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Understanding the Neurobiology of Complex Trauma

Building a framework for effective practice with children, young people and their network of relationships.




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The Australian Childhood Foundation acknowledges Aboriginal and Torres Strait Islander peoples as the traditional custodians and owners of this land and waters. We pay our respects to their Elders past and present and to the children who are their leaders of tomorrow. We acknowledge their history and living culture and the many thousands of years in which they have raised their children to be safe and strong.



2

The Australian Childhood Foundation



We Help Children Heal

On their own, children do not recover from the devastating impact of abuse, neglect and family violence. They need specialised support to heal. We provide therapeutic services to children.



We Keep Children Safe

We build the ability and confidence of individuals and organisations to protect children. We provide parents with education and support to help them raise happy, safe and loved children.



We Stand Up for Children

We advocate for changes to laws and policies that help to make all children safer. We work to strengthen community attitudes that prioritise the rights of children to love and safe relationships.



We Create Understanding for Children

We educate and support adults who look after and work with traumatised children to be better able to understand and respond to their complex needs.





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Safety

The content of this training can evoke strong emotions and may stir up personal experiences of trauma.

Please be mindful of your own wellbeing during this training and if you need support please ask the facilitator.





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Learning outcomes

- ✓ Learn in detail about brain/body development through childhood and adolescence,
- ✓ Understand the ways that trauma shapes children and young people's states, needs and experiences,
- ✓ Develop creative and evidence based approaches and practice strategies to enable children and young people to communicate and transform their experiences of trauma,
- ✓ Build approaches that resource change across all environments in which children and young people live, learn and relate.



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Holding the child at the centre...



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I need connection to my CULTURE



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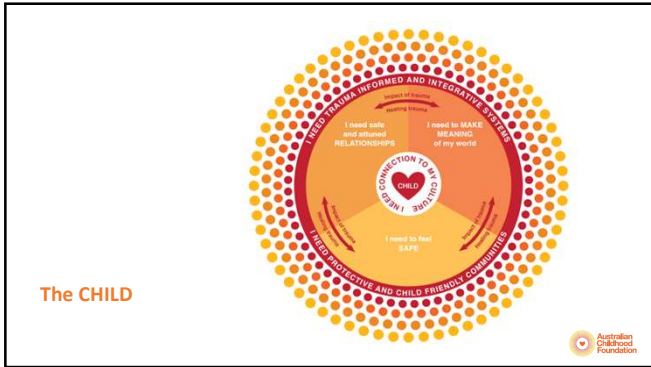
The Importance of Culture

How did you become who you are?

- Safety: Belonging
- Relationships: Connection
- Meaning making: Identity



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Brain development

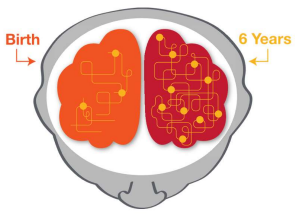
- The brain develops through a mix of genetics and environmental factors.
- Key to this development are relationships
- The brain develops sequentially from the bottom up



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Neuronal connections

- The neural system has the ability for one neuron to communicate with up to 10,000 other neurons
- The newborn brain has approximately 100 billion neurons

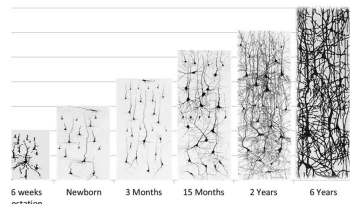


The diagram shows a cross-section of a brain with red and orange neurons. A red arrow labeled 'Birth' points to the left side of the brain, and a yellow arrow labeled '6 Years' points to the right side. The right side shows a much denser network of connections.

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Neuronal development



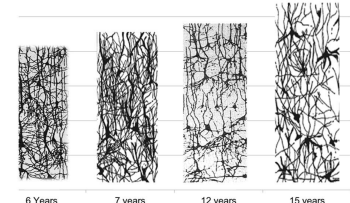
The timeline shows six stages of neuronal development: 6 weeks gestation, Newborn, 3 Months, 15 Months, 2 Years, and 6 Years. Each stage is represented by a vertical strip showing the increasing density and complexity of neuronal connections over time.

