Learning & Memory/Language & Lateralization

Tricia Ngoon
8.1.17

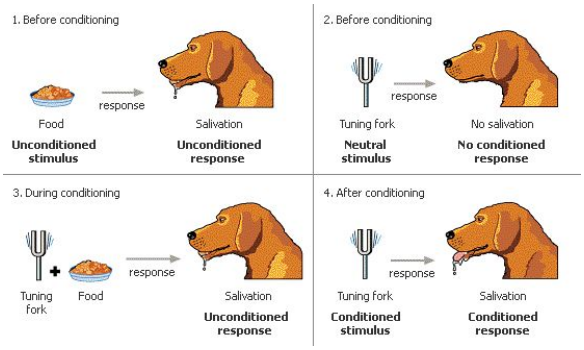
Sign into Section

- Sign in: **http://shoutkey.com/peel**
- Slides: **tinyurl.com/s1cogs17**
- MT3 Wednesday, Final Friday
- Office Hours Thursday, 11am CSB 233

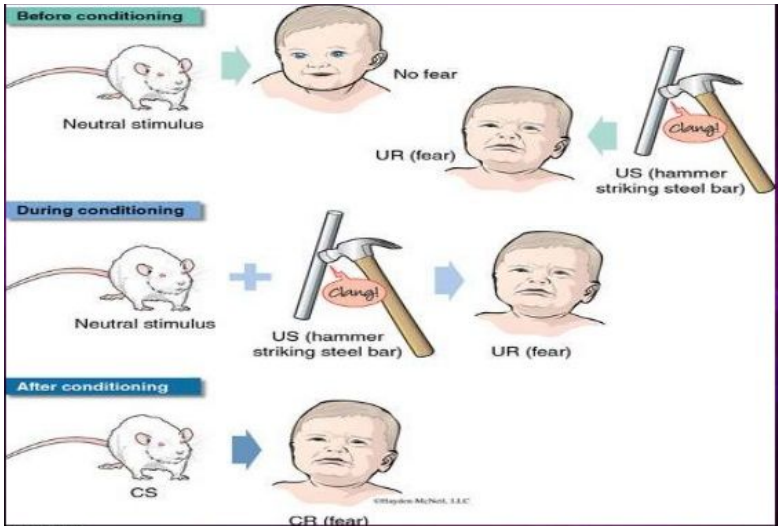
Conditioning

Conditioning

- Classical Conditioning
- Operant Conditioning



Little Albert: Classical Conditioning in Humans



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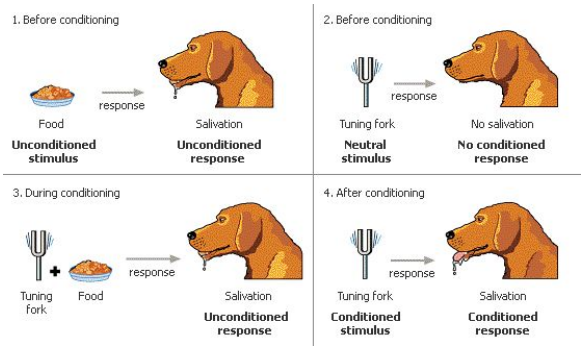
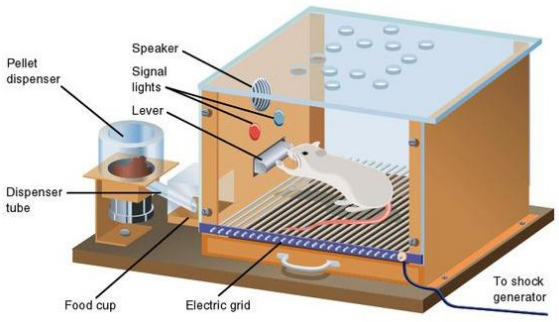
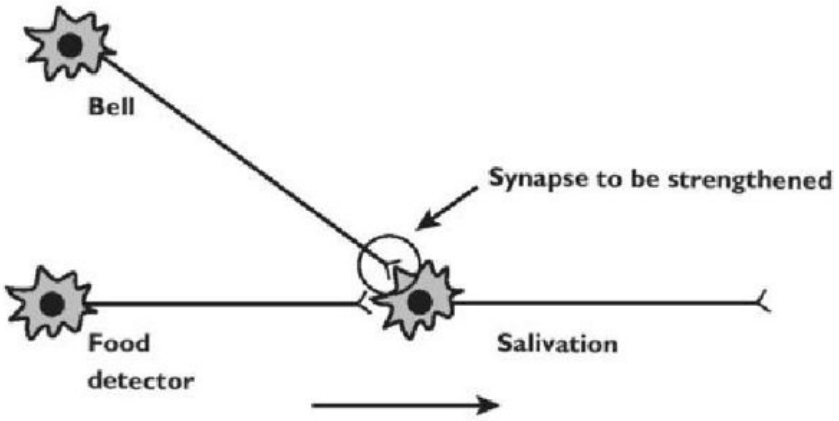




