

BEAUTIFUL MINDS

Finding Your Lifelong Potential



Beautiful Minds: Finding Your Lifelong Potential A Scientific Assessment of Brain Health Research May 2010

Most people assume that brain health is genetically programmed – we are either destined to have memory problems as we age or to stay sharp well into our later years. But that’s not the whole picture. The truth is that we have the power to positively influence our brain function throughout life. Research has suggested that less than 50 percent of our memory and brain function is inherited¹ – which means that more than 50 percent of memory and brain health is in our hands. In fact, an editorial in the May 12 issue of the *Journal of the American Medical Association* acknowledged the limitations of using genetics in predicting the risk of Alzheimer’s disease and instead challenged clinicians to encourage patients to engage in well-established preventive lifestyle behaviors to reduce risk of dementia or at least postpone its onset².

Brain health is one of the top health-related concerns of aging populations and has been identified by the Centers for Disease Control as a public health priority³. Many people worry about serious brain diseases like Alzheimer’s. And while Alzheimer’s is a serious concern as the world population ages, most who worry about Alzheimer’s are worrying needlessly. More than 80 percent of us will never get Alzheimer’s disease⁴.

What’s more, some experts now believe that it is time to redefine our understanding of age-related memory loss and dementia. Emerging research indicates that many people experiencing memory loss and dementia actually have mixed pathologies in their brains. In fact, very few senior citizens have "pure Alzheimer’s disease." Instead, late-life cognitive impairment may in fact be a result of multiple “hits” to the brain, from a variety of risk factors such as hypertension, obesity, sedentary lifestyle, chronic stress, head trauma and poor diet⁵. The good news? We have the opportunity to improve our brain health and function by incorporating simple lifestyle factors like exercise, a healthy diet, stress reduction, and intellectual and social engagement. Regardless of family history, the choices we make in life may be able to slow the progression of age-related cognitive decline or help prevent it altogether.

According to the late Gene D. Cohen, M.D., Ph.D., former acting director of the National Institute on Aging and first director of the Center on Aging, Health & Humanities at George Washington University, our minds can be jump-started, fine-tuned and remodeled throughout adulthood, allowing us to grow and flourish well into the second half of life. Contrary to popular belief that brain power inevitably declines as we age, Cohen believed that the mind continually creates opportunities for positive change, allowing us to grow and change in surprising ways throughout life⁶.

Indeed, the idea that brain growth and development is only for the young is quickly becoming outdated. Recent research suggests that brain activity, connections within the brain, and even the size and mass of the brain can be affected –

positively or negatively – throughout adulthood. There is very good evidence that the brain can be molded, for a lifetime, by experiences, lifestyle and activity.

This is a powerful concept, and one that challenges long-held beliefs about the aging brain. The realization that we can influence our brain health and cognition throughout adult life is crucial as 78 million baby boomers in the U.S. move into the second half of their lives. At the same time, we are now experiencing an unprecedented increase in life expectancy in this country to 78 years – an increase of 30 years over the past century. The largest aging population in history is going to experience the most longevity of any generation. Brain health is more important now than ever before.

A healthy and optimally functioning brain is central to well-being and quality of life, yet most people do not understand how lifestyle choices can influence brain health. In fact, lifestyle choices may actually play a larger role in influencing the risk of developing cognitive problems than family history. Some experts suggest that health and lifestyle issues such as obesity, diabetes, hypertension, smoking, sedentary lifestyle, high cholesterol and chronic stress have the potential to increase the risk of developing cognitive impairment as much as 16-fold – a far greater increase in risk than having a parent with Alzheimer’s disease^{7,8}.

The latest research suggests that there are a number of very simple but powerful things we can do to help ensure that our brains remain strong, healthy and beautiful as we age. These factors can be organized into the “*Four Dimensions of Brain Health*,” four key areas:

- The Nourished Mind
- The Physically Active Mind
- The Socially Connected Mind
- The Cognitively Engaged Mind

Firmly grounded in science, the *Four Dimensions of Brain Health* comprise a road map designed to help people understand the key areas of brain fitness and empower people to make lifestyle choices that will positively impact long-term brain health.

