

What Modern Neuroscience Reveals about what Memory is and isn't

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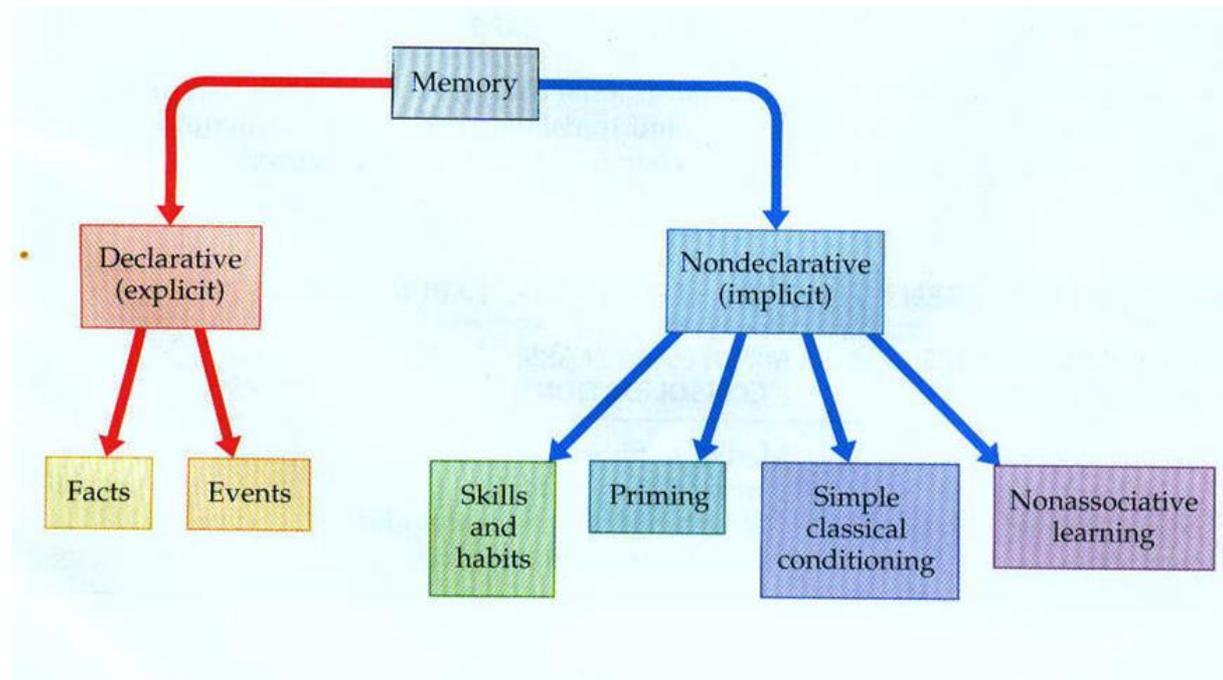
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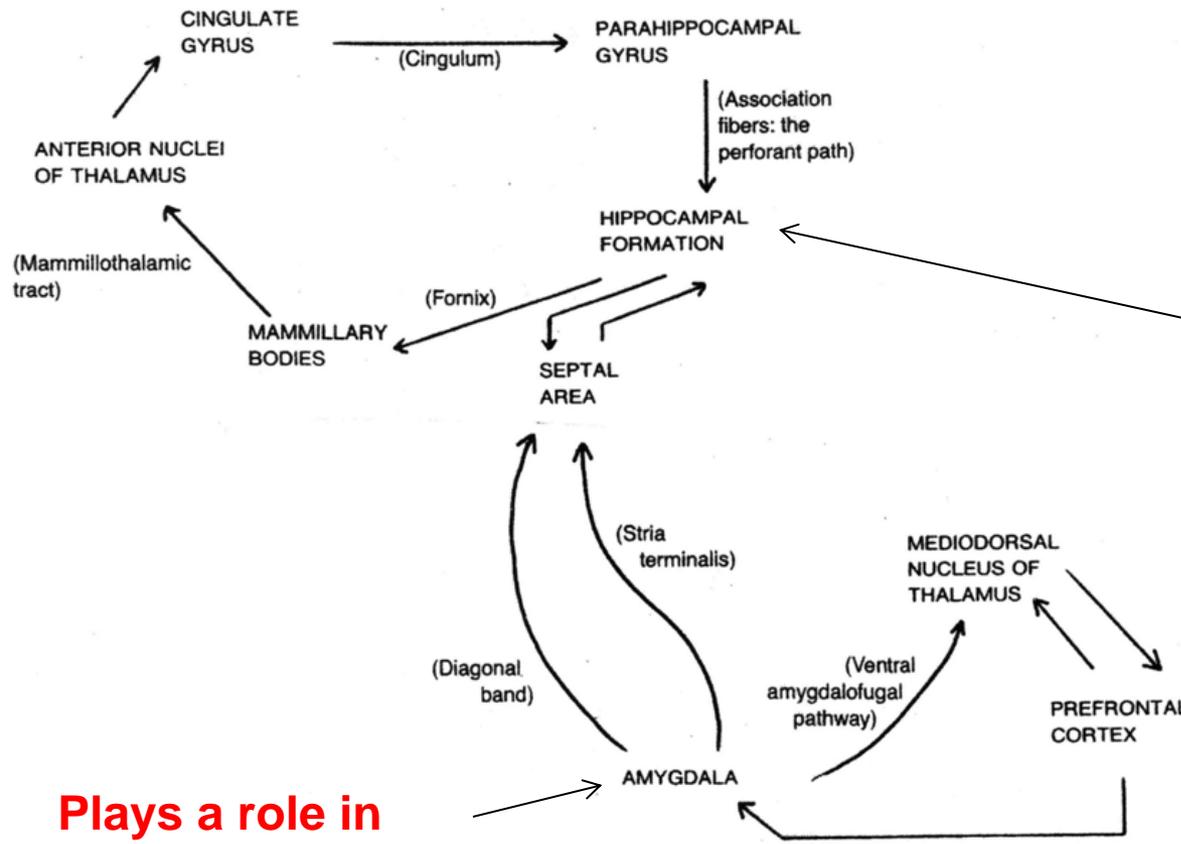
Review (😊)

