

## Reward and Reinforcement I

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

- A. opiate-related pathways are functionally related to the ventral tegmental area (VTA)
- B. opiate-related pathways are functionally related to nucleus accumbens
- C. dopamine is released by the axon/terminals of VTA cells
- D. endorphins are released by the axons/terminals of VTA cells
- E. three of the above are **TRUE**

A. **TRUE** opiate pathways in the brain can affect VTA cells and the release of DA in nucleus accumbens. This can be accomplished by two ways. Opiate pathways increase the level of DA being released in nucleus accumbens by turning up the firing of VTA cells and by inhibiting GABA terminals in the accumbens. This inhibition of the GABA terminals that are presynaptic to the VTA terminals (sound like the basal ganglia?) results in release of more DA from the VTA terminal. Circulating opiates can also cause an increase in accumbens DA release because there are opiate receptors on both VTA neurons (increases their firing) and on the GABA cells in the accumbens (inhibits the inhibitor=more DA released).

B. **TRUE** see A

C. **TRUE**

D. **FALSE**

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

2. Which of the following associations is **TRUE**?

- A. dopamine—VTA
- B. norepinephrine--LC
- C. epinephrine—adrenal medulla
- D. endogenous opioids---turn on VTA
- E. all of the above are **TRUE**

A. **TRUE**

B. **TRUE**

C. **TRUE**

D. **TRUE**

E. **TRUE**

3. The neural circuitry thought to mediate positive reinforcement:

- A. includes the nucleus accumbens
- B. includes nuclei rostral to the midbrain
- C. includes cell bodies within the ventral tegmental area
- D. is functionally related to endogenous opioid circuits
- E. all of the above are **TRUE**

A. **TRUE**

B. **TRUE** nucleus accumbens is rostral to the midbrain

C. **TRUE**

D. **TRUE**

E. **TRUE**

4. The mesocorticolimbic reward system:

- A. originates in the substantia nigra
- B. is thought to release dopamine into the nucleus accumbens in response to secondary but not primary reinforcers
- C. innervates the red nucleus and the dorsal striatum
- D. is involved in mediating electrical brain stimulation reward via dopamine
- E. the cortical part is related to visual cortex

A. FALSE it originates in the VTA

B. FALSE DA is released in nucleus accumbens in response to both primary and secondary reinforcers. DA release is associated with primary reinforcing stimuli, such as food for a hungry animal but also with **conditioned** (remember the experiments on Pavlov's dog in the Emotion chapter) or **secondary** reinforcing stimuli. Such stimuli are often called **incentive stimuli**. Incentive stimuli are previously neutral stimuli (the conditioned stimulus [auditory or visual stimulus] in "Pavlov's dog") which have become rewarding by virtue of being associated with the availability or delivery of reward.

C. FALSE innervates nucleus accumbens, limbic structures and prefrontal cortex

**D. TRUE** stimulate VTA axons on their way to nucleus accumbens and other limbic structures=feel good/euphoria/strong desire

E. FALSE cortical part is prefrontal cortex (long way from area 17!!)

5. The opioid peptide system:

- A. includes enkephalins, endorphins, and dynorphins
- B. decreases the intake of palatable foods
- C. increases anxiety by acting at pain receptors
- D. when blocked by a pharmacological antagonist, increases the sensation of hunger
- E. inhibits the mesocorticolimbic pathway

**A. TRUE**

B. FALSE when we eat a palatable food it somehow turns on the endogenous opiate pathways. You know that such systems can in turn influence the VTA and nucleus accumbens to release more DA (see 1A of this section). Thus the behavior of eating sweets =strong desire –euphoria-- to perform the action again.

C. FALSE reduces anxiety and pain (runners high!)

D. FALSE opiate blocker naltrexone during food consumption state that their perception of hunger hasn't changed, but that the "food doesn't taste as good" (no associated dopamine euphoria). Infusion of naltrexone into the nucleus accumbens of a rat **reduces** consumption of highly palatable/appetizing food (no associated DA euphoria).