The Nourished Mind

“A beautiful mind believes nutrition and exercise is as important as entertaining new ideas.”

Joanne Chow Winship, 63
San Francisco, California

It is understood that a nutritious diet that includes fruits, vegetables and whole grains and is low in saturated fat and added sugar but rich in good fats and nutrients, can reduce the risk of some of the most common chronic diseases, including cardiovascular disease, diabetes and obesity. The saying “you are what you eat” is a well-worn phrase indicating that food fuels our bodies. But food may also fuel our minds.

In recent years, animal studies, epidemiologic studies and clinical trials have explored whether a healthy diet also can help preserve cognitive function or even reduce the risk for brain diseases. Some experts believe that diet is one of the easiest ways to modify brain health and brain disease risk. A few key areas of nutrition have recently emerged as particularly promising, including healthy fats like the omega-3 fatty acid docosahexaenoic acid (DHA), antioxidants, and a heart-healthy diet.

DHA is an integral component of cell membranes and the major omega-3 fatty acid found in the brain. The presence of DHA at adequate levels in neural tissue is essential for optimal brain function during aging, as well as during other parts of life. In fact, observational research has indicated that low plasma DHA levels have been associated with cognitive decline in patients with Alzheimer’s disease and the aging adult. Notably, in April 2010, a panel of experts convened by the National Institutes of Health to review the evidence around the prevention of dementia issued their general findings,

which stated that of all the foods and supplements studied, long-term studies suggested omega-3 fatty acids are associated with reduced risk of cognitive decline⁹.

Most recently, the Memory Improvement with DHA Study (MIDAS) showed that algal DHA improved memory function in healthy aging adults, providing a benefit roughly equivalent to having the learning and memory skills of someone three years younger¹⁰.

MIDAS found that healthy people with memory complaints who took 900 mg algal DHA capsules for six months had almost double the reduction in errors on a test that measures learning and memory performance versus those who took a placebo. The DHA was well-tolerated and subjects taking the DHA also experienced a lower heart rate, providing a significant cardiovascular benefit. MIDAS suggests that algal DHA supplementation may ameliorate early learning and memory deficits associated with cognitive aging.

Another recent study that observed a group of subjects age 35 to 54 found that subjects with higher levels of DHA in their blood performed better on tests of nonverbal reasoning and mental flexibility, working memory and vocabulary, suggesting that DHA may have a positive effect on cognitive performance throughout life. In addition, the study found that the higher the DHA blood level, the better the cognitive performance¹¹.

Other recent studies have explored the effects of foods that are rich in antioxidants and anti-inflammatory components on age-related changes in the brain. Antioxidant-rich foods like blueberries, strawberries and cranberries have been shown to improve cognitive function in animal studies. For example, older dogs fed an antioxidant-rich diet performed better on learning tasks than those dogs fed a standard diet¹².

When it comes to diet, what is good for the heart is generally good for the brain, too. The Mediterranean diet – a diet already shown to significantly influence cardiovascular risks – may reduce the risk for Alzheimer’s disease by as much as 40 percent¹³. An April 2010 report on the risk factors and potential protective factors for Alzheimer’s disease and cognitive decline by the U.S. Agency for Healthcare Research and Quality (AHRQ) also stated that there is “preliminary evidence that greater adherence to a Mediterranean diet may be associated with less cognitive decline in later life¹⁴.” A Mediterranean diet is one that is rich in fruits and vegetables, nuts, seeds, beans and dairy products; and includes fish, olive oil and red wine in moderate amounts as well.

The strongest evidence indicates that a brain-healthy diet is one that reduces the risk of heart disease and diabetes, encourages good blood flow to the brain, is low in fat and cholesterol, and rich in antioxidants. Experts theorize that the components of a healthy diet may help support brain health by reducing oxidative damage to the brain and reducing inflammation. They may also influence the levels of certain brain compounds like beta-amyloid that may contribute to cognitive decline or reduce the risk for diseases like diabetes, obesity and stroke that contribute to a greater risk of cognitive decline.

