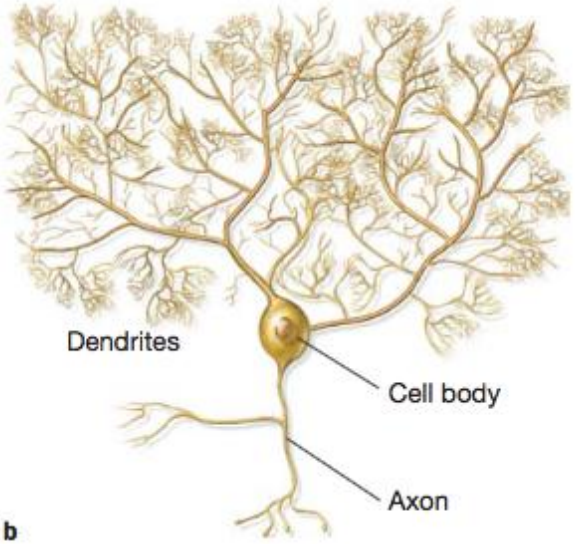
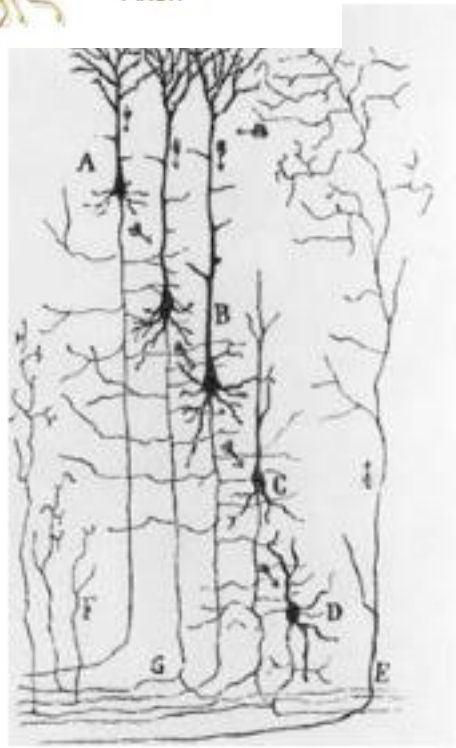
ΝΕΥΡΟΑΝΑΤΟΜΙΑ ΤΗΣ ΜΝΗΜΗΣ/ΜΑΘΗΣΗΣ - ΔΙΑΦΟΡΕΣ ΦΥΛΟΥ ΚΑΙ ΝΕΥΡΟΠΛΑΣΤΙΚΟΤΗΤΑ

Χριστίνα Δάλλα, Επ. Καθηγήτρια Ψυχοφαρμακολογίας-Φαρμακολογίας, Ιατρική Σχολή, ΕΚΠΑ

Golgi, Cajal, Purkinjie…





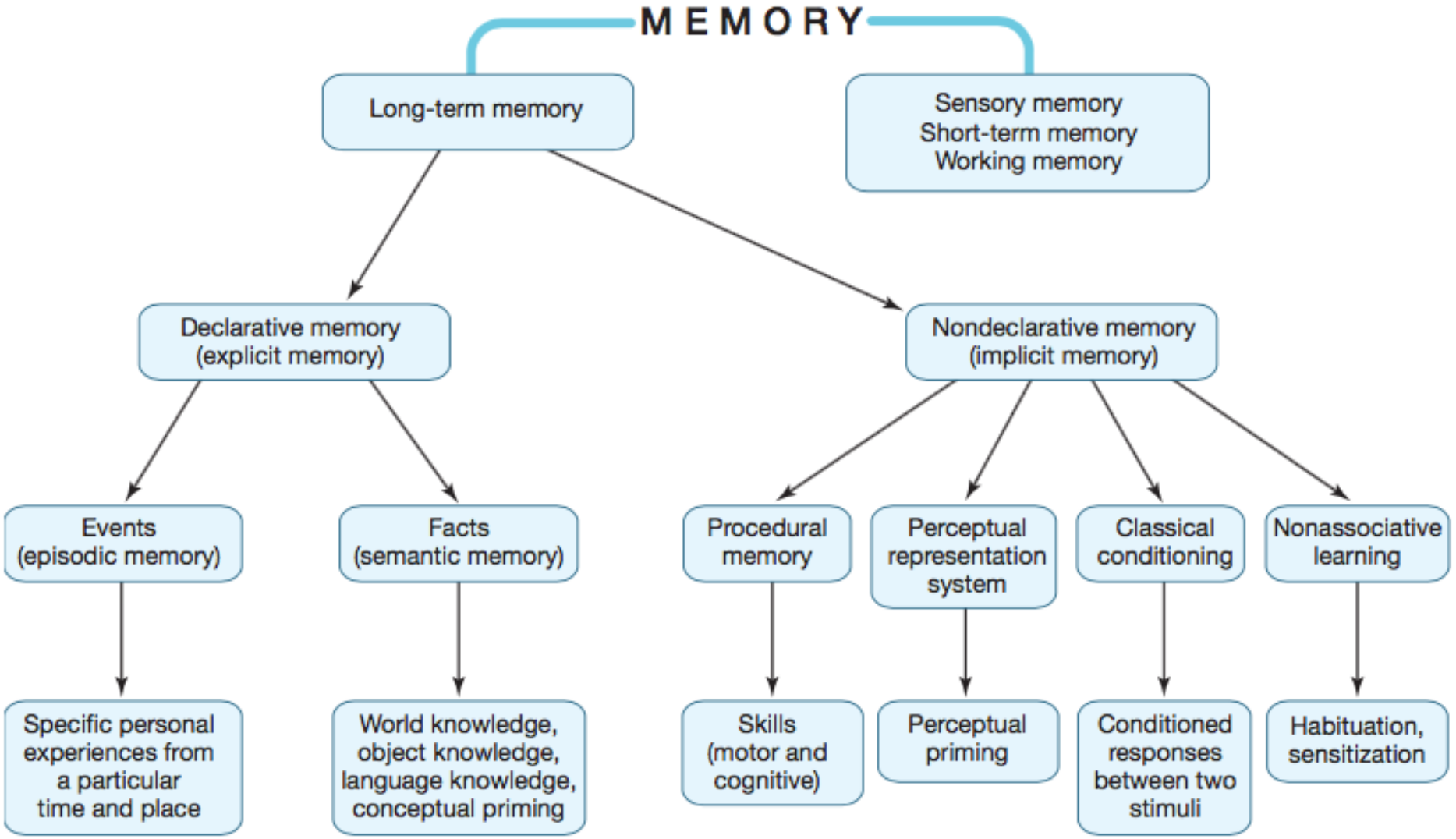


FIGURE 9.2 The hypothesized structure of human memory, diagramming the relationships among different forms of memory.

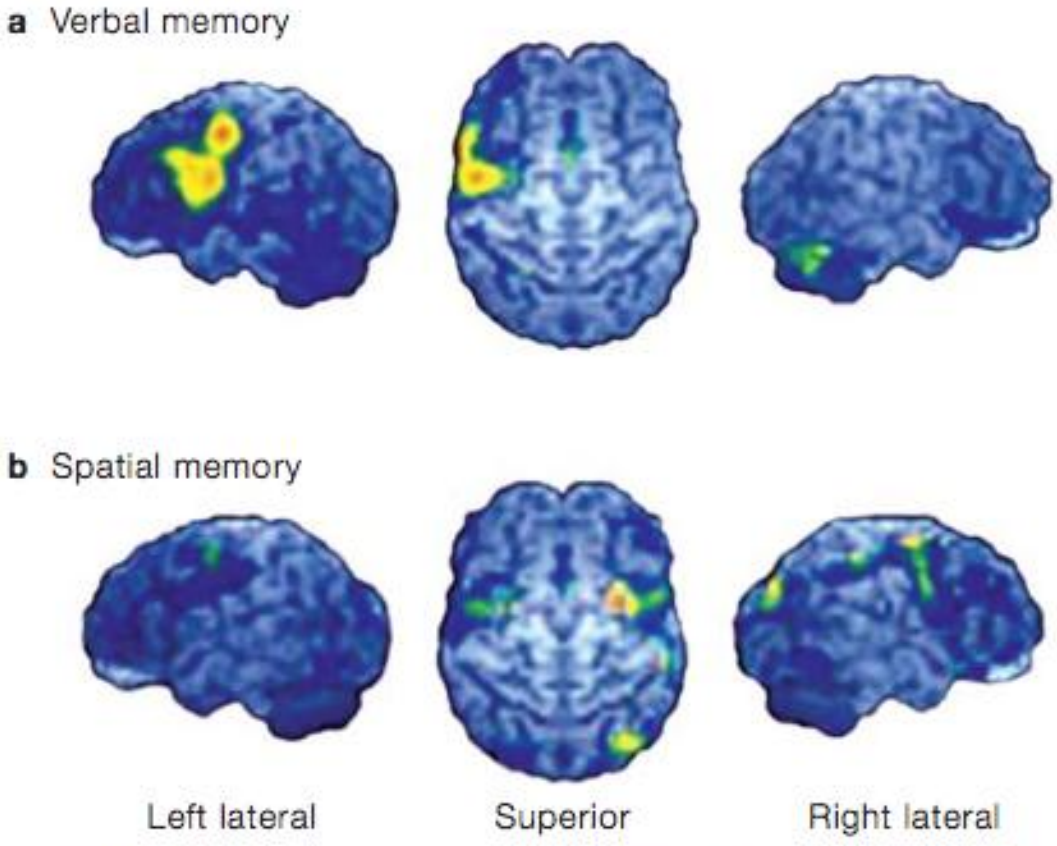
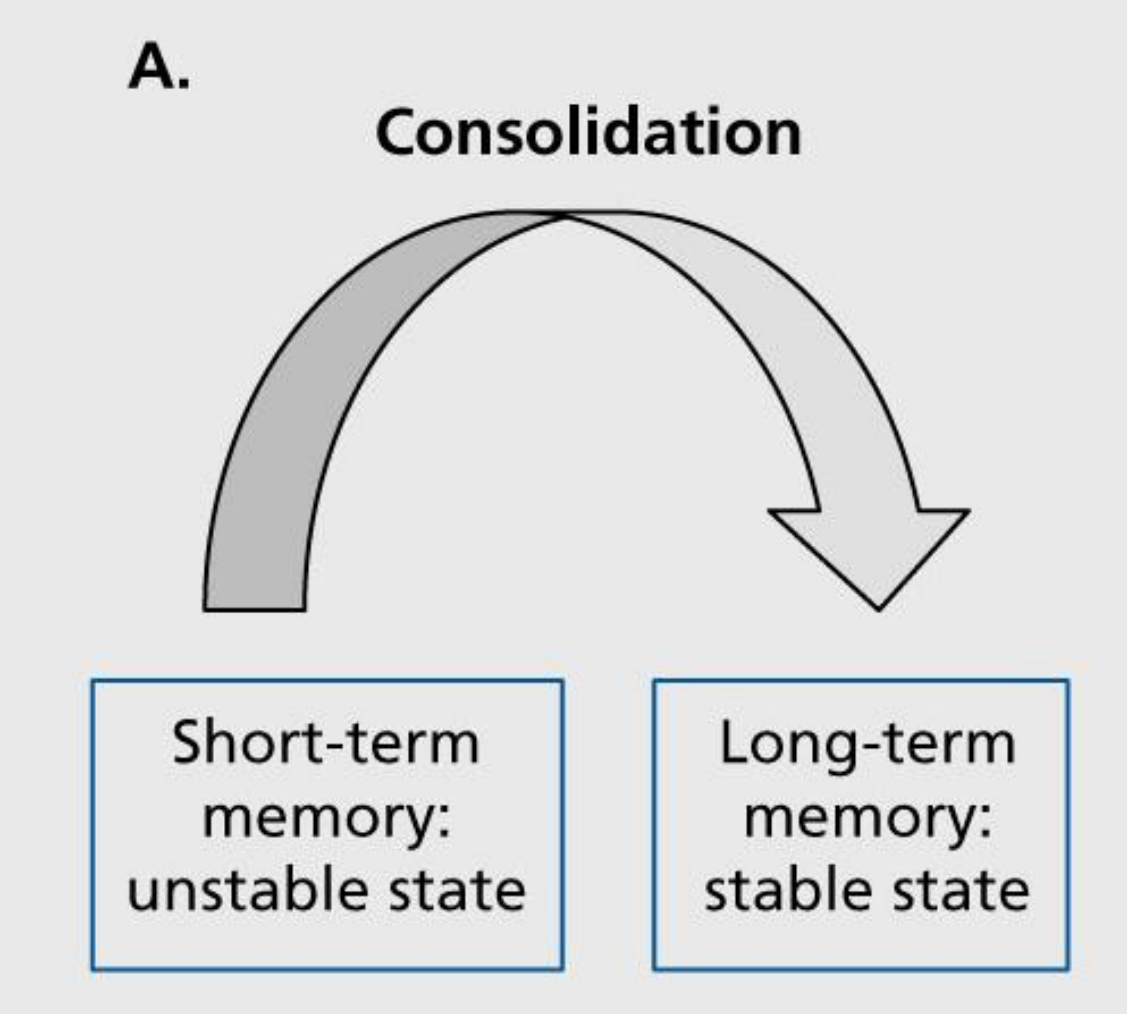
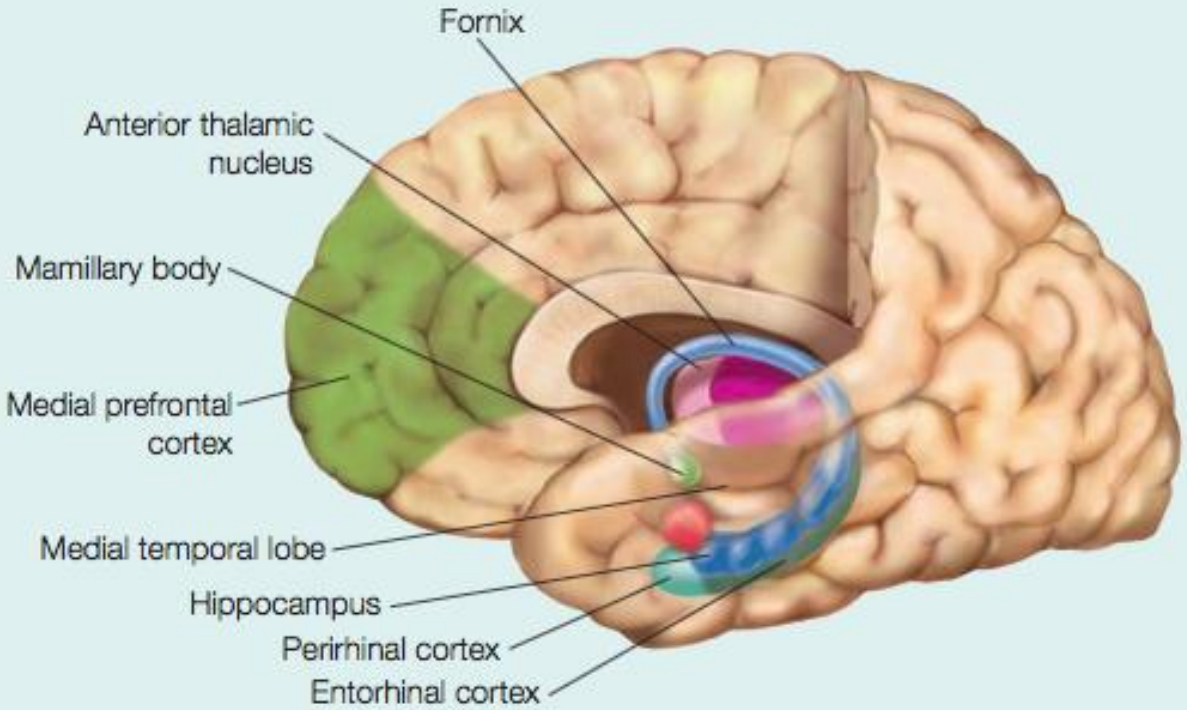


FIGURE 9.9 Changes in local cerebral blood flow, measured with positron emission tomography.
Verbal **(a)** and spatial **(b)** working memory tasks were tested in healthy volunteers. In each case, the views of the cortical surface show the left hemisphere **(left)**; superior (dorsal) surface of both hemispheres, with the frontal lobe at the top **(middle)**; and right hemisphere **(right)**. See text for details.

Παγίωση της μνήμης



The anatomy of memory



The components of the medial temporal lobe memory system are shown. Other regions of the brain, such as the prefrontal cortex, are involved in storage and retrieval of memories.

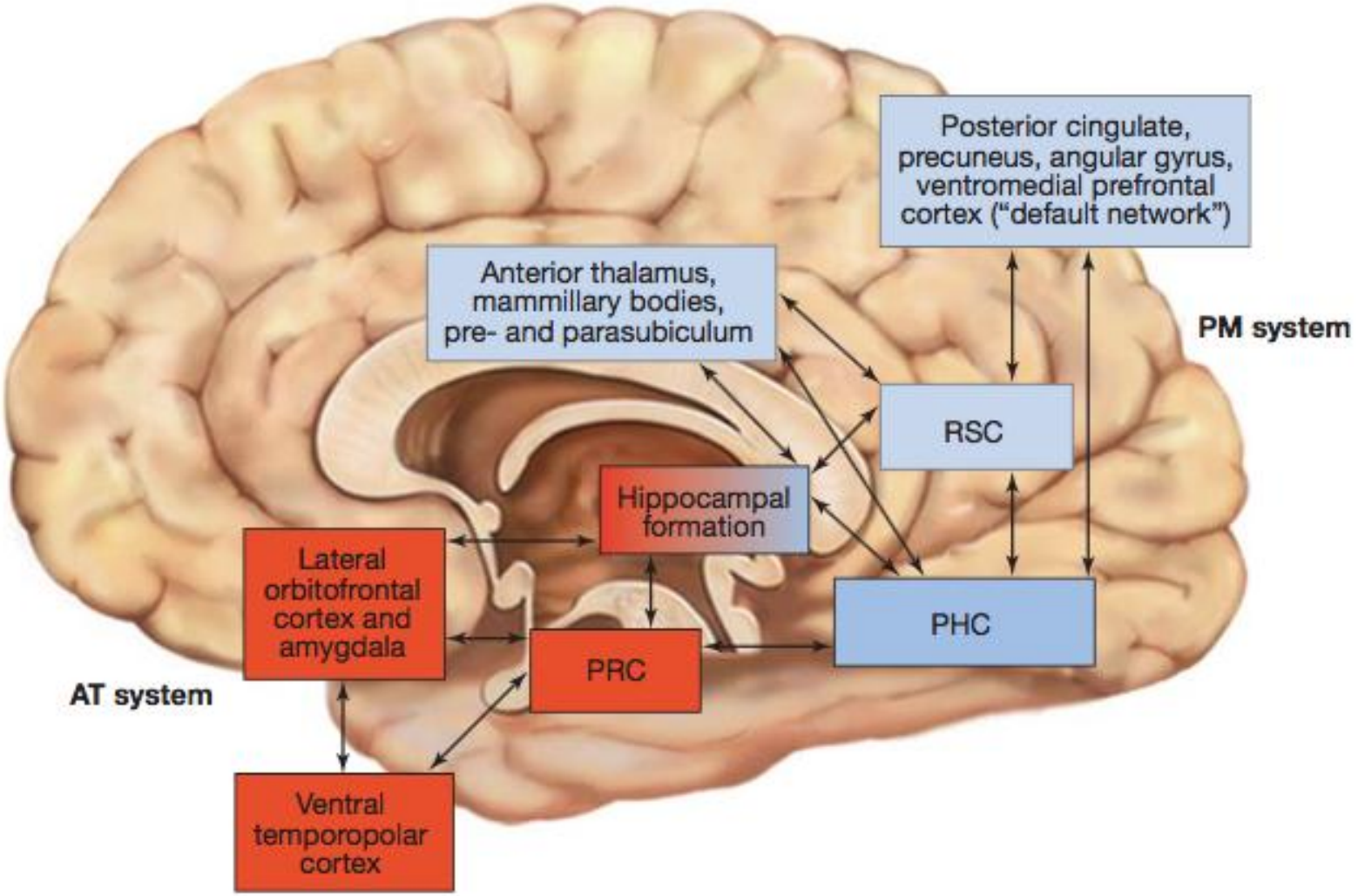
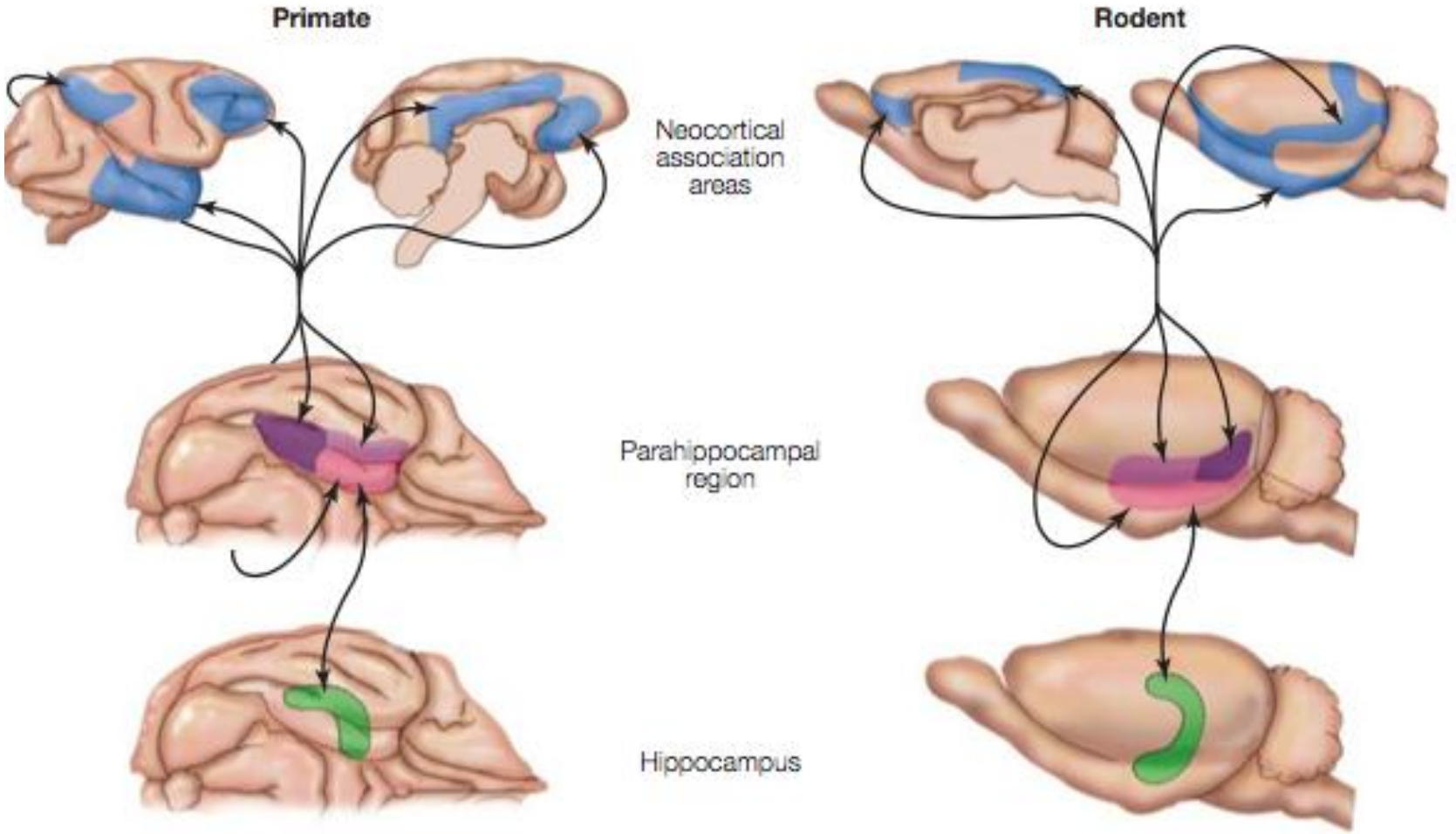


