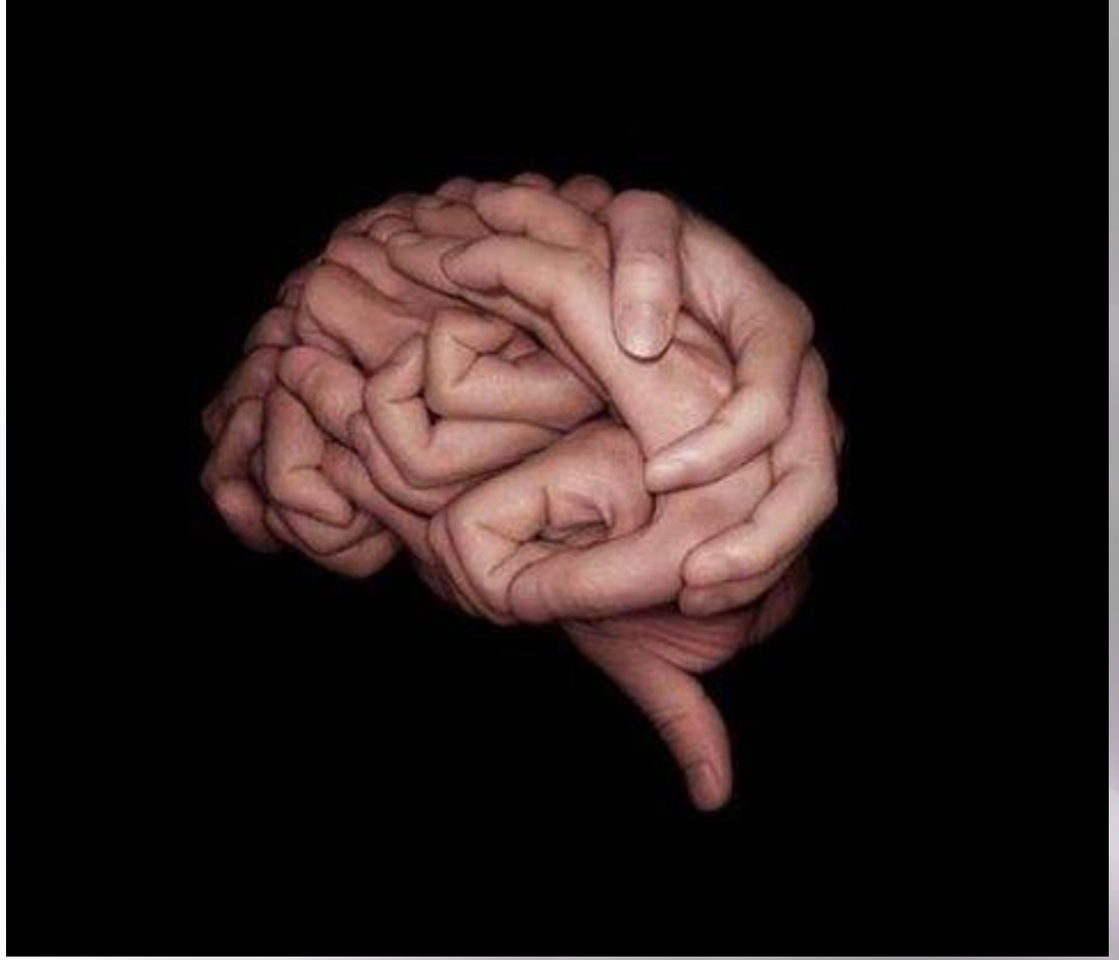
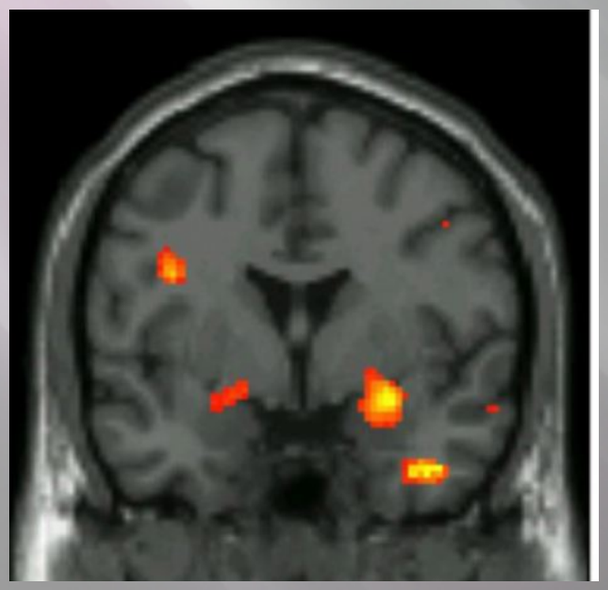


Learning and the Developing Brain



Nathan Mikaere Wallis

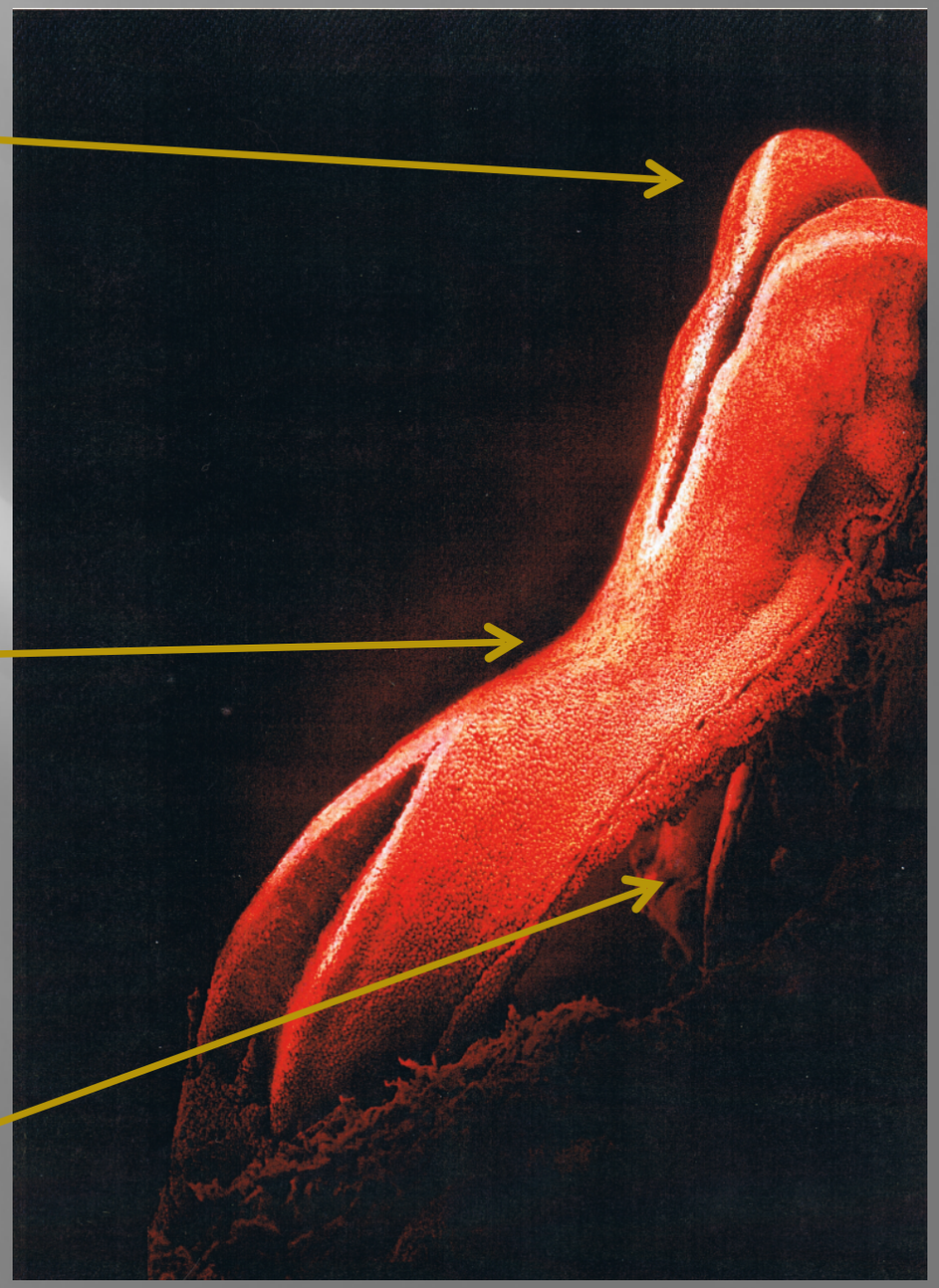
booknathanwallis@gmail.com

Rapid Changes

The head with the beginnings of a brain.

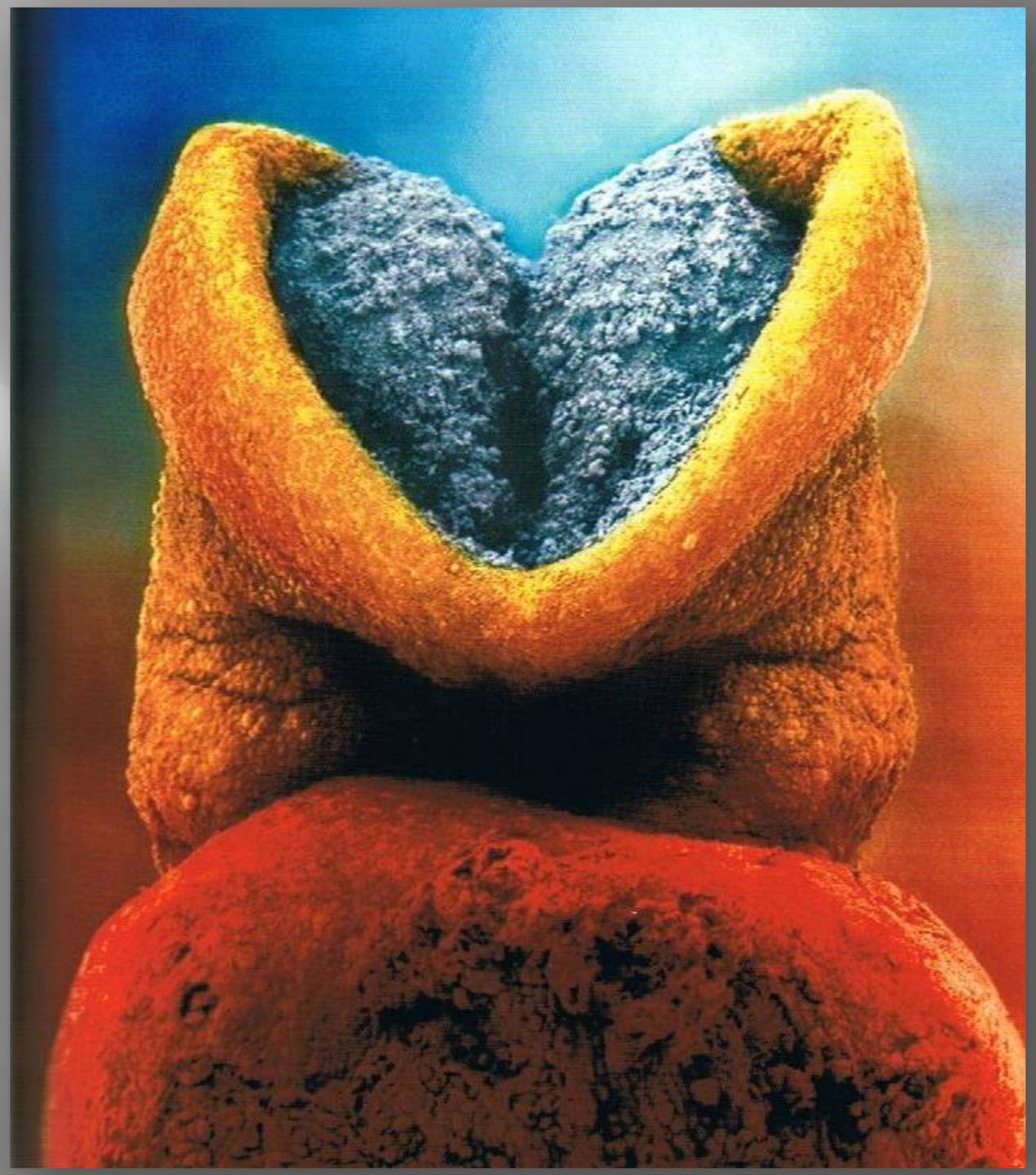
The nerve tube has closed at the torso end.

The primitive heart.



