



LONG TERM MEMORY

PSY435

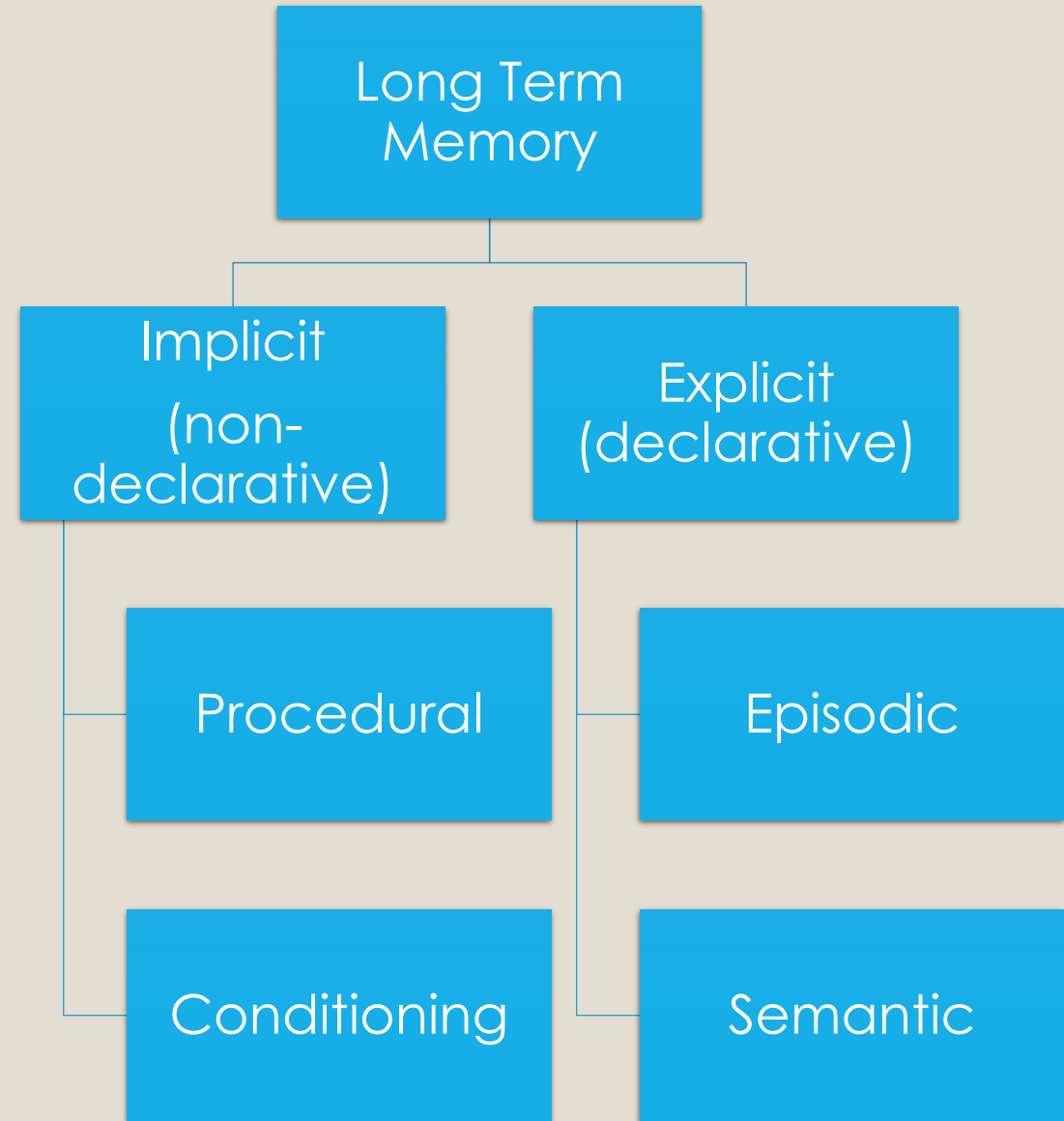
Roadmap

- What is Long Term Memory?
- How do we “get” memories into it?
- What kinds of long term memories are there?
- How are they “stored” in the brain?

What is long term memory?

- Any experience that creates a lasting change in the nervous system.
- This is in contrast to working memory, which disappears once you stop holding it “in mind.”

