

Affective Neuroscience—study of how the brain generates emotional experience

What Are Emotions?

- Emotions can be seen as a bridge between input (sensory or memory) and output (behavior)
- Both input and output are limited by bodily constraints; emotions help determine what is reacted to and how
- **Cognition**—symbolic or visual representation of things or events
- **Emotion**—evaluative, personal, reaction to things and events
- Animals can have emotions
- **Dimensional approach** to study of emotions:
 - Wilhelm Wundt
 - **Valence**—bad to good on horizontal axis
 - **Arousal**—low to high on vertical axis
- **Categorical approach** to study of emotions:
 - Charles Darwin and Paul Ekman
 - Types of emotion: happy, sad, angry, fearful, disgusted, etc.

Why Are Emotions?

- Western culture has not always valued emotions
- Darwin: Emotions help us survive and pass on genes to future generations
- Emotions are not fixed and may drive learning and behavior
- William James suggested that emotions were caused by physiological reactions of the body
- Walter Cannon pointed to role of brain circuits
- **Triune brain scheme**
 - Paul MacLean
 - Not fully accepted, but is a general map for linking deeper regions to emotional experience
 - 1. **“Reptilian”** brain regions: evolutionarily very old
 - Includes brainstem, hypothalamus, striatum
 - “Four Fs”: fear, flight, feeding, and fornication
 - 2. **“Old mammalian”** brain regions:
 - Mostly subcortical or old cortex (amygdalae, anterior cingulate cortex, and insular cortex)
 - Social emotions
 - 3. **“New mammalian”** brain regions:
 - Mostly cortical (including the frontal cortex)
 - Abstract representation
 - Research to determine links between specific brain regions and behavior
 - Animal research crucial for this: lesioning and stimulating
 - Walter Hess evoked rage behaviors in cats with electric stimulation
 - James Olds and Peter Milner found that rats would self-stimulate with electricity
 - Jaak Panksepp suggested brain circuits for certain emotions (seeking, fear, rage, panic).
 - ♦ **Positive and aroused:** nucleus accumbens to lateral hypothalamus to midbrain: excitement
 - ♦ **Negative and aroused:** amygdala through medial hypothalamus to midbrain: fear

When Are Emotions?

- Timescale varies from momentary (i.e.: startle) to mood state predisposition (i.e.: chronic anxiety)
- **Reactive emotions**—in response to an event
- **Anticipatory affect**—in anticipation of an event
- **Negative arousal**—promotes avoidance of threats
 - Involves the amygdalae (singular: amygdala)
 - Lesioning them causes animals to act fearless
 - Joseph Le Doux: Pathways in reaction to threats
 - Low road: bypasses cortex
 - High road: cortical involvement, more reasoned reaction
 - Neuroimaging also implicates insular cortex in anticipating negative events
 - Understanding negative anticipatory arousal may have implications for treating psychological distress (e.g., anxiety disorders)
- **Positive arousal**—promotes approach to opportunities
 - James Olds' and Peter Milner's self-stimulating rat
 - Dopamine and nucleus accumbens
 - Implications for dealing with "natural" rewards as well as drug abuse
- Research involved with studying negative and positive anticipatory affect in humans
 - Money is a useful tool
 - Anticipation of rewards raises nucleus accumbens activity
 - Anticipation of losses increases insular activation

Implications:

- Study of brain circuits involved with emotion in humans has just begun, and will depend on new research to advance
- Increased knowledge will most likely aid in helping people with everyday decisions, as well as mental illness and addiction problems

Related Films Also Available from Davidson Films

This is one of four films in Davidson Films' "Neuroscience" series. The other titles are:

- *Discovering the Human Brain: New Pathways to Neuroscience* (2006) 30 Minutes
- *Human Brain Development: Nature and Nurture* (2007) 30 Minutes
- *Making Sense of Sensory Information* (2008) 30 Minutes