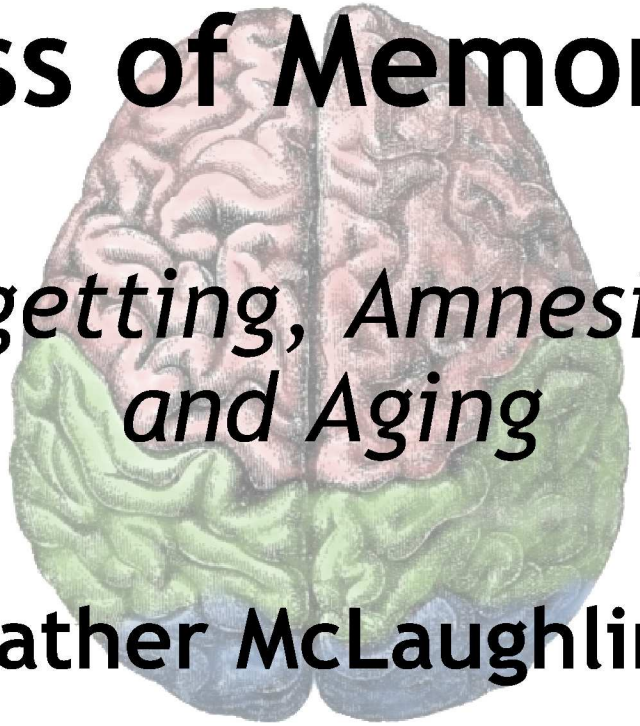
SITN
science in the news

Loss of Memory

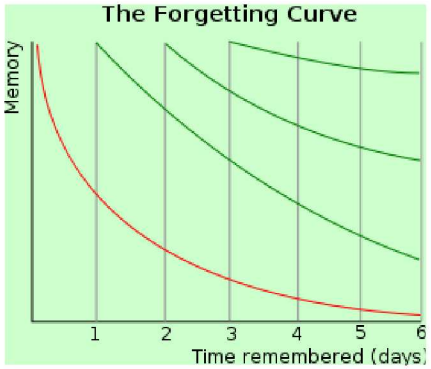
Forgetting, Amnesia, and Aging



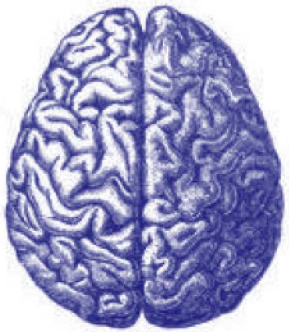
Heather McLaughlin

Cerebral Lobes, Author Unknown, Wikimedia Commons

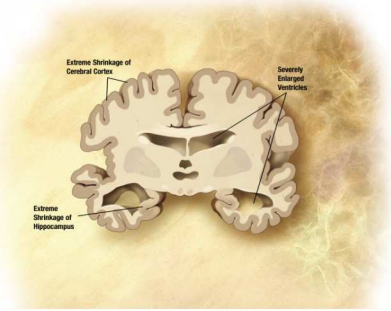
Outline



- Forgetting: Why we don't remember everything we learn



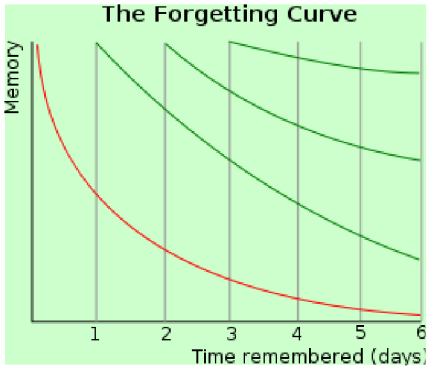
- Amnesia: Losing Memories



- Aging and Neurodegeneration

Brain, AndreFTG, Wikimedia Commons
Forgetting Curve, Uploaded by Icez, Wikimedia Commons

Outline



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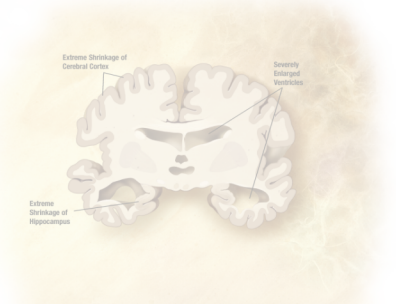
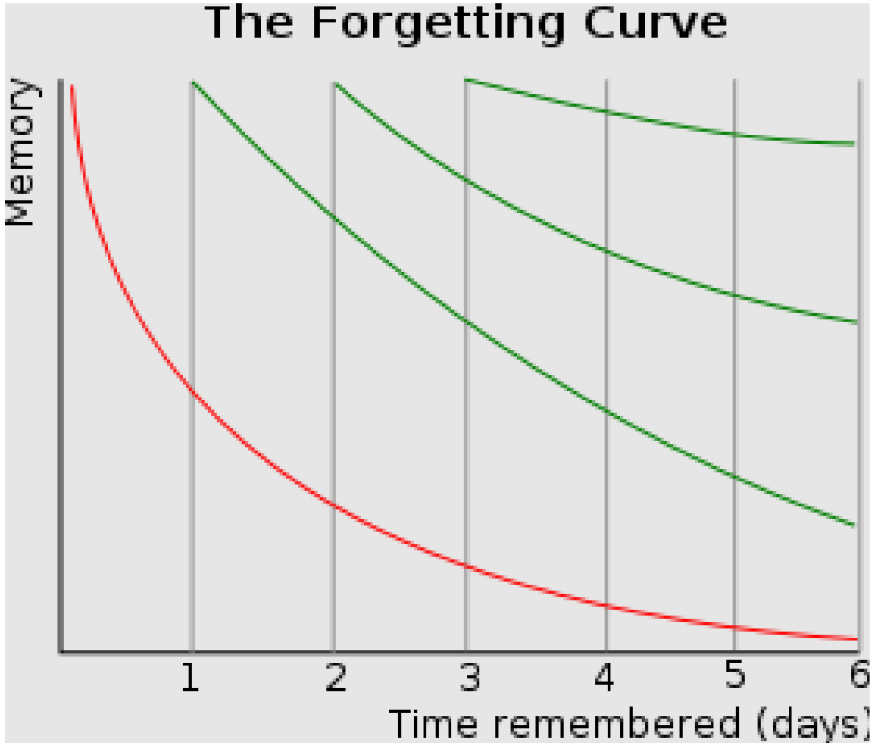


