

# Memory, Individuality, and Unconscious: a Biological Perspective

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A major outstanding issue in the field of psychoanalysis and psychotherapy is to understand the **underlying mechanisms**

- The “talking cure” relies heavily on language, words, and declarative memories, therefore, on conscious memory processes.
- These memories tap into the unconscious.
- How?



# *Memories*

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- Memories are the essence of who we are, therefore, how we think, feel, and act
- Understanding the mechanisms of memories will provide an understanding of information processing, mindset, personality traits, but also body representations, and where/how changes can occur
- Therapeutic approaches, whether via “the talking cure” or body language and bodily communications, are rooted in the processes of memory reactivation and new memory formation

**Today’s focus: the dynamic nature of memories of the  
“explicit” system (the medial temporal lobe–mediated)  
and its connections to the unconscious**

In the “Interpretation of dreams,” Freud writes:

*“...we may describe as a memory trace and to the function relating to it we give the name of memory...Memory traces can only consist in permanent modifications of the elements of the system. But, as already pointed out elsewhere, there are obvious difficulties involved in supposing that **one and the same system can accurately retain modifications of its elements and yet remain perpetually open to the reception of fresh occasions for modifications**....We must therefore assume that the basis of association lies in the mnemonic **systems**.....Our memories-not excepting those which are mostly deeply stamped in our minds-are in themselves unconscious. They can be made conscious; but there can be no doubt that they can produce all their effects while in an unconscious condition “*

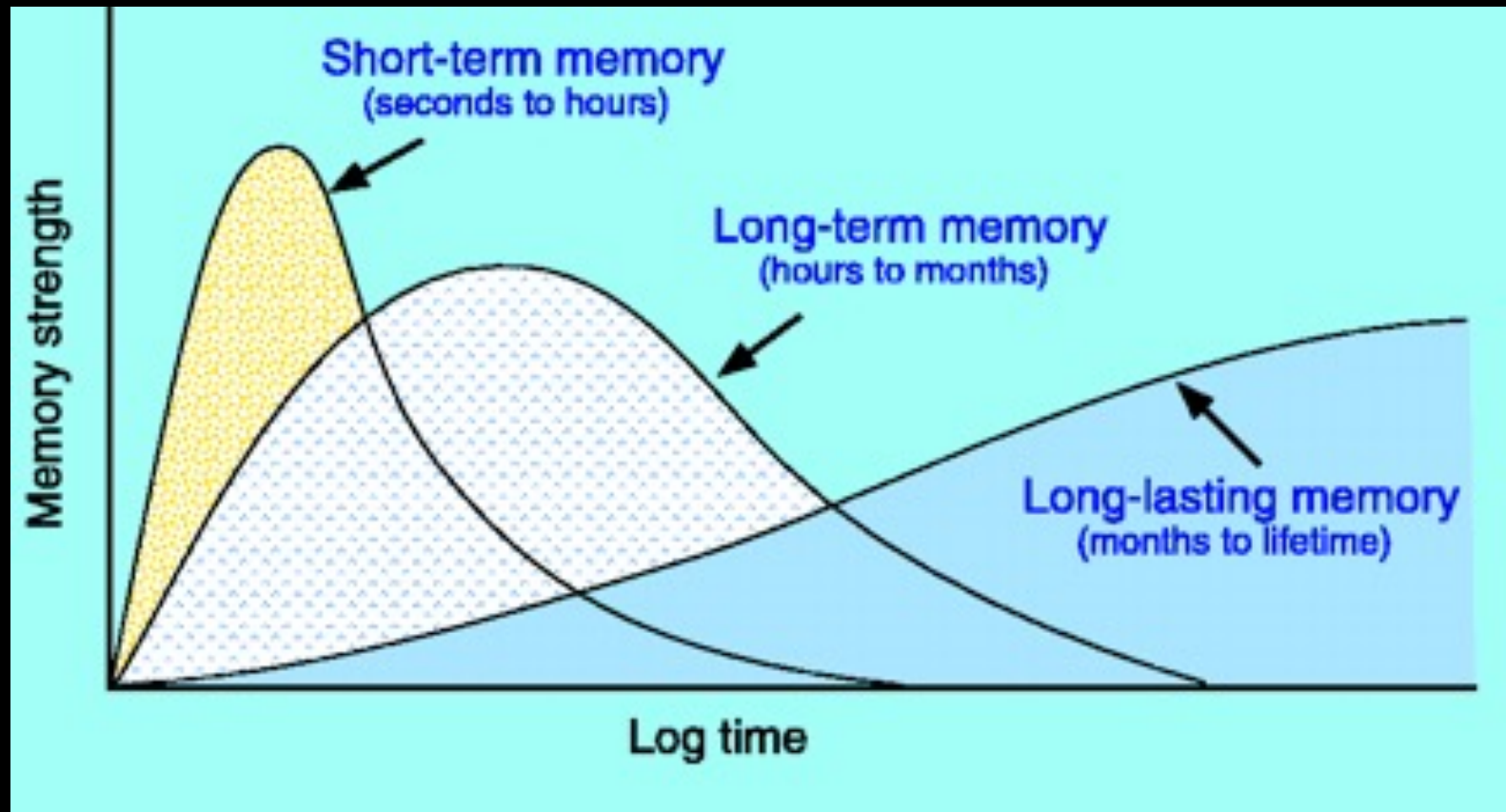
- Permanent modification
- Resulting from a system
- Unconscious