E. FALSE see 1A of this section

6. Deprivation of a reinforcer:

- A. causes opiate release in the medulla oblongata
- B. increases sensitivity to other reinforcers
- C. does not affect control over other reinforcers
- D. decreases responsiveness to other reinforcers
- E. all of the above are **TRUE**

- A. FALSE duh
- B. TRUE rats with a history of lever pressing for a sweet solution will increase lever pressing for drugs following deprivation of the sweet solution
- C. FALSE
- D. FALSE
- E. FALSE see B

7. Which of the following is an example of positive reinforcement?

- A. when you talk to your doctor, she / he ignores you
- B. when you take some Advil and it relieves your pain
- C. when you eat a dessert and it makes you sick
- D. when you tell a joke and people laugh
- E. when you play with a baby and he / she cries

- A. FALSE positive reinforcement=those consequences resulting in a subsequent increase of the probability of the behavior
- B. FALSE negative reinforcer increases a behavior that relieves a negative state
- C. FALSE those consequences that subsequently decrease the occurrence of the behavior are termed punishments
- D. TRUE** positive reinforcement=those consequences resulting in a subsequent increase of the probability of the behavior
- E. FALSE those consequences that subsequently decrease the occurrence of the behavior are termed punishments

8. An example of negative reinforcement is:

- A. taking cocaine for its euphoriant properties
- B. taking heroin to reduce withdrawal symptoms
- C. pressing a lever for food
- D. being shocked for pressing a lever
- E. non are true
- A. FALSE negative reinforcer increases a behavior that relieves a negative state
- B. TRUE** negative reinforcer increases a behavior that relieves a negative state
- C. FALSE positive reinforcement=those consequences resulting in a subsequent increase of the probability of the behavior
- D. FALSE those consequences that subsequently decrease the occurrence of the behavior are termed punishments
- E. FALSE see B

9. The VTA (ventral tegmental area) projects to:

- A. prefrontal cortex and nucleus accumbens
- B. nucleus accumbens and locus ceruleus
- C. hippocampus and motor cortex
- D. striatum and raphe nucleus
- E. nucleus accumbens and the ruber/duber/sluber

- A. **TRUE** and to other limbic structures
- B. FALSE not LC
- C. FALSE hippocampus yes (part of limbic system) but not motor cortex
- D. FALSE accumbens is called ventral striatum but VTA does not project to raphe
- E. FALSE there's the duber again!

10. A VTA dopamine neuron could expect to be activated:

- A. when the animal is presented with a loud noise
- B. when the animal is presented with food
- C. when the animal is awake but resting
- D. when the animal is presented with a stimulus previously paired with food
- E. B and D are **TRUE**

- A. FALSE VTA neurons increase their firing to appetitive (rewarding) stimuli
- B. TRUE VTA neurons increase their firing to appetitive (rewarding) stimuli
- C. FALSE VTA neurons increase their firing to appetitive (rewarding) stimuli
- D. TRUE VTA neurons increase their firing to appetitive (rewarding) stimuli and to conditioned stimuli predicting reward
- E. **TRUE** see B and D

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

- A. there is **no** relationship between deprivation of one reinforcer and intake of other reinforcers
- B. injections of opioids into the VTA decrease a rat's consumption of fatty food
- C. approximately 25-30% of obese people in weight loss programs are binge eaters
- D. consequences resulting in a subsequent increase of the probability of the behavior are termed negative reinforcers
- E. two of the above are **TRUE**

- A. FALSE there **is** a relationship between deprivation of one reinforcer and intake of other reinforcers
- B. FALSE injections of opioids into the VTA **increases** rat's consumption of fatty food
- C. **TRUE** remember that percentage; Classic.....(just kidding!)
- D. FALSE consequences resulting in a subsequent increase of the probability of the behavior are termed **positive** reinforcers
- E. FALSE see only C

