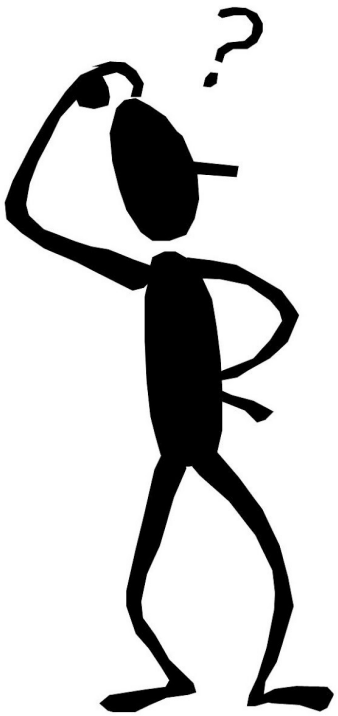
The Neurobiology of Trauma

Toward a deeper understanding of the science behind the experiences of victims/survivors of trauma

Christopher Wilson, Psy.D.
Licensed Psychologist
1020 SW Taylor, Suite #245
Portland, OR 97205

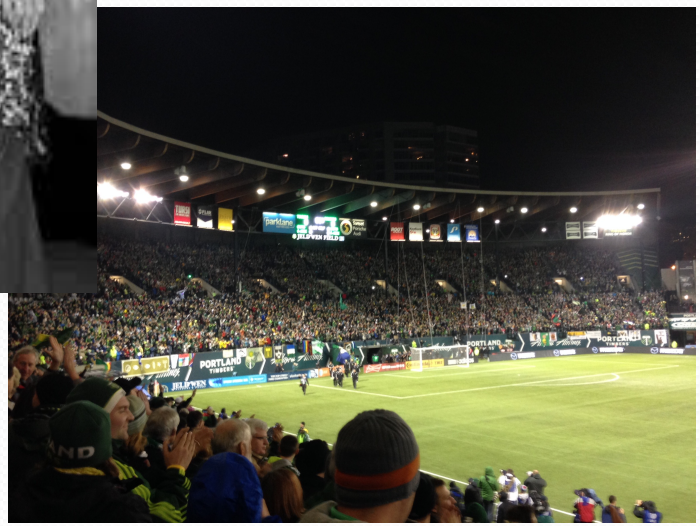
Email: chris@drchristopherwilson.com
Web: www.drchristopherwilson.com
Twitter: @drchriswilson

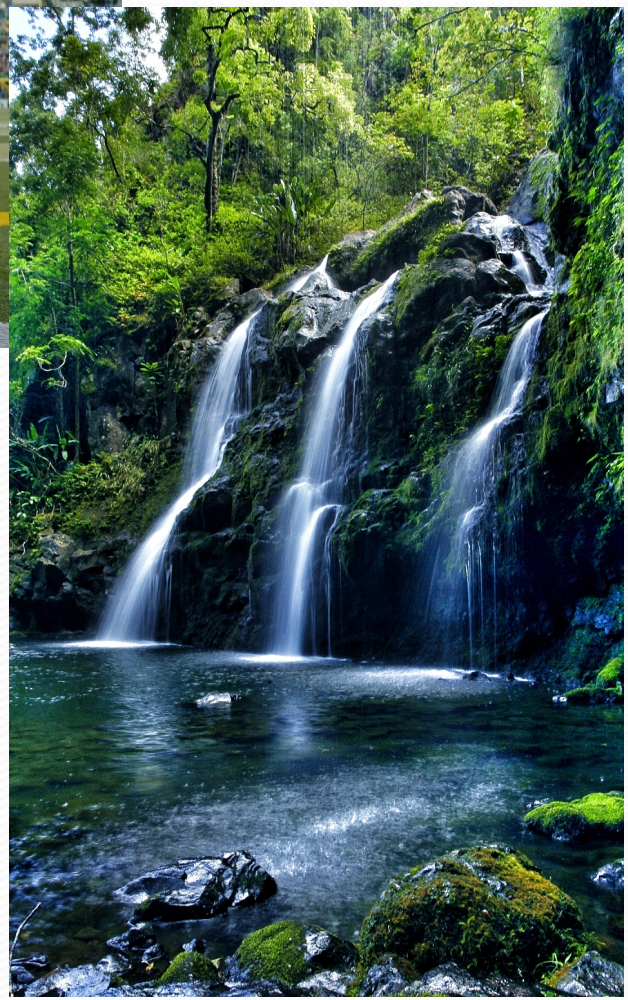
Who am I?



