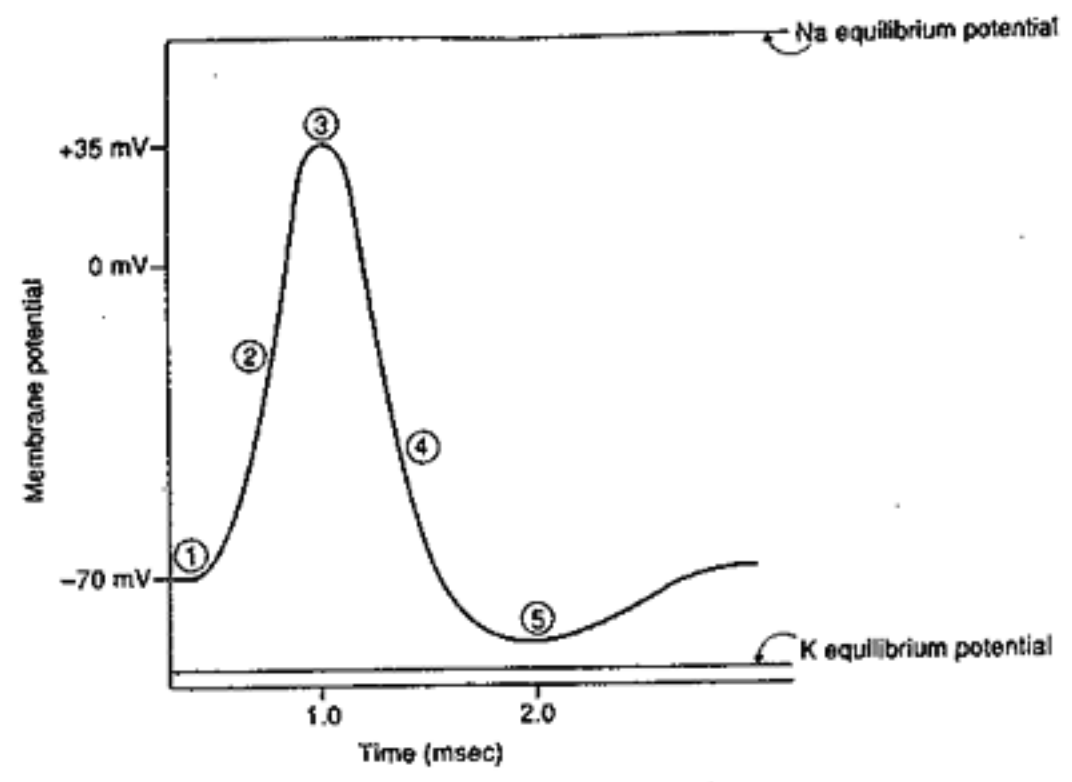


一、選擇題 (每題 2 分)

- Which of the following characteristics or components is shared by skeletal and smooth muscle?
    - Thick and thin filaments arranged in sarcomeres
    - Troponin
    - Elevation of intracellular  $[Ca^{2+}]$  for excitation-contraction coupling
    - Spontaneous depolarization of the membrane potential
    - High degree of electrical coupling between cells
  - Repeated stimulation of a skeletal muscle fiber causes tetanic contraction because the intracellular concentration of which of the following solutes increases and remains at high levels?
    - $Na^+$
    - $K^+$
    - Troponin
    - ATP
    - $Ca^{2+}$
  - A muscle cell has an intracellular  $[Na^+]$  of 14 mM and an extracellular  $[Na^+]$  of 140 mM. Assuming that  $2.3RT/F=60$  mV, what would the membrane potential be if the muscle cell membrane were permeable only to  $Na^+$ ?
    - 80 mV
    - 60 mV
    - 0 mV
    - +60 mV
    - +80 mV
- 4-6. The diagram of a nerve action potential applies to questions 4-6.

