QUIZ 10 - KEY

Instructions: Download the quiz from Blackboard (in Quiz Questions Folder), print a copy and use the paper copy to work through the various questions and problems. Mark the correct answers on it. When you are ready to **submit** your answers, you will see the quiz posted under Quiz Answer Sheets.

Click the quiz name to launch the quiz. Enter your answers to each of the corresponding numbered questions onto the **blank answer sheet** (the questions will not be repeated, simply a blank page for your answers). The quiz may be saved if you do not finish entering your answers in one sitting. When you are finished with the quiz, make sure to **submit** your answers and they will be recorded.

For each question, select the one **best answer** from among those given (multiple choice).   Each question is worth one (1) point.

1. The arcuate nucleus in the hypothalamus detects the level of leptin in the blood. Which of the following is **NOT TRUE**?

    a) Starvation leads to reduced leptin levels, which subsequently activates AgRP neurons in the arcuate nucleus and induces feeding behavior.
    b) Starvation activates the paraventricular nucleus to inhibit release of thyroid-stimulating hormone and increase metabolic rate.
    c) Satiation leads to inhibition of lateral hypothalamus mediated feeding behaviors.
    d) Satiation enhances leptin release and subsequently activates POMC neurons in the arcuate nucleus which decreases feeding behavior.
    e) Neither C nor D is true.

    Answer key: Starvation **inhibits** the paraventricular nucleus to **enhance** release of thyroid-stimulating hormone and **decrease** metabolic rate.

2. You want to create a drug which increases the drive to eat in a mouse strain that suffers from chronic under-eating. Which of the following drugs may accomplish this goal by its effect on the hypothalamus? (Use careful logic!)

    a) Leptin
    b) An agonist for the leptin receptors on POMC neurons.
    c) An agonist for the leptin receptors on AgRP neurons.
    d) An antagonist for the leptin receptors on AgRP neurons.
    e) More than one of the above.

    Answer key: Leptin increases activity of POMC neurons. Agonizing leptin receptors on αMSH/CART neurons would activate these neurons more. Since these neurons act to decrease feeding, Leptin receptor agonists here would further decrease feeding. Leptin inhibits AgRP neurons. These neurons stimulate feeding behavior, so adding an

antagonist to leptin receptors on these neurons would inhibit these neurons LESS, leading to MORE feeding.

3. Which of the following statements about the hypothalamus is **FALSE**?

   a) It communicates through the central nervous system and endocrine system.
   b) It influences the pituitary gland that releases hormones; however, the hypothalamus itself does not secret hormones.
   c) It influences preganglionic neurons in the autonomic nervous system.
   d) It maintains energy balance by sensing signals from adipose tissue.
   e) It receives sensory information from olfactory, taste, and visual areas of the brain.

   Answer key: B is false because the posterior hypothalamus can directly release hormones into general circulation, whereas the anterior pituitary can only release hormone into local capillaries connected with the pituitary.

4. Which of the following is TRUE about REM sleep?

   a) Characterized by tossing and turning of the body.
   b) Slow, "delta" wave activity in the Electro Encephalogram (EEG).
   c) Paralysis by inhibition of motor neurons.
   d) Absence of dreaming.
   e) All Above are wrong.

   Answer key: There is paralysis and dreaming during REM sleep. B do not occur during REM.

5. The suprachiasmatic nucleus (SCN) of the hypothalamus is the pacemaker for mammalian/human circadian rhythms. Which statement is **FALSE** about the SCN in regards to its function?

   a) When a test animal is put in a room lit only with a dim light 24 hrs a day for weeks, even a short series of bright light flashes will reset the rhythm and entrain it to the brief, bright light stimulus.
   b) The SCN regulates the pathways that release melatonin.
   c) The SCN is innervated by retinal ganglion cells whose photoreceptive pigment is melanopsin
   d) The SCN is involved only with the waking stage of the circadian rhythm and not with the sleep phase.
   e) The SCN has a natural rhythm of activity with a duration of approximately 24 hours, but the starting time can be shifted by artificial light.

   Answer key: D is incorrect- the SCN is the free-running master circadian clock- it is dictating the entire circadian cycle.

6. The reticular activating system is

a) a region of forebrain that activates the rest of the brain.
b) a thalamocortical loop involved in attention.
c) a group of brainstem neuromodulatory nuclei whose activation induces wakefulness.
d) a cerebellar region that becomes active at the end of a sleep cycle.
e) a reticular or meshlike network that wraps around the cerebrum.

Answer key: This is straightforward.

7. Which of these neural activities are likely encoded by the prefrontal cortex?

a) Relative preference for an object in a given situation.
b) Memory for an object during a delay.
c) Sensory maps of the main modalities (vision, sound, touch).
d) A and B only
e) All of above

Answer key: Sensory maps are located in the occipital (vision), parietal (touch) and temporal (audition) cortices. These project to the prefrontal cortex, which does not itself have maps.

8. You're studying for the final exam of BIONB 2220, it's late at night and you're very sleepy. However, unfortunately, your coffee ran out. Without caffeine, which of the following ways can most likely promote your wakefulness so that you can do your best on the final exam?
a) Increase the Adenosine concentration in your brain
b) Increase histamine secretion by hypothalamic neurons
c) Enhance the filtering function of reticular activating system
d) Speed up SCN oscillations
e) None of above will work

9. A patient comes into your clinic a few weeks after a construction accident left him with damage to his frontal cortex. Which of the following symptom(s) is/are seen with damage to the dorsolateral prefrontal cortex but NOT the orbito-ventromedial prefrontal cortex?

a) Errors in learning the first rule in the Wisconsin card sorting task.
b) Increased errors in the Stroop test.
c) Inappropriate social behavior.
d) Inability to make decisions based on preference.
e) Utilization behavior.

Answer key: A is wrong because errors only come in when the rule is changed in this task. C-E would result from orbito-ventromedial damage.

10. Think of this experiment: An experimenter places one chocolate pellet in front of a monkey. Meanwhile, a bowl containing 10 chocolate pellets is slowly approaching the monkey on a conveyor belt. If the monkey takes the one nearby pellet before the bowl arrives, the bowl and the 10 chocolate pellets are taken away. But if the monkey doesn't take the nearby pellet, the bowl continues to move closer until the monkey can reach it and eat all 10 pellets. It takes 2 minutes for the bowl to reach the monkey.

If you optogenetically silence all neurons in the prefrontal cortex, what would be the most likely result?

a) The more the monkey will learn to suppress their urge to eat the 1 chocolate pellet before the bowl arrives.
b) The less the monkey will learn to suppress their urge to eat the 1 chocolate pellet before the bowl arrives.
c) The less the monkey will eat any of the chocolate.
d) The more the monkey will eat any of the chocolate.
e) The animal's behavior would not change.

11. **Thought question (ungraded):** How would you do an experiment on an animal to test the effects of PFC damage on utilization behavior. In your answer, choose your study species, task, and manipulations.

> Answer key: There are many answers as well. One could lesion the PFC or stimulate/suppress activity in the PFC in a rodent and see changes in how the animal manipulates objects. Specifically, you could put a head fixed animal near objects that they could manipulate, but might not need to manipulate or that manipulating them would have negative consequences. You would expect animals to manipulate objects regardless of the valence of the outcome related to manipulating these objects.