

EMOTIONAL MEMORY

Claparade (1911)

amnesic and concealed pin



Boswell (Tranel & Damasio, 1990)

'good' and 'bad' guy



EMOTION-BASED LEARNING

The Iowa Gambling Task (Bechara et al, 1994)

A complex game:

100 trials

good, bad, good+bad decks

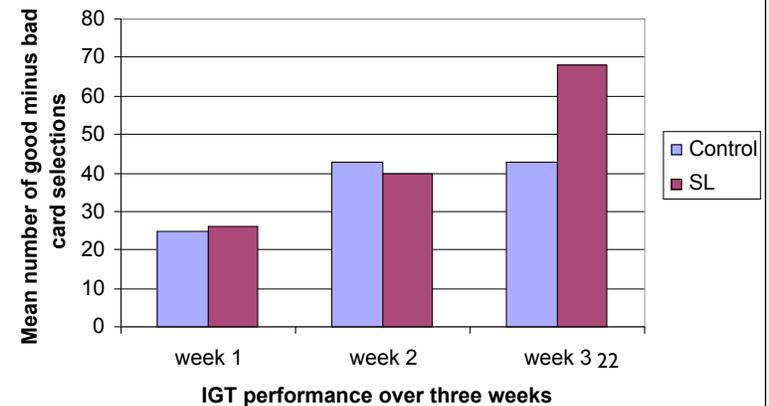
no clear explanation

Players don't *understand* the system

but clearly learn

Intuition, gut feelings, hunches...?

Turnbull & Evans (2006). Preserved complex emotion-based learning in amnesia. *Neuropsychologia*, 44: 300-306



Brain basis of the types of memory

Immediate

Remote...

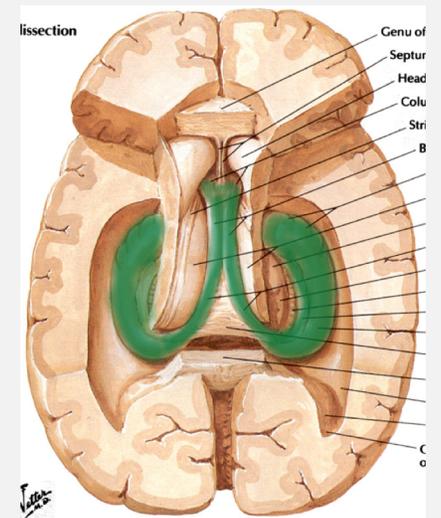
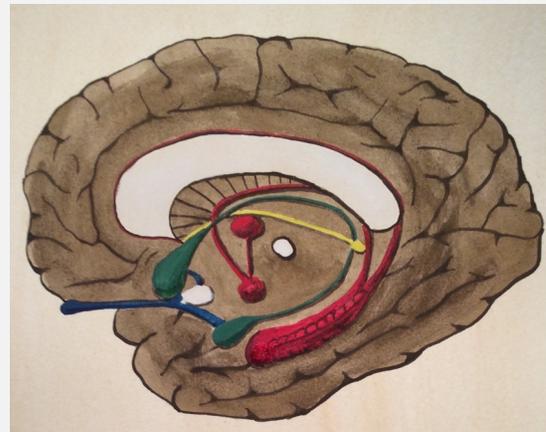
Recent episodic

