



INTEGRATING THE BRAIN

How diet, exercise and other everyday behaviors affect and nurture a healthy brain

When people think of diet and exercise, they often think of the body below the neck. However, research indicates that the brain also benefits from healthy foods and an active body. Brain health and physical health are inextricably linked, and it is unlikely to find one without the other. While some may not see the brain as a part of the body that should be routinely nurtured, this top organ should be cared for daily since nearly all of the body's functions rely on its well-being.

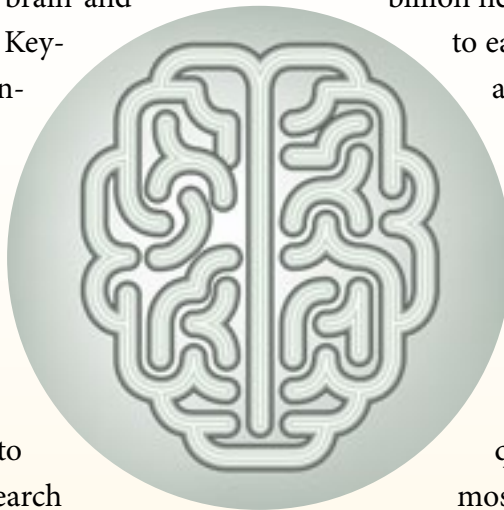
"People don't consider the healthfulness of their brains as often as they should, although now that more people are living longer, conditions like dementia are bringing attention to the mind and brain and what happens to it as they age," said Keyvan Golestaneh, director of the Conscious Health Institute (CHI) and practitioner of natural medicine. "The number of people with diseases like Alzheimer's is on the rise, and this makes people more aware of what can happen to the brain and how it relates to health, aging and quality of life. People are starting to pay more attention, there is more research and they want to prevent these kinds of health conditions."

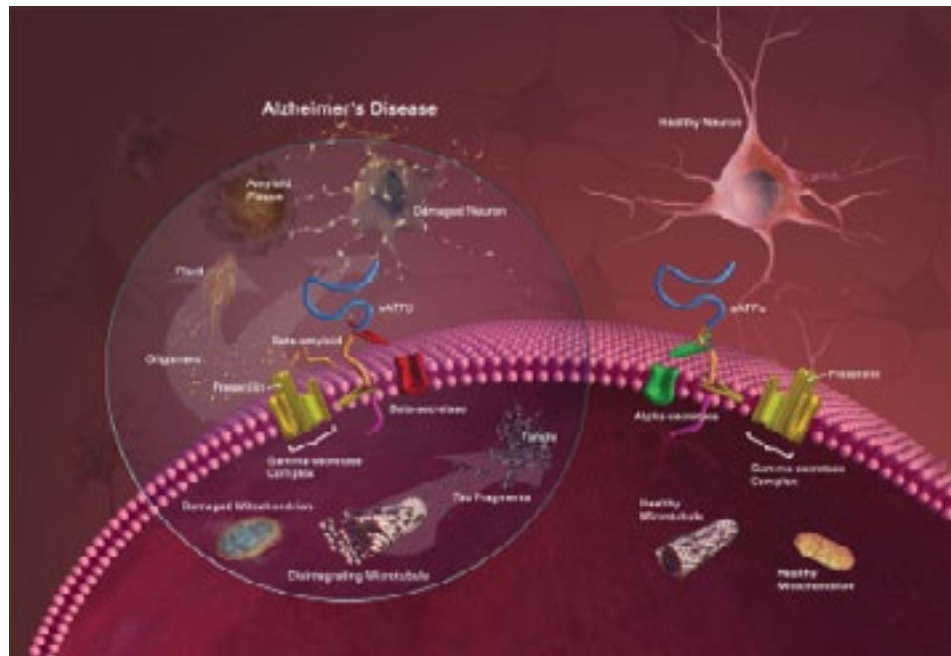
In this article CHI researchers summarize the brain and its unique disorders, consider developments in Western biomedicine and scientific research in brain health and relate this research to traditional Asian med-

icine and health practices in order to create a holistic perspective. In the process we highlight the latest scientific findings about how diet, physical exercise, mental exercise, socialization and stress reduction affect human brain health. Many of the studies that are talked about in this article are focused on conditions generally seen in elderly people, but the topics studied are all integral to brain health for people of all ages.

