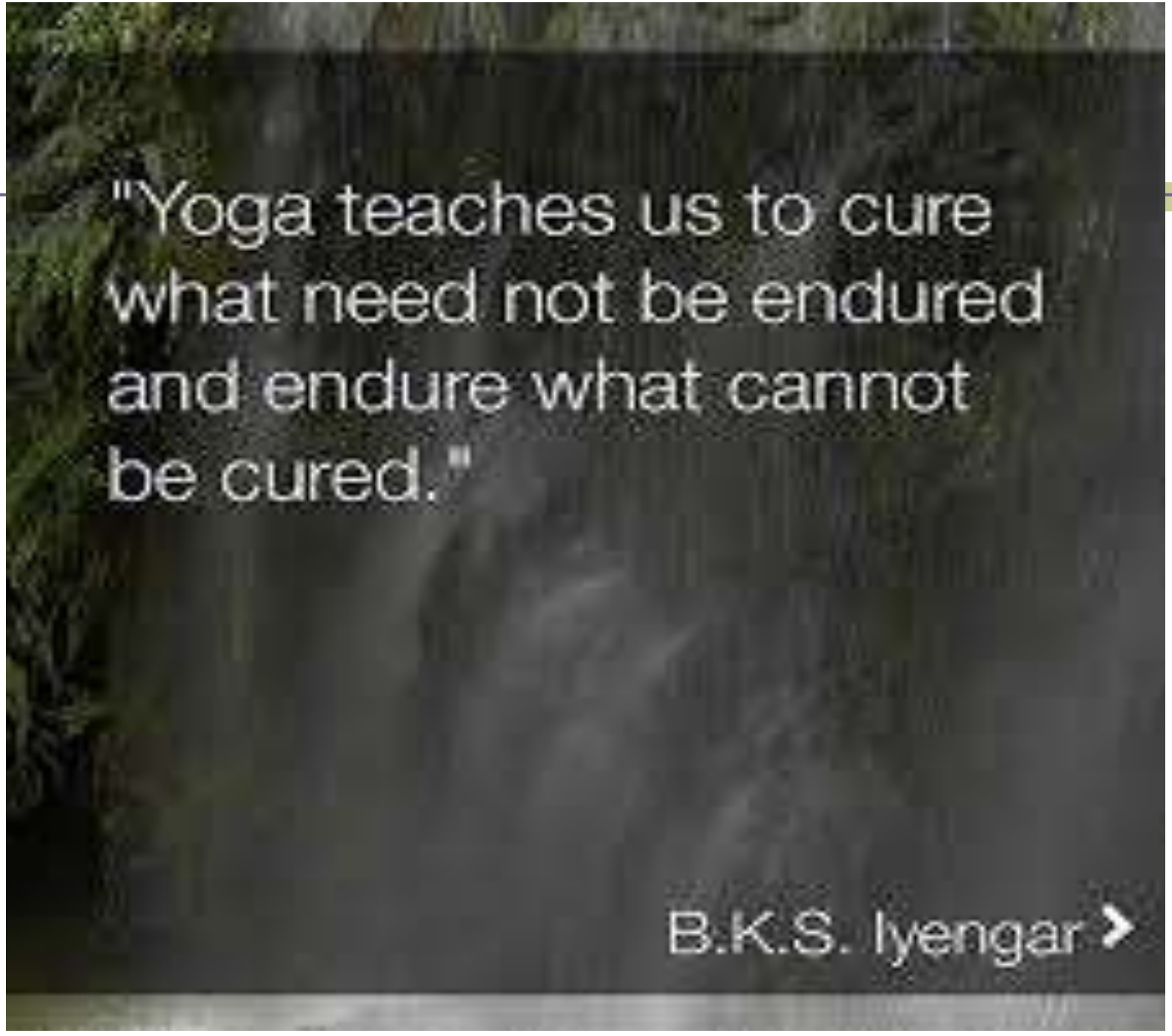
The Neurobiology of Traumatic Stress and the Healing Power of Yoga



Janine M. D'Anniballe, Ph.D., RYT

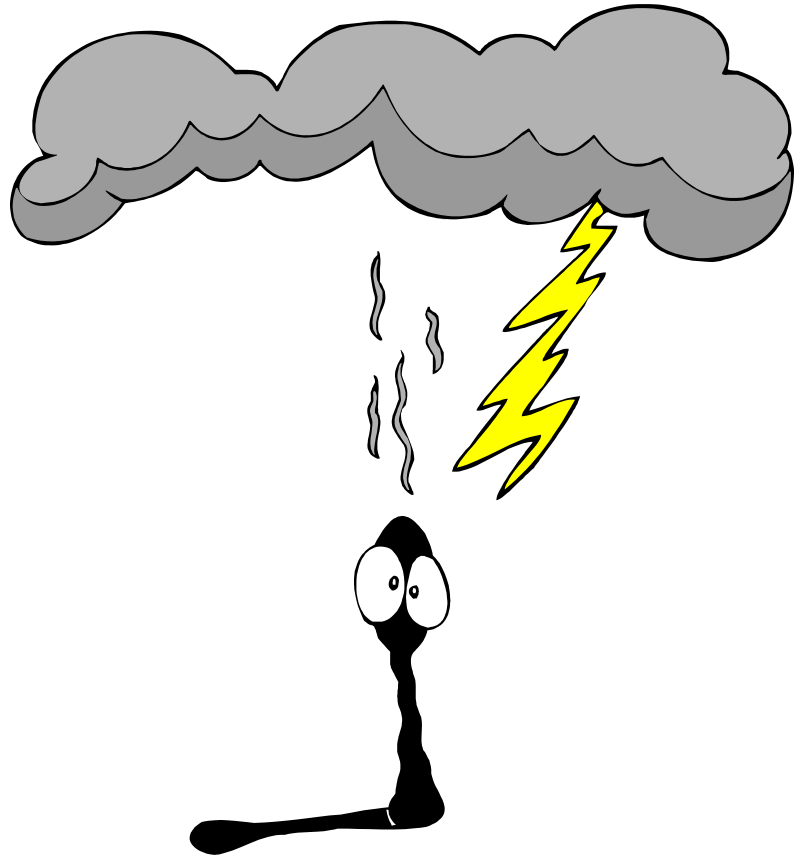
Mental Health Partners

Boulder, Colorado


"Yoga teaches us to cure what need not be endured and endure what cannot be cured."
B.K.S. Iyengar

The Stress-Trauma Continuum

- Normal
- Situational
- Traumatic



What is Trauma?