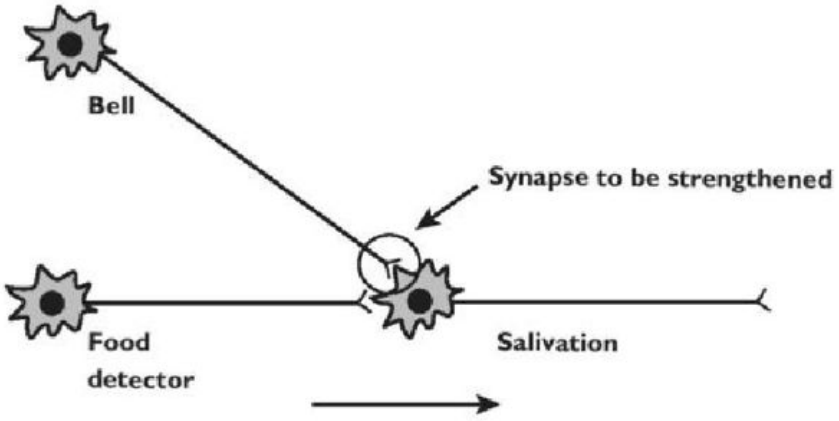
Long-term Potentiation

Hebbian Learning



Cells that _____ together, _____ together

Hebbian Learning



Cells that **fire** together, **wire** together

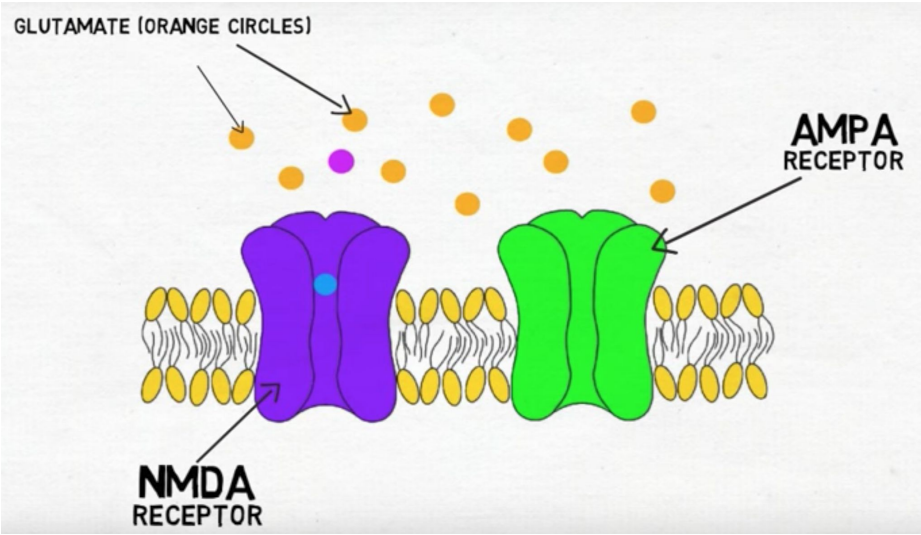
Describe Long-Term Potentiation

- LTP - semi-permanent structural connectivity changes as a result of frequent activation
- This is the primary NT in learning.
- This NT has 2 receptor sites. They are:
  - A___
  - N___

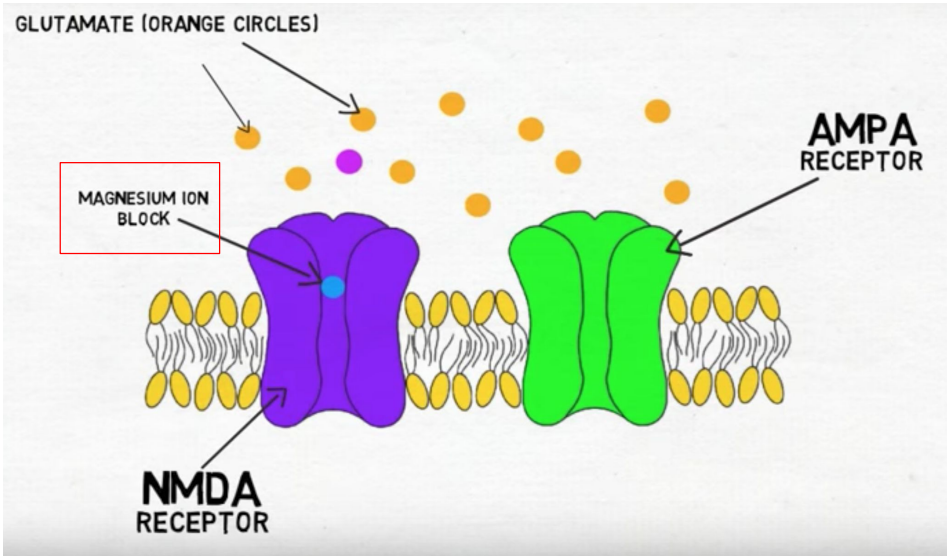
Describe Long-Term Potentiation

- LTP - semi-permanent structural connectivity changes as a result of frequent activation
- This is the primary NT in learning. **Glutamate**
- This NT has 2 receptor sites. They are:
  - **AMPA**
  - **NMDA**

