Exam 3

100 points total

**Multiple choice.** As with any test, choose the best answer in each case. Each question is 3 points.

1. Which of the following best describes the events that happen when blood reaches the lungs, under normal conditions?
   a. More carbamino compounds are formed in the blood.
   b. The Pco$_2$ of the blood increases.
   c. The oxygen saturation curve of hemoglobin right-shifts.
   d. H$^+$ and HCO$_3^-$ ions form CO$_2$ and H$_2$O.
   e. All of these occur at the lungs.

2. Which of the following factors, by itself, would cause an increase in glomerular filtration rate in the kidneys? (“By itself” means “if nothing else changed except that single variable.”)
   a. Decreased vasoconstriction of the afferent arteriole
   b. Decreased mean arterial pressure
   c. Decreased release of atrial natriuretic factor (ANF)
   d. Decreased permeability of the collecting duct
   e. Decreased aldosterone release

3. In the proximal tubule, glucose enters the epithelial cells on the apical side via __________, and exits the basolateral side via __________.
   a. primary active transport, secondary active transport
   b. secondary active transport, facilitated diffusion
   c. secondary active transport, primary active transport
   d. diffusion, facilitated diffusion
   e. facilitated diffusion, secondary active transport

4. What is the primary purpose of the loop of Henle? (Put another way, what would our kidneys not be able to do if we lacked the loop of Henle?)
   a. Create a hyperosmotic urine
   b. Create an isosmotic urine
   c. Reabsorb urea
   d. Reabsorb NaCl
   e. Regulate pH
5. A drug that actives antidiuretic hormone (ADH) receptors is given to a patient. This would most likely directly result in
   a. decreased permeability of the collecting duct.
   b. an increased rate of urine production.
   c. increased NaCl secretion.
   d. increased mean arterial pressure.
   e. Two of the above would likely occur.

6. Which of the following statements about urea and urine is true?
   a. Urea molecules are too big to enter the urine from the glomerulus.
   b. Urea is part of the urine at formation and is not reabsorbed.
   c. Urea is part of the urine at formation but is fully reabsorbed.
   d. Urea is part of the urine at formation but some is reabsorbed via active transport.
   e. Urea is part of the urine at formation but some is reabsorbed via diffusion.

7. Central venous pressure (CVP) helps to influence mean arterial pressure by directly affecting
   a. heart rate.
   b. stroke volume.
   c. vasoconstriction of the arterioles.
   d. Two of these are affected by CVP.
   e. All three of these are affected by CVP.

8. On a dare, a not-too-bright freshman drinks a gallon of water. Assuming that he is able to absorb this water without throwing it up, which of the following responses should his body show as it struggles to keep him alive?
   a. Increased sympathetic activity, increased ADH release, increased ANF release
   b. Increased sympathetic activity, increased ADH release, decreased ANF release
   c. Increased sympathetic activity, decreased ADH release, increased ANF release
   d. Decreased sympathetic activity, decreased ADH release, increased ANF release
   e. Decreased sympathetic activity, decreased ADH release, decreased ANF release

9. The mouth contributes, to at least some degree, to
   a. the physical breakdown of food.
   b. the digestion of food.
   c. the absorption of food.
   d. Two of these occur in the mouth.
   e. All three of these occur in the mouth.
10. Which of the following statements about gastric (stomach) acid is true?
   a. It breaks down cellulose into digestible monosaccharides.
   b. It digests fats.
   c. It emulsifies fats so they are easier to digest.
   d. It digests proteins into amino acids.
   e. It denatures proteins so they are easier to digest.

11. A person who did not secrete sufficient mucus in her stomach would probably have
   a. damage to the mucosal layer of her stomach.
   b. trouble digesting lactose.
   c. more pathogens surviving passage through the stomach than normal.
   d. metabolic acidosis.
   e. her own reality TV show.

12. Cholecystokinin (CCK) promotes all of the following except
   a. the appearance of lipase in the small intestine.
   b. the appearance of proteases in the small intestine.
   c. the appearance of amylase in the small intestine.
   d. the appearance of bile in the small intestine.
   e. the appearance of bicarbonate in the small intestine.

13. Trypsinogen is converted to its active form, trypsin, by the action of
   a. disaccharidase.
   b. enterokinase.
   c. segmentation.
   d. the pH in the small intestine.
   e. intestinal mucus.

