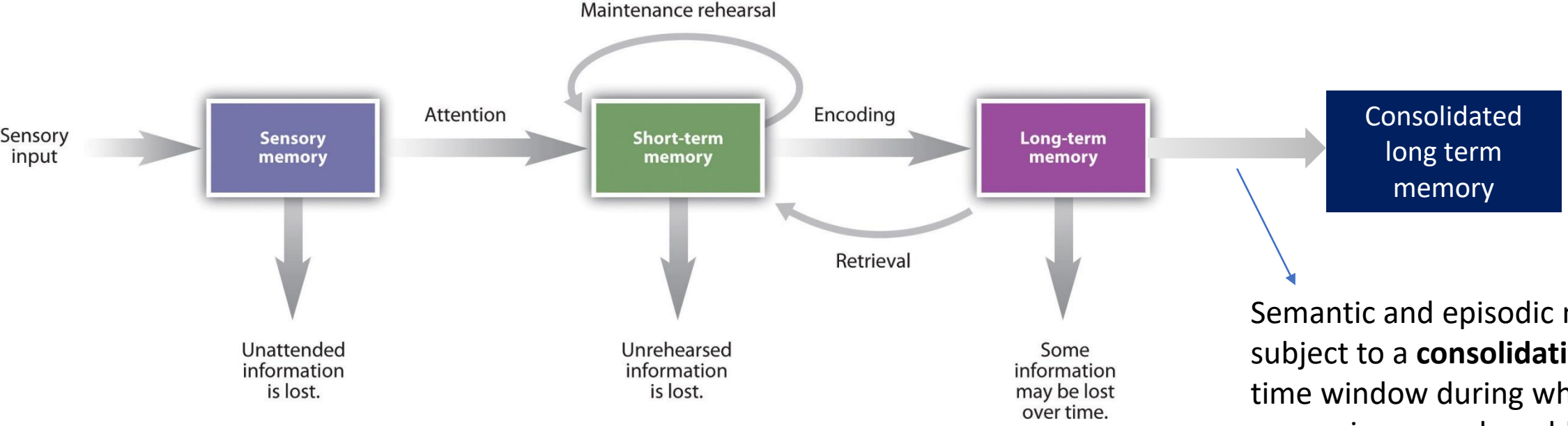
Class 11
Episodic and Semantic Memory

Thursday

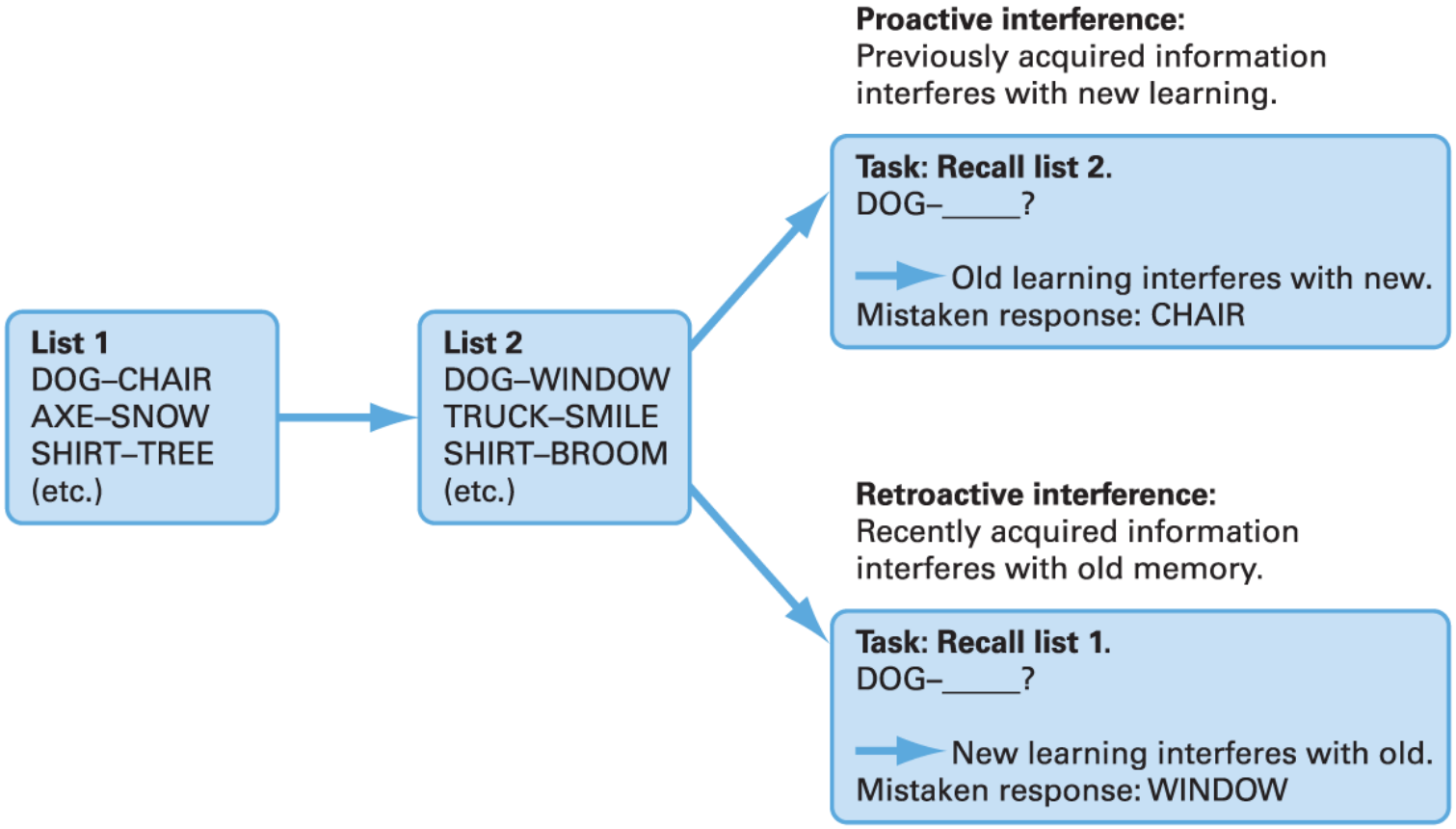
8th September 2022



Consolidated long term memory

Semantic and episodic memories are subject to a **consolidation period**, a time window during which new memories are vulnerable and easily lost

Interference: reduction in the strength of a memory due to overlap with the content of other memories
Proactive interference: disruption of new learning by previously stored information
Retroactive interference: disruption of old (previously stored) information by more recent learning



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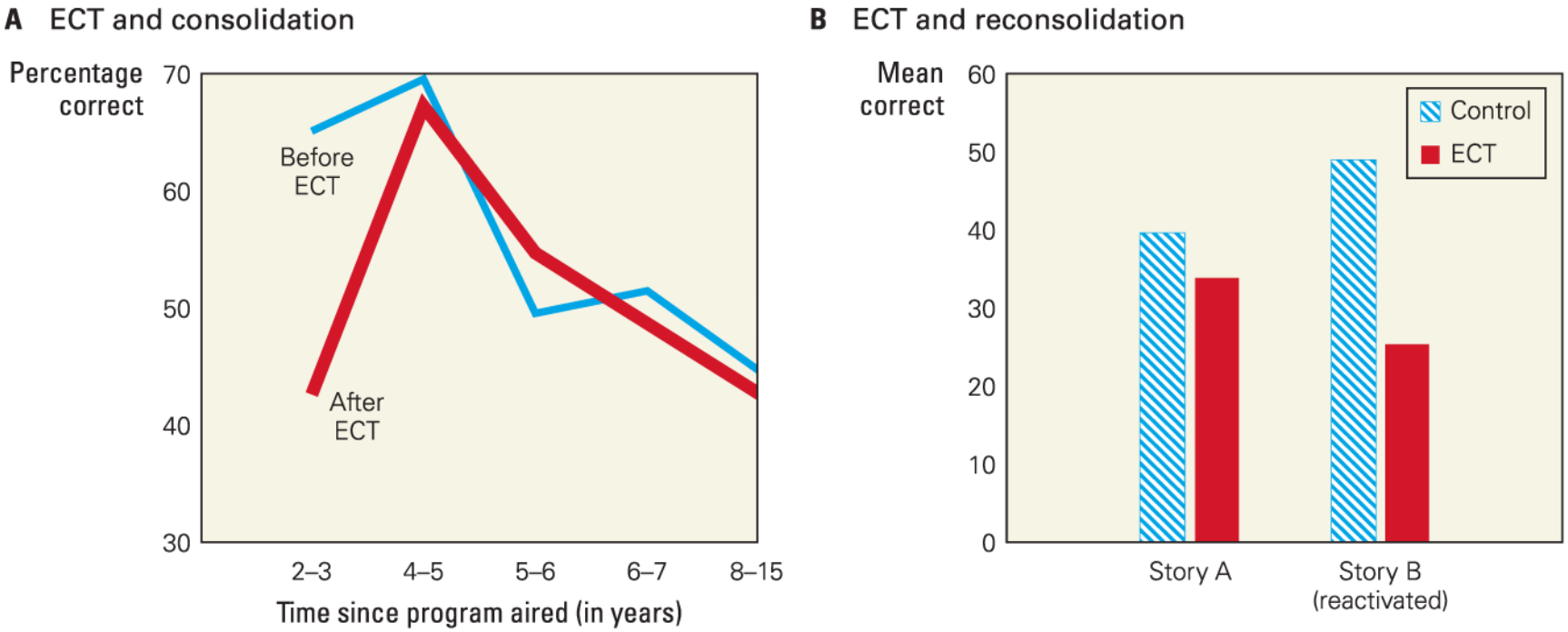
The Consolidation Period and the Effects of Electroconvulsive Therapy (ECT) on Memory



