Exam 2

100 points total

Multiple choice. As with any test, choose the best answer in each case. Each question is 3 points.

Comments are provided in italic for questions that too many people missed!

1. Which class of hormone does not contain any lipophilic members?
   a. Amine hormones
   b. Peptide hormones
   c. Steroid hormones
   d. a and b
   e. a and c

   [Steroid hormones are lipophilic, and the thyroid hormones, which are amines, are also lipophilic.]

2. Which of the following statements about intracellular hormone receptors is incorrect?
   a. They are activated by lipophilic hormones.
   b. When activated, they bind to DNA.
   c. They affect the rate of transcription of DNA.
   d. They bring about more rapid changes in cellular activity that membrane-bound receptors.
   e. All of these are true.

3. One of the ways that increased release of thyroid hormones (T₃/T₄) helps to increase the rate of heat production is by
   a. increasing Na⁺/K⁺-ATPase activity.
   b. increasing the amount of shivering.
   c. increasing vasoconstriction.
   d. increasing cutaneous fat storage.
   e. promoting hibernation.

4. Sometimes when a child breaks a finger bone, one of the epiphyseal plates in the bone is permanently destroyed and no longer functions. Although the bone will fuse back together and heal, which of these problems is the child most likely to have?
   a. The bone will not grow in diameter.
   b. The bone will grow in diameter, but not as much as it would have without the break.
   c. The bone will not grow in length.
   d. The bone will grow in length, but not as much as it would have without the break.
   e. The bone will grow normally.
[Long bones have an epiphyseal plate at each end. Since only one was damaged, the bone would keep growing at the other end. The existence of two plates should be clear based on a) the slide I showed in class, b) the fact that the question says “one of the epiphyseal plates”, and c) the likely symmetry of any structure that has similar articulations at both ends.]

5. One reason that sixth-grade girls are often taller than sixth-grade boys is that they have higher levels of growth hormone at this age. This is because
   a. they lack testosterone.
   b. they generally reach puberty earlier.
   c. they generally sleep more than boys.
   d. they generally are less physically active than boys.
   e. they are better than boys in every way.

6. Which of the following best describes a myofibril?
   a. A collection of muscle cells.
   b. A sheet of connective tissue.
   c. One muscle cell.
   d. A thick or thin filament.
   e. A series of sarcomeres stacked end-to-end.

7. The list of answers below describes the normal sequence of events in excitation-contraction coupling. Which of them is incorrect?
   a. An action potential travels along the sarcolemma and down the t-tubules.
   b. The action potential activates ryanodine receptors in the t-tubules, which then activate DHP receptors in the sarcoplasmic reticulum.
   c. Ca²⁺ leaves the sarcoplasmic reticulum and diffuses into the myofibrils.
   d. The Ca²⁺ binds to troponin and causes tropomyosin to move and expose myosin binding sites on actin.
   e. Cross-bridge cycling occurs until Ca²⁺ levels drop again.

8. During the cross-bridge cycle involving myosin and actin, which if the following events most directly triggers the power stroke in myosin?
   a. ATP binding to myosin.
   b. Myosin releasing actin.
   c. ATP hydrolyzing to form ADP and Pᵢ.
   d. Energized myosin binding to actin.
   e. Ca²⁺ binding to myosin.

   [ATP hydrolyzing energizes the myosin, which gets it ready to attach to actin, but the binding action actually triggers the power stroke.]
9. Compared to fast glycolytic muscle fibers, slow oxidative fibers are associated with
   a. higher myoglobin content, lower glycogen content, and smaller diameter.
   b. higher myoglobin content, lower glycogen content, and larger diameter.
   c. higher myoglobin content, higher glycogen content, and smaller diameter.
   d. lower myoglobin content, higher glycogen content, and smaller diameter.
   e. lower myoglobin content, higher glycogen content, and larger diameter.

10. A motor unit is
    a. all the fibers in a particular muscle.
    b. all the fibers of one type in a muscle.
    c. all the fibers innervated by one motor neuron.
    d. A single muscle fiber.
    e. The SI unit equivalent to horsepower.