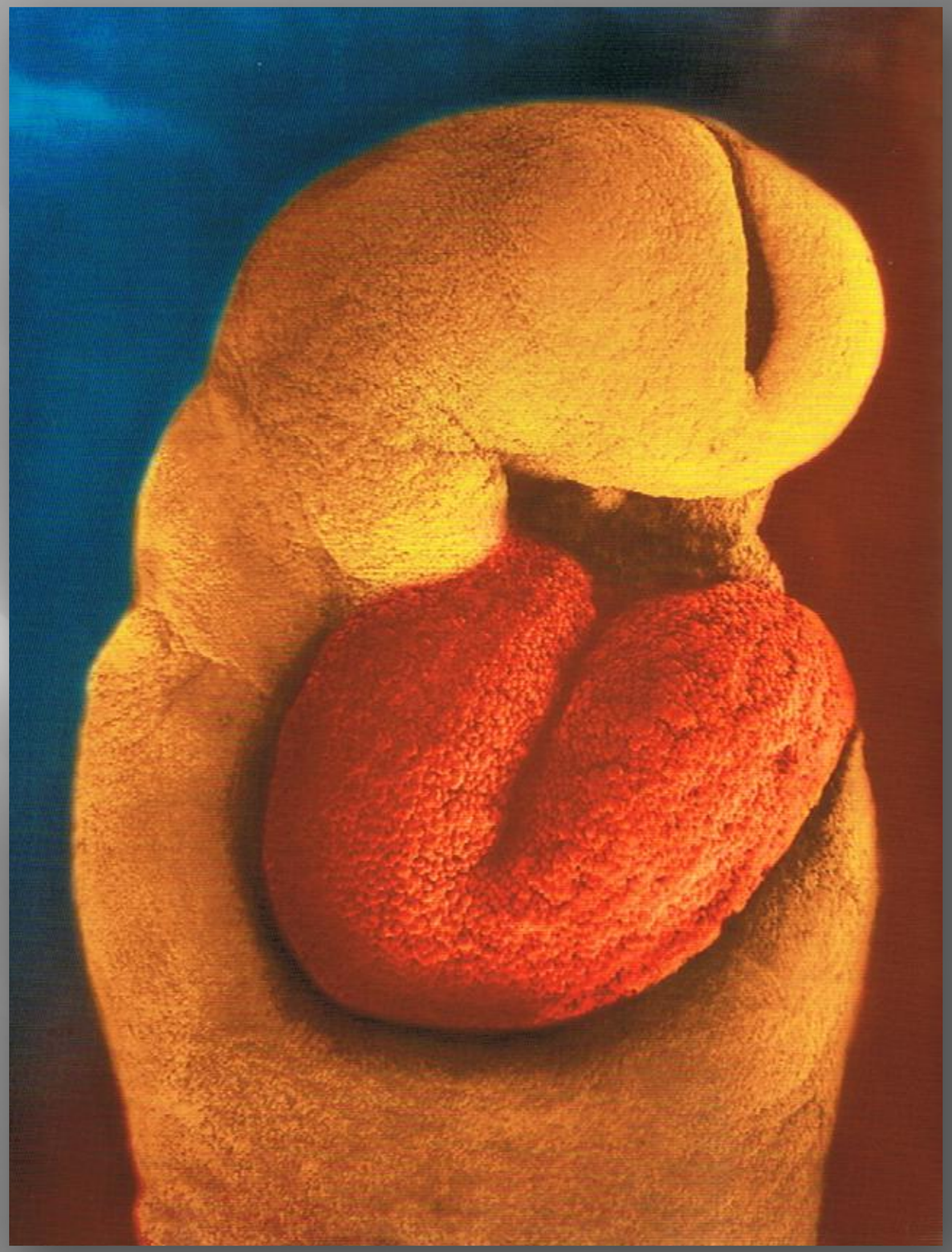
Embryo @ 3 Weeks

The embryo is about the size of a thumbnail. The brain is exposed. The head is the first part of the embryo to develop.



Embryo

The brain closes over. There are very rapid changes at this time. The heart starts to beat at 22 days. It beats very rapidly – twice as fast as the mother's. It won't stop beating until death.



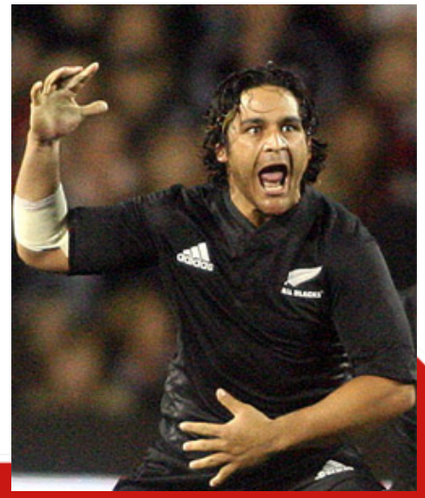
1990's The **Decade of the Brain**

* the growth of the frontal cortex is experience dependent

* the first three years ARE the most important

Cozolino, Louis (2006) The neuroscience of human relationships: Attachment and the developing social brain. New York, NY, US: W W Norton & Co.

Weights of Brain at 0, 3 and Adult



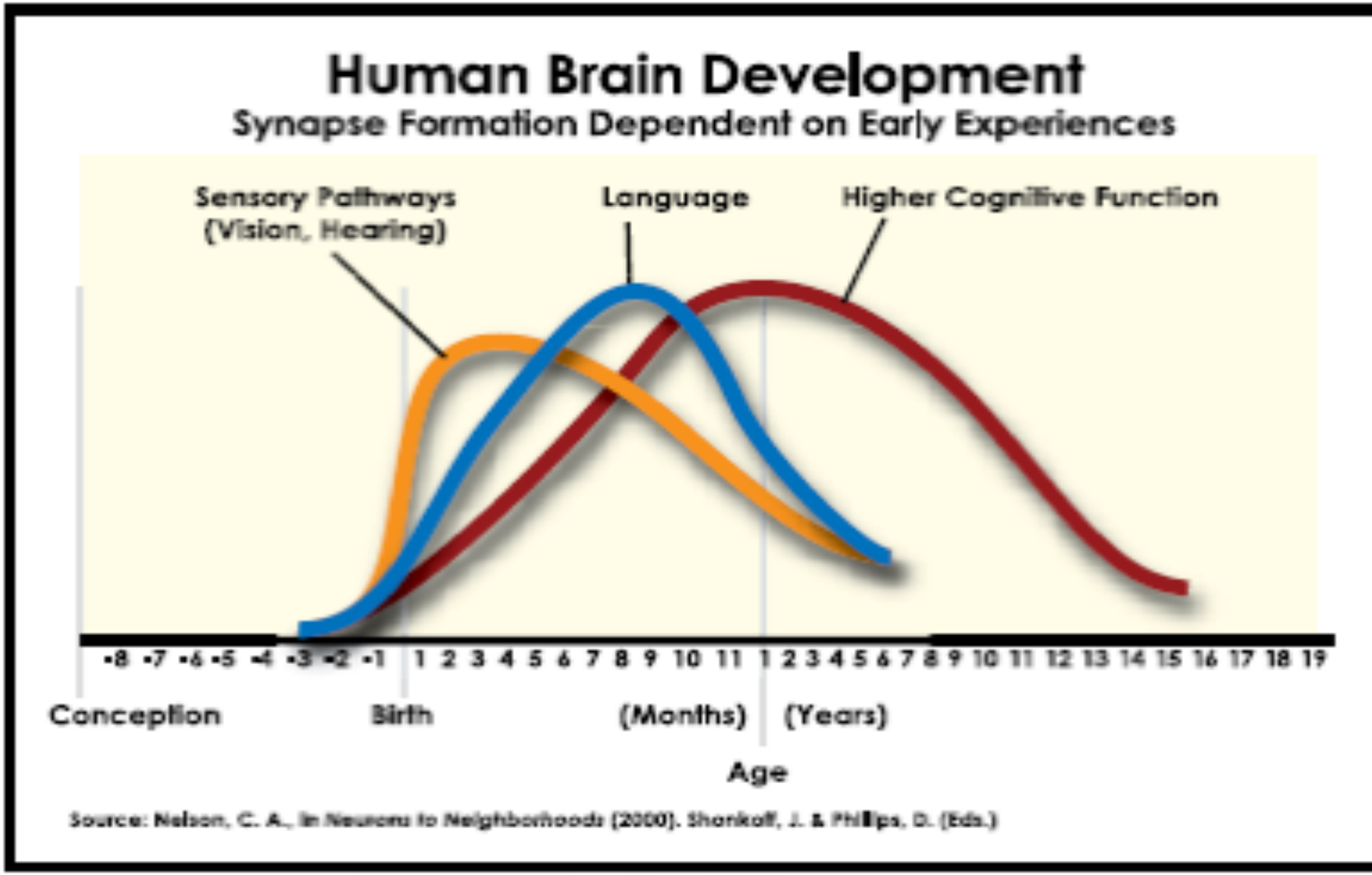
300 400 500 600 700 800 900 1 kilo 1.1 1.2 1.3 1.4

Newborn baby
brain
350 grams

3 year old
brain

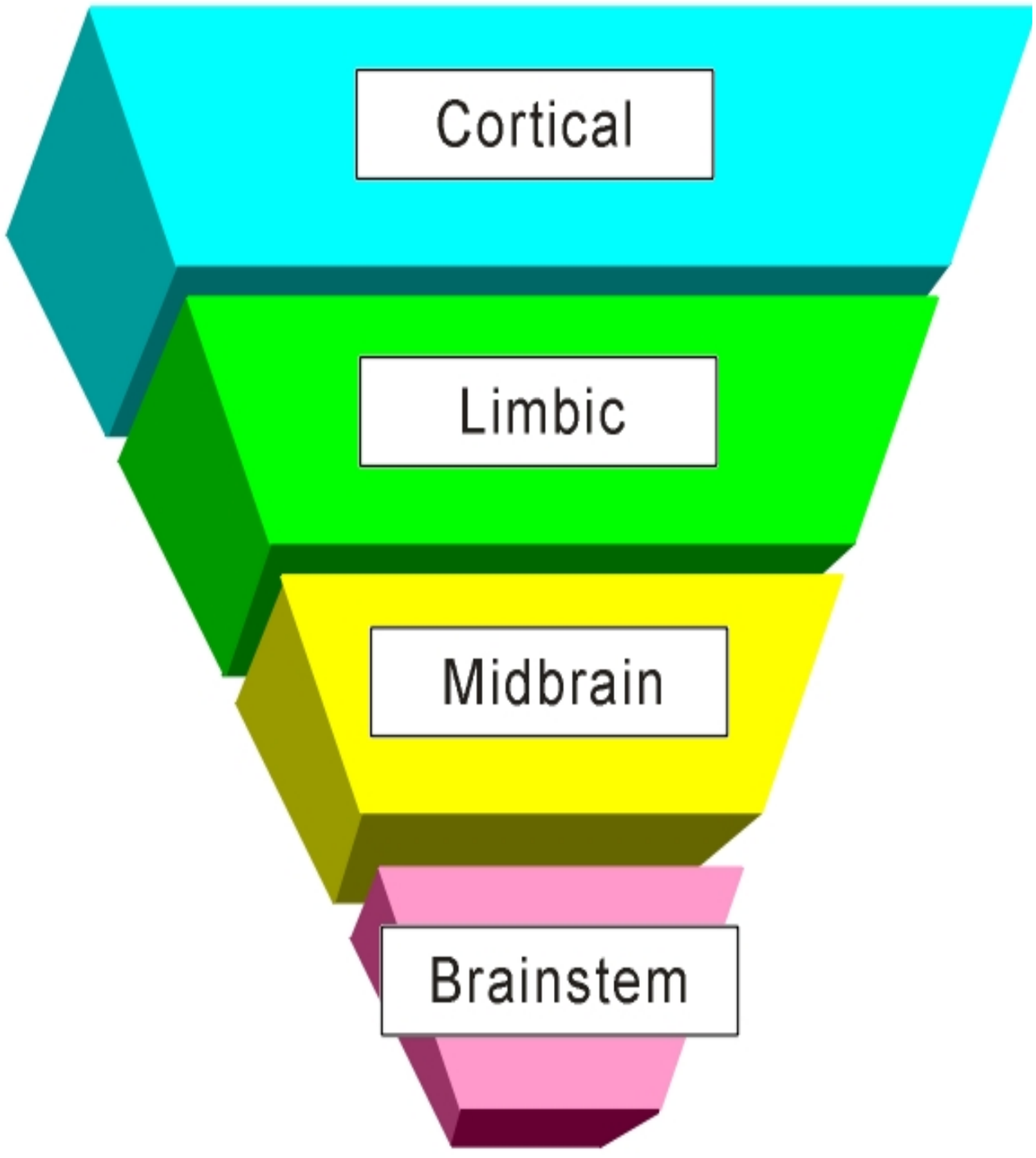
Adult
brain
1.4 kilos

Human Brain Development




SPL

Perry's Neurosequential Model



Empathy

Controlling yourself

Literacy

Emotional response

Coordination

Movement

Heart rate

Fight, flight, freeze

Perry, B.D. (2002). *Brain Structure and Function I: Basics of Organisation. Adapted in part from "Maltreated Children: Experience, Brain Development and the Next Generation (W.W. Norton & Company).*

