I. 3/22-Emotions By Scott

A. Intro

1. Issues
   a) Innate or learned?
   b) Voluntary or involuntary?
   c) Adaptive behavior or communication?
   d) Expression vs. experience
   e) Do animals have emotions?
      (1) Human emotions different from animal emotions?

2. Measuring Emotion
   a) Behavior (display of emotion)
   b) Autonomic system (heart rate, sweating, etc)
   c) Endocrine system (hormones such as epinephrine)
      (1) Endocrine triggers autonomic which triggers behavior

B. Four Theories

1. Common Sense
   a) Perception causes emotion which causes behavior

2. James-Lange
   a) Perception causes behavior which causes emotion
   b) Feedback from behavior leads to the emotion rather than the other way around

3. Canon-Bard
   a) Perception causes both emotion and behavior separately

4. Modern Biopsychology (LeDoux)
   a) Perception, emotion, and behavior are not ordered and are merely related processes

C. Neural Physiology re: Emotion

1. Limbic System
   a) Network of structures involved in emotional experience and expression
   b) Includes limbic cortex, fornix, mammillary body of hypothalamus, amygdala, and hippocampus

2. Amygdala and the LeDoux Pathway
   a) Gut reaction pathway: stimulus-thalamus-amygdala-response

3. Fear Conditioning via Amygdala
   a) Fear can be both innate and learned
   b) Association of neutral cue with negative stimulus can condition fear
      (1) E.g. sound and electrical shocks
      (2) Measured by freeze reaction when hearing the tone
   c) Lesioning of lateral amygdala causes conditioned fears to be lost
   d) Good animal model: both rats and humans have similar fear conditioning pathways and behaviors

4. Fear Extinction after Conditioning
   a) Repeated presentation of neutral cue without negative stimulus results in fear extinction
   b) Fear extinction is not forgetting, as the fear response is still in the brain but is merely downregulated
   c) Emotional learning is permanent in rats
   d) Ventromedial prefrontal cortex (vmPFC) is actively involved in the process

5. The Amygdala
   a) Lateral Nucleus
      (1) Inputs from cortex (primary input), thalamus, and hippocampus
      (2) Outputs to striatum (reinforcement learning) and prefrontal cortex (planning and extinction)
      (3) Involved with emotional learning, reward perception, fear conditioning (especially auditory and gustatory)
   b) Central Nucleus
      (1) Inputs from other nuclei in amygdala
      (2) Outputs to hypothalamus, midbrain, pons, medulla
      (3) Involved with expression of negative emotion, emotional learning, and long-term stress
         (a) Related to PTSD?
   c) Some nuclei which receive input from Central Nucleus
(1) Lateral hypothalamus (hunger)
(2) Ventral tegmental area (dopamine release)
(3) Locus coeruleus (attention)
(4) PAG (pain)
(5) Facial motor nuclei (facial muscles, emotional expression)

d) Evidence of Amygdala’s Role in Fear

(1) Stimulation of nearby hypothalamus results in sham rage, a fearful attacking behavior caused solely by the electrode
(2) Stimulation of human amygdala results in experiencing fear
(3) In humans, a damaged amygdala results in decreased startle response and emotional memory
(4) Amygdala damage in Alzheimer’s results in impaired emotional memory
(5) fMRI shows amygdala is active during perception of danger
(6) Are fear and aggression directly related?
   (a) Still not clear, different neural systems

D. Ethics

1. Trolley dilemma
   a) Passively allowing train to kill five instead of one, or actively switching train to kill one person but save five
   b) Different scenario: push person off bridge to save five or passively allow five to die
   c) Ventromedial prefrontal cortex involved in personal moral judgments such as this
      (1) Dysfunction of vmPFC could be indicatory for some criminal behaviors

E. Aggression

1. Expression
   a) Expression of aggression is genetically programmed and specific to each species (e.g. dog barking, snake rattle)
   b) Can be learned in humans
c) Threat and defensive behaviors are towards the same species and are emotional
   (1) Can also be involved in social hierarchy

d) Predatory behaviors are towards other species and are not emotional

e) Aggressive behaviors have both genetic and environmental causes

2. Neural Control
   a) Serotonin inhibits aggression
      (1) 5HT metabolites in CSF are negatively correlated with aggression
      (2) Twin studies show a genetic basis for aggression
   b) Ventral Frontal Cortex
      (1) Orbitofrontal cortex and cingulate cortex at the base of the frontal lobe
      (2) Inputs from thalamus, temporal cortex, ventral tegmental area and amygdala
      (3) Outputs to hippocampus, hypothalamus, and amygdala
         (a) Input and output with amygdala suggests fear and aggression are linked
      (4) Control of complex emotions
         (a) Final brain area to mature

F. Life Without Frontal Cortex
   1. Case Study of Phineas Gage
      a) Large metal rod launched through his skull in 1800s
      b) Accidental destruction of orbitofrontal cortex
      c) Cognitively normal, but became irresponsible, selfish, and inappropriate behaviors
      d) One of the most famous psychophysiological case studies
   2. Lobotomies
      a) Icepick driven into frontal lobe via top eyelid, then rotated to destroy neural tissue
      b) 50k-100k cases worldwide
      c) Meant to reduce anxiety and compulsive behaviors
(1) Succeeded, but also resulted in antisocial behaviors similar to Phineas Gage, and also irreversible

d) Fell out of favor when pharmacological treatments like SSRIs became available, now only legal in some countries and almost never performed