

The Developing Brain, K – 5th

Key Words: Myelination, Synaptogenesis, Prefrontal Lobe, Limbic system, Adrenaline, Noradrenaline, Cortisol, Dopamine, Serotonin, Interoception, Insula, *Growth MindSet*, *Fixed MindSet*, *Grit*, *Downstairs Brain*, Sleep Hygiene, Stress, Resilience

-
- To schedule THIS presentation in person or via Zoom:
 - Dj.dorothyjohnson@gmail.com Tel: 520-444-0018
 - Note: For a presentation, PowerPoint slide show will open slides stepwise with animations, including some content obscured in this pdf version.

For *BRAIN BUS (kindergarten up)* & other PRESENTATIONS:

- **The Center for Neuroscience Foundation's Each Brain Matters.**
 - Website <https://www.eachbrainmatters.org/>
 - **Director Susan Hopkinson** foundation@neurotucson.com

Tel: 520-529-5211 ext. 7988

The Developing Brain, K - 5

5 years – 5th grade

1. Myelination
2. Synapses & Learning
3. Helping Brains Thrive

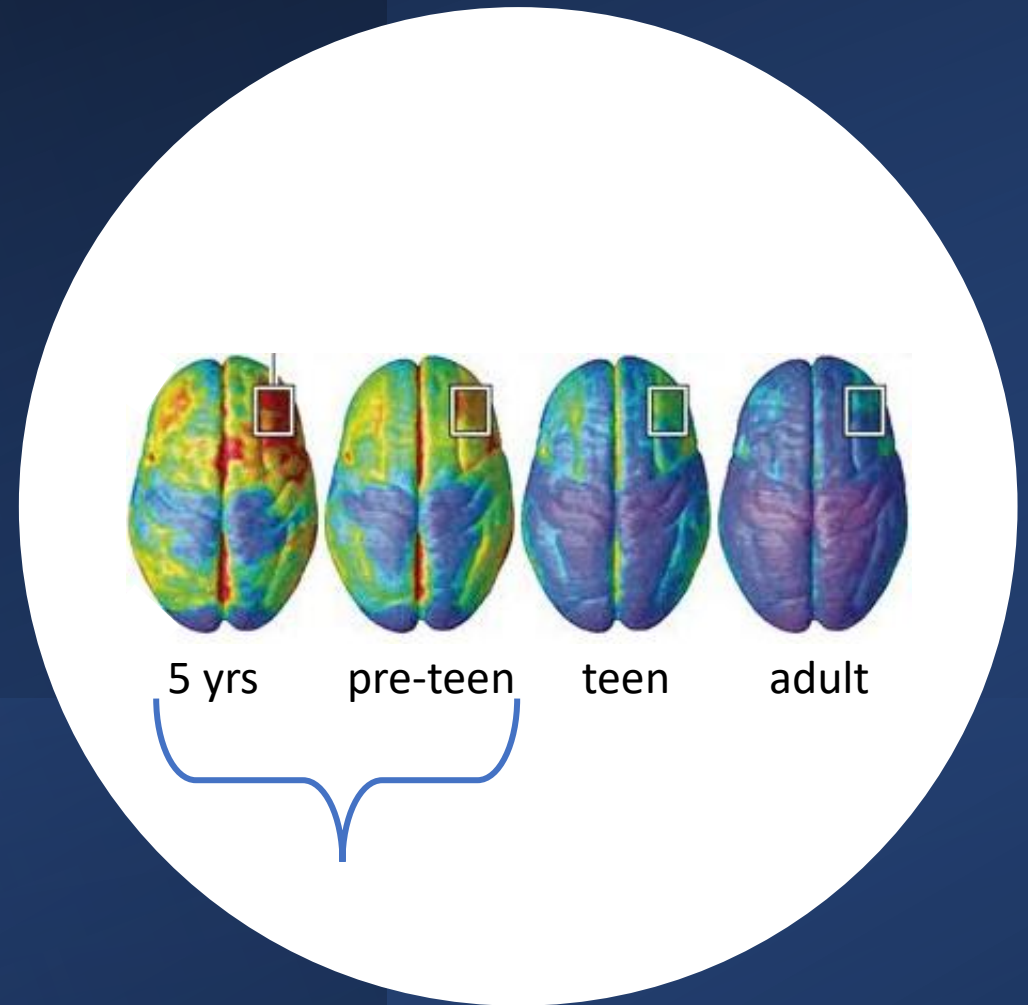
Presentation for AmeriCorps Foster Grandparents
July 25, 2024

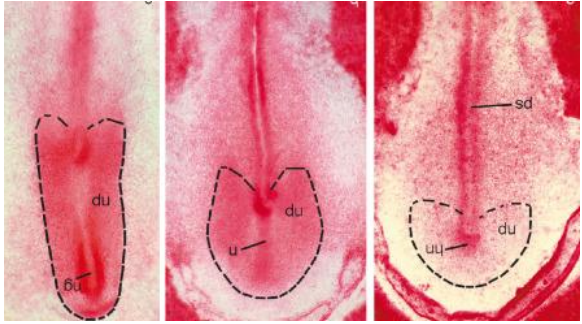
Provided by :

Dorothy Johnson, MD, FAAP (retired)

The Center for Neurosciences Foundation.

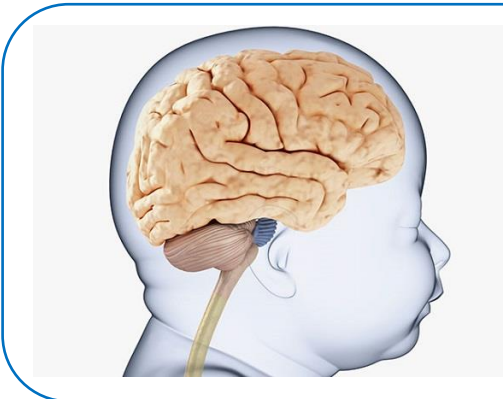
<https://www.eachbrainmatters.org/>



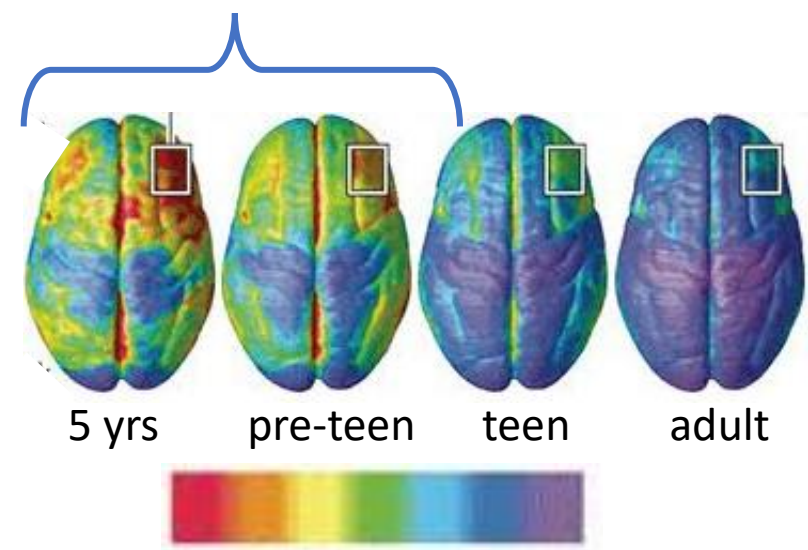


Brain beginning. Day 18
(32 days from LMP)

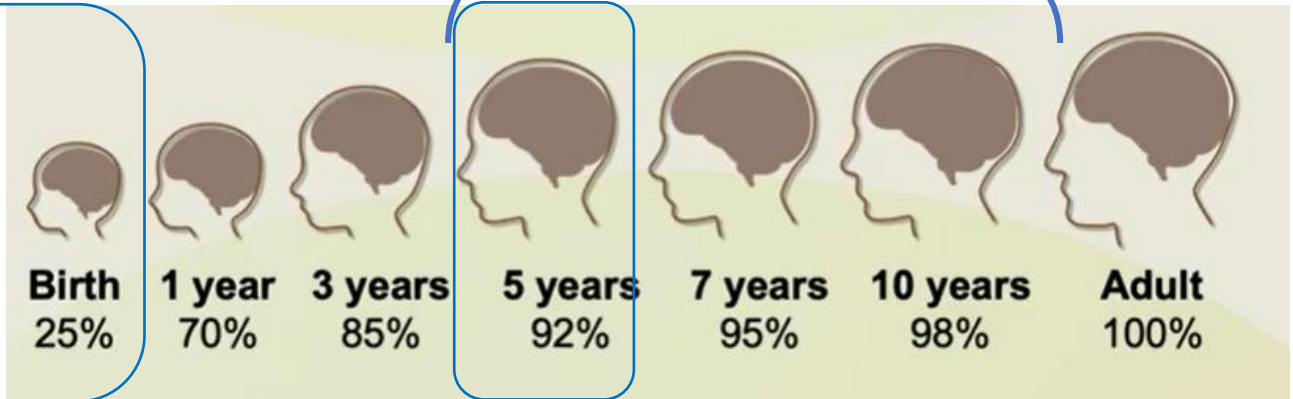
**100 Billion
Neurons!**



Brain Growth



Myelin (insulation) &
Synapses (connections)



Neurulation. A. Lawson, G.C. Schoenwolf, in Encyclopedia of Neuroscience, 2009
Tissue and Cellular Events Underlying Primary Neurulation
<https://www.sciencedirect.com/topics/neuroscience/neural-plate>

Patricia K Kuhl. The Baby Brain
<https://youtu.be/ErPPXfsY6a8>

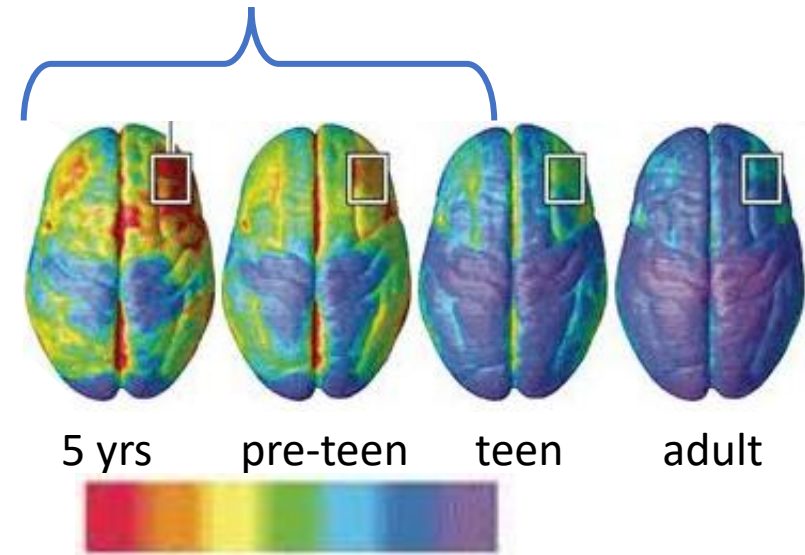
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1. Myelination:

- Age
- Speed, Thought vs Emotion, R ↔ L , self-awareness

2. Synaptogenesis:

- Experience
- Knowledge & Skill

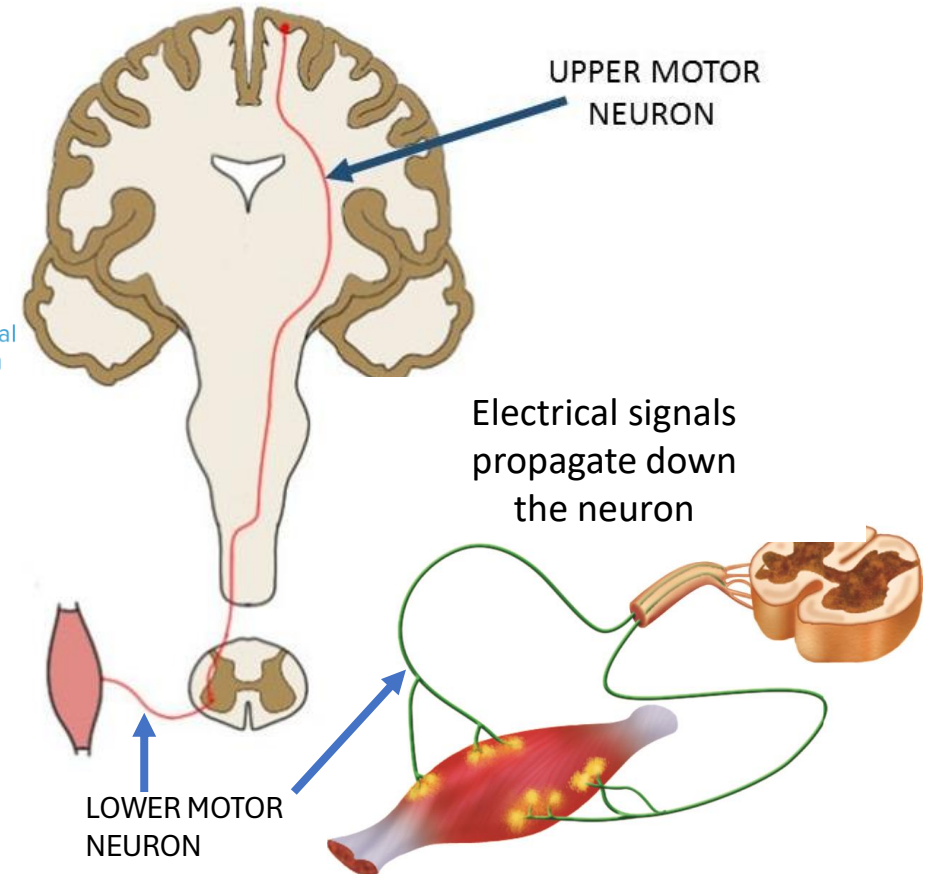
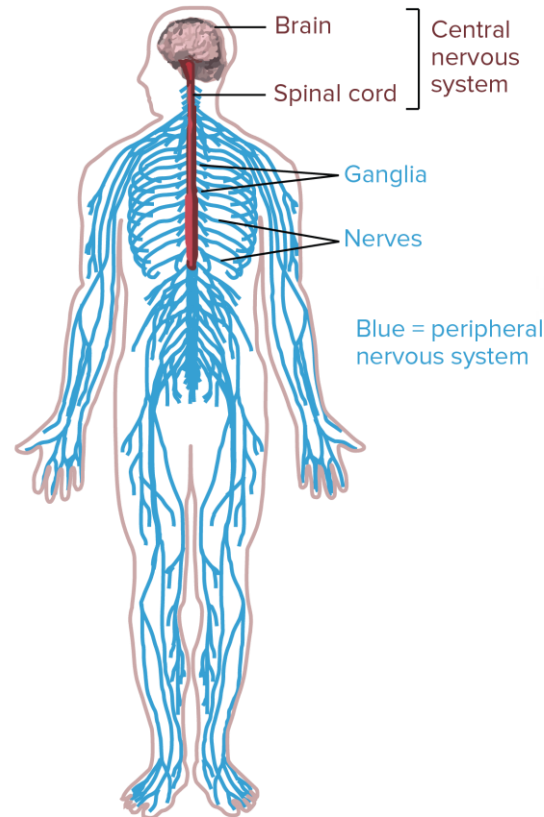
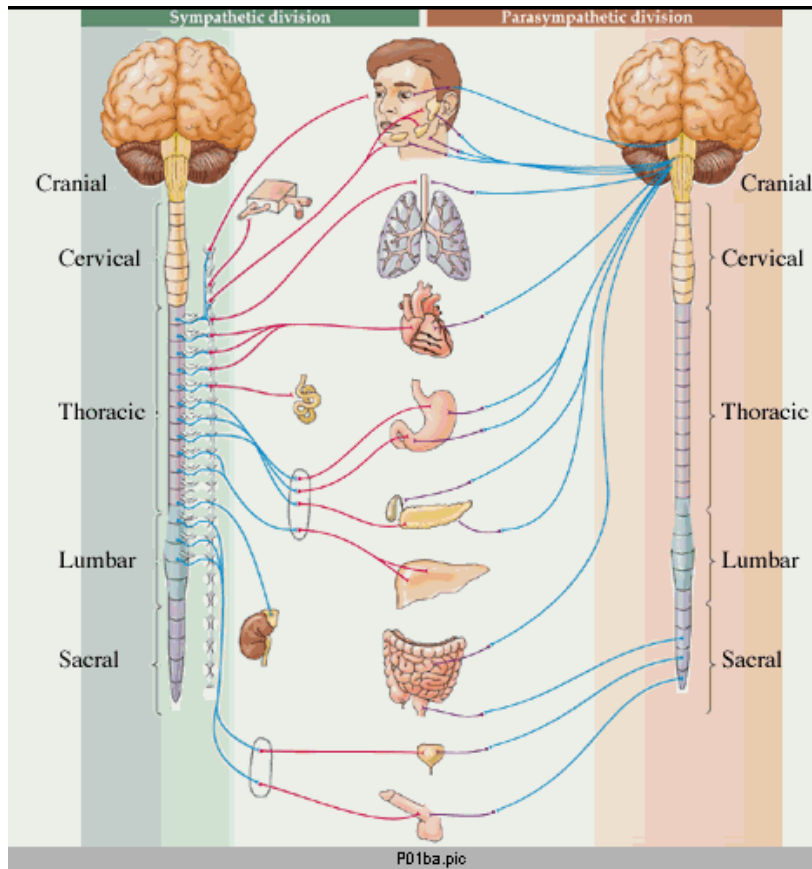
3. Optimizing Brain Function

- Caring for the Brain
- Nurturing the Student (& you) to Optimize Brain Function

