

Stress

1. Which of the following statements is **TRUE** regarding learned helplessness?
 - A. TRUE
 - B. TRUE
 - C. TRUE
 - D. FALSE
 - E. **TRUE** see A, B and C

2. Glucocorticoids:
 - A. FALSE ACTH turns on cells in the adrenal *cortex* to secrete cortisol.
 - B. TRUE the hippocampus is the most sensitive area of the brain to cortisol. Cortisol improves memory when it circulates briefly through the brain, but when cortisol levels are chronically elevated, patients show accelerated degeneration of the hippocampus.
 - C. FALSE cortisol inhibits anterior pituitary's secretion of ACTH (negative feedback)
 - D. TRUE ACTH turns on cells in the adrenal cortex to secrete cortisol
 - E. **TRUE** see B and D

3. Chronic uncontrollable (unpredictable) stress:
 - A. FALSE NE levels are decreased
 - B. TRUE
 - C. TRUE
 - D. TRUE cortisol for too long kills those hippo cells
 - E. **TRUE** see B, C and D

4. Which of the following is **FALSE** regarding extrahypothalamic CRH?
 - A. TRUE CRH cells in the amygdala and PVN project to the LC, which has CRH receptors. When stimulated by the CRH, the LC increases its firing and secretes NE that in turn excites preganglionic sympathetic cells in the lateral cell column and cardiac output increases (via turning on postganglionic sympathetics to the heart). The LC projection to the lateral cell column also influences the adrenal medulla via the preganglionic sympathetics that end on chromaffin cells.
 - B. TRUE CRH cells in the amygdala and PVN project to the LC, which has CRH receptors. When stimulated by the CRH, the LC increases its firing
 - C. TRUE see A
 - D. TRUE see A
 - E. **FALSE** NE is found in the LC terminals

5. The following neurotransmitter profile would be most likely to characterize the brain of an infant monkey recently separated from its mother:
 - A. FALSE the infant is stressed. The PVN is stimulating the anterior pituitary to secrete ACTH, which is stimulating the adrenal cortex to secrete cortisol. The PVN is also stimulating the LC, which turns on the lateral cell column, which turns on the chromaffin cells in the adrenal medulla to increase NE and epinephrine.
 - B. FALSE See A
 - C. **TRUE**
 - D. FALSE
 - E. FALSE see A

6. Posttraumatic stress disorder (PTSD):

A. **TRUE** people with PTSD frequently feel as if the trauma is happening again. This is sometimes called a flashback, reliving experience or abreaction. The person may have intrusive pictures in his/her head about the trauma, have recurrent nightmares or may even experience hallucinations about the trauma. Intrusive symptoms sometimes cause people to lose touch with the "here and now" and react in ways that they did when the trauma originally occurred. For example, many years later a victim of child abuse may hide trembling in a closet when feeling threatened, even if the perceived threat is not abuse-related.

B. **TRUE** symptoms of psychological and physiological arousal are very distinctive in people with PTSD. They may be very jumpy, easily startled, irritable, and may have sleep disturbances like insomnia or nightmares. They may seem constantly on guard and may find it difficult to concentrate. Sometimes people with PTSD will have panic attacks accompanied by shortness of breath and chest pain.

C. **TRUE** yohimbine=more NE. It has been shown that a single dose of yohimbine, even in a laboratory setting, produces a variety of symptoms in PTSD patients that evoke the original traumatic symptoms, including multisensory flashbacks. By contrast, the drug has no behavioral effect on normal healthy subjects.

D. **FALSE** remember that there is an increase in cortisol receptors on ACTH producing cells in PTSD patients leading to greater negative feedback.

E. **TRUE** see A, B and C

7. In the HPA axis:

A. **FALSE** CRH (or CRF) is released by the paraventricular nucleus of the hypothalamus

B. **FALSE** cortisol is released from the cortex of the adrenal gland

C. **FALSE** glucocorticoids are released from the cortex of the adrenal gland

D. **FALSE** the amygdala can cause the PVN to secrete CRH

E. **TRUE**

8. The locus coeruleus:

A. **FALSE** the LC sends *norepinephrine* projections to the neocortex, thalamus and the limbic system.

B. **FALSE** the LC projects to the neocortex, thalamus and the limbic system as well.

C. **TRUE**

D. **FALSE** means *blue* spot in *Latin*

E. **FALSE** only C is correct

9. Chronic uncontrollable stress:

A. **TRUE** animals that have experienced control over a stress are less likely to have a reduction in brain NE levels when exposed subsequently to an uncontrollable chronic stressor. In effect, animals with a history of stressor controllability appear to be "immunized" from the effects of uncontrollable stressors.