- Rapid growth occurs from birth to 6 years
- **Critical period** of development
- Healthy neuronal development occurs through **relationships, regulation, repetition**

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Neuronal development



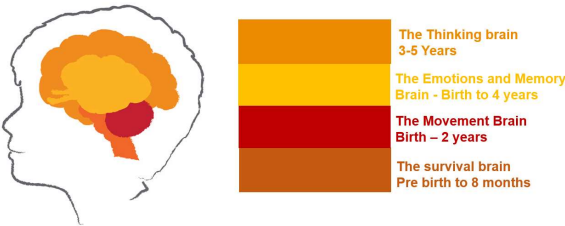
The timeline shows four stages of neuronal development: 6 Years, 7 years, 12 years, and 15 years. Each stage is represented by a vertical strip showing the changes in neuronal connections, including pruning and new neuron formation.

- Early years – period of **rapid growth**
- Followed by onset of puberty in which **synaptic pruning and formation of new neurons** occurs.

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Sequential brain development – building blocks




- The Thinking brain
3-5 Years
- The Emotions and Memory
Brain - Birth to 4 years
- The Movement Brain
Birth - 2 years
- The survival brain
Pre birth to 8 months

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Brainstem - basic life functions

- Basic life functions
- First part of our brain to develop
- This is the most developed brain part at birth
- Responsible for our heart beat, breathing, sucking, temperature control, blood pressure




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Superior Colliculus

- Processes visual threats – looming objects identified by cells in the retina of the eye
- Retinal neuronal input received by Superior Colliculus which engages the body in **Avoidance and defensive behaviours**





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Cerebellum- movement and balance


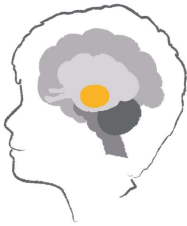
- Helps us to know where our body is in space
- Helps us with our posture and balance
- Helps us not to fall over and to control our movements
- Has its own connective pathways between the 2 halves- cerebellar vermis



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Diencephalon - sorting & sending centre



- This area of the brain develops mainly after birth
- It sorts out messages coming into the brain and sends them
- It uses hormones to send signals to body
- Hormonal signals tell your body what it needs, eg. food, water, love



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Limbic lobe- emotional gateway

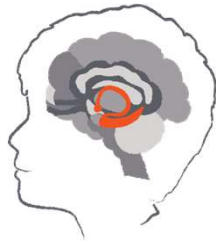
- The part of the brain that helps us attach an emotion to an experience or memory
- This part of the brain is particularly involved with the emotions of fear and anger
- Also heavily involved in attachment processes
- This area develops mainly after birth



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Hippocampus – Brain’s historian

- Explicit memory system
- Develops approximately 2-3 years of age
- Provides context to memory and embeds long term memory



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Amygdala – smoke alarm

- Detects threat
- Develops from birth
- Learns by association
- Involved in implicit memory processes



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Cerebral cortex- complex thinking



- The largest part of the brain
- Associated with higher brain function such as thought and action
- Examples of functions:
 - Reasoning
 - Logic
 - Judgement
 - Voluntary movement



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The prefrontal cortex- executive function



- Responsible for executive functions, such as judgement, reasoning, and self awareness
- Final part of the brain to reach maturity in one's mid 20s
- Under reconstruction in adolescents from the age of approximately 12 years



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Medial prefrontal cortex


- Associated with perceptions of self and similar others
- Known as centre for mindfulness
- Involved in maternal bonding – the parent child dyad and inter-subjectivity



