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

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

200ms
- See picture
  - dimensions
  - color
  - contours
- Semantic access
  - recognize
  - ascribe meaning
  - recall

300ms
- Phonologic retrieval
  - connect meaning to word
  - recall sound of word

400ms
- “BILL GATES!”
- Articulation
  - produce utterance (or sense “tip of the tongue”)

Shafto MA & Tyler LK Science 2014
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
ENVIROMENTAL 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?

People will forget what you said, people will forget what you did, but people will never forget how you made them feel.

Maya Angelou

References available upon request