- Physical abuse, sexual abuse, neglect
- Domestic violence
- Stalking
- School or gang violence
- Divorce/custody battle
- Kidnapping
- War
- Natural Disasters
- Immigration
- Serious health issues
- Severe accidents
- Witnessing or hearing about any of the above



Post-Traumatic Stress Response

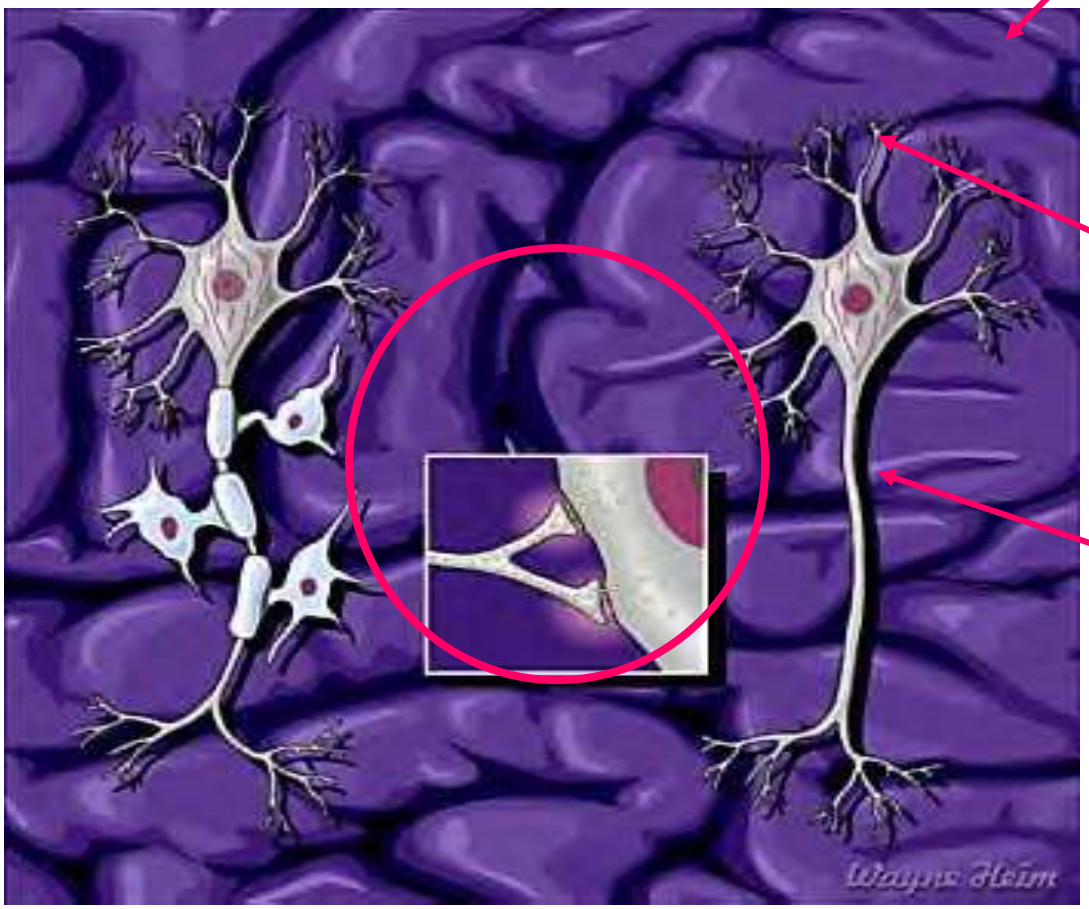
- Not everyone who experiences a traumatic event will meet the diagnostic criteria for PTSR (about than 20%)

- PTSR can be diagnosed when there is:
  - Exposure to a traumatic event
  - The event is re-experienced through intrusive memories, dreams, feeling as if the trauma is reocurring, distress when exposed to triggers
  - Persistent avoidance and numbing
  - Persistent increased arousal
  - Symptoms persist for more than 30 days
  - Life functioning impaired

The Neurobiology of Trauma

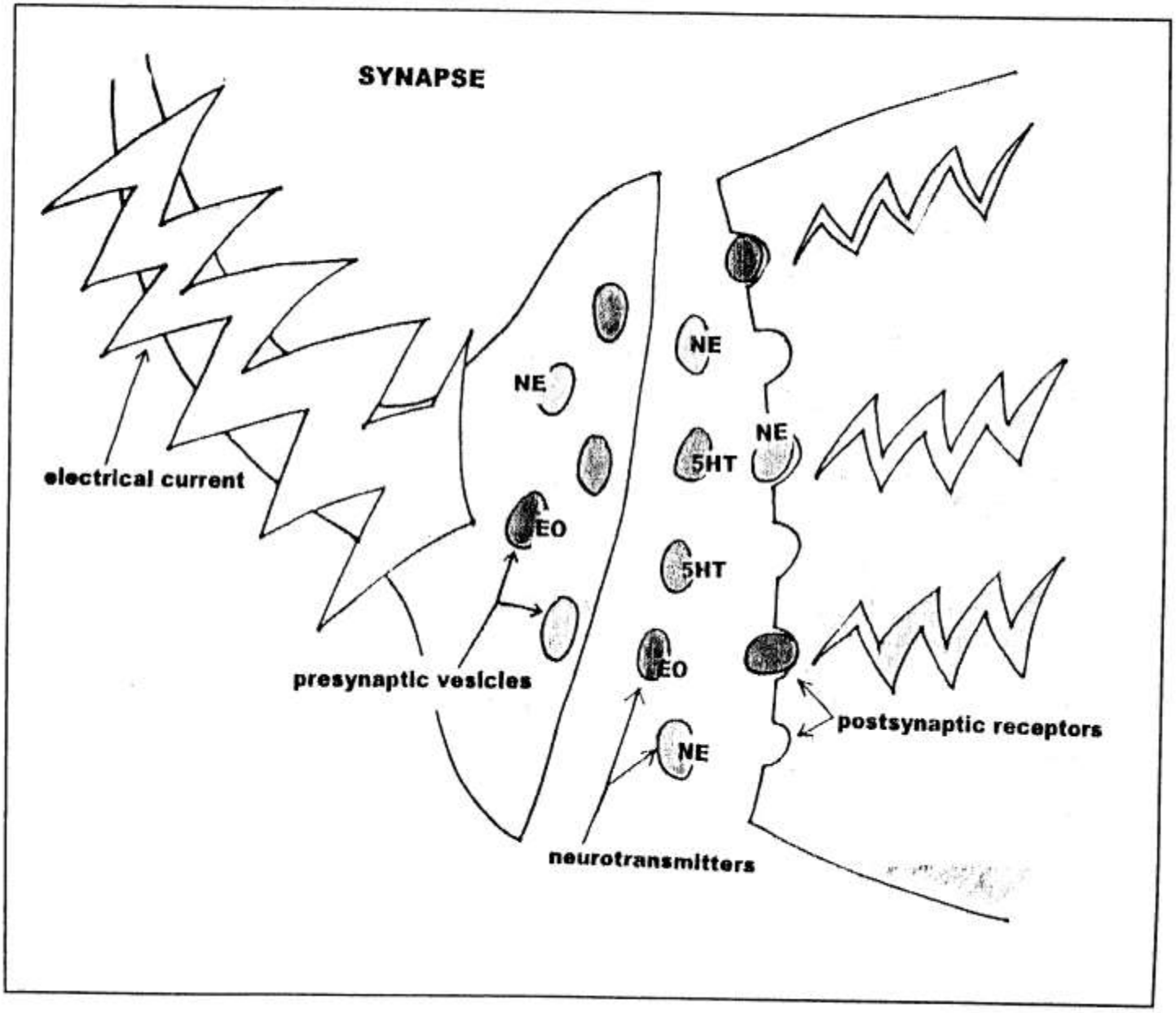
- Trauma is not purely a psychological issue
- The past becomes present because of the way that the brain dysregulates and changes after traumatic events
- What fires together wires together
- Neuroplasticity
- Trauma “echoes” in the brain – and effective treatment quiets the reverberations of the echo