4. Development of Thinking

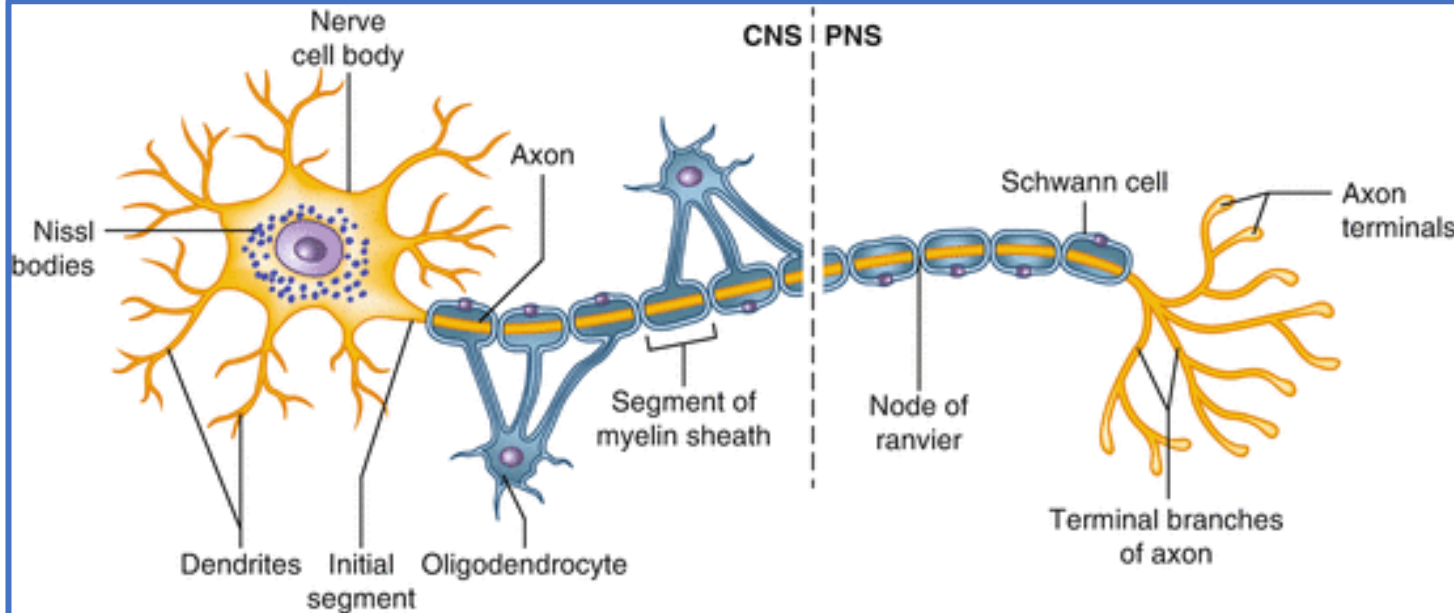
- Theory of Mind
- Impact on Social Comparisons & Self-Concept

Long-distance Axons Innervate Vital and Sensory Organs and Muscles

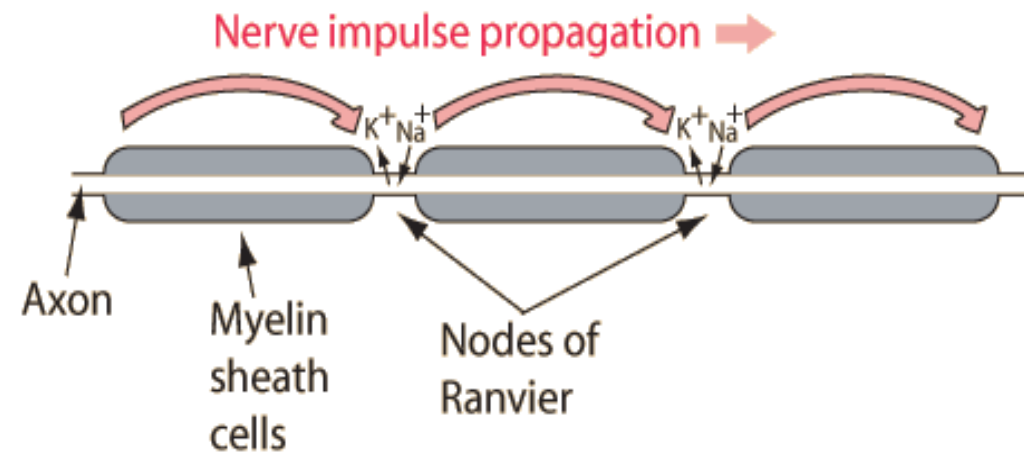


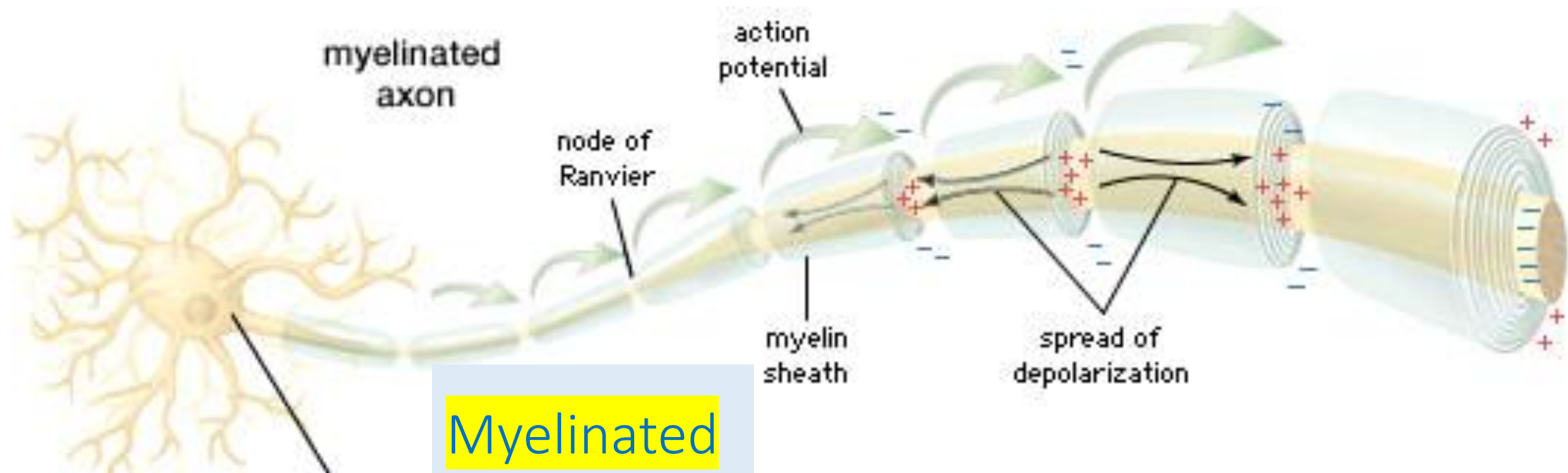
Where neuron's message-carrying arms are **wrapped in myelin**, messages go much much faster from one neuron to the next.

MYELINATION: Helper cells wrap a row of tiny **insulating blankets**, **myelin**, around the **axon** – the long sending arm of the neuron.



The result is like having an express bus for messages to travel the route to the next neuron, eliminating all the time-consuming stops between nodes.





With students pretend to be One AXON.
Line up and hold hands. Count off 1-7.

#7s, hold up the hand with #1.



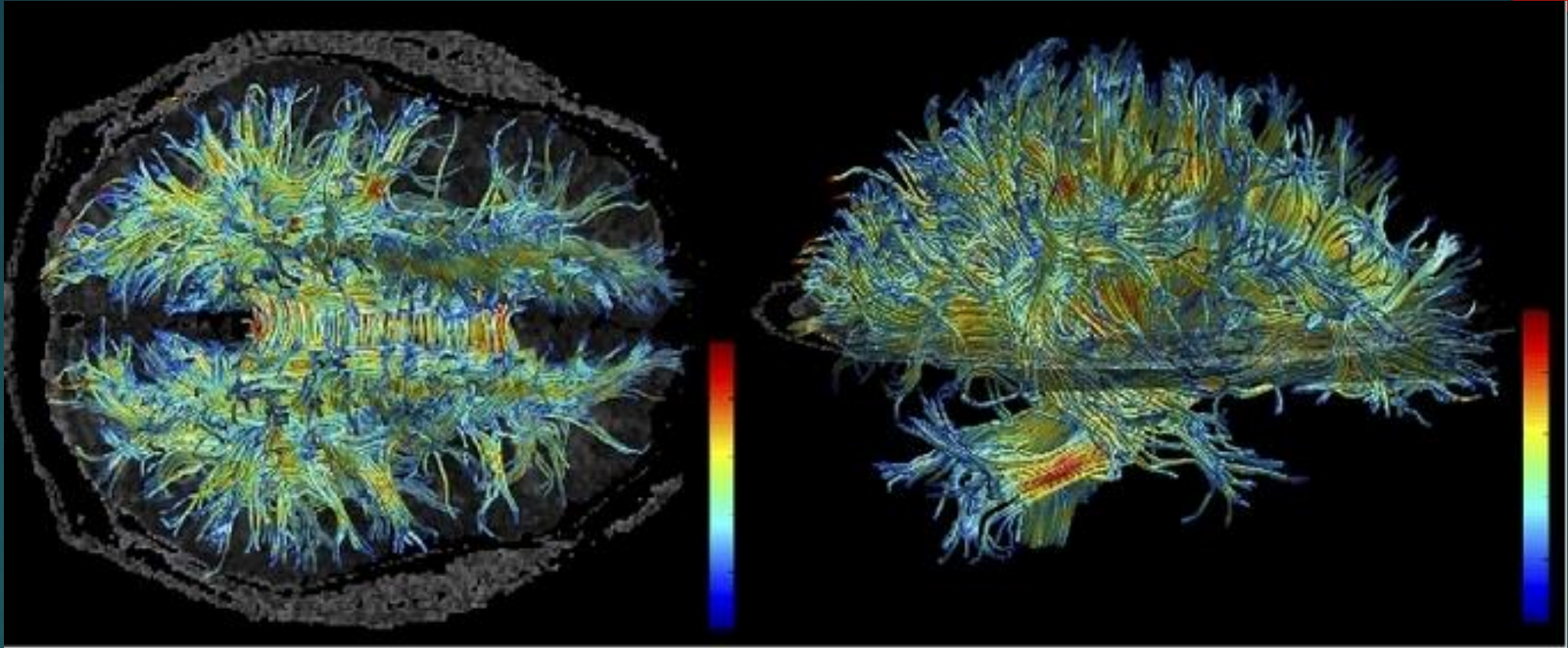
Unmyelinated: Start at left end, bell starts the squeezing of each hand in sequence until get to the bell at the other end .



Myelinated: Start at left end. When bell rings, hold up every 7th pair of #7-#1 hands in sequence until get to bell at the other end.

Myelinated axons may be 100 times faster than unmyelinated.

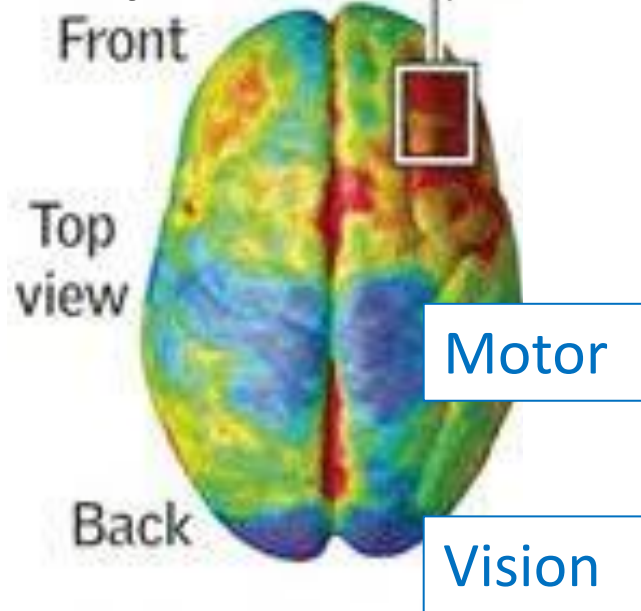
Myelinated Neurons in the Adult Brain



The body starts making myelin before birth. The Prefrontal Lobe, our executive center, is the last to be myelinated, completed at around 25 years of age.

5-year-old brain

Prefrontal cortex (“executive functions”)



Red/yellow: Parts of brain less fully mature



Blue/purple: Parts of brain more fully matured

Less myelin



More myelin

Age related myelin formation generally progresses inner to outer, & back to front, but axons of more necessary regions get myelin earlier.

Note good myelination of visual & primary motor cortex at 5 yrs.

Prefrontal cortex is myelinated last.

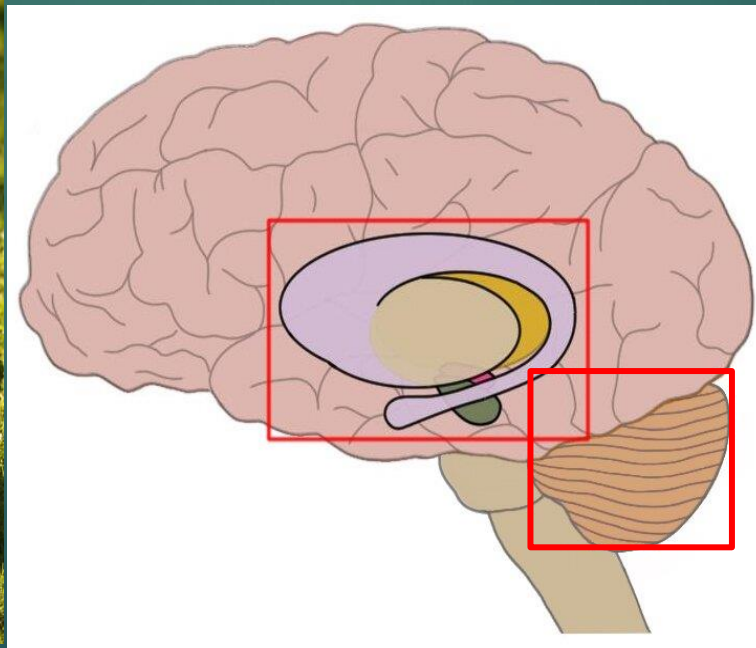
Thomas McKay | The Denver Post

Sources: National Institute of Mental Health; Paul Thompson, Ph.D., UCLA Laboratory of Neuro Imaging

How Increasing Myelination Helps Elementary Students

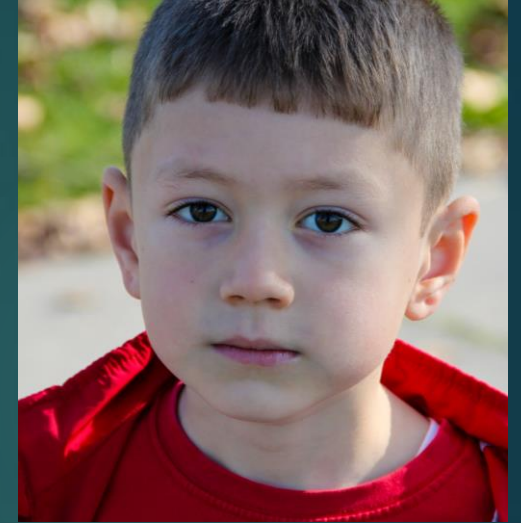
MOTOR SYSTEM

Early **myelination** of motor axons going from cerebellum & basal ganglia to muscles results in **increasing reaction times**.

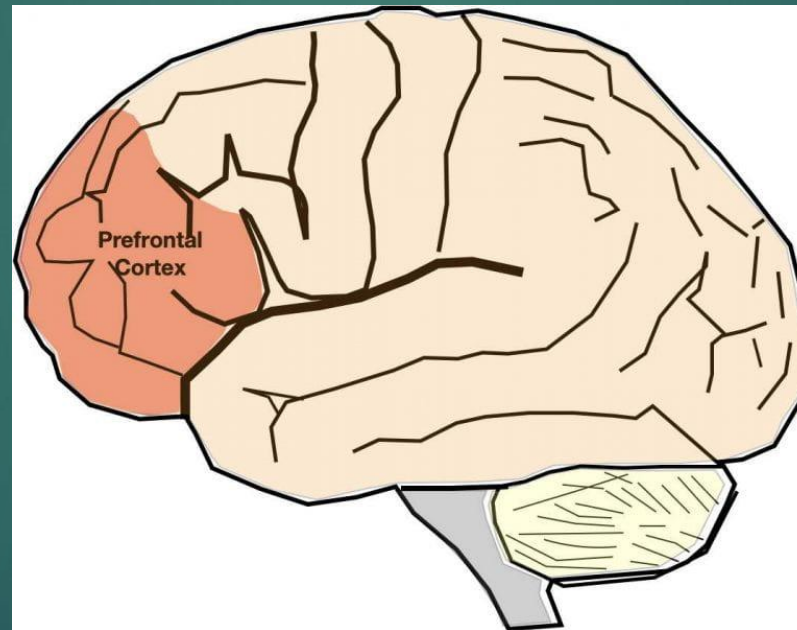


PREFRONTAL Lobe MYELINATION (later) → better mood modulation, planning, attention.

