ask the experts

Staying Sharp

Learning as We Age

NRTA: AARP's Educator Community

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The Dana Alliance for Brain Initiatives

The Dana Alliance for Brain Initiatives (www.dana.org) is a nonprofit organization of more than 300 leading neuroscientists, including 10 Nobel laureates. The Dana Alliance is committed to advancing public awareness about the progress and benefits of brain research and to disseminating information on the brain in an understandable and accessible fashion. Supported entirely by the Dana Foundation, the Dana Alliance does not fund research or make grants.

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NRTA
AARP's Educator Community

The Dana Alliance for Brain Initiatives

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Learning as We Age

We humans are learning machines, and the brain is the engine. Crammed into the three pounds of convoluted tissue inside our skulls is a dynamic mass of a hundred billion or more nerve cells, each one capable of making thousands of connections with others. These are the nuts and bolts.

From the day we are born—and even before—the brain is primed for learning, ready to capture the experiences of our lives and encode them into its web of nerve connections. Learning shapes, organizes, and strengthens the brain's connections. It fine-tunes the brain, preparing us for all that life has to offer, whether mundane or extraordinary. And according to the latest brain research, actively engaging our brains in learning throughout life can have a significant impact on how well our brains age.

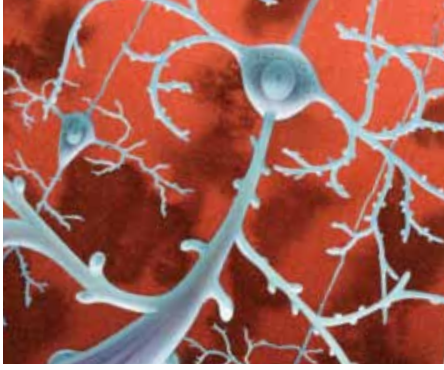
In this booklet, we'll explore what neuroscience has revealed about lifelong learning. Do we learn the same no matter our age? How does learning throughout life influence how we age? Are there things we can do to "rev up" our brains for learning? Recent advances in understanding each of these areas proffers good news for anyone interested in maintaining brain health in the "second half" of life.

What Do We Mean by "Learning"?

How much do you remember of what you learned in school? Algebraic formulas? Perhaps, if you're a mathematician. The periodic table of elements? If you're a chemist, certainly. Sentence diagramming? Maybe, if you're a writer.

The point is, you may have learned these things in school—you even may have aced the exams—but unless you've used them in your day-to-day life since, you may be hard-pressed to remember the details. This illustrates a distinction that brain researchers are quick to make: Learning and memory are not the same thing, though they are intricately linked.

"Learning is how you acquire new information about the world, and memory is how you store that information over time," says Eric R. Kandel, M.D., vice chairman of the Dana Alliance for Brain Initiatives and recipient of the 2000 Nobel Prize in Physiology or

