1pm lab N=13 $\bar{x}$=69.5 max=88.5 min 44.5 sd 11.7 median=72

Key

Vertebrate Physiology 437 EXAM II NAME Key **, Section (circle): am pm**
14 March 2008. Exam is worth 100 points. You have 50 minutes.

3pm $\bar{x}$=69.2 max=89 med=70 min=48 n=15 sd=14.4

True or False **(write 'true' or 'false'; 9 points total; 1.5 point each)**

1. False The oxygen concentration in 4°C (cold) water is higher than 0_2 concentration in 60°C (hot) air.
2. False Testosterone is an ~~amine~~ steroid hormone.
3. True The Bohr effect increases the P_{50} of hemoglobin.
4. False Fish get rid of most of their carbon dioxide across their skin.
5. True Oxytocin is released from the posterior pituitary.
6. True Melatonin is involved in regulation of circadian and seasonal rhythms.

Really Short Answer **(a few words or a sentence; 42 points total; 3.5 points each)**

1. What is the mechanism behind *rigor mortis*?

Muscles stiffen b/c cross-bridges become locked b/c w/o ATP the myosin head can't detach from actin filament.

2. How is the myosin head in FG muscle different from the myosin head in SO muscle?

↳ different, faster myosin ATPase than SO; speeds rate of contraction b/c cross-bridges cycle faster

3. What is detected in a human pregnancy bioassay using a rabbit or frog? How is the detected substance collected from the human female?

urine sample human chorionic gonadotropin

4. Very briefly, contrast the roles of myostatin and VEGF.

↳ signals muscles to stop growing

vascular endothelial growth factor adds capillaries to muscle to ↑ aerobic capacity

5. What is LD_{50}?

lethal dose at which 50% of study population dies

6. What is a prohormone and why do they exist?

↳ typically a longer, non-functional protein
- pieces can be snipped off as target sequence for moving the protein through the cell are no longer needed
- can turn hormone "on" quickly by cleaving part; faster than transcription + translation

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30

Key

7. How is motor unit size correlated with dexterity?

smaller motor unit size means more fine motor control + enhanced dexterity

8. Why might exogenous testosterone lead to reduced sperm count?

via negative feedback on hypothalamus + anterior pituitary — reduces release of gonadotropin-releasing hormone, which reduces release of FSH + LH, which reduces production of sperm in sertoli cells

9. What is the mechanism behind muscular tetanus?

very high frequency of APs leads to lots of Ca^{++} in muscle. with all that Ca^{++}, all actin binding sites are available + muscle is contracting as fast as it can (until it runs out of ATP or is inhibited by P_i or other metabolic products)

10. What is the most common role of satellite cells in mammalian muscle?

→ become new nuclei in hypertrophied muscle fibers

a bit flexible on this one

also can lead to hyperplasia

11. If you place a dog in a sealed 1 m^3 box at the same time you place a mouse in an identical, but different, sealed 1 m^3 box, which one will pass out first? Why?

dog needs more total O_2 even though requires less O_2/gram

12. What is the role of carbonic anhydrase in carbon dioxide homeostasis?

(catalyzes $H_2O + CO_2 \leftrightarrow H^+ + HCO_3^-$

↑ how most CO_2 moved from tissues to lungs

Short Answer **(a few sentences or a paragraph; 49 points total; 7 points each)**

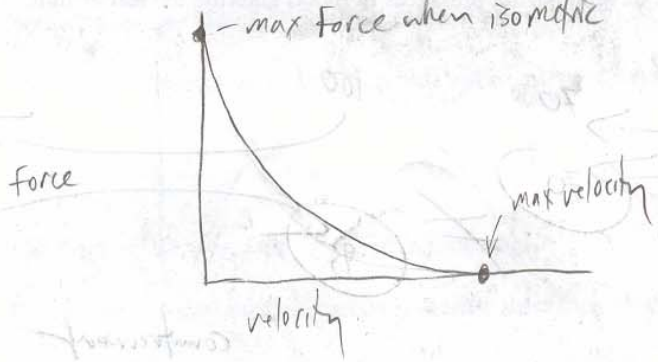
13. Explain why the diffusion distance from air to blood is shorter in birds than it is in mammals. Please include both mechanistic (proximal) and evolutionary (ultimate) explanations.

