How Can Current Brain Research Guide Us In Improving Practices For Children and Youth Who Are Deafblind?

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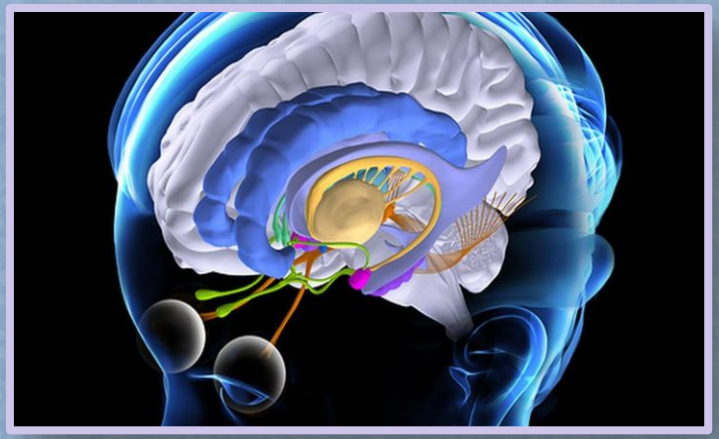
Goal of Presentation

Goal: To Support The Development Of Strong Brain Architecture For Children And Youth Who Are Deafblind

What does current brain research tell us related to:

- **Early brain development and functioning**
- **Communication development**
- **The impact of stress on brain development and functioning**
- **Social and emotional development**

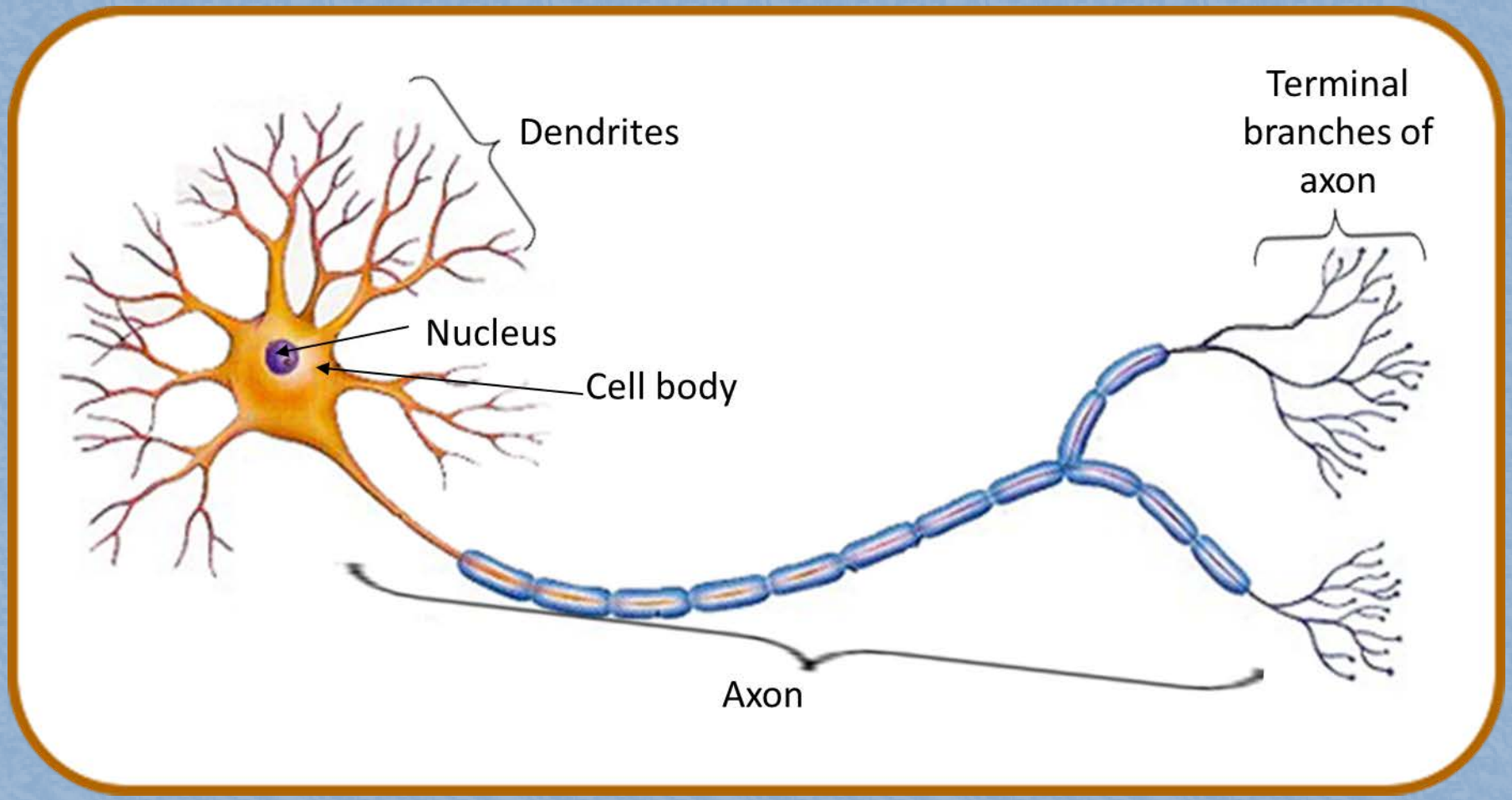
Based on the research, what recommendation should be given and what changes can be made to improve practices for children who are deafbind?



Experiences Build Brain Architecture Video

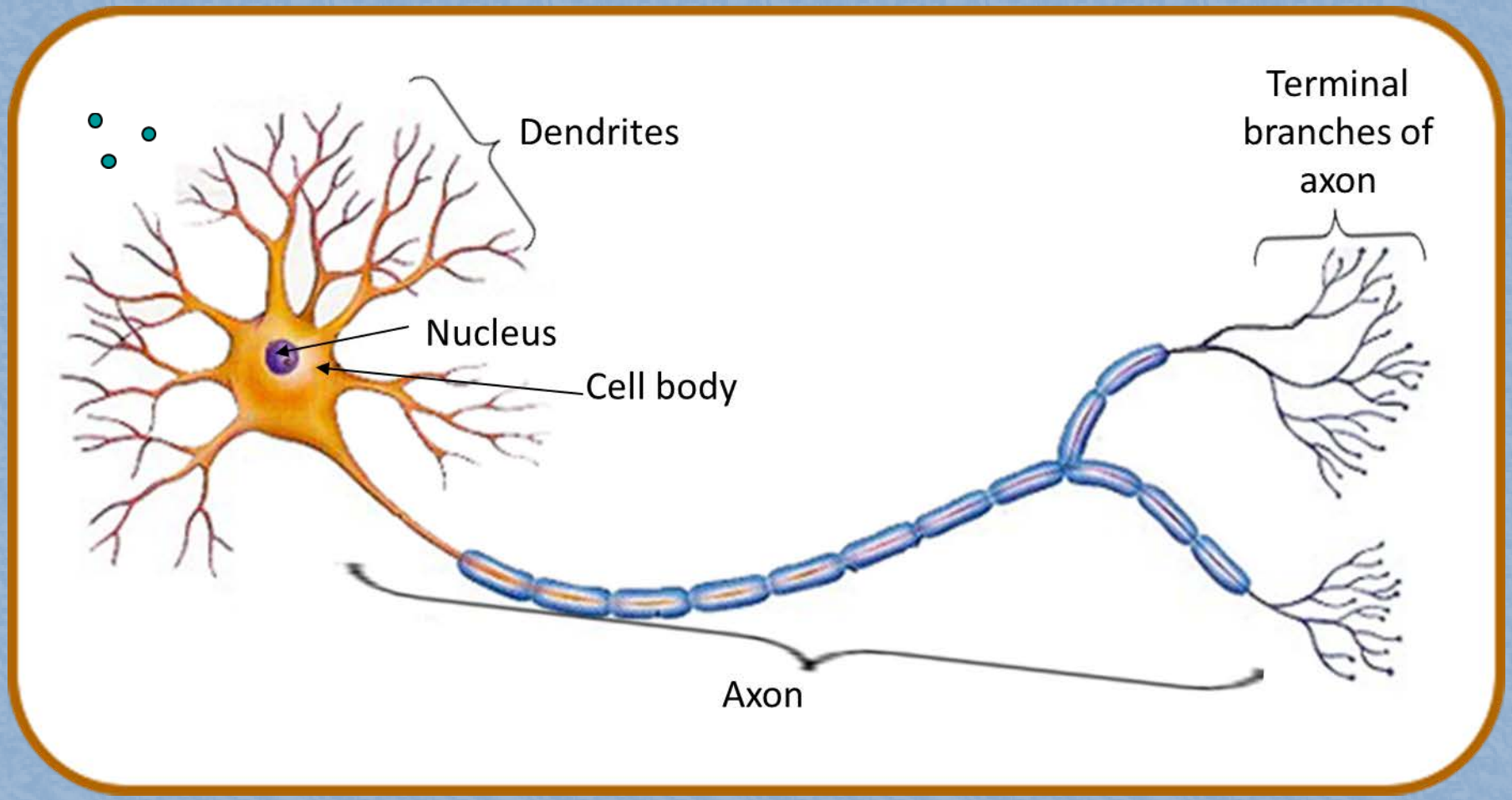
1. Captioned version of video: Experiences Build Brain Architecture -- https://www.youtube.com/watch?v=VNNsN9IJkws

