**PSYC 3020: Biopsychology**

**Mid-Term Exam II**

10/18/13

# **PLEASE WRITE YOUR NAME ON EACH PAGE.**

# **Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**True or False, please circle your answer. 2 points each.**

1. EEG is a suitable method for measuring what specific brain areas are associated with face perception.

True False

1. Parts of the body that are physically largest also have the largest representation in sensory cortex.

True False

1. Thermoreceptors do not have a precise coding for temperature.

True False

1. Noise-induced hearing loss is most likely for low frequencies.

True False

1. The fovea consists of both rods and cones.

True False

1. Imbalance, nausea, and vertigo can result from a head cold or ear infection when pairs of semicircular canals are simultaneously stimulated (i.e. depolarization in both left and right ear canals).

True False

1. If you look at a bright yellow square with a bright blue border for a long time and then look at white space, you will likely see a blue square with a yellow border.

True False

1. Simple cells are selective for orientation but not position of visual stimuli in the visual field.

True False

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1. Nociceptors like Ruffini corpuscles respond to one type of stimulus.

True False

1. If a participant were taking medication that lowered their blood pressure, this might affect fMRI results, but not EEG results.

True False

**Multiple choice, please circle your answer. 2 points each**

1. In the visual system, which of the following DO NOT fire action potentials (MARK ALL THAT ARE CORRECT)?
   1. Rods
   2. Bipolar cells
   3. Amacrine cells
   4. Ganglion cells
2. Which of the following stimuli would elicit the lowest number of action potentials in a Red OFF center/Green ON surround ganglion cell?
   1. A diffuse yellow light across its entire receptive field
   2. A spot of red light in the center of the receptive field
   3. A spot of green light in the center of the receptive field
   4. A ring of green light in the surround of the receptive field
3. Complete damage to the right optic nerve would produce which of the following?
   1. Loss of vision for the entire left visual field.
   2. Loss of vision of the outer half of the right visual field and the inner half of the left visual field.
   3. Loss of vision from the left and right nasal retinas.
   4. Loss of vision from the upper half of the right visual field and the lower half of the left visual field.
4. Which of the following neurons would have the largest receptive field?
   1. A complex cell
   2. A cell in the lateral geniculate nucleus
   3. A simple cell
   4. A neuron in V4

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1. All of the following tracts will completely cross over to the contralateral side of the body EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. The retinogeniculostriate pathway.
   2. The lateral lemniscus (the auditory pathway).
   3. Dorsal column pathway (mechanoreceptor pathway).
   4. Cortical spinal tract (a lateral motor tract).
2. Mirror neurons allow us to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. Recognize ourselves in mirrors.
   2. Imitate actions performed by others.
   3. Flip visual information right-side up.
   4. Recognize similar musical tones.
3. Which of the following cerebellar sub-regions is involved in coordinating the timing of movements?
   1. Thalamus
   2. Flocculondular Lobe
   3. Lateral hemispheres
   4. Vermis
4. All of the following are consequences of center-surround antagonism EXCEPT\_\_\_\_\_\_\_\_\_\_\_.
   1. The ability to accurately localize touch on the skin
   2. The ability to distinguish flutter from pressure on the skin
   3. The ability to read small font
   4. The perception of a gray border between a black and a white square
5. Which is the correct sequence of events involved in sensory transduction in the cochlea?
6. Ossicles vibrate, round window membrane oscillates, basilar membrane oscillates, tip links stretched
7. Ossicles vibrate, basilar membrane oscillates, tectorial membrane oscillates, tip links stretched
8. Oval window membrane oscillates, tectorial membrane oscillates, tip links stretched, hair cells depolarize
9. Oval window membrane oscillates, basilar membrane oscillates, tip links stretched, hair cells depolarize

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1. Which the following are necessary for spinal reflexes (MARK ALL THAT ARE CORRECT)?
   1. Intact primary motor cortex
   2. Lower (alpha) motor neurons
   3. A sensory neuron like the muscle spindle
   4. Muscarinic receptors
2. Deep pain can be difficult to localize because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. Cortical sensory neurons receive input from numerous nociceptors located within the internal body and have small receptive fields.
   2. Cortical sensory neurons receive input from few nociceptors located within the internal body and have small receptive fields.
   3. Cortical sensory neurons receive input from numerous nociceptors located within the internal body and have large receptive fields.
   4. Cortical sensory neurons receive input from few nociceptors located within the internal body and have large receptive fields.
3. Multiple sclerosis is associated with which of the follow?
   1. Death of oligodendrocytes
   2. Death of Schwann cells
   3. Death of motor neurons
   4. Death of sensory neurons
4. A patient with damage to Broca’s area also shows difficulty in following commands, such as “put on your robe.” This patient is showing symptoms of:
   1. Multiple sclerosis
   2. Amyotrophic lateral sclerosis
   3. Ataxia
   4. Apraxia
5. A patient with a history of stroke arrives unconscious to the emergency room and you need to order a test to assess his brain activity. You do not have access to his medical records. Which of the following would be the safest test to perform for your patient?
   1. A CT scan to determine if he has had another stroke
   2. A structural MRI scan to determine if he has had another stroke and where
   3. A functional MRI scan to determine if his auditory cortex is responsive to the sound of your voice.

