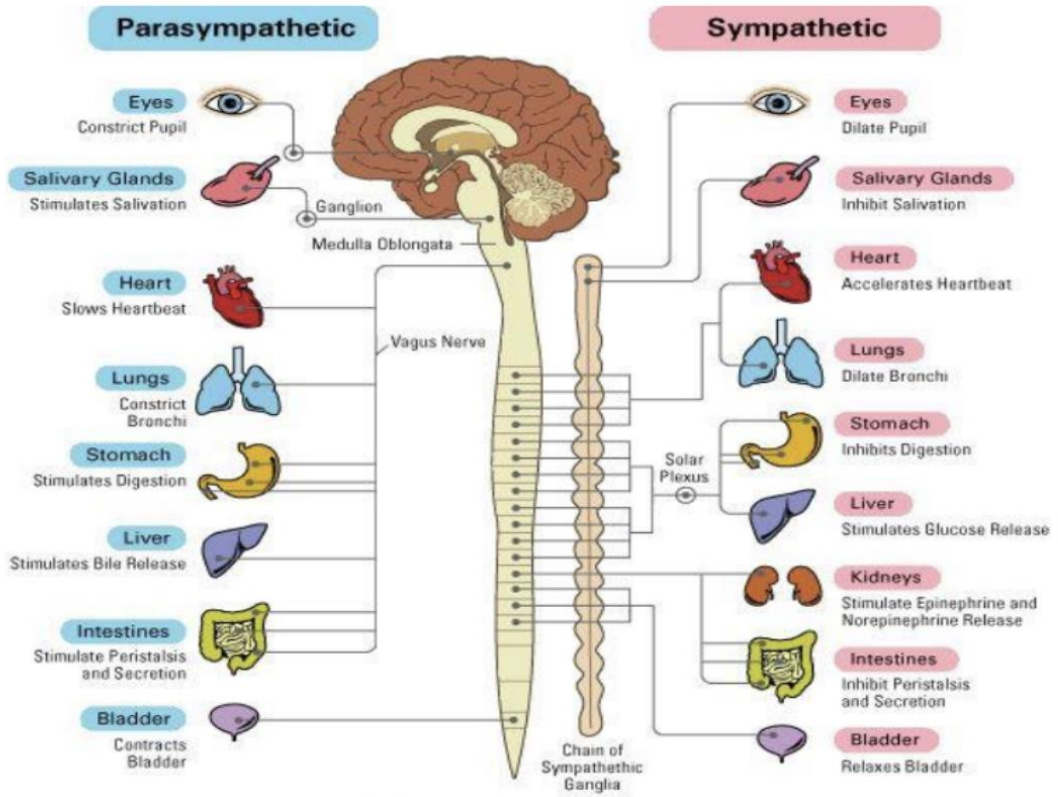
STATE OF THE BODY

Anatomy and Function: Autonomic Nervous System (ANS)

The ANS is made up of the **Sympathetic**, **Parasympathetic**, and **Enteric** Nervous systems. The Parasympathetic and Sympathetic are the most common ones:



Afferent Fibers: Sensory fibers emerging from the sensory receptors to the CNS.

Efferent Fibers: Innervating (stimulating and supplying) effector target organs or tissues.

The **SNS** and **PNS**, sympathetic and parasympathetic respectively, are involved in spinal and cranial involuntary reflex pathways within the body. The pupillary-size reflex is an example of an autonomic **cranial reflex**. (See **Figure 2**)

Figure 1: Parasympathetic fibers emerging from sacral (sacrum-related) and cranial region. Sympathetic fibers emerging from upper lumbar and thoracic regions of the spinal cord.

