Two ways to increase size of your brain's memory center (and reduce stress!) (1) Walk 40 minutes, 3 times a week (2) Meditate 30 minutes a day.

These two methods may affect different, important parts of the hippocampus. Meditation enlarged the grey matter in the left hippocampus (especially involved with verbal and memory of language), while walking enlarged the hippocampus's anterior part including the dentate gyrus. The dentate gyrus is the most metabolically active part of our brain and is involved in spatial memory, short-term memory and new learning. Neurogenesis is most prominent in this part of the adult brain; many surmise it is because creation of new brain cells and dendritic connections are essential to the production of new memories.

Mindfulness meditation training changes brain structure in 8 weeks

Participating in an 8-week mindfulness meditation program appears to make measurable changes in brain regions associated with memory, sense of self, empathy and stress. In a study that appeared in the January 30, 2011 issue of *Psychiatry Research: Neuroimaging,* a team led by Massachusetts General Hospital (MGH) researchers reported the results of their study, the first to document meditation-produced changes over time in the brain's grey matter. "Although the practice of meditation is associated with a sense of peacefulness and physical relaxation, practitioners have long claimed that meditation also provides cognitive and psychological benefits that persist throughout the day," says Sara Lazar, PhD, of the MGH Psychiatric Neuroimaging Research Program, the study's senior author. "This study demonstrates that changes in brain structure may underlie some of these reported improvements and that people are not just feeling better because they are spending time relaxing."

Previous studies from Lazar's group and others found structural differences between the brains of experienced mediation practitioners and individuals with no history of meditation, observing thickening of the cerebral cortex in areas associated with attention and emotional integration. But those investigations could not document that those differences were actually produced by meditation.

For the current study, MR images were taken of the brain structure of 16 study participants two weeks before and after they took part in the 8-week Mindfulness-Based Stress Reduction (MBSR) Program at the University of Massachusetts Center for Mindfulness. In addition to weekly meetings that included practice of mindfulness meditation – which focuses on nonjudgmental awareness of sensations, feelings and state of mind – participants received audio recordings for guided meditation practice and were asked to keep track of how much time they practiced each day. A set of MR brain images were also taken of a control group of non-meditators over a similar time interval.

Meditation group participants reported spending an average of 27 minutes each day practicing mindfulness exercises, and their responses to a mindfulness questionnaire indicated significant improvements compared with pre-participation responses. The analysis of MR images, which focused on areas where meditation-associated differences were seen in earlier studies, found increased grey-matter density in the hippocampus, known to be important for learning and memory, and in structures associated with self-awareness, compassion and introspection. Participant-reported reductions in stress also were correlated with decreased grey-matter density in the amygdala, which is known to play an important role in anxiety and stress. Although no change was seen in a self-awareness-associated structure called the insula, which had been identified in earlier studies, the authors suggest that longer-term meditation practice might be needed to produce changes in that area. *None of these changes were seen in the control group*, indicating that they had not resulted merely from the passage of time.

"It is fascinating to see the brain's plasticity and that, by practicing meditation, we can play an active role in changing the brain and can increase our well-being and quality of life." says Britta Hölzel, PhD, first author of the paper and a research fellow at MGH and Giessen University in Germany. "Other studies in different patient populations have shown that meditation can make significant improvements in a variety of symptoms, and we are now investigating the underlying mechanisms in the brain that facilitate this change." Amishi Jha, PhD, a University of Miami neuroscientist who investigates mindfulness-training's effects on individuals in high-stress situations, says, "These results …demonstrate that the first-person experience of stress …corresponds with structural changes in the amygdala," *Psychiatry Research: Neuroimaging, Volume 191, Issue 1, 30 January 2011, Pages 36-43* Britta K. Hölzel, James Carmody, Mark Vangel, Christina Congleton, Sita M. Yerramsetti, Tim Gard and Sara W. Lazar SOURCE: Massachusetts General Hospital press release

HealthCare Insights, LLC P.O. Box 2683, Acton, MA 01720
Telephone: 978-621-1926 Fax: 978-263-5085 Email and websites: nemerson@bu.edu
nemerson@healthcareinsights.net www.healthcareinsights.net www.juiceplus.com/nsa/+ne31058

Moderate walking 40 minutes, three times/week for 1 year increases size of hippocampus and improves memory

An exciting new study, a gold standard randomized controlled trial in normal older adults, shows that aerobic exercise training increases the size of the anterior hippocampus, leading to improvements in spatial memory. "Exercise training increased hippocampal volume by 2%, effectively reversing age-related loss in volume by 1 to 2 years. " Here are some excerpts of coverage of this study by Alzheimer's Research Forum (ARF).