- Aging and Neurodegeneration

Pioneer of Forgetting Research

Hermann Ebbinghaus

Memorized series of nonsense syllables and tested how long it took him to forget them



Ebbinghaus, Uploaded by Froseti11, Wikimedia Commons
Forgetting Curve, Uploaded by Icez, Wikimedia Commons

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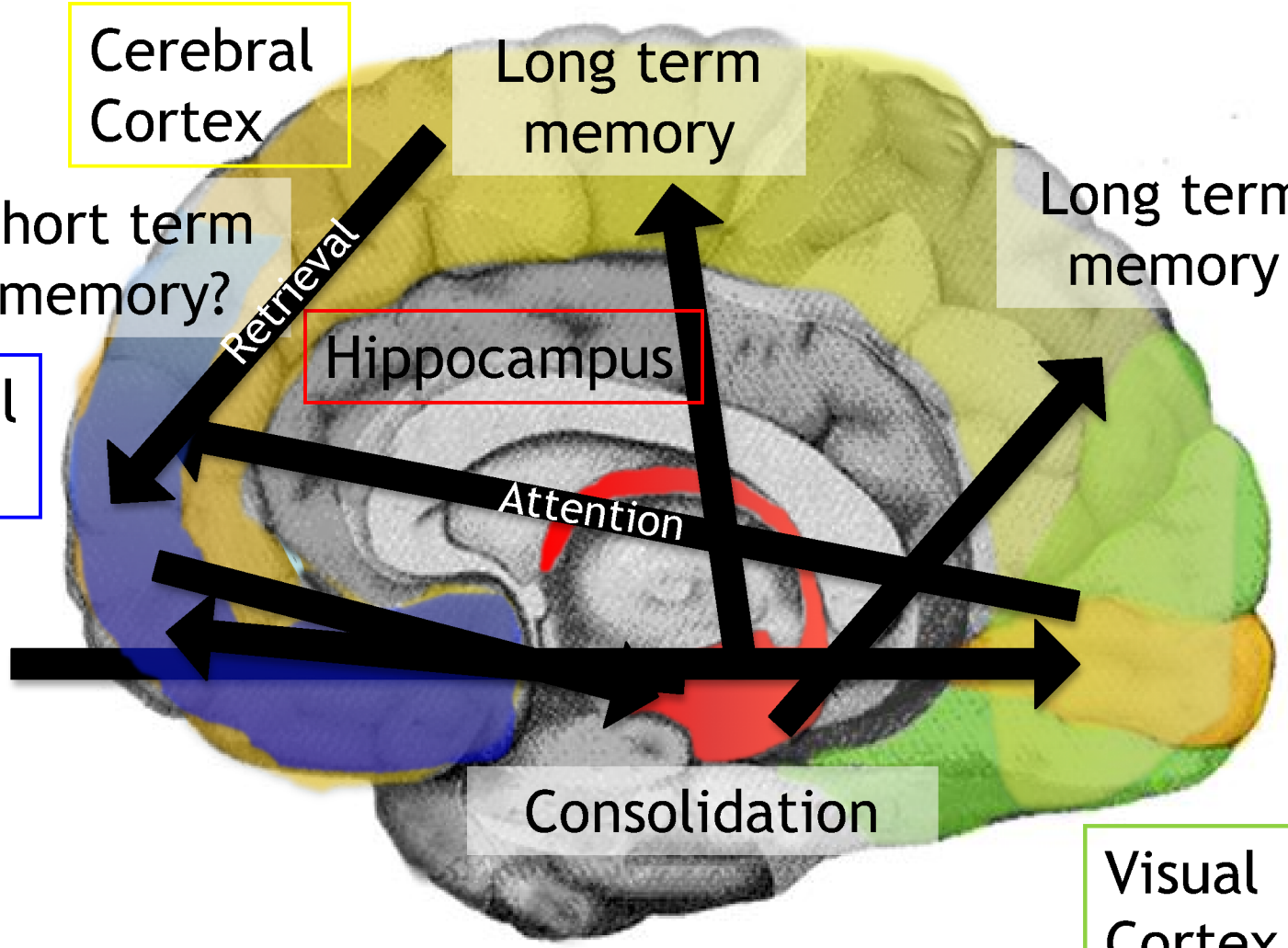
Memory: Where it can go wrong



Why do we forget anything?

Forgetting increases our ability to remember important information!