FIGURE 9.35 Model of two neocortical systems for memory-guided behavior.
The components of the anterior temporal (AT) system are shown in red. The posterior medial (PM) system is shown in blue. Regions with strong anatomical connections are indicated with arrows.

Ιππόκαμπος


Primate
Rodent
Neocortical association areas
Parahippocampal region
Hippocampus

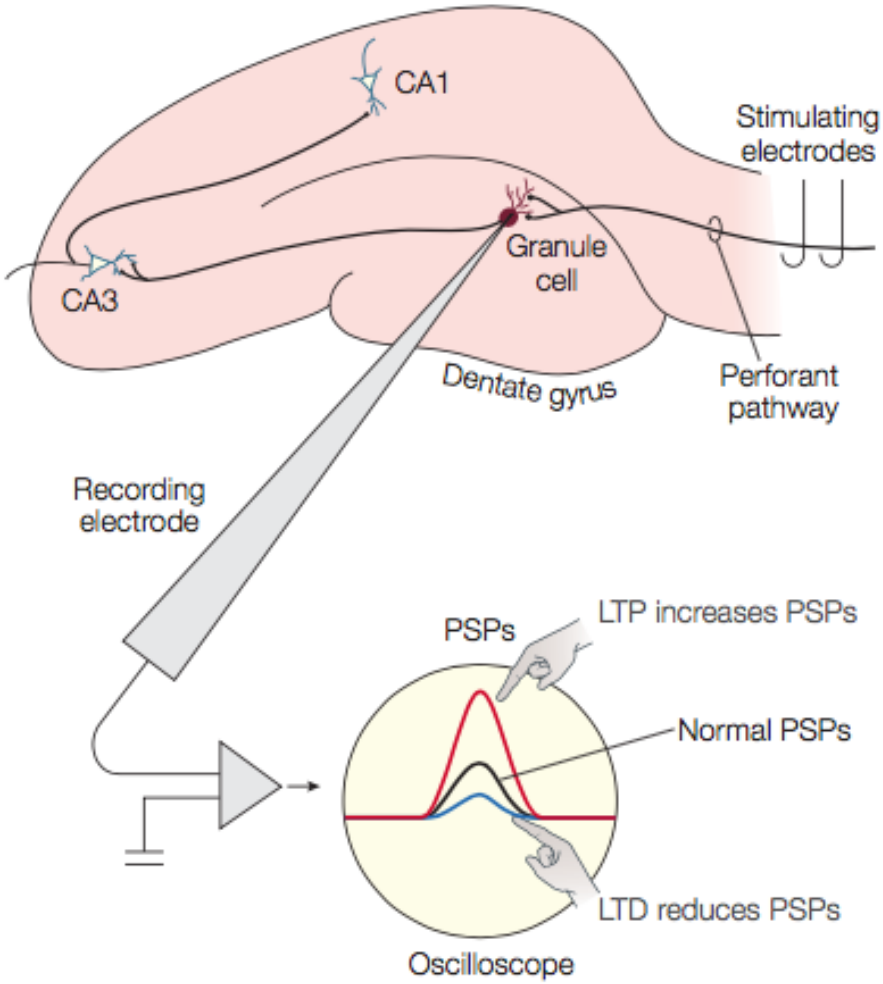
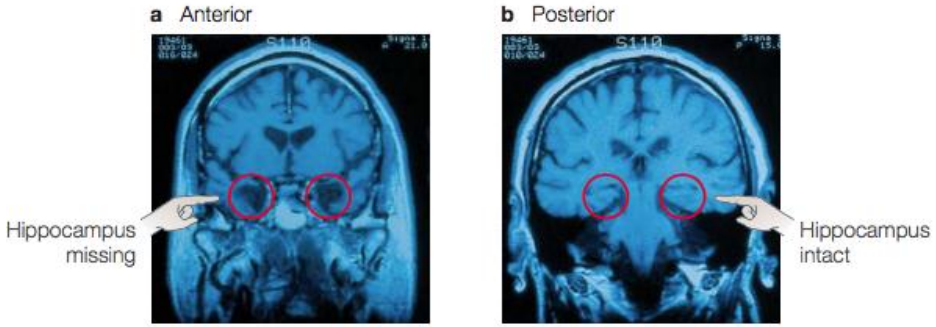
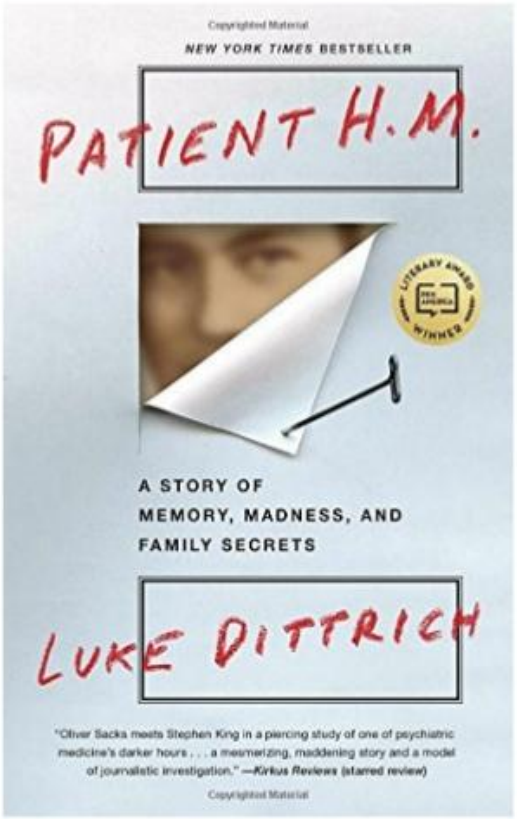


FIGURE 9.38 Stimulus and recording setup for the study of long-term potentiation (LTP) in perforant pathways.
The pattern of responses (in millivolts) before and after the induction of LTP is shown as the red curve. The pattern of responses in long-term depression (LTD) is shown as the blue curve. PSPs = postsynaptic potentials.

Βλάβες του ιπποκάμπου





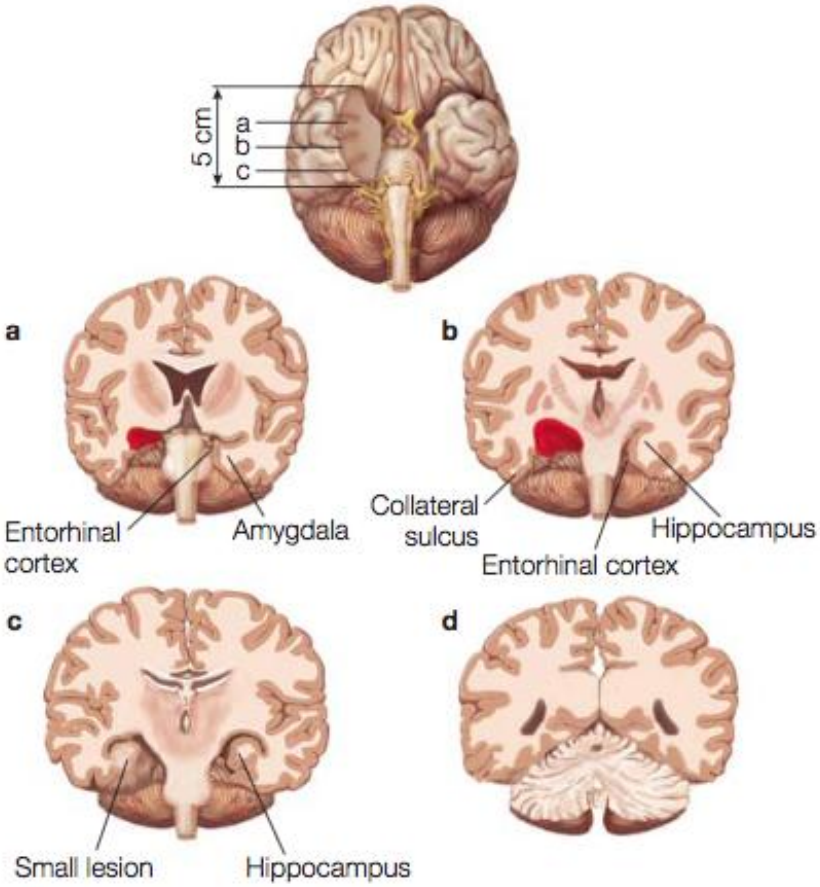


FIGURE 9.15 Region of the medial temporal lobe actually removed from H.M.
Modern reconstruction by Amaral and colleagues, showing that portions of H.M.'s posterior hippocampus were not removed during surgery. This tissue, however, shows signs of atrophy and may no longer be functioning normally. Red areas indicate where portions were removed. Compare with Figure 9.13.

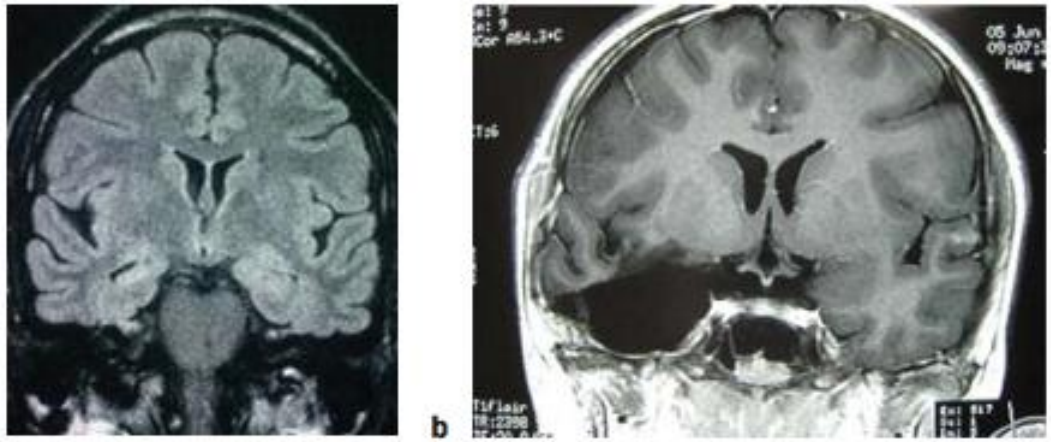


FIGURE 9.1 A temporal lobectomy.
(a) Coronal MRI image prior to surgery. **(b)** MRI image following removal of right amygdala, hippocampus, and anterior temporal lobe.

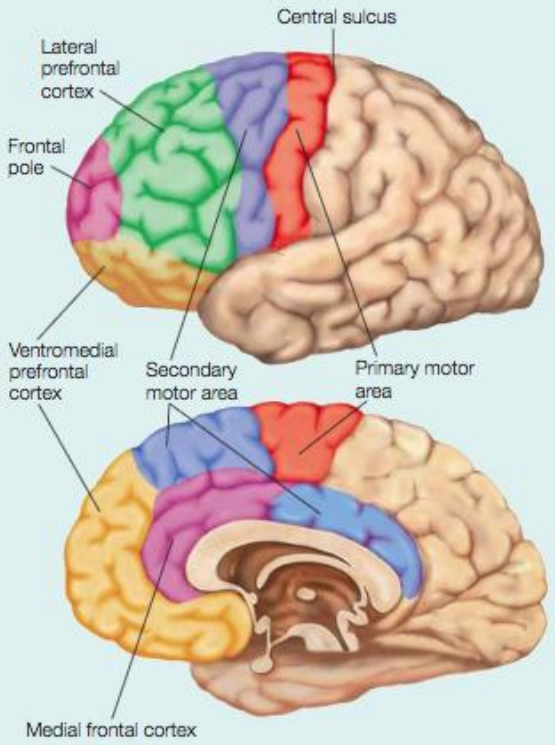
Πρόσθιος φλοιός

FIGURE 9.31 Summary of regions in the prefrontal cortex that show activation for episodic encoding and semantic retrieval or episodic retrieval. The data are from many studies, reported in Nyberg, Cabeza, and Tulving (1996, 1998) and Tulving et al. (1994).

Γνωσιακός έλεγχος

ANATOMICAL ORIENTATION

Anatomy of cognitive control



The prefrontal cortex includes all of the areas in front of the primary and secondary motor areas. The four subdivisions of prefrontal cortex are the lateral prefrontal cortex, ventromedial prefrontal cortex, frontal pole, and medial frontal cortex. The most ventral part of the ventromedial prefrontal cortex is frequently referred to as the orbitofrontal cortex, referring to the cortex which lies above the bony orbits of the eyes.

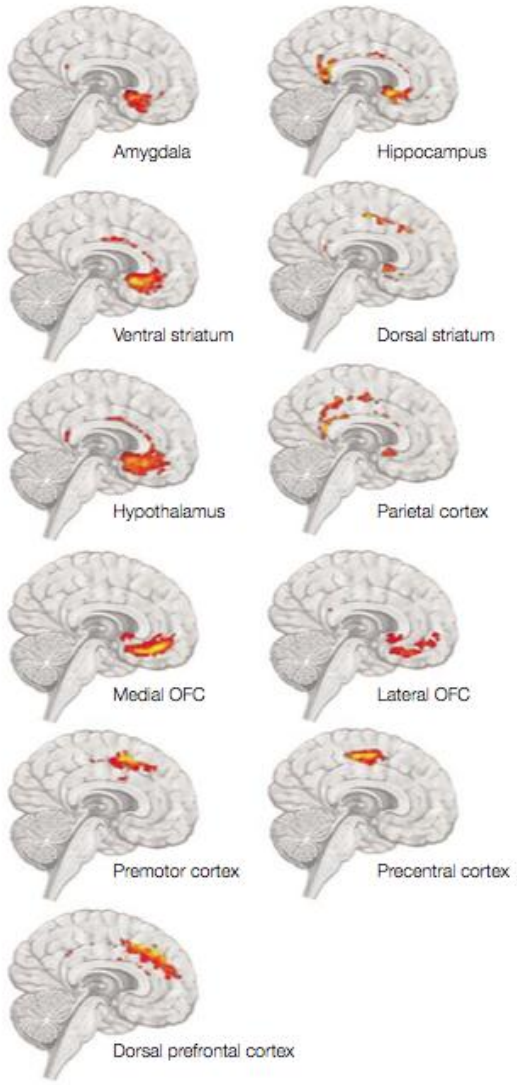


FIGURE 12.32 Diffusion tensor imaging (DTI) to identify anatomical connections between cingulate cortex and other brain regions. Highlighted regions indicate cingulate voxels that showed significant connectivity with eleven different brain regions.

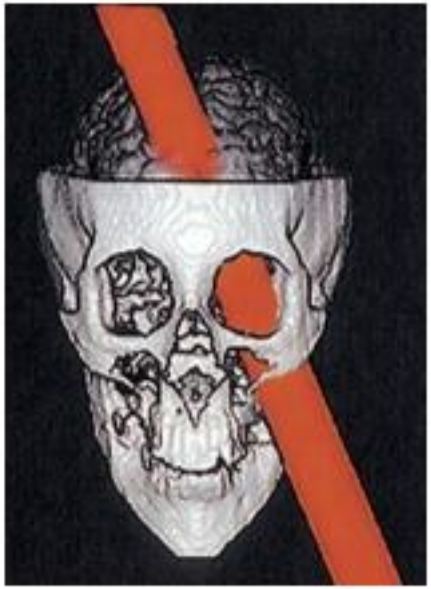
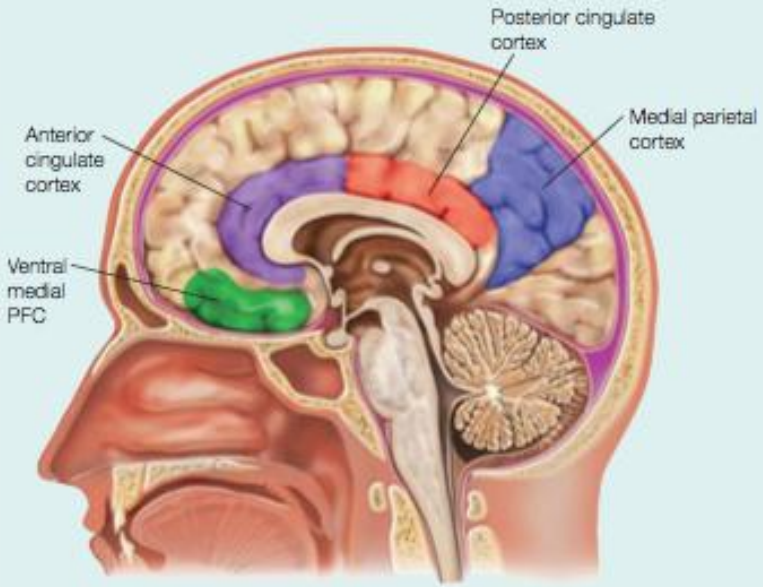
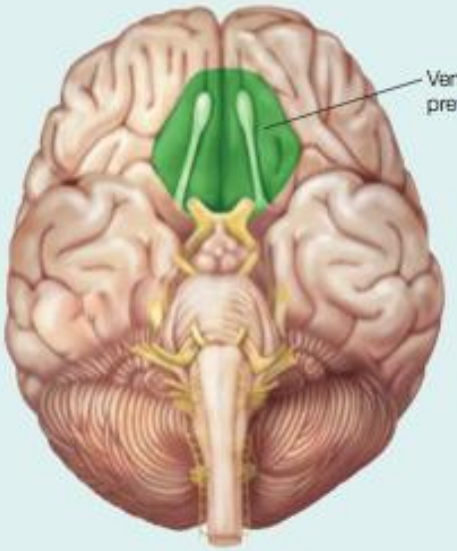
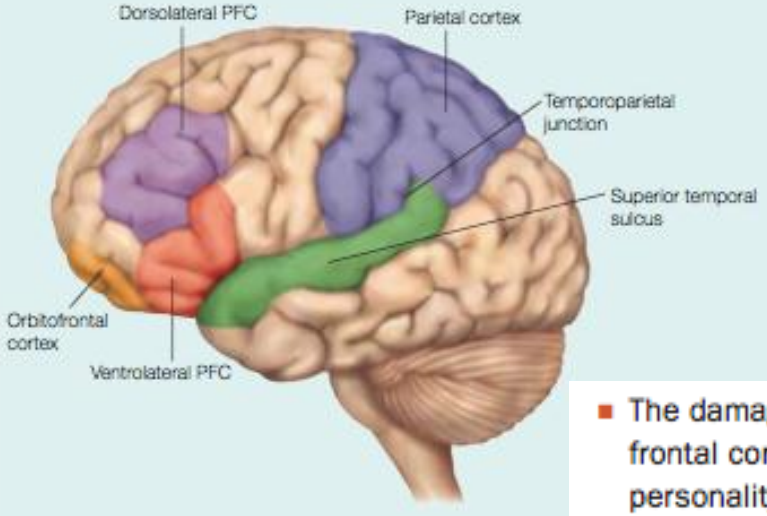


FIGURE 13.1 This computer reconstruction shows how the tamping iron passed through Phineas Gage's brain. The iron entered just below the left eye and exited from the top. It destroyed much of the medial region of the prefrontal cortex.