B. **TRUE** model of depression

C. **TRUE** model of depression

D. **FALSE** NE goes down in chronic uncontrollable stress and cortisol goes up

E. **TRUE** see A, B and C

10. Corticotropin releasing hormone (CRH):

A. FALSE found mainly in cells of the PVN and amygdala. Cells in the PVN send their axons to the portal capillary plexus of the median eminence. Here the CRH is secreted into the portal capillaries and reaches the anterior pituitary, where it stimulates the synthesis and release of ACTH. The CRH in the terminals of amygdala neurons and PVN cells is released onto LC neurons.

B. FALSE tough to have one without the other

C. FALSE CRH infusion into the brain reaches cells with CRH receptors For example, CRH reaches LC neurons which turn on pregang. sympathetics in lateral cell column which turn on chromaffin cells of adrenal medulla which leads to an increase in epi and norepi

D. FALSE CRH excites LC cells (increases their firing)

E. TRUE

11. The paraventricular nucleus (PVN) of the hypothalamus:

A. TRUE read on if interested for a windy JKH note. The prefrontal cortex assembles the sensory input we are receiving and puts it into context and makes sense of the information. It can then alert different parts of the brain/mind (i.e., the PVN) in order to make a response. Many areas in the brainstem project to the PVN. All kinds of sensory input reach the PVN from the "reticular formation" in the medulla, pons and midbrain. All of the ascending sensory pathways give collaterals to the reticular formation and this information is then sent to the PVN. Lots of general visceral information (respiration/cardiovascular) reaching the nucleus solitarius via CNs IX and X is sent to the PVN. There is a major projection from the amygdala to the PVN. There is a "back door" from our sensory input system to the amygdala. We each have two amygdalas, and they are the center of our emotional lives; they also seem to be the center of our emotional memory. Thus, current evidence suggests that we receive sensory input that is forwarded to the prefrontal cortex (from the primary sensory areas) but along the way, a "backchannel" message is sent to the amygdala (sort of a "heads up!" if you will). This allows the amygdala to "scan" the information to detect patterns that in the past have represented danger or pain/sorrow, and so enable an immediate reaction *via projections to the PVN* (and LC). This pathway bypasses our intellectual and analytic abilities, and perhaps leads to increased survival. The amygdala uses its stored emotional memory, built up since our birth, to scan for indications of danger or negative situations so that the body is immediately able to respond. The pathway through the prefrontal cortex takes a little longer which is why we sometimes can calm down once we realize we have misinterpreted a situation, etc.

B. FALSE the PVN is activated by stress, emotional or physical (e.g., hemorrhage)

C. FALSE sensory information reaches the PVN from the brain stem reticular formation, not directly from the spinal cord

D. TRUE the PVN, supraoptic and suprachiasmatic nuclei all lie in the rostral hypothalamus

E. TRUE see A and D

12. Which of the following **connections** is/are **TRUE**?

- A. TRUE see 11A response
- B. TRUE see 11A response
- C. TRUE see 11A response
- D. TRUE and uses CRH to turn it on
- E. TRUE**

13. Which of the following **connections** is/are **TRUE**?

- A. TRUE LC projects to all cortical areas where it releases NE
- B. TRUE the LC=arousal so it inhibits dorsal motor X (parasympathetic)
- C. TRUE uses this connection to influence chromaffin cells in adrenal medulla and increase norepi and epi
- D. TRUE stress/arousal
- E. TRUE**

14. Which of the following statements is **FALSE**?

- A. TRUE this is part of the feedback system for circulating cortisol.
- B. TRUE and ACTH is highest just before this
- C. TRUE
- D. FALSE** such levels are normal
- E. TRUE they are novelty detectors

15. Which of the following statements is **TRUE**?

- A. FALSE there are 20,000
- B. FALSE such levels are normal when stress is controllable
- C. TRUE** kills the hippo!
- D. FALSE LC projects all over cortex and lots of other places
- E. FALSE Carl will be upset if you don't know that the PVN lies in the rostral hypothalamus

16. Which of the following statements is/are **TRUE** regarding post-traumatic stress disorder (PTSD)?

- A. FALSE flashbacks are very common
- B. TRUE** the NE system is very sensitive
- C. FALSE the NE system is very sensitive and there are increased NE levels
- D. FALSE PTSD is distinct from acute or chronic stress
- E. FALSE patients have low cortisol levels