- 40 words with 6 attached associated words:

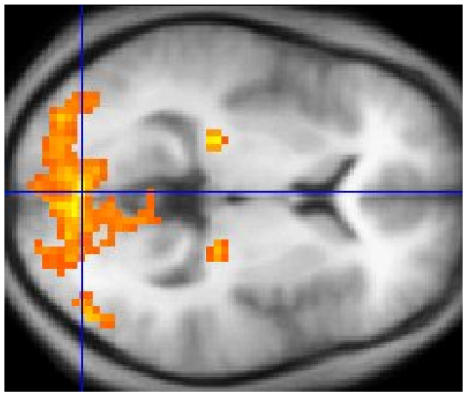
- Had to recall associated word given clue:

ATTIC-j = ATTIC-junk

- Measured brain activity using fMRI = functional magnetic resonance imaging

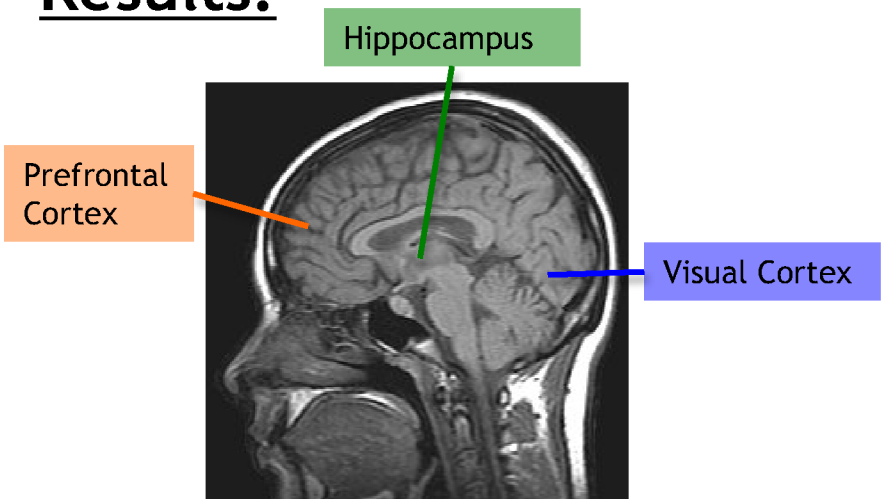
Kuhl *et al. (2007)* Decreased demands on cognitive control reveal the neural processing benefits of forgetting. *Nature Neuroscience*. 10:908-14.

fMRI: Imaging of Brain Activity

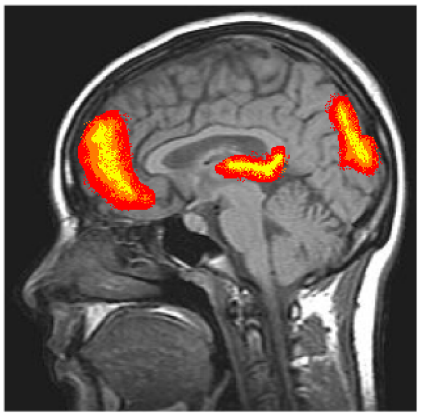


- Uses a magnetic field to measure the oxygen status of blood in the brain
- High oxygen = high brain activity

Results:



First Retrieval



Third Retrieval

The participants who forgot more competing words were the most efficient at remembering practiced words!

fMRI, Washington Irving, Wikimedia Commons
MRI, NASA, Wikimedia Commons
Kuhl *et al. (2007)* Decreased demands on cognitive control reveal the neural processing benefits of forgetting. *Nature Neuroscience*. 10:908-14.

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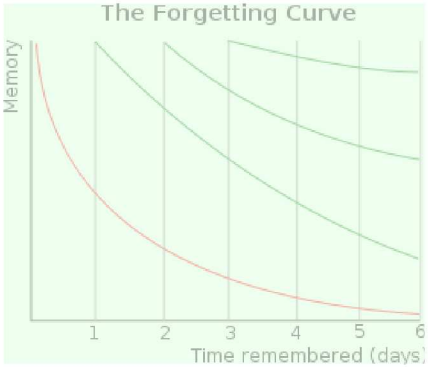

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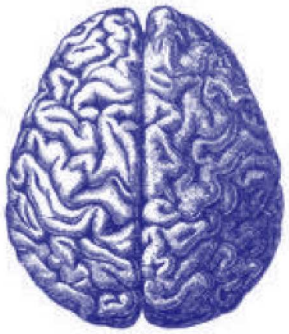

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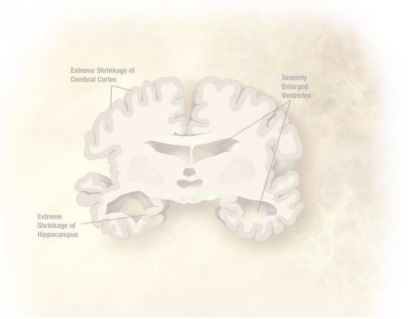
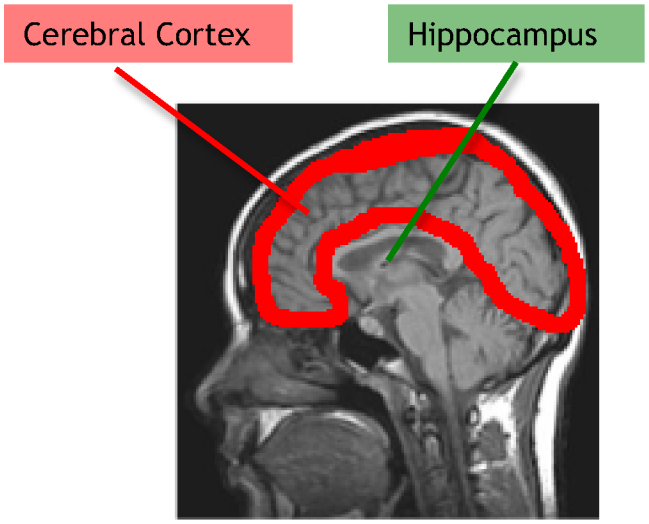


