The Impact of Trauma on Memory

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Acknowledgement of Country

- I would like to acknowledge the traditional owners of the land on which we are meeting today and pay my respect to elders past and present.

Overview

- Prevalence of sexual violence in Australia
- Impacts of trauma and sexual violence on mental health
- Neurobiology of trauma
- Memory processes and neurobiology
- Nature of trauma memories
- Impact of trauma on cognition
- Implications for legal contexts

Prevalence of sexual assault in Australia

1/5 women experienced sexual assault after age 15

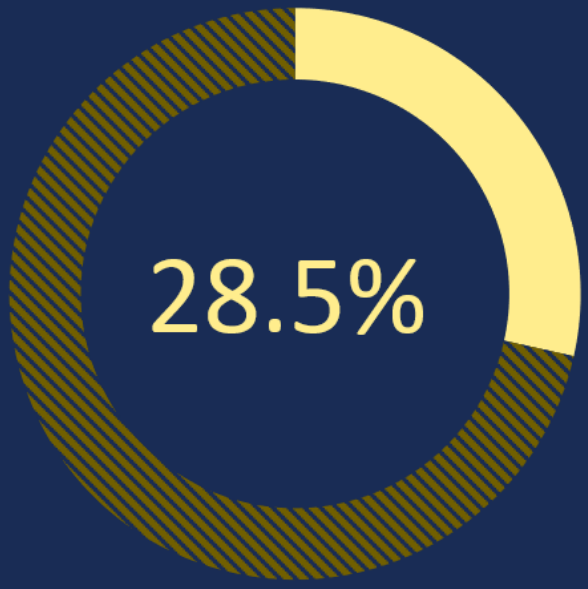
1/16 men experienced sexual assault after age 15

- 84% victim-survivors know the perpetrator of the sexual assault
- 97% perpetrators of sexual assault are male
- 87% female victim-survivors did not contact police
- 65% occurred in residential settings, 18% in community settings

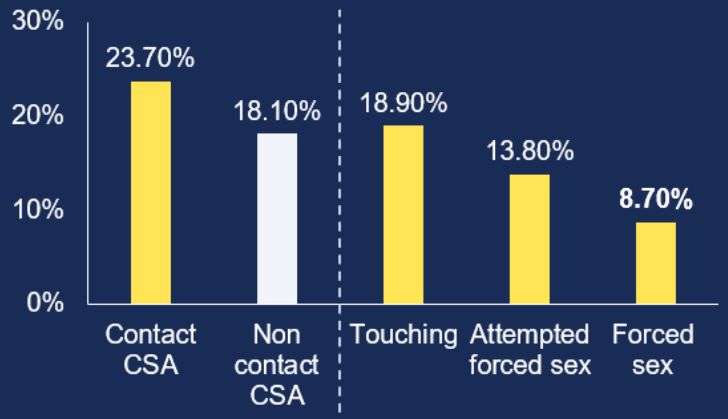
Australian Bureau of Statistics (2020; 2023), Australian Institute of Health and Welfare (2020)

Australian child maltreatment study

Child sexual abuse - Whole sample



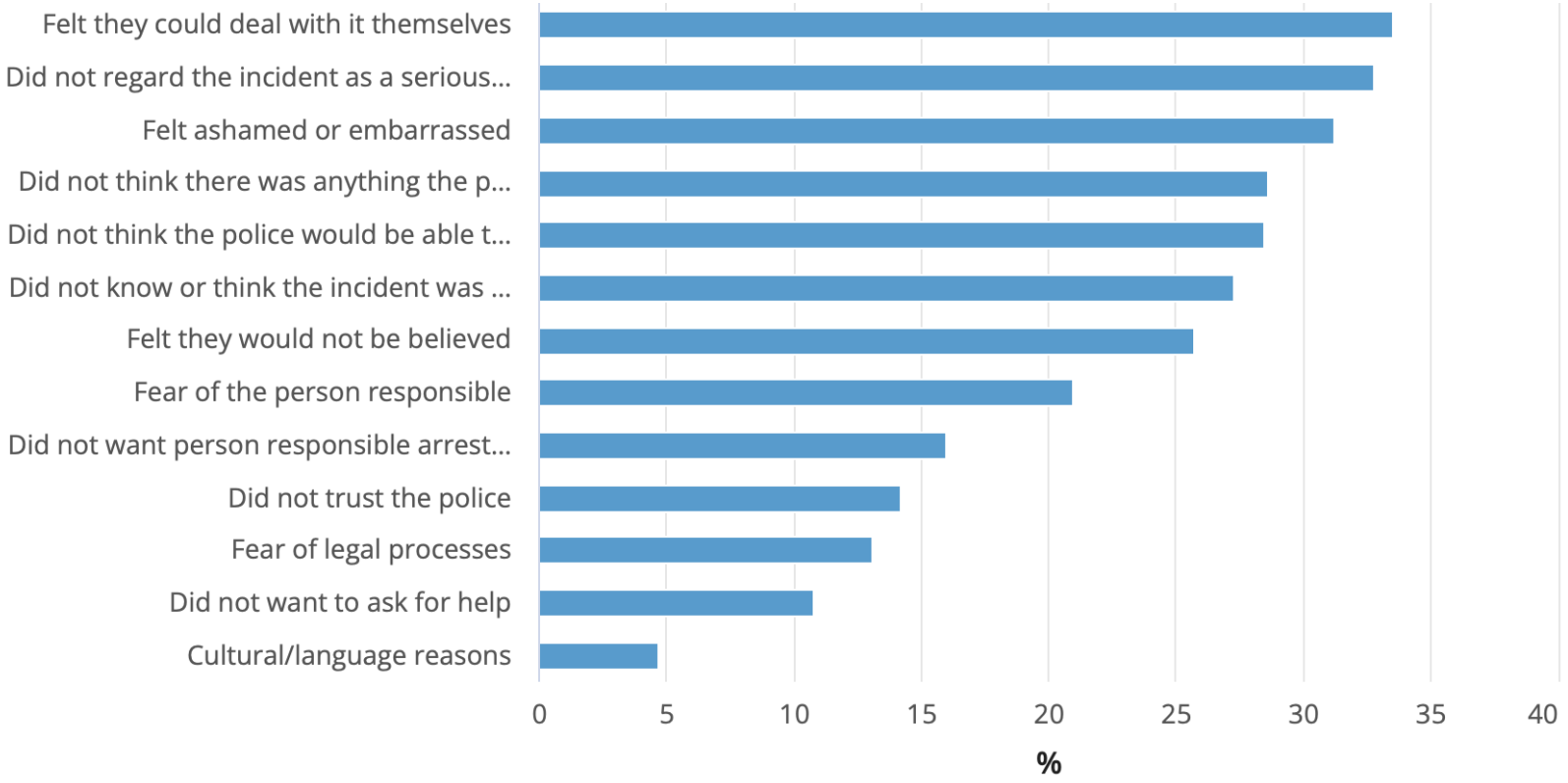
1 in 4 More than 1 in 4 Australians have experienced child sexual abuse