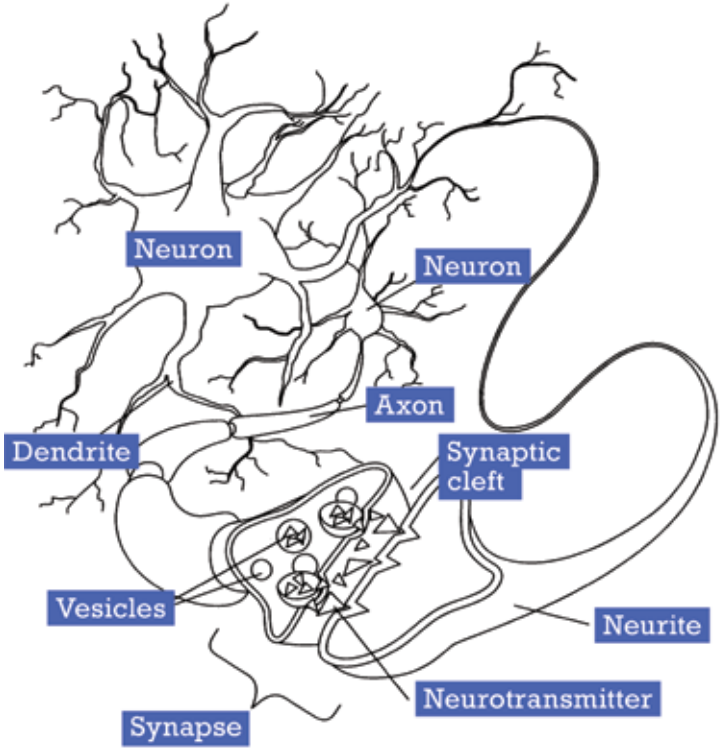


Medicine for his work on the molecular basis of memory. "There is no memory without learning, but there is learning without memory," Kandel says, because "you can learn things and forget them immediately."

In other words, not all learning transforms into memories that last. We look up a phone number and retain it just long enough to dial it, for example. This is sometimes called working memory. It still requires learning, just not for the long haul.

Scientific definitions aside, what most of us think of as learning is really an attempt to establish a memory that sticks. Learning a new dance step, how to play a musical instrument, or the name of a new acquaintance reguires that our brain encode new information and store it until we need it.

Getting to Know Your Brain

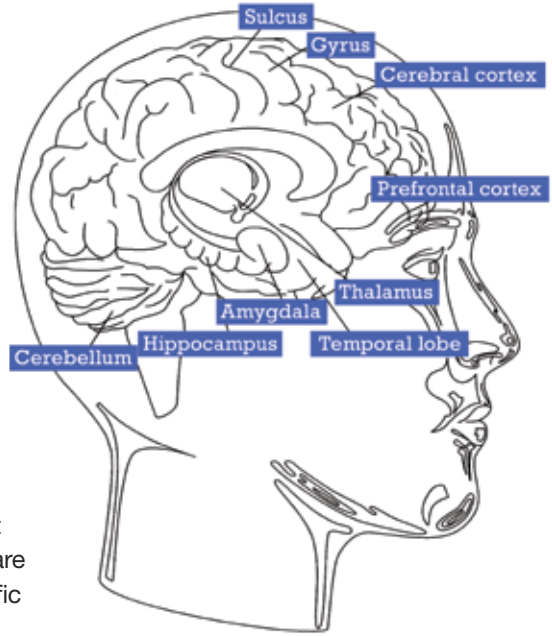


Every aspect of brain function, whether it's solving a mathematical problem, hitting a ball with a club, or feeling the warmth of the sun, is represented in the brain as patterns of electrical and chemical signals traveling between nerve cells. Each thought, action, or sensory perception stimulates distinct sets of nerve cells and brain chemicals. Imagine each cell as a musician in an elaborate symphony orchestra, playing its individual notes in harmony with other sections of the orchestra. If every musician is in sync, a beautiful concerto emerges. In the brain, the "music" that emerges from the symphony of brain activity is nothing less than human behavior itself.

Nerve cells, or neurons, are the workhorses of the brain. Their fibers, or axons, form connections called synapses with other neurons. When activated, a neuron sends low-level electrical currents down its axon, releasing brain chemicals (neurotransmitters) that diffuse across the gap where one neuron meets another and latch on to receptors on the receiving neuron. This sets off a cascade of changes inside the receiving cell that ultimately pass the signal along, like runners in a relay race.

When we experience something repeatedly, such as practicing a musical score, we are reactivating the same circuit of synapses. After several repetitions, the synapses change physically, enhancing the efficiency of the circuit and encoding the experience or behavior into a long-term memory.

Scientists believe that long-term memories are encoded within specific patterns of synapses in the cortex, the irregular folds and ridges on the surface of the brain. The frontal lobe of the cerebral cortex, especially the prefrontal cortex, is essential to high-level mental functions such as reasoning and planning. The hippocampus, the amygdala, and neighboring structures within the temporal lobe form the core of the brain's memory-processing system. These structures are connected to the cortex by elaborate pathways of neural circuitry that enable instantaneous cross talk among discrete brain regions.