Some types of memories

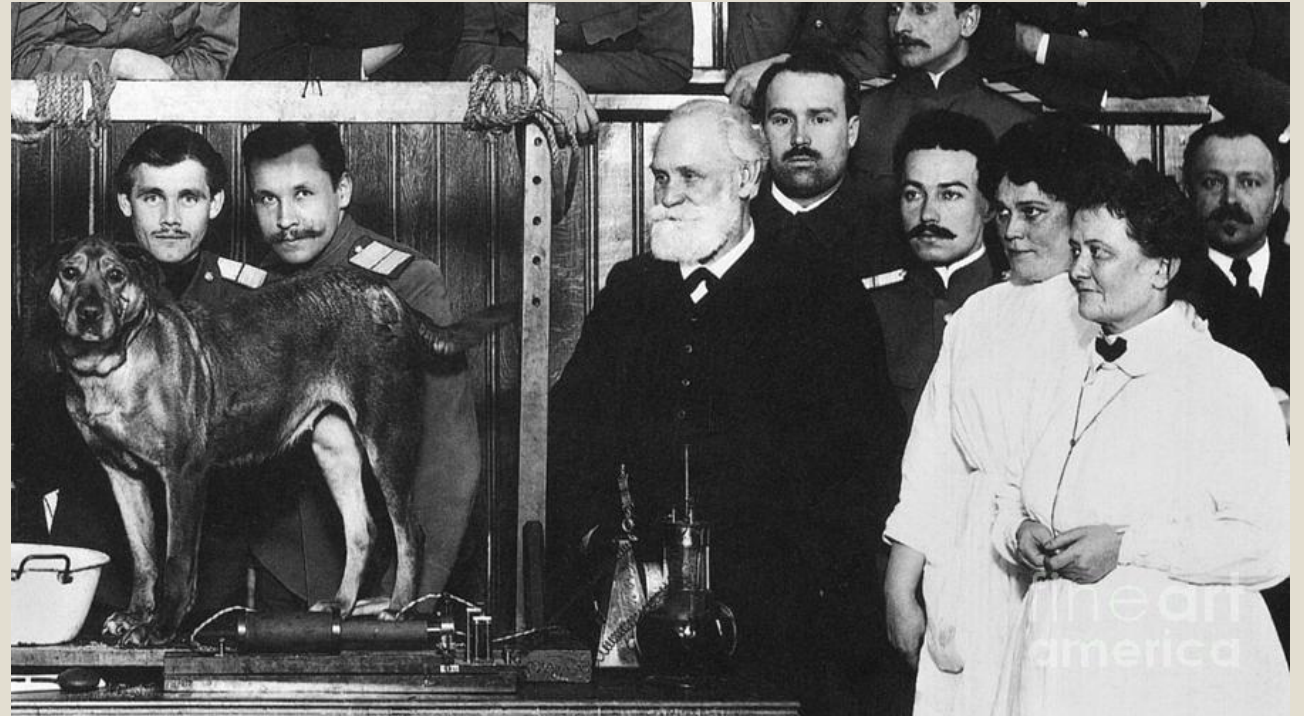


Implicit Memory

- Unconscious processing
- Difficult to convey except by direct demonstration
- May be acquired without awareness
- Requires several repetitions
- Can be divided into three broad categories:
 - Classical Conditioning
 - Priming
 - Procedural Learning

Classical Conditioning

- An associative learning process in which an **unconditioned stimulus (UCS)** automatically produces the **unconditioned response (UCR)**;
- After repeatedly pairing a neutral, **conditioned stimulus (CS)** with the US, the CS eventually comes to elicit a **conditioned response (CR)**, often similar to the UR, on its own.



Priming

- When exposure to one stimulus influences response to another stimulus.
- Types of priming:
 - **Perceptual priming**
 - The prime and the target share physical properties
 - *Example prime:* NURSE
 - *Example target:* N_R_E
 - *Answer:* NURSE
 - Sensitive to the modality and form of the stimuli
 - **Conceptual priming**
 - The prime and the target are related semantically
 - *Example prime:* NURSE
 - *Example target:* D_C_O_
 - *Answer:* DOCTOR



Procedural Memory

- Long-term memory for skills and procedures – a form of learning that doesn't rely on conscious strategy.
- Verbalizing these memories only reduces them.



Explicit Memory

- Memories that we have conscious and verbal access to.
- **Semantic Memory** – Specific pieces of knowledge that can be verbally conveyed. (Ex. $2+2=4$)
- **Episodic Memory** – Memories of events that one experienced. (Ex. *Being able to remember your 5th birthday*)
- *Experience creates both* – all semantic memories must have come from events that also have episodic memories connected to them.

Encoding explicit memories

- **Mere exposure does not guarantee memory**



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)



(j)

How do we “get” memories into
LTM?

Kinds of Rehearsal

- **Maintenance rehearsal:** rote mechanical process...usually requires little effort, but is most effective only for short term retention of information
- **Elaborative rehearsal:** involves active thinking about the to-be-remembered material, how it relates to itself, or other aspects of the surroundings or your previous knowledge. (“putting the information in context”).
- Elaborative rehearsal leads to much better long term retention...

Depth of Processing

Type of processing	"Incidental learning"	"Intentional learning"
"Shallow"	Are these words in the same typeface? "HOUSE—trick"	Are these words in the same typeface? "HOUSE—trick" <i>and</i> , in addition, you'll have to remember these words later on!
"Medium"	Do these words rhyme? "BALL—TALL"	Do these words rhyme? "BALL—TALL" <i>and</i> , in addition, you'll have to remember these words later on!
"Deep"	Are these words synonyms? "CAR—AUTOMOBILE"	Are these words synonyms? "CAR—AUTOMOBILE" <i>and</i> , in addition, you'll have to remember these words later on!

How to get deep processing?

Mnemonics

- Any learning technique that aids information retention
- Create a web of meaning
- Some techniques include
 - Method of Loci (Memory Palaces)
 - Elaboration
 - Creating narratives
 - Songs/Poems
 - Synesthetic associations

