Name: _____ Date: _____

AP Biology Exam Review 6: Organism Form and Function

Helpful Videos and Animations:

1. Bozeman Biology: Response to External Environments
2. Bozeman Biology: Plant and Animal Defense
3. Bozeman Biology: Development - Timing and Coordination
4. Bozeman Biology: Gene Regulation in Embryonic Development
5. Bozeman Biology: Cellular Specialization
6. Bozeman Biology: Mechanisms of Timing and Control
7. Bozeman Biology: The Nervous System

111. Describe the difference between reflexes and reactions
112. Describe how a nerve propagates a signal
113. Explain what a threshold potential is, and how the action potential is propagated (voltage-gated channels)
114. Explain how myelin sheath increases the speed of nerve signals
115. Describe how the nerve is "re-set" (Na/K pump)
116. Describe what happens in the synapse of a nerve
117. Explain the purpose of neurotransmitters
118. Describe the different types of neurons and explain their purpose
119. Describe the different types of sensory receptors
120. Explain the difference between CNS and PNS, and Sympathetic and Parasympathetic nervous system
121. Describe the evolution of nervous systems into brains
122. Describe the functions of the major parts of the brain
123. Describe the two different types of hormones, and explain how each acts on a cell
124. Describe how the body maintains homeostasis, and be able to explain how negative feedback loops and positive feedback loops work
125. Give examples of plant hormones and their functions
126. Explain how the body maintains proper water and solute levels
127. Describe how hormones help to maintain proper osmolarity
128. Describe different adaptations to excreting body wastes in differing environments
129. Explain how the body transports gases and nutrients through blood
130. Describe how homeostasis can be affected by changes in the blood, and how these changes affect proteins
131. Explain the evolution of plant reproduction from simple to complex forms, describing how alernation of generations decreases as plants become more complex
132. Describe the difference between sexual and asexual reproduction
133. Describe different sexual strategies besides strictly having two sexes (parthenogenesis and hermaphrodism)
134. Describe the role reproductive hormones have in humans
135. Describe the menstrual cycle and explain how it is controlled in females
136. Explain the difference between spermatogenesis and oogenesis, and describe the evolutionary advantages of each
137. Describe the process of development in humans, explaining how the body plan is determined, and how this is influenced by gene expression
138. Explain the role of stem cells in development and be able to describe why stem cell research is controversial (but becoming less so!)
139. Explain the importance of the placenta
140. Explain the laws of thermodynamics and how they apply to living organisms
141. Describe the two different metabolic strategies of temperature regulation – endothermic and exothermic, and explain how each relates to energy use
142. Describe how body size influences metabolic rate, and explain the reasons why
143. Explain how metabolic rate changes as external conditions vary
144. Describe the stages of defences the immune system has in the human body
145. Explain how acquired immunity helps protect against disease that the body has been previously exposed to, and the evolutionary advantages of this immunity
146. Describe how acquired immunity works to recognize invaders
147. Explain the difference between humoral and cell-mediated immunity
148. Describe how autoimmune disease and allergies are a malfunction of the immune system
149. Describe how other organisms maintain homeostasis and compare these mechanisms with those of the human body

Topic Outline:

1. The Nervous System
    - Functions
        - Sensory input – take in and integrate information (either internal or external)
            - Sensory receptors
                - chemoreceptors – sense chemicals (pheremones, solute concentration, etc)
                - mechanoreceptors – sense physical change (pressure, touch, etc)
                - thermoreceptors – sense temperature
                - pain receptors
                - electromagnetic receptors – allow some animals to navigate
        - motor function – allow movement to respond to changes (either internal or external)
        - regulation – keep body within homeostatic limits
    - Structure
        - Neuron (nerve cell) – Composed of:
            - Dendrites – branched portion of nerve that receive signal
            - Axon – long, slender portion of nerve cell that transmits signals
            - Myelin sheath – made of schwann cells, insulate signal; allows signal to propagate faster
            - Synapse – space between two neurons
    - Polarized neuron – Na^+ outside, K^+ and Cl^- inside (overall + charge on outside, overall - charge on inside)
    - Depolarization moves Na^+ into neuron, generating an action potential
        - All or nothing
    - Repolarization exchanges Na^+ and K^+ through the sodium-potassium pump
    - At synapse, calcium channels open to allow calcium to rush in, stimulating release of neurotransmitters
    - Neurotransmitters released into synapse to generate action potential for motor neuron or muscle cell
    - The structure of the neuron allows for the detection, generation, transmission and integration of signal information
    - Schwann cells separated by gaps of unsheathed axon over which the impulse travels as the signal propagates along the neuron
    - Different types of nerve cells
        - Sensory – receives signals from receptors
        - Interneuron – between sensory and motor
        - Motor – transmits signals to muscle cells (effector)
    - Parts of Nervous system
        - Sympathetic – fight or flight
        - Parasympathetic – rest and relax
        - Central – brain & spinal cord
            - Brain evolved from nerve nets to large, cephilized brains (cephilization); humans have large forebrain, where most complex functions occur
        - Peripheral – nerves branching off of spine

