Boost Your Brain:
Regenerate Cells Critical to Memory & Learning

Majid Fotuhi, MD PhD

Howard County 4th Annual Health & Wellness Expo
May 1, 2015

New Discoveries

Modifiable factors that alter the size of the hippocampus with ageing

Majid Fotuhi, David Do and Clifford Jack

Abstract | The hippocampus is particularly vulnerable to the neurotoxic effects of obesity, diabetes mellitus, hypertension, hypoxic brain injury, obstructive sleep apnoea, bipolar disorder, clinical depression and head trauma. Patients with these conditions often have smaller hippocampi and experience a greater degree of cognitive decline than individuals without these comorbidities. Moreover, hippocampal atrophy is an established indicator for conversion from the normal ageing process to developing mild cognitive impairment and dementia. As such, an important aim is to ascertain which modifiable factors can have a positive effect on the size of the hippocampus throughout life. Observational studies and preliminary clinical trials have raised the possibility that physical exercise, cognitive stimulation and treatment of general medical conditions can reverse age-related atrophy in the hippocampus, or even expand its size. An emerging concept—the dynamic polygon hypothesis—suggests that treatment of modifiable risk factors can increase the volume or prevent atrophy of the hippocampus. According to this hypothesis, a multidisciplinary approach, which involves strategies to both reduce neurotoxicity and increase neurogenesis, is likely to be successful in delaying the onset of cognitive impairment with ageing. Further research on the constellation of interventions that could be most effective is needed before recommendations can be made for implementing preventive and therapeutic strategies.

Fotuhi, M. *et al. Nat. Rev. Neurol.* **8**, 189–202 (2012); published online 13 March 2012; doi:10.1038/nrneurol.2012.27

Changing perspectives regarding late-life dementia

Majid Fotuhi, Vladimir Hachinski and Peter J. Whitehouse

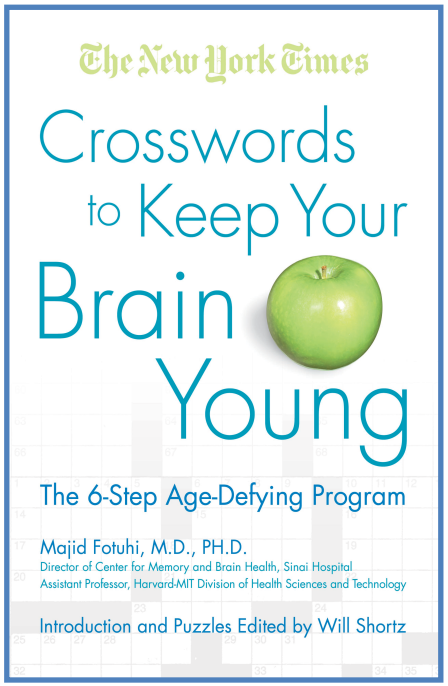
Abstract | Individuals over 80 years of age represent the most rapidly growing segment of the population, and late-life dementia has become a major public health concern worldwide. Development of effective preventive and treatment strategies for late-life dementia relies on a deep understanding of all the processes involved. In the centuries since the Greek philosopher Pythagoras described the inevitable loss of higher cognitive functions with advanced age, various theories regarding the potential culprits have dominated the field, ranging from demonic possession, through 'hardening of blood vessels', to Alzheimer disease (AD). Recent studies suggest that atrophy in the cortex and hippocampus—now considered to be the best determinant of cognitive decline with aging—results from a combination of AD pathology, inflammation, Lewy bodies, and vascular lesions. A specific constellation of genetic and environmental factors (including apolipoprotein E genotype, obesity, diabetes, hypertension, head trauma, systemic illnesses, and obstructive sleep apnea) contributes to late-life brain atrophy and dementia in each individual. Only a small percentage of people beyond the age of 80 years have 'pure AD' or 'pure vascular dementia'. These concepts, formulated as the dynamic polygon hypothesis, have major implications for clinical trials, as any given drug might not be ideal for all elderly people with dementia.

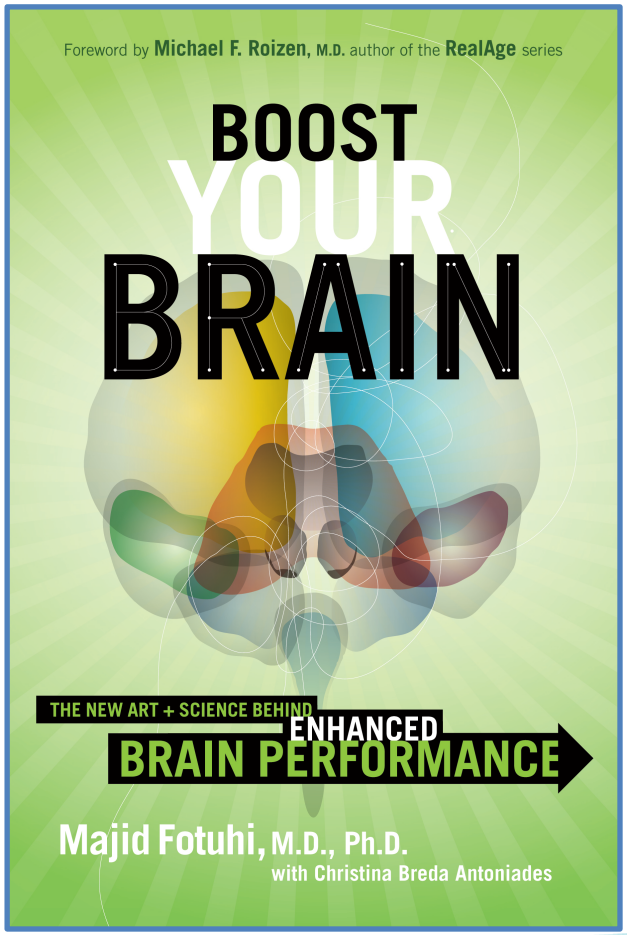
Fotuhi, M. *et al. Nat. Rev. Neurol.* **5**, 649–658 (2009); published online 17 November 2009; doi:10.1038/nrneurol.2009.

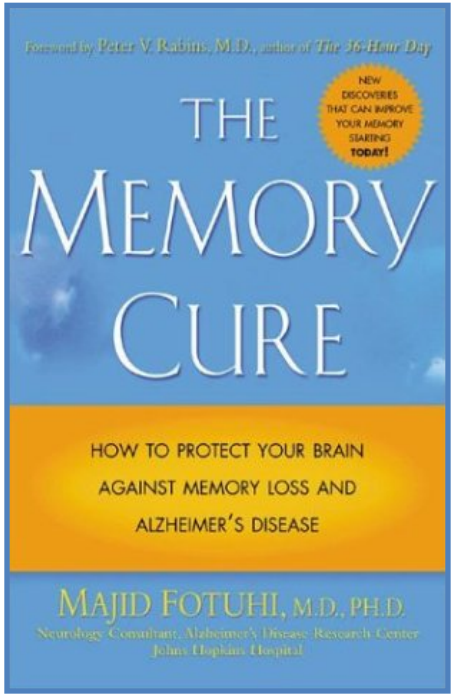
“This book may be the most important you’ll ever read. Certainly, what Dr. Fotuhi teaches in this book has changed *my* life.”

Michael Roizen, M.D.

Chairman of the Wellness Institute- The Cleveland Clinic

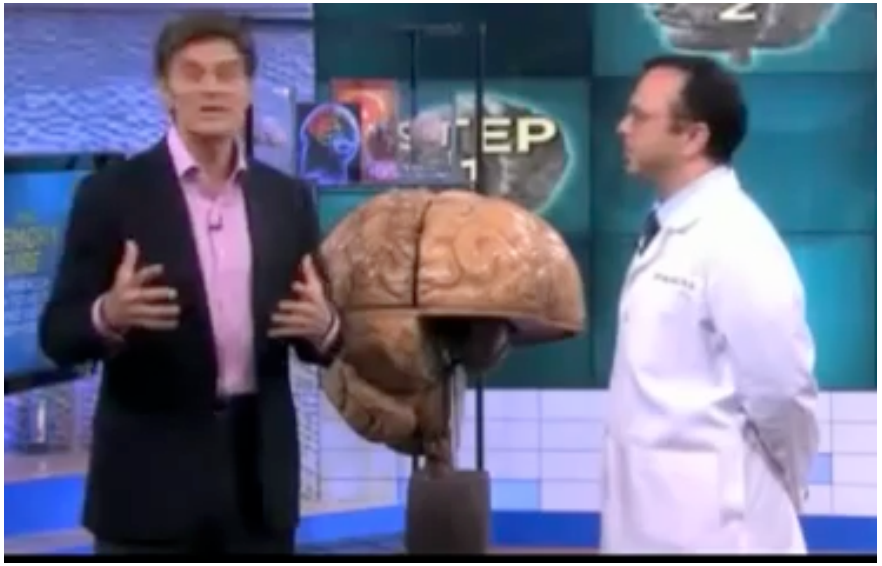






“Dr. Fotuhi has summarized the latest discoveries that show how we can grow our brains bigger and stronger…”

Mehmet Oz, M.D.