THE BRAIN AND ITS DISORDERS

The brain is a complex organ made up of one hundred billion neurons. These neurons are connected to each other by thin fibers called axons, and bundles of axons form the nerves that carry messages to the rest of the body. The brain regulates essential functions like breathing, thinking, and walking. Each region of the brain serves a specific function, and all regions need to work well for the brain, and consequently the body, to be healthy. Like most other parts of the human body, the brain can develop problems and diseases through genetic characteristics, direct physical damage and injury, toxicity in the environment, and age. When this happens, the neurons and nerves are affected and may have difficulty sending messages throughout the nervous system. One's memory, sensory system, and





Healthy brain **Advanced Alzheimer's**

Images courtesy of the National Institute on Aging

LEFT: Major players on the Alzheimer's disease stage. ABOVE: A cross section of a healthy brain and one with advanced Alzheimer's.

bodily functions can become compromised. Some common experiences people have are brain fog, the feeling of cloudy mind and thinking, forgetfulness and absent-mindedness (feeling unfocused and unclear.). Other people develop dementia-related diseases. Dementia is not a specific disease. Rather, the National Institute of Neurological Disorders and Stroke (NINDS), defines it as a descriptive term for a collection of symptoms, including agitation, delusions, hallucinations and the loss of ability to solve problems and maintain emotional control. Dementia often, though not always, involves memory loss; memory loss by itself does not define dementia.

Dementia-related diseases include Huntington's disease and Creutzfeldt-Jakob disease, but Alzheimer's disease is the most prevalent. According to the 2011 Alzheimer's Association annual report, Alzheimer's disease is the 6th leading cause of death in the U.S., and deaths related to Alzheimer's disease increased 66 percent between 2000 and 2008. The Alzheimer's Association describes the disease as a type of dementia that creates challenges to memory, thinking and behavior. The Association explains that one early symptom of the disorder includes difficulty remembering newly

learned information. The disease worsens over time and those with suffering from Alzheimer's will develop more severe symptoms: disorientation, mood and behavior changes, deepening confusion about events, time and place, unfounded suspicions about others, and increased memory loss.

Science is providing insights into the ways everyday behaviors can improve or damage the brains of young and old people alike. These insights are in line with ancient explorations of the body and mind.

"We must consider the brain within the framework of diet and exercise because the brain is an integral part of the whole person," said Golestaneh. "It's the central control system of the body and mind."

BUILDING OFF TRADITIONAL APPROACHES TO BODY AND MIND WELLNESS

In the Asian medical traditions of Chinese medicine (TCM) and Ayurvedic medicine, brain function is dispersed and dependent on the function of the five major organs. (In TCM the brain itself is not considered a separate organ; it is part of the marrow and spi-

nal system.) Thus, in these systems, any disorders of the brain naturally implicate other parts of the body. This understanding contrasts with biomedicine, which does not see brain disease as systemic. As Western medical research advances, it is quickly discovering how the brain is dependent on the rest of the body and environment for its health. In TCM, healthy brain function requires a healthy kidney system (including the adrenal glands), because the kidney system is believed to control the brain. In TCM, the shrinking of the brain that is seen in Alzheimer's disease is considered a result of the decrease in vital fluids, called yin. The brain is considered a hydroelectric fluid. In terms of physiology, there is a complex physiological process involved in producing synovial and cerebrospinal fluids which is integrated into and reliant on the digestive system. This is why in holistic paradigms like TCM and Ayurveda one looks at the whole body in considering the brain.

The pH balance in the body is key to maintaining health and balancing bodily functions. The proper flow of electrical signals in the body is controlled by pH levels. If the body's pH balance rises above 7.3, creating a basic environment, the cellular environment becomes toxic, mineral assimilation and oxygen delivery are inhibited, and inflammation can develop. Inflammation has been linked with mental deterioration. A 2009 Science Daily article summarized several recent studies that found that Alzheimer's disease is linked to inflammation. Researchers found that nonsteroidal anti-inflammatory drugs, particularly indomethacin, can protect against the disease. Other studies from 2000 and 2005, established a connection between neuroinflammation and Alzheimer's disease.

DIET AND BRAIN HEALTH

While some naturopathic medical traditions like TCM or Ayurveda have always pointed out the importance of diet in overall health, Western scientific research is now looking more and more at the effects of food and diet on the body and mind.

Proper nutrition can have an impact on brain functions such as memory, stress, and mood, as well as the body's overall performance. What some call a "brain-healthy" diet turns out to be one that also reduces the risk of heart disease and diabetes. In her work with

memory and brain health, Dr. Cynthia Green, founder and president of Memory Arts LLC, says she has been surprised by the strength of the relationship between physical well-being and everyday intellectual performance and long-term dementia risk.

"Studies on brain health and dementia have demonstrated robustly and repeatedly how much choices we make every day about physical exercise, diet, etc., matter to our overall brain fitness," said Green, whose company provides memory fitness and brain health training for organizations, corporations, and individuals.