## What I hope emerges from my talk today

How therapeutic work must consider that memories are very dynamic because:

- They exist in different forms
- They are based on memory processes, which change over time and with new experiences (consolidation and reconsolidation)
- They include emotional charges (modulation)
- The age when they were created
- They form mental schemas of the individual (early memories)

# Different Forms of Memory Defined by Their Duration



*From: McGaugh. Memory-a century of consolidation. Science, 2000*

## **Memory Processes:**

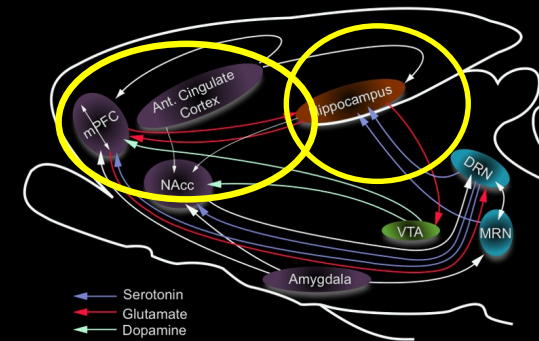
- **Acquisition**
- **Short-term memory**
- **Long-term memory**
- **Memory Consolidation**
- **Retrieval (recall)**
- **Reconsolidation**
- **Storage**
- **Forgetting**

## In adults: long-term episodic memories undergo consolidation

A new memory is initially labile and in fact temporarily sensitive to many types of interference. Over time it becomes stable and insensitive to the interferences; this process of stabilization is known as *memory consolidation*.