Emotion based memories

amygdala

BNST

Ventromesial frontal cortex



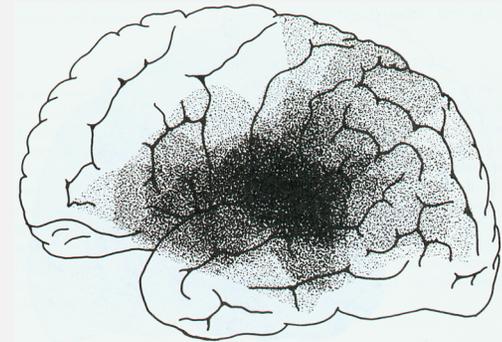
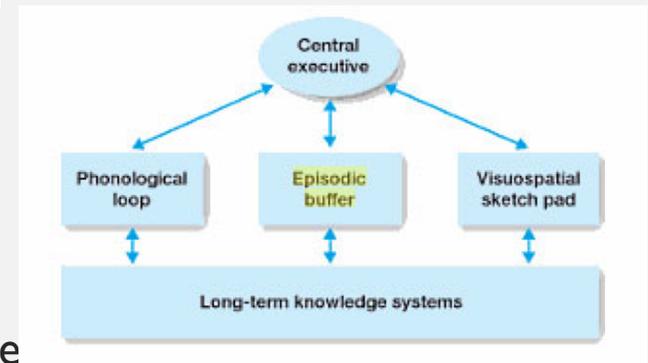
IMMEDIATE MEMORY:

Cortical lesions (lateral convexity)
parieto-temporal

Audio-verbal, phonological...

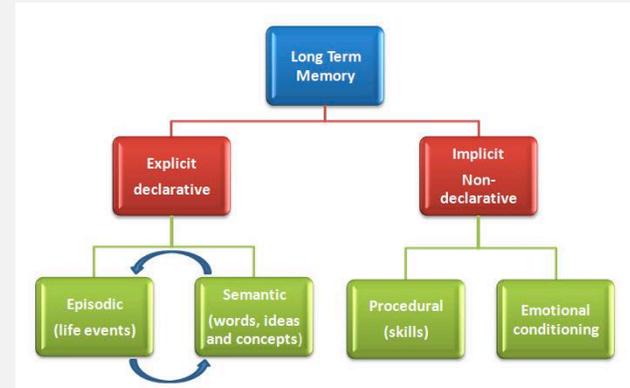
*Left convexity (with conventional cerebral dominance,
'Conduction' aphasia
(comprehension without repetition)*

*Visuo-spatial sketchpad, visual immediate memory
Right convexity*



SEMANTIC MEMORY

words, numbers,
names, concepts, objects...



Semantic memory

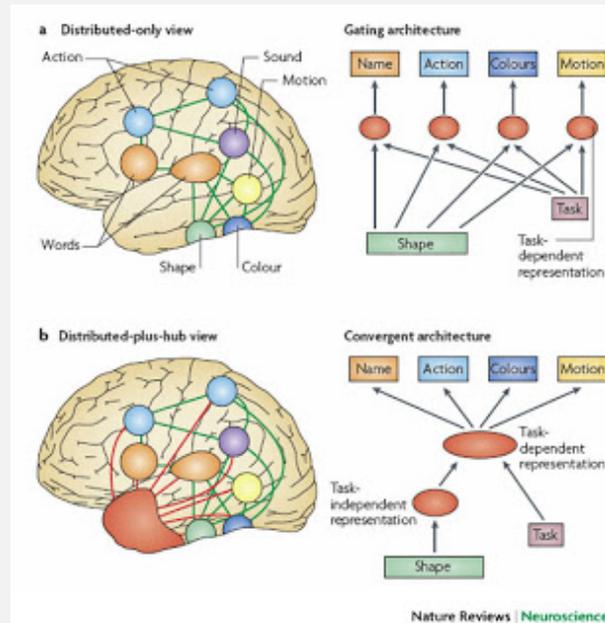
Apples
Edible – Fruit – Stem
Seeds – Tree – Red
Round – Sweet