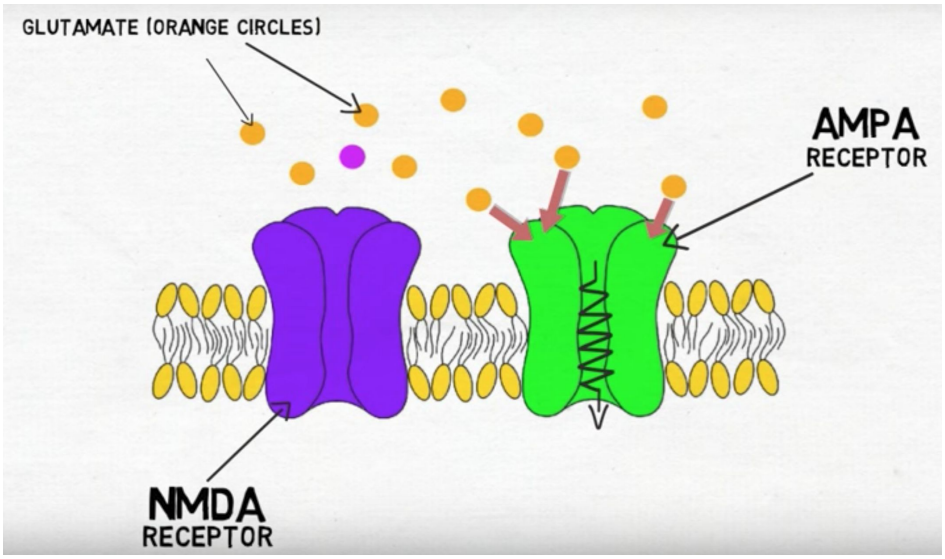
LTP: Glutamate Receptors -NMDA receptors blocked by what ion?



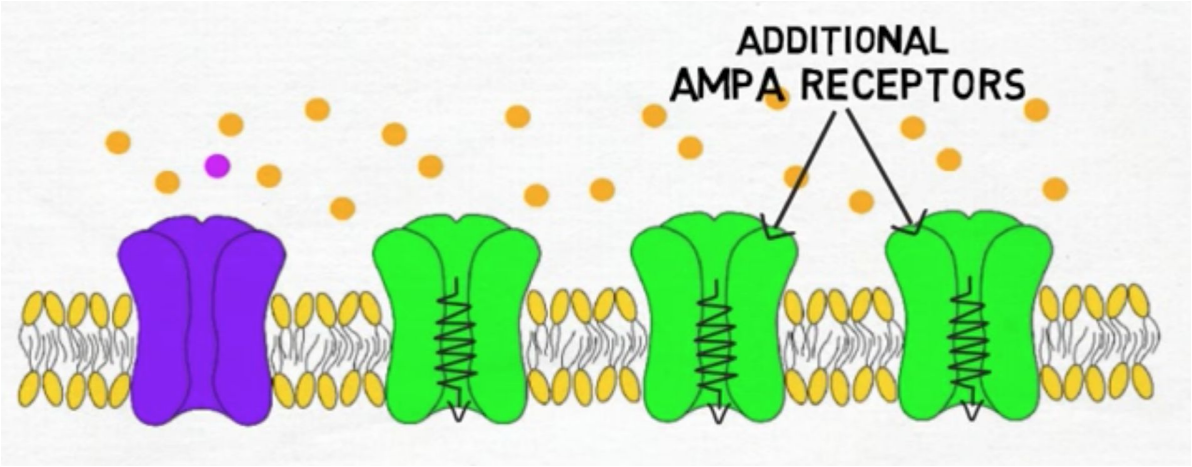
LTP: Glutamate Receptors -What causes the eviction of Mg++ from the NMDA receptors?