Less prefrontal myelin



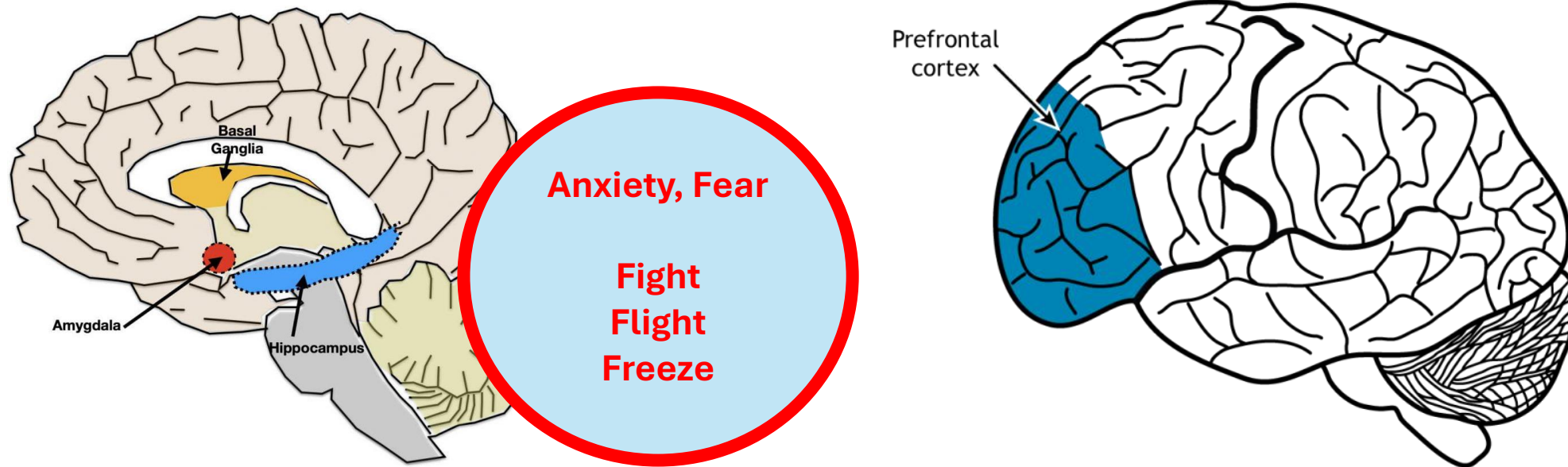
More prefrontal myelin



The limbic system, our emotional brain, is in the middle of the brain, **myelinated early.**



Myelination of the Limbic brain (EMOTIONS)
occurs much earlier than
myelination of the Prefrontal cortex (EXECUTIVE).



An efficient **prefrontal cortex** enables the **thinking** brain to get involved or take charge.

Increasing **prefrontal** myelin during grade school →
improving control of the emotional limbic system.



What does
the LIMBIC
SYSTEM
do?

Limbic system is responsible for **emotions** - experiencing, interpreting & responding to them - and **learning**.

Identifies threat and initiates response:

- Fear → fight, flight or freeze
- Sensory defensiveness

AMYGDALA

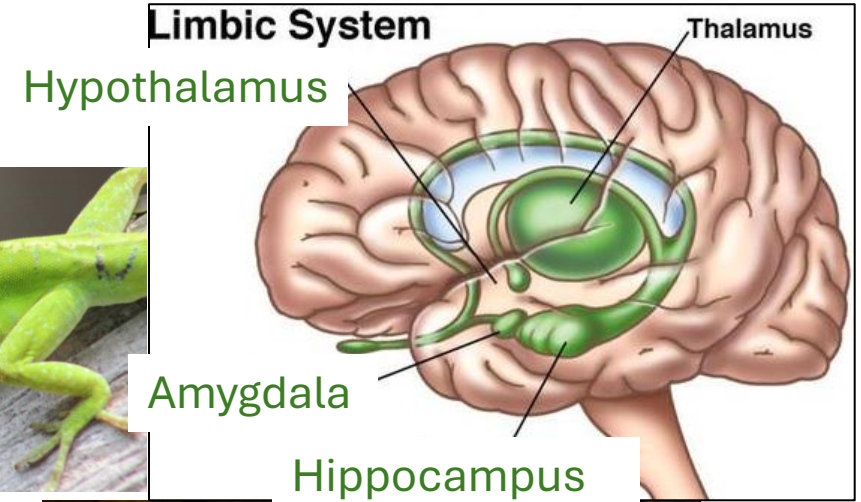


Emotional memory



HYPOTHALAMUS

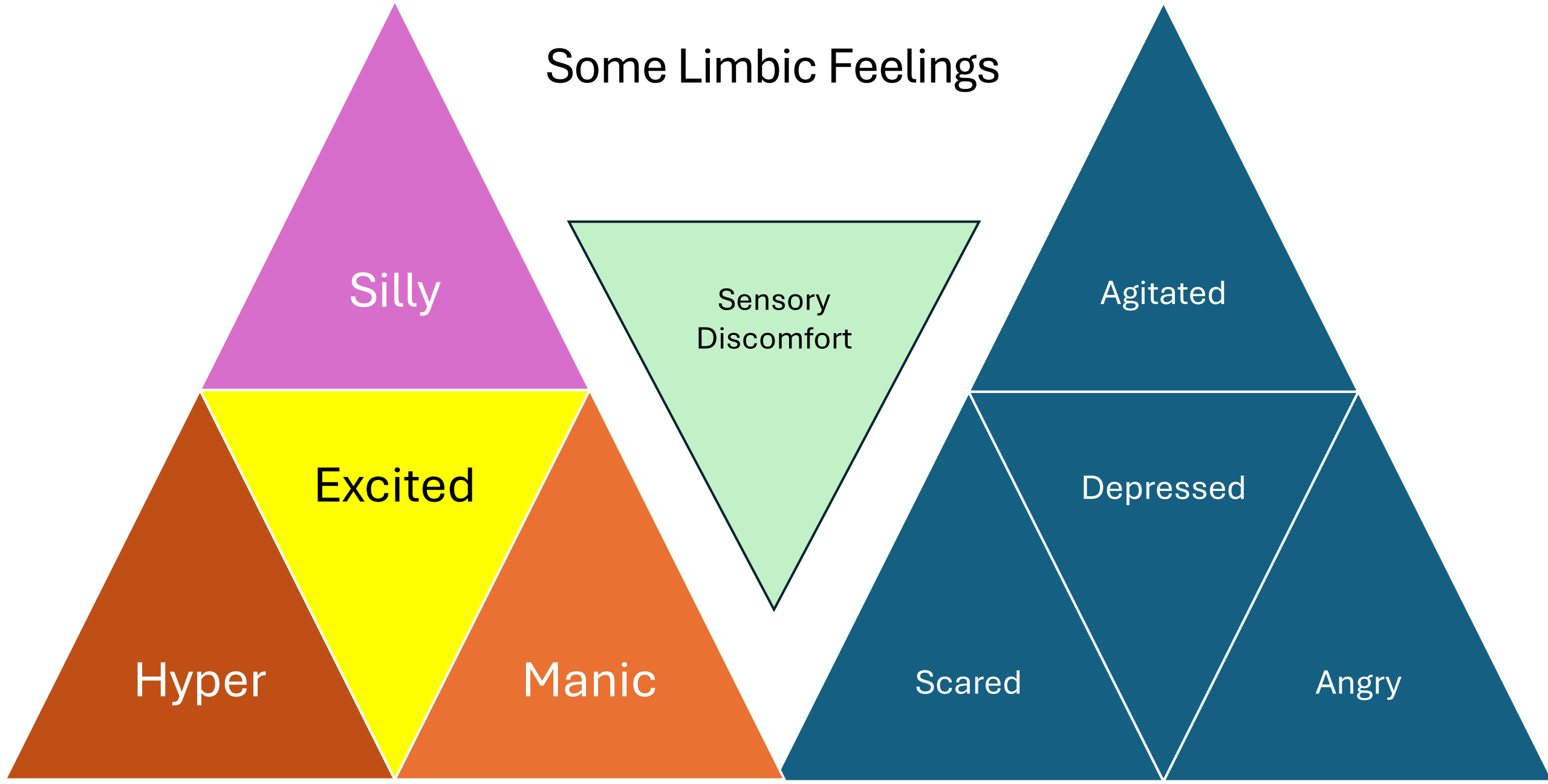
Hormonal and autonomic regulation



Learning

HIPPOCAMPUS

Some Limbic Feelings



Silly

Excited

Hyper

Manic

Sensory
Discomfort

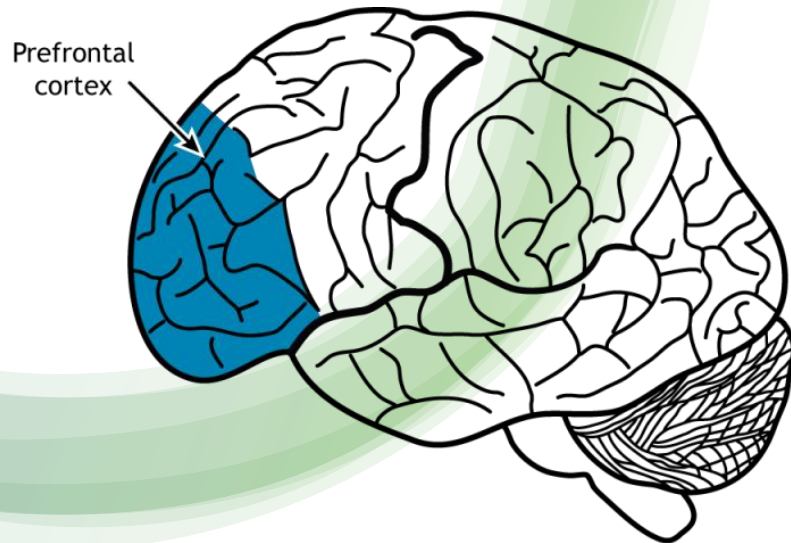
Agitated

Depressed

Scared

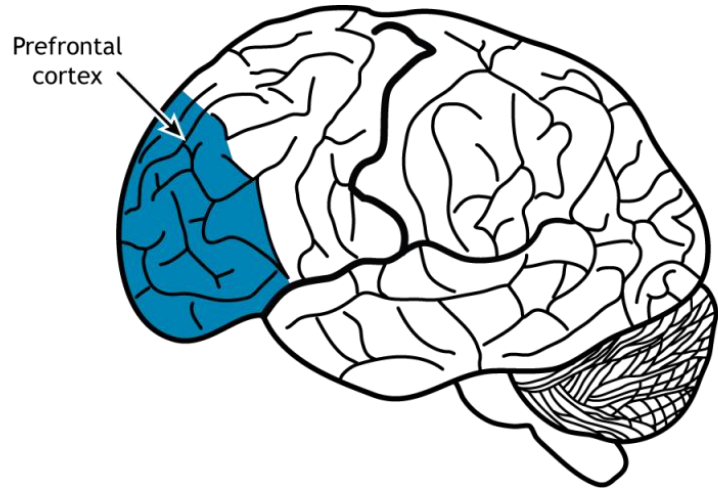
Angry

What does the
prefrontal brain
do?



Filters incoming stimuli.
(Sensory Processing)



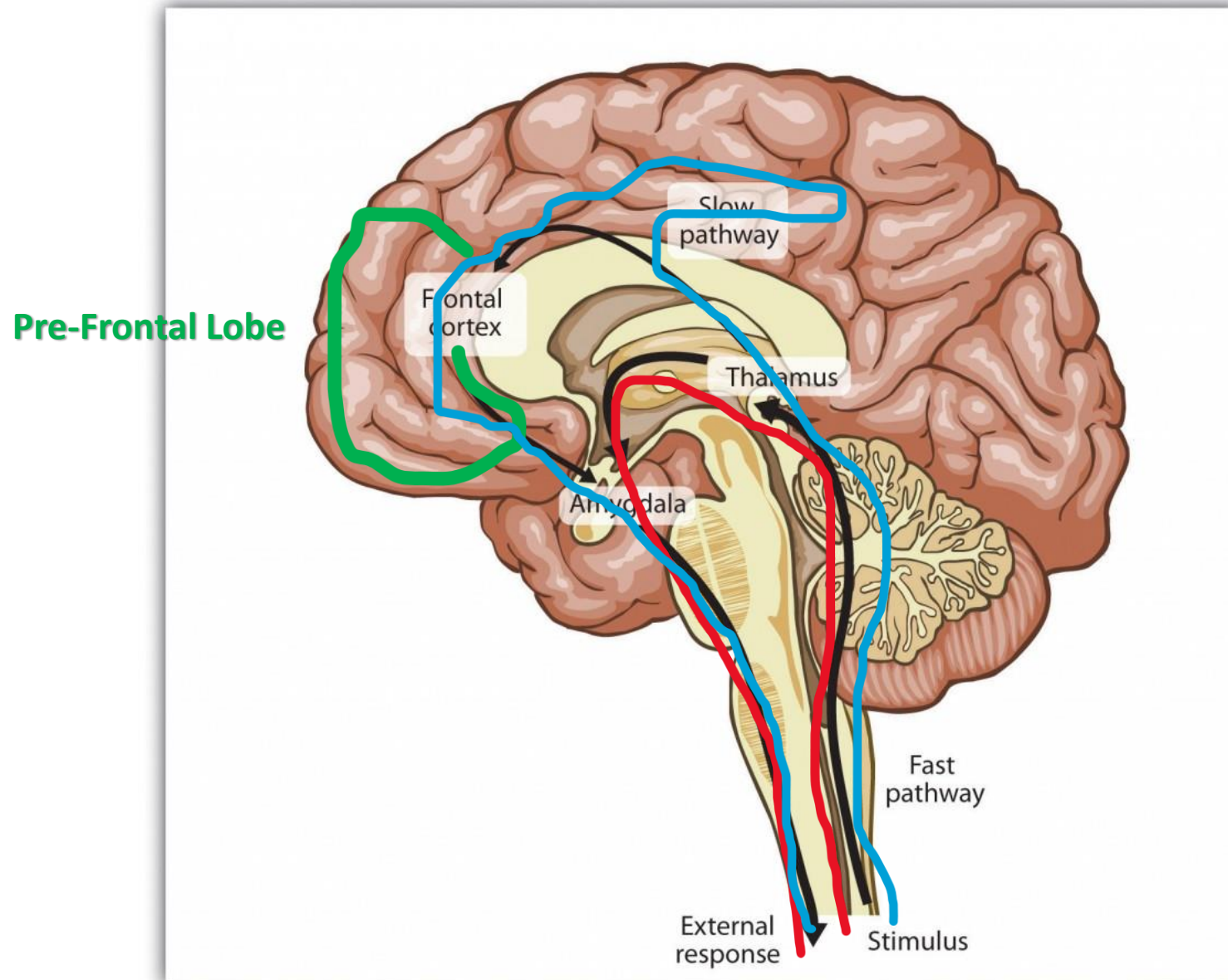


What does the prefrontal brain do?

It enables the thinking brain – the cortex – to be in charge of steering and braking.



Limbic vs Prefrontal Responses



- **More mature Prefrontal lobe (good brakes) enables controlled, thoughtful Cortical response**

UPSTAIRS BRAIN

DOWNSTAIRS BRAIN

- **Immature Prefrontal lobe (limited brakes & steering) results in rapid motor & emotional Limbic response.**

Downstairs Brain (Limbic: Fight- Flight-Freeze)



Upstairs Brain (With Prefrontal: Calms, solves problems)



With STRESS, Downstairs Brain hijacks Upstairs Brain

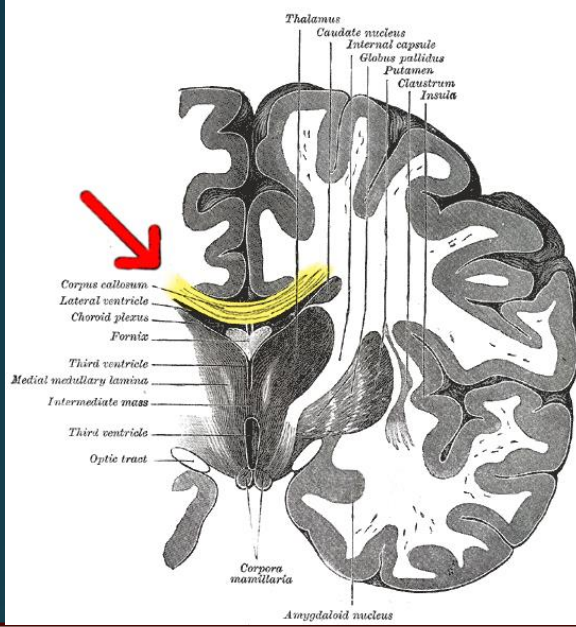


<https://resilienceandlearning.org/resources/how-stress-impacts-the-brain-with-the-wise-owl-and-barking-dog-analogy/>

“Explaining the Brain to Children and Adolescents, North Carolina Center for Resilience and Learning”

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0 – 2:37

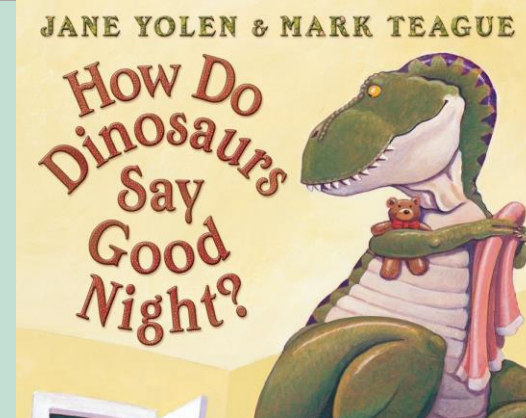


Myelination of the Corpus Callosum, which connects right and left brain, is important for speedy messaging to coordinate

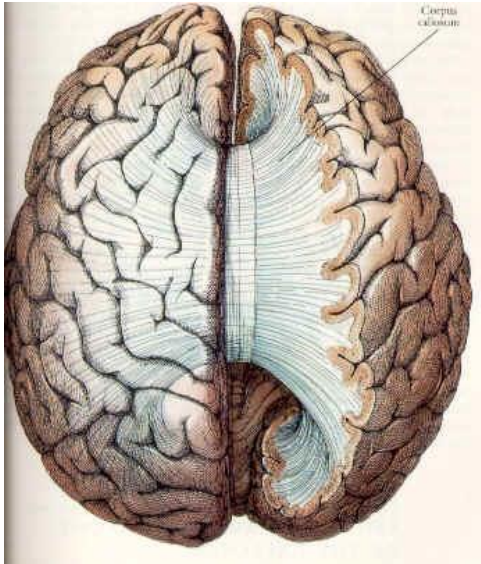
- fingers tying shoes and sewing
- arms and legs for sports
- vision for quickly identifying which way letters & numbers go.



was saw
bad dad



Corpus Collosum Myelination Powers R ↔ L Connections



Progressively **thicker myelination** of nerve fibers in the **corpus callosum**

results in much more efficient
right ↔ left
brain connections in cortex,

improving **integrated right-left motor coordination**
&
rapid information processing.

