

一、Discuss how ions and membrane features affect membrane potential of a neuron. (20%)

二、Sketch a typical animal cell containing all the major organelles and indicate how a secretory protein is synthesized and released. (20%)

三、以下每一小題一分，共六十分。

1. For each pair of structural elements, indicate with an A if the first element is a constituent part of the second, with a B if the second element is a constituent part of the first, and with an N if they are separate structures with no particular relationship to each other.

- A. Cell wall; extracellular matrix
- B. Chloroplast; granum
- C. Cytoplasm; cytoskeleton
- D. Golgi complex; nucleus
- E. Lipid bilayer; plasma membrane
- F. Mitochondrion; crista
- G. Nucleolus; nucleus
- H. Peroxisome; thylakoid
- I. Ryanodine receptor; neuron
- J. Smooth ER; ribosome

2. For each of the following statement, indicate which one of the five general membrane functions the statement seems to illustrate.

- a, compartmentalization;
- b, localization of function,
- c, regulation of transport;
- d, detection of signals;
- e, cell-to cell communication

- A. Adjacent plant cells frequently exchange cytoplasmic components through channels called plasmodesmata.

- B. All of the acid phosphatase in a mammalian cell is found within the lysosomes.
- C. Cells of multicellular organisms carry tissue-specific glycoproteins on their outer surface that are responsible for cell-cell adhesion.
- D. Insulin does not enter a target cell, but instead binds to a specific membrane receptor on the external surface of the membrane, thereby activating the enzyme adenylate cyclase on the inner membrane surface.
- E. Membranes are composed primarily of phospholipids and hydrophobic proteins.
- F. Photosystems I and II are embedded in the thylakoid membrane of the chloroplast.
- G. The membrane of a plant root cell has an ion pump that exchanges phosphate inward for bicarbonate outward.
- H. The mitochondrial membrane is impermeable to ATP but contains an ATP-ADP carrier that couples outward ATP movement to inward ADP movement.
- I. The plasma membrane of a muscle cell is excitable and capable of conducting an action potential.
- J. When cells are disrupted and fractionated into subcellular components, the enzyme cytochrome c reductase is recovered with the endoplasmic reticulum fraction.

3. Label each of the statements below with an S if it is true of smooth ER only, with an R if it is true of rough ER only, with an RS if it is true of both, and with an N if it is true of neither.

- A. Consists of about 70% protein and 30% lipid by weight.
- B. Is studded with ribosomes on its outer surface.
- C. Is involved in the breakdown of glycogen.
- D. Is involved in the detoxification of drugs.
- E. Is the site of the synthesis of secretory proteins.
- F. Usually consists of flattened sacs.

4. Indicate whether each of the following statements is true of adhesive junctions (A), tight junction (T), gap junctions (G), and/or plasmodesmata (P). A given statement may be true of any, all, or none of these structures.

- A. Associated with filaments that confer either contractile or tensile properties.
- B. Sites of true membrane fusion are restricted to abutting ridges of adjacent membranes.

- C. Contain hexagonal particles with a central opening or core.
- D. Membranes of two adjacent cells sealed tightly together.
- E. Allow the exchange of metabolites between the cytoplasm of two adjacent cells.
- F. Found in animal cells but not in plant cells.
5. Indicate whether each of the following statement is true of the G1 phase of the cell cycle, the S phase, the G2 phase, or the M phase. A given statement may be true of any, all, or none of the phases.
- A. The amount of nuclear DNA in the cell doubles.
- B. The nuclear envelope breaks into fragments.
- C. Sister chromatids separate from each other.
- D. Cells that will never divide again are likely to be arrested in this phase.
- E. The primary cell wall of a plant cell forms.
- F. Chromosomes are present as diffuse, extended chromatin.
- G. This phase is part of interphase.
- H. Mitotic cyclin is at its lowest level.
- I. A Cdk protein is present in the cell.
- J. A cell cycle checkpoint has been identified in this phase.
6. Indicate whether each of the following statement is true of microtubules (MT), microfilaments (MF), intermediate filaments (IF), or none of these (N). More than one response may be appropriate for some statements.
- A. Involved in muscle contraction.
- B. Involved in the movement of cilia and flagella.
- C. More important for chromosome movements than for cell division.
- D. More important for cytokinesis than for chromosome movements in animal cells.
- E. Most likely to remain when cells are treated with solutions of nonionic detergents or high ionic strength.
- F. Found in bacterial cells.
- G. Differ in composition in muscle cells versus nerve cells.
- H. Can be detected by immunofluorescence microscopy.
- I. Play well-documented roles in cell movement.
- J. Assembled from protofilaments.

7. For each of the following statement, indicate whether it is true of all nerve cells (A), of some nerve cells (S), or of no nerve cells (N).
- A. The axonal endings make contact with muscle or gland cells.
  - B. An electrical potential is maintained across the axonal membrane.
  - C. The axon is surrounded by a discontinuous sheath of myelin.
  - D. The resting potential of the membrane is much closer to the equilibrium potential for potassium ions than to that for sodium ions because the sodium-potassium pump maintains a much larger transmembrane gradient for potassium than for sodium.
  - E. Excitation of the membrane results in a permanent increase in its permeability to sodium ions.
  - F. The electrical potential across the membrane of the axon can be easily measured using electrodes.
  - G. Both the sodium and potassium concentration gradients completely "collapse" every time a nerve impulse is transmitted along the axon.
  - H. Upon arrival at a synapse, a nerve impulse causes the secretion of acetylcholine into the synaptic cleft.