2. The Endocrine System
    - Negative feedback mechanisms maintain dynamic homeostasis for a particular condition (variable) by regulating physiological processes, returning the changing condition back to its target set point'
        - End result reduced beginning, lowering end result (ex: insulin and glucose levels)
    - Positive feedback mechanisms amplify responses and processes in biological organisms. The condition initiating the response is moved farther away from the initial set-point. Amplification occurs when the stimulus is further activated which, in turn, initiates an additional response that produces system change
        - End result amplifies beginning, which amplifies end result, etc. (ex: oxytocin and contractions)
    - Endocrine system secretes hormones into the bloodstream and travel to different target cells (close or far)
        - One signal molecule can have multiple target cells/tissues/organs but it is a slow method of signaling
        - Hormones can be
            - Lipid based – diffuse easily through cell membrane, bind with receptor in cytoplasm of cell, which then acts as a transcription factor
            - Protein based – cannot diffuse easily through cell membrane, binds with receptor on the cell membrane, signal transduction occurs, eventually acting as a transcription factor

- Hormones to know:
    - Insulin/glucagon – regulate blood glucose levels by negative feedback (insulin lowers blood glucose when it is high, glucagon increases blood glucose when it is low)
    - ADH (anti-diuretic hormone) – regulates blood osmolarity by negative feedback (too much water being secreted in urine, ADH re-absorbs water)
    - Testosterone – male characteristics, causes sperm production
    - Estrogen – female characteristics, egg production, high levels = ovulation, low levels = menstruation
    - Progesterone – maintains uterine lining, low levels = menstruation
    - Auxin – plant hormone, causes phototropism
    - Ethyline – plant hormone, causes fruit ripening

3. Circulatory system
    - Oxygen comes in to lungs, enters blood stream through capillaries wrapped around alveoli, goes to heart, is transported to cells where oxygen is exchanged for CO_2, brought back to lungs where CO_2 is released
    - Blood pH is affected by amount of CO_2 in blood; more CO_2 = more acidic. This can shift curves of enzymes/protein saturation

4. Digestive & Excretory System
    - Food must be broken down so that it can diffuse into cells (broken into basic macromolecules); breaking down proteins produces toxic waste (ammonia)
    - Aquatic organisms can directly excrete ammonia b/c it is diluted in water; terrestrial organisms must convert ammonia to less toxic form (urea or uric acid) and dilute it with water in urine

5. Reproduction
    - Sexual vs. asexual reproduction
        - Sexual – two parents, genetic variation, takes longer
        - Asexual – one parent, exact copy, shorter
    - Reproductive systems – make gametes
        - Oogenesis and spermatogenesis – oogenesis allows one, large egg which provides nutrients; sperm produced quickly and in large numbers
    - Fertilization – sperm joins egg, happens in fallopian tubes; internal fertilization = safer, more effective
    - Embryo implants into uterine wall to develop

6. The Steps of Embryonic Development
    - Pattern Formation
        - Cytoplasmic Determinants
            - Cells near each other send signals determining other cells development
        - Homeotic (Hox) Genes
            - Body pattern genes
    - Cell Differentiation – cells become specialized by turning certain genes on
        - Controlled by transcription factors (stimulatory or inhibitory) and signaling

7. Stem Cells
    - Cells that are not yet differentiated – pluripotent vs. totipotent
    - Can be induced to become any type of cell
    - Adult stem cells in bone marrow
    - Research is controversial, but with new technologies may become less so due to being able to induce adult cells to become stem cells