Mnemonics in Action

- <https://www.youtube.com/watch?v=sbinQ6GdOVk>

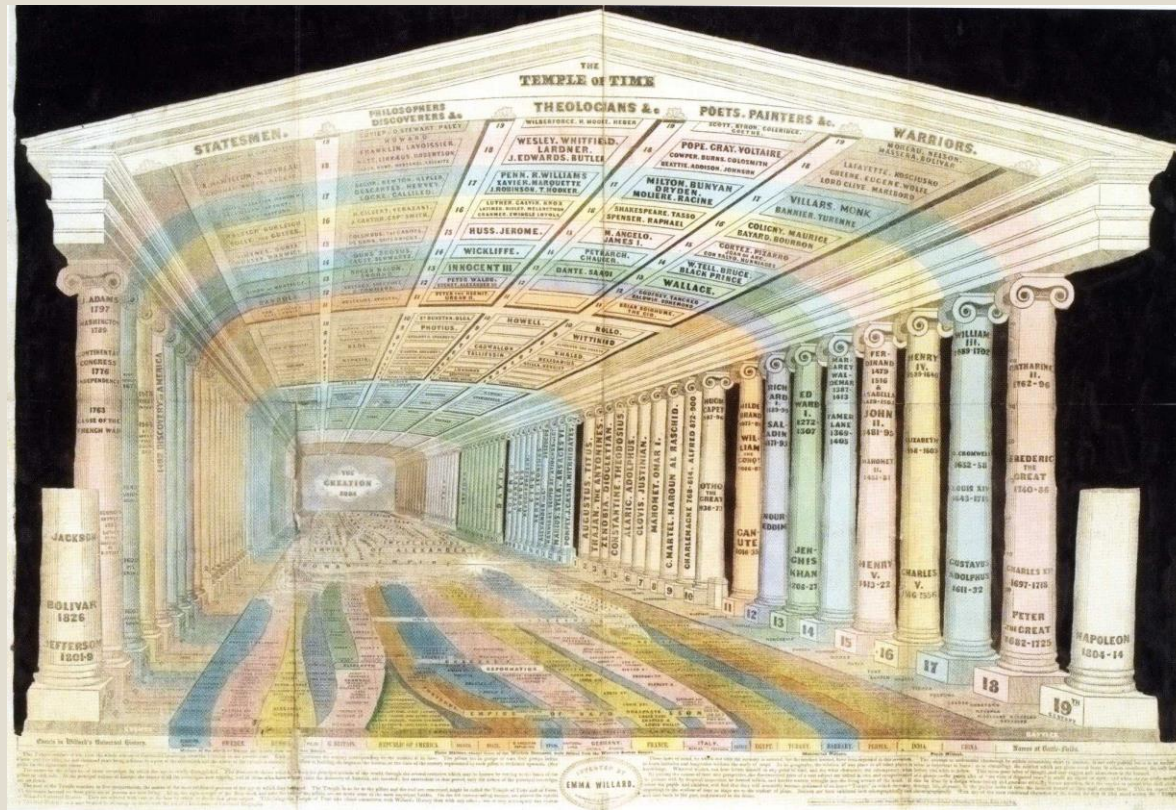


Method of Loci

- Used since ancient Greece.
- Individual remembers or creates mental space and places desired information along it.
- Each step along path is associated with desired information.
- When you want to remember information, just remember path.