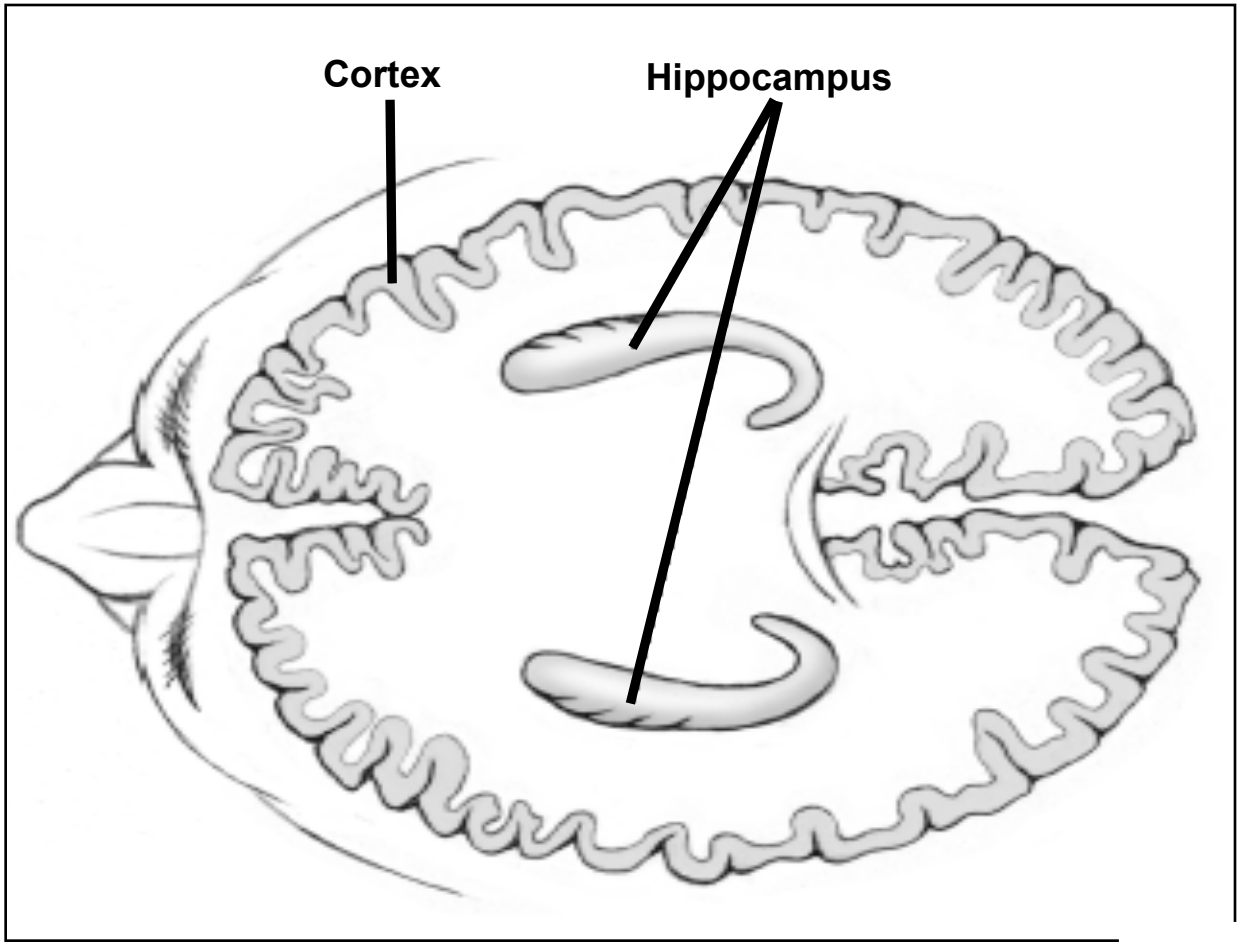


The Dr. Oz Show

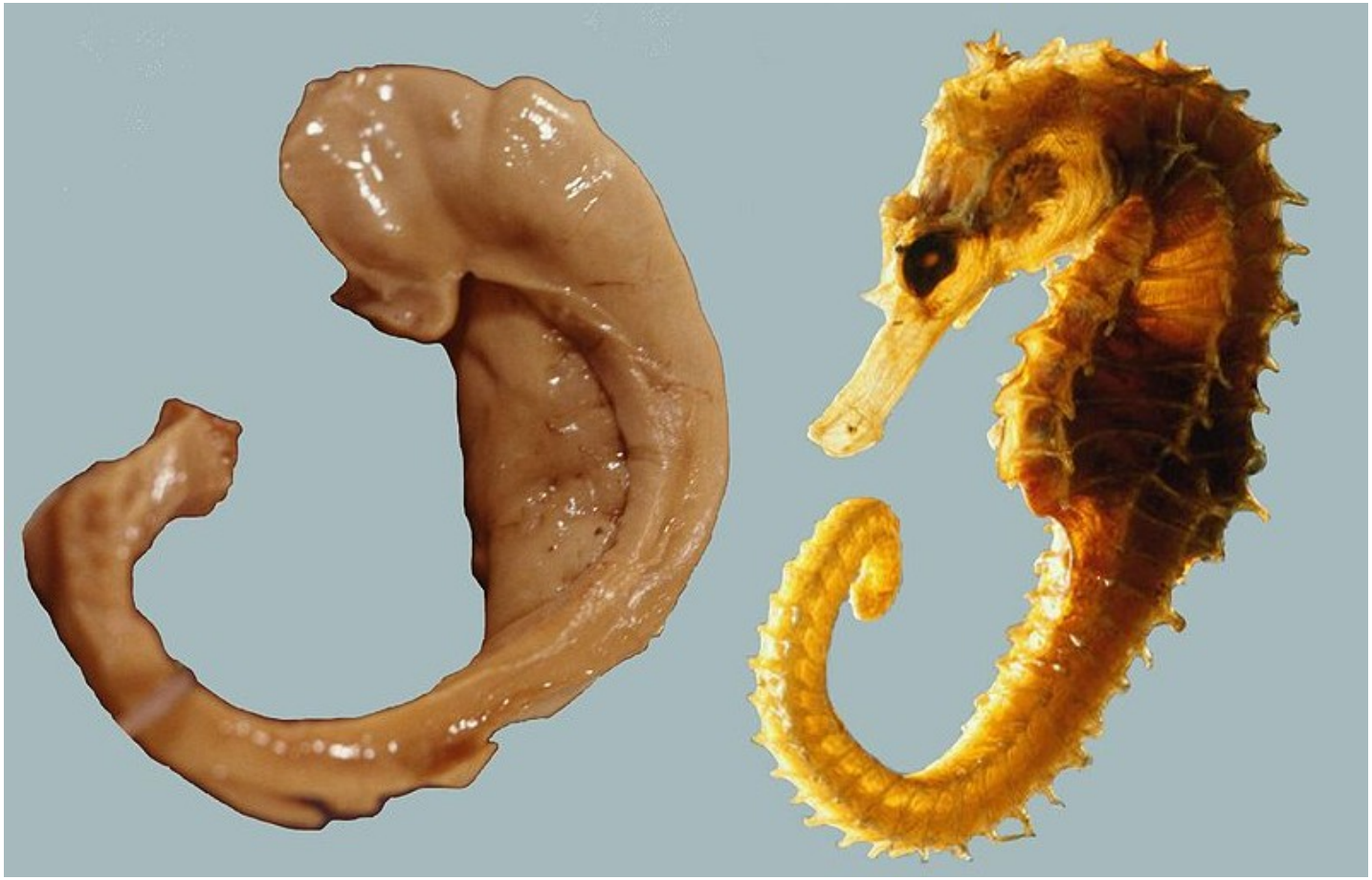
Objectives

- What happens to our brain with aging?
- How to reverse age-related brain atrophy?
- Brain Fitness Program

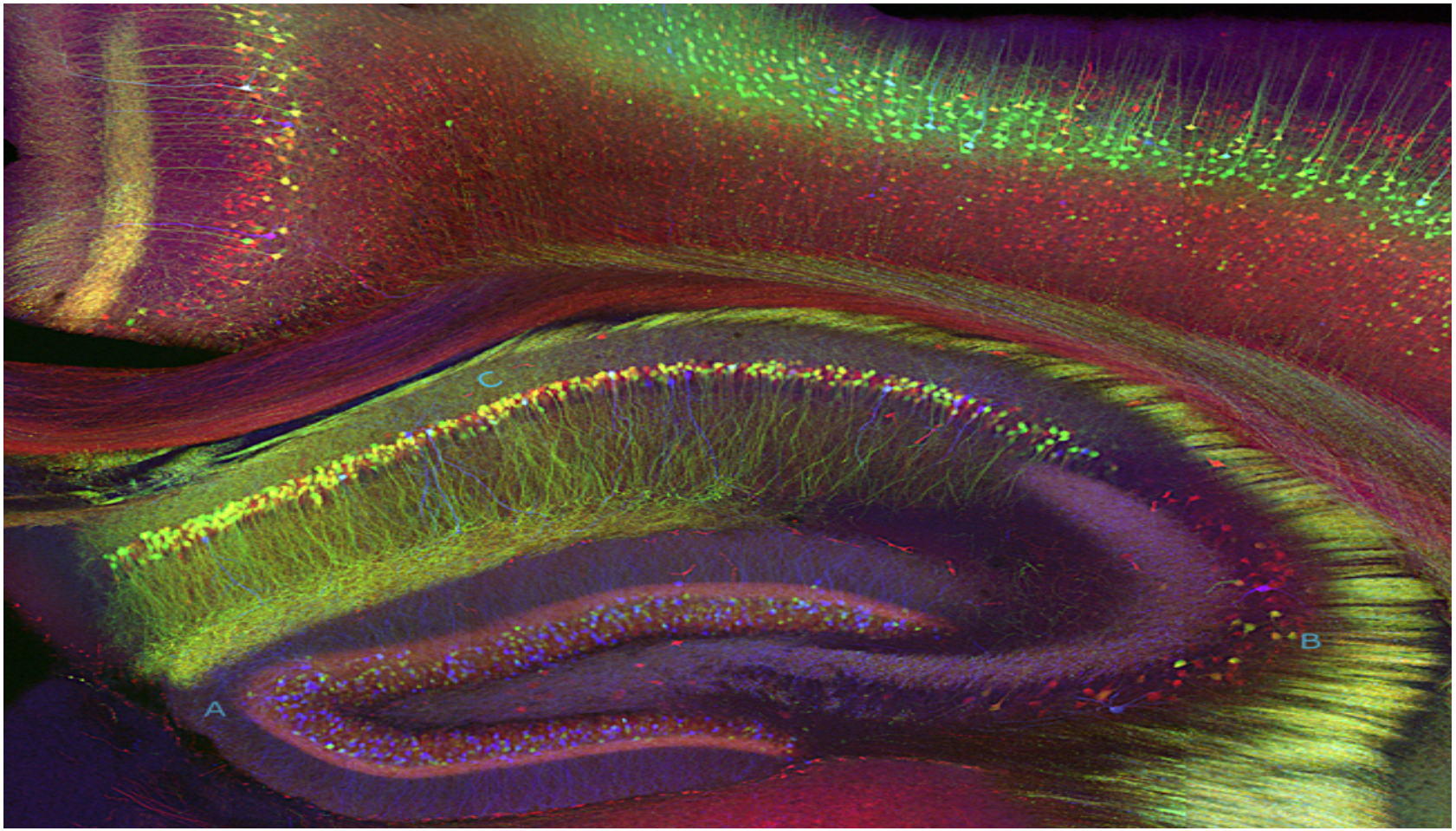
Short-term: Hippocampus
Long-term: Cortex