14. Which of the following shows the correct combinations of agents and their actions in the processes occurring during the digestion and absorption of fats?
   a. Bile salts \(\rightarrow\) digestion, lipase \(\rightarrow\) emulsification, chylomicrons \(\rightarrow\) packaging of fats
   b. Bile salts \(\rightarrow\) emulsification, lipase \(\rightarrow\) packaging of fats, chylomicrons \(\rightarrow\) digestion
   c. Bile salts \(\rightarrow\) emulsification, lipase \(\rightarrow\) digestion, chylomicrons \(\rightarrow\) packaging of fats
   d. Bile salts \(\rightarrow\) digestion, lipase \(\rightarrow\) packaging of fats, chylomicrons \(\rightarrow\) emulsification
   e. Bile salts \(\rightarrow\) packaging of fats, lipase \(\rightarrow\) emulsification, chylomicrons \(\rightarrow\) digestion
15. Uh-oh — mass movement in the middle of the exam! What’s your best option that’s under your voluntary control?
   a. Contract your internal anal sphincter
   b. Contract your external anal sphincter
   c. Relax your internal anal sphincter
   d. Relax your external anal sphincter
   e. Turn in your test now and run out of the room.

16. The reason we need to keep some energy stored in the form of glycogen rather than fats is that
   a. glycogen is more energy dense than fats.
   b. glycogen can be used to make fats if needed.
   c. fats can only be used for anaerobic respiration.
   d. some tissues can’t use fats as fuel.
   e. glycogen can be stored without using water.

17. One challenge with chemotherapy is that it often causes people to lose their appetites. If you’re working on a drug to counteract this problem (for use in states that haven’t legalized medical marijuana), which of the following would be the best approach?
   a. A drug that activates leptin receptors.
   b. A drug that blocks leptin receptors.
   c. A drug that activates glucagon receptors.
   d. A drug that blocks glucagon receptors.
   e. Tastier-looking Jello in the hospital lunches.

18. The “turgor,” or swelling, seen during the inflammatory response is due primarily to
   a. leakage of excess fluid out of the capillaries.
   b. expansion of macrophages as they engulf pathogens.
   c. rapid reproduction of bacteria or viruses.
   d. leaked contents of dying cells.
   e. gas bubbles resulting from the action of hydrogen peroxide.

19. The action of natural killer T cells is to
   a. phagocytose bacterial cells.
   b. insert perforins into bacterial cells.
   c. phagocytose infected body cells.
   d. insert perforins into infected body cells.
   e. try to get themselves renamed to something nicer, like “Hello Kitty T cells.”
20. Which of the following is not a lymphoid tissue?

   a. The appendix
   b. The bone marrow
   c. The spleen
   d. The tonsils
   e. The pancreas

**Short answer.** Your answers should fit in the space provided (assuming you have reasonably normal sized writing). For some questions, a diagram can save some writing, but needs to be clearly labelled with names, effects, etc. Each question is 8 points.

21. Diagram or describe the renin-angiotensin-aldosterone system, being sure to give the source of each of the three substances and to indicate what type of substance it is (e.g., a hormone, etc.). As part of your answer, indicate the two specific control pathways that affect the release of renin in the juxtaglomerular apparatus. (This is in addition to telling me what variables the system in helping to regulate.)
22. Answer the next set of questions based on the graph below. The black line is the oxygen saturation curve for hemoglobin (Hb), while the gray line is the saturation curve for myoglobin (Mb).

![Oxygen Saturation Curve](image)

a. What is the HbO₂ for blood (Hb) at Po₂ = 35 torr?

b. What Po₂ is required to saturate Hb to 40%?

c. A mountain climber at high altitude has an alveolar Po₂ of 50 torr and a tissue Po₂ of 15 torr. How much oxygen (in units of %HbO₂) gets delivered by the blood under these circumstances?

d. Relative to Hb, does Mb have a higher or lower affinity for oxygen?

e. One function of Mb is to act as a reservoir of O₂ for muscles if O₂ consumption rates increase rapidly and blood flow has not yet increased enough to meet the new demand. Based on the information from the graph above, why does Mb function effectively for this task? Think about what the conditions are in a resting muscle, and then what will happen as Po₂ levels in muscles drop below resting levels.
23. Two related questions:
   a. During a metabolic acidosis, what are the acute and longer term responses, and how do they help the problem?

   b. Breath-hold divers often hyperventilate (breath heavily and rapidly) immediately before taking a final deep breath for a dive. Given what you know about gas transport and ventilatory control, what is the reason for this?
24. For each of the following locations, describe the events that are taking place during the post-absorptive phase and what hormonal level(s) is/are controlling those events.

What is the source of each of the hormones you listed above?

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<tr>
<th>Tissue</th>
<th>Events</th>
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<tr>
<td>General tissues</td>
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<tr>
<td>Adipose tissue</td>
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25. Describe the events that would take place in the activation of the humoral portion of the acquired immune response to a bacterial infection. You do not need to describe the inflammatory response beyond any elements important in activating humoral immunity, nor do you need to explain what would happen if a second infection by the same bacterium occurred.