AGENDA for our Time Together

By the Hour –

- Didactic on Concepts
  (40 Minutes)
- Transition into small groups/quick break
  (5 minutes)
- Small group discussion
  (15 minutes)

LUNCH – noon-12:45
DONE – 2:30PM

An Introduction to the Neurosequential Model in Caregiving™

Session One

- Why Neurosequential?
- Why a Model?
- Why Neuroscience?
- Heuristic introduced.

Pareidolia - psychological phenomenon where people perceive faces in everyday objects

But why?

NEUROSEQUENTIAL NETWORK™

Why do we care so much about the brain?

"The human brain is the organ responsible for everything we do. It allows us to love, laugh, walk, talk, create or hate.

For each of us, our brain functioning is a reflection of our experiences."

-Dr. Bruce Perry

Your High-Tech Brain

Follow the 8 Sensory Inputs

Red Circuits are inhibitory, all other colors are excitatory

86+ Billion Neurons

15+ Billion Neurons in the Cerebral Cortex

65+ Trillion Connections in the Cerebral Cortex

Avg of 1,000-10,000 Connections(Synapses) per Neuron

(Transistor equivalent of 45,000 i7 Dual Core Processors since synapses work like transistor switches)

The Cortex is a 6 layer folded circuit board filled with electronics

1 mm^3 of cortex contains 50,000+ Neurons making over 100 Million Synapses (switches)

(Apple A8 processor (iPhone 6) has about 23 Million transistors (switches) per mm^3)

1 mm^3 processing power of over five A8 processors in this little box

The Total Surface area of the Cerebral Cortex = 2,500 cm^2

"Three frontal circuits have been associated with decision making: the OFC, the DLPFC, and the ACC, important in sorting among conflicting options, as well as outcome-processing." *-The Functional Neuroanatomy of Decision-Making*

"It can now be recognized that the region (Orbital and Medial Prefrontal Cortex) as a whole receives highly processed sensory afferents, provides for cortical influence over visceral functions, and participates in high-level cognitive and emotional processes." *-The Organization of Networks within the Orbital and Medial Prefrontal Cortex of Rats, Monkeys and Humans*

"Religious conviction acts like an anxiolytic, reducing emotional reactions to errors or uncertainty, providing people with a meaningful system helping them to understand the complex and uncertain world that we live in. In physiological terms, it reduces ACC activity and consequently distress." *-The Anterior Cingulate Cortex*

Visual Processing in the Retina

125 Million Rods & 6 Million Color Cone Photoreceptors to 1 Million axons in the Optic Nerve

compresses video, detects movement, accident avoidance system scans for objects on a collision path and automatically sends reflex control to limbs. Estimated processing power of over four Apple A8 processors per eye

Fovea High Resolution View
200,000 Cones in Fovea
Fovea Notch Diameter is 1.5 mm
Retina Thickness is .12 mm, area is 2,500 mm^2

The retina does not simply send a picture to the brain. The retina spatially encodes (compresses) the image to fit the limited capacity of the optic nerve. -Wikipedia

"It is now clear that even fairly innocuous-looking experiences can profoundly affect brain development and that the range of experiences that can alter brain development is much larger than had once been believed." *-Experience and the developing prefrontal cortex*

2. Smell

12 Million Olfactory Receptor Cells (Human)
1 Billion Olfactory Receptor Cells (Dog)
5 Billion Olfactory Receptor Cells (Hound)

Addiction/Arousal System

"Recent studies have shown that orexin (ORE) cells located specifically in lateral hypothalamus (LH) are involved in motivated behavior for drugs of abuse as well as natural rewards. The involvement of the orexin system in brain mechanisms that regulate motivation, especially highly motivated behavior, arousal, and stress, making it an ideal target for studying addiction and discovering treatments." *-Role of orexin/hypocretin in reward-seeking and addiction*

ORE *-A Model of the Perception of Facial Expressions of Emotion by Humans*

Research performed by an Aerospace Engineerer (BA Mechanical Engineering, Villanova), The supervisor of Computer Aided Design (CAD) for a top military guidance and navigation company who worked on the design of the Space Shuttle guidance system and later became a statistics software developer. Over 1,000 Neuroscience studies were analyzed over a 4 year period and a large schematic assembled. His comments, "The 3 axis gyro/accelerometer triad sensor we put in the Space Shuttle and all missile guidance systems is behind your ear. We're ultra high tech." -Adon Joseph

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Essentially action potential IF ($D^+ + G^+ - GABA^-$) > +20 mV Then FIRE

"There is overwhelming evidence that areas in the IPS are involved in complex hand use, reaching, grasping, matching visual and body centered frames of references for reaching and grasping, and programming intentional hand movements." *-Topographic Maps within Brodmann's Area 5 of Monkeys*

"Mirror neurons are a particular class of visuomotor neurons, that discharge both when performing a particular action and when observing another individual doing a similar action." *-The Mirror-Neuron System*

The Visual Processing System

4-6 Billion Neurons

"The recognition process likely entails a sequence of computations across visual cortex, starting from local computations in early visual cortex related to low-level properties of the visual stimulus, such as disparity, motion, or orientation, conveying little sense of the global object shape, then proceeding to more global computations in higher levels of the hierarchy of visual processing." *- Representation of Shapes, Edges, and Surfaces Across Multiple Cues in the Human Visual Cortex*

"Evidence from functional neuroimaging indicates that visual perception of human faces and bodies is carried out by distributed networks of face and body-sensitive areas in the occipito-temporal cortex." *-Different Cortical Dynamics in Face and Body Perception*

"Our results thus confirm that nudity of human bodies is detected early on during visual processing, and that the human brain exhibits enhanced visual processing to other people's nude bodies. Interestingly, the N170 response to nude bodies was even greater than that to faces." *-The Naked Truth: The Face and Body Sensitive N170 Response Is Enhanced for Nude Bodies*

"During head movements, both systems must interact with the vestibular system . The goal of the pursuit system is to keep the retinal target image on the fovea by matching the eye velocity to target velocity." *-The vestibular-related frontal cortex and its role in smooth-pursuit*

"It is now becoming increasingly apparent that even single neurons can perform complex computations." *-Wikipedia*

"Researchers have discovered a sophisticated neural computer, buried deep in the cerebellum, that performs inertial navigation calculations to figure out a person's movement through space." *-Brain's Inertial Navigation System Pinpointed*

Military Accelerometer-Gyro Triad

Vestibule is similar to the main sensor used in Military Guidance and the Space Shuttle

6. Balance & Acceleration

Image Stabilization
Navigation
Eye Reflex

5. Hearing

Cochlea
30,000 Connections in Auditory Nerve
15,500 Hair Cells in Cochlea
100,000,000 Neurons in Auditory Cortex

"DNA storage is very dense. At theoretical maximum, DNA can encode 455 Billion Gigabytes per gram." *-Next-Generation Digital Information Storage in DNA, Harvard University*

Rev 40c

Research performed by an Aerospace Engineerer (BA Mechanical Engineering, Villanova), The supervisor of Computer Aided Design (CAD) for a top military guidance and navigation company who worked on the design of the Space Shuttle guidance system and later became a statistics software developer. Over 1,000 Neuroscience studies were analyzed over a 4 year period and a large schematic assembled. His comments, "The 3 axis gyro/accelerometer triad sensor we put in the Space Shuttle and all missile guidance systems is behind your ear. We're ultra high tech." -Adon Joseph