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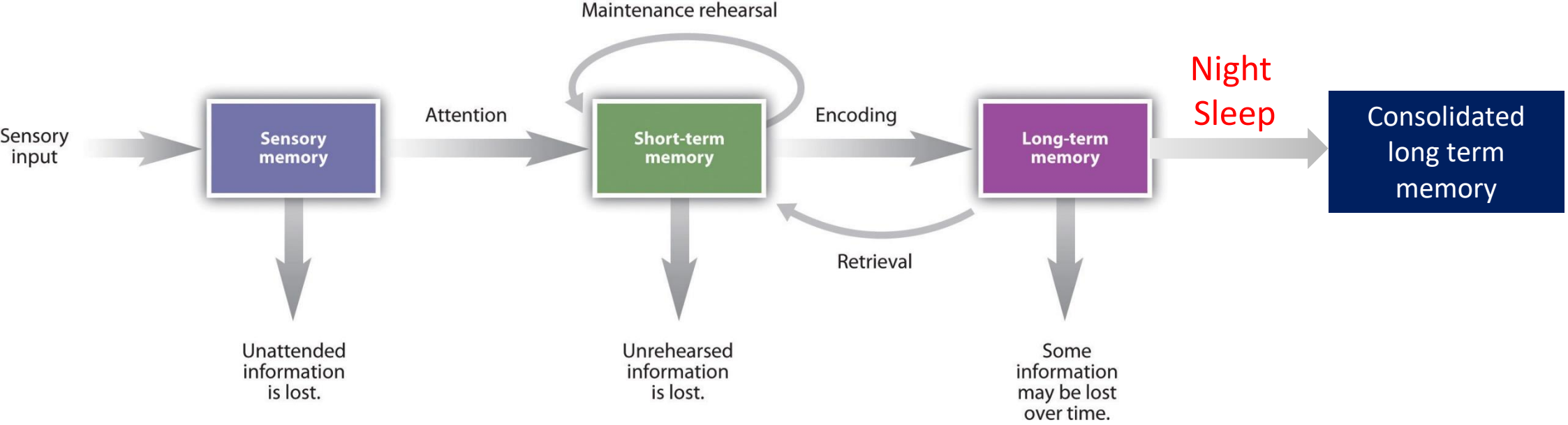
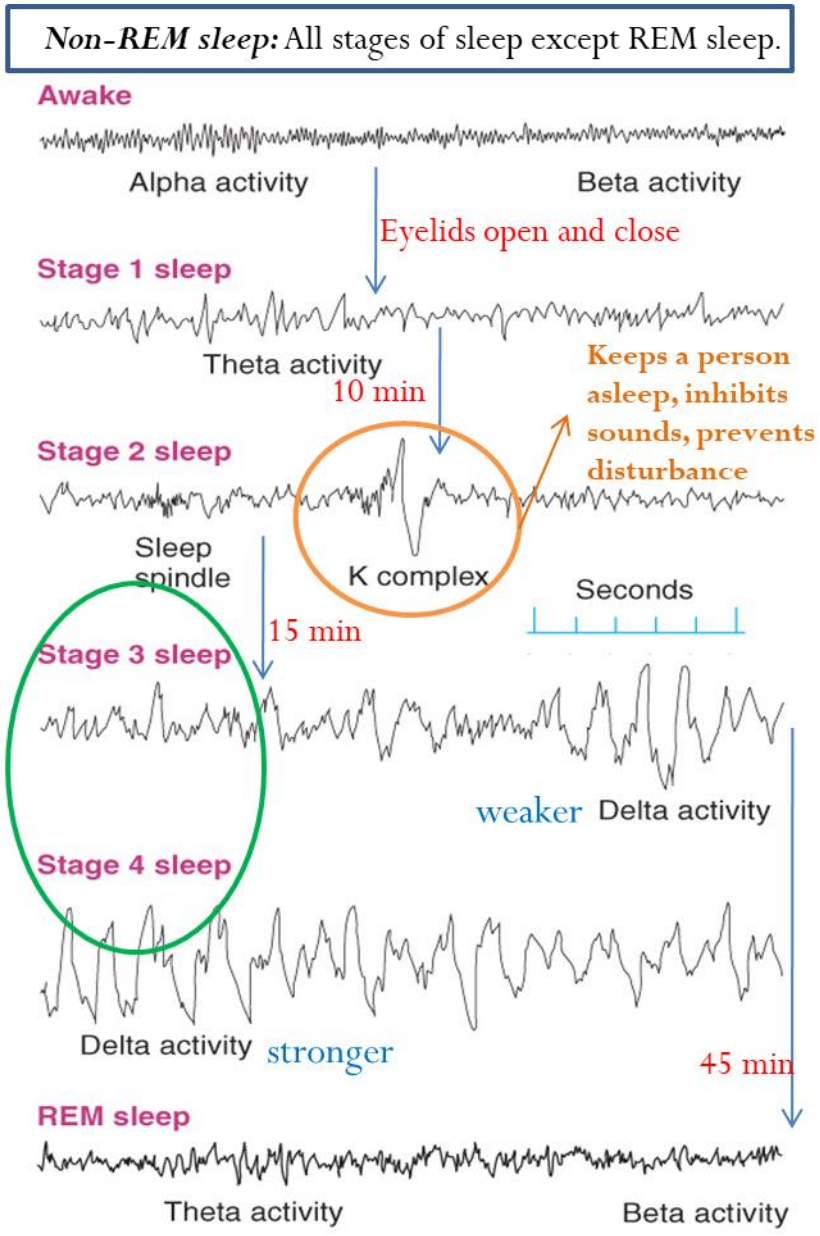