- Aging and Neurodegeneration

Traumatic Memory Loss

Anterograde: inability to remember new information

Retrograde: inability to recall events before the trauma



HM: **Henry Molaison**:

- unable to remember new events, limited loss of long-term memories

KC: **Kent Cochrane**: diffuse injury to brain following motorcycle accident

- loss of long-term autobiographical memories, unable to remember new events

Emotional Traumatic Memory Loss

Psychogenic amnesia = emotional amnesia

- primarily retrograde memory loss

Global

Depression
Severe stress

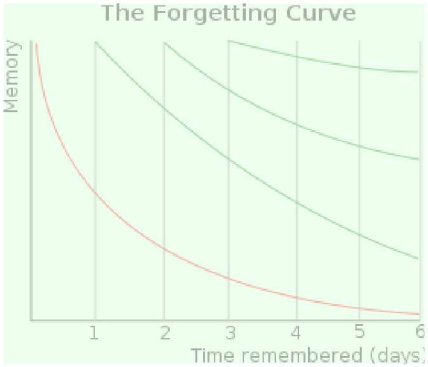
Situation Specific

Post-traumatic stress disorder
Abuse

No structural damage to brain, but altered brain activity

Brand et al. (2009) Functional brain imaging in 14 patients with dissociative amnesia reveals right inferolateral prefrontal hypometabolism. Psychiatry Res. 174(1):32-9.

Outline



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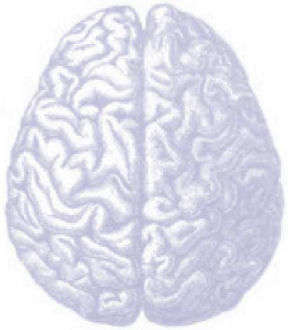

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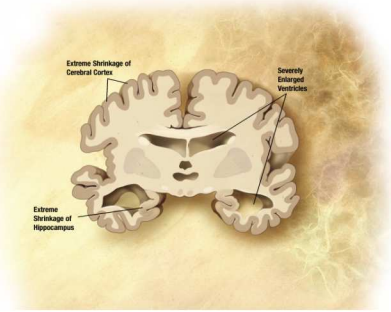

- Aging and Neurodegeneration

Brain, AndreFTG, Wikimedia Commons
Forgetting Curve, Uploaded by Icez, Wikimedia Commons

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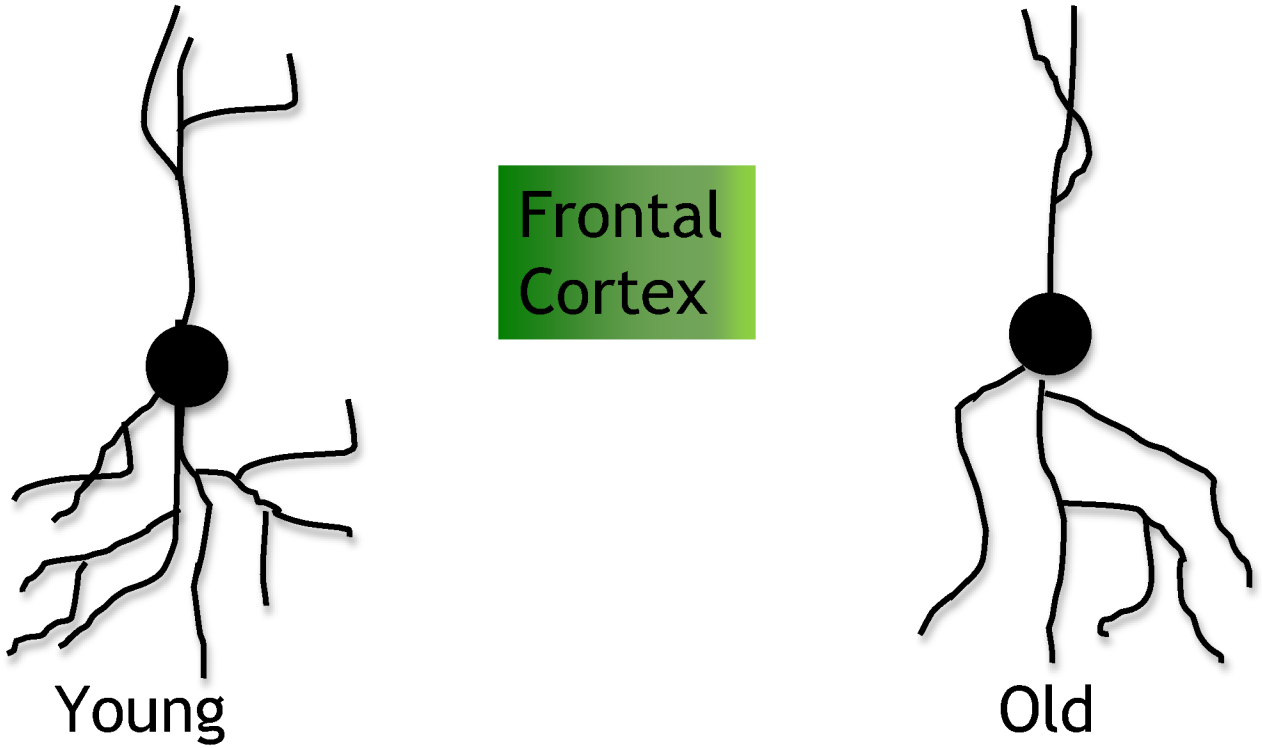
Changes in the Aging Brain

- The brain shrinks in volume, variable in region
- Frontal cortex an important area of greater decreased volume



Grill and Riddle (2002) Age-related laminar-specific dendritic changes in the medial frontal cortex of the rat. Brain Res 937: 8-21.
Burke and Barnes (2006) Neural plasticity in the ageing brain. Nature Rev Neurosci 7:30-40.