Anatomy of social cognition







- The damage that Phineas Gage suffered to the orbitofrontal cortex resulted in a change of his behavior and personality, such that, as one person commented, "Gage was no longer Gage."

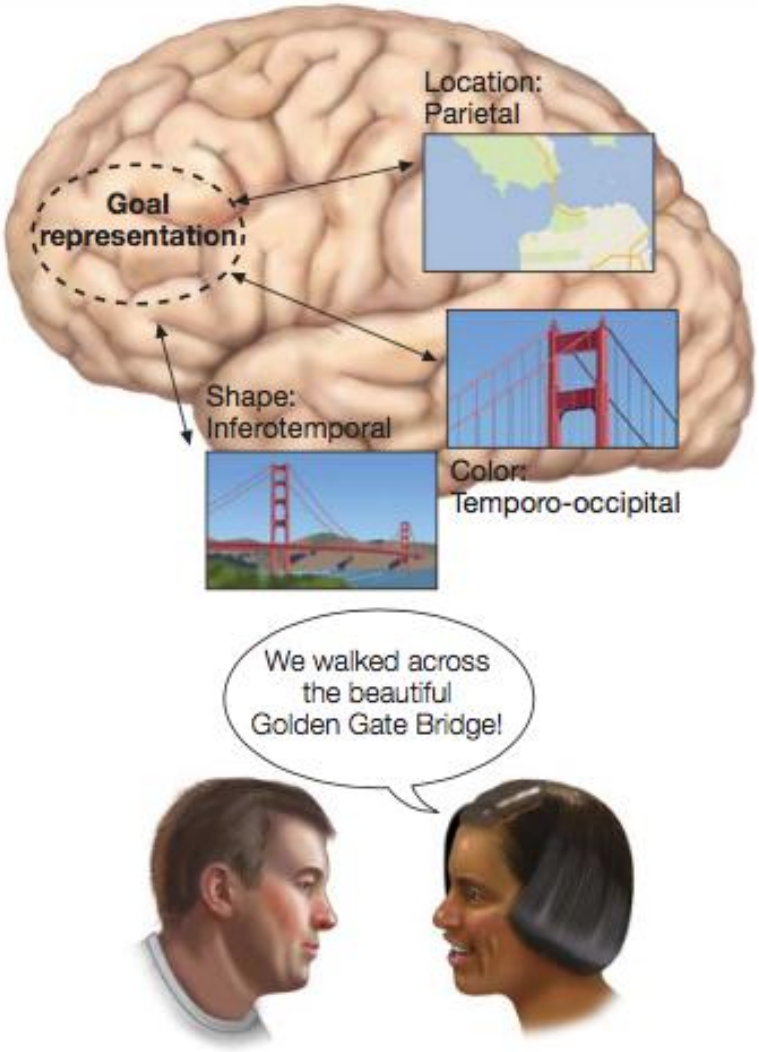


FIGURE 12.5 Working memory arises from the interaction of goal representations and the activation and maintenance of long-term knowledge.
In this example, the woman's goal is to tell her friend about the highlights of her recent trip to San Francisco. Her knowledge of the Golden Gate Bridge requires activation of a distributed network of cortical regions that underlie the representation of long-term memory.

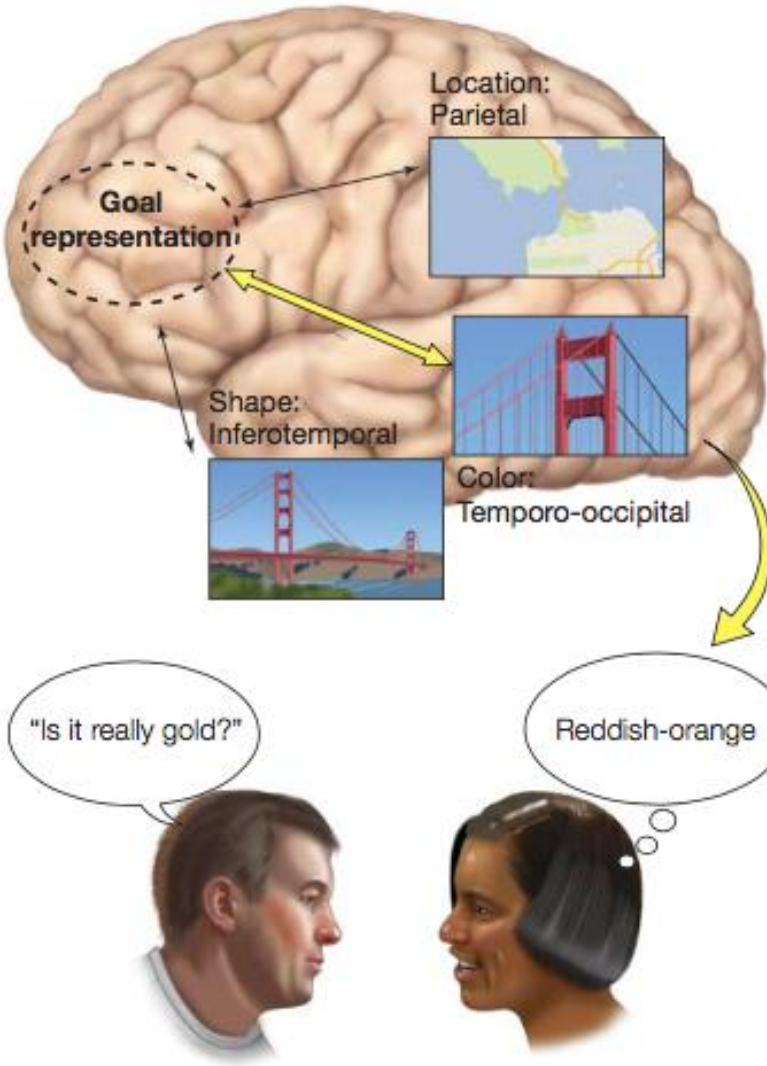
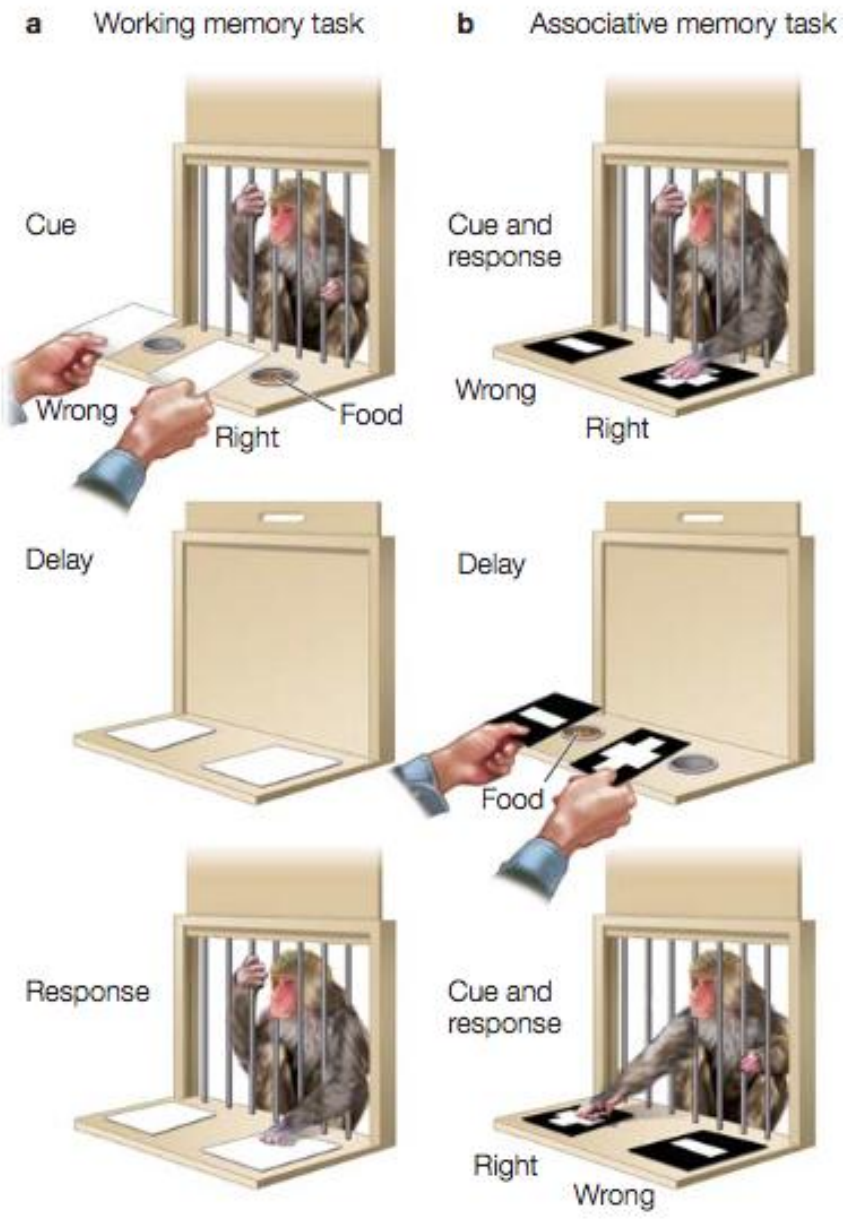


FIGURE 12.22 Prefrontal cortex as a filtering mechanism in t retrieval and maintenance of task-relevant information.
When the person is asked about the color the Golden Gate Bridg (the task goal), links to memory of the color of the bridge is am fied while links to memory of the location and shape of the brid are inhibited.

Μνήμη εργασίας και εξαρτημένη



Αποφάσεις

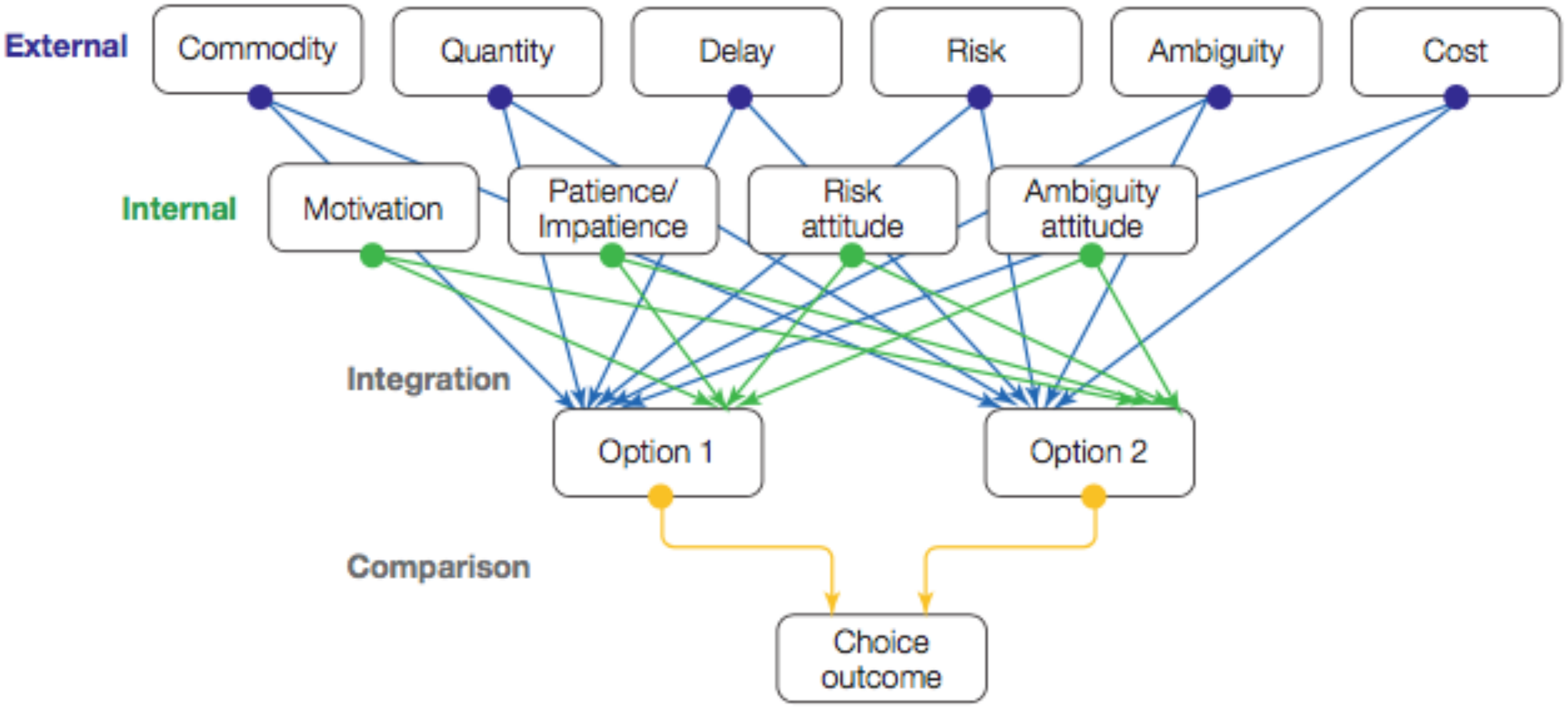
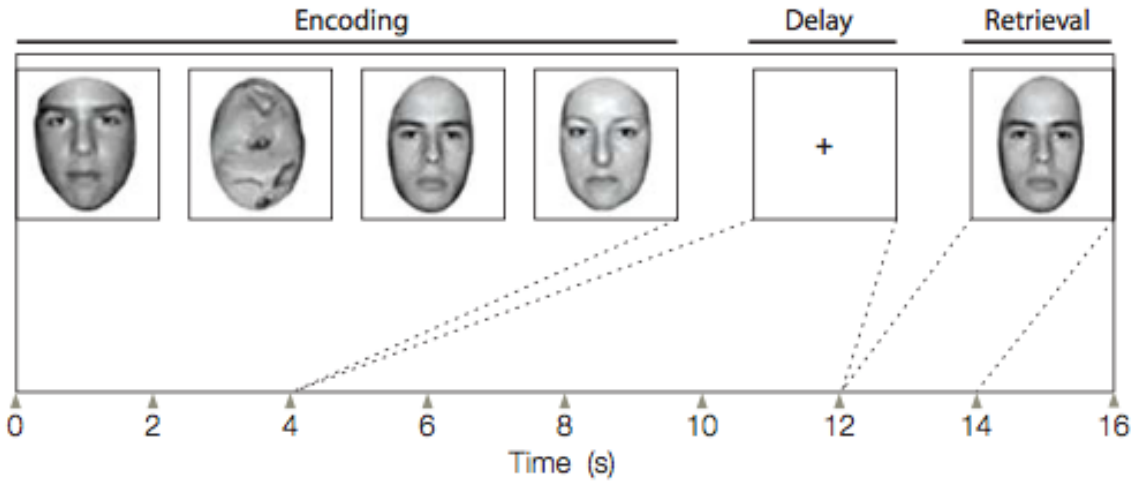
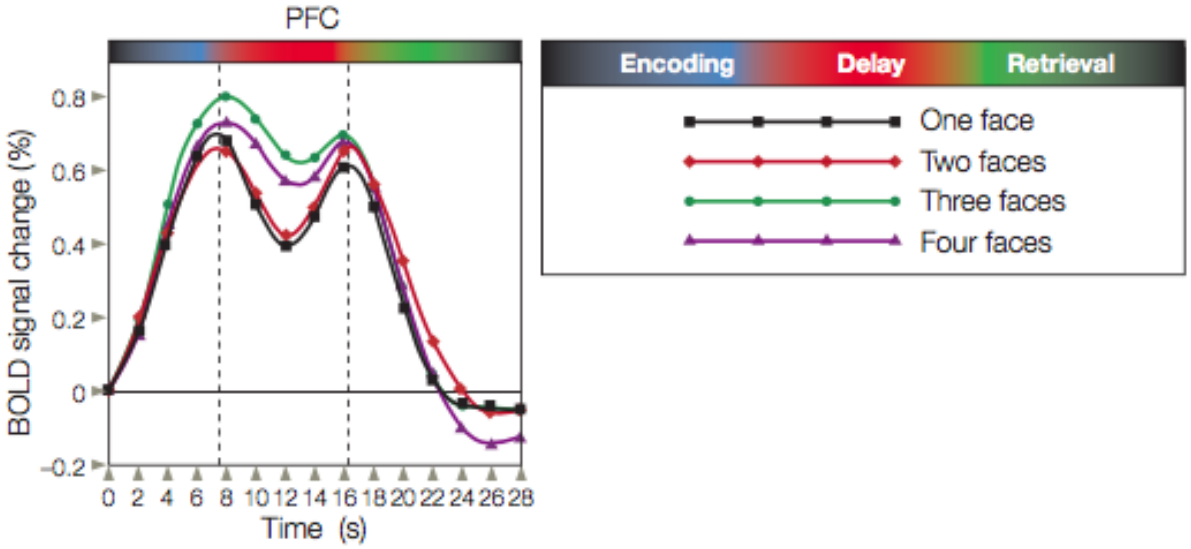


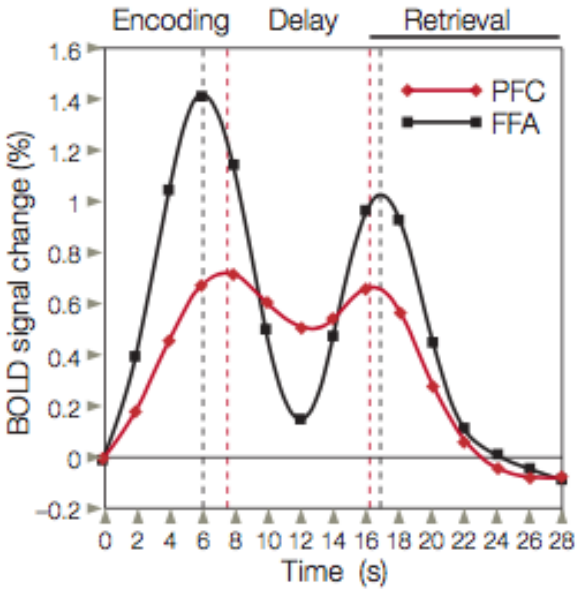
FIGURE 12.10 Decisions require the integration and evaluation of multiple factors.
In this example, the person is asked to choose between two objects, each of which has an inferred value (offer values). The values involve some weighted combination of multiple sources of information. Some sources are external to the agent: What will I gain (commodity), how much reward will be obtained, will I get the reward right away, and how certain am I to obtain the reward? Other factors are internal to the agent: Am I feeling motivated, am I willing to wait for the reward, is the risk worth it?


Encoding
Delay
Retrieval
+
0
2
4
6
8
10
12
14
16
Time (s)

a


PFC
Encoding
Delay
Retrieval
One face
Two faces
Three faces
Four faces
BOLD signal change (%)
0.8
0.6
0.4
0.2
0
−0.2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
Time (s)

b


Encoding
Delay
Retrieval
PFC
FFA
BOLD signal change (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−0.2
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
Time (s)

c

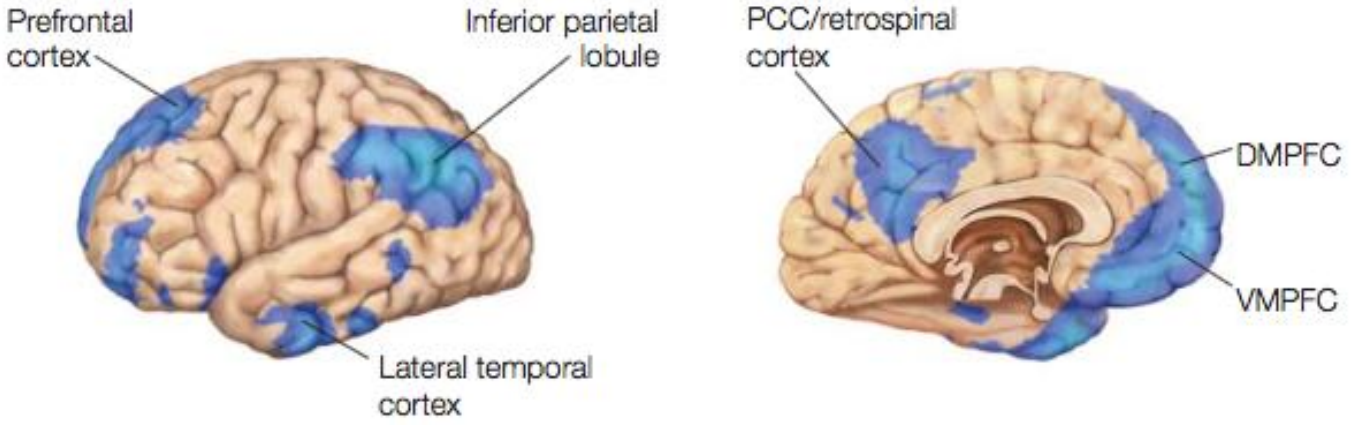


FIGURE 13.4 The Default Network.
Combined data from nine positron emission tomography (PET) studies showing the regions that were most active during passive tasks (in blue). The lateral (left) and medial (right) surfaces of the left hemisphere are shown.

