Νευροφυσιολογία και Αισθήσεις

Διάλεξη 18

Οι Συναισθηματικοί Μηχανισμοί στον Εγκέφαλο

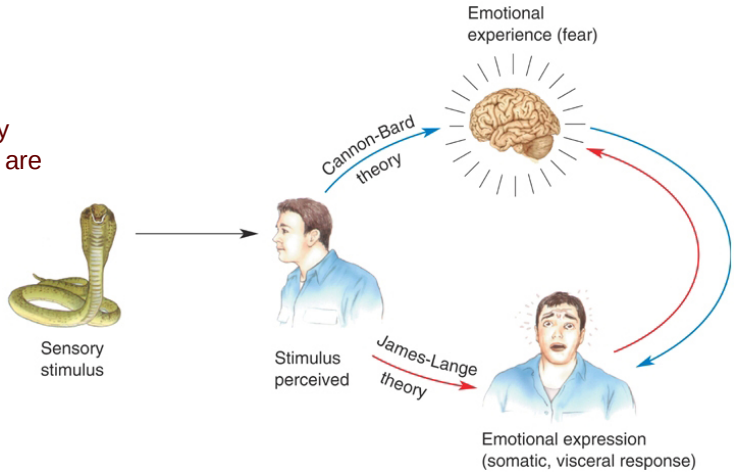
(Brain Mechanisms of Emotion)

Introduction

- **Emotions**
  - Love, hate, happiness, sadness, fear, anxiety, etc
- **Significance of Emotions**
  - Distinguish between Emotional experience and 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
    - Covered in chapter 22

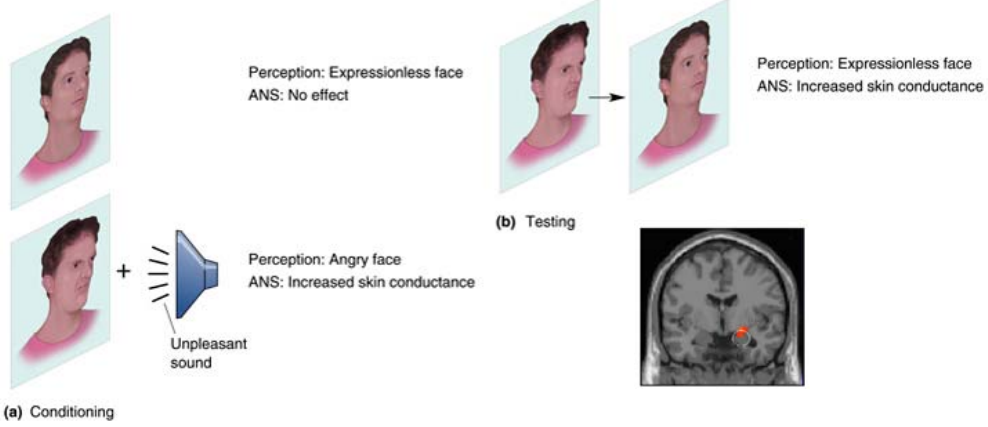
What Is Emotion?

- **Theories of Emotion**
  - The James-Lange Theory
    - We experience emotion
    - Response to physiological changes in the body
      - We are sad because we cry (we do not cry because we are sad)
  - The Cannon-Bard Theory
    - Emotional experience independent of emotional expression
      - Feel emotions even after transection of spinal cord
    - Thalamus—Key role in emotional sensations
  - The mechanisms are still not clear



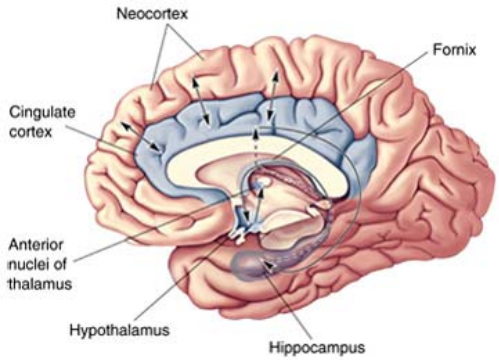
What Is Emotion?