As one increases, the other declines – and vice versa

High Activity

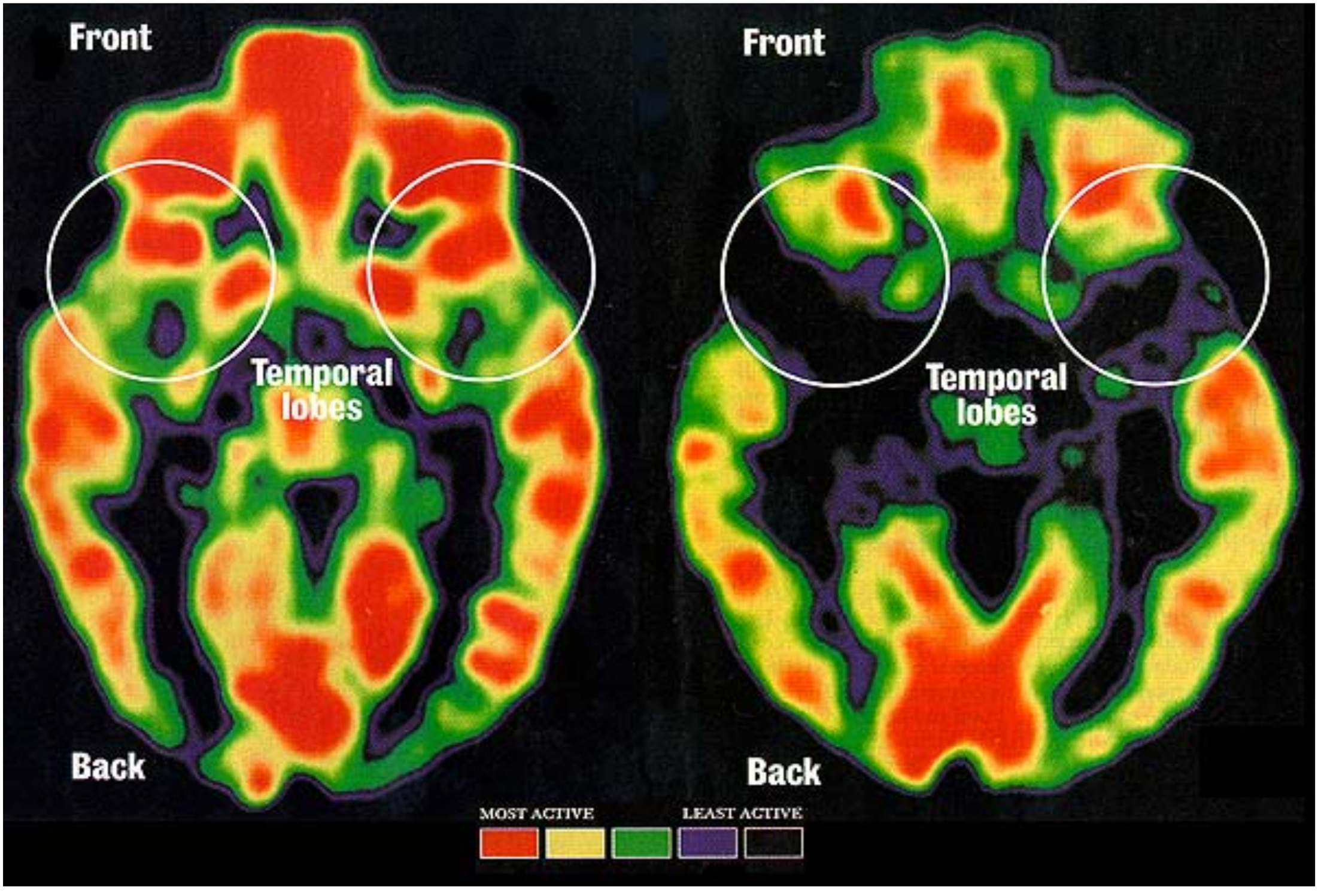
brainstem

Cortex

Low Activity

To really be using your cortex, your brainstem needs to be calm

Effects of Trauma, abuse and neglect on the developing brain



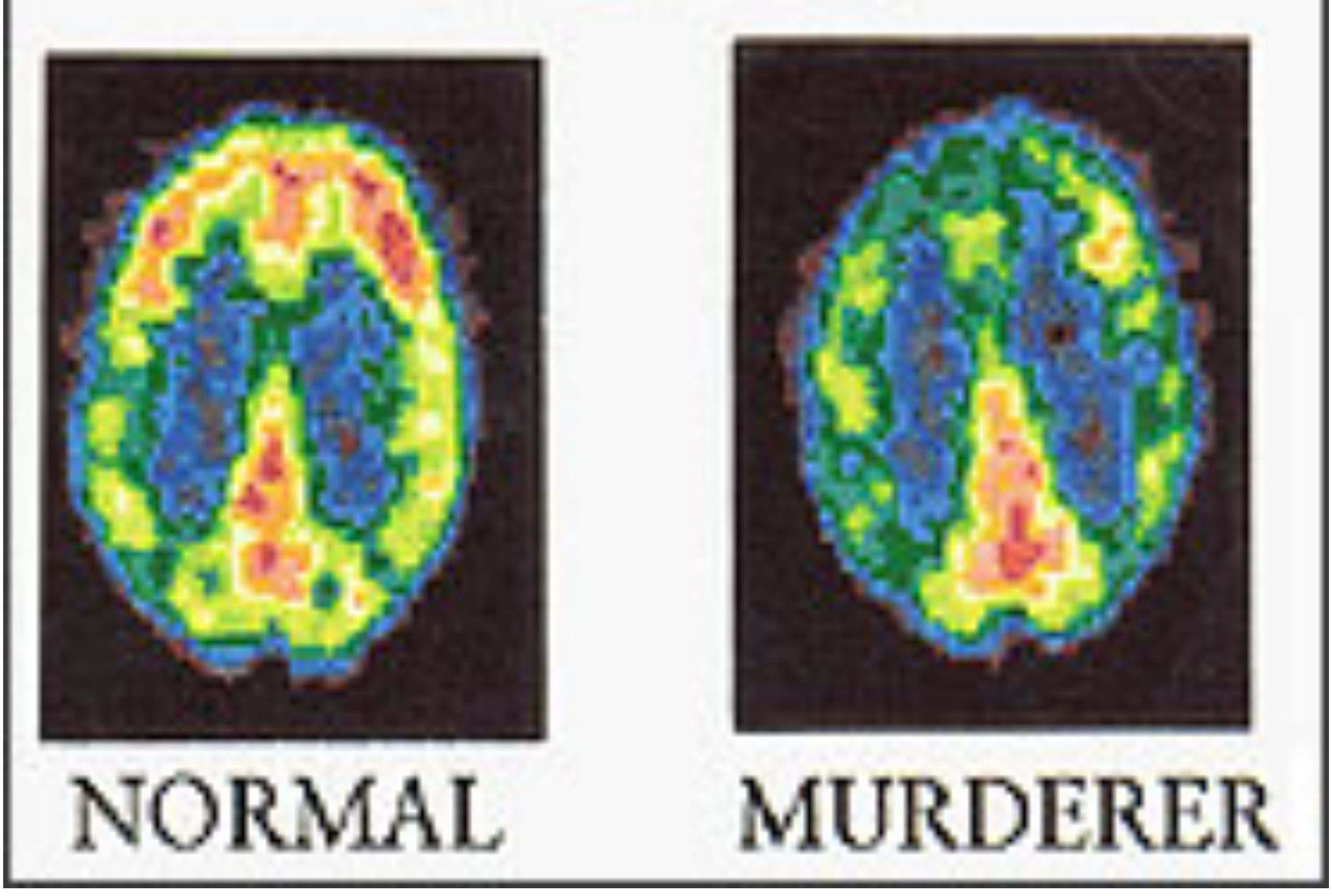


Image from Raine, A. (2009). *Murderous Minds: Can we see the mark of Cain? Accessed from http://www.dana.org/news/cerebrum/detail.aspx?id+3066 On 30/1/2011.*

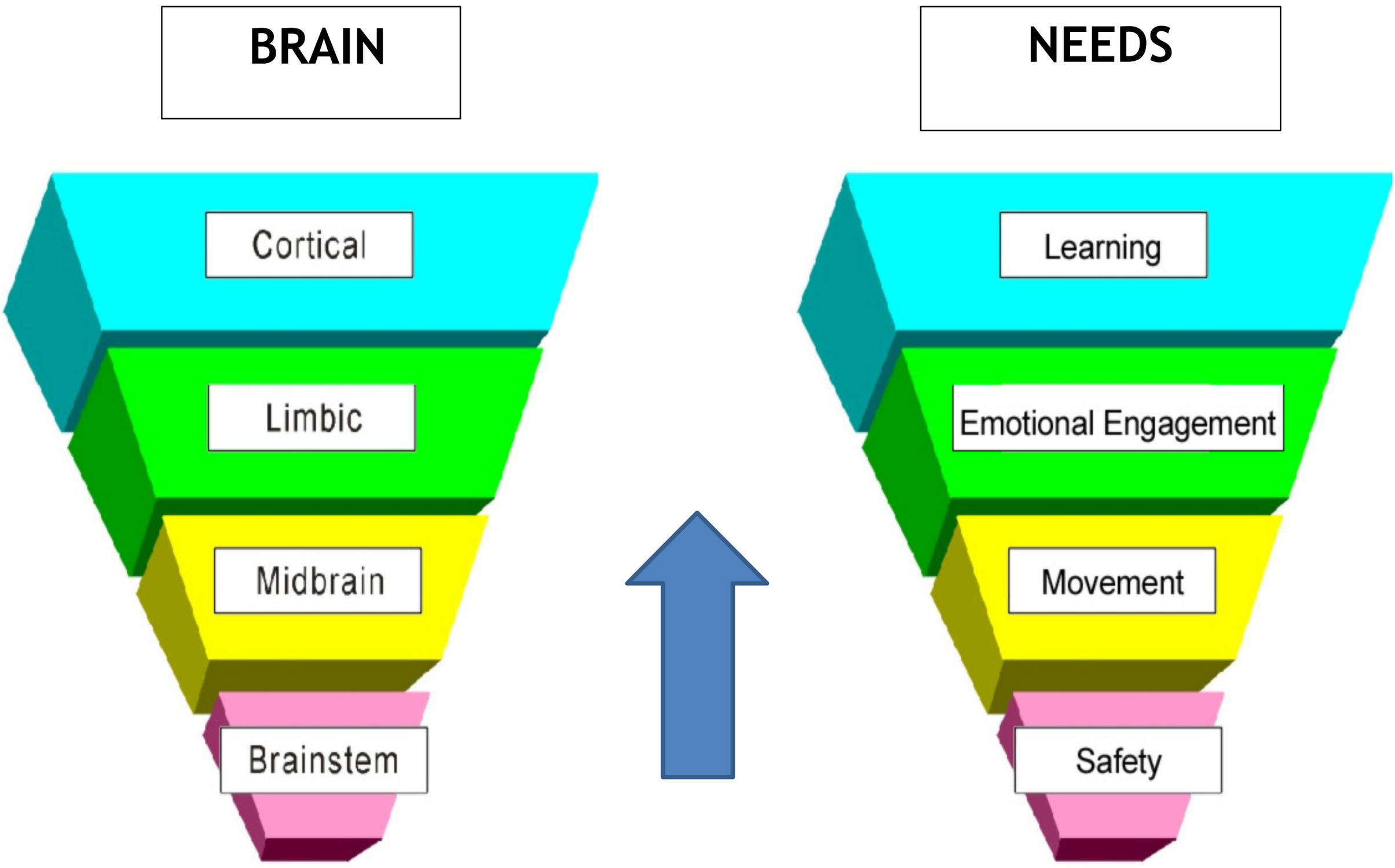
Orbitofrontal cortex

- Integrates environmental information with inner states
- Holds ability to empathise and to infer another's state of mind (read emotional cues)
- Connected to primitive brain functions – e.g. can process & control rage or sexual desire
- Begins to mature in toddlerhood
- 'socially programmed', relationship dependent
- Timing: Romanian orphans "virtual black hole" where orbitofrontal cortex should be

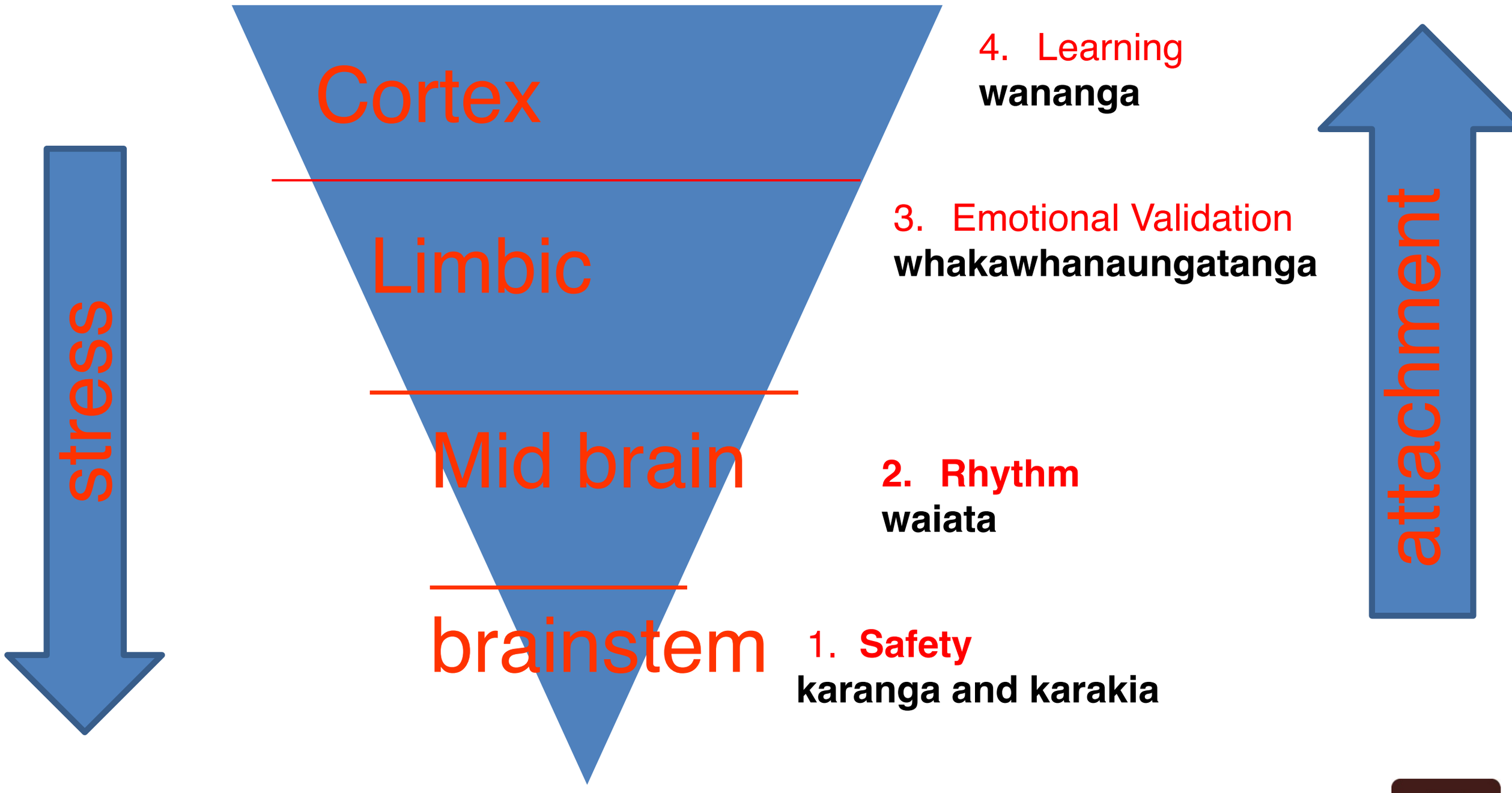
biology of comfort

- links brain stem to heart, lungs, stomach
- as child is reassured, the heart, lungs, & stomach settle
- alarm system dimmer switch: not just on/off
- good vagal tone linked to better emotional balance, clear thinking, improved attention span, more effective immune system

- Sunderland, M. (2006) *The Science of Parenting* London: Dorling Kindersley



Adapted from: McCaleb, M. & Mikaere-Wallis, N. Relationship-shaping: Teacher consistency and implications for brain development. *The First Years/Ngā Tau Tuatahi: New Zealand Infant and Toddler Education, 7*(2), 21-25