The Neuron



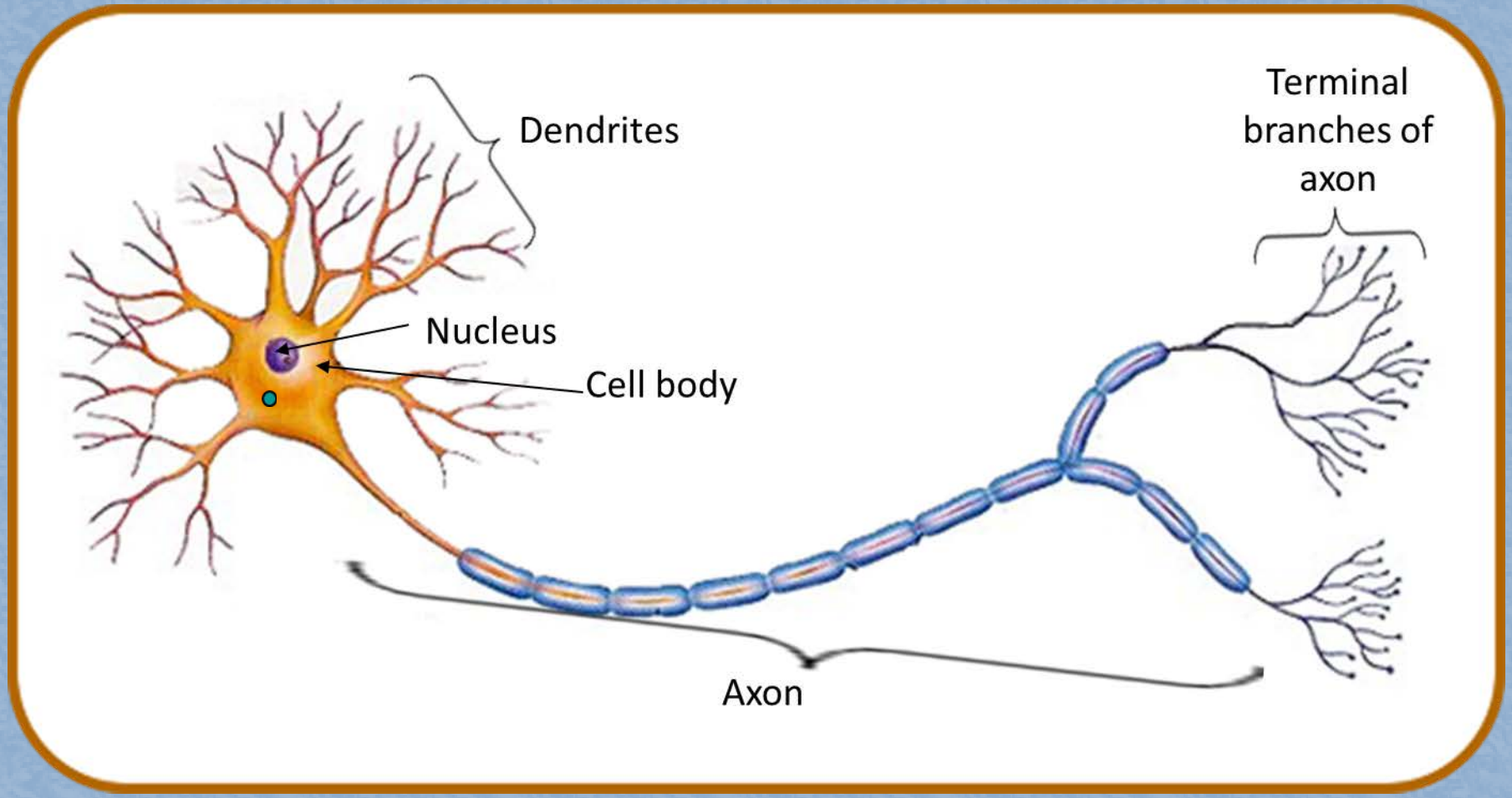
Wikipedia: Neuron

The Neuron: Dendrites



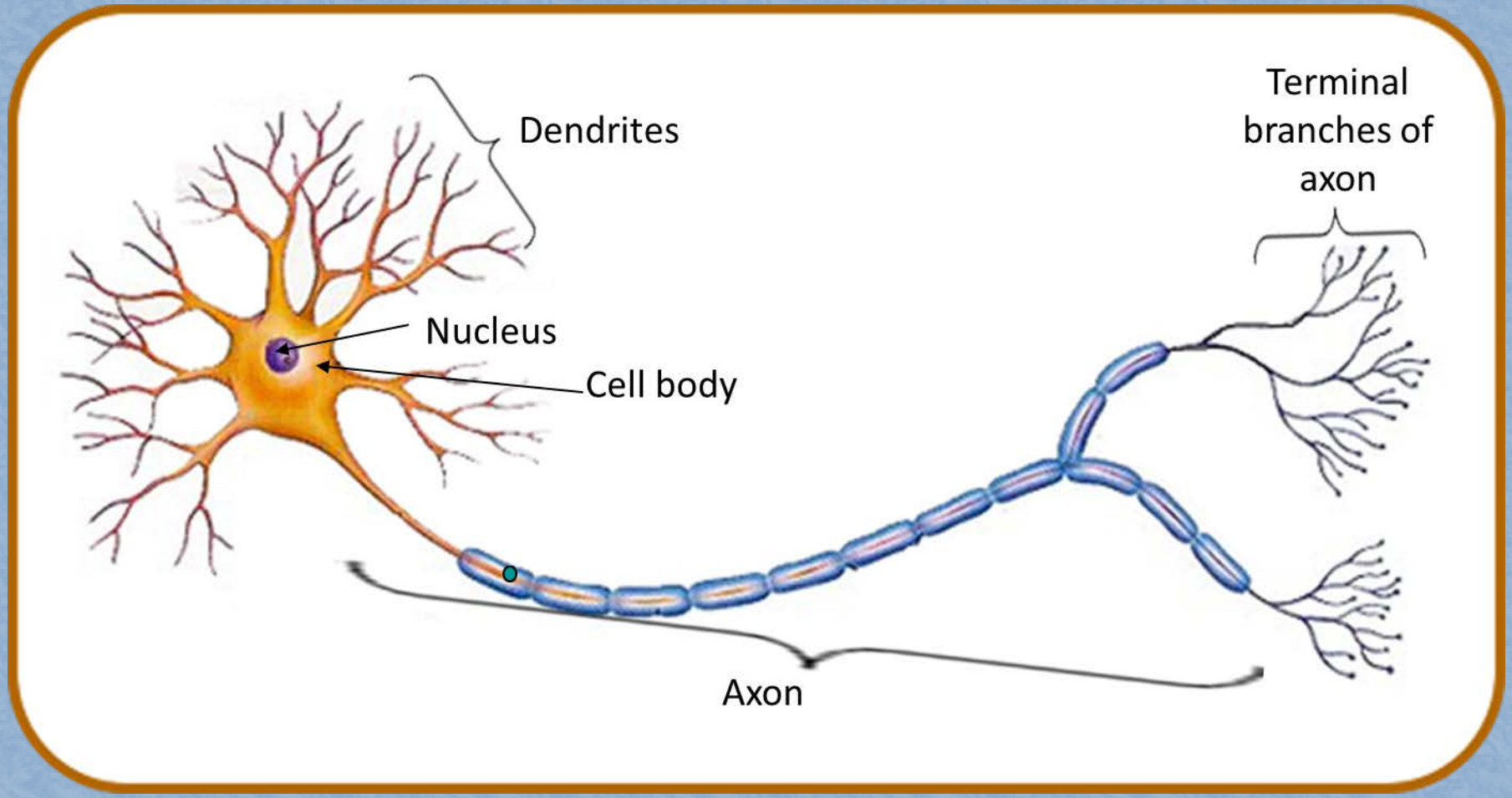
Wikipedia: Neuron

The Neuron: Nucleus



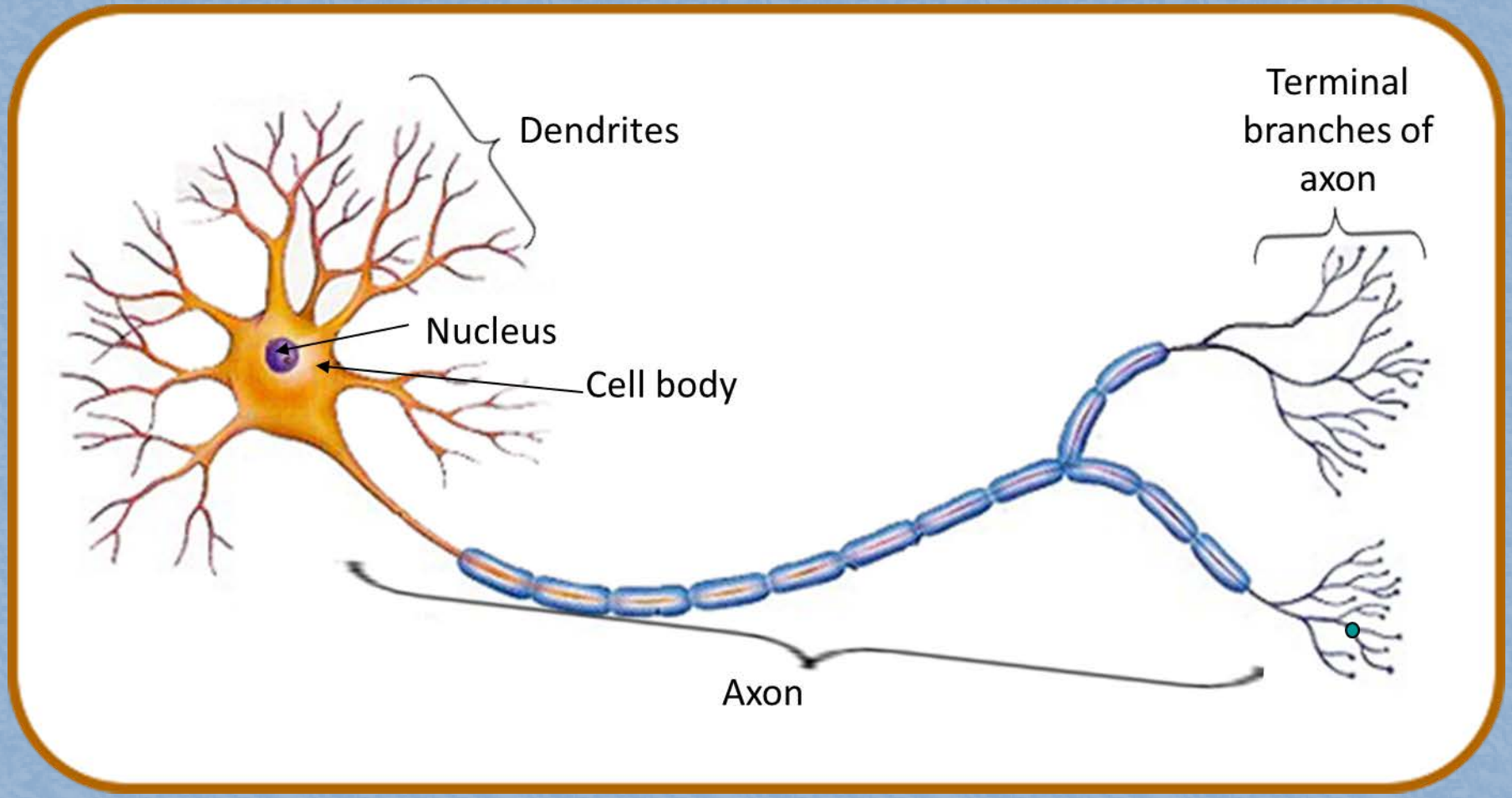
Wikipedia: Neuron

The Neuron: Axon



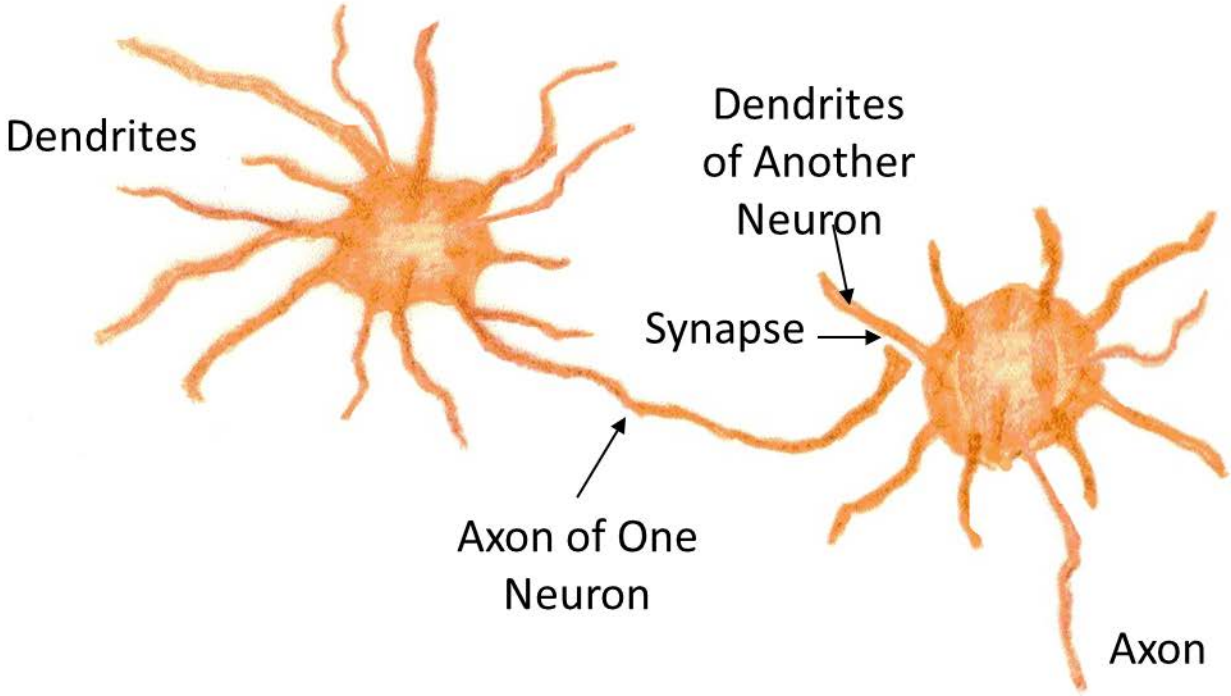
Wikipedia: Neuron

The Neuron: Terminal Branches

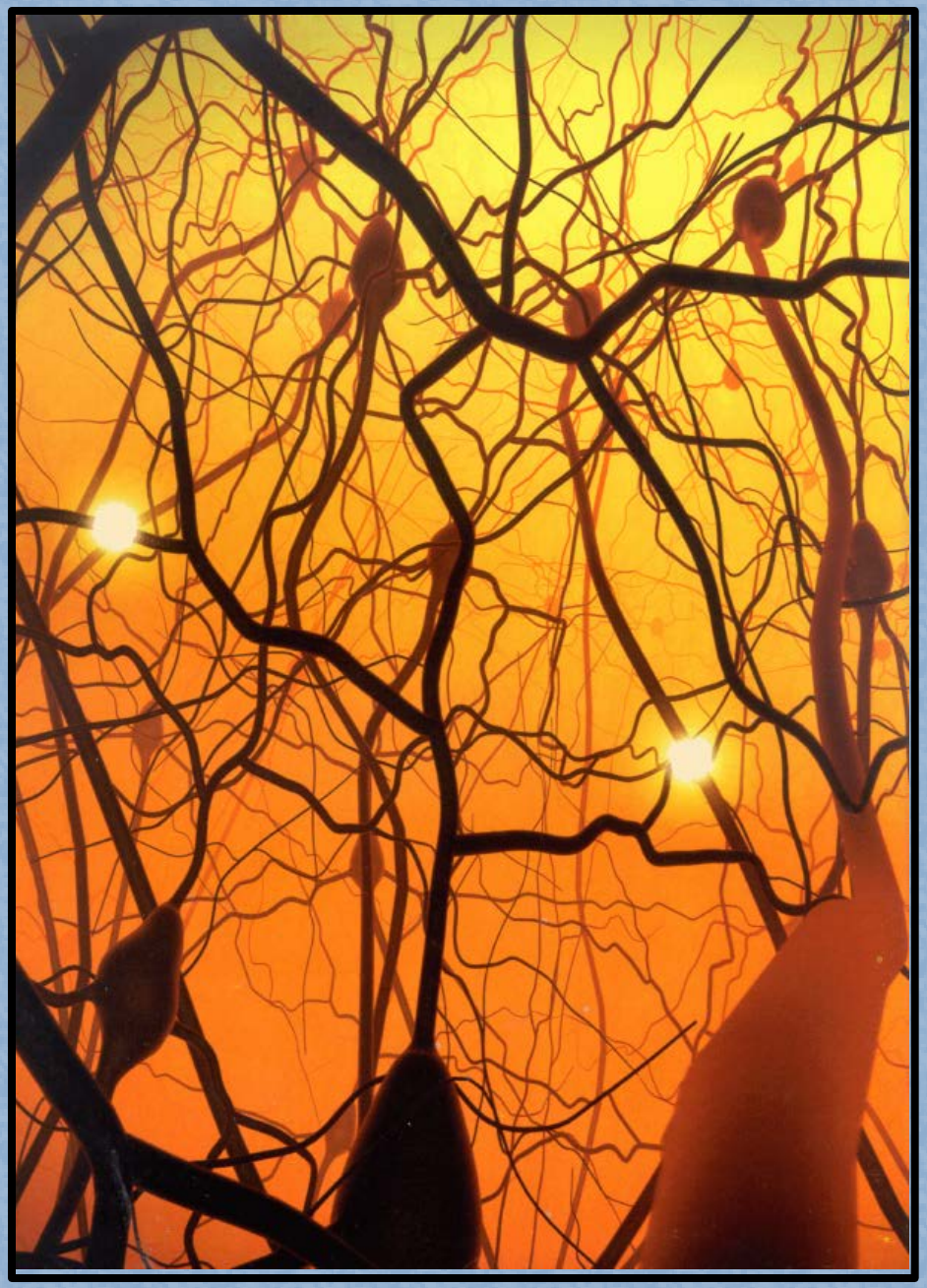


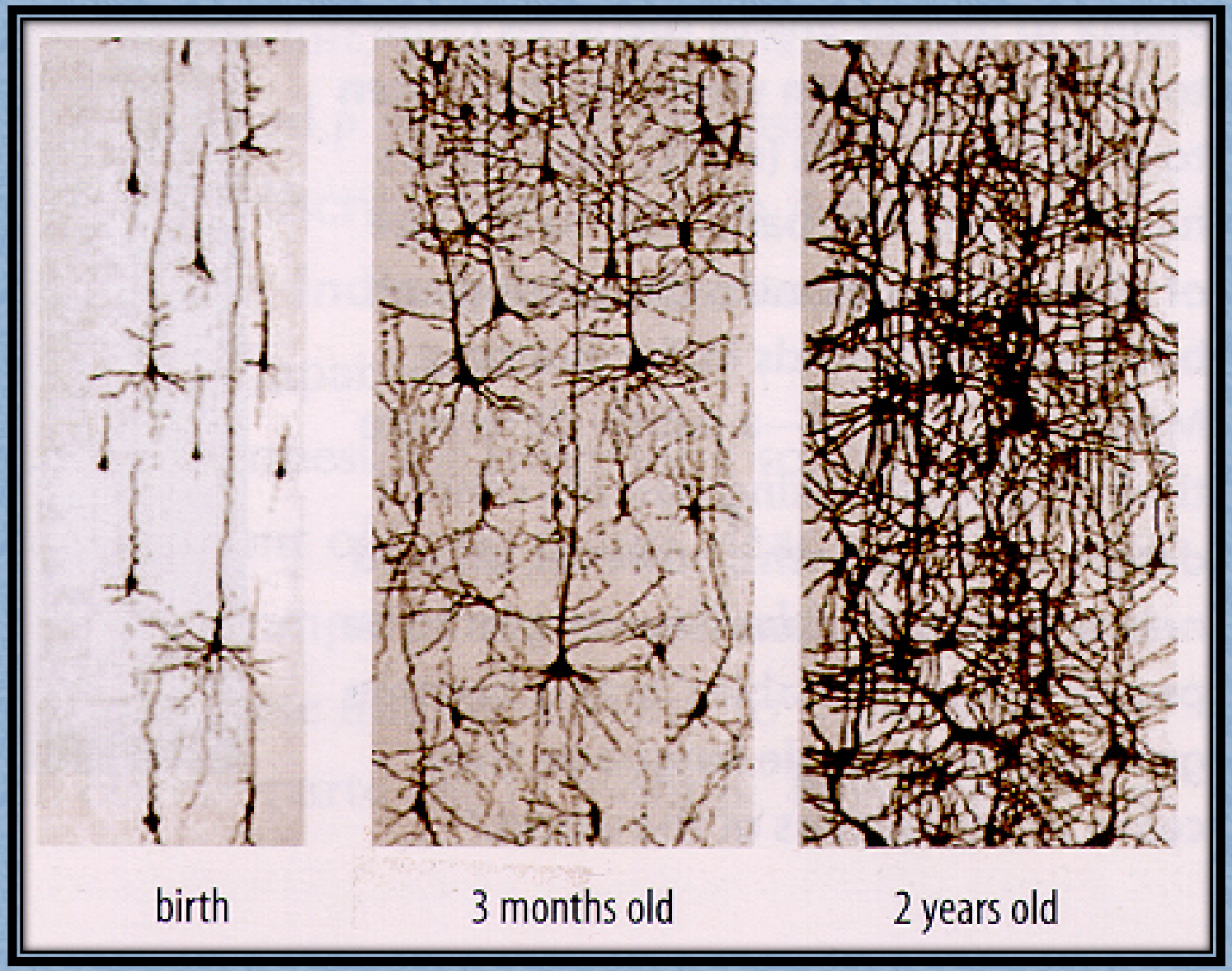
Wikipedia: Neuron

Neuron Connection

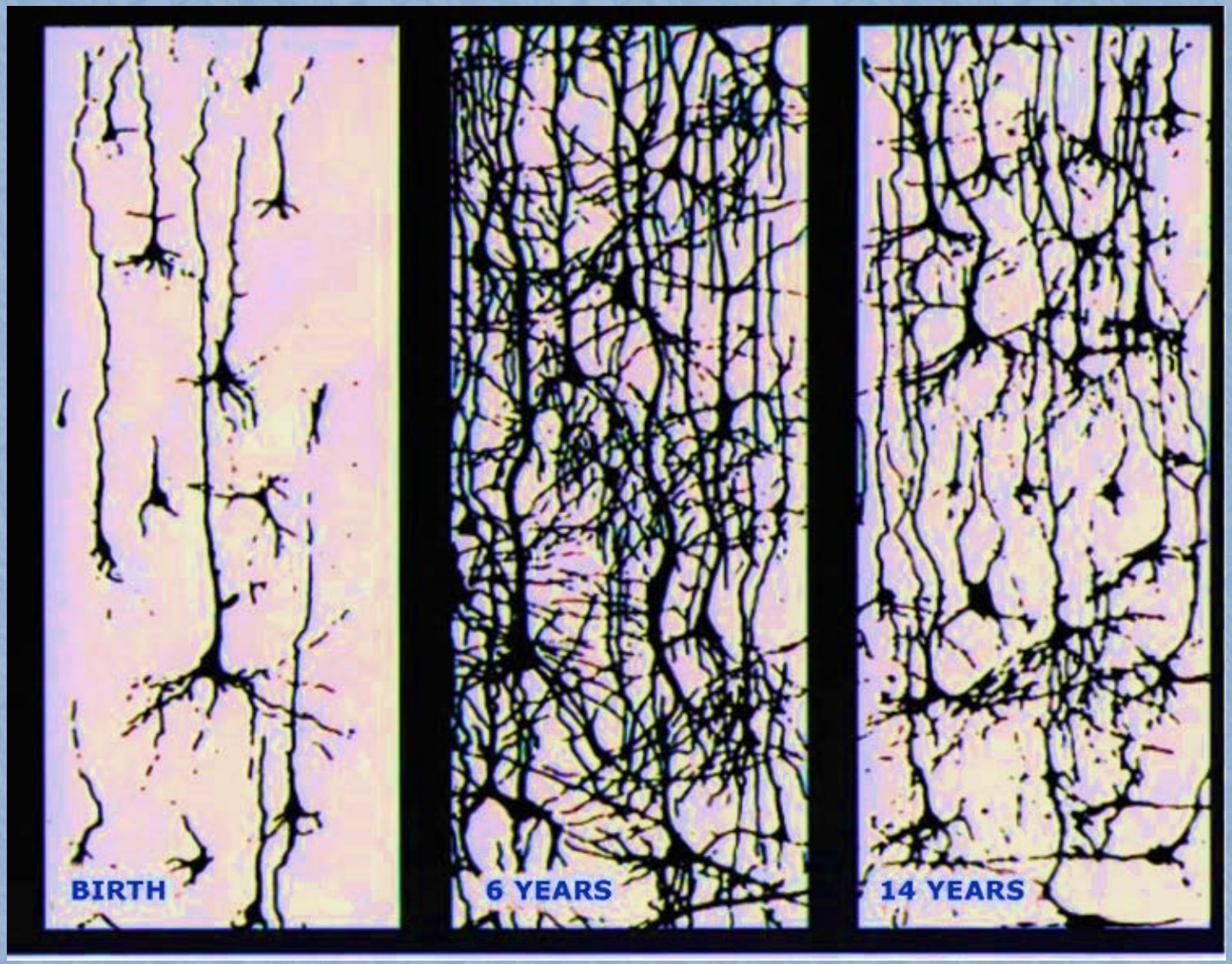


Joan Melim




birth
3 months old
2 years old

Pruning



Neuroplasticity

"Neuroplasticity is the capacity of the nervous system to modify its organization."

Jude Nicholas, Resource Center for the Deafblind, Norway

Neuroplasticity supports learning as the brain modifies itself through:

1. Chemical Changes
2. Structural Changes
3. Functional Changes

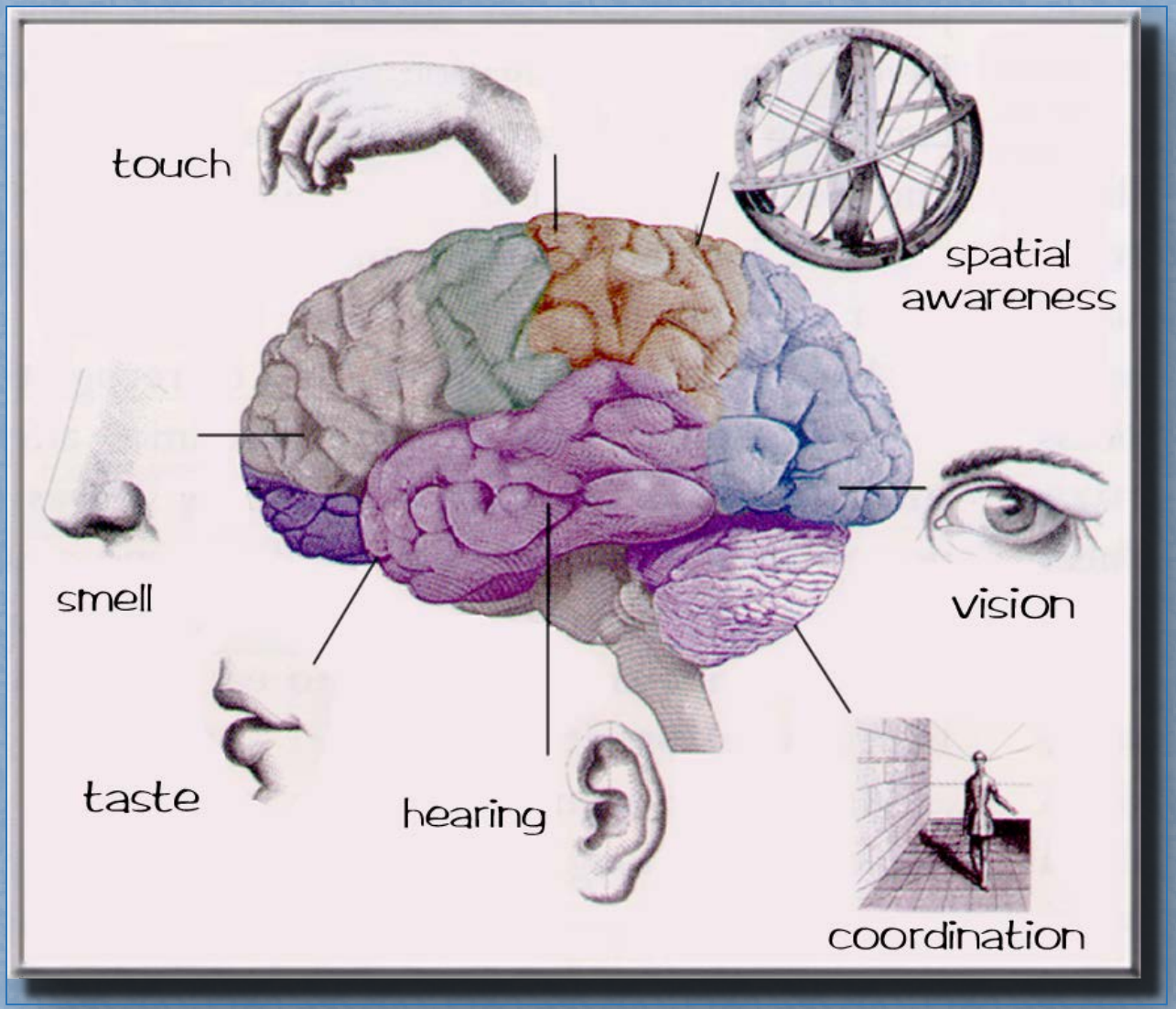