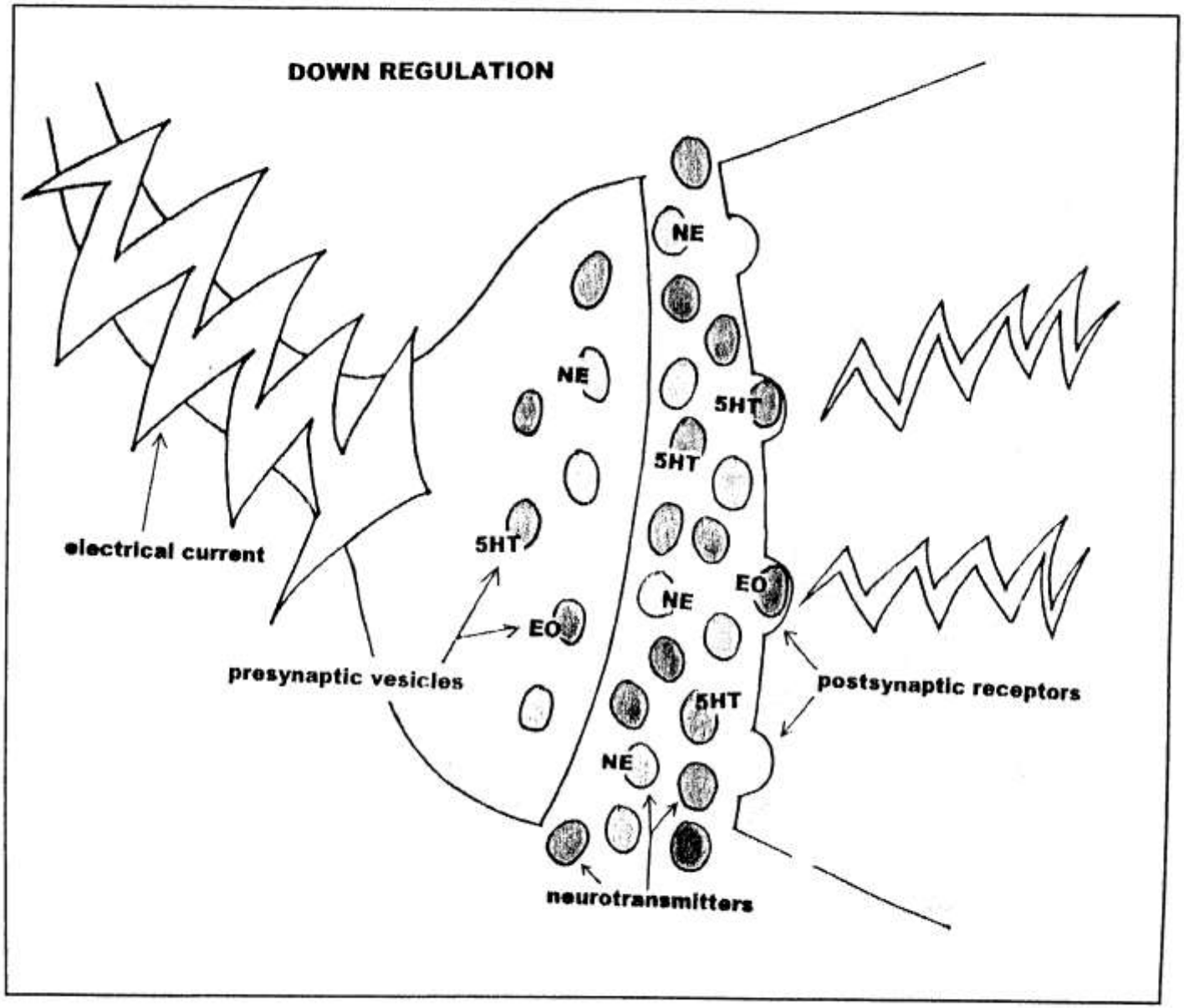
Neurobiology of Trauma

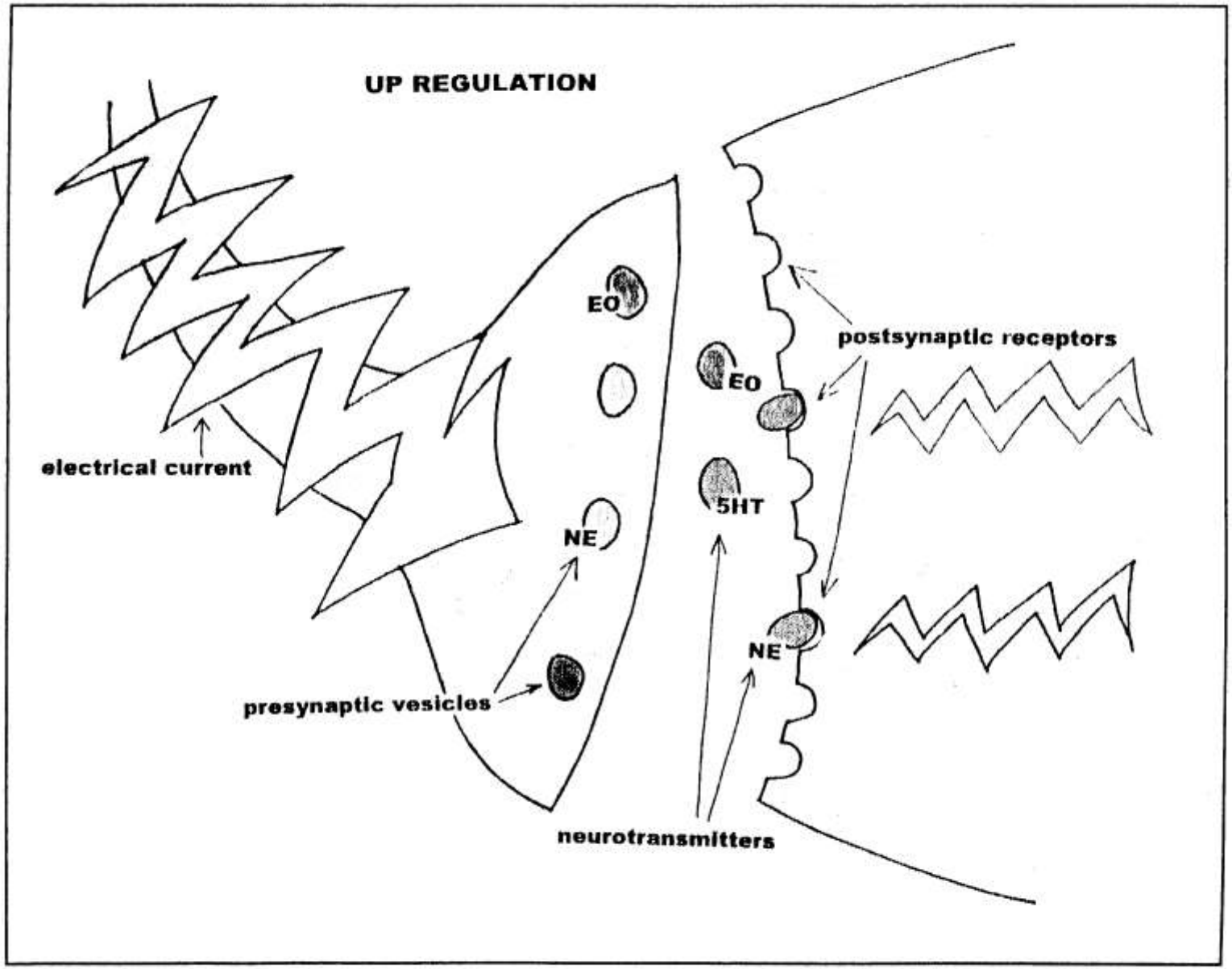


Synaptic Activity

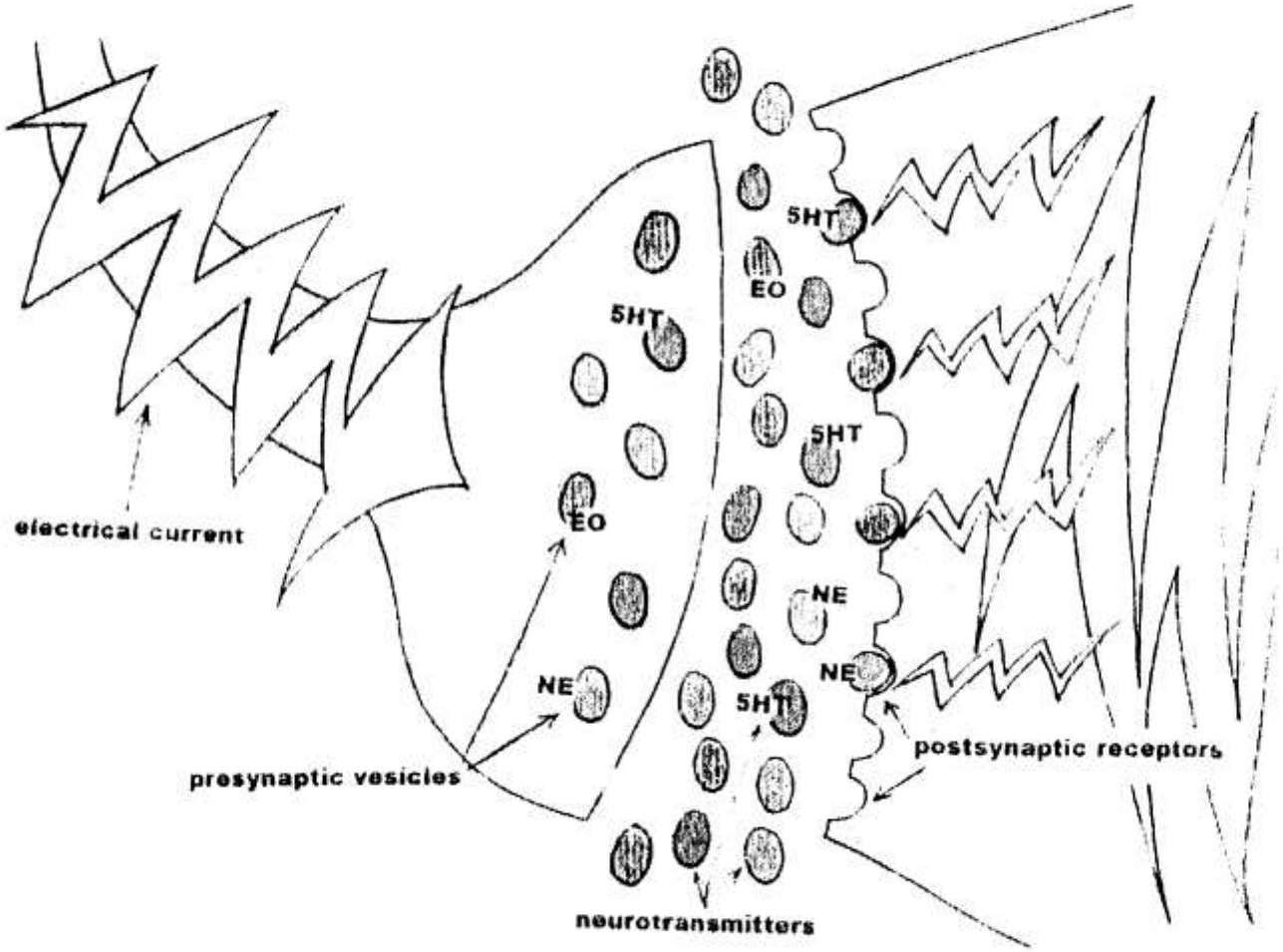



SYNAPSE
electrical current
NE
EO
presynaptic vesicles
NE
5HT
NE
5HT
EO
NE
postsynaptic receptors
neurotransmitters


DOWN REGULATION
NE
NE
5HT
5HT
5HT
EO
NE
EO
5HT
NE
electrical current
presynaptic vesicles
postsynaptic receptors
neurotransmitters


UP REGULATION
EO
EO
postsynaptic receptors
electrical current
5HT
NE
NE
presynaptic vesicles
neurotransmitters

E. AMPLIFICATION



L. Langhammer

More on the Sympathetic Nervous System Response