Let's Create a Memory Palace

- Africa
- Comma
- Door
- Parrot
- Clover
- Egg
- Llama

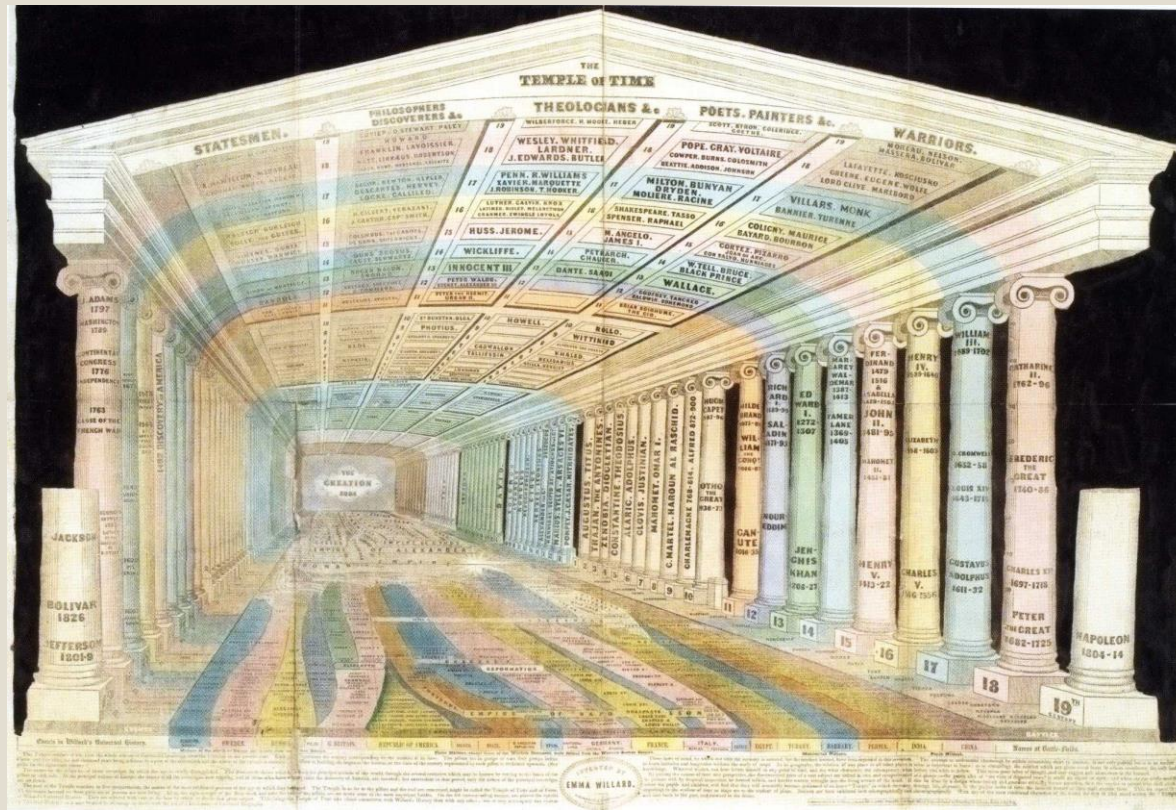


- https://www.youtube.com/watch?v=QguPS_iwgDg



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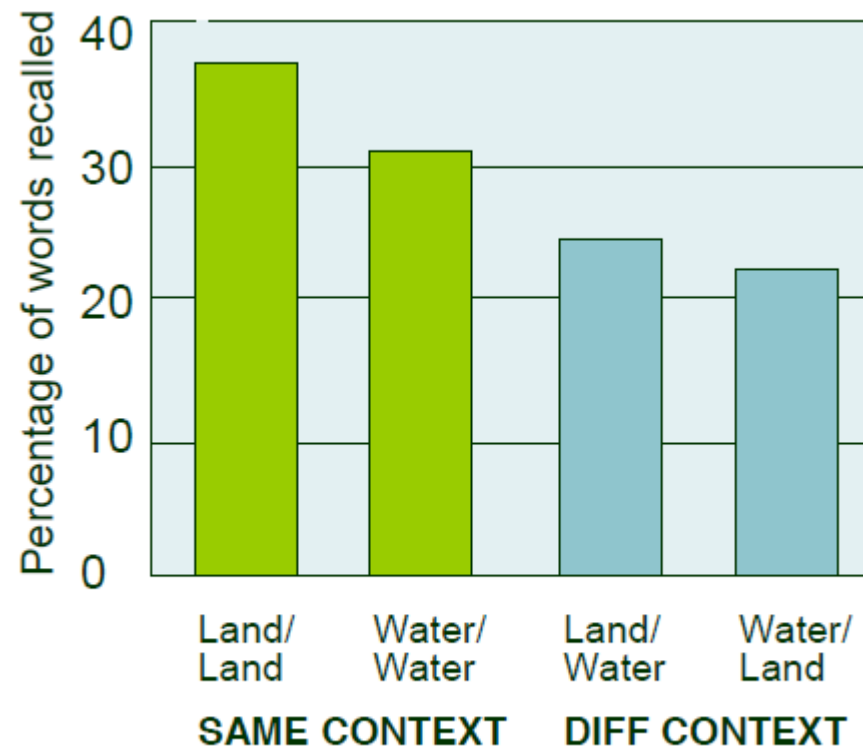


Three Principles of Good Mnemonics

1. Minimize interference.
2. Exploit pre-existing information in memory.
3. Use imagery to enhance memory.

Role of context

- Physical surroundings become encoded as a retrieval cue.
- Scuba divers who learned lists of words while under water later recalled them best while under water, whereas words they learned on land were best recalled on land.



Role of Context

- Physiological/psychological state is used as a retrieval cue.
- Moving from internal to external cues.
- Our ability to retrieve information is greater when our internal state at the time of retrieval matches our original state during learning.



Marcel Proust

- “And once again I had recognized the taste of the crumb of madeleine soaked in her decoction of lime-flowers which my aunt used to give me (although I did not yet know and must long postpone the discovery of why this memory made me so happy), immediately the old gray house upon the street, where her room was, rose up like the scenery of a theater.”
 - - In Search of Lost Time



Models of Memory Storage

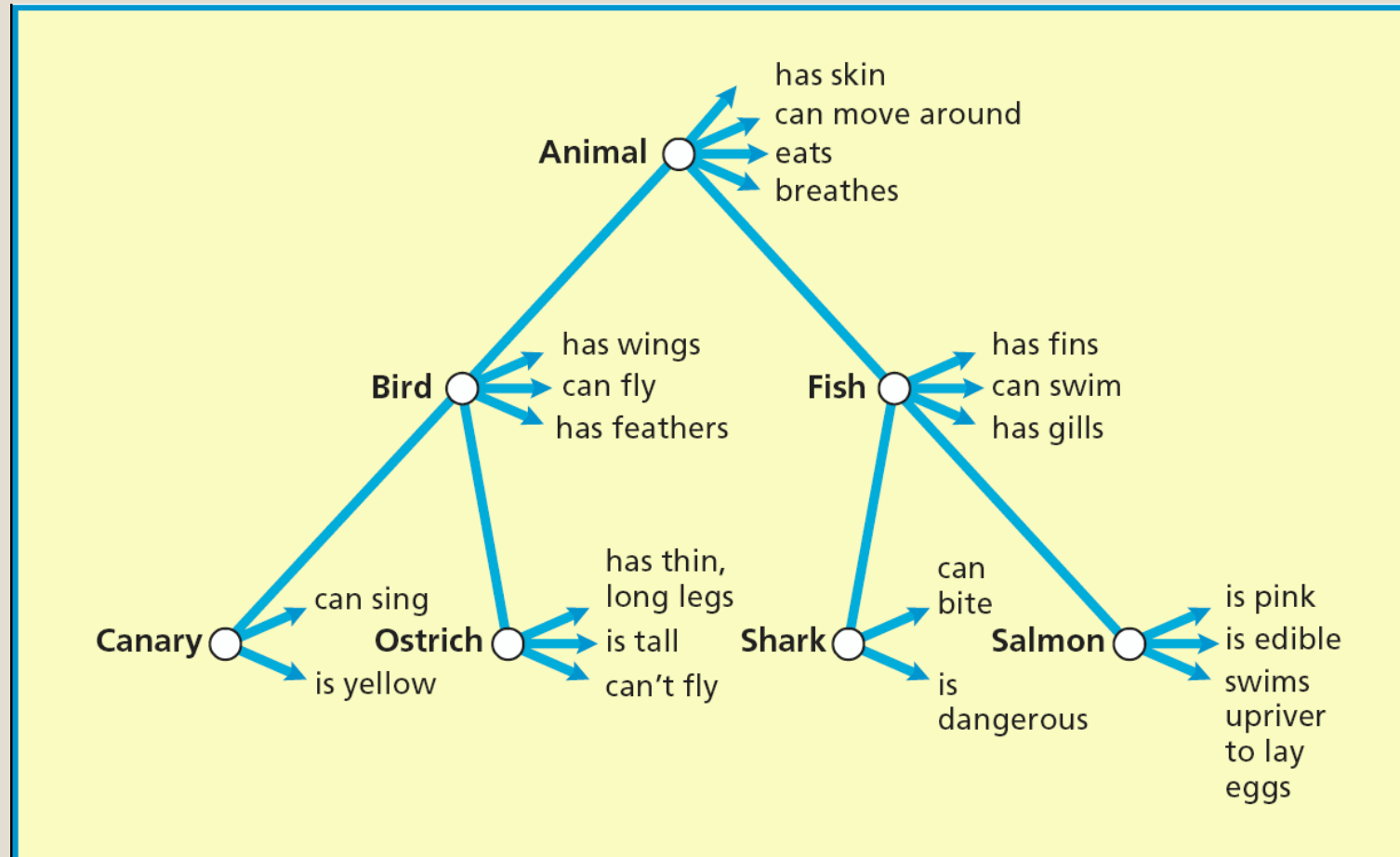
- The “file cabinet” doesn’t really work.
- <https://www.youtube.com/watch?v=rRHL5drAkOE>