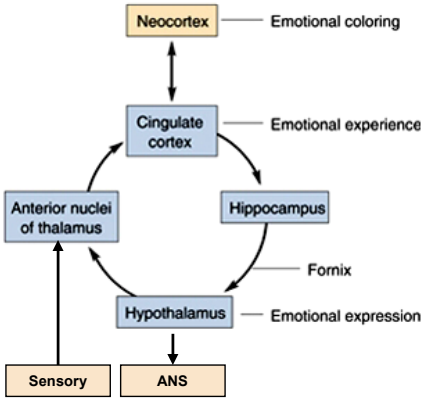
- **Unconscious Emotions**
  - Sensory input: Emotional impact
    - Without conscious awareness of stimuli
    - Rules out theories of emotion
      - Emotional experience not required for emotional expression?
  - Many ways to process emotional information



The Limbic System Concept

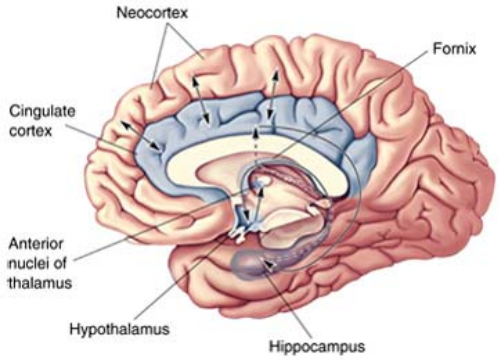
- **Broca's Limbic Lobe**
  - Group of cortical areas
    - Forms a ring around brain stem
- **The Papez Circuit**
  - Emotional system on the medial wall of the brain
  - Links cortex with hypothalamus
  - Output to other areas adds "emotional coloring"
- **The Papez Circuit Role**
  - Hippocampus: 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

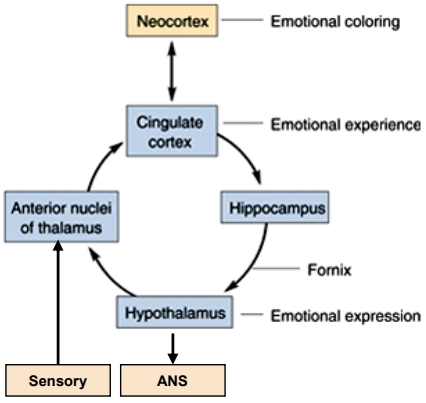




The Limbic System Concept

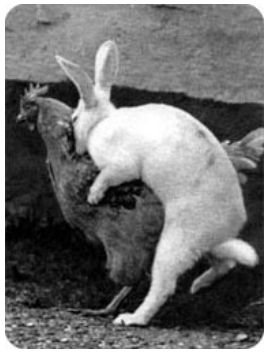
- **Difficulties with the Single Emotion System Concept**
  - Diverse emotions experienced
  - Structures involved in emotion
    - No one-to-one relationship between structure and function
  - Limbic system: Utility of single, discrete emotion system questionable





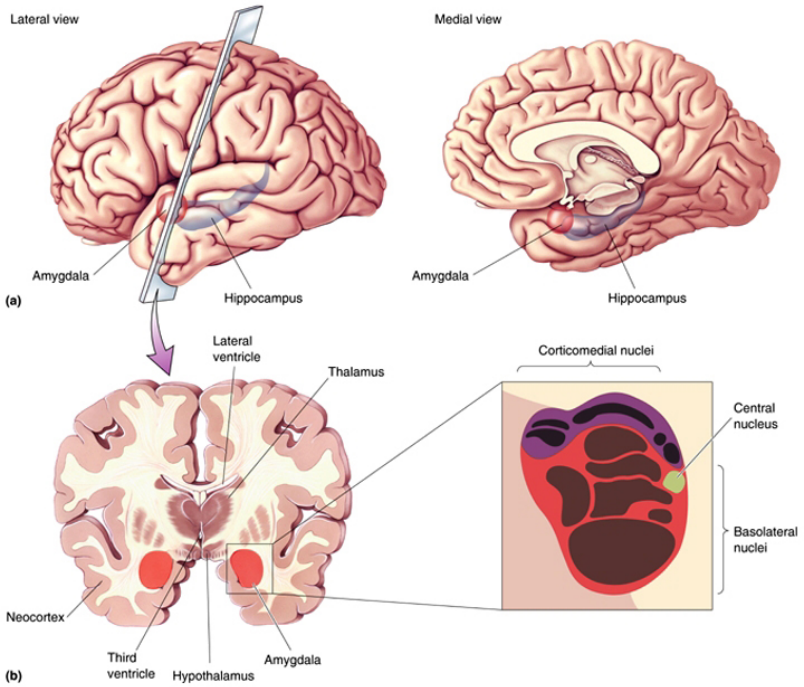
The Limbic System Concept

- **The Klüver-Bucy Syndrome**
  - Klüver and Bucy
    - Temporal lobectomy in rhesus monkeys
      - Poor visual perception (used mouth)
      - Increased interest in sex
      - Decreased fear and aggression
      - Decreased vocalizations and facial expressions
  - Temporal lobectomy in humans
    - Exhibit symptoms of Klüver-Bucy syndrome
    - Flattened emotions