Source: Autonomic Nervous System: A Comprehensive Review (2023)

There are three primary ANS divisions:

SYMPATHETIC (Four F's: associated with fight or flight, and the increased availability of energy resources)

PARASYMPATHETIC (SLUD; associated with a more relaxed state, and energy conservation)

ENTERIC (Second brain: associated with digestion and activity/microbiome of the gastrointestinal tract)

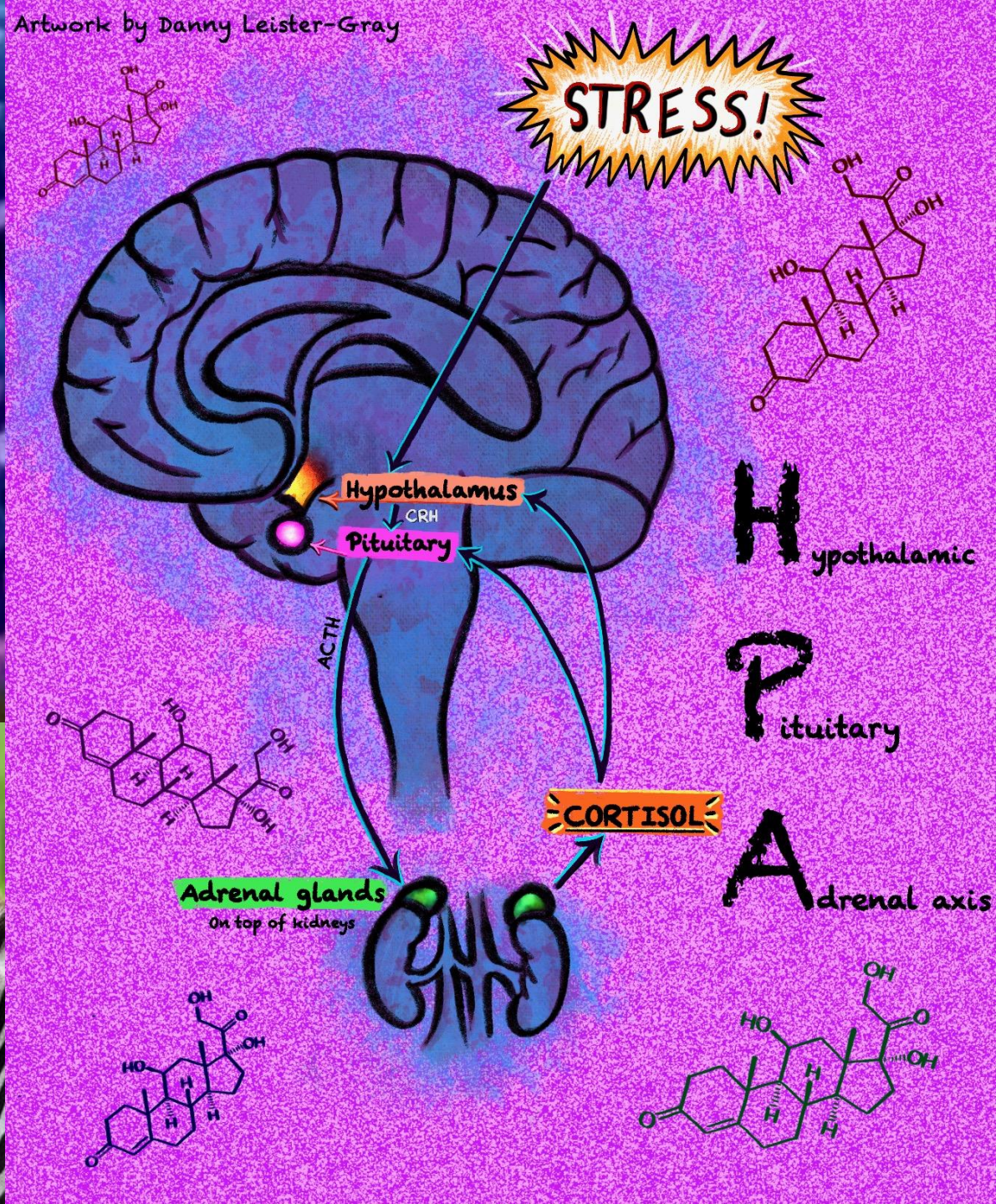
REACTIVITY VS. REGULATION

Emotional reactivity: autonomic response to stimuli. Some of us have BIG sympathetic responses, and some of us respond less. We pretty much arrive with a certain level of reactivity. Do you experience big sympathetic responses, or small? What if a spider dropped on your lap? What if you held a human brain specimen?