Hippocampus



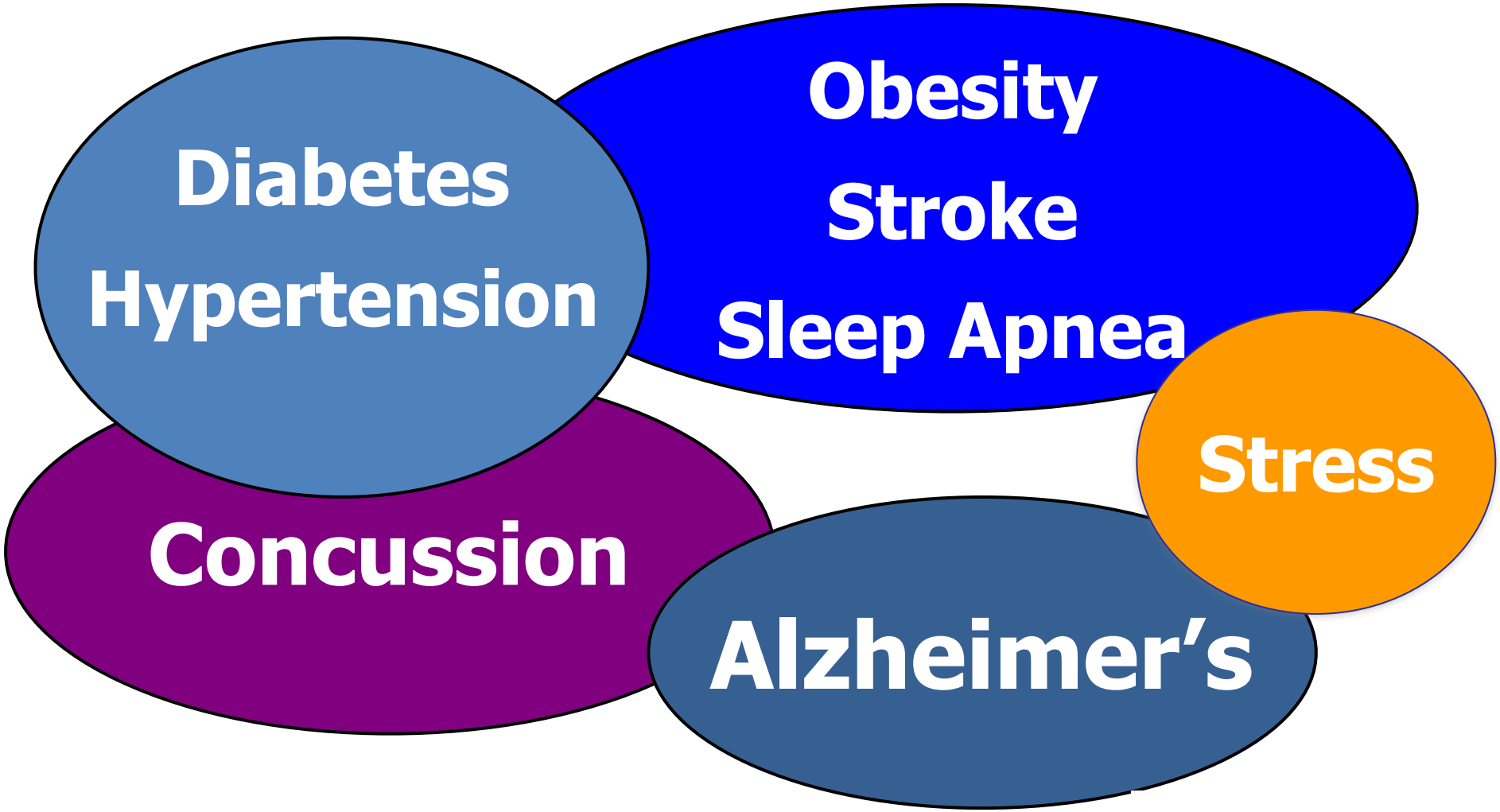
Beautiful Neurons in Hippocampus



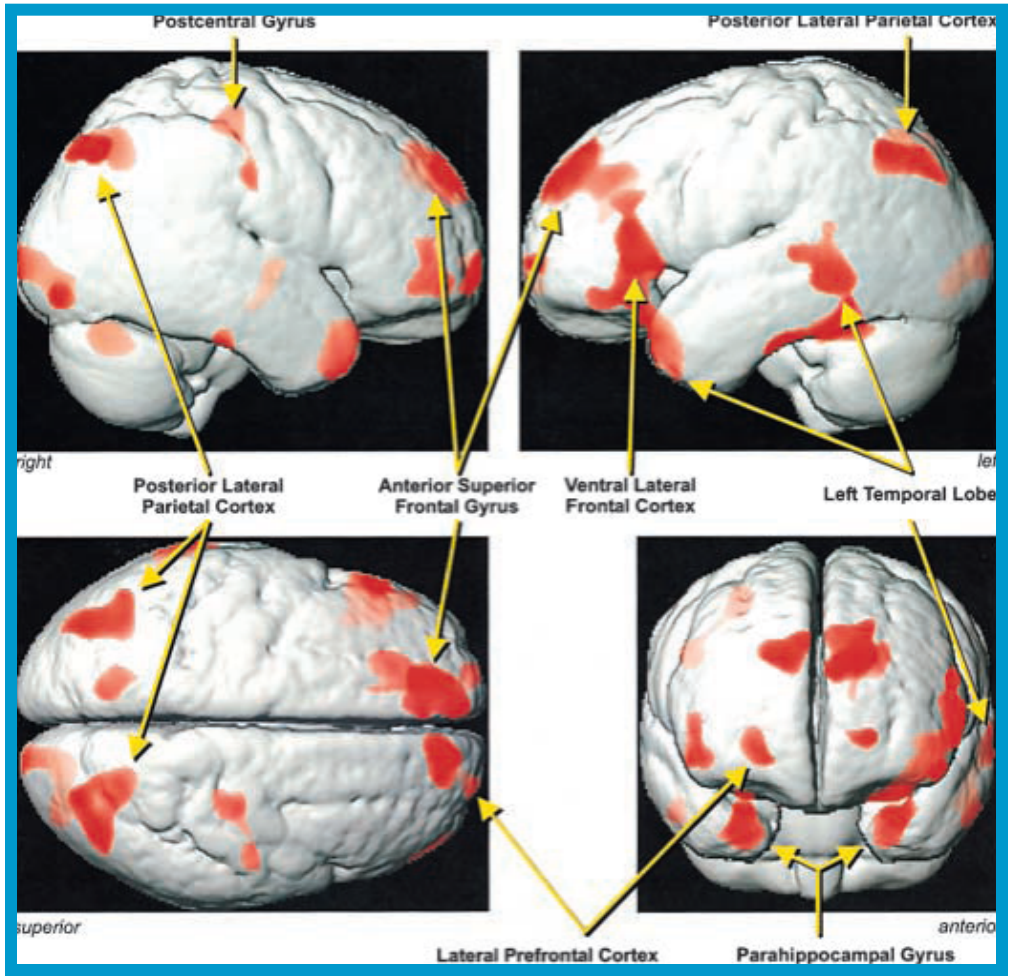
With Aging, Hippocampus Atrophies Faster than the Rest of the Brain

- **Hippocampus shrinks by about 0.5% per year after age 50**
- **That is the reason memory lapses become more frequent after age 50**

What Causes Atrophy in Hippocampus?



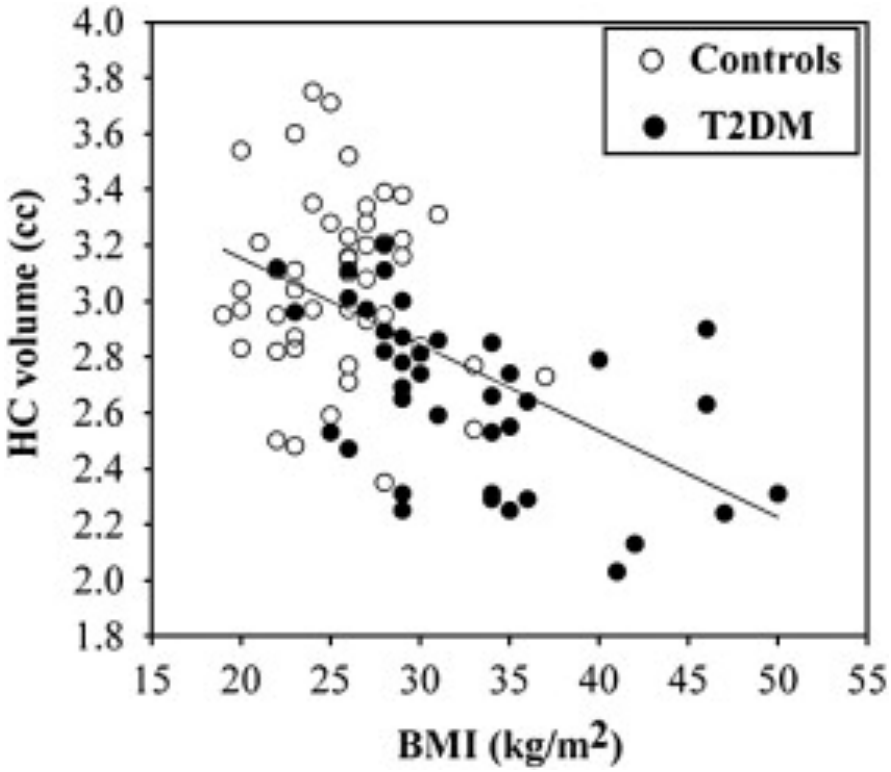
Less Brain Volume in Patients with Sleep Apnea