Cognitive Changes in Aging Brain

- Two types of studies:
  - **Cross-sectional**: compare people of different ages
  - **Longitudinal**: compare the same people at different ages

Preserved

Long-term memory
Verbal knowledge
Attention Span

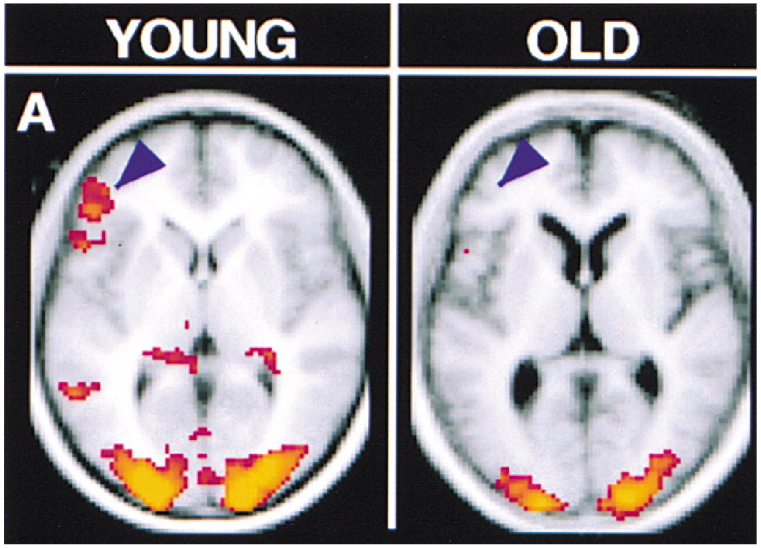
Diminished

Processing speed
New memory formation

Cognitive Activity in the Aging Brain

Experiment 1: Memorize list of words

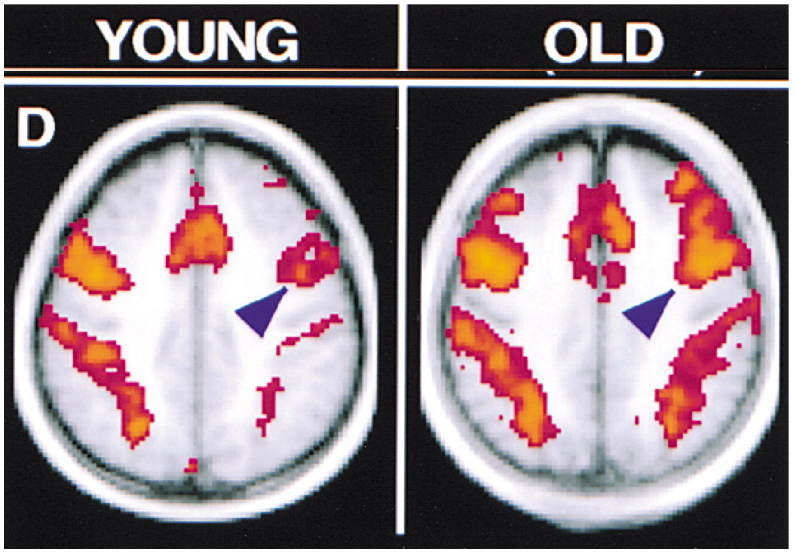
Remembered word: 86.2% in young and 67.2% in older adults



Under-recruitment

Experiment 2: Decide if a word represents an abstract or concrete entity

Remembered word: 94.3% in young and 91.0% in older adults



Nonselective recruitment

Logan et al. (2002) Under-recruitment and Nonselective Recruitment: Dissociable Neural Mechanisms Associated with Aging. Neuonr. 33(5): 827-840.

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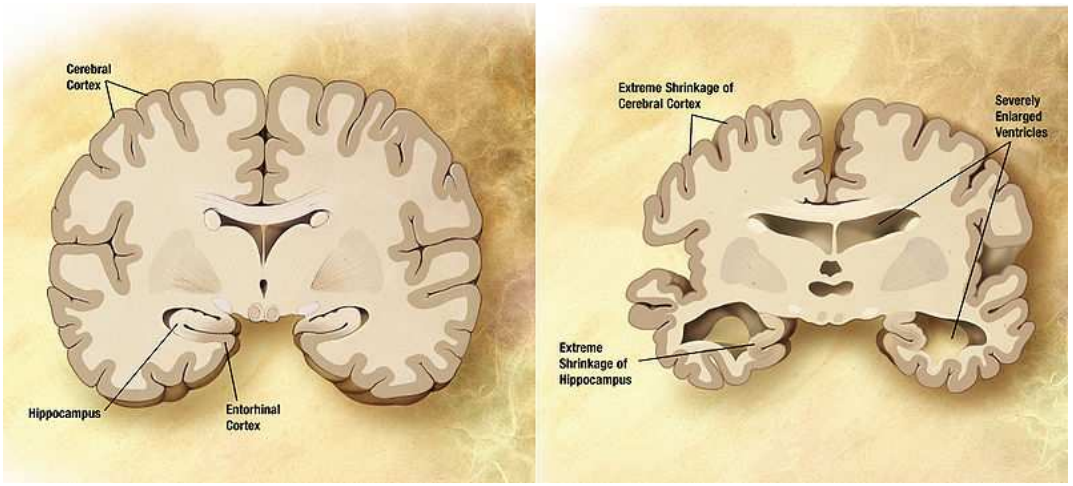
Accelerated Loss of Cognitive Function