Kai meets the need of all four

Pro social behaviours

Cortex

Limbic

brainstem

3. Cognitive Training

2. **Validation**

1. **Safety**

stress

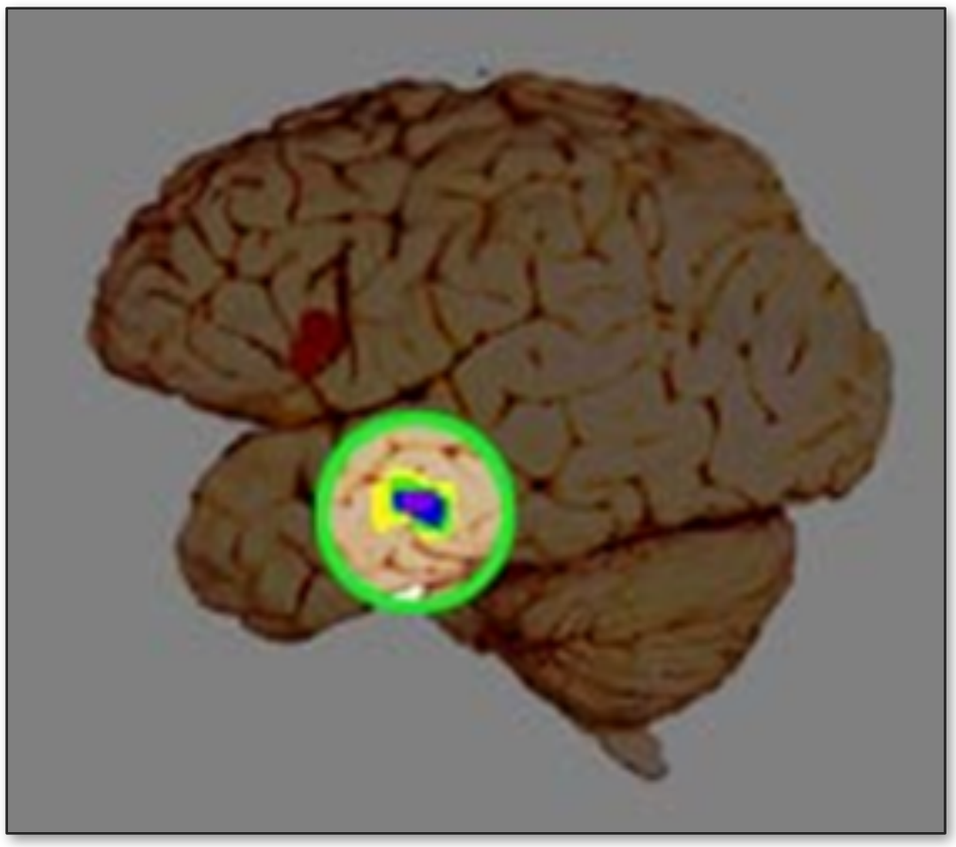
attachment

Survival/reptilian behaviours

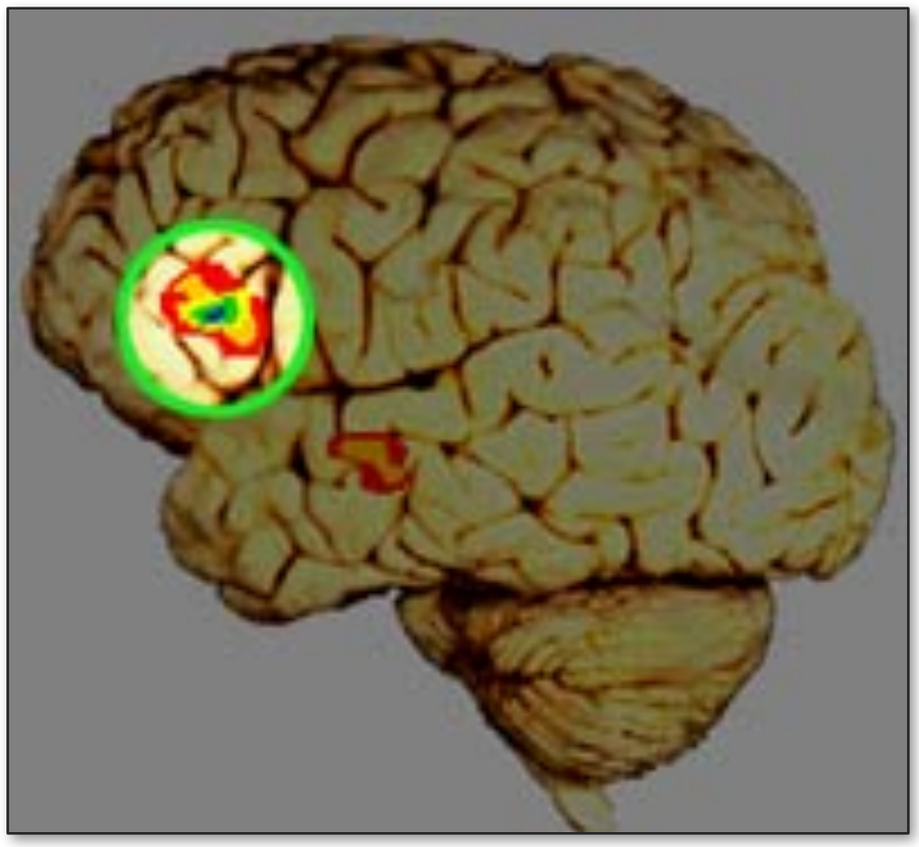
Cicadian Rhythm

Melatonin and Cortisol

Amygdala vs Cortex



Adolescent



Adult

Reference: Yurgelun-Todd, D. (2002) Frontline interview “Inside the Teen Brain” on www.pbs.org/wgbh/pages/frontline/shows/teenbrain/interviews/todd.html






Reading Facial Expressions

fusiform face area

- Amygdala vs Frontal Cortex

Yurgelun-Todd D. Emotional and cognitive changes during adolescence.
Current Opinion in Neurobiology 2007, 17:251-257.

Memory and Alcohol

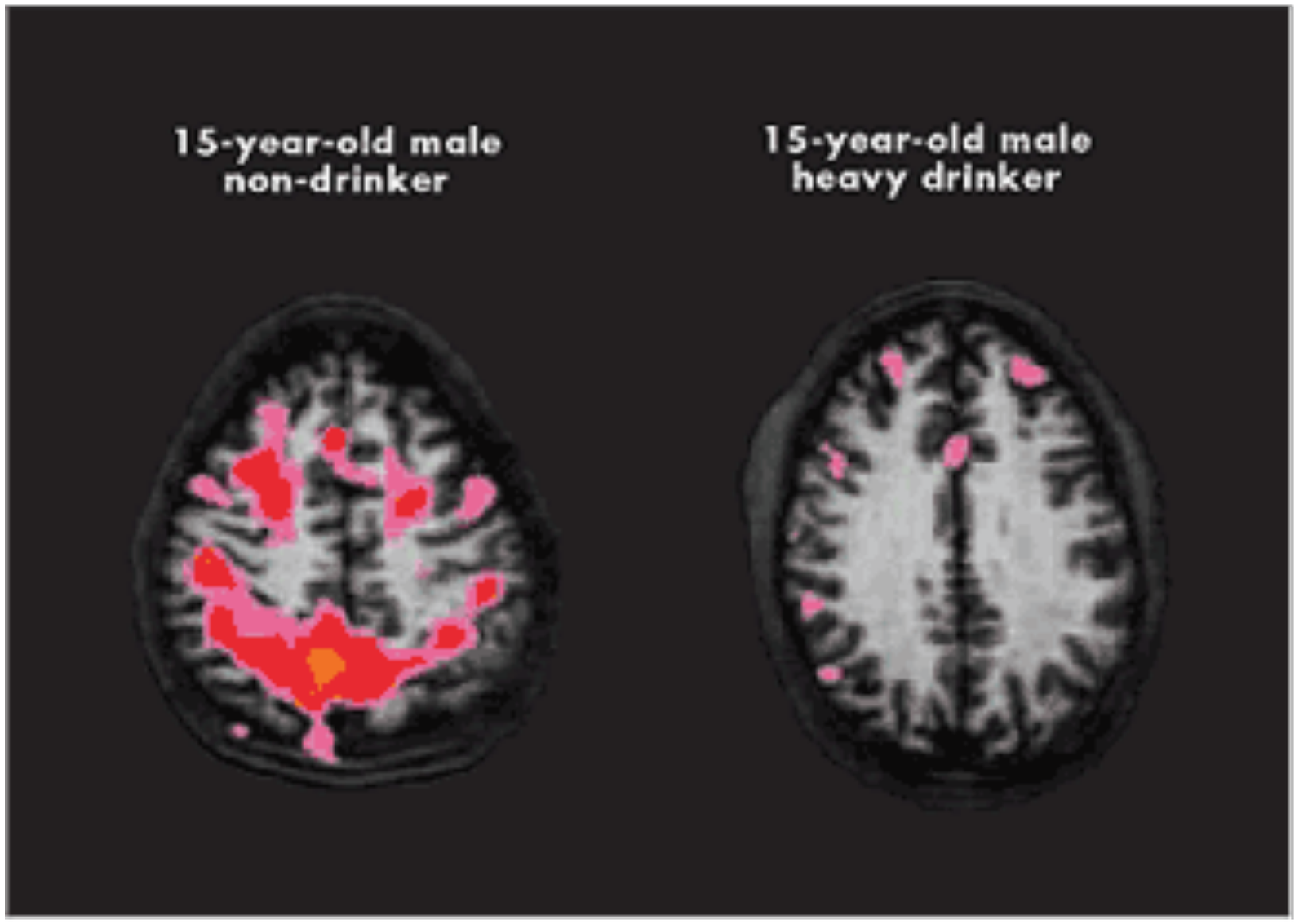
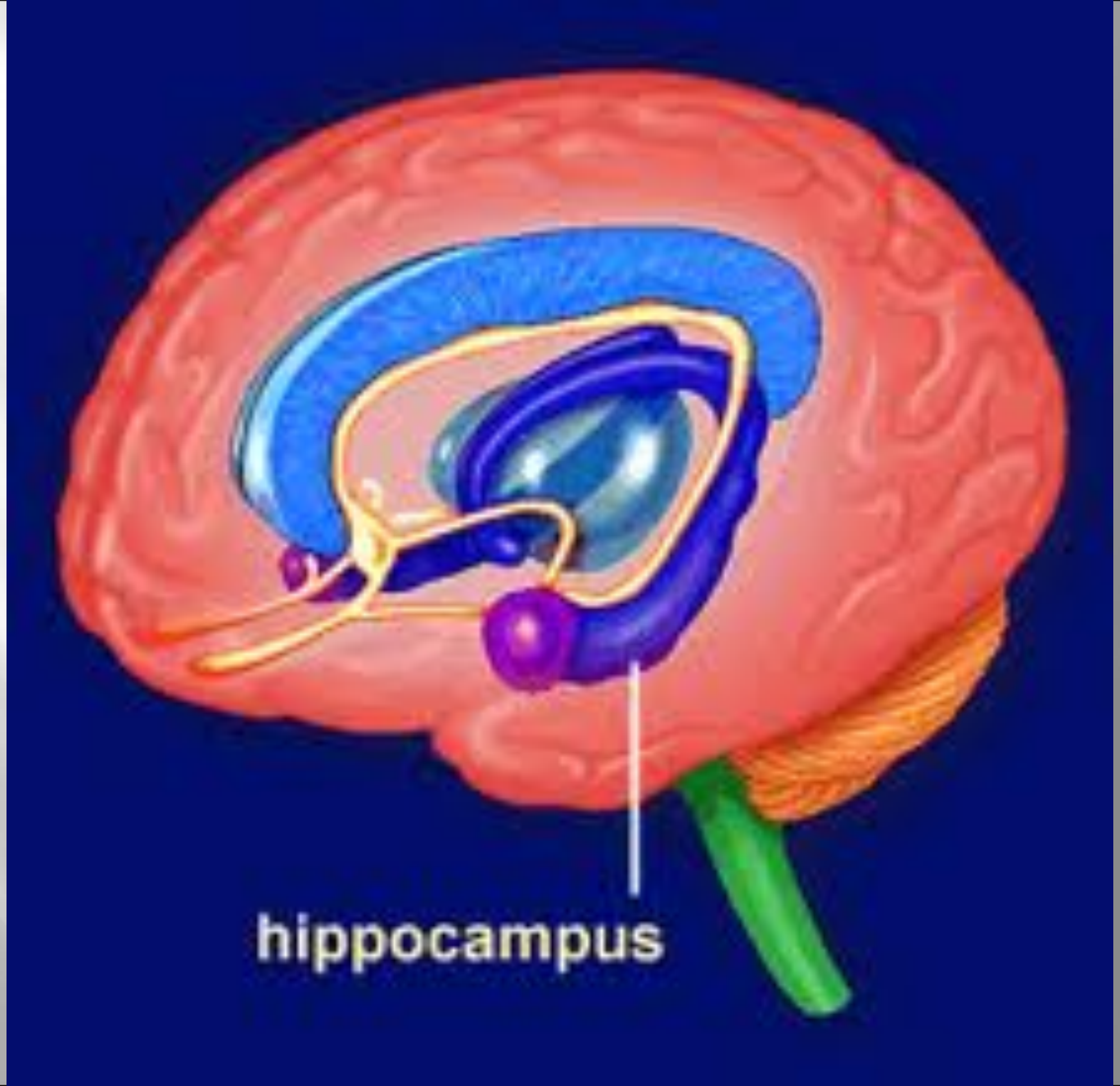
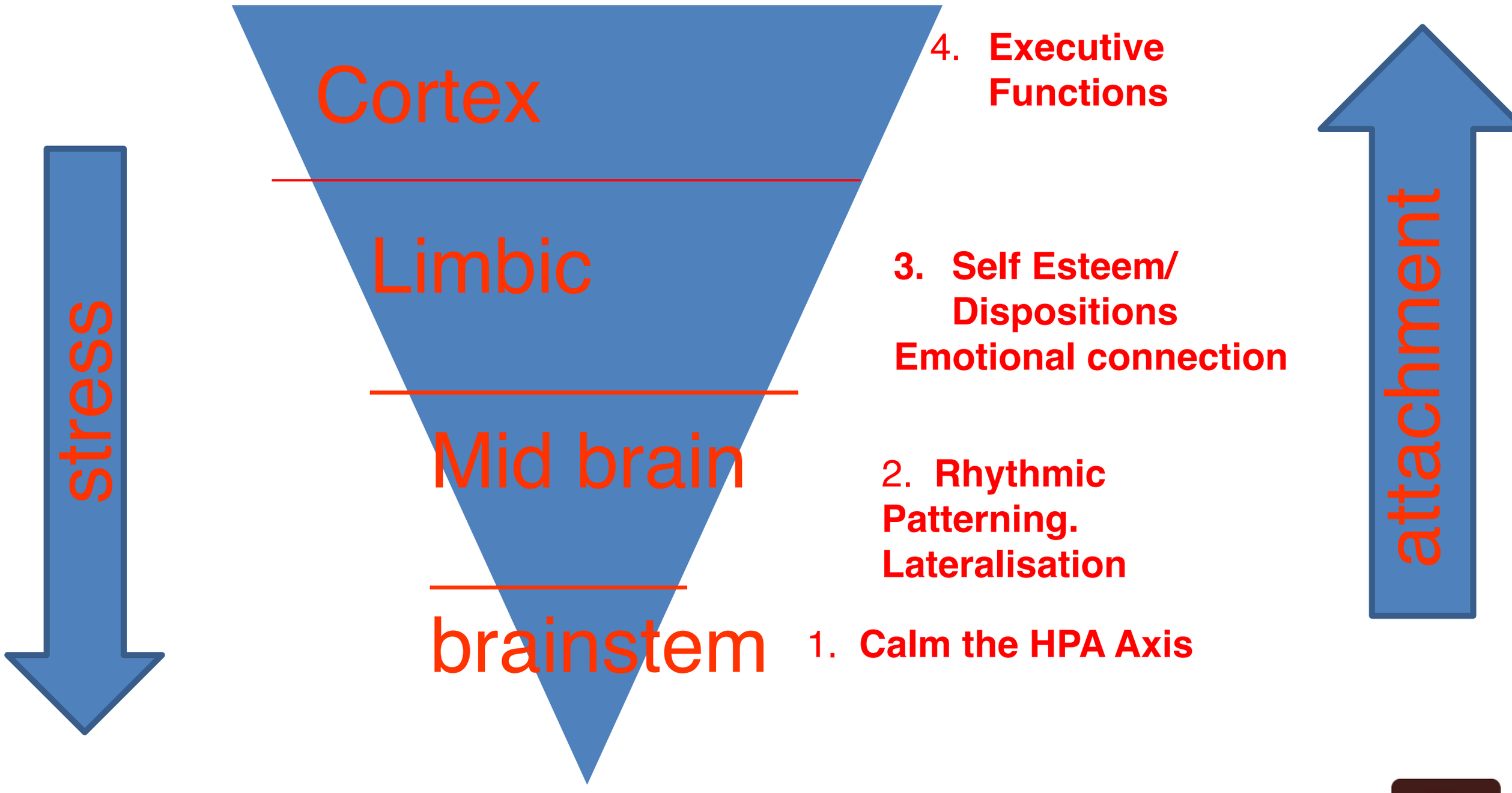