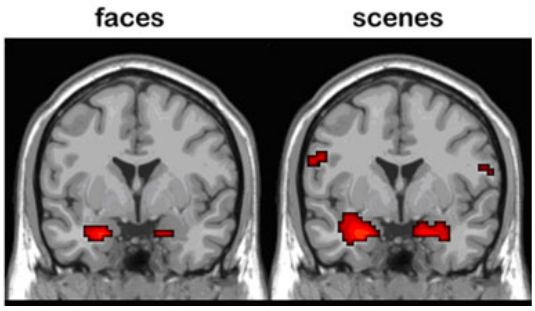
The Amygdala and Associated Brain Circuits

- **Anatomy of the Amygdala**
  - Critical in fear and aggression
  - Received a lot of attention and research



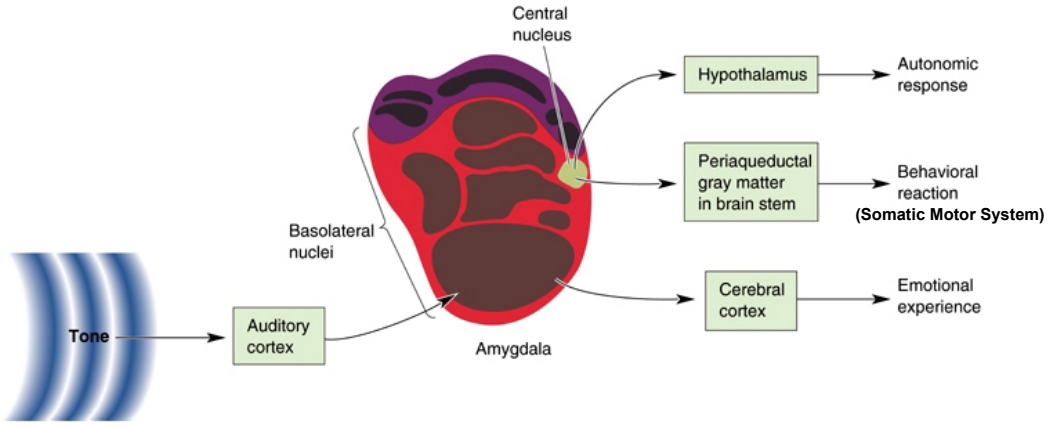
The Amygdala and Associated Brain Circuits

- **The Amygdala and Fear**
  - Bilateral amygdalectomy in animals—reduce fear and aggression
  - Range of effects of amygdala lesions
    - Deficits in fear, anger, sadness, and disgust
    - S.M. case study
      - Inability to recognize fear in facial expressions
      - Could recognize people and other emotions
  - Electrical stimulation of amygdala
    - Increased vigilance or attention, anxiety and fear
    - Lateral site in cats → fear and violent aggression
  - fMRI studies



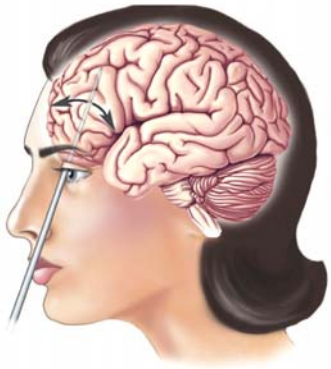
The Amygdala and Associated Brain Circuits

- **The Amygdala and Fear**
  - Memories of emotional events can be very vivid and long-lasting
  - A Neural Circuit for Learned Fear
    - Amygdala (central nucleus) responds to signals associated with fearful memories
      - Subjects also repond better to images with emotional content
    - Synaptic changes in the basolateral nuclei
    - fMRI images and PET imaging: Confirm the role of amygdala in emotion



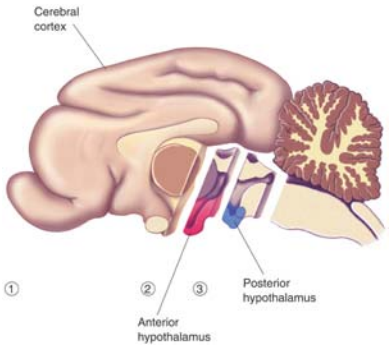
The Amygdala and Associated Brain Circuits