- Alzheimer's Disease (AD): most common form of dementia
  - No known cause for most cases, but highly associated with increasing age
  - Currently no cure, only treatment for symptoms
  - Alzheimer's is a progressive and fatal disease

High levels of cell loss



Brains, Garrondo, Wikimedia Commons

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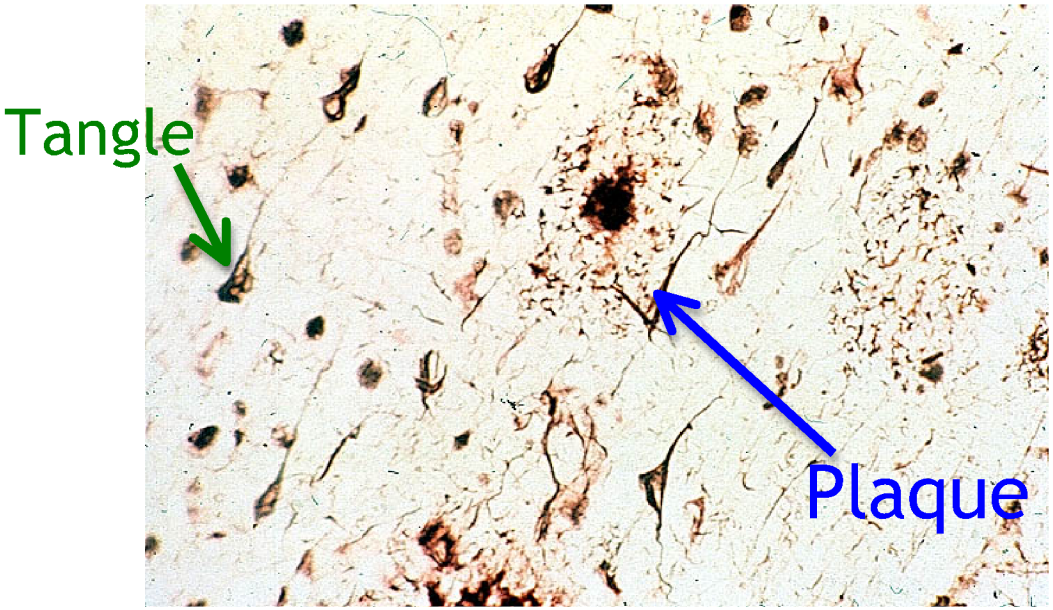
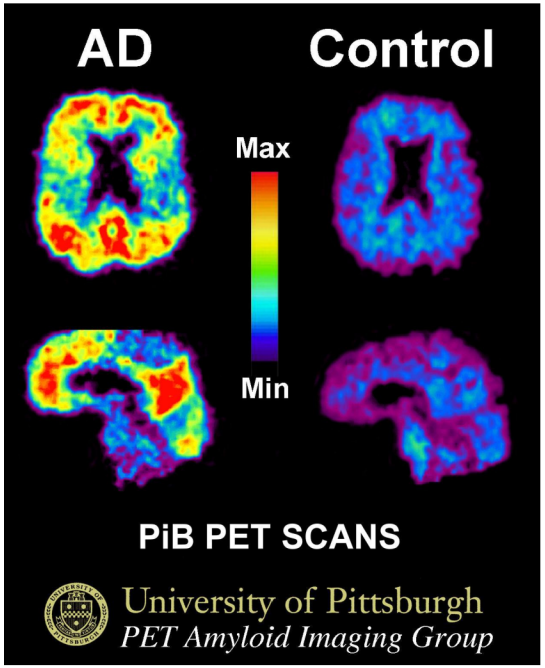
What is happening at a cellular level?

