BIO 308: Human Physiology
Practice Examination 2
2007 March 3

The following are multiple choice questions on the material that will be covered in Exam 2. These questions have been taken from last semester's examinations and practice examinations in BIO 308. Choose the best answer or completion.

1. Opioid peptides act to reduce pain intensity by

   A. desensitizing (inhibiting) nociceptive sensory endings
   B. causing chemical breakdown of noxious substances
   C. blocking action potential transmission on A-delta and C-fiber axons
   D. reducing synaptic excitability at spinal cord synapses in the pain pathway
   E. depressing the activity of regions of the primary sensory cortex associated with pain sensation

2. Substance P is released from

   A. nociceptive afferent endings
   B. first order nociceptive terminals in the dorsal horn of the spinal cord
   C. mechanoreceptors in muscle spindles
   D. terminals of descending fibers from the brainstem of the midbrain
   E. both A and B above

3. The physiological basis of the distinction between sharp (pricking) pain and dull (aching, burning) pain is

   A. site of stimulation, with visceral and deep organs giving rise to dull pain and superficial organs giving rise to sharp pain
   B. intensity of stimulation, with low intensity stimulation causing sharp pain and high intensity stimulation causing dull pain
   C. type of ending stimulated, with A-delta fibers mediating sharp pain and C-fibers mediating dull pain
   D. type of stimulus, with hypoxia causing sharp pain and inflammation mediators causing dull pain
   E. none of the above, since the submodalities of pain are a cultural phenomenon and have no physiological basis

4. The pain of a heart attack is sometimes sensed as originating in the left arm because

   A. stimulation of cardiac nociceptors causes reflex activation of left arm nociceptors
   B. the autonomic nerve fibers controlling coronary blood flow also control left arm blood flow
   C. stimulation of nociceptors in the left arm reduces coronary blood
   D. nociceptors in the heart and nociceptors in the left arm share the same dorsal root
   E. heart attacks are often accompanies by spasms of the left arm

5. Which of the following is an opioid peptide?

   A. substance P
   B. endorphin
   C. epinephrine
   D. capsaisin
   E. aspirin

6. Hypotension (reduced systemic arterial blood pressure) and sweating are characteristic responses to pain mediated by

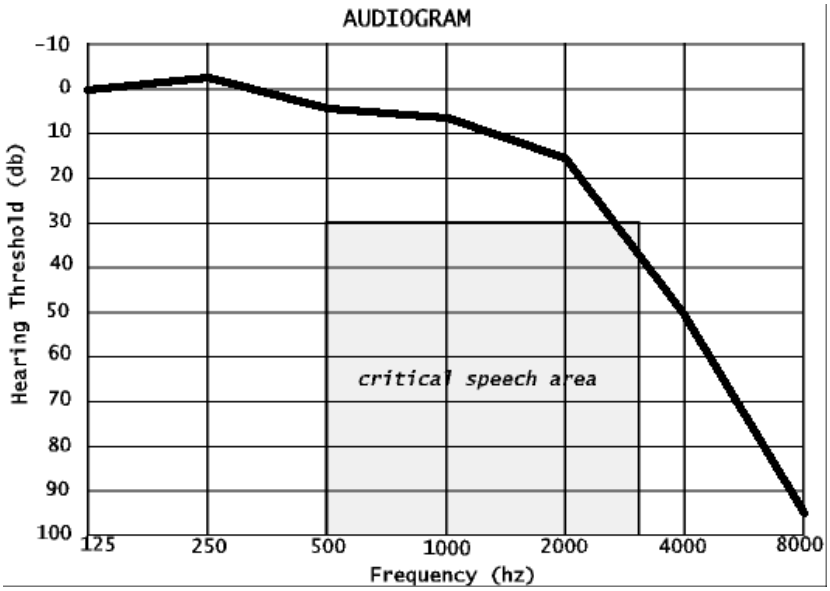
   A. large myelinated fibers
   B. small myelinated fibers
   C. unmyelinated fibers
   D. all of the above
   E. none of the above

7. What is the function of the inner and outer hair cells of the cochlea?

   A. inner hair cells respond to soft sounds and outer hair cells respond to loud sounds
   B. inner hair cells respond to high pitched sounds and outer hair cells respond to low pitched sounds
   C. inner hair cells respond to simple tones (sine waves) and outer hair cells respond to complex sound patterns
   D. inner hair cells respond selectively to human speech and outer hair cells respond to music
   E. inner hair cells respond to sounds and outer hair cells control the sensitivity of inner hair cells