ACMS Australian Child Maltreatment Study

37% female, 19% male victim-survivors

Influences on reporting to police



ABS Personal Safety Survey 2021-2022

Impact of sexual assault on mental health

After a review of >80 empirical studies:

- Sexual assault in adulthood increases the risk of psychiatric diagnoses in adulthood – in particular, PTSD, depression, suicidality and anxiety
- Childhood sexual abuse also increases the risk of mental illness in adulthood – in particular PTSD, depression, suicidality, anxiety, psychosis
- Sexual assault and CSA increase the risk of further victimization
- Risk factors for poor mental health post sexual assault:
  - Self-blame and shame
  - Negative responses to disclosure
  - More severe forms of sexual assault

Sax Institute (2019) Intersection between mental health and sexual assault, NSW MH Commission

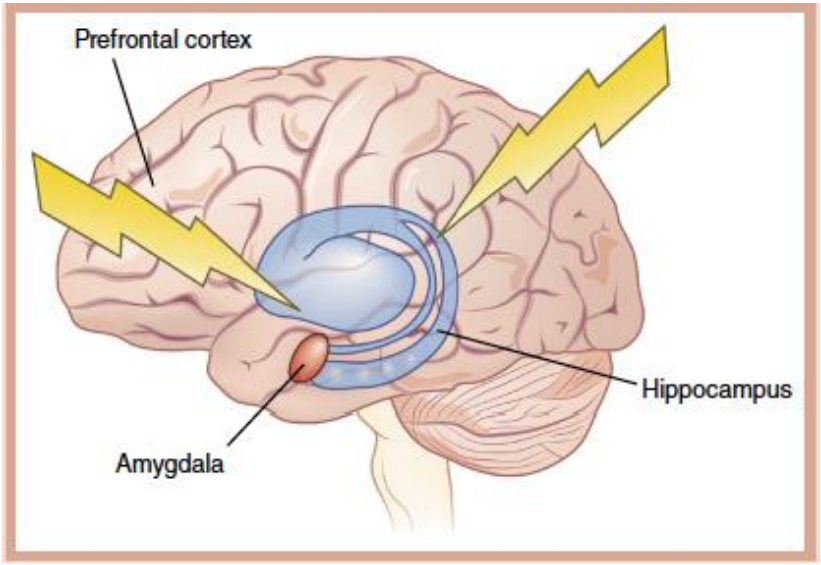
Individually variable responses to sexual assault

- Fear
- Terror/freezing
- Anger
- Numbness and disbelief
- Shame and self-blame
- Distrust
- Dissociation

Research reveals approximately 30% of people with PTSD following interpersonal violence have a dissociative numbing response Rather than a fear response (Lanius, 2010)

Neurobiology of Trauma and PTSD

- >100 neuroimaging studies (functional MRI) reveal specific brain regions are impacted by trauma exposure and PTSD –



- The main brain regions affected by both cumulative trauma exposure and PTSD are the amygdala, hippocampus and prefrontal cortex

These regions are heavily implicated in memory, fear and threat processing, and executive functioning

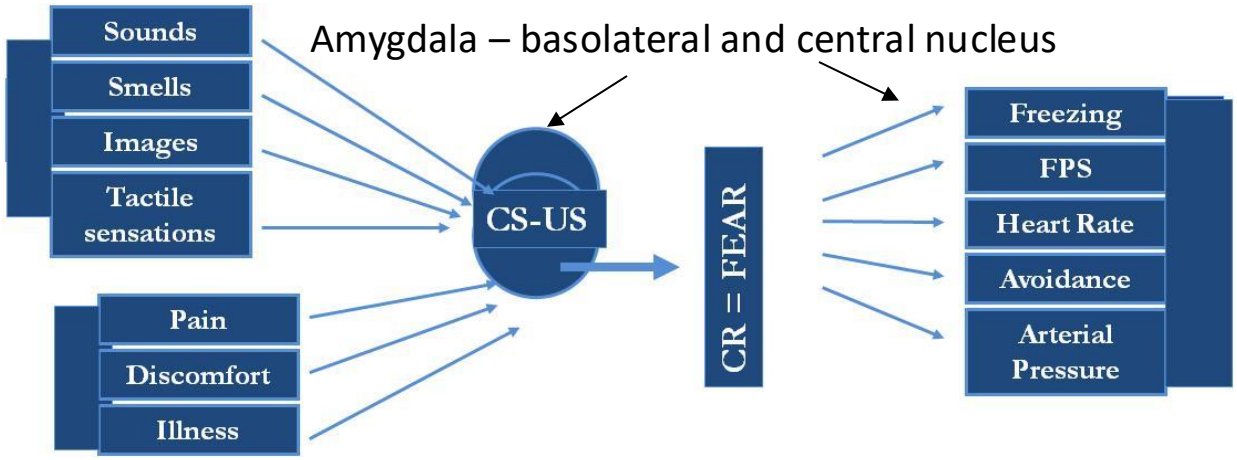
Stark et al., 2015 *Neurosci. BioBehav Reviews*; Hayes et al., 2012. *Biol Mood Anx Disorders,* Hinojosa et al 2024. *Mol Psychiatry*

Amygdala and Trauma

The amygdala is central to processing threat stimuli in the brain, and establishing fear memories.