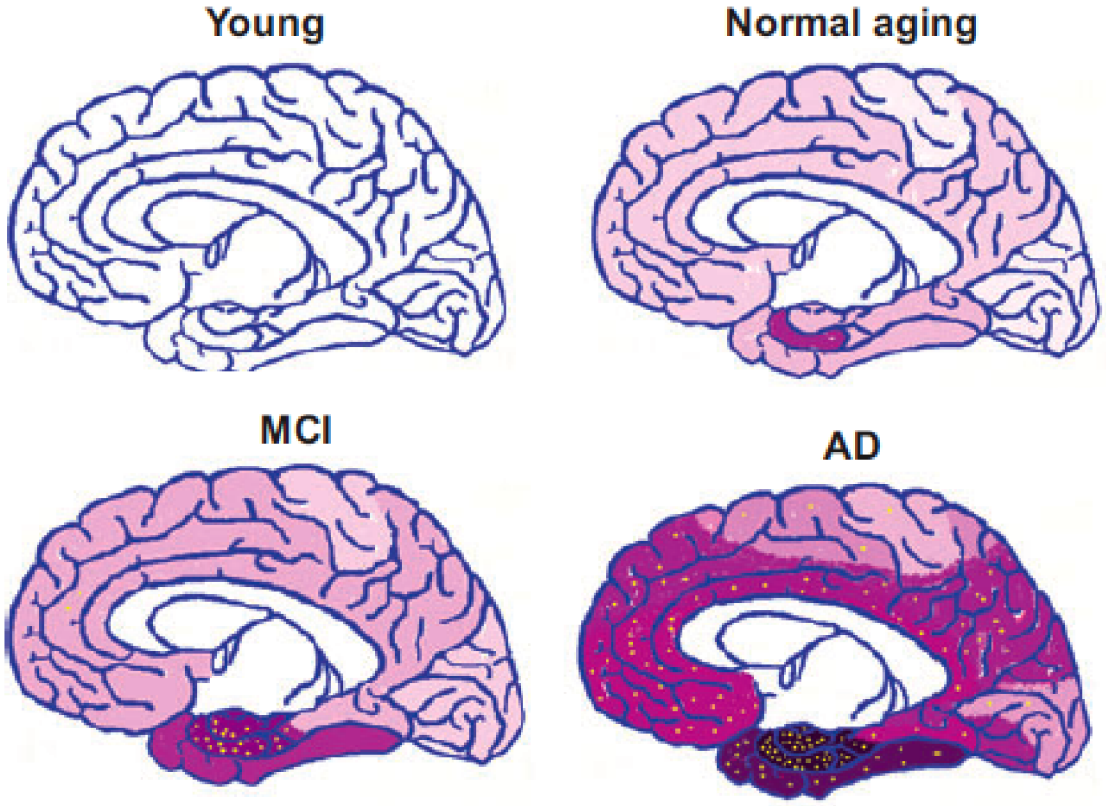
- Cell components form clumps, especially in the hippocampus
  - Amyloid plaques: outside the cells
  - Neurofibrillary tangles: inside the neurons





Parts of the Brain Affected

AD starts with decreased ability to make new long-term memories and leads to complete loss of cognitive functionality



MCI = mild cognitive impairment
NFT= Neurofibrillary tangles

Headlines

From The Times

November 1, 2008

Fight dementia with a keen social life

New research shows that there is hope for people with dementia, the

One way to ward off Alzheimer's: Take a hike

Study: Walking at least one mile a day reduce

Home / News

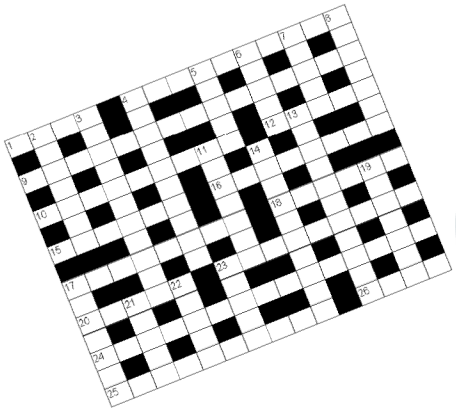
Keeping your mind active may help prevent or delay onset of Alzheimer's

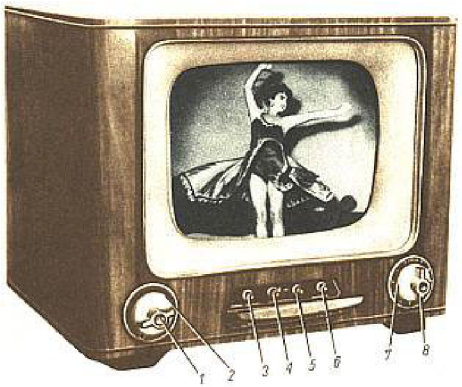
REUTERS

Mental "exercise" linked to faster dementia progression

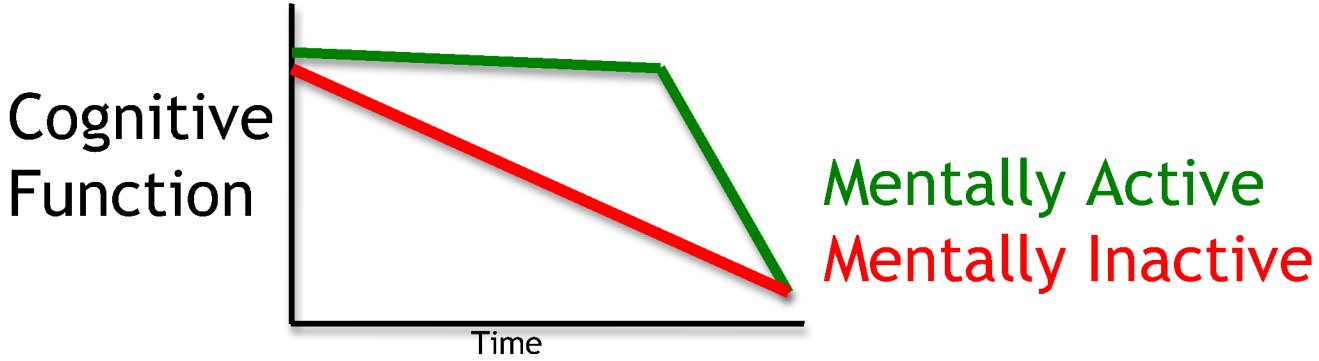
Religious Orders Study

- Compared level of cognitive activity to rate of loss of cognitive function






- Those most cognitively active took longer to develop dementia, but once decline started, the dementia progressed faster