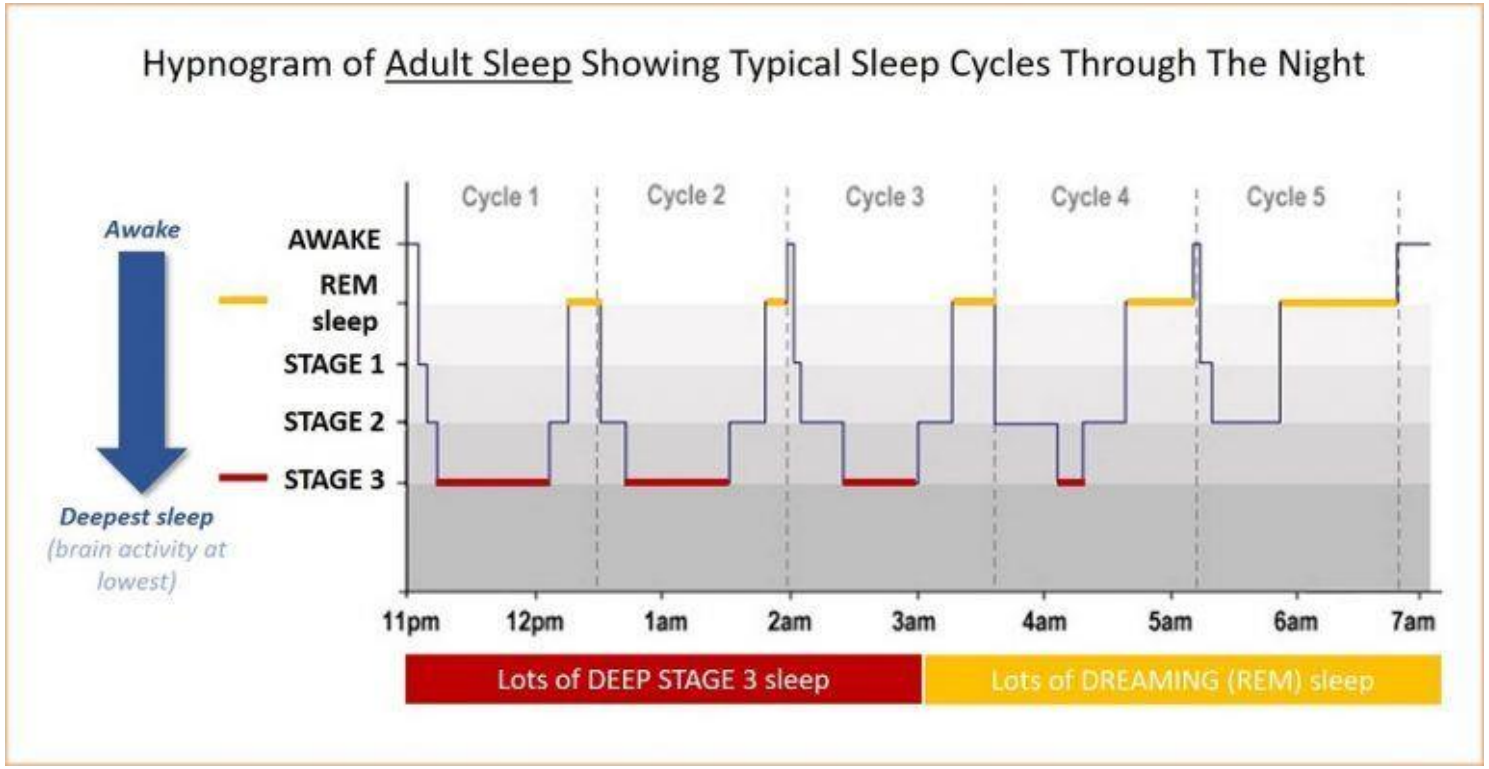
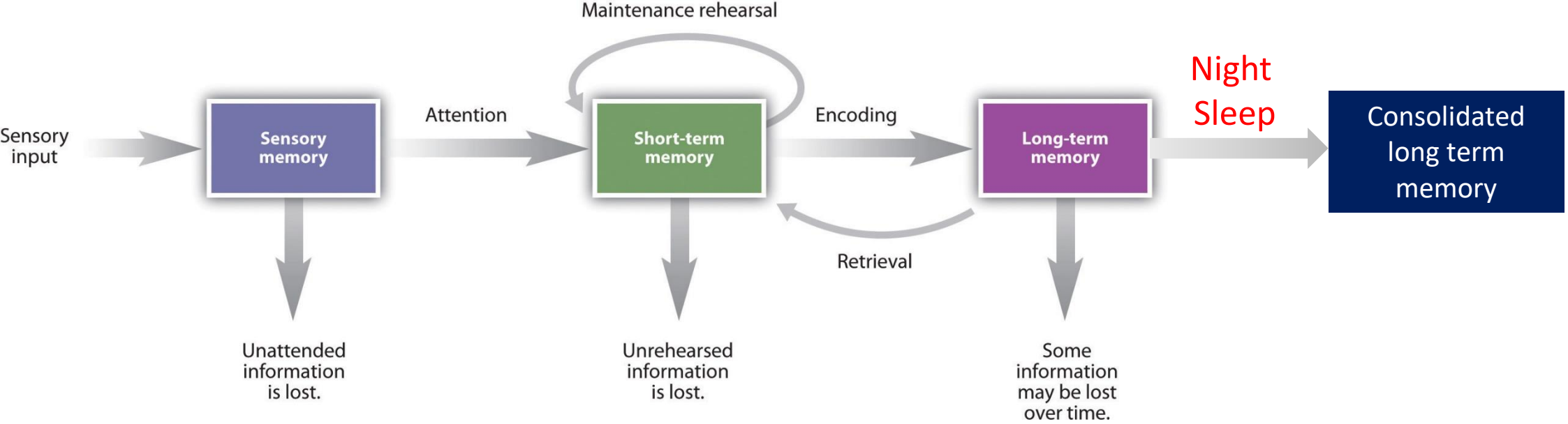
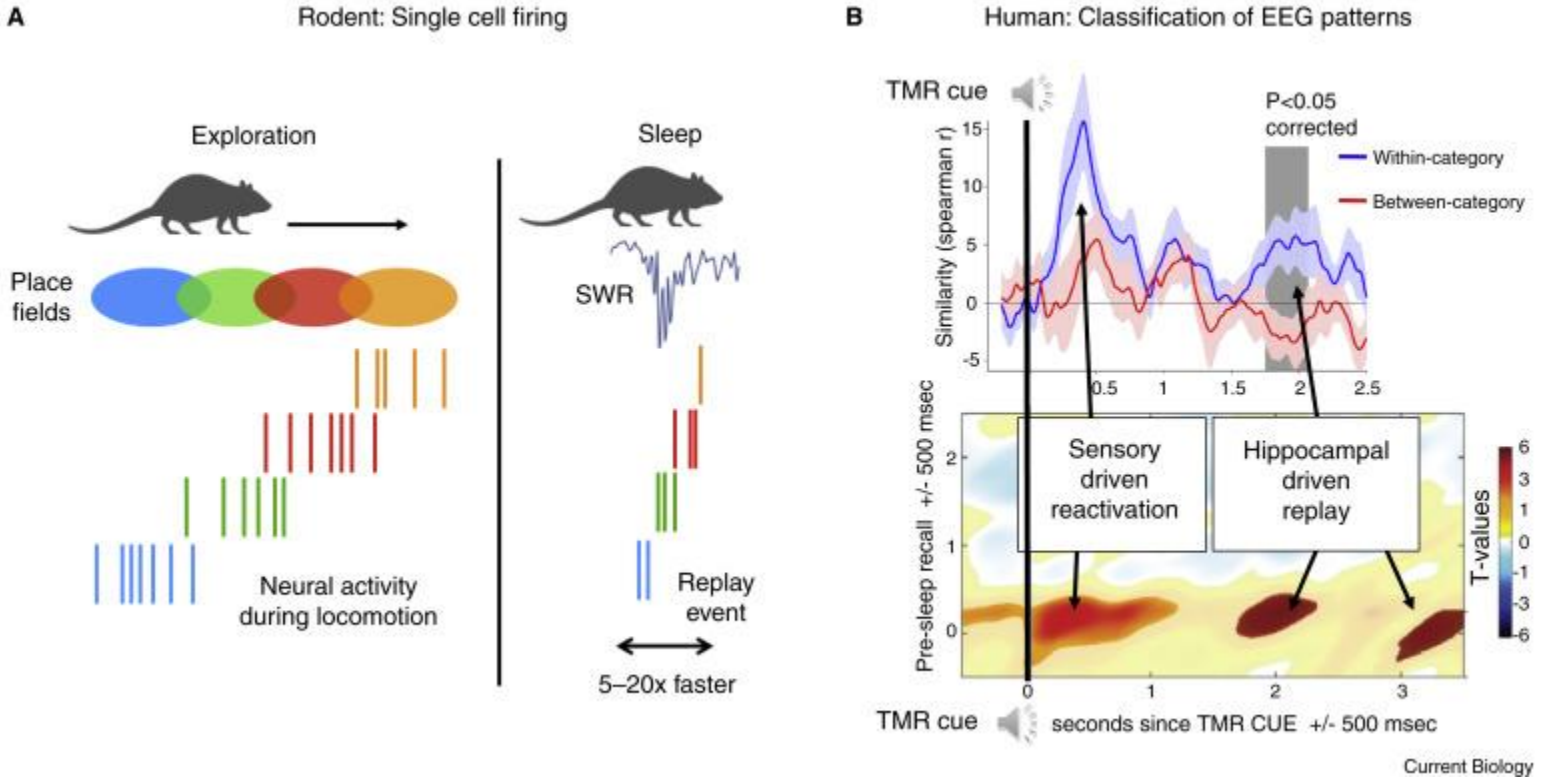