Psychologist

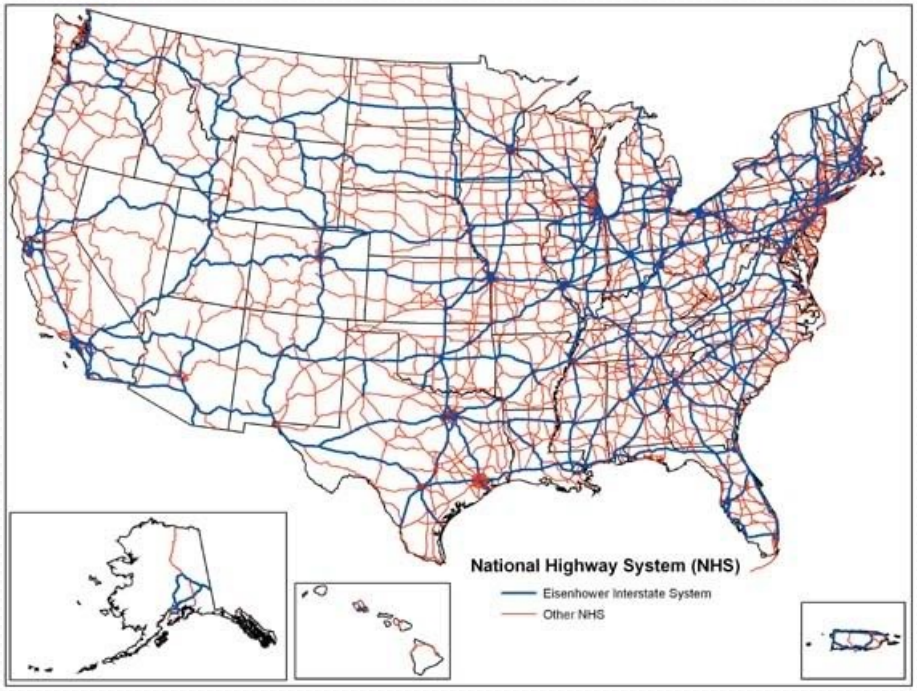
Trainer & consultant





A few thoughts before we jump in

- I'm not a neuropsychologist
- We'll simplify the brain
- We're discussing a small stretch of highway…no more than a few miles!



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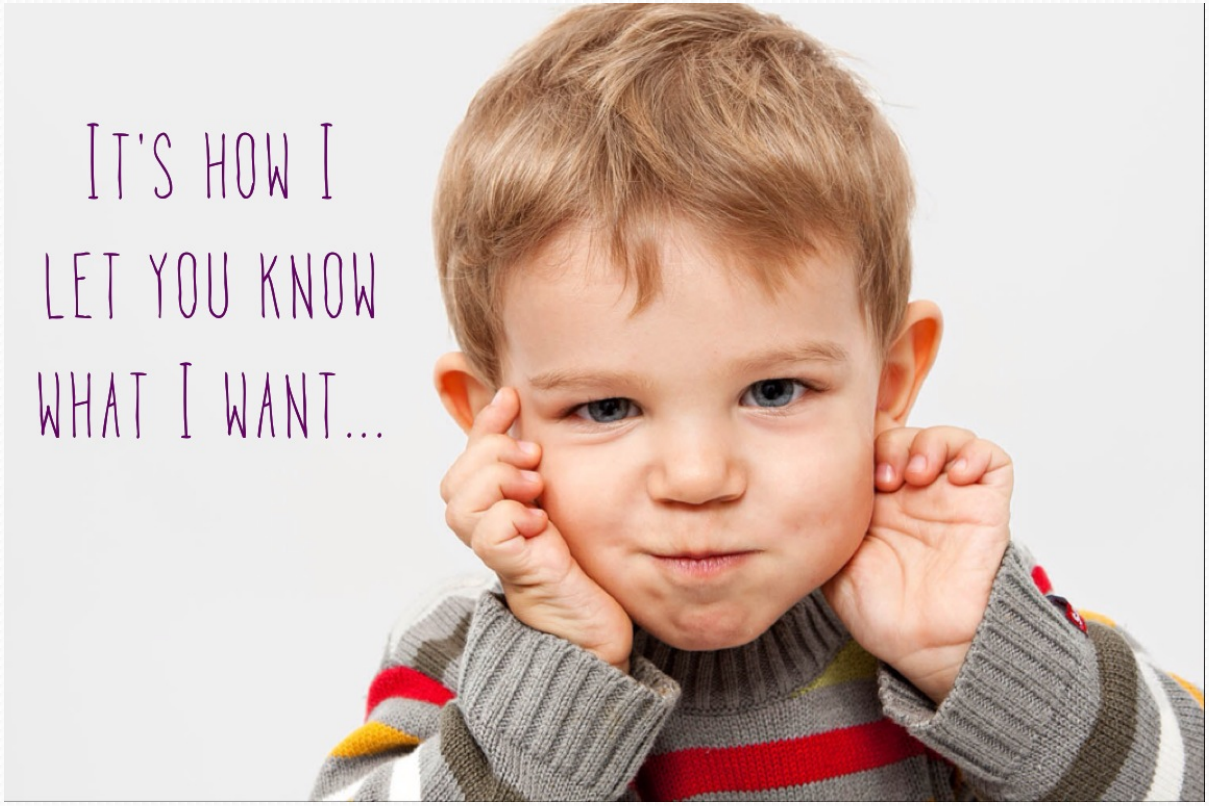
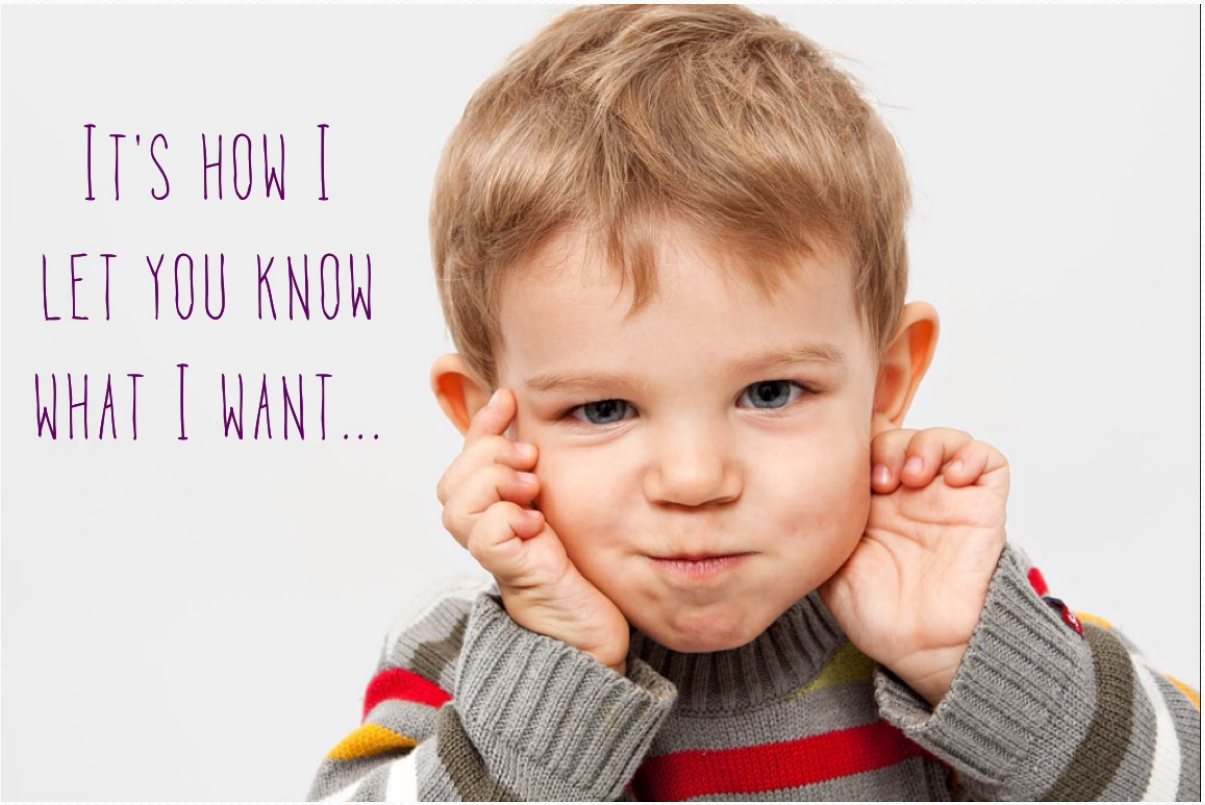
Organizing