The Physically Active Mind

“Having a beautiful mind means that if you treat your body well, it will treat you well.”

Roy Bengston, 70
Broomfield, Colorado

Physical exercise is important for good health. It can significantly reduce the risk of chronic diseases like cardiovascular disease, obesity and diabetes, reduce stress, encourage social interaction, and encourage mental stimulation and learning. It’s no surprise, then, that emerging evidence suggests that physical activity may be vital for brain health as well. Research has found associations between physical activity and improved cognitive skills or reduced risk for cognitive decline and serious brain diseases.

Experts believe that exercise may affect the brain in a number of ways, from improving oxygen consumption and blood flow, to increasing the growth of blood vessels and nerve connections. Some research has even suggested that physical activity may encourage chemical and cellular changes in the brain that may support learning, cognition and memory.

The April 2010 report from AHRQ on the risk factors and potential protective factors for Alzheimer's disease and cognitive decline found, based on their review, an association between higher physical activity and a reduced risk for Alzheimer's disease and cognitive decline¹⁴. One study showed that subjects confirmed to have problems with memory and were at risk for cognitive decline experienced improvements in cognitive performance after participating in an exercise program of just 150 minutes per week for 18 months. The improvements were measured by a comprehensive battery of cognitive tests. The author noted that the effects of physical activity demonstrated in this study were comparable to or better than results from some medication trials¹⁵.

Another recent study conducted at the University of Illinois and the University of Pittsburgh measured the aerobic fitness of healthy older adults. Using magnetic resonance imaging (MRI), the researchers also conducted an analysis of the size of the subjects' left and right hippocampi – areas of the brain responsible for spatial memory. They also tested the participants' spatial reasoning with a computer test. They found that higher levels of aerobic fitness are significantly associated with increased hippocampal volume in older adults, which translates to better memory function¹⁶. In other words, the participants who had better aerobic fitness had larger hippocampi, and in turn performed better on the memory tests.

Other studies have also demonstrated significant growth of the hippocampus after just three months of exercise¹⁷ and some trials have found significant growth in other areas of the brain following an exercise program as well, such as the frontal lobe, the part of the brain used for problem solving, planning and motivation¹⁸. And it's not just aerobic exercise – 12 months of strength training with weights once or twice weekly has been demonstrated in clinical research to improve the cognitive function of senior women¹⁹. It seems that exercise not only builds bigger muscles, but it may also help to build brains.

The Socially Connected Mind

“A beautiful mind discovers the benefits of being socially active.”

Annie Robinson, 64
Calumet Park, Illinois

Socializing and friendships aren't just a popularity contest. Indeed, a large body of evidence supports the idea that social connectedness is vital to health, wellness and longevity. The Grant Study, a famous longitudinal study that has been following 268 Harvard graduates since the early 1940s, has observed that social aptitude seems to be highly associated with successful aging, with the state of relationships at age 47 serving as one of the best indicators of health in late life. Dr. George Vaillant, the lead investigator of The Grant Study for the last 42 years, has stated that his biggest learning from his work following this group has been that “The the only thing that really matters in life are your relationships with other people.”

Experts theorize that having a rich social network may help support brain health in a variety of ways, from providing individuals better resources and support, to reducing stress and depression, to enhancing intellectual stimulation. On the flip side, preliminary evidence suggests that reported loneliness, dissatisfaction with social contacts, and decreased social networks might actually be risk factors for cognitive decline and disease²⁰.

In one study, researchers at the Harvard School of Public Health analyzed data gathered from 1998 to 2004 as part of the Health and Retirement Study, a large study of a representative population of American adults age 50 and older. The researchers found that men and women who had the most social interaction within their community had the slowest rate of memory decline. In fact, those who reported the most engagement and time with friends, family and people in their neighborhood had less than half the rate of memory loss as those with the least social engagement²¹.

