

一、選擇題(每題二分,均為單選,答錯不倒扣)

1. Although the progress of cell biology has depended greatly on advances in experimental methods, the microscope is still an indispensable tool. The first person who used this instrument to discover the existence of "cellulae" in cork was
 - A. Antonie van Leeuwenhoek (1632-1723)
 - B. Robert Hook (1635-1703)
 - C. Matthias Schleiden (1804-1881)
 - D. Rudolf Virchow (1821-1902)
2. Which of the following is NOT stated in the CELL THEORY?
 - A. Cells are mobile, irritable, and are able to reproduce.
 - B. The cell is the basic unit of structure for all living organisms.
 - C. Cells arise only from preexisting cell.
 - D. All living organisms are composed of one or more cells.
3. In the making of the first cell on earth, which of the following events must have occurred?
 - A. Self replication of polynucleotides.
 - B. Polynucleotides direct the synthesis of polypeptides.
 - C. The mixture of polypeptides and self-replicating polynucleotides are enclosed within a lipid membrane.
 - D. all of the above
4. A radioactive DNA precursor is added to a bacterial culture in order to study DNA synthesis. This type of experiment is considered to be
 - A. in vivo
 - B. in vitro
5. Which of the following are prokaryotes?
 - A. viruses, bacteria
 - B. cyanobacteria (blue-green algae), bacteria
 - C. algae, yeasts
 - D. amoebae, viruses
6. There are two cell divisions in the complete process of meiosis.
 - A. Each chromosome is duplicated in the first cell division.
 - B. The X chromosome separates from the Y chromosome in the second cell division.
 - C. Sister chromatids are duplicated in the second cell division.
 - D. Chromosomal crossing-over takes place during the second cell division.
7. Antibodies are produced by
 - A. mast cells.
 - B. macrophages.
 - C. plasma cells.
 - D. red blood cells.
8. Which of the following passes through an artificial lipid bilayer most quickly?
 - A. amino acid
 - B. ion
 - C. urea
 - D. nucleotide

9. The route of protein synthesis and secretion in an exocrine cell is
- A. endoplasmic reticulum → transport vesicle. → Golgi apparatus → secretory granule
 - B. endoplasmic reticulum → transport vesicle → Golgi apparatus → secretory granule.
 - C. endoplasmic reticulum → Golgi apparatus → transport vesicle → secretory granule.
 - D. Golgi apparatus → endoplasmic reticulum → transport vesicle → secretory granule.
10. Information from various sources are integrated in the nerve cell body and transmitted to the other cells by its
- A. axon.
 - B. dendrites.
 - C. myelin sheath.
 - D. dendritic spines.
11. The membrane of a living cells is
- A. charge-free.
 - B. free permeable.
 - C. selectively permeable.
 - D. static.
12. A signaling process is initiated when a given hormone X is bound to its cell surface receptors Y. If X is replaced by specific antibodies against Y, the signaling process remains unchanged. What does this experiment suggest?
- A. Hormone X enters the cell through a specific channel.
 - B. Receptors enter into the cell to act.
 - C. Hormone X is not a requisite for the signaling process.
 - D. Antibodies have higher affinity than hormone X to receptors Y.
13. A technique that uses antigen-antibody reaction to locate subcellular structures in situ is
- A. immunoelectrophoresis.
 - B. hematoxylin and eosin staining.
 - C. radioimmunoassay.
 - D. immunocytochemical staining.
14. _____ polymerize to form microfilaments.
- A. Myosins
 - B. Globular actins
 - C. Tropomyosins
 - D. Collagens
15. The coated vesicles provide a specialized pathway for _____ of specific macromolecules.
- A. receptor-mediated exocytosis
 - B. receptor-mediated endocytosis
 - C. nonreceptor-mediated exocytosis
 - D. nonreceptor-mediated endocytosis
16. Glycosylation first occurs in _____ during protein synthesis.
- A. smooth endoplasmic reticulum
 - B. rough endoplasmic reticulum
 - C. Golgi apparatus
 - D. secretory vesicle

17. Action potentials are _____.

- A. all or none in nature and uniform in size
- B. triggered only in depolarized nerve fibers
- C. the voltage differences between two sites inside the cell membrane
- D. observable under microscope

18. The myelin sheath in peripheral nervous system is produced by _____.

- A. oligodendrocytes
- B. mesenchymal cells
- C. Schwann cells
- D. microglial cells

19. Which of the following statements is correct concerning a young woman at her puberty?

- A. Spermatogonia are present.
- B. Y chromosome separates from X chromosome.
- C. No haploid cells are present in the gonads.
- D. Meiosis resumes in the ovaries at this time.