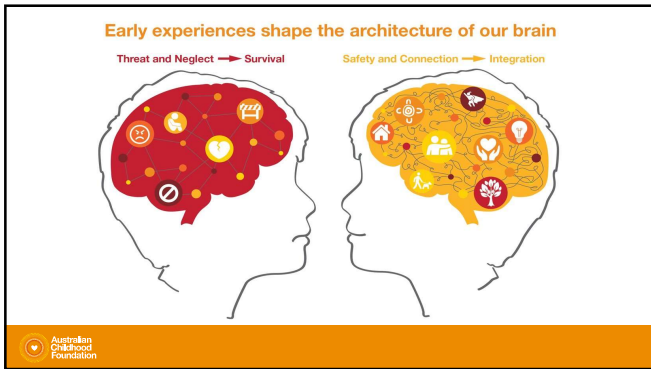
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Hemispheric integration

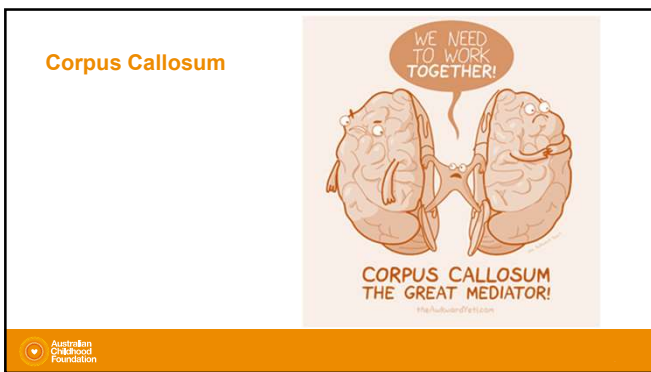
Left Hemisphere <ul style="list-style-type: none">• Evaluates language content• Optimistic hemisphere• Understands beginning, middle and end• Learns from the past and expects the future• Looks for patterns		Right Hemisphere <ul style="list-style-type: none">• In the present moment• Eye contact• Facial expression• Tone of voice• Posture• Gesture• Intensity• Is mute• Grasps the whole
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Strategies for building healthy brain development

Brainstem & Diencephalon	Basic survival & sensory processing	Pacification or stimulation. Activities in the child's preferred sensory modality
Cerebellum	Coordination of movement	Using music, rhyme and movement activities
Limbic	Emotional processing	Building relational connection through plays, animals, games
Cortex	Thinking processes	Linking experiences and sensations to words and descriptions
Prefrontal cortex	Analytical and abstract thinking	Challenges and safe risk taking activities

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Body Systems

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Oxytocin

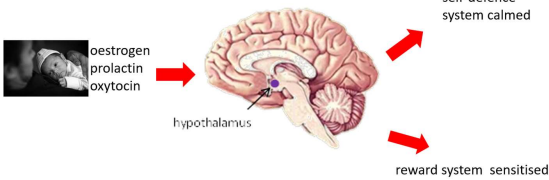
Role in regulating maternal care behaviours:

- Critical for maternal behaviour – motivates the parent to care for his/her infant
- In several mammalian species, facilitates physical proximity and nurturant care

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The Parental Approach System: the role of hormones



oestrogen
prolactin
oxytocin

hypothalamus

self-defence system calmed

reward system sensitised

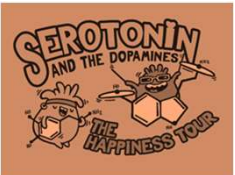
Don Hughes

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Dopamine

- A neurotransmitter - plays a big part in **motivation and reward**
- 'Feel good' hormone – nearly all pleasurable experiences come from a release of dopamine – eating, sex, etc




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The role of Dopamine in mother-infant bonding

'A study group investigated the role of dopamine in mother-infant bonding and found that both mother-infant vocalization synchrony and maternal attunement were associated with higher dopamine concentration in brain structures connected to bonding'.