Another recent study found that marriage and long-term relationships had a significant protective effect against age-related cognitive impairment. In fact, people living without a life partner at midlife had twice the risk of developing cognitive impairment than those with a partner, suggesting that the social engagement and stimulation inherent in a marriage or long-term relationship may provide important benefits²².

The Cognitively Engaged Mind

“To have a beautiful mind you need to trust your creativity, be in the moment, risk failing, and say yes to ideas.”

Jeff Byers, 63
San Francisco, California

According to conventional wisdom, brain growth occurs during childhood. A decade ago, many experts would have scoffed at the idea that the brains of adults, particularly older adults, could grow or develop in any significant way. But that has changed.

The development of imaging devices like functional MRIs have given scientists the ability to use brain-imaging to observe changes to brain mass and activity. As a result, numerous studies have been published that provide convincing evidence that brain cells, much like muscle cells, can grow bigger and stronger with cognitive challenges and stimulation. In one study, taxi drivers in London were shown to have larger areas of the brain responsible for direction and navigation, suggesting that the cognitive challenges of their chosen adult career produced observable changes in their adult brains^{23, 24}. In another trial, people learning the new skill of juggling were shown to increase the part of their brain responsible for hand-eye coordination just three months after taking up the new activity. In a follow up, the jugglers were asked to stop practicing – and the improved brain areas shrunk back to their previous size in just three months^{23, 25}. Growing brains is not just the work of children, it seems, but instead a lifelong pursuit.

Most recently, the April 2010 report from AHRQ indicated an association between more cognitive activity and a reduced risk for Alzheimer’s disease. The report considered four studies exploring cognitive engagement; all four showed a decreased risk of cognitive decline with more frequent participation in activities considered to be cognitively engaging. Activities included everything from reading books and magazines or playing games like chess, to playing musical instruments, visiting museums or attending club meetings¹⁴.

An ongoing study of Experience Corps, a national service program that trains older volunteers to tutor low-income children in urban schools, found that participation in the Corps resulted in improvements in cognitive functioning and was associated with significant changes in brain activity as illustrated through neuroimaging studies. Study authors suggest that the social and cognitive challenges and stimulation provided through work in the Experience Corps may actually reverse brain aging at a neurological level and delay or reverse cognitive and brain deficits²⁴.

One theory that experts have considered to explain why socially connected and intellectually engaged minds seem to have a reduced risk for age-related decline is “brain reserve.” Experts have observed that there does not seem to be a clear relationship between how diseased a brain is and the degree of the symptoms and behavioral changes. In other words, some people with very advanced brain diseases as seen in imaging or subsequent autopsy studies may exhibit no symptoms or only mild or moderate symptoms, while others with less severe disease may exhibit more severe clinical symptoms or signs of cognitive decline. Experts believe that brain reserve may help to explain this disconnect.

Brain reserve is defined as the brain’s ability to adapt to age-related changes and disease. Put simply, a brain with adequate “brain reserve” is able to adapt and figure out how to function normally despite the challenges presented by aging or disease, perhaps by developing new brain cells or connections. The good news is that, while the process of building brain reserve begins in childhood, emerging evidence appears to indicate that brain reserve can be developed and maintained, even later in life. Scientists exploring the role of brain reserve in cognitive decline have observed that individuals who continue to learn, embrace new activities, and develop new skills and interests, are exercising their brains

in ways that help to build up connections that in turn lower their risk of exhibiting the symptoms of cognitive decline. The old adage “use it or lose it” appears to ring true, even when it comes to the brain.

Put It All Together

“A beautiful mind enjoys every moment.”

Eugene Watts, 69
Mt. Vernon, New York

According to aging expert Dr. Gene Cohen, redefining our concept of what is possible as we age is important for everyone at every age. Understanding what is possible as we age not only enables older people to reach their potential later in life, it also challenges younger age groups to think about what is possible in their later years in a different way.

It is a myth that aging inevitably leads to the decline of brain health. A strong and growing body of scientific evidence demonstrates that we can in fact positively influence our aging minds by committing to some simple lifestyle choices. The individuals profiled in the *Beautiful Minds* campaign are demonstrating every day that the second half of life can be a time of health, excitement, growth and infinite potential.