Mechanisms: molecular and system levels

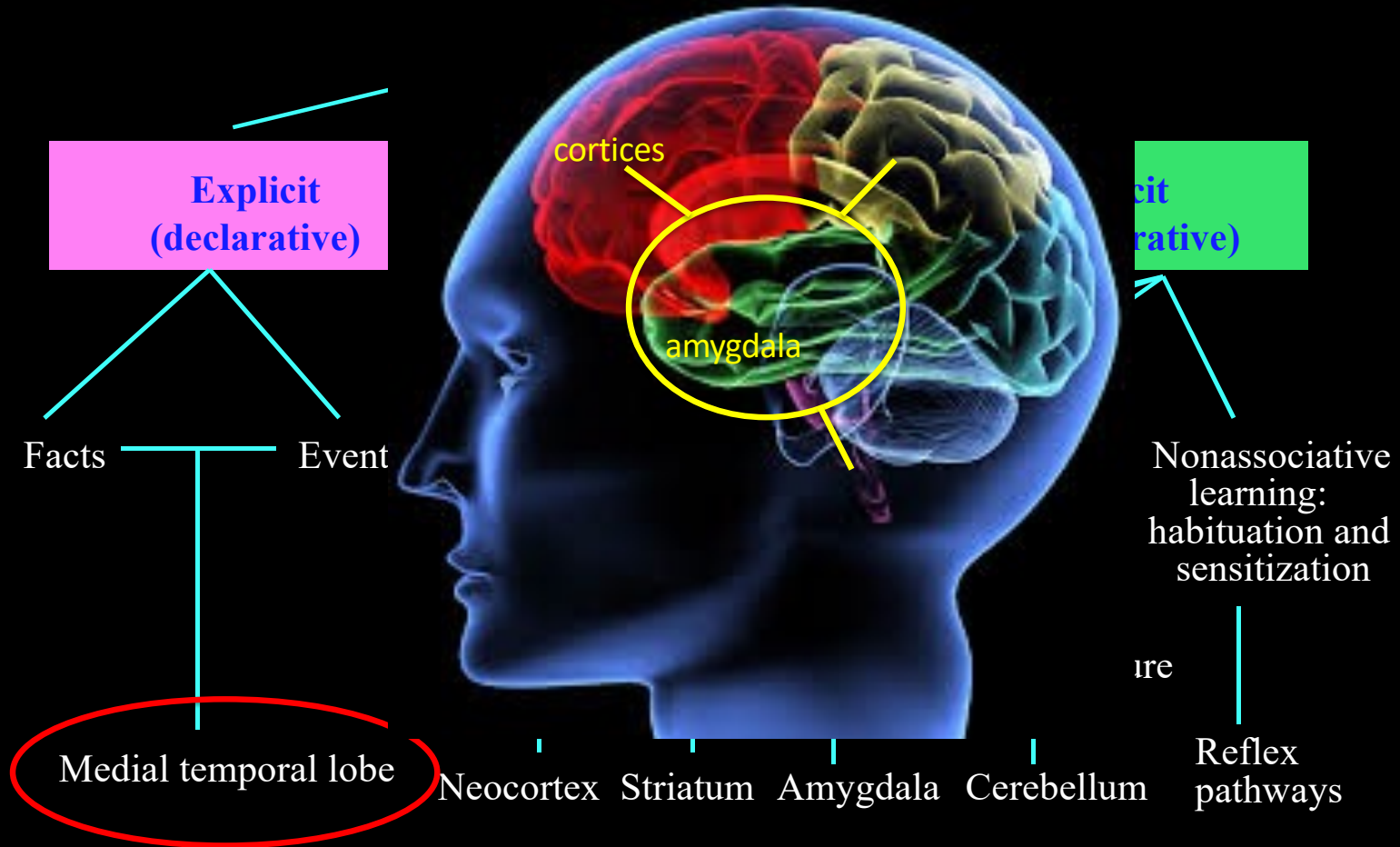
MECHANISMS: consolidation requires a cascade of molecular mechanisms starting from mRNA translation and gene expression, resulting in structural changes in different brain regions, including the hippocampus and prefrontal cortex in which activity reverberation leads to **system consolidation**.



Biological changes such as gene expression, epigenetics, translational and posttranslational changes in multiple cell types

Are there unconscious elements to these memories?

# Memory



# Memory recall and memory reconsolidation



## Reconsolidation has several boundaries and cannot not -alone explain the therapeutic process

- **Reconsolidation does not occur with all retrievals.**
  - **Retrievals lead to several processes, including reconsolidation, new learning, counterconditioning, and in some cases extinction**
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**-Reconsolidation does not occur every time a memory is recalled**

**-One major variable is the age of the memory: reconsolidation is temporally limited. Older episodic memories do not show fragility after recall, i.e., they do not reconsolidate**

**-A second major variable is memory strength: Very strong memories, such as memories of traumatic events, do not become labile after recall**

**-Reconsolidation of different types of memories (e.g. implicit memories), including procedural memories have distinctive features. It is NOT a one size fits all**

**-Memory updating with distinct information occurs via new memory consolidation**

Milekic and Alberini, Neuron 2002; Alberini TINS 2005; Tronel et al. Plos Biol. 2005; Inda et al. J. Neurosci 2011; Alberini Frontiers 2011; Alberini JAPA, 2015; Book on memory reconsolidation

For clinical aspects: An important dynamic dimension to think about and use is new experiences, building on past memories