- Knowledge learned over many interactions
- Takes effort

Episodic memory



- Memory for specific events that you have experienced
- Just happen – no effort



REMOTE MEMORY

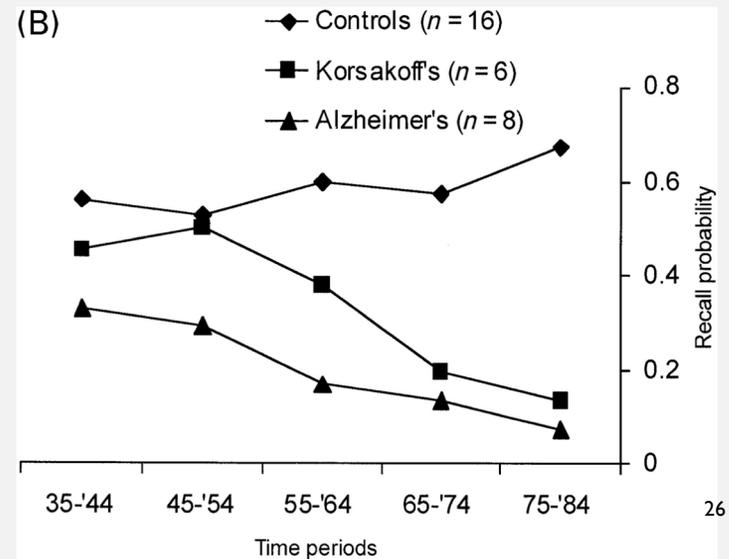
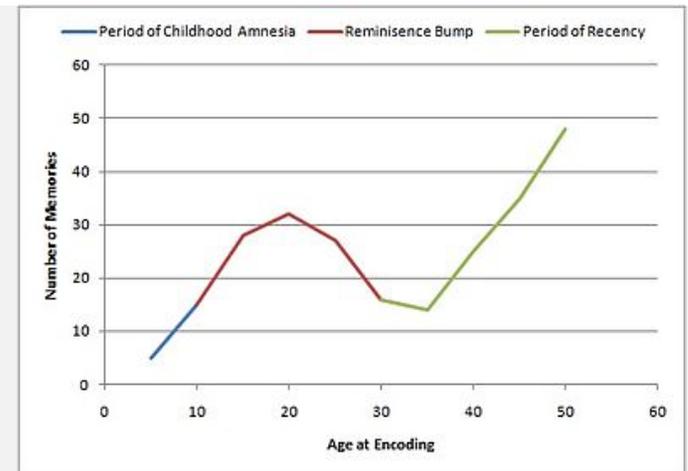
No known lesion site

Gradually lost in dementia

Distributed across systems?

associations of sounds, sights, feelings...

Therefore distributed across brain areas?



RECENT EPISODIC MEMORY

The core of classical ('axial') amnesia

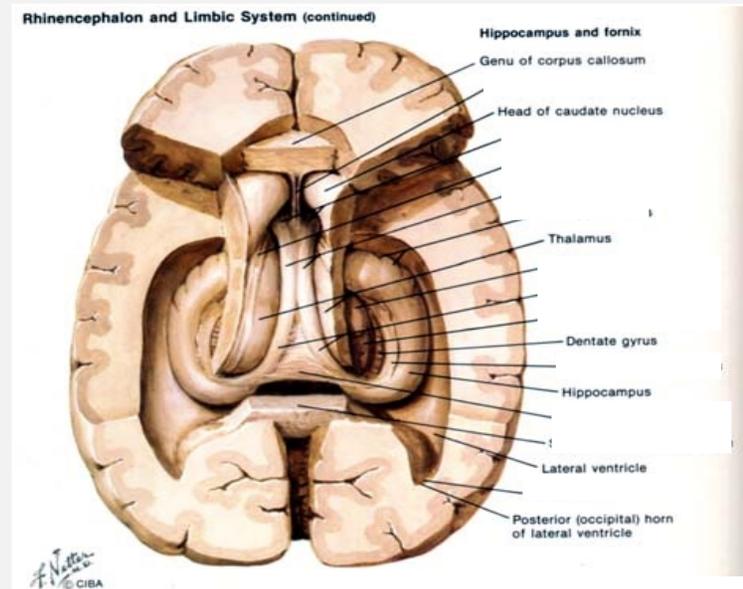
'Papez' Circuit or 'limbic' system

Damage (bilaterally) causes classical amnesia

specific diseases types selectively target

left lesions verbal impairment?

right lesions visuo-spatial impairment?