It is also critically involved in fear conditioning

Amygdala activity is increased following trauma and with PTSD



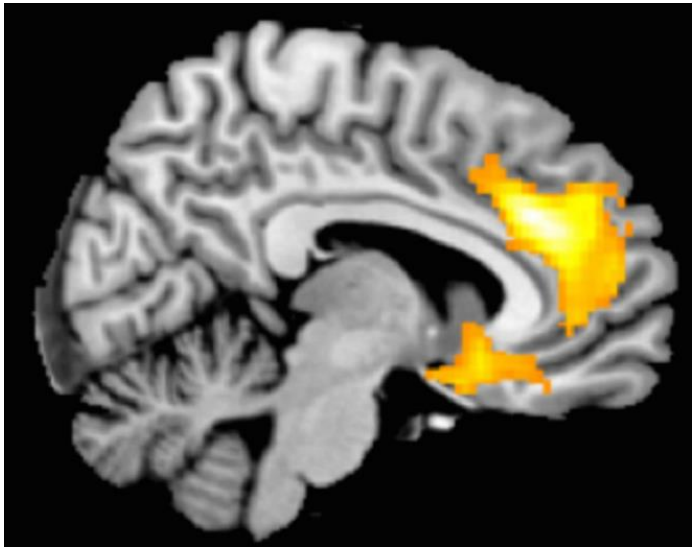
Unconditioned Stimulus →	Unconditioned response
Trauma	Fear
Conditioned Stimulus →	Conditioned Response
Trauma reminders	Fear response

Fear conditioning is a key mechanism involved in PTSD where neutral events at time of trauma become associated with intense fear and later exposure to these reminders trigger this fear response automatically

Pitman, 2012, *Nature Neuroscience*; Le Doux, 2000. *Ann Rev Neurosci.*

Hippocampus: reduced volume and impaired function in PTSD

- The hippocampus is important for episodic memory and contextual processing
- Robust evidence in a meta-analysis of over 89 structural MRI studies of reduced hippocampal volume and activity in PTSD
- This may result in impaired capacity to remember all details of trauma memories in PTSD, and impaired capacity to discriminate threat from safe contexts

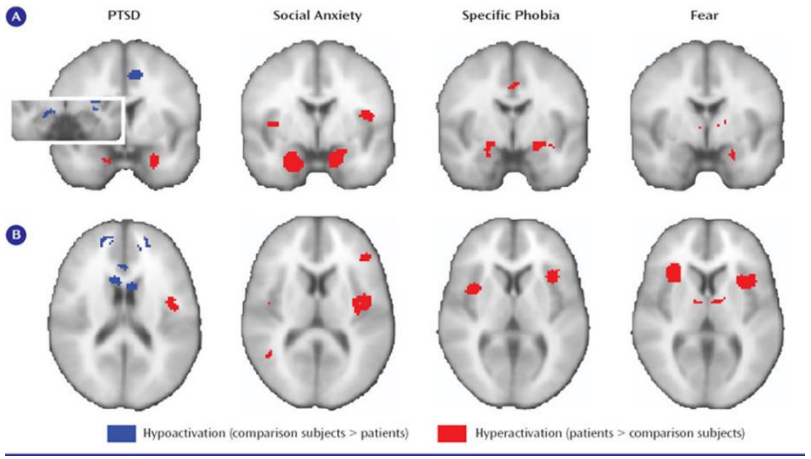


Meta-analysis of 89 structural MRI studies showing reduced volumes in hippocampus, and prefrontal cortex in PTSD and trauma-exposed patients compared to controls

Bromis et al., 2019, *Am J Psychiatry*

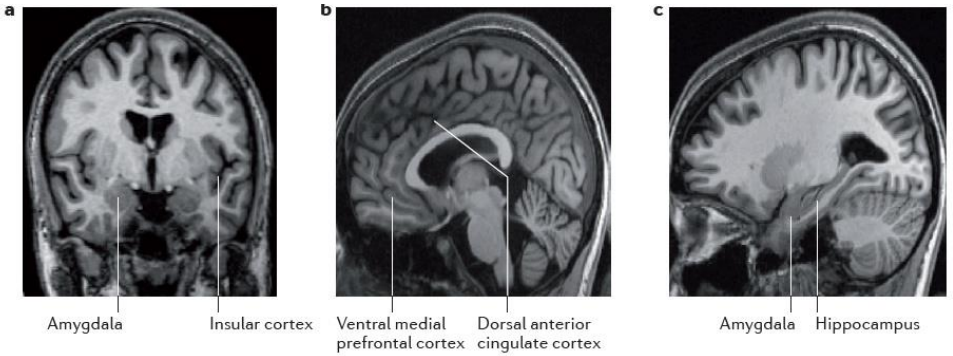
Medial prefrontal cortex activity reduced in PTSD

Medial prefrontal cortex is a critical region involved in attention, executive function and regulation of fear responses (including extinguishing conditioned fear responses)



Etkin & wager, 2007, *Am J Psychiatry*

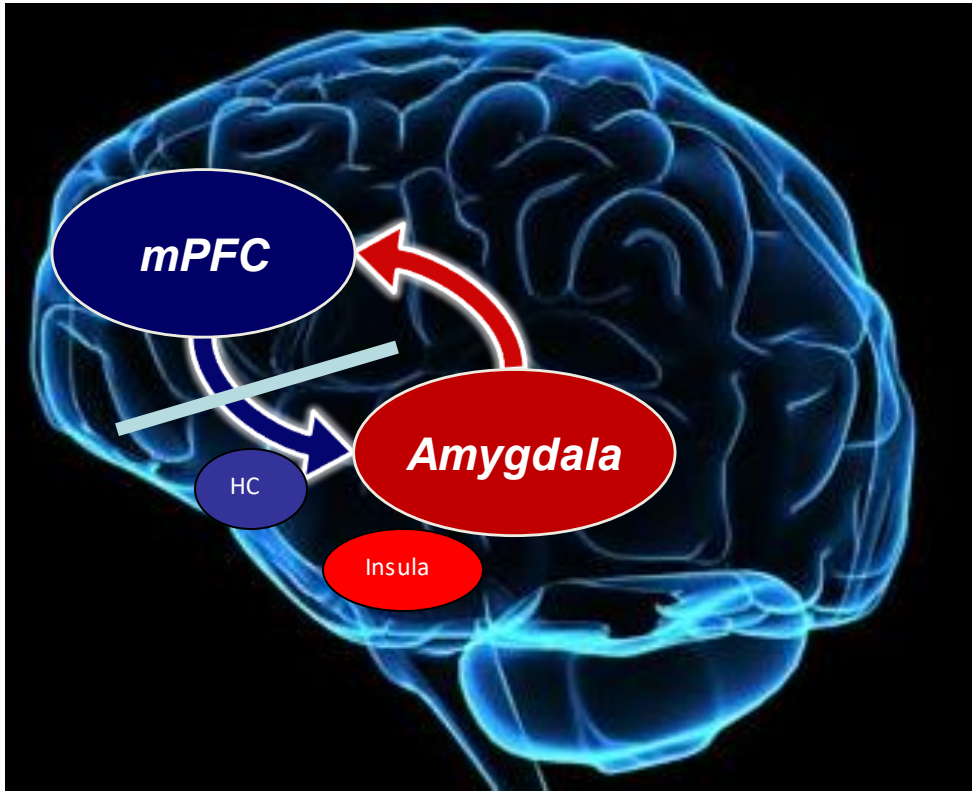
people with PTSD are thought to have impairments in fear extinction leading to ongoing intense arousal to trauma reminders