- We all do it!

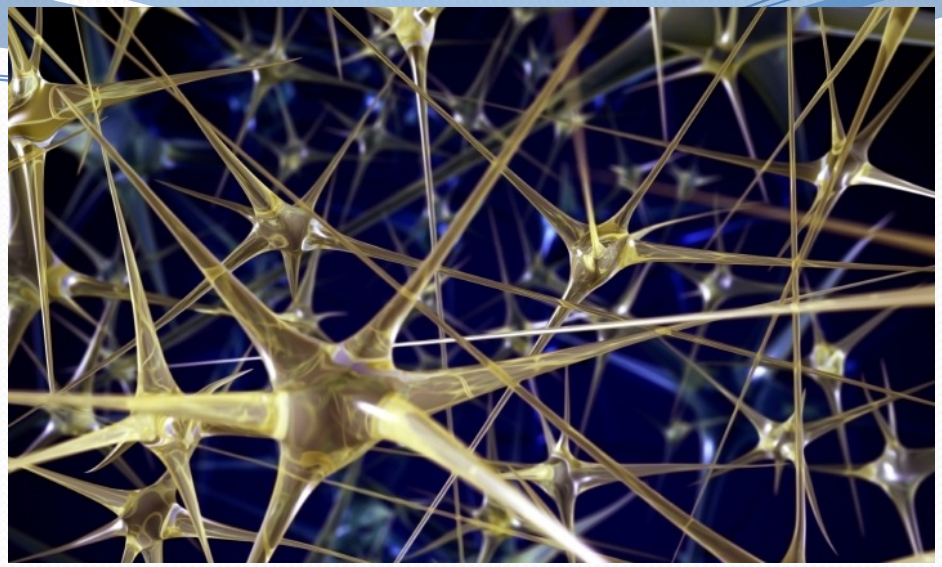


Organizing

- How has a victim likely been organized?



The brain and neural networks



- Repetition breeds neural networks
- The more often/more intense = deeper network
  - Will you ever forget how to ride a bike?

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Defining Trauma

- *"Trauma is not a disorder but a reaction to a kind of wound. It is a reaction to profoundly injurious events and situations in the real world and, indeed, to a world in which people are routinely wounded."*

~Bonnie Burstow

Defining Trauma

- Physical, cognitive, emotional response to a distressing situation that overwhelms existing coping mechanisms.

- Trauma is subjective, not objective.

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Understanding the Brain

You have a brain-map in your fist!

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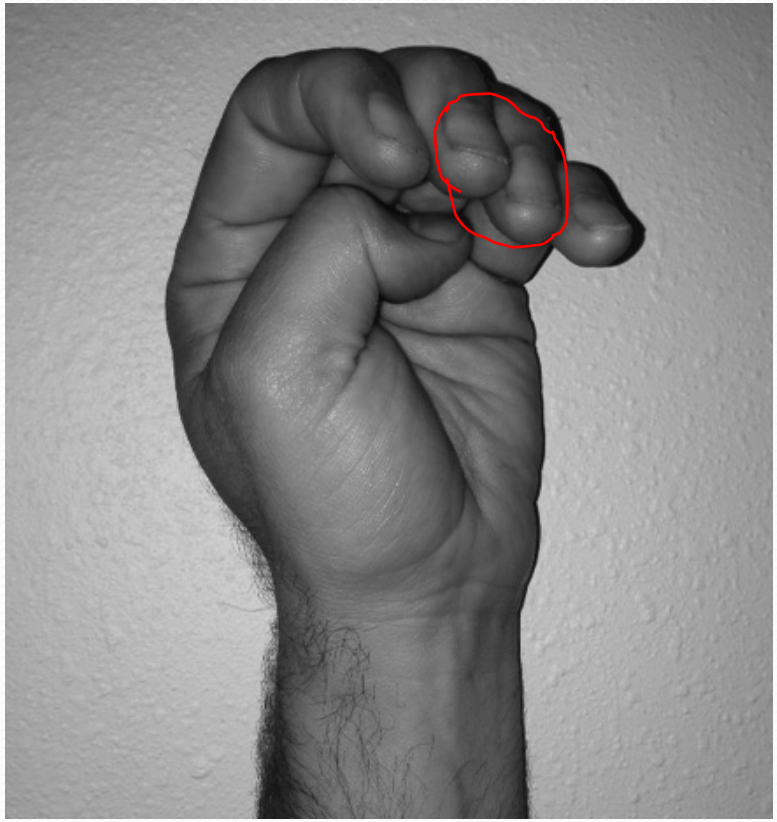
Understanding the Brain