<https://www.medicalnewstoday.com/role-dopamine-mother-infant-bonding/>

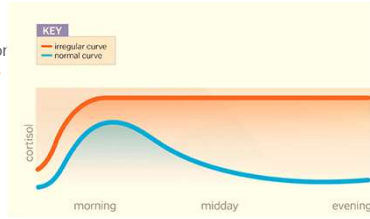
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Cortisol

Can help:

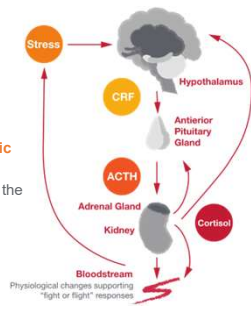
- your body respond to stress or danger – **fight, flight, freeze, submit response**
- increase your body's metabolism of glucose
- control your blood pressure
- reduce inflammation



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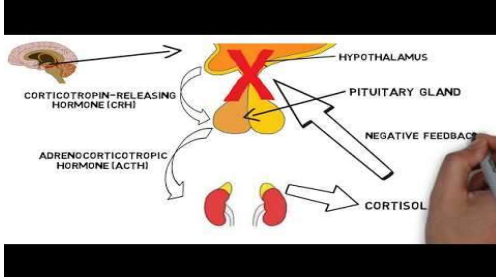
Hypothalamic (Diencephalon) / Pituitary / Adrenal Axis

1. The hypothalamus secretes the hormone **corticotropin-releasing factor (CRF)**, which rouses the body.
2. CRF travels to the pituitary gland.
3. The pituitary gland secretes **adrenocorticotropic hormone (ACTH)**.
4. ACTH circulates in the bloodstream, traveling to the adrenal gland.
5. The adrenal gland releases **cortisol**, another hormone.
6. Cortisol stimulates many reactions in your body, including a rush of energy and alertness.



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HPA Axis



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8 senses


1. **Visual**
2. **Auditory**
3. **Olfactory** (smell)
4. **Gustatory** (taste)
5. **Tactile System** (touch)
6. **Vestibular** (sense of head movement in space)
7. **Proprioceptive** (sensations from muscles and joints of body)
8. **Introception** (awareness of basic primary functions – hunger, toileting, breathing)



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Auditory - Ohm dad



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Olfactory



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Activities to support body awareness

Round – straight	Light – strong
Sit – stand	Under – over
Small – large	Yes – no
Freeze – melt	In – out
Push – pull	Tall – short
Wide – narrow	Loud – soft
Left – right	Up – down
Hot – cold	Happy – sad
Fast – slow	Fast slow



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Holding the child at the centre





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Trauma





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What is Trauma?

Trauma is the emotional, psychological and physiological reactions caused by the prolonged and overwhelming stress that accompanies experiences of abuse, neglect and family violence.

The trauma that results from experiences of abuse, neglect or family violence is often called **complex trauma** or **developmental trauma**.

This type of trauma occurs in the context of relationships and is different to the trauma that may be caused by a one-off event such as a car accident or bush fire.

Children and young people are very vulnerable to the effects of trauma because of their brains' developmental immaturity.

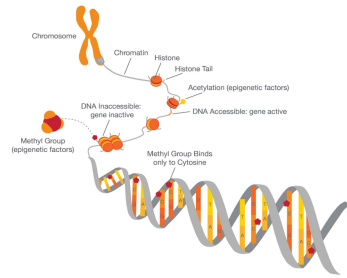


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Epigenetics

"The study of inheritable changes in gene function without the change in the DNA sequence"

Journal of Science



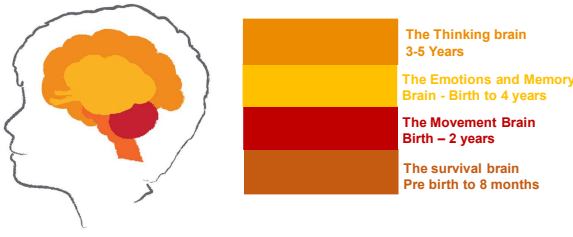
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Epigenetics



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Sequential brain development – disrupted by trauma

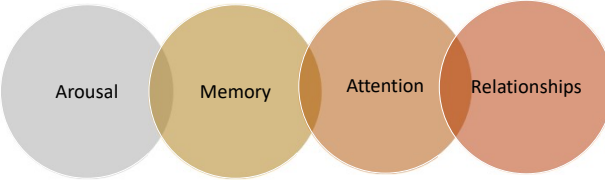


The Thinking brain
3-5 Years
The Emotions and Memory Brain - Birth to 4 years
The Movement Brain
Birth – 2 years
The survival brain
Pre birth to 8 months

