GROWING NEURAL CONNECTIONS THROUGH SENSORY ENGAGEMENT

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OUTLINE OF TODAY'S SESSION

- Why a Sensory Approach?
- Top-Down Versus Bottom Up Processing
- Eight Sensory Systems
- Enriched Environments are Neuroprotective

Disclosures:

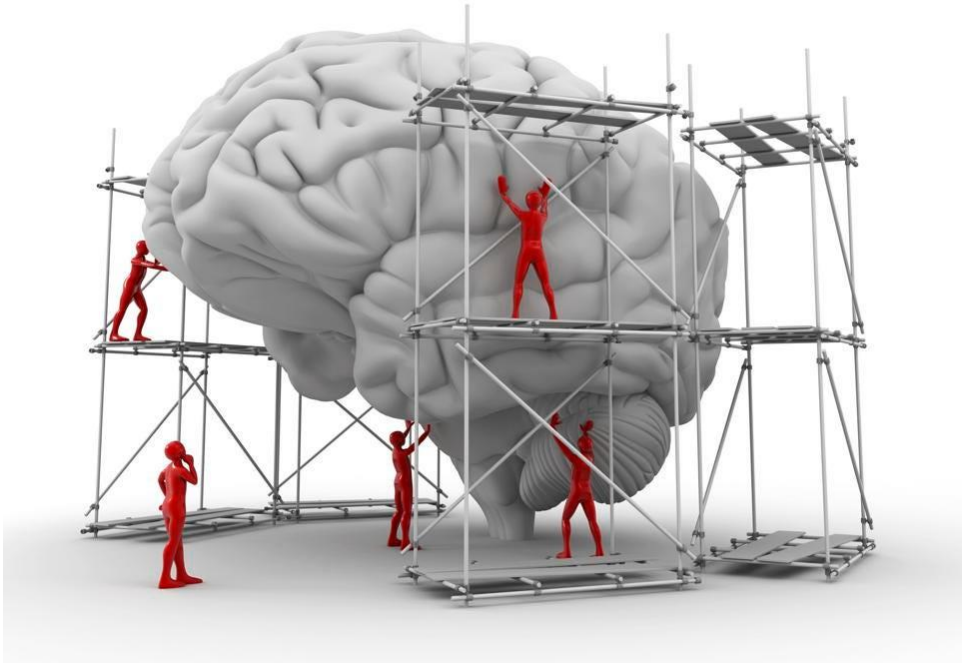
- NIH/NIA K23 AG075262: Improving Person-Environment Fit of Community-Residing Older Adults with Dementia Through Assessment and Individualized Intervention
- NIH/NIA P30 AG028383: University of Kentucky Alzheimer's Disease Research Center

WHY A SENSORY APPROACH?

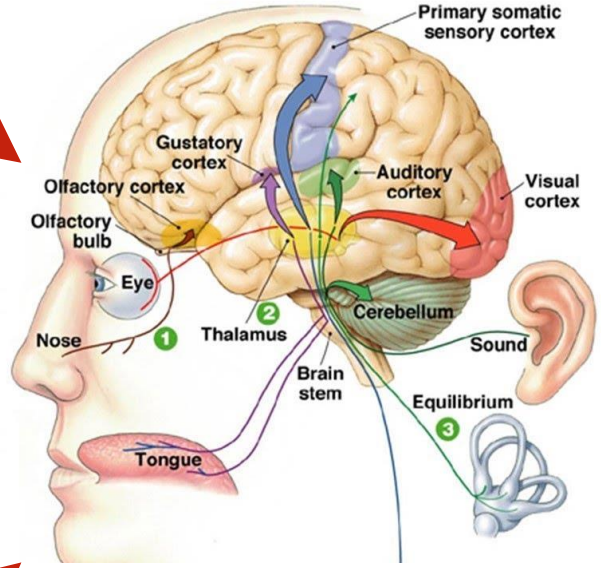
- **Cognitive Reserve** We build our brain through:
  - Preferences (likes and dislikes)
  - Memories and experiences
  - Knowledge
  - Routines and Habits

- **Neuroplasticity** The brain continually evolves and changes over time

- **Sensation** is paramount to drive neural, behavioral, and cognitive activation