Emotion

1. Which of the following is **FALSE** regarding **lesions** of the amygdala?
 - A. **TRUE** a lesion *would* affect emotional memories! JKH note of interest: Imagine driving down the road and having an accident. You hit your head on the steering wheel and the horn gets stuck on. You're bleeding and in pain. It's awful. Sometime later, you hear the sound of a horn. The sound goes to your amygdala and activates your autonomic nervous system (raising your blood pressure and heart rate, making you sweat), tenses your body muscles, releases stress hormones into your blood, and so on. The sound also goes to the temporal lobe system (hippocampus) and reminds you of the accident, who you were with and where you were going. It also reminds you that it was awful. But these are all just facts about the situation. They are memories of the emotional experience rather than emotional memories. In general, one difference between emotional and cognitive processing is that emotional processing often leads to bodily responses, whereas cognitive processing leads to more cognitive processing. Cognitions are seldom characterized by specific kinds of responses, but emotions usually are.
 - B. **TRUE** yes, lesions of the amygdala have a taming effect in animals. Remember Carl's Kluver-Bucy monkeys. They were not afraid of anything. Amygdalectomy (removal) reduces violent human behavior. Rabid animals are violently aggressive and rabies is caused by a virus that damages the temporal lobe (possibly amygdala?) Autopsy of Charles Whitman, who carried out a sniper attack from the University Tower at Texas in 1966, showed he had a tumor pressing on his amygdala.
 - C. **TRUE** see A
 - D. **TRUE** there would be a decrease in epi and norepi
 - E. **FALSE** with an amygdala lesion, rats won't freeze as in normal rats when they see a predator etc. The central nucleus of the amygdala projects to the central or periaqueductal grey, (not the part for SPA), a region with complex responses thought to be part of the general defense system. In part, this system is responsible for freezing and the cessation of behaviors.
2. Certain patients that have attempted or successfully committed suicide tend to have:
 - A. **FALSE** studies on brain tissue and cerebrospinal fluid (CSF) show that many people who kill themselves, especially those who use violent methods, have low levels of a brain tissue chemical neurotransmitter, serotonin, and its metabolic breakdown product, 5-hydroxyindoleacetic acid (5HIAA). Lower levels of 5-HIAA in CSF have been found to predict a 10-20 times higher mortality from suicide within 1 year after discharge from the hospital. Especially interesting is the fact that whether the psychiatric diagnosis was depression, alcoholism, schizophrenia, or personality disorder, low 5HIAA was associated with significantly more of the suicides and suicide attempts, as well as other violent or impulsive behavior. It is hypothesized that lower CNS serotonin levels makes people more aggressive and impulsive, and thus increases the effects of stress, depression, and psychosis.
 - B. **FALSE** suicide is best associated with reduced levels of CSF 5-HIAA
 - C. **TRUE**
 - D. **FALSE** suicide is best associated with reduced levels of CSF 5-HIAA
 - E. suicide is best associated with reduced levels of CSF 5-HIAA. MHPG is the metabolic breakdown product of NE

3. Serotonin:

- A. FALSE serotonin is reduced in suicide victims and both serotonin and NE are low in depressed people
- B. TRUE** SSRIs act within the brain to increase the amount of the serotonin (5-hydroxytryptamine/5-HT) by inhibiting its reuptake at synapses. One notable characteristic of SSRIs is that, unlike other classes of antidepressants, SSRIs were rationally designed drugs. Instead of being discovered by accident, SSRIs were specifically designed while considering the biological causes of depression. Like other antidepressants, SSRIs are not addictive. Therefore, they are much more difficult to use as a means to commit suicide.
- C. FALSE you don't want your serotonin levels to go down!
- D. FALSE substantia nigra=DA; raphe=serotonin
- E. FALSE LC=norepinephrine

4. Activity of LC neurons:

- A. FALSE remember, the PVN and amygdala project to LC and use CRH to turn on LC cells (LC has receptors for CRH).
- B. FALSE activation of alpha₂-noradrenergic receptors (autoreceptors) on LC neurons normally results in the slowing of neuronal impulse through the NE neuron and the reduction of NE-release. Yohimbine blocks these autoreceptors (is an alpha₂-noradrenergic receptor *antagonist*), so the activity of LC neurons increases.
- C. FALSE clonidine is an alpha₂-noradrenergic receptor *agonist*, which increases the negative feedback which decreases the activity of LC neurons
- D. TRUE** clonidine is an alpha₂-noradrenergic receptor agonist, so the activity of LC neurons decreases
- E. FALSE stress=lots of LC firing and lots of NE/arousal