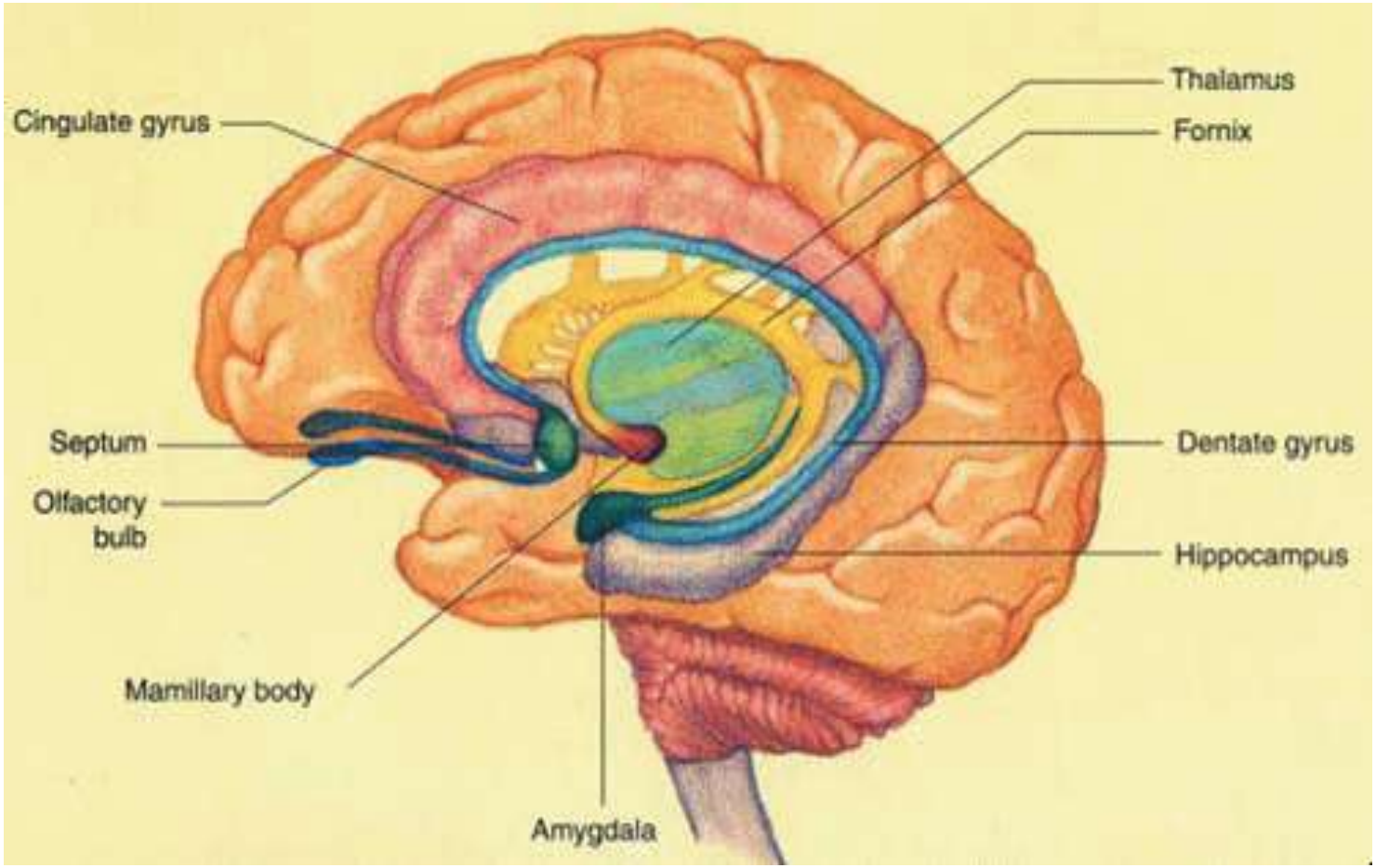
- HPA axis: hypothalamic-pituitary-adrenal
  - This system is responsible for bringing the body back into balance
  - The following chemicals/hormones are released:
    - Catecholamines (epinephrine and norepinephrine) – responsible for fight or flight
    - Corticosteroids (glucocorticoids, cortisol) – control energy and the body's immune functioning
    - Opiods – prevent pain, inhibit memory consolidation
    - Oxytocin – inhibits memory consolidation, promotes good feelings
- These chemicals are POWERFUL substances ….