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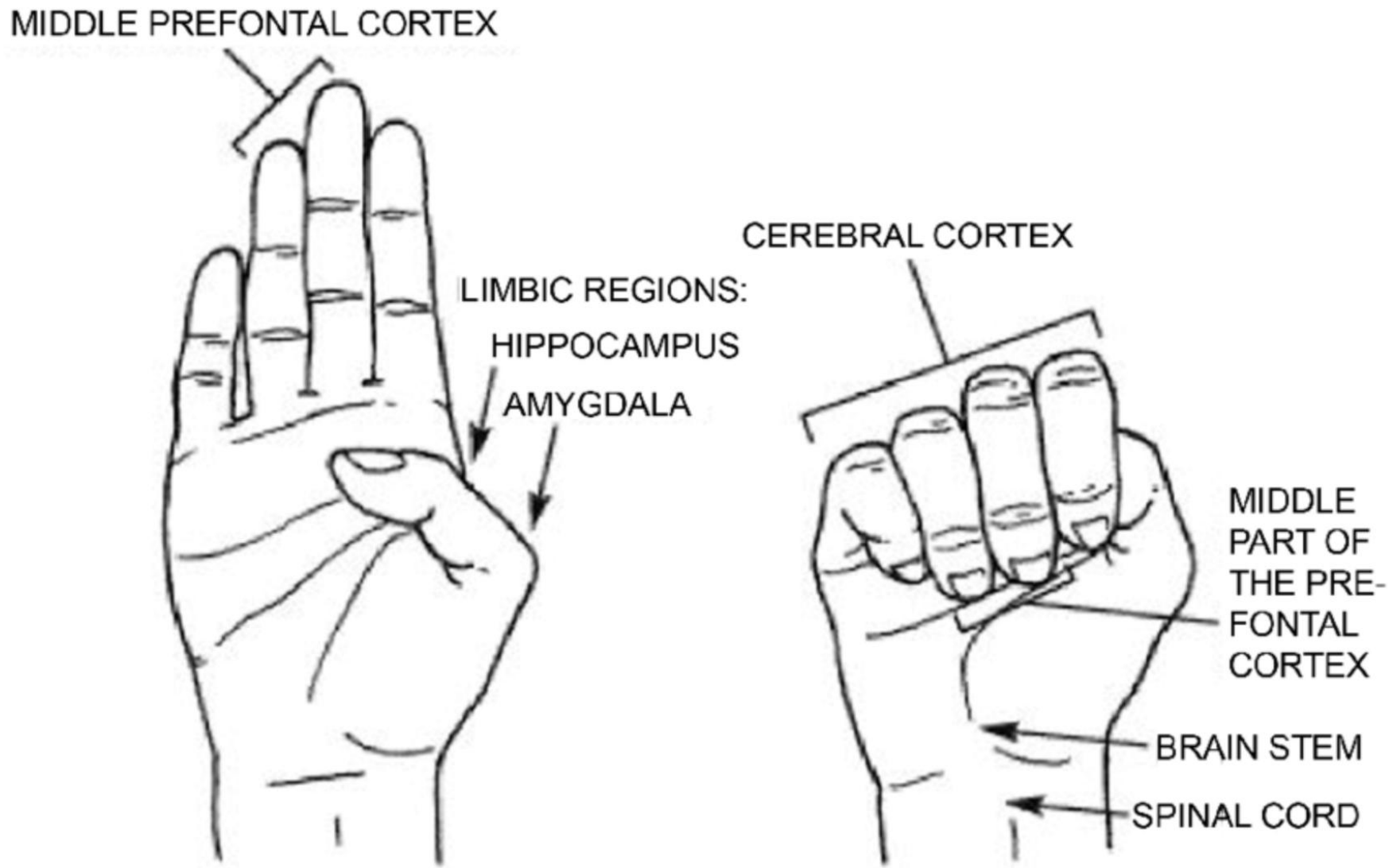

Hand model of the brain (Siegel, 2010)

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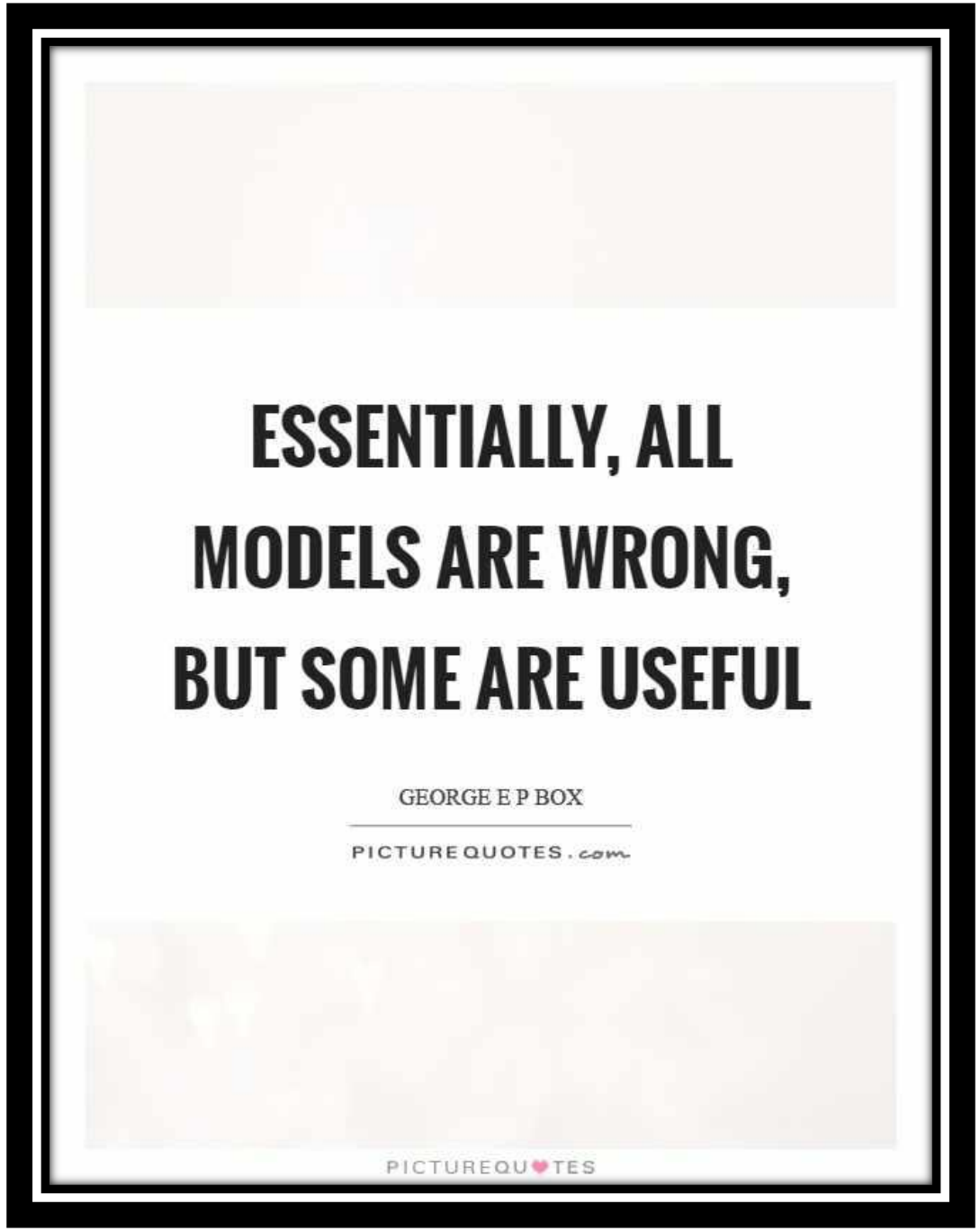
ESSENTIALLY, ALL MODELS ARE WRONG, BUT SOME ARE USEFUL
GEORGE E P BOX
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Heuristics of the Brain

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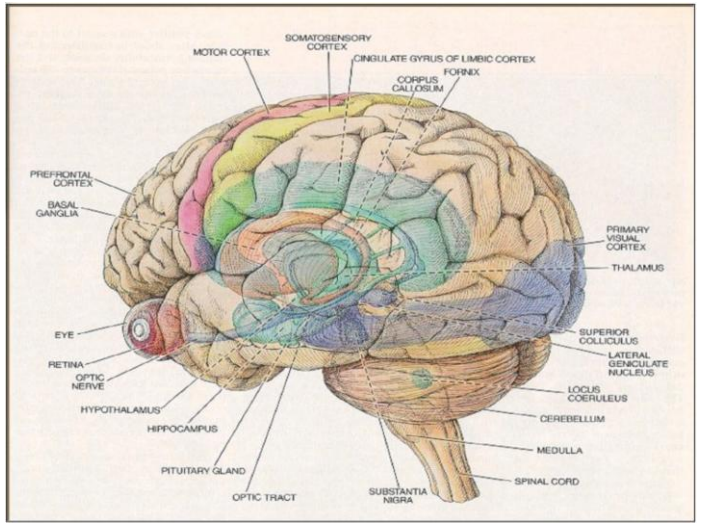