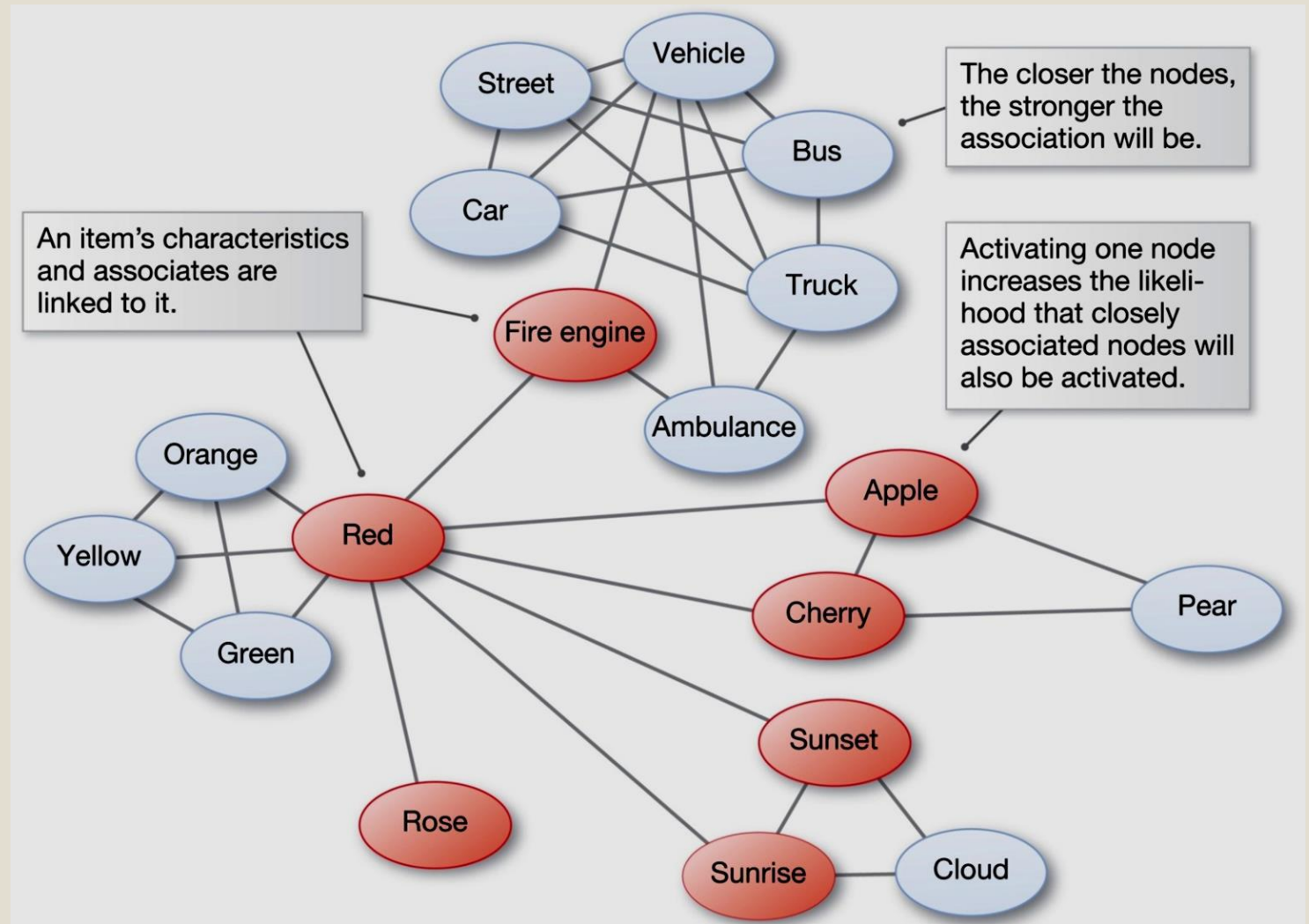
How are semantic memories stored?



