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 112 學年度碩士班考試入學試題

系所班組別：生命科學暨醫學院
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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考試科目（代碼）：細胞生物學(0405)

 *請在【答案卷】作答

一、單選題 (每題 2 分，共 50 分；答案請寫在答案卷上)

1) In the fractionation of homogenized cells using centrifugation, the primary factor that determines whether a specific cellular component ends up in the supernatant or the pellet is the _____.
(A) relative solubility of the component
(B) size and weight of the component
(C) percentage of carbohydrates in the component
(D) presence or absence of lipids in the component

2) What is the reason that a modern transmission electron microscope (TEM) can resolve biological images to the sub-nanometer level?
(A) The focal length of the electron microscope is significantly longer
(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.

3) All of the following are part of a prokaryotic cell **EXCEPT**
(A) a cell wall
(B) a plasma membrane
(C) ribosomes
(D) an endoplasmic reticulum

4) Which of the following is a major difference between prokaryotic cells and eukaryotic cells?
(A) Prokaryotes have cells while eukaryotes do not
(B) Eukaryotic cells have more intracellular organelles than prokaryotes
(C) Prokaryotes are not able to carry out aerobic respiration, relying instead on anaerobic metabolism
(D) Prokaryotes are generally larger than eukaryotes

5) Which of the following is present in a prokaryotic cell?
(A) mitochondrion
(B) ribosome
(C) chloroplast
(D) endoplasmic reticulum

6) What is the function of the nuclear pore complex found in eukaryotes?
(A) It regulates the movement of proteins into and out of the nucleus
(B) It synthesizes the proteins required to copy DNA and make mRNA
(C) It selectively transports molecules out of the nucleus, but prevents all inbound molecules from entering the nucleus
(D) It assembles ribosomes from raw materials that are synthesized in the nucleus

7) A cell with a predominance of ribosomes associated with the endoplasmic reticulum is most likely
(A) primarily producing proteins for secretion
(B) primarily producing proteins in the cytosol
(C) constructing an extensive cell wall or extracellular matrix
(D) enlarging its vacuole

8) A cell with an extensive area of smooth endoplasmic reticulum is specialized to
(A) play a role in storage
(B) synthesize large quantities of lipids
(C) actively export protein molecules
(D) import and export protein molecules

9) Which structure is **NOT** part of the endomembrane system?
(A) nuclear envelope
(B) chloroplast
(C) Golgi apparatus
(D) plasma membrane

10) Which of the following produces and modifies polysaccharides that will be secreted?
(A) lysosome
(B) mitochondrion
(C) Golgi apparatus
(D) peroxisome

11) What is the most likely pathway taken by a newly synthesized protein that will be secreted by a cell?
(A) ER → Golgi → nucleus
(B) Golgi → ER → lysosome
(C) ER → Golgi → vesicles that fuse with plasma membrane
(D) ER → lysosomes → vesicles that fuse with plasma membrane

12) Which of the following about chloroplasts and mitochondria is **NOT TRUE**
(A) They have their own DNA
(B) They make most of their own proteins
(C) They have double membranes
(D) They are capable of reproducing themselves

13) The evolution of eukaryotic cells most likely involved
(A) endosymbiosis of an aerobic bacterium in a larger host cell—the endosymbiont evolved into mitochondria
(B) anaerobic archaea taking up residence inside a larger bacterial host cell to escape toxic oxygen—the anaerobic bacterium evolved into chloroplasts
(C) an endosymbiotic fungal cell evolving into the nucleus
(D) acquisition of an endomembrane system and subsequent evolution of mitochondria from a portion of the Golgi

14) Motor proteins provide for molecular motion in cells by interacting with what types of cellular structures?
(A) membrane proteins of the inner nuclear envelope
(B) free ribosomes and ribosomes attached to the ER
(C) components of the cytoskeleton
(D) cellulose fibers in the cell wall

15) Amoebae move by crawling over a surface (cell crawling), which involves
(A) growth of actin filaments to form bulges (突出) in the plasma membrane
(B) setting up microtubule extensions that vesicles can follow in the movement of cytoplasm
(C) reinforcing the pseudopod with intermediate filaments
(D) cytoplasmic streaming

16) Cilia and flagella bend because of
(A) conformational changes in ATP that thrust microtubules laterally
(B) a motor protein called radial spokes
(C) the quick inward movements of water by osmosis.
(D) a motor protein called dynein

17) 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 is a characteristic 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 polymers that are synthesized in the cytoplasm and then transported out of the cell.
(D) They are composed of a mixture of lipids and nucleotides.

18) The extracellular matrix is thought to participate in the regulation of animal cell behavior by communicating information from the outside to the inside of the cell via which of the following?
(A) gap junctions
(B) the nucleus
(C) DNA and RNA
(D) integrins

19) 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) gap junctions
(D) desmosomes

20) Where would you expect to find tight junctions?
(A) in the epithelium of an animal's intestine
(B) between the smooth endoplasmic reticulum and the rough endoplasmic reticulum
(C) between plant cells in a woody plant
(D) in the plasma membrane of prokaryotes

21). Cell membranes are asymmetrical. Which of the following statements are the most likely explanation for the membrane's asymmetrical nature?
(A) Since the cell membrane forms a border between one cell and another in tightly packed tissues such as epithelium, the membrane must be asymmetrical.
(B) Since cell membranes communicate signals from one cell to another, the cell membranes must be asymmetrical.
(C) The two sides of a cell membrane are structurally different, and different phospholipids are found in each side of the membrane.
(D) Proteins only function on the cytoplasmic side of the cell membrane, which results in the membrane's asymmetrical nature.

22).Which of the following cell types have extensive area of endoplasmic reticulum?
(A) Neurons that transmit impulse
(B) Muscle cells that contract to move bones
(C) Pancreatic acinar cells that secret large amounts of digestive enzymes
(D) Epithelial cells on the surface of the skin

23). Which of the following factor do not affect the resolution of a light microscope?
(A) wavelength of light
(B) magnification
(C) index of refraction
(D) half angle of the light that enters the objective

24). Which of the following technique is used for preparing microsomes
(A) sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE)
(B) Flow cytometry
(C) sucrose-density gradient ultracentrifugation
(D) Column chromatography

25). Correlative light-electron microscopy is a technique?
(A) with samples that labeled with gold particle-conjugated antibodies
(B) with samples that use the fluorescence microscope to first highlight the regions of interest, in which structural details can then be visualized at high resolution by electron microscope
(C) with samples that do not need to be fixed chemically
(D) with samples that do not to be cut with ultrathin sections

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二、問答題 (每題 10 分，共 50 分)

1) (a) Which types of proteins are transported by co-translational transport and post-translational transport? (5%); (b) How proteins can be transported specifically to their final destination by co-translational transport and post-translational transport? (5%)

2) Describe what (a) endocrine signaling (2%); (b) paracrine signaling (2%); (c) autocrine signaling (2%); (d) synaptic signaling (2%); (e) neuroendocrine signaling are (2%)

3) How signals are transduced through (a) G protein coupled receptor (5%); (b) receptor tyrosine kinase (5%)

4) (a) What are smooth endoplasmic reticulum (SER) and rough endoplasmic reticulum (RER) (2%); (b) what are the main functions of SER (3%); (c) What post-translational modifications occur in the rough endoplasmic reticulum? (5%)

5) (a) What are the main components of the cytoskeleton (3%); (b) What are their main functions? (7%)