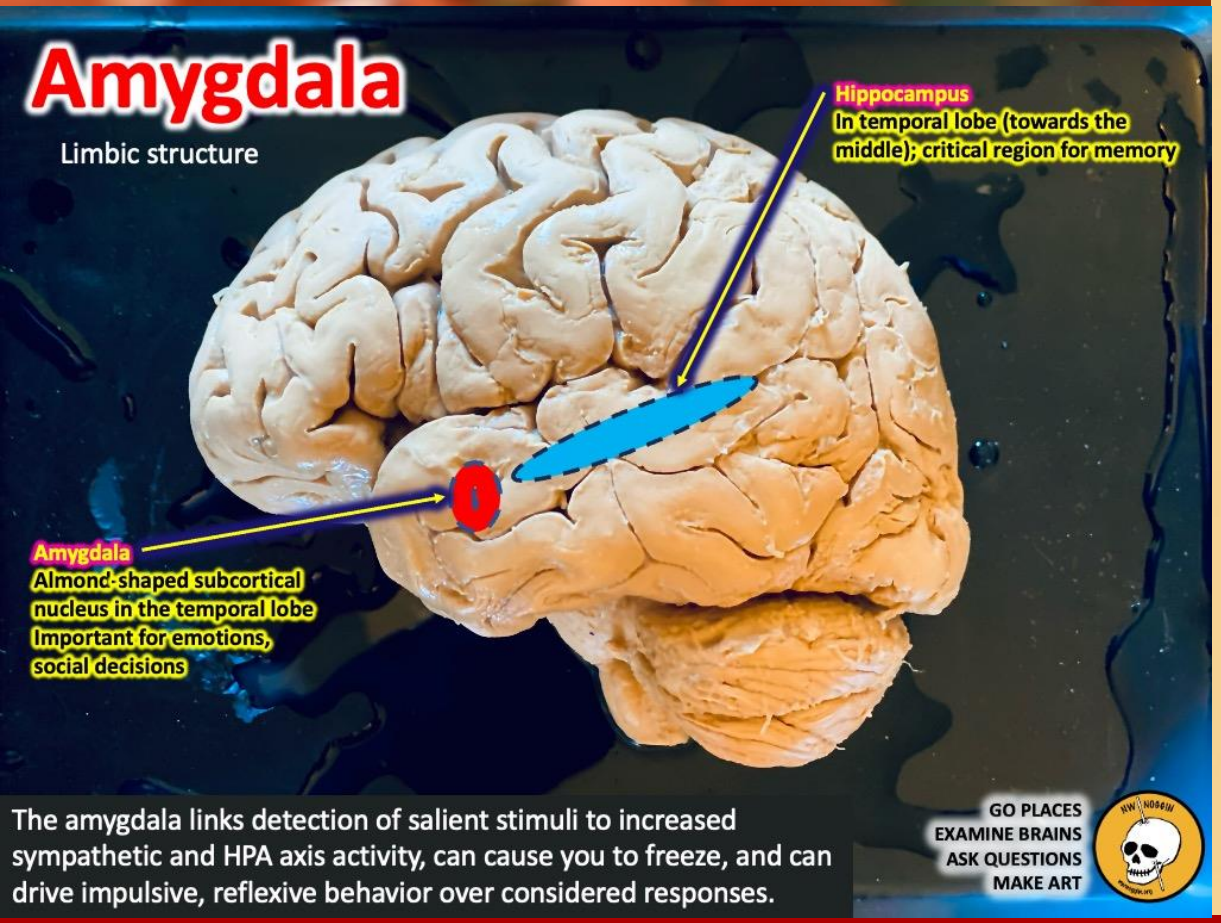
Emotional regulation: parasympathetic modulation of our bodily responses. Frontal lobe networks get trained through social experience to help inhibit, modulate - and regulate - our emotional responses, and thus our behavior.

