Memory, Mood and Limbic system

Innate emotions? Emotional expression in infancy

- Birth: interest, distress, disgust, contentment
- 2-7 months: sadness, joy, surprise and anger

FRUSTRATION: induced anger in a 4 year old girl. Did her parents teach her to behave this way?

Two types of Memory

Spatial memory

Emotional memory

Two types of Memory

1. Limbic system: emotion
   - Reptilian Brain
     - Basic life functions
     - 1st Brain, Low Level
     - Autonomous functions and basic desires
     - Perceptions, evaluations, and emotions
   - Frontal lobe: Reasoning, decision, planning

2. Neocortex: Thinking part
   - 2nd Brain
     - Executive function
     - Perceptions and discriminations
     - Convergent and divergent thinking

3. Human has three brains
   - 3rd Brain: (sub-level)
     - Basic and higher-level functions
     - Basic desires
     - Emotions
     - Memory
     - Attention
     - Learning
     - Interest
What is the Limbic System?

- Our brains have several primitive structures that give us important abilities needed for the survival of the species.
  - The “limbic system” is that group of brain structures devoted to the ability to fight or run away in an emergency.
  - The limbic system also helps us to remember events that caused strong emotions.

Where is the Limbic System?

- Deep within the center of our advanced “thinking brain” (cerebral hemispheres),
  - there is a primitive “emotion brain” (limbic system).
  - The limbic system consists of several structures, including:
    - the amygdala (sometimes called the rage center),
    - the hippocampus (an important part of our memory system).

Brain Structures mediate Emotion & Memory

How does the Limbic System Work?

- If someone were to be attacked, the limbic system would first produce fear and then perhaps rage.
  - The fear would energize the body to help you to run away, if possible.
  - If not, your limbic system might trigger a rage, which would prepare the body to fight in a ferocious manner, to protect yourself or your loved ones.
คนจัดเป็นสัตว์ที่ประเสริฐหรือสูงกว่าสัตว์ทั่วไป 13

มีความแตกต่างจากสัตว์ทั่วไป มีความแตกต่างจากสัตว์ทั่วไป 22

ประการ ประการ

ทางร่างกาย ทางร่างกาย คนมีโครงสร้างเจริญตามแนวดิ่งของโลก หรือขนานไปกับพื้นโลก

สัตว์ทั่วไป สัตว์ทั่วไป ร่างกายเจริญตามแนวนอนของโลก หรือขนานไปกับพื้นโลก

พุทธศาสนาจึงเรียกขั้นตอนไปทางขวาง

ทางด้านจิตใจ

คนมีเหตุผลคนมีเหตุผล อยู่เหนือความต้องการ แต่สัตว์มีความต้องการเหนือเหตุผล

คนมีการพัฒนาสัญชาตญาณในด้านต่างๆ เช่น การกิน การอยู่ สืบพันธุ์ เป็นต้น

(law law)

กฎหมายเข้ามาควบคุม

พฤติกรรม ภาวะ ที่มีความสัมพันธ์กับการพัฒนาสัญชาตญาณ เช่น การกิน การอยู่ สืบพันธุ์

Emotion Responses คอลส์เร้าที่มีส่วนสำคัญ

Complex Pathways of Emotion and Motivation

Since our “emotion brain” is vulnerable to disorders in brain chemistry and in brain electrical activity.

Some disorders : genetic in origin, others are acquired : environmental stimuli ; drugs or alcohol used during pregnancy, or a difficult birth).

A disorder in the “emotion brain” can produce emotions that are out-of-control.


Since our “emotion brain” is vulnerable to disorders in brain chemistry and in brain electrical activity.

Some disorders : genetic in origin, others are acquired : environmental stimuli ; drugs or alcohol used during pregnancy, or a difficult birth).

A disorder in the “emotion brain” can produce emotions that are out-of-control.


Limbic System Important for Neuropsychiatric Disorders?

