

# Trauma and memory in the brain

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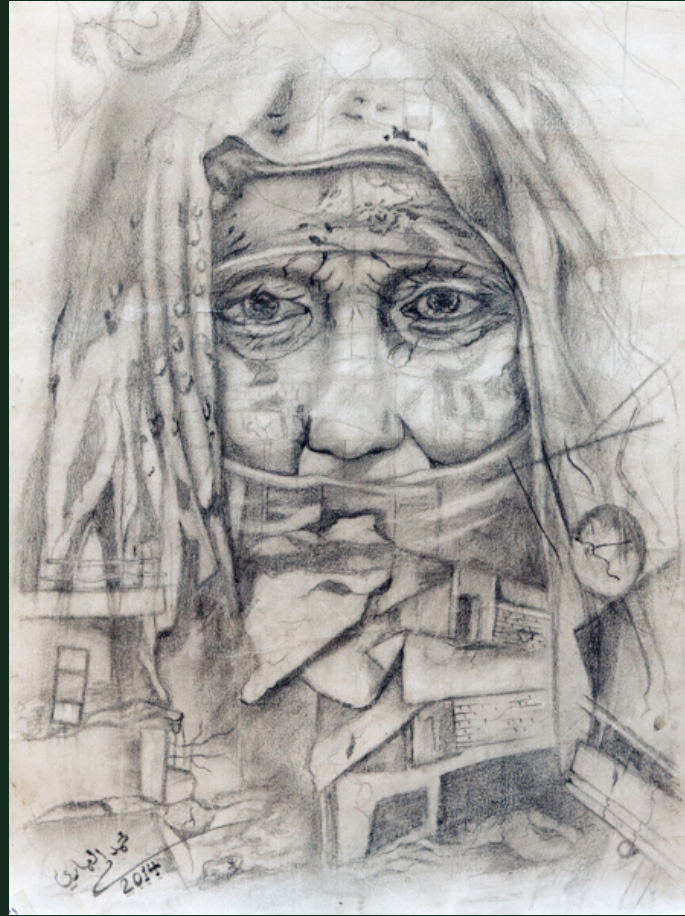
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# Core questions

- What can the neuroscientific perspective tell us about stress, trauma, and memory?
- How can this inform work with refugees and asylum seekers?
- What is the utility of such knowledge in a legal context?

# Key points

- Autobiographical memory requires the joint activity of multiple interacting brain systems
  - Hippocampus
  - Amygdala
  - Prefrontal Cortex (PFC)
- Chronic stress affects the structure and function all of these key brain regions
- This can lead to disruptions in autobiographical memory, making the task of recalling past events in one's life particularly difficult



