

Animal Structure & Function Review

1. Put check marks for the appropriate structures that these organisms have.

| | Open Circulatory System | Closed Circulatory System | Malphigian Tubules for Excretion | Protonephridia for Excretion | Metanephridia for Excretion | acoelmate | pseudocoelmate | coelomate |
|-----------|-------------------------------|---------------------------------|--|------------------------------------|-----------------------------------|-----------|----------------|-----------|
| Cnidaria | | | | | | | | |
| Annelids | | | | | | | | |
| Flatworms | | | | | | | | |
| Insects | | | | | | | | |

2. What is an advantage to storing energy in the form of fat versus glycogen? Be sure to cite specific structural differences.

3. Why not deliver food directly to the small intestine, bypassing the operations of mouth and stomach?

4. What is the role of the colon in modifying the outflow of the small intestine? Why would you probably die if your colon failed to function?

5. A jellyfish has only a mouth (no anus), apparently delivering ingested food directly into its intestine (or perhaps it has a stomach, but no intestine). I have seen jellyfish consume entire fish (small fish). How might digestion occur in such an organism?

6. What adaptive modifications might be useful for the digestive system of an animal living on a diet that is mainly:

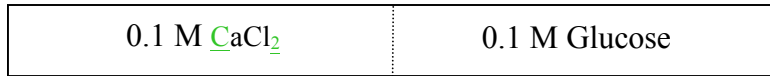
- a) animal -
- b) grass -
- c) nutritionally poor -
- d) seeds -

7. Ms. Ward has a rare pancreatic disorder that requires doctors to remove her pancreas.

a) What 3 aspects of digestion would this affect?

b) What treatments could the doctors use to counteract this?

Biological systems rely heavily on the properties of water movement. Excretion, digestion, and blood pressure are just a few examples of situations where water balance is important. Suppose you have a semi-permeable membrane that ONLY water can pass. On one side of the membrane you have 0.1 M CaCl_2 . On the other side of the membrane, you have 0.1 M Glucose.



8. What is the osmolarity of 0.1 M CaCl_2 ? _____
9. In the above system, which way will water move? (circle one)
 - a) To the right b) To the left c) There will be no water movement
10. Explain your answer.

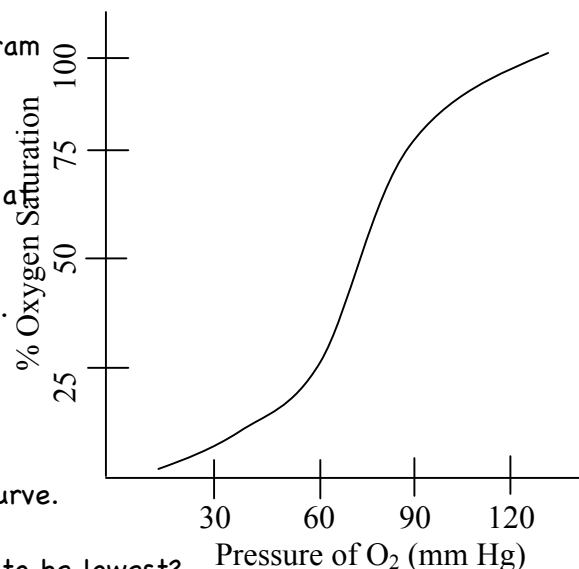
The diagram to the right shows the gas exchange system for a fish. This system is adapted to the oxygen needs of an underwater organism.

11. Which has a higher concentration of oxygen?
 - a) Air b) Water
12. At which point in the diagram is there the highest oxygen concentration?
 - a) Point A b) Point B
13. For the fish, which describes their blood flow most accurately?
 - a) Body → Heart → Gills → Body
 - b) Body → Heart → Gills → Heart → Body
 - c) Body → Gills → Heart → Body
 - d) Body → Gills → Body → Heart → Body



Hemoglobin is a protein that binds oxygen for efficient delivery in many animals. Hemoglobin is made up of four subunits. Each subunit contains a heme group that binds to one oxygen molecule. The diagram on the right represents the binding efficiency of human adult hemoglobin at pH 7.6.