TOP-DOWN VERSUS BOTTOM UP



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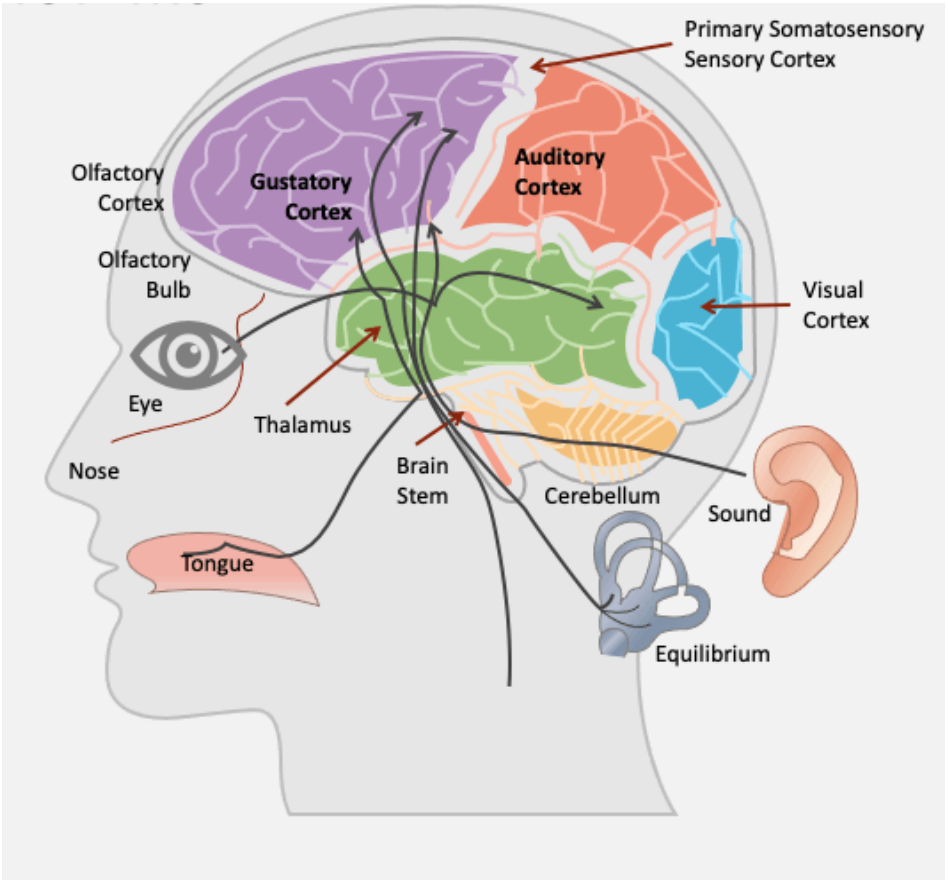
Functional Activity

EIGHT SENSORY SYSTEMS

System – Organ – Sensation

- Gustatory (tongue; taste)
- Vestibular (inner ear; balance)
- Tactile (skin; touch)
- Visual (eyes; seeing)
- Auditory (ears; hearing)
- Olfactory (nose; smell)
- Proprioception (joints; pressure)
- Interoception (internal organs; bodily needs)



AUDIENCE PARTICIPATION

On the next 3 slides, I am going to show you a series of photos.

If you recognize the person in the photo, yell out their name as quickly as you can.

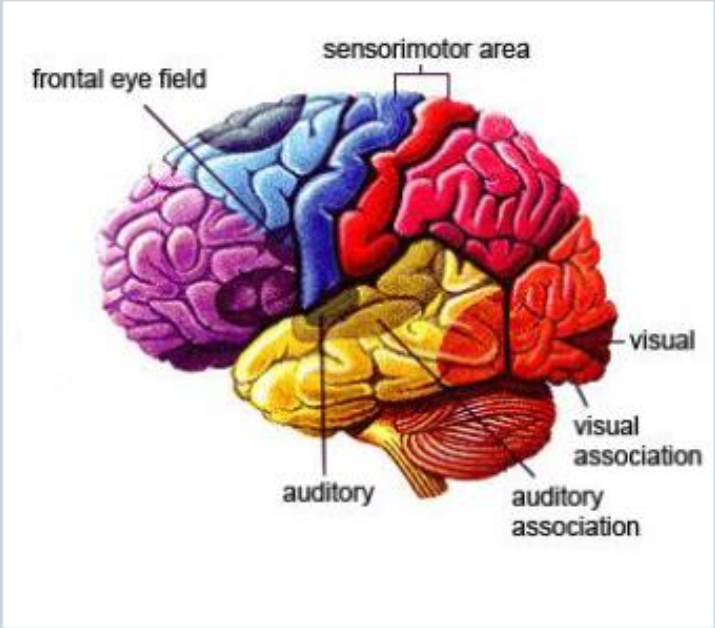
**This activity borrowed from Dr. Heather Whitson, MD of Duke University