"My Grandmother" by Mohammed Al-Amari

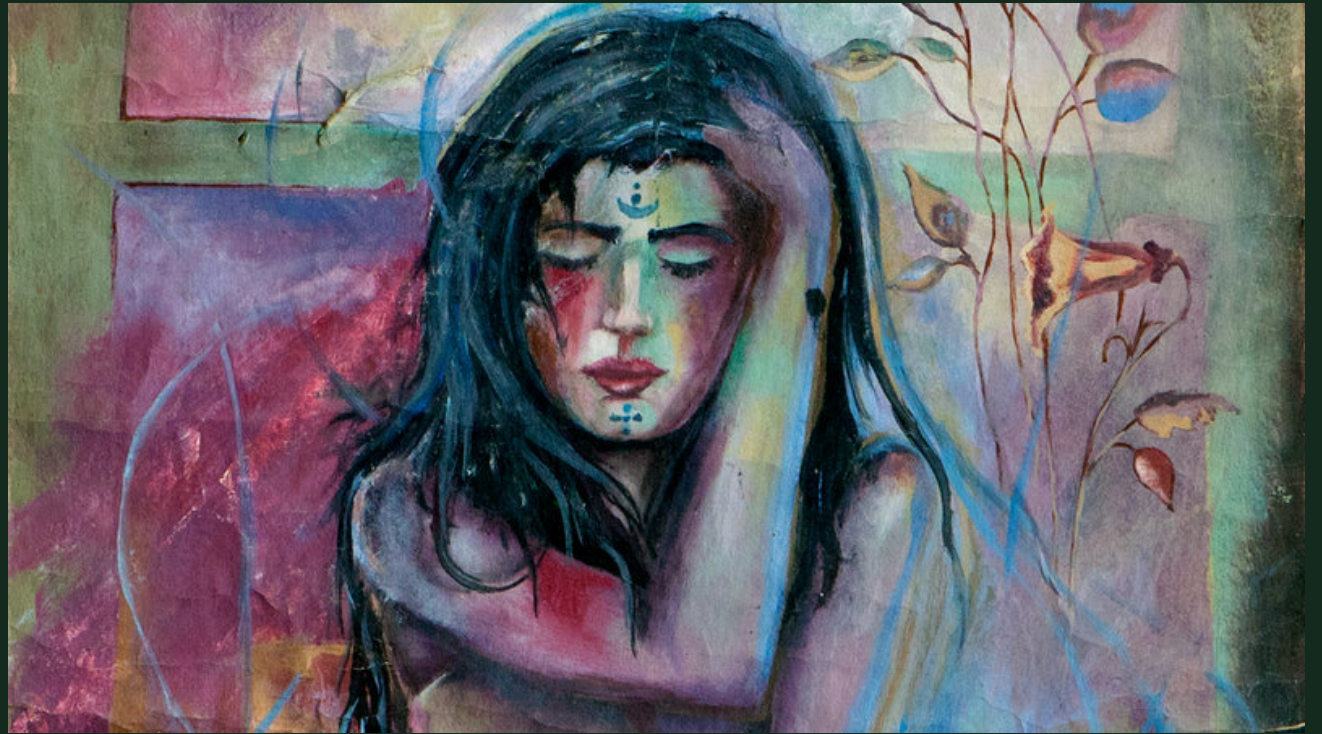
# The refugee's predicament

*Why does an understanding of memory processes specifically matter for refugee and asylum seekers?*



# What is autobiographical memory?

- The ability to remember past events from one's life
- Constitutes much of what a refugee or asylum seeker is asked to provide in a legal context
- A declarative memory that blends both **semantic** and **episodic** information
- The ability to report an autobiographical memory requires successful **encoding** and **retrieval**



“Exile from One’s Country” by Mohammed Al-Amari

# Studies of autobiographical memory **encoding** are lacking...

Research on other forms of long-term declarative memory tells us that the **hippocampus** plays an important role in binding, while the **PFC** is important for organization and elaborative processing

