

Bear: Neuroscience: Exploring the Brain 3e

◆ Chapter 18: Brain Mechanisms of Emotion

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Introduction

- ◆ Significance of Emotions
 - ✦ Emotional experience; Emotional expression
 - ✦ Human brain imaging techniques
 - * Renaissance in the study of emotion
 - ✦ Affective neuroscience
 - * Neural basis of emotion and mood
 - ✦ Mood
 - * Emotion extended in time

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What Is Emotion?

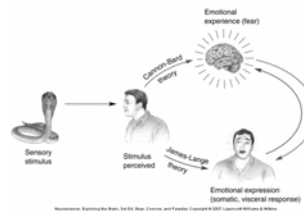
- ◆ Theories of Emotion
 - ✦ The James-Lange Theory
 - * Experience emotion
 - * Response to physiological changes in the body

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What Is Emotion?

- ◆ Theories of Emotion
 - ✦ The Cannon-Bard Theory
 - * Thalamus—Key role in emotional sensations



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What Is Emotion?

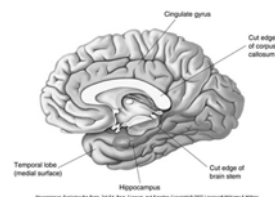
- ◆ Unconscious Emotions
 - ✦ Sensory input: Emotional impact
 - * Without conscious awareness of stimuli
 - * Rules out theories of emotion
 - ✦ Many ways to process emotional information

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The Limbic System Concept

- ◆ Broca's Limbic Lobe
 - ✦ Group of cortical areas
 - * Forms a ring around brain stem

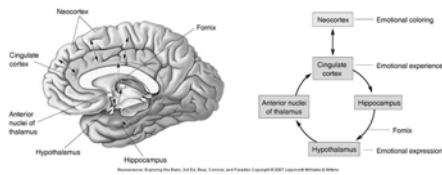


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The Limbic System Concept

- ◆ The Papez Circuit
 - ✦ Emotional system on the medial wall of the brain
 - ✦ Links cortex with hypothalamus



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The Limbic System Concept

- ◆ The Papez Circuit
 - ✦ Hippocampus: Emotion
 - ✦ Rabies infection:
 - ✦ Evidence of infection; Hyperemotional responses
 - ✦ Role of anterior thalamus in emotion
 - ✦ Lesions led to emotional disorder
 - ✦ Limbic system- interconnected structures around the brain stem
 - ✦ Together, thought to govern sensation and emotional expression

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The Limbic System Concept

- ◆ Difficulties with the Single Emotion System Concept
 - ✦ Diverse emotions experienced
 - ✦ Structures involved in emotion
 - ✦ No one-to-one relationship between structure and function
 - ✦ Limbic system: Utility of single, discrete emotion system questionable

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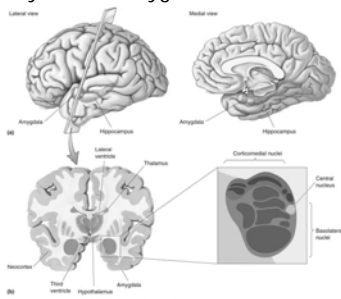
The Limbic System Concept

- ◆ The Klüver-Bucy Syndrome
 - ✦ Klüver and Bucy
 - ✦ Temporal lobectomy in rhesus monkeys
 - ✦ Decreased fear and aggression
 - ✦ Decreased vocalizations and facial expressions
 - ✦ Temporal lobectomy in humans
 - ✦ Exhibit symptoms of Klüver-Bucy syndrome
 - ✦ Flattened emotions

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The Amygdala and Associated Brain Circuits

- ◆ Anatomy of the Amygdala



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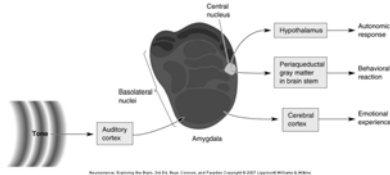
The Amygdala and Associated Brain Circuits