8. Thermoregulation
    - Endotherm vs. ectotherm
    - Endotherm (warm-blooded) – regulates body temperature; higher metabolic rate to maintain body temperature; smaller organism = higher metabolic rate due to increased SA:V (harder to maintain temp)
    - Ectotherm (cold-blooded) – body temperature fluctuates with external temperature; metabolic rate determined by external temperature; warm = high metabolic rate, cold = low metabolic rate

9. Plants, invertebrates and vertebrates have multiple, nonspecific immune responses, ex: phagocytes (i.e. macrophages) engulf and digest pathogens with the help of lysosomes

10. Mammals use specific immune responses triggered by natural or artificial agents that disrupt dynamic homeostasis
    - The mammalian immune system includes two types of specific responses: cell mediated and humoral
        - Cell-mediated response – cytotoxic T cells, a type of lymphocytic white blood cell, target intracellular pathogens when antigens are displayed on the outside of the cells; engulf infected cell
    - In the humoral response, B cells, a type of lymphocytic white blood cell, produce antibodies against specific antigens
        - Antibodies are proteins produced by B cells, and each antibody is specific to a particular antigen
        - A second exposure to an antigen results in a more rapid and enhanced immune response.

11. Immune response in humans
    - 1st line of defense – Barriers (skin, mucous, secretions)
    - 2nd line of defense – non-specific immune responses
        - WBC's (phagocytes), engulf invaders; inflammatory response; fever
    - 3rd line of defense – humoral vs. cell mediated
        - Respond to antigens on surface of the cell; cell name tags, mark as self or non-self
        - B-cells (humoral response) – antibodies recognize foreign antigen, produce many antibodies against specific antigens; remember for next time around, response is more rapid, prevents future infection
            - Vaccines – injection of antigens or dead/weakened virus, stimulates immune system to produce antibodies so it will recognize antigen more quickly next time
        - T-cells (cell-mediated response) – antigen-presenting cells display fragments of invader; killer T-cell recognizes that cell is infected, engulfs cell; remembers for next time infection is in body

Practice Multiple Choice Questions:

1. In the human body, the respiratory system and circulatory system work together to deliver oxygen to the tissues of the body and remove carbon dioxide from the tissues of the body. Gas exchange between the lungs and the blood vessels occurs at the alveoli, small sacs within the lungs that are covered in a network of capillaries. If the surface area of the alveoli is decreased, how will this affect the organism as a whole?
a. The individual will not be able to deliver enough oxygen to the tissues of the body but will still be able to remove carbon dioxide from the bloodstream.
b. The individual will not be able to remove carbon dioxide from the bloodstream but will still be able to deliver enough oxygen to the tissues of the body.
c. The individual will not be able to deliver enough oxygen to the tissues of the body OR remove carbon dioxide from the bloodstream.
d. The individual will have an enhanced ability to deliver oxygen to the tissues of the body and remove carbon dioxide from the bloodstream.

2. We know that plants bend toward light because
a. the sun stimulates equal cell expansion on both sides of the stem.
b. cell expansion is greater on the dark side of the stem.
c. cell expansion is greater on the light side of the stem
d. auxin is inactive on the dark side of the stem.

3. Plants often use changes in day length (photoperiod) to trigger events such as dormancy and flowering. There are two types of plants based on their photoperiod requirements to induce flowering. These two types of plants are called short-day plants and long-day plants. A long-day plant will flower
a. in the late fall.
b. when the night is shorter than a critical value.
c. only under artificial light in the summer.
d. during short days with proper fertilization.
e. regardless of the photoperiod imposed.

4. Macrophages are large white blood cells that can engulf foreign substances called antigens. Both macrophages and lymphocytes, such as T cells, appear together at the site of infection. Which statement best explains how macrophages initiate an immune response when a new antigen is first encountered?
a. Macrophages incorporate the antigen into their genetic material and produce a large number of identical macrophages that are programmed to destroy that specific antigen.
b. Macrophages present the antigen directly to a memory B cell that produces antibodies programmed to destroy that specific antigen.
c. Macrophages present the antigen to helper T cells, which activate memory B cells to produce plasma cells, and the plasma cells release antibodies that identify and destroy that specific antigen.
d. Macrophages present fragments of the antigen to other macrophages, which are then able to seek out and destroy the antigen by releasing helper T cells that engulf that specific antigen.