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Trauma impacts



Arousal Memory Attention Relationships


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Arousal - Affect dysregulation

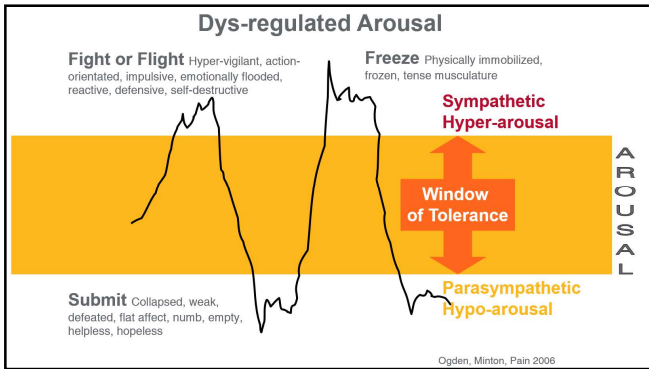
Extremes of affect state:

- **Terror** replaces fear
- **Despair** replaces sadness
- **Rage** replaces anger

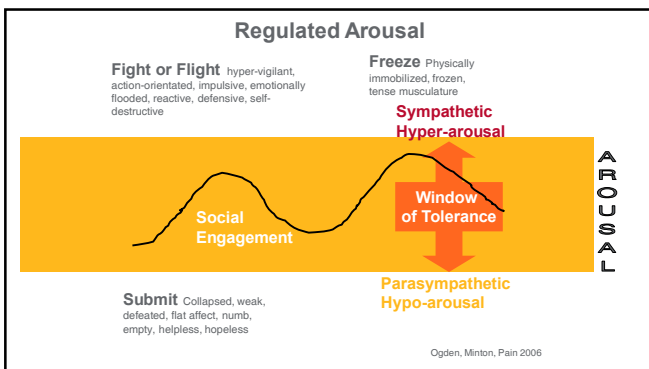


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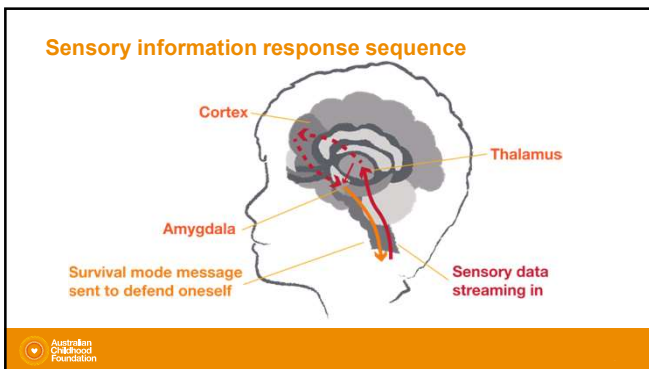
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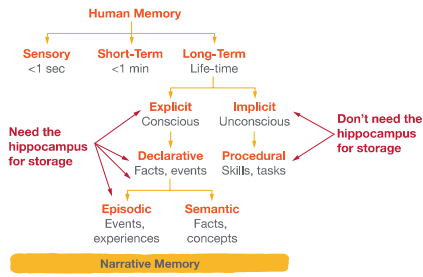
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Strategies for healing...Desktop drumming



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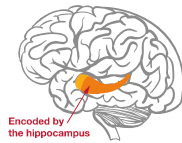
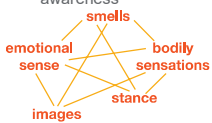
Memory



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Encoding memory

- | | |
|---|---|
| <p>Implicit Procedural Memory</p> <ul style="list-style-type: none"> • Non-verbal • Separate fragments • Emotional/sensational • Outside conscious awareness | <p>Explicit Memory</p> <ul style="list-style-type: none"> • Develops at 2-3 years of age • Consciously retrieved • Eg. Autobiographical story |
|---|---|



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Encoding traumatic memories

Implicit Procedural Memory

- Non-verbal
- Separate fragments
- Emotional/sensational
- Outside conscious awareness