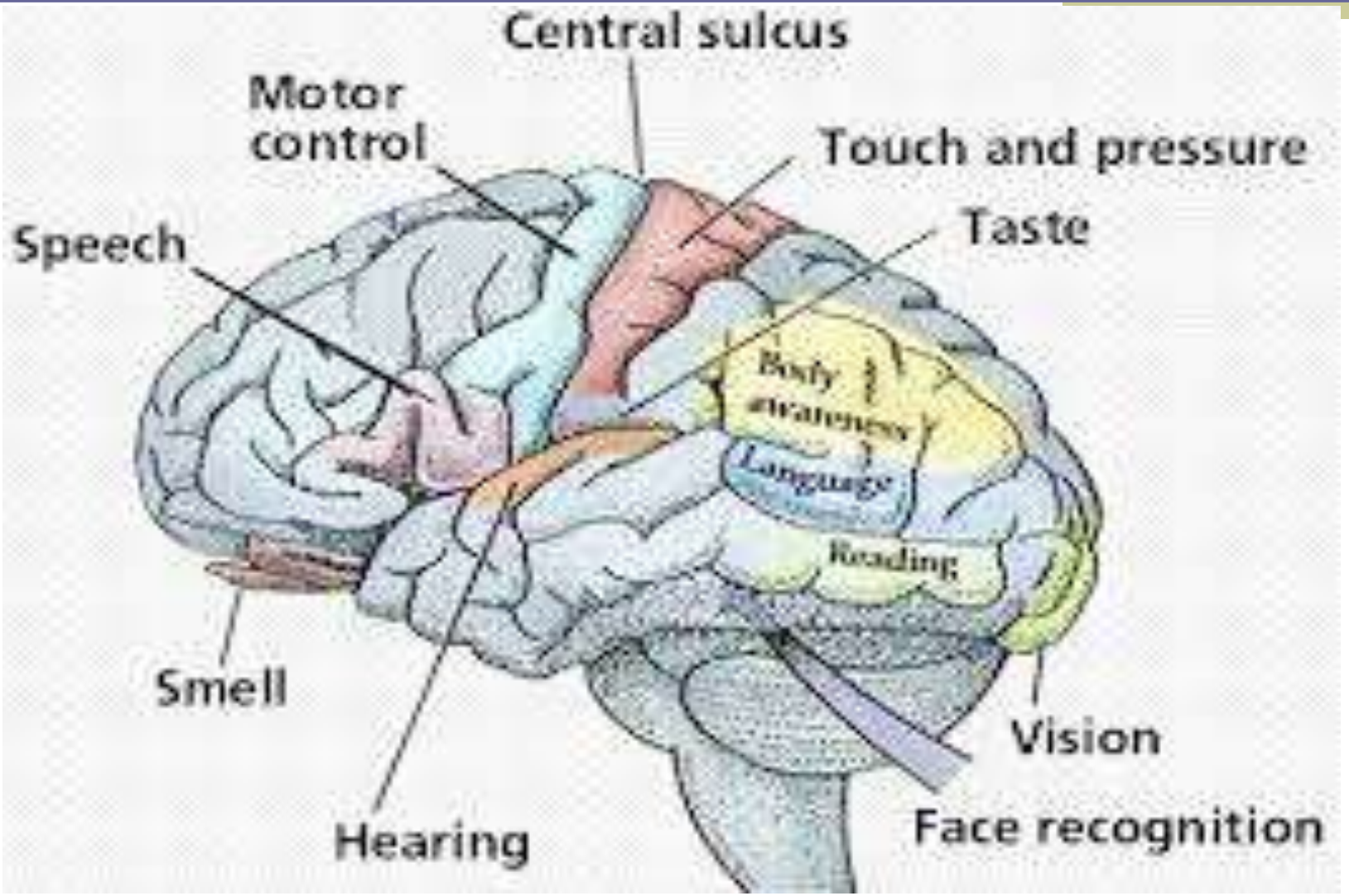


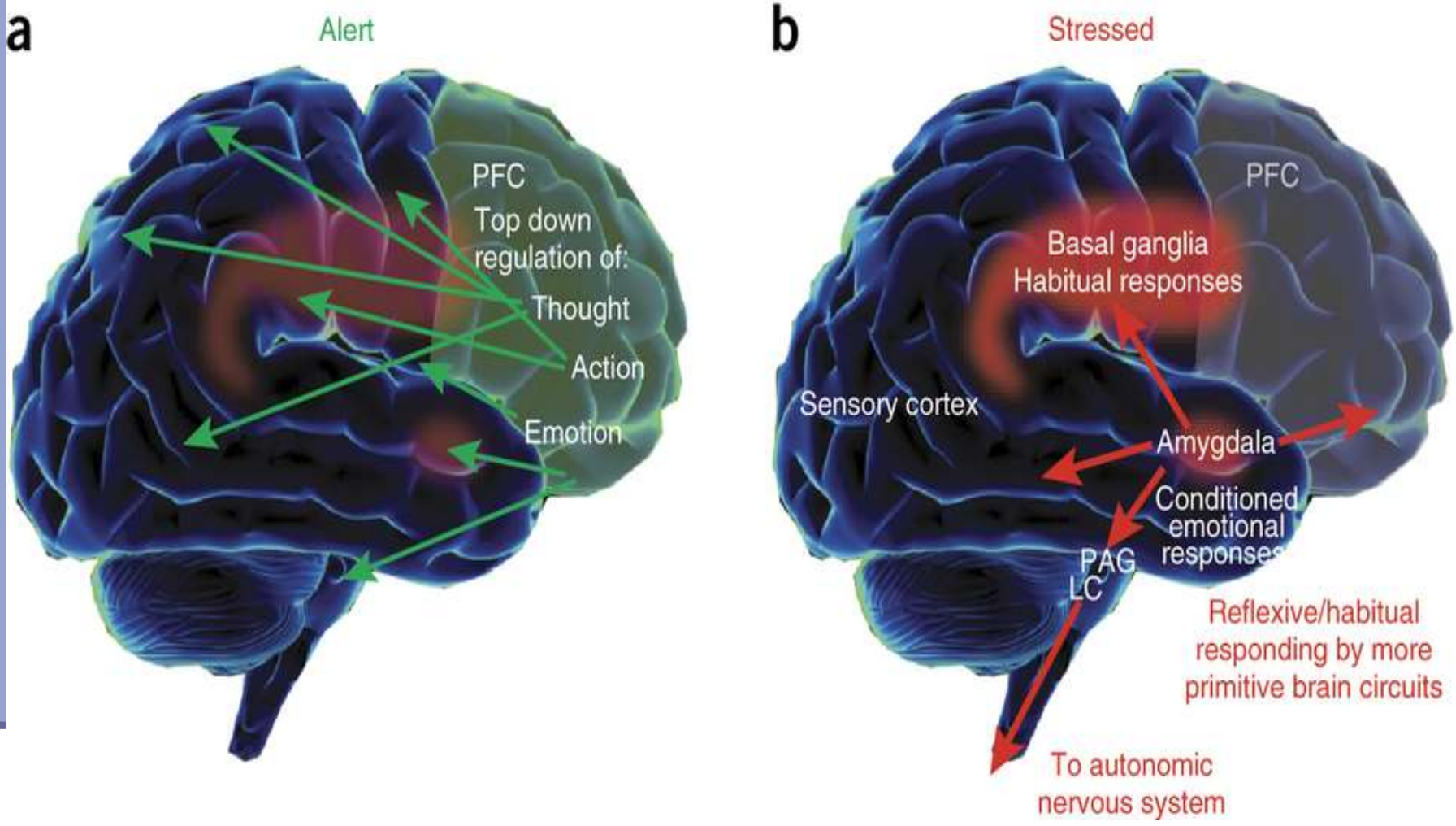
Sympathetic Nervous System Response

- **If traumatic stress is chronic, long-lasting and triggered often… then**:
- **Catecholamines** are chronically increased; damage to memory, rational thought, hypervigilance, inability to distinguish danger signals
- **Corticosteroids** are chronically low; reduced immune functioning (lupus, Graves disease, RA, fibromyalgia), catecholamines aren't regulated
- **Opiod** levels increase (equivalent to 8 mg of morphine); flat affect
- **Oxytocin** increased– memory impaired; bonding to people who may not be safe or healthy

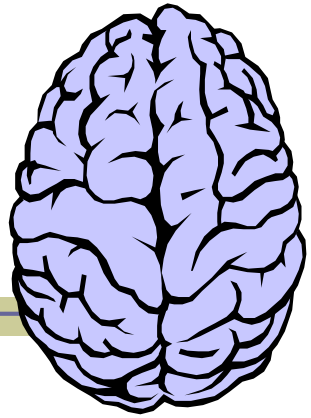
Structures of the Brain: The Limbic System




Central sulcus
Motor control
Touch and pressure
Speech
Taste
Body awareness
Language
Reading
Smell
Vision
Hearing
Face recognition


a
Alert
PFC
Top down
regulation of:
Thought
Action
Emotion
b
Stressed
PFC
Basal ganglia
Habitual responses
Sensory cortex
Amygdala
Conditioned
emotional
responses
PAG
LC
Reflexive/habitual
responding by more
primitive brain circuits
To autonomic
nervous system

The Prefrontal Cortex (PFC)



- Highly developed in primates and humans
- Allows “executive control” – or at least guidance – over more primitive brain structures