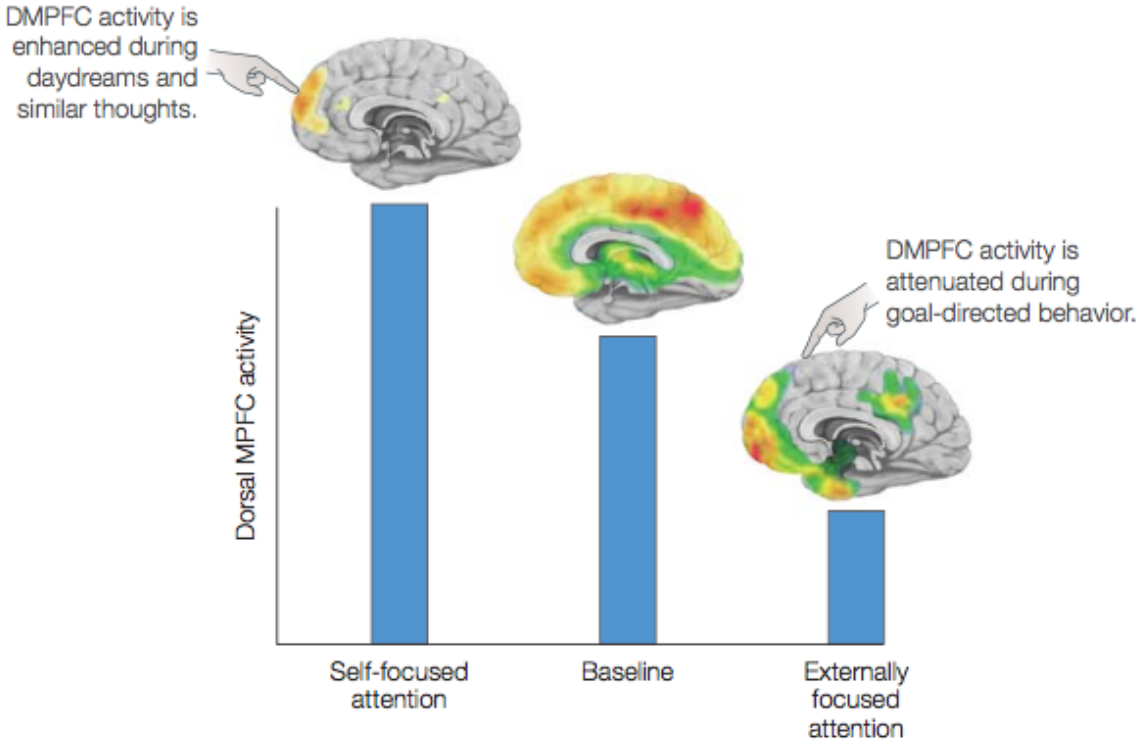


FIGURE 13.5 Activity in the dorsal medial prefrontal cortex increases during tasks that involve self-referential mental activity or self-focused attention and decreases during tasks that involve externally focused attention. This finding is consistent with the observation that during goal-directed behaviors, self-focused attention decreases, and also indicates that at baseline, there should be some degree of self-referential mental activity engaging this region, a suggestion which has been supported by functional imaging data.

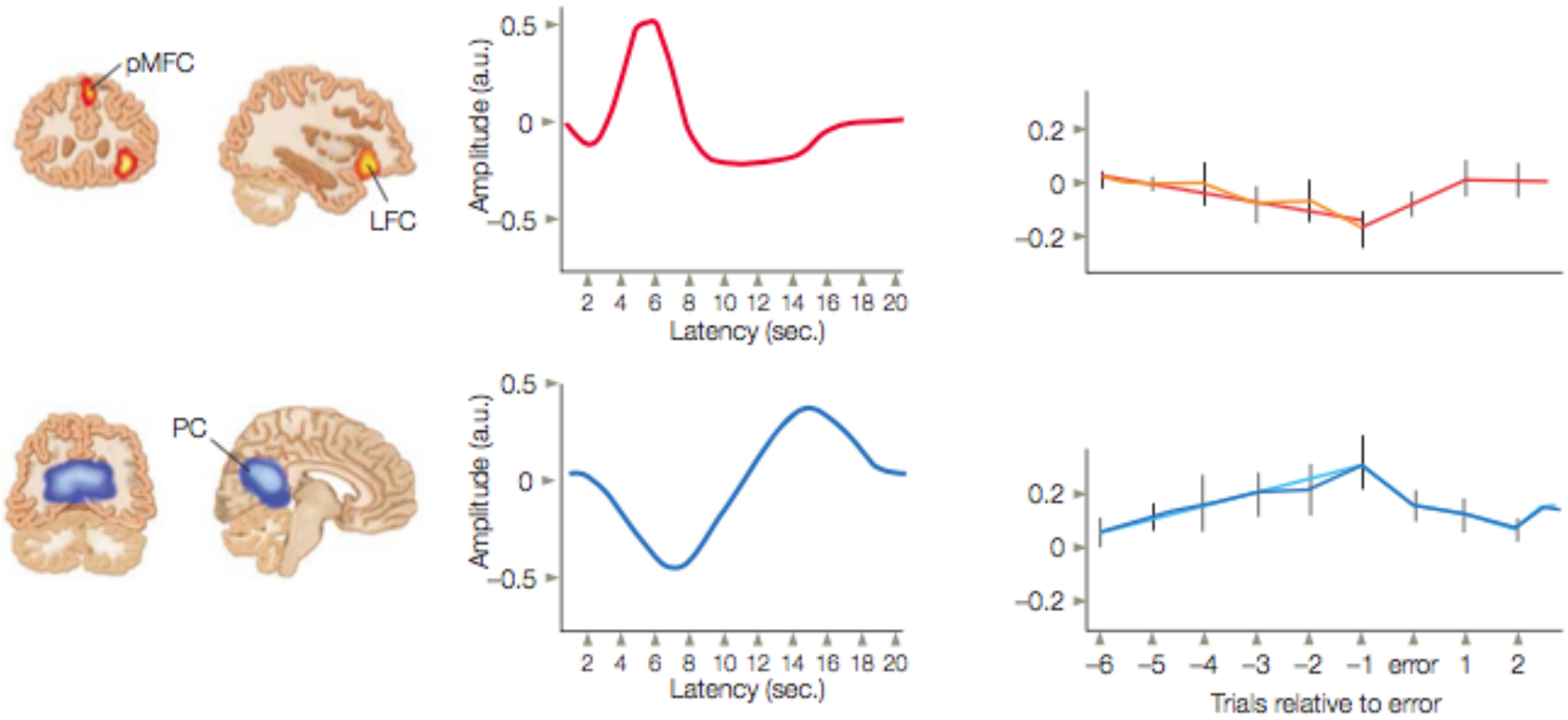


FIGURE 12.35 Balance of activity between monitoring and default networks correlates with likelihood of making an error.

Top row shows areas in medial and lateral frontal cortex that exhibit increased BOLD response after stimulus onset. Bottom row shows precuneus area, a part of the default network, in which BOLD response decreases after stimulus onset. Right side graphs indicate relative response in pMFC and precuneus across trials. Activation in pMFC is relatively low just before an error, whereas BOLD in precuneus is relatively high before an error. Note the dramatic change in relative activation in both areas right after an error occurs.

Επιλογή

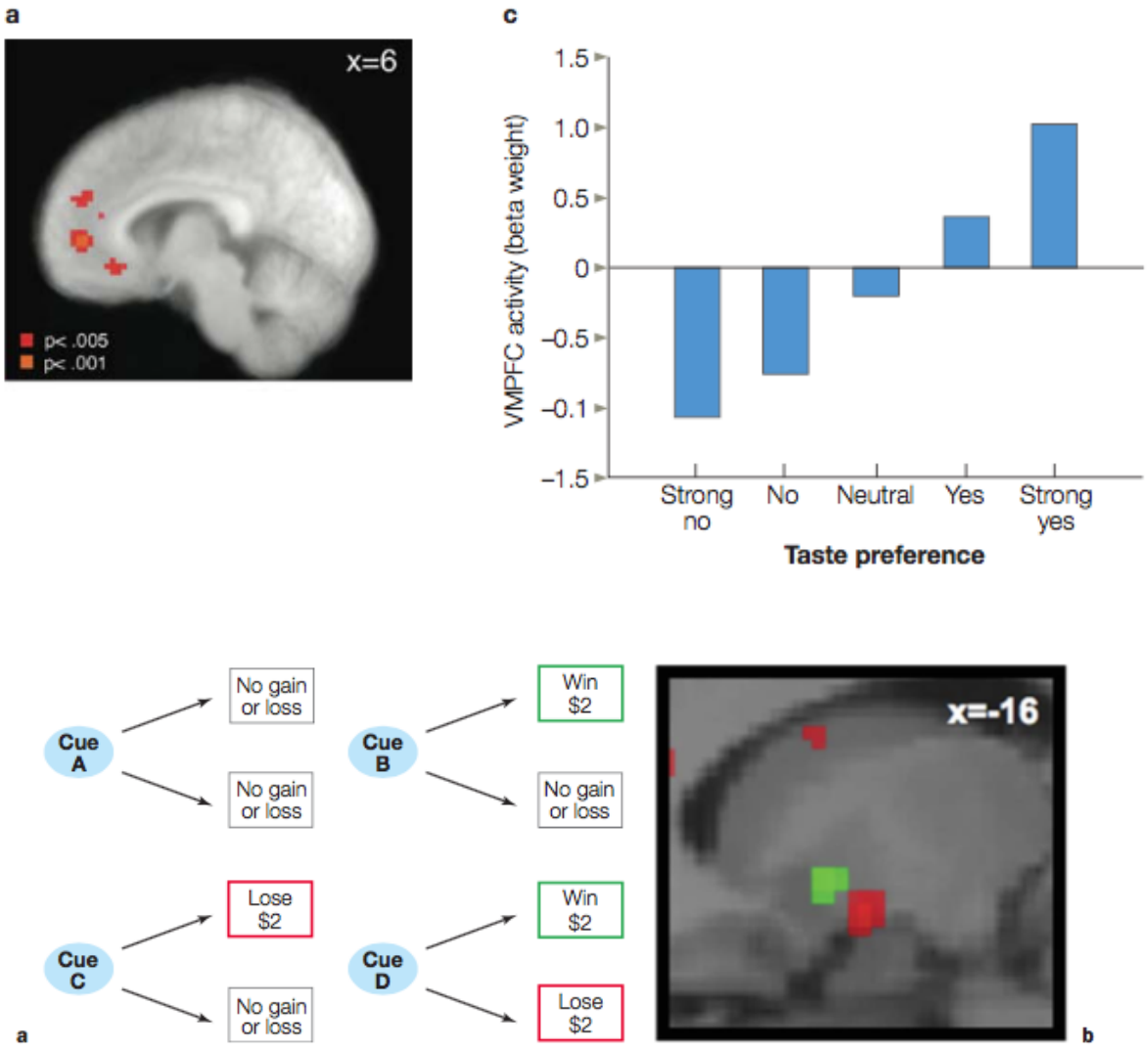


FIGURE 12.17 Coding of gain and loss in the ventral striatum with fMRI.
(a) People were presented with one of four cues. Over time, they learned that each cue was associated with one of two possible outcomes (or for Cue A, the same neutral outcome). **(b)** Prediction errors reliably predicted the BOLD response in the ventral striatum, with the center of the positive prediction error response (green) slightly anterior to the center of the negative prediction error response (red).

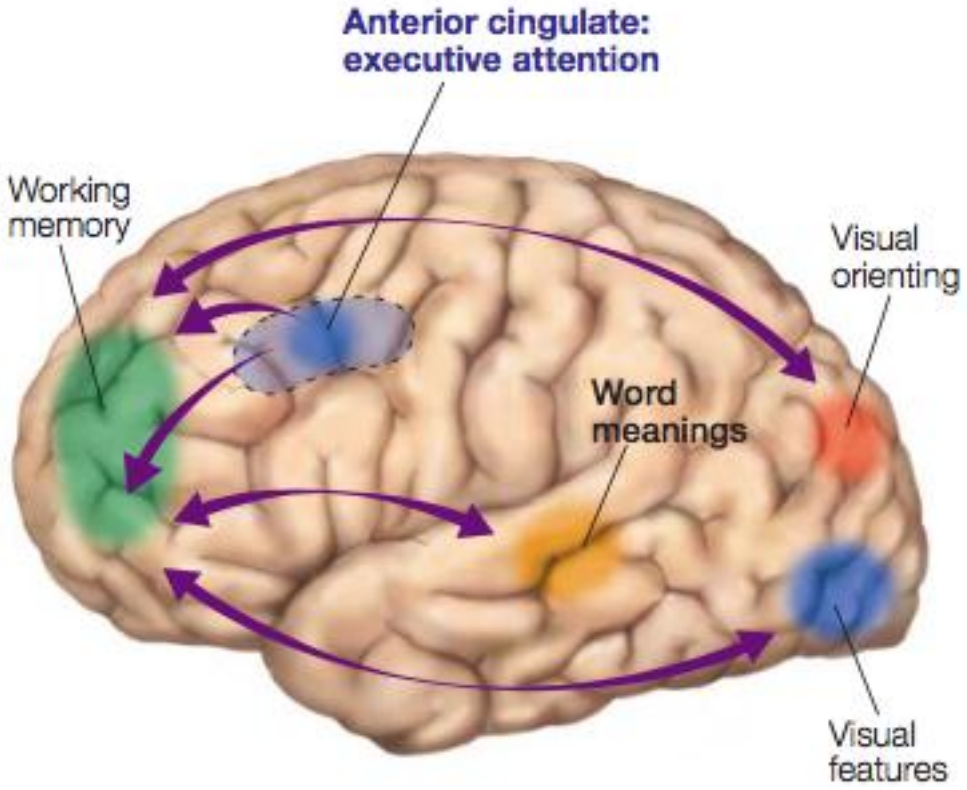


FIGURE 12.33 The anterior cingulate has been hypothesized to operate as an executive attention system.
This system ensures that processing in other brain regions is most efficient, given the current task demands. Interactions with the prefrontal cortex may select working memory buffers; interactions with the posterior cortex can amplify activity in one perceptual module over others. The interactions with the posterior cortex may be direct, or they may be mediated by connections with the prefrontal cortex.

Ενσυναίσθηση (empathy)

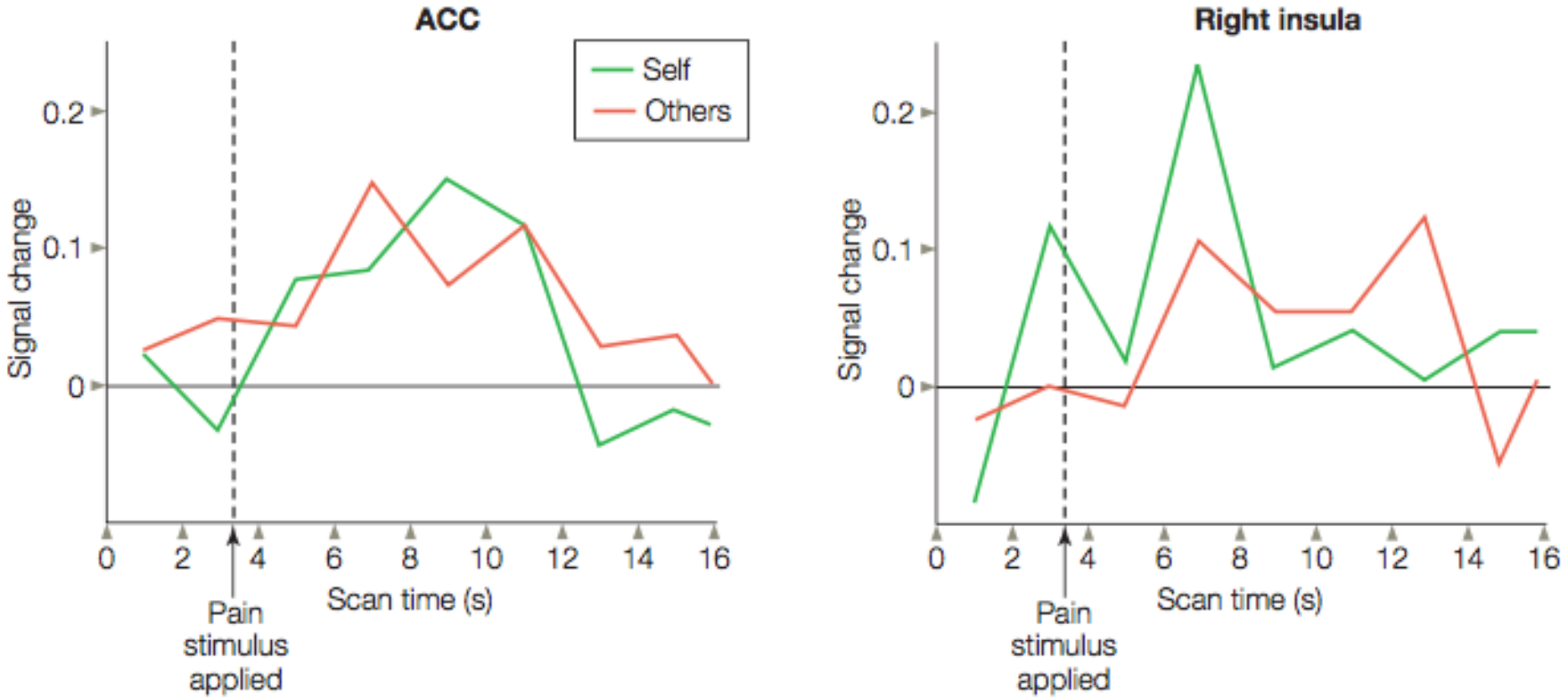
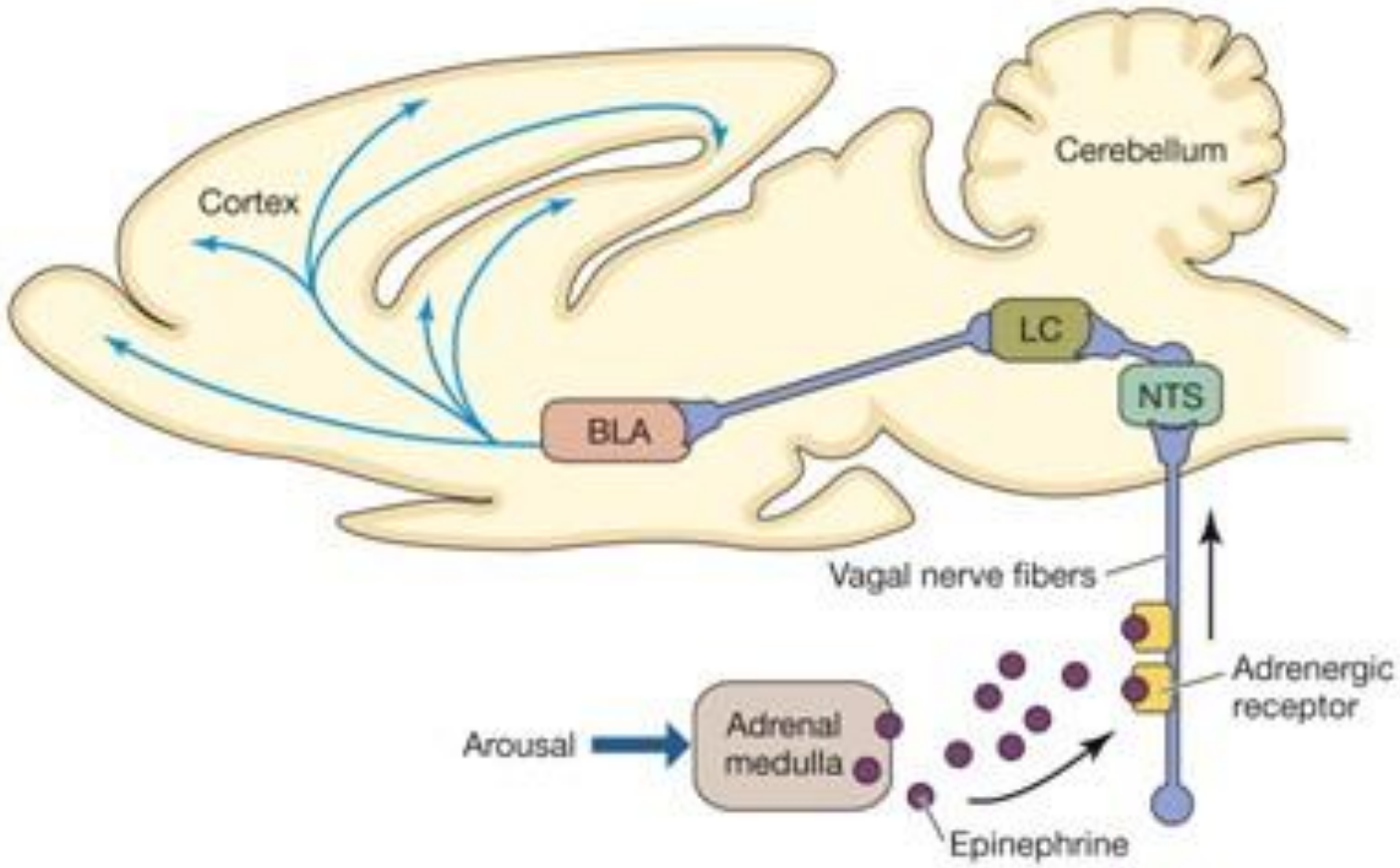


FIGURE 13.11 Study of empathy for pain.
Each participant watched as a partner's hand received a shock through a set of electrodes. Brain activity was very similar for one's own pain and the pain of the partner, and the degree of brain activation was correlated with empathy.