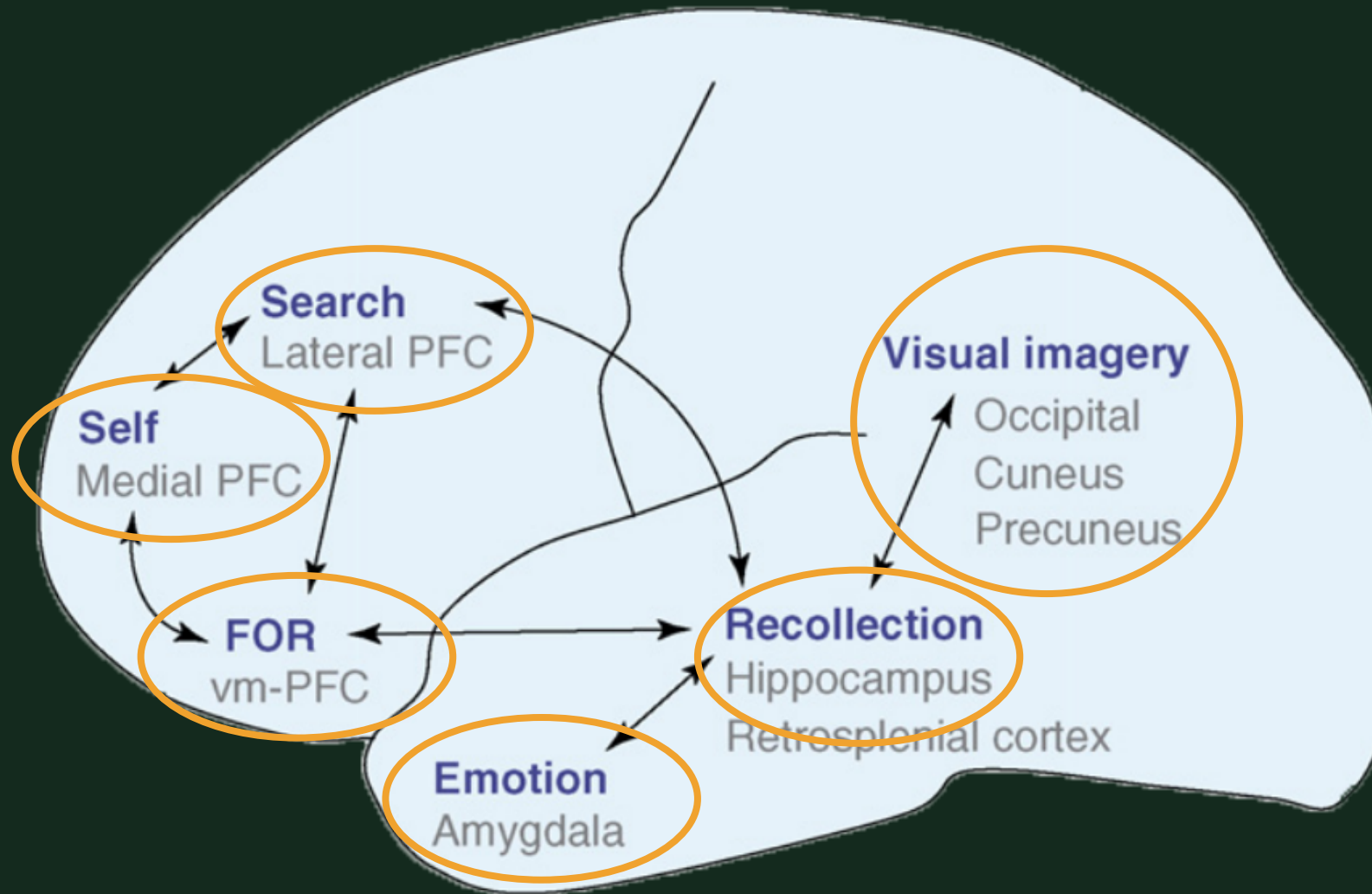


Following consolidation, memories are stored in traces, distributed throughout the cortex