"To get such dramatic results from a few hours a week was somewhat surprising," said senior investigator Arthur Kramer of the University of Illinois, Champaign-Urbana, in an interview with ARF. He and colleagues reported the findings online January 31 in the Proceedings of the National Academy of Sciences USA.

Plenty of research suggests that physical activity is good for the mind. Prior studies of older adults correlated regular exercise with reduced dementia risk (Larson et al., 2006). Investigations by first author Kirk Erickson, University of Pittsburgh, Pennsylvania, linked aerobic fitness to bigger hippocampi (Erickson et al., 2009) and showed, longitudinally, that walking prevents gray matter loss (Erickson et al., 2010 and ARF related news story). Randomized trials on the benefits of physical activity are rare, though, as it is hard to get people to stick to a specific exercise regimen (McCurry et al., 2010). One such study on seniors with subjective memory complaints did have promising findings—six months of moderate exercise led to modest improvements on the Alzheimer's Disease Assessment Scale-Cognitive Subscale (ADAS-cog), measured at 18 months (Lautenschlager et al., 2008 and ARF related news story).

The current study, another randomized trial of dementia-free seniors, offers "much more concrete proof" for the idea that exercise helps the brain, said Eric Larson of Group Health Research Institute in Seattle, Washington. "It looked at a biologic endpoint—the size of the part of the brain most important for memory, and one of the parts most affected by dementia"—i.e., the hippocampus. Collaborating with researchers at Ohio State University in Columbus and Rice University in Houston, Texas, Kramer and Erickson analyzed 120 older adults with normal cognition (average age: 66.5 years) randomized to one year of moderate-intensity walking, OR (control group) stretching and toning exercises, three times a week. The groups began the study with comparable hippocampal volumes, assessed by magnetic resonance imaging (MRI), and had similar attendance rates. Participants had brain scans, as well as fitness and memory assessments, at baseline, six months, and after the 12-month intervention.

Consistent with the expected 1 to 2 percent annual hippocampal loss in dementia-free seniors (Raz et al., 2005), the control group lost about 1.4 percent volume in this brain region by the end of the 12-month trial. In contrast, the hippocampi of the walkers grew roughly 2 percent. The benefit seemed specific to **the anterior part** of this brain structure, which mediates acquisition of spatial memory. Similar effects did not appear in the thalamus, caudate nucleus, or posterior hippocampus.

By measuring changes in the participants' maximal oxygen consumption, the researchers determined that the intervention succeeded in raising aerobic fitness levels, and that larger fitness boosts correlated with greater hippocampal growth. Furthermore, the team found that, within the control group, people with higher baseline fitness levels had less hippocampal shrinkage than those who were less fit, suggesting that fitness protects against loss of brain tissue.

To explore possible mechanisms underlying these changes, the authors looked at serum levels of brain-derived neurotrophic factor (BDNF) in blood collected from participants at baseline and 12 months. BDNF is an important mediator of neurogenesis in the dentate gyrus of the hippocampus. People who exercise more have higher levels of hippocampal BDNF (Cotman and Berchtold, 2002; Neeper et al., 1995), and increased serum BDNF levels have been correlated with larger hippocampi and better memory performance (Erickson et al., 2010 and Alzheimer's Research Forum related news story). In the present study, greater elevations in serum BDNF were linked to greater gains in hippocampal volume. All told, the study "attempted to tie together changes in anatomy with changes in blood chemistry with changes in cognition, in a brain region with a pretty well-defined function (episodic memory)," Kramer said.

Of note, participants in the present study had fairly poor cardiovascular fitness and were asked, in the exercise group, to "walk to 60 percent of their maximal heart rate," Larson said. "This is stuff anybody could do. You're not getting winded by this level of exercise."—Esther Landhuis. Reference: Erickson KI, Voss MW, Prakash RS, Basak C, Szabo A, Chaddock L, Kim JS, Heo S, Alves H, White SM, Wojcicki TR, Mailey E, Vieira VJ, Martin SA, Pence BD, Woods JA, McAuley E, Kramer AF. Exercise training increases size of hippocampus and improves memory. 2011 Jan 31. PNAS Early Edition.

HealthCare Insights, LLC P.O. Box 2683, Acton, MA 01720
Telephone: 978-621-1926 Fax: 978-263-5085 Email and websites: nemerson@bu.edu
nemerson@healthcareinsights.net www.healthcareinsights.net www.juiceplus.com/nsa/+ne31058