Explicit Memory

- Develops at 2-3 years of age
- Consciously retrieved
- Explicit memory systems can become shut down when trauma is present

terrifying sounds
terrifying smells
terrifying visions
terrifying thoughts
terrifying bodily sensations
Hippocampus

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Implicit memory

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Attention – impacts of trauma

- Affects sustained and focused attention
- Focus remains on the perceived threat
- Difficulty in focussing on task at hand, listening to instructions or following directions
- Shark music – always playing

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Working with attention issues

- **Check yourself** – your body language, tone of voice, facial expressions
- **Check the environment** – reduce overstimulation
- **Know the child** and their triggers
- **Use relationship** to help the child regulate – co-regulation
- **Provide sensory tools** that the child can ground with
- Try music, song, rhythm, to calm the brain stem and reduce bottom up hijacking by the survival brain



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Neuroplasticity



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Holding the child at the centre...



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I need to feel SAFE...

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Safety principles

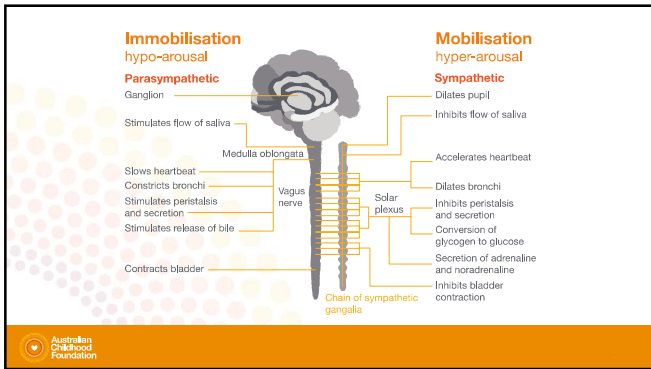
Safety is embedded in our physiology
 Safety is a relational experience
 Child abuse is a deep violation of a child's sense of safety

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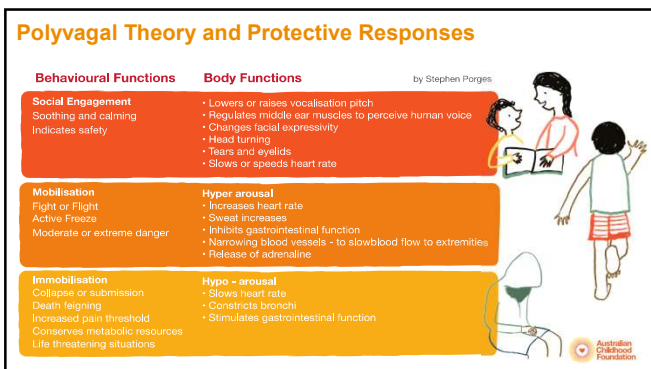
A hierarchical nervous system response

<p>Safety</p> <p>S= social engagement</p> <p>S= mobilised play</p> <p>S= immobilised for sexual intimacy</p>		<p>Danger</p> <p>D= social engagement</p> <p>D= mobilised fear responses to threat</p> <p>D= immobilised responses to threat</p>
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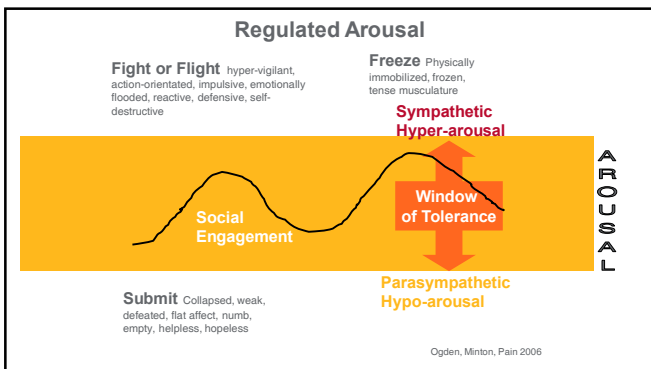
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Strategies for healing - Creating safety

Environment

Posture and gestures

Tone of voice

Facial expressions

Proximity

Eye Contact

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I need safe and attuned RELATIONSHIPS

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The right hemisphere in infancy

- Normatively develops in an integrated fashion through healthy attuned, co-regulatory relationships in the primary years of life.