Image from Susan Tapert PhD. University of California, San Diego.


hippocampus

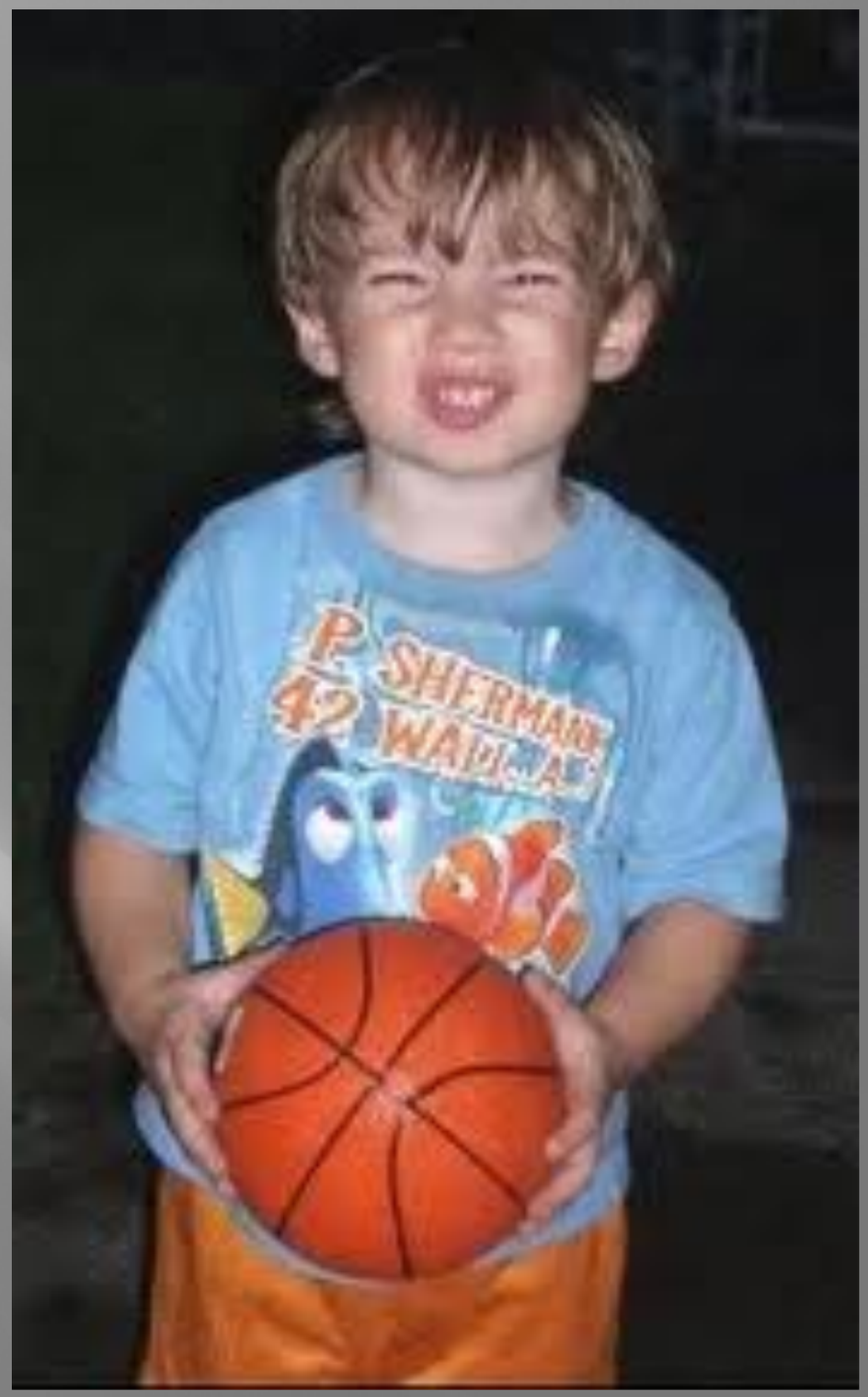
Neurosequential Needs



1960's Psychologist
Walter Mischel (Stanford)

1 now or 2 later (4yrs)

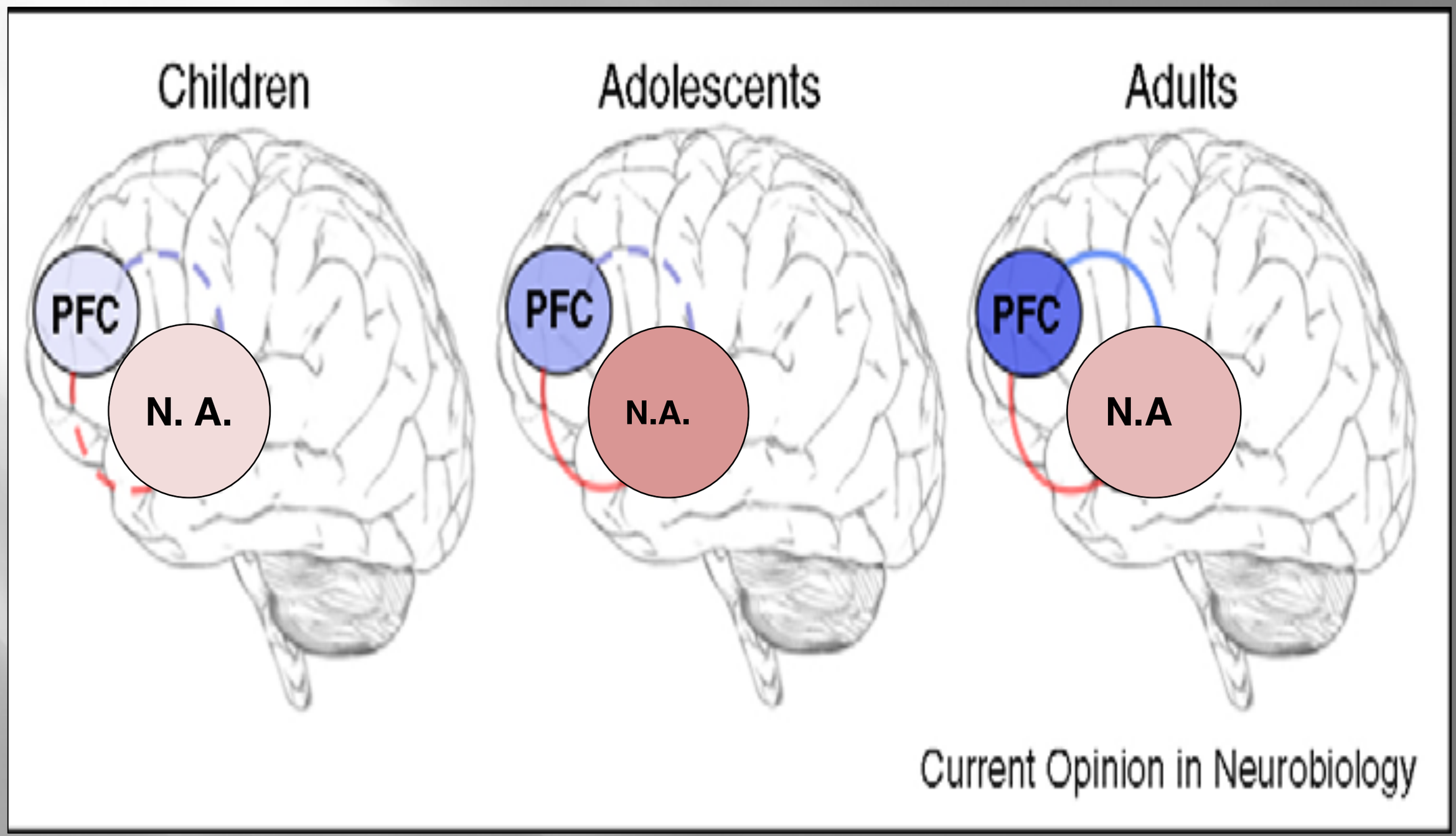
210 points higher on
SAT's waiting for 15 mins
than 30 seconds.