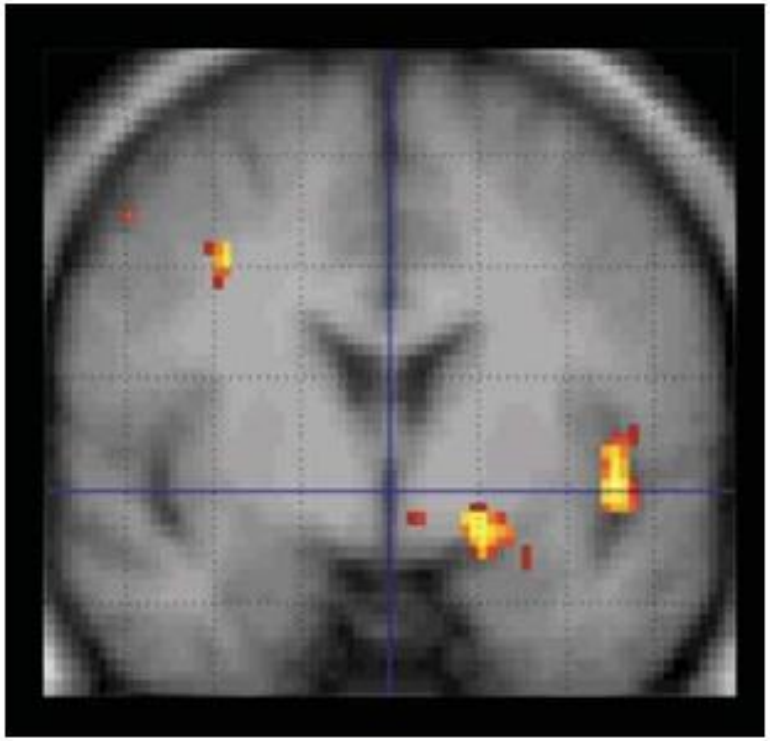
Συναισθηματικά φορτισμένα γεγονότα

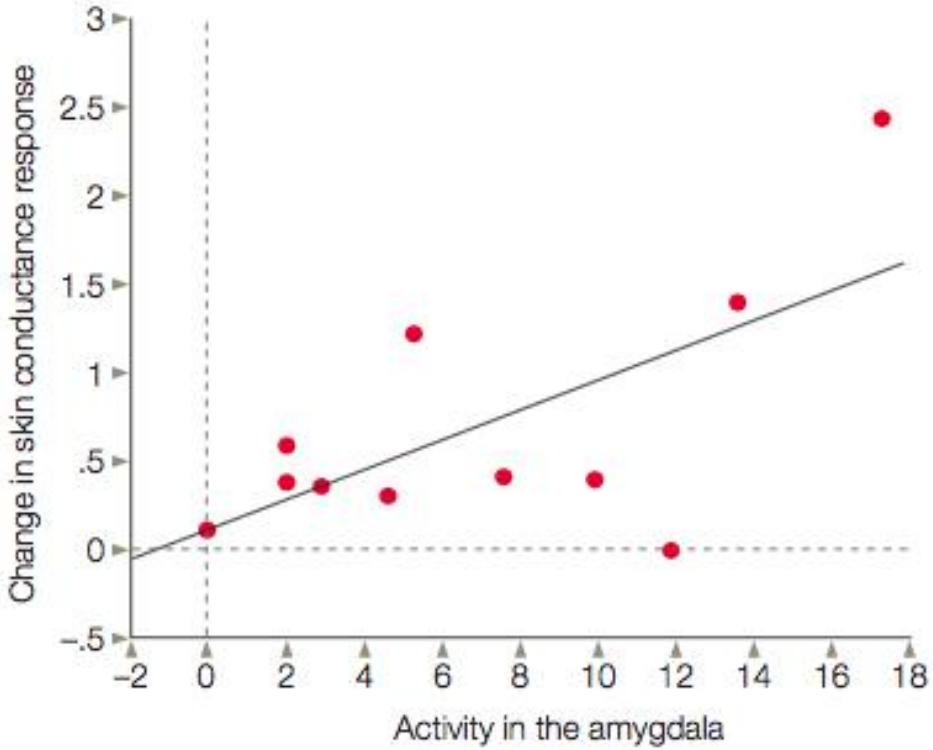
AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.1



THE NEUROBIOLOGY OF LEARNING AND MEMORY 2e, Figure 13.6

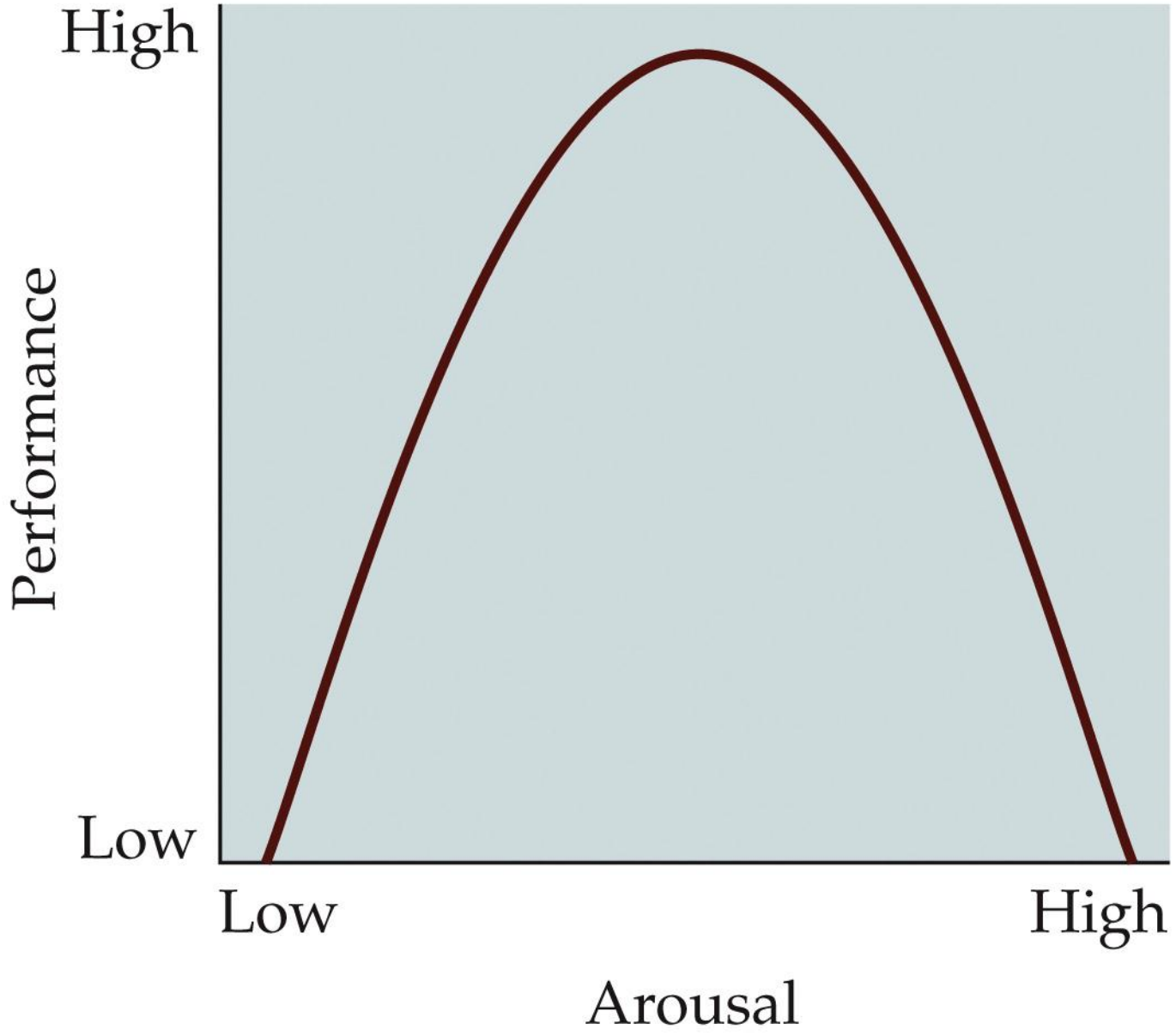
Αμυγδαλή





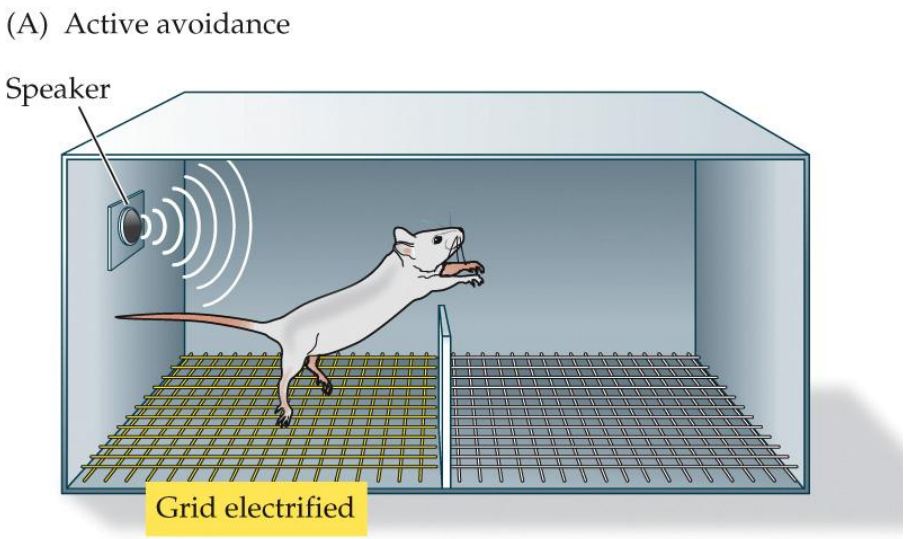
a b

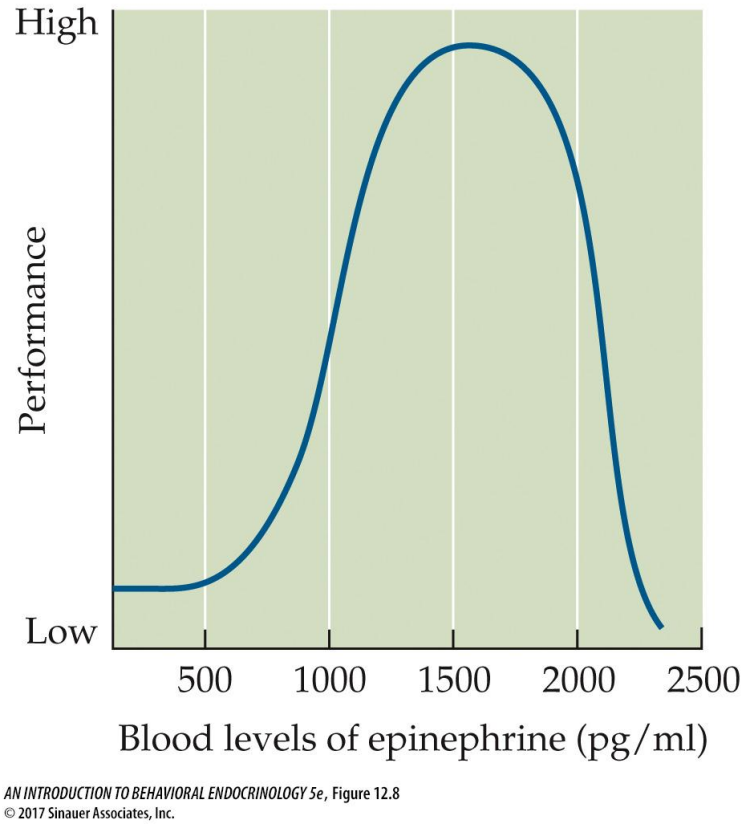
FIGURE 10.13 Responses to instructed fear.
(a) While performing a task in the instructed fear protocol, participants showed an arousal response (measured by skin conductance response) consistent with fear to the blue square, which they were told might be linked to a shock. The presentation of the blue square also led to amygdadal activation. (b) There is a correlation between the strength of the skin conductance response indicating arousal and the activation of the amygdala.



AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.2

Η αύξηση της αδρεναλίνης αυξάνει τη μαθήση (αρσενικά)

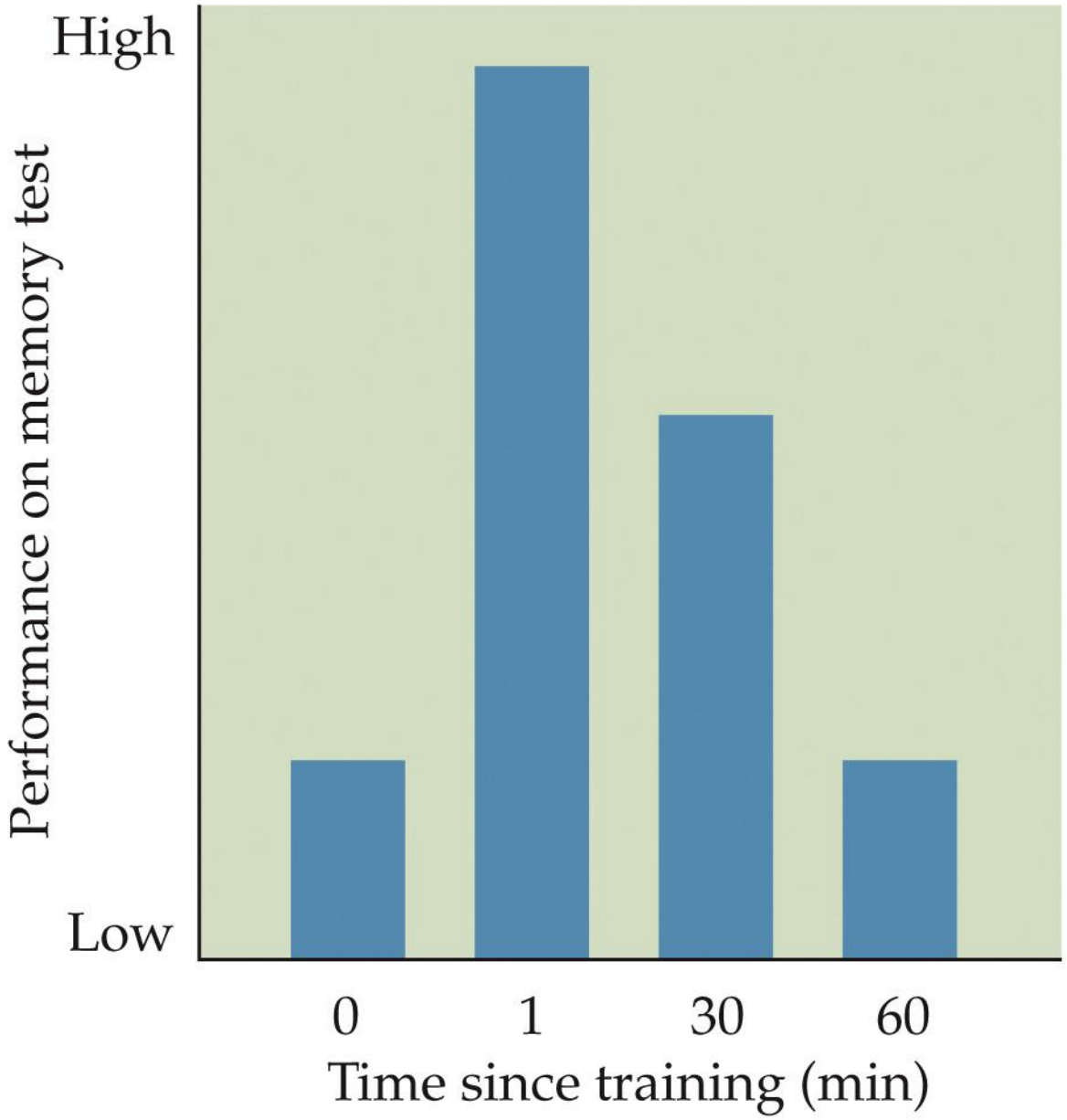




AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.8

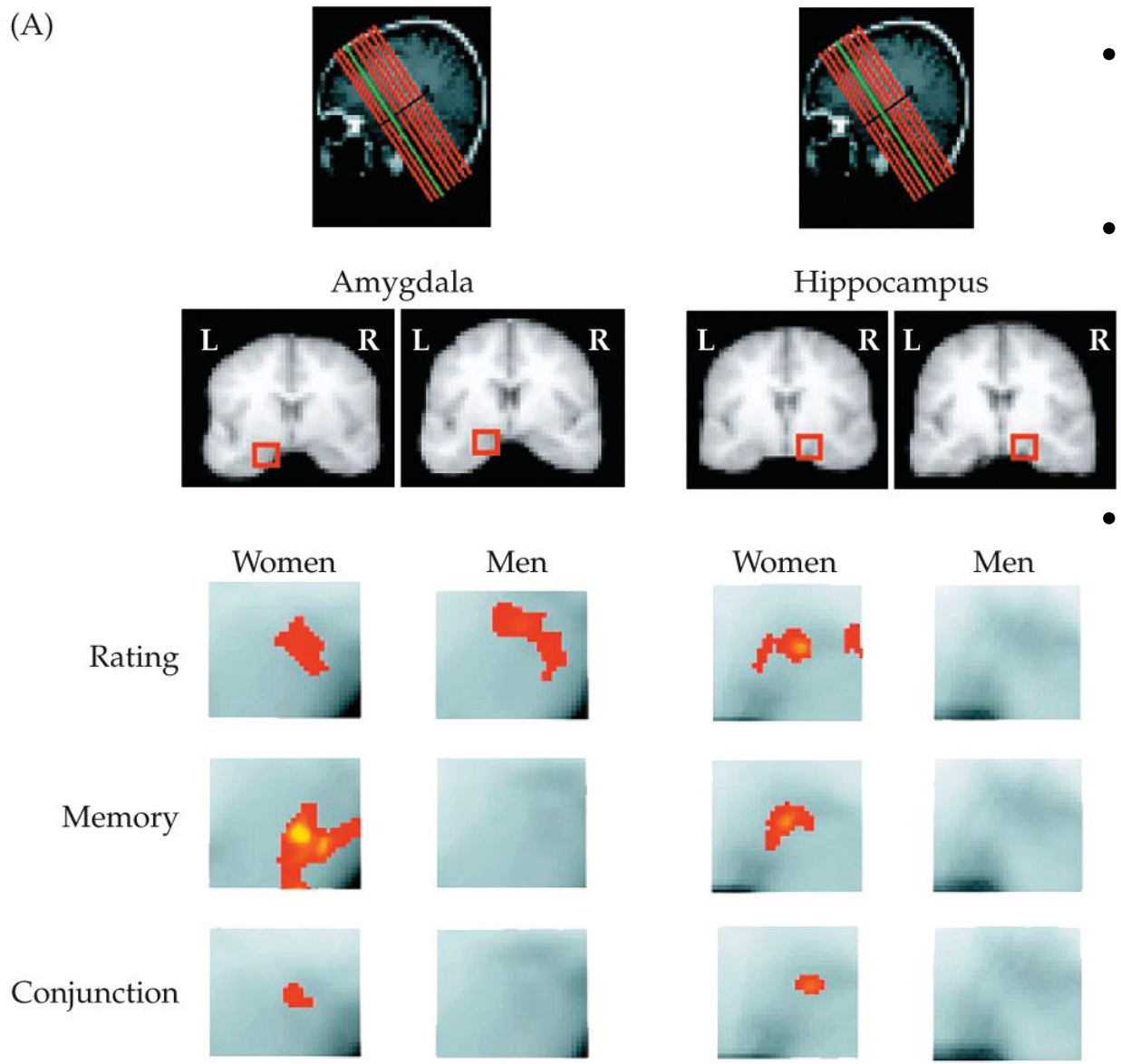
Gold and Van Buskirk, 1975-footshock or injection (or both) yields optimal concentrations

