Emotional Regulation and Mood disorders
What is emotion?
Defining Emotion

- **Emotion**—A feeling that differs from a person’s normal affective state (baseline); a biological function of the nervous system.

- Emotions have three central attributes:
  - A change in **physiological arousal**, ranging from slight to intense.
  - An **affective (feeling) response**, which may be pleasant or unpleasant.
  - The capacity to motivate a specific behavior (**a behavioral response**).
Experiencing an Emotion

- **James-Lange Theory**

  The view that physiological changes occur in response to an event. Emotion is the interpretation of the physiological response.
Experiencing an Emotion

- **Cannon-Bard Theory**

  The view that an event activates the thalamus, which stimulates the cerebral cortex to produce the feeling component (the experience) of the emotion and, at the same time, stimulates the rest of the body to produce the expression of the emotion.
Experiencing an Emotion

- **Schachter’s Cognitive Model**
- The view that if the emotional reaction is caused by attribution of environmental conditions to the physiological arousal experienced.
The Papez Circuit

- Emotional expression and experience are mediated by a system of interconnected forebrain structures known as the Papez circuit (limbic system).
Primary and Secondary Emotions

Antonio Damasio

- **Primary emotions**—Innate, built-in, hardwired emotions; processed by the limbic system, particularly the amygdala, e.g. fear.

- **Secondary emotions**—The experience of an emotion, the feeling of it, and learning is involved; processed not only by the limbic system, but also the prefrontal areas and somatosensory cortices, e.g. guilt.
What is fear?

- Open question…

- Like memory, this is a construct that is used to describe the seemingly regular relationship of particular sensory inputs and particular motor outputs
Fear as a defensive system

Innate danger signals

Learned danger signals

Fear

- Freezing
- Flight
- Fight
- Analgesia
- Autonomic arousal
A neural system for fear

- Sensory information comes into the thalamus.

- A subcortical pathway takes unprocessed information directly to the amygdala.

- A cortical pathway brings this information to the neocortex and the hippocampus, where more detailed representations of experience are constructed. Projections from these regions converge on neurons located in the amygdala.
A neural system for fear

- The important nuclei in the amygdala complex and in the midbrain that play an important role in fear behaviors.

- Note that the CEm projects to the midbrain nuclei and can generate fear-associated behaviors.

CEc = lateral capsule of the central amygdala
CEm = medial nucleus of the central amygdala.
Monkeys with bilateral temporal lobe resections showed hyperorality, hypersexuality, visual agnosia, and a loss of fear (Klüver & Bucy 1937).

Led to follow up studies that localized the loss of fear to the amygdala (Weiskrantz 1956).
Fearless - The case of S.M.

- 44 year old woman with a rare genetic condition (Urbache-Wiethe) that caused her amygdala to calcify and harden — i.e. amygdala lesion.

- Experimenters exposed her to snakes and spiders, took her to one of the world’s scariest haunted houses, and had her watch a series of horror films.

- They also had her fill out questionnaires probing different aspects of fear, from the fear of death to public speaking.

- SM consistently failed to experience fear.
“Other events in SM’s life are less benign. Fourteen years ago, she was walking through a small park at 10pm, when a man beckoned her over to a bench. As she approached, he pulled her down stuck a knife to her throat and said, “I’m going to cut you!” SM didn’t panic; she didn’t feel afraid. Hearing a church choir sing in the distance, she confidently said, “If you’re going to kill me, you’re gonna have to go through my God’s angels first.” The man let her go and she walked (not ran) away. The next day, she returned to the same park.”

BUT she can experience panic (e.g. air hunger), despite the absence of an amygdala! There’s more than one kind of fear.
Mood Disorders

- **Major depression**—A type of depressive disorder characterized by a depressed mood of at least two weeks in duration.

- **Dysthymia**—Chronic low-level depression.

- **Bipolar disorders**—A type of affective disorder characterized by episodes of **mania** and depression that typically continue throughout a person’s lifetime.

- **Cyclothymia**—One of the bipolar disorders characterized by less intense episodes of mania and depression than are seen in the bipolar disorder.

- **Hypomania**—A milder form of mania in which occupational or social functioning is not impaired.
Depression - DSM IV Diagnosis

- Depressed mood or loss of interest in activities for more than two weeks
- Deviates from the person’s baseline (i.e. change from the norm)
- Impaired function: social, occupational, educational
- Specific symptoms such as:
  - Irritability
  - Anhedonia
  - Weight loss/gain
  - Change in sleep habits
  - Fatigue/loss of energy,
  - Guilt/feelings of worthlessness
  - Trouble concentrating
  - Suicidal ideation
Mood Disorders: Brain Changes

- Depression is associated with increased levels of stress chemicals – cortisol (glucocorticoids in the brain).

- Glucocorticoids reduce dendritic spines necessary for structural plasticity

Work by Tallie Z. Baram, UCI
Mood Disorders: Brain Changes

- Depression is associated with reduced dendritic spines in the hippocampus.

Normal Depression
Mood Disorders: Brain Changes

- Reduced GM volume in orbitofrontal cortex.
- Reduced volume of hippocampus, amygdala, entorhinal cortex, basal ganglia, and thalamic nuclei.
PET scans reveal lower-than-normal activity during depressive episodes and higher-than-normal activity during manic episodes.

In depression, the reduction is especially apparent in the **left frontal cortex**.

Decreased blood flow and metabolism have also been found in the cingulate gyrus and the basal ganglia of depressed individuals.

Courtesy: Helen Mayberg
Affective Disorders: ECT Treatment

- For drug-resistant depression
- Disadvantages
  - High relapse rate
  - Memory deficits
- A right unilateral ECT may work as well as a bilateral application with fewer side effects.
- A new promising alternative treatment is repetitive transcranial magnetic stimulation (rTMS).