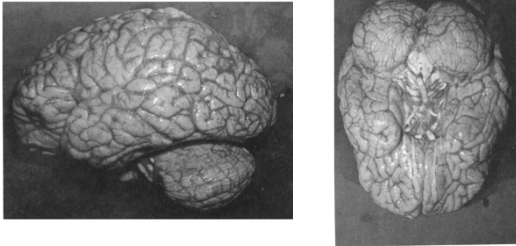


The Brain: Structure

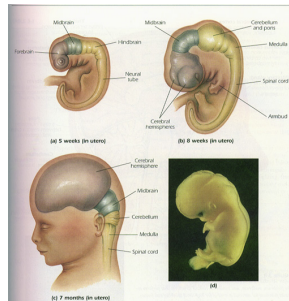


Brain Structure

- Brain structure evolved over millions of years
- Divided into sections
- Each section built upon the others

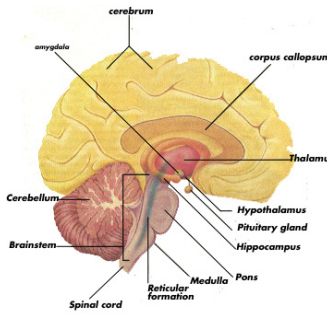
Brain Divisions

- Hindbrain
- Midbrain
- Forebrain



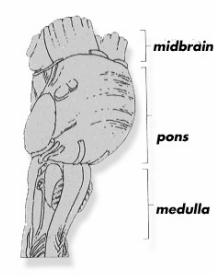
Hindbrain

- Components
 - Brainstem
 - Cerebellum
 - Medulla oblongata
 - Pons




Hindbrain: Brainstem

- Oldest & deepest part of brain
 - "Reptilian" brain
- Life support
 - Alertness
 - Warns of important incoming information
- Basic bodily functions
 - Breathing
 - Heart rate



Hindbrain: Cerebellum

- Attached to rear of brainstem
- Originally a motor structure
 - Control of balance
 - Body posture
 - Movement through space

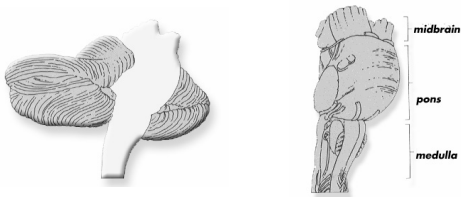


Cerebellum Evolution

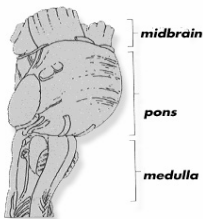
- Memory for simple learned responses stored in cerebellum
 - Memories stored in evolutionarily newer sections
- Old structure of brain expanded to handle new functions
 - Cerebellum size has tripled over the last million years

Hindbrain: Pons

- Just below midbrain
 - Developed as neural tissue was added to cerebellum
 - Relays information to and from cerebellum
- Involved in controlling sleep and arousal



Hindbrain: Medulla Oblongata



- Located where the spinal cord enters skull and joins with the brain
- Part of reticular activating system
- Crossover of nerves
- Controls vital bodily functions

Midbrain



- Connects higher and lower parts of the brain
- More important to non-mammals
 - Source of visual/auditory control
 - Mammal forebrain is main source of visual/auditory control
- Relays information from eyes and ears to brain

Midbrain: Reticular Activating Formation

- Part of midbrain
- Regulates consciousness
 - Sleep, wakefulness, arousal, attention
- Regulates motor functions
 - Heart rate, breathing
 - Stereotyped patterns of behavior

Forebrain

- Largest and most complex region of the brain
- Encompasses a wide variety of structures
 - Hypothalamus
 - Limbic system
 - Hippocampus
 - Cerebrum

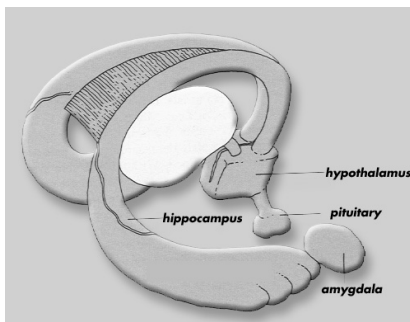
Forebrain: Limbic System

- **Located between the brainstem and cortex**
- **Evolved 300 - 200 million years ago**
 - Reptilian forebrain
 - Olfactory input
 - Highly developed in mammals
 - “Mammalian brain”
- **Human limbic system**
 - Dwarfed by more recent structures
 - Assumed different functions
 - Stores memories of life experiences