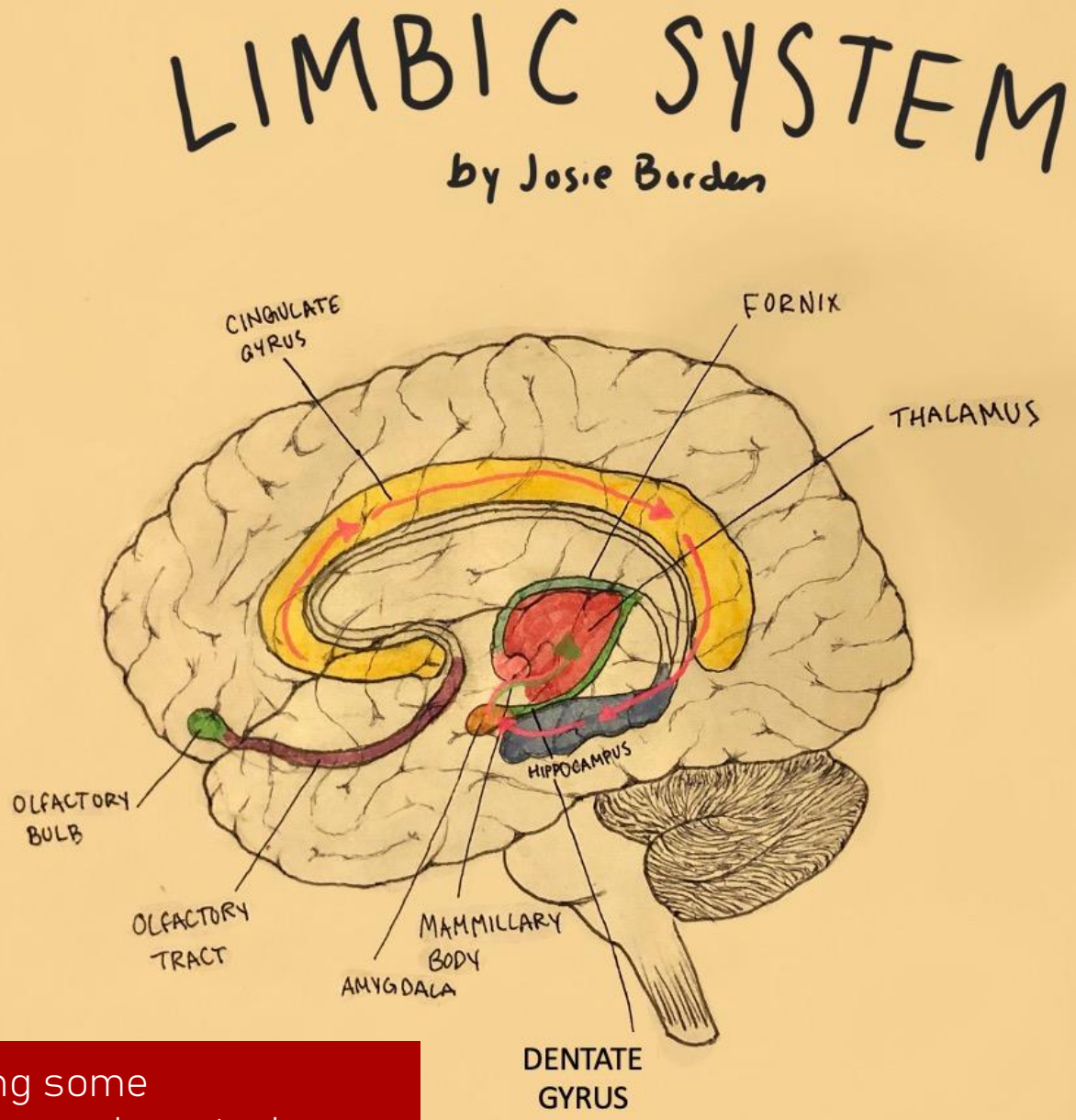
STRESS RESPONSE

"A zebra's stress response kicks in when a zebra is chased by a lion; when the zebra escapes, the stress response shuts off. In between predation attempts, the zebra is at ease. It doesn't flood itself with stress hormones wondering when the next lion is going to show up...Primates are super smart and organized just enough to devote their free time to being miserable to each other and stressing each other out. But if you get chronically, psychosocially stressed, you're going to compromise your health...we've evolved to be smart enough to make ourselves sick."" - Robert Sapolsky