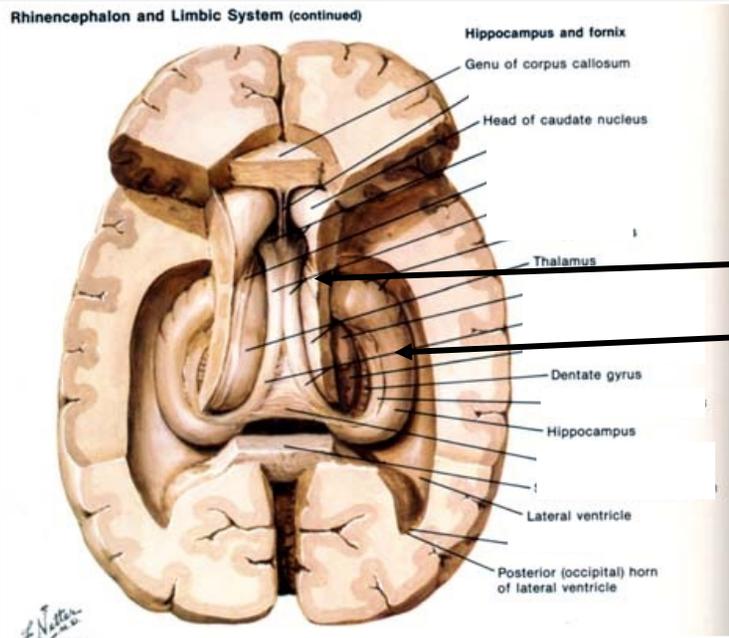
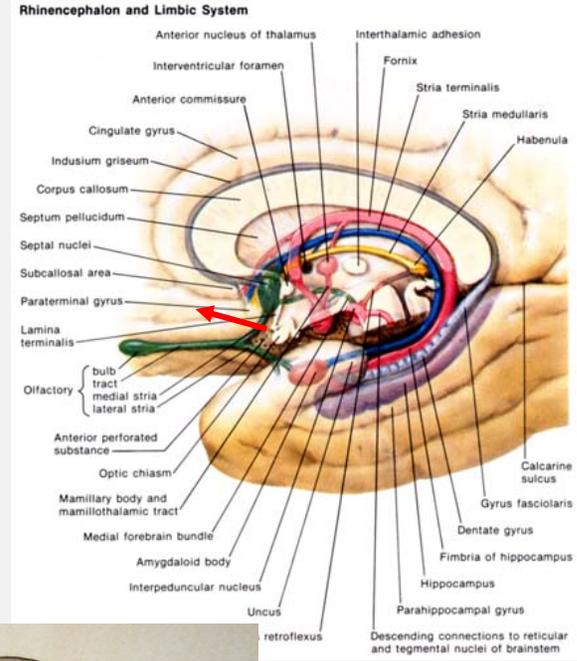