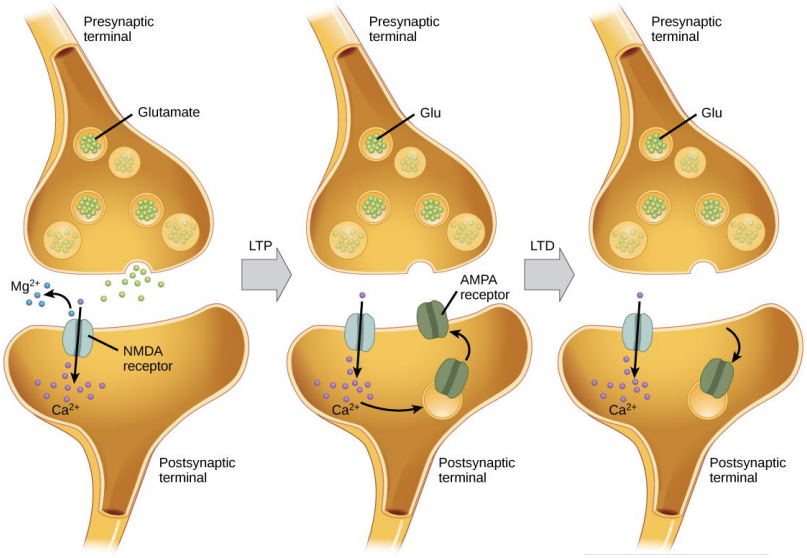
LTP: The eviction of Mg++ from EPSP of AMPA receptor allows what ions to flow into cell?



LTP: The eviction of Mg++ from EPSP of AMPA receptor allows what ions to flow into cell? Ca++ and Na+



LTP: Use it or Lose it



Other structural changes from LTP

- Formation of new dendritic branches:
- Can lead to synthesis of this that prolongs NT release from post-synaptic cell to pre-synaptic cell:
- Division of pre-synaptic cell into 2 terminal buttons:
- Formation of new hippocampal cells:

Other structural changes from LTP

- Formation of new dendritic branches: **dendritization**
- Can lead to synthesis of this that prolongs NT release from pre-synaptic cell to post-synaptic cell: **retrograde messenger**
- Division of pre-synaptic cell into 2 terminal buttons: **perforation**
- Formation of new hippocampal cells: **neurogenesis**

Memory

3 types of memory

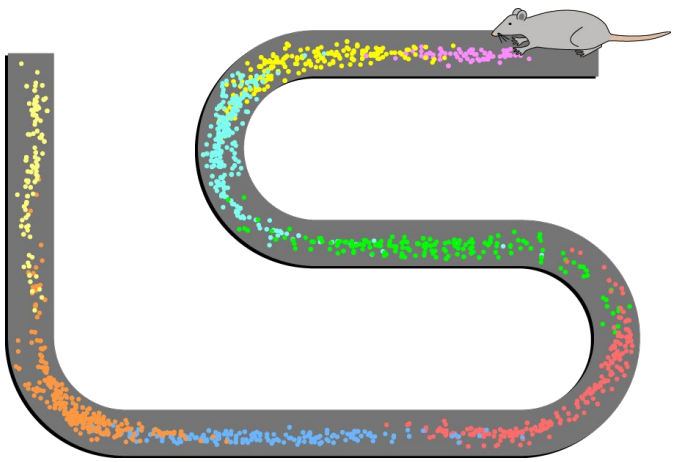
- Knowing how to ride a bike:
- Knowing how to get around campus:
- Answering questions on your midterm:

3 types of memory

- Knowing how to ride a bike: **Procedural**
- Knowing how to get around campus: **Spatial**
- Answering questions on your midterm: **Declarative**

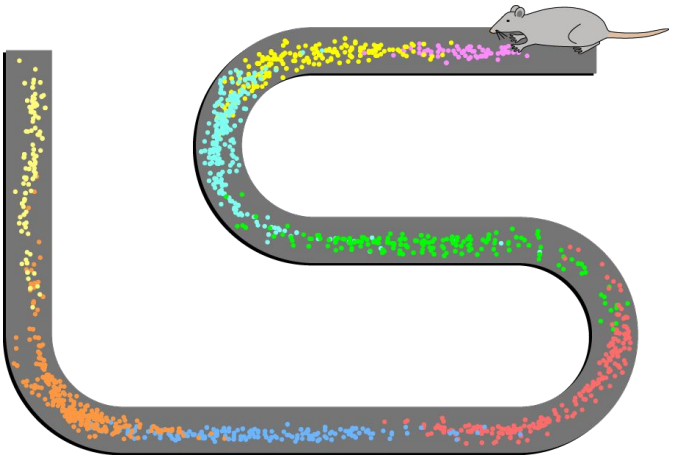
Spatial Memory

- In rats, what cells correspond to different locations they travel to?
- These cells aid in creating a cognitive map of a location
- They are located in what region of the brain?