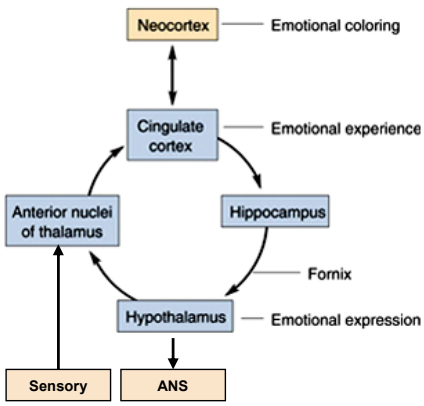
- **The Amygdala and Aggression**
  - Predatory Aggression—Attacks
    - Against different species for food
    - Few vocalizations; Attack head or neck
    - No activity in sympathetic division of ANS
  - Affective aggression
    - Used for show, not kill for food
    - High levels of sympathetic activity
    - Makes vocalizations; Threatening posture
  - Surgery to Reduce Human Aggression
    - Amygdalactomy
    - Psychosurgery – last resort
  - Symptoms
    - Reduced aggressive asocial behavior
    - Increased ability to concentrate
    - Decreased hyperactivity
    - But also side effects (see Fineas Cage)



Neural Components of Aggression Beyond the Amygdala

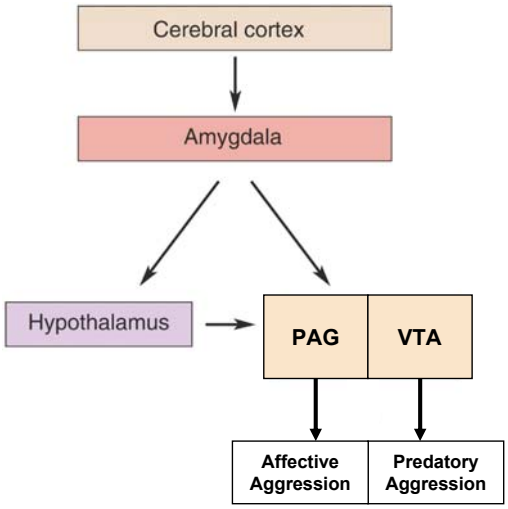
- **The Hypothalamus and Aggression**
  - Removal of cerebral hemispheres
    - Sham rage
      - No reason, no attack
    - Behavior reversed by small lesions in hypothalamus
    - Specific lesions, posterior hypothalamus in fear, aggression behaviors
  - Electrical stimulation
    - Hess, 1920s
      - Sham rage, imaginary attackers
      - Varying effects with varied intensities
    - Flynn, 1960s
      - Elicited affective and predatory aggressions from different areas of the hypothalamus





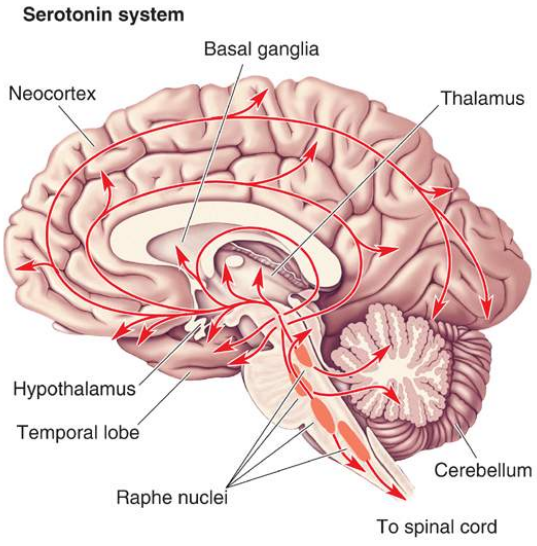
Neural Components of Aggression Beyond the Amygdala

- **The Midbrain and Aggression**
  - Hypothalamus sends signals to brain stem
    - Lateral Hypothalamus →Medial forebrain bundle → Ventral Tegmental Area
      - Stimulation evokes predatory aggression
    - Medial Hypothalamus → Dorsal longitudinal fasciculus → Periaquaductal Gray → Affective aggression
  - Behavior not evoked if midbrain pathways are severed



Serotonin and Aggression

- **Neurotransmitter Serotonin**
  - Regulating aggression
    - Decreased turnover in aggressive animals
  - Raphe nuclei of brain stem
  - Drug PCPA
    - Blocks serotonin synthesis
    - Increase in aggressive behavior
  - Interesting finding in primates
    - Aggression does not correlate with dominance
    - Dominant animal becomes the one with high serotonin turnover
      - Skills to recruit females
- **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



Conclusion

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

Επόμενη Διάλεξη …

Διάλεξη 19

Ψυχασθένειες

(Mental Illness)