


注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 108 學年度碩士班考試入學試題

系所班組別：生命科學院 丁組

考試科目(代碼)：細胞生物學(0705)

— 作答注意事項 —

1. 請核對答案卷(卡)上之准考證號、科目名稱是否正確。
2. 作答中如有發現試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清(含未依範例畫記)致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

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系所班組別：生命科學院甲組、丁組

考試科目（代碼）：細胞生物學(0405、0705)

共 5 頁，第 1 頁 *請在【答案卷】作答

I. 單選題 (每題 2 分，共 18 分)

1. Of the following molecules, which would you predict diffuses most readily across membranes?
 - (A) water
 - (B) glucose
 - (C) oxygen
 - (D) serine
 - (E) hydrogen ions
2. The composition of lipids in the outer and inner monolayers of cell membrane lipid bilayers is
 - (A) asymmetrical; i.e., different in each monolayer.
 - (B) identical in each monolayer.
 - (C) twice as concentrated in the inner monolayer as in the outer monolayer.
 - (D) highly random for each monolayer.
 - (E) the same for all cell plasma membranes but different from the composition in mitochondrial and chloroplast membranes.
3. Which of the following lipids is found concentrated in lipid rafts in animal cell plasma membranes?
 - (A) cholesterol
 - (B) phosphatidylcholine
 - (C) phosphatidylserine
 - (D) phosphatidylethanolamine
 - (E) phosphatidylinositol
4. Which of the following would you expect to find predominating in the plasma membrane of a unicellular eukaryotic organism thriving in glacier ice?
 - (A) 20 carbon long saturated fatty acids.
 - (B) 18 carbon long saturated fatty acids.
 - (C) 20 carbon long fatty acids with 1 double bond.
 - (D) 18 carbon long fatty acids with 1 double bond.
 - (E) 16 carbon long fatty acids with 3 double bonds

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共 5 頁，第 2 頁 *請在【答案卷】作答

5. Which of the following would be the most thermodynamically unfavorable membrane lipid activity in a membrane?
- (A) lateral diffusion
 - (B) transverse diffusion
 - (C) association with a neighboring lipid
 - (D) association with cholesterol
 - (E) rotation
6. Naturally occurring unsaturated fatty acids typically
- (A) are highly branched.
 - (B) are omega-3 fatty acids.
 - (C) contain double bonds primarily in the *trans* configuration.
 - (D) contain double bonds primarily in the *cis* configuration.
 - (E) contain an odd number of carbon atoms.
7. Each of the following organelles is part of the endomembrane system *except*
- (A) the peroxisome.
 - (B) the Golgi complex.
 - (C) the smooth endoplasmic reticulum.
 - (D) the endosome.
 - (E) the rough endoplasmic reticulum.
8. Which of the following proteins requires GTP in the process of LDL receptor-mediated endocytosis?
- (A) LDL receptor
 - (B) dynamin
 - (C) AP-2 complex
 - (D) uncoating enzyme
 - (E) clathrin
9. Which of the following cellular processes may be inhibited in tumor cells?
- (A) autophagy
 - (B) N-linked glycosylation
 - (C) caveolae uptake
 - (D) LDL degradation
 - (E) catalase activity

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共 5 頁，第 3 頁 *請在【答案卷】作答

II. 複選題 (每題5分，共30分，在A-E 選項中，每答對一個選項得1分；答錯一個選項倒扣1分)

10. Which of the following techniques are frequently used in electron microscopy?

- (A) Negative staining
- (B) Electroencephalogram (EEG) recording
- (C) Metal shadowing
- (D) Electrophoresis
- (E) Immunogold labeling

11. Which of the following signaling pathways are controlled by ubiquitination and proteolytic modification of signaling proteins?

- (A) MAP kinase pathway
- (B) Wnt signaling pathway
- (C) Hedgehog signaling pathway
- (D) NF- κ B signaling pathway
- (E) Notch/Delta signaling pathway

12. The cytoskeleton is an interconnected network of

- (A) Microtubules
- (B) Microfilaments
- (C) Thick filaments
- (D) Collagen fibers
- (E) Intermediate filaments

13. N-linked glycosylation of protein occurs mainly in the endoplasmic reticulum.

What are the main functions of this post-translational modification?

- (A) Monitor protein folding and protein quality control
- (B) Protect proteins from proteolysis
- (C) Participate in cell-cell adhesion
- (D) Help rearrangement and formation of disulfide bonds
- (E) Function as antigens

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共 5 頁，第 4 頁 *請在【答案卷】作答

14. Which of the following proteins are involved in the interconversion between GTP and GDP during Ran-dependent nuclear transport?

- (A) Exportin
- (B) Importin
- (C) GTPase activating protein (GAP)
- (D) Nuclear export factor 1 (NXF-1)
- (E) Guanine nucleotide exchange factor (GEF)

15. Which of the following are main features of signal transduction?

- (A) Specificity
- (B) Amplification
- (C) Signal integration and coordination
- (D) Feedback circuits
- (E) Long distance communication

III. 問答題 (共 52 分)

1. Choose either true or false in response to the following statement question. Write your answer with **O** for True and **X** for False for each of the question.

(10 %)

- (1) Cotranslational glycosylation helps to promote proper protein folding.
- (2) A sorting signaling on the transported protein is required for fluid-phase endocytosis.
- (3) Lysosomes function in autophagy.
- (4) Peroxisome is formed by division of preexisting peroxisomes.
- (5) Membrane proteins do not have mobility.

2. Recently, consumption of *trans* fatty acids has been linked to high blood cholesterol levels and increased risk of heart disease. How the presence of *trans* fats in cell membranes affect the membrane transition temperature and the membrane fluidity? Please provide the explanation. (8%)

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共 5 頁，第 5 頁 *請在【答案卷】作答

3. According to our current understanding, animal cells are anchored to the ECM by several different kinds of protein-mediated linkages. (8 %)
 - (1) What is the full name of ECM?
 - (2) In these protein-mediated linkages, what are the main protein(s) serve as (i) structural fiber (ii) components of hydrated matrix and (iii) adhesive molecules?
4. Vasopressin (VP) is a peptide hormone that has two different GPCRs. VP receptor A (VPRA) is found in peripheral blood vessels; VP receptor B (VPRB) is found in kidney cells. VP causes peripheral blood vessels to constrict; VP stimulates water transport in kidney cells. From the info given above (ignore any additional info below or on other pages), what can you conclude about the VP receptors? (6 %)
5. How a mitochondrial protein, after being synthesized in the cytoplasm, can be targeted precisely to the mitochondrial matrix. (10%)
6. Describe method(s) that can purify endoplasmic reticulum (ER) from cells. (10%)