POSTERIOR COMPONENTS

Hippocampus

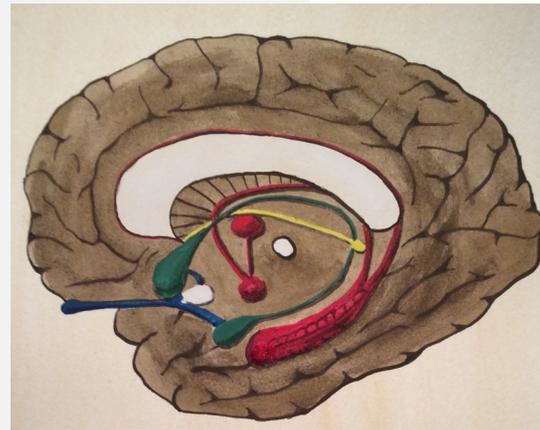
Para-hippocampal gyrus

Fornix



Fornix

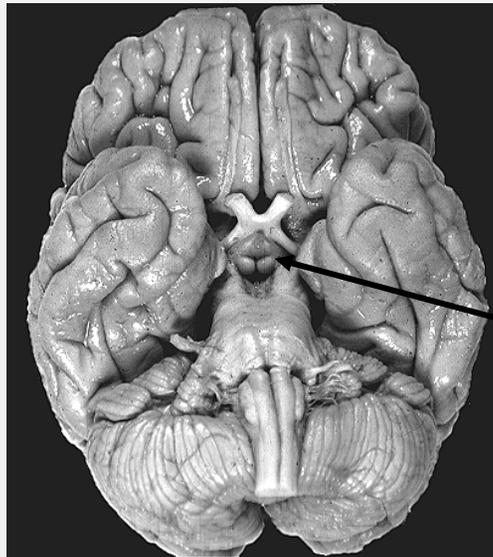
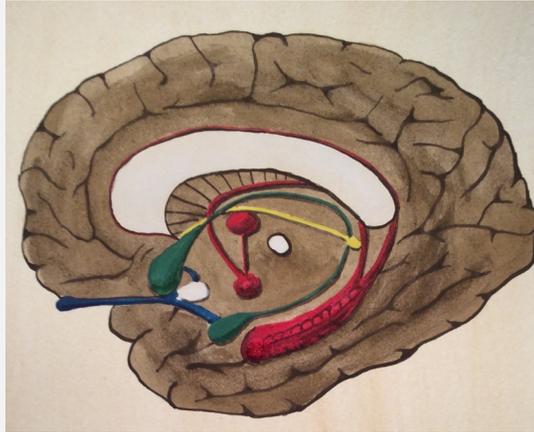
Hippocampus



ANTERIOR COMPONENTS

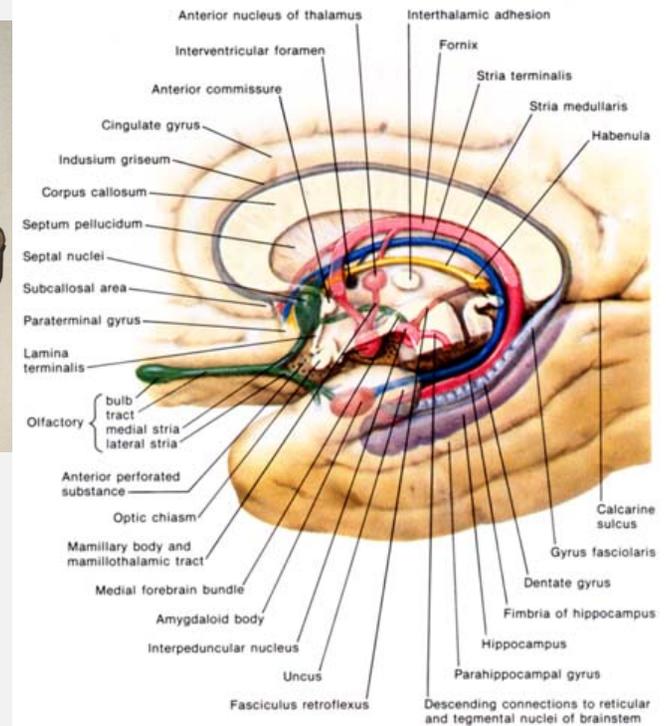
- Mamillary body projects
- Mamillo-thalamic tract
- Anterior nucleus of the thalamus
- Cingulate gyrus

back to the hippocampus!



Mammillary body

Rhinencephalon and Limbic System



CLASSIC ('AXIAL') AMNESIA

Unable to retain new information for explicit recall
episodic memory impairment.