Attunement

Exploration

Responsiveness/Modulation

Self regulation

Acknowledgement/Validation

Self awareness

Another's self experience

Relational experience

Self experience

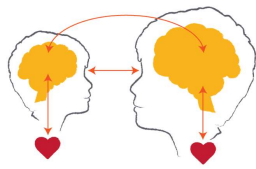
Connection

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The right hemisphere in relationship

- These primary relationships contribute to:
- stored internal working models of primary relationships recorded in the right hemisphere
- the perception of emotion in self and others, enabling empathy and humour.



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Still face



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Rupture and repair

What you did is not ok, but you're still a good person and our relationship is still strong.'



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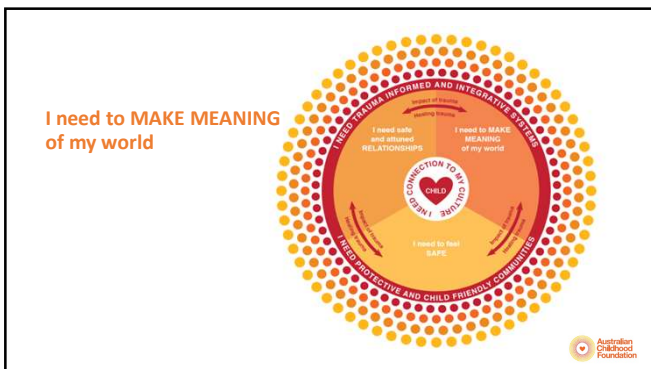
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Meaning making

How children understand and make meaning of their world often occurs through what is reflected back to them through their interactions with significant adults.


If adults respond to the child's behaviour in a punitive way, it reinforces negative schemas and stories that the child has developed about themselves.



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Self Concept: Internal working models


	Positive internal working model	Negative internal working model
View of self	I am lovable I am worthy	I am unlovable I am unworthy
View of the world and relationships	Others are responsive Others are loving Others are interested in me Others are available to me The world is relatively safe	Others are unavailable Others are neglectful Others are rejecting Others are unresponsive The world is unsafe



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Trauma response patterns

- To cope with trauma children use initial adaptive responses to survive
- This is reasonable as a once off occurrence, but, if they continue they can become maladaptive patterns of behaviour
- These responses will be different for an individual child at different developmental stages
- Often a combination of appropriate developmental behaviours and maladaptive patterns of behaviour emerge



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Behavioural – narratives of trauma

- Behaviour tells a story!
- Traumatized children's behaviour can be difficult and complex for parents, teachers and carers to understand, manage and shape
- However, it is functional and almost always makes sense given their specific experiences of trauma
- Children's behaviour is the manifestation of the impacts of trauma outlined in the previous sections

Sometimes when we are angry, there are other emotions under the surface

Icebergs are giant floating pieces of ice found in the coldest parts of the ocean. What you can see from above is just a tiny part. Most of the iceberg is hidden under the surface.

Angry, straight Ahead! Watch Out!

Let's go deeper?

Embarrassed, Annoyed, Rejected, Guilt, Insecure, Disappointed, Shame, Attacked, Scared, Grief, Alone, Darned, Med

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Behavioural – narratives of trauma

Behaviour is communication

If we can understand what drives a behaviour, we can work out how to respond to it.

If we can meet the need that is driving a behaviour, the behaviour can start to reduce.

Behaviours are functional and almost always makes sense given their specific experiences of trauma.

Openness and curiosity about behaviour is an important response.

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Common themes

- "manipulative" inability to trust
- "Inattentive" worried and preoccupied
- "attention seeking" needing/ seeking connection
- "disruptive" difficulty asking for help

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Meaning making

In making meaning we want the child to understand who they are despite their experiences of trauma
And for them to know they are ok, they are loved, they are accepted no matter what trauma symptoms are being expressed.



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Holding the child at the centre...




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