

Memory

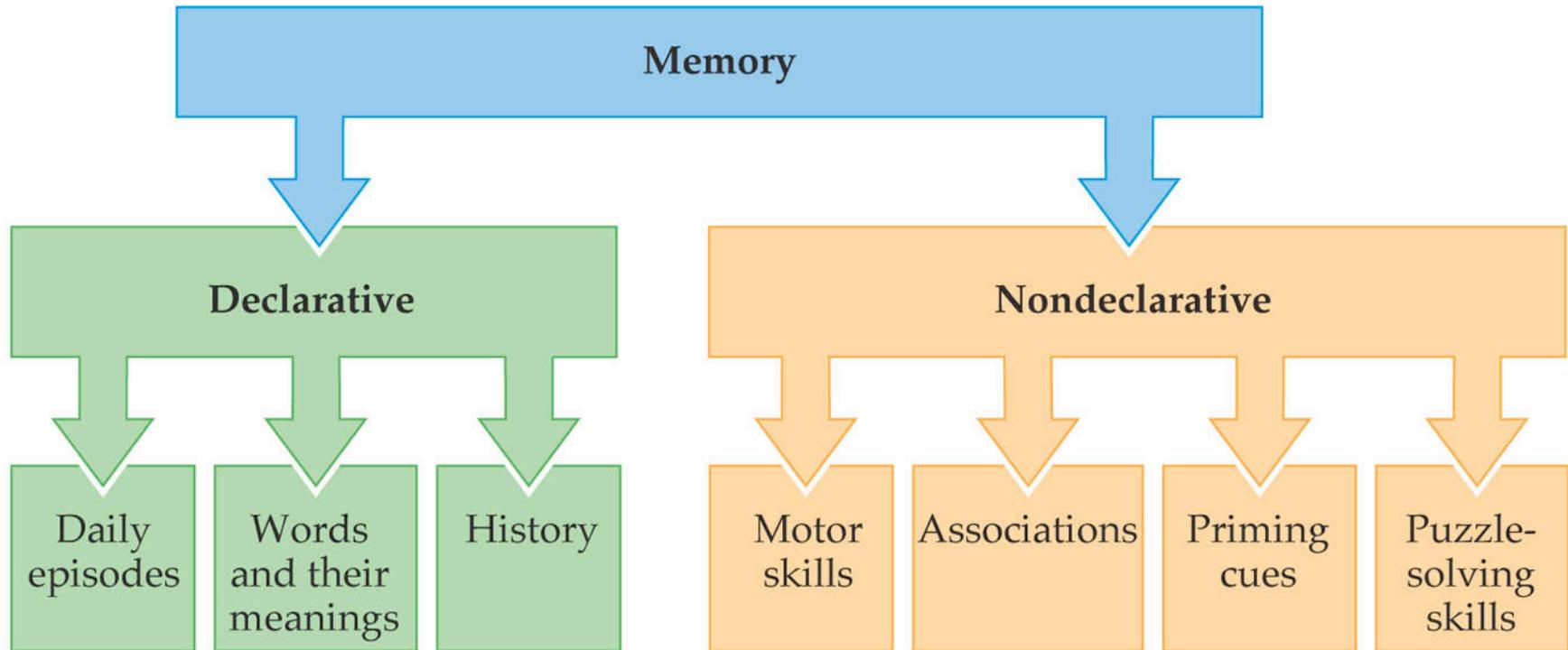
And the brain

General considerations

- Consider how important memory is in defining the human experience.
- In many ways, memory seems to be like an input to the CNS, as significant as the only real input, namely sensory input.
- Probably most believers' concept of an after-life relies on memories being intact.
- In many ways memory formation is a continuation of development.

More

- Forgetting vs extinction ("unlearning")
- Dementia - Alzheimer's memory quality of human life.
- short- and long-term memory.
- Amnesia:
 - retrograde for period long ago (rare)
 - anterograde, cannot learn new.
- Recent memory loss, a patient might know how to play cards but not know how (s)he came to be playing that particular game.