Maintenance rehearsal
Sensory input
Sensory memory
Attention
Short-term memory
Encoding
Long-term memory
Night Sleep
Consolidated long term memory
Retrieval
Unattended information is lost.
Unrehearsed information is lost.
Some information may be lost over time.

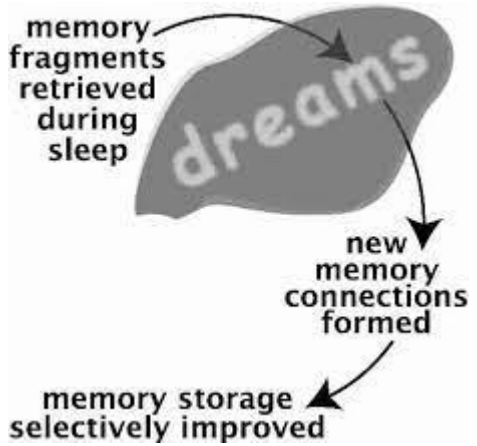




- ***Alpha activity:*** A smooth electrical activity of 8–12 Hz recorded from the brain; generally associated with a state of relaxation.
- ***Beta activity:*** Irregular electrical activity of 13–30 Hz recorded from the brain; generally associated with a state of arousal.
- ***Theta activity:*** EEG activity of 3.5-7.5 Hz that occurs intermittently during early stages of slow-wave and REM sleep, a transition between sleep and wakefulness.
- ***Delta activity:*** Regular, synchronous electrical activity of less than 4 Hz recorded from the brain; occurs during the deepest stages of slow-wave sleep.

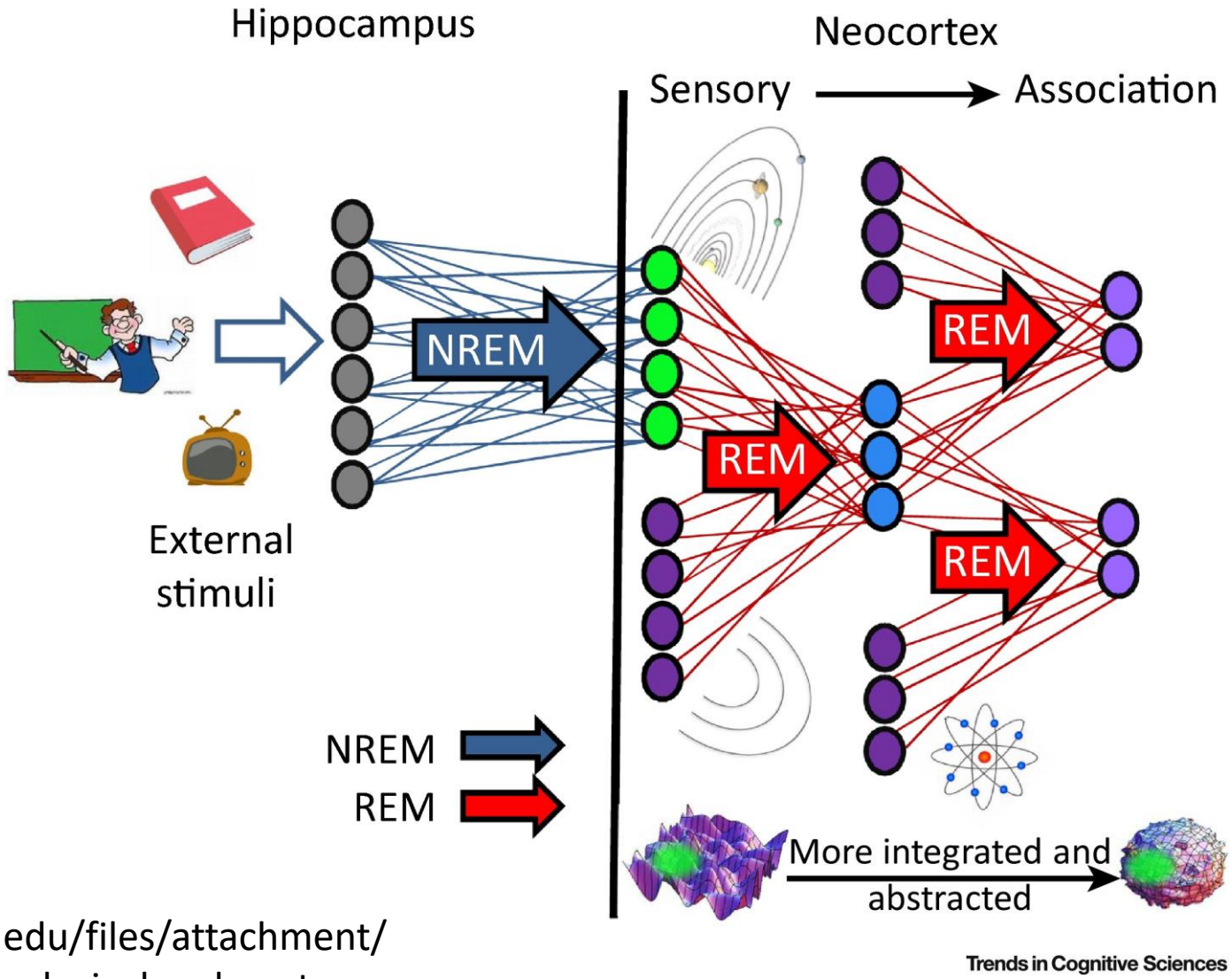






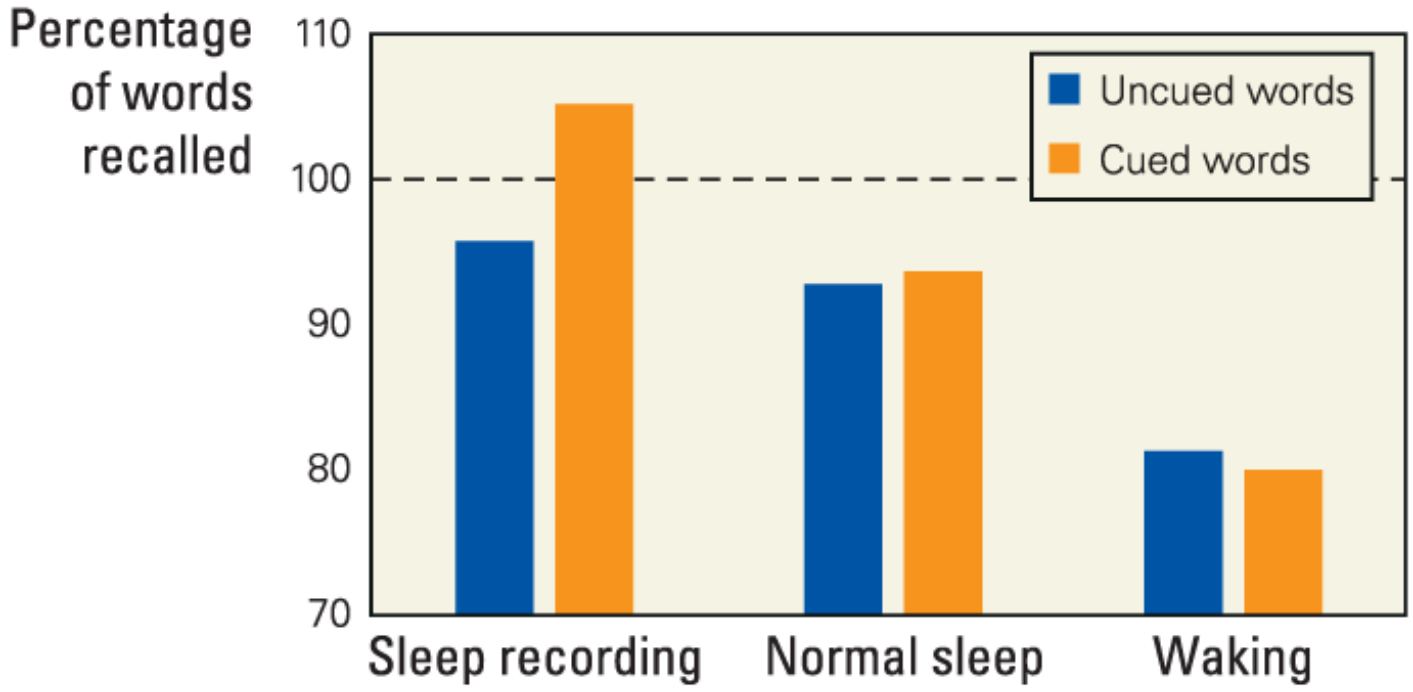
https://www.sciencedirect.com/science/article/pii/S0960982219310358#fig1

How Memory Replay in Sleep Boosts Creative Problem-Solving



https://somby.ceu.edu/sites/somby.ceu.edu/files/attachment/basicpage/6/knoblich2018howmemoryreplayinsleepboostscreativeproblem-solving.pdf