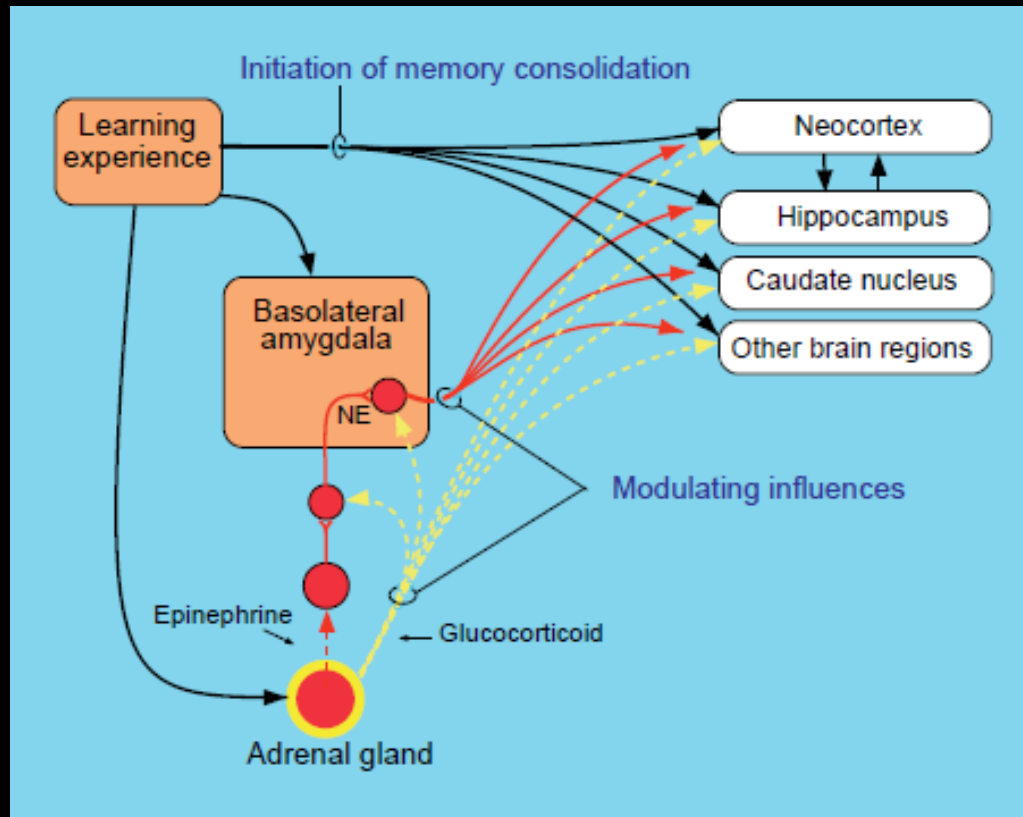
consolidation of new memories and reconsolidation can occur in parallel following retrieval. They contribute to different types of memory updating

In the adult brain: trace reassociation and the role of the past (individual experiences)

## Another dynamic foundation of memories is modulation

- Emotionally arousing events tend to be better remembered,
- Consistent with the hypothesis, adrenaline and cortisol enhance long-term memory.
- Consolidation in the amygdala and hippocampus is not the same mechanism