Famous patient

- HM studied by Brenda Milner
- - lesion temporal lobe + hippocampus and amygdala at age 27 for epilepsy [grand mal seizures]- has anterograde amnesia -
- after 50 yrs of study Milner still has to introduce herself -
- but HM can learn mirror drawing task (procedural memory)
- **Landmark Paper:** WBScoville & B Milner, Loss of recent memory after bilateral hippocampus lesions, 1957

Interesting stories

- Extraordinary memory of Luria's subject Sherashevsky
- Another subject - NA, lesion [accidentally stabbed by roommate playing with fencing] of dorsomedial thalamus, mammillary bodies, right medial temporal lobe - amnesia like HM.
- Another, RB, had ischemia with only loss of hippocampus, verified after his death.

Short-term memory-

- presumably something electrical Hebb circuits
- - easily disrupted, say, by electroconvulsive shock (used to treat depression).
- Then there must be a consolidation for the sake of long-term memory which must involve permanent changes like changes in synapses.
- mRNA and protein MUST mediate change.
- Retrieval is an important consideration.

Long term memory-

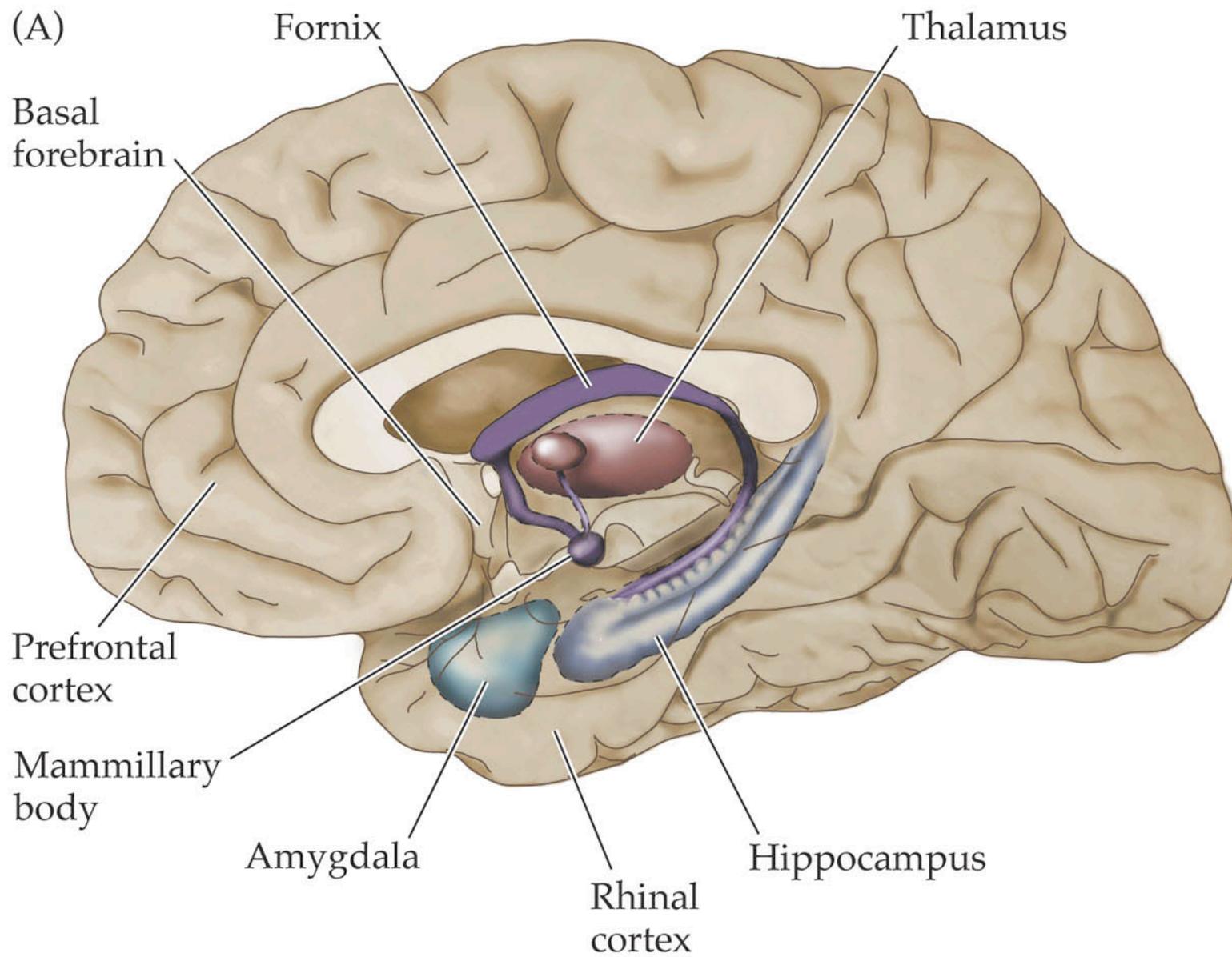
- Biochemistry of memory terrible start
- **RNA Classic (bad) papers**
- R. Thompson and J.V.McConnell (1955) Classical conditioning in planarian,
- Poor controls, not replicated
- J.V.McConnell, (1962) Memory transfer through cannibalism in planarium,
- **Classic (spoof) paper**J. G. Nicholls, D. A. Baylor et al.. (Yale), Persistence transfer, Science 158, 1967:

