1. Compare and contrast the nervous system control pathways and the endocrine system pathways in the following:
   - anatomical structures involved
   - time course of action
   - general effectors involved
   - use of chemical mediators and receptors
   - types of pathways controlled

2. What did the results of Berthold's classic rooster castration experiment reveal about the importance of testicular hormones and how they might work.

3. How do endocrine, paracine and autocrine chemicals differ and how are they similar? What are target cells? Why are receptors necessary?

4. What is the difference between an endocrine gland and a exocrine gland and give an example of each.

5. Give examples of the control of a hormone's secretion rate (also including the endocrine gland, the hormone involved and its main function) by:
   - an inorganic chemical
   - a neurotransmitter
   - a neurohormone
   - a releasing or inhibiting hormone
   - a tropic hormone

6. What is the anatomical and functional relationship between the brain, hypothalamus, anterior pituitary and posterior pituitary. What are two hormones of the posterior pituitary, what controls their release and name one major function of each. Be familiar with the hormones of the anterior pituitary listed in Table 18.3 of your text and their principle actions listed in Table 18.4.

7. Describe a negative feedback system that maintains cortisol secretion at relatively stable levels and a positive feedback system that elevates oxytocin during childbirth. In the case of cortisol, how can this negative feedback system be over-ridden in stressful situations? What is the significance of this ability to override the typical negative feedback control?

8. Compare the hormones of the adrenal medulla with cortisol from the adrenal cortex, including control, chemical class, one major effect and the conditions under which they are elevated.

9. What is the role of binding proteins for hormones in the blood? What would happen to the effectiveness of the hormone if concentration of its binding protein was...
increased or decreased? What kinds of hormones tend to have specific binding proteins in the blood and why?

10. What is meant by up-regulation and down-regulation? What is the difference between synergism and permissiveness in hormone systems? Give examples.

11. Explain why the water solubility of a hormone determines the major features of its signal transduction pathway. Compare the signal transduction pathway for a water soluble and a lipid soluble hormone. Give examples of each. In second messenger systems, why does the effect of the hormone often appear more rapidly (within seconds or minutes vs. hours) than for lipid soluble hormones.

12. Why is diabetes mellitus said to a heterogeneous collection of diseases? What is the hallmark condition that defines this disease and how it is usually measured in a clinical setting?

13. Compare type I and type II diabetes in their usual age at onset, treatment, prevalence in the US, associated symptoms and characteristics.

14. Explain how the ratio of insulin and glucagon varies with absorptive vs. post-absorptive states and how the change in the ratio of I/G alters the basic biochemical pathways of many cells in the body. Why is insulin said to be the "hormone of plenty"? Where do insulin and glucagon come from?

15. Why is type I diabetes fatal if not treated and what is the usual treatment? What are some long-term health effects of this condition.

16. Work through the answers to matching question 13 on page 631 or your textbook.

**MUSCLE**

1. Describe the sliding filament mechanism of muscle contraction. How does the sarcomere change in length and appearance when going from a relaxed to contracted state? What structural characters of actin and myosin are important to the sliding filament mechanism?

2. Describe the cross bridge cycle in skeletal muscle and the roles that ATP and calcium play.

3. Describe excitation contraction coupling and all the structures and events that are involved in contraction and relaxation of a muscle fiber (see Fig 10.12).

4. How and why does tension a muscle can exert on a load vary with (a) muscle length, (b) recruitment (c) frequency of action potentials? Why is the tension that a muscle can generate during fused tetany exceed that in a single twitch?

5. How does a neuromuscular junction compare and contrast with a neuron-neuron synaptic connection? Include both structural and functional aspects.
6. What are the components of a simple muscle twitch and what determines the shape and time length of a muscle twitch?

7. How does the speed of muscle shortening vary with the load on the muscle and what is thought to be the mechanism behind this functional relationship? Why is the efficiency of power output maximized at intermediate muscle loads?

8. Where do muscles get the ATP they need to work? What are three different roles for ATP in muscle function? What is meant by oxygen debt?

9. How are some muscles adapted for fatigue-resistance and others for power production?

10. What are the performance and structural characteristics of muscle fiber types expressing the 3 different isoforms of myosin in humans. To what extent can exercise regimes change muscle fiber types within a muscle? Know the characteristics of muscle fiber types shown in table 10.1.

11. In what ways (both structural and functional) are smooth muscle fibers similar to skeletal muscle fibers and in what ways are they different? Answer the same question for cardiac muscle. Are cardiac and smooth muscle fibers adapted for fast, anaerobic contractions or slow, aerobic contractions?

12. Compare length-tension relationships in smooth, skeletal and cardiac muscle fibers. What is the functional significance of the difference?

13. What is a pacemaker potential? What do intercalated discs do in the heart? Why can’t the heart go into tetany? What increases contractility of the heart?

Be familiar with the following terms:
- myofiber/myofibril
- epi-/peri-/endomysium
- sarcomere
- actin/myosin
- troponin/tropomyosin
- thick filament/thin filament
- actinomyosin ATPase
- cross bridge cycle
- transverse tubule
- sarcoplasmic reticulum
- excitation contraction coupling
- power stroke
- rigor state
- motor end plate
- acetylcholine/acetylcholinesterase
- end plate potential
- tension/load
- isotonic/isometric contractions
- motor unit
- series elastic component
- myoglobin
- fused tetanus
- creatine phosphate
- creatine kinase
- oxygen debt
- fast glycolytic/oxidative
- slow oxidative
- myoglobin
- single unit/multi unit smooth muscle
- varicosity
- gap junctions
- autorhythmic