Anatomy and physiology comprehensive final

At the start 1. Recall that Jim's heart and respiratory rate are increased, he was sweating and that his mouth was dry before the raise began. Explain what is happening to his autonomic nervous system (including which division is the most active) and specify exactly how those ANS responses are creating the symptoms noted.

What changes do you think are occurring in the digestive and urinary systems at this time? (8 points) In his autonomic nervous system, the sympathetic division was the most active before and during the race because it is what prepares your body for extra somatic activity. It activated as he was preparing for the race because he was becoming more stressed and nervous. It started in the sympathetic center located in his hypothalamus, and from there led multiple places causing his symptoms.

His increased heart rate started when the cardioacceleratory center in the Medulla oblongata sent impulses down the spinal cord to the preganglia and ganglionic neurons of the Cervical and T1-T3 spinal cord segments, then the cardiac and pulmonary plexuses, which then leads to the heart and increases the rate at which it pumps. At the same time, his respiratory rate increased similarly. Impulses sent down his spinal cord through the preganglia and ganglionic neurons of the Cervical and T1-T3 spinal cord segments, to his cardiac and pulmonary plexuses, which then led to a higher breathing rate.

The sweating is another response to the activation of his fight or flight mode, the sympathetic division. His body perceived his nervousness as a sign that there is a threat and he may begin to exert more energy and in turn become hot, so it prepares for that by sweating in an effort to cool his body. His postganglionic fibers began to innervate his sweat glands by releasing

acetylcholine and activating his muscarinic receptors. The cause of his dry mouth was his preganglionic fibers which ascend to his superior cervical sympathetic ganglia and inhibited his salivary glands.

Finally, during a time where the sympathetic division of the ANS has been activated, the blood flow to the digestive system will be restricted and temporarily restricts digestive activities. Then, in the urinary system, kidney functioning is reduced, the detrusor urinae muscle of the bladder wall relaxes as the internal urethral sphincter contracts, which overall suspends the urinary system. One minute in 2. Consider the power stroke of rowing from the perspective of the actions at the shoulder and elbow joints.

Create a table that shows what muscles, under control of what nerves, pull on what bones to cause each action. Be sure to include the action of fixating the shoulder blade and pulling it back. The first column for your table must be the action. This column should describe what is occurring in both English and anatomical terminology (see chapter 9). But only include those actions needed to row the boat. Points will be deducted for unneeded actions. See example below.

Maintain Handle Height: Angular motion of the humerus at the shoulder Deltoid, Clavicle, spine and acromion of scapula , Deltoid tuberosity of humerus, Axillary Nerve, Pulls Together The Shoulder Blades: Adducts and rotates scapula downward Rhomboidmajor and minor, Spinous processes of C7 and T1-T5, Medial border of scapula, Dorsal Scapular Nerve, Pulling The Handle Toward Your Body: Flexes the forearm at the hinge joint of the elbow, Biceps brachii, Long head at supraglenoid tubercle of the scapula through the intertubercular groove, short head at coracoid process of scapula, Radial

tuberosity, Musculocutaneous Nerve, Pushing The Handle Away From Body: Extend the forearm at the hinge joint of the elbow, Triceps brachii, Lateral head at posterior side of humerus, medial head at distal radial groove of humerus, long head at margin of the glenoid cavity, Olecranon process of the ulna, Radial Nerve.

Now, pick one of those muscles and trace their control from the appropriate brain structure all the way to the NMJ. Be sure to include all intermediate structures, synapses, plexuses and nerves. (8 points) Movement of the deltoid begins in the cerebrum of the brain, but more specifically: in the frontal lobe, the premotor cortex is relaying instructions to the primary motor cortex.

The primary motor cortex contains the upper motor neurons whose axons will travel down the pyramids of the medulla oblongata and synapse on lower motor neurons in the anterior gray horns of spinal cord segments C5-C6. From there, the ventral rami of spinal nerves C5-C6 form the superior trunk of the brachial plexus, which splits into two divisions. We will follow the posterior division that supplies to extensor muscles. This posterior division then runs into the posterior cord from which the axillary nerve is derived. The axillary nerve’s motor end innervates the deltoid through its neuromuscular junction. 4. Rowing full speed is putting maximum demands on Jim's muscles.

What metabolic process is providing most of the energy for Jim’s muscles at this point and why do Jim's muscles feel like they are burning? (5 points) As Jim’s muscles are at maximum demand, his mitochondria are unable to produce the needed ATP through aerobic respiration because oxygen is

unable to diffuse fast enough into his muscle fibers. At this time anaerobic glycolysis takes the lead as the metabolic process producing two-thirds of the ATP needed so that his muscles can continue contracting. However, during glycolysis, there is soon more pyruvic acid produced then can be used at the time. That pyruvic acid gets converted to lactic acid, which is an organ acid that is able to dissociate in body fluids.

The lactic acid breaks up into hydrogen ions and negatively charged lactate ions that lowers intracellular pH and causes a burning sensation in his muscles. 5. Trace the sensation of pain in Jim’s left Quadriceps muscle from the receptor to perception in the brain. Be sure to include the nerve and all intermediate structures involved in relaying this sensation. (8 points) When Jim felt a pain sensation in his Quadriceps muscle, it began with the local nociceptors being activated. A signal was then transmitted from his nociceptor neurons, through the dorsal root ganglia where the cell bodies are located. Then, the signal is processed through the Central Nervous System, reaching the interneurons and being relayed to the brain through the lateral spinothalamic tract.