Learning While You Sleep: Targeted Memory Reactivation



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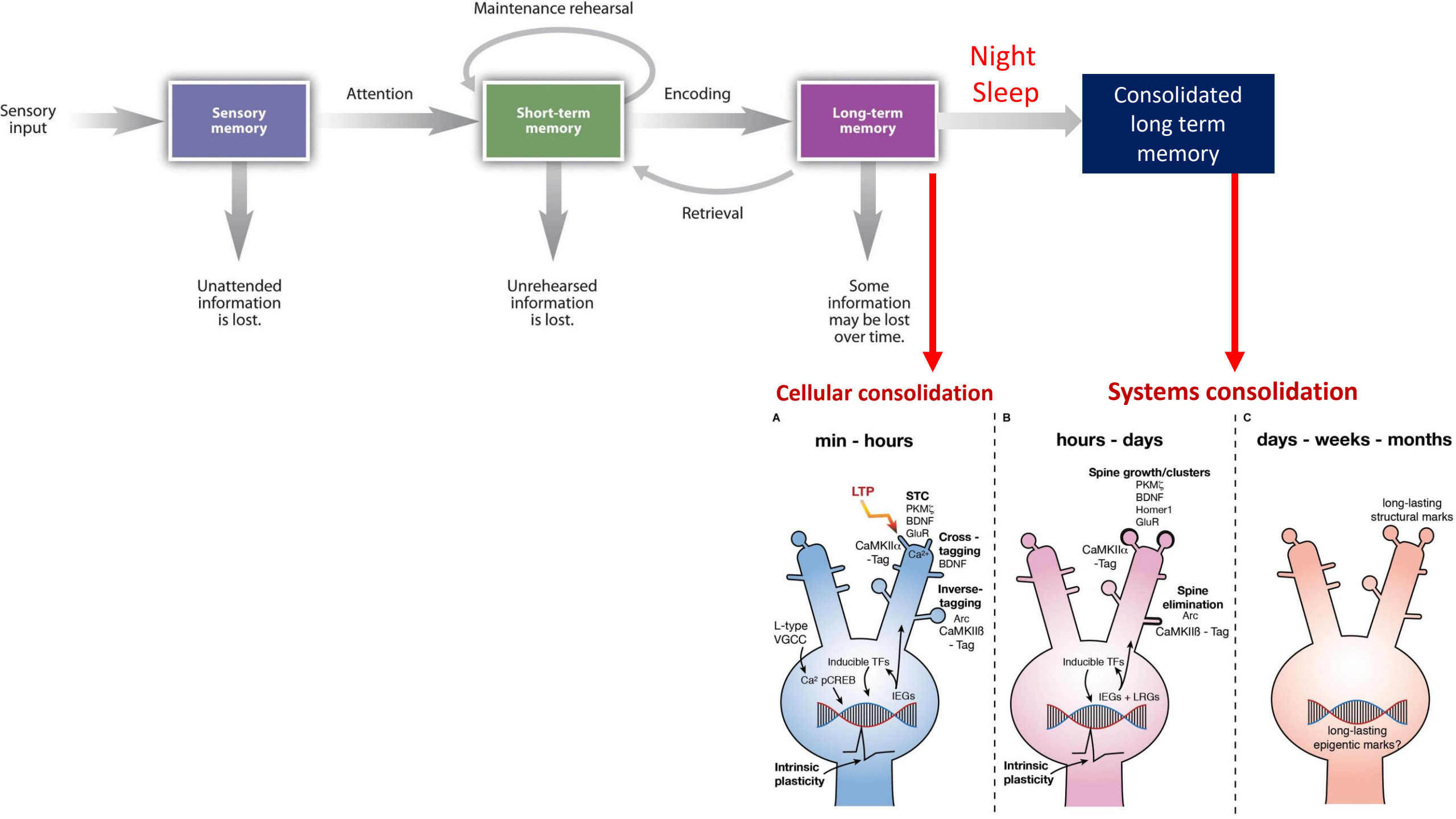
Inception movie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Long-term memory
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Consolidated long term memory
Retrieval
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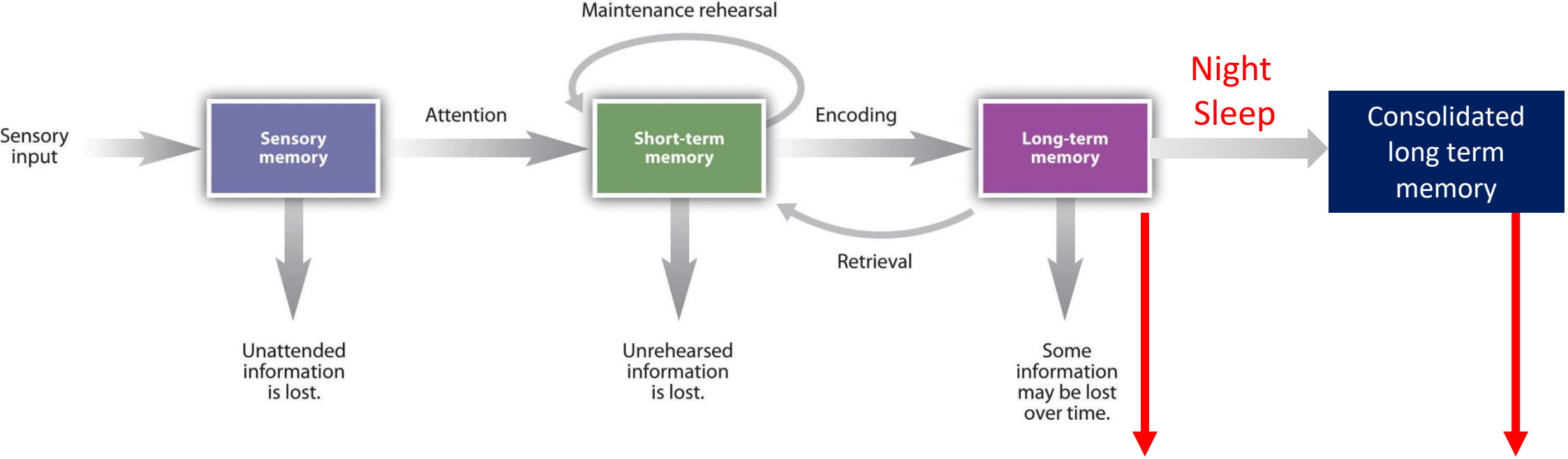
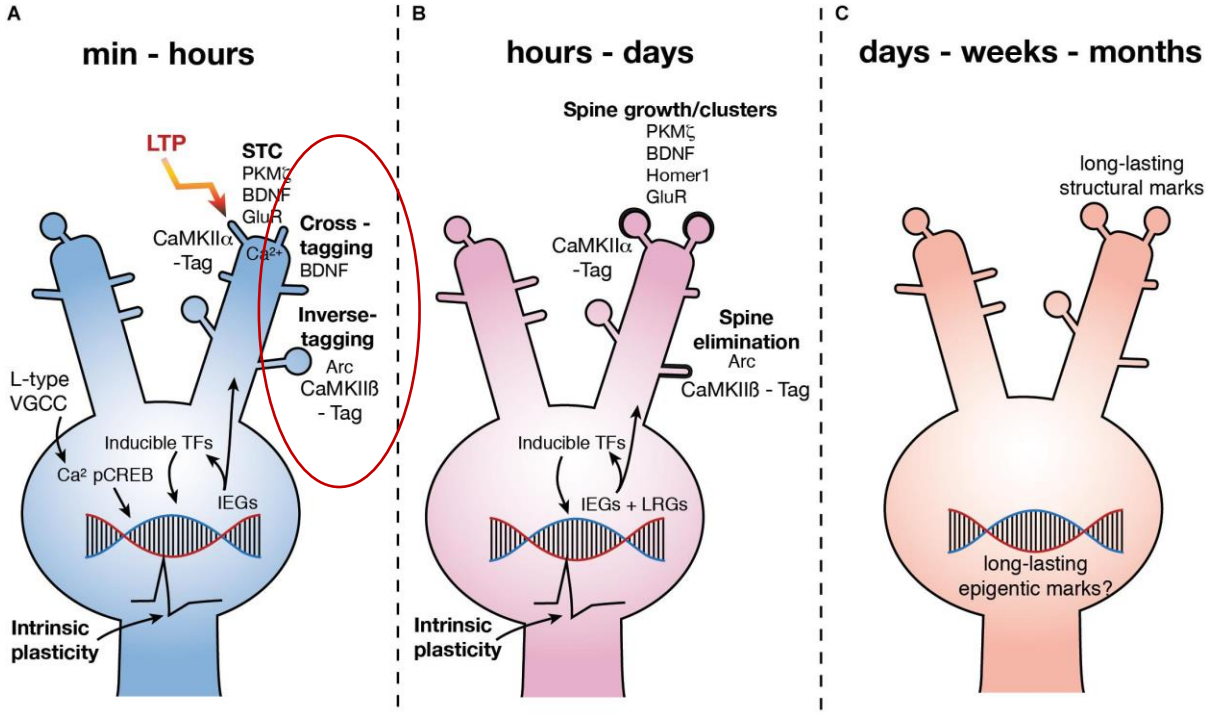
Unrehearsed information is lost.
Some information may be lost over time.
Cellular consolidation
Systems consolidation
A
min - hours
LTP
STC
PKMζ
BDNF
GluR
CaMKIIα -Tag
Ca2+
Cross - tagging
BDNF
Inverse-tagging
Arc
CaMKIIß - Tag
L-type VGCC
Ca2 pCREB
Inducible TFs
IEGs
Intrinsic plasticity
B
hours - days
Spine growth/clusters
PKMζ
BDNF
Homer1
GluR
CaMKIIα -Tag
Spine elimination
Arc
CaMKIIß - Tag
Inducible TFs
IEGs + LRGs
Intrinsic plasticity
C
days - weeks - months
long-lasting structural marks
long-lasting epigentic marks?