"Quiet Noise" by Parmis



# Autobiographical memory **retrieval** involves a broad assembly of brain regions





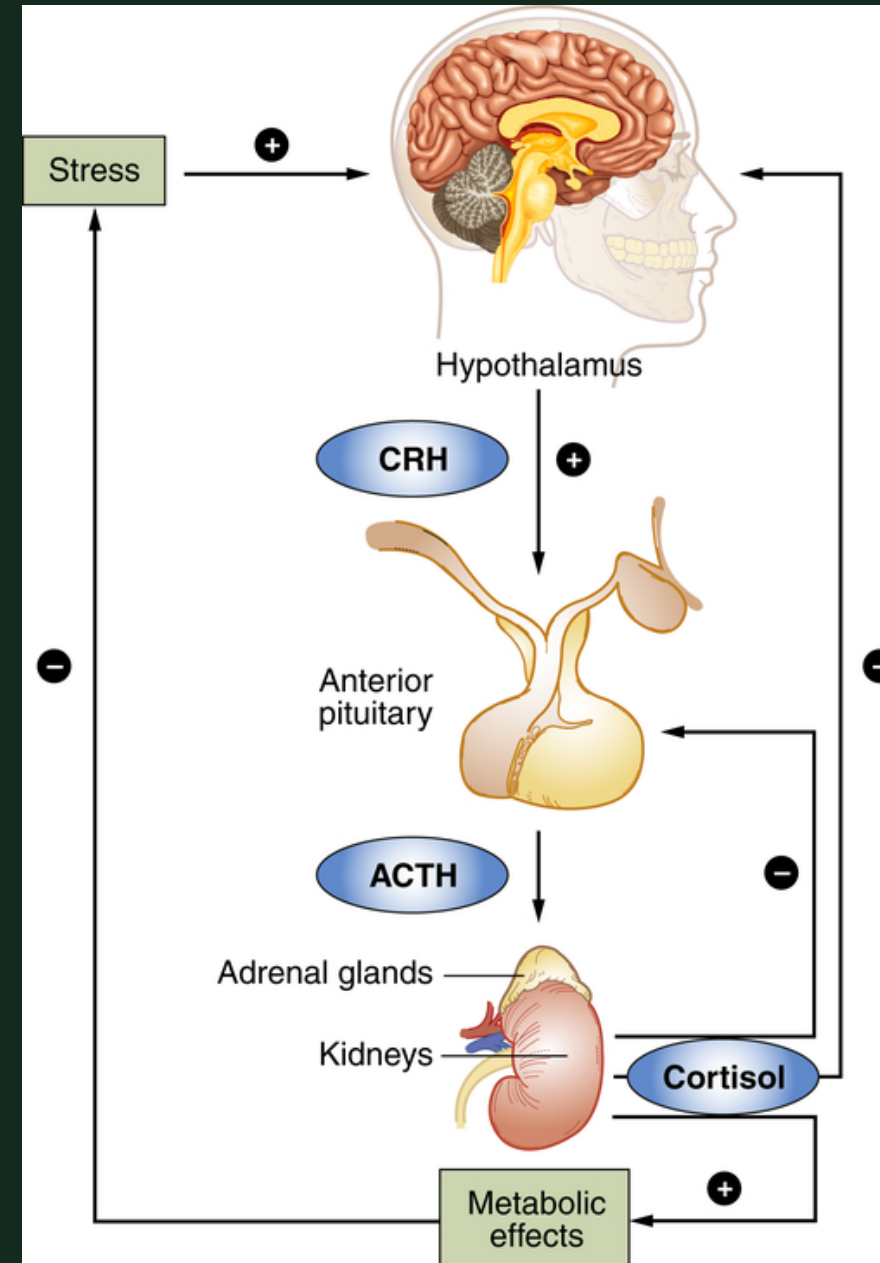
Azraq Camp, Jordan

The brain and memory under conditions of stress and trauma



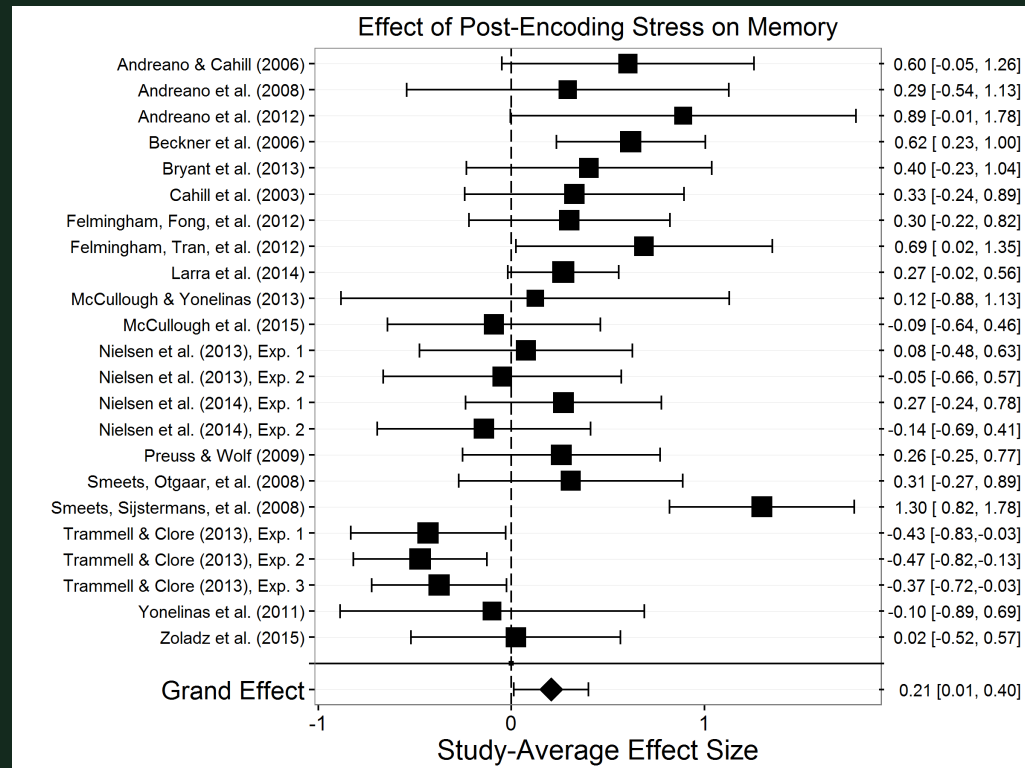
# Stress activates the HPA (hypothalamus-pituitary-adrenal) axis

- **Amygdala** can activate the HPA axis via projections to the hypothalamus
- **Hippocampus** plays a role in regulating stress – essential for returning **cortisol** to baseline following stress
- **PFC** can also regulate the stress response