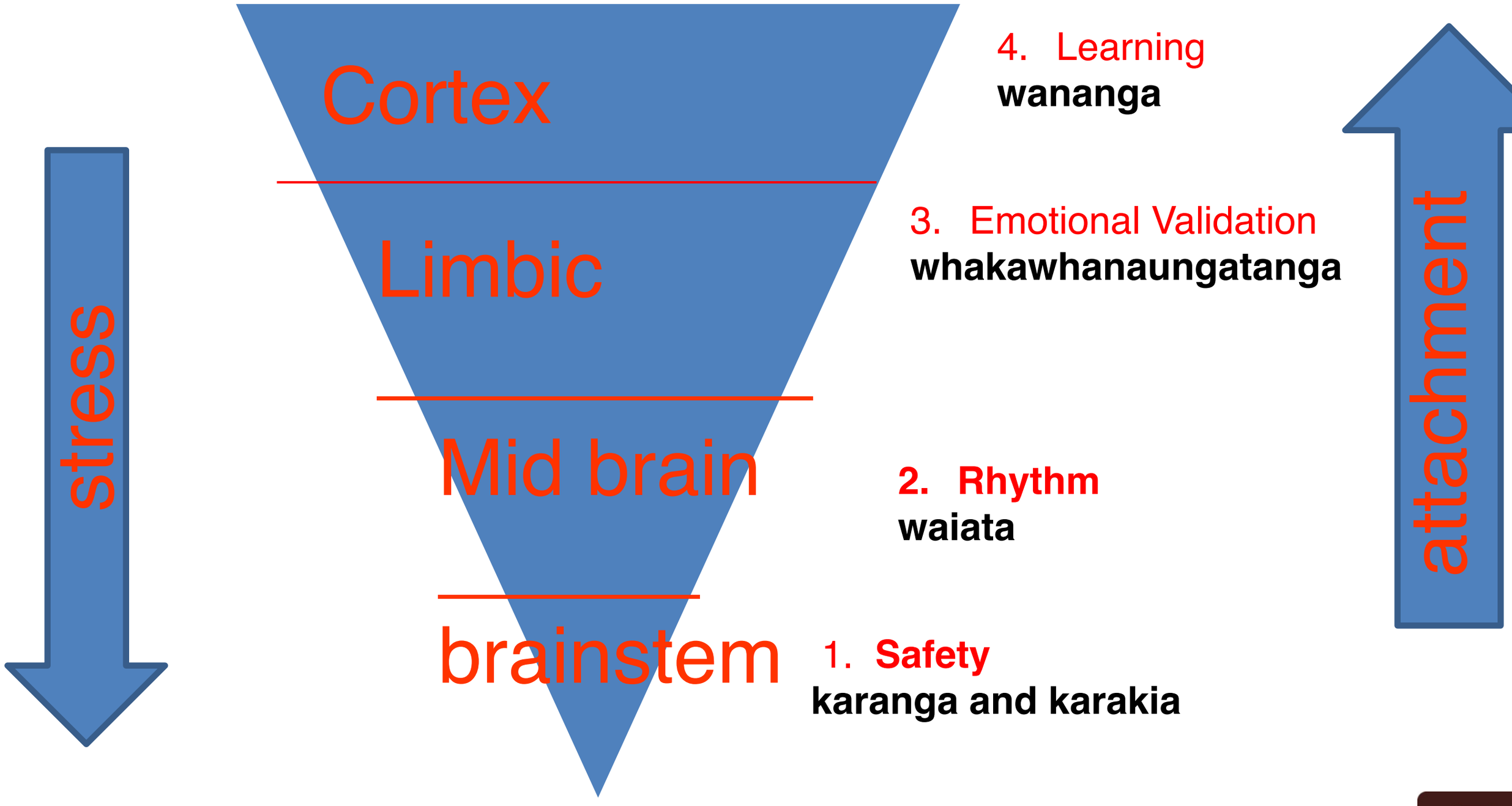


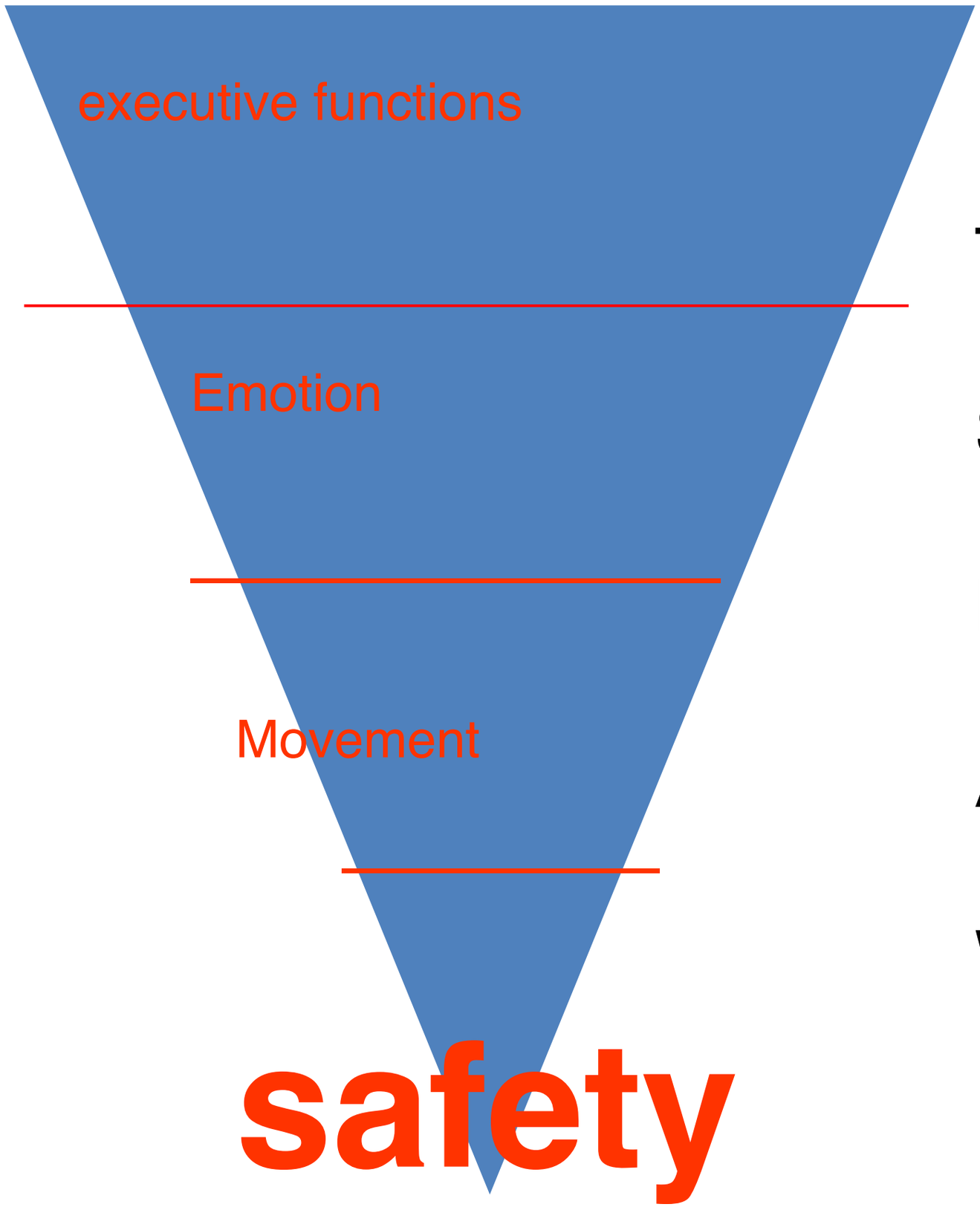
- As adolescent less behaviour
- issues and found it easier
- to focus attention

- Dunedin multi-disciplinary study

Self Regulation




stress
Cortex
Limbic
Mid brain
brainstem
4. Learning
wananga
3. Emotional Validation
whakawhanaungatanga
2. Rhythm
waiata
1. Safety
karanga and karakia
attachment



Touch

SensoryPathways

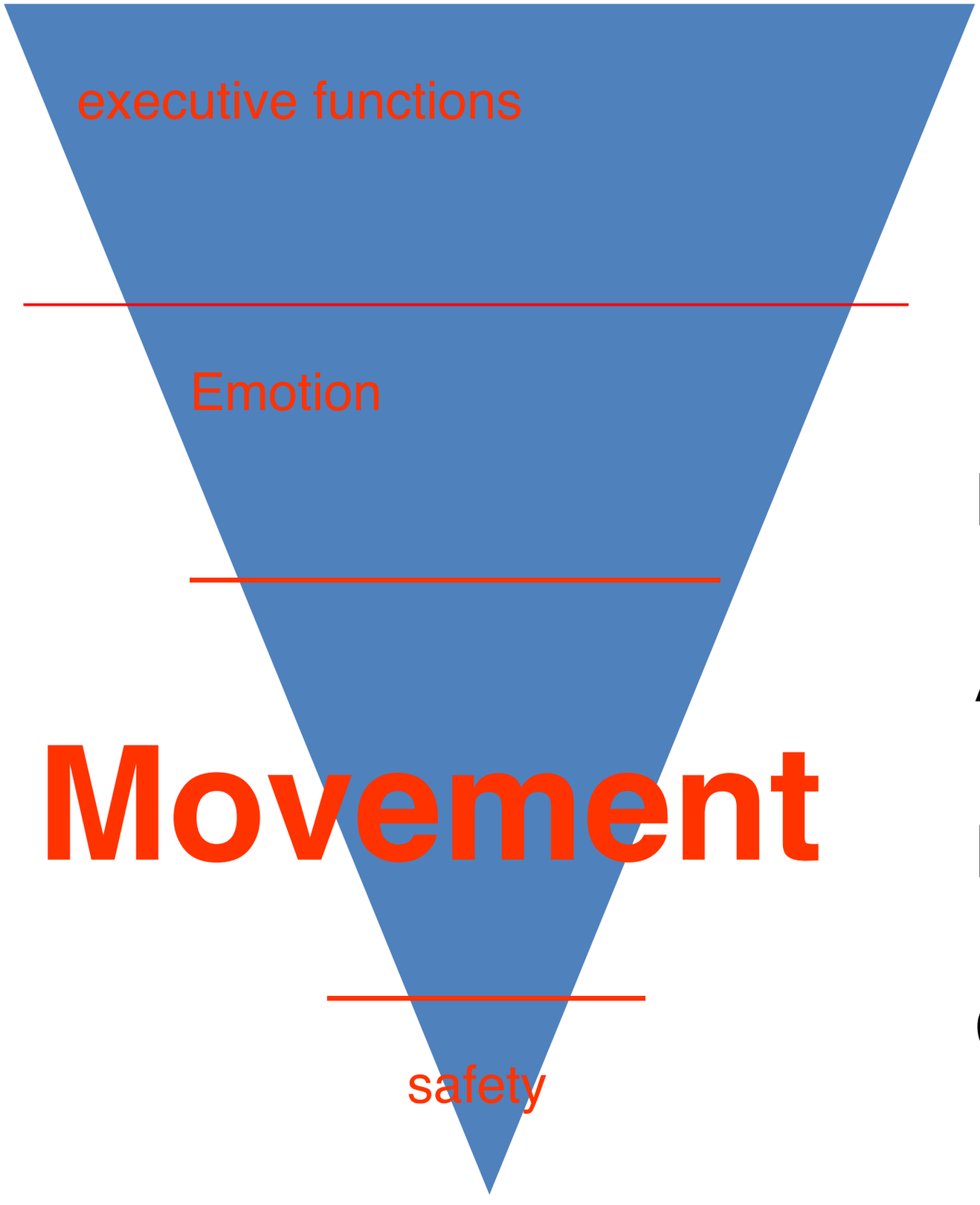
Predictability

Autonomy

Water and kai.