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

- A. sexual stimuli are associated with marked decrease in dopamine release in the nucleus accumbens
- B. an inattentive doctor acts as a negative reinforcer because you wont go back to see him soon
- C. injection of an opiate blocker into nucleus accumbens will result in rats eating voraciously
- D. the nucleus accumbens lies lateral to the lenticular nucleus (globus pallidus and putamen)
- E. none of the above statements is **TRUE**

- A. FALSE marked **increase** in DA
- B. FALSE he/she is a punisher!!
- C. FALSE reduces consumption (no DA increase)
- D. FALSE ventromedial to caudate and putamen; called by some “ventral striatum”
- E. TRUE**

13. Stephan and Cody were two mentally disabled boys who seldom smiled at other people. Dr. Hopkins used a procedure in which he would take them for walks, and if they smiled at passers by, he would give them some pieces of M & M's candy. This procedure caused Stephan and Cody to smile much more often than they had before.

- A. this is an example of negative reinforcement
- B. this is an example of punishment
- C. the consequence is smiling
- D. the behavior is receiving the candy
- E. this is an example of positive reinforcement

- A. FALSE no negative state is relieved?
- B. FALSE the smiling behavior continues
- C. FALSE the consequence is getting a reward/candy
- D. FALSE the behavior is smiling
- E. TRUE** positive reinforcement=consequences resulting in a subsequent increase of the probability of the behavior

14. A rat presses a bar in its cage and receives a mild electrical shock on its feet. The rat presses the bar again and again receives a shock.

- A. this is an example of negative reinforcement
- B. this is an example of punishment
- C. the rat will keep pressing the bar until it receives a reward
- D. the rat will stop pressing the bar
- E. two of the above are **TRUE**

- A. FALSE this is punishment!
- B. TRUE this is punishment!
- C. FALSE rats are no that dumb
- D. TRUE
- E. TRUE** see B and D

## Reward and Reinforcement II

1. Dopamine levels in the nucleus accumbens:
  - A. increase when you eat a donut
  - B. increase during sex
  - C. increase when you think of eating a donut
  - D. increase when you think about sex
  - E. all of the above are **TRUE**

- A. TRUE a reward!
- B. TRUE a reward!
- C. TRUE knowing a reward is on its way!
- D. TRUE knowing a reward is on its way!**
- E. TRUE E never fails!

2. Administration of MK-801 along with amphetamine:

- A. has no effect on the immediate early gene zif/268
- B. blocks the activation of the immediate early gene zif/268
- C. enhances the activation of zif/268
- D. blocks the dopamine transporter
- E. A and B are **TRUE**

A. FALSE it blocks the activation of the immediate early gene zif/268it

- B. TRUE** it blocks the activation of the immediate early gene zif/268
- C. FALSE it blocks the activation of the immediate early gene zif/268
- D. FALSE it blocks the activation of the immediate early gene zif/268
- E. FALSE see only B

3. Which of the following occur following long-term drug use in rats?

- A. activation of IEGs in nucleus accumbens
- B. increase in neurofilaments in VTA neurons
- C. enlargement of cell bodies of VTA neurons
- D. other inputs to the nucleus accumbens and VTA are affected
- E. A and D are **TRUE**

A. TRUE

- B. FALSE decrease in neurofilaments in VTA neurons
- C. FALSE shrinkage of cell bodies of VTA neurons
- D. TRUE
- E. **TRUE** see A and D

4. Which of the following drugs are self-administered by animals?

- A. cocaine
- B. LSD
- C. morphine
- D. A and C
- E. A, B, and C

A. TRUE

- B. FALSE all the compounds that humans use, with the exception of hallucinogens (LSD, mescaline) are avidly self-administered by animals
- C. TRUE
- D. TRUE** see A and D
- E. FALSE see only A and D

5. Dopamine is released in the nucleus accumbens by:

- A. alcohol
- B. eating highly palatable food if you're hungry
- C. nicotine
- D. allowing a male rat to mate with a female rat
- E. all of the above

- A. TRUE reward
- B. TRUE reward
- C. TRUE reward
- D. TRUE reward
- E. **TRUE** reward!!!!!!!!!!!!!!