Spatial Memory

- In rats, what cells correspond to different locations they travel to? **Place cells**
- These cells aid in creating a cognitive map of a location
- They are located in what region of the brain? **Hippocampus**



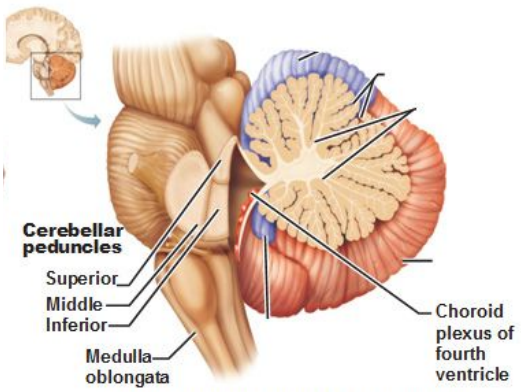
London taxi cab drivers have larger hippocampi

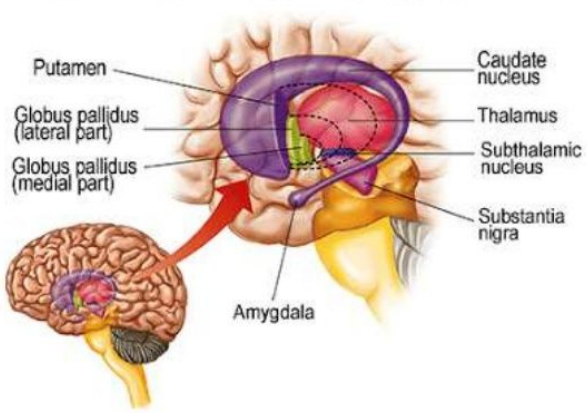
What regions associated with learning motor skills (procedural memory)?

- This region is associated with coordination of movements:
- This region is associated with planning of movement:

What regions associated with learning motor skills (procedural memory)?

- This region is associated with coordination of movements: **cerebellum**
- This region is associated with planning of movement: **basal ganglia**





Impairment of procedural memory

- Impairment of this region leads to inability to learn conditioned eye blink
- NMDA-antagonist injected into this region interferes with recall of cued-procedures
- Suppression of this region leads to no blink when air is puffed into the eye

A. Striatum
B. Lateral Interpositus Nucleus (LIP) of cerebellum
C. Red Nucleus of tegmentum

Impairment of procedural memory

- Impairment of this region leads to inability to learn conditioned eye blink **B**
- NMDA-antagonist injected into this region interferes with recall of cued-procedures
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A. Striatum
~~B. Lateral Interpositus Nucleus (LIP) of cerebellum~~
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Impairment of procedural memory

- Impairment of this region leads to inability to learn conditioned eye blink **B**
- NMDA-antagonist injected into this region interferes with recall of cued-procedures **A**
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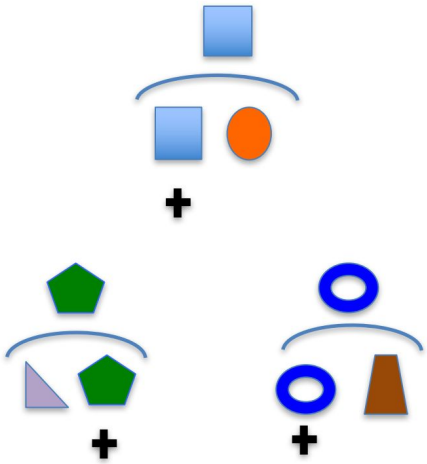
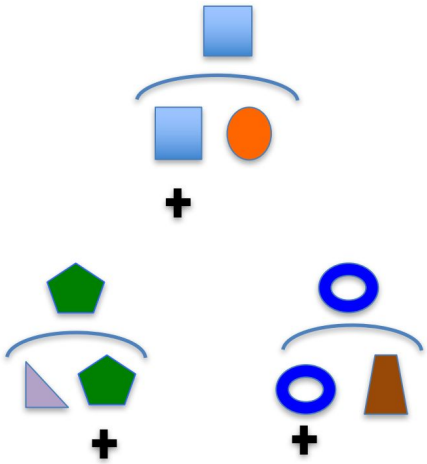
Declarative memory: Describe match-to-sample task



- Rats trained to pick the correct stimulus which matches the original stimulus
- What happens when the hippocampus is lesioned?
- This implies what about the hippocampus?

Declarative memory: Describe match-to-sample task



- Rats trained to pick the correct stimulus which matches the original stimulus
- What happens when the hippocampus is lesioned? **Performance is impaired**
- This implies what about the hippocampus? **Hippocampus is important in forming and retrieving memories**

What happens in Korsakoff's Syndrome?

- Associated with damage to what region?
- This region forms connections to what other region associated with higher-order functioning?
- Can be caused by what type of drug abuse?
- Leads to what symptoms?

What happens in Korsakoff's Syndrome?

- Associated with damage to what region? **Medial dorsal thalamus**
- This region forms connections to what other region associated with higher-order functioning? **Prefrontal cortex**
- Can be caused by what type of drug abuse? **Chronic alcoholism**
- Leads to what symptoms? **Anterograde amnesia, confabulation**

**What other famous patient had anterograde amnesia?

What happens in Korsakoff's Syndrome?

