Review of main topics for Exam #2 – BIO 345 Spring 2008

Our second exam is Thursday, March 27. We will have a review session on Tuesday March 25th from 4-5 pm in Dobo 202.

The exam will be a mix of question types – a few multiple choice, a few fill-in-the-blank, some definitions, diagram labeling and some short answers, with one or two longer answers. There will also be a few bonus questions for extra points. This exam will be worth 25% of your final grade for this course.

Below is a list of the main topics we have covered since the start of the semester. This list is meant to help guide you as you study, but IT IS NOT THE ENTIRE SET OF MATERIALS THAT WILL BE COVERED ON THE EXAM. ***Anything*** that we have talked about in class since the first exam is fair game on the second exam.

A. Gas exchange surfaces, respiratory gases
- Henry's Law, gas solubility in air and water
- insect trachaeal systems, gills (counter-current exchange), lungs of mammals and birds, skin as a respiratory surface
- respiratory pigments
- the Hb-O_2 dissociation curve, effects of PO_2, PCO_2, pH, temperature on the curve; loading and unloading of O_2 from Hb during rest and exercise
- neuroglobin
- CO_2 transport in the blood (3 forms), role of carbonic anhydrase, buffers in the blood

B. Circulation
- open vs. closed circulatory systems
- cardiac muscle cells: roles, types, action potentials and how these differ (shape, timing, ions involved, resting potentials) from others we have seen before in neurons and skeletal muscles
- how the heart can be myogenic/autorhythmic
- the cardiac cycle (ECG)
- blood flow, blood pressure, role of arteries in circulation, function of elasticity of aorta and arteries
- the mammalian heart: systemic and pulmonary circuits
- hearts & circulation of other animals (teleosts, lungfish, amphibians, non-crocodilian reptiles); advantages of undivided ventricles
- diving in marine vertebrates – how to use less oxygen (bradycardia, vasoconctriction) and store more oxygen (more Mb, more Hb, more red blood cells, greater blood volume); ADL; why it's useful for muscles to be ischemic (vasoconstricted)

C. Osmoregulation
- functions of water and salts
- epithelial transport
- standing gradient hypothesis
- functions of the kidney
- the nephron: functional unit of the kidney. Anatomy; functions in various regions; connection between tubular and vascular components; filtration, reabsorption and secretion; osmotic gradients in the kidney, role of the collecting duct and ADH.
- osmoregulators vs. osmoconformers
- challenges associated with freshwater (FW) and salt water (SW) habitats
- strategies used by FW and SW fish to osmoregulate (pay particular attention to gill structure and function for salt uptake/secretion and how this works from a comparative perspective).
- forms of nitrogenous waste and tradeoffs associated with producing each one

- osmoregulatory specializations in other animals: avian salt gland, TMAO and urea in elasmobranchs, anadromous and catadromous species, insect malpighian tubules and rectal glands
- adaptations for desert life: kangaroo rates, camels, oryxes
- tardigrades and mechanisms for cryptobiosis; forms of cryptobiosis

D. Digestion and nutrition
- the Big Three: proteins, carbohydrates and lipids - Basic structure, roles for each, comparative energy contents.
- feeding methods and animals that use each one
- structure of the digestive system: headgut, foreguy, midgut, hindgut
- monogastric and digastric stomachs, and hindgut fermenters
- secretion of acids and enzymes
- role of bile
- hydrolytic cleavage
- activation of proteases
- absorption of nutrients: transport, pathways (sugars, amino acids, lipids)