**Homeostasis**

1. The mechanisms of homeostasis

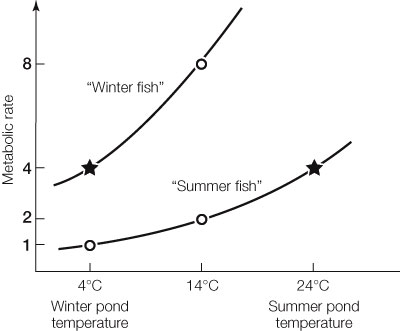
a. maintain a relatively constant internal physiological environment regardless of the changes in the external environment.

b. keep vital organs working at their maximum potential.

c. keep all cells working at the same metabolic rate.

d. keep the body’s metabolic rate constant in varying environmental temperatures.

e. keep the body’s temperature constant in varying environmental temperatures.



2. The “winter fish”has a *Q*10 of \_\_\_\_\_\_\_; the “summer fish”has a *Q*10 of \_\_\_\_\_\_\_.

a. 4; 4

b. 4; 1

c. 8; 2

d. 2; 2

e. The answer cannot be determined from the data provided.

3. Elephants use their ears to release heat to the environment. What mechanisms might they employ to increase heat loss from the ears?

a. Increased convection by means of ear flapping

b. Moving into the sun

c. Increased blood flow to the ears

d. Covering their ears with dust

e. Both a and c

4. The hypothalamus serves in part as an integrated thermoregulatory center defining an organism’s response to changes in its thermal environment. Because the hypothalamus normally serves to produce metabolic responses that reverse the direction of environmental temperature change, the control it exerts is termed

a. positive feedback.

b. metabolic compensation.

c. negative feedback.

d. feedforward.

e. None of the above

5. Increased heat for thermoregulation or thermogenesis is produced either by shivering or by nonshivering mechanisms. Which of the following is *not* necessary for nonshivering thermogenesis?

a. Brown fat

b. Thermogenin

c. Pyrogens

d. The consumption of metabolic fuels

e. The uncoupling of proton movement from ATP production

6. Within a range of environmental temperatures called the thermoneutral zone, the metabolic rate of an endotherm is

a. variable.

b. low, and independent of temperature.

c. high, and independent of temperature.

d. below the basal metabolic rate.

e. dependent upon the temperature.

7. Countercurrent heat exchange

a. moves warm blood coming from the muscles past cold blood flowing into the muscles.

b. allows “hot” fish to maintain body temperatures higher than the surrounding water temperature.

c. is found in large, rapidly swimming fish.

d. increases a fish’s sustainable power output threefold for every 10°C rise in muscle temperature.

e. All of the above

8. As the environmental temperature in a closed, empty chamber increases (up to 25°C), the metabolic rate of an ectotherm \_\_\_\_\_\_\_ and that of an endotherm \_\_\_\_\_\_\_.

a. increases; increases

b. increases; decreases

c. decreases; increases

d. decreases; decreases

e. stays the same; decreases

9. In response to a 10°C rise in environmental temperature, an endotherm’s body temperature will

a. rise at a constant rate.

b. fall at a constant rate.

c. fall to a point, then become stable.

d. rise to a point, then become stable.

e. remain relatively constant.

10. Which of the following statements about hibernation is *false*?

a. The change in body temperature and length of duration is similar to those of daily torpor.

b. It is a form of regulated hypothermia.

c. The body’s thermostat is turned down to a low level.

d. Metabolic rate is reduced to only a fraction of the basal metabolic rate.

e. It may be interrupted by brief returns to normal body temperature.

**Nervous System**

11. The two primary cell types of the nervous system are \_\_\_\_\_\_\_ and \_\_\_\_\_\_\_.

a. fibroblasts; chondrocytes

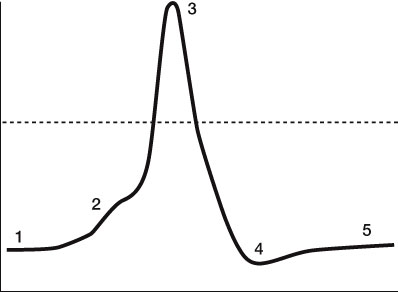
b. neurons; glial cells

c. epithelial cells; glandular cells

d. neurons; epithelial cells

e. neuromuscular cells; epithelial cells

Refer to the graph below, showing the course of an action potential.



