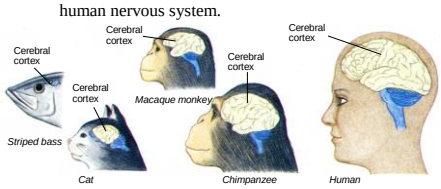
Chapter 2

Biological Psychology (aka biopsychology, behavioral neuroscience, psychobiology, physiological psychology)

The subarea of psychology focusing on the biological basis of behavior & mental processes(brain, body chemistry, genetics, hormones)

Similar nervous system organization in all vertebrates means that we can learn things from animal research that apply to the human nervous system.



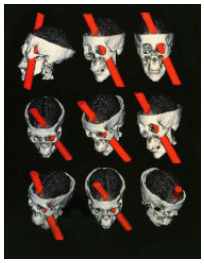
Note: I will not be taking you on a tour of the parts of the brain and nervous system. You do that on your own in our assignment & then will use what you learn to compete for EXTRA CREDIT points in a game next Wednesday.

How Have We Learned About Brain-Behavior Relationships?

- Study the effects of brain **damage** on behavior
  - Human case studies of brain damage
  - Experimental brain research in animals
- **Stimulate** or turn on brain region and see how it affects behavior
- **Monitor brain activity** or differences in anatomy to see how it **correlates** with behavior

The Case of Phineas Gage

http://www.youtube.com/watch?v=jK1sj4JEJ2o



- Experimental brain research example

This rat has surgically induced brain lesions (damage) in the hypothalamus leading to overeating until it weighs 5 X normal weight.

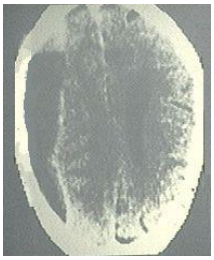
In animal research we can repeat this on dozens of animals to make sure that this change occurs consistently.

Bull Stereotaxic Surgery to Implant a Stimulating Electrode

- In the past there were limited ways to monitor or measure differences in brain anatomy or brain activity – for example, the EEG that we just saw in our sleep unit.
- But now have a variety of new **neuroimaging techniques.**
- **Some show brain structure (CAT, MRI)**
- **Some show brain *activity* (PET, fMRI)**

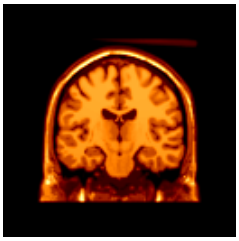
CAT or CT Scan of Hematoma

- Computer uses x-ray data to generate hazy images of brain structure. Can see fairly large abnormalities

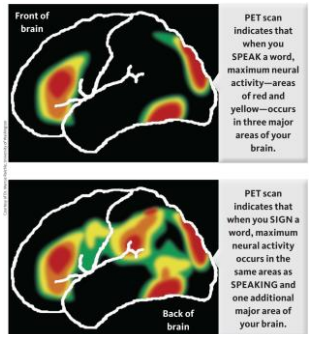


Magnetic Resonance Imaging (MRI)

- Uses magnets & radio waves, not radiation
- Provides sharper, more detailed anatomy – looks like you actually cut into brain.



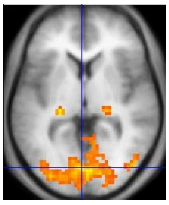
PET Scan

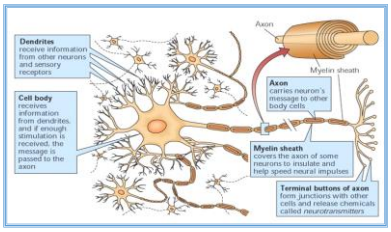


Functional MRI or fMRI

- Bright spots indicate regions of brain that are active during a particular behavior

Can also look at what brain areas are active during mental tasks: **"cognitive neuroscience"**





Within a neuron, communication results from an action potential (an electrical impulse that carries message along the axon of a neuron).

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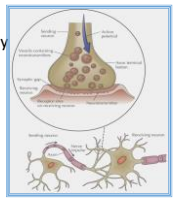
Neural Bases of Psychology: Neural Communication (Continued)

- *Between* neurons, communication occurs through transmission across a **synapse** by **neurotransmitters** (chemicals released by neurons that alter activity in other neurons).