5. What is the main difference between the humoral response and the cell-mediated response?
a. The humoral response is a type of nonspecific immunity, whereas the cell-mediated response is a type of specific immunity.
b. The humoral response is a type of specific immunity, whereas the cell mediated response is a type of nonspecific immunity.
c. The humoral response involves the creation of antibodies to attack pathogens that are free-floating in the body fluids (ex: blood and lymph), whereas the cell mediated response involves the creation of cytotoxic T cells to destroy infected body cells.
d. The humoral response involves the creation of cytotoxic T cells to destroy infected body cells, whereas the cell mediated response involves the creation of antibodies to attack pathogens that are free-floating in the body fluids (ex: blood and lymph).

6. Secondary immune responses upon a second exposure to a pathogen are due to the activation of
a. memory cells (both B cell and T cell varieties)
b. macrophages
c. stem cells
d. antigens

7. Secondary immune responses (aka immunological memory) explain
a. a macrophage's ability to "swallow" an antigen (a foreign particle)
b. the observation that some strains of the pathogen that causes dengue fever cause worse disease than others.
c. the ability of a helper T cell to bind to an antigen-presenting cell
d. the ancient observation that someone who had recovered from the plague could safely care for those newly diseased.

8. In animals, all of the following are associated with embryonic development EXCEPT
a. migration of cells to specific areas
b. formation of germ layers
c. activation of all the genes in each cell
d. inductive tissue interactions
e. cell division at a relatively rapid rate

Questions 9-12. Use the following choices:

a. Testis
b. Anterior pituitary
c. Thyroid
d. Pancreas

9. Releases hormones that control blood sugar levels by stimulating glycogen formation or breakdown

10. Secretes steroid hormones that affect secondary sex characteristics

11. Releases hormones that increase the rate of cellular respiration throughout the body

12. Secretes the hormones FSH and LH, which control ovulation

13. Nerve cells communicate with one another via chemical messengers called neurotransmitters. GABA is a neurotransmitter that causes the opening of channels on the post-synaptic neuron that let negatively charged chloride ions (Cl^-) into the cell or positively charged potassium ions (K^+) out of the cell. Is GABA an excitatory or inhibitory neurotransmitter and how do you know?
a. Excitatory; It causes the influx of positive charge to bring the postsynaptic neuron to threshold.
b. Excitatory; It prevents the influx of positive charge to prevent the postsynaptic neuron from reaching threshold.
c. Inhibitory; It causes the influx of positive charge to bring the postsynaptic neuron to threshold.
d. Inhibitory; It prevents the influx of positive charge to prevent the postsynaptic neuron from reaching threshold.

14. Suppose there is a drug that increases the number of Schwann cells on the axon of a neuron. How will this affect signaling down the length of this axon?
a. Nerve signaling will increase in speed.
b. Nerve signaling will decrease in speed.
c. Nerve signaling will require a smaller stimulus to trigger an action potential.
d. Nerve signaling will require a larger stimulus to trigger an action potential.

15. A toxin that binds specifically to voltage-gated potassium channels in axons and prevents them from opening would be expected to
a. prevent the repolarization and hyperpolarization (aka undershoot) phase of the action potential.
b. prevent the depolarization phase of the action potential.
c. enable the axon to reach threshold potential more rapidly.
d. prevent the axon from reaching threshold potential

16. When the concentration of solutes in the blood (blood osmolarity) is high, the pituitary gland releases antidiuretic hormone (ADH). ADH stimulates the kidneys to reabsorb water in order to increase blood volume and decrease blood osmolarity. When the kidneys reabsorb water, this causes the urine to be extremely concentrated. A student overhydrates in preparation for a big race. How will her body respond to this massive intake of water, which results in a high blood volume?
a. The high blood volume (low blood osmolarity) will inhibit the secretion of ADH from the pituitary, the kidney will not reabsorb water, and the urine will be very dilute (i.e. have a high water content)
b. The high blood volume (low blood osmolarity) will inhibit the secretion of ADH from the pituitary, the kidney will reabsorb water, and the urine will be very concentrated (i.e. have a low water content)
c. The high blood volume (low blood osmolarity) will stimulate the secretion of ADH from the pituitary, the kidney will not reabsorb water, and the urine will be very dilute (i.e. have a high water content)
d. The high blood volume (low blood osmolarity) will stimulate the secretion of ADH from the pituitary, the kidney will reabsorb water, and the urine will be very concentrated (i.e. have a low water content)