A brain-healthy diet should include n-3 polyunsaturated fatty acids—typically found in cold water fish like

salmon, halibut, and tuna. For vegetarians, there are non-animal sources of Omega-3 DHA (docosahexaenoic acid) extracted from microalgae, which would provide similar benefits. A collaborative 2003 study found that eating a higher-than-normal amount of unsaturated, unhydrogenated fats may protect against Alzheimer's disease, while eating a high level of saturated or trans-unsaturated (hydrogenated) fats may increase

Brain-healthy foods include:

- olive oil
- coconut oil
- omega-3 fatty acids
- green leafy vegetables
- dark-skinned fruit
- avocados
- almonds and walnuts
- black sesame seeds
- kelp & microalgae
- shiitake & black mushrooms



the risk of contracting Alzheimer's disease. Similarly, a 2010 [study](#) concluded that elderly people with higher levels of high-density lipoproteins (HDL) (also known as "good cholesterol") were less likely to contract Alzheimer's disease than similar people with lower levels of HDL. Ingesting substances such as omega-3 fatty acids and soluble fiber can increase HDL.

Unlike many other oils, coconut oil has unique properties that might benefit brain health. The brain needs energy to function, and glucose provides that energy. If the brain loses its ability to burn glucose and cells become insulin resistant, the brain deteriorates (a process that plays a key role in the development of diseases such as Alzheimer's disease and Parkinson's disease.) Coconut oil contains medium chain triglycerides in the form of lauric acid. The liver can easily convert lauric acid into ketone bodies needed for energy. Ketone bodies do not need insulin to enter cells, so for people with insulin resistance, coconut oil can provide some extra energy if glucose is not immediately available, enabling the brain to function regardless of insulin levels. Ketone bodies also help reduce inflammation in the brain. Inflammation can disable a cell's ability to make glucose for energy.

Moderate consumption of certain fatty acids like monosaturated oleic acid (found in foods like olive oil, almonds, and avocados) also enhances brain function. Myelin, the protective sheath that covers nerves, is composed of **70 percent fat and 30 percent protein**. Thus, an insufficient level of fatty acids in the diet can decrease the rate and/or speed of communication between neurons. Also, the membrane of each neuron is made up of a thin double-layer of fatty acid molecules that helps regulate the flow of oxygen, glucose, and the micronutrients into brain cells.

In addition to foods that contain fatty acids, foods rich in antioxidants and vitamins E and C also have the potential to protect the brain from damage associated with disease-linked changes. A [study](#) of elderly women, conducted over a period of 10 years at Harvard Medical School, showed that those who ate eight servings of green, leafy, and cruciferous vegetables per week were 1-2 years younger in mental function, as measured by tests that assessed cognition and memory, than other women in the group who ate three or fewer servings of these vegetables per week. The Alzheimer's Association [recommends](#) a diet that includes dark-skinned

fruits (i.e., prunes, raisins, most berries, plums, oranges) and vegetables (i.e., kale, spinach, brussel sprouts, broccoli, beets) because of their high levels of naturally occurring antioxidants, which increase brain health, as well as reduce the risk of heart disease and stroke. Refined sugars, such as refined sucrose and high fructose corn syrup, adversely affect the brain. As a person ages the impact is magnified and can interfere with optimal brain functioning.

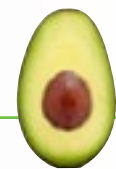
Research suggests that combinations of certain nutrients can benefit brain health. A 2004 [study](#) found that

a combination of vitamins E and C, which act as antioxidants in the body, was associated with reduced prevalence and incidence of Alzheimer's disease. However, when used alone, for example in the form of tablets or capsules, the vitamins did not have a protective effect, suggesting that the vitamins need to be taken with particular foods, taken in whole states, or are only useful when derived from ingested food. Nuts such as almonds, pecans and walnuts, are a good source of vitamin E and can protect brain cells if combined with vitamin C-rich foods like papaya, red bell peppers, strawberries, and oranges. More research needs to be done to determine



Healthful combinations

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what quantities of these foods might be most beneficial for brain health.

If a person usually does not or cannot get his or her daily dose of vitamins from foods, taking supplements is a good alternative. However, the Livestrong Foundation [explains](#) that supplements should be taken with caution since overdosing on vitamins like vitamin B6 can damage the brain and the nervous system.