More

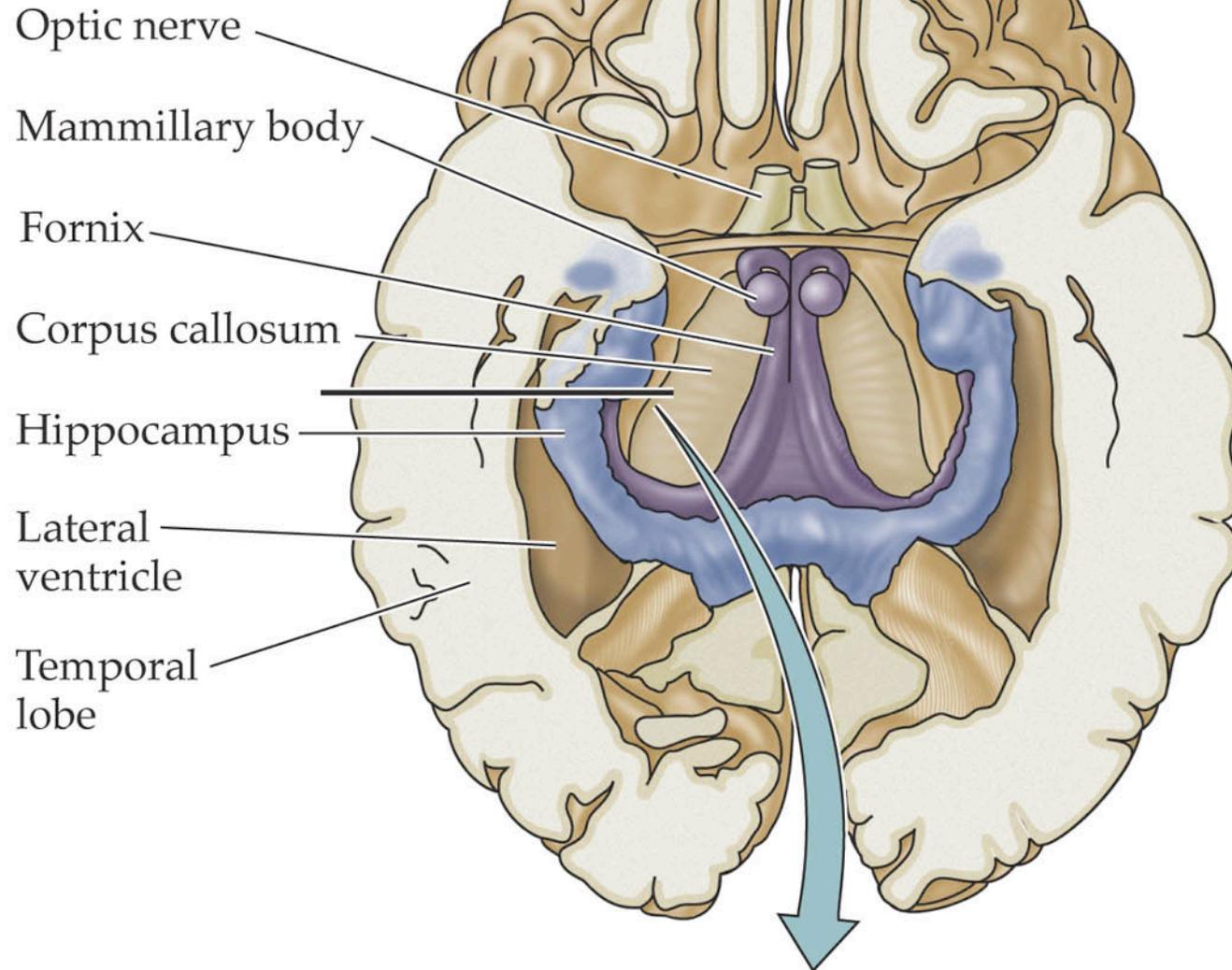
- **Hollywood [book](#)** (1970 [movie](#)) Hauser's memory
- **Personal reflection.** professors graduate student quickly dissecting the brain after teaching a rat in a T-maze and showing that RNA in the hippocampus changed.
- control experiments show these changes might not be attributed to the maze learning experience.
- In summary, RNA experiments were naively done with great optimism & poor controls