17. High blood glucose triggers cells in the pancreas to release the hormone insulin, which lowers blood glucose levels. Type 1 diabetes occurs when the pancreas cannot produce insulin. In an experiment, the blood glucose levels of several diabetic rats are measured and the rats are then fed a high carbohydrate meal. Which statement explains how a rat's blood glucose levels will most likely be affected by the high-carbohydrate meal?
a. The rat's blood glucose level will increase after eating, which will cause insulin levels to rise until blood glucose decreases below the pre-meal level.
b. The rat's blood glucose level will increase after eating and, after the rat is given an insulin injection, will decrease to the pre-meal level.
c. The rat's blood glucose level will increase for several hours after eating, and then will gradually decrease over several hours to the pre-meal level.
d. The rat's blood glucose level will increase after eating and, even after the rat is given an insulin injection, will remain higher than the pre-meal level.

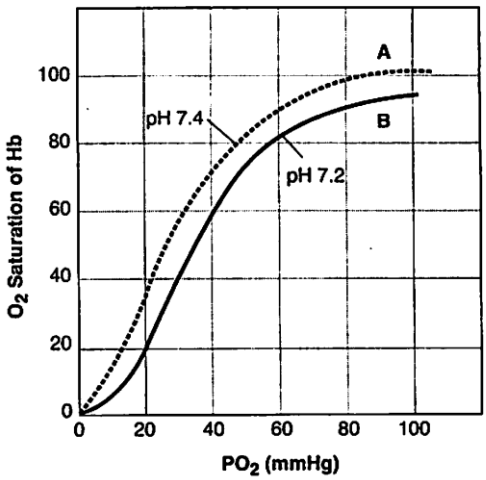
18. The hormone ethylene causes ripening in fruits. As fruits ripen, they produce more ethylene, which causes fruits in the nearby vicinity to ripen as well and produce ethylene. This is why all the apples in a barrel ripen at approximately the same time. This system is an example of
a. Positive feedback because the plant's response (i.e. ripening) increases the stimulus (i.e. release of ethylene)
b. Positive feedback because the plant's response (i.e. ripening) removes the stimulus (i.e. release of ethylene)
c. Negative feedback because the plant's response (i.e. ripening) increases the stimulus (i.e. release of ethylene)
d. Negative feedback because the plant's response (i.e. ripening) removes the stimulus (i.e. release of ethylene)

19. A toxin binds to voltage-gated calcium channels on the axon terminal membrane of a pre-synaptic cell and prevents them from opening in response to the wave of depolarization passing down the pre-synaptic cell's axon. What will be the most immediate effect of this toxin on transmission of the signal across a synapse from the pre-synaptic cell to the post-synaptic cell?
a. Neurotransmitter molecules cannot diffuse across the synapse.
b. Neurotransmitter molecules cannot bind to ligand-gated Na^+ channels on the postsynaptic cell's dendrite membrane.
c. Ligand-gated Na^+ channels on the postsynaptic cell's dendrite membrane will not open, allowing Na^+ to enter the cell and bring the postsynaptic cell to threshold potential.
d. Calcium cannot come into the pre-synaptic cell and cause vesicles filled with neurotransmitter molecules to fuse with the pre-synaptic cell's axon terminal membrane.