Tenets of Successful Brain Aging

We all know people who stay sharp as a tack well into old age, or who seem to blossom creatively in the second half of their lives. A large and growing collection of scientific research focuses on determining what is different about people who tend to age successfully—that is, with minimal declines in cognition and memory. It turns out that they seem to share certain characteristics, described below, which may contribute to keeping them mentally sharp.

- **Mental exercise,** especially learning new things or pursuing activities that are intellectually stimulating, may strengthen brain-cell networks and help preserve mental functions.

- **Longer formal education** is associated with mental sharpness among older people, possibly because continued learning creates a neural reserve of denser, stronger nerve-cell connections that increase the brain's ability to compensate for age-related changes in neural structure and function. Better-educated people also may tend to lead brain-healthier lifestyles in general.

- **Self-efficacy**, the sense that we exert some control or influence over our lives and the lives of others—that what we do makes a difference—seems to prevent cognitive decline. The reasons are not entirely clear, but some experts believe that self-efficacy may be related to a greater resilience to stress.

- **Social interaction**—staying socially active and regularly engaging with family and friends—is an important predictor of healthy brain aging; and the flip side, social isolation, is associated with greater cognitive decline and other health problems. How social interaction benefits the brain is not well understood; one theory is that a strong social network may facilitate new learning and help people better manage stress. People who are socially engaged are also likely to be more active, both mentally and physically, which may help explain the apparent brain benefits.

How Does Learning Change the Brain?

It's remarkable to consider that we can change our brains just by learning. The brain is in a state of continuous activation as we go about our daily lives, with various systems turning on and making connections with others to respond to our environment and orchestrate our reactions in thoughts and behaviors. As we learn, the brain is adapting to reflect the new information that we're feeding it; our life experiences literally shape the brain as we age. Because no one else will have encountered the same set of experiences and learning that we have, no one else's brain looks exactly like our own.

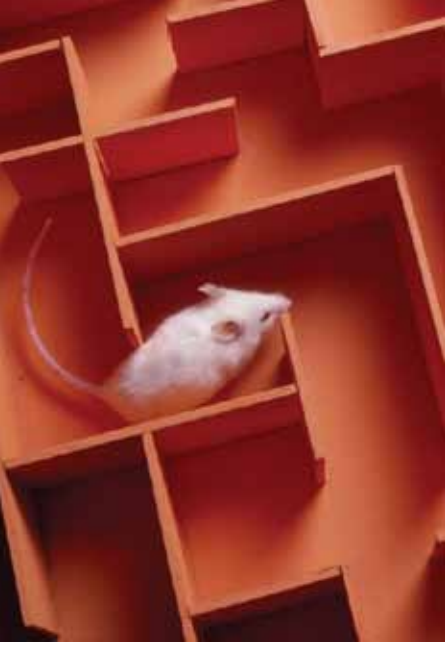
"The adult brain, and even the adult aging brain, is fine-tuned by experience in both its performance and its abilities, essentially organizing itself in accord with its experience to prepare for the future," says William T. Greenough, Ph.D., a Dana Alliance member and neurobiologist at the University of Illinois, Urbana-Champaign. "Since one of the best predictors of future needs is past demands, having a brain that is optimally tuned to prior experience is ideal."

> This capacity of the brain to structurally adjust itself to reflect our life experience—which scientists call plasticity—is what enables us to learn and thereby to change the brain.

The Incredible Plastic Brain

Plasticity is reflected in many ways in the brain. Much of what we know about the brain processes that underlie learning comes from studies of laboratory animals engaged in experimental learning situations. Taken together, these effects paint a picture of a brain capable of responding fairly rapidly and stably to new learning from experience.