In addition to these recommendations about what foods lead to optimal brain health, studies have also demonstrated the specific dangers of exposure to environmental toxins such as pesticides, mercury, and lead. A 2011 [study](#) that measured levels of organophosphate pesticides in women and children both before and after birth found that children exposed to pesticides before birth tended to have poorer intellectual development than those exposed to pesticides after birth. Mercury poisoning, which can be caused by ingesting foods high in mercury levels such as certain fish or through exposure to household items such as broken thermostats and fluorescent light bulbs or emissions from certain manufacturing plants, can damage one's nervous system,

brain, kidney, and lungs. Another harmful toxin, lead, is found in paint for homes and furniture built before 1978. It's also found in soil in areas with heavy traffic and through pollution from industrial sources such as smelters, waste incinerators, utilities, and lead-acid battery manufacturers. Lead can damage neurons in the sections of the brain responsible for memory, learning, and the coordination of muscle movement. Although the brain has a natural barrier that prevents foreign substances from entering the brain via the bloodstream (the so-called "blood-brain barrier"), lead can damage the blood-brain barrier, leaving the brain vulnerable to

other toxins.

EXERCISE YOUR BODY & HEART

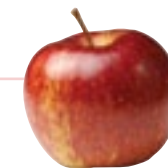
People are aware of the benefits of exercise for overall health, specifically for muscles, bones and organs such as the heart, but researchers are finding that exercise is also a key to brain health. Numerous human and animal studies suggest that exercise targets many aspects of brain function and has broad effects on resilience, learning, memory, depression, and overall brain health, particularly in elderly populations.

A 2007 [study](#) from the University of California found that exercise increases brain plasticity, or the brain's ability to grow and structurally change. This can enhance cognitive function and stimulate the production of new neurons, or neurogenesis. The same study found that exercise may also reduce inflammation in the brain, thereby decreasing peripheral risk factors (e.g., diabetes, hypertension, and cardiovascular disease) that lead to cognitive decline and neurodegeneration. Specifically, exercise suppresses the growth of pro-inflammatory mol-



Weighty matters

A study of 8,500 people over the age of 65 found that those who were obese in middle age had a 300 percent higher risk of dementia in later years.



ecules in the brain and at the same time increases the level of growth factors in the brain, particularly brain-derived neurotrophic growth factor, an important factor for neurogenesis.

Over the past decade, magnetic resonance imaging (MRI) studies have pointed to cardiovascular, or aerobic, fitness as a key component to brain health. A 2002 [study](#) found that aerobic fitness helps preserve the density of grey matter in the brain and tissue density in general, characteristics typically lost with age. A 2011 [study](#) found that endurance exercise leads to mitochondrial rejuvenation, which can contribute to longer life

and healthier neurological function. Studies have also shown that exercise **increases levels** of the PGC-1 alpha, a key regulator of energy metabolism for many different types of cells. Increasing the levels of PGC-1 alpha may protect against the onset of Alzheimer's. Exercise also stimulates the production of endorphins, the body's own opioids. When one engages in strenuous physical activity over an extended period of time, the brain may release endorphins, which bind to the brain's opioid receptors and cause a sensation of happiness, or of being "high." This endorphin-induced "runner's high" acts as a pain killer and has been considered for therapeutic uses, especially for anxiety, stress, and depression.

For those already affected by dementia, exercise can help slow the progression of symptoms. A 2004 **meta-analysis** of studies analyzing the effects of exercise training on elderly persons with cognitive impairment and dementia suggests that walking, dancing, and some weight training (in addition to other low-impact exercises) can improve one's performance on cognitive tasks. Also, a 2008 **study** suggests that those who engage in long-term, regular aerobic exercise three hours or more per week have many more small blood vessels in their brains than those who exercise sparsely, or only one hour or less per week. The increased blood flow to the brain can help those with Alzheimer's disease retain cognitive function, and it can help delay the onset of Alzheimer's disease.

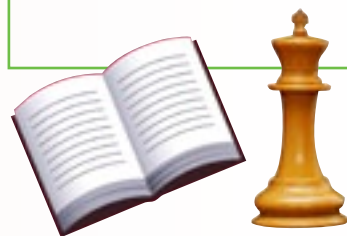
Exercise can also help prevent and treat depression, which is linked to cognitive decline and has been **described** as a global health burden. Numerous human studies have shown the therapeutic effects of exercise on depression in both young and older individuals. These therapeutic effects may be linked to neurogenesis in the hippocampus. (The hippocampus is one of the

few parts of the brain that is able to generate neurons in adults.) A 1999 Duke University **study concluded** that an exercise training program may be a viable alternative to antidepressant use among older people.



It pays to play

Research suggests that reading, playing board games, playing musical instruments, and dancing can reduce the risk of dementia and protect the brain.