20. Which of the following sequences describes the passage of a nerve impulse through a simple reflex arc in humans?
a. receptor → effector → interneuron → motor neuron → sensory neuron
b. receptor → sensory neuron → interneuron → effector → motor neuron
c. sensory n euron → effector → motor neuron → interneuron → receptor
d. receptor → sensory neuron → interneuron → motor neuron → effector

21. Which of the following is correct about blood type?
a. blood type O has O antigens on the surface of the red blood cells
b. blood type A has A antibodies circulating in the plasma
c. the danger in a transfusion is if the donor has antibodies to the recipient
d. A and B antigens can be found on the surface of red blood cells

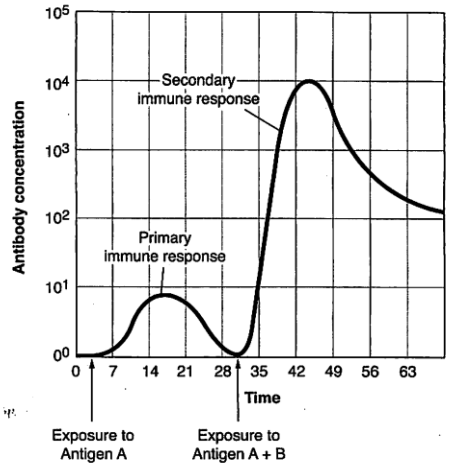
22. Oxygen is carried in the blood by the respiratory pigment hemoglobin, which can combine loosely with four oxygen molecules, forming the molecule oxyhemoglobin. To function properly, hemoglobin must bind to oxygen in the lungs and drop it off at body cells. The pH of the blood affects the oxygen-binding capabilities of hemoglobin. Below is a graph showing two different saturation-dissociation curves for hemoglobin at two different pH levels.



Based on your knowledge of biology and the information in the graph, which statement about hemoglobin is correct?
a. Hemoglobin at pH 7.2 has a greater affinity for oxygen and therefore binds more easily to the oxygen in the lungs.
b. Hemoglobin at pH 7.4 is characteristic of a mammal that evolved at sea level where oxygen levels are high.
c. Carbon dioxide causes the blood to be more acidic, which causes hemoglobin to drop off oxygen more readily at body cells.
d. Oxygen causes the blood to be more basic, which causes hemoglobin to drop off oxygen more readily at body cells.

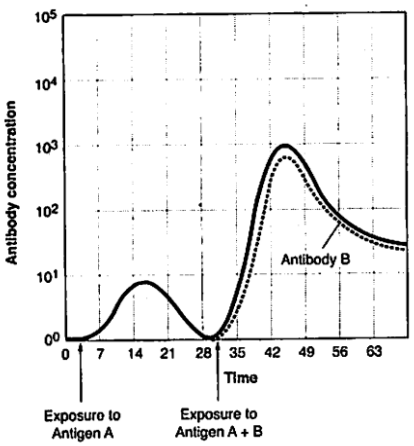
23. In a classic experiment, a scientist grafted a cell from the dorsal (back) side of one amphibian embryo onto the ventral (stomach) side of a second embryo. A second notochord and neural tube developed at the location of the graft. This experiment shows that
a. embryonic development does not follow any particular developmental pathway and can be easily altered
b. the dorsal side of an embryo can be transformed into the ventral side
c. the dorsal side of an embryo can develop into an organ or structure
d. the dorsal side of an embryo signals adjacent tissue to transform into specific structures during development

24. Below is a graph depicting a person's first exposure to antigen *A*, after being given a vaccine on day 1, with a subsequent immune response. A second exposure to antigen *A* on day 30 results in a secondary immune response. There is also a first exposure to antigen *B* on day 30.

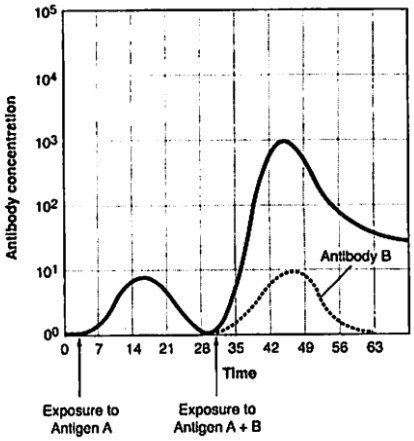


Which of the following graphs accurately depicts the immune response to antigen *B* and the reason for it?

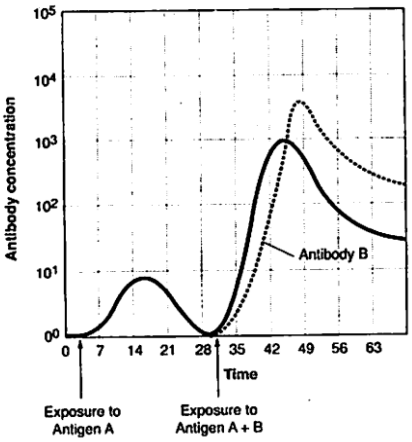
a.