What are some of the changes occurring in the plastic brain when we learn? ▶



Synaptic connections: When scientists raise laboratory animals in enriched environments in which they have many opportunities for new experiences, their nerve cells form more and larger synapses than do those of animals reared in simple cages.

Capillaries: The tiny blood vessels that connect veins and arteries in the brain increase in certain areas of the brain when animals live in complex environments where they can exercise freely. Denser capillaries enhance the flow of blood and oxygen to brain tissue, which may in turn have other beneficial effects on neurons and neurochemicals.

Support cells: Animal research shows that glial cells, the so-called support cells of the brain, increase both in individual size and overall number in response to complex environments. Although these changes don't appear to be as long lasting as synaptic changes, they are believed to be vitally important for synaptic plasticity.

Myelination: Data from animals suggest that learning increases myelin, the fatty sheath that wraps around axons and enhances their transmission of nerve signals. Some studies have found a particularly pronounced effect in the corpus callosum, the large bundle of axons that connects the brain's left and right hemispheres.

Birth of new neurons: Scientists have found strong correlations between learning and the generation of new neurons (neurogenesis) in the brain's hippocampal region. When researchers increase neurogenesis experimentally, animals perform better on learning tasks. Decreasing neurogenesis has the opposite effect. Animal studies suggest that one method for reliably increasing

neurogenesis is engaging in aerobic exercise—one more reason to get off the couch!

Formation of new proteins: The transformation of newly acquired information into long-term memories requires a specific genetic switch that stimulates the formation of new proteins. Repeated exposure to the new information throws the switch to activate long-term encoding. If scientists block the switch experimentally, they can prevent long-term memories from being formed. One important model used to study these processes is called long-term potentiation, a term used to describe a long-lasting increase in the strength of the relevant synaptic connections.

How Does Learning Change with Age?

Neurobiologist and Dana Alliance member James L. McGaugh, Ph.D., of the University of California, Irvine, likes to tell the story of the elderly man who went to visit his minister.

"How've you been?" asked the minister.

"Not so great," the man said, sighing. "I find that lately, I've been thinking a lot about the hereafter."

"Really?" said the minister, somewhat concerned. "Tell me about it."

"Well," the man replied, "every time I walk into a room, I turn around and wonder what I came in here after."

As a memory expert, McGaugh says people come to him all the time, with a look of desperation in their eyes, and say, "It's happening to me: I can't remember people's names anymore." What these people don't realize, McGaugh says, is that they did the same thing in their 20s—they just didn't give it a second thought then. "But now, they think about it all the time, and they get stressed and

anxious about it, when in fact it could just be a normal slip of the mind."

The truth is, such slips of the mind are ubiquitous, even among the young. Subtle deficits in certain types of memory processes—primarily memory for dates and events—begin showing up around age 20 and continue in a relatively linear fashion right into old age. Similar trends are seen in some other aspects of cognition.

This is not surprising, experts say, and it parallels the changes over time in other body systems, from muscle coordination to lung capacity to cardiovascular strength. Why should the brain be any different?

Cognition

Scientists often speak of brain aging in terms of cognitive changes. Cognition encompasses mental skills including attention, learning, memory, language, and executive functions such as decision-making, goal-setting, planning, and judgment.

What Types of Changes Are Common?

Not everyone ages in the same way, and our brains don't either. About a fifth of 70-year-olds perform as well on cognitive tests as 20-year-olds do on average. Still, some types of memory changes are common with normal aging. Practical strategies for coping with these changes are reviewed on page 14 ("Minding Your Memory"), and many good books that go far beyond what we can cover here are available.

- **Taking longer to learn**
  As we age, our brains process information at a gradually slower speed. As a result, it may take longer to learn new information and retain it, particularly larger amounts of information. Still, if we take the time to really commit the new information to memory—focus on it and learn it well—then we will typically remember it just as well as a

younger person would. Processing speed comes into play in situations such as understanding a train schedule, remembering directions to a new place, or comprehending highway signs when you're zooming down the interstate.