- Exerts inhibitory control over stress responses and emotional reactivity
- Prefrontal cortex actually shrinks with PTSR; children/adolescents/young adults don’t have developed PFC

The Insula Cortex or Insula

- **The Insula** is critical to relational functioning, empathy, connecting
- Helps us with:
  - Being able to focus
  - Interoception: tuning into bodily sensations
  - Memory and reason
  - Self-awareness, reflection, emotions, impulses
  - Empathy, compassion

High Arousal (Fear) = Impaired Prefrontal and Insular Cortex

- Stress chemicals disable the mid cortex and limbic brain takes over

So what activates and rewires the Prefrontal and Medial Cortex?

- Meditation
- Mindfulness practices (Mono-tasking)
- Moving and focusing in new ways
- Conscious breathing

These behaviors kick-in “top-down” brain functioning versus “bottom-up” processing

Fight, Flight, or Freeze

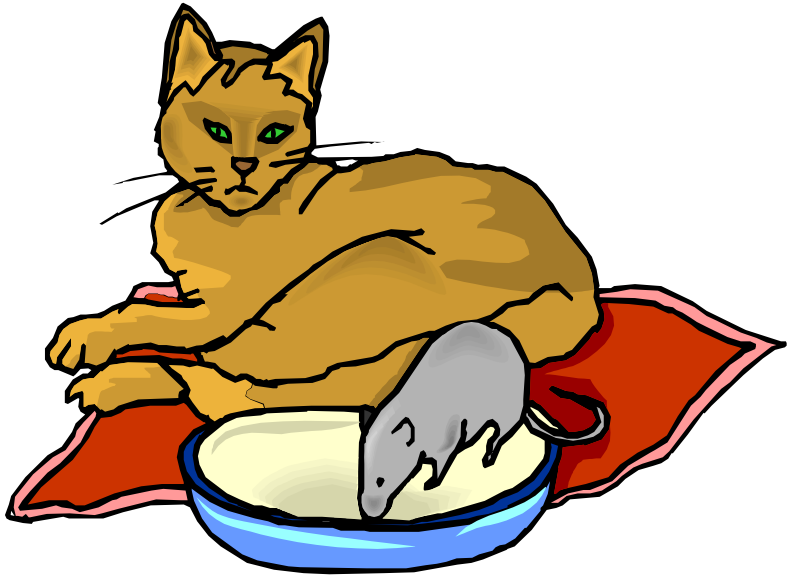
A lesson from Jakey Cat

Jakey Cat (RIP)



The Freeze Response: Tonic Immobility

- Autonomic Nervous System: sympathetic and parasympathetic nervous system
- Both systems heightened simultaneously under extreme stress
- Tonic immobility as an adaptive survival response; if you move in the animal world – the predator will chase and kill



