.
 - (C) Phosphorylation of RNA polymerase II by the protein kinase TFIIF negatively regulates transcription.
 - (D) Binding of TFIID to the promoter enhances the rate of RNA polymerase II binding, and therefore enhances transcription.

(背面仍有題目,請繼續作答)

23. An ion channel that opens when the membrane is depolarized would be considered a:
- (B) ligand-gated ion channel.
 - (C) voltage-gated ion channel.
 - (D) ion-gated voltage channel.
 - (E) ligand-gated pumping channel.
24. Concerning enhancer-binding proteins:
- (A) Sequence-specific DNA binding requires an appropriate match of H-bond donors and acceptors presented by the nitrogenous bases of DNA and the R-groups of amino acids.
 - (B) Sequence-specific interactions between proteins and DNA always occur at the major groove.
 - (C) Initial low-affinity binding of protein to DNA is driven by Van der Waal's interactions between peptide bonds and the phosphodiester backbone of DNA.
 - (D) Beta sheets are incapable of inserting into the major groove of DNA and therefore, interaction with DNA is always via alpha-helices.
25. Regulation of gene expression:
- (A) occurs (in part) through regulated DNA replication.
 - (B) occurs (in part) through regulated RNA processing.
 - (C) doesn't occur in different cell types of the same organism.
 - (D) occurs only in the nucleus.

簡答題 (每題 5 分)

SHORT ESSAY

1. The cells have machinery to label and destroy certain proteins. Briefly explain why it is advantageous for cells to be able to destroy certain proteins.
2. What is one difference between a primary culture and a cell line?
3. There are separate Na⁺ and K⁺ channels, yet there is a single Na⁺/K⁺ pump. What is (are) the difference(s) between channels and pumps?
4. Dynamin is a GTPase required for the formation of endocytotic vesicles. Cells expressing a "mutated" form of dynamin that is unable to bind and hydrolyze GTP exhibit severe defects in the internalization of both transferrin (a marker for receptor-mediated endocytosis) and lucifer yellow (a marker for "fluid-phase" endocytosis). Why is endocytosis of both lucifer yellow and transferrin affected?
5. What is one difference between signal transduction via steroids and other forms of signal transduction?

6. Why are additions or deletions of nucleotides often more damaging to the protein produced than simply changing a nucleotide?
7. What is the difference between autocrine and paracrine messengers?
8. A single gene leads to a single type of protein. Disprove this statement with evidence from prokaryotic and eukaryotic cells.
9. Many transcription factors shuttle into and out of the nucleus. One such factor that has been widely studied is Smad3. In unstimulated fibroblast cells, Smad3 is present exclusively in the cytosol. After binding of TGF- β to cell surface TGF- β receptors, the receptor protein, a serine kinase, phosphorylates Smad3 on 3 serines near its C-terminus. Smad3 then moves into the nucleus, where it activates expression of a set of genes. After TGF- β is removed from the cell, the phosphate residues on the serines of nuclear Smad3 are hydrolyzed by a nucleus-localized phosphatase, and the (non-phosphorylated) Smad3 moves immediately (i.e. within 5 min.) from the nucleus back into the cytosol.

Assume you can add segments of amino acids or even sequences encoding entire proteins to the N-terminus of Smad3 and still have a fully functional Smad3 protein. How could you monitor experimentally the movement of Smad3 into and out of the nucleus in response to TGF- β addition or removal in living cells?

10. Five proteins are represented schematically below. The boxes represent hydrophobic segments and the arrows indicate sites for cleavage of the signal sequences. Predict the localization of each soluble protein and the topology of the membrane integral protein. Be sure to clearly indicate the N- and C-termini relative to the cytosol and ER lumen for the membrane proteins.