The Ability to Read is Dependent on Brain Maturation (Myelination)

Reading is a novelty in human evolution

- Brain adapts through “ ‘**massive interconnection**’ between all parts of the brain dealing with sounds, vision, comprehension, and so on – coordinated by the **prefrontal cortex**” & dependent on the **Corpus Callosum** for right - left “traffic”
- More regions of a child’s brain tend to be activated for a given task, requiring more interconnections.

Increasing myelination of the Prefrontal Lobe and the Corpus Callosum is essential for reading.



Reading & Math require selective & focused attention and directional & sequential distinction

- 6 9
- b d
- p g q
- saw was
- bad dab deb bed
- he was was he
- $9 - 6 = ?$ $6 - 9 = ?$
- carrying & borrowing



$$24 + 39 = 63$$

Learning reading and math is possible with:

Instruction

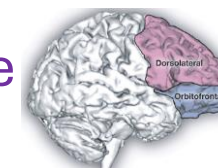
- mentors drawing attention to the distinctions and directional differences,

Attention

- greater myelination of the **Prefrontal lobe** with improved executive function &

Lateralization

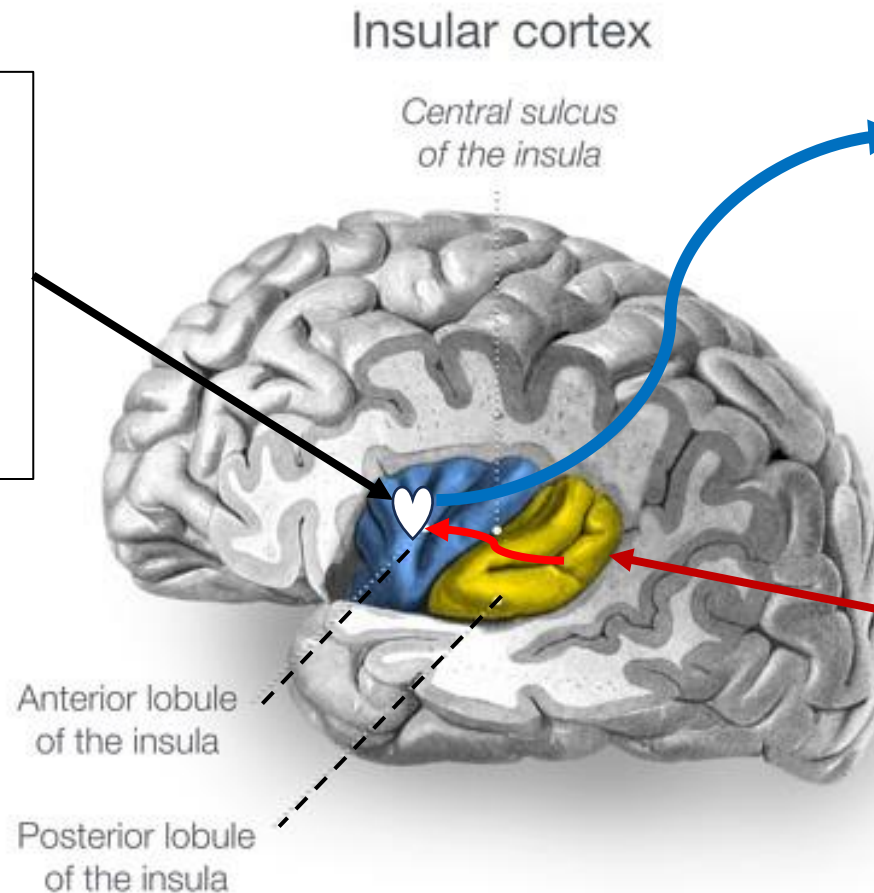
- greater myelination of **Corpus Callosum** and maturing lateralization of cortex .



Myelination of the Insula Facilitates Self-Knowledge, Empathy & Self-Management

Information related to emotion, motivation and cognition from amygdala, prefrontal cortex and other cortical and subcortical regions.

Self-awareness, as subjective feelings are introduced into higher cognition and motivation.



INTEROCEPTION
Sensory information from body states

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5538352/>

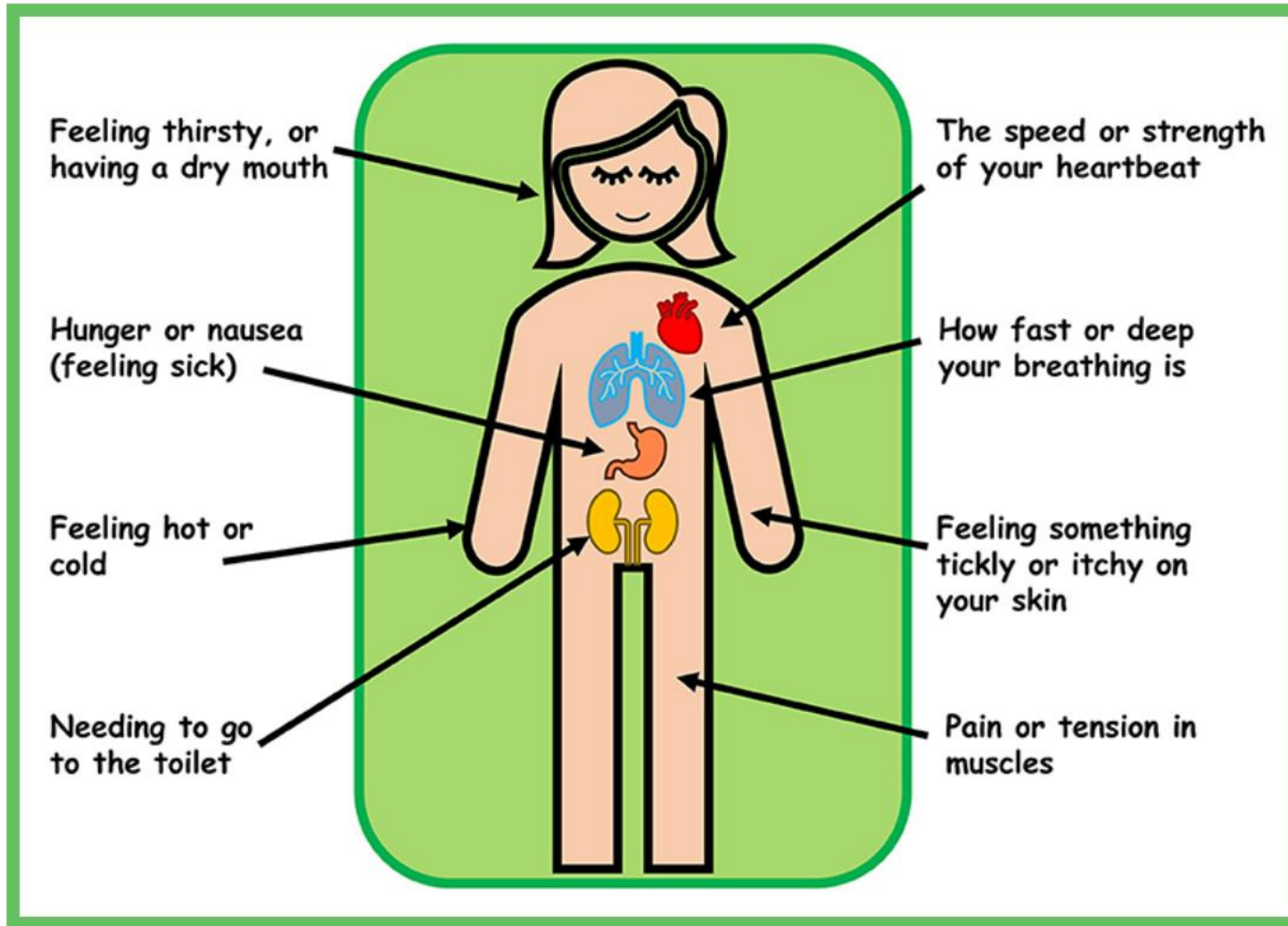
Namkung H, Kim SH, Sawa A. The Insula: An Underestimated Brain Area in Clinical Neuroscience, Psychiatry, and Neurology. Trends Neurosci. 2017 Apr;40(4):200-207. doi: 10.1016/j.tins.2017.02.002. Epub 2017 Mar 15. Erratum in: Trends Neurosci. 2018 Aug;41(8):551-554. PMID: 28314446; PMCID: PMC5538352.

This Photo by Unknown Author is licensed under [CC BY-SA-NC](https://creativecommons.org/licenses/by-sa/4.0/)

Adapted from illustration from "Cocaine: Toxicology and Abuse of Human Anatomy" 1900, now in the public domain.



INTEROCEPTION – feeling myself



What is Interoception and Why is it Important?

- Barker M, Brewer R and Murphy J (2021) What is Interoception and Why is it Important?. *Front. Young Minds.* 9:558246. doi: 10.3389/frym.2021.558246

Myelination of the Insula & Prefrontal Lobe Facilitates Identifying and Thinking About Feelings

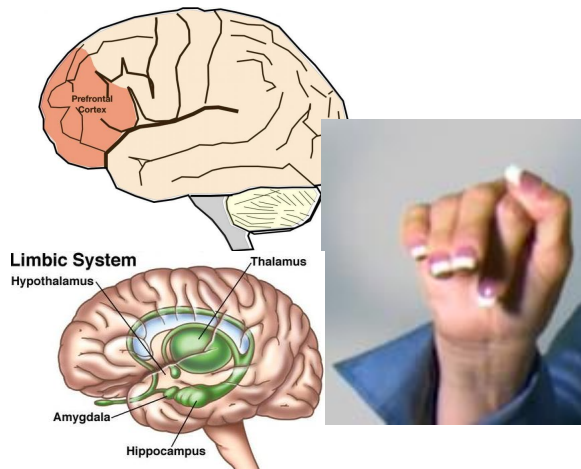
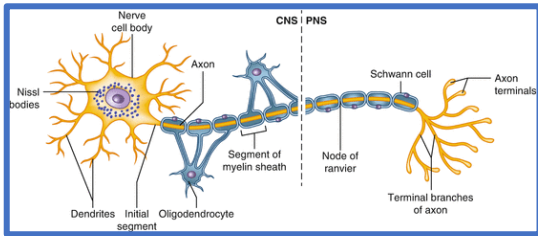
The insula is situated near the middle of the cerebral cortex, so its myelination is well underway during elementary school. Thus we can --

- Talk about “them” (characters in stories):
 - How are they feeling?
 - Why?
 - What is the result?
 - How can feelings be changed?
- Talk about “you”:
 - What do your arms feel like when you feel angry?
 - When your stomach feels queasy, do you feel brave or nervous?
- Self-understanding facilitates empathy.



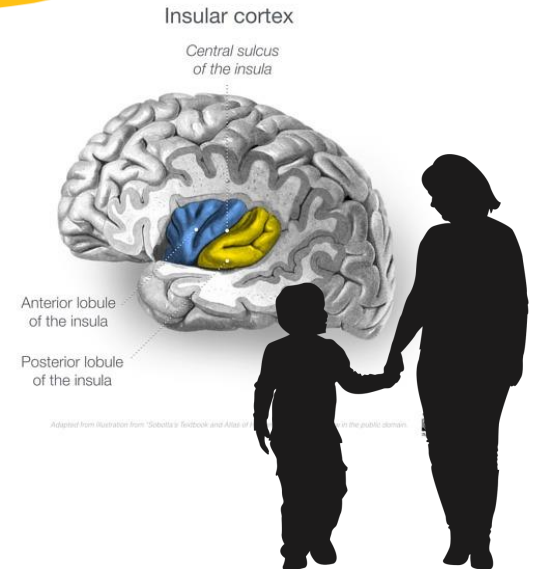
Questions about increasing myelination related to

- a) speed and function
- b) prefrontal Upstairs brain vs limbic Downstairs brain
- c) Right-left sequencing & reading
- d) insula and self-awareness



He was the god who saw taf.

He saw the dog who was fat.

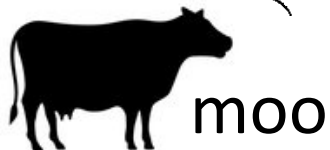
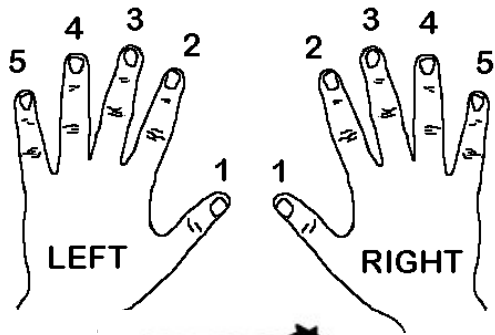


2. *SYNAPSES & LEARNING*

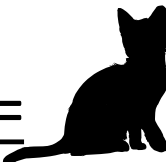
Every year, children's Motor and Cognitive (thinking) **Reaction Times to respond are Faster**

Because:

1. More nerves have **myelin**.
2. **Practice** makes responses **automatic**.
3. **Knowledge base grows**.



$$\underline{5+7 = 12}$$

cat = c a t = 

Harry Potter
& the
Sorcerer's
Stone

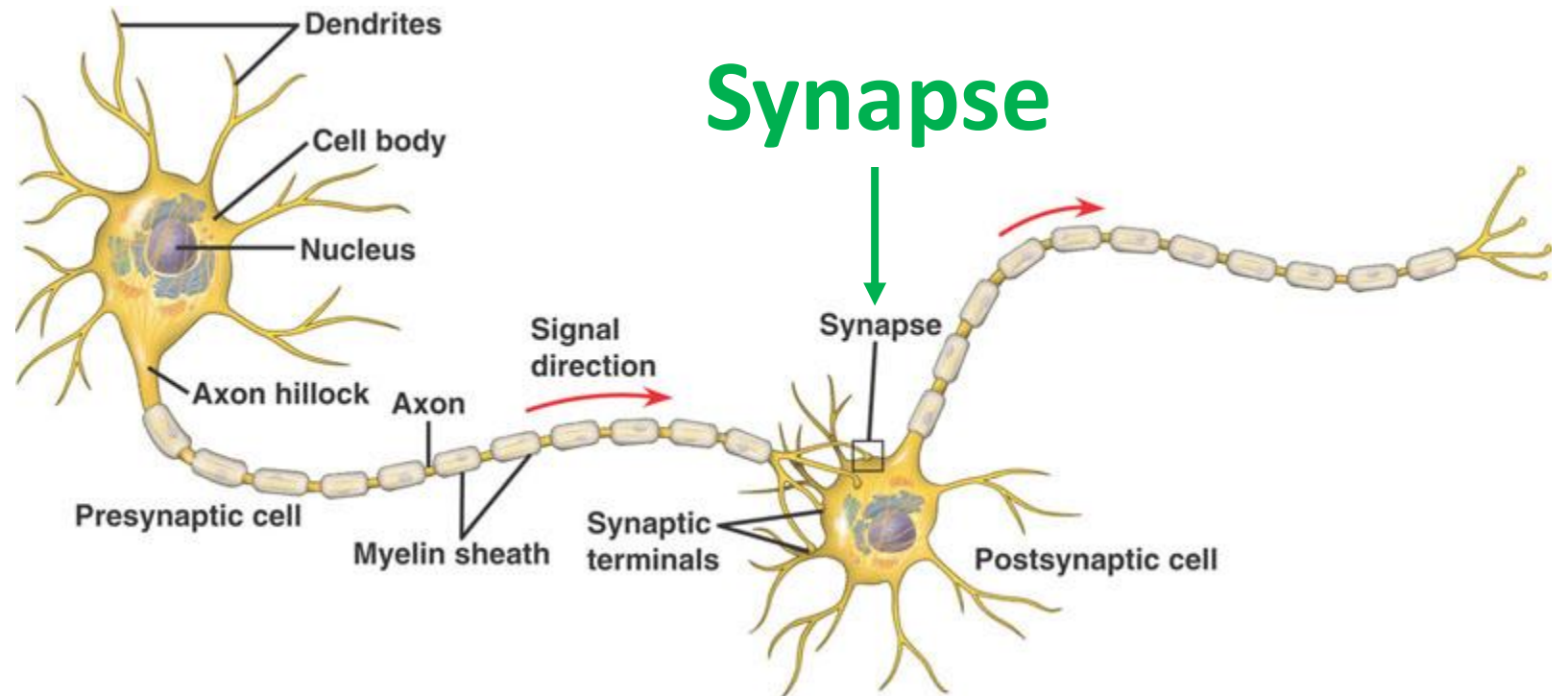
$$\begin{array}{r} 422 \\ 6 \overline{) 2532} \\ \underline{24} \\ 13 \\ \underline{12} \\ 12 \\ \underline{12} \\ 0 \end{array} \text{ YIKES!}$$

Automatic:

