**PSYC 3020: Biopsychology**

**Mid-Term Exam III**

11/20/13

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

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

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

1. The hallmark of amnesia is confabulation.

A) True B) False

1. Priming tasks, like completing the missing letters for the first word that comes to one’s mind, test implicit memory.

A) True B) False

1. The same mutation in the gene that codes for monoamine oxidase has been implicated in both sociopathy and unipolar depression.

A) True B) False

1. Alcoholism is the direct cause of Wernicke-Korsakoff syndrome.

A) True B) False

1. Patients with sociopathy typically have lower than average intelligence.

A) True B) False

1. The fugue state is associated with forgotten identity and personality.

A) True B) False

1. Resperine can be used as a treatment for depression.

A) True B) False

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1. Higher blood concentrations of testosterone have been seen in winning athletes, but not in their fans.

A) True B) False

1. Perceptual learning of scenes depends upon the fusiform gyrus.

A) True B) False

1. People with damage to the amygdala have impaired recognition of scary, but not happy or sad music.

A) True B) False

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

1. All of the following are true about LTD EXCEPT:
   1. Results in pre- and post-synaptic changes.
   2. Can be caused by low frequency stimulation.
   3. Like LTP, it is NMDA receptor dependent.
   4. Results in reduced AMPA receptors.
2. Which of the following was not one of H.M.’s problems after surgery?
   1. Remembering practicing the mirror drawing task
   2. Remembering meeting new people
   3. Remembering what he had for breakfast yesterday
   4. Having a conversation about the weather
3. The Thorndike Puzzle Box experiment, in which a cat learns to press a lever to open the box, allowing him to receive a food reward is an example of\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
   1. Classical conditioning
   2. Instrumental conditioning
   3. Explicit memory
   4. Cat torture

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

1. All of the following are true about associative LTP EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. A strong input like a foot shock can sustain a weak input like a tone only if paired close together in time
3. A strong input can sustain a weak input only if the inputs converge on the same neurons
4. The influx of sodium via the strong synapse washes back to the weak synapses and “primes” them, dislodging magnesium ions from NMDA receptors.
5. Associative LTP has been shown to support fear conditioning in humans
6. Antipsychotics, namely DOPA antagonists treat which signs of Schizophrenia?
   1. Positive
   2. Negative
   3. Cognitive
   4. Affective
7. Wernicke’s encephalopathy could lead to all of the following EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_.
   1. Impaired delayed eyeblink conditioning
   2. Impaired trace eyeblink conditioning
   3. Drunken sailor gait
   4. Uncoordinated movements
8. Abnormal movements, negative emotion, and social withdrawal have been observed in children who later develop \_\_\_\_\_\_\_\_\_\_\_\_.
   1. Unipolar depression
   2. Bipolar depression
   3. Sociopathy
   4. Schizophrenia
9. The ataxia associated with Wernicke’s encephalopathy is most likely the result of damage to which region?
10. Motor cortex.
11. Cerebellum.
12. Prefrontal cortex.
13. Hippocampus.

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

1. Amygdala outputs mediate all of the following behaviors EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Stalking prey
3. Screaming when the little ghost girl climbs out of the TV in The Ring
4. A cat hissing when a strange cat approaches
5. Enhanced memory for positive events
6. Hypoactivity in which pathway is thought to underlie the negative and cognitive signs of schizophrenia?
   1. Mesocortical.
   2. Nigrostriatal.
   3. Mesolimbic.
   4. Tuberinfundibular.
7. Bipolar disorder and schizophrenia share all of the following characteristics EXCEPT\_\_\_\_\_\_\_.
8. Disorganized thinking
9. Hallucinations
10. Approximate age of diagnosis
11. Rapid onset of symptoms
12. All of the following have been associated with an increased risk of schizophrenia EXCEPT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    1. Complications during childbirth
    2. Exposure to winter viruses in utero
    3. A family history of seasonal affective disorder
    4. Living in westernized countries
13. The hypothesis that NMDA receptors may be necessary for LTP and memory has been supported by work with:
    1. Cats in puzzle boxes.
    2. Mice with hippocampal lesions.
    3. Doogie/Knockout mice.
    4. Cats with hippocampal lesions.
14. What was Papez’s key error in investigating the brain regions important for emotion?
15. He focused his study on the hippocampus
16. He studied the Rabies virus which has no effects on emotional behavior
17. He only studied animals
18. He only studied post-mortem brains

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

1. What makes the case of the man in the film “Unknown White Male” so unusual?
2. He has focal retrograde amnesia for episodic information
3. He has focal anterograde amnesia for episodic information
4. He has pronounced retrograde and anterograde amnesia
5. His brain damage is limited to the CA1 fields of the hippocampi, which does not usually produce such profound memory loss.