There are many different types of memory

- Memory is generally divided into two broad categories: *explicit and implicit memory*



Many areas of the brain play a role in Explicit Memory (even more than shown below)



Our focus has been on these 2 areas

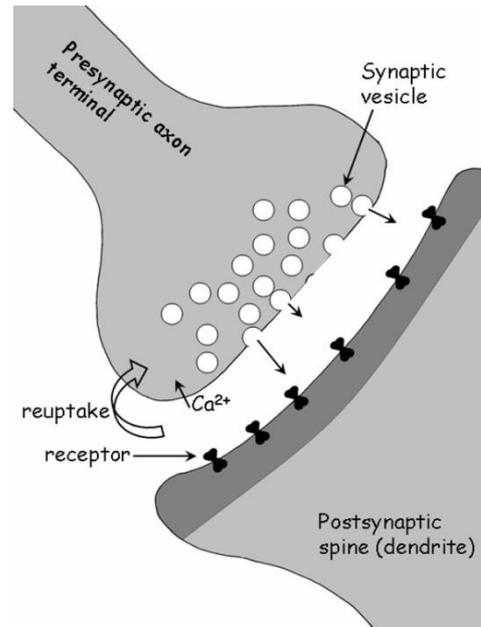
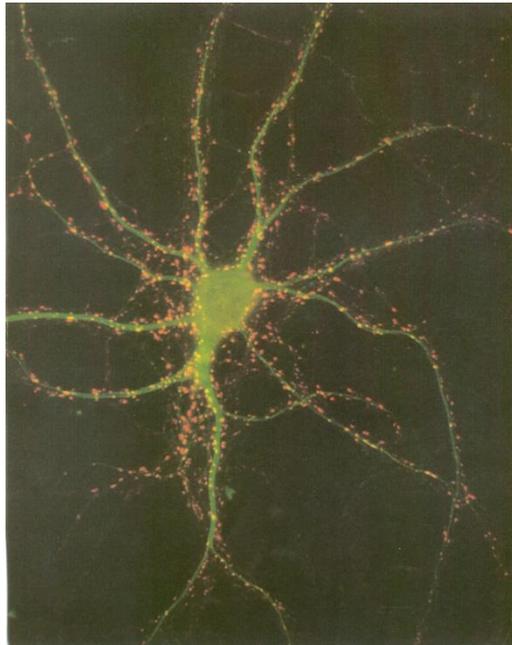
Plays a role in "emotional" memory

How do we know that these areas of the brain are involved in different types of memory?