12. In the action potential shown, which of the following cellular events is mispaired with the position at which it occurs?

a. Position 1 – Voltage-gated sodium channels are closed

b. Position 2 – Activation gates of some sodium channels open

c. Position 3 – Voltage-gated potassium channels close

d. Position 4 – Inactivation gates of sodium channels close

e. Position 5 – Inactivation gates of sodium channels reopen

13. In the action potential shown, the *x*-axis should be labeled \_\_\_\_\_\_\_, and the *y*-axis should be labeled \_\_\_\_\_\_\_.

a. distance (mm); current (mA)

b. time (msec); voltage (mV)

c. distance (mm); voltage (mV)

d. time (msec); current (mA)

e. current (mA); voltage (mV)

14. While you read this question, your neurons are busy sending information to and from your brain; meanwhile, the metabolic needs of those neurons are met by

a. afferent neurons.

b. efferent neurons.

c. interneurons.

d. glial cells.

e. None of the above

15. Neurons that transmit information from sensory cells to the central nervous system are part of the

a. brain.

b. peripheral nervous system.

c. central nervous system.

d. spinal cord.

e. nerve net.

16. Which of the following differs the *least* among species?

a. Brainstem

b. Olfactory lobe

c. Cerebrum

d. Cerebellum

e. These all vary equally among species.

17. Action potentials are also called

a. potential energy.

b. resting potentials.

c. nerve impulses.

d. neural potentials.

e. leak currents.

18. The resting potential across the neuronal membrane is generally maintained by the

a. sodium–potassium pump.

b. action potential.

c. resting potential.

d. voltage-gated channels.

e. negative ion pump.

19. Which of the following can carry electric charges across the cell membrane?

a. Electrons

b. Protons

c. Water

d. Ions

e. Proteins

20. Which of the following statements about voltage-gated channel proteins is true?

a. If the membrane voltage reaches threshold potential, ions are pumped through the membrane.

b. If the membrane voltage reaches threshold potential, ions can diffuse through the membrane.

c. Ions can move through the membrane only if the overall membrane voltage stays the same.

d. Ions are pumped through the membrane in order to maintain existing membrane voltage.

e. When the gates close, membrane voltage does not change.

21. Saltatory conduction results when

a. continuous propagation of the nerve impulse speeds up.

b. a nerve impulse jumps from one neuron to another.

c. the threshold for an action potential is suddenly increased.

d. action potentials spread from node to node down the axon.

e. the direction of an action potential suddenly changes.

22. The frequency at which a single neuron can “fire” action potentials is limited by the

a. number of synapses that the neuron forms.

b. number of other cells that the neuron contacts.

c. refractory period for the neuron’s Na+ channel.

d. length of the axon of the neuron.

e. number of dendrites on the neuron.

23. In general, the more autonomic functions are found in the \_\_\_\_\_\_\_, and the more complex functions are found in the \_\_\_\_\_\_\_.

a. forebrain; hindbrain

b. telencephalon; diencephalon

c. thalamus; hypothalamus

d. midbrain; hindbrain

e. hindbrain; forebrain

24. Controls physiological functions such as breathing and circulation

a. Medulla

b. Cerebellum

c. Diencephalon

d. Telencephalon

e. Thalamus

25. Orchestrates and refines motor commands

a. Medulla

b. Cerebellum

c. Diencephalon

d. Telencephalon

e. Thalamus

26. The largest difference between the brains of humans and the brains of fish is in the size of the

a. medulla.

b. cerebellum.

c. cerebrum.

d. diencephalon.

e. thalamus.