What we can learn from animals and The Slinky









The Power of Yoga to Heal Trauma

Trauma = Split between mind and body
Yoga = Unifying mind and body



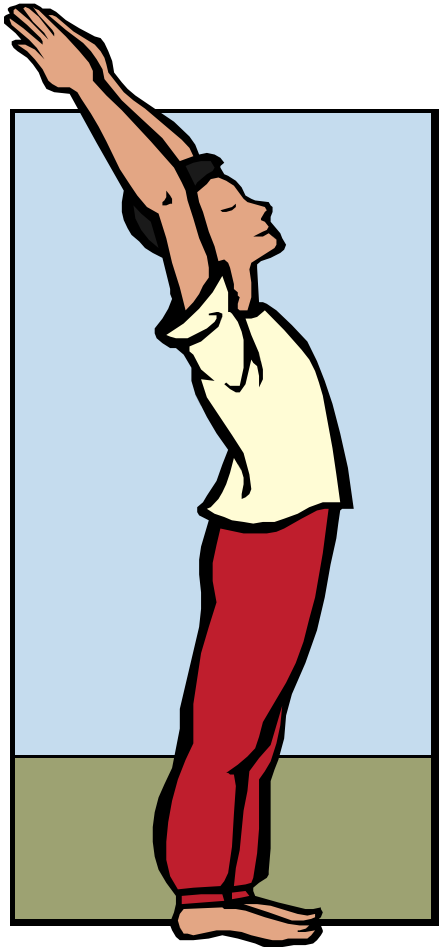




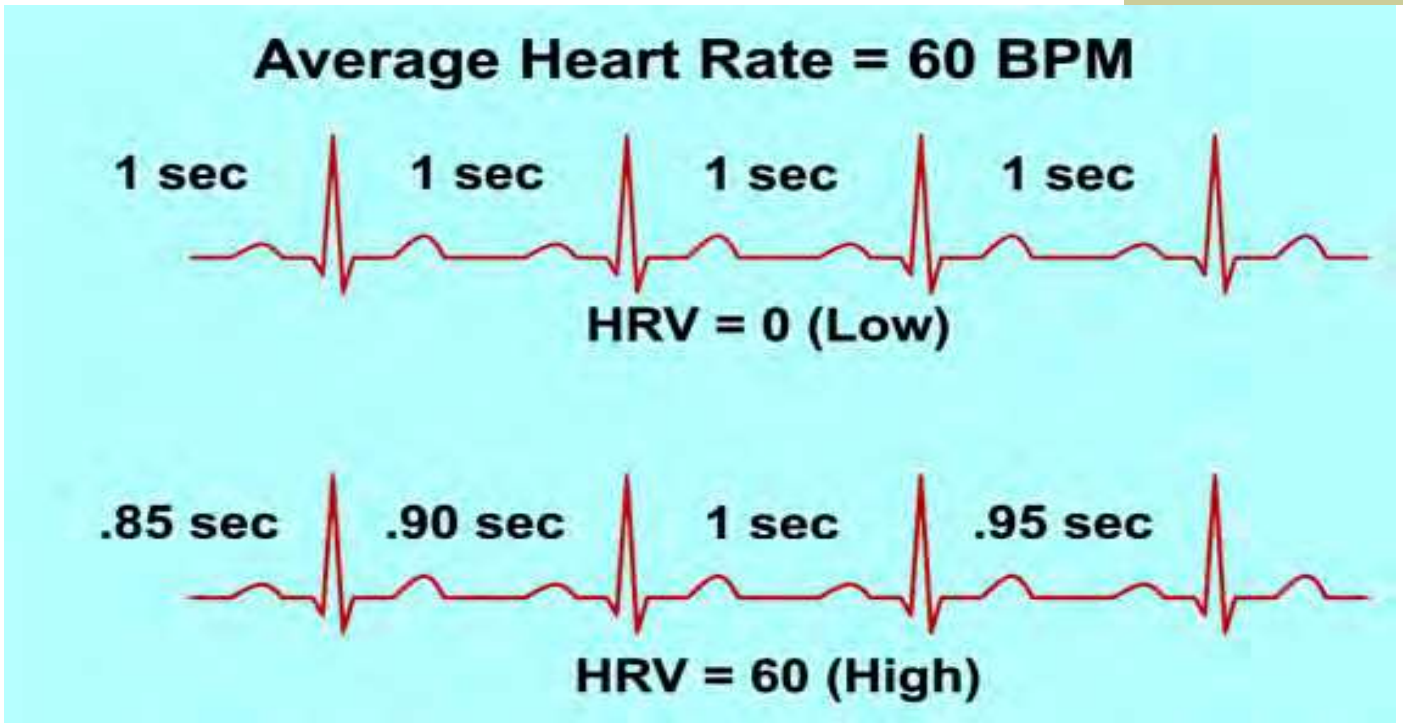


The Neurobiology of Yoga

- Yoga increases heart rate variability (HRV); an indicator of the body's ability to respond more flexibly to stress; the measurement of HRV is often applied as an index of autonomic nervous system (ANS) balance. ANS balance is important to balance flight, fight, and freeze response.
- Benefits of controlled breathing activates parasympathetic system similar to those receiving electroconvulsive therapy (ECT), and taking an antidepressant .



Yoga and Heart Rate Variability (HRV)



HRV is the variation in the time interval between one heartbeat and the next. When you inhale, heart rate speeds up; when you exhale it slows down. When HRV is high, a person experience lower levels of stress and great resiliency. Dozens of research studies show that yoga of all kinds (Vinyasa, Hatha, Yoga Nidra) increases HRV.

The Neurobiology of Yoga









- Yoga increases Gamma-aminobutyric (GABA) levels in the brain (measured by fMRIs)
- Low GABA levels are associated with depression and anxiety
- Activate the GABA receptors with ambien, xanax, or a glass of wine, and you get relaxed and sleepy. When these substances are constantly in the brain and then rapidly withdrawn, you suddenly have overexcited GABA receptors and you can get side effects such as insomnia, anxiety

- Streeter et al., **Effects of Yoga Versus Walking on Mood, Anxiety, and Brain GABA levels: A Randomized Controlled MRS Study**. *The Journal of Alternative and Complementary Medicine*, 2010.

Yoga Down-Regulates the HPA Axis and the SNS



Transforming from the Sympathetic to the Parasympathetic System

- The more anxiety we have, the less optimally our brains function
- **Sympathetic System -**
  - Ready to react, on alert, high arousal
  - Multi-tasking overload



- **Parasympathetic System** (PNS) -
  - Relaxed, comfortable, intentional, optimal functioning
  - Yoga increases PSN dominance through vagus nerve stimulation