Fingers = thinking/awareness

Below fingers = beyond awareness

Limbic System (emotion) = your thumb

Pre-frontal cortex (thinking) = your middle nails



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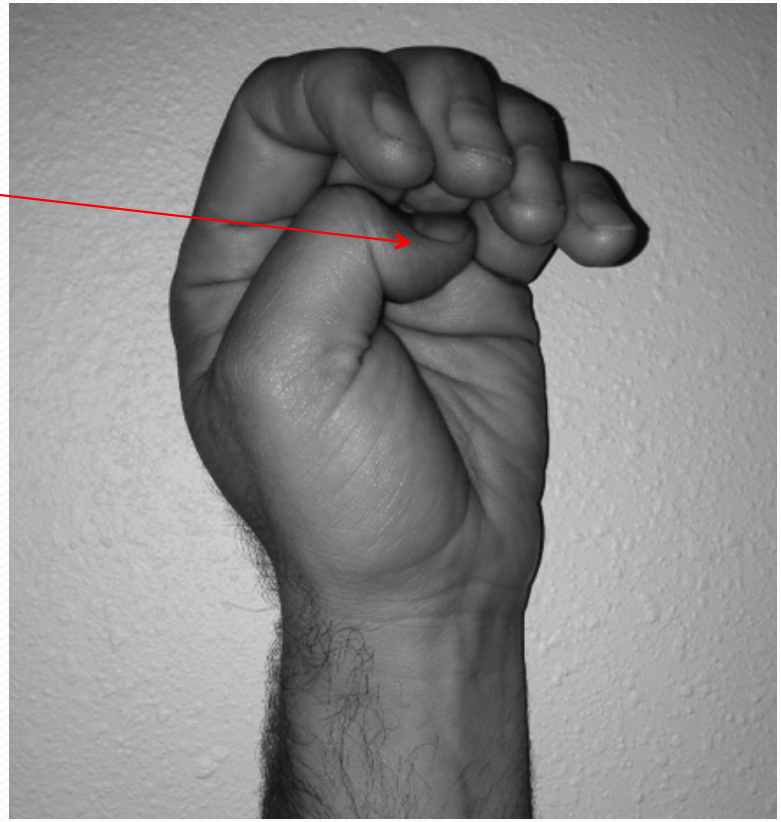
Predict and Protect!

The Brain and Threat: 3 areas

- In your thumb:
  - The amygdala –



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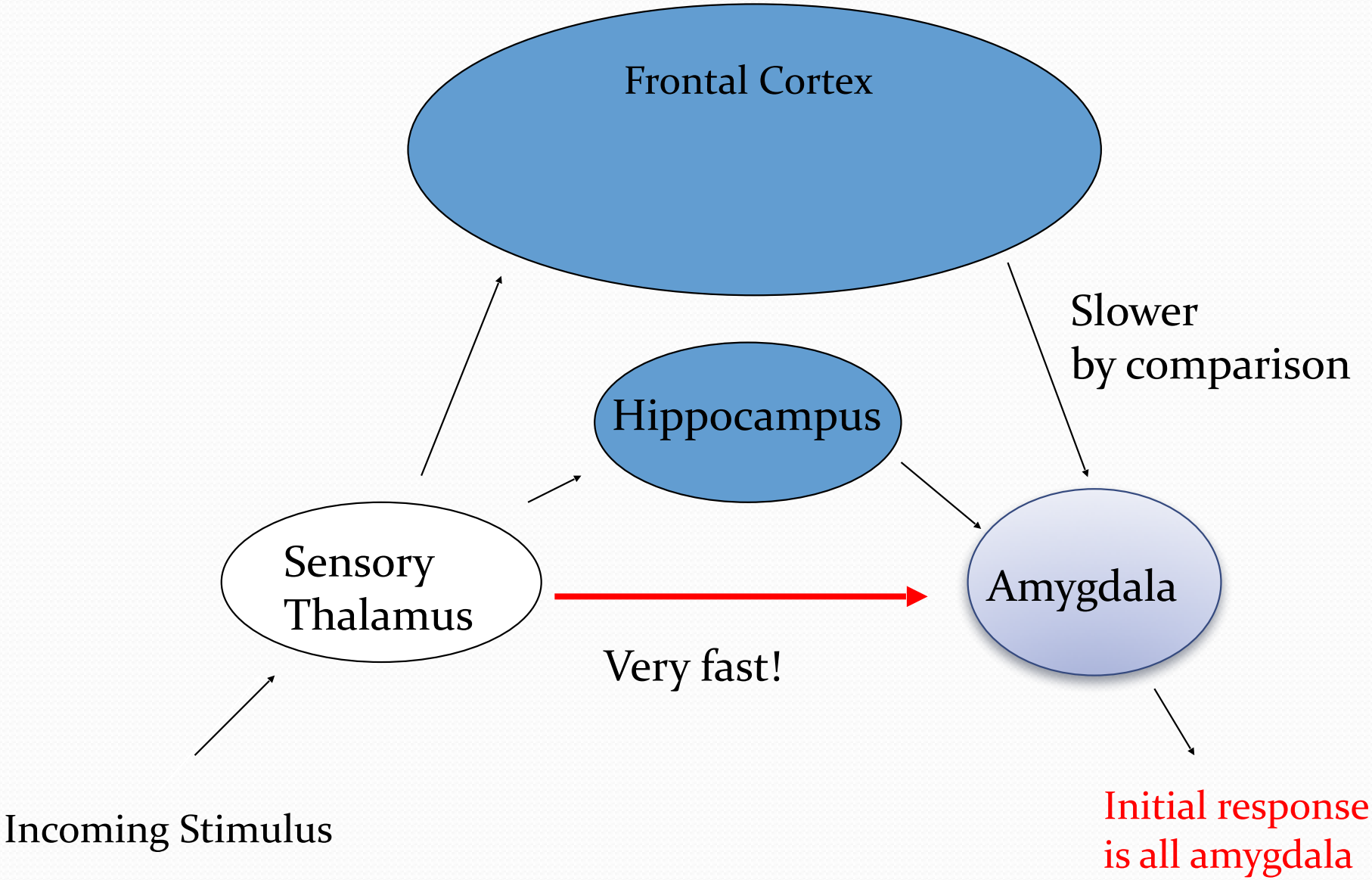
How the brain responds to threat



Le Deoux, 1996

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Predict and Protect!