The goal of the *Beautiful Minds* campaign is to empower Americans with inspiring profiles of aging, and to increase awareness about brain health and the simple yet powerful actions we can take to ensure that we build and maintain minds that are healthy and beautiful for an entire lifetime. Keeping your brain healthy might be simpler than you think ... and more fun. It just takes a little inspiration and commitment.

Do more of what you love, longer. It’s the best way to have a beautiful mind and find your lifelong potential. Tips to try:

- Switch out saturated and trans fats for healthier fats like the ones found in olive oil and fatty fish such as salmon or trout.
- Maximize your intake of DHA, the omega-3 fatty acid that makes up 50 percent of the brain and is a must-have to support lifelong brain health. Find DHA in fatty fish such as salmon and trout, along with algal DHA fortified foods like juice, milk, eggs, tortillas, yogurt and supplements.
- Aim for a varied diet rich in fresh, washed fruits and vegetables with the skin on to maximize the nutritional punch. Make sure you’re eating the colorful ones like red grapes, cranberries, blueberries and tomatoes.
- A healthy diet is the foundation for heart health as well. Manage your weight and keep cholesterol, blood sugar and blood pressure in check to reduce the risk for cardiovascular disease.
- Make time for at least 30 minutes of exercise every day of the week. Exercising is a stress reliever, supports emotional health and helps reduce the risk for chronic diseases, including cardiovascular disease. Brisk walking fits the bill.
- Get regular check-ups with your health care provider to help prevent illness and maintain good health.
- Find a brain-stimulating activity that is challenging and enjoyable – reading, dancing, crosswords, learning a new language – and engage in it regularly.
- Pursue your passion! The second half of life can be incredibly freeing, inspiring and creative. Creative pursuits like dancing, music, painting or gardening are fun – and healthy.
- Get enough sleep and manage stress levels.

!
!

- Laugh often!
- Keep working as long as you can and want to.
- Volunteer for a cause that is meaningful to you.
- Make friends and family a priority and spend time with them regularly.
- Join clubs or participate in religious/spiritual activities.

“Beautiful Minds: Finding Your Lifelong Potential” honors people who are keeping their minds beautiful, and raises awareness of the actions people can take to maintain better brain health. For more information, visit www.beautiful-minds.com.

Created by The National Center for Creative Aging, an affiliate of George Washington University School of Medicine and Health Sciences in partnership with Martek Biosciences, a division of DSM Nutritional Products. May 2010.

References

1. Oz M and Roizen M. *YOU Staying Young: The Owner’s Manual for Extending Your Warranty*. New York, NY: Free Press, a Division of Simon & Schuster; 2007: 27.
2. Pedersen N. Reaching the Limits of Genome-wide Significance in Alzheimer Disease: Back to the Environment [editorial]. *JAMA*, 2010; 303 (18): 1864-1865.
3. Centers for Disease Control and Prevention. Healthy Brain Initiative. 2009. (Accessed 4/14/10 at <http://www.cdc.gov/aging/healthybrain/index.htm>).
4. Alzheimer's Association. 2010 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2010;6(2):158-194.
5. Fotuhi M, Hachinski V, Whitehouse PJ. Changing perspectives regarding late-life dementia. *Nat Rev Neurol*, 2009; 5: 649-658.
6. Cohen GD. *The Mature Mind: The Positive Power of the Aging Brain*. New York, NY: Perseus Books Brou; 2005.
7. Xu W, Qiu C, Gatz M, et al. Mid- and late-life diabetes in relation to the risk of dementia: a population-based twin study. *Diabetes* 2009;58(1):71–7.
8. Kivipelto M, Ngandu T, Laatikainen T, Winblad B, Soininen H, Tuomilehto J. Risk score for the prediction of dementia risk in 20 years among middle aged people: a longitudinal, population-based study. *Lancet Neurol* 2006;5(9):735–41.
9. National Institutes of Health, *Conference Statement, NIH State-of-the-Science Conference: Preventing Alzheimer’s Disease and Cognitive Decline*, April 26–28, 2010.
10. Yurko-Mauro K, McCarthy D, Rom D, et al. Beneficial effects of docosahexaenoic acid on cognition in age related cognitive decline. *Alzheimers Dement*. 2010; doi:10.1016/j.jalz.2010.01.013.
11. Muldoon M, Ryan C, Sheu L, Yao J, Conklin S, Manuck S. Serum Phospholipid Docosahexaenoic Acid is Associated with Cognitive Functioning during Middle Adulthood. *J. Nutr*. 2010; 140: 848 - 853.