Protein

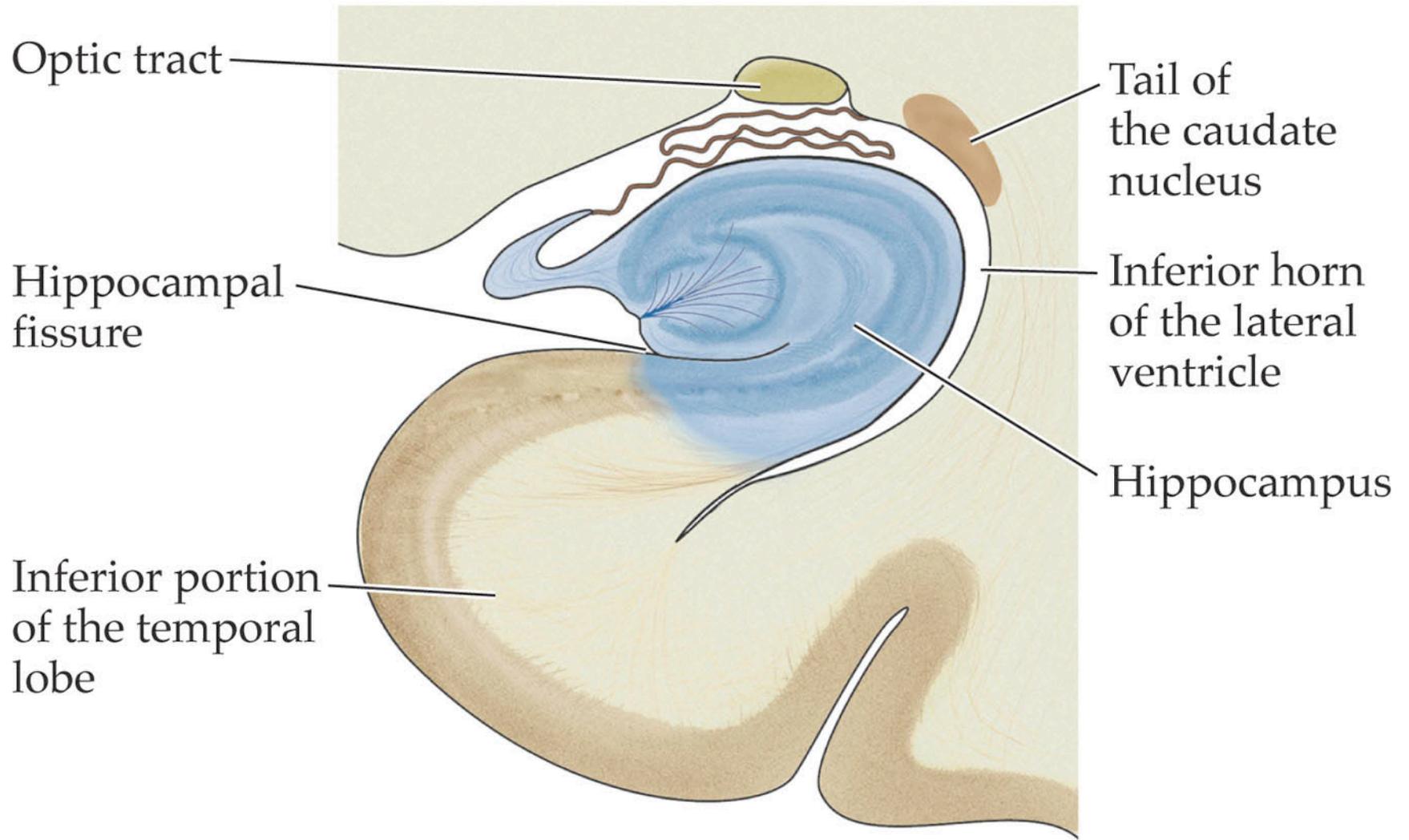
- **Landmark papers**
- B. W. Agranoff Memory and protein synthesis, 1967
- L. B. Flexner et al. Memory in mice analyzed with antibiotics, 1967,
- antibiotics like puromycin block protein synthesis
- but return of memory with saline washout suggests interference with retrieval