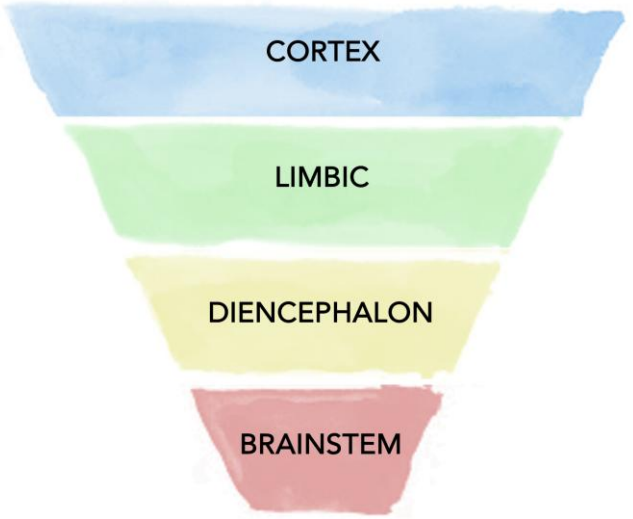

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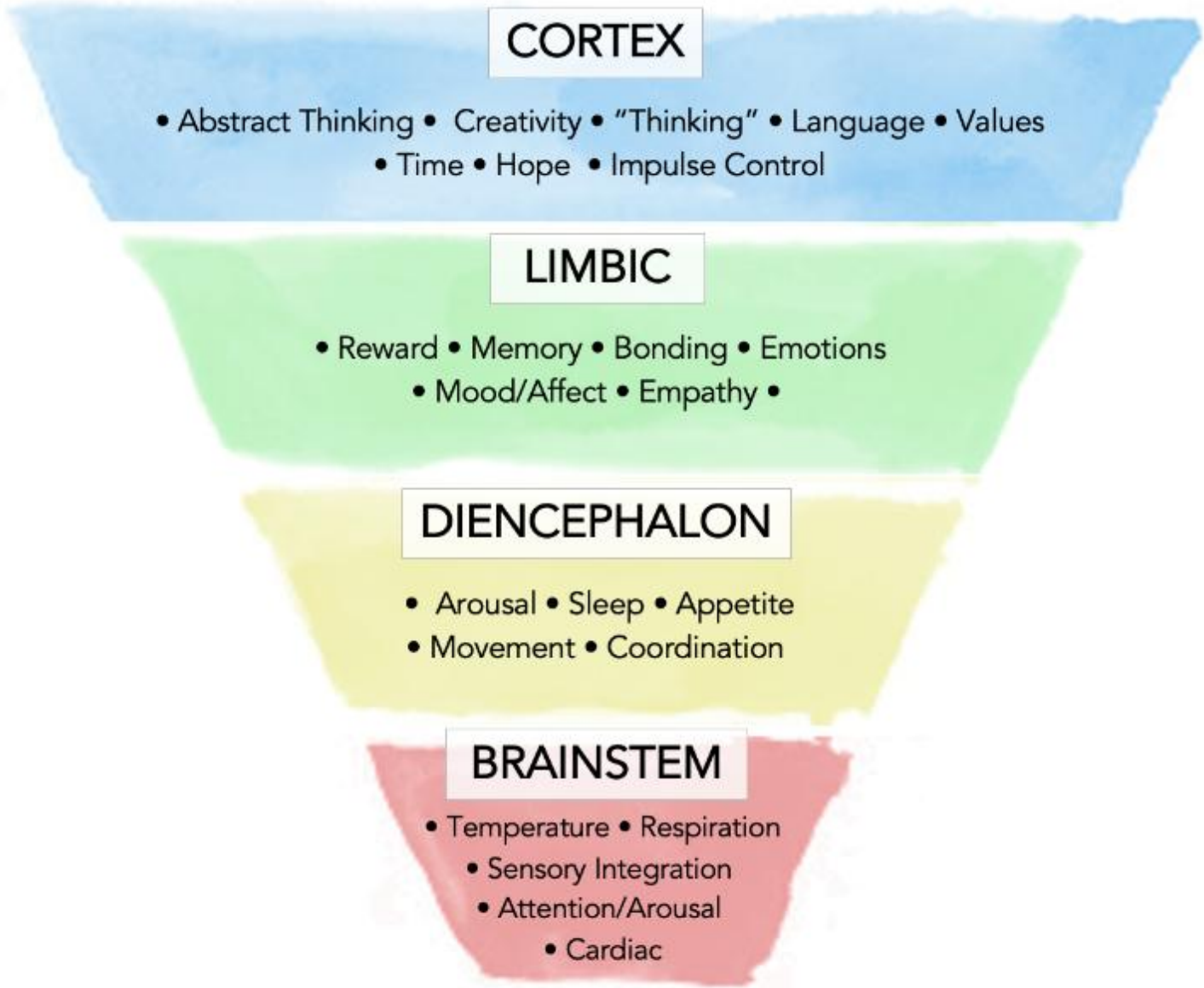
NM Brain Heuristic

NEUROSEQUENTIAL NETWORK



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What is the brain's #1 directive?

HINT: It's not for you to be happy


Alien Song
©1999 victor navone

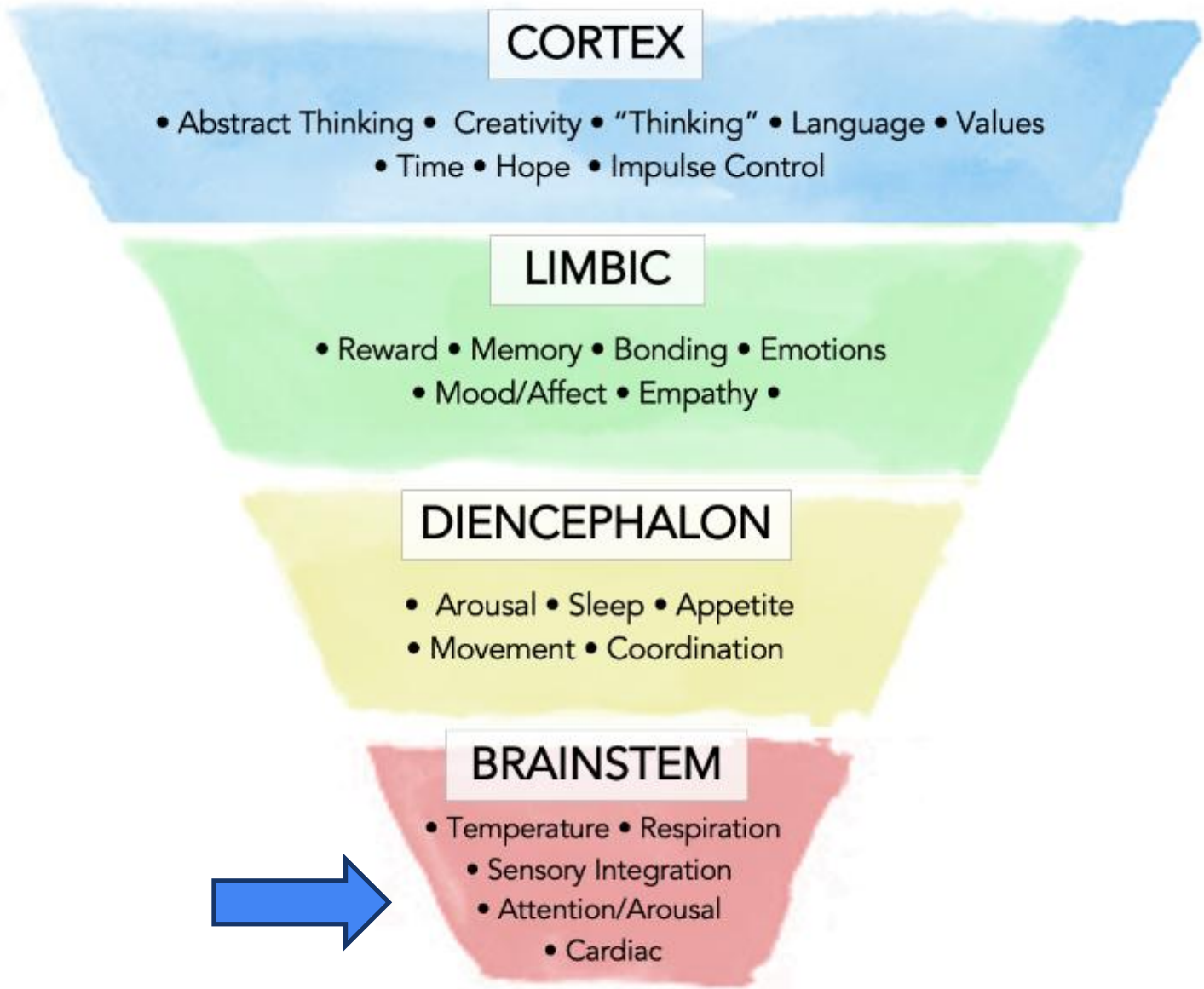
DJ's QUILT

My quilt is soft.
To touch it is like floating on a forever.
I love my quilt because it keeps me sane.
My quilt is like a cup of cocoa on a cold day.
My quilt is the harmony to my music.