rigid parabronchi that do not change shape can be thinner b/c don't need to be able to expand + contract (stretch + shrink) repeatedly

likely selected for higher aerobic capacity (flight is expensive) and unidirectional flow, coupled w/ cross-current circulation, allows for much higher alveolar PO_2 heading back to heart

Ken

14. Draw a graph that explains the force-velocity curve observed for vertebrate skeletal muscle. Be sure to label your axes. Please also indicate where maximal force production occurs.



15. How is change in membrane potential in at least two different cells required for skeletal muscle contraction? Can you list or describe four membrane proteins and/or channels involved? (writing 'yes' will not get you full credit)

motor neuron to transmit AP + release Ach
muscle membrane to depolarize + release Ca^{++}

other cells in NS possible
other proteins/channels possible

1 voltage-gated Na^{+} channels in axon
2 " Ca^{++} channels in axon terminal
3 nicotnic-Ach receptors on muscle membrane @ neuromuscular junction
4 dihydropyridine receptors in muscle membrane are voltage-sensitive and
5 cause mechanically linked ryanodine receptor to let Ca^{++} out of SR

16. Draw two cartoon arms. Focusing on the elbow joint and the biceps, indicate how bones of the same size and length, and muscles of the same mass, can produce very different forces at the hand. What equation would you use to plug in measured values to validate the different forces in your two cartoons?

$L_{in} \times F_{in} = L_{out} \times F_{out}$

make outlever shorter to ↑ Force

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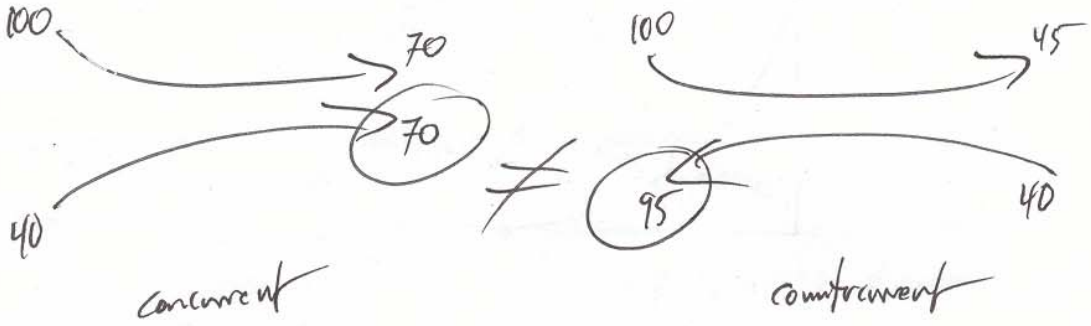
17. The partial pressure of oxygen of alveolar air is 100 mmHg. The partial pressure of oxygen of venous blood is 40 mmHg. Use cartoons to indicate how 1) concurrent and 2) countercurrent exchange in the lung would lead to different oxygen partial pressures in blood entering the left atrium.



18. Calcium has been integral to many of the physiological mechanisms we have discussed in this course. Describe three ways that calcium deficiency would affect homeostasis of a rabbit.

quite open – NT release, hormone release
muscle contraction
2nd messenger

19. Explain the significance of the article you read about the 'emergency life-history' stage of vertebrates. How does this article inform our understanding of vertebrate physiology in the context of ecology and evolution?

open

Ability to upregulate stress hormones + alter behavior/physiology in response to perturbations like weather, predators, etc. Allows animal to deal w/ short-term stress and not prolong stress response which can be detrimental to health, survivorship, fitness.