DANGER WILL ROBINSON! (amygdala)

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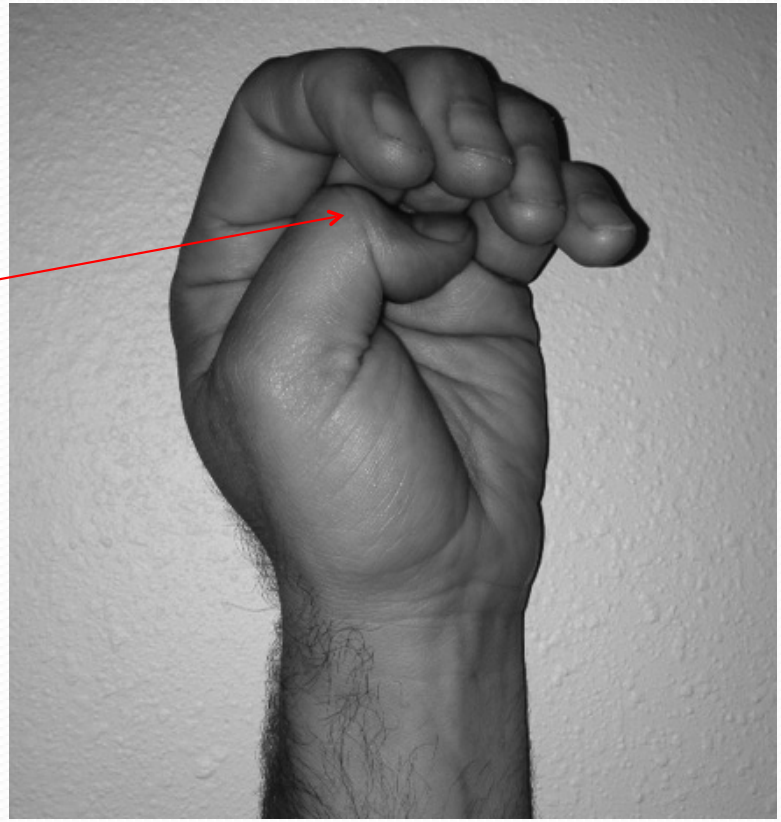
The Brain and Threat: 3 areas

- In your thumb:
  - The amygdala –
  - The hippocampus –



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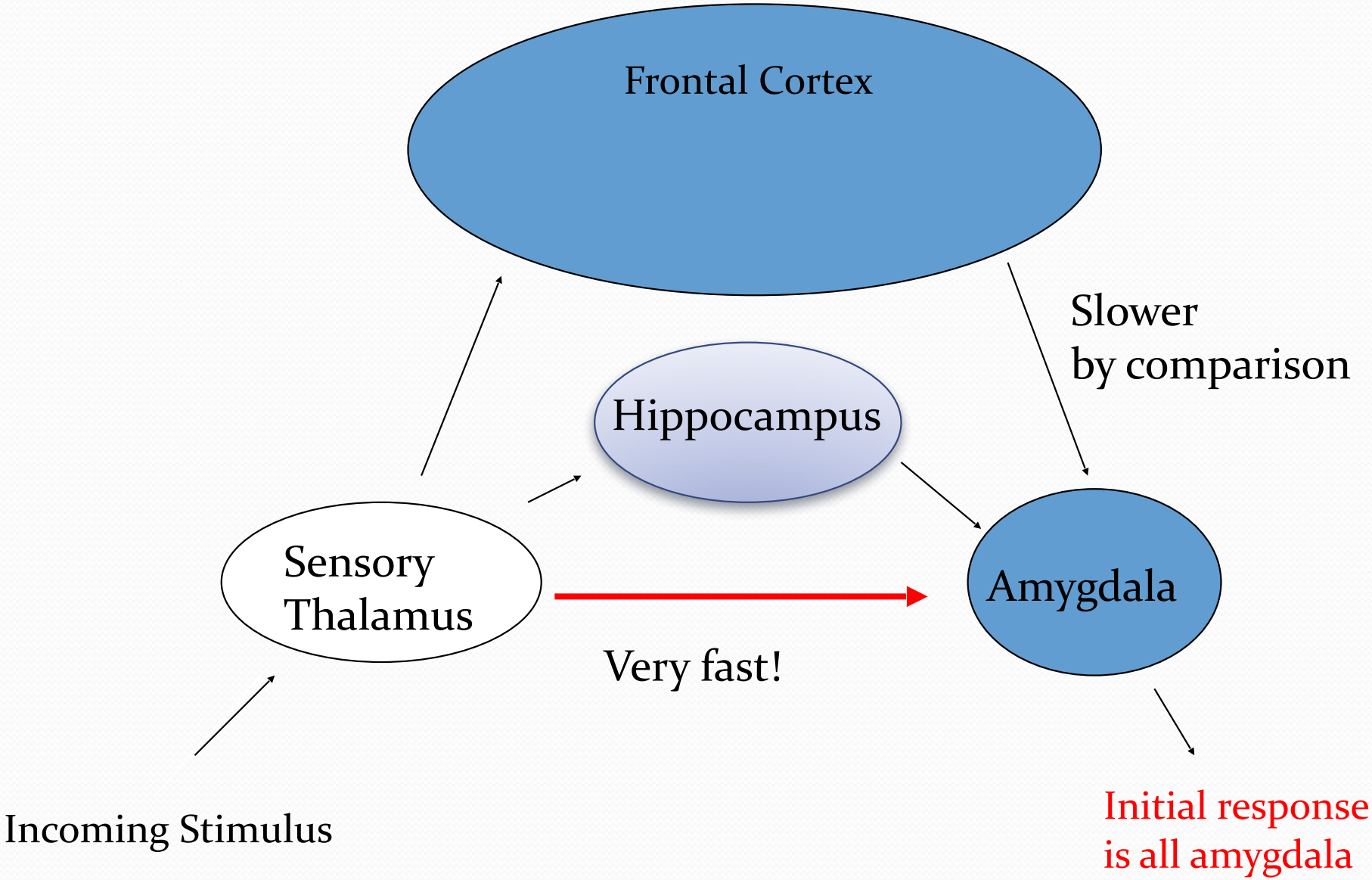
How the brain responds to threat