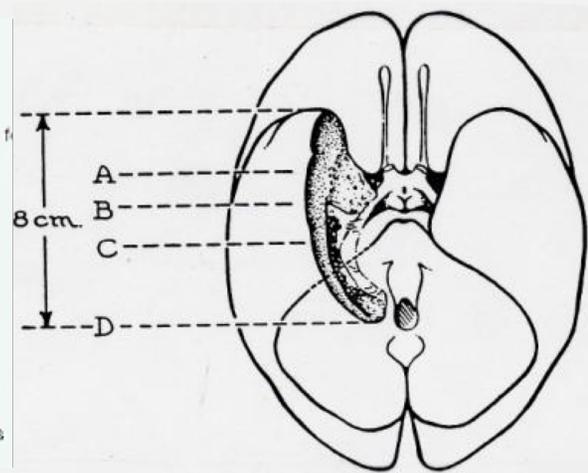
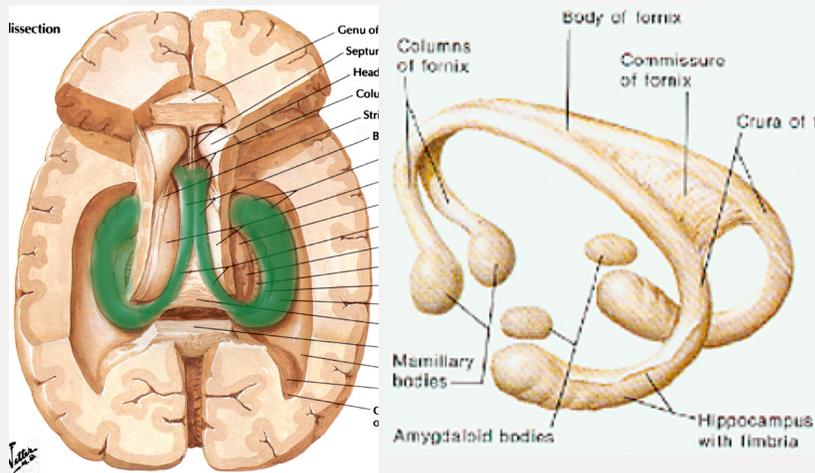
Disoriented to time and place
live in the perpetual present and past

Multiple effects in everyday life
no recollection of the learning attempt
cannot *recall* the information,
but also can't recall being *asked* to remember



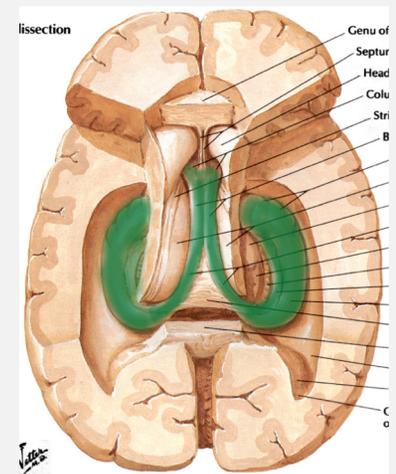
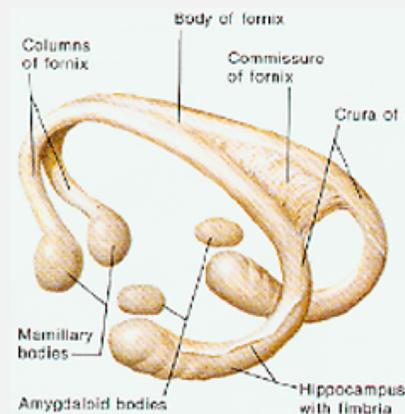
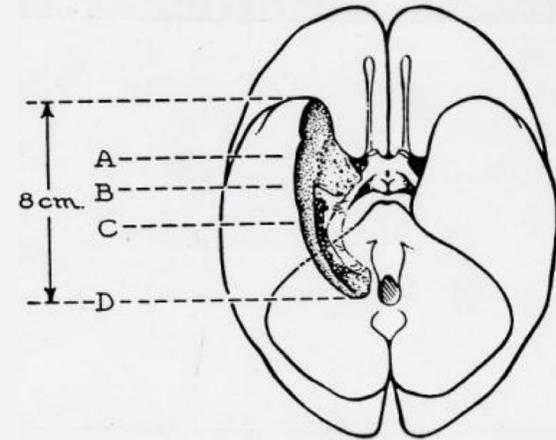
LEARNING IN AMNESIA

