

Wednesday, November 17<sup>th</sup>, 2021

Following directions on the mark-sense form, write your **name, and student number** in the blanks and fill in the bubbles. In addition, write your **name** on this exam.

When finished with the test, turn in both the mark-sense form and the exam at the front of the room.

***PLACE ALL ANSWERS ON THE MARK-SENSE FORM***

**MULTIPLE CHOICE:** Always choose the BEST, most complete answer. (2 points each)

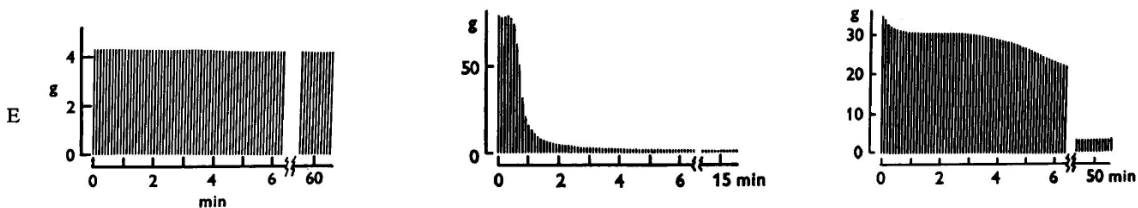
Correct Answers are given in **red boldface**.

1. The essence of the “neural code” can be best expressed as follows:
  - a) Each amino acid is represented by a sequence of three nucleotides.
  - b) All sensory receptors have an adequate stimulus.
  - c) All sensory receptors respond equally to many kinds of stimuli.
  - d) The discharge rate of a sensory receptor is proportional to the intensity of the stimulus.**
  - e) Different types of stimuli produce different types of action potentials.
  
2. The sensory pathway for olfaction does not include
  - a) any secondary sensory neurons.
  - b) a projection to the thalamus.**
  - c) the olfactory bulb.
  - d) olfactory sensory neurons.
  - e) a projection to the cerebral cortex.
  
3. Tonic sensory receptors
  - a) cannot detect the intensity of a stimulus.
  - b) slowly decrease the frequency of action potentials generated in response to a constant stimulus.**
  - c) are quick to adapt to a constant stimulus.
  - d) produce action potentials only at the onset of a stimulus.
  - e) produce action potentials only at the end of a stimulus.
  
4. Which of the following sensations is not detected by the somatosensory system?
  - a) nociception
  - b) cold
  - c) vibration
  - d) touch
  - e) sound**

5. Dull, diffuse pain is transmitted to the central nervous system along
- a) **small unmyelinated C-fibers.**
  - b) small, myelinated A-delta fibers.
  - c) large, unmyelinated A-delta fibers.
  - d) large, myelinated A-beta fibers.
  - e) large, myelinated C-fibers.
6. The reduction of pain sensation produced by activating A-beta fibers can be explained by
- a) the electrical stimulation of motor nerve fibers.
  - b) **the Gate Control Theory of signal transmission in the spinal cord.**
  - c) the activation of C-fibers.
  - d) the heat sensitivity of A-delta fibers.
  - e) the reduced mechanical thresholds of C-fibers.
7. Which of the following primary gustatory (taste) sensations are transduced by G-protein coupled receptors?
- a) **sweet, bitter, umami**
  - b) spicy, salty, bitter
  - c) sweet, salty, floral
  - d) hot, salty, umami
  - e) sweet, salty, sour
8. Fill in the blank. The binding of an odorant molecule to its receptor triggers \_\_\_\_\_ in an olfactory sensory neuron
- a) the closing of ligand-gated ion channels
  - b) an increase in ATP release
  - c) an influx of  $K^+$  ions
  - d) the activation of voltage-gated channels
  - e) **increases in adenylyl cyclase activity and cAMP concentration**
9. The mechanically-gated ion channels that open in response to a sound wave are found on the
- a) tympanic membrane.
  - b) **stereocilia of hair cells.**
  - c) cell bodies of hair cells.
  - d) basilar membrane.
  - e) tectorial membrane.
10. Low and high frequency sounds are detected by
- a) different types of hair cells.
  - b) only the middle portion of the basilar membrane.
  - c) **hair cells located at different sites along the basilar membrane.**
  - d) hair cells located exclusively at the helicotrema end of the basilar membrane.
  - e) the vibration of the tympanic window.