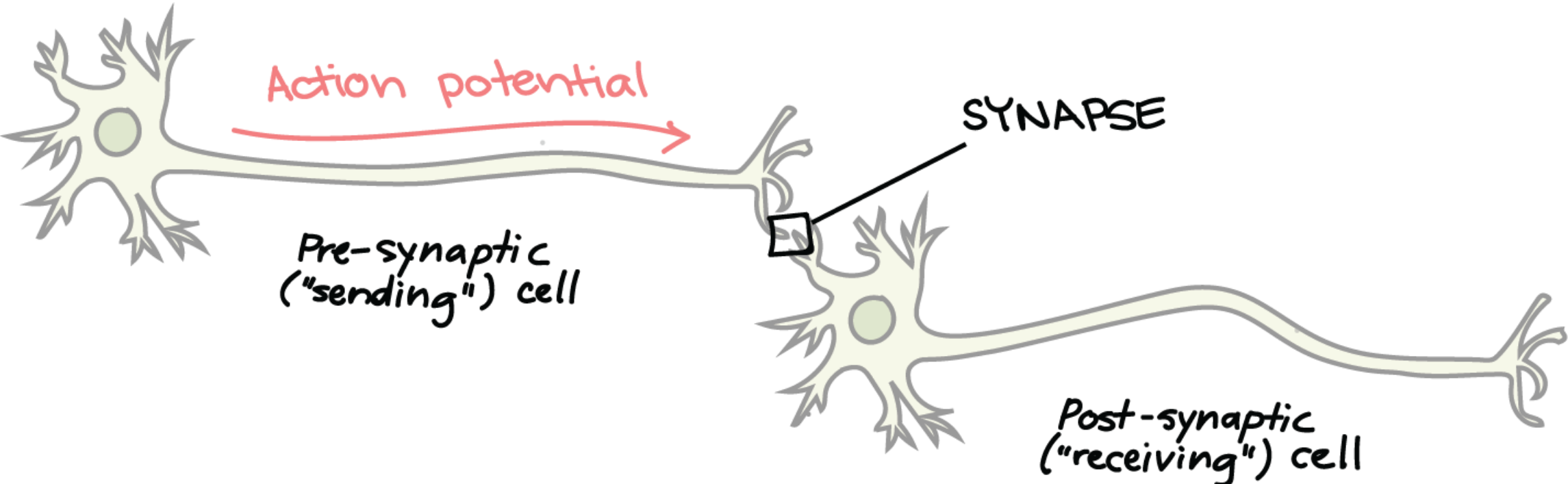
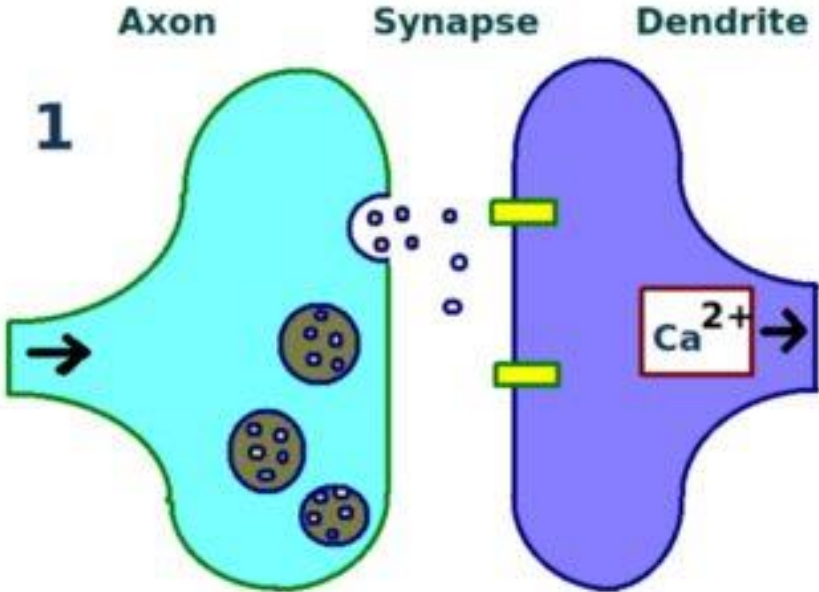
When you've done the same thing over and over (practiced), it becomes AUTOMATIC because of a change in the SYNAPSES.

Synapse:

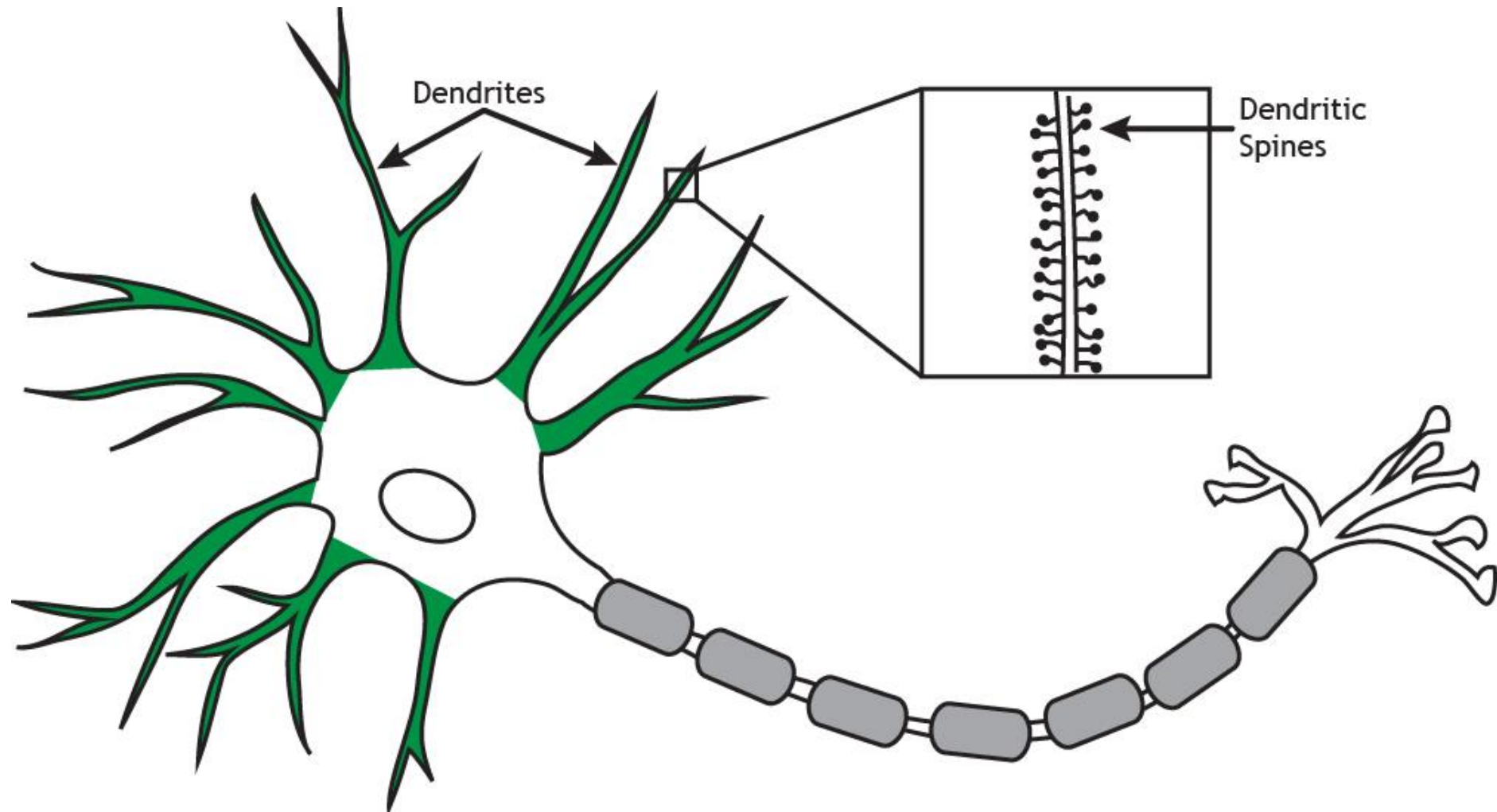
The **Synapse** is where the axon from one neuron meets and can send messages to a dendrite of the next neuron.

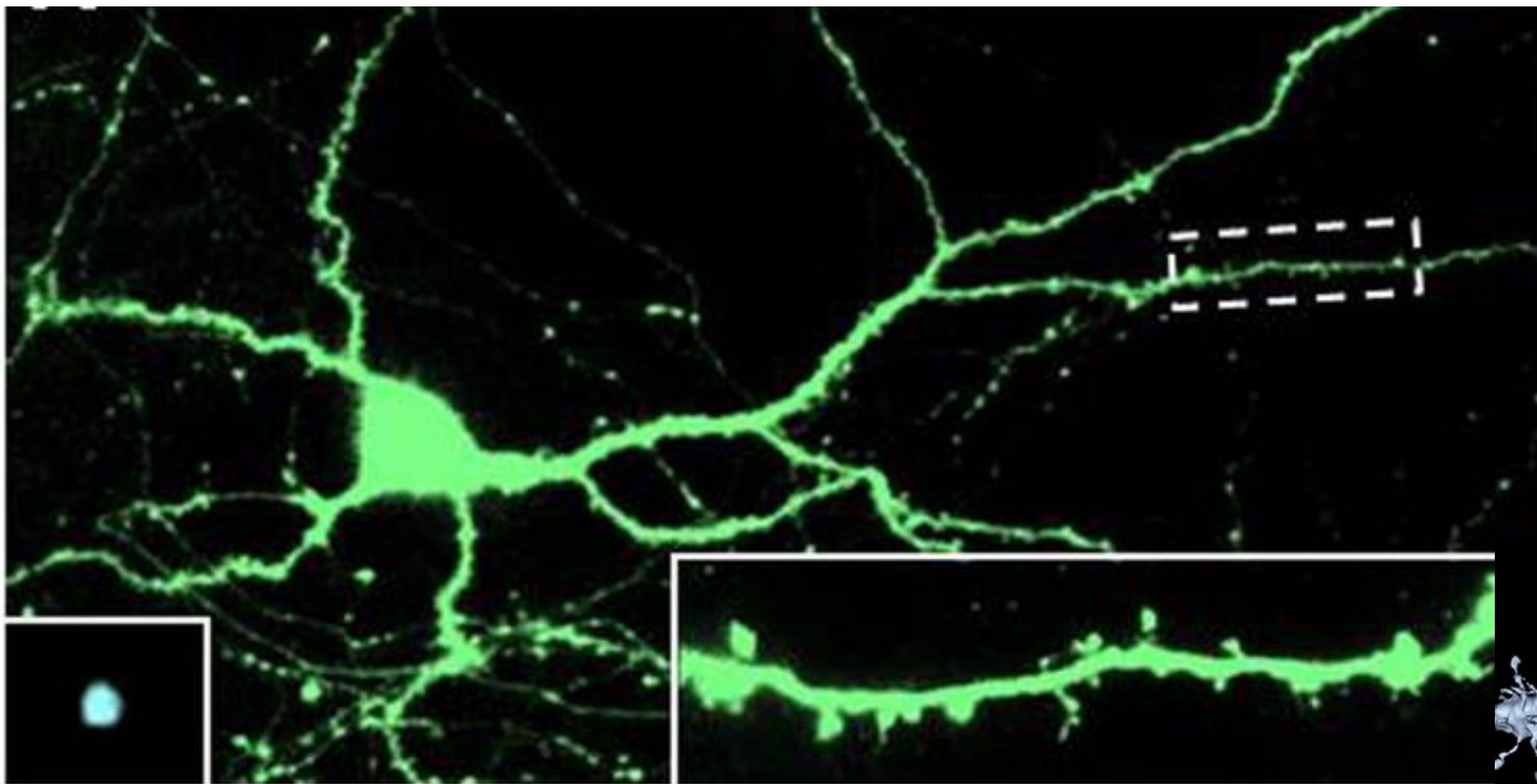


Neurotransmitters:
Chemicals carrying
the message
across the synapse
to the next neuron.

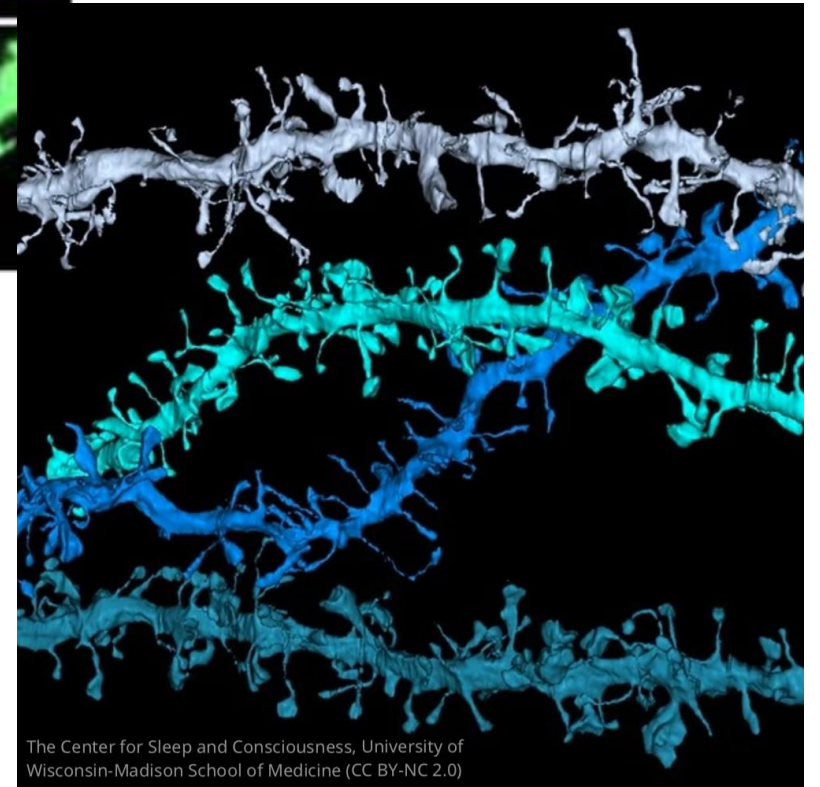


The dendrites of a given neuron may have many hundreds of dendritic spines that can each receive a synapse.





There are enough dendritic spines in the brain for over a trillion synapses!



Synapse Formation correlates with use.

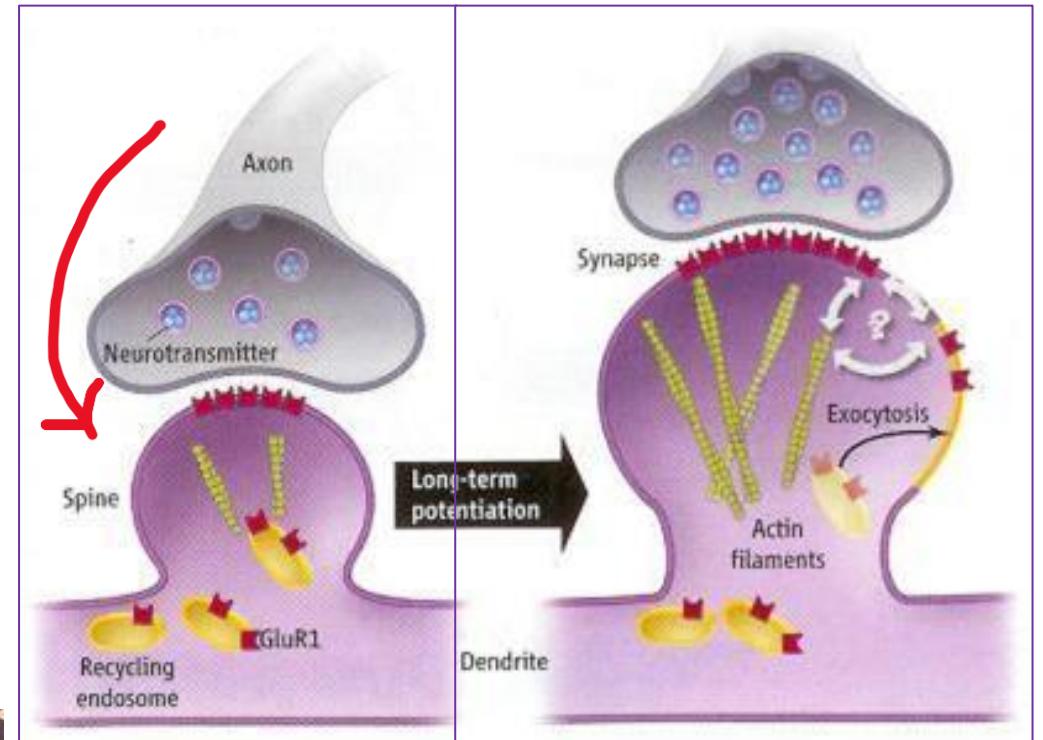
Repeated use (neurotransmission) changes the synapse structure and function

The structure of the dendrite receiver changes.

The synapse is changed from a temporary to permanent connection.