14. How many oxygen molecules does human adult hemoglobin carry at pH 7.6 at a P_{O_2} of 60 mm Hg? _____



15. Oxygen must be able to be transferred from mother to fetus. What is true about a fetal hemoglobin binding curve (compared to adult hemoglobin)?
 - a) It is shifted to the right.
 - b) It is shifted to the left.
 - c) It is at the exact same position as the mother's binding curve.
16. Where would you expect to find the partial pressure of oxygen to be lowest?
 - a) In the air outside the mouth c) In the trachea
 - b) In the lungs d) In the blood stream next to the alveoli

17. Organisms can have circulatory systems that are classified as single circulation or double circulation paths. Fish have single circulation while human beings have double circulation.

a) Discuss the differences between single circulation and double circulation.

b) Does an organism with single circulation have a higher or lower metabolic rate when compared to an organism with double circulation? _____

18. An organism must be able to release the waste product of carbon dioxide from its cells.

a) What specific organelle in the cell produces Carbon Dioxide (CO_2)? _____

b) After CO_2 is released from the cell, it enters a red blood cell and undergoes a specific reaction. What is the final product of this reaction? _____

c) After a blood donation, the blood is separated into various components, including plasma, platelets, and red blood cells. Which component of the blood (AND WHY) would you find the MOST final product of the reaction you answered in (b)?

19. Suppose you take a blood sample from left atrium and analyzed it for various compounds. What would you expect (for a normal adult)? (put a HIGH or LOW in each box)

| Concentration of Oxygen in Red Blood Cell | Concentration of Carbon Dioxide in Red Blood Cell | Concentration of Oxygen in Plasma | Concentration of Bicarbonate in Plasma |
|---|---|-----------------------------------|--|
| | | | |

20. Suppose you are participating in a research study to look at connections between respiratory rates and exercise. You run 2 miles and then are tested by the research assistant.

a) Would you expect the areas around your muscles to have a higher or lower than normal pH? Explain.

b) What effect would this kind of environment (the one you answered in part (a)) have on hemoglobin and its binding to oxygen?

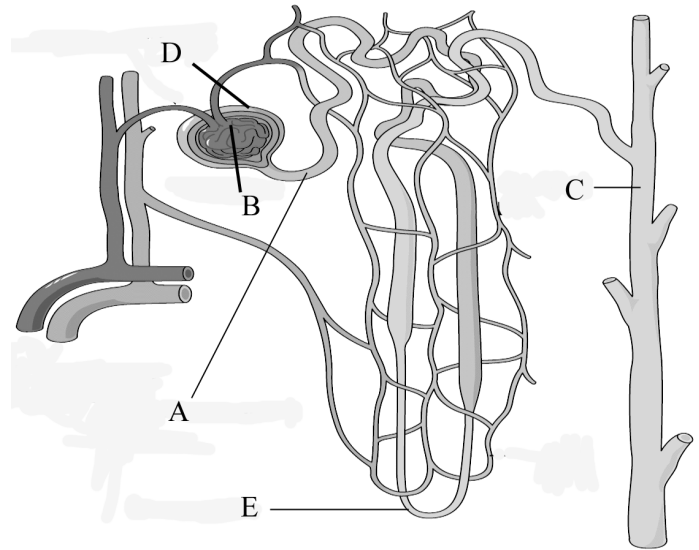
c) Relate this effect to what you know about protein structure and R-groups. Basically, why does this change in binding capabilities occur at a molecular level - what is happening?

d) Suppose that you measure your systolic blood pressure after this run. What effect would the vasodilation of your capillaries have on systolic blood pressure?

21. Several different examples of respiratory surfaces can be found in the animal kingdom.
- What advantage does a large surface area in the alveoli have for animals that use lungs?
 - Why is it advantageous for an insect to rely on tracheal systems for delivery of oxygen to individual cells, rather than their circulatory system?

22. The human kidney's function is to produce concentrated urine. The kidney is made up of approximately one million nephrons to help this occur. A diagram of a nephron is below.

- On the diagram, circle where the concentration of salt in the extracellular environment will be HIGHEST.
- On the diagram write "ADH" where you will find a large amount of ADH receptors.
- Caffeine will inhibit ADH receptors. Will this cause an INCREASE or DECREASE in water reabsorption by the kidney.
- What is the name of structure "D"?
- What is the name of structure "A"?