- **Multitasking**
  Slowed processing speed may influence other aspects of cognition, including so-called executive functions such as planning and reasoning, and tasks that require a kind of parallel processing of holding and integrating multiple items in memory. Trying to do several things at once may become more difficult as we get slower at shifting from one set of skills to another. Think of looking up a phone number to make a call, but the phone rings before you can dial. By the time you finish talking, you may not remember the number you looked up. Multitasking taxes the brain at any age.

- **Random facts and sources**
  Remembering names and numbers and recalling where or when you learned something are examples of strategic memory, which seems to undergo a steady decline beginning at about age 20. We may have to work a little harder to make sure our brains are engaged in learning something we want to remember later. In practice, this means paying attention to information when it is presented; it may help to literally tell yourself, "This is important, and I need to remember it." Repeating the information out loud and making associations with other things you already know can also help improve recall later.

- **Forgetting to remember**
  Sometimes, without a specific cue to jog our memory, we "forget to remember" things, such as an appointment made days or weeks earlier. When we get the "Where are you?" phone call, our brain clicks. In such cases, the problem is that we're not accessing the information at the time we need it, not that we haven't put it into storage properly. The best remedies for these kinds of problems are visual reminders: Write notes to yourself; keep a calendar with important dates in a visible area; and post notices, invitations, or papers that need attention in a prominent designated space.

Minding Your Memory

Based on what brain science tells us about how memory changes with age, the following simple strategies should help us improve our ability to remember things when we need to.

- **Pay attention:** Engage your brain and actively attend to what you're trying to learn.
- **Stay focused:** Concentrate on what you're doing and reduce distractions or interruptions.
- **Repeat it:** Repetition increases the strength of the relevant connections in your brain.
- **Write it down:** Writing down important things serves two purposes: It constitutes another way to repeat the information, and it provides a visual reminder.
- **Visualize it:** Creating a visual image of what you're trying to remember can reinforce brain connections, essentially giving your brain another way to access the information.
- **Make associations:** Relate new information to things you already know. By doing so, you're using existing synaptic connections to learn something new. This strategy can also be useful when trying to remember names. At a dinner party, for example, you might associate "Pam" with "red dress," "lawyer," "friend of Bill," "drinking red wine," or the like.
- **Stay organized:** Keep things you use regularly in the same place, and always return them to their place. Put keys on a hook by the door and your wallet in a basket on your dresser, for example.
- **Plan and prioritize:** Because multitasking may be more difficult, planning our time and prioritizing our activities becomes more critical. This may mean that some things simply have to wait. Recognize that doing it all may not be realistic, and let yourself off the hook. This can go a long way toward reducing stress and regaining control over your time and your life.

How Aging Alters the Brain

What's going on in the brain that might account for changes in cognitive functioning as we age?

Sophisticated brain-imaging technology and other advanced research techniques are enabling scientists to piece together the puzzle of brain aging. Much is at stake: Understanding the neural basis of cognitive decline may point the way to drug therapies and other strategies that could slow, stop, or prevent it.

Some central findings are described below. Note that these statements represent generalizations about brain aging based on what we know today. Specific changes vary considerably from one person to the next.

- **Brain mass:** Beginning in about the sixth or seventh decade of life, overall brain mass seems to shrink steadily. Certain brain areas show more pronounced shrinkage than others, including the frontal lobe (important for higher cognitive functions) and the hippocampus (a key structure for encoding new memories). In addition, the brain's ventricles, the cavities through which cerebrospinal fluid flows, are larger in older people, and this contributes to lower overall brain mass.

- **Cortical density:** The cortex, the heavily ridged outer surface of the brain, undergoes modest thinning with age. This thinning is not, as scientists once believed, the result of widespread loss of neurons (see "Brain-Aging Myths You Can Forget," page 16). Rather, the likely culprit is a steady decline, starting around age 20, in the density of synaptic connections.