6. Which of the following statement(s) is/are **TRUE**?

- A. cocaine's mechanism of action is to bind to the acetylcholine re-uptake transporter
- B. drugs of abuse from different chemical classes cause an increase in dopamine release in the nucleus accumbens
- C. a conditioned stimulus cannot control drug-seeking behavior
- D. both positive and negative reinforcement are involved in drug-seeking behavior
- E. two of the above are **TRUE**

- A. FALSE it binds to the DA transporter
- B. TRUE
- C. FALSE it sure can!
- D. TRUE problems of withdrawal are relieved=negative reinforcement
- E. **TRUE** see B and D

7. Drug-associated conditioned stimuli:

- A. can activate the prefrontal cortex in addicts
- B. can activate the nucleus accumbens
- C. play a role in human but not animal drug-seeking behavior
- D. do not evoke physiological arousal and drug craving
- E. two of the above are **TRUE**

- A. TRUE
- B. TRUE
- C. FALSE
- D. FALSE
- E. **TRUE** see A and B

8. Which of the following statement(s) about the sequelae of chronic exposure to a drug of abuse is/are **FALSE**?

- A. repeated exposure to drugs of abuse causes neuroadaptation in the brain
- B. physical dependence includes the need for the drug to function normally
- C. tolerance involves an increased response to a drug after it has been taken repeatedly
- D. withdrawal signs can include seizures, nausea, and severe depression
- E. during desensitization progressively more drug is needed in order to obtain the same effect.

- A. TRUE
- B. TRUE and if the drug is withdrawn, the person has severe physical and psychic disturbances)
- C. **FALSE** exposure to a drug causes less response than previously caused
- D. TRUE
- E. TRUE

9. Which of the following statement(s) about a heroin addict who quits using drugs “cold turkey” is/are **TRUE**?

- A. he/she might experience gastrointestinal disturbance
- B. he/she might experience chills
- C. he/she might resume drug taking according to the principle of negative reinforcement
- D. he/she might experience a runny nose and tearing
- E. all of the above are **TRUE**

- A. TRUE
- B. TRUE
- C. TRUE negative reinforcer increases a behavior that relieves a negative state
- D. TRUE
- E. **TRUE**

10. Brain systems involved in positive reinforcement:

- A. are inactivated by acute administration of drugs of abuse
- B. include norepinephrine transmission within the nucleus accumbens
- C. undergo neuroadaptation with chronic exposure to drugs of abuse
- D. can be similarly affected by primary and secondary reinforcers associated with either naturally rewarding stimuli or drugs of abuse
- E. C and D are **TRUE**

- A. FALSE are activated
- B. FALSE DA transmission
- C. TRUE
- D. TRUE
- E. **TRUE**

### **Thought and Emotion**

1. Which are found in the temporal lobe?

- A. Broca's area, primary somatosensory cortex, visual association areas
- B. amygdala, hypothalamus
- C. Wernicke's area, amygdala, primary auditory cortex
- D. Broca's and Wernicke's areas, amygdala, hippocampus
- E. area 4

- A. FALSE Broca's=frontal (inferior frontal gyrus or convolution); primary somatosensory cortex=3,1,3=parietal; visual association areas=occipital and temporal
- B. FALSE amygdala=temporal lobe; hypothalamus=diencephalons
- C. TRUE** Wernicke's=temporal, parietal and occipital; amygdala=temporal; primary auditory cortex=temporal
- D. FALSE Broca's=frontal; Wernicke's=Wernicke's=temporal, parietal and occipital; amygdala=temporal; hippocampus=temporal
- E. FALSE frontal