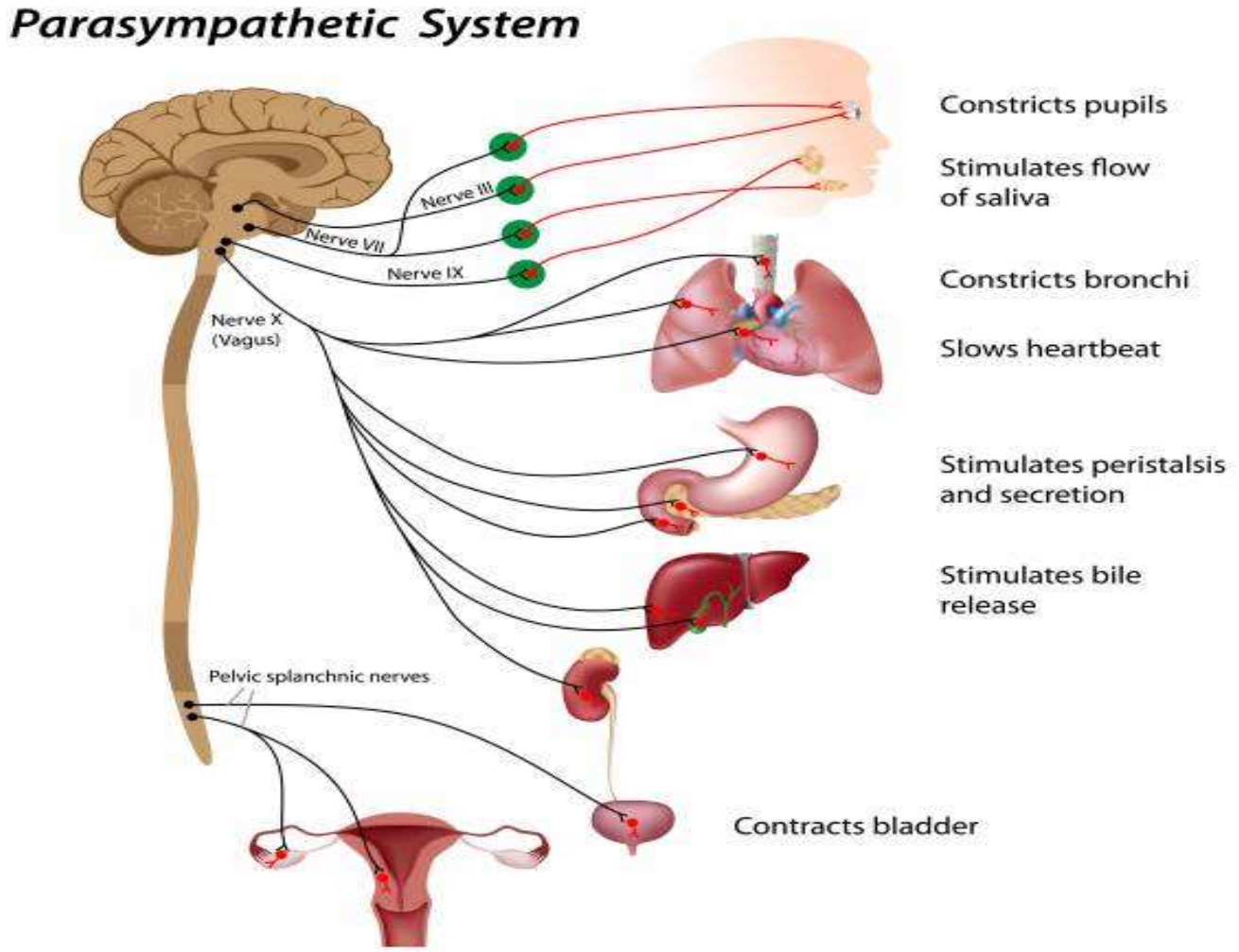








Vagus Nerve Stimulation and the PNS



How to Activate the Vagus Nerve



- long, deep breathing
- gentle backbends, forward bends, and twists
- inversions like downward dog or legs up the wall
- chanting or singing in low resonant tones
- laugh with deep diaphragmatic laughs

Three-Part Yogic Breath – Dirga Pranayama



When asked to slow the rate of breathing and expand breathing volume – this activates the parasympathetic nervous system and the Vagus Nerve.

Other benefits of Vagus Nerve stimulation:

- reduces the inflammatory response throughout our system
- helps the brain grow new cells
- decreases depression and anxiety
- assists in developing memory
- raises immunity
- raises the level of endorphins, which bring about positive feelings in the body and reduce the sensation of pain



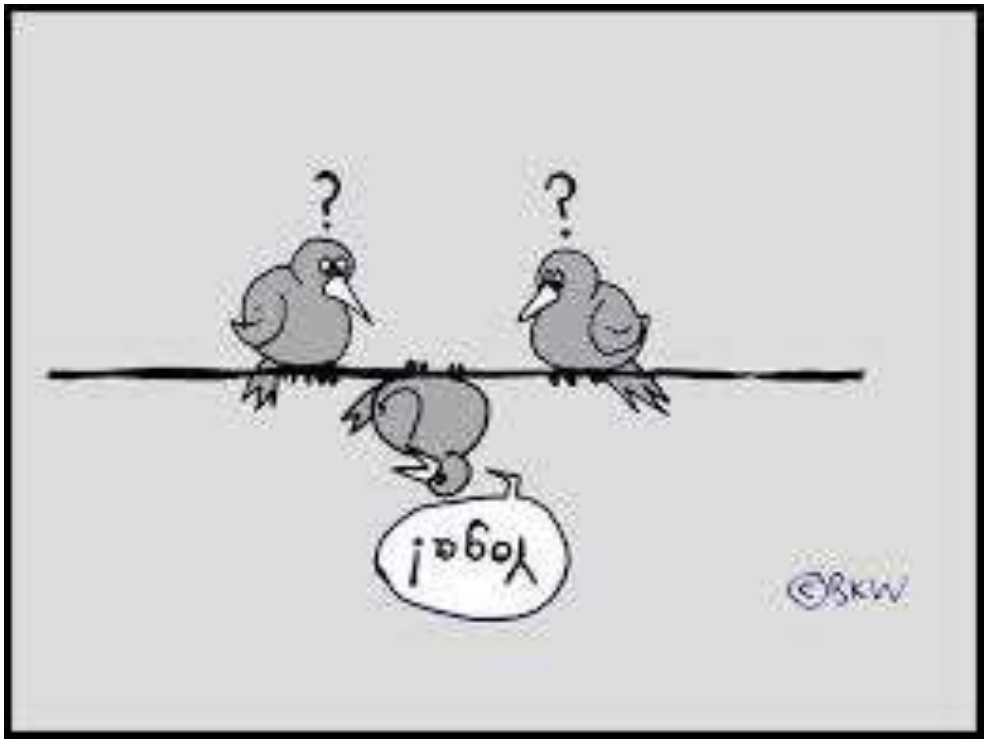


Traumatic Stress disrupts the Nervous System; Yoga regulates it

- Patanjali said that yoga “is the practice of quieting the mind.” Neuroscience tells us that it is also the practice of healing the heart and the nervous system.



Cellular Awkwardness is Necessary for Change



Yoga is a physical practice that teaches you how to get through psychological and physiological stress





Yoga works, not because the poses are relaxing, but because they are stressful.

Yoga Helps to Develop Interoception: Befriending the Body

- Instead of just thinking or talking about the traumatic incident – one experiences sensation (stress, discomfort) and instead of backing away (disconnecting, dissociating) – you move toward sensation.



Meditation/Mindfulness: Psychosomatic State Shift



- Thickens the cerebral cortex (due to trauma, age)
- Increases attention span, sharpens focus, improves memory
- Restores synapses, similar to sleep

Study: Boston-area workers who meditated for 40 minutes a day had significantly thicker cortexes than controls (Lazar et al, 2005)



More Benefits of Yoga to Mitigate Effects of Trauma

- Research shows that yoga decreases oxidative stress in the cells after an eight week practice. Less inflammation, less cell damage, less acidity in the body = health



Janine and Scout Practicing

The Root Chakra: Muladhara



This chakra is linked to our ability to feel grounded, safe, secure in our bodies, and connected to people around us. Our ability to access any of these is compromised when our root chakra is not strong.





Many survivors develop patterns of disassociation or disconnection from their physical bodies – a necessary survival mechanism to make it through the traumatic event.

Yoga poses that help to gradually re-establish a healthy grounded connection to the earth and physical body are critical to promote healing.

Trauma as a First Chakra Issue: threat to survival, feeling safe

Grounding poses:

Mountain

Warrior I and II

Chair

Triangle

Goddess

Boat

Child's pose

Cat/Cow

Seated twists

Forward folds

Tree

Hugging knees



Important Trauma-Informed Yoga Practices for Teachers

- Choice
- Control
- Boundaries
- Language of inquiry
- Predictability
- Making the stakes low
- Be mindful of pace
- Hands off assists



References

Trauma-Sensitive Yoga in Therapy: Bringing the Body into Treatment
- **David Emerson**

Overcoming Trauma Through Yoga: Reclaiming Your Body
- **David Emerson and Elizabeth Hopper.**

The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma
- **Bessel van der Kolk**



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