

Vertebrate Physiology 437 EXAM III NAME _____, **Lab Section (circle):** am pm
16 November 2006. Exam is worth 100 points. You have 75 minutes.

True or False (write 'true' or 'false'; 6 points total; 1 point each)

1. _____ Most oxygen moved via convection in the circulatory system of vertebrates is attached to a pigmented molecule such as hemoglobin.
2. _____ Pulmonary surfactant acts to reduce the compliance of alveoli in mammals.
3. _____ Oxygen is more soluble in water than carbon dioxide.
4. _____ The sympathetic nervous system acts on the heart to increase contractility by recruiting more cardiac muscle fibers.
5. _____ Carbonic anhydrase facilitates conversion of carbon dioxide to bicarbonate ion and vice versa.
6. _____ In the ascending loop of Henle, water moves rather freely from the tubule into the interstitial fluid.

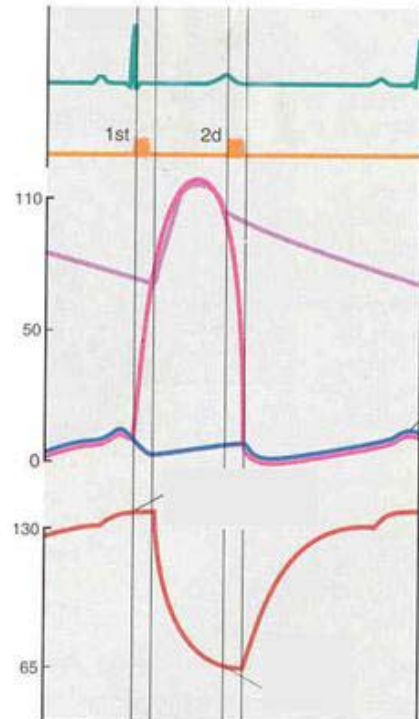
Really Short Answer (maybe a few words or a sentence; 30 points total; 3 points each)

1. Explain why marine teleost fish have plasma osmolarities so different from the osmolarity of sea water.
2. Mechanistically, how do sharks have plasma that is slightly hyperosmotic to sea water, but with much lower salt (NaCl) concentrations?
3. How is glomerular filtration rate regulated both before and at the Bowman's capsule?
4. Why do fish gills function better in water than in air even though air has more oxygen than water?
5. This equation explains what in the context of osmoregulation? $C_6H_{12}O_6 + 6O_2 \leftrightarrow 6CO_2 + 6H_2O$

7. Describe a situation in which a lizard might use a left-to-right shunt. What does “left-to-right shunt” mean?

8. On the Wigger’s Diagram to the right, clearly indicate (using circles/lines & letters) the following:

- AV valve closes (pressure curves cross)
- T wave of the electrocardiogram
- diastole
- isometric contraction of ventricular muscle
- aortic semilunar valve opens



Long Answer (10 pts; ~a paragraph or two or an explained diagram).

1. Draw a graph that depicts the a) oxygen-dissociation curve of hemoglobin. Be sure to label your axes. Also indicate how the b) Bohr shift works, and where oxygen is unloaded at the tissues during c) rest and during d) vigorous exercise. Where would a graph of e) myoglobin oxygen saturation fit in your diagram?

Short Essay (14 pts; ~2-3 paragraphs, complete sentences). *NOTE: Choose only ONE of the questions to answer. If you answer both, only the first will be graded.

A. Using examples from lecture, your text book, or lab assignments and discussions, discuss how anhomeostasis can be adaptive in many situations. What are the trade-offs involved?

B. You have just been diagnosed with an extremely rare disorder known as endocrine-atrial-renal-whoops (EARWhoop; the etiology of this disease has been traced to a diet of Burger King breakfasts in an era of global heating [*sensu* Andrew Comrie's talk on global climate change and disease outbreaks in humans, UA College of Science 14 November 2006]). EARWhoop manifests as a reduced ability to produce ANP OR renin OR aldosterone. The bizarre thing is that only one of these hormones is affected in any one person. How would you be able to tell which of three kinds of EARWhoop you had contracted? Assume that you are one of the few lucky U.S. citizens with excellent health insurance and you can afford to have all kinds of tests run on your physiology. As a concluding remark, indicate which of the three forms of EARWhoop you think would be easiest to live with. Why?