8. Otitis media (inflammation of the middle ear) can cause partial or total deafness by which of the following routes?

   A. air (or ossicular) conduction
   B. bone conduction
   C. both A and B above
   D. neither A nor B above
   E. loss of hearing by air conduction for high frequency sounds and loss by bone conduction for low frequency sounds



9. The audiogram shown above could be due to

   A. degeneration of hair cells at the base of the basilar membrane
   B. degeneration of hair cells at the apex of the basilar membrane
   C. degeneration of hair cells throughout the length of the basilar membrane
   D. a tumor that the destroyed the nerve innervating the organ of Corti
   E. none of the above, since this is a normal audiogram for an adult

10. A patient cannot hear a tuning fork in air when placed just outside the right ear but has no difficulty hearing the tuning fork with the right ear when its base is placed on the right mastoid process (bone). All of the following are possible causes of his right ear hearing loss except

    A. rupture of the tympanic membrane
    B. loss of the middle ear ossicles
    C. infection and inflammation of the middle ear (otitis media)
    D. a lesion of the cochlear branch of the cochlear-vestibular cranial nerve
    E. none of the above, the patient must be faking, since it is impossible to lose hearing by air/ossicular conduction and still hear by bone conduction

11. The tympanic reflex acts to

    A. amplify soft sounds
    B. attenuate (reduce) loud sounds
    C. amplify high frequency sounds and attenuate low frequency sounds
    D. amplify low frequency sounds and attenuate high frequency sounds
    E. protect the tympanic membrane from excess vibration

12. The primary auditory cortex can be best described as organized by

    A. sound intensity
    B. sound duration
    C. sound frequency
    D. sound pattern (a combination of A, B, and C)
    E. sound source direction by comparing of input from the dominant ear with the non-dominant ear

13. The adequate stimulus for the semicircular canals of the vestibular apparatus is

    A. high pitched sounds
    B. low pitched sounds
    C. sounds of middle frequency
    D. angular (rotational) acceleration
    E. gravitational attraction

14. An individual who lacked otoliths (calcium carbonate crystals) in the utricle and saccule of the inner ear would have a sensory deficit for which of the following?

    A. high pitched sounds
    B. low pitched sounds
    C. angular (rotational) acceleration
    D. gravitational force
    E. none of the above, since he would suffer no sensory deficit at all

15. The primary motor cortex is organized

    A. somatotopically (distorted map of the body)
    B. by reflex function (myotatic/stretch reflex controlled by one cortical region, flexion/withdrawal by another region, etc.)
    C. by muscle function (flexor muscles controlled from one cortical region, extensor muscles from another cortical region, etc.)
    D. by motor unit size (small motor units subserving delicate movements controlled from one region, large motor units subserving forceful movements from another location, etc.)
    E. by sensory awareness (conscious movements in one region, unconscious or automatic movements in another region)

16. A stroke that destroyed the primary motor cortex on the right side of the brain would be expected to result in

    A. flaccid paralysis of voluntary muscles on the left side of the body
    B. spastic paralysis of voluntary muscles on the left side of the body
    C. flaccid paralysis of voluntary muscles on the right side of the body
    D. spastic paralysis of voluntary muscles on the right side of the body
    E. no paralysis but the person would have difficulty executing fine, detailed movements

17. Damage to the cerebellum could cause which of the following?

    A. tremor at rest (passive tremor)
    B. tremor accompanying voluntary motion (intension tremor)
    C. paralysis or weakness of skeletal muscles
    D. all of the above
    E. none of the above, since the cerebellum is involved in conscious sensation, not in movement

18. Hyperkinetic movements, such as ballismus and chorea, are characteristic of lesions of

    A. basal ganglia
    B. spinal cord
    C. cerebellum
    D. primary somatosensory cortex (S1)
    E. primary motor cortex (M1)

19. The function of the premotor and supplementary motor cortex areas involve

    A. control of muscles involved in rapid motion, as in vigorous exercise
    B. control of muscle tone
    C. control of muscles involved in fine, delicate movements
    D. coordination and planning of movement by control of the primary motor cortex
    E. feedback to the sensory cortex so the person becomes aware of the contraction of his muscle

20. In executing a complex movement, in what order would the primary motor area (M1), the supplementary motor area (SMA), and the alpha motoneurons of the muscles involved discharge? That is, which is active first, which next, and which last?