Taken from: *Reasonable People* by Ralph James Savarese Pg. 281

NM Brain Heuristic

NEUROSEQUENTIAL NETWORK



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NM Brain Heuristic

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CORTEX

• Abstract Thinking • Creativity • "Thinking" • Language • Values
• Time • Hope • Impulse Control

LIMBIC

• Reward • Memory • Bonding • Emotions
• Mood/Affect • Empathy •

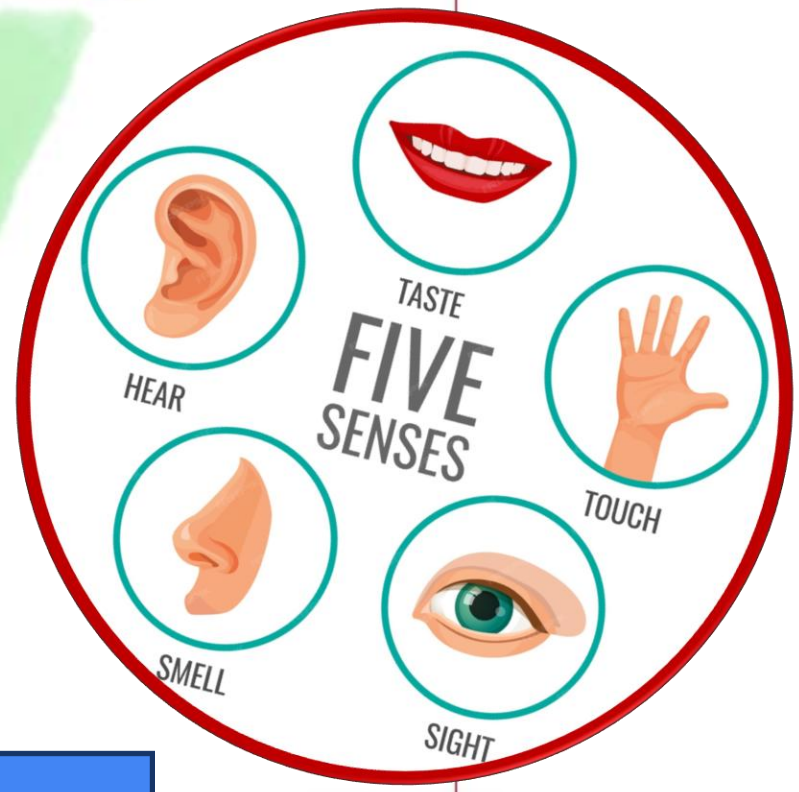
DIENCEPHALON

• Arousal • Sleep • Appetite
• Movement • Coordination

BRAINSTEM

• Temperature • Respiration
• Sensory Integration
• Attention/Arousal
• Cardiac

Inside world:
eat/drink/sleep
Bathroom
break



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NM Brain Heuristic

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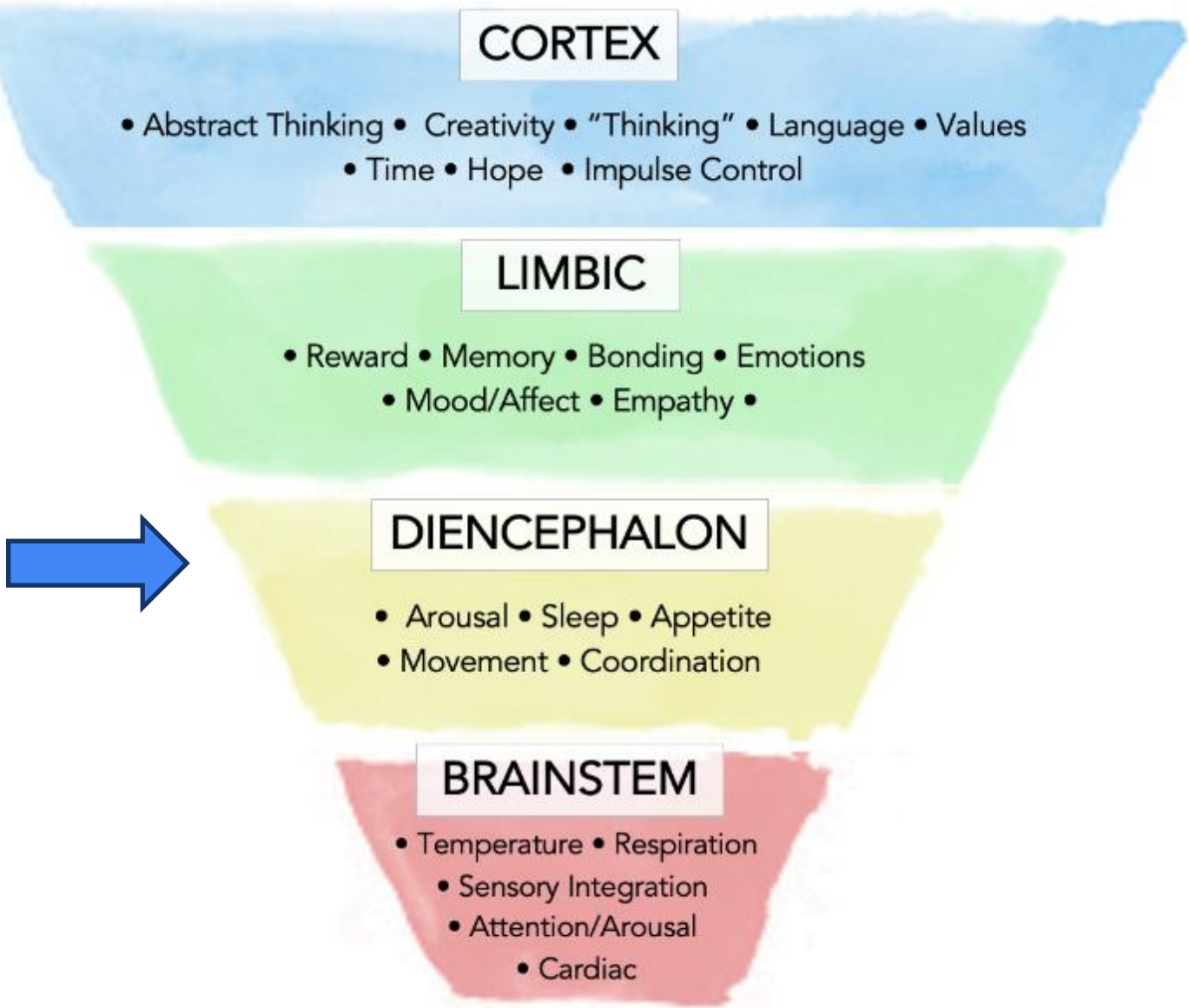

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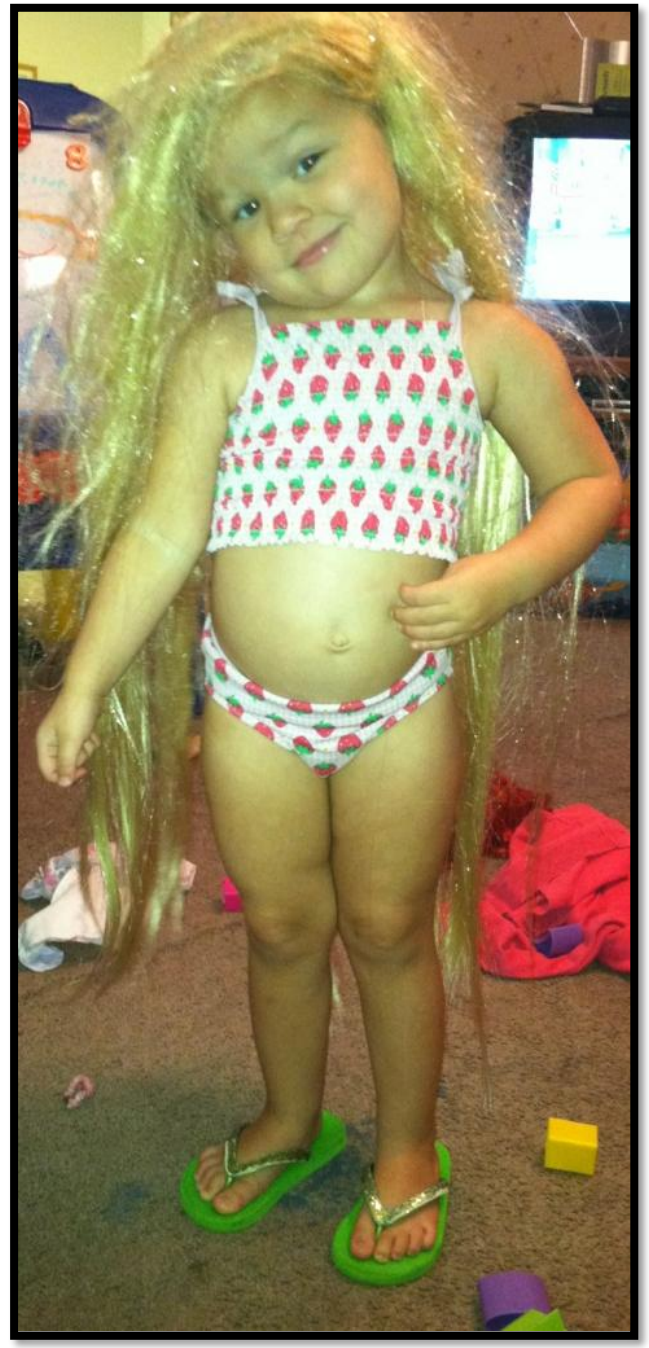