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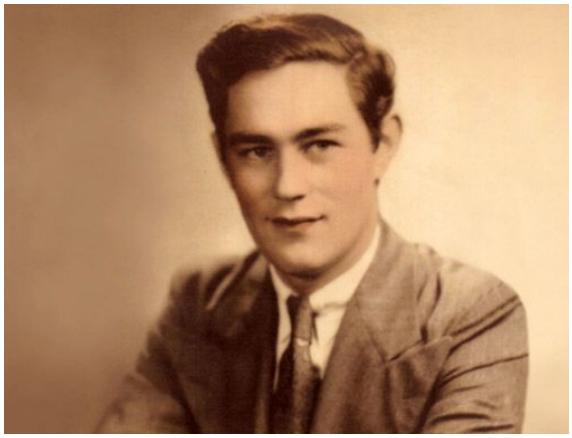
What other famous patient had anterograde amnesia? **H.M.

H.M.: Damage to hippocampus, but procedural memory intact. Long-term memory intact.



Recap

- Law of Effect - learning of behavior from learned associations and reinforcements
- Cells that “fire together, wire together” from LTP
- 3 types of memory: spatial, procedural, and declarative

Lateralization of Brain Functions

What is lateralization?

- The dominance of one side of the brain for certain functions over others
- The right hemisphere is usually dominant for what tasks?
- The left hemisphere is usually dominant for what tasks?

What is lateralization?

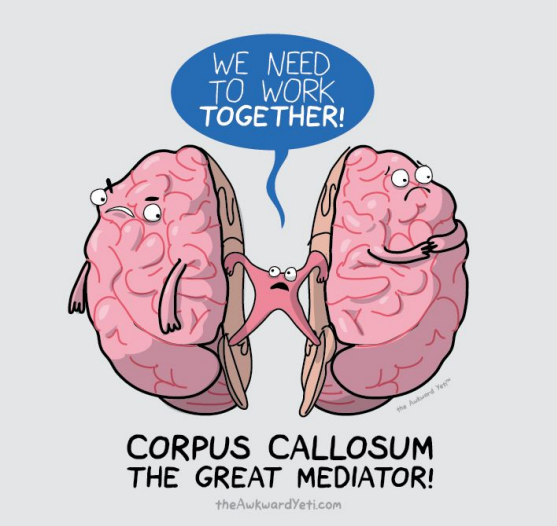
- The dominance of one side of the brain for certain functions over others
- The right hemisphere is usually dominant for what tasks? **Visuo-spatial processes, emotional processes**
- The left hemisphere is usually dominant for what tasks? **Analytical processes, fine motor control**

How are the 2 hemispheres connected?

- This region connects the 2 hemispheres.
- What purpose does this region serve?

How are the 2 hemispheres connected?

- This region connects the 2 hemispheres. **Corpus callosum**
- What purpose does this region serve? **Enables communication between the 2 hemispheres**



Split-Brain Studies

- What physical ailment is split-brain surgery used to treat?

Split-Brain Studies

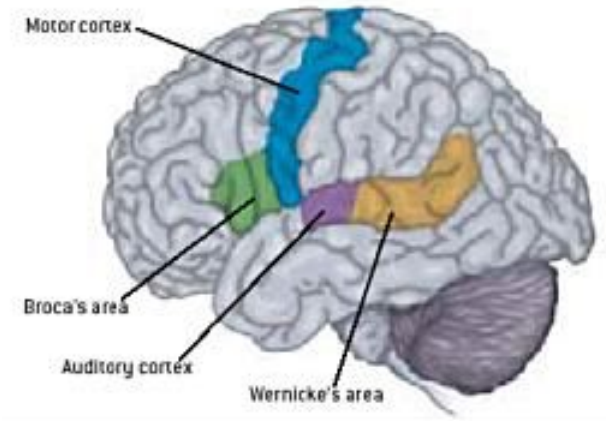
- What physical ailment is split-brain surgery used to treat? **Epilepsy**

Why are brain functions lateralized?