Hayes et al., 2012, *Biol Mood Anx Dis*

Most robust finding (>100 fMRI studies) is of reduced mPFC activity in PTSD or cumulative trauma- results in impaired attention, regulation of fear and cognitive flexibility in PTSD

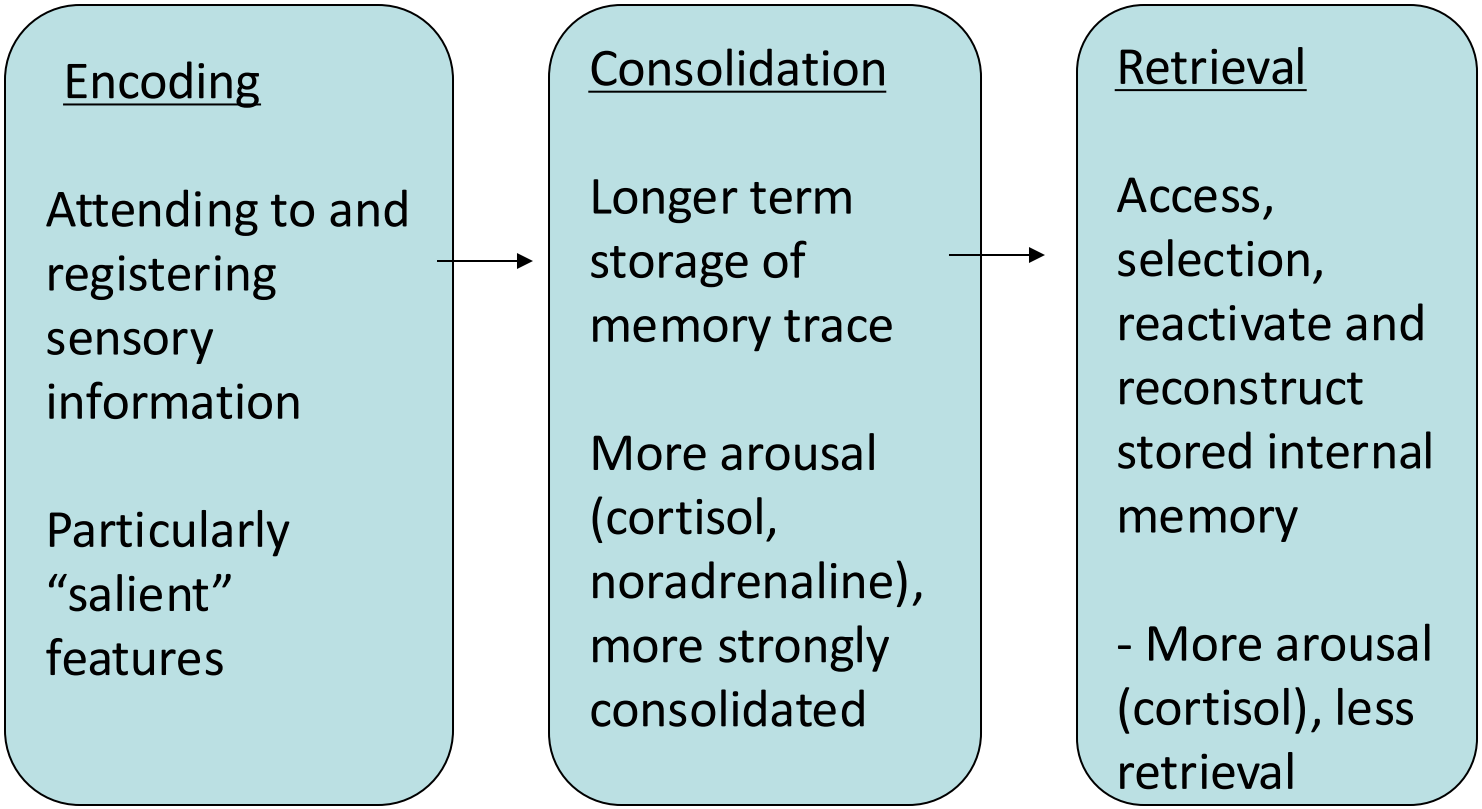
Neurobiological Model of PTSD



Impaired mPFCinhibition onto amygdala-centred fear and arousal networks leads to ongoing hyper-arousal and intrusive memories.