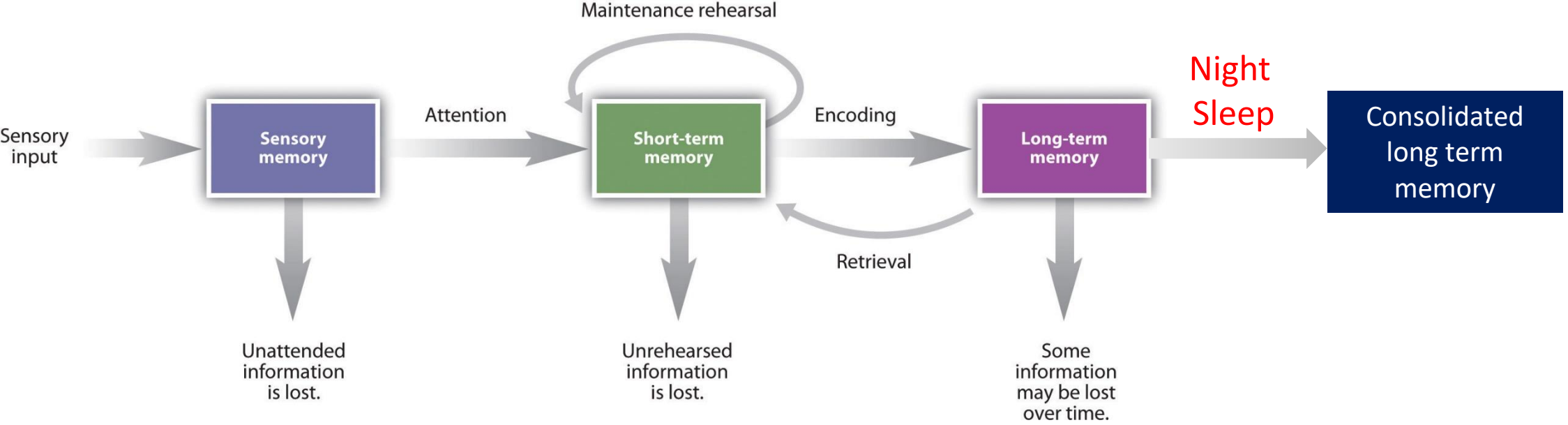


Cellular consolidation **Systems consolidation**



Experiments strongly suggest that the frontal lobes help determine what new information gets encoded as episodic and semantic memories and what gets forgotten

Maintain a balance between remembering and forgetting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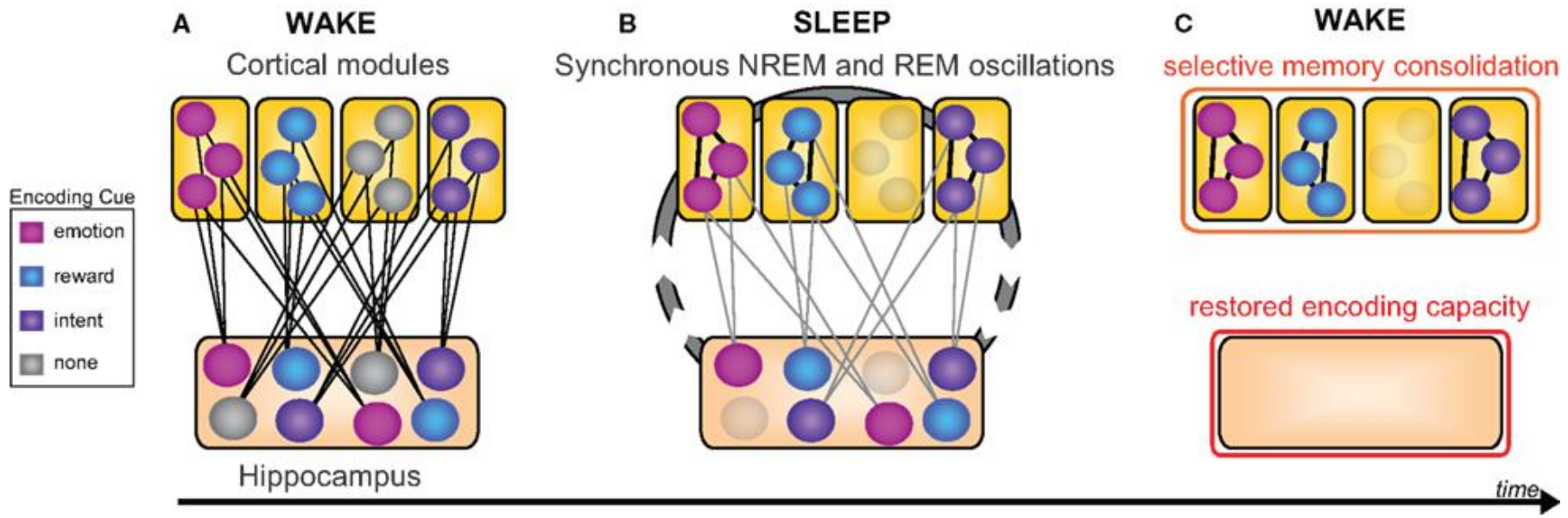
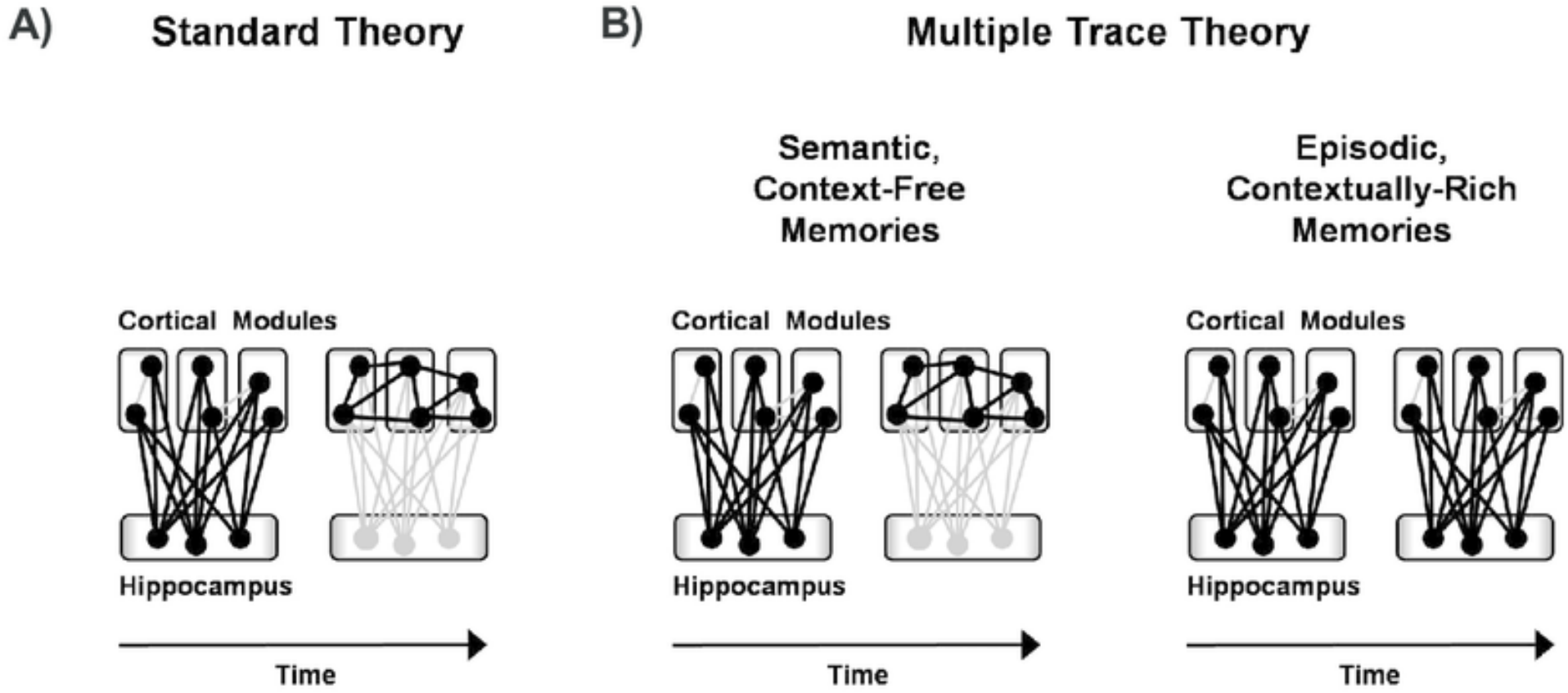
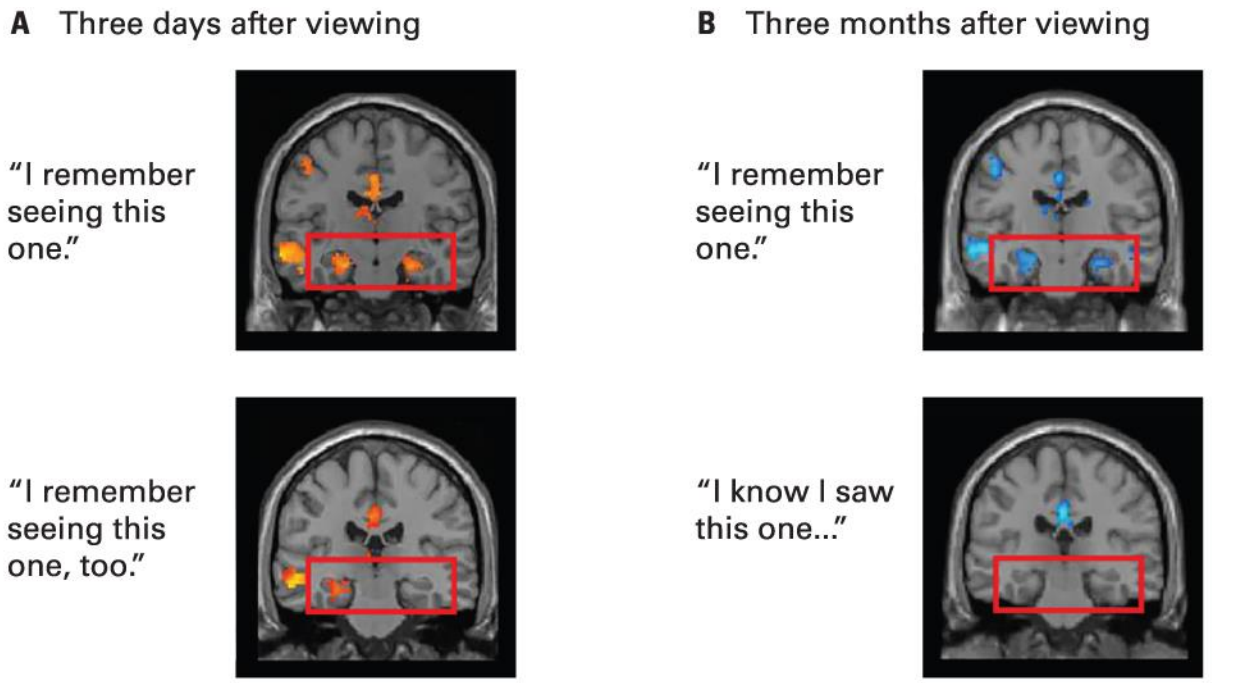