It is now **AUTOMATIC.**

Kopec, C. and Malinow, R. 2006. Science. 314: 1554-1555



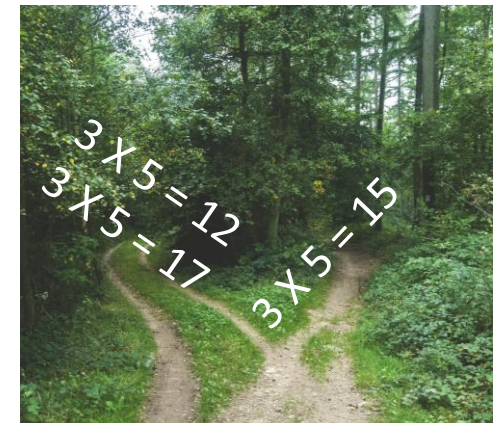
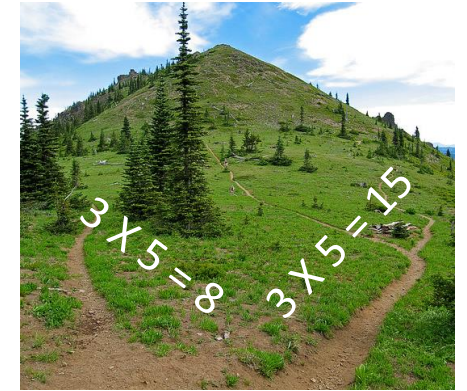
$$3 \times 5 = 15$$



“Practice makes permanent.”

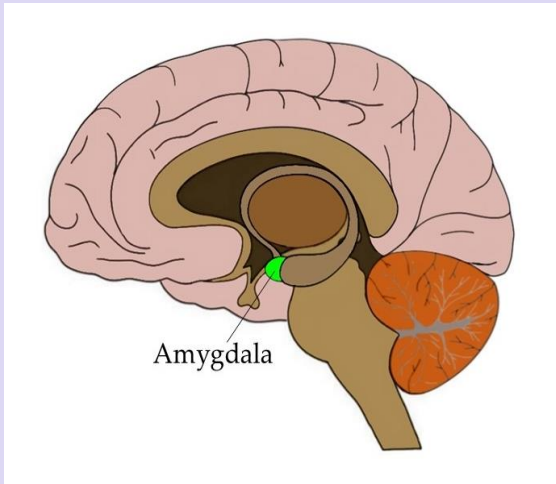
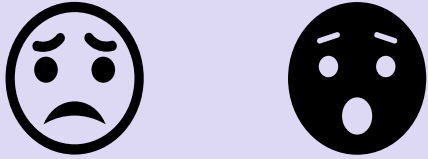
Making sure that 3×5 is always 15

- Each time you walk across a field of grass the grass lays down. If you repeat, it stays down and eventually there is a path. To form a path from A to B, always go the same best way.
- Every time you walk the wrong way, the wrong path starts to form.



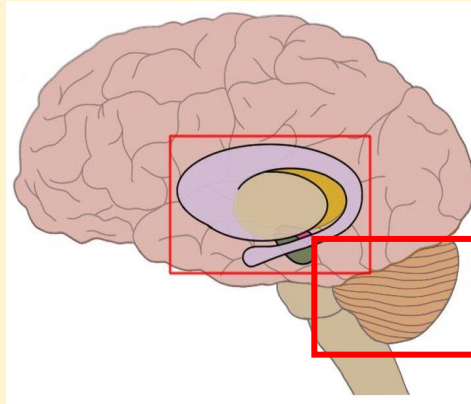
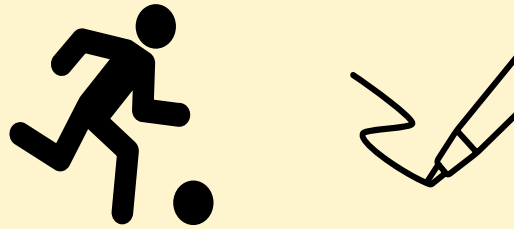
Remembering: 3 kinds, 3 ways

Emotional Memory



Amygdala

Motor Memory

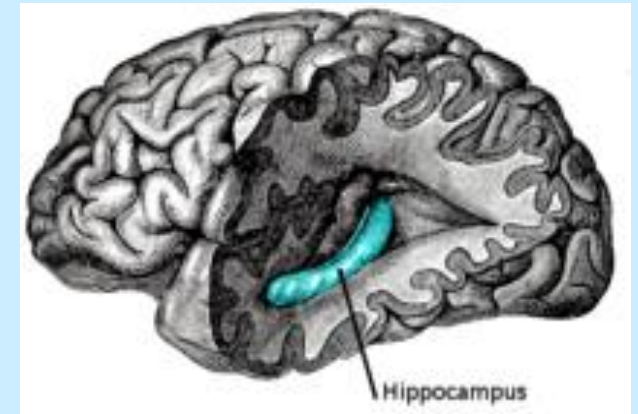


Cerebellum &
Basal Ganglia

Explicit Memory

$5+7 = 12$

The Constitution is --



Hippocampus

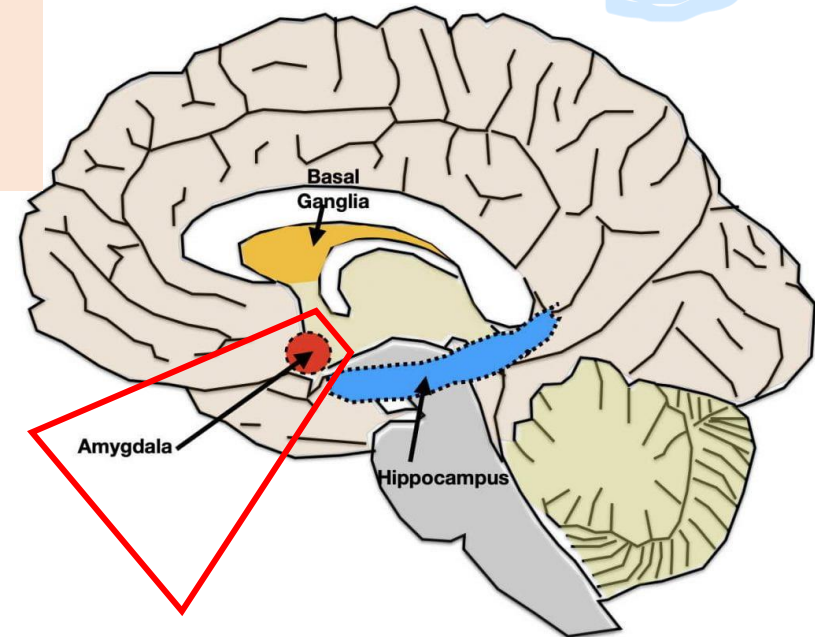
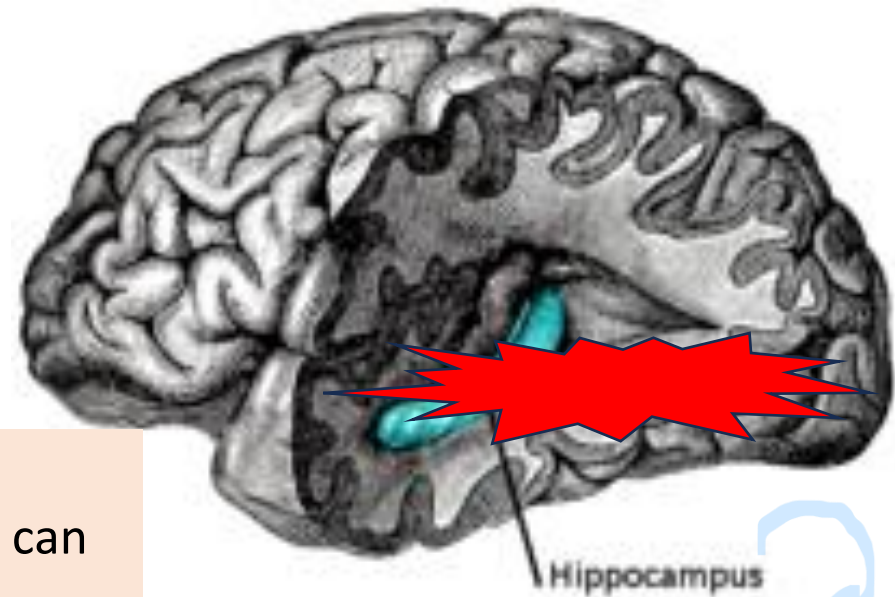
INFORMATION PROCESSING

Hippocampus forms the memories of knowledge and connects new information with existing knowledge.

The Amygdala, forming emotional responses and memories, is adjacent.

TOXIC STRESS activates the Amygdala & compromises Hippocampus function!

But: **Minor** stress can **activate** the hippocampus, **enhancing** memory storage.



We're going to play a short
auditory memory game.

Please don't write down your responses
until I say "now".

What was the first sentence about?



What was the second sentence about?



Which sentence was easier to remember -
The first (19 words) or the second (14 words)?

Why?

Here are the answers.

A. Samantha wanted the larger wallet but did not have enough cash, so she decided to use her credit card.

It's easy to remember the sequence using visualization, word knowledge, & identification with the experience. Your knowledge base has a "basket" with this stuff.



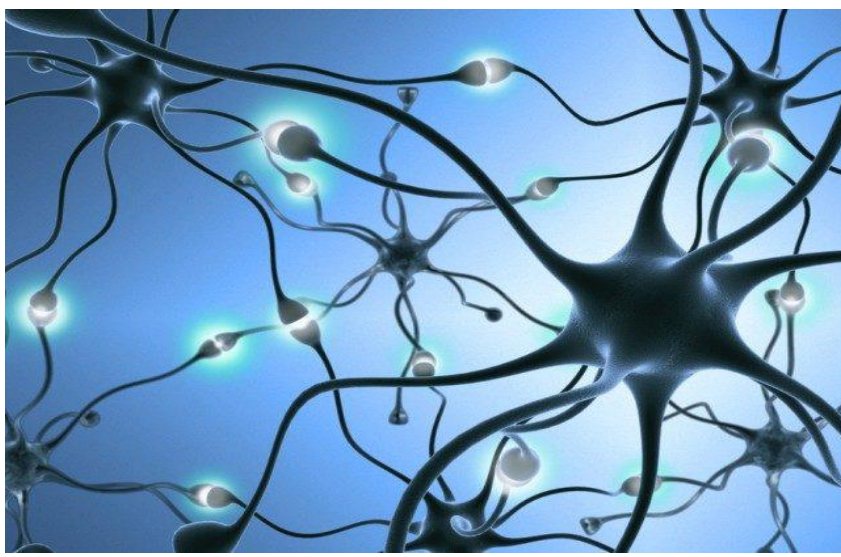
B. Dallas Abbot of the Holocene Impact Group identified the Mahuika crater near Steward Island.

This is most likely all new to you, not part of your knowledge base. Since you don't have any "basket" for it, it's much harder to remember it.

One's
Knowledge Base
provides baskets which
help hold and integrate
new information.

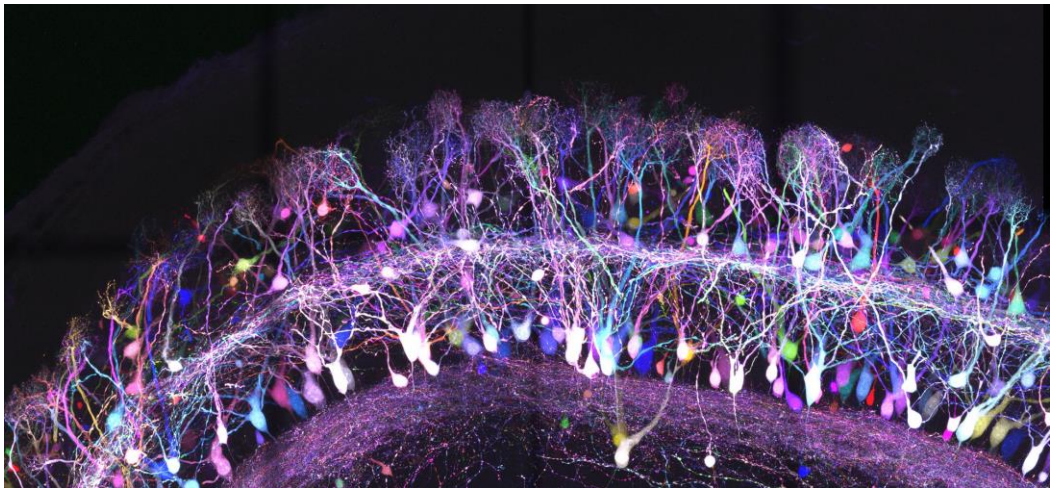


**The more you have learned,
the easier it is to learn more.**



Billions of synapses

connect neurons through their short and long-distance axons,



LEARNING

building interconnected baskets of knowledge.



NEW INFORMATION

Sense it

- Hear it
- See it
- Feel it

Connect



Pay Attention

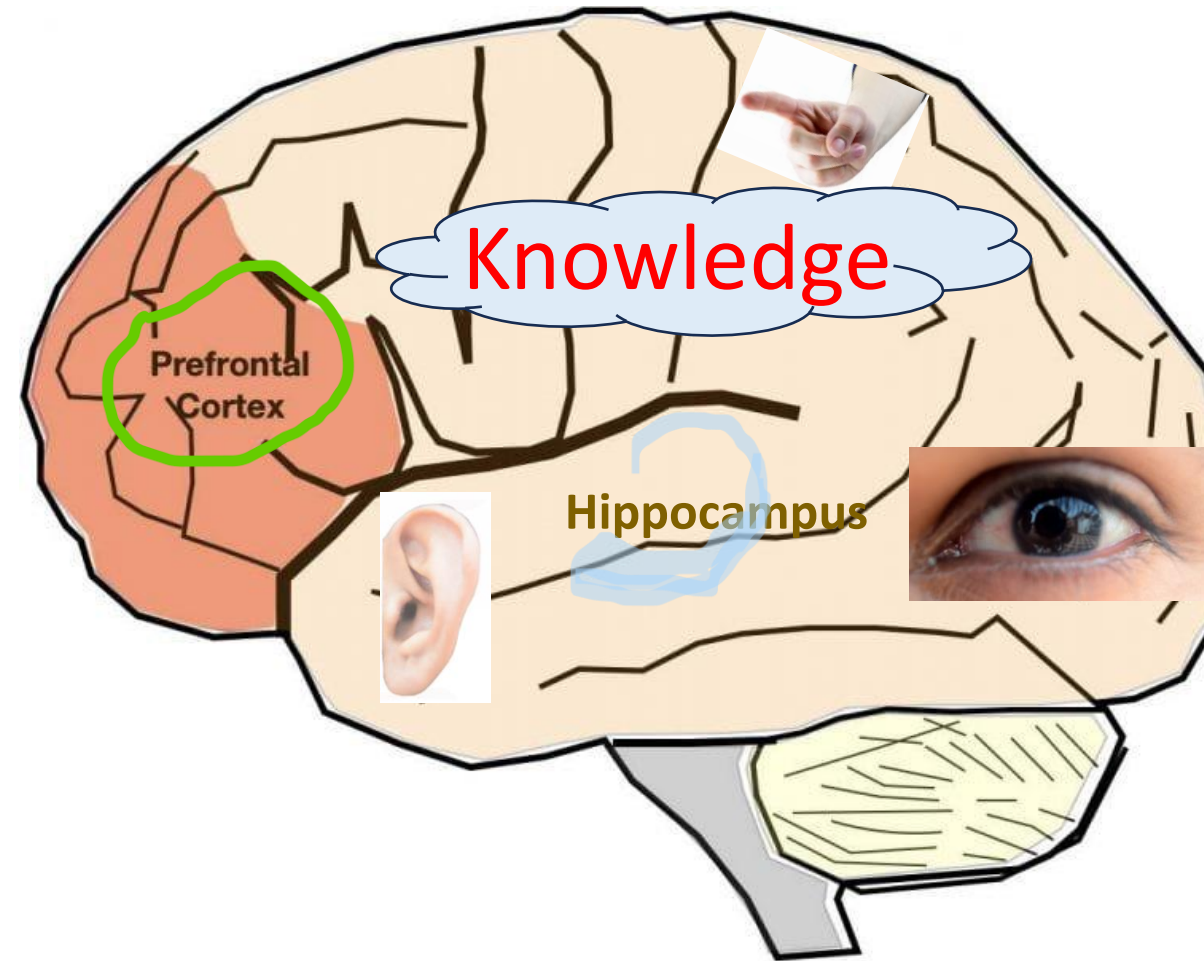
- Pay attention
- Be willing and interested
- Be healthy and rested
- Not be depressed, stressed or distracted

Study it

- **Relate it: to what you already know, to a picture or an experience.**
- Repeat it, copy it.
- Change it: Draw, diagram or sing it.
- Explain it to your grandparent or sibling.
- Use it!

Now You Know It

Growing Knowledge



Learning energizers that make it easier to master new information:

- Knowledge base /past experience
- Current opportunity
- *Personal motivation, enhanced when*
 - personal connection,
 - emotionally impactful,
 - identified as priority,
 - involved.



- How have personal motivation enhancers assisted your learning from talks this summer?
- What ways do you enhance personal motivation of your students?

How does **stress** impact learning?

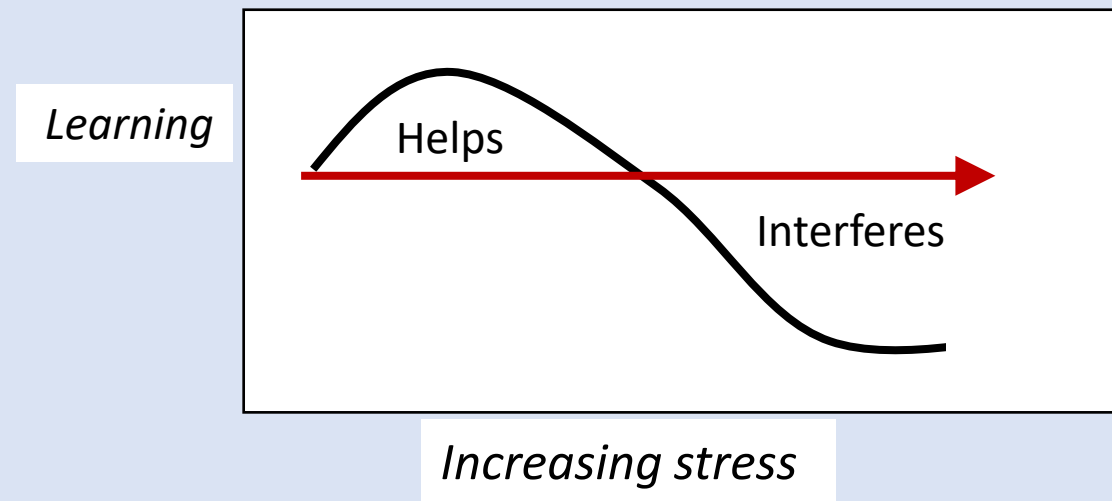
Stress causes release of noradrenaline, adrenaline and cortisol.