- **White matter:** Many studies have linked aging with decreases in the brain's white matter, neural tissue that comprises the axons that carry nerve signals between brain cells (axons are sheathed in myelin, a fatty, white substance). With age, the overall length of white-matter tracts seems to decrease, and the myelin surrounding some axons shrinks. Scientists have correlated these changes with

lower cognitive functioning. Because myelin normally enhances the efficiency of nerve transmission, this shrinkage may help explain the decreased "processing speed" that commonly occurs with aging.

- **Neurotransmitter systems:** The aging brain both generates fewer of the chemical messengers called neurotransmitters and has fewer of the receptors that lock on to the chemicals. Decreased availability of neurotransmitters such as dopamine, acetylcholine, serotonin, and norepinephrine may factor in declining memory and cognition and may contribute to a greater risk for depression and other mood disorders among older people.
- **Synapse density:** Axons and dendrites, the threadlike fibers that send and receive nerve signals, become less elaborate with aging. The result is a decrease in overall synaptic density, which may contribute to slower cognitive processing.

Brain-Aging Myths You Can Forget

You can't change your brain. Your brain is constantly changing in response to your experiences, and it retains this fundamental plasticity well into old age. Everything we do and think about is reflected in patterns of activation in our brain. Scientists can see these patterns in brain-imaging scans that show which parts of the brain are active during specific tasks. Changing our thinking or changing the way we behave induces corresponding changes in the brain systems involved. For example, psychological therapies that teach people to alter negative patterns of thought and behavior can be effective in treating some mental disorders. Brain-imaging studies provide evidence that brain pathways actually change as a result of successful therapy.

We lose thousands of neurons every day. This persistent myth is based on early, flawed efforts to count the number of neurons in various brain regions. Scientists now know that the brain actually

loses relatively few neurons with age. Loss that does occur tends to be concentrated in certain regions deep in the brain, including some that supply important neurotransmitters to other brain areas.

The brain doesn't make new cells. This was the prevailing dogma for generations of neuroscientists, but research in the past few years has shot it down. Certain areas of the brain, including the hippocampus and the olfactory bulb (the scent-processing center), regularly generate new neurons, many of which go on to become fully functioning players in brain circuits. This is a hot area of neuroscience, and new insights are emerging rapidly.

Memory decline is inevitable as we age. Plenty of people reach very old age still as sharp as ever. Genes clearly are involved in this "successful aging," but how we live our lives on a day-to-day basis is also critical—and something we can control. Physical and mental activity, diet, social connections, stress management, worldview, and self-image are all important factors.

Improving with Age

There is good news from brain research: The brain is just as capable of learning in the second half of life as in the first half. We've also learned more already, simply because we're older. In many ways, the brain is not unlike a fine wine, growing richer with each new season.

In healthy people, the fundamental mechanics of learning in the brain probably don't change much as we age; it just may take a bit longer for the gears to engage. But once we learn something well, it tends to stick with us just as well as it did in younger years. Skills that we acquired earlier in life and have practiced over the years may be at their finest, be they mental skills such as debating about the stock market or procedural skills such as playing tennis or a musical instrument. As we age, we also develop a richer and more extensive vocabulary

and contextual history in which to use words effectively.

Some types of memory generally hold up well as we age, including short-term memory and recalling events from our past. Our memory for factual and conceptual information, which we use to make inferences about situations and solve problems, also remains well preserved.

Aging Wisely

Wisdom, by many definitions, denotes an enhanced capacity to grasp the essence of complex situations or problems and to act accordingly. While wisdom is almost always associated with older age, it may be more a result of cumulative life experience than of age per se. From when we are young children, we gain experience in all facets of living. By the time we are older, we've been exposed to more situations and, presumably, have learned from past mistakes as well as past successes. We can integrate our learning from previous decades and apply it to the challenges and opportunities we face on a daily basis. The wisdom we've gained throughout life affords us advantages in judgment and decision-making, guiding our choices and reactions to events.