A WAKE
Cortical modules
B SLEEP
Synchronous NREM and REM oscillations
C WAKE
selective memory consolidation
restored encoding capacity
Encoding Cue
emotion
reward
intent
none
Hippocampus
time

Memory Consolidation Theory



Evidence from Healthy Brains



Harand C, Bertran F, La Joie R, Landeau B, Mézenge F, Desgranges B, et al. (2012) The Hippocampus Remains Activated over the Long Term for the Retrieval of Truly Episodic Memories. PLoS ONE 7(8).

In adult humans with normal memory function, fMRI shows that the hippocampus is active even for retrieval of very old episodic information (Ryan et al., 2001). Does this prove that episodic memories always remain at least partially dependent on the hippocampus?

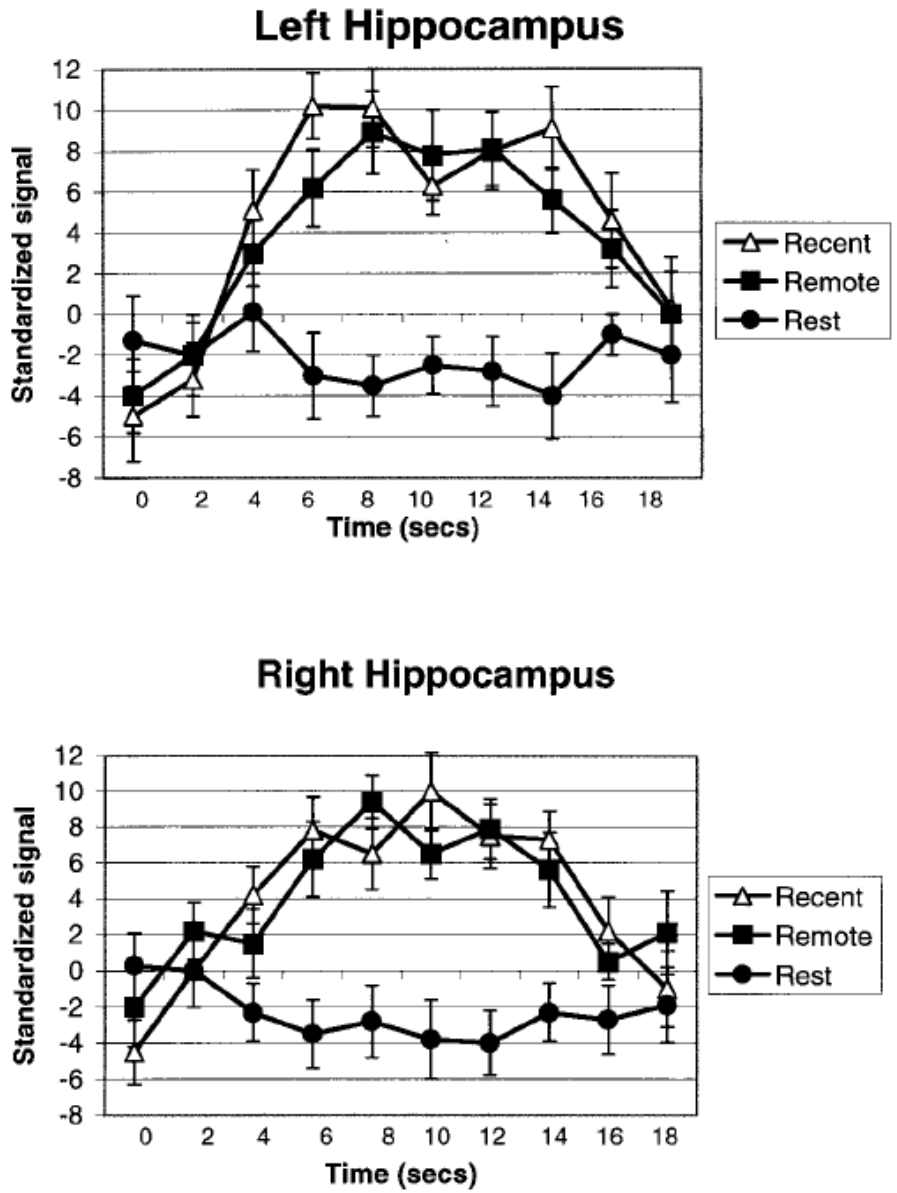
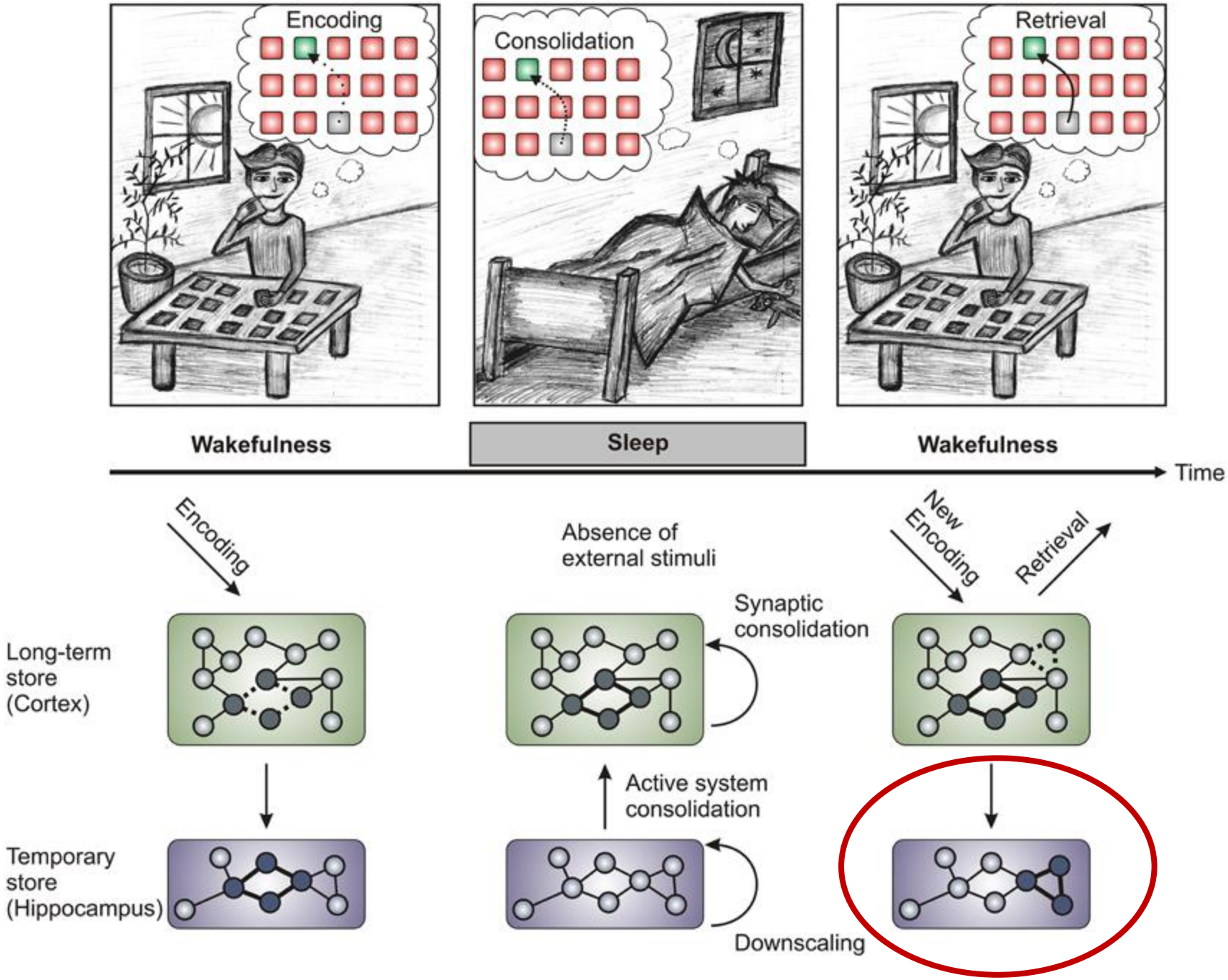
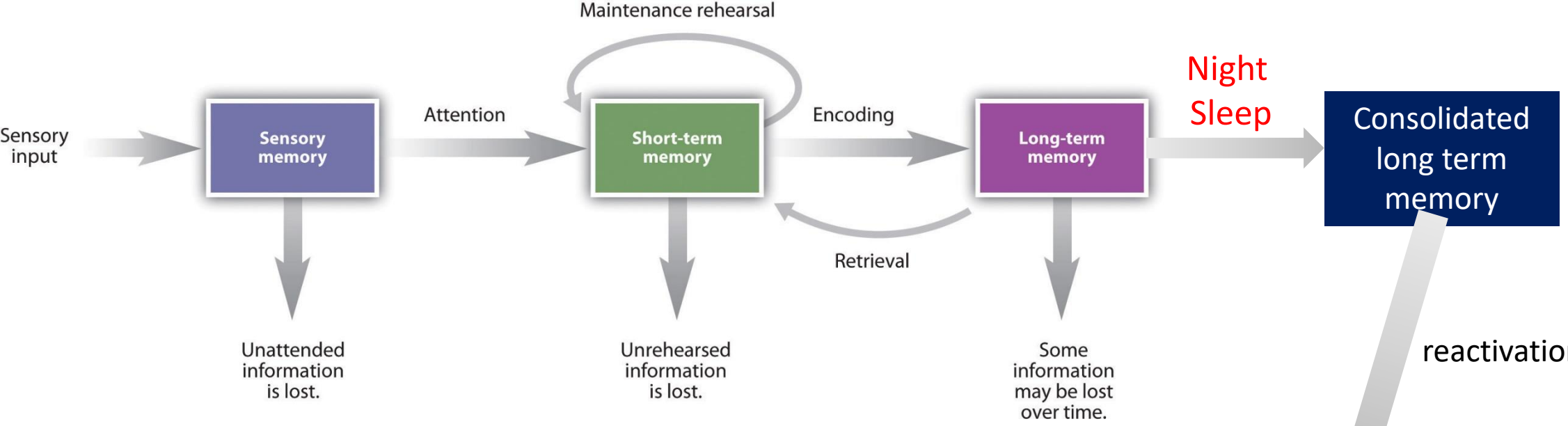


FIGURE 3. Mean (SEM) activations in left and right hippocampus for recollection of recent events, remote events, and rest, from three subjects who were unaware of the event cues that were to be presented in the scanner.


Encoding
Consolidation
Retrieval
Wakefulness
Sleep
Wakefulness
Time
Encoding
Absence of
external stimuli
New
Encoding
Retrieval
Synaptic
consolidation
Long-term
store
(Cortex)
Active system
consolidation
Temporary
store
(Hippocampus)
Downscaling

- Memory is not permanent, not static
- It continuously evolves



Night Sleep

Consolidated long term memory

reactivation

Labile memory trace

Novel experience

Stress & Depression

Disrupted memory

Updated memory

Reconsolidation

Each time a memory is recalled, it may become vulnerable again until it has been "reconsolidated"

Protein synthesis inhibitors (chemicals) or ECT.

Hot
Snow
Warm
Winter
Ice
Wet
Frigid
Chilly
Heat
Weather
Freeze
Air
Shiver
Arctic
Frost


NISSAN
TS10EU1297

Evolutionarily, what do we benefit from such a complex system?

Word list memory

Cold

DRM (Deese-Roediger-Mc Dermott) – Paradigm

(Deese, Roediger, & McDermott, 1995)