Wilson et al. (2010) Cognitive activity and cognitive morbidity of Alzheimer's disease. Neurology 14(75): 990-6

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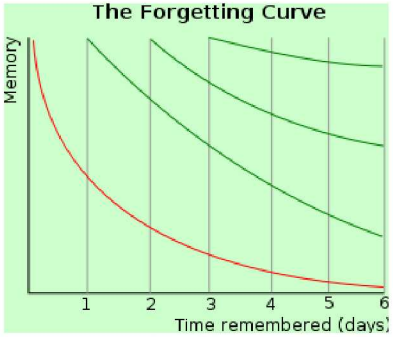
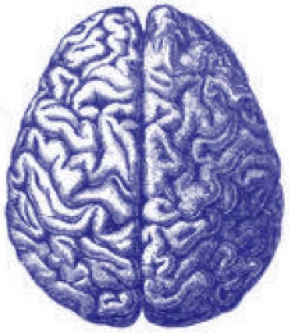
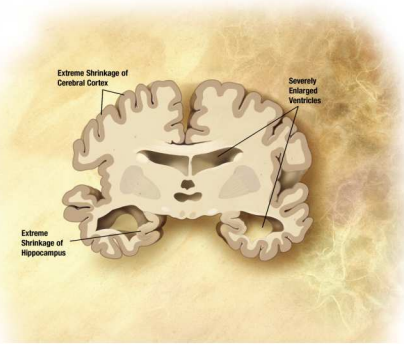
Summary



- Forgetting helps improve ability to remember important information

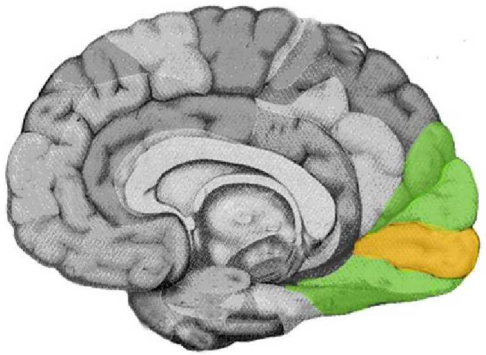


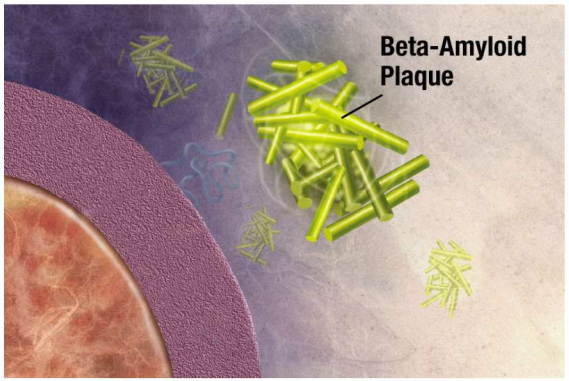
- Memory loss can be due to both physical and psychological trauma



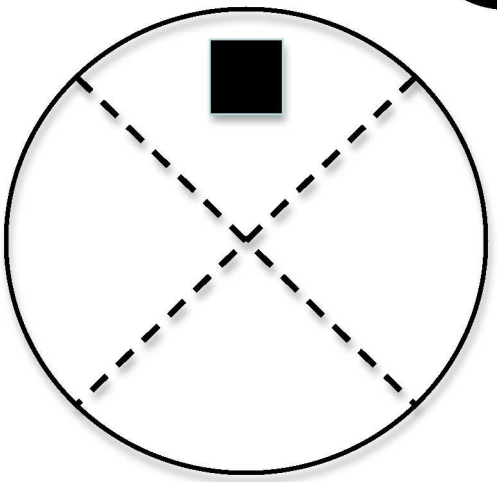
- There is some loss of cognitive function during aging, but much is maintained
- Alzheimer's disease is a form of accelerated cognitive decline for which there is no known cause or cure

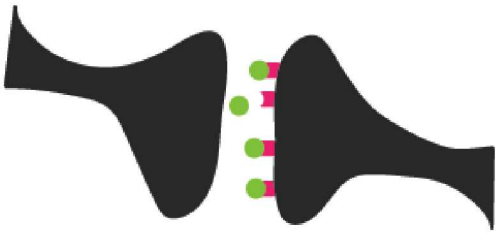
Questions

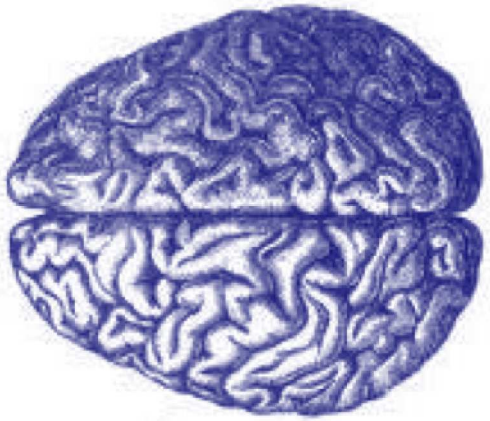




Questions?







Thank you!

SITN would like to acknowledge the following organizations for their generous support:

- Harvard Medical School
  - Office of Communications and External Relations
  - Division of Medical Sciences
- The Harvard Graduate School of Arts and Sciences (GSAS)
- The Harvard Biomedical Graduate Students Organization (BGSO)
- The Harvard/MIT COOP
- Restaurant Associates

- SITN is a student organization at Harvard GSAS