LIMBIC SYSTEM

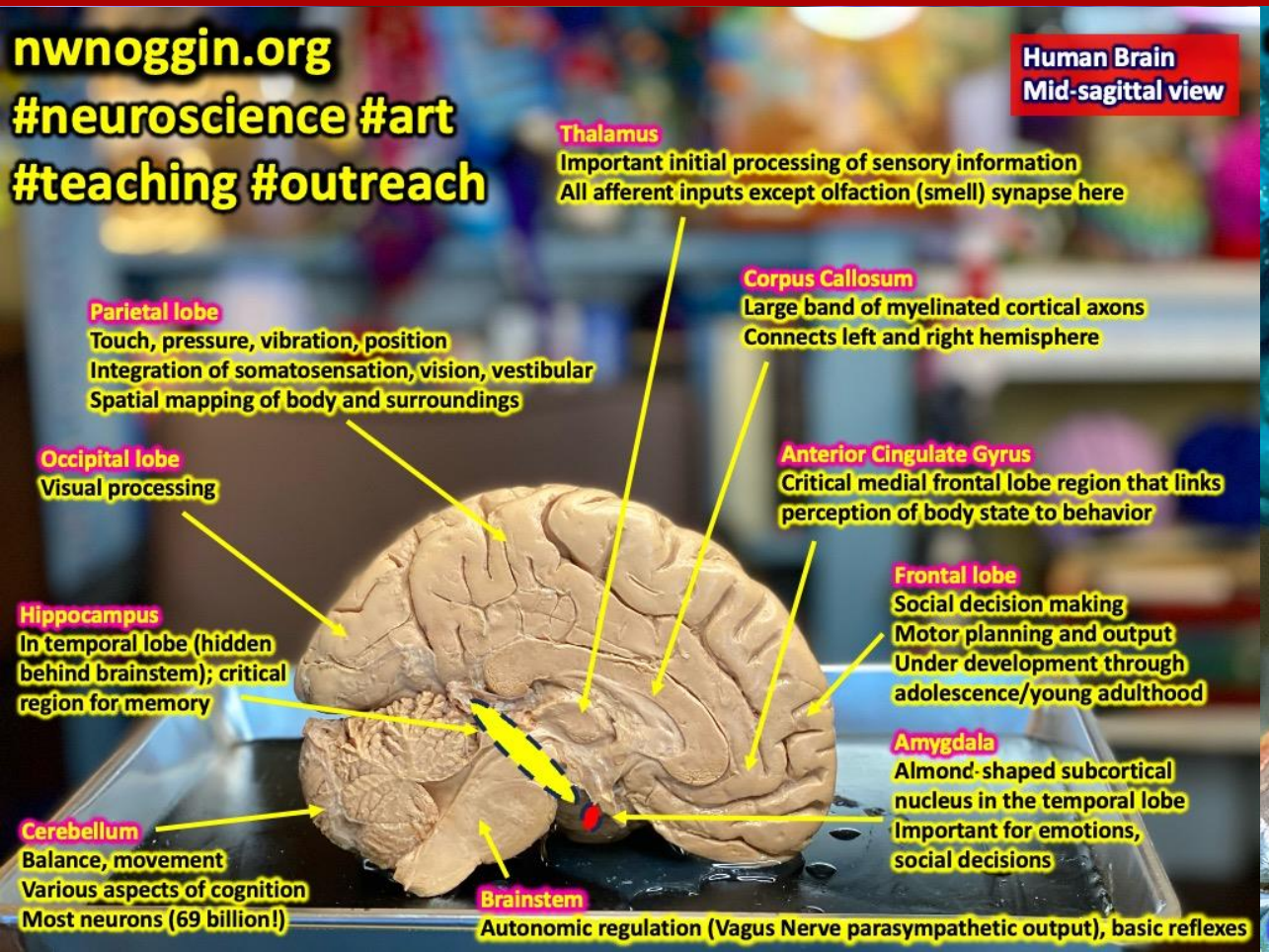


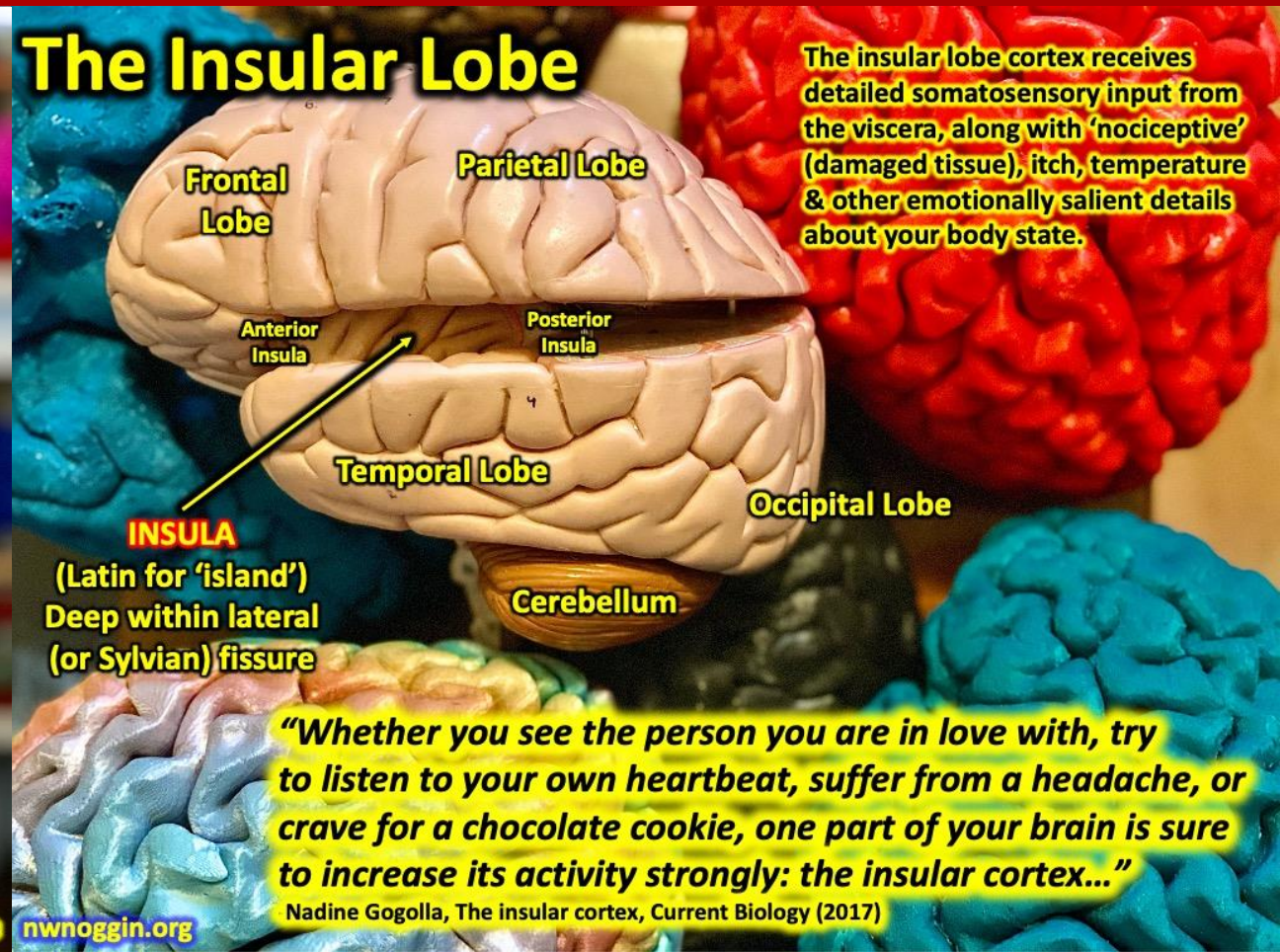


The limbic system refers to those areas of the brain, including some evolutionarily ancient cortical (paleocortical) regions and some subcortical structures, that are involved in emotional experience and expression.

BODY...AND BRAIN

Autonomic balance, HPA axis, limbic system - and frontal lobe/insular networks!