23. In the production of gametes and reproductive hormones, regulation of pathways like the one shown in the diagram below is very important.

a) Suppose a man has more Leydig cells than the average male usually does. What hormone would you expect to see elevated in this man because he has more Leydig cells? _____

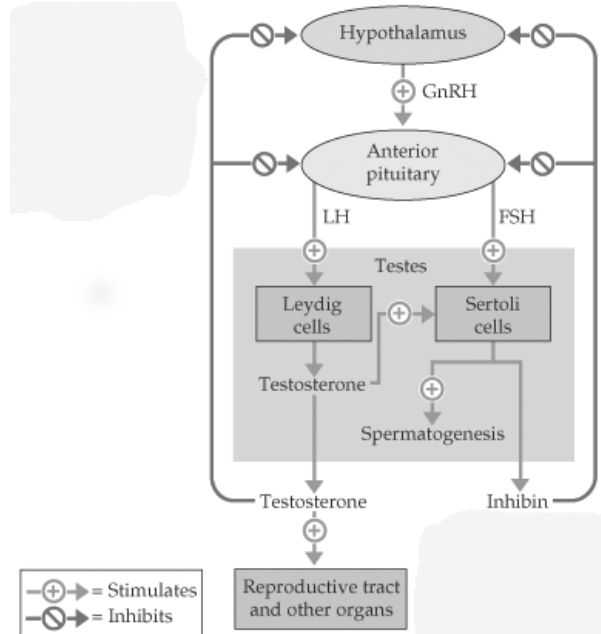
b) Suppose a new cancer drug has been discovered to have an unexpected side effect—it also binds to Inhibin and causes it to be nonfunctional. Compared to a normal male who has not used the drug, what effect will this have on

- Testosterone Production?

| | |
|----------|---------------|
| Increase | Stay the Same |
| Decrease | |
- Sperm Production?

| | |
|----------|---------------|
| Increase | Stay the Same |
| Decrease | |
- GnRH Production?

| | |
|----------|---------------|
| Increase | Stay the Same |
| Decrease | |



- c) When the sperm mature and then travel out of the man's body, what pathway do they follow?
- Epididymis → Vas Deferens → Urethra → Testes
 - Testes → Epididymis → Vas Deferens → Urethra
 - Urethra → Testes → Epididymis → Vas Deferens
 - Testes → Vas Deferens → Epididymis → Urethra

The female menstrual cycle is set up to prepare the woman for pregnancy. The diagram represents the various events that occur during this cycle.

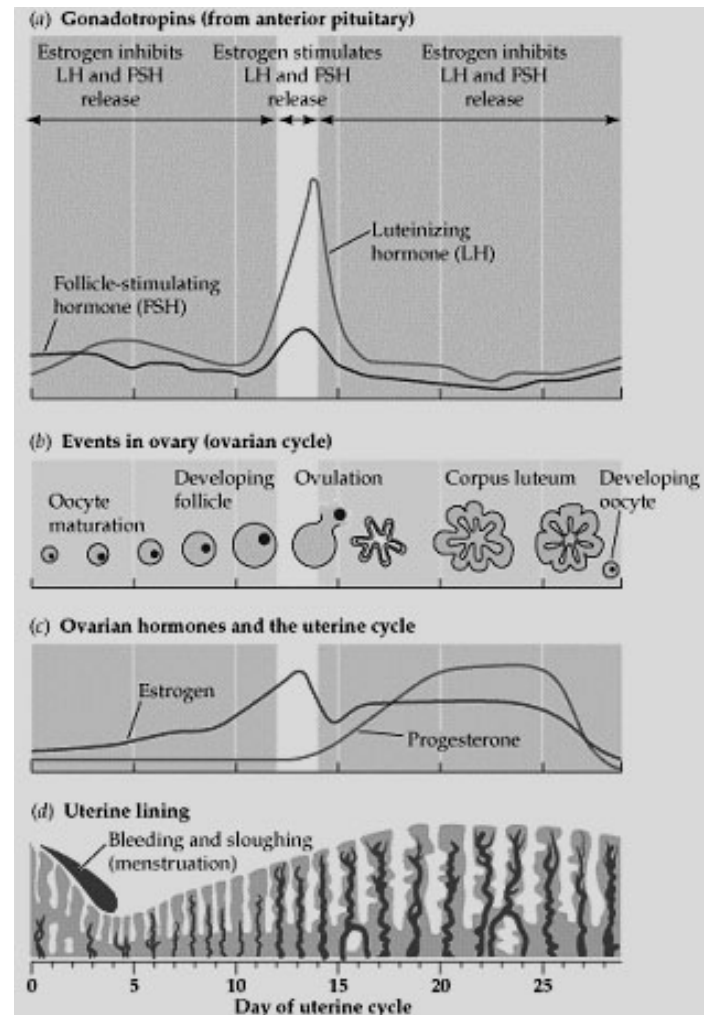
24. Where would you find the egg around days 16-17?