At low stress doses,

- adrenaline and noradrenaline increase **alerting** and **focus**
- cortisol increases **glucose** available for the cell activity of learning.

When toxic (more, longer):

- Cortisol results in
 - **depletion** of glucose stores
 - **compromises** synaptogenesis.
- Adrenaline and noradrenaline trigger **fight-flight-freeze** response.



A little stress helps learning.
Too much or too long, interferes.

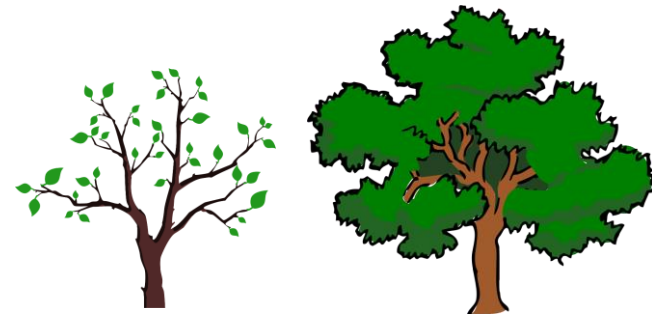
Anxiety, Fear

Fight
Flight
Freeze

Are people BORN SMART

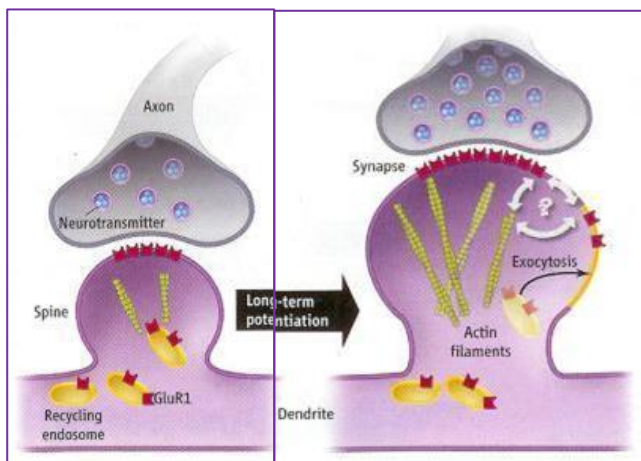


or do they GROW SMART?



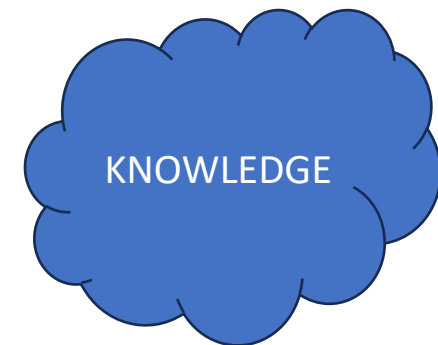
Remember:

Practice converts temporary brain connections (synapses) to permanent ones.



Pay attention. You grow your stored knowledge by

1. Exposure
2. Interest, Motivation
3. Active Engagement, Strategies



The more you learn, the bigger your knowledge base, the easier it is to understand and learn more.



The understanding that you grow your brain is called “**growth mindset.**”

Believing you won't ever be able to learn something is called a “**fixed mindset**”.

*If you hear a
fixed mind set
voice saying
“**I can't do it**”,*



*talk back with your
growth mindset voice,
“**yet!**”.*

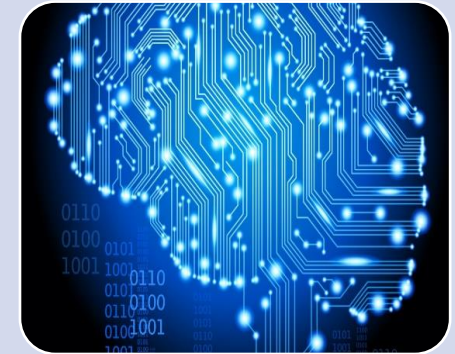
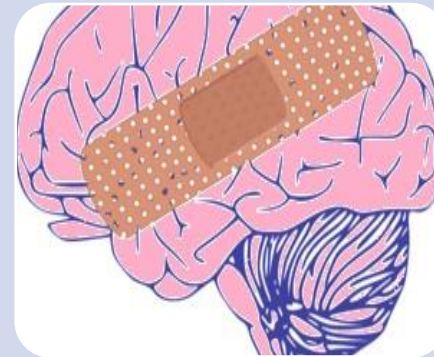
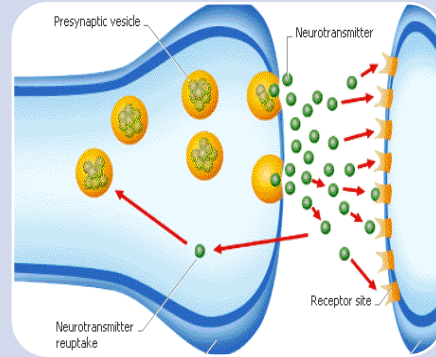
Who has a fixed mind set?



Who has a growth mind set?

Varieties of Developmental Psychopathology

But ---
brains are
not all the
same, and
some brains
make school
harder.



Problem of
**Neuro-
transmitters:**

ADHD
Anxiety
Depression
Bipolar

**Local Brain
Problem:**

Learning Disability
Fetal Marijuana
Cerebral Palsy
Stroke
Post-Trauma

**General Wiring
Problem:**

Fetal Alcohol
Lead poisoning
Down's Syndrome
Autism
Fragile X

Medication can increase or decrease the quantity of or responsiveness to a particular neurotransmitter.

PREDICTOR OF SUCCESS?

Per research by Angela Duckworth,
the most successful people have--

GRIT:

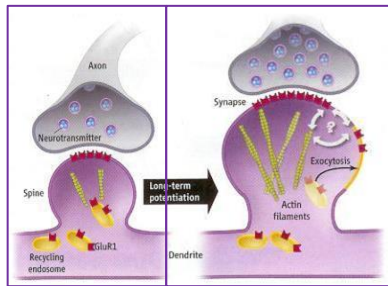
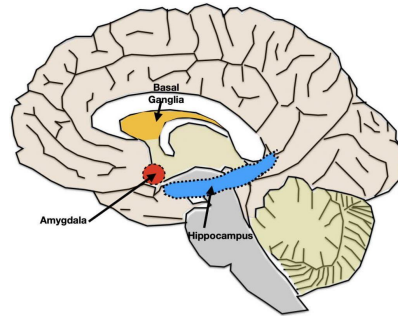
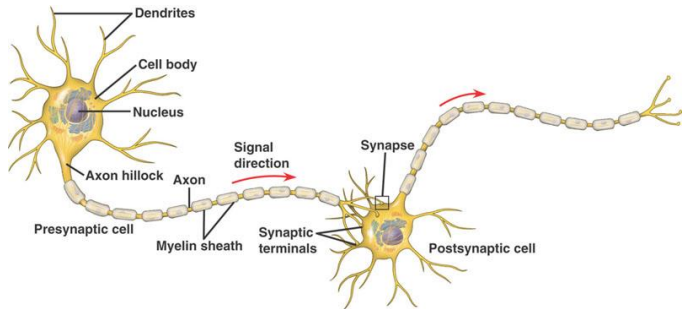
The sustained application of
effort
toward a long-term goal.

- **Ability x Effort = Skill**
- **Skill x Effort = Achievement**

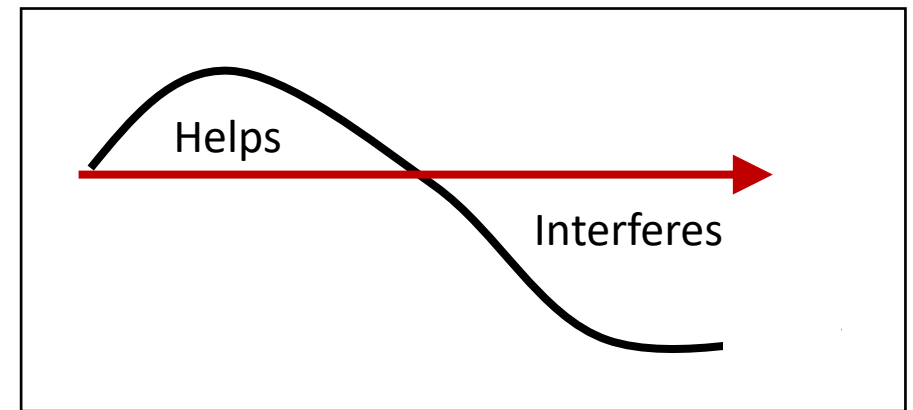


Questions about Synapses and Learning?

- a) Practice makes permanent
- b) Knowledge & learning
- c) Growth mind-set
- d) Stress vs learning



Learning



Increasing stress

3. Helping Brains Thrive

a) Caring for the brain

b) Nurturing student & self

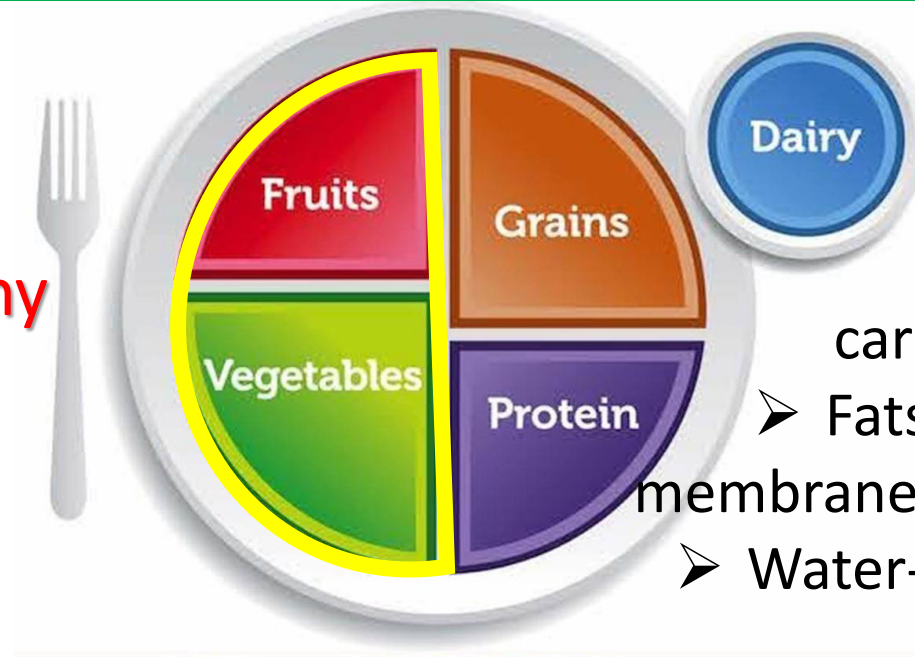
c) Stress & resilience

3.a. The Brain needs:

Safety,
security,
nurture.



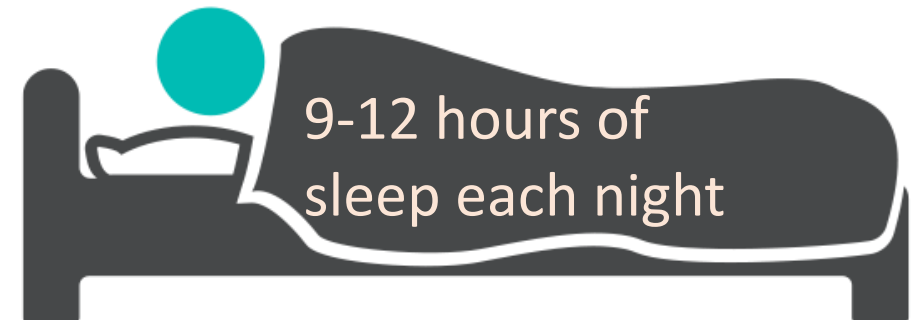
Healthy
Food



- Protein.
- Complex carbohydrates.
- Fats for neuron membranes & myelin.
- Water- 80% of the brain is H₂O vs. 60% of the rest of the body

Sleep

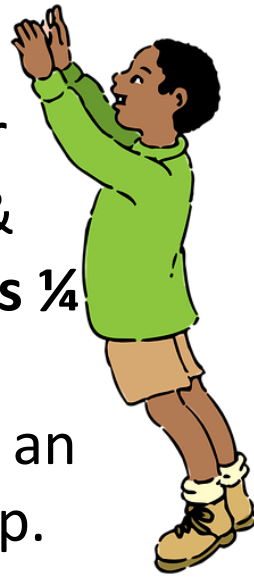
z z z



9-12 hours of
sleep each night

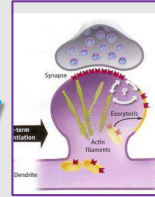
Exercise

60 min./day for heart, muscles & bone. **Brain uses ¼ of the body's oxygen**, so need an excellent ❤️ pump.



We need sleep because, during sleep, the brain is busy:

➤ Strengthening synapses for memory



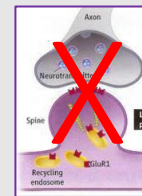
➤ Integrating new information with stored information/memories



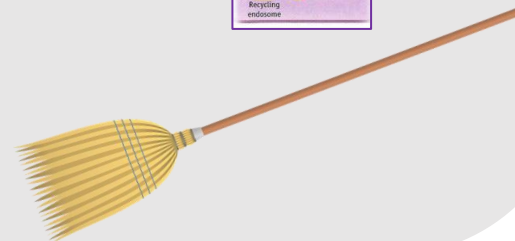
➤ Rebuilding energy stores



➤ Getting rid of weak synapses

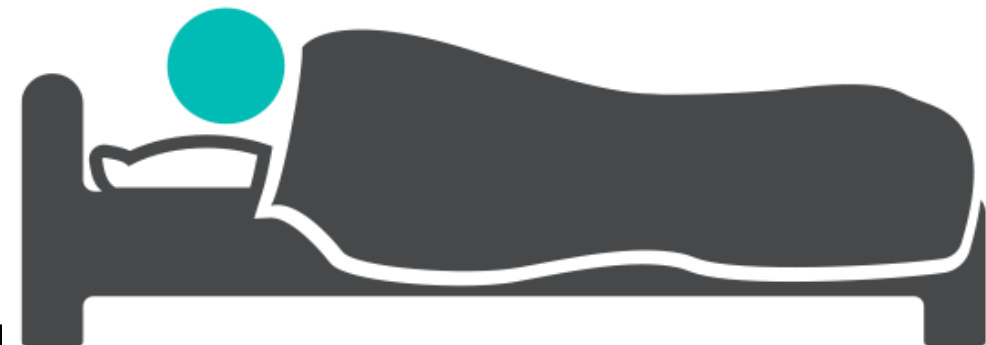


➤ Clearing metabolic junk



Preschool	3–5 years	10–13 hours per 24 hours (including naps)*
School Age	6–12 years	9–12 hours per 24 hours*
Teen	13–18 years	8–10 hours per 24 hours*
Adult	18–60 years	7-9 hours per 24 hours

z z z

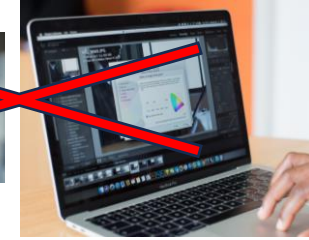


*https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html

Sleep Hygiene:

Light interferes with sleep.

- Dark quiet room
- Avoid screens the hour before bed



Stimulants keep one awake



Alcohol awakens one later



Keep the same schedule.

Don't change more than an hour on weekends.

- It's easy to get up later and fall asleep later.
- It's hard to move earlier.



For **teens**, it's not all their fault: Teens' bodies are **programmed** to **stay up later** and **get up later**. Is first period too early for 8th graders?

Optimizing Brain Function

2.6. Nurture the Student to Support the Cortex



Stress activates the emotional Downstairs Brain

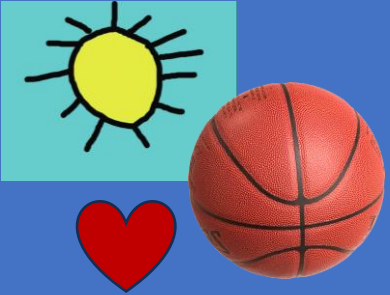


Upstairs Brain is the **Thinker**, guiding Downstairs Brain



Repeated or Chronic Stress exercises the Downstairs Brain, making it so strong that it overpowers thinking Upstairs Brain.

Other ways to increase serotonin



Touch

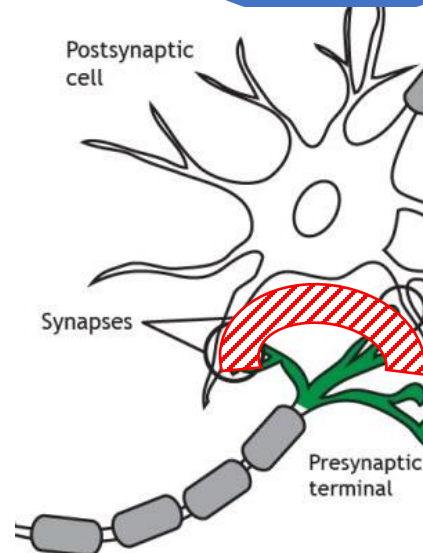
Stress

Serotonin



More serotonin →
less cortisol →
increased formation of
dendrites and
synapses.