2. The dopaminergic system functionally links anatomical areas of:

- A. VTA, dorsal raphe nucleus, and prefrontal cortex
  - B. LC, limbic system, and prefrontal cortex
  - C. VTA, limbic system, and prefrontal cortex
  - D. LC, raphe nucleus, and prefrontal cortex
  - E. dorsal raphe nucleus, prefrontal cortex, visual cortex
- A. FALSE VTA and prefrontal=yes; dorsal raphe=no
  - B. FALSE limbic system and prefrontal cortex=yes; LC=no
  - C. TRUE** meso-limbic-cortical
  - D. FALSE prefrontal cortex=yes; LC, raphe nucleus=no
  - E. FALSE prefrontal cortex=yes; dorsal raphe nucleus=no; visual cortex=no

3. Phineas Gage would be likely to:

- A. forget most past experiences
  - B. not be able to read or write
  - C. forget meeting HM
  - D. make loud jokes in church
  - E. lose his working memory
- A. FALSE his working memory was OK as the dorsolateral prefrontal cortex was OK (his lesion involved the orbital and medial PFC)
  - B. FALSE cortical areas involved in reading and writing were preserved in Phineas
  - C. FALSE his memory was fine so if he met HM he would remember HM, who of course would not remember Phineas!
  - D. TRUE**
  - E. FALSE his memory was fine

4. Working memory:

- A. is stored in the hippocampus
  - B. is damaged following lesions of the dorsolateral PFC
  - C. is used for planning a chess move
  - D. is used for performing mental arithmetic
  - E. three of the above are **TRUE**
- A. FALSE it is stored in the dorsolateral PFC
  - B. TRUE
  - C. TRUE the "chalk board"
  - D. TRUE the "chalk board"

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

5. Which of the following statement is **TRUE** regarding the phrase “purple rounding to fagilimate all zoom and cross?”

- A. is something a schizophrenia patient might say
- B. is something a person with abnormalities of the frontal and temporal lobes might say
- C. is something that a patient taking a dopamine agonist might say
- D. patient would be helped by taking a neuroleptic drug
- E. all are **TRUE**

- A. TRUE
- B. TRUE
- C. TRUE too much DA
- D. TRUE blocks DA receptors
- E. TRUE**

6. Damage to the prefrontal cortex (all parts included) results in:

- A. inappropriate affect
- B. perseveration
- C. intellectual decline
- D. problems with working memory
- E. three of the above

A. TRUE the word "schizophrenia" derives from the Greek, "schizo" meaning "split" and "phrenia" meaning mind. Thus, those diagnosed with schizophrenia often display flat or inappropriate affect (laughing out loud at a funeral, wearing a tank top and shorts in cold weather) reflecting a splitting apart of normal emotions from responses, and a separation of thought and perceptual experiences from rational processes.

- B. TRUE perseveration=persistent repetition of an activity, word, phrase, or movement, such as tapping, wiping, and picking. Commonly see in schizophrenia
- C. FALSE Phineas had a normal IQ after his accident
- D. TRUE dorsolateral PFC
- E. TRUE** see A, B, D

7. Hallucinations, perceptual distortions, and altered sensory experiences can be elicited by:

- A. high doses of dopaminergic antagonists
- B. high doses of carbachol (cholinergic agonist)
- C. high doses of MHPG
- D. high doses of alpha-2 NE autoreceptor agonists
- E. high doses of dopaminergic agonists

- A. FALSE schizophrenic tendencies result from too much DA (agonists)
- B. FALSE schizophrenic tendencies result from too much DA not Ach
- C. FALSE MHPG is the metabolite of NE
- D. FALSE schizophrenic tendencies result from too much DA
- E. TRUE** schizophrenic tendencies result from too much DA (agonists)