A stereotaxic surgery to relieve pressure inside the skull

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. Damage to auditory association cortex could produce all of the following EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. Wernike’s aphasia (speech comprehension deficit)
   2. Amusia
   3. Cortical deafness
   4. Difficulty telling the difference between 2 similar melodies

**Fill in the blank. 2 points each**

1. \_\_\_\_\_\_\_\_\_\_Magnetoencephalograpy/(MEG)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_is a direct measure of neural activity that measures the magnetic fields produced by neurons.
2. Photoreceptors in the \_\_\_\_fovea\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_area of the retina show a lower degree of convergence than do photoreceptors in the \_\_\_\_\_\_\_\_peripheral\_\_\_\_\_\_\_\_\_\_\_\_\_ area of the retina.
3. Pacinian corpuscles and hair cells are both depolarized by movements that cause opening of cation channels. Thus, they are both examples of \_\_\_\_\_mechanoreceptor\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_type neurons.
4. The \_\_\_\_\_\_\_\_\_tympanic membrane\_\_\_\_\_\_\_\_ is also more commonly known as the eardrum.
5. Influx of \_\_\_\_Ca2+\_\_\_\_\_\_\_\_\_\_ into muscle cells causes myosin to row along actin, producing a muscle contraction.
6. In the visual system, horizontal cells connect to multiple photoreceptors, and \_\_\_\_\_\_\_\_\_amacrine\_\_\_\_\_\_\_\_\_\_\_\_\_ cells connect to multiple bipolar cells, to establish center/surround receptive fields.
7. The Organ of Corti is composed of the basilar membrane, hair cells, & \_\_\_\_tectorial membrane\_\_\_\_.
8. Muscles/tendons contain two types of proprioceptors, muscle spindles and \_\_\_golgi tendon organs\_\_.
9. \_\_\_Pseudoathetosis \_\_\_\_\_is a disorder associated with abnormal writhing, a symptom that is worsened when patients close their eyes.
10. In the patellar tap reflex, the motor spindle releases \_\_\_\_\_\_\_\_\_\_glutamate\_\_\_\_\_\_\_\_ while the alpha motor neuron releases \_\_\_\_\_\_\_acetylcholine\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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**Essays: please answer each question thoroughly. 10 points each.**

1. Please compare and contrast ON and OFF bipolar cells. Be sure to include the following terms: **sodium channels, potassium channels, glutamate, depolarized, hyperpolarized, light, dark.**

In the dark, photoreceptors are depolarized and release glutamate onto both ON and OFF bipolar cells (2pts). ON bipolar cells contain glutamate receptors that are coupled to a potassium channel (1pt). This means that when glutamate binds, potassium leaves/diffuses from the ON bipolar neuron, hyperpolarizing it and resulting in less glutamate being released by the ON bipolar cell (2pts). OFF bipolar cells contain glutamate receptors that are coupled to a sodium channel (1pt). This means that when glutamate binds, sodium enters the OFF bipolar neuron, depolarizing it and resulting in more glutamate being released by the OFF bipolar cell (2pts). In the light when photoreceptors hyperpolarize and release less glutamate onto bipolar cells, less potassium leaves the ON bipolar cells and less sodium enters the OFF bipolar cells, causing these cells to depolarize and hyperpolarize, respectively (2pts).

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1. Please discuss two disorders produced by damage to the visual association cortex. **Hint:** we discussed four in class. Two were associated with damage to the “what pathway” and two were associated with damage to the “where pathway.”

Damage to the “what” pathway in the inferior portion of the extrastriate cortex in V4 (1pt) can produce Achromatopsia, which is impaired color vision (2pt). Patients can see all the elements of visual space except for the color (2pt). Agnosias are also associated with what pathway damage, specifically in the inferior temporal lobe (1pt). Patients with agnosias have difficulty perceiving and recognizing objects (2pt). Although they may be able to copy drawings of objects, in some cases, they cannot say what they have drawn (1pt). They have intact visual acuity and understanding of the objects’ functions, however (1pt).

Damage to the where pathway, in the superior extrastriate cortex (V5) (1pt) can produce akinetopsia, which is the inability to perceive motion (2pt). Patients perceive moving images as through a strobe light, seeing several static images but not the fluid movement (2pt). Hemispatial neglect is associated with damage to the superior parietal cortex, typically on the right (2pt). Neglect patients have difficulty perceiving the left side of visual, but also auditory and sensory space (2pt). This can be demonstrated in drawings, where patients fail to draw or copy the left side of the image. They may turn their bodies to the right side of space and generally favor that side, although they can be directed to the left side of space (1pt)

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1. Please explain the proposed mechanisms by which we perceive pitch and spatial location of sound. **Hint:** there were two proposed mechanism for pitch and three for spatial location.

(2pts) Pitch is perceived by both place coding and rate coding. Place coding refers to the idea that different places on the basilar membrane resonate/oscillate in response to different frequencies. This mapping is maintained through the auditory pathway to the primary auditory cortex. Different populations of neurons respond to different frequencies allowing us to perceive pitch. Rate coding refers to the idea that higher frequencies are associated with higher rates of firing of action potentials in the auditory system.

(3pts) Interaural intensity differences (IID). High frequency sound waves are attenuated in amplitude by the head and thus are higher intensity at the ipsilateral cochlea (relative to the location of the sound wave) than the contralateral cochlea. Different populations of neurons in the lateral superior olive in the brainstem are maximally excited (EPSPs) by particular IIDs. Each IID reflects a different location for high frequency sounds.

(3pts) Interaural timing differences (ITD). Low frequency sound waves can travel around the head and are of the same intensity for both ears. They arrive to the ipsilateral cochlea earlier than the contralateral cochlea. Different populations of neurons in the medial superior olive are maximally excited (EPSPs) by particular ITDs. These neurons are called coincidence detectors referring to the fact that they detect the coincidence of the arrival of the inputs from each cochlea. Each ITD reflects a different location for low frequency sounds.

(2pts) Vertical localization. The pinna (outer ear) can attenuate or enhance particular frequencies present in a sound wave. This changes the timbre of the sound. Sounds coming from above the head have different timbre than those coming from below the head. Neurons in the cochlear nuclei in the brainstem are responsive to these differences in timbre.