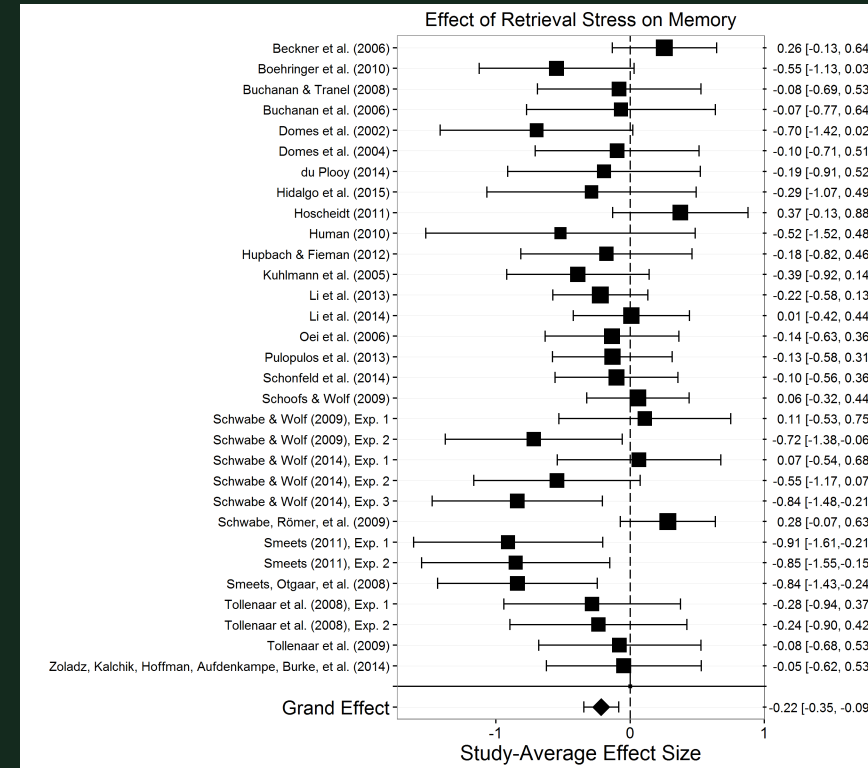


# Acute stress effects on memory depend partly on timing

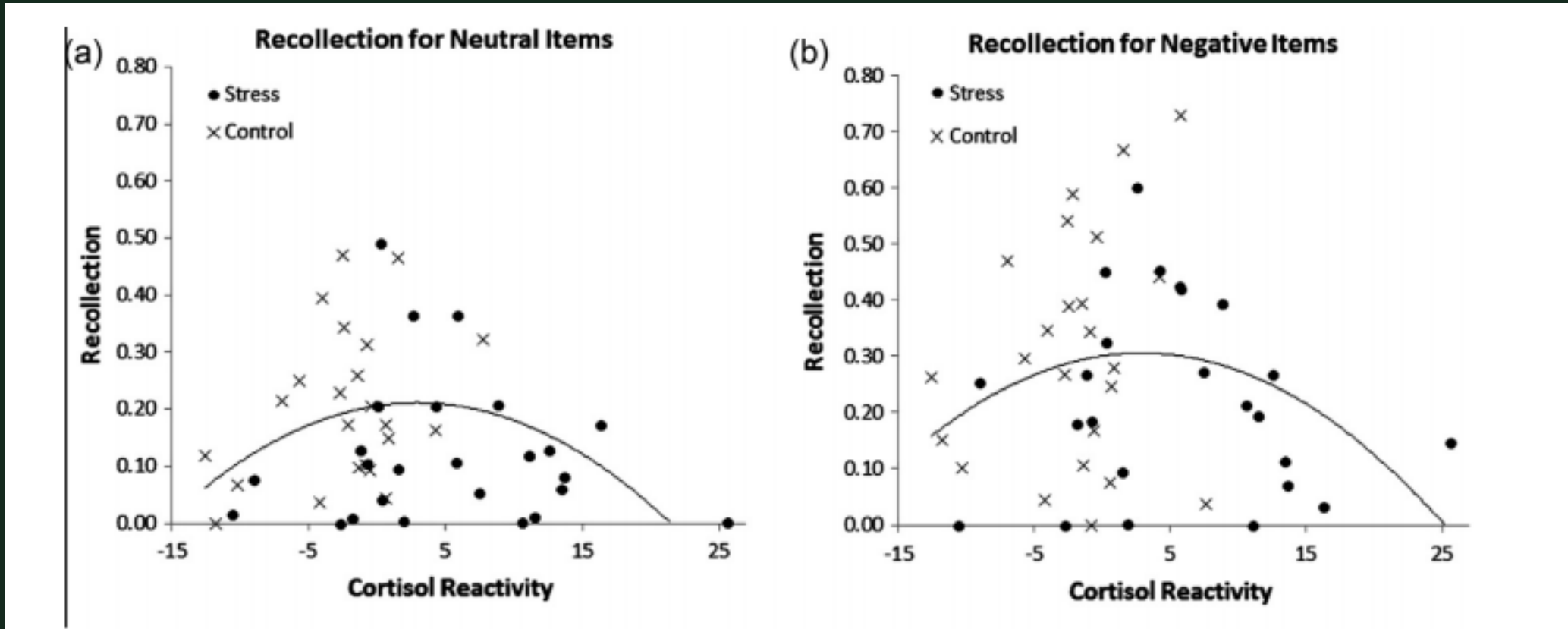
Stress post-**encoding** enhances memory performance