Hot
Snow
Warm
Winter
Ice
Wet
Frigid
Chilly
Heat
Weather
Freeze
Air
Shiver
Arctic
Frost

→ **COLD**

(critical lure)

False Memory

Incorrectly associating words or experiences to our memories

Mental context that links all the words

- Color of the two cars in the picture?
- What was written on the building behind?
- Car number?

Elizabeth Loftus

Instances of false memory – eye witness testimony

Crime, law, memory – Ted talk

Creating False Memories in the Real World

A

B

Photo illustration by Slate, original images by Getty; left: SAUL LOEB/AFP/Getty Images, right: JUAN BARRETO/AFP/Getty Images.

False Memory

- Related to the phenomenon of source monitoring errors is **false memory**, or memory for events that never actually happened
- In laboratory research, false memories are particularly likely to occur when people are prompted to imagine missing details; later, they may mistakenly remember those details as the truth
- One study reviewed 62 cases in which people were convicted of crimes and later exonerated based on DNA evidence. In more than 80% of these cases, the crucial evidence leading to conviction was eyewitness testimony in which witnesses had mistakenly identified people later proven to be innocent

Evolutionarily, what do we benefit from such a complex system?

- What do you plan to do after your semester is over?

Mental Time Travel

1) Remember our past – The nature of information processing, in the internal circuits in the hippocampus, allow our past experiences to be retrieved with exceptional detail, as though we were reliving those moments.

- Adaptive advantage of episodic memory - it allows us to learn from the same event more than once. We can mentally revisit events and compare them to similar and related episodic memories.

2) Simulate the Future – By using our past experiences, we can construct or simulate future scenarios, predict outcomes in novel circumstances by reorganizing our past experiences.