25. What is the role of progesterone?

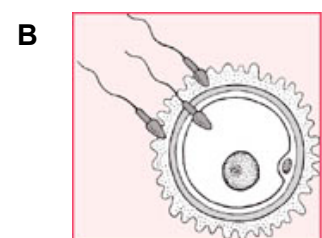
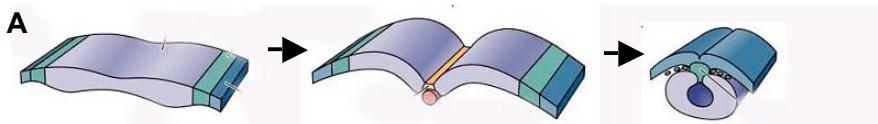
26. Describe two changes to the right diagram (either hormone levels, structural changes, etc) that would occur if a woman became pregnant. What hormone would be responsible?

1

2



27. There are many different stages of development that an organism undergoes as an embryo. For each of the diagrams below, indicate if it is showing **fertilization**, **cleavage**, **blastula formation**, **gastrulation**, or **neurulation**. Each term can only be used once.



A = _____
 B = _____
 C = _____

28. On occasion, organisms are born with inverted organs, when a developmental process runs awry. For example, the heart is backwards such that the left atrium is where the right atrium usually is and the left ventricle is where the right ventricle usually is. If all tissues except for this organ are as they should be, the defect occurred during what developmental stage?

- | | | |
|------------------|-----------------|-----------------|
| a) Organogenesis | b) Oogenesis | c) Gastrulation |
| d) Cleavage | e) Blastulation | f) Neurulation |

29. Hormonal control is one of the methods used to regulate body systems such as the excretory system. One important hormone for the excretory system is ADH (Antidiuretic hormone).

a) There are many substances that inhibit the actions of ADH. Caffeine is an example of a substance that inhibits ADH. Which of the following are symptoms that you would find in a person who ingested caffeine? (circle all that apply).

- I) more concentrated urine
- II) a feeling of dehydration (losing too much water)
- III) high concentrations of urea in the blood
- IV) greater volumes of urine

b) What part of the nephron does ADH act on?

Glomerulus Loop of Henle Collecting Duct Bowman's Capsule

c) Individuals with diabetes insipidus do not produce enough ADH. Would individuals with diabetes insipidus have urine that was MORE or LESS concentrated with urea than a normal individual?

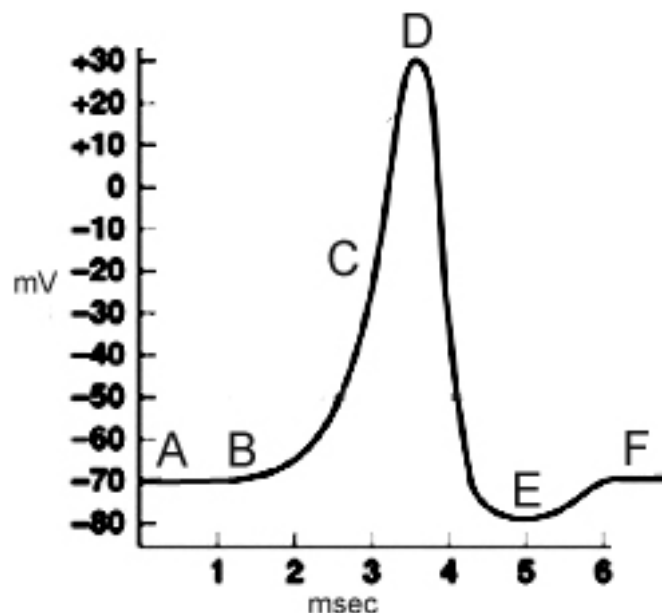
d) Would a person that has diabetes mellitus have a higher or lower amount of glucose in their blood? _____