Am J Respir Crit Care Med 2002; 166:1382–7

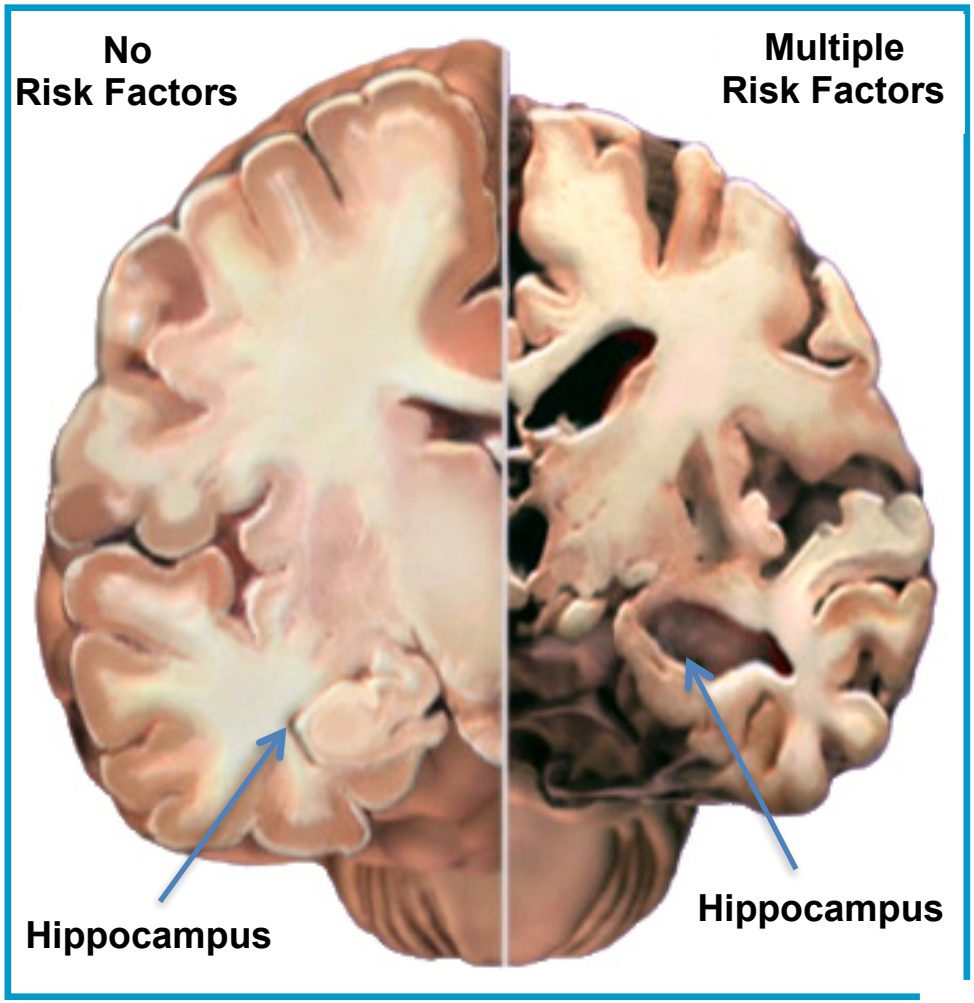
Obesity Shrinks the Brain

- Associated with reduced brain volume
  Ward, et al., 2005
- Slows cognitive function
  Debette, et al., 2011
- Brains of overweight and obese individuals appeared 8 and 16 years older, respectively
  Raji, et al., 2010

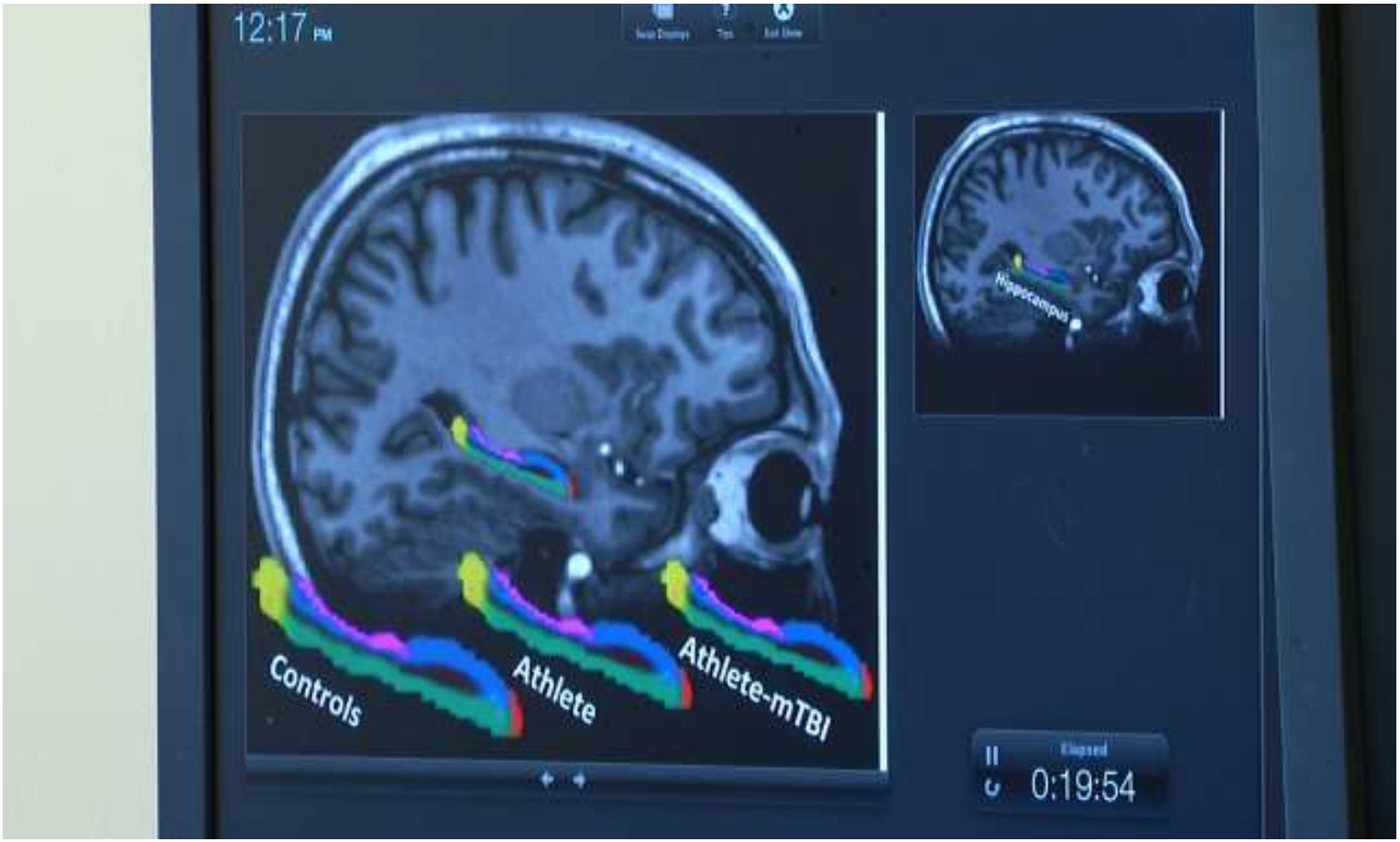


Brain Research Volume 1280, 14 July 2009, Pages 186–194

Multiple Risk Factors Shrink the Hippocampus

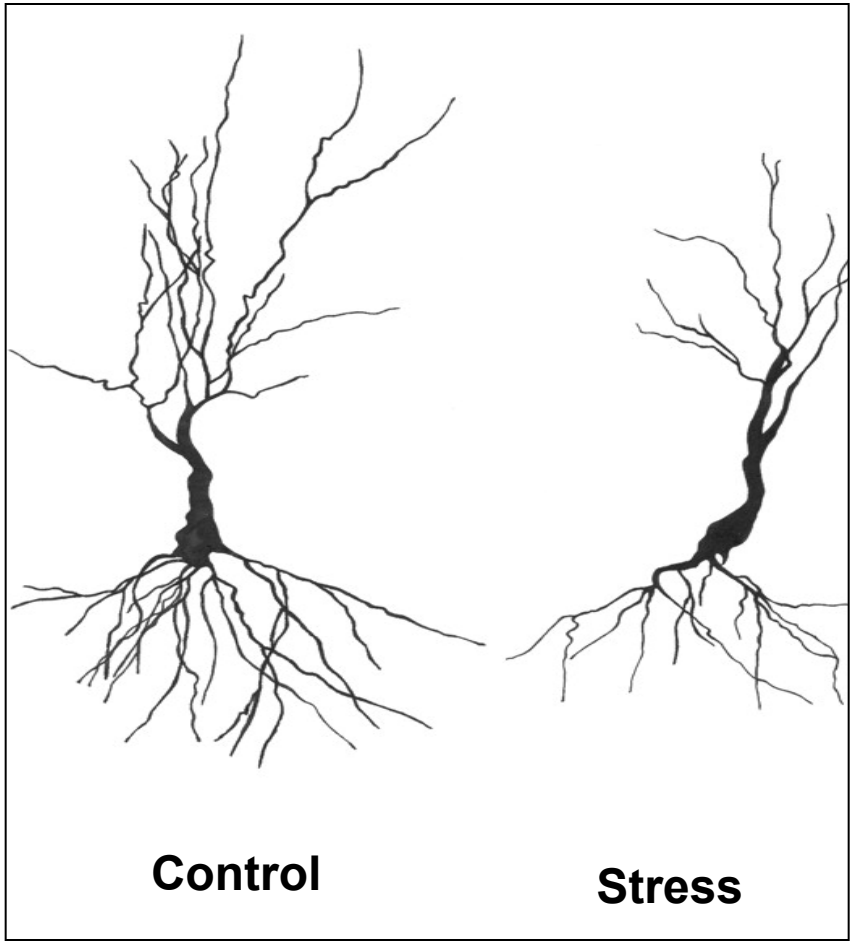


Smaller Hippocampus in football players, With or Without Documented Concussion



Singh et al, JAMA 2014

Stress Shrinks Brain Cells in Hippocampus



Depression Shrinks the Brain

- The number of days of depression is associated with the severity of hippocampal atrophy

  Sheline, et al, (1996). *PNAS*, 93(9);3908-13.

- Depression is associated with impaired memory, executive function and processing speed

  Egger et al, (2008). *Psychiatry Research: Neuroimaging;* 164(3): 237-44)

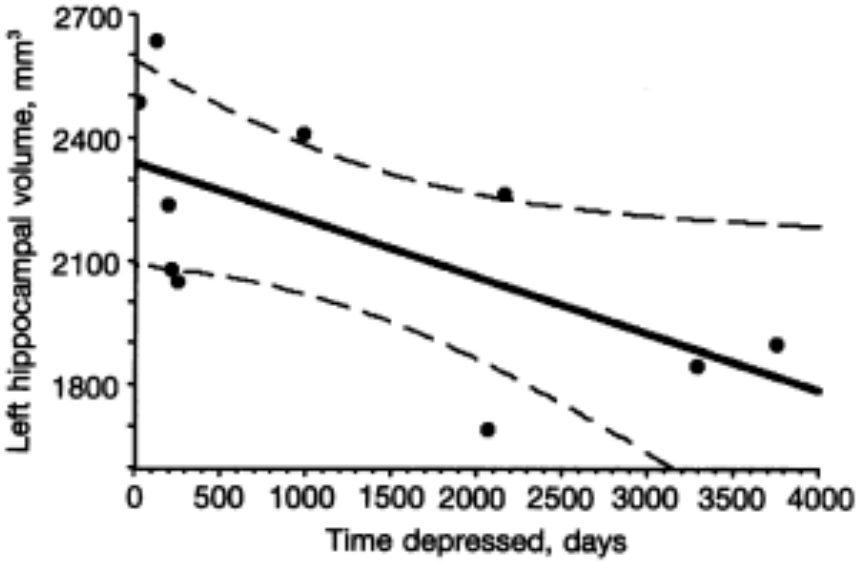
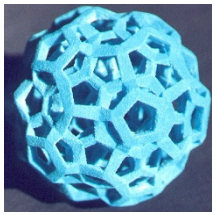


FIG. 3. Correlation between left hippocampal gray matter volumes and total days of major depression.