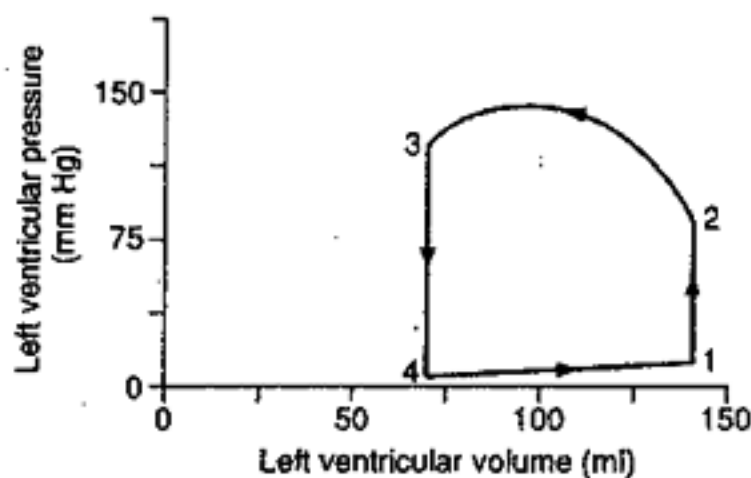


(背面仍有題目,請繼續作答)

4. At which labeled point on the action potential is the  $K^+$  closest to being at electrochemical equilibrium?
  - (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
  - (E) 5
5. What process is responsible for the change in membrane potential occurring between point 1 and point 3?
  - (A) Movement of  $Na^+$  into the cell
  - (B) Movement of  $Na^+$  out of the cell
  - (C) Movement of  $K^+$  into the cell
  - (D) Movement of  $K^+$  out of the cell
  - (E) Inhibition of the  $Na^+-K^+$  pump
6. What process is responsible for the change in membrane potential occurring between point 3 and point 4?
  - (A) Movement of  $Na^+$  into the cell
  - (B) Movement of  $Na^+$  out of the cell
  - (C) Movement of  $K^+$  into the cell
  - (D) Movement of  $K^+$  out of the cell
  - (E) Inhibition of the  $Na^+-K^+$  pump
7. Which of the following is a property of C fibers?
  - (A) Have the slowest conduction velocity of any nerve fiber type
  - (B) Have the largest diameter of any nerve fiber type
  - (C) Are afferent nerves from muscle spindles
  - (D) Are afferent nerves from Golgi tendon organs
  - (E) Are preganglionic autonomic fibers
8. All of the following are steps in photoreception in the rods EXCEPT
  - (A) Light converts 11-*cis* rhodopsin to all-*trans* rhodopsin
  - (B) *meta*-rhodopsin II activates transducin
  - (C) cyclic GMP levels decrease
  - (D) Rods depolarize
  - (E) Decreased release of neurotransmitter
9. Which adrenergic receptor produces its stimulatory effects by formation of  $IP_3$  and an increase in intracellular  $[Ca^{2+}]$ ?
  - (A)  $\alpha_1$  Receptors
  - (B)  $\beta_1$  Receptors
  - (C)  $\beta_2$  Receptors
  - (D) Muscarinic receptors
  - (E) Nicotinic receptors

10. Which of the following parts of the body has cortical motorneurons with the largest representation on primary motor cortex (area 4)?
- (A) Shoulder  
(B) Ankle  
(C) Fingers  
(D) Elbow  
(E) Knee

11-14. The diagram applies to questions 11-14.



11. On the graph showing left ventricular volume and pressure, isovolumetric contraction occurs from point
- (A) 4 → 1  
(B) 1 → 2  
(C) 2 → 3  
(D) 3 → 4
12. The aortic valve closed at point
- (A) 1  
(B) 2  
(C) 3  
(D) 4
13. The first heart sound corresponds to point
- (A) 1  
(B) 2  
(C) 3  
(D) 4
14. If the heart rate is 70 beats/min, then cardiac output from this ventricle is closest to
- (A) 3.45 L/min  
(B) 4.55 L/min  
(C) 5.25 L/min  
(D) 8.0 L/min  
(E) 9.85 L/min