HM (Scoville & Milner, 1957)
Epilepsy surgery
Bilateral temporal lobectomy

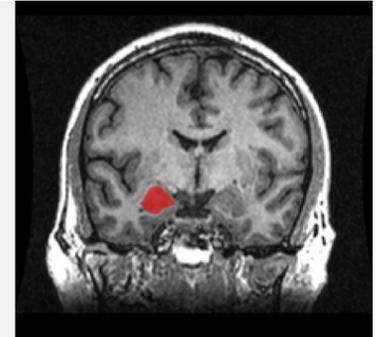


HM'S DEFICITS

Recalls life before surgery
No new memories
anterograde amnesia
New events, personalities?
since 1953



EMOTION-BASED MEMORY



Amygdala

Fear, especially fear *conditioning*, and threat *detection*
basolateral, particularly the lateral nuclei

Finding: *Amygdala damaged - threatening stimuli treated as benign.*
True

e.g. no longer fearful of snakes

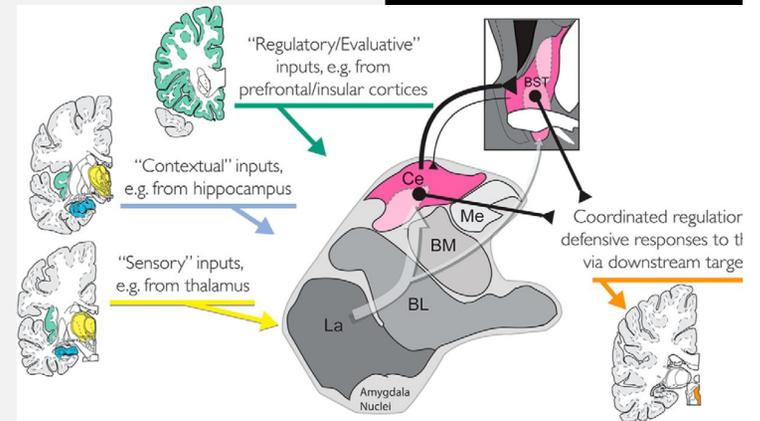
Misinterpretation: *Feelings of "fear" are produced by the amygdala.*

False

People (and other animals) can still experience fear

"I am often said to have identified the amygdala as the brain's "fear" center. But the fact is, I have not done this, nor has anyone else."

(Joe Le Doux, 2015)



URBACH-WIETHE DISEASE

SM: Adolphs, Damasio...

handling snakes and spiders, fear-inducing film clips
dubbed the "woman with no fear"

incapable of recognizing fear in facial expressions

difficulty judging trustworthiness and approachability

impaired declarative memory for emotional material

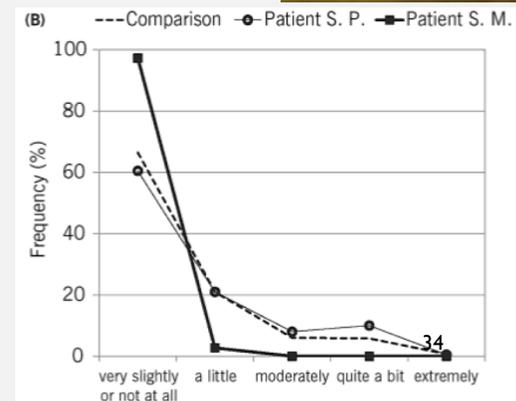
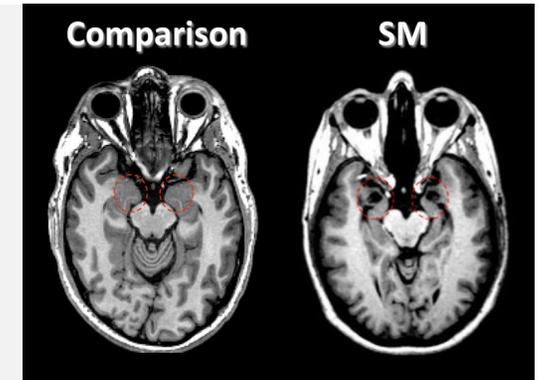
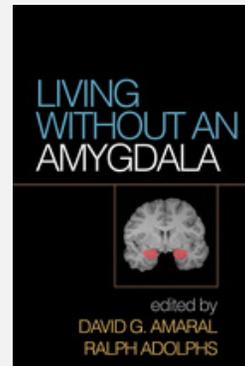
memory consolidation for neutral material is normal

Victim of numerous acts of crime and life-threatening encounters.

held up at both knifepoint and gunpoint

almost killed in a domestic violence incident...