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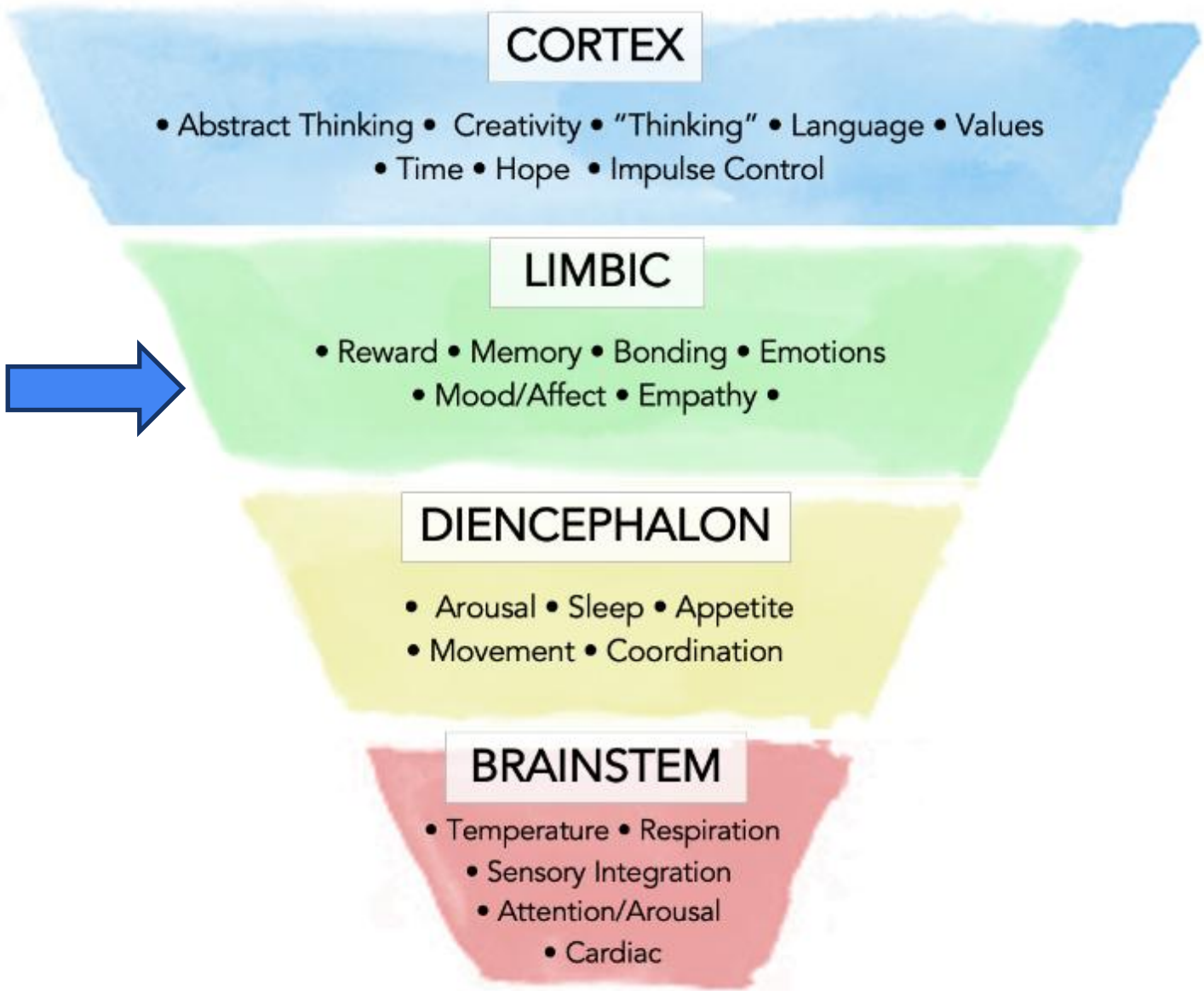

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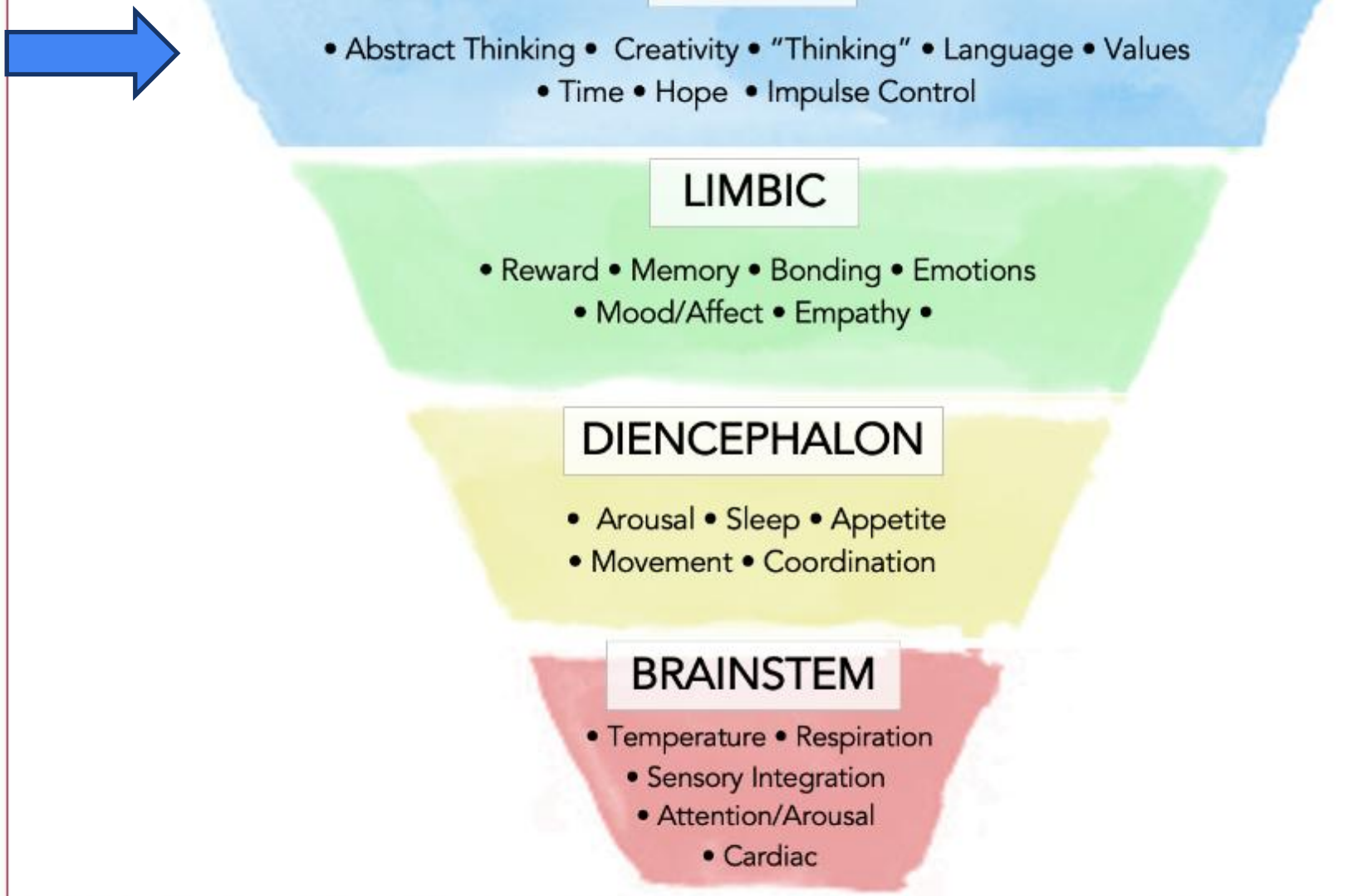

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Experiences – both good and bad