Relationship

FACTOR EDUCATION



Rhythmic Patterning

Routine

Ritual

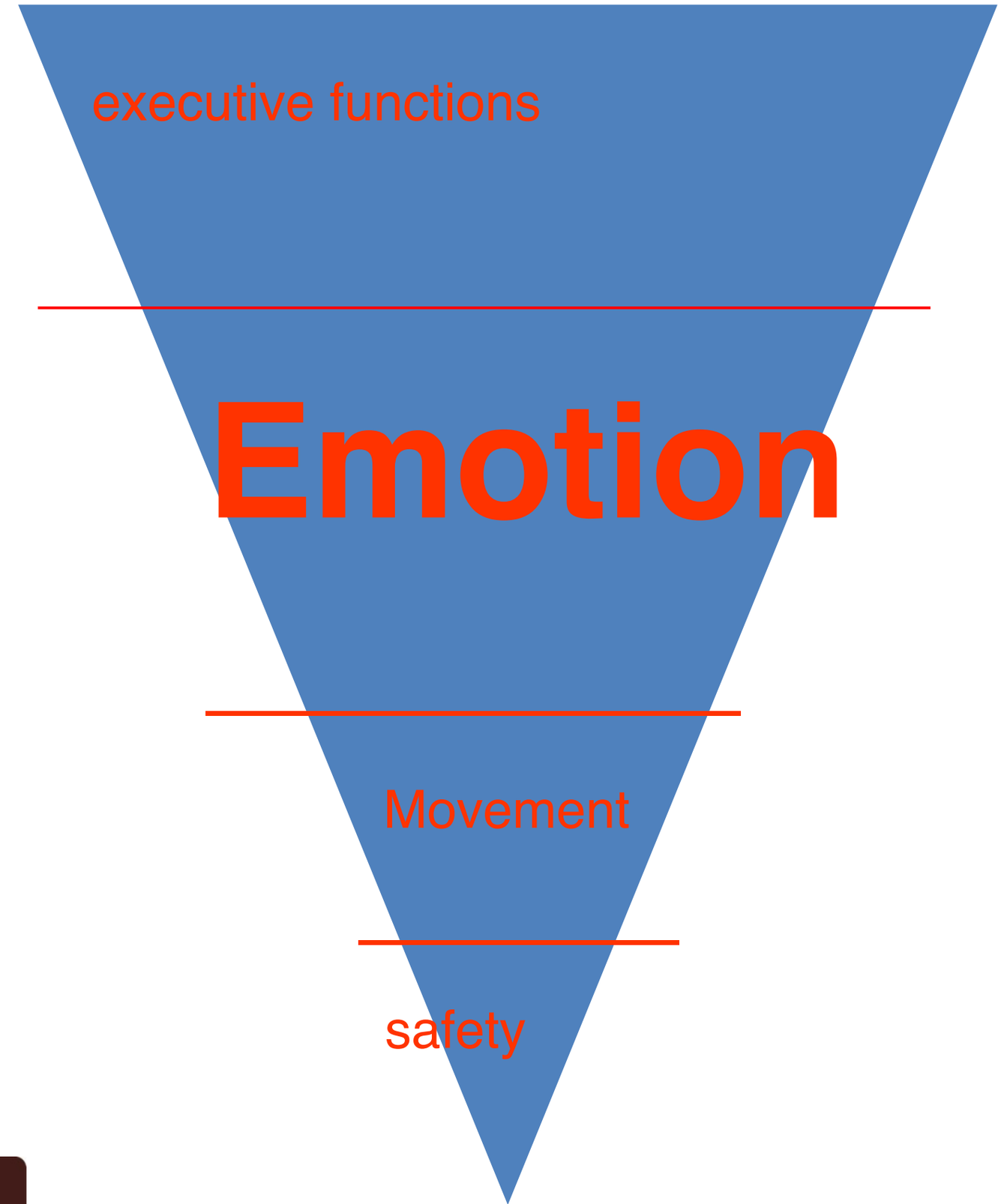
Motivation

Activity/Vestibular

Movement Autonomy

Corpus Callosum

FACTOR EDUCATION



Validation

Self esteem

Dispositions

Naming emotions

Reframing

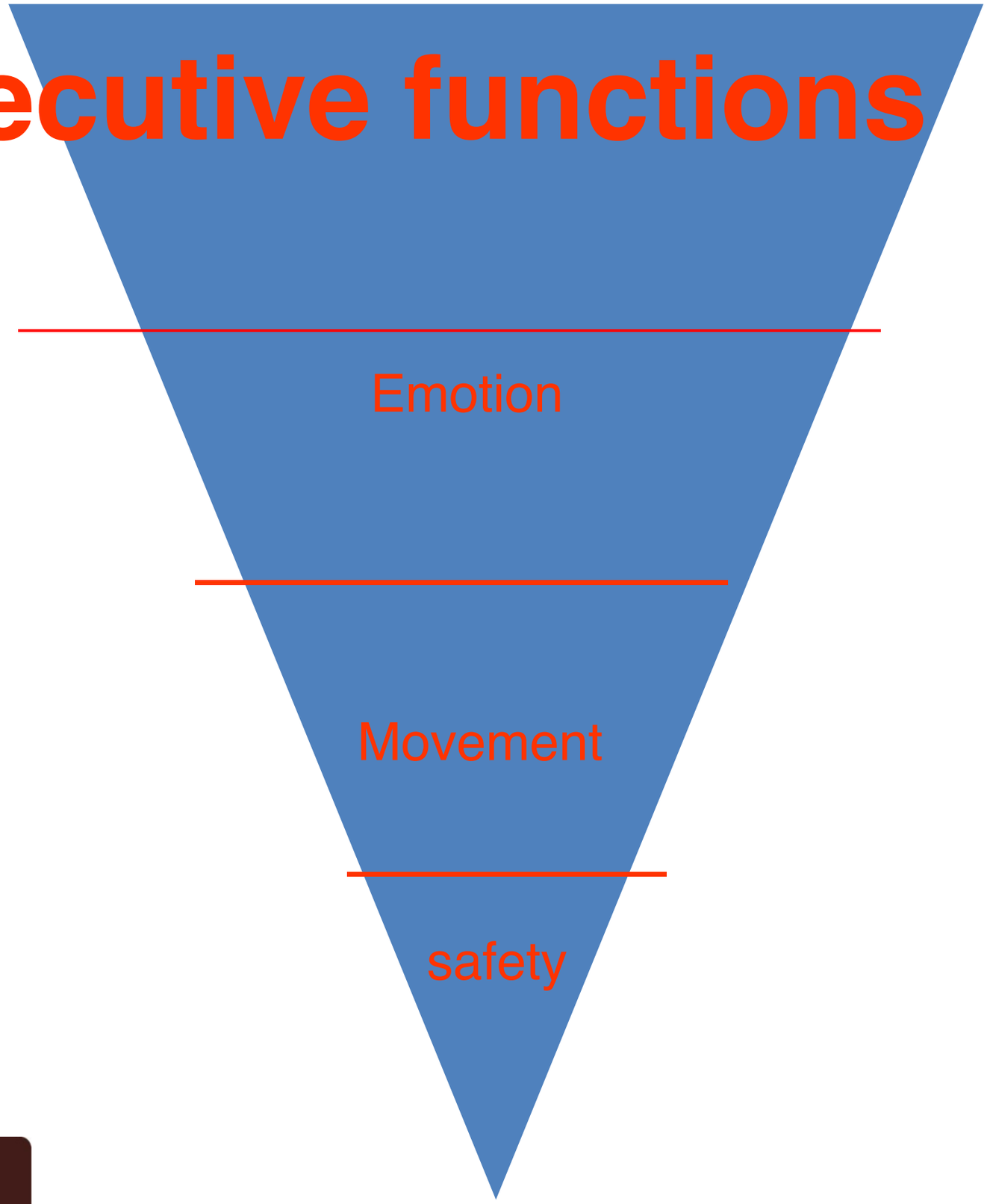
Mindfulness

Enjoyment

Paralimbic system

FACTOR EDUCATION

executive functions



Consequence logic

Judgement

Empathy

Self regulation

Cognitive training

Inhibitory control

Working memory

Metacognition /detachment

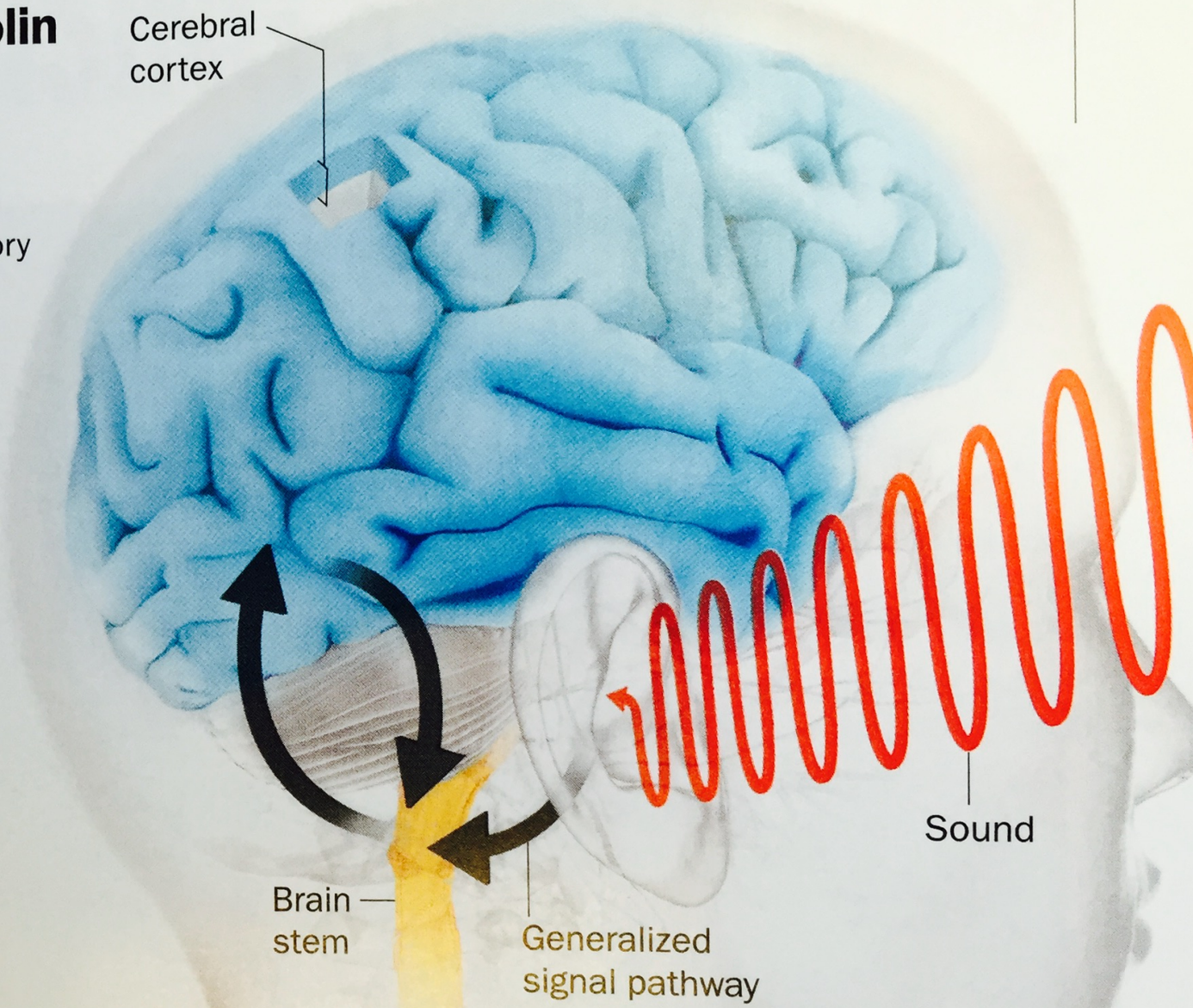
FACTOR EDUCATION

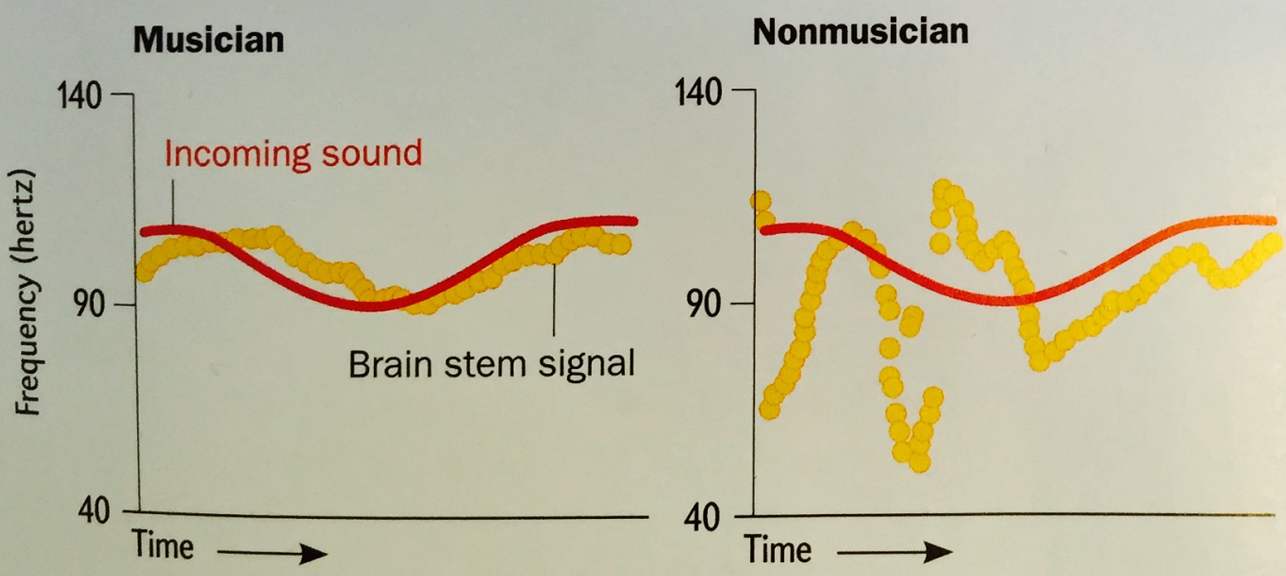
The Best Brain Training: Practice That Violin

Intensive musical training from a young age fosters skills beyond just an ability to play an instrument. The musician's concentration on the fine-grained acoustics of sound helps with language comprehension and promotes cognitive skills: attention, working memory and self-regulation.

BETTER LISTENERS

Musicians perceive sound more clearly than nonmusicians because practicing an instrument trains the entire brain. The sounds of an instrument travel from the cochlea in the inner ear to the primitive brain stem before moving to the cortex, a locus of high-level brain functions, and then back again to the brain stem and cochlea. This feedback loop allows the musician to recruit various brain areas to produce, say, the proper pitch for a tune. Monitoring of an electrical signal in the brain stem (*yellow graph line*) reveals the musician's exquisite sensitivity to pitch: the musician tracks an incoming sound wave (*red line*) more accurately than a nonmusician does.