Hierarchical Model



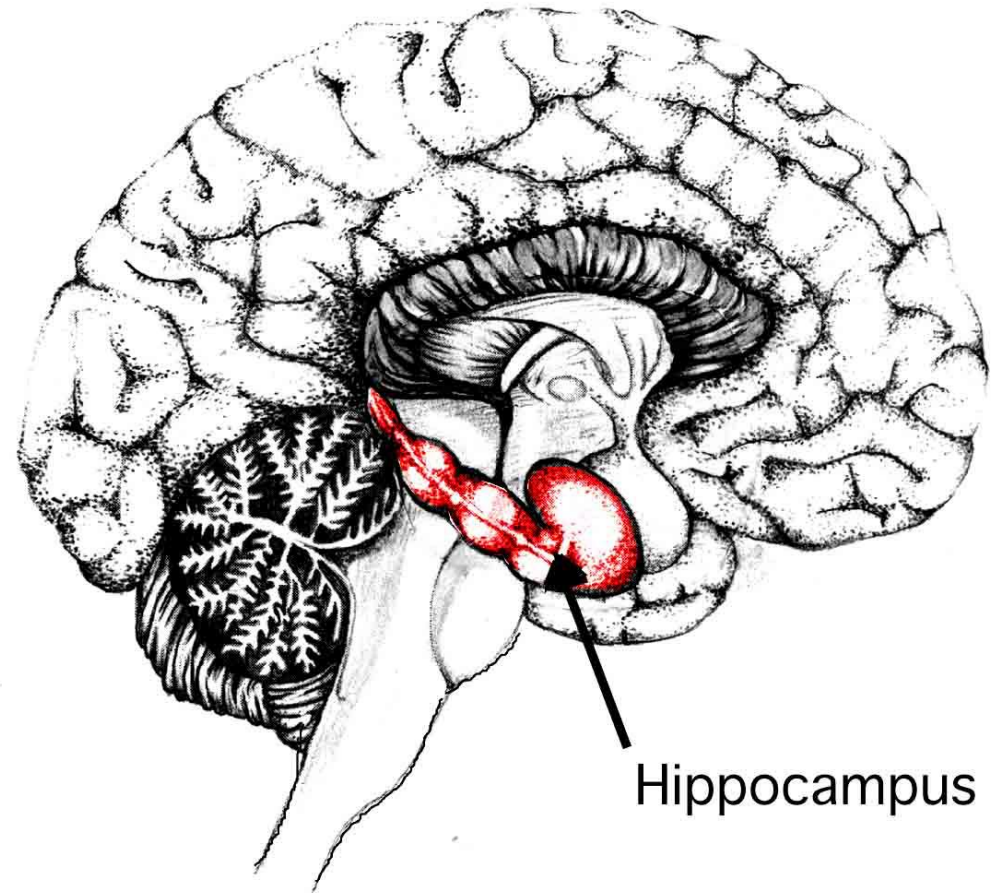
Network Model



How are episodic memories stored?



