

Use It or Lose It

-Aging Brain and Its Plasticity-

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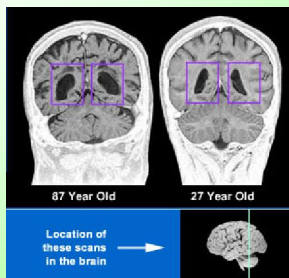
The 5th Annual Art and Science of Aging Conference



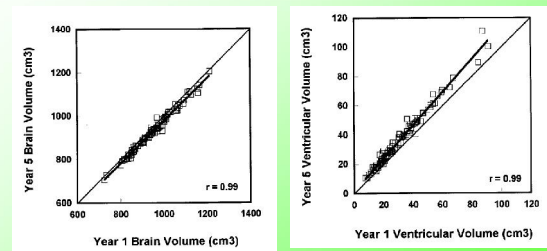
Outline

- Ø Structural changes in the aging brain
- Ø Neurogenesis and cortical reorganizations
- Ø The adaptive brain
 - Brain activations when cognitive tasks are performed

Structural changes in the aging brain:



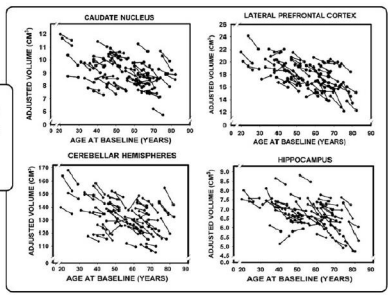
Resnick et al., 2003 A longitudinal study of 92 non-demented old adults (59-85)





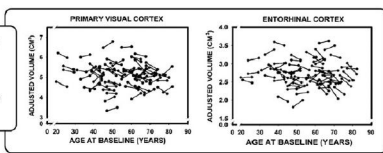
Raz, et al., 2005
A 5-year study of healthy older adults (mean age 63.79)

Brain regions that reduce in volume with age.

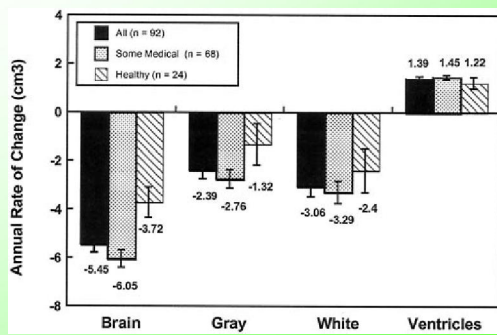


Raz, et al., 2005
A 5-year study of healthy older adults (mean age 63.79)

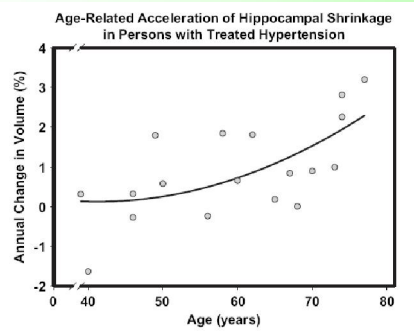
Brain regions with minimal reduction or stable volume with age.



Resnick et al., 2003
Individual differences in the rate of volume change

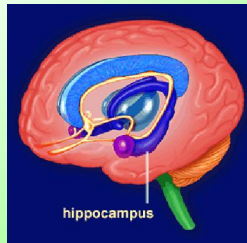


Raz, et al., 2005 – People treated with hypertension



Neurogenesis and cortical reorganizations

Growth of new nerve cells: Kempermann & Gage, 1999



Exercises and neurogenesis:

Van Praag, Shubert, Zhao, & Gage, 2008

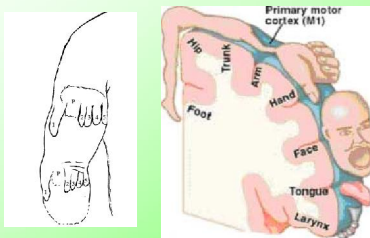
Fabel & Kempermann, 2005

Depression and neurogenesis:

Jacob, 2004

Cortical reorganization in adults' brain:

Ramachandra (1992):



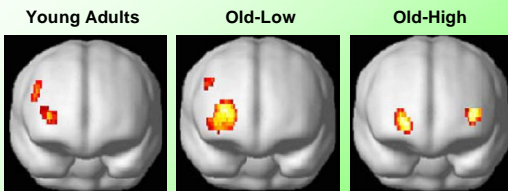
The adaptive brain

- Brain activations involved in cognitive tasks

Two major age-related changes are reported:

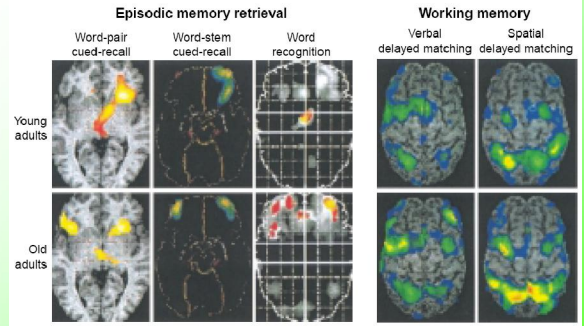
1. There are more bilateral activations in the brain (Cabez et al., 2002; Reuter-Lorenz, 2002).
2. There are reliable increases in prefrontal activation (Park&Reuter-Lorenz, 2009).

**More bilateral Activation in older brain:
Two hemispheres are better than one when we age**



Cabeza, R., Anderson, N. D., Locantore, J. K., & McIntosh, A. R. (2002). Age gracefully: Compensatory brain activity in high-performing older adults. *NeuroImage*, 17, 1394-1402.

Bilateral involvement and more activation in the frontal regions:



Reuter-Lorenz (2002). New vision of the aging mind and brain. *Trends in Cognitive Science*, 6, 394-400.

**The Scaffolding Theory of Aging and Cognition
- Park&Reuter-Lorenz, 2009**

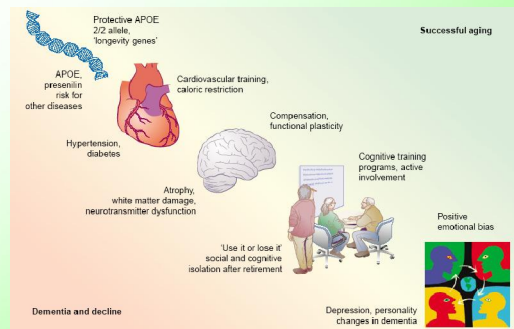
Compensatory scaffolding:

- Frontal recruitment
- Neurogenesis
- Distributed processing
- Bilaterality

Scaffolding enhancement:

- New learning
- Engagement
- Exercise**
- Cognitive training**

The Concept of Successful Aging:



Reuter-Lorenz, P.A., & Lusting, C. (2005). Reorganizing discoveries about the aging mind. *Current Opinion in Neurobiology*, 15, 245-251.