!

12. Milgram N, Head E, Zicker SC, et al. Learning ability in aged beagle dogs is preserved by behavioral enrichment and dietary fortification: a two-year longitudinal study. *Neurobiol Aging*, 2005, 26: 77-90.
13. Gu Y, Nieves J, Stern Y, Luchsinger J, Scarmeas N. Food Combination and Alzheimer's Disease Risk: A Protective Diet. *Arch Neurol*. 2010; 67(6):(doi:10.1001/archneurol.2010.84).
14. Williams JW, Plassman BL, Burke J, Holsinger T, Benjamin S. Preventing Alzheimer's Disease and Cognitive Decline. Evidence Report/Technology Assessment No. 193. (Prepared by the Duke Evidence-based Practice Center under Contract No. HHS 290-2007-10066-I.) AHRQ Publication No. 10-E005. Rockville, MD: Agency for Healthcare Research and Quality. April 2010.
15. Lautenschlager C, Cox KL, Flicker L, et al. Effect of Physical Activity on Cognitive Function in Older Adults at Risk for Alzheimer's Disease. *JAMA*. 2008;300(9):1027-1037.
16. Erickson K, Prakash S, Voss M, et al. Aerobic fitness is associated with hippocampal volume in elderly humans. *Hippocampus*, 2009 Oct;19 (10):1030-9.
17. Pajonk F, Wobrock T, Gruber O, et al. Hippocampal Plasticity in Response to Exercise in Schizophrenia. *Arch Gen Psychiatry*. 2010;67(2):133-143.
18. Colcombe S, Erickson K, Scalf P, et al. Aerobic Exercise Training Increases Brain Volume in Aging Humans. *J Gerontol A Biol Sci Med Sci*. 2006; 61(11): 1166-1170
19. Liu-Ambrose T, Nagamatsu L, Graf P, Beattie L, Ashe M, Handy T. Resistance Training and Executive Functions: A 12-Month Randomized Controlled Trial. *Arch Intern Med*. 2010;170(2):170-178.
20. Wilson R, Krueger K, Arnold S et al. Loneliness and Risk of Alzheimer's disease. *Arch Gen Psychiatry*. 2007; 64(2):234-240.
21. Ertel K, Glymour M, Berkman L. Effects of Social Integration on Preserving Memory Function in a Nationally Representative U.S. Elderly Population. *Am J of Public Health*. 2008;98(7):1215-20.
22. Hakansson K, Rovio S, Helkala E, et al. Association between mid-life marital status and cognitive function in later life: population based cohort study. *BMJ*, 2009; 339: b2462.
23. Fotuhi M. *Crosswords to Keep Your Brain Young: The 6-Step Age-Defying Program*. New York, NY; St. Martin's Press; 2007.
24. Maguire EA, Woollett K, Spiers HJ. London taxi drivers and bus drivers: a structural MRI and neuropsychological analysis. *Hippocampus*. 2006;16(12):1091-101.
25. Draganski B, Gaser C, Busch V, Schuierer G, Bogdahn U, May A. Neuroplasticity: changes in grey matter induced by training. *Nature*. 2004 22;427(6972):311-2.
26. Carlson MC, Erickson K, Kramer A, et al. Evidence for neurocognitive plasticity in at-risk older adults: the experience corps program. *J Gerontol A Biol Sci Med Sci*. 2009 Dec; 64(12):1275-82.