11. Which of the following statements about capillaries is incorrect?
    a. They are the blood vessel type with the thinnest walls.
    b. They are the vessels with the narrowest diameter.
    c. Blood moves through the capillaries at a lower velocity than other vessels.
    d. More blood moves through the combined capillaries each minute than through the combined arteries.
    e. All of these are true.

12. The action potentials that initiate each heartbeat normally occur in the
    a. sympathetic and parasympathetic neurons innervating the heart.
    b. sinoatrial node.
    c. atrioventricular node.
    d. bundle of His.
    e. contractile cardiac cells.

13. Starling’s “Law of the Heart” would not be true if it were not for which fact?
    a. The sympathetic nervous system increases the contraction strength of cardiac muscle.
    b. The parasympathetic nervous system does not appear to affect contraction strength.
    c. The arteries stretch out more as ventricular ejection increases.
    d. Venous pressure is lower than arterial pressure.
    e. Stretching out heart muscle more causes the sarcomeres to produce more force.
    [The only one of these that has anything to do with Starling’s Law is the last one.]
14. Patients with heart trouble are sometimes given nitroglycerin tablets, because in the bloodstream nitroglycerin is converted into nitric oxide (NO). Heart patients who take these tablets are most likely suffering from
   a. insufficient blood flow to the heart muscle.
   b. an abnormally high heart rate.
   c. an unstable heart rate.
   d. a problem with a heart valve.
   e. a lack of explosiveness.

15. Which of these equations correctly describes the relationship between flow and the variables listed?
   a. Flow is proportional to \( r^2 \times \text{Length} \).
   b. Flow is proportional to \( r^4 \times \text{Length} \).
   c. Flow is proportional to \( \text{Length} / r^2 \).
   d. Flow is proportional to \( r^2 / \text{Length} \).
   e. Flow is proportional to \( r^4 / \text{Length} \).

16. In the blood circulatory system, one variable we actively regulate (in the physiological sense) is
   a. arterial blood pressure.
   b. heart rate.
   c. stroke volume.
   d. total peripheral resistance.
   e. We regulate all of these.

[This is something I pointed out in lecture. I also poured on the hints, with both an underline and a parenthetical statement. Remember that physiological regulation means we’re keeping something ~constant. Answers b-d are all things we control, but we don’t regulate them — in fact, we vary them extensively to keep MAP from changing too much.]

17. Which of the following changes, by itself, would tend to make lymph form more slowly?
   a. An increase in capillary blood pressure.
   b. An increase in the osmotic concentration of the interstitial fluid.
   c. An increase in the osmotic concentration of the blood plasma.
   d. Two of the above would make lymph more slowly.
   e. All of the above would make lymph more slowly.

[Think about which way we need water to move to reduce lymph formation. It needs to be pulled or pushed towards the blood rather than the ISF. Hyperosmotic fluids draw water from hyposmotic ones, so of these answers only c moves water the right way.]
18. Which of the following statements is true?
   a. Oxygen moves from the atmosphere into the alveoli by diffusion and from the alveoli into the blood by bulk flow.
   b. **Oxygen moves from the atmosphere into the alveoli by bulk flow and from the alveoli into the blood by diffusion.**
   c. Oxygen moves from the atmosphere into the alveoli and from the alveoli into the blood by diffusion.
   d. Oxygen moves from the atmosphere into the alveoli and from the alveoli into the blood by bulk flow.
   e. Oxygen does not move from the atmosphere to the blood.

19. Which of the following statements about ventilation is **incorrect**?
   a. The anatomical dead space includes the trachea, bronchi and bronchioles.
   b. **The alveolar ventilation rate will always be higher than the minute ventilation.**
   c. A typical tidal volume for an average size male at rest is 500ml.
   d. In a person breathing normally, the anatomical dead space is less than half the tidal volume.
   e. The deeper a breath you take, the more fresh air reaches your lungs.

20. In a person at rest, exhalation normally requires contraction of the
   a. internal intercostals.
   b. external intercostals.
   c. diaphragm.
   d. Two of the above.
   e. **None of the above.**

   *[This is another one I really tried to point out carefully in lecture. The internal intercostals are used as ventilation becomes deeper and faster, but are not normally needed at rest. Instead, the elasticity and surface tension in the lungs decrease the volume of the thorax.]*