Use It or Lose It
-Aging Brain and Its Plasticity-

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Outline

- Structural changes in the aging brain
- Neurogenesis and cortical reorganizations
- 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)
Resnick et al., 2003
Different regions show different among of age-related changes

Piguet et al., 2009
A postmortem analysis of brain without neuropathological abnormalities (age 46-92).

Resnick et al., 2003 - Loss of gray matters

Kennedy & Raz, 2009
Regional white matter involvement and cognitive performance
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).
Young Adults | Old-Low | Old-High

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


Bilateral involvement and more activation in the frontal regions:


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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