27. The fight-or-flight mechanisms are a function of the \_\_\_\_\_\_\_ branch of the autonomic nervous system.

a. sympathetic

b. parasympathetic

c. contralateral

d. efferent

e. afferent

28. You are about to jump off the high dive for the first time; your pupils dilate and your pulse rate increases, reflecting the actions of this part of the nervous system. Two answers apply. Choose both.

a. The parasympathetic nervous system

b. The autonomic nervous system

c. The sympathetic nervous system

d. Cholinergic neurons

e. The voluntary nervous system

29. The primary motor cortex is found in the \_\_\_\_\_\_\_ lobe and controls \_\_\_\_\_\_\_.

a. parietal; the detection of touch or pressure

b. parietal; movement

c. temporal; movement

d. frontal; movement

e. frontal; the detection of touch or pressure

30. Which of the following is *not* a function of the spinal cord?

a. Generation of repetitive motor patterns

b. Reflexes

c. Conduction of motor impulses from the brain

d. Refinement of motor and behavioral processes

e. Conversion of afferent to efferent information

**Endocrine System**

31. The neurohormones antidiuretic hormone (vasopressin) and oxytocin are produced by the

a. anterior pituitary and released by the posterior pituitary.

b. hypothalamus and released by the posterior pituitary.

c. pituitary and signal the hypothalamus.

d. hypothalamus and signal the brain.

e. pituitary and signal to the reproductive organs.

32. Portal blood vessels connect the \_\_\_\_\_\_\_ to the \_\_\_\_\_\_\_.

a. hypothalamus; brain

b. hypothalamus; posterior pituitary

c. hypothalamus; anterior pituitary

d. anterior pituitary; posterior pituitary

e. pancreas; liver

33. Under which of the following conditions would a mammal tend to increase thyroxine levels?

a. Following childbirth in a female

b. During illness and fever

c. When blood glucose levels are high

d. During sleep and rest

e. When exposed to cold

34. Which of the following would signal a reduction in thyrotropin release?

a. Increased levels of thyrotropin

b. Decreased levels of thyrotropin

c. Increased levels of thyroxine

d. Decreased levels of thyroxine

e. Decreased activity of the thyroid

35. In the disease diabetes mellitus, a lack of insulin prevents

a. the excretion of glucose.

b. glucose breakdown.

c. glucose uptake by cells.

d. the conversion of glucose to glycogen.

e. the synthesizing of glucose.

36. Responsible for the conversion of glycogen into glucose when serum glucose levels fall

a. Insulin

b. Glucagon

c. Epinephrine

d. Somatostatin

e. Cortisol

37. Which of the following statements about biological rhythms is *false*?

a. Melatonin, which influences biological rhythms, is released by the pineal gland during the day.

b. Photoperiodicity, which influences biological rhythms, is the phenomenon whereby seasonal changes in day length cause physiological changes in animals.

c. Melatonin release, which influences biological rhythms, is inhibited by exposure to light.

38. Produced by the adrenal medulla

a. Insulin

b. Glucagon

c. Epinephrine

d. Somatostatin

e. Cortisol

39. Which of the following is the earliest event in puberty?

a. The hypothalamus releases more GnRH.

b. The level of circulating androgens rises in males.

c. The menstrual cycle is initiated in females.

d. The gonads differentiate into testes or ovaries.

e. The hypothalamic GnRH-producing cells become more sensitive to negative feedback from sex steroids and gonadotropins.

40. Which of the following is *not* a function of cortisol?

a. Metabolizing fats for energy

b. Mediating response to stress

c. Slowing down metabolism of glucose

d. Stimulating the immune response

e. Metabolizing proteins for energy

**Immune System**

41. Interactions between macrophages and lymphocytes are coordinated by

a. antibodies.

b. T cell receptors.

c. mast cells.

d. platelets.

e. MHC proteins.

42. The bacteria and fungi that typically live and reproduce on the skin without causing disease are called

a. microcytes.

b. ectocytes.

c. pathogens.

d. normal flora.

e. normal fauna.