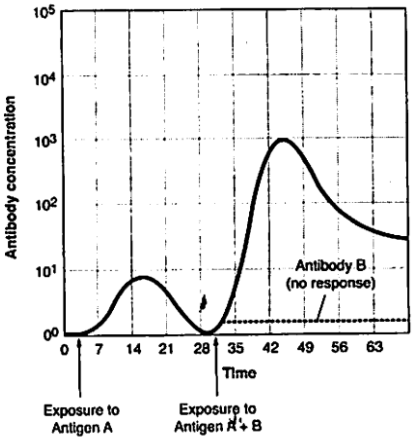
b.



c.

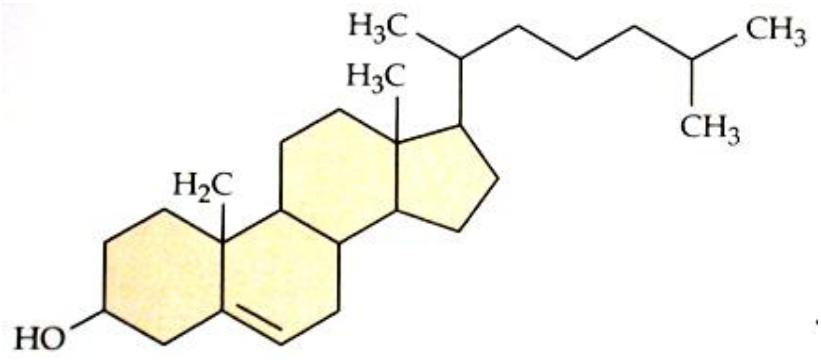


d.



a. Graph A. The primary response to antigen *B* is almost as fast and large as the secondary immune response to antigen *A* because the entire immune system was activated by the first exposure to antigen *A*.
b. Graph B. Immune responses are specific. An earlier exposure to antigen *A* will only cause a heightened immune response to this antigen, not antigen *B*.
c. Graph C. The response to antigen *B* on day 30 is larger than the secondary immune response to antigen *A* because the immune system has already been activated and all new responses are heightened.
d. Graph D. There is very little immune response to antigen *B* because the immune system is fully engaged in a secondary response to antigen *A*.

25. Below is a diagram of a molecule of the sex hormone, testosterone, which is derived from cholesterol.

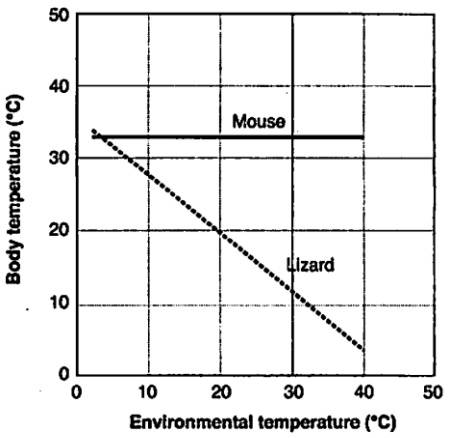


Which of the following statements best describes the action of this hormone on cells of the human gonads?

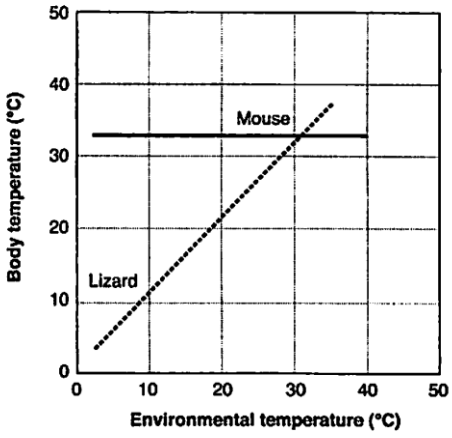
a. The hormone acts as the first messenger when it binds to and activates the G protein-coupled receptor in the surface of cells in the testes. This activates the mobile G protein located inside the cell.
b. The hormone enters the cells in the testes by first binding with a membrane receptor, which causes a channel to open in the membrane, allowing the testosterone to flood into the cell
c. The hormone readily passes through the cell membrane and binds to a receptor in the cytoplasm. The hormone and receptor then enter the nucleus and act as a transcription factor that turns on one or more genes.
d. The hormone binds with cAMP on the surface of the cell. Once attached to cAMP, the hormone enters the cell and initiates a signal transduction pathway.