- Timing
- Duration
- Frequency

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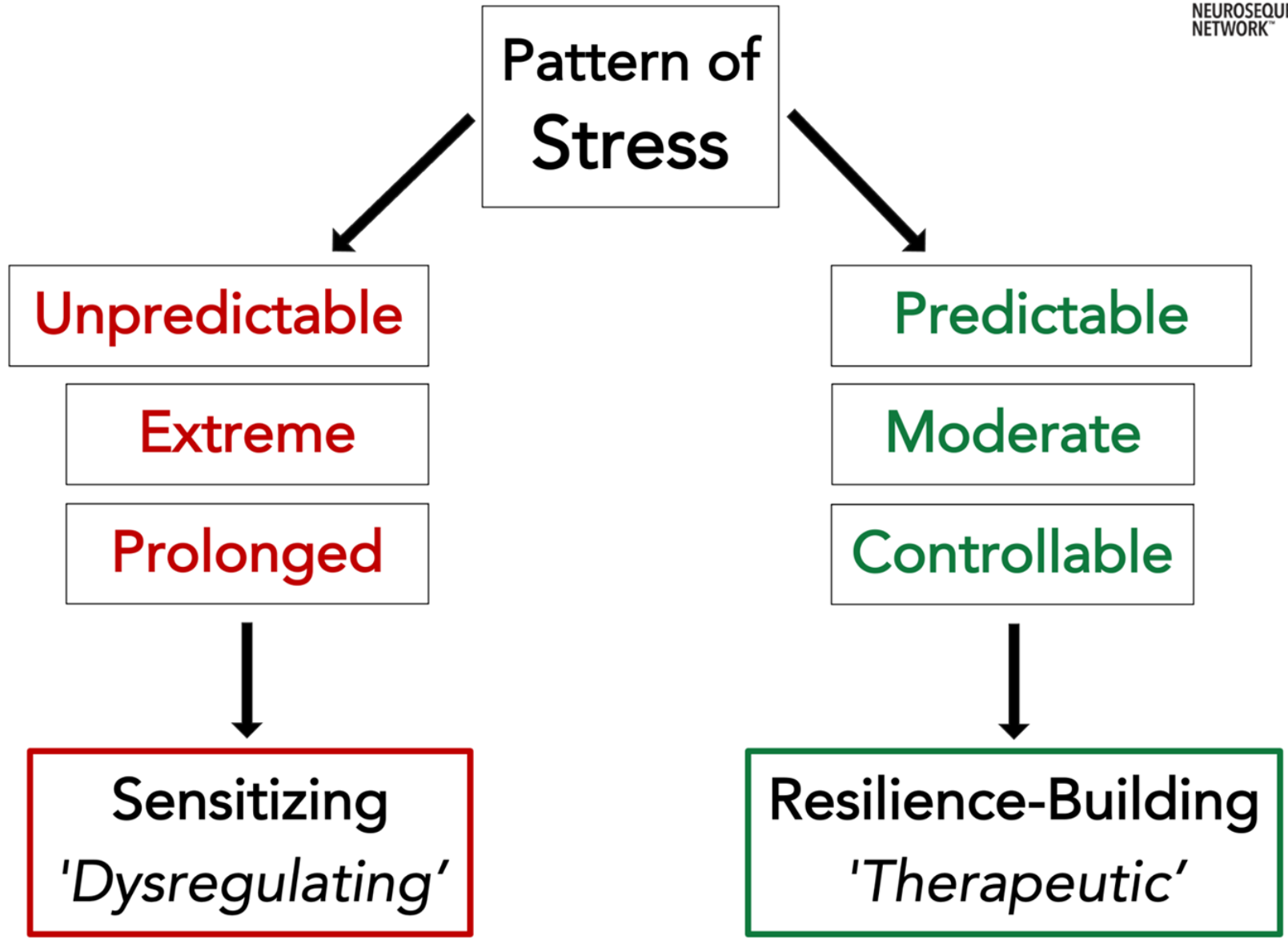

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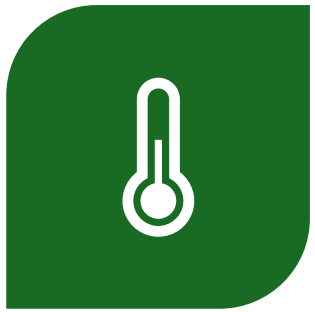
Our first environments...

What about. . .

SOUNDS



TEMPERATURE

SATIETY

SENSORY

What does the brain identify as being “happy”?

decreases physiological distress and increases pleasure

WANTED

REWARD

Why is attachment with a caregiver important?

Both the
stress response and
the ***reward networks***
in the brain are shaped by
relationships in
early childhood –
in healthy
and unhealthy ways.

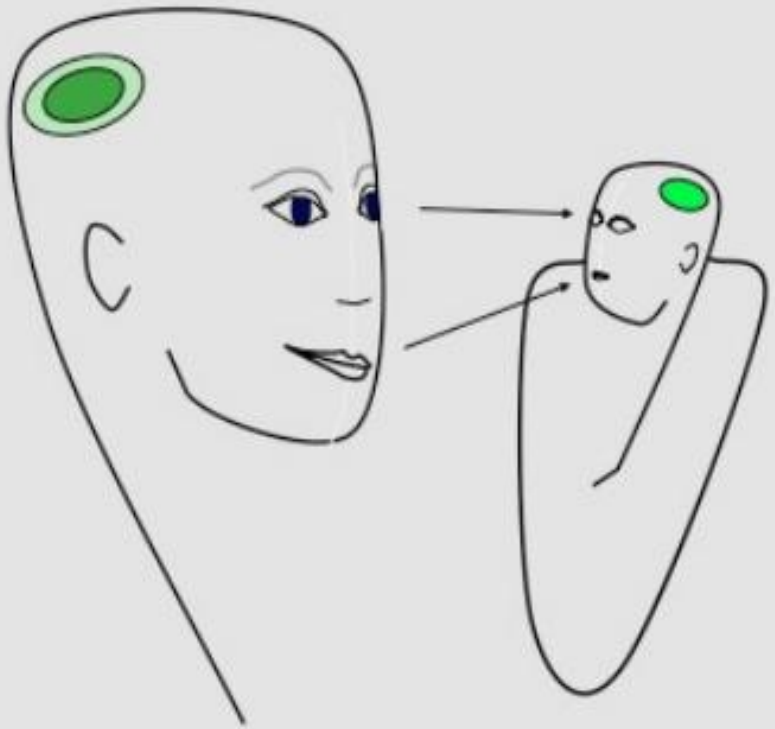
Optimal Early Caregiving

- Present
  - Quantity matters
- Attentive
  - To the infant/child
- Attuned
  - Accurately interpret non-verbal cues
- Responsive
  - Respond to the needs of the infant

NEUROSEQUENTIAL NETWORK™

The Magical Moments

Weaving Together the Neurobiology of Relationship, Reward and Regulation



Relational Regulation

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Six Risk Factors to Healthy Development

- Difficult pregnancy
- Difficult birth
- Abuse
- Neglect
- Attachment issues
- Trauma
- Anything that causes severe, prolonged stress
  (DV, poverty, being “other”, chaos, transitions)

- Combination

Information taken from: The Connected Child, 2007
Dr. Karyn Purvis, Dr. David Cross, & Wendy Lyons Sunshine

Developmental Trauma is The Great Imposter

DIAGNOSTIC IMPRESSIONS:

AXIS I : Oppositional Defiant Disorder; R/O Attention Deficit Hyperactivity Disorder, combined type; Mood Disorder NOS; R/O Bipolar Disorder; Post Traumatic Stress Disorder; Reactive Attachment Disorder, Disinhibited type; Primary Enuresis, Nocturnal Type; Sexual Abuse of a Child as Victim; Physical Abuse of a Child as Victim

AXIS II: Deferred

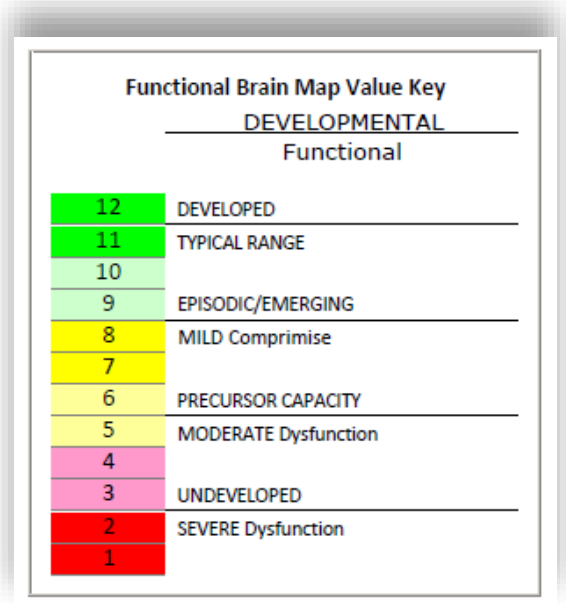
AXIS III: Primary Enuresis

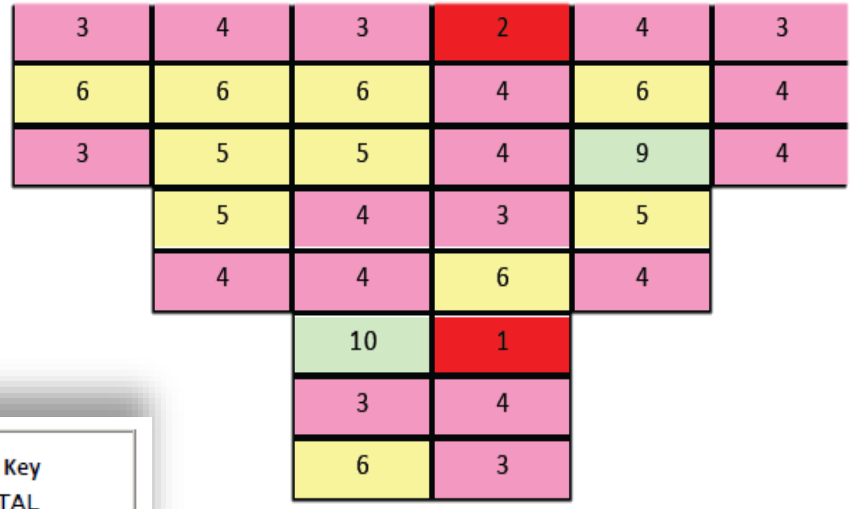
AXIS IV: Severe

AXIS V : 40

The Tale of Two Different Brains

Typical
9 year old





Atypical
9 year old

When we feel threatened:

- Flock/Freeze – get more info
  - Social referencing
- Fight or Flight?