Phineas Gage

A railroad construction foreman who survived a grisly 19th century accident – an iron tamping rod blew straight through his frontal lobes!

His personality changed, at least initially. He was impulsive, failing to inhibit inappropriate social behaviors, and had trouble organizing activities. Some accounts suggest that his social abilities did improve over time.

Iron rod

Medial PFC
(pre-frontal cortex)

Parietal Lobe

Frontal Lobe

Occipital Lobe

Temporal Lobe

Katz's Delicatessen, NYC

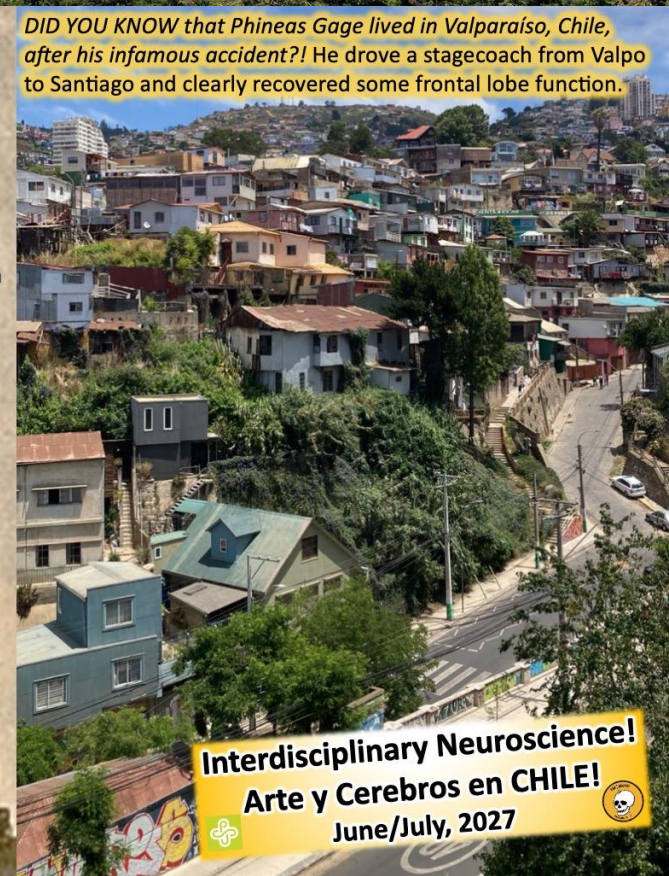
"Gage was no longer Gage."

nwnoggin.org

The bar that shot through the skull!

The skull

DID YOU KNOW that Phineas Gage lived in Valparaíso, Chile, after his infamous accident?! He drove a stagecoach from Valpo to Santiago and clearly recovered some frontal lobe function.



