Human Memory

- Sensory Memory (< 1 sec)
- Short-term Memory (Working Memory) (< 1 min)
- Long-term Memory (life-time)
  - Explicit Memory (conscious)
    - Declarative Memory (facts, events)
      - Episodic Memory (events, experiences)
      - Semantic Memory (facts, concepts)
  - Implicit Memory (unconscious)
    - Procedural Memory (skills, tasks)
Aging and Recall*

• Some types of memory improve or stay the same
• The type of memory called semantic memory continues to improve for many older adults.
• Semantic memory is the ability to recall concepts and general facts that are not related to specific experiences.
• For example, understanding the concept that clocks are used to tell time is a simple example of semantic memory.
• This type of memory also includes vocabulary and knowledge of language.
• In addition, procedural memory, your memory of how to do things, such as how to tell time by reading the numbers on a clock, typically stays the same.
Aging and Recall*

• Some types of memory decline somewhat
• Do you sometimes arrive at the grocery store and have trouble remembering what you are there to get?
• Do you occasionally have trouble remembering where you left your car in the parking lot?
• Or do you have difficulty remembering appointments such as what time you’re supposed to meet your neighbor for coffee?
• Episodic memory, which captures the “what,” “where,” and “when” of our daily lives, is to blame
Aging and Recall*

• Several reasons have been speculated as to why older adults use less effective encoding and retrieval strategies as they age.
• The first is the “disuse” view, which states that memory strategies are used less by older adults as they move further away from the educational system.
• Second is the “diminished attentional capacity” hypothesis, which means that older people engage less in self-initiated encoding due to reduced attentional capacity.
• The third reason is the “memory self-efficacy,” which indicates that older people do not have confidence in their own memory performances, leading to a self-fulfilling prophecy.
Aging, sleep and memory*

• The medial prefrontal cortex, the brain region behind the forehead, tends to lose volume with age, and that part of this region helps sustain quality sleep, which is critical to consolidating new memories.

• This region was about one-third smaller on average in a retirement age group compared to a group in their twenties— a difference due to natural atrophy over time.
Memory myths vs. reality*

• Myth: “Alzheimer’s disease is inevitable in old age.”

• In fact, Alzheimer’s disease, which accounts for about 50%-70% of all dementia cases, occurs in 0.9%, 4.2% and 14.7%, of those 65, 75 and 85 years of age,

• Although the risk of Alzheimer’s disease and other dementias increases with age, a minority of older adults are affected.
Aging and Recall*

Number of words remembered vs Age in years

Number of words recognized is stable with age

Number of words recalled declines with age
Brain changes, aging and memory*

• the structural brain changes associated with normal aging consist of declining brain tissue volume, with the prefrontal cortex and hippocampus particularly affected.

• The hippocampus plays an essential role in episodic memory functioning, and also must “work with” the prefrontal cortex in order for episodic encoding and retrieval to work effectively.

• Among the three types of long-term memory, only episodic memory is negatively affected in normal aging
Brain changes, aging and memory*

In this figure, areas of the brain significantly involved in episodic memory (events, experiences), shown from a midline view of the brain. The medial temporal lobes, including the hippocampus critical for normal episodic memory functioning, as are other brain regions (e.g. prefrontal cortex, amygdala) highlighted in blue.
Brain changes, aging and memory*

Areas of the brain significantly involved in semantic (facts), procedural (skills) and working memory (short term memory) as shown from a lateral (external) view of the brain.

The temporal lobe areas involved in semantic memory are different from those involved in episodic memory. Brain regions involved in procedural memory do not overlap with those involved in either episodic or semantic memory. As mentioned before, the prefrontal cortex is involved in working memory and, in turn, encoding information into, and retrieving information from, long-term episodic and semantic memory.
Aging and Memory*

- **Normal age-related forgetfulness**
- The following types of memory lapses are normal among older adults and generally are *not* considered warning signs of dementia:
  - Occasionally forgetting where you left things you use regularly, such as glasses or keys.
  - Forgetting names of acquaintances or blocking one memory with a similar one, such as calling a grandson by your son’s name.
  - Occasionally forgetting an appointment.
  - Having trouble remembering what you’ve just read, or the details of a conversation.
  - Walking into a room and forgetting why you entered.
  - Becoming easily distracted.
  - Not quite being able to retrieve information you have “on the tip of your tongue.”
Aging and Memory*

• Normal forgetfulness vs. mild cognitive impairment (MCI)
  Mild cognitive impairment (MCI) is an intermediate stage between normal age-related cognitive changes and the more serious symptoms that indicate dementia.
  MCI can involve problems with memory, language, thinking, and judgment that are greater than normal age-related changes, but the line between MCI and normal memory problems is not always a clear one.
  The difference is often one of degrees.
  For example, it’s normal as you age to have some problems remembering the names of people. However, it’s not normal to forget the names of your close family and friends and then still be unable to recall them after a period of time.
Alzheimer

- Disrupts normal brain function, causing dementia. Memory, mental clarity, and at times even language capabilities become increasingly impaired over time. Produces physical changes in the brain, with some areas shrinking and others widening.

Dementia

- Not a specific disease, but rather a term that refers to symptoms of mental and communicative impairment found in a variety of brain conditions and diseases, including Alzheimer's. About 20% of dementia can be reversed.
Occurrence*

Alzheimer
• Chance of developing Alzheimer's doubles every five years from age 65 to 85. About 5% of cases are caused by a rare and hereditary genetic mutation that results in early onset of the disease, usually between age 30 and 50.

Dementia
• Percentage of elderly suffering from some form of dementia increases with age, with 2% of those aged 65-69, 5% of those aged 75-79, and over 20% of those aged 85-90 experiencing symptoms. One third of those 90+ have moderate to severe dementia.
Symptoms*

Alzheimer
• Understood in three stages. Goes from slowly worsening memory loss (early stage), to personality changes and aggression (middle stage), to extreme physical and communicative deterioration (late stage).

Dementia
• Memory loss is the earliest and most common sign. Irritability, depression, and other personality changes are also common. In more severe or worsening cases, language difficulties may occur, and spatial understanding deteriorates.
Microscopically*

- Three defining characteristics
  - 1/ Neurofibrillary tangles- threadlike tangles of protein in the neural cytoplasm
  - 2/ Amyloid plaques- clumps of scar tissue composed of degenerating neurons and a protein called amyloid. May block cell-to-cell signaling at synapses and may activate immune system cells that trigger inflammation and devour disabled cells.
  - 3/ Substantial neuron loss
Spread and location*

- Although tangles and plaques occur throughout brain of patient there are prevalent areas
- Hippocampus, entorhinal cortex, amygdala (all to do with memory)
- Inferior temporal cortex, posterior parietal cortex & prefrontal cortex (all important in mediating complex cognitive functions)