…αλλά αυτό μειώνεται στον χρόνο



AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.9

Περιοχές του εγκεφάλου που ενεργοποιούνται με τη συναισθηματική μνήμη

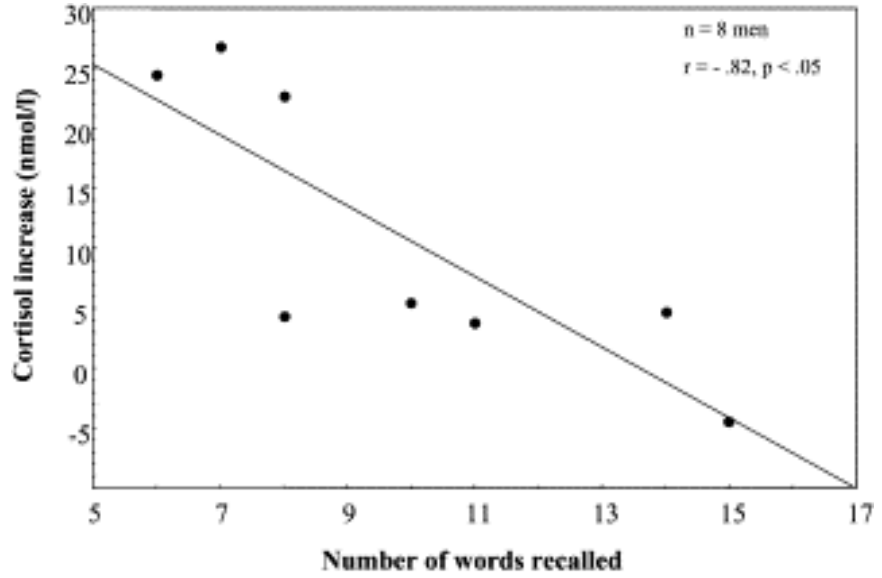


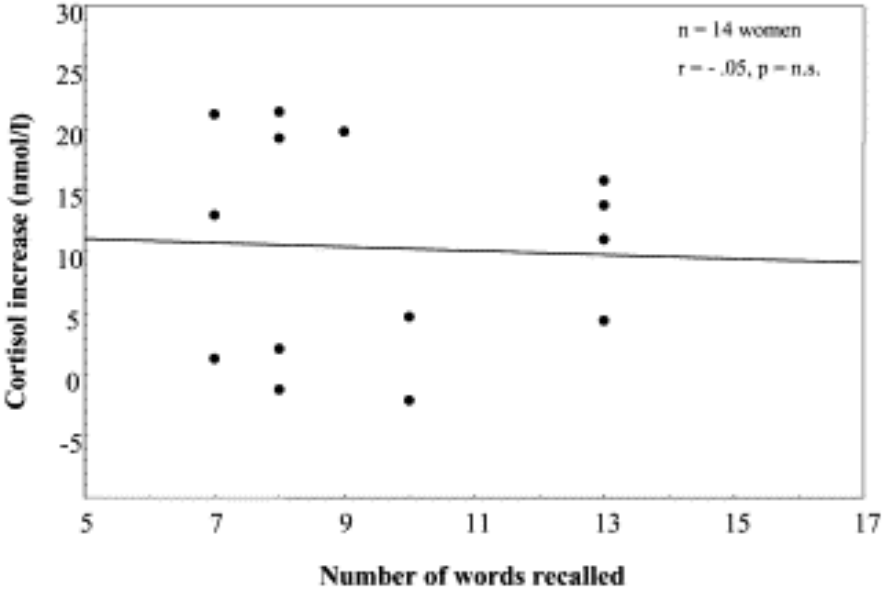
AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.11 (Part 1)

- Scenes that were emotionally intense were remembered better
- Amygdala activation correlated with emotional-intensity rating and better memory

- Sex difference:
  - In women, enhanced activity in the left amygdala correlated with memory.
  - In men, enhanced activity in the left amygdala correlated with memory

Η κορτικοστερόνη συσχετίζεται με τη μάθηση μόνο στους άνδρες

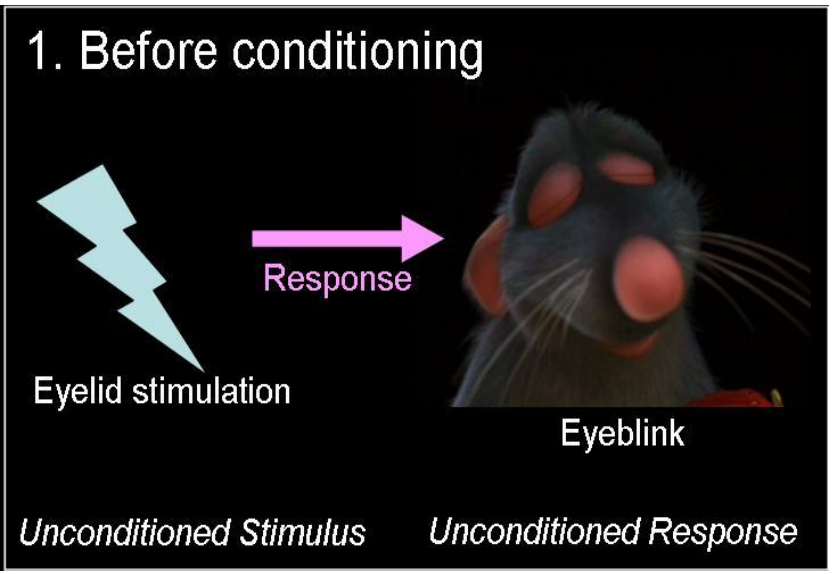


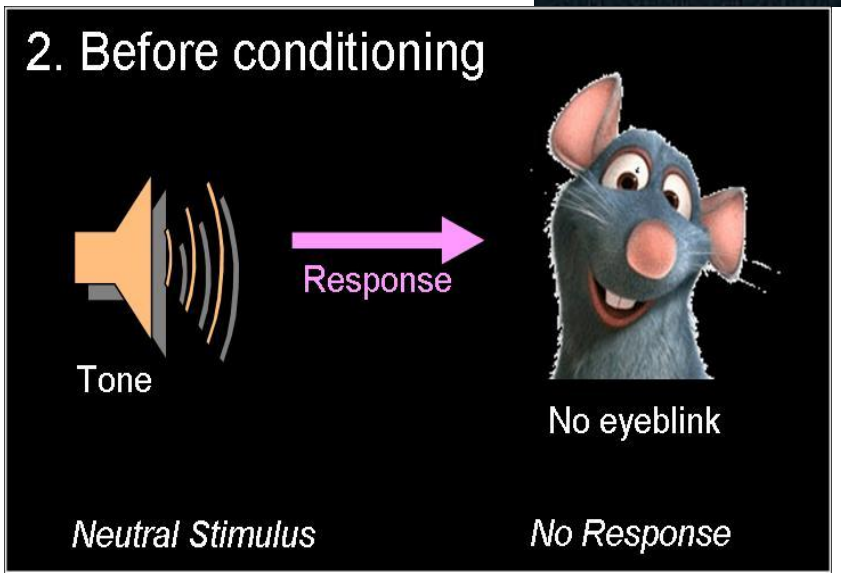


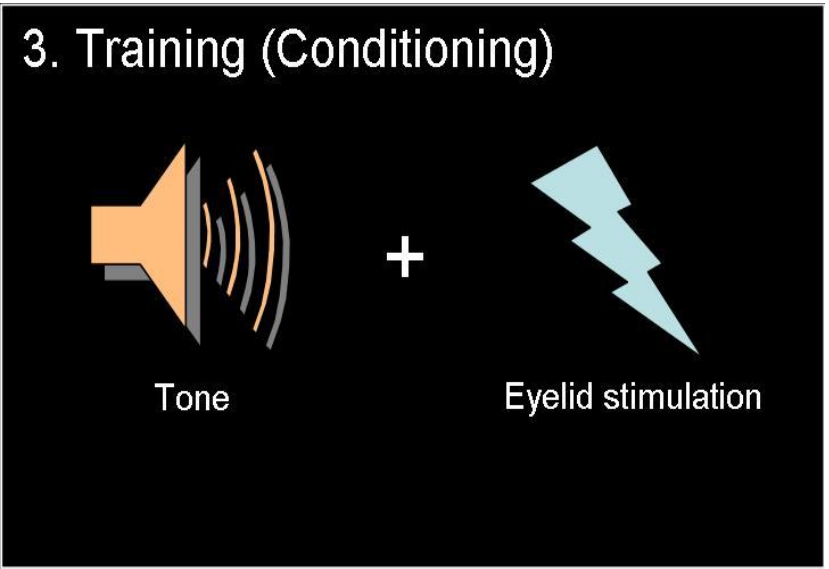
- Healthy young adults
- TSST & salivary cort measured
- Tested on word list test

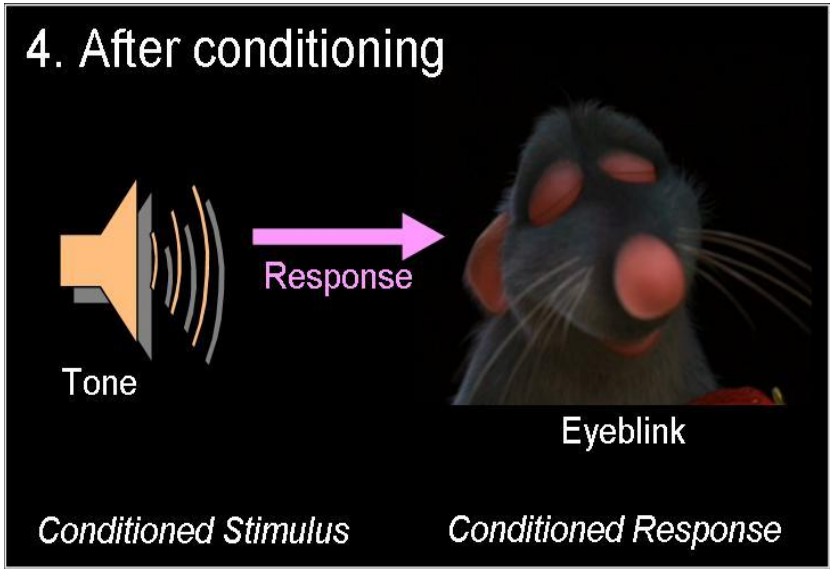
Psychoneuroendocrinology 26 (2001) 711–720

Pavlovian eyeblink conditioning

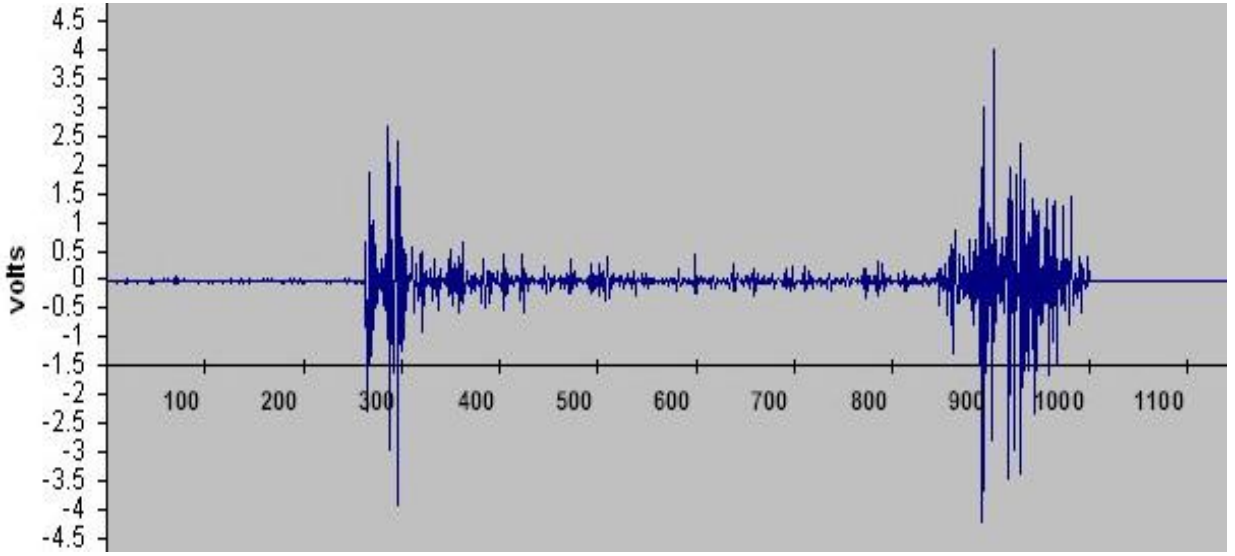








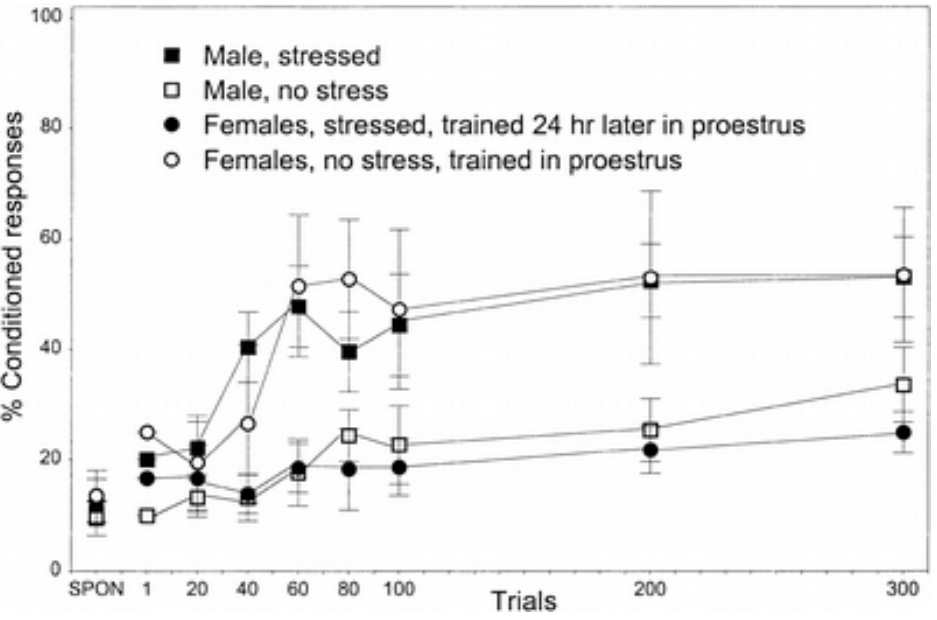
Μάθηση…

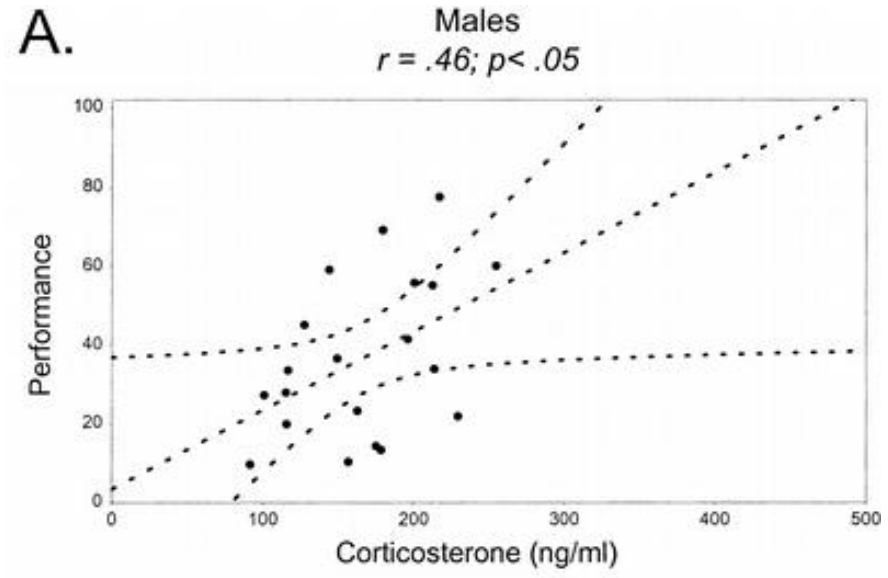


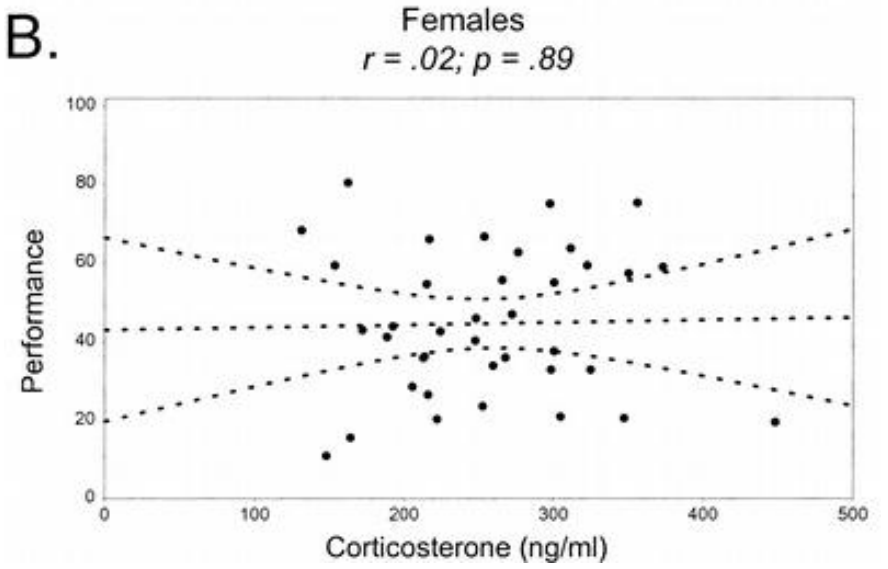
CR

Conditioned response

Οξύ στρες και eyeblink conditioning







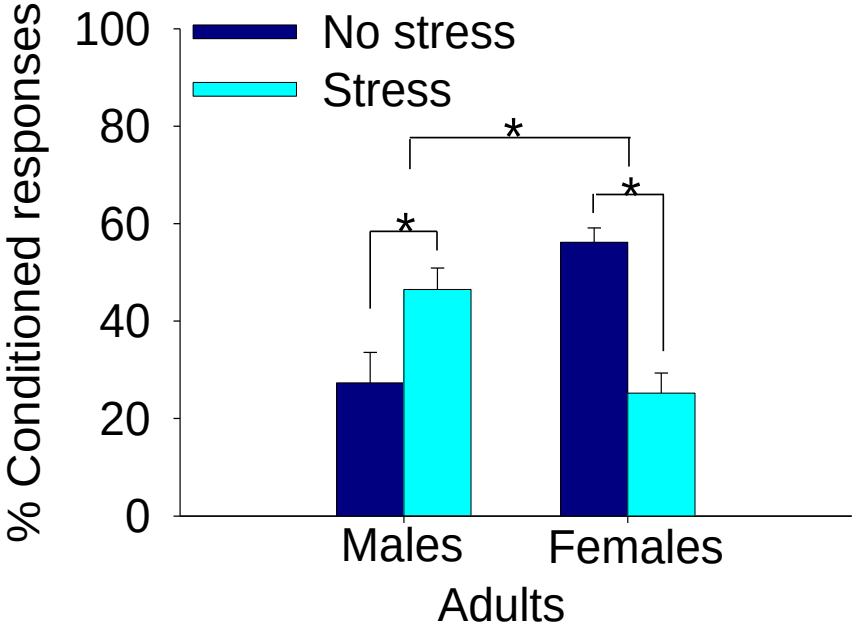
Behavioral Neuroscience
2001, Vol. 115, No. 1, 175–187

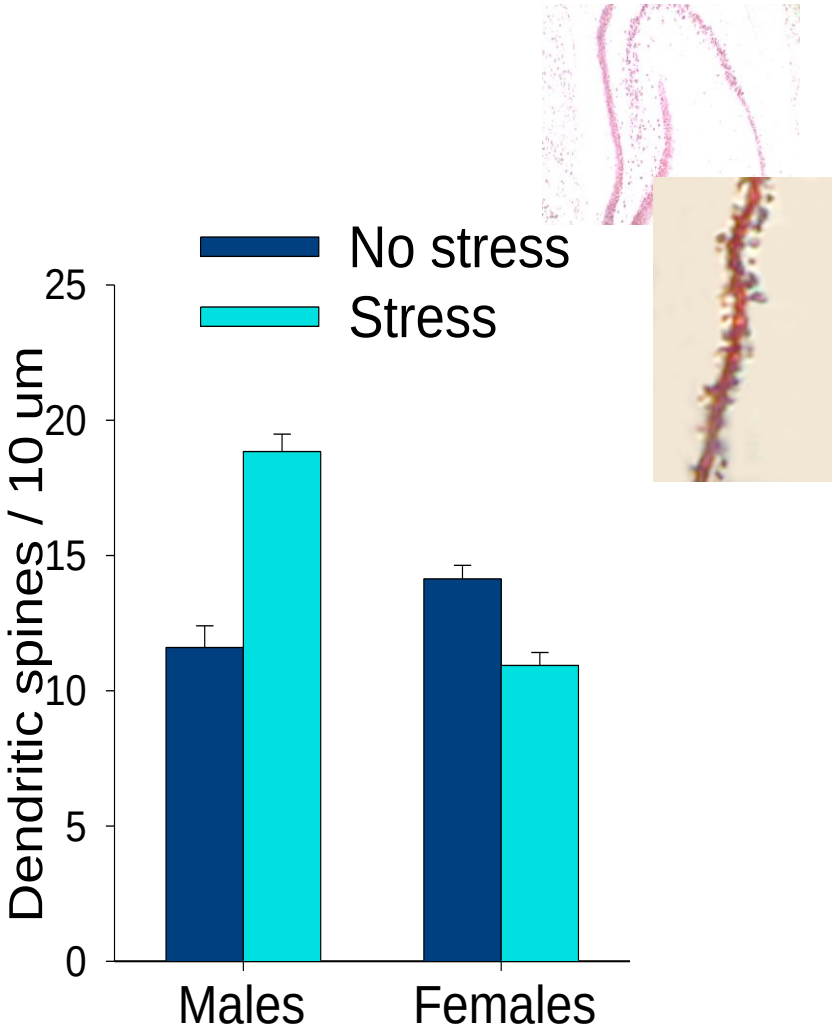
Wood, Beylin, & Shors

Πλαστικότητα του εγκεφάλου

Στον ενήλικο εγκέφαλο πεθαίνουν συνέχεια νευρικά κύτταρα. Αλλά, επίσης γεννιούνται συνέχεια νέα κύτταρα και δημιουργούνται νέες συνάψεις μεταξύ των ήδη υπαρχόντων κυττάρων.

