

BIO 3302
ANIMAL PHYSIOLOGY II

Midterm examination February 12 2009

80 minutes

Dr. Steve F. Perry

Section 1. Please answer all of the following true or false questions (20 marks total) by circling the letter T (true) or F (false).

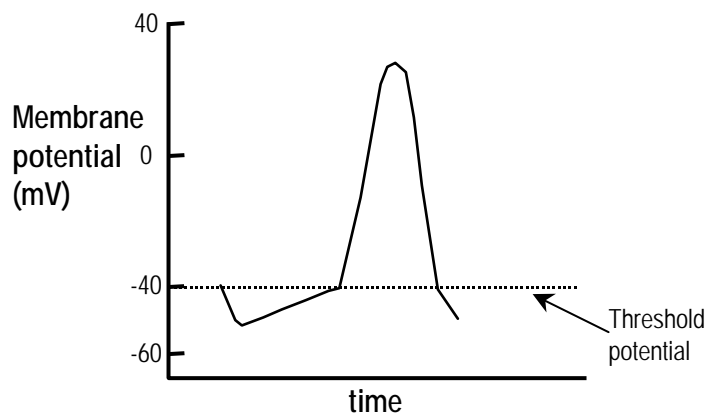
1. Cephalopod mollusks possess closed circulatory systems. **T** **F**
2. Fenestrated capillaries are found in the brain of mammals. **T** **F**
3. The velocity of blood flow within capillaries is low owing to their small diameter. **T** **F**
4. Kwashiorkor syndrome describes edema of the legs and ankles associated with nutritional deficiency of protein. **T** **F**
5. Red blood cells tend to aggregate in the center of blood vessels because turbulent flow is less likely in this region. **T** **F**
6. Veins are highly compliant blood vessels that experience large changes in elasticity with small changes in pressure. **T** **F**
7. The increase in blood viscosity in vessels less than 0.3 mm diameter is known as the Fahraeus-Lindqvist effect. **T** **F**
8. The majority of ventricular filling occurs during atrial diastole. **T** **F**
9. Cardiac Purkinje fibers enable rapid propagation of action potentials through the atrial myocardium. **T** **F**
10. In an electrocardiogram, the T-wave represents the repolarization of the ventricles. **T** **F**
11. A decrease in PO₂ of the pulmonary vasculature leads to vasodilation. **T** **F**

12. An α 1 adrenergic receptor agonist is inappropriate medication for chronic hypertension. **T F**
13. The extended refractory period during the plateau phase of the pacemaker potential is physiologically significant because it prevents temporal summation. **T F**
14. The metabolic cost of ventilation in fish is reduced owing to unidirectional water flow. **T F**
15. Despite their large volume, the avian air sacs contain less air than the lung itself. **T F**
16. An appropriate treatment for an asthma attack is administration of a β 2 adrenergic receptor agonist. **T F**
17. The velocity profile of laminar blood flow in a blood vessel is termed hyperbolic. **T F**
18. Cutaneous gas transfer contributes to the high metabolic rates of flying bats. **T F**
19. The energetic costs of ventilating water are less than breathing equal volumes of air because of the greater density of water. **T F**
20. Fish are more likely to exploit ram ventilation at higher swimming velocities. **T F**

Section 2. Fill in the blanks (15 marks)

- Systolic pressure can be detected during a routine examination by listening for vibrations in the brachial artery caused by _____ flow.
- The basis for the rapid conduction of action potential throughout the atria is the conduction of current through _____.
- The prolonged depolarization (plateau phase) of the cardiac muscle cell action potential is caused by the opening of voltage dependent _____ channels.
- The increase in _____ associated with increased venous return is known as Starling's law of the heart.

5. The slope of the cardiac pacemaker potential is lowered by the neurotransmitter _____.
6. Changes in pressure in the venous system are minimized during changes in vascular volume owing to the _____ of veins.
7. An increase in blood flow following a period of ischemia is known as _____.
8. Anticipatory increases in skeletal blood flow immediately prior to exercise are caused by increased activity of _____.
9. The main site of gas exchange in the bird lung is the _____.
10. The high efficiency of gas exchange in the bird lungs is a consequence of the _____ arrangement of blood and air flows.
11. The figure below presents the membrane potential for a cardiac muscle fibre. Where in the heart would this fibre probably be located?



12. The velocity of blood flow is _____ near the wall of blood vessels giving rise to the phenomenon of _____ when blood flows into a vessel branch.
13. _____ is responsible for converting angiotensin I to angiotensin II.

Section 3. Answer question 1 and one of the two remaining questions (5 marks each).

1. A graduate student was asked by her supervisor to determine the cardiac output of a fish. Unfortunately, the blood flow monitor normally used for such measurements was away being repaired following a slight misadventure with a tank of seawater. Undaunted by this setback, the enterprising graduate student recorded the following respiratory variables and from them calculated cardiac output:

$P_{iO_2} = 160 \text{ torr}$
 $P_{eO_2} = 100 \text{ torr}$
 $V_w = 0.5 \text{ L min}^{-1}$
 $\beta_w O_2 = 2 \mu\text{mol L}^{-1} \text{ torr}^{-1}$
 $CaO_2 = 4 \text{ mmol L}^{-1}$
 $CvO_2 = 2 \text{ mmol L}^{-1}$

What was the cardiac output that she calculated from these data? Please show your calculations and express your answer in mL min^{-1} .

- Blood enters an arteriole at a flow rate of 20 L min^{-1} and with a pressure of 50 mmHg (Torr). The arteriole provides $0.5 \text{ mmHg L}^{-1} \text{ min}$ of resistance to flow. What is the pressure exerted by blood entering a subsequent capillary bed? Within the capillary bed, the hydrostatic pressure of the interstitial fluid is 4 mmHg . Blood flowing through the capillaries exerts a colloid osmotic pressure of 20 mmHg , and chemical analysis of plasma and interstitial fluid revealed that they are of identical composition. Where might this capillary be found? Why? What is the force for fluid exchange at the arterial end of the capillary, and in which direction will net fluid movement occur? Please show your calculations.
- Discuss the physiological significance of **TONIC** sympathetic **AND** parasympathetic activities to the heart.

BONUS QUESTION (1 mark)

What is the scientific (Latin) name of the common groundhog? PS. In the spirit of socialism, the entire class will receive the bonus if a single student answers this question correctly.