Memory and Brain Health as You Age: Understanding Changes and Dispelling Myths

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An Overview:

• What is memory?
• How does memory function in the brain
• What are some changes that all of us will experience in healthy aging?
• Dispelling myths about this journey
• Protective factors and tips for keeping your memory sharp:
  • Exercising memory
  • Nutritional and dietary factors
  • Lifestyle factors
What Exactly is Memory?

• A malleable and long-lasting representation that is reflected in thought, experience, or behavior.
What Kinds of Memory Are There?

• Broadly defined into four systems:
  • Episodic
  • Semantic
  • Working
  • Procedural
Where is Memory in the Brain?
Medial Temporal Lobes and the Hippocampus

• Ammon’s Horn
• The Temporal lobes
  • Object recognition
  • Auditory/ Spatial processing
  • Language
• The Hippocampus is a special structure in the middle of the temporal lobe
• It combines different streams of sensory information into episodes
• Hippocampus is heavily connected to frontal lobe
Why is Memory so Dynamic?

- A fundamental process for navigating, understanding, and relating our worlds to others
- Memories are constantly active and flexible
- Metabolic activity is highest in the Hippocampus
- Constant cycle of information exchanged between our external and internal worlds
Why can Memory be so Fragile?

- High metabolic activity also leads to high vulnerability
- Vulnerability involves interactive factors including environment, genetics, lifestyle, and cognitive reserve
- Location in the brain
- Proximity to vasculature
Brain Changes in Healthy Aging

- Blood vessels naturally change with age
- Blood flow reduced as arteries narrow
- The brain loses weight
- Blood Pressure commonly increases (medication controlled)
- Increased blood pressure = white matter changes
- The communication between neurons slows
- Activation in the brain becomes more bilateral
- Plaques develop in the hippocampus and cortex
There is some cell loss and shape change associated with healthy aging, but this by itself does not indicate significant memory loss or impending memory difficulties.
Cognitive Changes in Healthy Aging:

• Recollection becomes more difficult, yet familiarity is preserved
• Working memory slows as well
• However... equated for time, older adults = younger adults
Cognitive Changes in Healthy Aging:

- Multitasking ability declines beginning in early adulthood

Myths we Can Comfortably DispEl

- We only use 10-20% of our brains
- Older individuals can’t learn new things
- Learning a new language is for the young
- You are stuck with the brain you are born with
- It’s inevitable that everyone will develop dementia in later life
- Older individuals are doomed to forget things
- Fancy memory supplements

Global Council on Brain Health and AARP
Cognitive Protection and Exercise

• Learn...Learn...Learn
• Working mnemonic strategies for maximizing learning and recall
  • Memory increases with practice at all ages
  • Rhyming
  • Face-name associations
  • Chaining new information to prior information
  • Deliberately attending longer
• Go for a walk and associate items with your path
Additional Ways to Exercise your Memory

- Add to your cognitive reserve!
- Testing your own recall.. Make lists and quiz yourself
- Crossword puzzles, Sudoku, Word-Finds, Memory Games, Trivia
- Lumosity, Fit Brains, Peak, Elevate, Sporcle, MindSparke
- Music…Its power cannot be understated
- Challenge your taste and sense
Protective Factors
Number of Words Correctly Completed vs Chronological Age for different studies:

- Hambrick, Salthouse, & Meinz (1999), Study 2
- Hambrick et al. (1999), Study 3
- Hambrick et al. (1999), Study 4
- Salthouse (2001b)

Salthouse, 2004
How does this change happen?

- Reduction in cortical thickness
  - Cortex is the outside of the brain
  - It is responsible for higher-level thinking
  - It is very important – that’s why its so
Role of exercise

• High fitness older adults have a thicker cortex than low fitness older adults
  • It will not be as thick as that of a younger adult, so while staying active is important, exercise alone is not enough to fight off some of the negative effects of aging

• Something that increases respiration (like going for a walk) can help defend your brain
Reactive Oxygen Species

• Molecules that are a byproduct of the oxygen we breathe in, and they cause damage to our cells
  • That damage is called oxidative stress
  • The nervous system is particularly susceptible to this damage
  • How do we fight against oxidative stress? With antioxidants!
Antioxidants in nutrition

- Eating antioxidant rich food can protect your brain
- Radiation can affect the brain in a similar way, so we use radiation in labs to see how the brain may act over time
Blueberries!

- Put rats on diet with anthocyanin-rich blueberries for 4 weeks (equivalent to 1 cup a day in humans)
- Radiate them with $^{56}$Fe, which disrupted cognitive performance
- Test for pro-oxidants
  - These will help in the development of ROS

Poulbose, Rabin, Bielinski, Kelly, Miller, Thangthaeng & Shukitt-Hale, 2017
NOX2 levels in the hippocampus

Poulose, Rabin, Bielinski, Kelly, Miller, Thangthaeng & Shukitt-Hale, 2017
Other foods suspected to help:

- Cherries
- Raspberries
- Strawberries
- Spinach
- Walnuts
- Omega-3 fatty acids
In Conclusion

“No memory is ever alone; it’s at the end of a trail of memories, a dozen trails that each have their own associations”.

-Louis L’Amour-