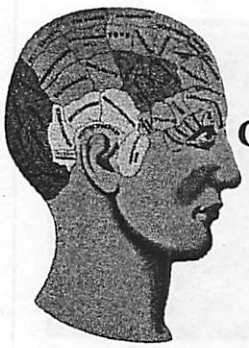


# Critical Thinking & The Brain

Presenter: Carrie Nepstad, M.S.

## *Agenda*

Orientation to the brain –
its growth and development

Thinking and learning process

Executive Function and the Prefrontal Cortex

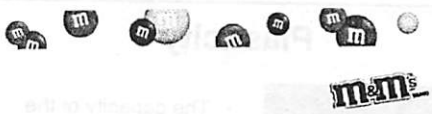
Critical Thinking –
strategies for supporting students

Individual differences

## The Brain and Nervous System Underlie All Behavior

(University of Illinois Extension)

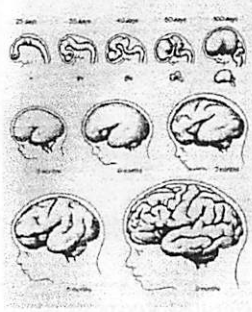
- Thought
- Action
- Emotion
- Communication



What do M & M's have to do with the brain?

## Brain Development in the Prenatal Period

(by Tom Prentiss, from W.M. Cowan, 1979, *Scientific American*)



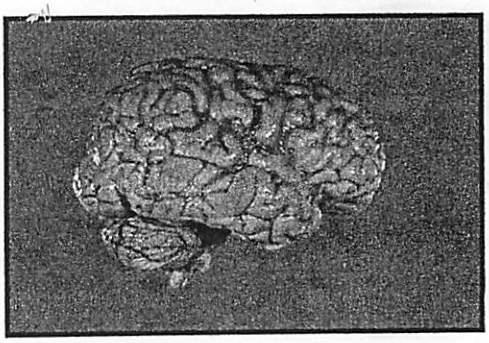
- Begins with the formation of the neural tube.
- Ends looking much like an adult's brain

## Brain Maturation:

- Myelination
- Dendritic arborization
- Synaptic connections

Synaptic Connections:

- Blooming and pruning
- Use it or lose it
- Experience dependant



http://medlib.med.utah.edu/WebPath/HISTHTML/NEURANAT/CNS014A.html

## Plasticity

(University of Illinois Extension)

- The capacity of the brain to change its structure and function in response to experience
- "What the brain does is what the brain becomes" (Gunnar, 1997).

## Plasticity over the Life Span

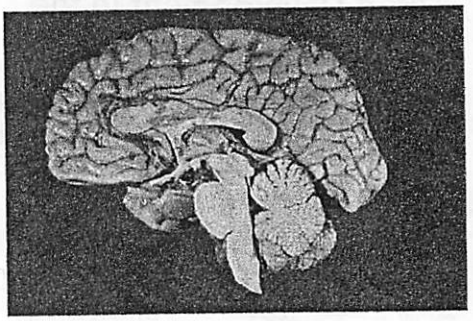
(Carrie Nepstad)

## Major Brain Systems

4

2

1. Brainstem
2. Limbic system
3. Cerebellum
4. Cortex



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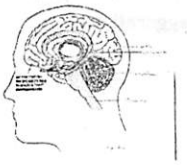
## Memory: The Hippocampus


(Richland)

- Involved in the long-term storage of conscious memories
- Close connection to amygdala links emotion and memory

## The Cortex


(Klein)



- The "thinking" part of the brain
- Has sensory, motor, and association areas
- Takes the longest to develop

## Basic Geography of the Cortex

## "Executive Functions"


(Richland)

- Direct attention, plan, initiate, sequence, reason, control behavior, make decisions, and use good judgment
- Last area of the brain to develop

**The Prefrontal Cortex**
***The most evolved brain system***

**Functions:**

- **Attention**
- **Perseverance**
- **Planning**
- **Judgment**
- **Impulse control**
- **Organization**
- **Self-monitoring/supervision**
- **Problem solving**
- **Critical thinking**
- **Learning from experience and mistakes**
- **Empathy**


**Mel Levine, M.D.**

**Attention:**
- **Attention -Mental energy control**
- **Attention - Intake control**
- **Attention - Output control**
- **Sequential ordering**
- **Spatial ordering**

- **Memory**
- **Language**
- **Motor**
- **Social thinking**
- **Higher thinking**

## Step-by-step approach to critical thinking

**Step 1- Enumerating the Facts**

**Step 2 – Uncovering the Author's/Creator's Point of View**

**Step 3- Establishing what the student thinks**

**Step 4 – Searching for Errors and Exaggerations**

**Step 5 – Getting Outside help**

**Step 6 – Weighing the Evidence**

**Step 7 - Communicating**

## Brains are like faces....

(Richland)

- Similar - Yet unique
- Growing – Over time
- Imperfections – Due to internal & external factors
- Changing – Based on experiences

## Our Social Thinking System

HWC – CD 143 Math & Science for the young Child

Harold Washington College
Assessment Committee
Faculty Workshop Series: "Critical Thinking"

Critical Thinking and the Brain
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