Lecture 7

Emotions

The Limbic System
- Hypothalamus
- Hippocampus
- Cingulate gyrus
- Amygdala
- Nucleus accumbens
- Orbitofrontal cortex

The Amygdala

- Kluver-Bucy syndrome
  - Damage to temporal lobes, amygdala, hippocampus in monkeys
    - Become docile
    - No signs of fear
  - Structurally complex
    - Many different parts
    - Removal in one study led to more rage

Dominance structures in monkeys

- Lesions to the amygdala of the monkey at the top of the dominance hierarchy lead to a drop to the bottom of the hierarchy
  - Lesions to the amygdala of a monkey in the middle produced no change in status

Stimulating the Amygdala in Humans

- Temporal lobe epilepsy
  - During seizures may lead to bursts of violence
- Stimulation with electrodes (ala Penfield's method) leads to violent outbursts
- Usually causes fear and anxiety
  - Only leads to violence in those individuals that are prone to violence

The Amygdala in Conditioned Fear

- Neurons in the amygdala do not respond to a tone
  - When the tone is linked to a shock, they respond more and more
  - Lesions to the amygdala lead to a loss in the conditioned fear response
Two pathways of fear information to the Amygdala

- The “low road” provides quicker response to a fearful stimulus

Perception of Fear

- The amygdala showed an increased response to fearful faces
  - Also is active in remembering emotionally arousing events (violent crimes)
  - Urback-Wiethe disease
    - Damage to amygdala
    - Problems remembering emotional stories
      - No problem with neutral stories
  - Autism

Autism and the amygdala

- Larger in autistics
- Have abnormal face perception brain activity
  - Also have problems identifying emotions of others

Anatomy of the frontal lobe

- Prefrontal cortex
  - Divided into
    - Dorsolateral prefrontal cortex
    - Orbitofrontal region
    - Medial frontal cortex

The case of Phineas Gage

- Major personality changes after the accident
  - Before: polite, responsible, hard-working, caring, energetic
  - After: childish, selfish, impatient, disrespectful, angry, highly emotional
- Had damage to both frontal lobes
  - Especially the left orbitofrontal cortex
Frontal Lobe lesions
- Found to make chimps docile
  - Proposed as a treatment to emotionally disturbed patients
- AKA: Frontal Lobe Lobotomy
  - Reported significant gains with patients that were depressed and disturbed (through the 50’s)
  - Later it was found that the improvements were slight at best and there were other drawbacks (lack of any emotions)
- Invention of psychiatric drugs led to a reduction in the need for these procedures

The orbitofrontal cortex
- The case of EVR
  - Bilateral damage to orbitofrontal cortex
  - Able to make appropriate decisions about moral dilemmas when given a situation
    - Unable to make the same decisions about his own life
    - Lack of emotional response when shown horrific pictures - even though he admitted to thinking that he should have a reaction to them
  - “Acquired sociopathy” (Damasio)
    - Behavior was very similar to sociopaths

General Adaptation Syndrome
- Alarm reaction
  - Short term
  - Fight or flight
  - Gets the body’s resources ready to cope with a threatening situation
- Resistance stage
  - Alteration of metabolism and other internal systems to help keep up with the increased energy needs from the stressor
    - Glucocorticoids released as a stress response
- Exhaustion stage
  - Resources have become depleted

Anxiety Disorders
- Obsessive-Compulsive Disorder
  - Repetitive, intrusive thoughts accompanied by ritualistic, repetitive behaviors
  - Concordance rate of 68%
  - Birth trauma, infection and injury may also cause OCD
  - Abnormal activity in the basal ganglia, prefrontal cortex, orbitofrontal cortex and cingulate gyrus

Panic Disorder
- Stimulants can initiate an attack in a patient with panic disorder, probably by stimulating the locus coeruleus
- Antidepressants effective in panic disorder reduce activity in the locus coeruleus
- A circuit connecting the hippocampus, orbitofrontal cortex, and cingulate gyrus may mediate panic attacks

Correlates of PTSD
- A smaller than normal hippocampus
- Propanolol blocks glucocorticoids in the brain and may prevent PTSD if administered immediately following a traumatic experience
- Treatment consists of medication and/or cognitive-behavior treatment
### Anxiolytic Drugs

- **Barbiturates**
  - Dangerous sedating properties
- **Benzodiazepines**
  - Seemed to help with anxiety without the extreme sedation
  - Addictive

### Conflict tests in rats

- Rat pushes lever to get food
  - If tone is playing when the lever is pushed, the animal gets a shock with the food
  - Normal rats stop pushing the lever during the tone
  - Benzodiazepine rats keep pushing it

### How do benzodiazepines work?

- **Allosteric modulation**
  - Works on GABA receptors
    - Does not open receptors on its own
    - When GABA is present, the benzodiazepines seem to increase the inhibition caused (compared to GABA by itself)
- Found in the cerebral cortex, basal ganglia, cerebellum, limbic system