Το οξύ στρες αυξάνει τη μάθηση και τις συνάψεις στον ιππόκαμπο των αρσενικών, αλλά τη μειώνει στα θηλυκά κατά τη φάση του πρόοιστρου



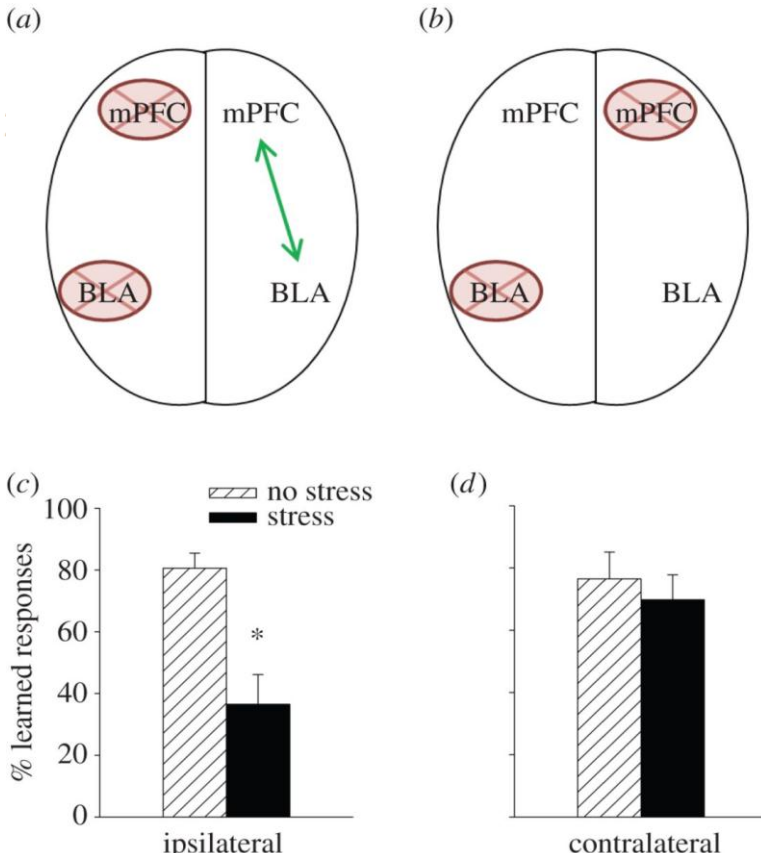


Reviewed in Dalla C. and Shors T. J. 2009

Behavioral/Systems/Cognitive

The Prefrontal Cortex Communicates with the Amygdala to Impair Learning after Acute Stress in Females but Not in Males

Lisa Y. Maeng, Jaylyn Waddell, and Tracey J. Shors
Department of Psychology and Center for Collaborative Neuroscience, Rutgers University,



Εφηβεία…

Available online at www.sciencedirect.com
SCIENCE DIRECT
Hormones and Behavior 48 (2005) 163 – 171
Hormones and Behavior
www.elsevier.com/locate/yhbeh

Distinctive stress effects on learning during puberty

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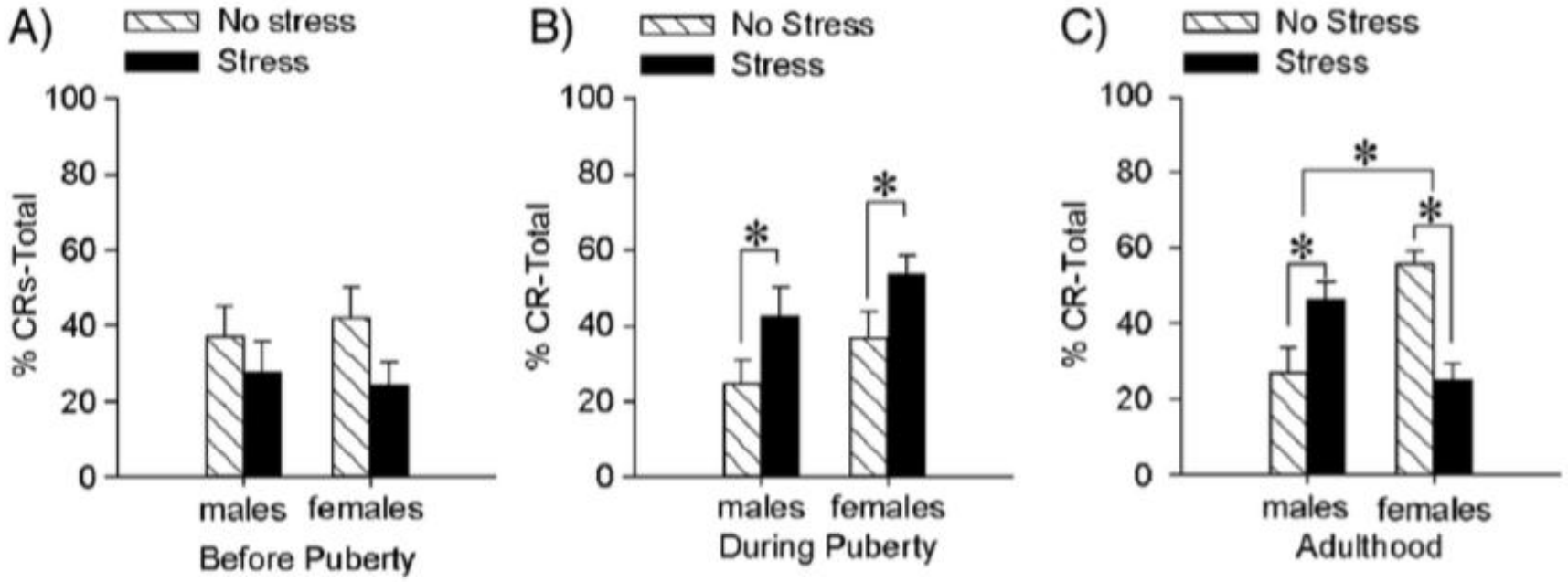
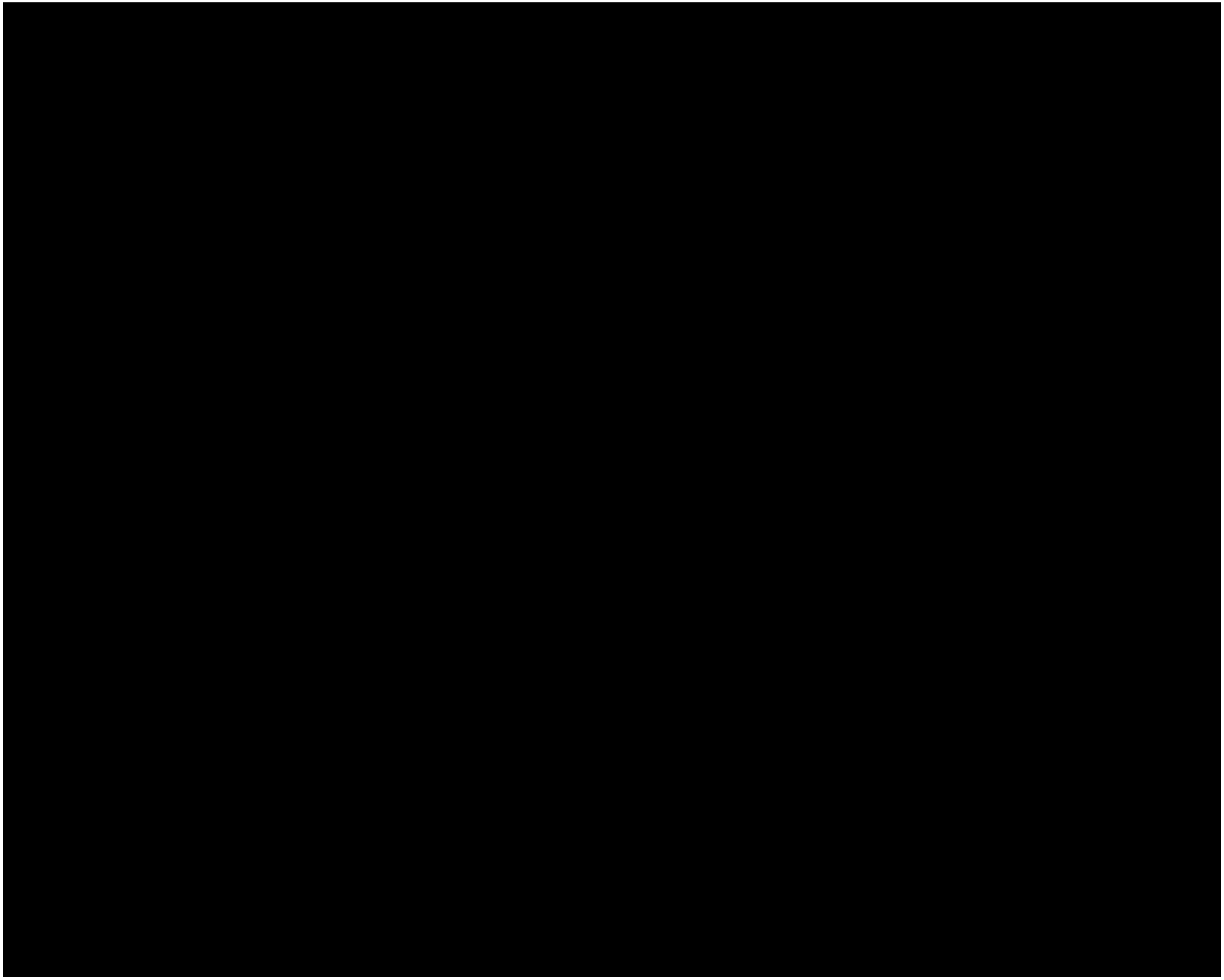
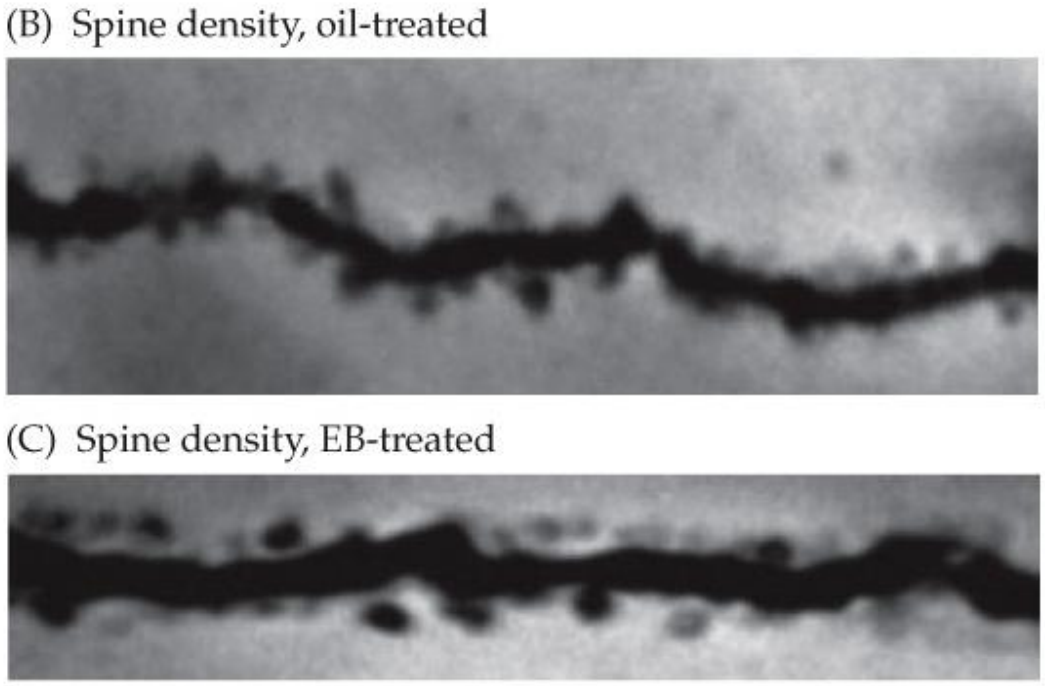
Department of Psychology and Center for Collaborative Neuroscience, Rutgers University, 152 Frelinghuysen Road, Piscataway, NJ 08854, USA

Received 13 October 2004; revised 3 February 2005; accepted 7 February 2005
Available online 10 May 2005



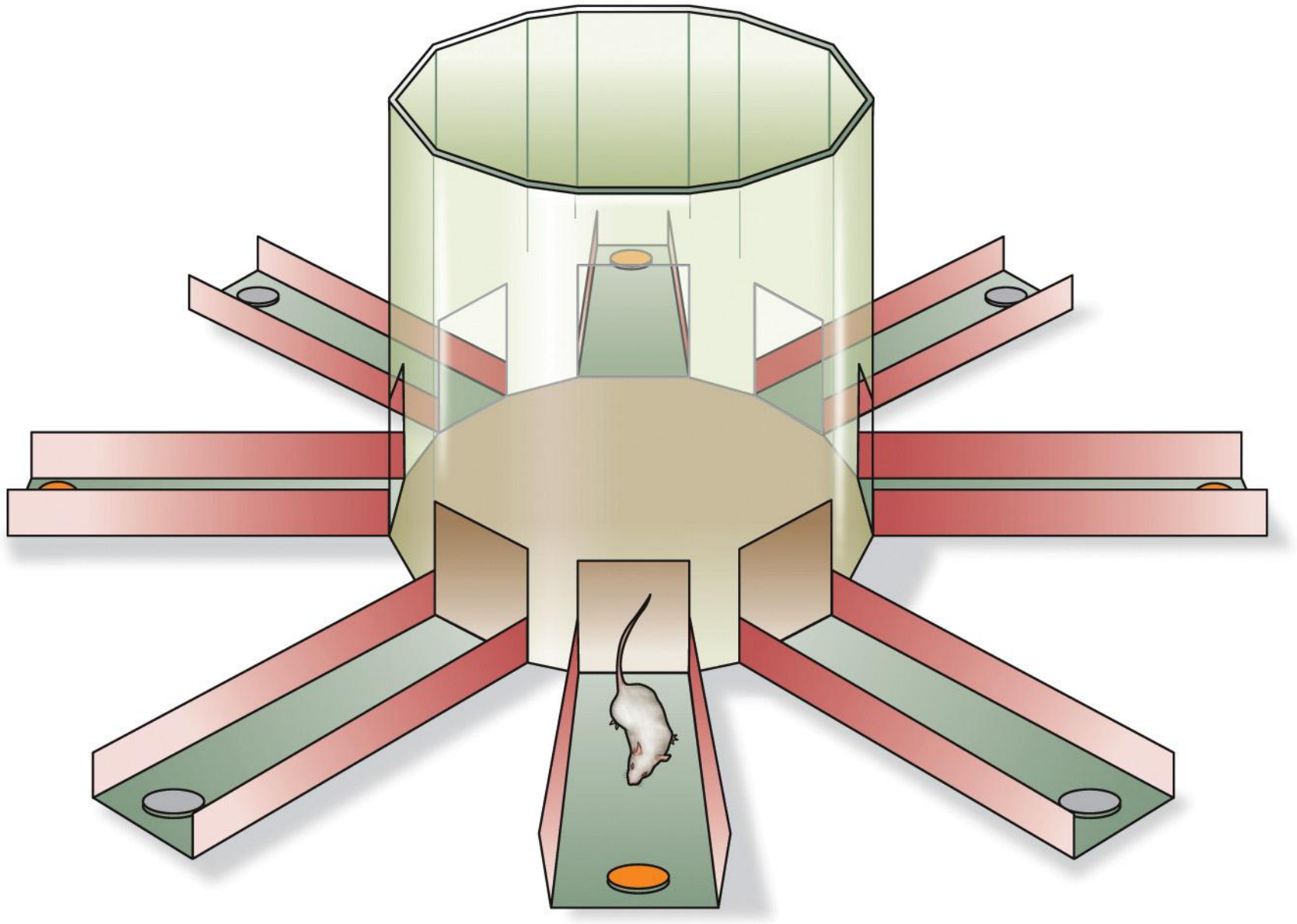


Estrogens influence CA1 dendritic spine function and spatial memory



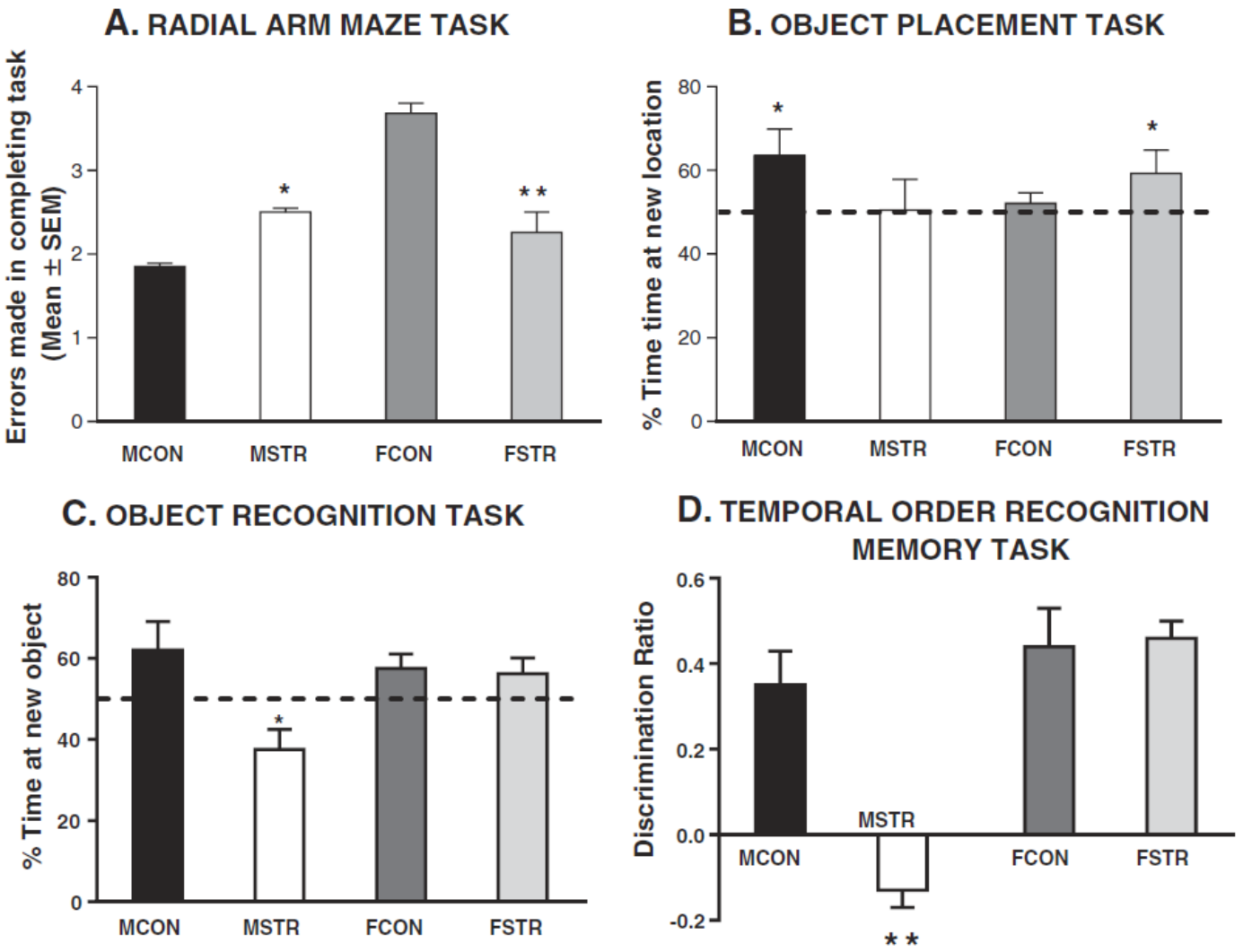
- Treatment with estradiol benzoate (EB) does not increase overall density of dendritic spines in mice.
- It does increase mushroom-shaped spines
- The same dose of EB improves spatial memory