What your brain just did with that visual cue

See picture
- -dimensions
- -color
- -contours

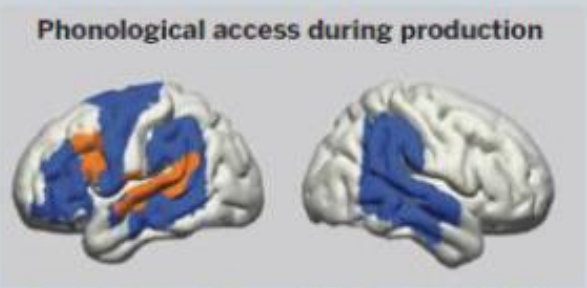
200ms

Semantic access
- -recognize
- -ascribe meaning
- -recall



300ms

Phonologic retrieval
- -connect meaning to word
- -recall sound of word



Shafto MA & Tyler LK *Science* 2014

400ms

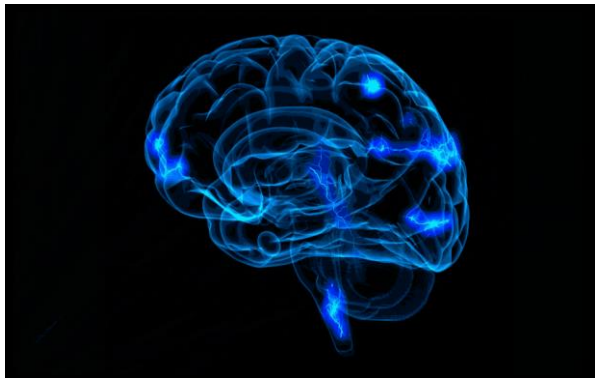
"BILL GATES!"

Articulation
- -produce utterance (or sense "tip of the tongue")

TOP DOWN = Thinking

- Knowledge
- Past Experiences
- Retained Learning
- Expectations
- High Level Cognition
- Prediction

Prefrontal Cortex



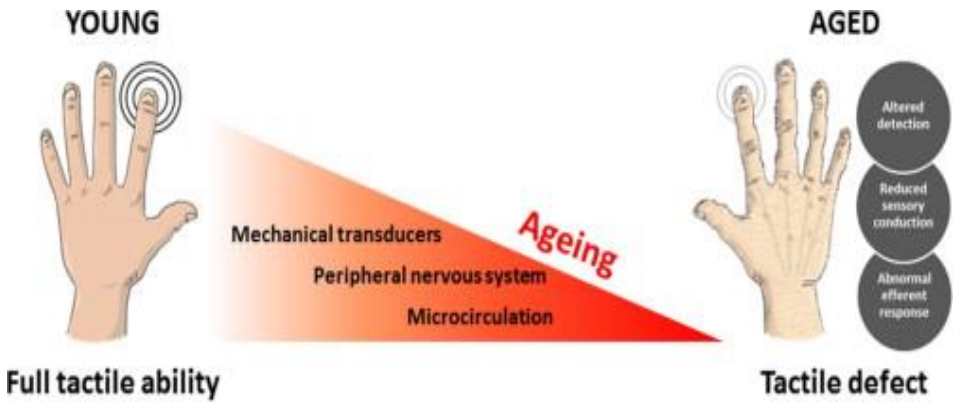
BRAIN STEM

- Sensation-Based
- Supportive Environment
- Caregiver Facilitation
- Grounded in momentary feelings

BOTTOM UP = Sensation

SPECIAL CONSIDERATIONS: SENSORY SYSTEM AGING

- Peripheral sensory modalities peak in 20's to 30's
  - Hearing loss starts in 30-40's and gradually declines
  - Vision begins to decline in 40's
  - Tactile awareness declines in elderly persons
  - Taste bud loss between 40-50, significant reduction in taste in 60's
  - Declines in proprioceptive messaging in late 50's
  - Reduction in the number of vestibular ganglion cells as early as 60
  - Decreased olfaction in more that 50% of those older than 60



