Introduction to Cognitive Neuroscience
Midterm Test 1 Practice Questions
Spring 2024

Multiple Choice Questions

1. Gall's method for investigating phrenology was flawed because
    a. he used the wrong language to explain the characteristics he observed
    b. he did not tell Napoleon Bonaparte that he possessed noble characteristics
    c. he sought only to confirm, not disprove, the correlations he observed
    d. he used his own skull as the base model
    e. he thought brains expanded to fill skulls

2. Which of the following things would have been the most difficult for the famous individual studied by Paul Broca to do, compared to before his stroke?
    a. Listening to a piano recital
    b. Appreciating a painting
    c. Dancing at a ball
    d. Reading a book aloud
    e. Playing a game of cards

3. If you were to insert a microelectrode through the cell membrane of a neuron, you would be able to demonstrate that
    a. the region inside the cell membrane is more positively charged than the region outside the membrane
    b. the region inside the cell membrane is more negatively charged than the region outside the membrane
    c. there is a greater concentration of potassium ions outside the cell membrane than inside the membrane
    d. there is a greater concentration of potassium ions inside the cell membrane than outside the membrane
    e. the region inside the cell membrane has the same charge as the region outside the membrane

4. A patient reports that she is functionally blind after a focal brain injury, even though her eyes and optic nerves are completely intact. Of the structures listed here, the most probable location for the brain injury is the
    a. Inferior colliculus
    b. Lateral geniculate nucleus
    c. Superior temporal lobe
    d. Postcentral gyrus
    e. Area MT

5. Which of the following functions is NOT mediated primarily by the hypothalamus?
    a. Endocrine system regulation
    b. Maintenance of homeostatic states in the body
    c. Relay of sensory information from the body to the cortex
    d. Hormone control
    e. Communicating circadian rhythms

6. The central sulcus is an anatomical landmark that separates the _____ lobe from the _____ lobe:
    a. Frontal; parietal
    b. Temporal; frontal
    c. Parietal; occipital
    d. Occipital; temporal
    e. Frontal; occipital

7. The poison tetraethylammonium (TEA) interferes with normal neural communication. The toxin binds to and blocks voltage-gated potassium channels in the neuron cell membrane. Which of the following best describes the effects of TEA on the action potential?
    a. The depolarization phase of the action potential fails to occur
    b. The refractory period of the action potential is shortened
    c. The action potential fails to be regenerated at the nodes of Ranvier
    d. The resting membrane potential is made more negative
    e. The repolarization phase of the action potential is blocked

8. A patient has an injury to the parietal lobe and has a selective deficit in processing information about the spatial location of visual stimuli. You hypothesize that this region of the brain is distinct in function from other visual areas in the temporal lobe, in which you suspect shape perception information is processed. To establish a double dissociation between the two functions and brain regions, you would need to find another person who had damage to the
    a. same part of the parietal lobe but did not have a visuospatial deficit
    b. temporal lobe and had both visuospatial and shape perception deficits
    c. same part of the parietal lobe and had only a shape perception deficit
    d. temporal lobe and had only a shape perception deficit
    e. different part of the parietal lobe and also had a visuospatial deficit

9. Research questions about the time course of cognition are better addressed using methods like _____, whereas questions about the anatomy of cognition are better addressed using methods like _____:
    a. ERP; fMRI
    b. fMRI; PET
    c. PET; MEG
    d. MEG; ERP
    e. EEG; MEG

10. All of the following are common across each sensory system, except:
    a. Neuronal signals are passed along specific sensory nerves
    b. System nerves terminate either monosynaptically or disynaptically in different parts of the thalamus
    c. The system begins with a structure for collecting, filtering, and amplifying information from the environment
    d. The system contains specialized receptor cells that transduce environmental stimuli
    e. Receptors have defined receptive fields that respond to specific types of stimuli within the sensory domain

11. After suffering from a focal brain injury, a patient has difficulty in recognizing visually presented objects, despite normal acuity and color perception. Notably, she has severe difficulty in judging whether two pictures, each showing a different view, represent the same object. What is the most probable diagnosis?
    a. Apperceptive visual agnosia
    b. Associative visual agnosia
    c. Synesthesia
    d. Prosopagnosia
    e. Alexia

12. Neural adaptation (aka habituation) in fMRI occurs when the same object is presented to someone repeatedly, which results in decreases of neural activation with each repetition of that object. Interestingly, showing a picture of a real banana several times and then showing a drawing of a banana continues to elicit decreasing activation with each presentation despite these variations. This is an example of:
    a. Category specific processing
    b. Form-cue invariance
    c. Depth perception
    d. Receptive field sensitivity
    e. Stimuli competition

13. Of the following choices, the strongest evidence for a link between the sense of smell and the triggering of memories is the observation that:
    a. the olfactory cortex has direct connectivity to the limbic cortex
    b. the olfactory cortex has direct connectivity to area MT
    c. people with damage to the basal ganglia have compromised odor recognition
    d. people with damage to the cerebellum have compromised odor recognition
    e. the olfactory sense is the earliest to develop

14. The orbitofrontal cortex is an integration area for which two senses?
    a. Somatosensation and vision
    b. Vision and audition
    c. Olfaction and gustation
    d. Somatosensation and proprioception
    e. Proprioception and audition

15. In the auditory system, the conversion of sound waves into action potentials occurs in the:
    a. Ganglion cells
    b. Eardrum
    c. Cochlear nucleus
    d. Basilar membrane
    e. Hair cells

16. Before entering the brain, each optic nerve splits into two branches so that information from the _____ half of each retina crosses to the opposite side of the brain:
    a. Nasal (medial)
    b. Left (dorsal)
    c. Temporal (lateral)
    d. Right (ventral)
    e. Top (superior)

17. If you were to conduct a single-cell recording from a neuron in the MT region of the extrastriate visual cortex, you would probably find that the cell fires most vigorously to a:
    a. Bar of light that alternates in colour between red and green
    b. Bar of light tilted at a 15 degree angle in the center of the cell's receptive field
    c. Corner-shaped region of light on a dark background
    d. Bar of light that moves across the cell's receptive field
    e. Bar of light that spans the entire length of the receptive field

18. Which area of the body has the greatest amount of representation in the human primary somatosensory cortex?
    a. Hands
    b. Feet
    c. Gums
    d. Trunk
    e. Legs

Short-answer questions

1. Describe the process of an electrical signal changing into a chemical signal at the axon terminal. (3 marks)

2. Give a description of how coincidence detectors are thought to work to detect the location of a stimulus. How can these discriminate between when a stimulus is directly in front of a person or to the right of a person? (3 marks)

3. Name one similarity and one difference between EEG and MEG. Why might someone use EEG instead of MEG? (3 marks)

4. Someone comes to you with complaints that although they can still feel pain from their right hand, they have lost all fine touch sensitivity from their right hand and fingertips. Based on this information, where do you think one locus of damage would be, and why? Why does this locus of damage not affect the pain information? (3 marks)

5. You are taking a tour of a local art museum and have taken a seat in front of a brightly coloured painting, focusing your vision to admire it. Describe the path of an electrical signal that would be passed from the retina to the striate cortex in response to a yellow flower in the center of the painting (i.e. in the left/right temporal retinal field). (3 marks)