"After Watching This Your Brain Will Not Be The Same"

Lara Boyd

Brain Researcher at the University of British Columbia

TEDxVancouver

Sensory Processing Areas



Adaptability of the Brain

The occipital cortex is normally associated with processing visual information, but in the case of blindness, it is recruited to process tactile information (including Braille reading and recognition of complex tactile forms and shapes), auditory information (for sound localization and speech processing), and verbal memory tasks.

With individuals who are deaf, cortical regions normally associated with auditory and language processing are activated in response to vibrotactile stimuli and observing sign.

Obretenova, S. Halko, M.A., Plow, E.B., Pascual-Leone, A., & Merabet, L.B. (2010). Neuroplasticity associated with tactile language communication in a deaf-blind subject. *Front Hum Neurosci*, 3:60.

Learning

A person's ability to interact, perceive, and learn from the environment comes from the ability to process incoming sensory information and react to the information with a motor response which, in turn, feeds back sensory information.

Information Flow

- Receiving
- Attending
- Gathering
- Interpreting
- Synthesizing
- Generalizing
- Remembering

Information Access

All learning relies on the ability to access information.

How does the child/youth access:

- Visual information?
- Auditory information?
- Tactile information?

What are the access points?

Is the information getting in?

Is it clear and consistent?

Is the information understood?

Questions/Recommendations (1 of 4)

Questions

- If the information is not getting into the brain, how will neural networks be built?
- How can access be better understood and guide all individualized programming?

Recommendations

- Understanding of individualized access points
- Focus and diligence related to getting information "in"
- Intervener support

Communication Development

Serve & Return Interaction Shapes Brain Circuitry Video

2. Captioned version of video: Serve & Return Interaction Shape Brain Circuitry -- https://www.youtube.com/watch?v=m_5u8-QSh6A

Communication

Serve and Return Interactions

- Key to forming strong brain structure
- The foundation of brain architecture upon which all future development is built
- New neural connections formed as young children serve and adults responds and then the child responds, and so on
- Creates neural connections between all parts of the brain, building emotional and cognitive skills
- Vital to have adult caregivers who can consistently engage in Serve and Return beginning in infancy

Challenges of Serve and Return Process

Lack of communication skills interferes with the Serve and Return Process for children and youth who are deafblind.