43. Which of the following does *not* occur during inflammation and wound healing?

a. Histamines cause capillaries to constrict.

b. Phagocytes engulf bacteria and other dead cells.

c. Wound healing begins when signaling molecules stimulate endothelial cell division.

d. Some cytokines elevate body temperature.

e. All of the above occur.

44. When an individual is first exposed to the smallpox virus, several days pass before significant numbers of specific antibody molecules and T cells are produced. However, a second exposure to the virus causes a large and rapid production of antibodies and T cells. This response is an example of

a. antigenic determinants.

b. phytoalexins.

c. phagocytosis.

d. interferon production.

e. immunological memory.

45. The diversity among antibodies occurs mainly through

a. posttranslational modifications.

b. protein-folding differences.

c. different patterns of methylation.

d. DNA changes.

e. None of the above

46. Which of the following must take place for a B cell to become an antibody-secreting plasma cell?

a. Clonal anergy (anergy refers to immune cells that are unable to mount a response)

b. Binding to the antigen by a helper T cell that has the same specificity as the B cell

c. The production of IgE

d. The production of IgG

e. Activation of Class I MHC proteins

47. The \_\_\_\_\_\_\_ region of an antibody determines its class; the \_\_\_\_\_\_\_ region determines its specificity.

a. constant; specific

b. constant; variable

c. specific; constant

d. specific; variable

e. variable; constant

48. Which of the following statements is true?

a. There is little polymorphism at MHC loci in humans.

b. T cell receptors recognize antigenic fragments only when they are bound to an MHC molecule.

c. Helper T cells have a surface protein that binds to MHC Class II molecules.

d. Both a and b

e. Both b and c

49. A plasma cell produces IgM molecules that recognize an antigenic determinant on an influenza virus. After several days, the cell begins to produce IgG molecules that recognize the same antigenic determinant. This process is called

a. activation.

b. RNA splicing.

c. gene mutation.

d. class switching.

e. autoimmunity.

50. The retrovirus HIV specifically destroys helper T cells and thus disrupts the \_\_\_\_\_\_\_ response.

a. humoral immune

b. cellular immune

c. inflammatory

d. Both a and b

e. Both a and c

Bonus 51. Which of the following statements about regulation of hormone receptors is *false*?

a. Continuous high levels of a hormone can decrease the numbers of its receptors.

b. Type II diabetes is characterized by a downregulation of insulin receptors.

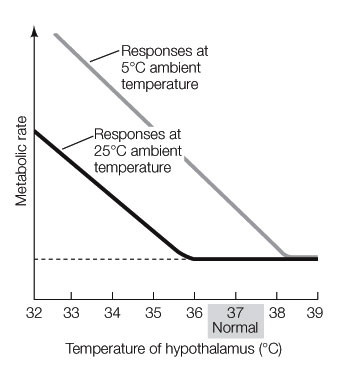
c. Upregulation of receptors can occur when the levels of hormone secretion are suppressed.

d. The abundance of receptors for a hormone can be under feedback control.

e. All of the above are true; none is false.

**Short Answer:** Choose questions to total 10 marks. Circle those you want me to grade.

1. In the experiment graphed below, researchers heated and cooled the hypothalamus of a mammal and determined the metabolic rates at different environmental (ambient) temperatures. Based on this experiment, what can you say about this mammal’s differing metabolic responses at ambient temperatures of 5oC compared to 25oC? (2 marks).
   1. Why are the thermoneutral zones different under these different ambient conditions. (2 marks).



1. If the cytotoxic T cells were eliminated from a person’s array of immune defenses, what kinds of disease would he or she be susceptible to? (2 marks)
2. Why would breast-feeding an infant soon after birth help a mother’s uterus return to its prepregnancy size? (2 marks)
3. Refer to the diagram below of a neuromuscular junction. Outline the events involved in the transmission of a nerve impulse from one neuron to another across the synaptic cleft. Use or don’t use the numbers in the diagram as much as it helps your answer. (6 marks)