(B)



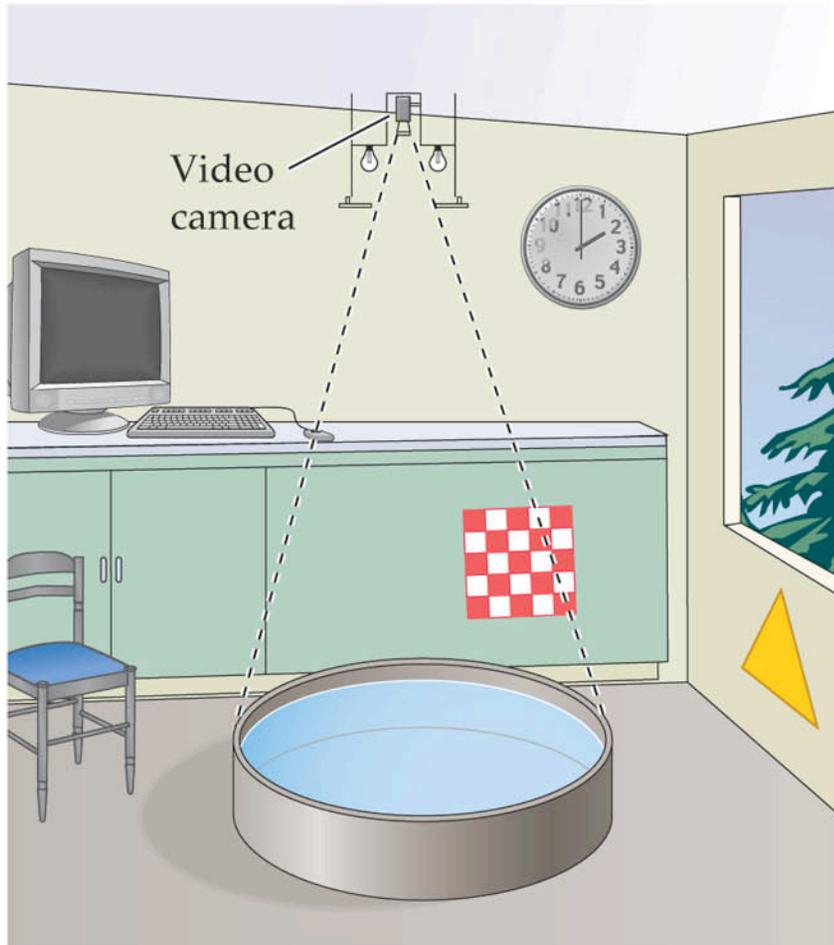
(C)



