NROSCI / BIOSC 1070 -- MSNBIO2070
Exam # 2
October 26, 2018

Total POINTS: 100 20% of grade in class

1) Prazosin is a selective antagonist for α_1 receptors, while Phenoxbenzamine is an antagonist for both α_1 and α_2 receptors. Neither drug crosses the blood brain barrier and acts in the central nervous system.

a) Which of the following effects on the heart are produced by the drugs (circle the correct answer; ***2 points***)?

Negative Chronotropic and Negative Inotropic

Positive Chronotropic and Positive Inotropic

Negative Chronotropic and Positive Inotropic

Positive Chronotropic and Negative Inotropic

No Inotropic or Chronotropic Effects

b) Which of the drugs, if either, produces the largest effects on the heart? Provide a justification for your answer. ***(6 points)***.

2) During an experiment on an anesthetized animal, which is artificially ventilated to maintain stable blood oxygenation, 20% of the blood volume is removed. Physiological parameters are measured at 5 minutes and 2 hours following the blood removal. Answer the following questions about the physiological changes that are determined.

a) Is heart rate higher, lower, or the same at 5 minutes after the blood removal than before the blood removal? Provide a brief justification for your answer. ***(5 points)***.

b) Blood volume is higher at 2 hours following the blood removal than at 5 minutes following the blood removal, but lower than before the blood removal. Explain the main factor causing blood volume to return towards normal at 2 hours following the blood removal, even though the animal is provided no fluid. ***(5 points)***.

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Question 2, Continued

c) Is hematocrit different at 2 hours following the blood removal different than at 5 minutes following the blood removal? Provide a brief justification for your answer. ***(3 points)***.

3) A blood sample is taken from an astronaut living on the International Space Station, and hormone levels are compared to those for the individual prior to leaving Earth Discuss the changes in the levels of the following physiological parameters after a prlonged exposure to microgravity. ***(1 point each; 4 points total).***

Atrial Natriuretic Peptide Levels:	Lower	Higher	The Same
Angiotensin II Levels:	Lower	Higher	The Same
Aldosterone Levels:	Lower	Higher	The Same
Vasopressin Levels:	Lower	Higher	The Same

4) Sheer stress along an arteriole wall and pressure on the arteriole wall elicit opposite changes in resistance of the vessel. Briefly describe the change in resistance evoked by each force, and the physiological mechanism that mediates the response ***(6 points total).***

5) NATRECOR® is a natriuretic peptide indicated for the treatment of patients with acutely decompensated heart failure. The most severe side effect of NATRECOR® is a sudden drop in blood pressure. Briefly explain the mechanism through which NATRECOR® can produce hypotension. ***(4 points total).***

6) Millions of Americans are taking drugs to lower their blood LDL-cholesterol levels. Answer the following questions regarding these drugs.

a) Why is important to maintain low blood LDL-cholesterol levels? What are the negative physiological consequences of high blood LDL-cholesterol? ***(5 points).***

b) For the past two decades, drugs called statins such as Lipitor, Mevacor, and Crestor have been prescribed to lower LDL-cholesterol levels. How do these drugs work to produce this effect? ***(5 points).***

c) The latest treatment for patients with high blood LDL-cholesterol is proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors. Briefly describe how these drugs act to reduce blood LDL-cholesterol levels in patients that are unresponsive to conventional therapies. ***(5 points).***

7) Sketch a schematic figure of a cortical nephron and label the major segments. ***(2 points)*.**

a) In each segment note the osmotic concentration (assuming an ADH level of ~3 pg/ml). ***(5 points)***.

b) Assuming a creatinine concentration of 1 mg/ml in plasma, describe the albumin/creatinine ratio at each segment of the nephron. Assue that albumin concentrations in serum is approximately 35 - 50 g/L. ***(5 points)***.

8) A new superhero was created who has unusually long loops of Henle. What special powers does this superhero have? Explain your answer. ***(5 points).***

9) The hormone aldosterone plays an important role in renal system regulation. Answer the following questions about this hormone.

a) What are the two main factors that stimulate the release of aldosterone? ***(2 points each; 4 points total).***

b) Describe the actions of aldosterone in the kidney (indicate which segment and which cells it acts on, and the responses when aldosterone binds to its receptor). **(*5 points).***

10) What is meant by the term “renal filtration fraction,” and how would you measure its value by determining the clearance of particular substances? ***(9 points).***

11) Describe the actions of three drugs that could serve as diuretics. For each drug, indicate the negative actions (side effects) that could be result from its use. ***(5 points for each drug; 15 points total).***