NINA KRAUS, IN NATURE NEUROSCIENCE

Pro social behaviours

Cortex

Limbic

brainstem

3. Cognitive Training

2. **Validation**

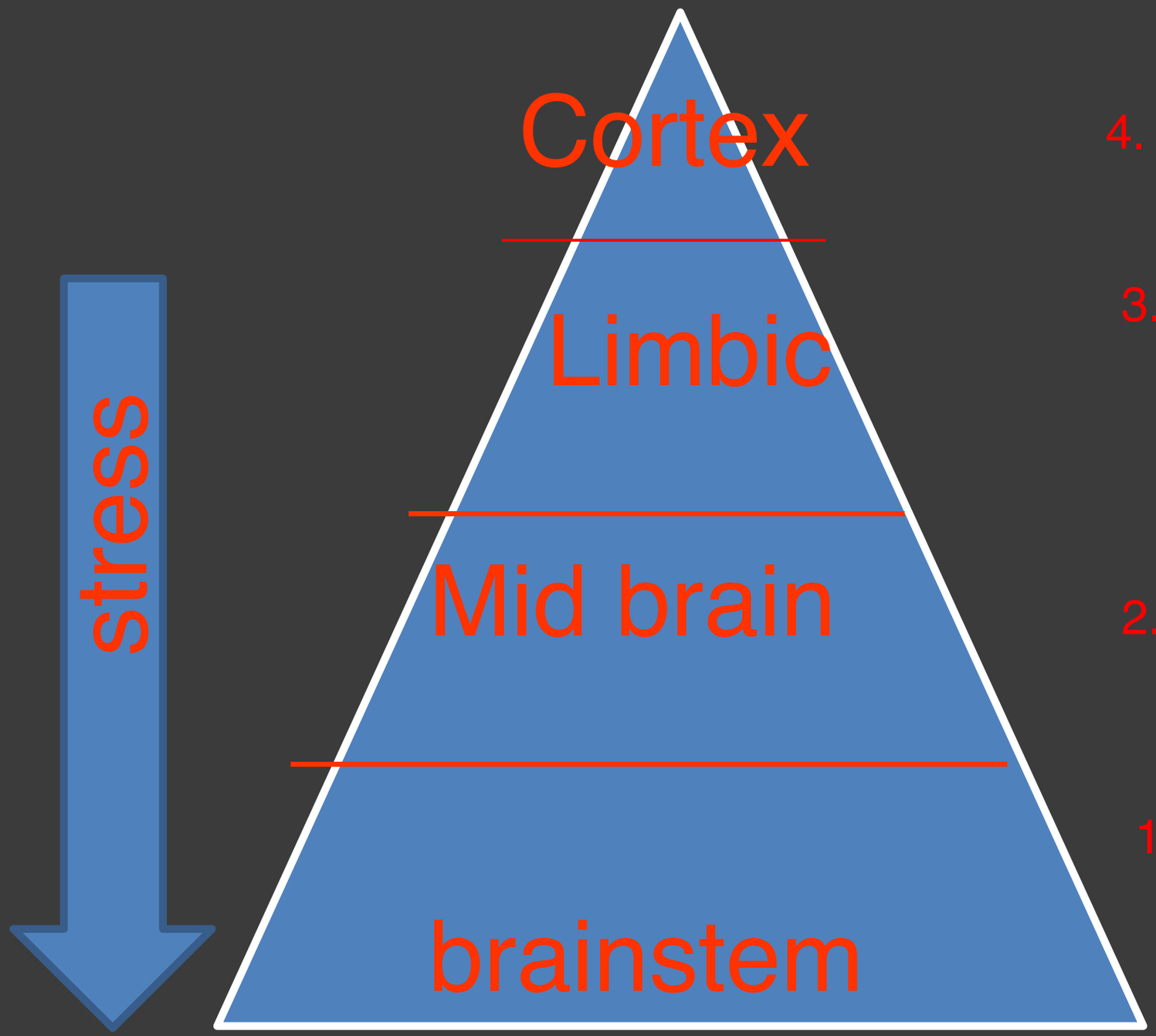
1. **Safety**

stress

attachment

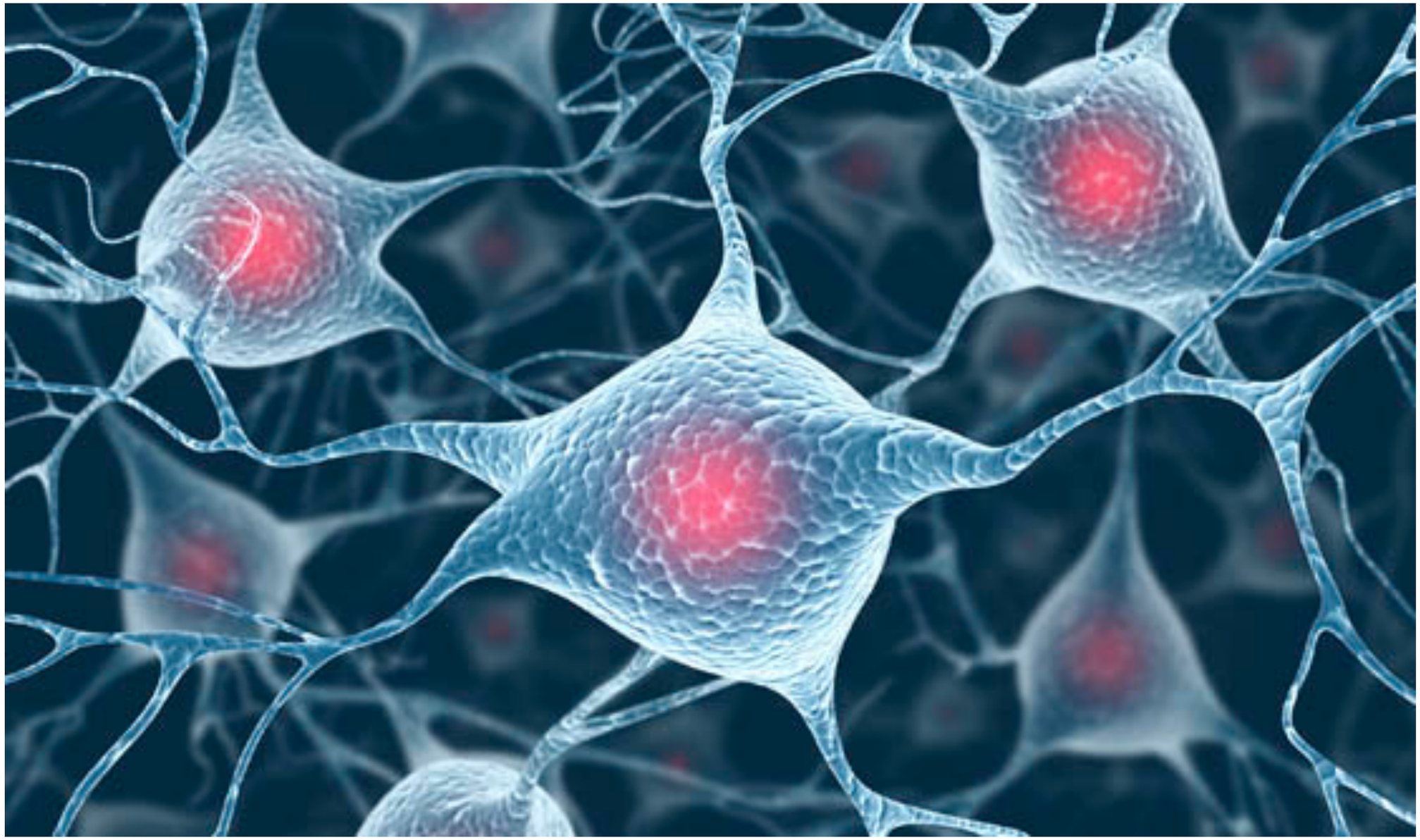
Survival/reptilian behaviours

Trauma Background



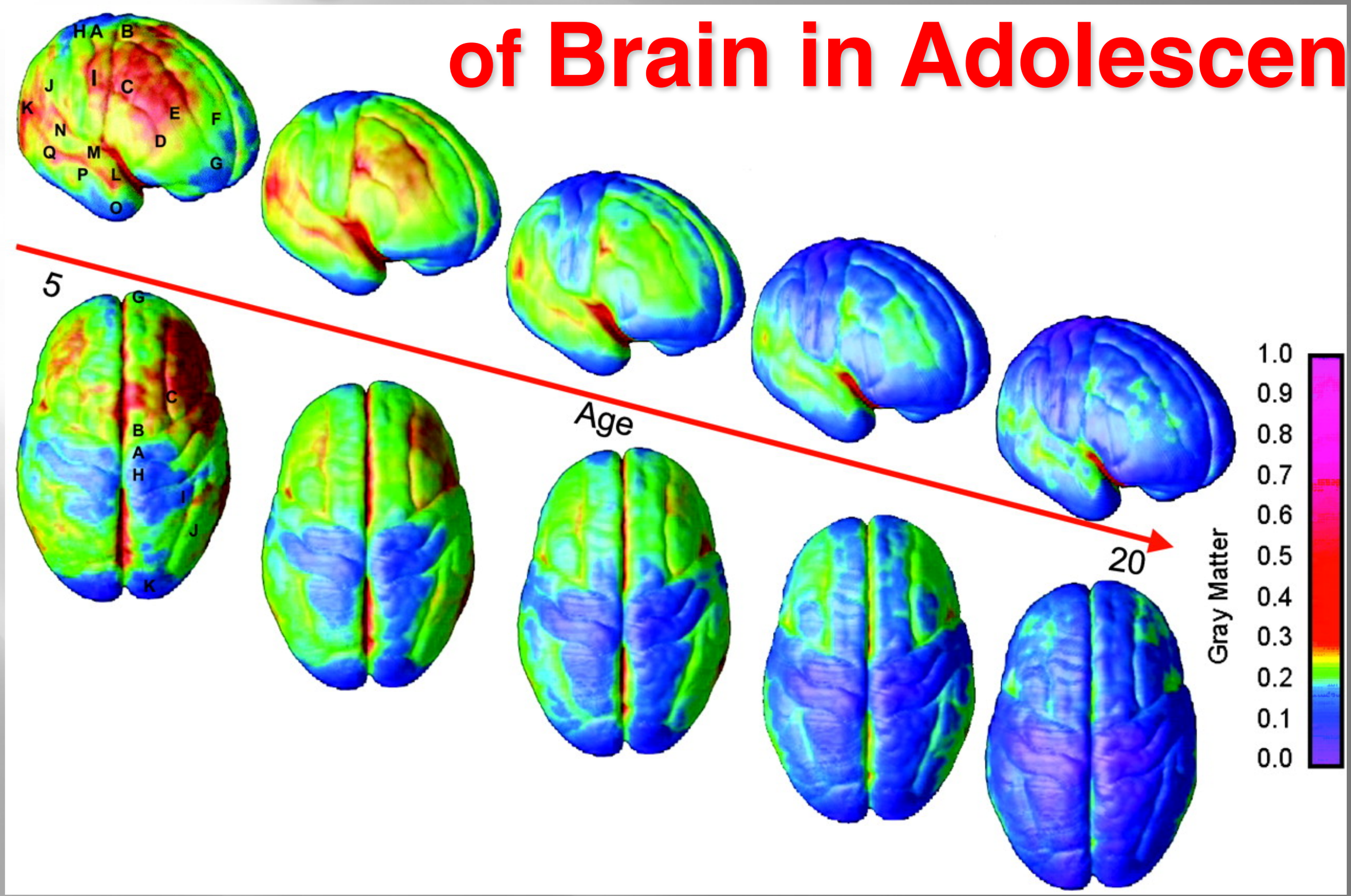
4. Learning
3. Emotional Validation
2. **Rhythm**
1. **Safety**

Food meets the need of all four



Pinel, J.P.J. (2000). *Biopsychology (4th ed.) Boston: Allyn & Bacon. p. 57.*

Changes to Cellular Architecture of Brain in Adolescence

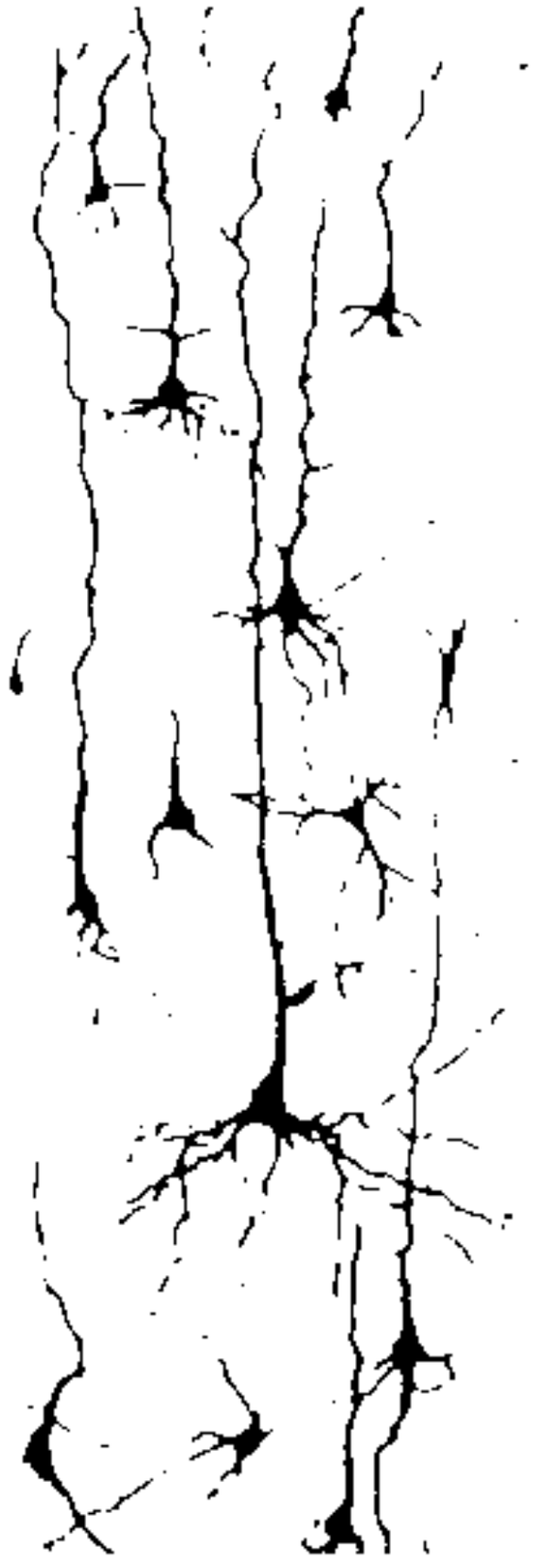


If we imagine the brain as a garden....

Endorphins = Fertilizer

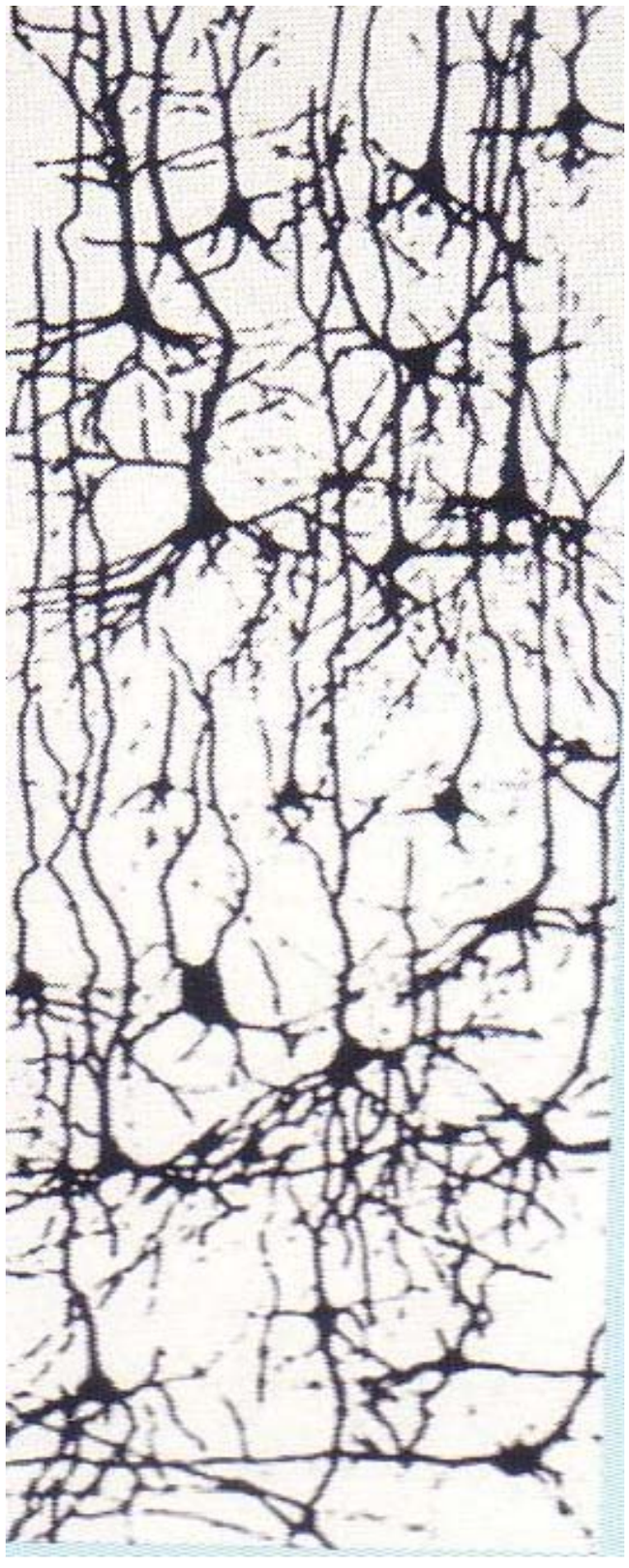
Cortisol = weed killer

At birth



At 3-6 years

14 years



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Interventions Shown to Aid Executive Function Development in Children 4 to 12 Years Old. Adele Diamond and Kathleen Lee in *Science,* V ol. 333, pages 959-964; August 19, 2011

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Can Training in a Real-Time Strategy Video Game Attenuate Cognitive Decline in Older Adults? C. Basak, W.R. Boot, M. W. Voss and A. F. Kramer in *Psychology of Aging*, Vol. 23, No. 4, pages 765-777; December 2008

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Short- and Long-Term Benefits of Cognitive Training. Susanne M. Jaeggi Marton Buschkuehl, John Jonides and Priti Shah in *Proceedings of the National Academy of Sciences USA,* Vol. 108, No. 25, pages 10,081-10,086; June 21, 2011

Short-Term Music Training Enhances Verbal Intelligence and Executive Function. Sylvain Moreno, Ellen Bialystok, Raluca Barac, E. Glenn Schellenberg, Nicholas J. Cepeda and Tom Chau in *Pysochological Science,* Vol. 22, No. 11, pages 1425-1433; June 21, 2011

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