Pitman et al., (2012), *Nature Neuroscience.*

Types and Stages of Memory

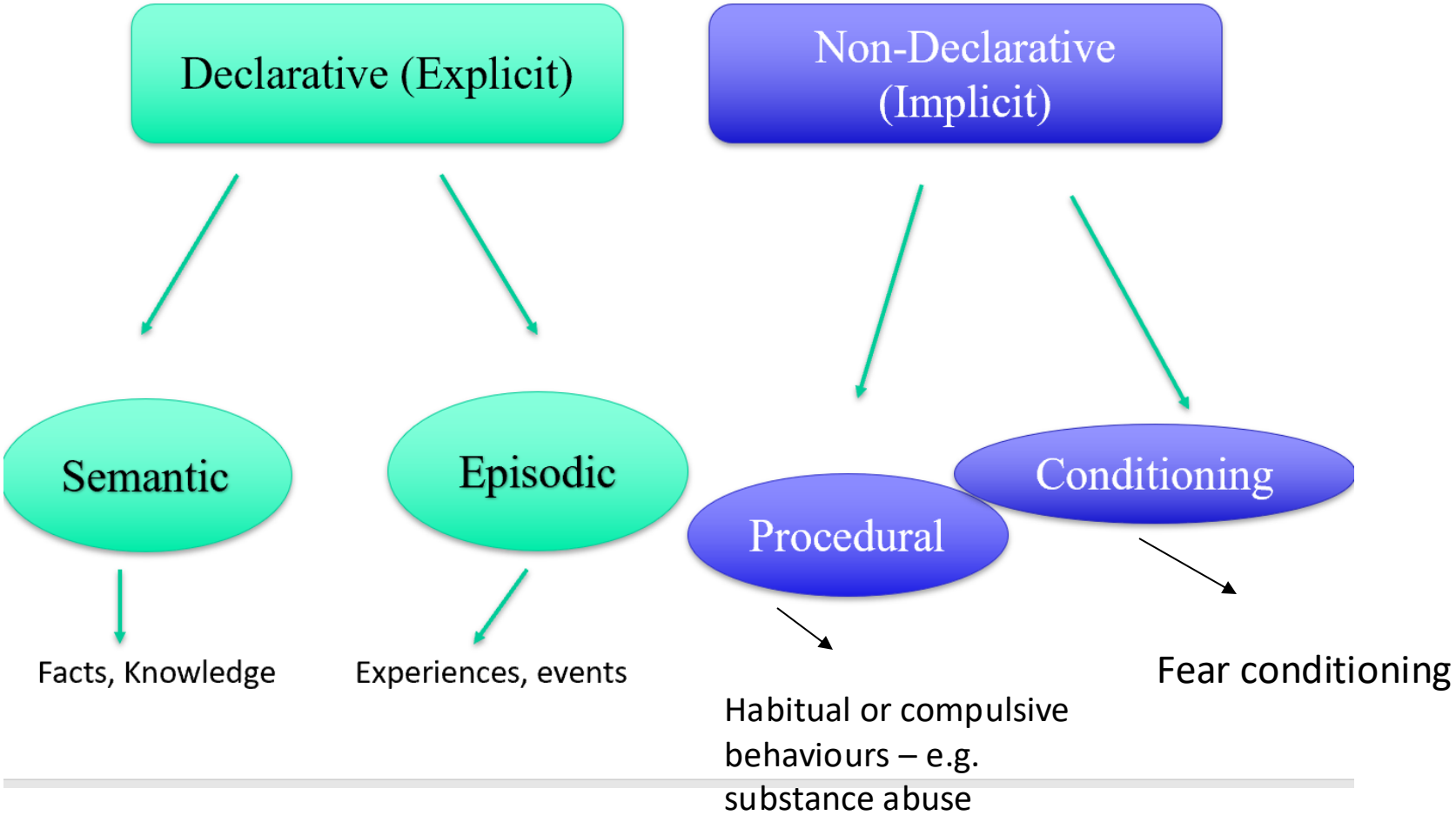


McGaugh (2004) *Ann Rev Neuroscience*, Schwabe L (2024) Memory under stress: From adaptation to disorder. *Biological Psychiatry, in press*.

Types of Memory: Explicit and Implicit

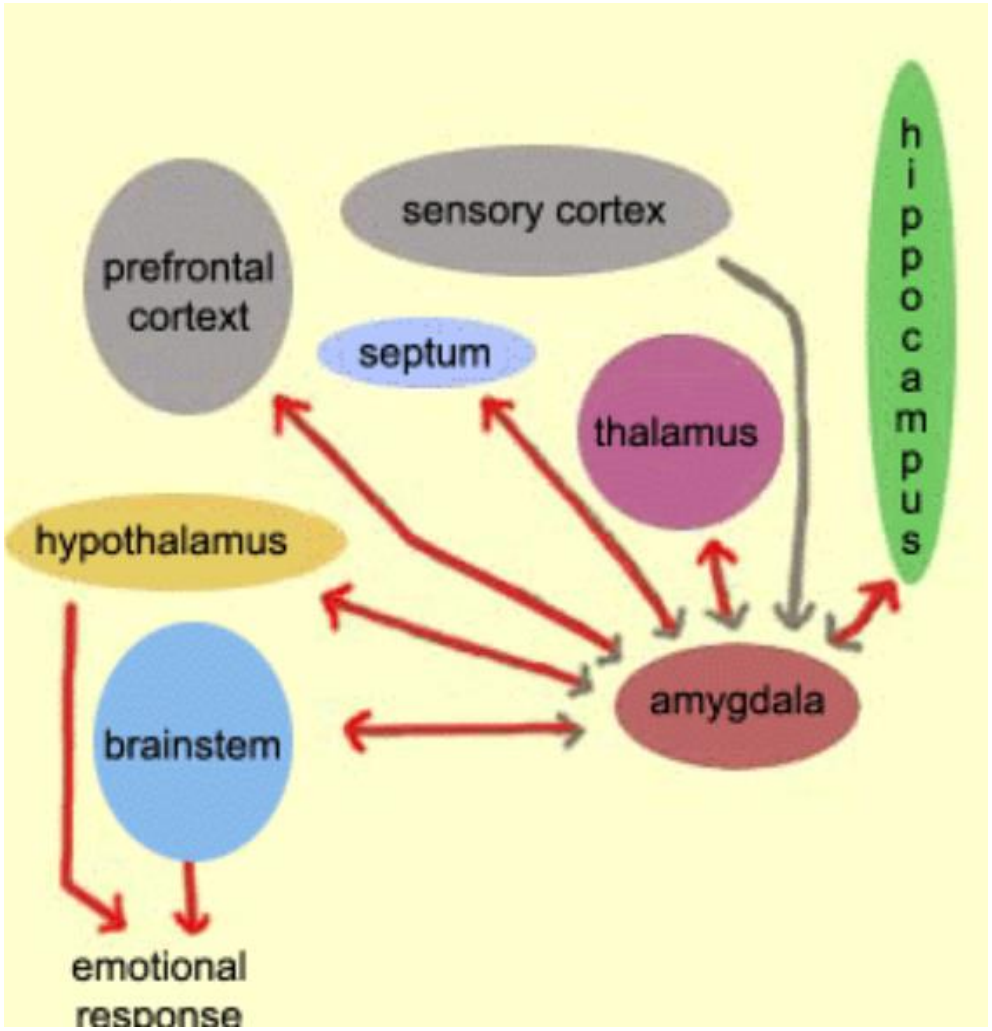
Explicit memory generally impaired in PTSD – except typically fragments of worst moments of trauma

Implicit memory often elevated in PTSD –especially unconscious conditioned fear responses



Visser, Lau-Zhou, Hensen, Holmes. (2018) *Philos Trans R London B Biol Sci, 373 (1742), 20170209.*

Brain regions involved in memory



Explicit memory: medial temporal regions (hippocampus), prefrontal cortex involved in retrieval, default mode network involved in autobiographical memory (Schacter/Addis et al., 2016)

Non-declarative memory: Amygdala (conditioned fear), striatal regions (habits, motor skills, procedural memory)