- Prevent competition between the hemispheres
- Evolutionary purpose for multi-tasking

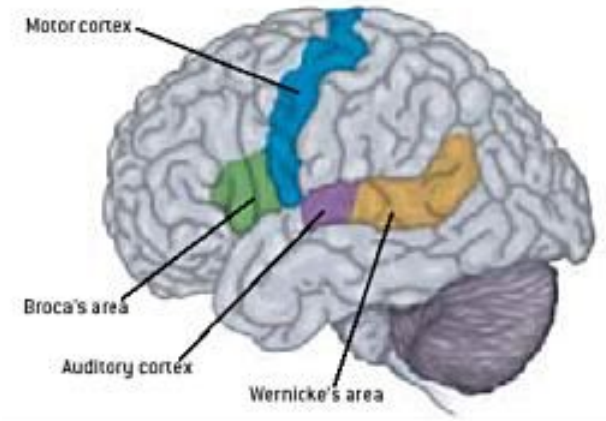
Language

Language Centers



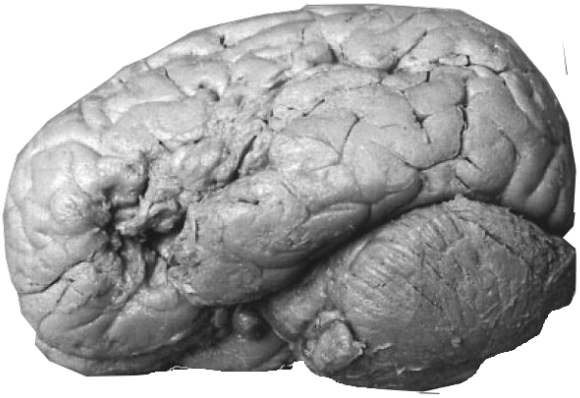
- Broca's Area associated with:
- Wernicke's Area associated with:

Language Centers



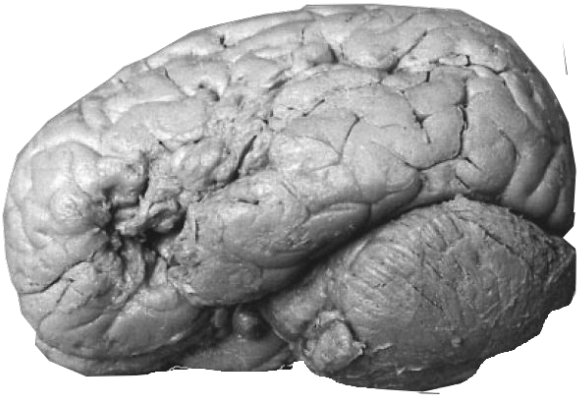
- Broca's Area associated with: **Language production**
- Wernicke's Area associated with:

Broca's Aphasia



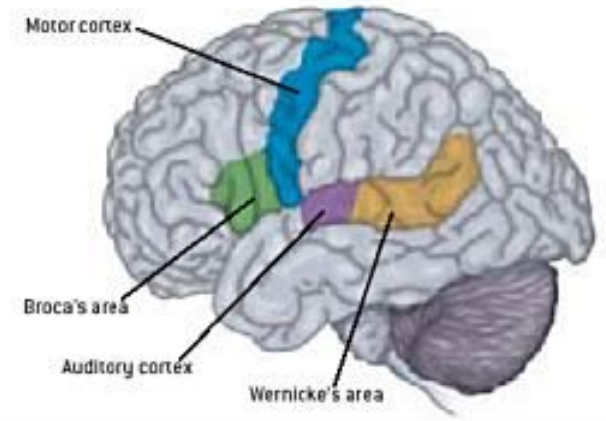
- Broca's aphasia will cause what?

Broca's Aphasia



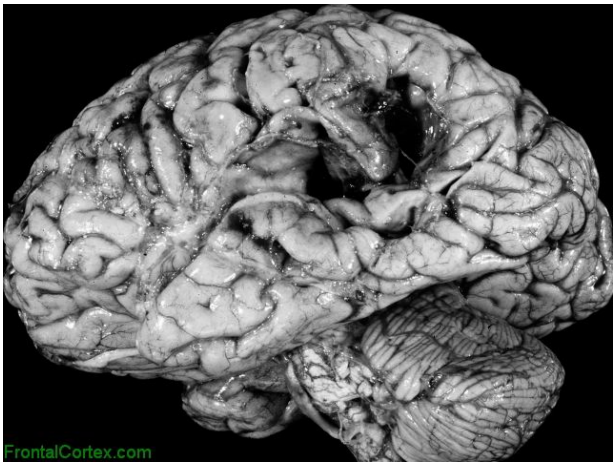
- Broca's aphasia will cause what? **Slow, halting speech; mispronunciation of words**
- Anomia - difficulty saying closed class terms
- Agrammatism - difficulty producing grammatical forms
- Broca's area near motor cortex.

Language Centers



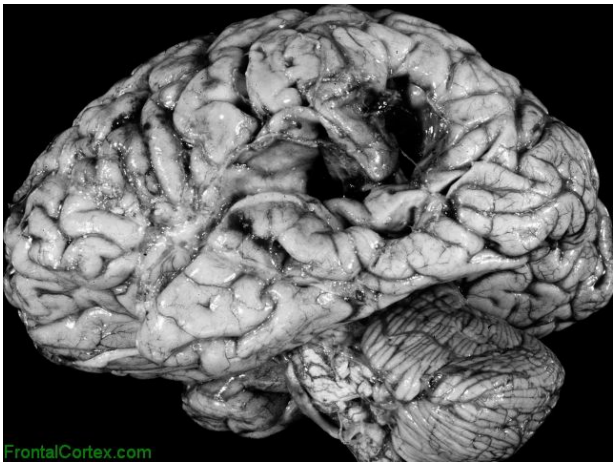
- Broca's Area associated with: **Language production**
- Wernicke's Area associated with: **Language comprehension**

Wernicke's aphasia



- Wernicke's aphasia can cause what?