- ◆ The Amygdala and Fear
 - ✦ Bilateral amygdectomy in animals—reduce fear and aggression
 - ✦ Range of effects of amygdala lesions
 - ✦ Fear, anger, sadness, and disgust
 - ✦ S.M. case study
 - ✦ Inability to recognize fear in facial expressions
 - ✦ Electrical stimulation of amygdala
 - ✦ Increased vigilance or attention

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The Amygdala and Associated Brain Circuits

- ◆ The Amygdala and Fear (Cont'd)
 - ✦ A Neural Circuit for Learned Fear
 - * fMRI images and PET imaging: Confirm the role of amygdala in emotion



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The Amygdala and Associated Brain Circuits

- ◆ The Amygdala and Aggression
 - ✦ Predatory Aggression—Attacks
 - * Against different species for food
 - * Few vocalizations; Attack head or neck
 - * No activity in sympathetic division of ANS
 - ✦ Affective aggression
 - * Used for show, not kill for food
 - * High levels of sympathetic activity
 - * Makes vocalizations; Threatening posture

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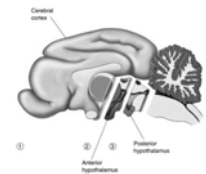
The Amygdala and Associated Brain Circuits

- ◆ The Amygdala and Aggression (Cont'd)
 - ✦ Surgery to Reduce Human Aggression
 - * Amygdalotomy
 - * Psychosurgery - last resort
 - ✦ Symptoms
 - * Reduced aggressive asocial behavior
 - * Increased ability to concentrate
 - * Decreased hyperactivity

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Neural Components of Aggression Beyond the Amygdala

- ◆ The Hypothalamus and Aggression
 - ✦ Removal of cerebral hemispheres
 - * Sham rage
 - * Behavior reversed by small lesions in hypothalamus
 - * Specific lesions, posterior hypothalamus in fear, aggression behaviors



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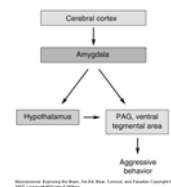
Neural Components of Aggression Beyond the Amygdala

- ◆ The Hypothalamus and Aggression (Cont'd)
 - ✦ Electrical stimulation
 - * Hess, 1920s
 - * Varying effects with varied intensities
 - * Flynn, 1960s
 - * Elicited affective and predatory aggressions

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Neural Components of Aggression Beyond the Amygdala

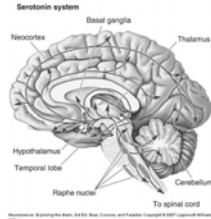
- ◆ The Midbrain and Aggression
 - ✦ Two pathways
 - * Hypothalamus sends signals to brain stem
 - * Medial forebrain bundle
 - * Dorsal longitudinal fasciculus



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Serotonin and Aggression

- ◆ Neurotransmitter Serotonin
 - ◆ Regulating aggression
 - ◆ Raphe nuclei of brain stem
- ◆ Experiments
 - ◆ Induced aggression in rodents
- ◆ Drug PCPA
 - ◆ Blocks serotonin synthesis



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Serotonin and Aggression

- ◆ Serotonin Receptor Knockout Mice
 - ◆ 14 serotonin receptor subtypes
 - ◆ Knockout Mice (recombinant DNA techniques)
 - ◆ 5-HT_{1A} and 5-HT_{1B}
 - ◆ High concentrations in raphe nuclei
 - ◆ 5-HT_{1A} and 5-HT_{1B} autoreceptors—global regulatory role
 - ◆ Agonists: Decrease anxiety, aggressiveness

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Concluding Remarks

- ◆ Neural Pathways
 - ◆ Involved in the experience, expression of emotion
 - ◆ Involves widespread activity in the nervous system
- ◆ Emotional Reactions
 - ◆ Result of interactions between sensory stimuli
 - ◆ Brain circuitry; Past experiences; Neurotransmitter systems

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- ◆ End of Presentation

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