Less serotonin →
more cortisol →
decreased new
dendrites & synapses.



Setting the stage –
a foundation of support for
the day's ups and downs.

0:05 / 3:49

Every Opportunity

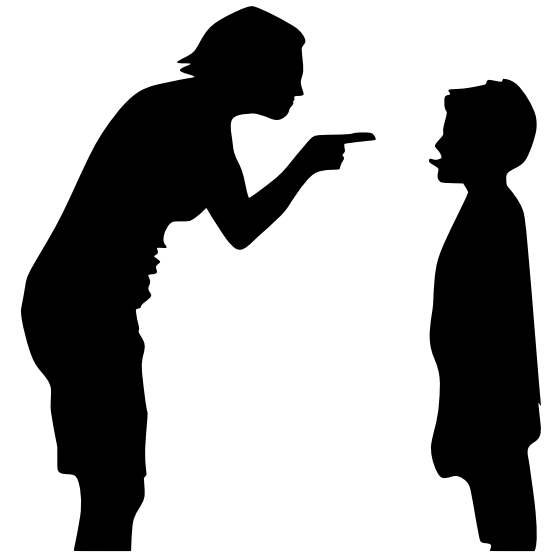
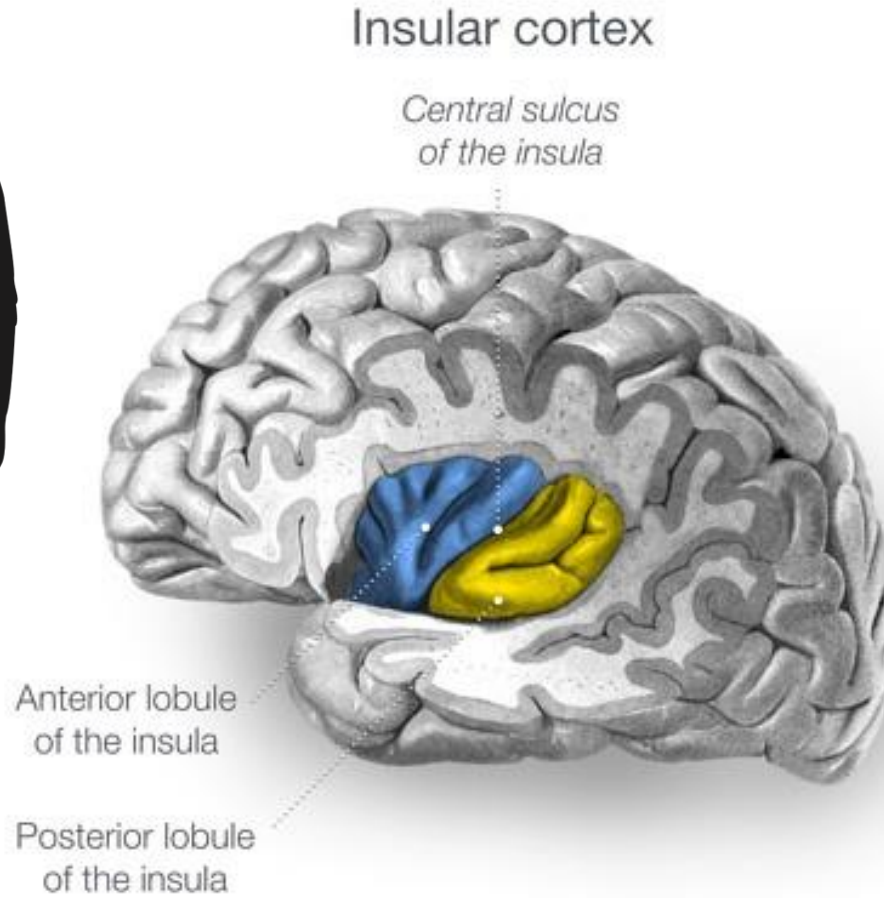
<https://www.youtube.com/watch?v=5Nyr1OizVo0>

“46,909 views Aug 22, 2016
Brownieland produced this video
for The Atlanta Speech School to
demonstrate **how small
changes in adult behavior
can enhance a child's
approach and their ability to
learn**. It was featured on CNN
and in the Huffington Post, going
on to receive over 1.5 million
views through other links.”





Think about your students. How are they feeling – as individuals, as a class?



Is the behavior of some “inviting” shaming? What causes the “bad” behavior, and what could help change it?



• What are they feeling?

Check my insula and look in the mirror --- Am I OK?



How can I care for myself well enough to care well for my students?

Care for
my brain.



Safety, security,
nurture.

Healthy
Food

Exercise

Sleep

**Visualize myself with
someone whose presence,
voice, touch, face has made
me feel safe and good.**



How do we
– and could
we -
support
one
another ?



c. Resilience and Stress

Resilience: “a **dynamic** process encompassing **adaptation** within the context of **significant adversity**” (Luthar et al, 2000 in Berger 2016, p 285).

1. Resilience is **dynamic** –

A person may be resilient at some periods but not at others.

2. “Resilience is a **positive adaptation to stress**”

Finding alternative means of strength, support and success, as if rejected by a parent, establish a closer relationship with another adult (often a TEACHER!)

3. “Adversity must be **significant**”, **potentially overwhelming** –

It can be a single major stress, multiple cumulative small stresses, or a combination.

4. Resilience is more feasible in the face of a **single major stress**.

The **MORE STRESSORS** that are present &/or cumulative →
LESS likely to have RESILIENT response



Cognitive Coping:

Impact of **Child's Interpretation** of the Situation

- A. Children are stressed by **poverty, with raised cortisol if:**
1. They see poverty as a **threat to their own well being**
 2. Family **lacks order and routines**
 3. **Parent** perceives poverty as highly stressful



- B. In the face of **conflict between parents**, development in child of psychic and academic problems is related to:
1. Whether child felt **at fault**
 2. Whether child felt **in danger**



When Coping Fails - And child feels at fault and/or endangered:

Raw, exposed, all emotion ---



Externalizing Symptoms:

Agitated, angry, destructive,
physically or verbally aggressive



Internalizing Symptoms:

nightmares, stomach aches,
panic attacks, feeling lonely, depressed



Coping with Stress in Childhood

Self-righting –

the inborn drive to correct challenges to one's own development.

Successful self-righting, or resilience, is dependent on both:

- Child's perceptions and abilities and
- Available support and resources



CHILD FACTORS IMPROVING RESILIENCE:

Cognitive Coping: Helped by the Child's positive perception of the situation

More resilient if:

1. High IQ
2. Easy going temperament
3. "Realistic goal orientation,
4. "Persistence, &
5. "Learned creativity"

In long term Hawaiian study of at-risk children (Emmy Werner)



Resilience and Stress

Protective factors:

***Problem solving abilities**



***School success**



***Ability/opportunities to establish friendships, develop skills, participate in activities**



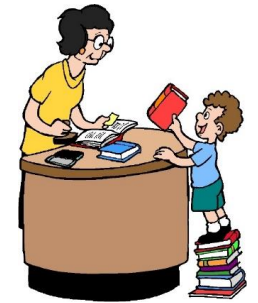
Social Support Helps Children Deal with Stress



Parents, grandparents, teachers, unrelated adults, peers, and pets help children cope with stress.

YOU!

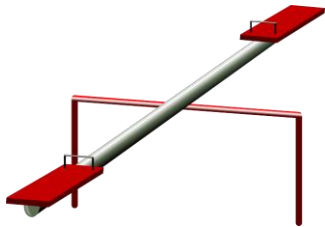
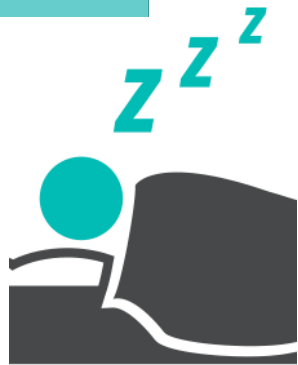
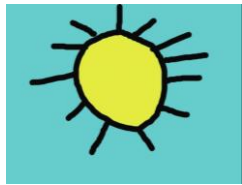
Community institutions (e.g. faith communities, libraries) can also be crucial sources of social support.



Questions about :

- Caring for the brain
- Nurturing student & self
- Stress & resilience

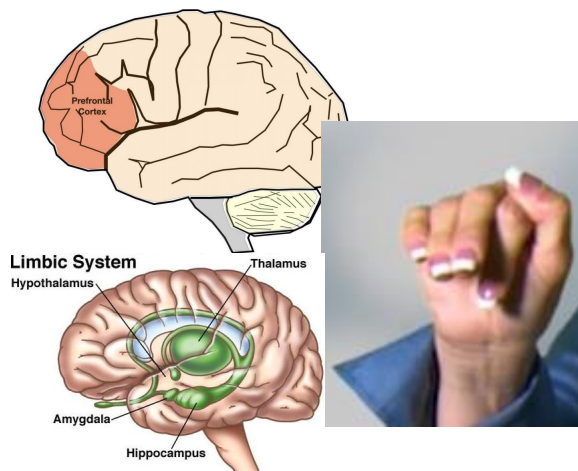
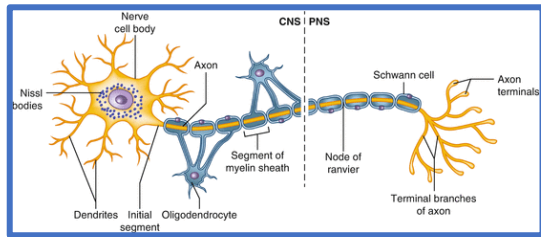
?



A quick review:

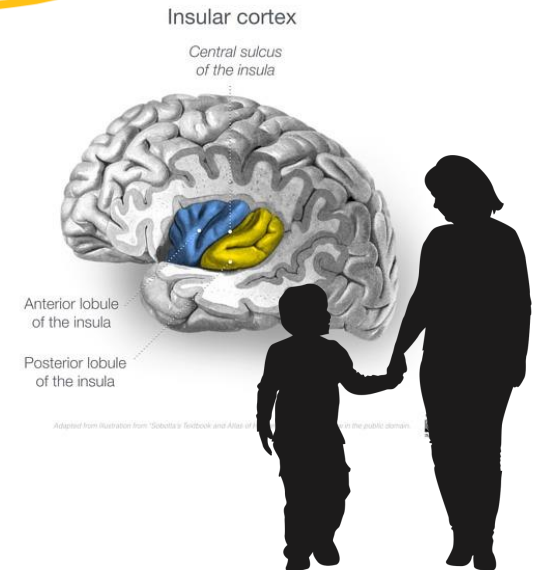
MYELINATION relative to

- a) Neuron speed and function
- b) Prefrontal Upstairs brain vs limbic Downstairs brain
- c) Right-left sequencing & reading
- d) Insula and self-awareness



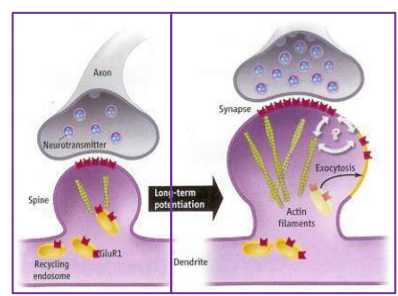
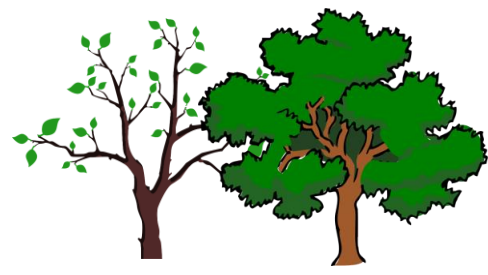
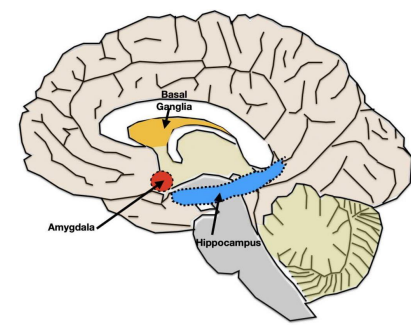
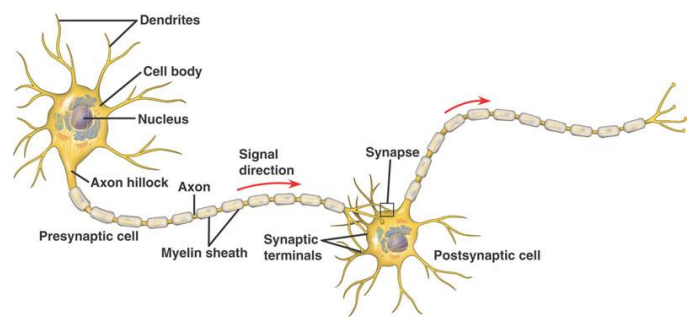
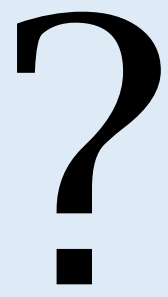
He was
the god
who
saw taf.

He saw
the dog
who
was fat.

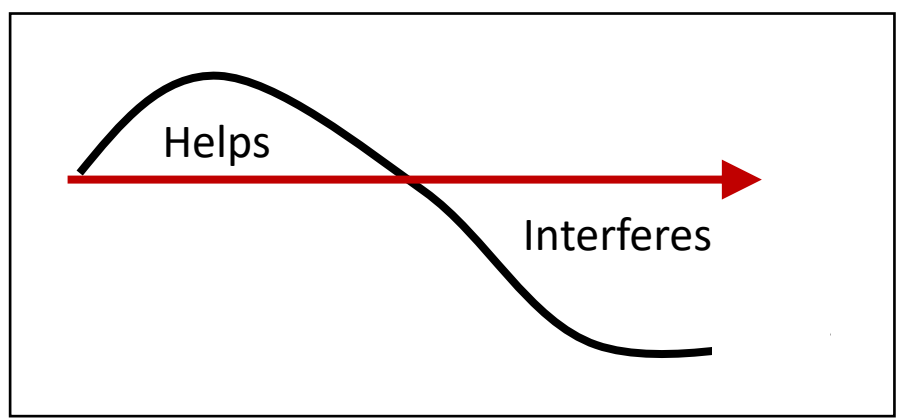


Synapses and Learning

- a) Practice makes permanent
- b) Knowledge & learning
- c) Growth mind-set
- d) Stress vs learning



Learning

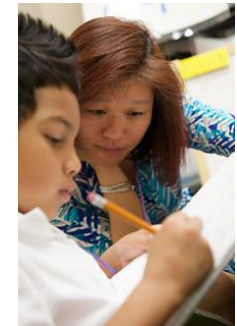
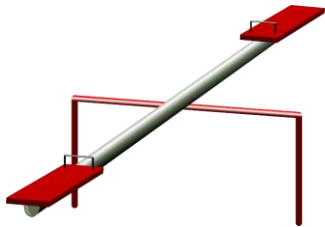
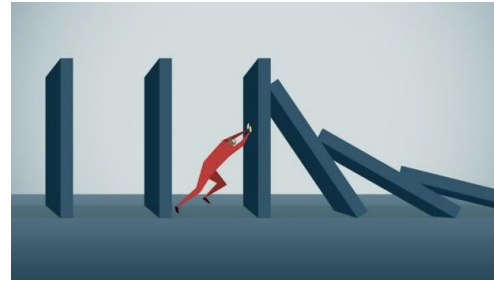
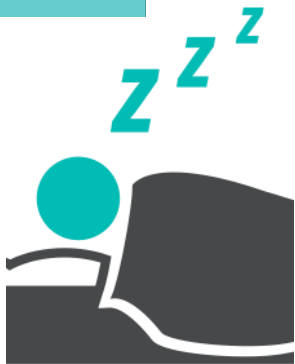
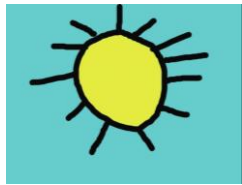


Increasing stress

Helping brains thrive:

- a) Caring for the brain
- b) Nurturing student & self
- c) Stress & resilience

?





*Thank
You*



*for
Caring*





You change brains!



THANK YOU!!!

Feedback please.

We would be grateful if you would email feedback and questions to us at foundation@neuroTucson.com.

We'll listen

Listening

- Focused
- Voluntary
- Intentional

Note: This has the first 3 sections of the four-part
K-5th Brain
(Kindergarten to 5th Grade)

The K – 5th Brain

1. Myelination
2. Synapses & Learning
3. Helping Brains Thrive

See also:

The K – 5th Brain

4. Maturing thinking
 - a) Theory of Mind
 - b) Impact on Social Comparisons, Self-Concept & Self-Esteem
 - c) Building Socio-Emotional Maturity

Contact information

The Center for Neuroscience Foundation

- **Each Brain Matters** website <https://www.eachbrainmatters.org/>
- To request PRESENTATIONS and Brain Bus – website form, or contact
 - **Susan Hopkinson** foundation@neurotucson.com
Tel: 520-529-5211 ext. 7988
- To discuss details for Dr. Johnson's presentations (in-person or Zoom):
 - Dj.dorothyjohnson@gmail.com Tel: 520-444-0018



<https://www.eachbrainmatters.org/>

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foundation@neurotucson.com



If requesting this presentation, allow roughly 30 minutes per section. Only slides of first 3 are here. See separate .pdf for the 4th. Section, Maturing Thinking.

The K – 5th Brain

1. Mylenation
2. Synapses & Learning
3. Helping Brains Thrive
4. **Maturing Thinking**