Sheline, (1996). *PNAS*, 93(9);3908-13.

Why do we forget names?



- Hypertension
- Diabetes
- Alcoholism
- Depression
- Heart failure
- Obesity
- High cholesterol
- Head trauma
- Aging
- Poor sleep
- Too much work
- Information overload
- Too many responsibilities
- Fatigue
- Poor attention
- Poor diet
- “Can’t do it” mentality

Diabetes
Hypertension
Obesity
Sleep Apnea
Head Trauma
Genes
Stress

Physical Fitness
Cognitive Stimulation
Brain-healthy Diet
Meditation

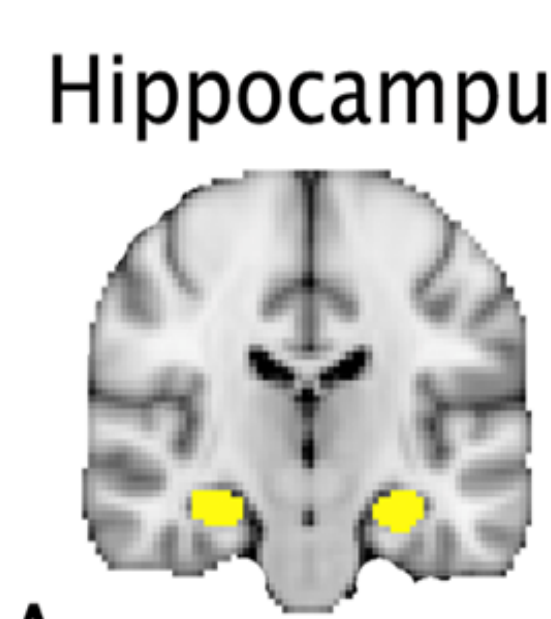
Objectives

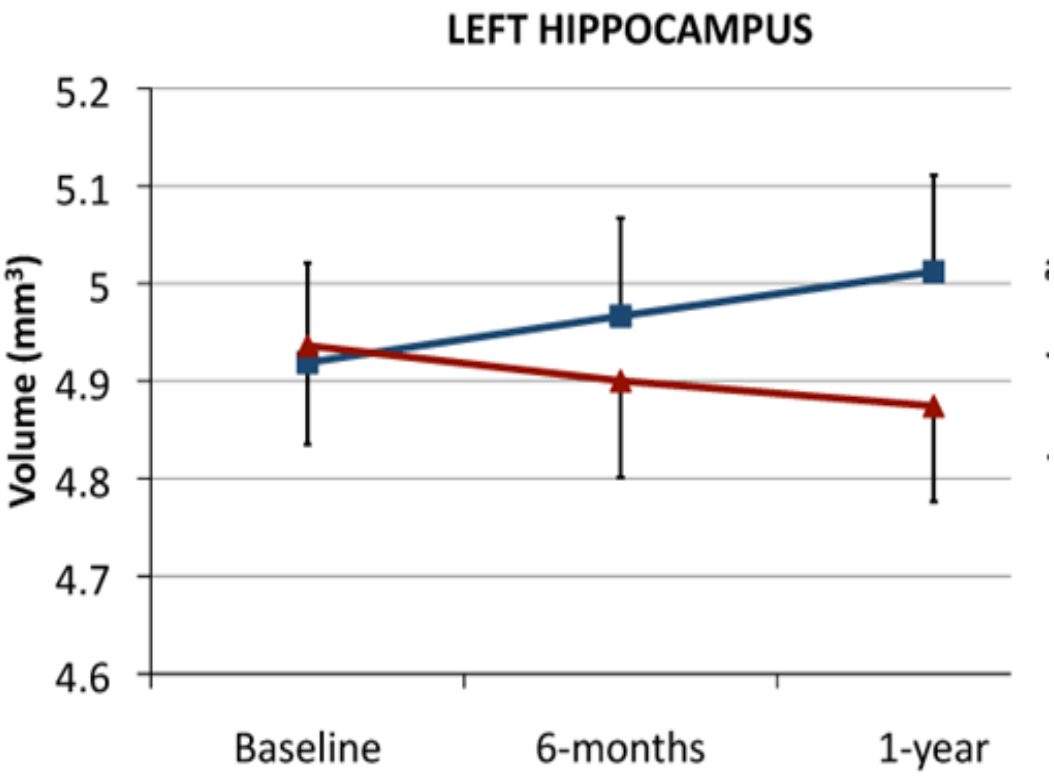
- What happens to our brain with aging?
- How to reverse age-related brain atrophy?
- Brain Fitness Program