Interdisciplinary Neuroscience!
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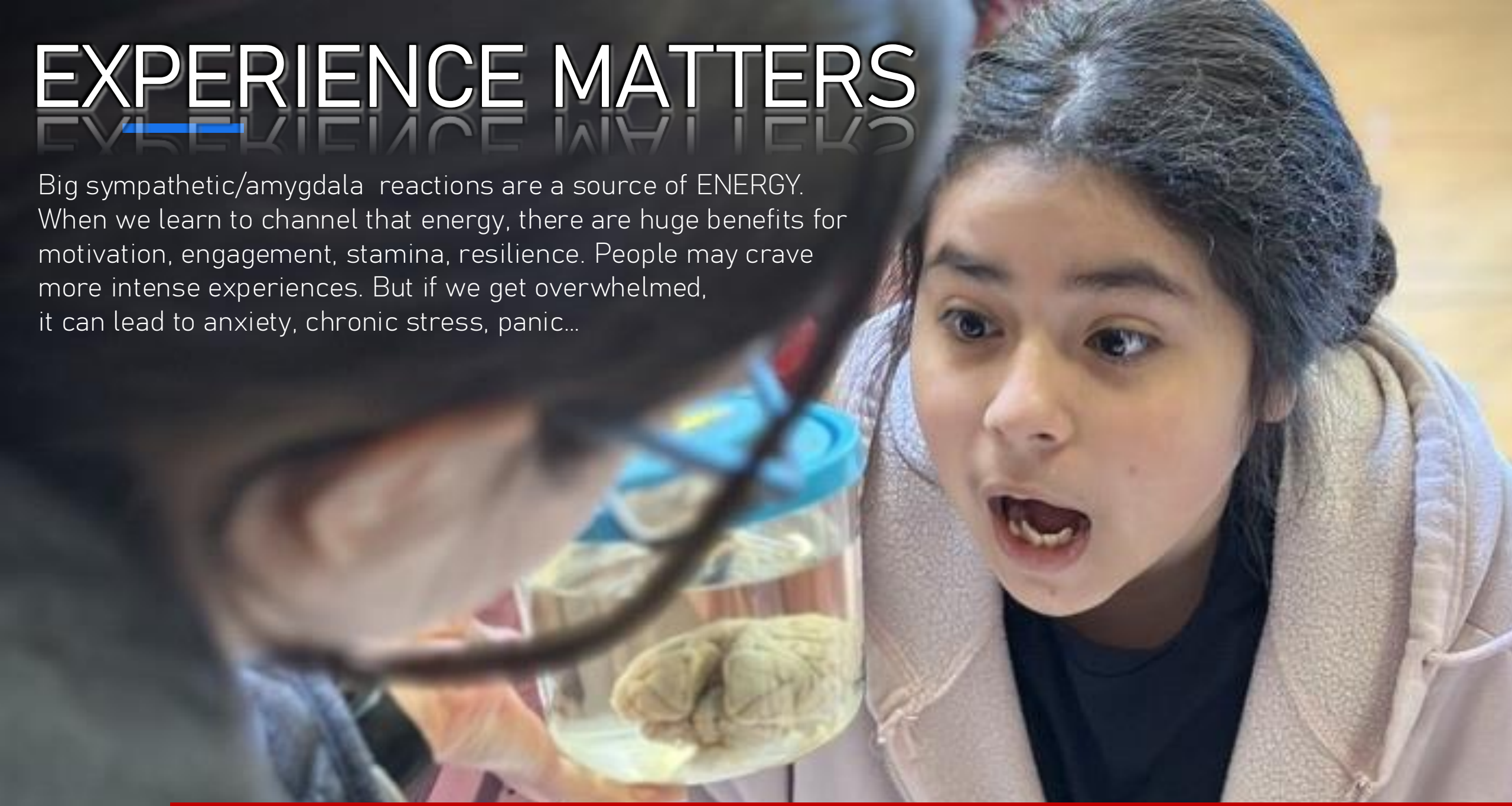
EXPERIENCE MATTERS

Big sympathetic/amygdala reactions are a source of ENERGY. When we learn to channel that energy, there are huge benefits for motivation, engagement, stamina, resilience. People may crave more intense experiences. But if we get overwhelmed, it can lead to anxiety, chronic stress, panic…



How might educational experiences support *positive* reactions to strong emotional reactivity?