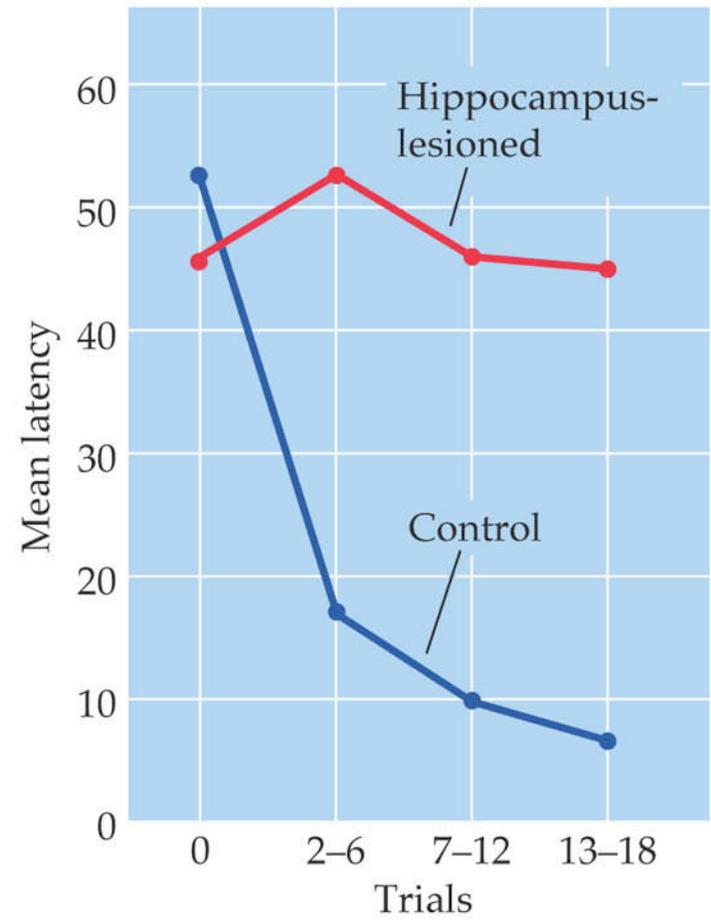
How and where are memories stored?

- Lashley - search for engram - found "equipotentiality" [in cortex]
- (vs. localization of function)
- [Pribram](#) - it is like a hologram - everything is stored a little bit everywhere (lasers and holograms were popular science in the 1960s; half a hologram has all the information of the whole hologram, but degraded -- you have to "look around the corner" to see everything.).

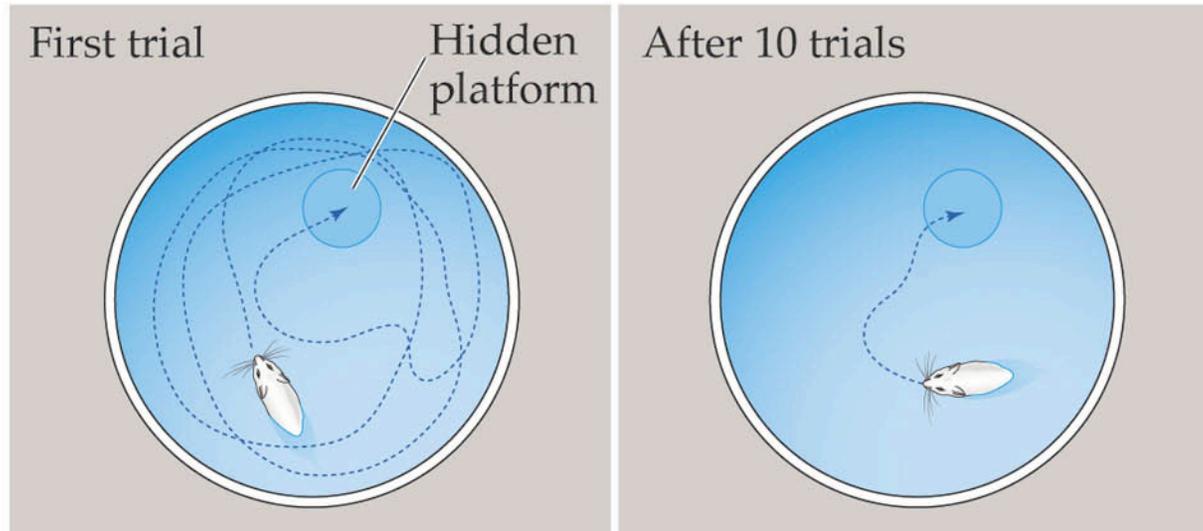
(A)