5. If the amygdala is damaged:

- A. FALSE without the amygdala the association will not be learned. JKH expands: If a normal rat receives a footshock, there is a reflex removal of the foot by spinal pathways you already know. However, ALS fibers also reach the amygdala (in addition to going to VPL). Once the amygdala is turned on, all of its descending pathways will kick in and there will be an autonomic response and freezing. If the footshock is accompanied by a noise, then the pain and auditory information will *both* reach the amygdala and classical Pavlovian conditioned learning will occur. Eventually, only the sound will turn on the amygdala and descending pathways. Without the amygdala, such learning will not occur. Interestingly, the rat will remember (via the hippocampus and cortex) the apparatus etc but there will be no amygdala memory so no autonomic responses.
- B. FALSE remember the Kluver-Bucy monkeys. Following bilateral amygdala lesions, previously fierce monkeys will approach fear-inducing stimuli with no display of anger or fear.
- C. TRUE** In humans this can be due to a rare genetic disorder in which there is bilateral calcification of the amygdalae. This is Urbach-Wiethe disease.
- D.FALSE without the amygdalae, the fear/stress response is blunted. Remember, the amygdala contains CRH and releases it on LC neurons to increase NE. With no amygdalae, you will have less release of CRH.
- E. FALSE if the pathways out of the amygdala (via the central nucleus) are damaged, you will have reduction/loss of freezing

6. Yohimbine:

- A. FALSE yohimbine is an α_2 -noradrenergic receptor antagonist! It binds to the autoreceptor and blocks negative feedback leading to increased NE.
- B. FALSE yohimbine acts as an antagonist of presynaptic autoreceptors on noradrenergic neurons
- C. TRUE**
- D. FALSE from the bark of the South African yohimbe tree
- E. FALSE yohimbine can precipitate panick attacks in susceptible individuals

7. Which of the following statements about depression is **TRUE**?

- A. FALSE NE is low
- B. FALSE reserpine depletes monoamines. It inhibits the vesicular monoamine pump and prevents the active uptake of monoamines into the synaptic vesicles.
- C. TRUE** all keep levels of serotonin and NE up
- D. FALSE NE is decreased in depression
- E. FALSE MHPG is a metabolite of NE and 5-HIAA is a metabolite of serotonin. These would be decreased in depression.

8. Which of the following statements about emotion is **TRUE**?

- A. FALSE
- B. FALSE
- C. FALSE there are many connections between the cortex and the limbic system, especially the frontal and temporal lobes of the cortex.
- D. FALSE among other areas, the amygdala has a huge role in emotional processing
- E. TRUE**

9. Which of the following statements is **TRUE**?

- A. TRUE
- B. TRUE PVN=stress response; dorsal motor X=ulcers in fear response; LC=NE
- C. TRUE in this rare genetic disorder, you get bilateral calcification of the amygdalae
- D. FALSE clonidine is an α_2 -noradrenergic receptor agonist, which increases negative feedback to LC neurons, thereby decreasing their activity
- E. TRUE** see A, B and C

10. Which of the following statements is **TRUE**?

- A. TRUE
- B. TRUE
- C. FALSE they arise in the midbrain—remember the ventral tegmental area and the substantia nigra
- D. FALSE reboxetine is selective for NE
- E. TRUE** see A and B

11. Which of the following statements is **TRUE**?

A. **TRUE** CNs IX and X convey information about CO₂ and it reaches nucleus solitarius. Nucleus solitarius conveys the information to LC. This info. does NOT go via the STT.

B. **TRUE** see A

C. **TRUE** LC turns on preganglionic sympathetics (PGS), PGS turn on chromaffin cells of adrenal medulla which release NE

D. **TRUE** amygdala turns on LC, LC turns on preganglionic sympathetics (PGS), PGS turn on chromaffin cells of adrenal medulla which release NE

E. **TRUE** see A, B, C, and D

12. Which of the following statements is **TRUE**?

A. **FALSE** when lab-bred monkeys are first presented with a snake they show little signs of any fear

B. **TRUE** if the baby sees that Mom is afraid of a snake, the baby will also show fear; if the baby sees that Mom is afraid of a rose, the baby will not show fear. The babies are biologically prepared to learn to be fearful of snakes, not roses!

C. **TRUE**

D. **FALSE**

E. **TRUE** see B and C