Koeppen: Berne and Levy Physiology, 7th Edition

Chapter 01: Principles of Cell Function

Test Bank

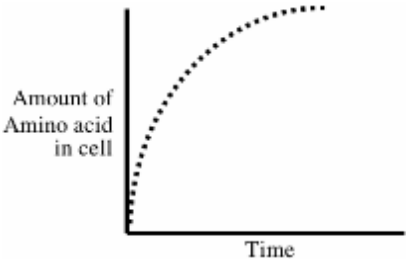
Multiple Choice

1. The subcellular structure that degrades proteins is called the:

A. Tight junction
B. Mitochondria
C. Lysosome
D. Plasma membrane
E. Ribosome

ANS: C

2. An experiment is done to measure the uptake of an amino acid into a cell. The following data are obtained:

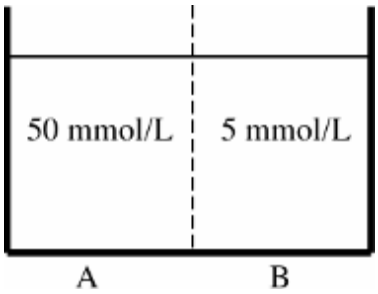


If Na^+ is removed from the extracellular bathing solution, or if a drug is added that prevents the cell from making adenosine triphosphate (ATP), the uptake of amino acid into the cell is markedly reduced. According to this information, which of the following mechanisms is probably responsible for the transport of the amino acid into the cell?

A. Passive diffusion through the lipid bilayer
B. Uniporter
C. Transport ATPase
D. Na^+ symporter
E. Na^+ antiporter

ANS: D

3. A membrane permeable by only Na^+ separates two compartments containing Na_2SO_4, shown as follows:



Electrodes are placed in both compartments, and a voltage is applied (that of compartment A is held at 0 mV). What voltage applied to compartment B would result in *no* net movement of Na^+ across the membrane separating the compartments?

A. –60 mV
B. –30 mV
C. 0 mV
D. +30 mV
E. +60 mV

ANS: E

4. The resting membrane potential of a cell is –85 mV. The intracellular and extracellular concentrations of several ions are indicated in the following table, as is the calculated Nernst equilibrium potential (E_i) for each of these ions:

Ion	Concentration Inside Cell	Concentration Outside Cell	E_i
Na^+	12 mEq/L	145 mEq/L	66 mV
K^+	150 mEq/L	4 mEq/L	–96 mV
Cl^-	30 mEq/L	105 mEq/L	–33 mV
Ca^{++}	0.0001 mmol/dL	1 mmol/dL	122 mV

The membrane has channels for Na^+, K^+, Cl^-, and Ca^{++}. The conductance of the membrane is the greatest for which ion?

A. Na^+
B. K^+
C. Cl^-
D. Ca^{++}

ANS: B

5. A cell contains the following membrane transporters:

Na^+ channel
K^+ channel
Na^+,K^+-ATPase

The resting membrane voltage of the cell is –80 mV, and the intracellular and extracellular ion concentrations are as follows:

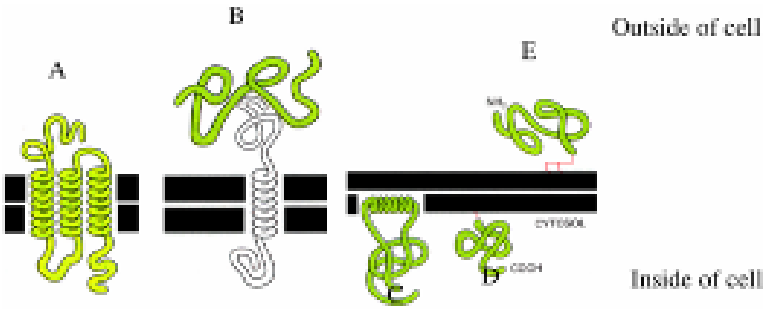
Ion	Intracellular Concentration	Extracellular Concentration
Na^+	10 mEq/L	145 mEq/L
K^+	120 mEq/L	4 mEq/L

The cell is treated with a drug to inhibit the Na^+,K^+-ATPase. What would be the effect of this drug on the following parameters?

	Intracellular [Na^+]	Intracellular [K^+]	Cell Volume	Membrane Voltage
A.	Decrease	Decrease	Decrease	Depolarize
B.	Increase	Decrease	Increase	Depolarize
C.	Increase	Increase	Increase	No change
D.	Decrease	Increase	Decrease	Hyperpolarize
E.	Increase	Increase	Increase	Hyperpolarize

ANS: B

6. Which of the labeled proteins (shaded) is attached to the membrane by a glycosylphosphatidylinositol (GPI) anchor?



ANS: E

7. A cell has channels for Na^+, K^+, and Cl^- in its plasma membrane. The resting membrane potential is –60 mV (cell interior negative). The intracellular and extracellular concentrations for these ions, as well as the calculated Nernst potentials, are listed as follows:

Ion	Intracellular Concentration	Extracellular Concentration	E_i
Na^+	14 mEq/L	140 mEq/L	60 mV
K^+	150 mEq/L	5 mEq/L	–89 mV
Cl^-	10 mEq/L	100 mEq/L	–60 mV

A drug is applied to the cell that increases the permeability of the cell by Cl^- (i.e., it opens Cl^- channels). What effect will this drug have on the net movement of Cl^- across the plasma membrane?

A. Net Cl^- movement out of the cell will be increased.
B. Net Cl^- movement into the cell will be increased.
C. There will be no change in the net movement of Cl^-.

ANS: C

8. Reducing the extracellular $[K^+]$ would be expected to have which of the following effects on the resting membrane potential and on the excitability of ventricular myocytes?

	Membrane Potential	Excitability
A.	Unchanged	Unchanged
B.	Hyperpolarized	Decreased
C.	Hyperpolarized	Increased
D.	Depolarized	Decreased
E.	Depolarized	Increased

ANS: B

9. A cell is bathed in an isotonic NaCl solution that contains 5 mmol/L of glucose. The intracellular concentration of glucose is 10 mmol/L. What is the most likely mechanism for the transport of glucose across the plasma membrane into this cell?

A. Glucose uniporter
B. Na^+-glucose symporter
C. Na^+-glucose antiporter
D. Diffusion of glucose through the lipid bilayer of the membrane

ANS: B

10. A blood sample is taken from an individual whose blood osmolality is 295 mOsm per kilogram of water. Red blood cells from this sample are then placed in the following solutions:

Solution	Osmolality (mOsm/kg H_2O)	Reflection Coefficient (σ) of Solute
1. NaCl	300	1
2. Fructose	300	0.5
3. Urea	300	0
4. $CaCl_2$	100	1
5. KCl	150	1

The red blood cells in which of these solutions will swell to the greatest degree?

A. 1
B. 2
C. 3
D. 4
E. 5

ANS: C

11. A solution that causes a cell to shrink is:

A. Isotonic
B. Hypotonic
C. Hypertonic

ANS: C

12. Osmosis is:

A. The active transport of water
B. The number of solute particles in 1 kg of water
C. The diffusion of water across cell membranes
D. The defined as the weight of a volume of a solution divided by the weight of an equivalent volume of distilled water
E. The amount of a substance relative to its molecular weight

ANS: C