20. The prime determinant in cell specialization is

- A. selective gene expression.
- B. exocytosis.
- C. mitosis.
- D. DNA amplification.

21. Until recently, cytoplasm was described as a structureless fluid in which the organelles and soluble proteins "floated" and diffused freely. However, this concept has changed due to the finding of a three-dimensional network of filamentous proteins, which are collectively known as

- A. cytoskeleton.
- B. cytosol.
- C. procollagen.
- D. reticular fibers.

22. That DNAs are more favorable than RNAs for preserving hereditary information is because

- A. RNAs come in and out of the nucleus; thus they run the risk of losing genetic information.
- B. DNAs can direct the synthesis of RNAs but not vice versa.
- C. The double-stranded structure of DNA allows more stable storage of genetic information and permits the operation of repair mechanism.
- D. RNAs aggregate to form nucleolus which would disappear during cell division.

23. The best method for the separation of organelles is

- A. osmotic shock.
- B. ultrasonic vibration.
- C. chromatography.
- D. differential centrifugation.

24. Which of the following is found only in oögenesis?

- A. lampbrush chromosome
- B. gluconeogenesis
- C. translation
- D. transamination

- _____ 25. Concerning a stem cell, which is INCORRECT?
- A. Its proliferation rate cannot be regulated.
 - B. It can divide endlessly.
 - C. It is not itself terminally differentiated.
 - D. Each of its daughter cell can either remain as a stem cell or differentiate to a specialized cell type.
- _____ 26. Concerning the regulation of gene expression in development, which of the following statements is CORRECT?
- A. The mRNA common to all tissues probably code for "housekeeping" proteins.
 - B. Differentiated adult tissues appear to have more functional genes than undifferentiated tissues.
 - C. Genes that are actively transcribed in the adult tissues are also turned on at the embryogenesis.
 - D. Embryonic mRNAs are transcribed in as early as the cleavage stage.
- _____ 27. To trace the route of protein synthesis and secretion within cells, which method would you choose?
- A. SDS polyacrylamide gel electrophoresis
 - B. radioimmunoassay
 - C. autoradiography
 - D. immunocytochemical staining
- _____ 28. Which of the following is the marker enzyme of lysosome?
- A. peroxidase
 - B. galactosyl transferase
 - C. acid phosphatase
 - D. lactase
- _____ 29. In human body, different target cells respond differently to testosterone (a male hormone) to produce different proteins. A syndrome with a single gene defect results in all target cells failing to respond to testosterone. Which of the following conclusions is INCORRECT?
- A. The activated receptor regulates different genes in each cell type.
 - B. The receptors are the same but the genes activated by them are different.
 - C. Different types of cells have different receptors for the same hormone.
 - D. The affected gene is responsible for the proper function of the receptors.
- _____ 30. Membrane proteins are responsible for most of the membrane functions, but they cannot serve as _____.
- A. specific receptors
 - B. hormones
 - C. enzymes
 - D. ion channels
- _____ 31. Which of the following statements concerning $\text{Na}^+\text{-K}^+$ pump is INCORRECT?
- A. It generates K^+ and Na^+ concentration gradients in opposite direction.
 - B. It actively pumps Na^+ in and K^+ out of the cells.
 - C. It is crucial for generating and maintaining membrane potential.
 - D. It needs biological energy.
- _____ 32. Which of the following pairs most comply with the concept of homeostatic regulation?
- A. nervous system and cardiovascular system
 - B. digestive system and cardiovascular system
 - C. digestive system and urinary system
 - D. nervous system and endocrine system