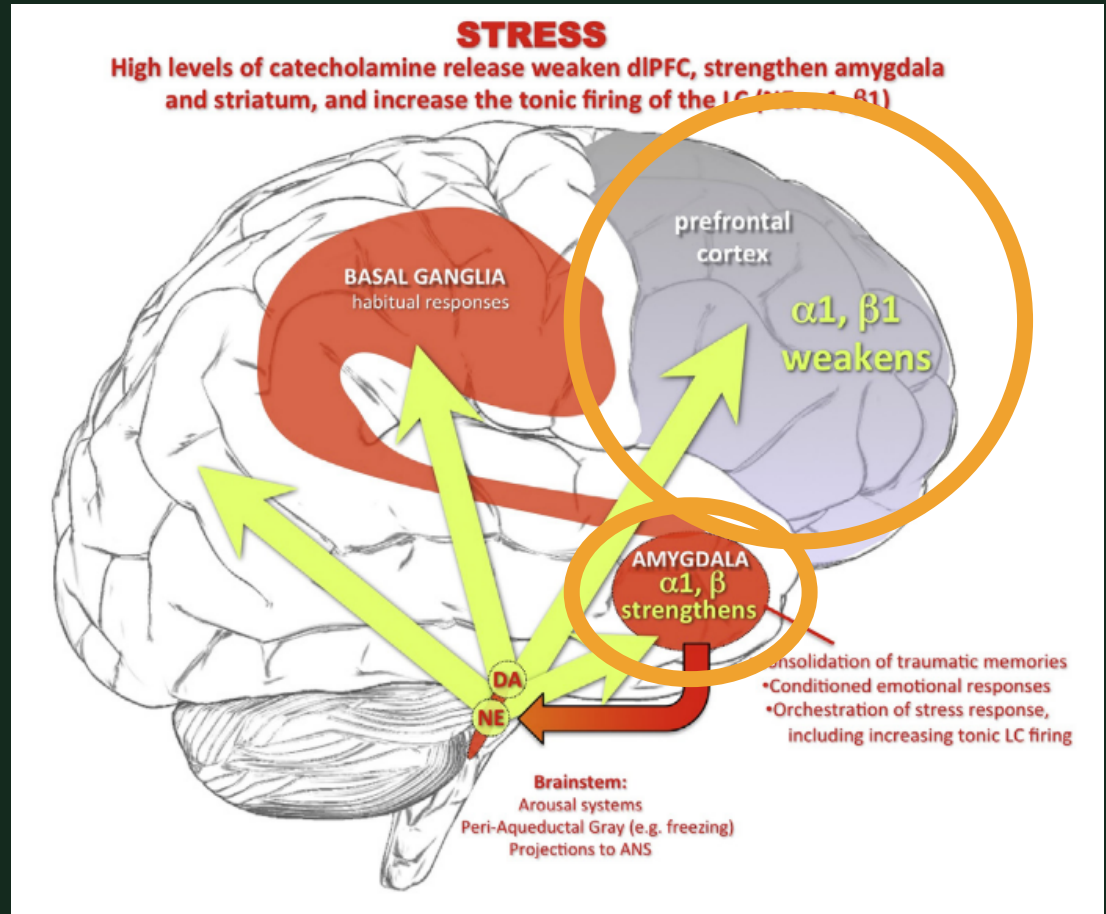
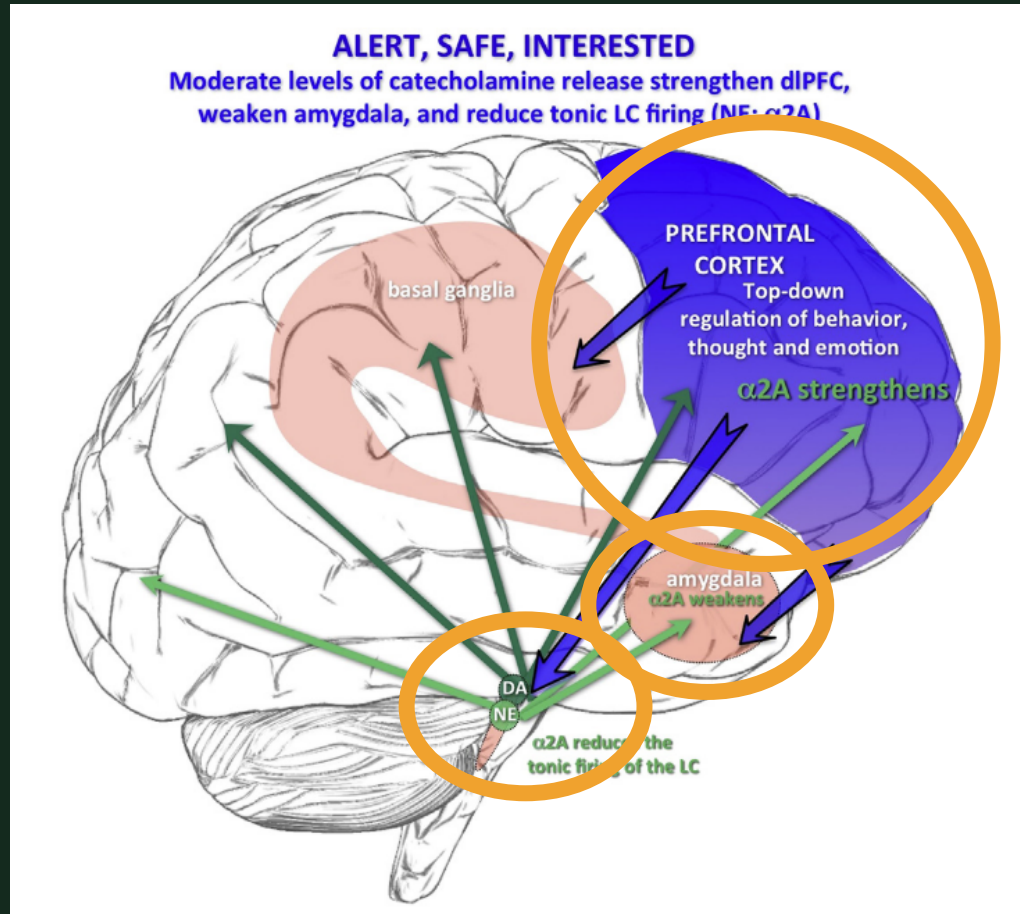
Stress during **retrieval** dampens memory performance