> "We can make the brain work better simply by accumulating more knowledge, which builds more networks of connections in the brain," says James McGaugh. "The wisdom that we acquire can compensate for the decline that may be gradually occurring."

One clue to why we associate wisdom with aging comes from scientific research into how various parts of the brain's cortex develop throughout life and their varying susceptibility to decline as we age. The prefrontal cortex (PFC), the area of the brain just behind the forehead, is essential to higher-thinking, executive functions such as planning, reasoning, and judgment. The middle part of the prefrontal cortex (the medial PFC) is involved in the control of cognitive and motor processes and the execution of predictable behaviors. The regions under our temples (the lateral PFC) seem to support adaptive thinking. Neuroscientist Jordan Grafman, Ph.D., director of the Traumatic Brain Injury Research

Laboratory at the Kessler Foundation Research Center, points out that the medial PFC develops relatively early in childhood, while the lateral PFC may not mature fully until young adulthood. In line with the general rule that areas of the brain that develop latest in life also tend to decline first, the lateral areas of the PFC typically begin to decline before the medial areas.

As a result, Grafman says, "The knowledge that we acquire early in life tends to be stored throughout life. As we age, we develop a history of life experiences, and we see the end of processes as well as the beginnings." In old age, continued access to this wealth of information that began accumulating in our medial prefrontal cortex in childhood affords us advantages in understanding situations and in reacting appropriately.

Think Positive

Keeping a positive outlook on life may be one of the most important things we can do to keep our brains healthy and ready for learning. How we view ourselves, how we perceive the world around us, and how we interact with others can have profound effects on our overall well-being and on our brains. These are things that are completely within our control. No matter what challenges we face, we can choose to start each day by looking at the glass as half full rather than half empty. Feeling good about ourselves and having a sense of self-worth and effectiveness in our lives—attributes scientists sometimes call self-efficacy—are pillars of successful aging, according to the results of large studies that have chronicled lifestyle factors of people who stay mentally sharp into old age. Marilyn Albert, Ph.D., a Dana Alliance member and neuroscientist at Johns Hopkins University who led one of the first and most important of these studies, defines self-efficacy as an ability to adapt to life's challenges, to maintain a degree of control over our lives, and to feel as if we are contributing to our families and society.

Social Networks

Maintaining supportive relationships is one important element of effective aging. The more contact we have with others as we age, the better we may be at retaining mental sharpness. Some evidence suggests that people who engage in social activities, such as learning to play a musical instrument or dancing, may be less likely to develop dementia.

How can we ensure that strong human connections continue to be an integral part of our lives as we age? Aging experts recommend staying involved in religious and community functions, maintaining a network of friends and family with whom we regularly interact, and volunteering in organizations that get us out and among other people. Pursue social activities, such as wine tastings, traveling with friends, playing golf, or taking yoga classes.

As the late neuroscientist Lawrence Katz once said, "People are the most unpredictable things you can encounter, so activities that have you engaging with other human beings are a fantastic form of brain exercise."

Managing Stress

Learning to manage stress so that it doesn't overwhelm us can go a long way toward improving our outlook on life. Although acute, short-term stress can actually improve memory, chronic stress takes a toll on the brain. Exercise and positive social interactions can help us cope with stress, as can proven techniques such as biofeedback, meditation, and relaxation or visual-imagery therapies. Although eliminating stress entirely from our lives is unrealistic, we can and should learn coping strategies. By distinguishing between what we can and can't control and prioritizing our activities so we spend our time on things that really matter and bring us pleasure, we'll be taking important steps toward gaining control of stress.

Tuning Out the Negative

Tuning in to the positive aspects of life may come naturally to older adults, who may perceive their remaining time as limited and therefore want to make the most of it. A study by scientists at Stanford University, who used functional magnetic resonance imaging (fMRI) to track patterns of activation in the brain, found that older adults are more

responsive to positive images than they are to negative ones. Compared with younger adults, people ages 70 to 90 showed greater activation in the amygdala, a brain region central to emotional processing, when they looked at pictures of people expressing positive emotions versus negative ones. Older people, it seems, tend to tune out the negative and focus on the positive.