# Memory Modulation: circuitry and mechanisms

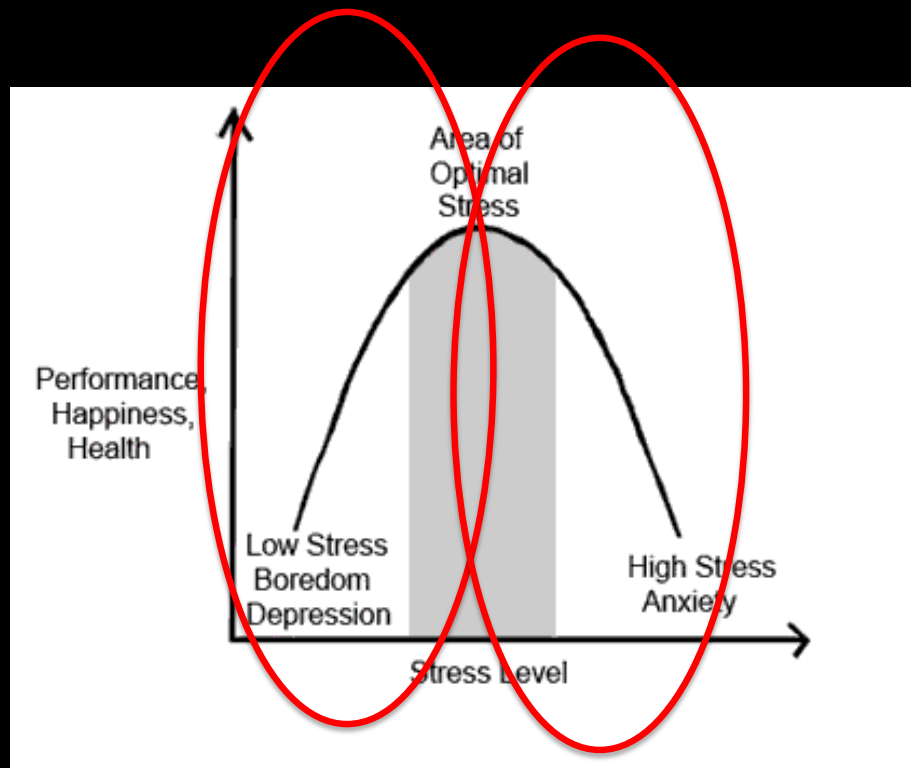


Noradrenaline  
and  
Glucocorticoids

*McGaugh, 2000, Science*

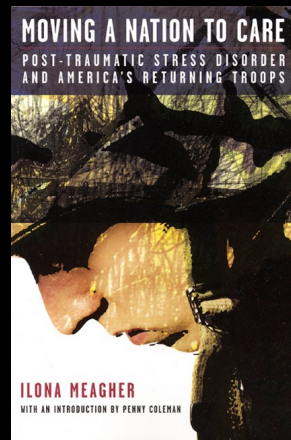
# The levels of arousal/stress during learning modulate memory expression and storage

The inverted U relationship or Yerkes-Dodson law





We have reproduced in rat models the inverted U curve of a memory and studied the underlying biology



- The biology of the hippocampus and prefrontal cortex involved in forming and storing adaptive vs. traumatic memories are different
- The circuitry involved is different
- Traumatic memories are resilient to extinction as well as reconsolidation
- The behaviors of those memories are different

# Learning, memory, and traumas in children



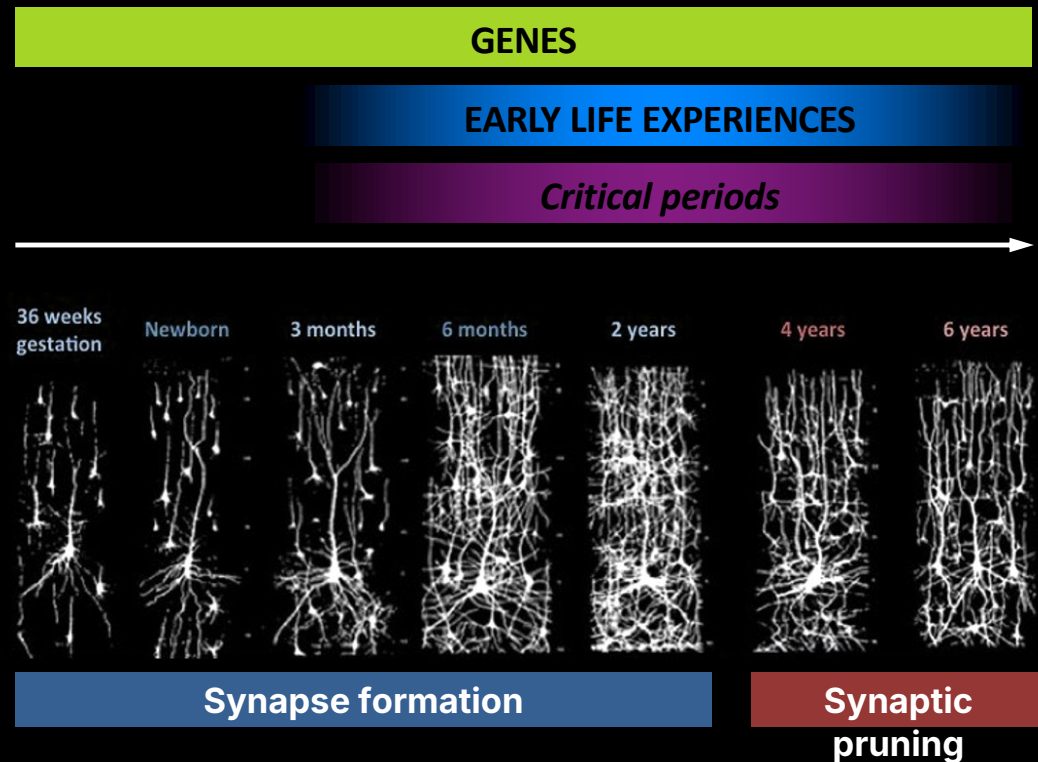
## Another dynamic dimension of memory:

