Alzheimer: What, When, and How

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# Clinical syndrome: episodic memory impairment

## Table 1. Selected Memory Systems.

<table>
<thead>
<tr>
<th>Memory System</th>
<th>Major Anatomical Structures Involved</th>
<th>Length of Storage of Memory</th>
<th>Type of Awareness</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Episodic memory</td>
<td>Medial temporal lobes, anterior thalamic nucleus, mammillary body, fornix, prefrontal cortex</td>
<td>Minutes to years</td>
<td>Explicit, declarative</td>
<td>Remembering a short story, what you had for dinner last night, and what you did on your last birthday</td>
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<td>Semantic memory</td>
<td>Inferolateral temporal lobes</td>
<td>Minutes to years</td>
<td>Explicit, declarative</td>
<td>Knowing who was the first president of the United States, the color of a lion, and how a fork differs from a comb</td>
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<td>Procedural memory</td>
<td>Basal ganglia, cerebellum, supplementary motor area</td>
<td>Minutes to years</td>
<td>Explicit or implicit, nondeclarative</td>
<td>Driving a car with a standard transmission (explicit) and learning the sequence of numbers on a touch-tone phone without trying (implicit)</td>
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<td>Working memory</td>
<td>Phonologic: prefrontal cortex, Broca’s area, Wernicke’s area, Spatial: prefrontal cortex, visual-association areas</td>
<td>Seconds to minutes; information actively rehearsed or manipulated</td>
<td>Explicit, declarative</td>
<td>Phonologic: keeping a phone number “in your head” before dialing. Spatial: mentally following a route or rotating an object in your mind</td>
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Clinical syndrome: autobiographic memory impairment

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Autobiographical memory

Semantic autobiographical memory

Episodic autobiographical memory

## Clinical syndrome: autobiographic memory impairment

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![Diagram](image)

**Autobiographical memory**

- Remembering the past
- Imagining the future

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M. El Haj, ... D. Kapogiannis, Autobiographical memory decline in Alzheimer's disease, a theoretical and clinical overview, Ageing Research Reviews 2015

M. El Haj, ... D. Kapogiannis, Similarity between remembering the past and imagining the future in Alzheimer's disease: Implication of episodic memory, Neuropsychologia 2015

M. El Haj, ... D. Kapogiannis, Flexibility decline contributes to similarity of past and future thinking in Alzheimer's disease, Hippocampus 2015
The networks supporting different types of memory

Neuropathological entity: atrophy
Neuropathological entity: Neuritic plaques (Aβ)

Neuropathological entity: Neurofibrillary tangles (Tau)

Bridging clinical manifestations with neuropathology

FDG - PET

Controls > EOAD

Controls > IvPPA

Controls > PCA

PIB - PET

EOAD > controls

IvPPA > controls

PCA > controls

D. Kapogiannis, MP Mattson, Disrupted energy metabolism and neuronal circuit dysfunction in cognitive impairment and Alzheimer's disease, Lancet Neurology 2011
Baseline gene expression differences → Differential vulnerability

Tau vulnerable areas:
- ↓ IRS1, Akt, GSK3β
- ↓ GLUT1, ↑ GLUT4

Aβ vulnerable areas:
- ↓ GLUT4
- Anaerobic glycolysis
- ↑ interstitial lactate
↑ interstitial Aβ

R. Mullins, …, and D. Kapogiannis, Insulin resistance as a link between Amyloid-Beta and Tau Pathologies in Alzheimer’s disease, Frontiers in Aging Neuroscience 2017