15. All of the following parameters are increased during moderate exercise EXCEPT
- (A) Arteriovenous difference for  $O_2$
  - (B) Heart rate
  - (C) Cardiac output
  - (D) Pulse pressure
  - (E) TPR
16. In which vascular bed does hypoxia cause vasoconstriction?
- (A) Coronary
  - (B) Pulmonary
  - (C) Cerebral
  - (D) Muscle
  - (E) Skin
17. Residing at high altitude causes all of the following EXCEPT
- (A) Hyperventilation
  - (B) Hypoxemia
  - (C) Increased 2,3-DPG concentrations
  - (D) Shift to the left of the hemoglobin- $O_2$  dissociation curve
  - (E) Pulmonary vasoconstriction
- 18-19. A woman with a history of severe diarrhea has the following arterial blood values: pH = 7.25;  $PCO_2$  = 24 mm Hg;  $[HCO_3^-]$  = 10 mEq/L  
Venous blood samples show decreased blood  $[K^+]$  and a normal anion gap.
18. The correct diagnosis for this patient is
- (A) Metabolic acidosis
  - (B) Metabolic alkalosis
  - (C) Respiratory acidosis
  - (D) Respiratory alkalosis
  - (E) Normal acid-base status
19. Which of the following statements about this patient is correct?
- (A) She is hypoventilating.
  - (B) The decreased arterial  $[HCO_3^-]$  is a result of loss of  $HCO_3^-$  in diarrheal fluid.
  - (C) The decreased blood  $[K^+]$  is a result of exchange of intracellular  $H^+$  for extracellular  $K^+$ .
  - (D) The decreased blood  $[K^+]$  is a result of decreased circulating levels of aldosterone.
  - (E) The decreased blood  $[K^+]$  is a result of decreased circulating levels of ADH.
20. Slow waves in small intestinal smooth muscle cells are
- (A) Action potentials
  - (B) Phasic contractions
  - (C) Tonic contractions
  - (D) Oscillating resting membrane potentials
  - (E) Oscillating release of CCK

21. Micelle formation is necessary for the intestinal absorption of all of the following EXCEPT
- (A) Cholesterol
  - (B) Fatty acids
  - (C) Bile acids
  - (D) Vitamin K
  - (E) Vitamin D
22. A woman has hypocalcemia, hyper phosphatemia, and decreased urinary phosphate excretion. Injection of PTH causes an increase in urinary cyclic AMP. The most likely diagnosis is
- (A) Primary hyperparathyroidism
  - (B) Vitamin D intoxication
  - (C) Vitamin D deficiency
  - (D) Hypoparathyroidism following thyroid surgery
  - (E) Pseudohypoparathyroidism
23. The following measurements were obtained in a male patient:  
Heart rate=70 beats/min; Pulmonary vein  $[O_2]=0.24$  ml  $O_2$ /ml; Pulmonary artery  $[O_2]=0.16$  ml  $O_2$ /ml; Whole body  $O_2$  consumption=500 ml/min  
What is this patient's cardiac output?
- (A) 1.65 L/min
  - (B) 4.55 L/min
  - (C) 5.0 L/min
  - (D) 6.25 L/min
  - (E) 8.0 L/min
24. Which of the following lung volumes or capacities CANNOT be measured by spirometry?
- (A) Tidal volume
  - (B) Inspiratory reserve volume
  - (C) Expiratory reserve volume
  - (D) Inspiratory capacity
  - (E) Functional residual capacity
25. To maintain normal  $H^+$  balance, total daily excretion of  $H^+$  should equal the daily
- (A) Fixed acid production plus fixed acid ingestion
  - (B)  $HCO_3^-$  excretion
  - (C)  $HCO_3^-$  filtered load
  - (D) Titratable acid excretion
  - (E) Filtered load of  $H^+$

二、問答題 (每題 10 分)

1. 請詳細說明人體調控食慾 ( feeding behavior ) 的生理機制。
2. 請比較「呼吸性酸血症 ( respiratory acidosis )」及「代謝性酸血症 ( metabolic acidosis )」的異同點，並以生理學的觀點說明其形成原因。
3. 請提出人體既有的「消化酵素 ( digestive enzymes )」並說明其生理作用。
4. 請詳細說明人體可讓血壓維持在衡常 ( homeostasis ) 的生理調控機制。
5. 請以膀胱為例，說明神經的調控方式。