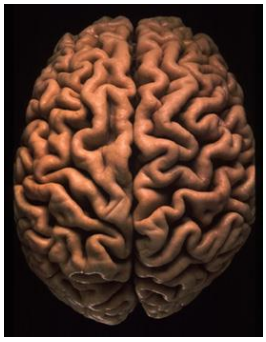
Best Known Neurotransmitters

- Acetylcholine (ACh) – contracts muscles; memory
  - Alzheimer's – too little ACh
- Norepinephrine (NE) – sympathetic N.S.; arousal
- Dopamine (DA)- movement; reward system
  - Parkinson's – too little DA; schizophrenia – overactive DA
- Serotonin (5HT) – mood, emotional balance
- Endorphins – pain suppression; mood
- GABA – calm nervous system & emotions

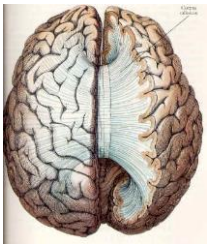
"Split Brain" Research

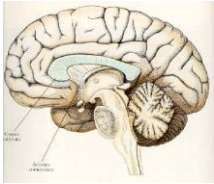
Learning about
right brain/left brain differences

Two Cerebral Hemispheres Seen From Above



Corpus Callosum

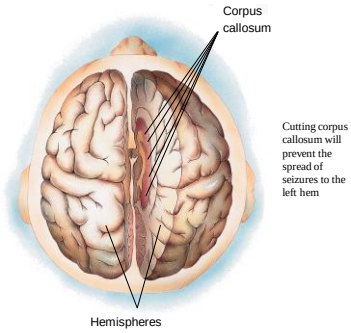




- Seizure – period of abnormal firing in brain or brain area
- **Epilepsy - Recurring** seizures; only about 1 in 100 has epilepsy
- Occurs in many forms
- May be inherited or or may follow some injury to the brain)
- In the latter case, seizures usually begin at the injured spot (the "focus") and it is called "focal epilepsy"

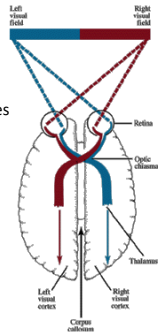
- Imagine X is epileptic focus generating abnormal electrical activity that spreads to left hem. during seizures

Fig3_19

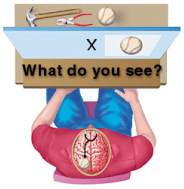


Visual Fields

- Each half of your brain sees the opposite half of your visual world

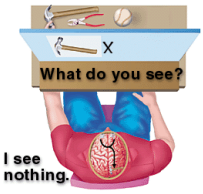


Testing a Split Brain Patient: Left Brain Sees a Ball



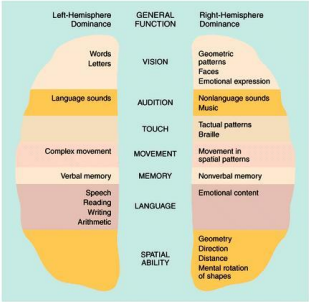
- "I see a baseball"

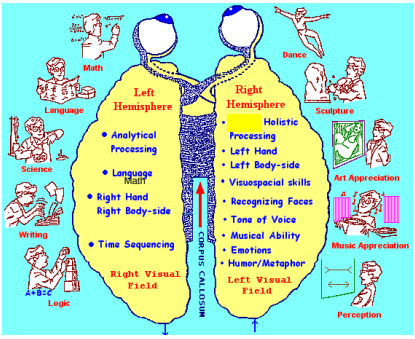
Right Brain Sees a Hammer

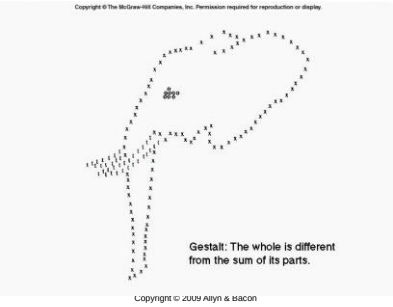


- Alan Alda meets a split brain patient
- http://www.youtube.com/watch?v=lfGwsAdS9Dc

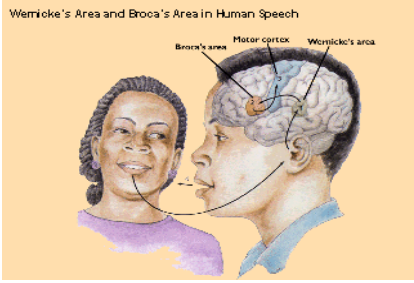
▸ Abilities That Display Cerebral Lateralization of Function







Wernicke's area – comprehending speech
Broca's area – producing speech

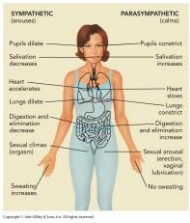


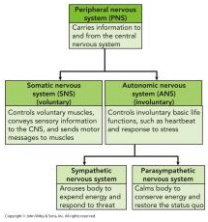
Aphasia: language problems due to brain damage