Le Deoux, 1996

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Predict and Protect!

- Scan the environment!
- Compare what I'm seeing/smelling/hearing, etc. with my memories or "mental maps" of safety (hippocampus)

and compare
(thanks to your hippocampus!)

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Predict and Protect!

What's been safe/not safe in the past??
(Hippocampus)

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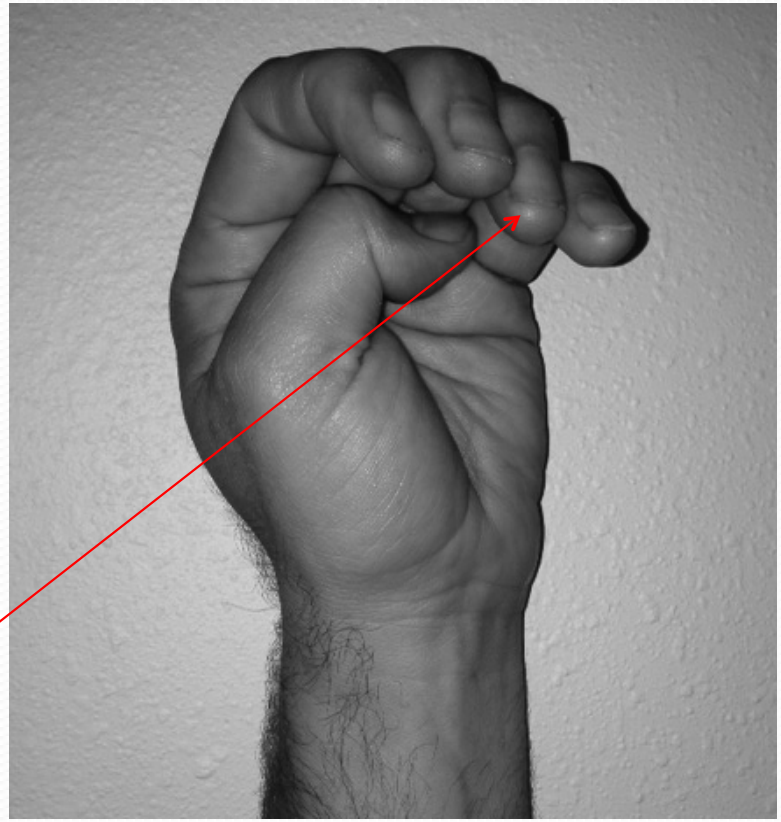
The Brain and Threat: 3 areas

- In your thumb:
  - The amygdala –
  - The hippocampus –
- In your ring finger:
  - The left pre-frontal cortex –



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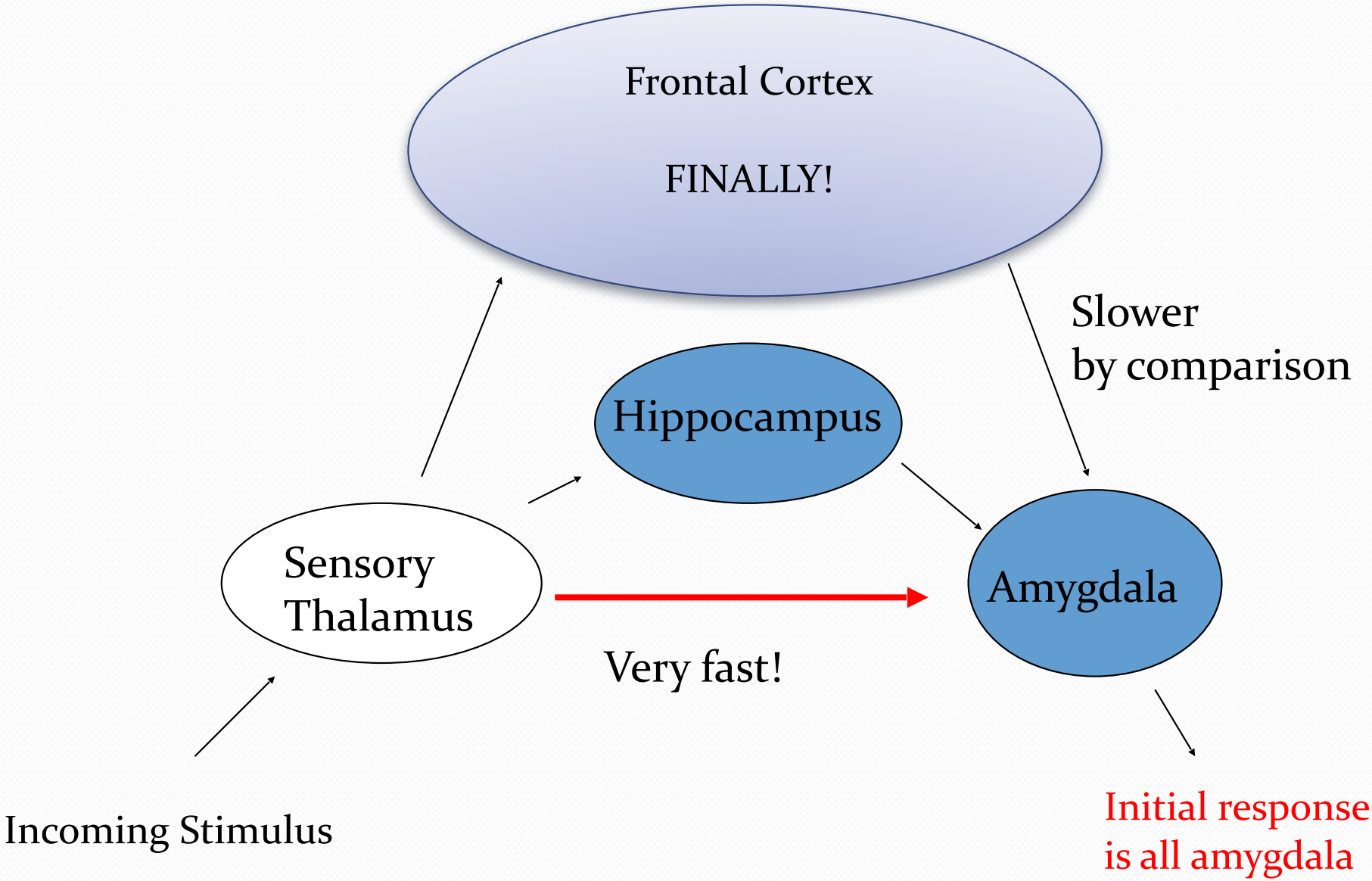
How the brain responds to threat



