

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 111 學年度碩士班考試入學試題


系所班組別：生命科學院

甲組(生物與醫學科學組)

科目代碼：0405

考試科目：細胞生物學

—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. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，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)

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*請在【答案卷】作答

一、單選題 (每題 2 分，共 40 分)

1. Which of the following is the smallest structure that would most likely be visible with a standard research-grade light microscope?
(A) mitochondrion
(B) double membrane of nucleus
(C) ribosome
(D) virus
2. In the fractionation of homogenized cells using differential centrifugation, which of the following will require the greatest speed to form pellets at the bottom of the tube?
(A) nuclei
(B) mitochondria
(C) chloroplasts
(D) ribosomes
3. Why a modern transmission electron microscope (TEM) can achieve a resolution of about 0.2 nanometers, whereas a standard light microscope has a maximum resolution of about 200 nanometers?
(A) Glass lenses in light microscopes refract light, which reduces resolution.
(B) Contrast is enhanced by staining with atoms of heavy metal.
(C) Electron beams have much shorter wavelengths than visible light.
(D) The electron microscope has a much greater ratio of image size to real size.
4. Which of the following is a major difference between prokaryotic cells and eukaryotic cells?
(A) Prokaryotic cells have cell walls, while eukaryotic cells do not.
(B) Eukaryotic cells have flagella, while prokaryotic cells do not.
(C) Eukaryotic cells have membrane-bound organelles, while prokaryotic cells do not.
(D) Prokaryotic cells are generally larger than eukaryotic cells.
5. Which of the following are found in plant, animal, and bacterial cells?
(A) mitochondria
(B) ribosomes
(C) chloroplasts
(D) endoplasmic reticulum

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6. What is the function of the nuclear pore complex found in eukaryotes?
- (A) It regulates the movement of proteins and RNAs into and out of the nucleus.
 - (B) It synthesizes the proteins required to copy DNA and make mRNA.
 - (C) It synthesizes secreted proteins.
 - (D) It assembles ribosomes from raw materials that are synthesized in the nucleus.
7. The nuclear lamina is an array of intermediate filaments that line the inner side of the nuclear membrane. If a chemical treatment caused the lamina to disassemble, what would you expect to be the most likely immediate consequence?
- (A) closing of nuclear pores
 - (B) the inability of the nucleus to divide during cell division
 - (C) a loss of genetic information from chromosomes
 - (D) a change in the shape of the nucleus
8. A cell with a predominance of rough endoplasmic reticulum is most likely.
- (A) producing large quantities of proteins for secretion
 - (B) producing large quantities of proteins in the cytosol
 - (C) producing large quantities of carbohydrates to assemble an extensive cell wall matrix
 - (D) producing large quantities of carbohydrates for storage in the vacuole
9. Which structure below is independent of the endomembrane system?
- (A) nuclear envelope
 - (B) chloroplast
 - (C) Golgi apparatus
 - (D) endoplasmic reticulum
10. Which of the following organelles produces and modifies polysaccharides that will be secreted?
- (A) lysosome
 - (B) mitochondrion
 - (C) Golgi apparatus
 - (D) peroxisome

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*請在【答案卷】作答

11. Thylakoids, DNA, and ribosomes are all components found in _____.

- (A) chloroplasts
- (B) mitochondria
- (C) lysosomes
- (D) nuclei

12. The evolution of eukaryotic cells most likely involved _____.

- (A) endosymbiosis of an oxygen-using bacterium in a larger bacterial host cell-the endosymbiont evolved into chloroplasts
- (B) endosymbiosis of a photosynthetic archaeal cell in a larger bacterial host cell to escape toxic oxygen—the anaerobic archaea evolved into chloroplasts
- (C) endosymbiosis of an oxygen-using bacterium in a larger bacterial host cell-the endosymbiont evolved into mitochondria
- (D) evolution of an endomembrane system and subsequent evolution of mitochondria from a portion of the smooth endoplasmic reticulum

13. Ions can travel directly from the cytoplasm of one animal cell to the cytoplasm of an adjacent cell through _____.

- (A) plasmodesmata
- (B) tight junctions
- (C) desmosomes
- (D) gap junctions

14. Which of the following structures form cytoplasmic channels that connect adjacent plant cells through the cell walls?

- (A) desmosomes
- (B) gap junctions
- (C) plasmodesmata
- (D) tight junctions

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*請在【答案卷】作答

15. The cell walls of bacteria, fungi, and plant cells, and the extracellular matrix of animal cells are all external to the plasma membrane. Which of the following characteristics are common to all of these extracellular structures?

- (A) They must block water and small molecules to regulate the exchange of matter and energy with their environment.
- (B) They must provide a rigid structure that maintains an appropriate ratio of cell surface area to volume.
- (C) They are constructed of materials that are synthesized in the cytoplasm and then transported out of the cell for assembly.
- (D) They are composed of a mixture of lipids and nucleotides.

16. Cilia and flagella bend because of _____.

- (A) conformational changes in ATP that thrust microtubules laterally
- (B) a motor protein called radial spokes
- (C) contraction by myosin
- (D) a motor protein called dynein

17. Vinblastine, a drug that inhibits microtubule polymerization, is used to treat some forms of cancer. Cancer cells given vinblastine would be unable to _____.

- (A) form cleavage furrows during cell division
- (B) migrate by amoeboid movement
- (C) separate chromosomes during cell division
- (D) maintain the shape of the nucleus

18. Suppose a cell has the following molecules and structures: enzymes, DNA, ribosomes, plasma membrane, and mitochondria. It could be a cell from _____.

- (A) a bacterium, but not a eukaryote
- (B) an animal, but not a plant
- (C) nearly any eukaryotic organism
- (D) a plant, but not an animal

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19. Which cell would be best for studying lysosomes?

- (A) muscle cells
- (B) nerve cells
- (C) endocrine cells
- (D) phagocytic white blood cells

20. Amoebae move by crawling over a surface (cell crawling), which involves _____.

- (A) growth of actin filaments to form bulges in the plasma membrane
- (B) assembly of microtubule extensions that vesicles can follow in the direction of movement
- (C) reinforcement of the pseudopod with intermediate filaments
- (D) localized contractions driven by myosin and microtubules

二、問答題 (每題 10 分，共 60 分)

1. (a) What are lipid rafts (5%) and (b) what are the cellular processes they are involved in (5%).
2. (a) What are the three main components of the cytoskeleton? (3%) (b) what are the common functions of these three components? (2%) (c) what are the specific functions of each cytoskeletal component? (5%)
3. How proteins are sorted by (a) co-translational transport (5%) and (b) post-translational transport (5%)?
4. What are (a) “smooth” endoplasmic reticulum and “rough” endoplasmic reticulum? (5%) (b) What are their main functions in the cell (5%)?
5. (a) How proteins are transported into the nucleus? (5%) (b) how mRNA is transported out of the nucleus? (5%)
6. (a) What is G-protein coupled receptor (GPCR)? (5%) (b) Take an example to explain how signal is transduced by GPCR (5%).