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

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

1. Disordered sleep may contribute to major depression potentially due to the greater proportion of REM sleep experienced and the enhanced blockade of the release of \_\_\_\_\_\_\_\_\_\_monoamines\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. In class (assuming this is something you attend), you saw a video of amnesia patient K.C. In addition to profound anterograde amnesia and mild retrograde amnesia, he also showed an inability to imagine the \_\_\_\_\_\_\_\_future\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. Relative to controls, emotional murderers who have been found guilty of committing “crimes of passion” have been shown to exhibit increased neural activation in the \_\_\_\_\_\_amygdala\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and decreased activation in the \_\_\_\_\_\_\_\_\_\_\_orbitofrontal cortex\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. The \_\_\_\_limbic\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system has expanded over the last 100 years as we have learned more about the contributions of the amygdala and orbitofrontal cortex to emotional processing.
5. Memory for facts is referred to as \_\_\_\_\_semantic\_\_\_\_\_\_\_\_ memory while memory for events is referred to as \_\_\_\_\_\_episodic\_\_\_\_\_\_\_\_\_ memory.
6. \_\_\_Unipolar\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ depression is twice as common in women as men while \_\_bipolar\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ depression has a stronger hereditary linkage.
7. In addition to its role in declarative memory, the hippocampus provides negative feedback on the \_\_\_\_\_hypothalamic-pituitary-adrenal axis\_\_\_\_\_\_.
8. Phototherapy (UV Light) is used to treat \_\_\_\_\_\_seasonal affective disorder\_\_\_\_\_\_\_.
9. The false belief by the patient that the government is controlling a schizophrenic patient’s mind is an example of a \_\_delusion/ or delusion of control\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
10. Damage to the \_\_\_\_\_\_\_\_\_\_thalamus/mammillary bodies\_\_\_\_\_\_\_\_\_ is believed to be the principal cause of confabulation.

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

1. Compare and contrast early and late LTP, being sure to discuss both pre-and post-synaptic effects where appropriate. Name at least one place in the brain where LTP occurs (i.e. specific pathway or nucleus).

Glutamate released by the presynaptic neuron binds AMPA and NMDA receptors (1). In AMPA receptors, ion channels permeable to sodium/potassium open and the cell depolarizes (1). The depolarization causes magnesium to be moved so it no longer blocks the NMDA receptor’s calcium channel (1). Further glutamate release by the presynaptic neuron will subsequently bind to the NMDA receptors resulting in calcium influx (1). In early LTP, lasting several hours after glutamate release and binding, calcium activates CAMII Kinase which phosphorylates AMPA receptors sitting in the post-synaptic membrane, increasing their activity, and moves intracellular AMPA receptors to the postsynaptic membrane strengthening the synapse, producing stronger EPSPs to subsequent stimulation (3). In late LTP, lasting days, weeks or potentially a lifetime, calcium-activated enzymes phosphorylate other enzymes involved in protein synthesis. This results in the creation of more AMPA and NMDA receptors in the postsynaptic neuron (1). Finally, calcium-activated enzymes stimulate production of a retrograde messenger, likely nitric oxide, which affects the presynaptic neuron, stimulating glutamate release (1). Thus while early LTP has post-synaptic effects, late LTP acts both pre-and post-synaptically. LTP occurs in the perforant pathway (entorhinal cortex >>> dentate gyrus), the Schaeffer collateral pathway (CA3 >>> CA1), and the amygdala (1 point for any of these).

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

1. Describe the case of Phineas Gage, including the likely location of brain damage and its subsequent impact on his behavior. What are typical symptoms of damage or dysfunction in this area and what does this suggest about this area’s function?

Phineas Gage was a railroad worker who sustained brain injury when an unexpected explosion sent a tamping iron through his skull (1). Post-mortem analyses of his skull suggest that he had bilateral damage to the orbitofronal cortex (1). Phineas Gage was a serious man before his accident but afterward, he was said to curse frequently, he was short-tempered, inappropriate, he would make plans but not fulfill them, jumping from one thing to the next. Friends said he was not the same man (2). We know today from the observation of many patients with this lesion that OFC damage produces “acquired sociopathy” syndrome in which patients are impulsive, show disturbed social behavior, impaired theory of mind or understanding the thoughts/feelings of others, and sometimes obsessive compulsive disorder (3). OFC lesion patients have been shown to engage in risk-taking behavior, as evidenced by continued draws from “bad” decks on the Iowa Gambling Task. One of the major roles of the OFC is to inhibit the mesolimbic pathway, which mediates reward-seeking behaviors, as well as the amygdala, which mediates emotional processing and behavioral responses. Thus, OFC damage results in disinhibition of emotional reactivity (i.e. emotional outbursts) and risk-taking behavior (3).

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1. What is posttraumatic stress disorder (PTSD)? How does PTSD affect the hypothalamic-pituitary-adrenal (HPA) axis? What do the twin studies we discussed suggest about the relationship between genetics and the likelihood of PTSD diagnosis?

PTSD is an anxiety/stress disorder induced by exposure to one or more life-threatening situations (1). Although the stressful event is acute, the patient often relives the experience with flashbacks and nightmares or by remaining in the stressful environment (e.g. combat), producing chronic stress symptoms like insomnia, anger and hyper-vigilance (2). Via output from the amygdala, stressors enhance corticotrophin releasing hormone (CRH) from the hypothalamus, which stimulates release of adrenocorticotropic releasing hormone (ACTH) from the pituitary gland, which in turn stimulates release of glucocorticoids from the adrenal glands (2). Glucocorticoids bind and induce excitation in the hippocampus, which in turn inhibits the hypothalamus and the HPA axis (1). Chronic glucocorticoid stimulation results in neuronal death in the hippocampus, reducing its inhibition on the HPA axis (2). Thus, PTSD leads to reduced inhibition of the HPA axis. Monozygotic twin studies show that having a smaller hippocampus can increase the risk of PTSD, since healthy twins of combat-exposed PTSD patients have similarly smaller hippocampi than sets of healthy twins, one of whom was also in combat. Thus, it isn’t just the traumatic event that increases PTSD risk, it’s also the genetically smaller hippocampus (2).