Le Deoux, 1996

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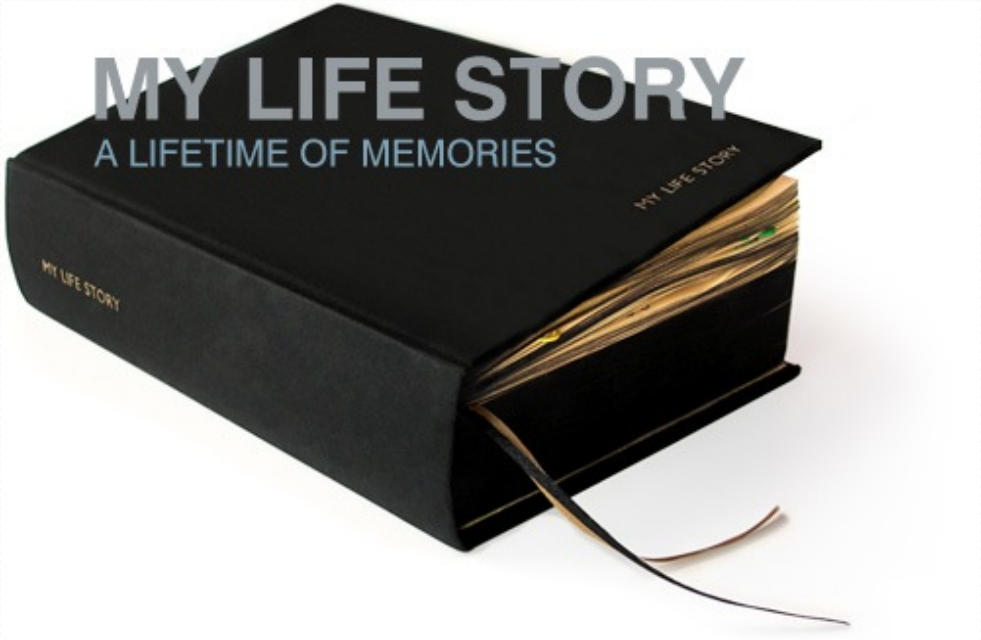
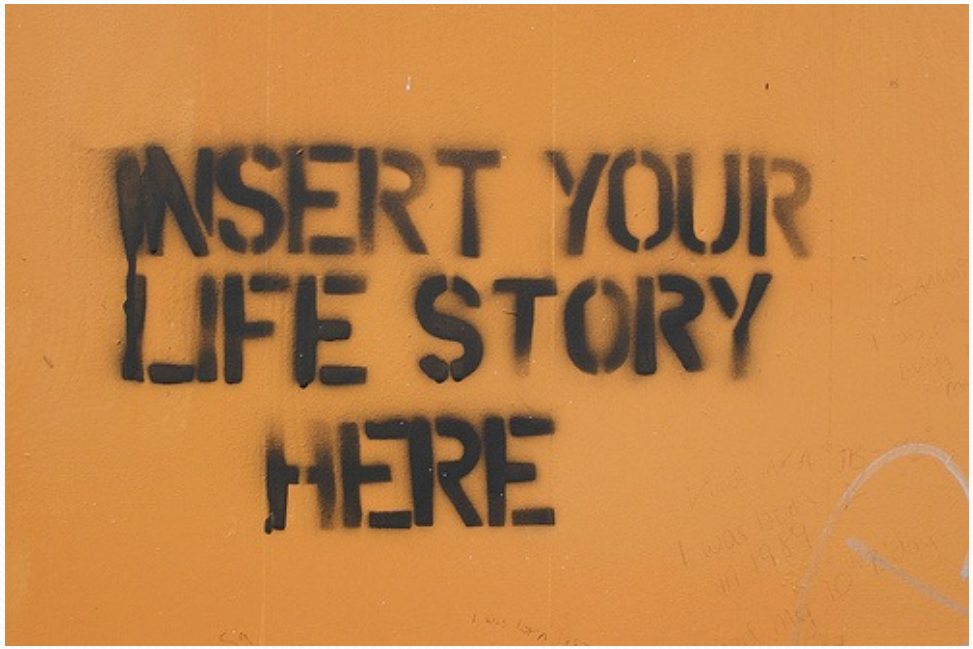
Predict and Protect!