    A. first M1, then SMA, last alpha
    B. first M1, than alpha, last SMA
    C. first SMA, then M1, last alpha
    D. first SMA, then alpha, last M1
    E. all there would be active more-or-less simultaneously

21. During what phase of the myocardial action potential does calcium ion (Ca^{2+}) move into the myocardial cell?

    A. initial rapid depolarization
    B. plateau phase
    C. repolarization phase
    D. prepotential phase in nodal cells
    E. none of the above, because the myocardial cell is not permeable to calcium ion

22. During which part of the ECG are all ventricular muscle cells depolarized?

    A. during the P wave
    B. during the QRS complex
    C. during the T wave
    D. from the end of the P wave to the beginning of the QRS complex (P-Q or P-R interval)
    E. from the end of the QRS complex to the beginning of the T wave

23. The repolarization of myocardial cells that terminates the action potential is due to

    A. Na-K active transport pump in the myocardial cell membrane
    B. closing of the fast Na channels
    C. increase in K^+ permeability
    D. movement of Cl^- ions into the cell
    E. discharge of the parasympathetic fibers innervating the heart

24. If the SA node ceased to function so that the AV node became the cardiac pacemaker, the heart rate would be expected to:

    A. increase (tachycardia)
    B. decrease (bradycardia)
    C. remain the same as normal
    D. increase initially but then return to normal
    E. stop, because the AV node cannot become a pacemaker

25. The first heart sound ("lub") indicates the beginning of which of the following phases of the cardiac cycle?

    A. atrial contraction
    B. isovolumetric contraction
    C. rapid ejection
    D. isovolumetric relaxation
    E. rapid filling

26. The papillary muscles in the heart help support the

    A. mitral valve during systole
    B. mitral valve during diastole
    C. aortic valve during systole
    D. aortic valve during diastole
    E. intraventricular septum during all phases of the cardiac cycle

27. During which phase of ventricular diastole are both the mitral and aortic valve <u>open</u>?

    A. isometric (isovolumetric) relaxation
    B. rapid ventricular filling
    C. reduced ventricular filling
    D. ventricular rapid and reduced ejection
    E. none of the above

28. A patient has a systemic arterial pressure of 120/90 mmHg. His mean arterial pressure and his pulse pressure are

    A. mean = 105; pulse = 30
    B. mean = 110; pulse = 30
    C. mean = 105; pulse = 100
    D. mean = 110; pulse = 80
    E. mean = 105; pulse = 190

29. Comparing the left and right ventricles, which develops the higher pressure in systole and which has the higher stroke volume?

    A. the left ventricle develops the higher pressure and stroke volume
    B. the right ventricle develops the higher pressure and stroke volume
    C. the left ventricle develops the higher pressure but the right ventricle has the higher stroke volume
    D. the right ventricle develops the higher pressure but the left ventricle has the higher stroke volume
    E. the left ventricle develops the higher pressure but both ventricles have the same stroke volume

30. In the cardiac cycle, most of the filling of the ventricle occurs

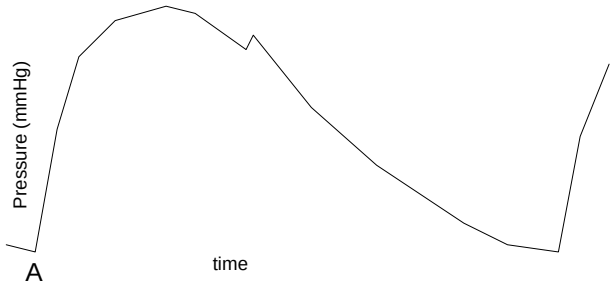
    A. early in diastole
    B. late in diastole
    C. during atrial systole
    D. during isovolumetric relaxation
    E. during isovolumetric contraction

31. The role of venoconstriction (contraction of venous smooth muscle) is to

    A. maintain venous pressure during diastole
    B. force blood from veins into the heart (increase venous return)
    C. prevent blood from entering the heart too rapidly (decrease venous return)
    D. increase the rate of blood flow through capillaries
    E. decrease capillary hydrostatic pressure to prevent edema

32. Compared to the systemic circulation, the pulmonary circulation has a

    A. higher blood flow rate and higher peripheral resistance to blood flow
    B. higher blood flow rate but lower peripheral resistance to blood flow
    C. lower blood flow rate but higher peripheral resistance to blood flow
    D. lower blood flow rate and lower peripheral resistance to blood flow
    E. lower peripheral resistance to blood flow but the same blood flow rate



33. Above is shown a typical systemic arterial pressure pulse. In this drawing, the point "A" represents the time of

    A. closing of the mitral valve
    B. opening of the mitral valve
    C. closing of the aortic valve
    D. opening of the aortic valve
    E. closing of the pulmonic valve

34. The time when <u>all</u> ventricular myocardial cells are in the plateau phase of the action potential corresponds to which part of the normal electrocardiogram?