- Age: memories formed at early ages are very different



The behavior is different  
The biology is different

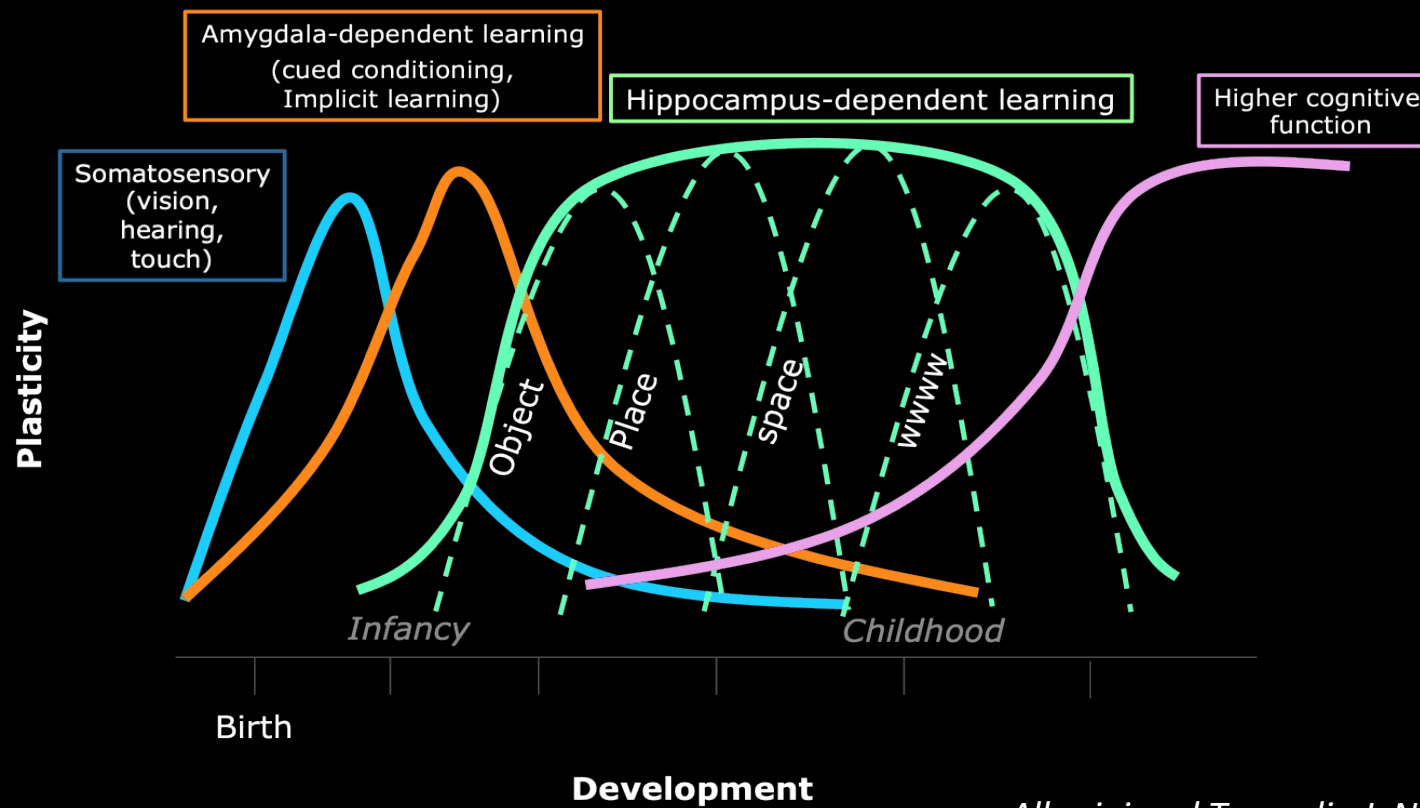
# Genes (nature) and Early Life Experiences (nurture) cooperate during Brain Development



Golgi-stained sections of human middle frontal gyrus showing growth of pyramidal neuron soma and dendrites. Courchesne et al. 2005.



Our studies showed that the hippocampus-dependent learning and memories, like sensory systems, develop and mature through **critical periods**



*Alberini and Travaglia J. Neuroscience 2017*

## Summary of our studies and conclusions

- Infant episodic-like learning stores long-lasting memories through which it develops the hippocampus-dependent system
- Infant learning is highly efficient, but the adult memory storage ability has not yet developed, as the system is laying the foundations for **schemas** rather than forming detailed episodic memories
- The infant memory schemas stored in a “latent” (not yet explicit) modality influence behaviors throughout life.

**More specifically, the infant episodic learning consolidates stable schemas via the dHC-PFC system and stores them in the PFC. These schemas are based on experiential traces and, in adulthood, re-engage the dHPC to facilitate the formation of new memories.**

## General Conclusions

Studying the mechanisms of memory will greatly help in discussing psychoanalytic theories and identifying more precise approaches in therapy

For example:

Memories of traumas are different and intimately linked to a distinct modulation. Approaching traumas requires focusing on emotional regulation and building new memories at the appropriate time

It also requires an understanding of the individual memory schema.

Thank You