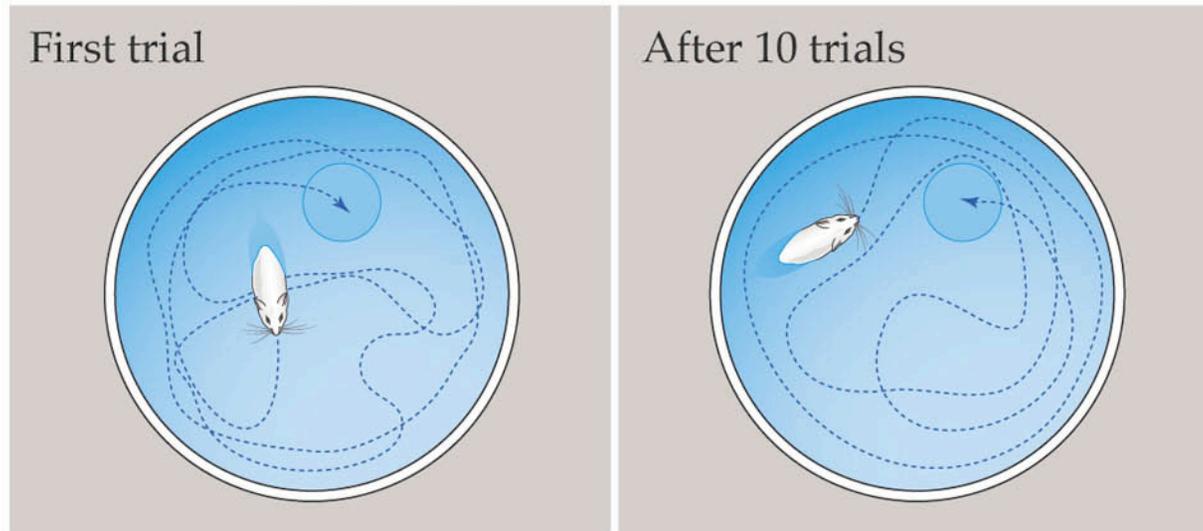
(B)



(C) Control rat



(D) Rat with hippocampus lesioned



Working memory for spatial location

- radial 8 arm maze food on the end of each
- rat quickly learns to visit each arm one time
- Olton - rat has amazing spatial memory and hippocampal lesion disrupts that.
- **Personal reflection -**
- undergraduate project of Robert Samuelson,
- Scientific American 1977

Alzheimer's disease

- neurofibrillary tangles (tau) in cells
- amyloid plaques (BA) outside cells -
- 5% are familial early onset -
- beta amyloid precursor protein mutations on chromosome 21
- 695-770 aa long
- beta and gamma secretase cut to 42 aa fragment - bad-
- presenilin 1 on chromosome 14

more

- presenillin 2 on chromosome 1
- also apolipoprotein E (E4 allele) variant (on chromosome 19) predisposes for this.
- tau on chromosome 17
- There is lots more information and it pours in fast these days.

Recent paper

- G Miller Computer game sharpens minds, Science 310, 1261, 2005
- Can mental exercise help?
- Garden view care center activity based dementia care