Limbic System Functions

- **Helps maintain homeostasis**
 - Regulates blood pressure, body temp, heart rate, blood sugar levels
- **Involved in the emotional reactions responsible for survival**
 - Sexual desire, self protection

Limbic System Components



Limbic System: Hypothalamus

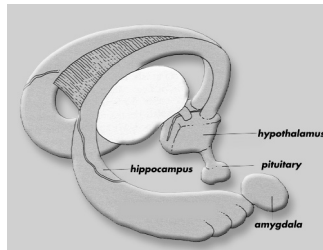
- Important part of limbic system
- Maintains bodily systems through feedback
- Involved in emotional states and our ability to handle stress
 - Electrical and chemical messages sent to pituitary gland

Hypothalamus: Pleasure centers

- Olds & Milner ('54)
 - Electrode in mouse hypothalamus
 - Delivered mild electric current
 - Pleasure center discovered
- Olds ('58)
 - Rats would press bar to receive stimulation to hypothalamus pleasure center

Limbic System: Hippocampus

- Structure
 - “Seahorse”
 - Two: one in each hemisphere
- Special role in memory storage
 - Transfers new memories to cortex
- Severe damage causes amnesia for events following damage



Forebrain: Cerebrum

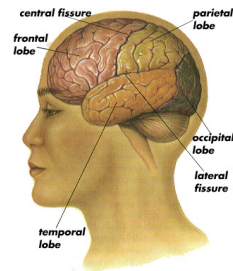
- Largest part of the human brain
 - 80% of brain tissue
- Most evolutionarily recent part of brain
- Includes brain areas responsible for our most complex mental activities

Forebrain: Cerebrum

- Cerebral cortex: convoluted outer layer of cerebrum
- Covers lower portions of brain like a cap
- Divided into hemispheres
 - Hemispheres separated by fissure descending to a thick band of fibers known as the **corpus callosum**

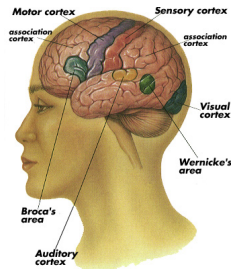
Cerebrum: Hemispheric Lobes

- Frontal lobe
- Parietal lobe
- Temporal lobe
- Occipital lobe



Cerebrum: Frontal lobe

- Located near the front of the head
- Contains primary motor cortex
 - Planning, execution, and control of movements



Topographic mapping

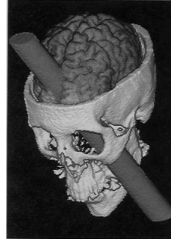
- Used to determine mapping between cortex and body
- Brain stimulated and behavior observed
- Motor stimulation - body moves
- Sensory stimulation - sensory perception

Frontal lobe: Primary motor cortex

- One-to-one mapping
 - Stimulation of cortex causes movement in corresponding body part
- Reverse mapping
 - Lower extremities represented on upper side of cortex
 - Upper extremities represented on lower side of cortex
- Representational space correlated with use & need for fine motor control

Cerebrum: Frontal lobe

- Responsible for intelligence & behavior
 - Phineas T. Gage
 - Prisoners convicted of violent crimes



Cerebrum: Parietal lobe

- Specialize in sensory and perceptual activity
- Contains the primary somatosensory cortex
 - Receives information about pressure, texture, temperature, and pain
 - One-to-one mapping as in motor cortex
 - Stimulation results in a sensory experience
 - The need for sensitivity and fine control correlated with representational space

Cerebrum: Temporal lobe

- Located to the sides of the parietal lobes
- Contains areas responsible for hearing
 - Performs complex auditory analyses
 - Specialized
- Stimulation results in reports of hearing sounds

Cerebrum: Occipital lobe

- Located at the back of the head
- Includes the visual cortex - the primary visual region of the cortex
- Nerves from eyes terminate here
- Stimulation results in the perception of random flashes of light