- ***Famous Patients:***
 - Phineas Gage (prefrontal cortex)
 - Patient H.M. (Henry Molaison – died 2008) (hippocampus and adjacent structures in the temporal lobe)
- ***Alzheimer's Patients – and patients with other types of dementia***

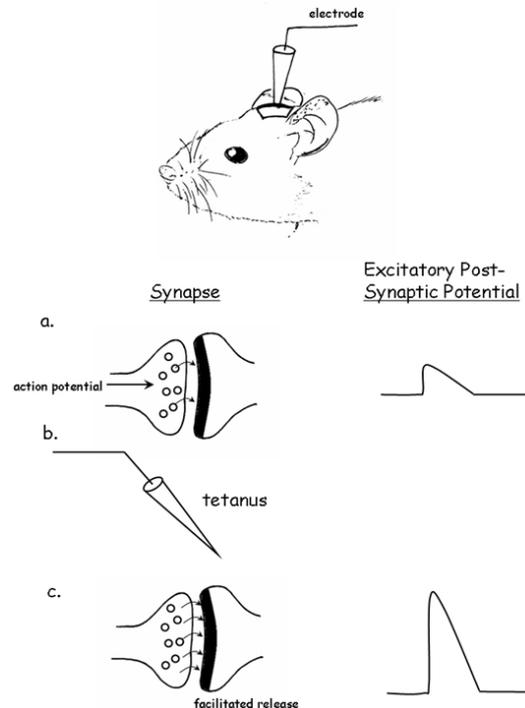
What “is” Memory?

- Memory is a change at the synaptic level, altering the processing of “information” in the brain
- Stimulation of particular “networks” of neurons within specific brain structures (like the hippocampus) – leads to a *subjective experience* – which we call a “memory”



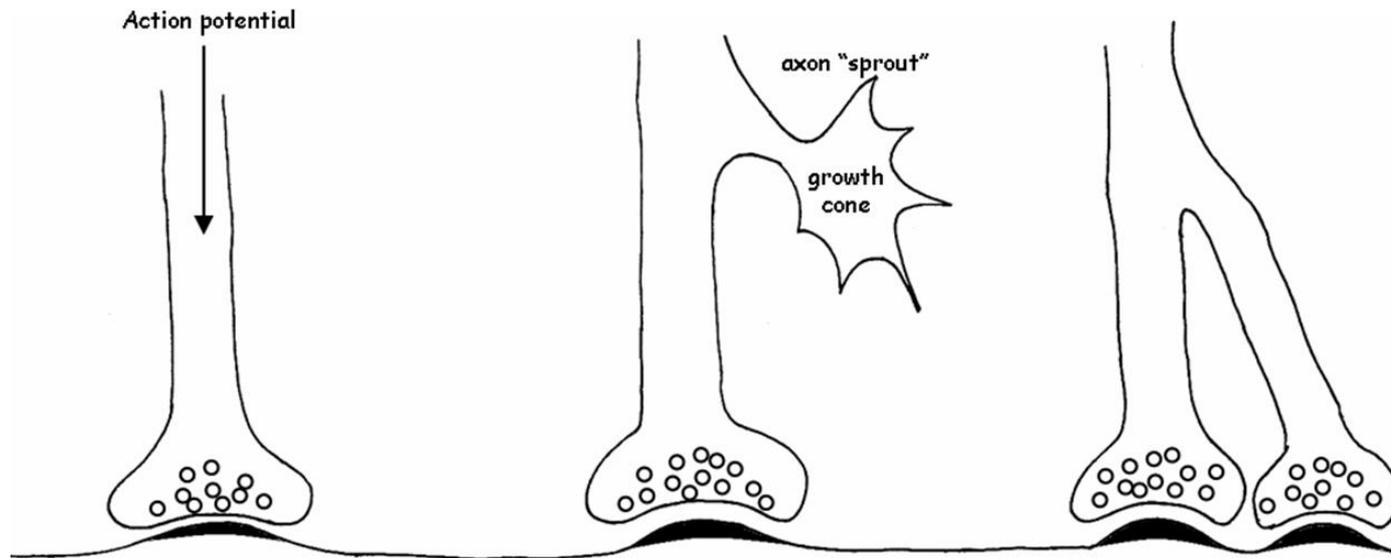
As the Result of Experience (Learning), Synapses can be altered in a Number of Ways (here we mentioned only 2 of these ways)