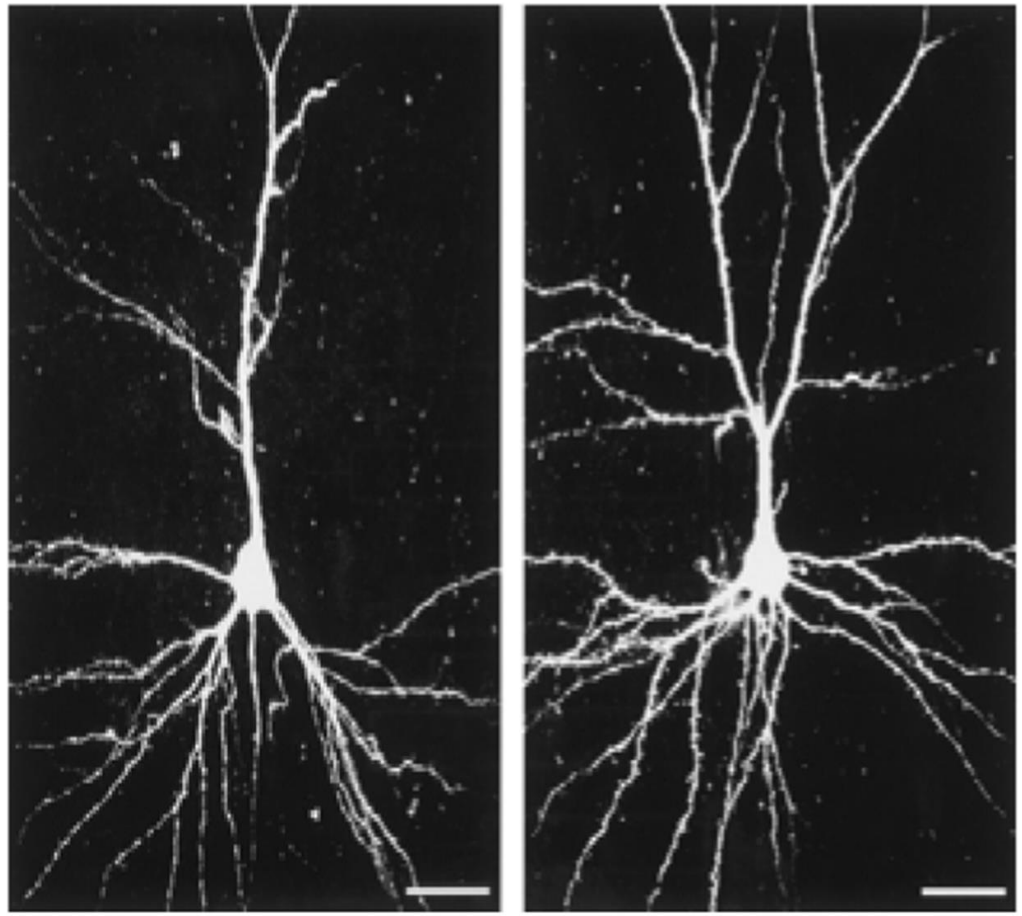
ENVIRONMENTAL ENRICHMENT

- **Sensory Stimulation**- Specific release of acetylcholine in cortex and hippocampus (Inglis, 1995)
- **Physical Exercise**- Neurotrophic changes leading to neurogenesis and synaptogenesis; specific neurogenesis in hippocampus (Kleim, Jones, Schallert, 2003; Mustroph, et al., 2012)
- **Social** – Social activity is a critical element for cognitive stimulation
- **Cognitive-** Novel activities build neurological pathways
- **Nutrition-** Required for brain health
- **Sleep-** Restores and cleanses brain toxins

ENRICHED ENVIRONMENTS ARE NEUROPROTECTIVE

- Produces neurogenesis across the life span in hippocampus, olfactory bulbs, frontal, parietal, and occipital cortices of animals and humans
- Increased cortical weight and thickness
- Life time synaptogenesis
- Creation of cognitive reserve

(Diamond, 2001; Neidl, et al., 2015; Nithianantharajah & Hannan, 2006; Speisman, et al., 2013)



QUESTIONS AND COMMENTS?

References available upon request