The lateral spinothalamic tract and interneurons end in the ventral nuclei of the thalamus, where third-order neurons process and relay the painful sensation to the primary sensory cortex. 6. Since the end of the first minute, Jim has decreased the demands his muscles are making. What metabolic process is now providing most of the energy for his muscles? What muscle protein has been storing Oxygen for this activity? (6 points) Now that Jim has decreased the demand on his muscles, they are able to function primarily on aerobic metabolism, breaking down pyruvic acid to produce ATP. However,

he is still working at a high level of energy, which will require a lot of oxygen. Myoglobin, an oxygen-binding protein helps to supply some of the needed oxygen for aerobic respiration. 7. What energy molecules is Jim’s body consuming?

What might Jim have done the night before to increase his endurance today? (4 points) During the race, Jim was using broken down glucose from the glycogen reserves in his sarcoplasm. A good way to improve endurance during a race is to eat a meal full of complex carbohydrates. These carbs provide energy the next day because they take longer than almost any otherfoodto be broken down, and as they are slowly digested they continue to provide energy throughout the race. 8. Identify the components of the homeostatic control system that is keeping Jim’s body cool and then explain specifically how that system works, including the messaging system involved. (8 pts)

The homeostatic control system that maintains body temperature is called thermoregulation. The system has a control center known as the thermoregulatory centre that’s located in the hypothalamus. There are two sets of temperature receptors that send information to the control center. One monitors the core by looking at the temperature of the blood that flows through the brain, and the second monitors the external temperature through the receptors in the skin. Once his body temp rose above 37. 20C, the higher temp stimulated his heat loss center. There are then two effectors that were at work lowering his body temperature. First, the smooth muscle of his arterioles supplying the skin relaxed, which caused vasodilation.

Second, his sweat glands became more active and began cooling his skin surface. Finally, as his body regains its normal body temperature and that information gets to the hypothalamus, the control center becomes dormant. 9. Recall that Jim could see boats on either side of him. Trace the image of those boats to perception. (Include all focusing, transduction, transmission and perception processes and structures) (10 points) As Jim was rowing and watching the boats beside him, the first step was reception. This happens as light is entering his eyes and the lens is focusing it onto the fovea of his retina, which is where his photoreceptors are located.

The second step is transduction, during which the rods and codes are converting the electro-magnetic energy into electro-chemical nerve impulses. This is the step that allows the light energy to move across our optic nerve and be processed in the brain. That step where his nerve impulses are sent to his primary visual cortex is called transmission. The next step, selection, is where feature detector cells are working to break up the image. Then during organization, through multiple visual perceptual principles, the information is being reassembled into a way that we can understand it. The image goes to both our temporal and parietal lobes so that we can identify and determine where the object is located.

Finally, the interpretation stage is where the boats he saw where both identified and given meaning. 10. Jim has stopped rowing and his muscles are now at rest. Why are his heart and breathing rates still so high? (3 points) His rowing competition took a lot of energy and oxygen. Once it was over, his body needed to restore what was used during his exercise. A higher breathing rate brings more oxygen into the lungs, and a higher heart rate

pumps blood so that the oxygen can get into the blood stream then into the muscles. Oxygen in the muscles will allow restoration of the ATP levels. 11. Why did Jim lose 4 pounds during this event? What tissue/body material was lost and will this be a “ permanent” weight loss? (5 points)

About half a pound out of Jim’s four-pound loss could have been the glycogen reserves in his muscles that were depleted, but most of the weight loss was due to water loss while he was sweating during the race. Both of these things will be restored in his body though, causing the weight loss to only be temporary.

Works Cited

- “ Breathing Rate And Heart Rates After Exercise. ” LiveStrong. Demand Media, Inc. , 14 Jul. 2011. Web. 1 Dec. 2012. “ Chapter 6 – Visual Perception. ” Oup. n. p. , n. d. Web. 1 Dec. 2012. PDF file.
- “ Homeostasis. ” BiologyMad. IHW, Mar. 2006. Web. 1 Dec. 2012. “ Keeping Your Autonomic Nervous System Healthy. ” DrWilson.
- The Center For Development. June 2011. Web. 27 Nov. 2012. “ Muscles Used In A Rowing Machine. ” LiveStrong. Demand Media, Inc. , 3 May, 2011. Web. 28 Nov. 2012.
- “ The Body Can Use Glycogen As An Energy Source When Aerobic Exercise Lasts How Long? ” LiveStrong. Demand Media, Inc. , 7 Jul. 2011. Web. 30 Nov. 2012.
- “ The Brachial Plexus. ” UpState. HealthScienceCenter, n. d.
- Web. 28 Nov. 2012. “ What Is Most Of The Weight Loss From When Individuals Lose Weight Quickly? ” LiveStrong. Demand Media, Inc.

- , 28 Apr. 2011. Web. 1 Dec. 2012. “ Why Do You Sweat When You’re Nervous? ” WiseGeek. Conjecture Corporation, 15 Nov. 2012. Web. 27 Nov. 2012.
- “ Why You Should Load Up On Good Carbs The Night Before A Big Game. ” FitDay. Internet Brands, Inc. , n. d. Web. 30 Nov. 2012.