- Broca's aphasia – damage to Broca's area makes producing speech difficult
- Wernicke's aphasia – damage to Wernicke's area disrupts speech comprehension & comprehensibility
- http://www.youtube.com/watch?v=f2IiMEbMnPM&feature=related B
- http://www.youtube.com/watch?v=gocIUW3E-go
- http://www.youtube.com/watch?v=aVhYN7NTIKU&feature=related W

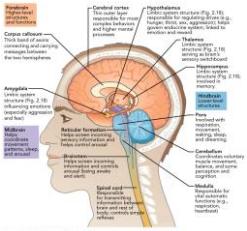
- The following slides were NOT part of lecture but are related the anatomy you are supposed to cover on your own in our chapter.

Peripheral Nervous System: Connecting CNS to the Body





A Tour of the Brain: The Big Picture



Hindbrain

Medulla:

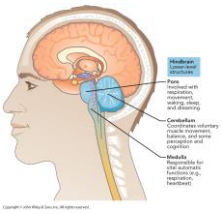
Hindbrain structure responsible for vital, automatic functions, such as respiration and heartbeat

Pons:

Hindbrain structure involved in sleep and dreaming

Cerebellum:

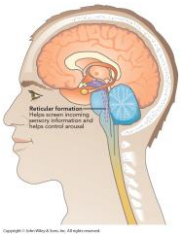
Hindbrain structure responsible for coordinating fine muscle movement, balance.



The hindbrain is critical to sustaining life!

Reticular Formation:

Diffuse set of neurons that helps screen incoming information and controls arousal of forebrain for consciousness.



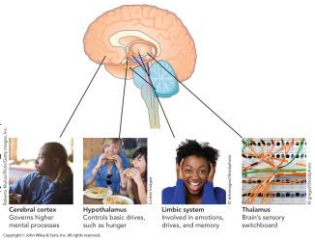
Forebrain

Thalamus

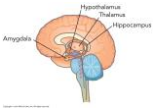
Hypothalamu

Limbic Systen

Cerebral Cort



Limbic System



Limbic System

Interconnected group of forebrain structures involved with emotions, drives, and memory, as well as major physiological functions

Hypothalamus

Small brain structure beneath the thalamus that helps govern drives (hunger, thirst, sex, and aggression) and hormones

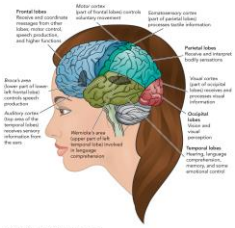
Hippocampus

Seahorse-shaped part of the limbic system involved in forming and retrieving memories

Amygdala

Part of the limbic system that controls emotions, like aggression and fear, and the formation of emotional memory

Major Functions of the Lobes of the Brain



Frontal Lobes

Two lobes at the front of the brain governing motor control (motor cortex), speech production in left lobe (Broca's area), and higher cognitive functions, such as thinking, personality, self-control, emotion, and memory

Parietal lobes

Two lobes at the top of the brain where bodily sensations are received, interpreted (somatosensory cortex)

& used to generate one's body image

Major Functions of the Lobes of the Brain

Temporal Lobes

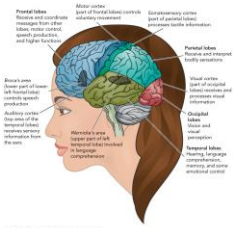
Two lobes on each side of the brain above the ears involved in audition (auditory cortex), language comprehension in the left lobe (Wernicke's area), memory, and some emotional control

Occipital Lobes

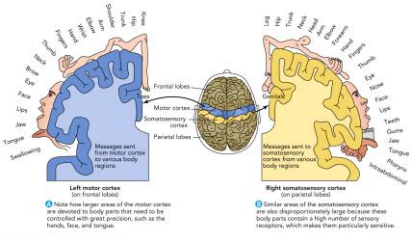
Two lobes at the back of the brain responsible for vision (visual cortex) and visual perception

Association Areas

Higher level processing areas in the cerebral cortex involved in interpreting, integrating, and acting on information processed by other parts of the brain



Visualizing your Motor & Somatosensory Cortex



a Note how larger areas of the motor cortex are devoted to body parts that need to be controlled with great precision, such as the hands, face, and tongue.

b Similar areas of the somatosensory cortex are also disproportionately large because these body parts contain a high number of sensory receptors, which makes them particularly sensitive.