The limbic system— the emotional brain
How are we wired?

• CNS vs Periferal nervous system
• Somatic vs autonomous nervous system
• Motor vs sensory impulses
• Limbic system vs consciousnes
Autonomous nervous system

Parasympathetic
- Stimulates flow of saliva
- Slows heartbeat
- Constricts bronchi
- Stimulates peristalsis and secretion
- Stimulates release of bile
- Contracts bladder

Sympathetic
- Dilates pupil
- Inhibits flow of saliva
- Accelerates heartbeat
- Dilates bronchi
- Inhibits peristalsis and secretion
- Conversion of glycogen to glucose
- Secretion of adrenaline and noradrenaline
- Inhibits bladder contraction

Ganglion
Medulla oblongata
Yagus nerve
Chain of sympathetic ganglia
(c) **White matter** in the spinal cord consists of axons carrying information to and from the brain.

**KEY**
- **Ascending tracts** carry sensory information to the brain.
- **Descending tracts** carry commands to motor neurons.
Tracts in the spinal cord
The pyramidal motor pathways.
Fine touch, vibration, pressure, and proprioception sensations from right side of body

Crude touch and pressure sensations from right side of body
1. Cerebrum Cortex
   Responsible for sensing, thinking, learning, emotion, consciousness, and voluntary movement

2. Corpus callosum
   Bridge of fibers passing information between the two cerebral hemispheres

3. Thalamus
   Relay center of cortex; handles incoming and outgoing stimuli

4. Hypothalamus
   Responsible for regulating biological functions such as hunger, thirst, and temperature control

5. Pituitary gland
   "Master" gland that regulates other endocrine glands

6. Hippocampus
   Part of limbic system involved in learning and memory

7. Amygdala
   Part of limbic system involved in emotion and aggression

8. Cerebellum
   Structure that coordinates fine muscle movement, balance

9. Brainstem

10. Spinal cord
    Responsible for transmitting information between brain and rest of body; handles simple reflexes

11. Reticular formation
    Group of fibers that carry stimulation related to sleep and arousal through brainstem

12. Midbrain

13. Pons

14. Medulla
    Involved in sleep and arousal

Structures and areas in the human brain

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The anatomy of impairment

Parietal lobe
- inability to attend to more than one object at a time
- inability to name an object (anosmia)
- inability to locate the words to write (agraphia)
- problems with reading (alexia)
- difficulty drawing objects
- difficulty distinguishing left from right
- difficulty doing mathematics (dyscalculia)
- lack of awareness of certain body parts and/or surrounding space (apraxia)
- inability to focus visual attention
- difficulty with eye-hand coordination

Occipital lobe
- defects in vision (visual field cuts)
- difficulty locating objects in the environment
- difficulty identifying colors (color agnosia)
- hallucinations
- visual illusions, or inaccurately seeing objects
- word blindness, or inability to recognize words
- difficulty recognizing drawn objects
- inability to recognize the movement of an object (movement agnosia)
- difficulty reading and writing

Cerebellum
- loss of ability to coordinate fine movements
- loss of ability to walk
- inability to reach out and grab objects
- tremors
- dizziness (vertigo)
- slurred speech (scanning speech)
- inability to make rapid movements

Frontal lobe
- loss of simple movement of various body parts (paralysis)
- inability to plan a sequence of complex movements needed to complete multisteped tasks, such as making coffee (sequencing)
- loss of spontaneity in interacting with others
- loss of flexibility in thinking
- persistence of a single thought (preservation)
- inability to focus on a task (attending)
- mood changes (emotionally labile)
- changes in social behavior
- changes in personality
- difficulty with problem solving
- inability to express language (Broca's aphasia)

Temporal lobe
- difficulty recognizing faces (prosopagnosia)
- difficulty understanding spoken words (Wernicke's aphasia)
- disturbance with selective spoken words to what the person sees and hears
- difficulty with identification of and verbalization about objects
- short-term memory loss
- interference with long-term memory
- increased or decreased interest in sexual behavior
- inability to categorize objects
- persistent talking (right lobe damage can cause this)
- increased aggressive behavior

Brain stem
- difficulty swallowing food and water (dysphagia)
- difficulty organizing or perceiving the environment
- problems with balance and movement
- dizziness and nausea (vertigo)
- sleeping difficulties (insomnia, sleep apnea)

Specific types of impaired function can be traced to specific areas of the brain.

ALEXANDRA N. SHERMAN AND KENNY GRADY
• Cortex – control brain, social and environmental integration

• Limbic system – emotional brain
Cingulate gyrus
This area, together with the parahippocampal gyrus and the olfactory bulbs, comprises the limbic cortex, which modifies behavior and emotions.

Fornix
The fornix is a pathway of nerve fibers that transmits information from the hippocampus and other limbic areas to the mamillary body.

Septum pellucidum
A thin sheet of nervous tissue connects the fornix to the corpus callosum.

Column of fornix

Mamillary body
This tiny nucleus acts as a relay station, transmitting information to and from the fornix and thalamus.

Olfactory bulbs
The connection of these structures with the limbic system helps explain why the sense of smell evokes long-forgotten memories and emotions.

Amygdala
This structure influences behavior and activities so that they are appropriate for meeting the body’s internal needs. These include feeding, sexual interest, and emotional reactions such as anger.

Parahippocampal gyrus
With other structures, this area helps modify the expression of emotions such as rage and fright.

Midbrain
The limbic areas influence physical activity via the basal ganglia, the large clusters of nerve cell bodies below the cortex. Limbic midbrain areas also connect to the cortex and the thalamus.

Pons

Hippocampus
This curved band of gray matter is involved with learning and memory, the recognition of novelty, and the recollection of spatial relationships.
Prefronto-limbic circuitry – age-related architecture
Emotions – what are they?
What are the negative emotions?

• a. Fight/flight/freeze - from fear to anger is it all about survival?

• b. Sadness is not depression!
Stunned Limbic system processing

1. Fact, Idea, or Evidence
   - Does person presenting item have adequate social stature?
   - No
     - Do not send to rational faculty for analysis
   - Yes
     - Stop Processing: Item not true or not relevant. Respond using common cliches for any queries that emerge.

2. Does item differ from what is asserted by iconographic authorities?
   - Yes
     - Process in rational faculty or, better yet, "call a friend."
   - No
     - Has authority provided instructions for acting on item?
       - Yes
         - Follow instructions
       - No

3. Mom and Dad
   - Sports’ Authorities
   - "God"
   - Nation
   - Etc., Etc.

4. www.brianrwright.com
Falling in love - targeting the positive emotions

- Romantic love
- Detachment
- Fight for power
- Compromise
- Object permanence