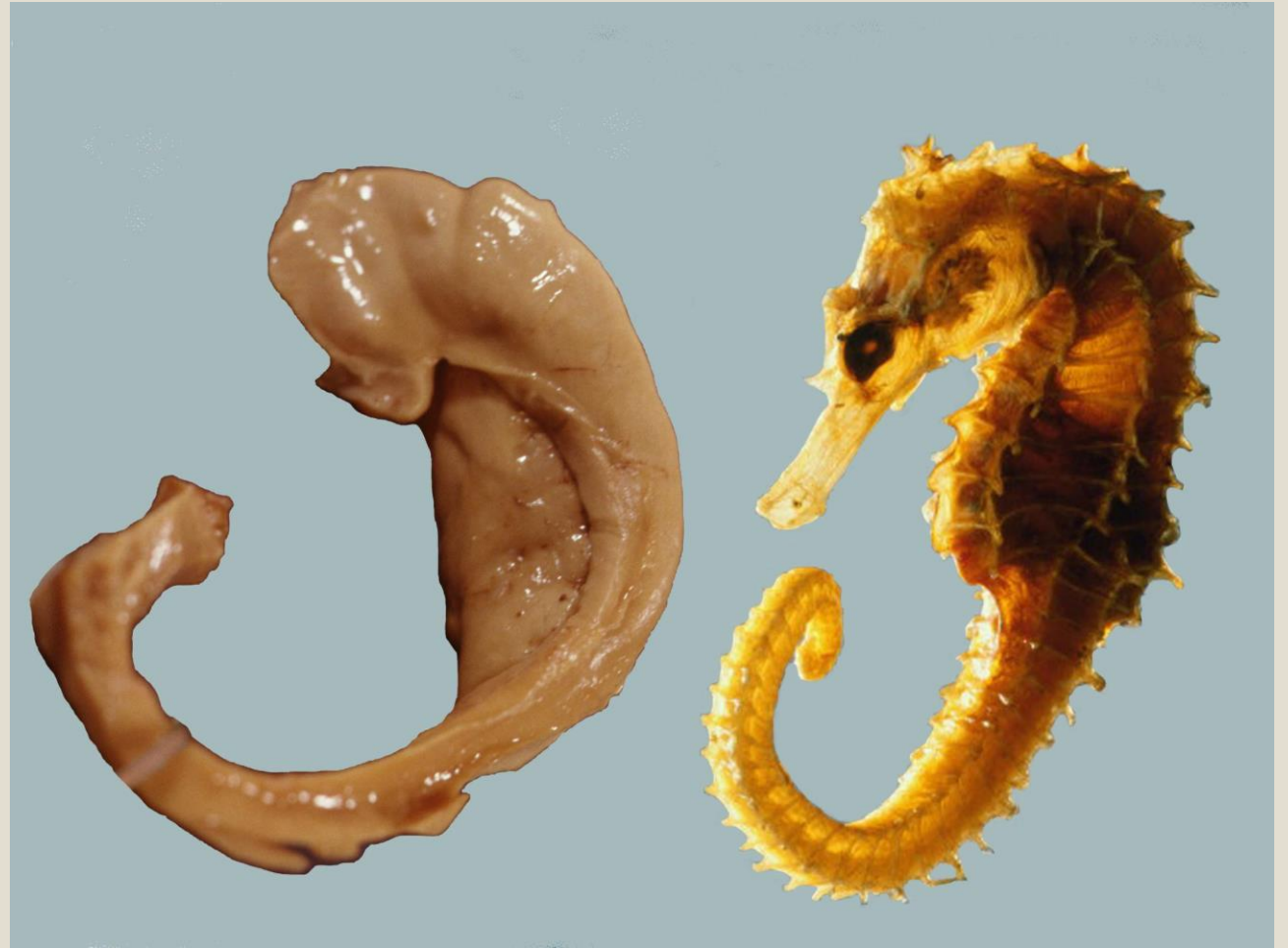
Going
from STM
to LTM



Hippocampus

—

Greek for seahorse

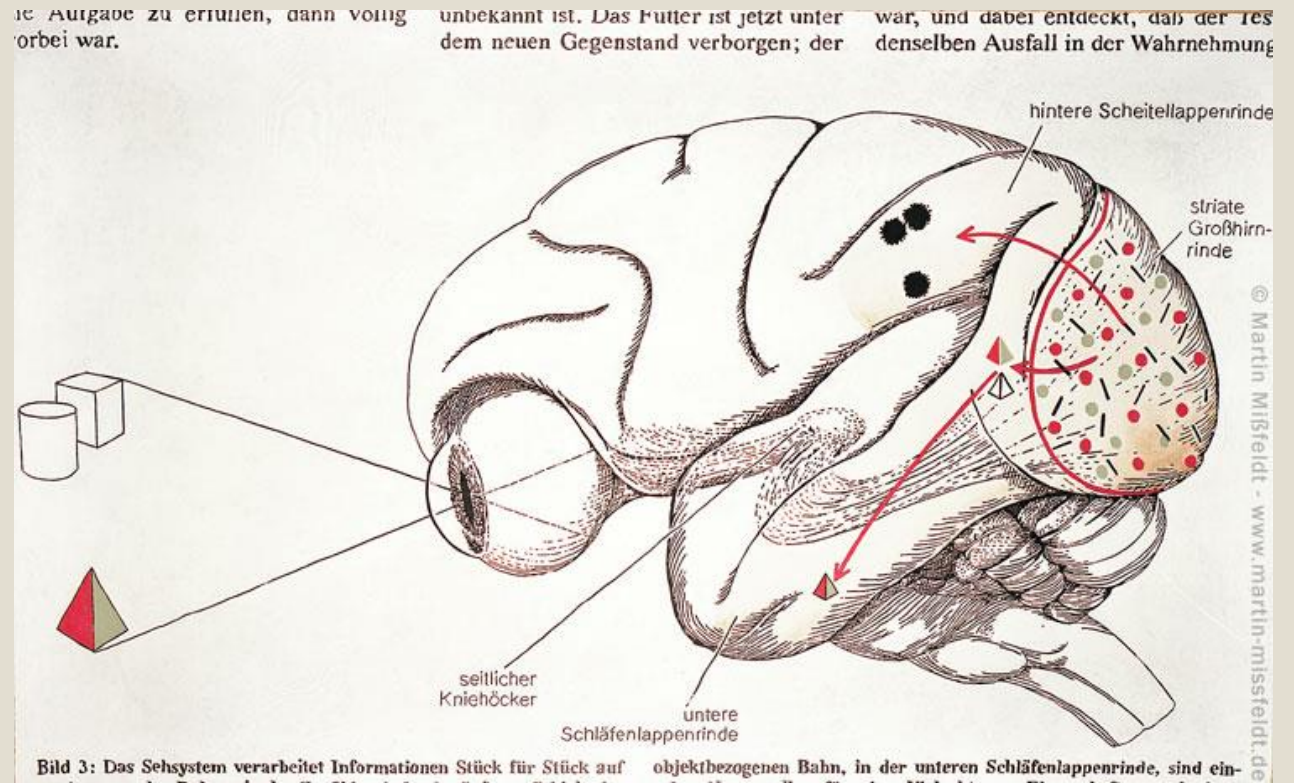


Experiencing and Remembering

- Cortical recruitment is critical

Cortical Recruitment

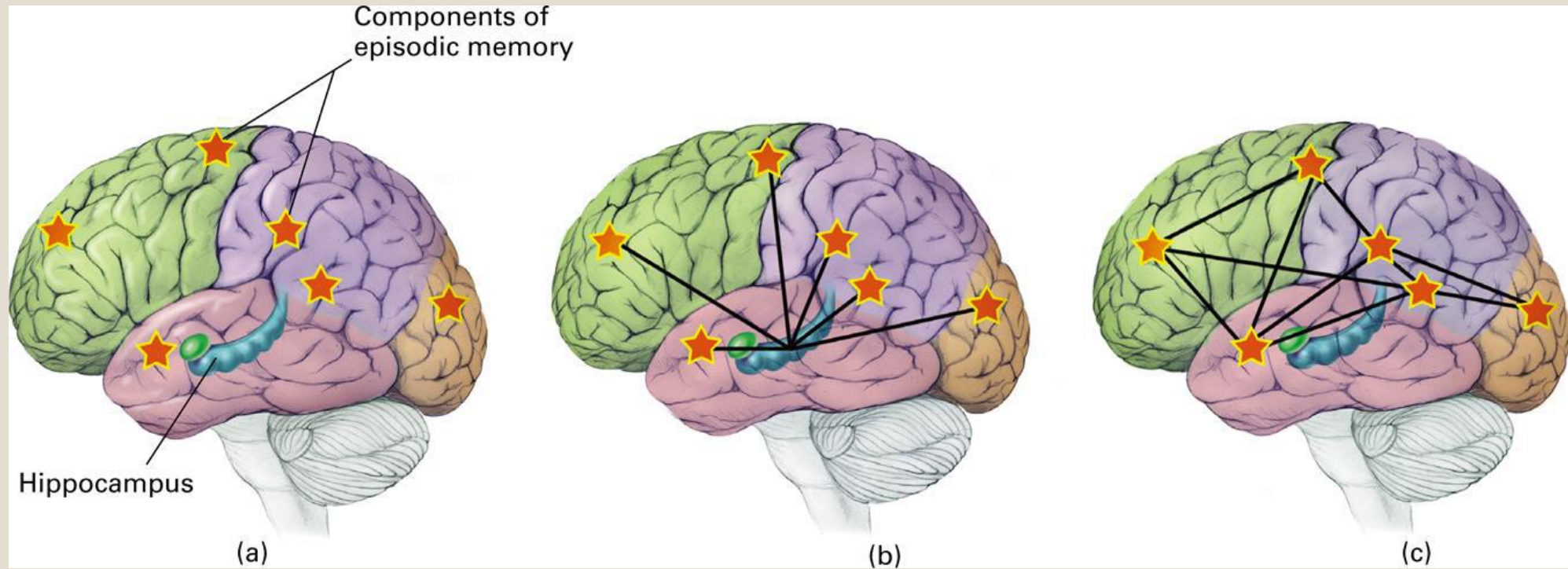
- When a memory is recalled, our brain uses the sensory areas to re-experience it.



