Vertebrate Physiology 437 EXAM II NAME__________________________, Section (circle): am pm 20 October 2005, Exam is worth 100 points. You have 75 minutes.

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

1. ______ F. Catecholamines are released from the adrenal cortex.
2. ______ T. A nerve is made up of many neuronal axons.
3. ______ F. Thyroid-stimulating hormone, when it acts on the thyroid gland, initiates a 2nd messenger cascade that involves cAMP.
4. ______ T. Hormones were historically difficult to study because they occur in such low concentrations.
5. ______ F. A 'kinase' phosphorylates glycogen. (not a very good question)
6. ______ F. The number of muscle fibers per motor unit is lower in your triceps muscle as compared to in your tongue muscle.

Multiple Choice (one correct answer, 2 points each, 10 points total):

1. Which of the following is not released from the anterior pituitary:
   A. Follicle-stimulating hormone
   B. Prolactin
   C. Luteinizing hormone
   D. Oxytocin
   E. Two of the above

2. The pineal organ (parietal eye) in reptiles is useful for:
   A. detecting polarized light
   B. entraining the photoperiod
   C. avoiding predation
   D. all of the above
   E. none of the above

3. During shortening of a sarcomere, which of these also shortens:
   A. Z-disk
   B. I-band
   C. A-band
   D. M-line
   E. None of the above

4. Which of the following levels, when elevated, seems to be correlated with skeletal muscle fatigue:
   A. Bi
   B. ADP
   C. Lactic acid
   D. All of the above
   E. None of the above

5. Which, if any, of the above levels in question 4 seem most likely to cause fatigue in skeletal muscle?
1. How are release of hormones and neurotransmitters functionally similar?
   - **Release of hormones** occur through **exocrine glands** (e.g., endocrine system), while **neurotransmitters** are released during **nerve impulses** (e.g., nervous system).

2. Assuming you know where you are starting on a map, what three pieces of information do you need to keep track of in order to navigate by dead reckoning?
   - **Time**, **speed**, and **direction**

3. Why might you see a trade-off between **speed** and **endurance** in individual muscles, but not in whole animals?
   - Muscle **tissue composition** and **energy source availability**

4. How is myostatin involved in “double-muscle” cows?
   - **Myostatin** regulates muscle mass, reducing muscle growth when present, and allowing more muscle growth when absent.

5. Is prosulin a larger peptide hormone than insulin? Why or why not?
   - Yes, prosulin contains additional amino acids that are cleaved off before the final hormone, resulting in a larger molecule.

6. If a human patient was told they had a problem with their cells’ response to insulin, what type of diabetes does the patient most likely have? How is the other type of diabetes different?
   - Type I diabetes primarily involves the **deficiency of insulin production**.

7. In the context of navigation, what would a typical salamander do in a novel environment when placed on a sloped surface? Why?
   - Move down the slope, as they typically orient themselves using gravitational cues.

8. In the paper you read for lab, how were hormone levels correlated with home-range size in lizards?
   - **Corticoesteroids** levels increased as home-range size increased, indicating increased stress and aggression.

9. Very briefly, how do human birth control pills work?
   - **Progestin** is added to the pill, which binds and prevents the uterus from becoming receptive to fertilized eggs.

10. By studying the response of a cell sensitive to a given hormone, briefly list two ways you could likely tell if the hormone was lipid-soluble or lipid-insoluble?
    - **Lipid-soluble** hormones can **cross the cell membrane** directly, while **lipid-insoluble** hormones must be **transported** into the cell. Additionally, **lipid-soluble** hormones can be **stored** in lipid droplets, while **lipid-insoluble** hormones are **activated** by enzymes or **membrane receptors**.
In the serial sections of lizard iliofibularis muscle fibers above, clearly label a slow-conductive fiber and a fast-glycolytic fiber in each figure. The figure on the right is a histochemical stain for succinic dehydrogenase activity. What is the left figure staining for?

The figure above depicts force production in a muscle fiber as a response to different numbers and timing of excitatory action potentials. Explain the mechanism underlying the increased force (y-axis) being produced during twitch summation (and during tetanus) as compared to during single twitch events.

Short Answer (a few sentences; 20 points total; 5 points each)

1. Describe three ways that the follicular phase and the luteal phase differ in the female reproductive cycle.

very open, see lecture 11 (27 Sept 2005), slides 31-36, or your textbook
2. Draw and explain the force-velocity curve for skeletal muscle.

3. Draw and label a graph that explains the length-tension relationship for vertebrate skeletal muscle in vivo. Please also include very simple drawings of two sarcomeres that help explain the mechanism behind the graph you drew. Make it clear how your sarcomere drawings are related to your graph.

4. Choose an example of negative feedback in the endocrine system and explain how it works. How is homeostasis involved?
1. Describe the stress response pathway beginning with the stress (e.g., exposure to cold or exams) as detected by the hypothalamus. Include the relevant organs, glands, and hormones.

Stress is detected by brain causing hypothalamus to release corticotropin-releasing hormone which travels down portal vessel to anterior pituitary. Ant. pit. is stimulated to release ACTH (adrenocorticotropic hormone) which travels in blood stream to adrenal cortex (or kidney). Adrenal cortex releases stress hormones like cortisosterone (which is a glucocorticoid) or cortisol (corticosteroids influence kidney and reproductive function. They also mobilize amino acids from muscle, glucose from the liver, and fatty acids from fat stores. Prolonged stress can lead to excessive muscle atrophy, loss of reproductive system function, etc.

2. Draw a diagram to explain the patellar tendon reflex. Please include the quadriceps muscle, the hamstring muscle, a muscle spindle, an a- and b-afferent neuron, two alpha motor neurons, a gamma motor neuron, and a little hammer. You may need to include an interneuron or two to make the picture complete. At synapses, indicate if they are generally excitatory or inhibitory synapses.