That won’t work.

- Dissociate
- Try both.

Dissociation

NEUROSEQUENTIAL NETWORK™

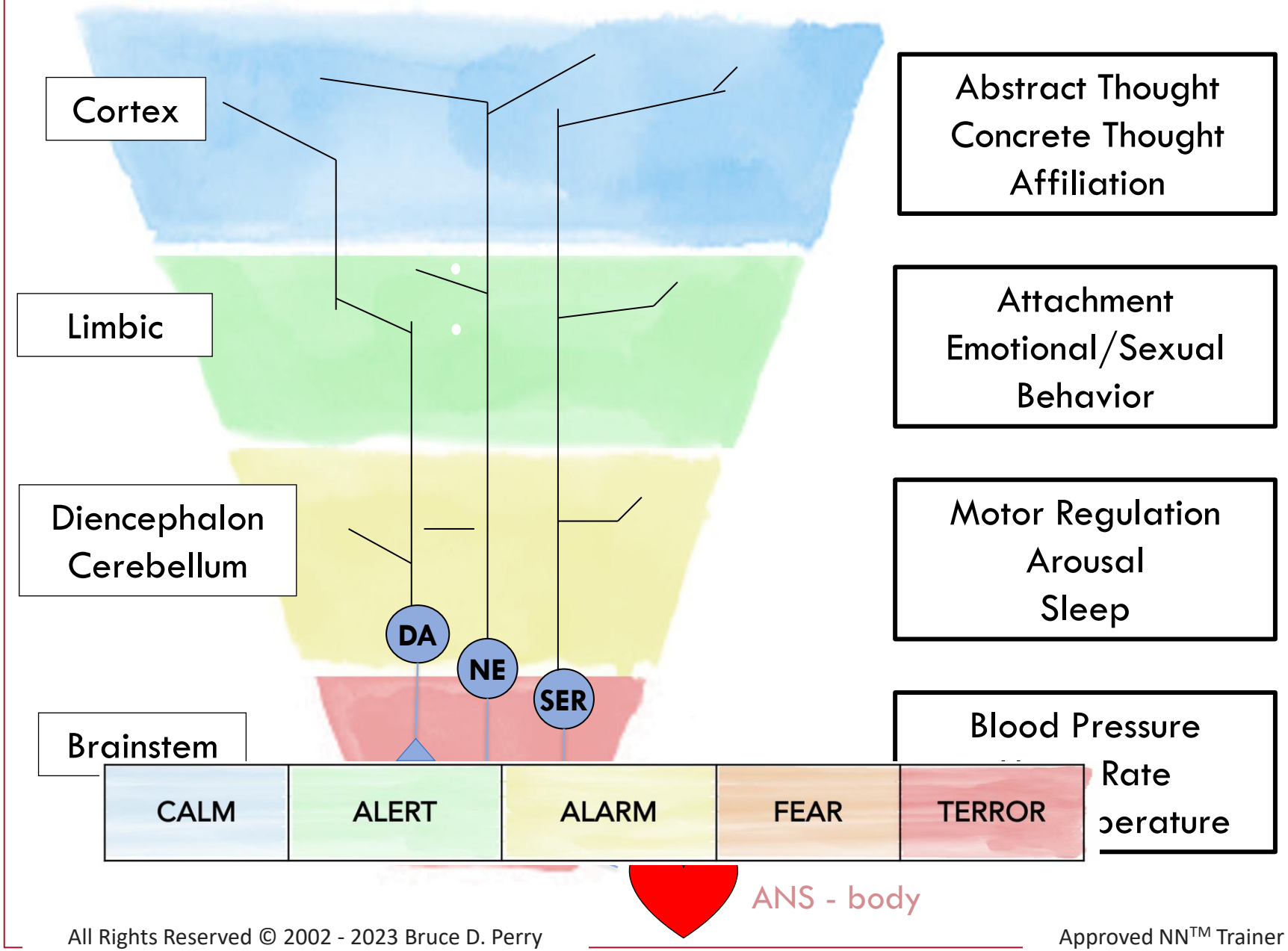
- Disengaging from the “external” world cues
- Attending to elements of the “inner” world
- Daydreaming, mind wandering, reflective cognition

So, what is a threat?

It depends.

What is state dependent functioning?

- What things are dependent upon our current state?
  - Thinking
  - Feeling
  - Behaviors
  - Ability to relate
  - Ability to regulate
  - Ability to receive reward



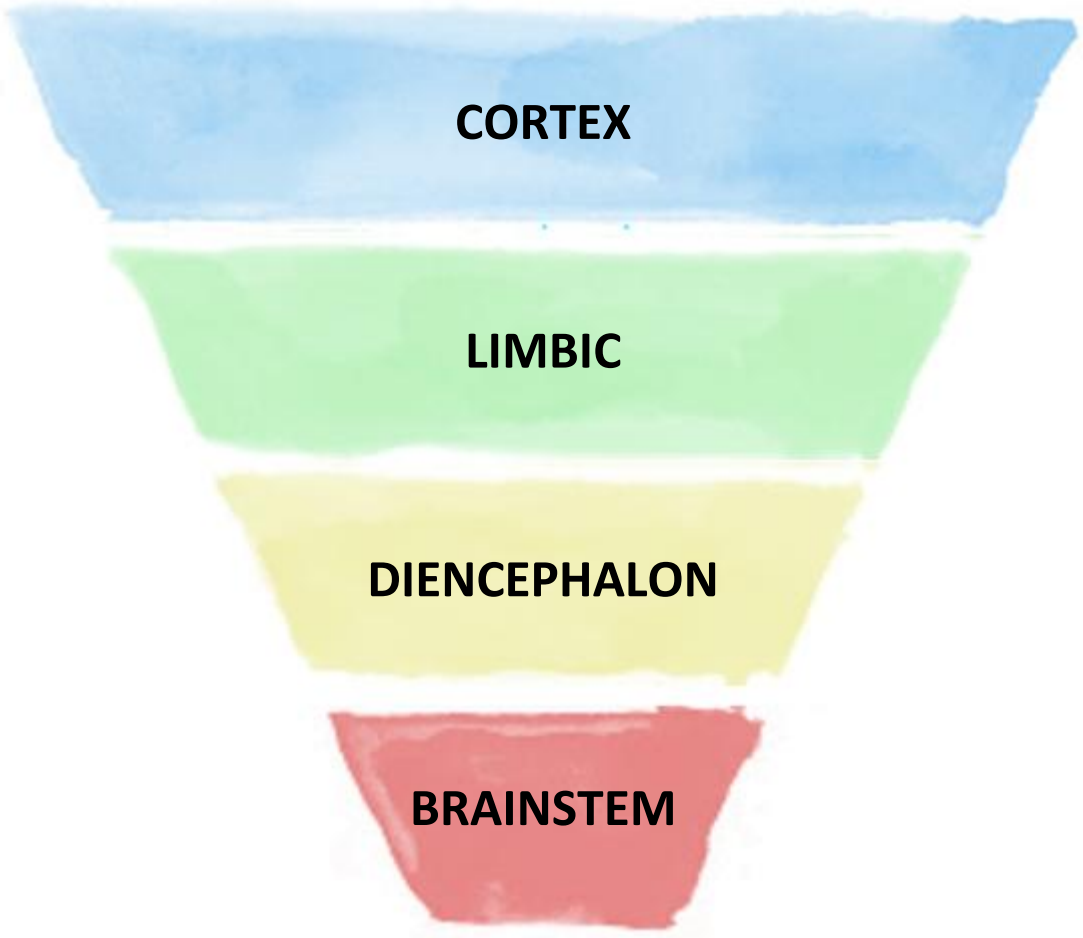

Everyone has a plan 'till they get punched in the mouth.
Mike Tyson

State Dependence

Adaptive "Option" Arousal & Dissociation

"STATE"	CALM	ALERT	ALARM	FEAR	TERROR
Dominant Brain Areas	**Cortex** (DMN)	**Cortex** (Limbic)	**Limbic** (Diencephalon)	**Diencephalon** (Brainstem)	**Brainstem**
Adaptive *"Option" Arousal*	**Relect** (Create)	**Flock** (Hypervigilance)	**Freeze** (Resistance)	**Flight** (Defiance)	**Fight**
Adaptive *"Option" Dissociation*	**Reflect** (Daydream)	**Avoid**	**Comply**	**Dissociate** (Paralysis/ Catatonia)	**Faint** (Collapse)

The brain is organized to act on incoming information before it feels and before it thinks about the incoming information



THINKS

FEELS

ACTS

State Dependent Cognition

State	Calm	Alert	Alarm	Fear	Terror
Cognition	Abstract	Concrete	Emotional	Reactive	Reflexive
Fidelity with which information is processed and stored	80%	60%	40%	30%	10%

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"When people have a hard time cognitively acting on an instruction they will default to a practiced behavior."