# Severity of acute stress has differential effects on memory



# Acute, *uncontrollable* stress can strengthen the action of the **amygdala** and weaken the influence of the **PFC**

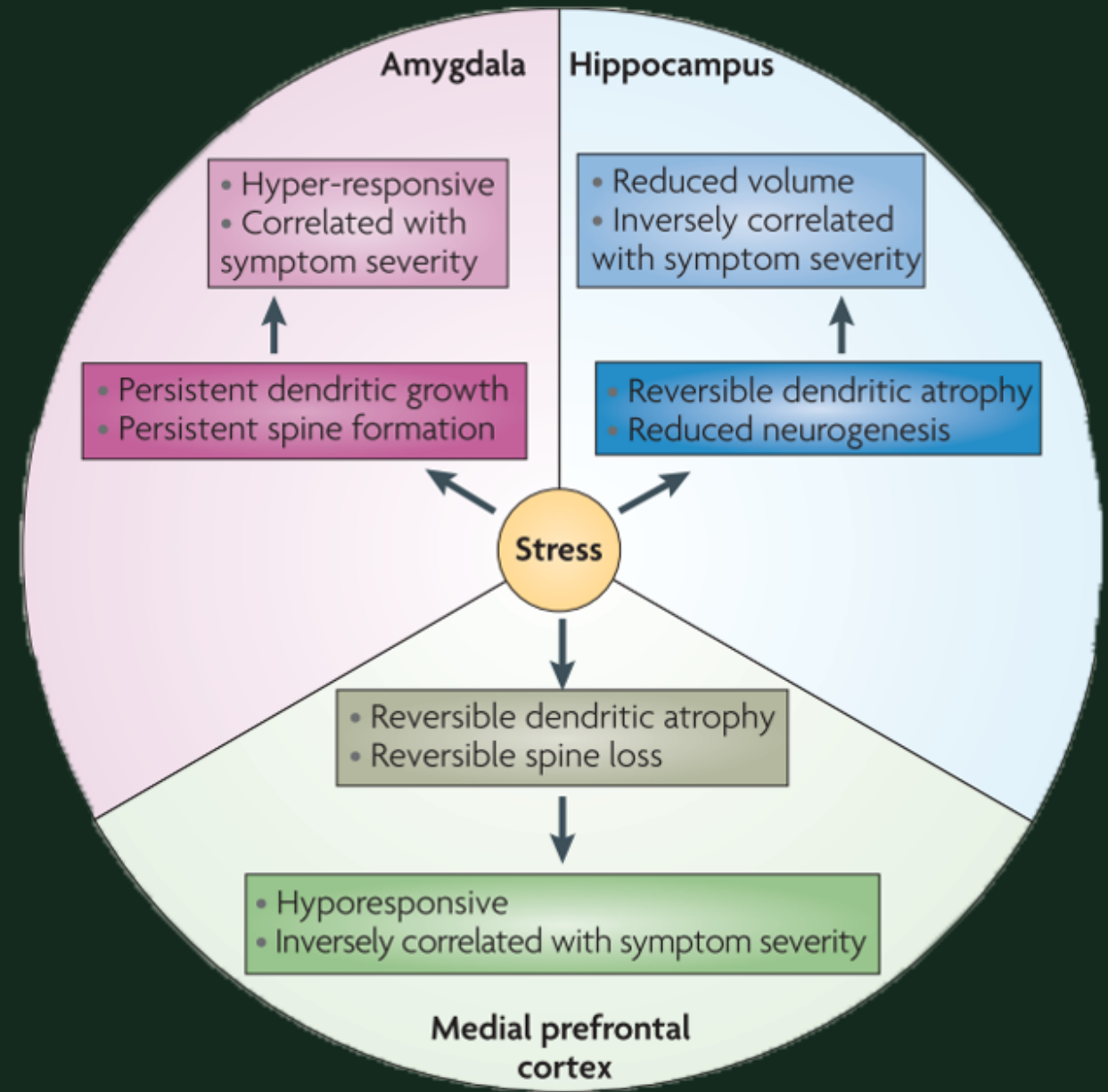




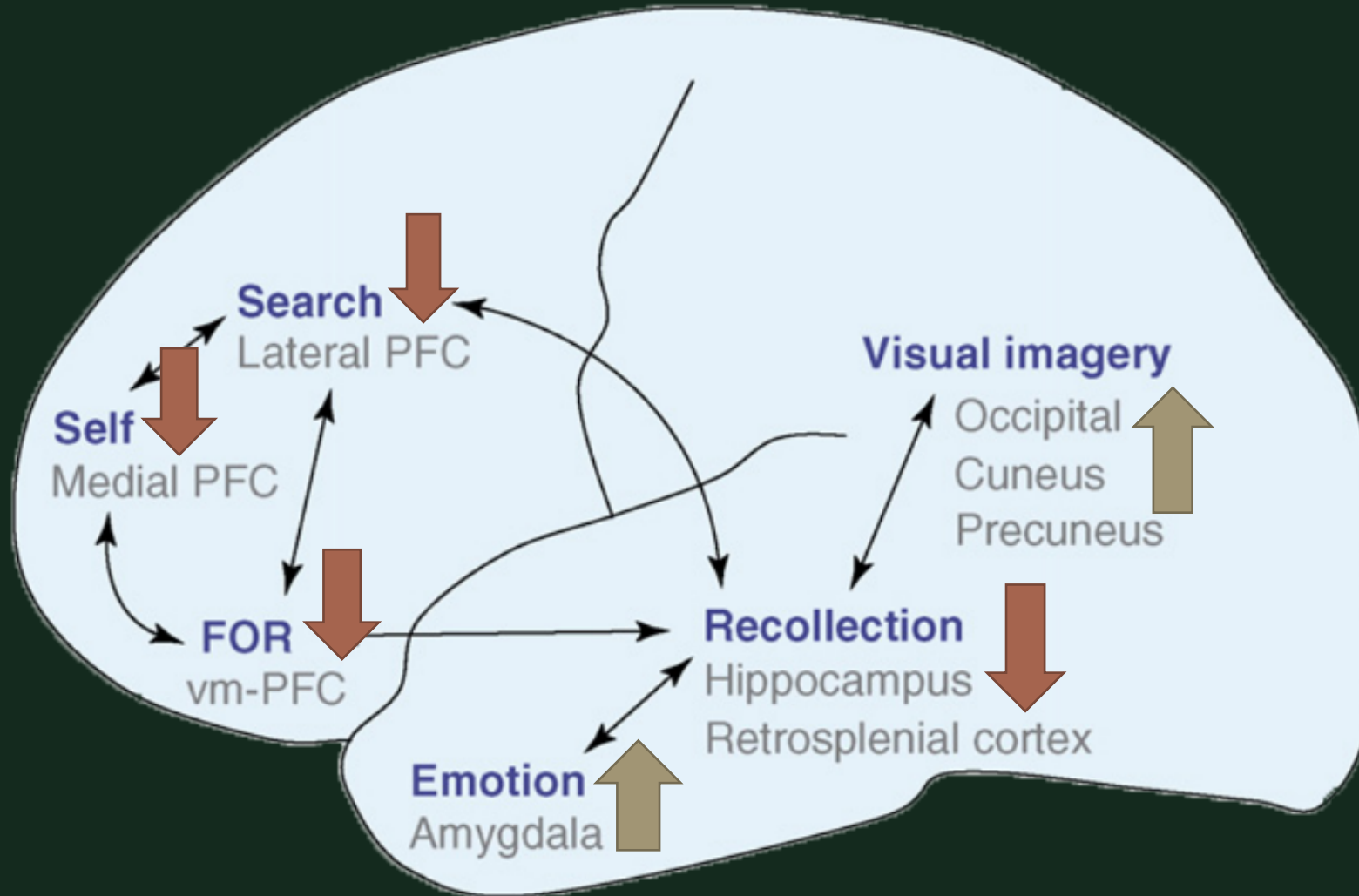
# Chronic stress leads to remodeling of neurons and connections in the **PFC**, **hippocampus**, and **amygdala**

Over time...

- High levels of stress-related hormones and neurotransmitters (**cortisol** and **catecholamines**) lead to:
  - Loss of spines and dendrites in **PFC**
  - Dendritic growth in the **amygdala**
  - Impaired structural and functional plasticity in **hippocampus**



# Alterations throughout autobiographical memory systems under conditions of chronic stress and PTSD



- Increases in amygdala volume and reactivity
- Reductions in hippocampal volume, and neuronal and functional integrity
- Reductions in prefrontal volume and responsivity
- Weakened prefrontal control processes
- Disturbances in self-referential processing in the MPFC
- Alterations in amygdala/hippocampal/prefrontal connectivity

# Challenges and caveats

- Refugees and asylum seekers face complex, chronic stressors
  - May predate need to leave home country, and continue in country of asylum
    - High rates of depression/anxiety, which also affect memory
- Limited direct applicability of laboratory research
  - Most is on acute stress
  - Much of what we know from chronic stress comes from animal models and/or observational studies in populations with PTSD
- Trauma does not equal PTSD
  - Individual differences in PTSD susceptibility (Dopfel et al., 2019)
  - Even within populations with PTSD, different traumatic events may result in different neural modifications (Boccia et al., 2016)
- Individual differences in trauma response
  - Age, gender, early life experience

# This is not the end of the road!

- Neural plasticity: these changes appear to be largely reversible
- Knowledge of neurotransmitters and hormones involved allows for advances in pharmacological interventions
- Potential for community interventions: psychosocial support matters!
- Cross-disciplinary dialogue allows for the development of better support systems



"Mr. Man in the Garden" by Maryam, Neda, and Parastoo Bahrami and Madina and Yalda Sayer



# Key references

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# Panel discussion

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