Behavioral responses

Facial expression

Vocal tone

Physiological response

••

autonomic & hormonal response
**Hippocampus and Alzheimer's Disease**

- Progressive dementia
- Forgetful, abnormalities of memory, cognition, orientation and behavior
- Neuronal loss in hippocampus/parahippocampal gyrus/cortex
- Reduction in cholinergic innervation of cortex

**Brain Structures mediate Emotion & Memory**

- Orbitofrontal cortex (Neocortex)
- Limbic cortex (Paleocortex)
  - Cingulate cortex
  - Entorhinal cortex
- Subcortical nuclei
  - Amygdala
  - Hippocampus
  - Hypothalamus

**Limbic System**: major center for emotion formation and processing, for learning, and for memory

- The hippocampus is involved in memory storage and formation, complex cognitive processing.
- The amygdala is associated with forming complex emotional responses i.e. aggression

**General Concepts of Limbic System Function**

- Audition
- Vision
- Olfaction
- Hypothalamus
- Hormone-ANS Association

**Amygdala and Learned emotions**

Learned fear: Rats and classical conditioning

**Passive Avoidance Paradigm**

- Step-Through Passive Avoidance
- Step-Down Passive Avoidance
  - Train
  - Text: measure time to step through
  - Test: measure time to step down
Emotion is essential for learning
Emotion is essential for survival

Does Intelligence Require Emotion?
- Emotion is essential for survival
  - what is desirable and what should be avoided
- Emotion is essential for learning
  - reinforce what brought about good results
  - learn from experience

The amygdala appears to intercede between fear and attention in two related ways.
1. First, signals from the amygdala enhance the processing of fear-inducing-images by higher level cortical regions (cortico-amygdala pathway)
   - the amygdala can register danger signals via an ancient, but crude, visual pathway.
   - the amygdala can register danger signals via an ancient, but crude, visual pathway. Instead, without communication from higher visual areas. Instead, without communication from higher visual areas.
   - This direct connection reaches the amygdala faster than the more highly evolved pathway.
   - So this direct way is so important when responding to danger. (thalamo-amygdala pathway)

2. Second, it is suggested that the amygdala can also operate without communication from higher visual areas. Instead, without communication from higher visual areas. Instead,
   - the amygdala can register danger signals via an ancient, but crude, visual pathway.
   - This direct connection reaches the amygdala faster than the more highly evolved pathway.
   - So this direct way is so important when responding to danger. (thalamo-amygdala pathway)

Physiological response
- Autonomic nervous system controls physiological arousal

Rage response:
- Hearts accelerates
- Ears increase
- and so on...
Dementia and Alzheimer’s disease

- People with dementia may eventually:
  - Lose the ability to recognize
    - People
    - Places
  - Because their brain can no longer remember or put information together.
    - cannot remember new people he meets
    - cannot find his way home to his new house

Causes of Dementia

- Stroke is one of the most common cause of vascular dementia
  - When blood flow in the brain is blocked by a blood clot in an artery or when an artery bursts.
- Hypertension
- Alzheimer’s dementia
- Aging dementia
- Hence, dementia becomes public health problems.
**Hippocampal Damage and Amnesia**

- Patient H.M. suffered from severe epilepsy.
- To minimize his epilepsy, H.M.'s surgeons removed his medial temporal lobe (including the hippocampus).
- Consequently, H.M. developed severe anterograde amnesia.
- He was unable to form short-term memory into long-term memory, leading to cognitive difficulties.
- He had difficulty in retaining new memories, even for 2-3 months, which left him unable to perform daily tasks.

**Two types of Memory**

- **Spatial Memory**
- **Memory of Events**
- **Procedural Memory**
- **Emotional Memory**

**Cognitive functions**

- Sensory Association Motor cortex Prefrontal cortex
- Autonomic Hormonal Somatic Response
- Voluntary Goal-directed Behaviors
- Involuntary

**Psychosomatic disease**

- Illness associated with emotional stress.
- Conditions include:
  - Depression
  - Anxiety
  - Hypertension
  - Cardiovascular disease
  - Cancer

**Brain structures**

- The hippocampus plays a crucial role in memory formation.
- Dysfunction of the limbic system can lead to dyscontrol syndrome.

**Psychosurgery**

- A treatment option for individuals with severe cognitive impairments.