    A. P wave
    B. QRS complex
    C. ST segment
    D. T wave
    E. none of the above, since there is never a time when all ventricular myocardial cells are in the plateau phase simultaneously

35. In normal function, the pulmonic valve <u>prevents</u> blood from flowing (regurgitating)

    A. from the right atrium to the right ventricle
    B. from the right ventricle to the right atrium
    C. from the right ventricle to the pulmonary artery
    D. from the pulmonary artery to the right ventricle
    E. from the pulmonary artery to the right atrium

36. When listening to the heart with a stethoscope, the second heart sound indicates the:

    A. beginning of atrial systole
    B. beginning of ventricular systole
    C. beginning of atrial diastole
    D. beginning of ventricular diastole
    E. beginning of ventricular filling

37. The time between the beginning of the first heart sound and the second heart sound represents the duration of

    A. atrial systole
    B. atrial diastole
    C. ventricular systole
    D. ventricular ejection
    E. ventricular diastole

38. During isovolumetric ventricular contraction, which of the following cardiac valves are open?

    A. mitral and aortic valves
    B. mitral and tricuspid valves
    C. tricuspid and pulmonic valves
    D. pulmonic and aortic valves
    E. none of the above

39. Which of the following represents the normal cardiac output of the left and right ventricles for a young adult of average size at rest?

    A. left ventricle CO = 2.5 liters/minute; right ventricle CO = 2.5 liters/minute
    B. left ventricle CO = 5.0 liters/minute; right ventricle CO = 2.5 liters/minute
    C. left ventricle CO = 2.5 liters/minute; right ventricle CO = 5.0 liters/minute
    D. left ventricle CO = 5.0 liters/minute; right ventricle CO = 5.0 liters/minute
    E. left ventricle CO = 10 liters/minute; right ventricle CO = 10 liters/minute

40. The arterial system is able to maintain arterial pressure during diastole ("pressure reservoir") by means of

    A. active contraction of arterial smooth muscle during diastole
    B. contraction of skeletal muscles, thus putting pressure on the arteries ("muscle pump")
    C. energy stored in the elastic fibers of the arterial wall during systole
    D. high resistance to blood flow, which prevents blood from flowing out of the arterial system
    E. a combination of all of the above

41. The velocity of blood flow is smallest in the capillaries (compared to other parts of the vascular system) because capillaries have the

    A. highest total vascular resistance
    B. largest total cross sectional area
    C. lowest total blood flow (F or Q)
    D. smallest radius
    E. thinnest walls

42. Which of the following requires active transport in order to move across capillary walls?

    A. Na^+ and K^+ ions
    B. monosaccharides, such as glucose
    C. amino acids
    D. all of the above
    E. none of the above

43. What is the relation between the composition of interstitial fluid and blood plasma.

    A. interstitial fluid has few small organic molecules (e.g. glucose, amino acids)
    B. interstitial fluid has a higher osmotic pressure
    C. interstitial fluid has low plasma protein concentration
    D. interstitial fluid and blood plasma are identical
    E. both A and C above

44. What is the relation between the size of the hydrostatic pressure difference ($\Delta P = P_{cap} - P_{tissue}$) and the osmotic pressure difference ($\Delta\pi = \pi_{cap} - \pi_{tissue}$) across the capillary wall in systemic capillaries? (Assume normal vasomotor state.)

    A. $\Delta P > \Delta\pi$ throughout the length of the capillary
    B. $\Delta\pi > \Delta P$ throughout the length of the capillary
    C. $\Delta P = \Delta\pi$ throughout the length of the capillary
    D. $\Delta P > \Delta\pi$ at the arteriolar end of the capillary but $\Delta\pi > \Delta P$ at the venular end
    E. $\Delta\pi > \Delta P$ at the arteriolar end of the capillary but $\Delta P > \Delta\pi$ at the venular end

45. All of the following are possible causes of systemic edema <u>except</u>

    A. loss of plasma protein due to kidney disease
    B. increase capillary permeability to plasma proteins
    C. blockage of lymph nodes
    D. right ventricular failure
    E. arteriolar vasoconstriction