Experiencing and Remembering

- Cortical recruitment is critical
- Hippocampus acts as a scaffolding for creation of long-term memories

Memory Consolidation



Experiencing and Remembering

- Cortical recruitment is critical
- Hippocampus acts as a scaffolding for creation of long-term memories
- Once connections are strong enough, hippocampus is no longer needed

Sleep in Memory Consolidation

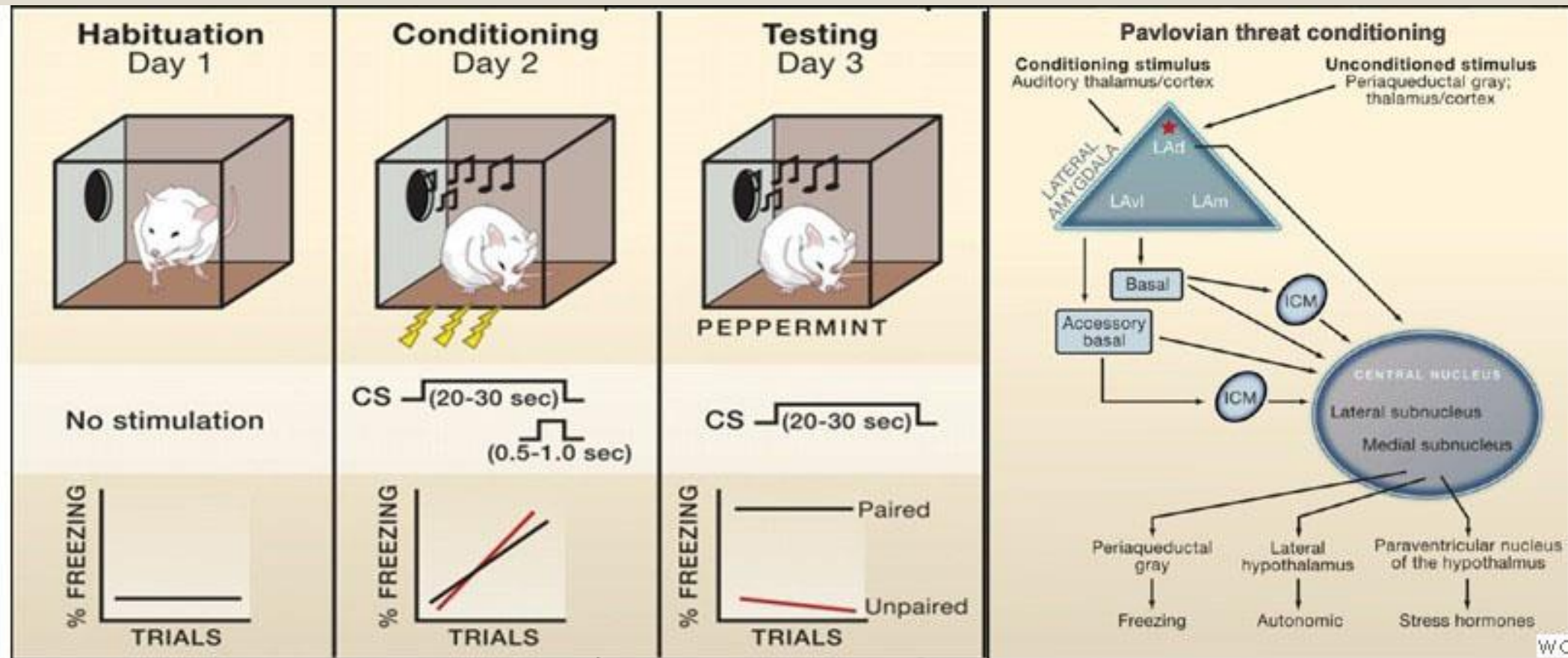
- During sleep memories are consolidated.
- Connections are strengthened that were made during the day that represent different memories.
- Getting a good nights rest before a test is pretty important.



Mice Memories Changed

- <http://www.radiolab.org/story/91570-eternal-sunshine-of-the-spotless-rat/>





Discussion

- Memory is pattern activity constructed activity
- Proteins allowing for memory trace construction
- Remembering is to recreate memory
 - This is idea behind therapy
 - Treatment for PTSD
 - Ethical Implications!?
- No “purely stored” experiences
- The more you remember, the less accurate it becomes