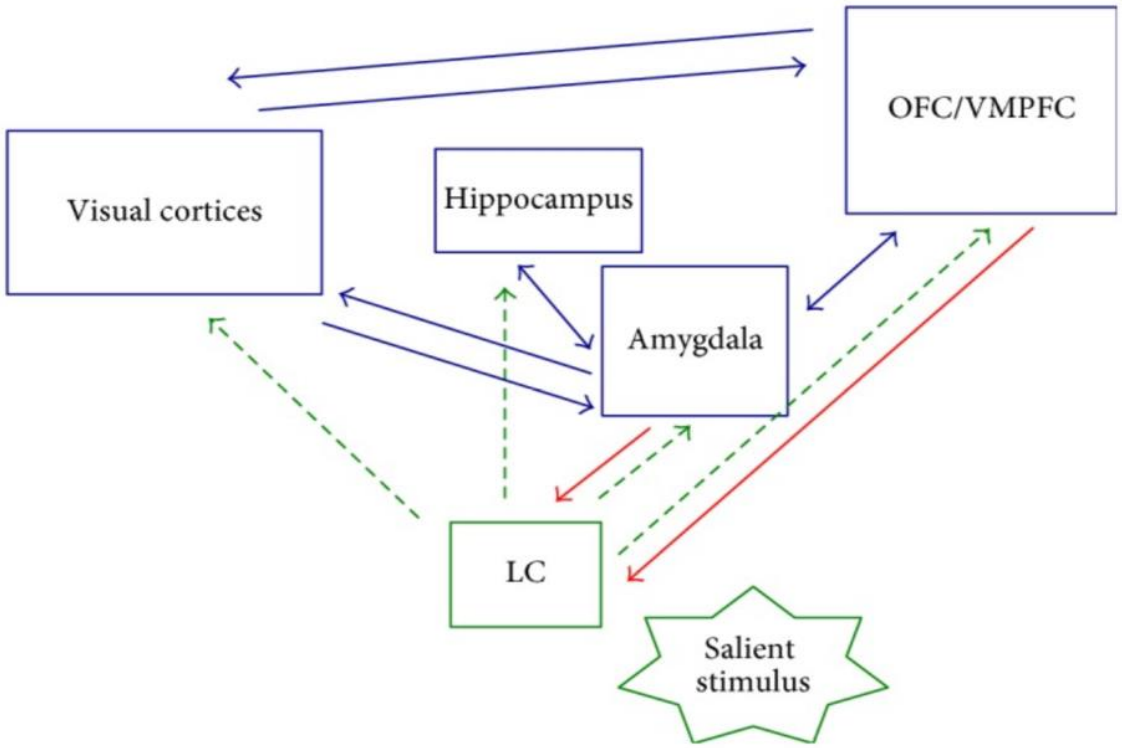
Visser, Lau-Zhou, Hensen, Holmes. (2018) *Philos Trans R London B Biol Sci, 373 (1742), 20170209.*

Nature of Trauma Memory

- Typically fragmented
- Associated with intense arousal
- Triggered by trauma reminders (including needing to talk about trauma)
- Triggers intense distress leading to avoidance
- Difficult to verbalise – particularly early childhood memories – stored visually
- Not a coherent narrative - typically frozen at worst moments (flashbulb memories – "salience tagging"). Due to intense arousal – central salient details are clearly recalled, often in fragments, but peripheral less important details are often not properly encoded or recalled

Brewin C (2010). *Psychological Research*

Salience Tagging:



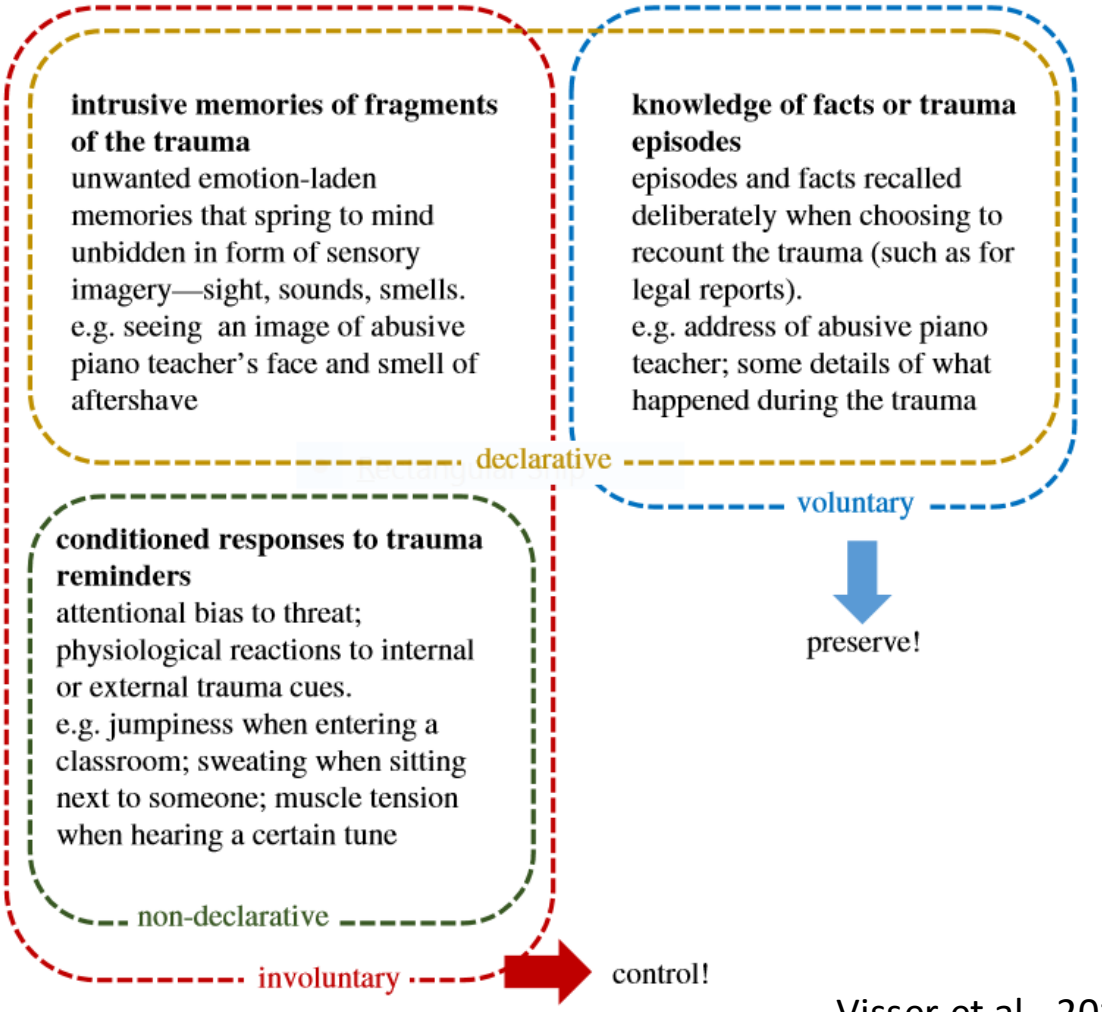
Ehlers & Todd, 2017, *Neural Plasticity*