6 Steps to Grow Your Brain

1. Get Fit
2. Tease Your Memory
3. Mediterranean Diet – DHA-EPA
4. Sleep Well
5. Focus Your Mind
6. Start Today

1. Get Fit: Hippocampus Grows Bigger with Exercise



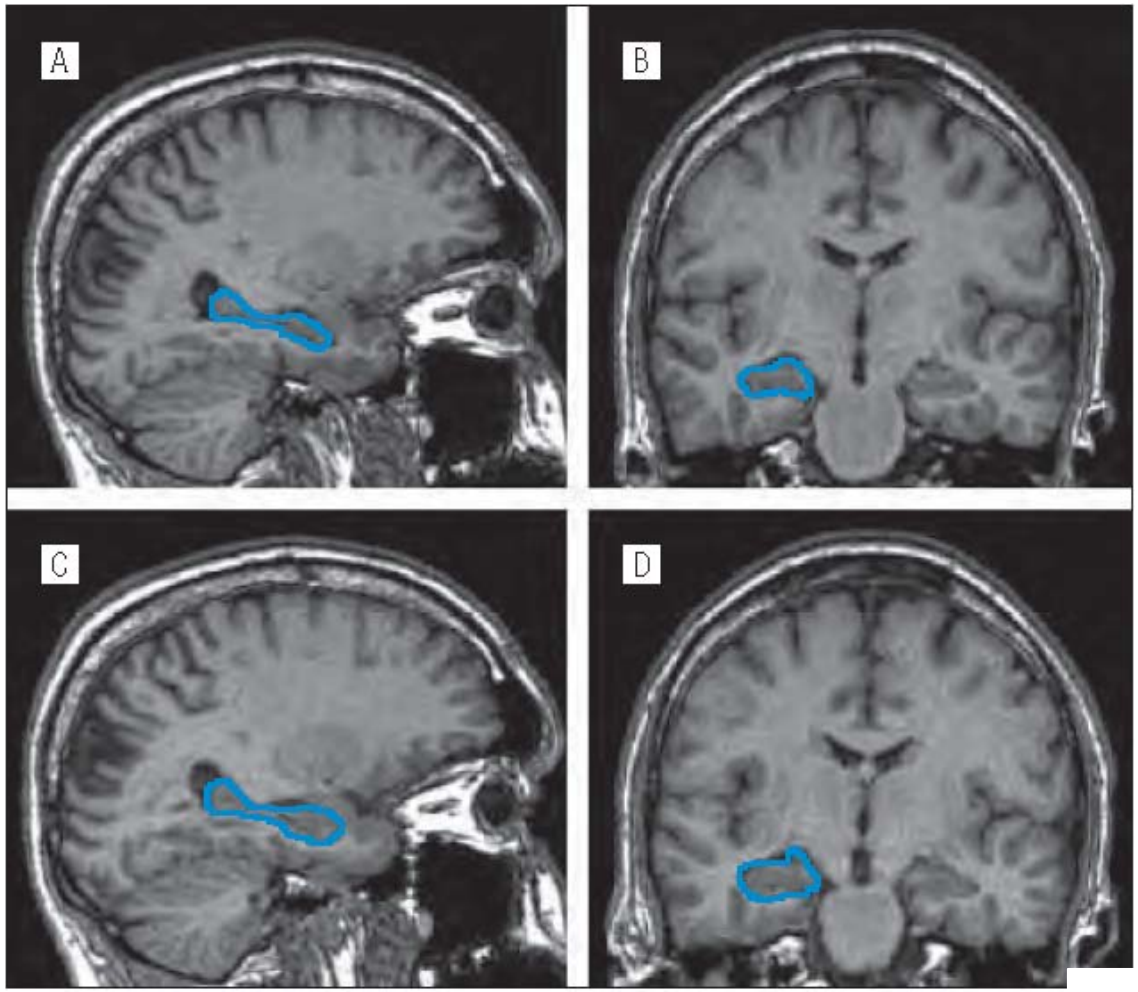


Erikson, PNAS 2011

Hippocampus Grows Bigger with Exercise, Even After 3 Months

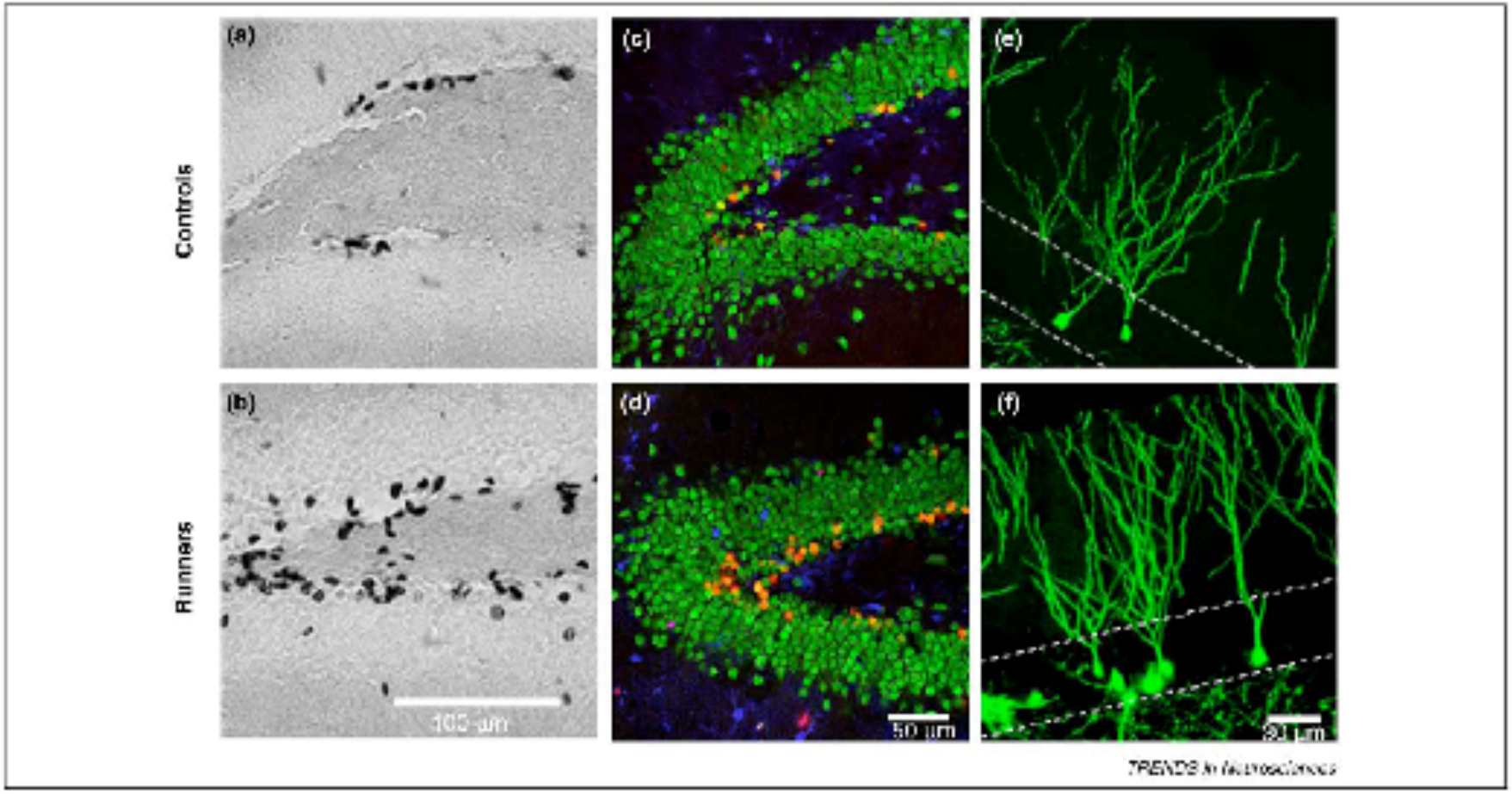
Before

After

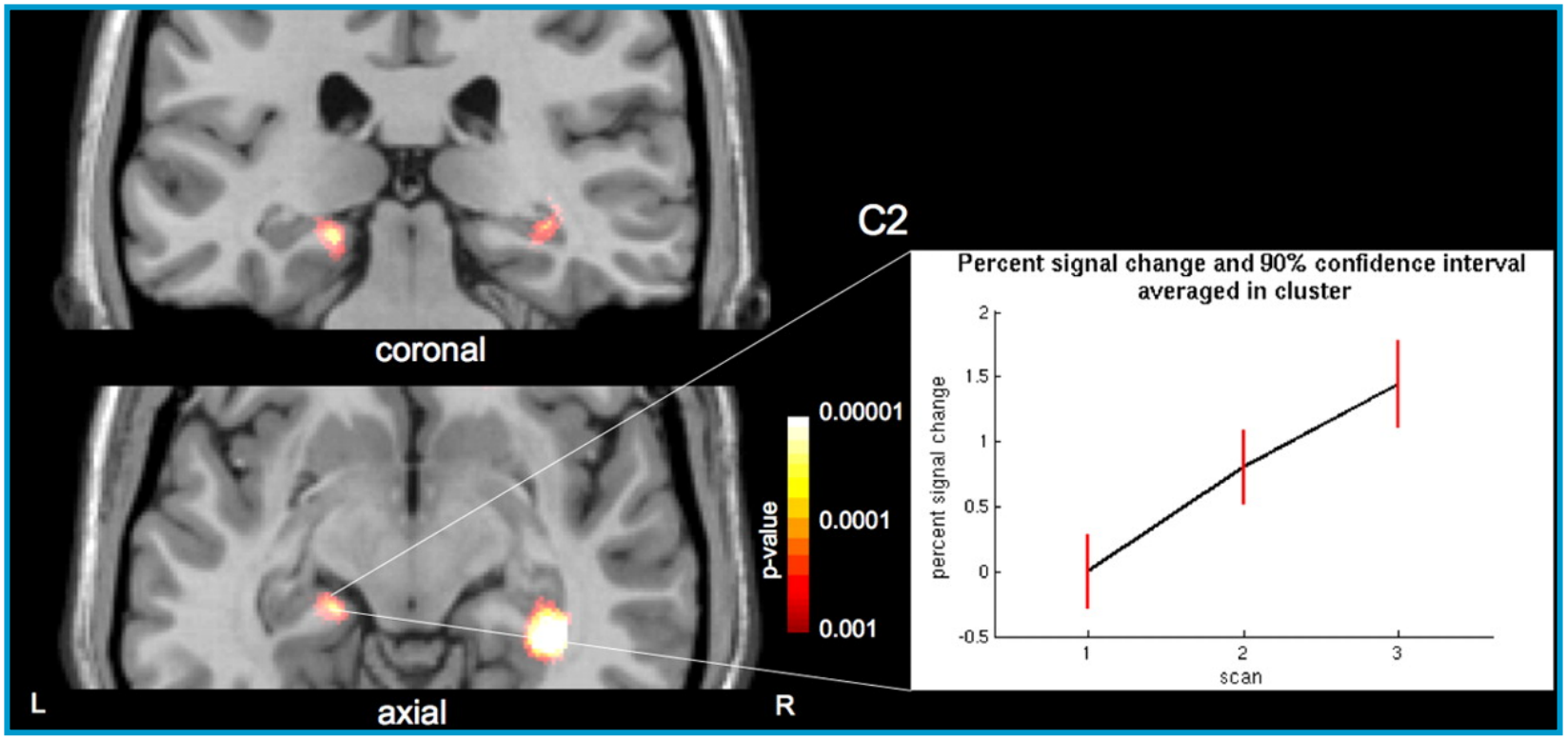


Arch Gen Psychiatry, 2010

More Exercise: More Brain Cells



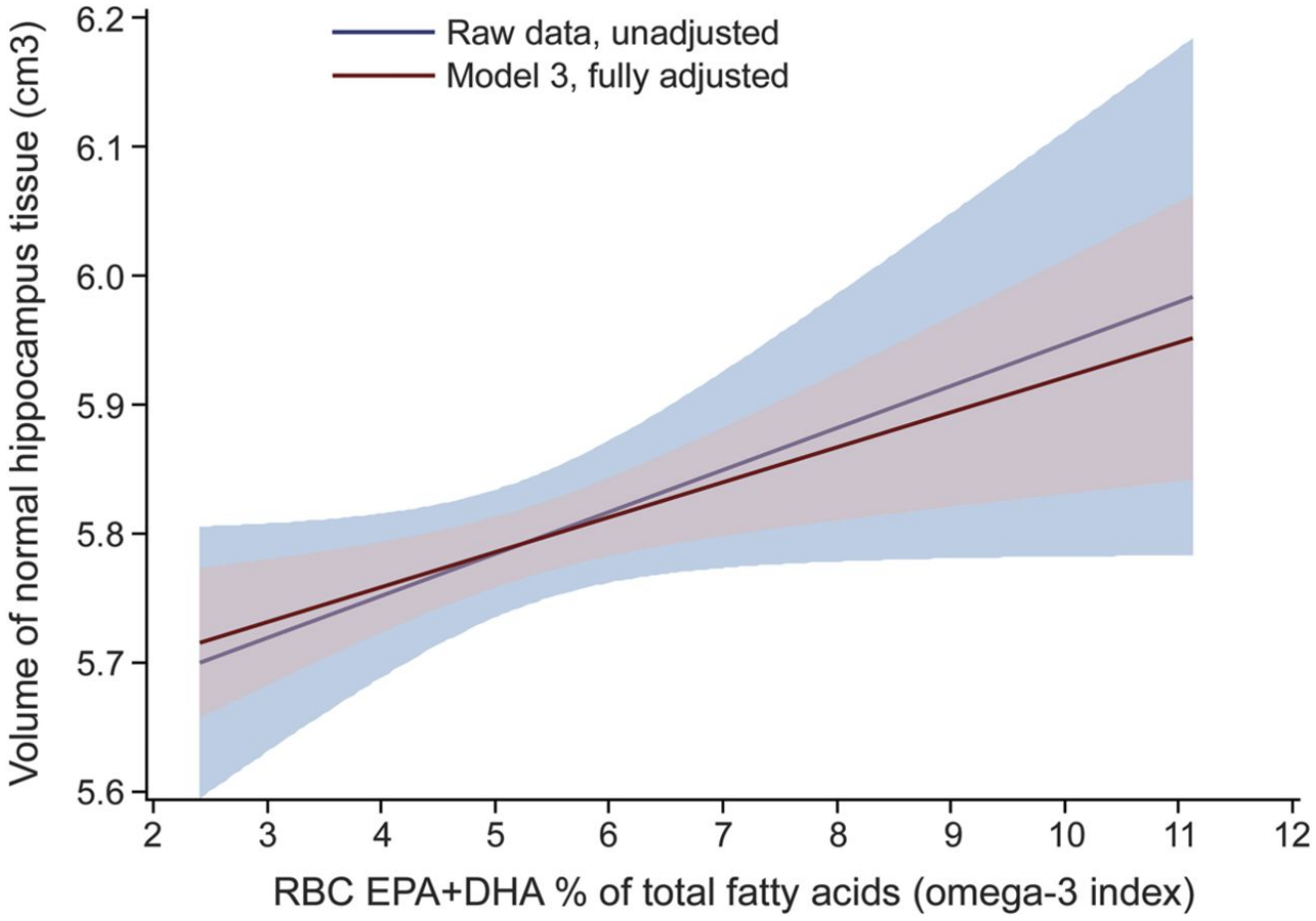
2. Tease Your Memory: Hippocampus Grows Bigger with Memorization Training