Challenges include:

- Lack of visual and auditory information
- Eye contact
- Lack of responsiveness
- Parent stress
- Lack of parent training in communication

Tactile Cognition and Learning

Tactile cognition refers to the higher order processing and integration of tactile information through active touch.

Tactile learning is the process of acquiring new information through tactile exploration. Research studies of tactile information processing in humans have shown that people can be trained to perceive a large amount of information by means of their sense of touch.

Nicholas, J. (2010). *From active touch to tactile communication: What's tactile cognition got to do with it?* Denmark: The Danish Resource Centre on Congenital Deafblindness.

Tactile Abilities of Deafblind People

Deafblind people use active touch in ways that no one else does to explore objects and the environment, to perceive feelings and to act and communicate. There are various tactile communication and tactile language interventions, which are used within the deafblind field, such as haptic communication, full co-active signs, one hand coactive signs and hand-over-hand signing.

Two studies indicated that deafblind individuals perform more effectively than sighted-hearing people on tasks of tactile working memory and tactile memory. A possible explanation for the better performance is that deafblind individuals are expected to have more tactile experience since this is the sensory system that they must rely on for information about their environment (Meshcheryakov, 1974).

Nicholas, J. (2010). *From active touch to tactile communication: What's tactile cognition got to do with it?* Denmark: The Danish Resource Centre on Congenital Deafblindness.

Questions/Recommendations (2 of 4)

Questions

- How can we better understand tactile cognition and learning?
- How can we encourage the practice of tactile communication for interaction and language development?

Recommendations

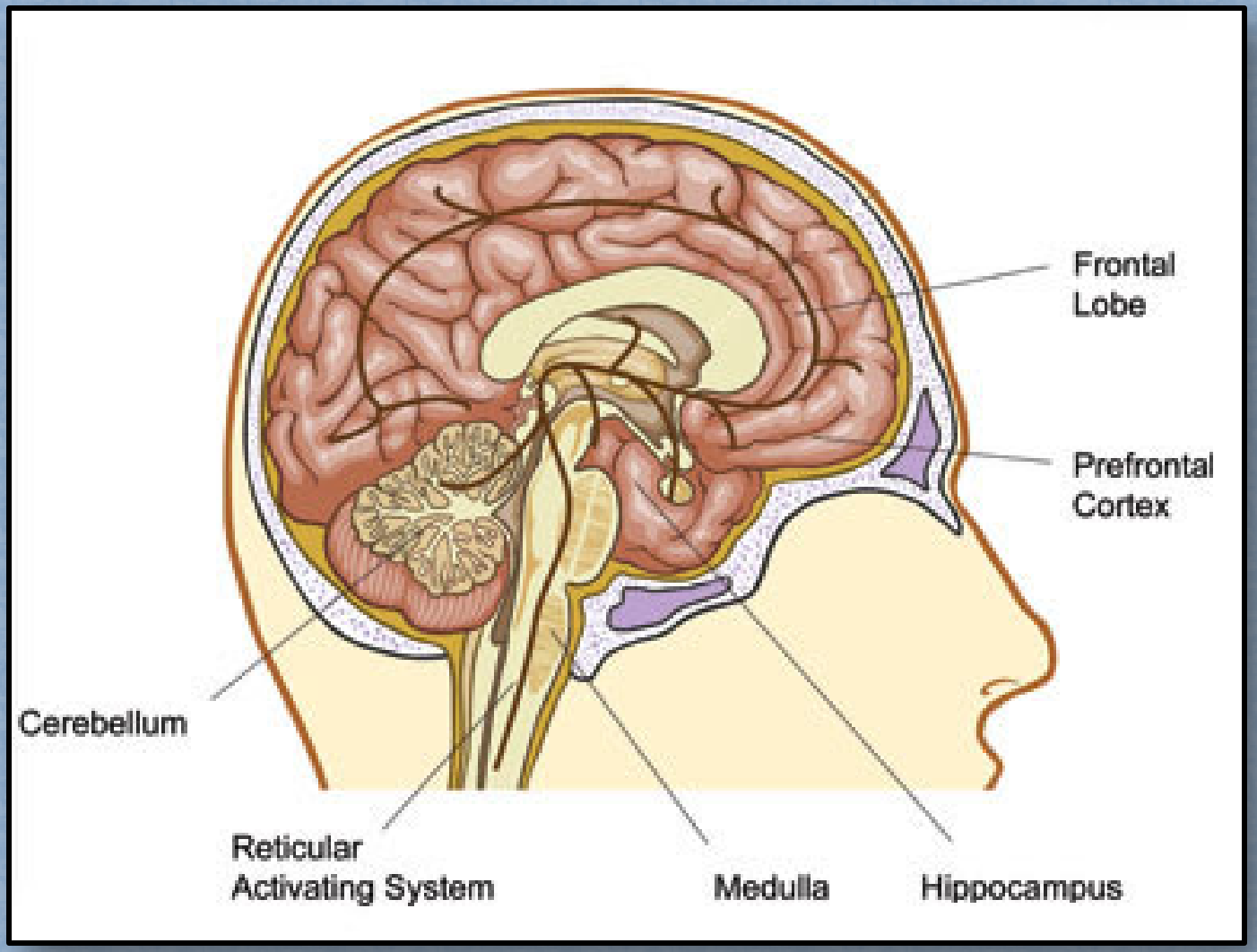
- Parent training
- Focus on early communication development
- Emphasis on tactile communication
- Emphasis on language development
- Skilled communication supports - interveners

Stress and the Brain

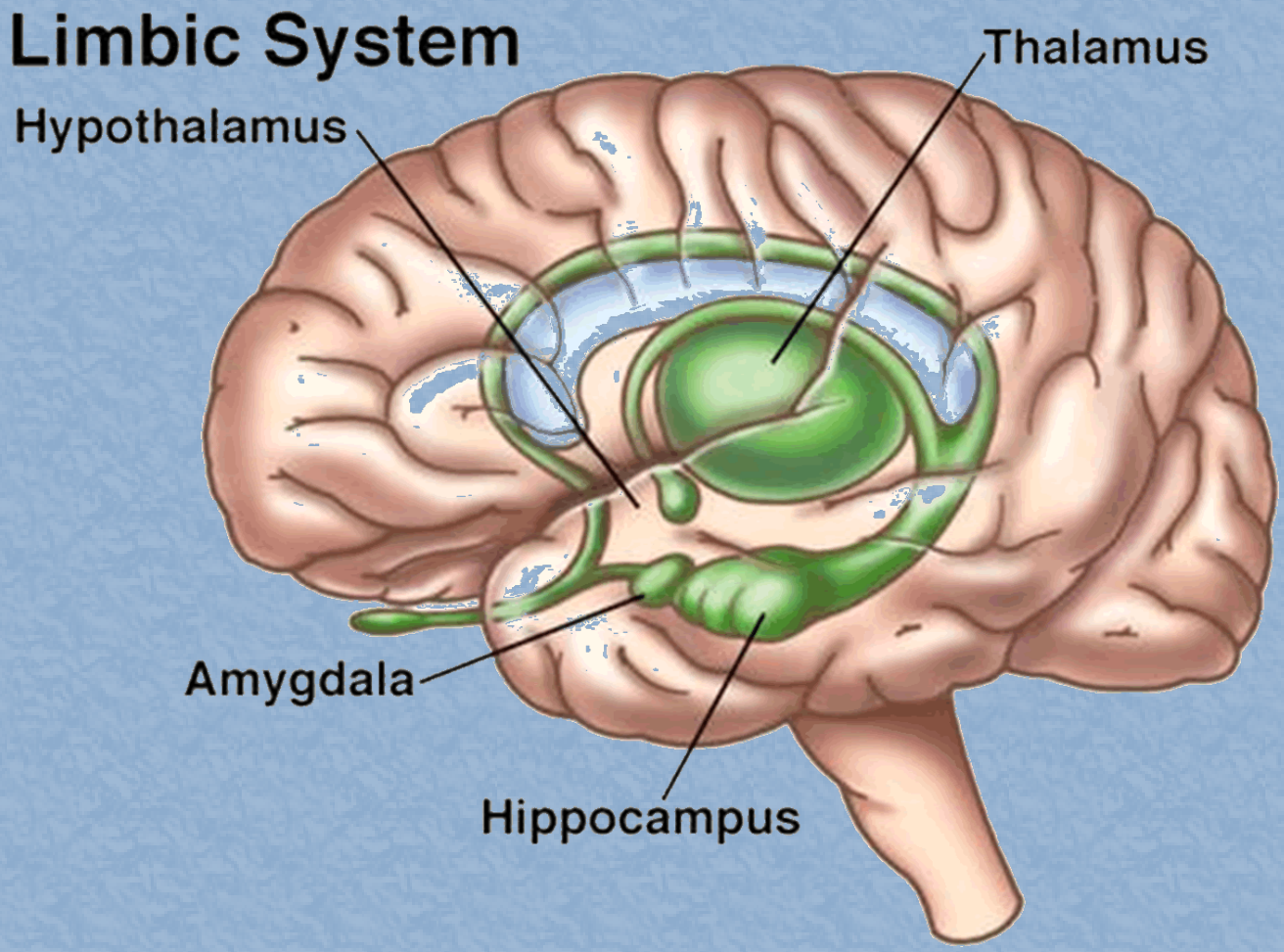
Toxic Stress Derails Healthy Development