Arousal at the time of trauma prioritises encoding salient at the expense of peripheral, less salient stimuli

Noradrenergic arousal (LC) activates amygdala and hippocampus and prefrontal regions, and visual cortices to attend to 'salient' stimuli

– important/threat stimuli promoting survival in the environment is strongly encoded and recalled at the expense of encoding peripheral/less salient details

PTSD involves dysregulation of both explicit and implicit memories



PTSD affects declarative memory by impairing explicit recall of episodic memory (e.g full details of the trauma), but also impacts on the implicit memory system via creation of aversive conditioned fear responses

Intrusive memories might be both explicit (fragments of event) and implicit (arousal, smells, sounds and their involuntary nature)

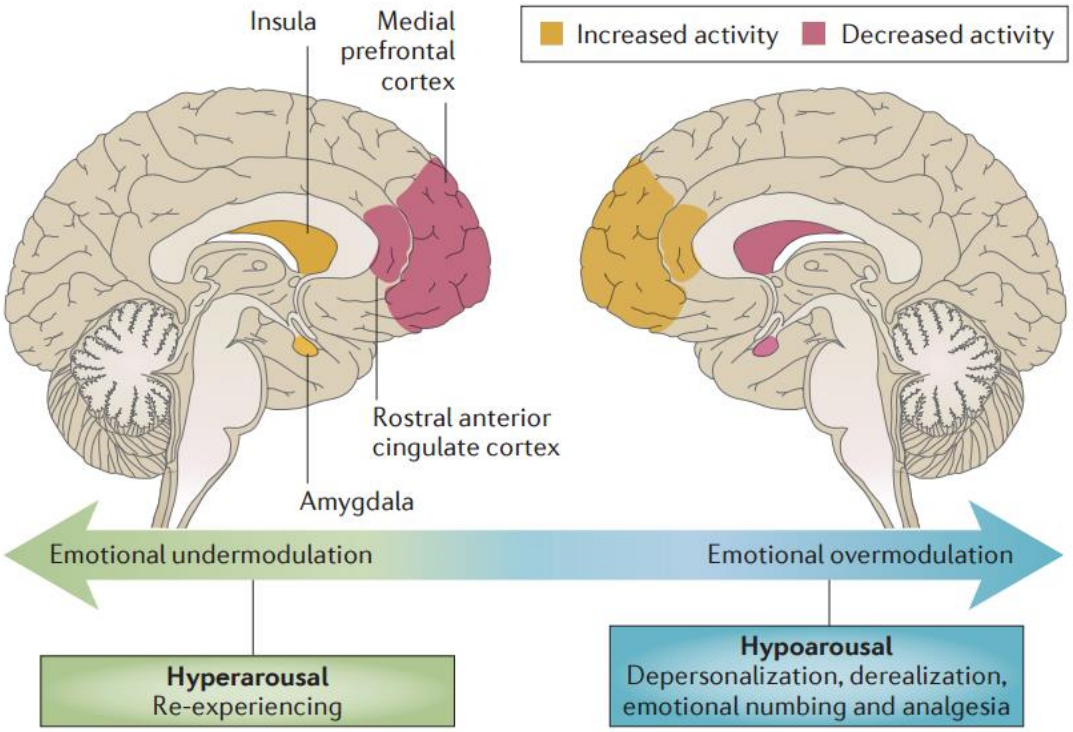
Visser et al., 2018

Effects of dissociation on memory

- Trauma memory can also be impacted by intense arousal which can trigger dissociation at the time of trauma
- Dissociation at the time of trauma interrupts encoding, leading to greater fragmentation of memories and less coherent narratives
- Dissociation is particularly common in sexual assault survivors, and childhood sexual abuse survivors
- Persistent dissociative responses are also prevalent (in fact, between 20-30% trauma survivors have a more dissociative than hyperarousal response chronically)

Lanius et al., (2010). Emotion modulation in PTSD: Clinical and neurobiological evidence for a dissociative subtype. *American Journal of Psychiatry, 167(6), 640-60.*

Dissociation and the brain



Dissociation has a specific impact on brain function – with increased activity in medial prefrontal regions and reduced activity in amygdala- thought to reflect "overregulation" (Lanius et al., 2010) and linked to memory suppression. (Anderson 2022, *Neuropsychopharmacology*).

Individuals with dissociative amnesia for trauma show dysregulated frontal activity and reduced hippocampal activity

(Taib S et al., (2023) What are the neural correlates of dissociative amnesia? A systematic review of functional neuroimaging studies. *Frontiers in Psychiatry, 14*.

Myths about memory of traumatic events

- Trauma memories are indelibly imprinted on the brain – vivid, complete in detail, and unchangeable

- The more detailed and coherent the memory, the more reliable

- Changing recall of details of memory indicate false memory

- The more the memory has a narrative, a beginning, middle and end, the more convincing it is

- the more confident the person is about the memory, the more reliable

- when recounting trauma memories, there is a “genuine victim” response

Reasons for delayed recall of memories

- Robust research reveals that trauma memories can be forgotten and subsequently remembered later –16% of survivors report periods of time where they haven't remembered the trauma (Williams, 1995)

- Delayed recall of memories may occur for a multitude of reasons:

  - Significant dissociation at the time of the trauma – encoding fragments of memories (memory not fully encoded or stored at time of trauma)
  - Avoidance and conscious suppression,– avoidance is a strong and nearly ubiquitous symptom of PTSD
  - Minimisation or denial of trauma memories – often by others
  - Shame and fear of not being believed– not feeling safe to report
  - 'enforced silence' due to threats of violence from perpetrators
  - Simple forgetting due to lack of exposure to retrieval cues (related to avoidance), or lack of state-dependent retrieval cues

