**Basic Principles of Animal Form and Function Review**
**Chapter 40**

1. Describe how the endocrine and nervous systems help coordinate and control responses to stimuli. (Signaling molecules released into the bloodstream by endocrine cells are carried to all locations in the body. Neurons transmit signals along neural pathways between specific parts of the body. These two methods allow a coordinated response to a stimulus experienced in one part of the body.)

2. Some signals must be received by a single cell while others must be received by many different cells. Identify which method – a hormone or a nerve impulse – would be best for each purpose. Justify your responses. (A hormone is best for signals which must be received by several cells because hormones can travel widely in the bloodstream. A nerve impulse can travel only along an existing neural pathway, making it better suited for a signal that must be received by a single cell.)

3. Suppose you are standing at the edge of a cliff and suddenly slip, barely managing to keep your balance and avoid falling. As your heart races, you feel a burst of energy, due in part to a surge of blood into dilated (widened) vessels in your muscles and an upward spike in the level of glucose in your blood. Why might you expect that this "fight-or-flight" response requires both the nervous and endocrine systems? (The nervous system perceives the danger and provokes a split-second muscular response to keep from falling. The nervous system, however, does not make a direct connection with blood vessels or glucose-storing cells in the liver. Instead, the nervous system triggers the release of a hormone (called epinephrine, or adrenaline) by the endocrine system, bringing about a change in these tissues in just a few seconds.)

4. Using body temperature as an example, distinguish between a regulator and a conformer. (Some organisms (homeotherms) maintain a consistent internal temperature, making them regulators. The internal temperature of others (ectotherms) is dependent on the ambient temperature, making them conformers.)

5. Again, using temperature as an example, describe how negative feedback can be used to maintain homeostasis. (During times when an organism is active, it produces heat, increasing its body temperature. The increased temperature is detected by the nervous system which triggers some mechanism (sweating, in humans) to decrease temperature. The triggered mechanism decreases the temperature, eliminating the stimulus, and shutting off the mechanism.)

6. a) Distinguish between endotherms and ectotherms. (Endotherms are warmed mainly by heat produced by metabolism. Ectotherms gain heat from external sources.)

   b) Explain why the basic metabolic rate of an endotherm is much higher than that of an ectotherm. (In order to produce sufficient heat to warm themselves, endotherms must have a higher basic metabolic rate.)

7. a) A mouse and a small lizard of the same mass (both at rest) were placed in experimental chambers under identical environmental conditions. Identify which animal would consume oxygen at a higher rate. Provide reasoning to justify your response. (The mouse would

consume oxygen at a higher rate because it is an endotherm, so its basal metabolic rate is higher than the ectothermic lizard's standard metabolic rate.)

b) Identify the animal that must eat a larger proportion of its weight in food each day: a house cat or an African lion caged in a zoo. Provide reasoning to justify your response. (The house cat; smaller animals have a higher metabolic rate per unit body mass and a greater demand for food per unit body mass.)

8. In 1847, the German biologist Christian Bergmann noted that mammals and birds living at higher latitudes (farther from the equator) are on average larger and bulkier than related species found at lower latitudes. Propose an evolutionary hypothesis to explain this observation. (Larger animals have a lower ratio of surface area to volume and therefore lose body heat more slowly than smaller animals. During evolution, larger body forms would have been favored for endotherms in higher latitudes because they could maintain body temperature more readily in the cold climate. In the warmer climates at lower latitudes, endotherms instead need to shed body heat, favoring smaller body forms because their higher ratio of surface area to volume facilitates heat loss.)

9. Suppose the animals at a zoo were resting comfortably and remained at rest while the nighttime air temperature dropped. If the temperature change were sufficient to cause a change in metabolic rate, predict the changes you would expect in body temperature and metabolic rate for an alligator and a lion. Provide reasoning to justify your responses. (The alligator's body temperature would decrease along with the air temperature. Its metabolic rate would therefore also decrease as chemical reactions slowed. In contrast, the lion's body temperature would not change. Its metabolic rate would increase as it shivered and produced heat to keep its body temperature constant.)

10. Animals often experience times of limited energy because food is unavailable. Explain how torpor and hibernation are adaptations for coping in during times. (Torpor is a period of decreased activity and metabolism. During this time, an animal uses less energy, requiring less food. Hibernation is long term torpor.)