Draganski et al. J Neurosci 2006; 26:6314–7

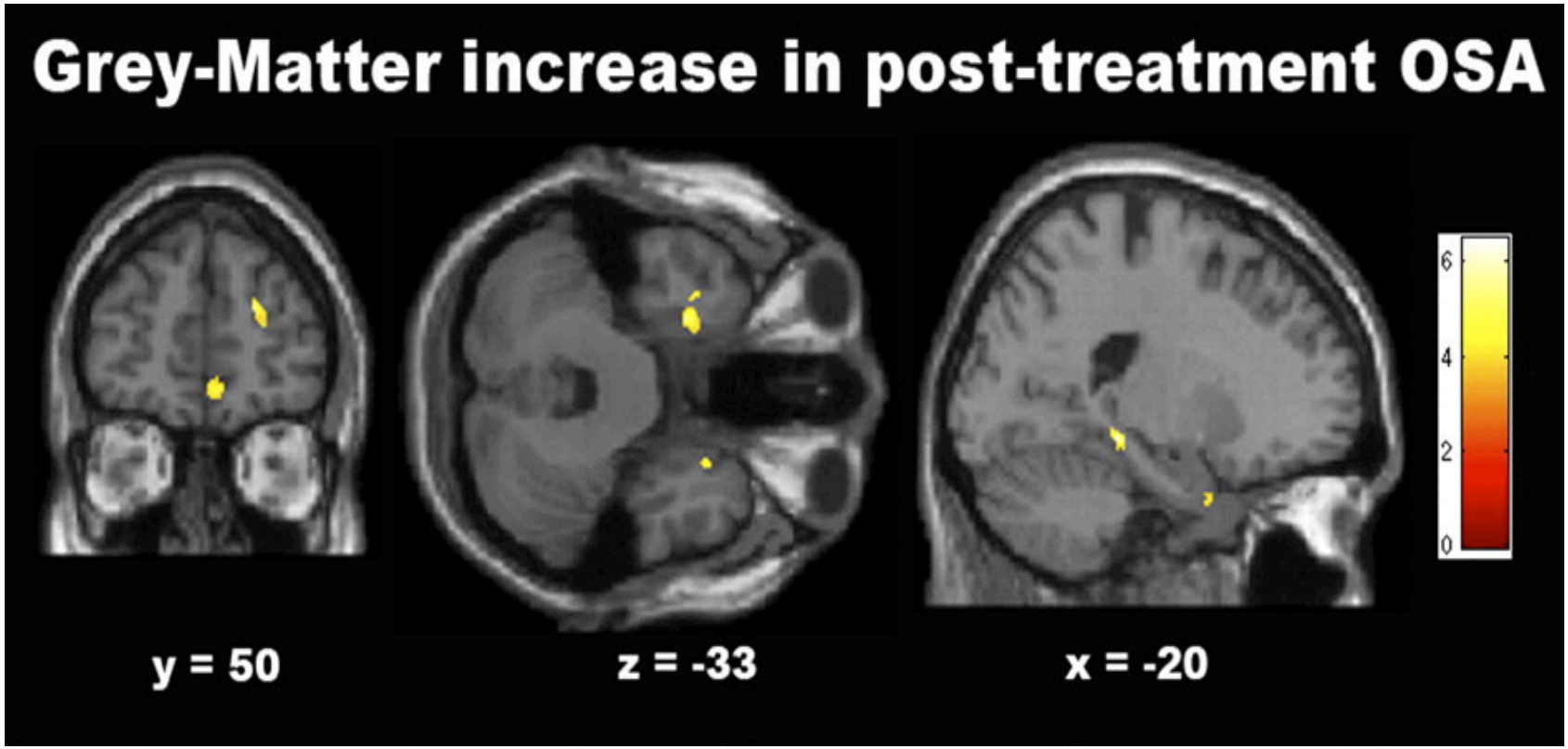
3. “Mediterranean Diet” plus DHA-EPA

More DHA-EPA: Bigger Hippocampus



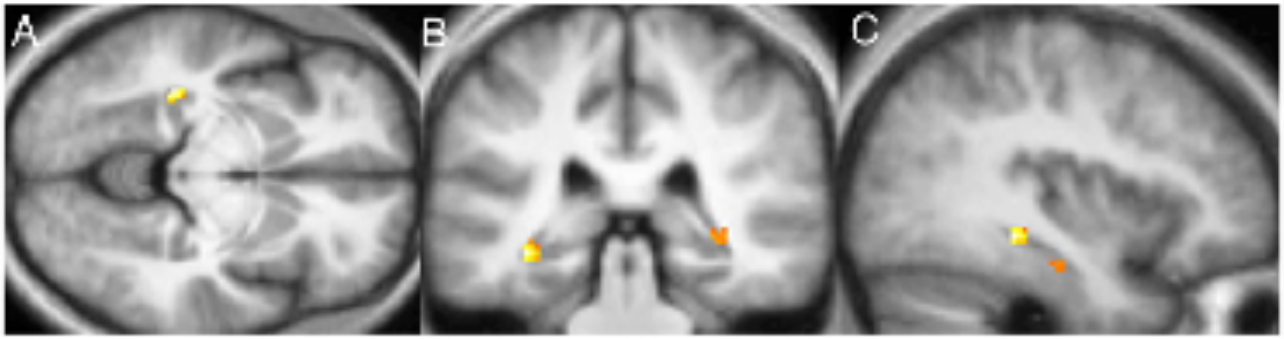
Pottala J V et al. Neurology 2014;82:435-442

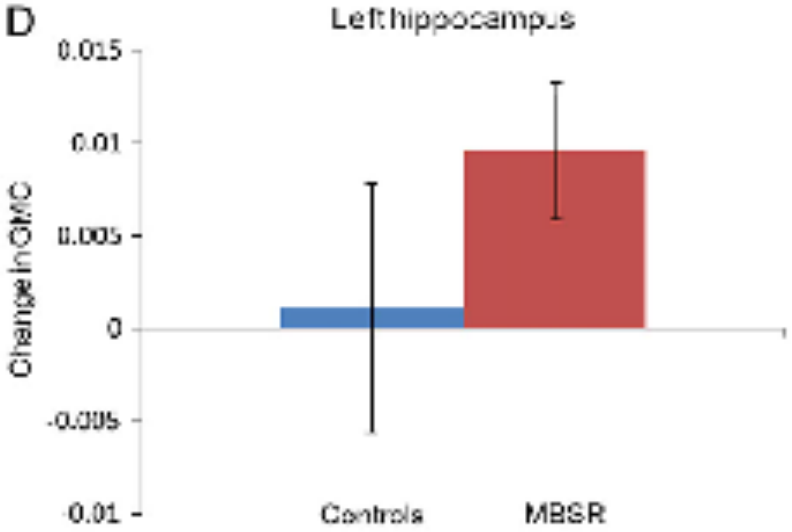
4. Sleep Well: Hippocampus Grows Bigger with Treatment of Sleep Apnea



Canesa, American Journal of Respiratory Medicine, 2011

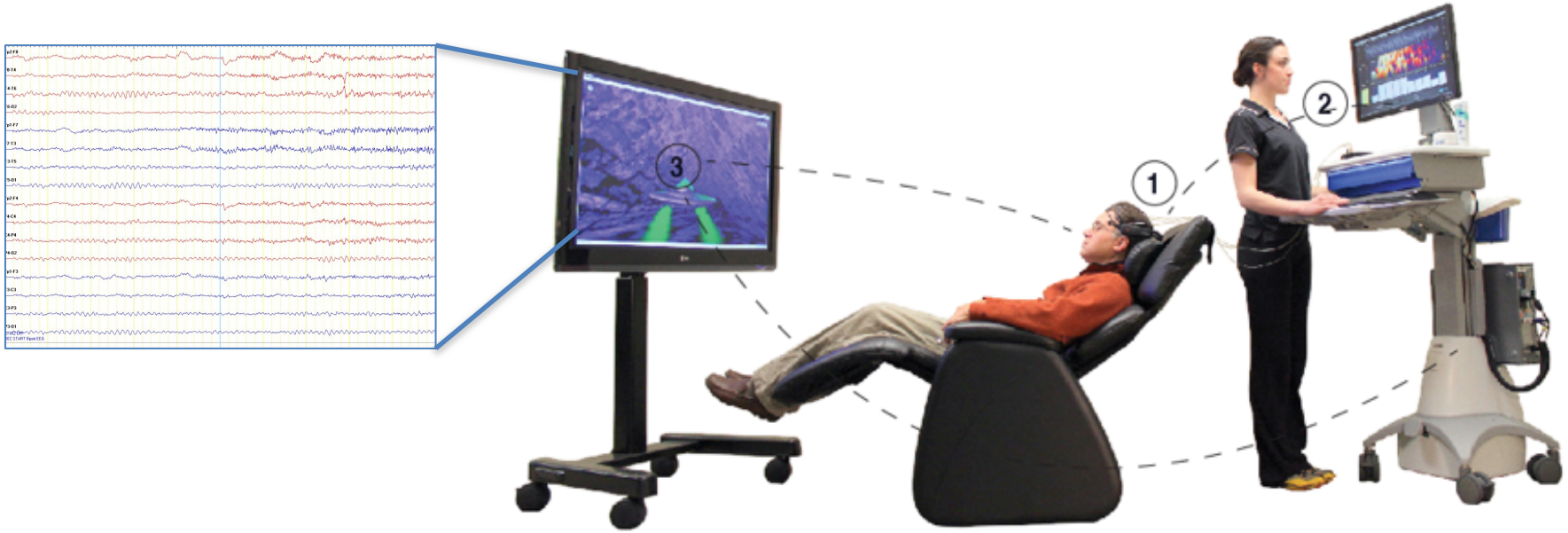
5. Focus Your Mind: Hippocampus Grows Bigger with Meditation