Psychologist practice guidelines for recovered memories

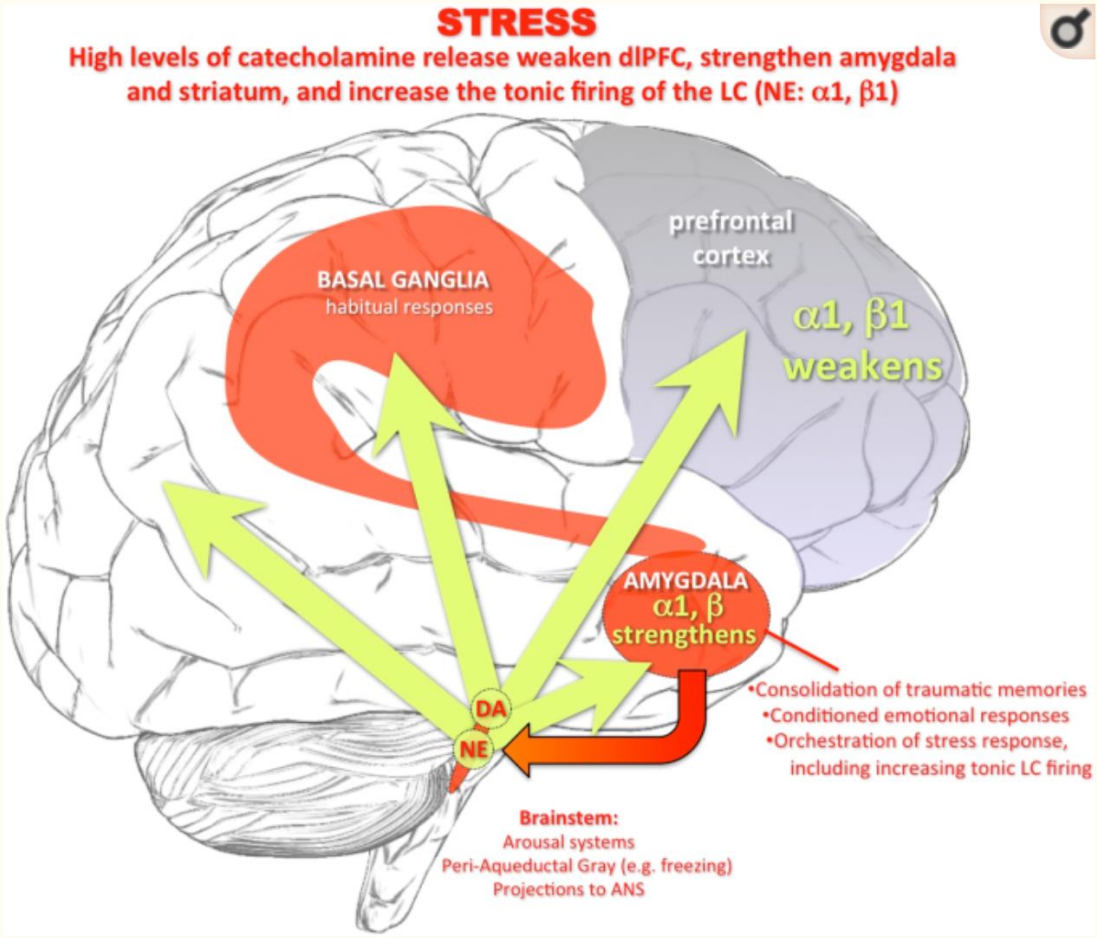
- With the controversy over recovered memories in the early 1990's, Australian Psychological Society and American Psychological Association guidelines clearly outline the following principles which are incorporated into training programs.

- 1. Clinician never suggests a client has been abused
- 2. Clinician only asks open-ended questions about trauma experiences, never leads or suggests specific experiences have occurred
- 3. Take client seriously and listen to their story – avoid imposing your own conclusions and avoid making suggestions
- 4. Avoid searching for memories that have not arisen spontaneously and do not use techniques like hypnosis to reveal memories

This is important for both assessment, diagnosis and trauma-focused therapy - in EMDR or Exposure therapy, therapist listens to accounts, never suggests, implants or alters memory

Australian Psychological Society, Guidelines on Recovered Memories; Psychological and Counselling Federation of Australia Consensus Guidelines for Working with Recovered Memory (201&).

Effects of trauma on brain responses in acutely stressful environments



High arousal due to stressful environments is particularly increased for those with trauma histories (and PTSD) – especially if reminded of the trauma or talking about the trauma. The impact of high levels of stress/arousal on brain includes:

Increasing brainstem and midbrain arousal activity – increases adrenaline and sympathetic arousal and can lead to panic or freezing responses– can lead to dissociation

Increased amygdala activation – leading to conditioned fear responses, triggering of emotional memories

What does this mean in a courtroom?

- Important to consider that in a court-room environment, with requirement to describe the trauma experience, or being questioned about the trauma this will be a highly stressful context and a powerful reminder of the trauma that may trigger:

- **Conditioned fear responses** – leading to intense physiological arousal (similar to a panic attack),
- **Intrusive memories of the trauma** – this may make the person less aware of their current surroundings, and potentially interfere with their responsiveness to questions (at least momentarily)
- **Dissociative responses** – this may lead them to be non-responsive or have difficulty in being consciously aware (again typically for a short-time frame)
- **Difficulty with attention/executive function –** this may lead to difficulty in attending to questions, responding flexibly to multiple questions
- **Increased cortisol due to acute stress –** can directly impair memory retrieval processes

- **** important to be aware of power differentials in legal contexts, victim-survivors often fear not being believed, and being questioned can enhance this fear**

Implications for legal practice

- Fragmented memories are the norm for trauma rather than having a consistent, coherent story of a traumatic event – particularly for childhood trauma

- Inconsistent reporting about peripheral details are common given the 'salience tagging' of memories

- Memories can change across time naturally, they can be cued strongly at later dates, often there may be a delay in recall due to shame, dissociation, suppression/avoidance, fear of reprisal or not being believed

- Court appearances, needing to talk about the trauma, and particularly being questioned about the trauma, can trigger conditioned fear responses and intrusive memories – leading to panic attacks, or freezing, or recall difficulties (cortisol)

- There is no such thing as a "genuine" victim response – people respond in very individual ways – fear, numbness and freezing, anger

Recommendations

- Considering scientific evidence around trauma memory to minimise the impact of some of the myths of memory

- Recognising power differential within court and threat context for the victim survivor – high potential of freezing, panic attacks, triggering of intrusions during court

- Trauma-informed care for the victim-survivor – minimizing stress, aggressive questioning, and validating responses
  - Allow the person time to respond
  - Respond with a gentle supportive tone of voice to reassure them
  - Non-verbal communication is very helpful to communicate support – smile, nod or make eye-contact and acknowledge it may be difficult and to take their time
  - Allow them a short break if they need it
  - Ideally avoid in-session questioning
  - Intervene with inappropriate lines of questioning

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Questions?

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