33. The reversible covalent modification of proteins regulates a large number of cellular processes. The following are some examples EXCEPT
- A. phosphorylation-dephosphorylation.
 - B. polymerization-depolymerization.
 - C. methylation-demethylation.
 - D. acetylation-deacetylation.
34. Which of the following statements concerning nucleolus is INCORRECT?
- A. The nucleolus is the location for the formation and accumulation of ribosomal precursors.
 - B. The nucleolus is the place where genes encoding ribosomal RNA reside.
 - C. The nucleolus is a distinctive organelle within which heterogeneous nucleic acids are synthesized.
 - D. The nucleolus contains DNA-dependent RNA polymerase capable of synthesis of RNA.
35. The enzymes that mediate the reaction of the tricarboxylic acid cycle are associated with_____.
- A. mitochondria
 - B. lysosomes
 - C. microsomes
 - D. Golgi apparatus
36. DNA is present in three areas in the nucleus: euchromatin, heterochromatin and interchromatinic matrix, each representing different degrees of condensation of the nucleosome fiber and hence different degrees of DNA replicative activity. Heterochromatin is usually located near the nuclear envelope and interchromatinic matrix is the well diffused chromatin located in the nucleoplasm. If [³H]-thymidine is used to label the cells, the appearance of radioactivity in these nuclear fraction is expected to follow the order of (i.e. the fraction labeled earlier)
- A. heterochromatin, euchromatin, interchromatinic matrix.
 - B. euchromatin, interchromatinic matrix, heterochromatin.
 - C. interchromatinic matrix, euchromatin, heterochromatin.
 - D. euchromatin, heterochromatin, interchromatinic matrix.
37. Which of the following types of microscope CANNOT be used to observe living organisms?
- A. electron microscope
 - B. dark-field microscope
 - C. phase contrast microscope
 - D. fluorescent microscope
38. In each somatic cell of a particular animal species, there are 46 postmitotic chromosomes. Which of the following cells has 46 chromosomes?
- A. first polar body
 - B. sperm
 - C. zygote
 - D. mature egg
39. Often time when people say "tumor", we immediately associate it with "cancer". Indeed, one of the characteristics of a cancer cell is its uncontrollable proliferation. Aiming at this feature, scientists have been using followings for cancer therapy EXCEPT
- A. Colchicine, which causes the disappearance of mitotic spindle.
 - B. Methotrexate, which inhibits dTMP synthetase, a key enzyme for dTTP synthesis.
 - C. Thymic hormones, which modulate the immune response of the host.
 - D. X-ray, which also destroy bone marrow cells.

40. One important feature of cancer cells is "metastasis", transference of tumor cells from ONE PART of the body to another. It involves

- A. cell junction.
- B. extracellular matrix.
- C. cytoskeleton.
- D. all of the above

二簡答題

(4%) 41. Describe briefly the structure and properties of unit membrane. Illustrate with a simple figure.

(4%) 42. Nerve cells seldom divide again once a baby is born, which is why damages to the brain is usually irrevocable. What are the morphological properties that yield the nerve tissue unsuitable for proliferation.

(6%) 43. Indicate four stages of somatic cell cycle in order and describe the major events occurring during each stage.

44. A cell biologist using human somatic cells has isolated some mutant clones in the laboratory. All the mutant clones need some nutrient E for normal proliferation. The intermediate metabolites leading to the synthesis of E are known and are used to test if they can support the growth of the mutant clones:

mutant clone	gene product				
	A	B	C	D	E
1	-	-	-	+	+
2	+	+	-	+	+
3	-	-	-	-	+
4	-	+	+	+	+
5	-	+	-	+	+

+ means growth
- means no growth

(2%) 44a. From the above experimental data, decide which of the following is the CORRECT anabolic pathway?

- A. A → B → C → D → E
- B. A → C → D → E
 ↑
 B
- C. A → B → D → E
 ↑
 C
- D. B → A → D → E
 ↑
 C

(4%) 44b. Indicate the defect step(s) of each mutant clone.