8. Some of the structural abnormalities associated with schizophrenia include:
- A. ventricular enlargement, decreased volume of medial temporal lobe structures, and altered pattern of cellular arrangement in temporal and frontal brain regions
  - B. ventricular enlargement, increased hippocampal volume, and altered pattern of cellular arrangement in temporal and frontal brain regions
  - C. ventricular shrinkage, increased temporal lobe volume, and altered pattern of cellular arrangement in the entorhinal cortex
  - D. ventricular enlargement, decreased temporal lobe volume, and increased frontal cortical volume
  - E. decreased temporal lobe volume, decreased frontal lobe volume, and under activity of dopamine in these regions

**A. TRUE**

- B. FALSE decreased instead of increased hippocampal volume
- C. FALSE decreased instead of increased temporal lobe volume
- D. FALSE decreased instead of increased frontal cortical volume
- E. FALSE over activity instead of under activity of dopamine in these regions

9. Antipsychotic drugs are thought to exert their beneficial effects via:

- A. blockade of the  $\alpha_2$  NE autoreceptors
- B. decreasing the effects of physostigmine (cholinesterase inhibitor)
- C. blockade of dopaminergic receptors
- D. blockade of clonidine receptors
- E. blockage of DA release in visual cortex

A. FALSE they exert their benefits via blocking DA receptors

B. FALSE they exert their benefits via blocking DA receptors

**C. TRUE** they exert their benefits via blocking DA receptors

D. FALSE they exert their benefits via blocking DA receptors

E. FALSE they exert their benefits via blocking DA receptors in temporal and frontal areas

10. Which is **TRUE** regarding the following sentence? “He strode across the court and protested vigorously that his opponent was infringing upon the rules by using an illegally strung tennis racket.”

A. lesions of a higher visual cortical area (19 for example) would affect one’s ability to know that the “court” refers to a tennis court rather than a court of justice

B. immediately after reading the sentence, Phineas Gage would not have been able to understand that the “court” refers to a tennis court rather than a court of justice

C. immediately after reading the sentence, you are using your PFC to understand that the “court” refers to a tennis court rather than a court of justice

D. none of the above is/are TRUE

E. two of the above are **TRUE**

A. FALSE this is working memory issue—the black board!

B. FALSE Phineas had no memory problem because his dorsolateral PFC was intact and so were his hippocampi

**C. TRUE** ahhh, the black board!

D. FALSE see C

E. FALSE see only C

11. Which of the statements below is **FALSE** regarding the prefrontal cortex (PFC)?

- A. targeted by DA neurons in VTA
- B. is supplied by anterior and middle cerebral arteries
- C. receives inputs from the mediodorsal (MD) of the thalamus
- D. is interconnected with the amygdala, hypothalamus, and hippocampus
- E. lies caudal to supplementary motor cortex (SMA) and lesions result in apraxias

A. **TRUE** meso-limbic-prefrontal!

B. **TRUE** middle cerebral=lateral surface, anterior cerebral=medial wall portion; middle and anterior cerebrals=orbital portion

C. **TRUE**

D. **TRUE**

E. **FALSE** lies **rostral** to supplementary motor cortex (SMA). Apraxias=lesions higher motor areas (area 6)

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

A. in a working memory task, some cells in the dorsolateral PFC increase their firing during the period when the target location needs to be “kept in mind”

B. infant monkeys, and monkeys with lesions of the dorsolateral PFC, would have difficulty keeping the location of the target “in their mind”

C. a monkey with abnormally high levels of DA in the dorsolateral PFC would have difficulty keeping the location of the target “in mind”

D. a short order cook with abnormally high levels of DA, and no pencil, would have trouble keeping your order “in mind”

E. all of the above are **TRUE**

13. Which of the statements below is **TRUE**?

A. patients with lesions of the dorsolateral PFC would have difficulty on the Wisconsin Card Sort Test (WCST)

B. lesions of the dorsolateral PFC result in perseveration

C. schizophrenics exhibit decreased blood flow in the dorsolateral PFC during the WCST

D. schizophrenics engage in repetitive behaviors