The radial arm maze



AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.20

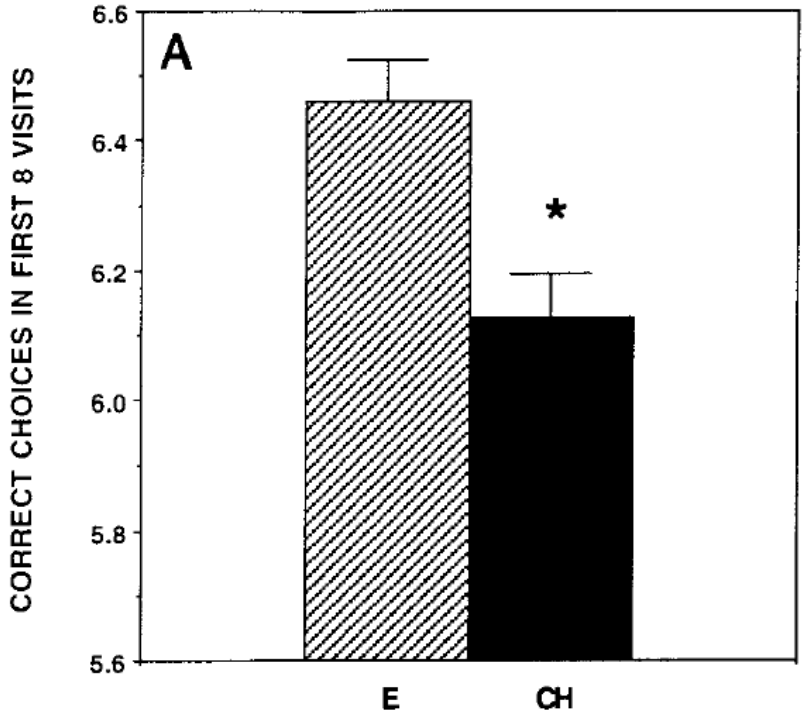
Διαφορές του φύλου στην επίδραση του χρόνιου στρες στη μάθηση

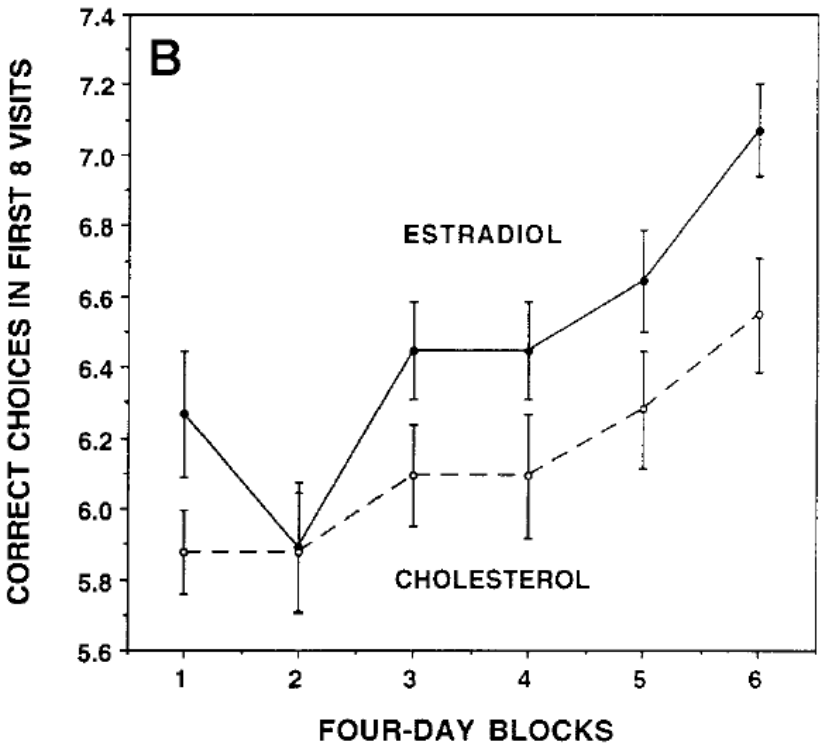


Pharmacology, Biochemistry and Behavior 152 (2017) 13–19

Victoria Luine [a,*], Juan Gomez [b], Kevin Beck [c,d], Rachel Bowman [e]

Η οιστραδιόλη βελτιώνει τη μάθηση





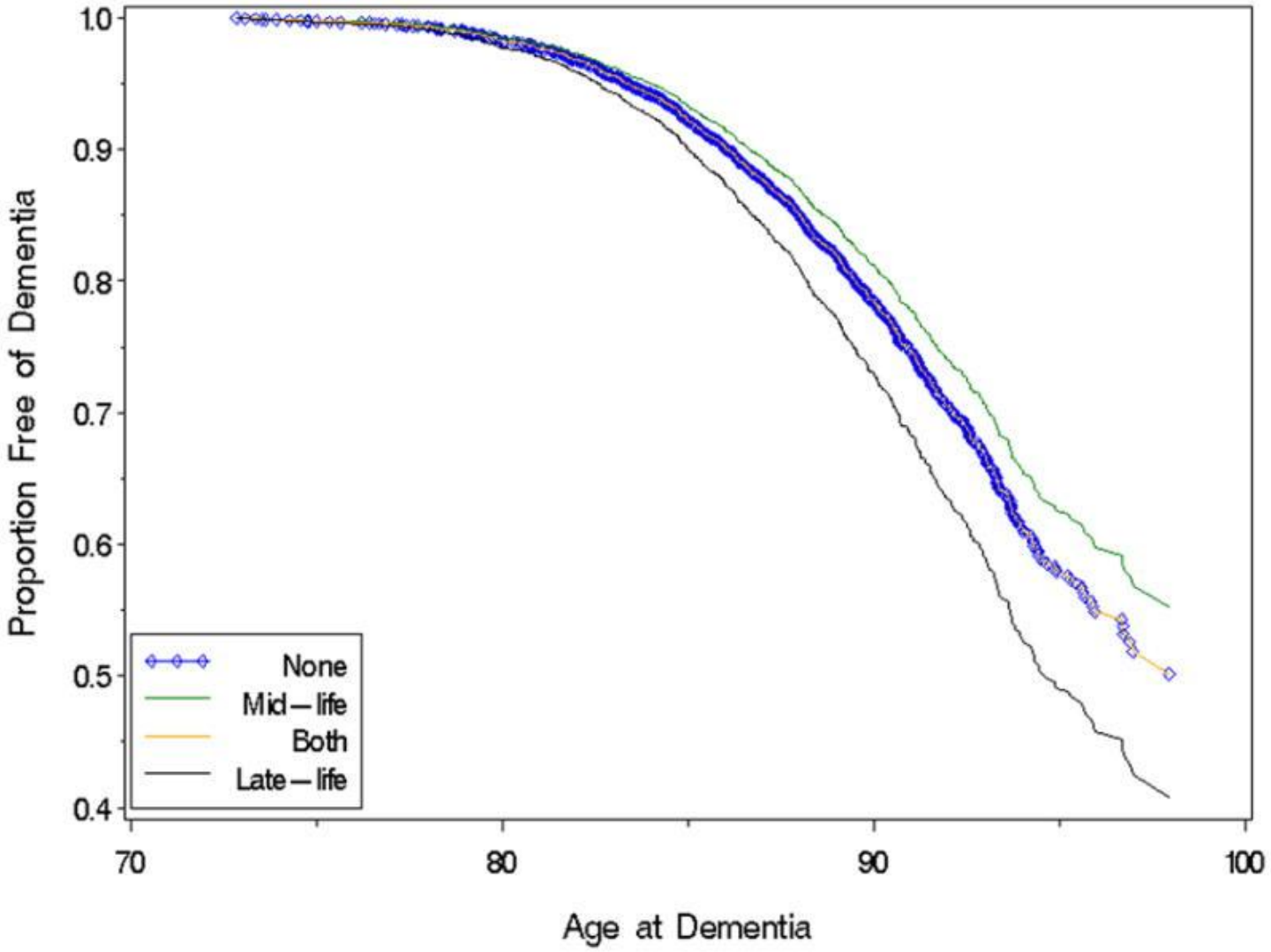
Hormones and Behavior **32,** 217–225 (1997)

Women's Health Initiative study

- Treated postmenopausal women with estrogen and progestin (E+P; Prempro) and estrogen alone (Premarin)
- Predicted it would decrease risk of heart disease and breast cancer and prevent cognitive decline, found it did the opposite
- However, they treated older patients

- "Critical Window Hypothesis"

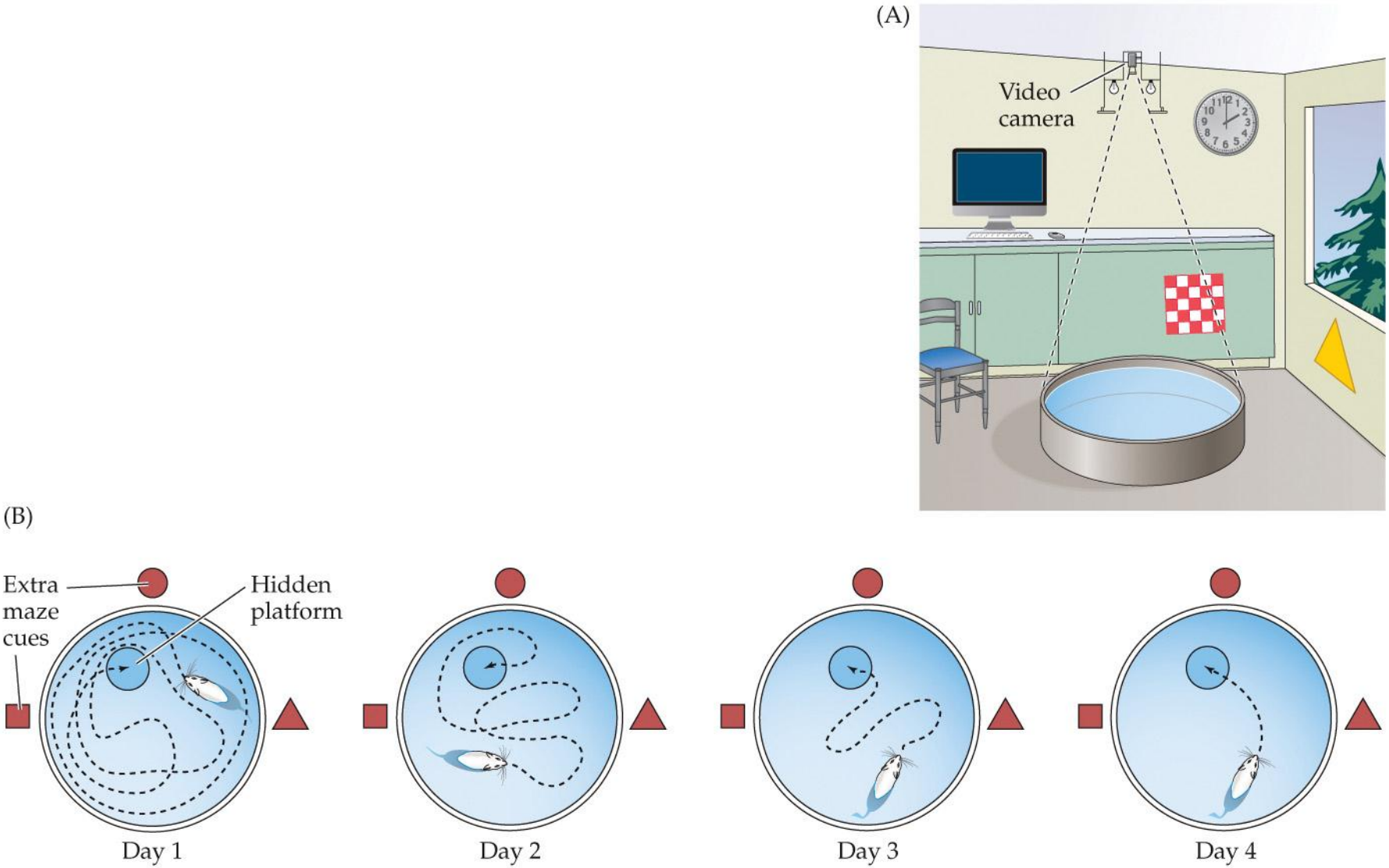
Timing of HT and Dementia onset



Both means HT mid and late life

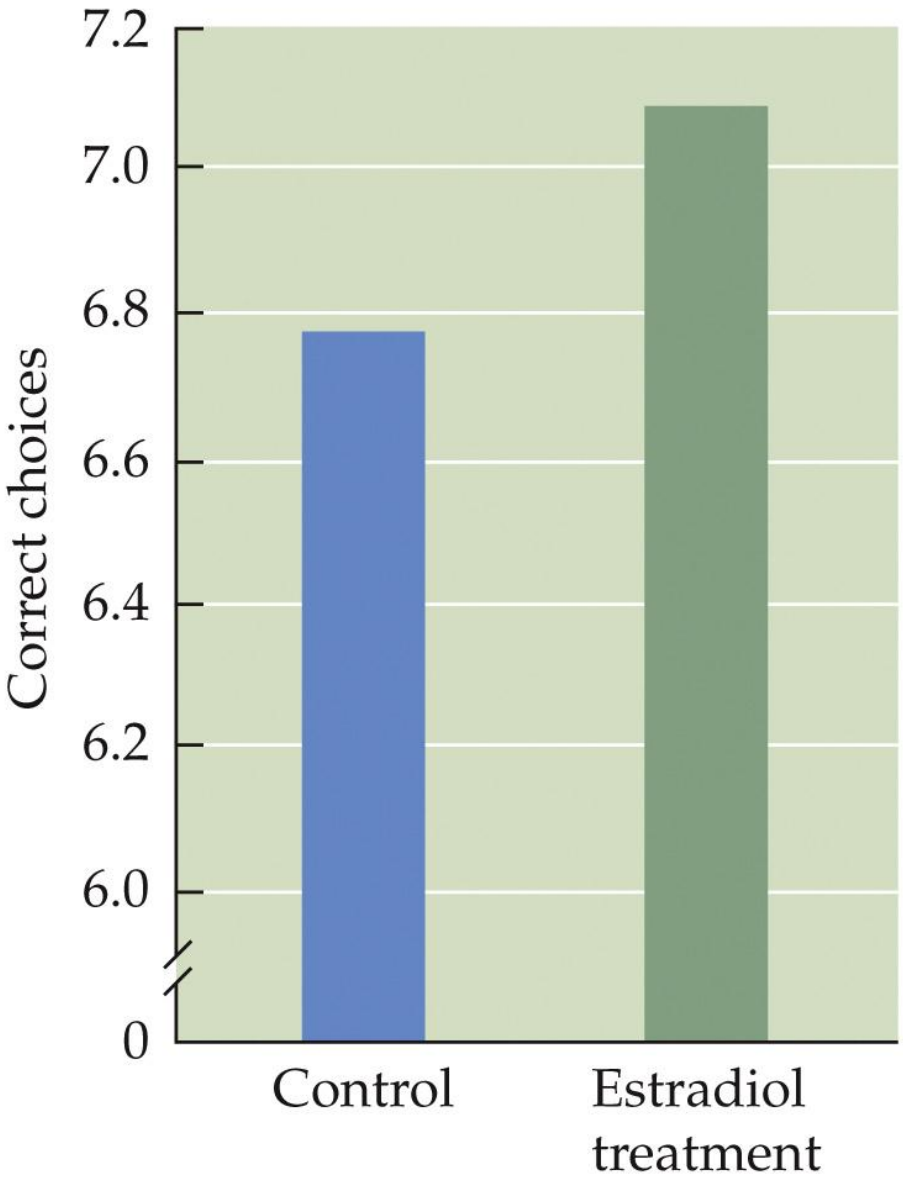
Whitmer, et al., Ann Neurol. 2011 Jan;69(1):163-9

Spatial memory can be assessed in the Morris water maze



AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.16

Estrogen improves spatial memory



Male rats treated with estradiol

AN INTRODUCTION TO BEHAVIORAL ENDOCRINOLOGY 5e, Figure 12.29

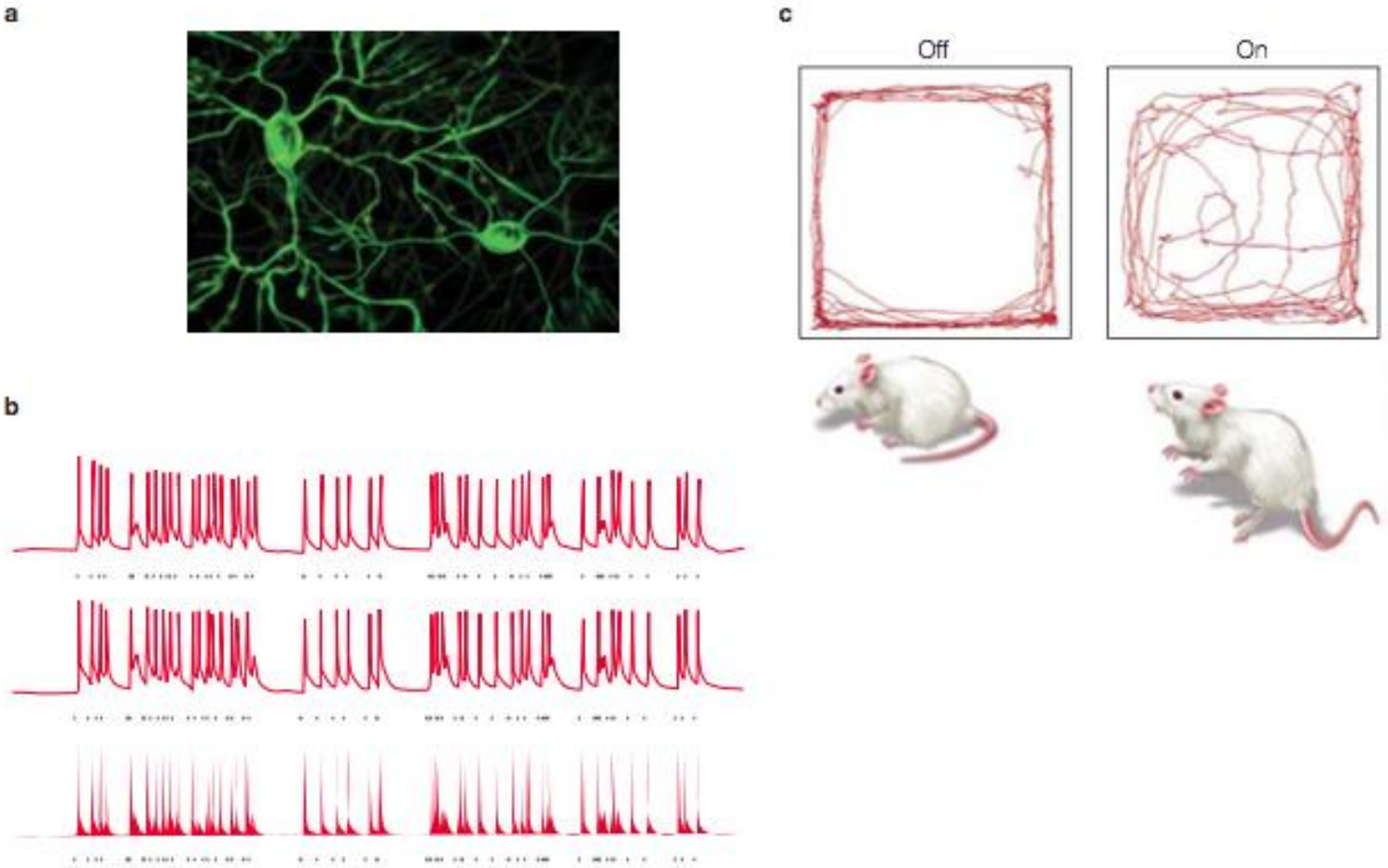


FIGURE 3.1 Optogenetic control of neural activity.
(a) Hippocampal neuron that has been genetically modified to express Channelrhododopsin-2, a protein which forms light-gated ion channels. **(b)** Activity in three neurons when exposed to a blue light. The small grey dashes below each neuron indicate when the light was turned on (same stimulus for all three neurons). The firing pattern of the cells is tightly coupled to the light, indicating the experimenter can control, to a large extent, the activity of the cells. **(c)** Behavioral changes resulting from optogenetic stimulation of cells in a subregion of the amygdala. When placed in an open, rectangular arena, mice generally stay close to the walls. With amygdala activation, the mice become less fearful, venturing out into the open part of the arena.