- **Change in “efficacy”** – changing the probability of firing of particular circuits within specific areas of the brain



As the Result of Experience (Learning), Synapses can be altered in a Number of Ways

- **Change in the number of synapses** – which would also change the probability of firing of particular circuits within specific areas of the brain



How Memory fails us

- D. Schachter: *The Seven Sins of Memory*

- ***Sins of Omission***

- **Transience**

- A weakening of memory over time; the past “recedes” as we have new experiences
 - Over time, the brain may retain the “gist” of the experience, without much detail
 - Bias affects this – we remember what “fits” with our paradigms and our “autobiography”
 - Increases with age, decreases with educational level



– Absent-mindedness

- Represents a breakdown between attention & memory
- Then again, how much DO we really notice???
- Note that many things we do – are automatic (*non-conscious*)
- Also note that we are effectively blind (*literally and figuratively*) to unattended objects – so no memory of the event occurs!
- *But* – the brain (particularly the reticular system) IS paying attention (☺)

– Blocking

- A fact, etc. that has been stored as a memory, but cannot be recalled when we *WANT* to recall it!
- Most often occurs with familiar facts – like names of people
- Thought to be due to a “loosening of associations”
- Note that a person’s name does **NOT** allow synonyms to be used, and that the name means nothing in itself

- ***Sins of Commission***

- **Misattribution**

- **Memory of events that never occurred!**
 - **Believed to represent a misattribution of current perceptions and experiences onto past events**
 - **Note that memory “glues together” aspects of our experience – if not glued together properly – misattribution occurs**
 - **Our “imagination” also plays havoc with accurate memory and plays a role in misattribution**

– Suggestibility

- **Strong individual differences in vulnerability to suggestibility**
- **Particularly important in certain settings: police interrogation, interaction with children, psychotherapy**
- **An individual may “confess” to a crime they did not commit**
- **An individual can be made to believe something happened to them, i.e., alter their “autobiography”, which never happened**

– Bias

- Re-scripting of past memories to fit with current view
- We remember ourselves in a more positive light (generally)
- We remember events consistent with our “autobiography” (or “self-schema”)
- Stereotypes strongly influence *if* we remember and *what* we remember

– Persistence

- Intrusive memories of events you *WANT* to forget
- Can be mild to debilitating (think a song in your head vs. Post-Traumatic Stress Disorder [PTSD])
- Strong individual differences; linked to depression
- May be related to “self-schema” and to resilience
- In disorders like PTSD, strongly linked to abnormal amygdala activation

What do the “Sins” tell us about what Memory is or is not?

- **Memory is *NOT* a snapshot of an event**
- **Memory results from some change in electrical activity of neurons – and as such is vulnerable to what has happened before – and what happens after – an event**
- **Memory is, at best, fragmentary, and contains “just enough” information about what “actually” happened, to be useful *most of the time***

The Brain cares most about the “gist” of the event – details may or may not be correct

RECALL OF DETAILED MEMORIES IN NORMAL, TEMPORAL LOBE-DAMAGED, AND AUTISTIC INDIVIDUALS

| | <u>GIST</u> | <u>TRUE DETAILS</u> | <u>FALSE DETAILS</u> |
|--|-------------|---------------------|----------------------|
| Normals | ↑ | ↑ | ↑ |
| Patients with TL damage | ↓ | ↓ | ↓ |
| Autistic individuals w/ exceptional memory | ↓ | ↑ | ↓ |

- **Suggested additional readings:**

- Allman, J. *Evolving Brains*.

- W.H. Freeman, 2000.

- Kandel, E. *In Search of Memory*.

- W. W. Norton, 2006.



THIS HANDSOME LITTLE DUDE IS A "SEA SLUG"

- Margalit, A. *The Ethics of Memory*. Harvard U. Press, 2004.

- Schachter, D. *The Seven Sins of Memory*. Houghton Mifflin Co., NY, 2001. (Other books by the same author as well.)

- Squire, L. *Memory and the Brain*. Oxford, 1987. (Other books by this author.)