3. Captioned version of video: Toxic Stress Derails Healthy Development -- https://www.youtube.com/watch?v=rVwFkcOZHJw

Reticular Activating System



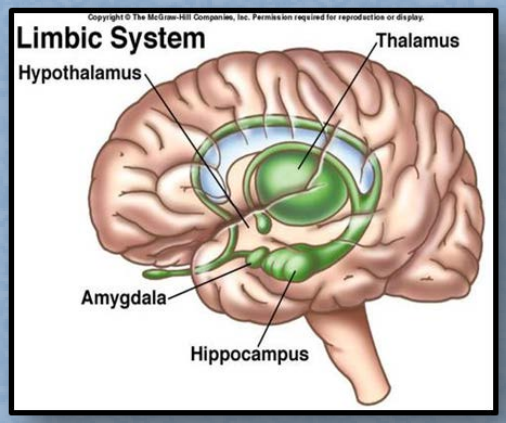
Limbic System Diagram



Guides our emotional behaviors

Thalamus

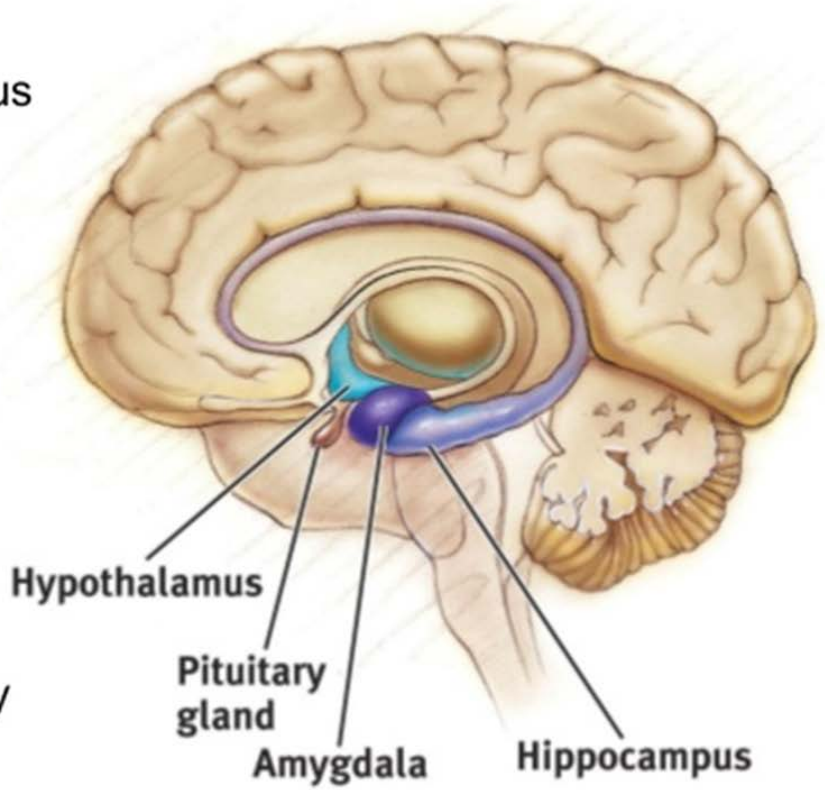
- Determines which sensory information will receive the most conscious awareness
- All incoming sensory information, except for smell, is “sorted” by importance
- “Harmless” information is ignored
- New information requires more attention
- If incoming information contradicts existing information, rest of brain will be alerted to pay attention to it
- Helps the rest of the brain to know what is important to attend to and what is not



The Limbic System

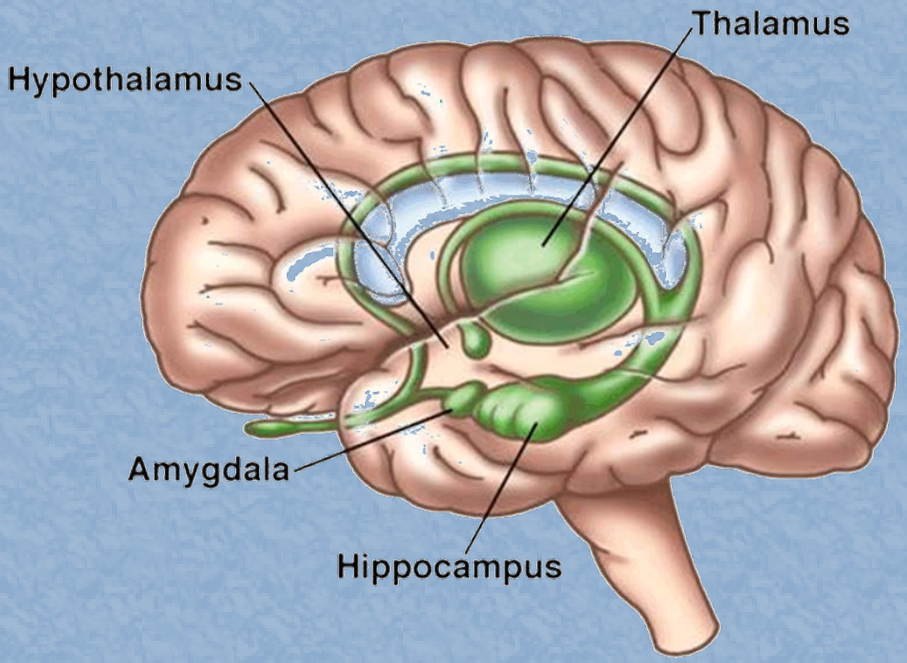
The Limbic System

- Hypothalamus, pituitary, amygdala, and hippocampus all deal with basic drives, emotions, and memory
- Hippocampus → Memory processing
- Amygdala → Aggression (fight) and fear (flight)
- Hypothalamus → Hunger, thirst, body temperature, pleasure; regulates pituitary gland (hormones)