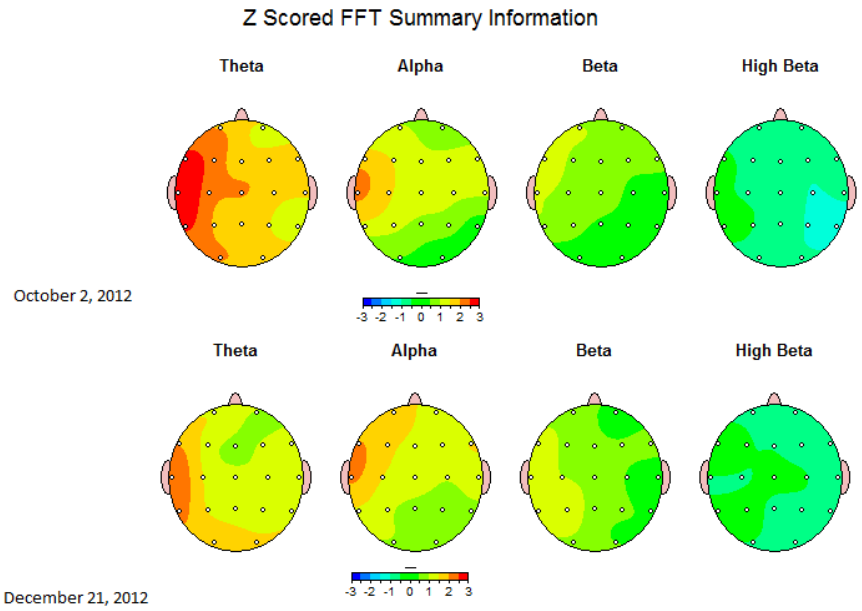
Holzel , Psychiatric Research, 2011

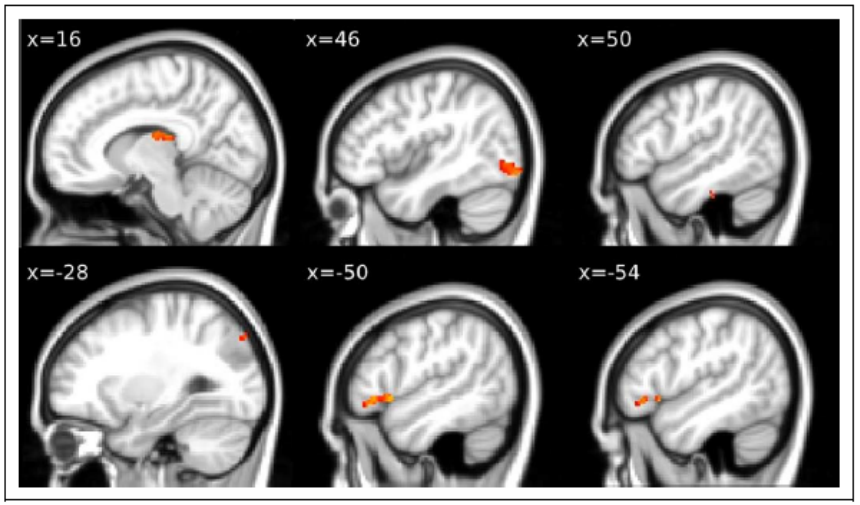
Neurofeedback



- Performed by a certified EEG neurofeedback specialist
- Live EEG feedback is provided through auditory and visual responses to help the patient move brain activity towards an optimal state
- Benefits are long-lasting

Neurofeedback Improves Brain Function and Increases Volume of Cortex





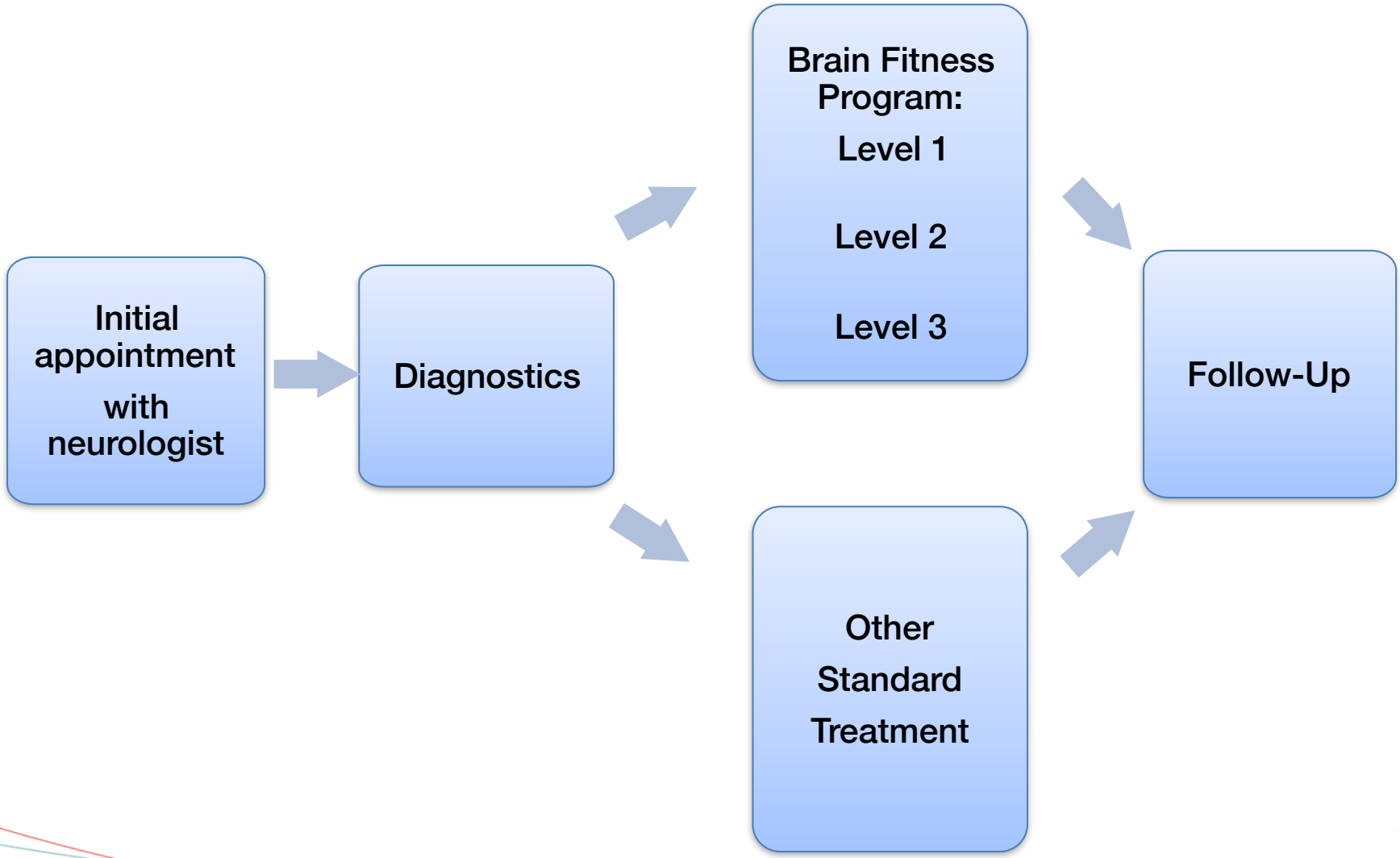
Ghaziri et al. Clin EEG Neurosci 2013; 44 (4) 265-72

6. Start Today: Hippocampus Grows Bigger When You Start Early

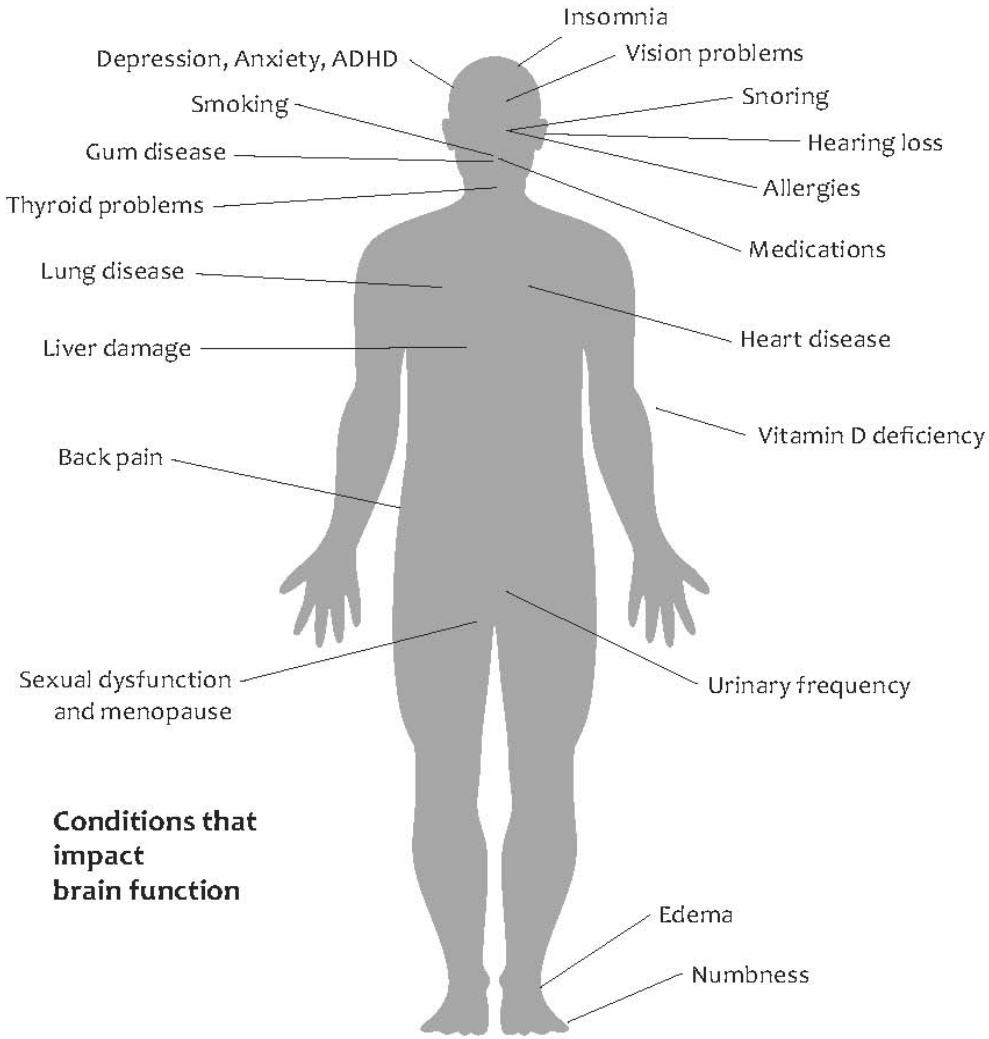
Objectives

- What happens to our brain with aging?
- How to reverse age-related brain atrophy?
- Brain Fitness Program

Brain Fitness Program



BFP: Evaluating &Treating All Causes of anxiety and depression



Diabetes
Hypertension
Obesity
Sleep Apnea
Head Trauma
Genes
Stress

Brain-healthy Diet
Physical Fitness
Cognitive Stimulation
Meditation

Brain Fitness Program: Goals

Short Term

- Think faster
- Remember more
- Improve efficiency of problem solving
- Sharpen focus
- React quicker
- Enhance self esteem
- Brighten mood

Long Term

- Help to regrow brain cells in hippocampus
- Establish a brain healthy lifestyle change that results in lifelong benefits
- Reduce risk of dementia in late-life

THANK YOU!

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