26. Mice are endotherms, while lizards are ectotherms. Which of the following graphs correctly depicts this?

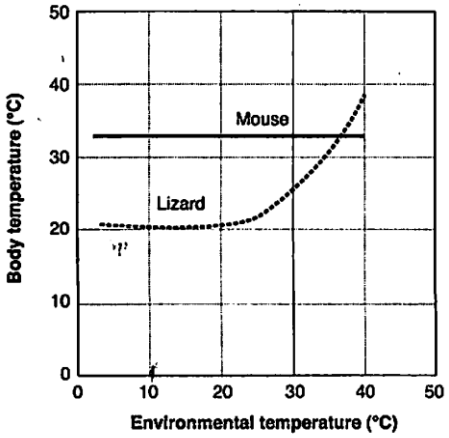
a.



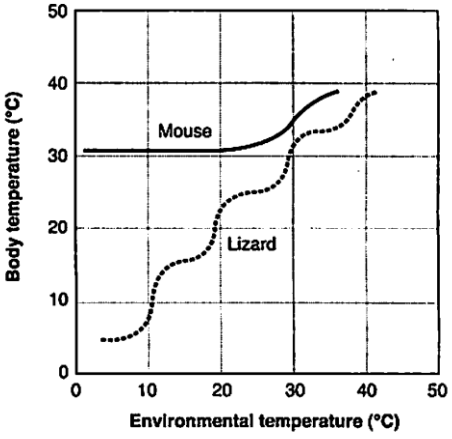
b.



c.



d.



27. The enzyme phosphofructokinase (PFK) is an allosteric enzyme at a critical step in glycolysis. PFK is also allosterically inhibited by ATP. Which of the following best explains why the interaction between PFK and ATP is an efficient means of controlling glycolysis and cell respiration?
a. This is an example of positive feedback; the presence in the cell of large amounts of ATP further increases the production of ATP
b. This is an example of negative feedback; the presence in the cell of large amounts of ATP shuts down the process to produce more ATP
c. This is an example of positive feedback; an increase in PFK increases the rate of glycolysis and further increases the production of ATP
d. This is an example of negative feedback; a decrease in PFK shuts down glycolysis and also stops the further production of ATP

28. Which would be associated with the parasympathetic nervous system?
a. increase in blood sugar
b. increase in adrenaline
c. increase in breathing rate.
d. increase in digestion

Practice Long Response Questions:

1. An important defense against diseases in vertebrate animals is the ability to eliminate, inactivate, or destroy foreign substances and organisms. Explain how the immune system achieves THREE of the following:

- Provides an immediate nonspecific immune response
- Activates T and B cells in response to an infection
- Responds to a later exposure to the same infectious agent
- Distinguishes self from nonself

2. Homeostasis, maintaining a steady-state internal environment, is a characteristic of all living organisms. Choose three of the following physiological parameters and for each, describe how homeostasis is maintained in an organism of your choice. Be sure to indicate what animal you have chosen for each parameter. You may use the same animal or different animals for your three descriptions.

- Blood-glucose levels
- Body temperature
- pH of blood
- Osmotic concentration of the blood
- Neuron resting-membrane potential

3. a. Communication occurs among the cells in a multicellular organism. Choose THREE of the following examples of cell-to-cell communication, and for each example, describe the communication that occurs and the types of responses that result from this communication.

- Communication between two plant cells
- Communication between two immune-system cells
- Communication either between a neuron and another neuron or between a neuron and a muscle cell
- Communication between a specific endocrine-gland cell and its target cell

b. Compare the cell-signaling mechanisms of steroid hormones and protein hormones.

4. Reproduction can be either asexual or sexual.
(a) Using a specific example, describe how organisms can reproduce asexually. Discuss TWO evolutionary advantages of asexual reproduction.
(b) Identify THREE ways that sexual reproduction increases genetic variability. For each, explain how it increases genetic diversity among the offspring.
(c) Discuss TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.