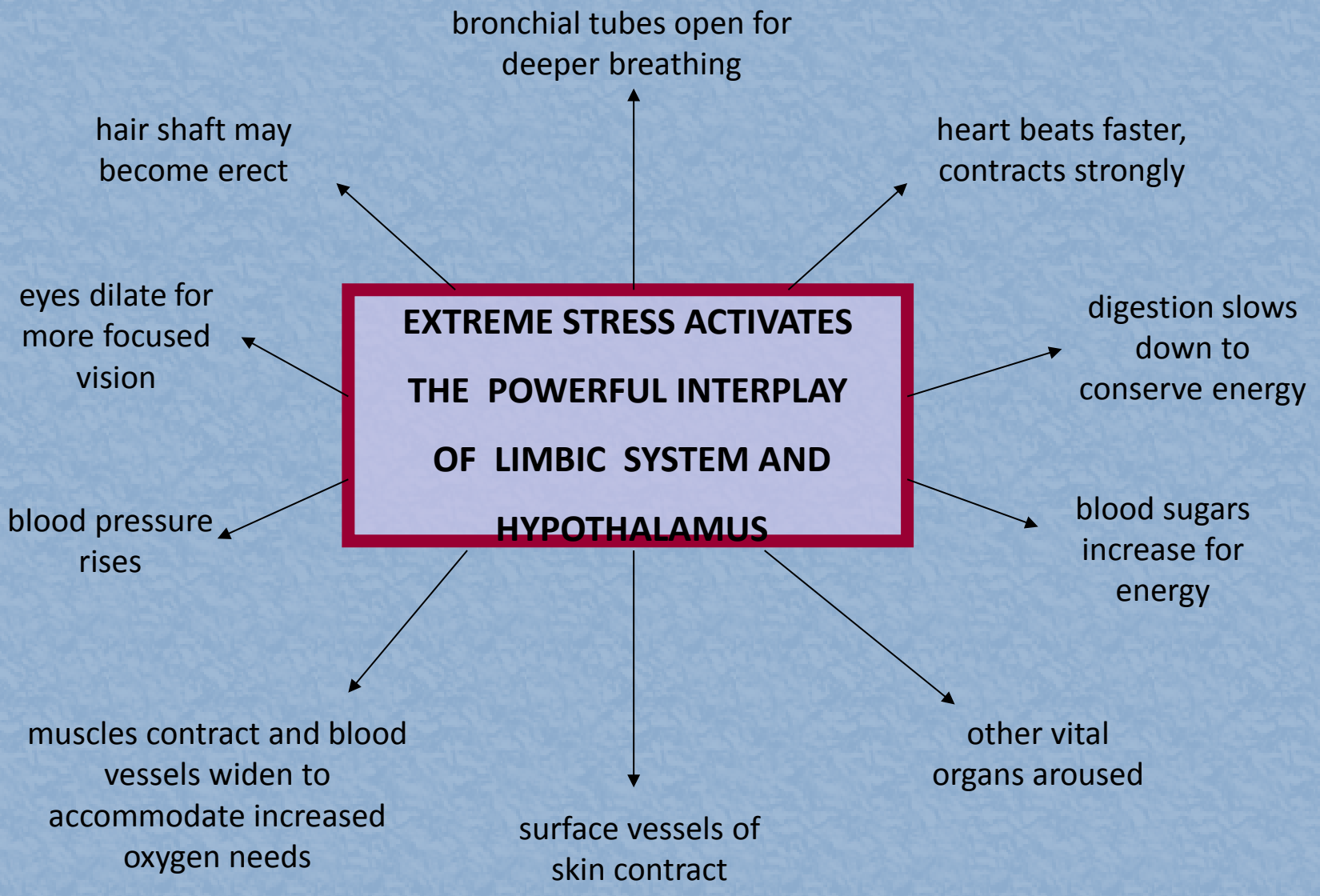


Hypothalamus

- Regulates automatic functions (hunger, thirst, body temperature)
- Controls release of hormones
- If a situation is perceived as threatening, a “fight or flight” response kicks in, sending warning signals to the hypothalamus which sends out other hormonal signals to prepare for battle

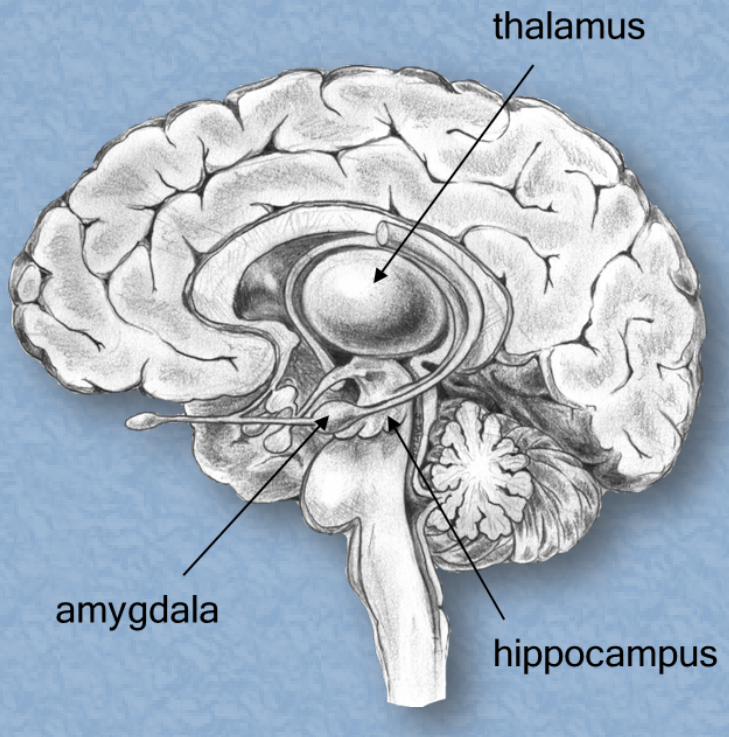


Body Responses to Extreme Stress



Amygdala and Hippocampus

- Associated with pleasure, fear, addiction
- Critical in the role of memory, in anticipation, and habituation
- Important in forming and storing memories of emotional events
- Also affected by stress



Stress

- Stress has detrimental effects on the brain and on behavior.
- **Acute Stress:** The body's stress system activates for a short period of time in response to a temporary stimulus.
- **Chronic Stress:** The body's stress system is activated very frequently or for a prolonged period of time or in response to a persistent stimuli.
- **Toxic Stress:** The body experiences strong, frequent, or prolonged adversity that is overwhelming.

Effect of Stress on Brain Architecture

Stress Hormones

Released when the brain receives a signal that a threat is present

Cortisol:

- Gets glucose into our bodies
- Revs up the sympathetic nervous system
- Increases our viligance and attention to threat
- Decreases our attention for other things

High Cortisol Levels:

- Decrease memory and the ability to control behavior and focus attention
- Slow down the immune system

Toxic Stress

Overwhelming experiences change the structure of the brain:

- Cortex and limbic regions may be smaller
- Regions have fewer synapses
- Hippocampus is smaller
- Increased activity in brain structure involved in vigilance and arousal
- Brain regions may be reactivated by a reminder of the trauma
- Scrambles neurotransmitter signals

Questions/Recommendations (3 of 4)

Questions

- What practices alleviate the impact of stress for children and youth who are deafblind and promote healthy brain functioning?
  - Lack of information is stressful
  - Limbic system always on high alert
  - Fear/confusion
  - Behaviors

Recommendations

- Consideration of the emotional brain in activities and educational programming
- Focusing on stress reduction - ensuring that environments are emotionally manageable
- Intervener support

Social & Emotional Development

Social-Emotional Development

Social-emotional development is a term used to describe growing children's ability to form close, secure relationships and to use their emotions productively in interactions with others" (T. S. Hartshorne & Salem-Hartshorne, 2011, p. 205). Three factors that have an impact on social-emotional development are:

- Attachment
- Empathy
- Friendships

Hartshorne, T. S., & Schmittel, M. C. (2016). Social- emotional development in children and youth who are deafblind. *American Annals of the Deaf, 161*(4), 444–453.

Risks for Poor Social-Emotional Development

There are a number of factors putting children who are deafblind at risk for poor social-emotional development.

These factors include:

- Genetic risk
- Sensory impairment
- Family stress
- Lack of resources
- Challenging behavior
- Problems with self-regulation and self-monitoring

Self Regulation (1 of 2)

Ramirez, T. S. Hartshorne, and Nicholas (2014) define self-regulation as “the capacity to manage one’s own thoughts, actions, feelings, and physiological states in adaptive and flexible ways across a range of contexts.”

Self Regulation (2 of 2)

- Dual sensory impairment interferes with aspects of self-regulation development, because of a lack of understanding of the environment and the behavior of others. Social- emotional development depends on watching the behavior of others and learning from the interaction of others; in other words, children rely on role models. This is challenging in the presence of sensory impairments.
- Children who are deafblind, just like other children, and perhaps even more than other children, require interaction with others for development to happen.

Social and Emotional Development

- Typically developing children learn social skills and emotion regulation skills incidentally through observation and auditory feedback. Children who are deafblind have difficulty learning information this way because of their multisensory impairment. They are not incidental learners. They are unable to take in visual and auditory information that other children learn from the environment (Murdoch, 2004).
- It is clear that social-emotional development does not occur in a vacuum. Children who are deafblind, just like other children, and perhaps even more than other children, require interaction with others for development to happen.

Hartshorne, T. S., & Schmittel, M. C. (2016). Social- emotional development in children and youth who are deafblind. *American Annals of the Deaf, 161*(4), 444–453.

Questions/Recommendations (4 of 4)

Questions

- How can healthy social and emotional development be facilitated for children and youth who are deafblind?
- How can we support the forming of close, secure relationships?

Recommendations

- Previous recommendations all support social and emotional development
- Provide opportunities for the development of close and secure relationships with adults.
- Provide opportunities for friendships.
- Understand self-regulation.
- Support the development of self regulation and self monitoring skills
- Intervener support

Thoughts or Questions

Thank you!