This finding demonstrates a neural basis for something psychologists and sociologists have long recognized: that older adults experience fewer negative emotions and are less likely to remember negative emotional stimuli than positive. Stanford psychologist John Gabrieli, Ph.D., a co-author of the report, says this may reflect "a change in what matters to you depending on how old you are and how you see the horizon of your life." Negative experiences may be seen as a poor investment in the future, prompting a desire to "maximize your positive emotional experiences," he says. "That's probably a wise choice of how to allocate your time and effort and attention."

Engaging Your Brain

The brain's capacity to alter and reorganize itself in response to learning and experience affords a tremendous opportunity to pursue a lifestyle that maximizes brainpower and keeps the engine of learning revved up as we age. Brain experts are convinced that engaging in active learning throughout life will help maintain brain health in our later years.

The brain wants to learn. It wants to be engaged as a learning machine. That means stepping out of the same old routines, in which the brain is largely operating on autopilot, and trying something new and different. When we settle in to old routines that we repeat almost automatically day to day, the brain activity required for those activities decreases. By approaching established routines in novel ways, we can activate other parts of the brain. Some studies suggest that doing so may stimulate growth factors that support nerve cells, among other beneficial effects on neural processes.

Think about the route you take to work each day, or to a familiar destination. It becomes

so automatic that you do it without even thinking about it. When you take a new route, your brain is forced to focus its attention on what you're doing at the time you're doing it, to be fully engaged in the act of that simple task. Tricks such as finding your keys or picking out coins in a purse by using your sense of touch rather than sight, or brushing your teeth with your nondominant hand, can have the same effect.

So, take up a new hobby, learn a new craft or language, join a club or group to meet new friends, or take new approaches to familiar tasks. There are a million and one ways to challenge and engage your brain. Find the ones that work for you.

Learning to Change Your Brain

Brain scientists are only beginning to understand the degree to which we can influence the state of our brains just by thinking and learning. In the years ahead, brain research will undoubtedly reveal many more surprises about the wondrous mass of synapses and cells encased in our skulls. By putting the good news from neuroscience into practice in our day-to-day lives, we can all benefit from this knowledge and improve our brain health as we age.

Engaging in active, lifelong learning is essential. What you do today and every day for the rest of your life can make a real difference in keeping the engine of learning tuned up and running smoothly throughout your tomorrows. By minding your brain, you can reap the rewards of learning throughout life.

Resources

AARP
601 E Street, NW
Washington, DC 20049
Toll-Free Nationwide: 1-888-OUR-AARP (1-888-687-2277)
Toll-Free Spanish: 1-877-MAS-DE50 (1-877-627-3350)
International Calls: 1-202-243-3525
www.aarp.org
Email: member@aarp.org

Alliance for Aging Research
2021 K Street, NW, Suite 305
Washington, DC 20006
202-293-2856
www.agingresearch.org
Email: info@agingresearch.org

Alzheimer's Association
225 N. Michigan Ave., Fl. 17
Chicago, IL 60601
1-800-272-3900
www.alz.org
Email: info@alz.org

Alzheimer's Disease Education and Referral Center: National Institute on Aging
P.O. Box 8250
Silver Spring, MD 20907
1-800-438-4380
www.nia.nih.gov/alzheimers

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31 Center Dr., MSC 2292
Bethesda, MD 20892
1-800-222-2225
www.nih.gov/nia

National Institute of Neurological Disorders and Stroke: NIH Neurological Institute
P.O. Box 5801
Bethesda, MD 20824
1-800-352-9424
www.ninds.nih.gov

National Sleep Foundation
1522 K Street, NW, Suite 500
Washington, DC 20005
202-347-3471
www.sleepfoundation.org
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