"Did not exhibit any signs of desperation, urgency, or other behavioral responses that would normally be associated with such incidents"

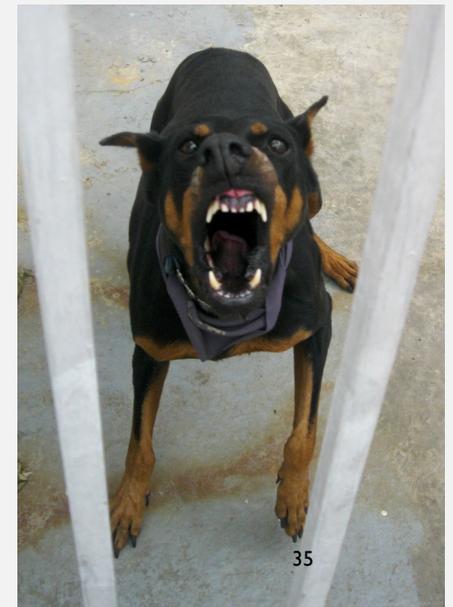
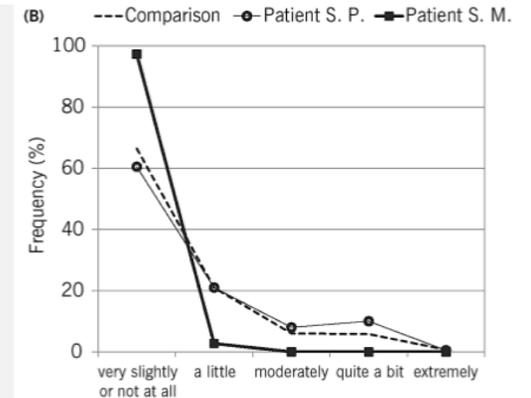


AN ABSENCE OF FEAR

to feel like. As an adult, S. M. denies experiencing any intense states of fear despite the fact that she has faced numerous situations that would be considered fear-inducing or even traumatic in nature. It is evident that she has great difficulty detecting looming threats in her environment and learning to avoid dangerous situations, features of her behavior that have in all likelihood contributed to her high incidence of life-threatening encounters.

of fear across the entire battery of fear measures. In contrast to her paucity of fear as an adult, S. M. remembers experiencing several fearful incidents as a young child, all occurring before the age of 10 and likely before the onset of her amygdala damage (Feinstein et al., 2011). One incident involved a large and vicious Doberman pinscher that trapped her in a corner and caused her to feel “gut-wrenching scared,” suggesting that S. M. understands, at an experiential level, what fear is supposed

Amaral & Adolphs, 2016



AN ABSENCE OF FEAR?

an excess of exploratory approach. For example, at the haunted house, S. M. voluntarily anointed herself the leader of our group, excitedly guiding five strangers and two researchers down dark hallways and into scare traps. S. M. would continually run ahead of the group, yelling, "This way guys, follow me!" as she summoned us with a wave of her arm before jetting down another dark passageway. The whole experience felt as if we were being led into battle. Yet, if this were a real battle, our group would not have survived very long. There was no caution or hesitation in S. M.'s approach. She always seemed to take the most direct path into harm's way.

When an elaborately dressed actor would suddenly appear from behind a wall to scare us, the rest of the group would jump backwards and scream. S. M. never screamed. She never jumped backwards. She never flinched. The repeated attempts at scaring her all failed, and with the exception of a very loud explosion, she was never startled either. Instead, she would