Wernicke's aphasia



- Wernicke's aphasia can cause what? **Incomprehension, nonsensical speech, anomia for content terms**
- Wernicke's is in higher auditory cortex.

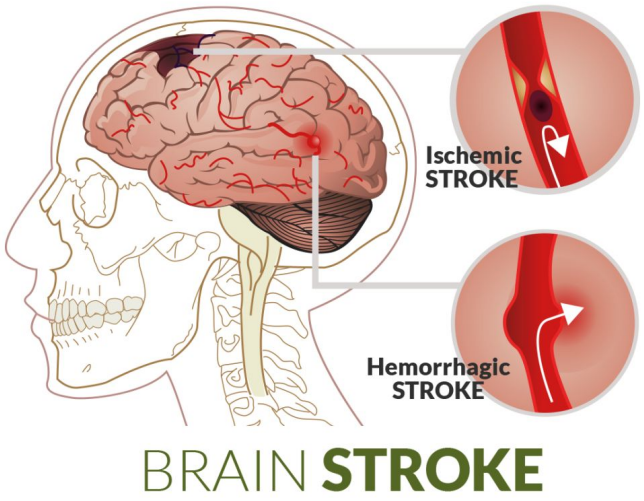
What is conduction aphasia?

- Damage to the (gray matter/white matter) connections between Broca's and Wernicke's areas
- This bundle known as?
- What does conduction aphasia cause?

What is conduction aphasia?

- Damage to the (gray matter/**white matter**) connections between Broca's and Wernicke's areas
- This bundle known as? **Arcuate fasiculus**
- What does conduction aphasia cause? **Impairment to repeating words, phonemic paraphasia, impairment to coherent conversation**

Common cause of aphasia: stroke



Right hemisphere lateralizations

- What is the broad specialization of the right hemisphere?

Right hemisphere lateralizations

- What is the broad specialization of the right hemisphere? **Global processes**
- What's one example of a global process?

Right hemisphere lateralizations

- What is the broad specialization of the right hemisphere? **Global processes**
- What's one example of a global process? **Organizing narratives, musical processing, spatial reasoning, understanding a joke**

What happens when right regions damaged?

- Damage to right parietal lobe leads to deficit in what ability?

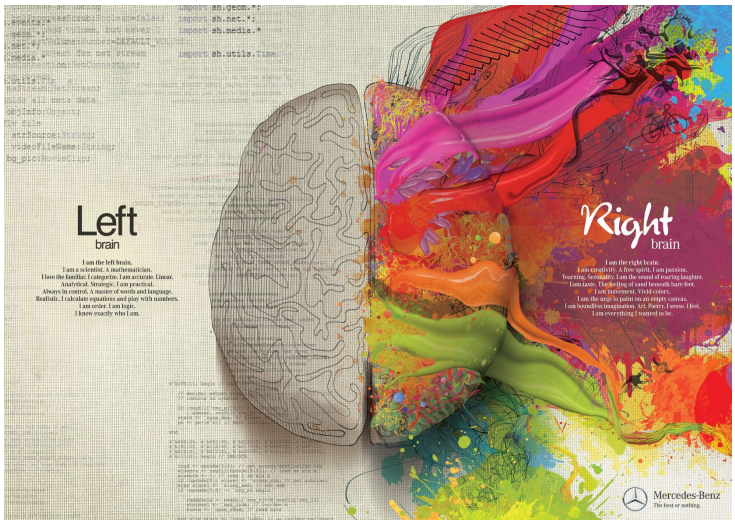
- Damage to frontal lobe leads to deficit in what aspects of emotional processing?

What happens when right regions damaged?

- Damage to right parietal lobe leads to deficit in what ability? **Map reading, solving spatial puzzles**

- Damage to frontal lobe leads to deficit in what aspects of emotional processing? **Emotional expression/interpretation, sarcasm/irony**

The myth of left-brain/right-brain



Recap

- Brain functions are lateralized with each hemisphere specializing in certain functions (i.e. left=analytical processes, right=socio-emotional processes)
- Split-brain studies reveal the mediating role of the corpus callosum
- Language centers: Broca's area (language production), Wernicke's area (language production), many other areas in coordination
- Right hemisphere involved in global processes (i.e. narrative organization, processing music, understanding emotional expressions)