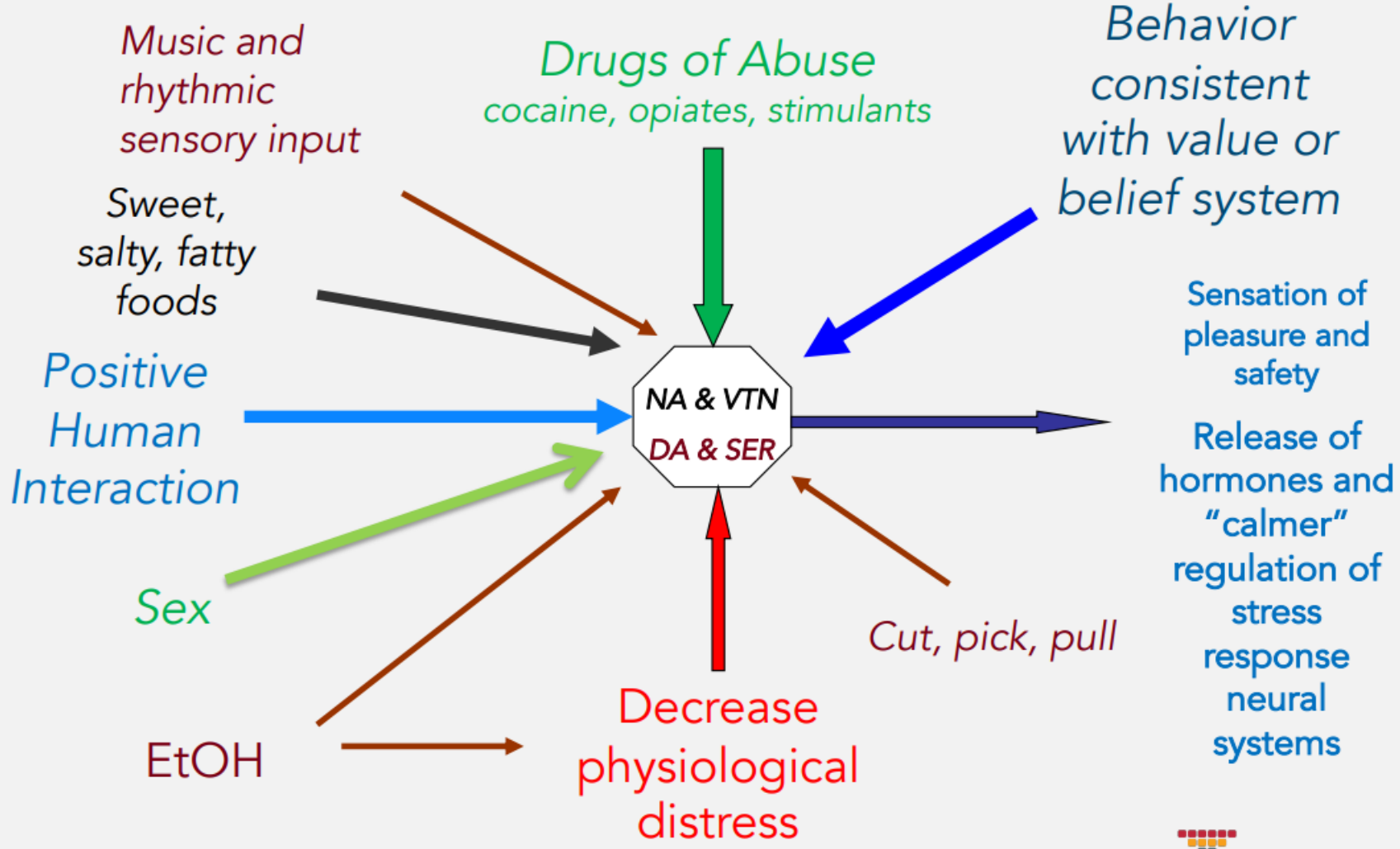
– Dr. Bruce D. Perry

Why is attachment with a caregiver important?

Both the
stress response and
the ***reward networks***
in the brain are shaped by
relationships in
early childhood –
in healthy
and unhealthy ways.

Activating the Brain's Neural Networks of "Reward"

Multiple 'Routes' to Pleasure



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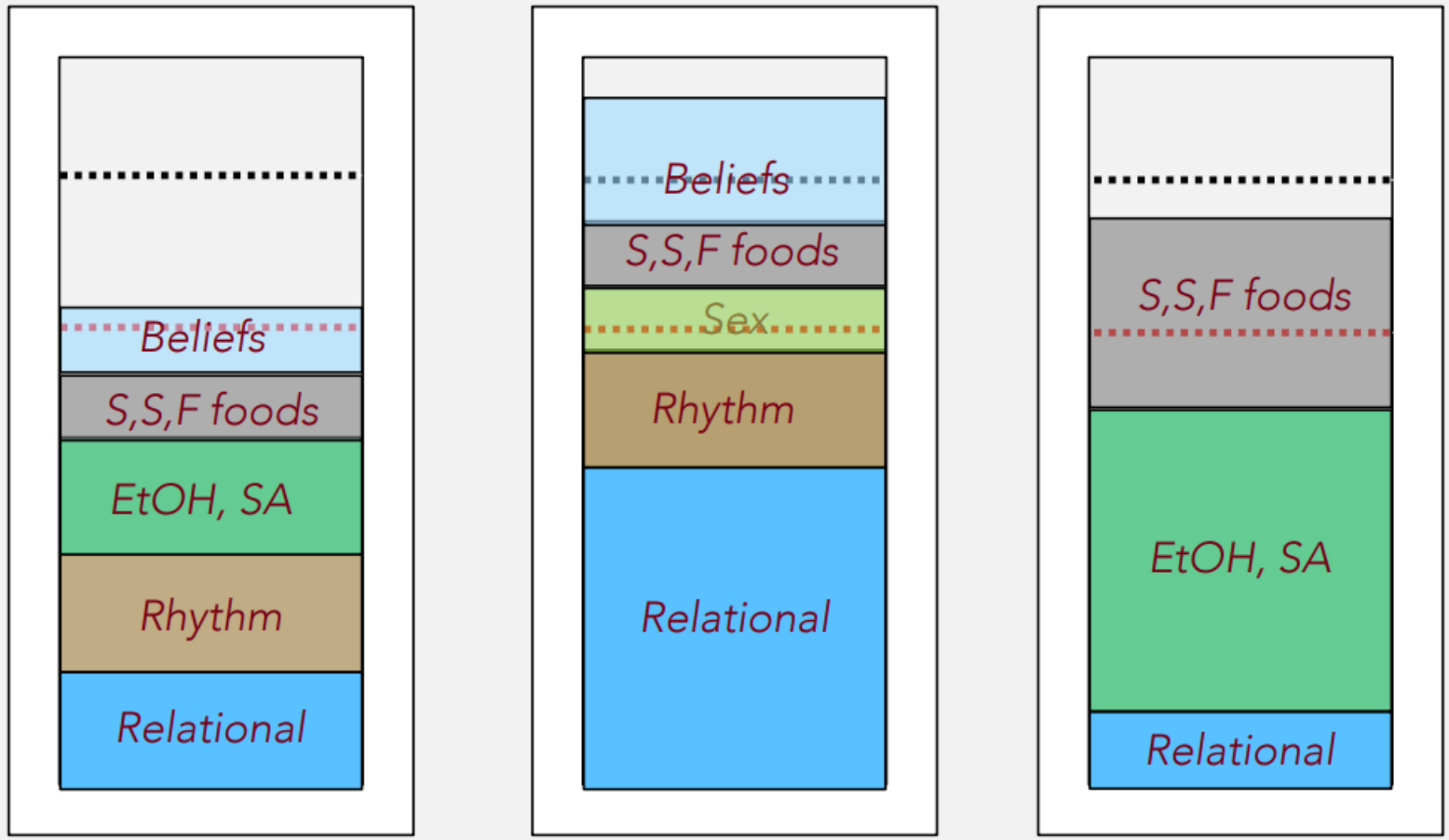
Our ability to experience reward and be relational is also state dependent.

Filling the "Reward Bucket"



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Questions?

Breakout Questions

1. What motivated you to participate in this course?
2. What are you hoping to get out of this experience?
3. How does Dr. Perry's use of the NM's upside-down triangle heuristic help to engage you in thinking about and understanding the brain?
4. Children are not simply "small adults." Reflect on why it's important to understand this.
5. State dependent functioning was discussed. Describe in your own words what this is. Include examples from your own life.