Reaching or sustaining a healthy weight also can affect one's brain health and lower the risk of dementia. A **study** of 8,500 people over the age of 65 found that those who were overweight and/or obese in middle age are much more likely to develop dementia later in life. Those who had been overweight in middle age had an 80 percent higher risk of being diagnosed with dementia later in life, and those who were obese (having a body mass index (BMI) of 30 or above) in middle age had a 300 percent higher risk of dementia. Exactly how being overweight can influence the brain is not certain, but the authors suggest that higher body fat associated with diabetes and vascular diseases are related to dementia risk.

EXERCISE YOUR MIND

While physical activity increases blood flow and oxygen to the brain, mental exercise helps increase one's neural connections and thus mental vitality. A 2003 **study** found that keeping the brain active, or training it, may improve the brain's performance by building reserves of brain cells and connections and by possibly generating new brain cells. Another **study** the same year found that mental stimulation, including reading, playing board games, playing musical instruments, and dancing can reduce the risk of dementia and provide a protective effect for the brain. The AARP recommends a variety of brain boosting exercises, from playing video games to leaving your comfort zone to learning something new.

Sleep is an important part of keeping the brain fit.

According to researchers, sleep—in at least 90-minute intervals—enables the brain to review memories more quickly than in an awake state, and allows the formation of long-term memory storage by replaying memories.

IMPACT OF SOCIALIZATION AND STRESS ON BRAIN HEALTH

Remaining socially active and keeping stress to a minimum can also boost one's brain health. Studies show that men and women aged 75 and older who are more physically active, more mentally active or more socially active have a lower risk for developing dementia—those who combined these activities did even better. Thus, engaging in cultural activities, volunteer opportunities, and social gatherings (even with family) can have a protective effect against dementia.

A 2006 **study** analyzing how social networks reduce the risk of cognitive impairment in old age found that the size of one's social networks can affect cognitive function, even among those with signs or symptoms of Alzheimer's disease. Thus, the larger one's social network, the better one will function cognitively in old age. As the AARP **recommends**, engaging in conversation and in activities with others also can help decrease one's stress levels. Stress can shrink the brain's memory center if left uncontrolled. Dr. Green agrees that stress can negatively impact brain function.

"Current research suggests that stress has negative effects on brain health," said Green. "In the short term, when we are stressed we are easily distracted, which interferes with our ability to stay focused and learn new information. Also, studies suggest that long-term, chronic exposure to stress can lead to atrophy or shrinkage in the areas of the brain most responsible for

new learning."

Stress is **linked** to the body's survival instincts (the "fight or flight" response), which triggers chemicals in the brain meant to help us deal with threatening situations. Long-term stress has been linked with increased risk of Alzheimer's disease and dementia, with some research suggesting that long-term stress can stimulate the growth of proteins that cause Alzheimer's disease. Thus, it is important to routinely relax the body and mind via individual or group activities like meditation, yoga, or afternoon tea. Participating in meditation classes can be especially beneficial, as studies have consistently linked this physical activity to improved brain structure and function. For instance, some studies suggest that mindfulness-based cognitive therapy (MBCT)—a group program that teaches mindfulness meditation to those with mental illnesses—can help participants with **bipolar disorders**, and those at **risk for hypertension and depression relapse/recurrence**. Mindfulness skills acquired from the therapy improved participants' overall coping skills and were significantly associated with changes in depressive symptoms for participants with more than two depressive episodes.

Some of the most revolutionary scientific evidence for the psychological and physical impacts of meditation comes from studies published over the past 10 years. Researchers have had the opportunity to use neuroimaging techniques (e.g., magnetic resonance images) to document changes in brain activity and even **brain size**. Recently, in 2011, researchers from Harvard University, Yale University, and the Massachusetts Institute of Technology found that mindfulness meditation can **alter** the brain's structure by affecting **gray matter density** in the hippocampus and amygdala, areas that affect stress, memory, empathy, and sense of self. Thus,





meditation is quickly gaining acceptance as a practice that can contribute to brain health.

Though some in the medical profession argue that mental disorders such as Alzheimer's disease are incurable, research continues to reveal the ways in which diet, physical exercise, mental exercise, socialization and stress reduction can improve, if not eliminate, symptoms of such conditions. Golestaneh recommends that all people, not just the elderly, pay attention to these findings.

“People of any age should be concerned with brain health,” said Golestaneh. “The younger you are, the more flexibility and regenerative potential you’ll experience. You’re never too old to start improving the health and functionality of your brain.”

The Conscious Health Institute (CHI)

is a not-for-profit institute whose mission is to research, educate and inform the public on issues related to health and healing. To learn more, visit conscioushealthinstitute.org or call 1-(866)-745-2947.