11. Which sense organs are principally involved in detecting gravitational forces?
- a) the semicircular canals
  - b) the crista within the ampulla
  - c) the Pacinian corpuscles
  - d) the utricle and saccule**
  - e) the basilar and tectorial membranes
12. In response to rapid head movements, the eyes move in the opposite direction due to the
- a) vestibulo-ocular reflex.**
  - b) flexion reflex.
  - c) pupillary light reflex.
  - d) clasp-knife reflex.
  - e) activation of the visual cortex.
13. The capacity of the eye to focus incoming light on the retina depends on
- a) the rods and cones.
  - b) changing the shape of the lens.**
  - c) the composition of the vitreous humor.
  - d) the size of the visual receptive fields.
  - e) eliminating the blind spot.
14. The fovea of the retina is the area of sharpest visual acuity and has
- a) the axons of retinal ganglion cells.
  - b) only rod photoreceptors.
  - c) only cone photoreceptors.**
  - d) the optic disc.
  - e) no retinal pigmented epithelium.
15. The “blind spot” in the visual field
- a) causes double vision.
  - b) creates nearsightedness.
  - c) is called strabismus.
  - d) always bypasses the macula.
  - e) occurs where the optic nerve exits from the retina.**
16. Which of the following events occurs in photoreceptors when they are **excited by light**?
- a) membrane cyclic nucleotide-gated (CNG) channels open
  - b) cGMP concentration is increased
  - c) the membrane depolarizes
  - d) transducin is activated**
  - e) ALL of the above occur.

17. Fill in the blanks. An essential step in the initiation of crossbridge formation is when  $\text{Ca}^{++}$  is released from the \_\_\_\_\_ and binds to \_\_\_\_\_ on the thin filaments.
- sarcoplasmic reticulum; tropomyosin
  - sarcoplasmic reticulum; titan
  - sarcoplasmic reticulum; troponin**
  - transverse tubules; troponin
  - transverse tubules; tropomyosin
18. Action potentials that are initiated adjacent to the neuromuscular junction
- are conducted into the transverse tubules and activate DHP receptors.**
  - directly activate myosin to enable muscle contraction.
  - directly activate actin to enable muscle contraction.
  - directly activate ryanodine receptors (RyR).
  - activate a  $\text{Ca}^{++}$ -ATPase in the sarcoplasmic reticulum membrane.
19. Muscle contraction and shortening are mediated by
- cAMP release.
  - inhibition of serotonin release from the sarcoplasmic reticulum.
  - the formation of crossbridges between the heads of myosin molecules and actin filaments.**
  - the release of troponin from the sarcoplasmic reticulum.
  - inactivating actin molecules during the power stroke.
20. When a skeletal muscle contracts
- both thick and thin filaments shorten.
  - only thin filaments shorten.
  - only thick filaments shorten.
  - Z-discs shorten.
  - thick and thin filaments slide past each other, and sarcomeres shorten.**



21. The figure presented above shows the tension produced by three types of motor units in response to repeated stimulation. The motor units that fatigue most rapidly (middle panel) are
- the slowest contracting.
  - the first recruited.
  - the smallest motor units.
  - the largest motor units.**
  - innervated by the smallest motor neurons.

22. In reflexive, voluntary, and rhythmic movements, motor units are recruited
- in order of decreasing size.
  - in a random sequence.
  - in order of decreasing axonal conduction velocity.
  - from largest to smallest.
  - in the same order.**
23. Traumatic damage to one cortical hemisphere often results in profound motor deficits
- that appear only in reflex movements.
  - that affect only the facial muscles
  - on the opposite side of the body.**
  - of the hands and feet on both sides of the body.
  - but never interferes with speech.
24. Acetylcholine is the neurotransmitter released by all of the following cells EXCEPT
- sympathetic preganglionic neurons.
  - sympathetic postganglionic neurons.**
  - parasympathetic preganglionic neurons.
  - parasympathetic postganglionic neurons.
  - somatic motor neurons.
25. Which of the following **does not** involve sympathetic nervous system activation?
- pupil dilation
  - decreasing heart rate**
  - epinephrine release from the adrenal medulla
  - dilation of bronchioles in the lungs
  - fat breakdown
26. Fill in the blank. Drugs that block adrenergic receptors are particularly effective on the target tissues of \_\_\_\_\_ postganglionic neurons.
- sensory
  - parasympathetic
  - sympathetic**
  - olfactory
  - cholinergic
27. Which of the following areas of the brain is most directly involved in autonomic regulation?
- olfactory bulb
  - primary motor cortex
  - basal ganglia
  - cerebellum
  - hypothalamus**

28. During which phase of human sleep is the electrical activity recorded from the surface of the brain most similar to that observed in the “awake state”?
- a) slow-wave sleep
  - b) stage 1 sleep
  - c) stage 2 sleep
  - d) REM sleep**
  - e) drowsy stage
29. The two cerebral hemispheres are connected to each other by nerve fibers that comprise the
- a) cerebellum.
  - b) corpus callosum.**
  - c) amygdala.
  - d) nucleus.
  - e) thalamus.
30. When recalling a prior experience, individual neurons in the brain often generate discharge patterns that are
- a) very similar to those that they produced during the experience.**
  - b) very different to those that they produced during the experience.
  - c) unrelated to their prior activity.

**END OF TEST**

Turn in your mark-sense form  
and your question sheets  
at the front of the room.