- Integrate your life's narrative (LPFC)
- Think rationally/make rational decisions





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Imagine for a moment…

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As an aside…

- Hippocampus & LPFC do memory and consolidation
- No trauma? No problem. We'll store that in a nice time line for you.
- File that away for later…

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Exposure to trauma =

- **A more sensitive amygdala (danger!)**

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Exposure to trauma =

- **Shut down of the hippocampus**

Due to the increased activation of your amygdala, your access to your hippocampus is denied. Mental maps of safety are currently not available. Please try again later.

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The science behind the experience

Look at this photo and take it in – really examine it.

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The science behind the experience

Now turn to your neighbor and describe what you saw in as much detail as possible.

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Exposure to trauma =

Shut down of the hippocampus

When is a bang more than just a loud noise?

When you can't put it in context!

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Exposure to trauma =

Shut down of the hippocampus =

So much for that time line...

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Exposure to trauma =

- Decreased activity in Broca's area
  - Broca's area is related to speech
  - May explain why victims have difficulty talking about their traumatic experiences

"I just can't find the words"

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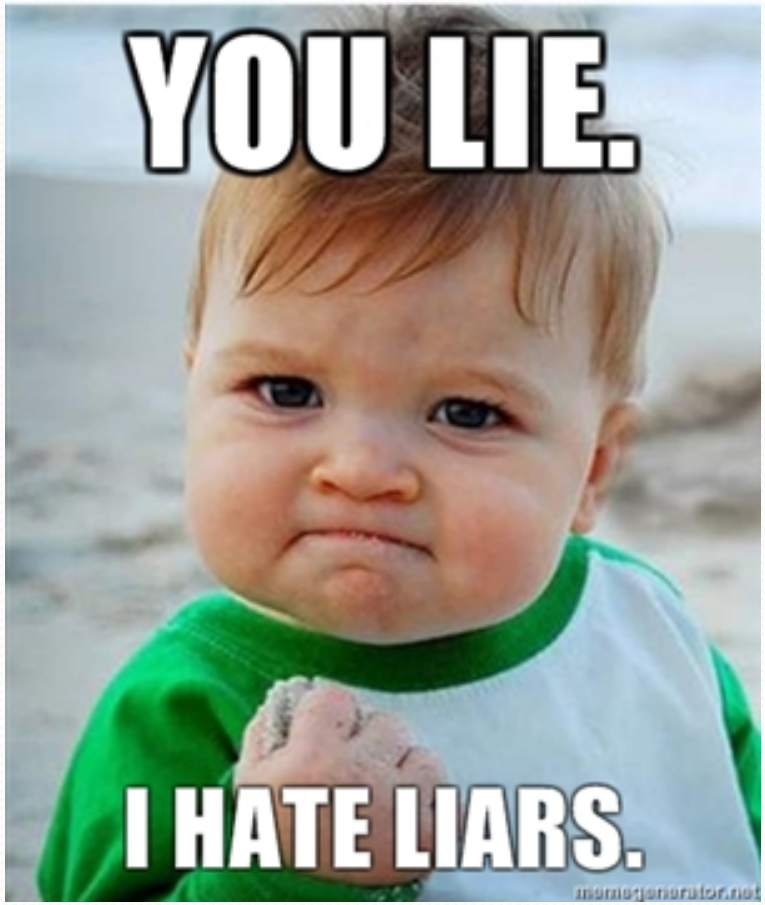
Ever seen a witness discredited because the witness' account of the crime was disjointed?

Hmmmm…



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Memory as a story:

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Memory as a disjointed collection of data points:

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This is traumatic memory:

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Imagine for a minute:

The memories don't form a story…

…you can't even find the words to describe them!

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Exposure to trauma also means:

- A neural network that leads to an automatic response to any perceived threat.

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Exposure to trauma also means:

- A neural network that leads to an automatic response to any perceived threat.

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Healing from Trauma

- The hippocampus and amygdala appear to be able to "heal" over time – neuroplasticity!

- BUT…healing requires time & support

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Are you saying the criminal justice system should be concerned with healing?

Not exactly.

But by letting neuroscience inform your methods, you get a BETTER WITNESS!

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Suggestions for interacting with victims

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Suggestions for interacting with victims

- Avoid asking temporally focused questions like “what happened next?”
- Encourage with questions like “what else do you remember?”
- Seek to corroborate individual aspects of the story, instead of building a timeline

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Suggestions for interacting with victims

- The importance of soft eyes

It may sound like something only a therapist could say…but it's based in hard science!!

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The science behind soft eyes…

- Monkey see…monkey do…
- Monkey see…monkey's brain fires like he's doing…but he's not doing!
- What the WHAT???

More on mirror neurons

- Mirror neurons are connected to the limbic system (which is about our emotions)

- When we mirror the motor activity of facial expression, it allows for emotional resonance (or empathy)

More importantly

- The victims you work with will mirror YOUR facial expressions…

- Where is the limbic system? It's not conscious.

One last thought…

"As part of its legacy, trauma leaves its victims with fear networks etched into the amygdala, networks that can be triggered by a multitude of cues that would ordinarily not evoke fear. Trauma also leaves its victims with fragmented and discontinuous memories of what happened to them. As a consequence of these legacies, the…victim faces enormous challenges in the judicial process. To participate in that process - to endlessly recount their trauma, to appear in the court room where the [perpetrator] sits - is equivalent to the zebra consciously choosing to return to the water hole where the lion attacked." (Lisak, 2002)

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Questions? Comments?

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chris@drchristopherwilson.com

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