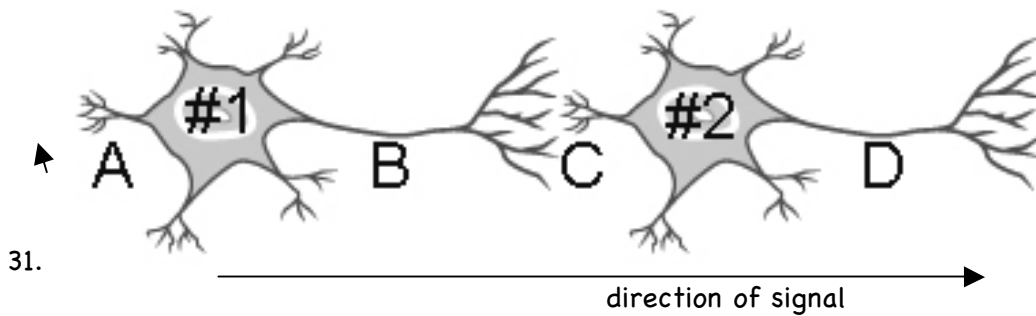
30. The following diagram shows an action potential of a neuron. For each question, you can answer with one letter or multiple letters.

- a) At which letters would you find Na⁺ voltage-gated OPEN? _____
- b) At which letter(s) would you find the Na⁺/K⁺ pump WORKING? _____
- c) At which letter(s) would you find K⁺ voltage-gated channels OPEN? _____
- d) At point F, would there be a more positive charge on the INSIDE or OUTSIDE of the neuron? _____

e) At point B, would you find more Na⁺ on the INSIDE or OUTSIDE of the neuron? _____

f) What is the charge (in millivolts) on the INSIDE of a neuron when it is at rest? _____





For each of the following letters, state which part of the neuron is represented using the following list:

Axon Axon Terminal/Dendrite Synapse Cell Body Synaptic Vesicle

A _____

B _____

C (refers to the space between the two neurons) _____

32. Acetylcholine is the neurotransmitter that is released by a neuron to activate a muscle cell. Acetylcholine receptors are found on the muscle cell. After acetylcholine is released and activates the muscle, it is important to have a method to shut down this activation. What are two possible ways that this neurotransmitter can be stopped from activating the muscle cell for too long? Be sure to briefly explain the method - don't just put one or two words.

a)

b)

33. Interferon is a part of your non-specific immune system. It prevents the replication of viral DNA and protein. The specific immune system will also respond to a viral infection. For each of the following statements, state whether it is part of the HUMORAL (H) response, or the CELL MEDIATED (C) response or BOTH (B)

_____ Involves MHC molecules

_____ Involves Antibodies

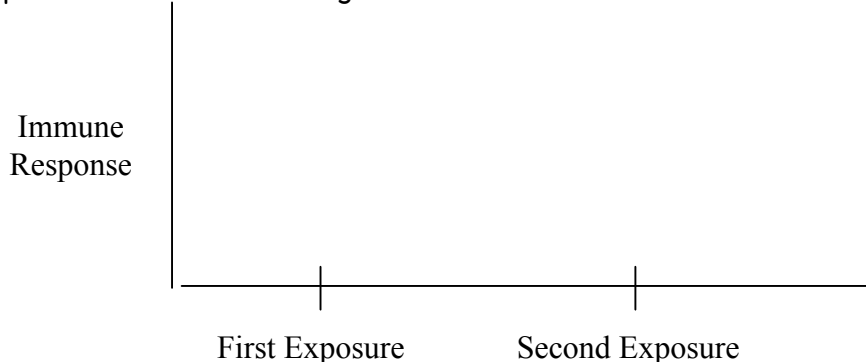
_____ Macrophages consume antigen

_____ Killer T cells secrete perforin

_____ Memory B cells are made

_____ Involves antigens

34. Below is a chart showing the immune response compared to time. Please draw in the two lines to show how the immune response would compare between the first exposure to a certain antigen, to the second exposure to that same antigen.



35. Describe two specific ways that antibodies help to fight an infection.

a)

b)